ASSESSMENT OF POTENTIAL RELATIONSHIPS BETWEEN MICROCLIMATE VARIABLES MEASURED WITHIN A FOREST PATCH AND THE PRESENCE OF INTERIOR FOREST BIRDS

by

Christopher Scott Farabaugh

A Dissertation
Submitted to the
Graduate Faculty
of
George Mason University
in Partial Fulfillment of
The Requirements for the Degree
of
Doctor of Philosophy
Environmental Science and Public Policy

Committee:

Dr. Larry L. Rockwood,
Dissertation Director

Dr. Cody W. Edwards, Committee Member

Dr. Hillary B. Cressey, Committee Member

Dr. Clifton D. Sutton, Committee Member

Dr. Albert Torzilli, Program Director

Dr. R. Christian Jones,
Department Chairperson

Dr. Peter Becker, Associate Dean
for Graduate Programs, College of Science

Dr. Vikas Chandhoke, Dean,
College of Science

Date: May 1, 2008

Spring Semester 2008
George Mason University
Fairfax, VA

Assessment of Potential Relationships Between Microclimate Variables Measured Within a Forest Patch and the Presence of Interior Forest Birds

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at George Mason University

By

Christopher Scott Farabaugh
Masters of Science
George Mason University, 2005
Bachelor of Science
The College of William and Mary, 2001

Director: Larry L. Rockwood, PhD
Department of Environmental Science and Public Policy

Spring Semester 2008
George Mason University
Fairfax, VA

ACKNOWLEDGEMENTS

I would like to thank the many friends and relatives who have supported me throughout the course of my education. First of all, I would like to thank my parents, Timothy and Deborah Farabaugh, who assisted me in and supported my research. I would like to thank Adam Hasemeyer for his assistance in my research. I would also like to thank Dr. Larry Rockwood and Dr. Ron Stewart, who served as invaluable resources throughout my education and with my research. In addition, I would like to thank Dr. Cody Edwards, Dr. Hillary Cressey, and Dr. Clifton Sutton, who provided guidance for my research and Dr. Chris Jones, who provided supplies and funding for my research. Finally, I would like to thank Ron Circe at Banshee Reeks, who allowed me to conduct research at Banshee Reeks and Paul Peterson and the National Park Service for allowing me to conduct research at Prince William Forest Park.

TABLE OF CONTENTS

LIST OF FIGURES

ABSTRACT

ASSESSMENT OF POTENTIAL RELATIONSHIPS BETWEEN MICROCLIMATE VARIABLES MEASURED WITHIN A FOREST PATCH AND THE PRESENCE OF INTERIOR FOREST BIRDS

Christopher Scott Farabaugh, PhD

George Mason University, 2008

Dissertation Director: Dr. Larry L. Rockwood

Research was conducted over three field seasons in isolated eastern deciduous forest patches of three different sizes (~10, ~90, and ~300 hectares) in Loudoun and Prince William Counties in Virginia, to determine if there was a relationship between microclimate variables, temperature and photosynthetically active radiation (PAR), the presence of interior forest birds, and forest patch size. The results of this study indicate that microclimate variables, temperature, and photosynthetically active radiation (PAR), generally decreased from the edge to the interior of the forest patch. The number of birds observed held fairly constant from the edge to the interior of the forest patch, while the number of species observed increased from the edge to the interior of the forest patch. The number of birds observed was significantly related to PAR in the ~10 hectare forest patch and to distance from the edge in the ~90 hectare forest patch. The number of birds

observed was not significantly related to any of the variables measured in the ~300 hectare forest patch. When data from all three patches were combined, the Wood Thrush, which was the most frequently observed species, was statistically linked to distance from the forest edge with the number of Wood Thrush observed decreasing with distance from the forest edge. Overall, the number of birds seen per day per location, the number of species of birds seen per day per location, and the number of forest-interior species increased with increasing forest patch size. Policy makers should be aware of these results when determining minimum remnant patch size when allowing forest fragmentation.

INTRODUCTION

Forest fragmentation is a process that results in the reduction of an original forest area's size, and the creation of new, smaller, or split patches (Desouza et al., 2001). These patches are the results of land use changes such as clearing for agriculture, urbanization, logging, and road construction. Human activities can lead to the drastic reduction and fragmentation of natural habitat, reduce patch size, increase distance between patches, reduce total area of habitats, and increase the ratio of edge to interior in patches (Rosenblatt et al., 1999). The results of fragmentation and human disturbance affect both temporal and spatial habitat use for mammals (Tigas et al., 2002). For migratory species, habitat loss and fragmentation are major problems across their total range (Terbrough 1992).

Forest fragmentation has important effects for birds; Fraser and Stutchbury (2004) found that many North American songbird populations are declining as a result of habitat fragmentation. Forest patch size is also an important factor as most bird populations in patches of less that 100 hectares are likely headed to extinction without regular immigration of birds from larger patches (Stouffer and Borges, 2001). Additionally, area-sensitive birds experience lower reproductive and pairing success with decreased forest area, and are frequently absent in smaller forest fragments (Fraser and Stutchbury,

2004). While several studies have focused on the effects of habitat fragmentation on forest birds (Barlow et al., 2006; Brooks et al., 1999; Castelletta et al., 2005; Laurence et al., 2004; Lindenmayer et al., 2002; Mac Nally et al., 2000; Vergara and Simonetti, 2004), none of these studies has incorporated microclimate variables and the effects on birds.

Loudoun and Prince William Counties in Virginia are two of the fastest growing counties in the nation. Between 2000 and 2006, the population in both countries grew by more than 30% (http://www.loudoun.gov/news/growth.htmLoudoun County Department of Economic Development, 2006; Weldon Cooper Center website). This population growth has led to forest fragmentation and increased human activities. For this study, research was conducted at a county park in Loudoun and a national park in Prince William that were fairly isolated from human intrusion. This isolation provided the opportunity to study the effects of forest fragmentation on birds in area surrounded by rapid growth.

Specifically, I examined the following questions:

1. How do air temperature and photosynthetically active radiation (PAR) change from the edge towards the interior of a forest patch?
2. How do numbers and species of forest birds change from the edge towards the interior of a forest patch?

3. Is the point within a forest patch where air temperature and PAR stop changing a good indicator of interior forest conditions as measured by the presence of interior forest birds?

Data from three field seasons (2005, 2006, and 2007), utilizing patch sizes of ~10, ~90, and ~300 hectares and different distances between sensor locations (25, 50, and 100 meters) were analyzed and compared to address these three questions.

FOREST FRAGMENTATION

Over the past 8,000 years, nearly half of the Earth's forests have been converted to farms, pastures, and other uses. But the human impact on forests did not stop there as humans have heavily altered most of the remaining forests resulting in a patchwork of fragmented forests. According to a 1997 World Resources Institute assessment, just one fifth of the Earth's original forest remains in large, relatively natural ecosystems (Bryant et al., 1997).

Wade et al. (2003) indicate that over half of the original global temperate broadleaf and mixed forests, those that the authors have classified as being located in eastern North America, have been fragmented or removed. Sampson and DeCoster (2000) found that there is a trend in the United States for private forest owners to hold smaller and smaller patches, with 94% owning patches smaller than 40 hectares. Results of the Virginia's 1992 Forest Land Survey indicate that approximately 7% of the forested land in Virginia is less than 4 hectares in size, approximately 22% is between 4 and 20 hectares, and approximately 70% is greater than 20 hectares with a median patch size of 29.2 hectares (Scrivani, 2003).

Fragmentation caused by anthropogenic factors leads to changes in forest functions, such as regulations of hydrological and nutrient cycles, fire prevention, and evapotransporation, and changes in ecological processes such as nutrient cycling, pollination, and decomposition (Gascon et al., 2001). For example, Mac Nally et al. (2000) indicated that fragmentation driven by land clearing for agricultural use affects natural habitats by depleting the most fertile land. Agricultural use introduces chemicals, such as nitrogen used in fertilizers, into the environment. Additionally, processes such as wildfires, logging, and edge effects have detrimental affects on soils (Barlow et al., 2006).

In cases where forest is fragmented due to road construction, species are introduced to many variables such as pollution, noise, road kill, human disturbance, exotic species, and reduced patch connectivity (Reed et al., 1996). Laurence et al. (2004) found that linear barriers such as roads significantly inhibit the movement of forest species. They suggest that road-crossing movements were inhibited because area-sensitive species tended to avoid both edge-affected habitat near the road and the road clearing itself. They found that even narrow roads with little traffic inhibit the movement of forest species. Reed et al. (1996) suggest that edges created due to the introduction of roads produce unique habitat as edges created by roads persist for longer periods of times and are more often disturbed than natural and clearcut edges.

Desouza et al. (2001) suggest that there are three possible outcomes of fragmentation: diminishment, increment, or maintenance of the species number in the community. After fragmentation, biological and structural changes are observed. Biological changes include the loss of individuals, species, and habitats. Structural changes involve isolation of the patch from its original matrix and increased proximity of the interior to the surrounding environment. Biological changes are linked to local processes such as species interactions, while structural changes are related to regional processes such as immigration. Edge creation is a structural change, but it is also a biological change with effects on immigration and habitat suitability.

Bierregaard et al. (2001) suggest that edges are the most important aspect of forest fragmentation. Edges, created by deforestation, expose forest to conditions found in the surrounding matrix while areas of forest close to the edge undergo changes in microclimate, vegetation, and species composition. What was once interior forest becomes edge, or zones of transition where microclimate changes expand until they stabilize as interior conditions (Stevens and Husband, 1998). In a natural landscape, there is a gradual transition from the forest patch to the adjacent landscape (Gascon et al., 2001). In a fragmented landscape, transitions from forest patches to urbanized areas or fields are often very abrupt, creating edges that expose the forest to surrounding conditions (Stevens and Husband, 1998). Changes in microclimate affect both plants and animals in the forest patches by exposing interior species to edge conditions.

Introduction of edges into the landscape often results in changes in microclimate such as increased temperature, increased solar radiation, decreased soil moisture, and increased evaporation (Reed et al., 1996; Stevens and Husband, 1998; Bierregaard et al., 2001). Continuously connected canopy shades the forest interior producing a cool, dark and humid microclimate when compared to areas near the edge. On the contrary, air temperature and photosynthetically active radiation increases and relative humidity decreases at the edge (Turner, 1996).

Fragmentation is a scale dependent process and, within limits, results in no loss of species. Simply put, larger areas will support more species than smaller ones (Desouza et al., 2001). As fragmentation continues, however, the remaining area is reduced to a critical size below which it will not support many of the original species and local extinction occurs. In fact, according to Desouza et al. (2001), local extinction is the most frequent outcome of forest fragmentation. The first to disappear are those species, termed interior species, which require large areas of habitat to maintain viable populations. For these species, the probability of occurrence increases with patch size. Others are area-sensitive because they require large territories or foraging areas (Whitcomb et al., 1976; Robbins et al., 1989; McCollin, 1993).

As fragmentation continues, edge and area-insensitive species, ones at home in small to large units of habitat, increase in abundance. Lindenmayer et al. (2002) indicate modifications of natural landscape do not lead to a disadvantage for all species, as some

species are unaffected of may benefit from the modifications. A study by Gascon et al. (1999) found that species richness of frogs and small mammals increased after forest fragmentation. The authors state that the increase in species richness is primarily due to species in the surrounding matrix invading the forest fragment.

Forest edges may also be beneficial to some nest predators such as skunks, foxes and raccoons since they are nocturnal and hunt by scent, easily finding ground nests near edges (Harris and Sliva-Lopez, 1992). Robbins et al. (1989) indicate that densities of avian nest parasites such as Common Grackles, Brown-headed Cowbirds, Blue Jays, and American Crows are higher along forest edges than on the interior.

Although the species richness in a fragmented habitat may be maintained or increase initially with the creation of edge environments, the number of species it contains will eventually decline as fragmentation continues (Lindenmayer et al., 2002; Desouza et al., 2001). Ambuel and Temple (1983) suggest that edge species and field species exclude interior forest species as the area of the patch decreases.

Small isolated populations suffer from inbreeding and genetic drift that ultimately reduces fitness and genetic variation while increasing homozygosity. According to Turner (1996), small patches may contain ecologically extinct populations of species doomed because of their small size. Additionally, Bierregaard et al. (2001) suggest that small populations are vulnerable to random genetic and demographic effects that often

lead to local extinctions. Immigration is one way to circumvent the issue of a reduced gene pool, but if the non-forested area is inhospitable to forest species, there will be little to no immigration of individuals. Limited immigration means that new genes seldom enter the breeding population leading to detrimental effects such as extinction (Turner, 1996; Chiarello, 1999).

Stochastic events also play a role in extinctions as species richness is decreased. Environmental stochasticity is variations in populations due to unexpected events such as floods, droughts, wildfires, landslides, and diseases (Rockwood, 2006). Stochastic extinctions often will not occur for several generations after fragmentation. These extinctions are secondary, induced by a loss in population density (Desouza et al., 2001).

Forest fragmentation often leaves patches that are completely isolated from other forested areas, a matrix that brings the ecological ideas of metapopulations into play. The MacArthur and Wilson model, known as the mainland-island metapopulation, is one in which there is a constant source of species from a mainland. The mainland source disperses to the islands, or fragmented patches, with no dispersal from island to island. The number of species on the island is due to the equilibrium between extinction and immigration from the mainland. The Levins classical metapopulation model suggests that the metapopulation exists because of local extinctions and recolonizations of habitat patches. Species in the classical metapopulation interact with each other and exchange genetic material through immigration and emigration. Unlike the MacArthur and Wilson

model, there is not a constant source from which species come but rather a matrix of patches among which species move. In general, the number of patches, the quality of patches, the size of patches, and the connectivity of patches influences metapopulations. Though there is still discussion among ecologists around which model is more appropriate, the theory of metapopulations is an important aspect of ecology and conservation biology (Desouza et al., 2001; Rockwood, 2006).

FOREST FRAGMENTATION AND BIRDS

Forest fragmentation has important consequences for avian communities. Blake and Karr (1987) studied the importance of area and habitat structure on avian communities. They found that area accounted for ~90% of the variation in total number of species from various patch sizes. They also found that birds found in small woodlots are subsets of those species found in large forests.

Fragmentation produces forest patches of various sizes. Lindenmayer et al. (2002) found that fragments of all shapes and sizes have important conservation values. They suggest that smaller fragments contain an abundance of those species that thrive in a fragmented landscape. However, often as a result of area reduction, smaller patches lead to less diverse species composition when compared to larger patches. Cornelius et al. (1999) suggest that there is a positive relationship between area of the forest patch and the number of bird species. In research conducted in Chile, they found that the number of species increased as the patch size increased. They also suggested that a minimum patch size of ~7500 hectares is necessary to hold the expected temperate forest species.

Biotic and abiotic differences between forest edges and forest interiors, such as differences in microclimate, vegetation, predation, and insect composition, affect

different species in different ways depending on their breeding and foraging requirements. Since there is a greater proportion of forest edge area with a smaller patch, edge influences are often related to patch size. Although patch-size sensitivity and edge sensitivity in birds are likely correlated, patch size is not a precise measure of edge sensitivity and vice versa (Brand and George, 2001).

Stouffer and Borges (2001) conducted research on understory bird assemblages in forest patches in the Amazon. They studied avian abundance in patches of 1, 10, and 100 hectares as well as continuous forest. The results of the study indicate that abundance was slightly reduced in 100-hectare fragments when compared to continuous forest. Perhaps the most telling result was that the 1 and 10 hectare patches held less than 25% of the abundance of birds when compared to continuous forest. Most bird populations in patches of 100 hectares and smaller are likely headed to extinction without regular immigration of birds from larger patches. Patches of fewer than 100 hectares have little conservation value for birds and are not important as stepping-stones for bird movements from patch to patch. The authors indicate that patches of greater than 100 hectares are critical for the persistence of understory birds and that patches in the tens of thousands hectare size are necessary for stable tropical forest bird populations.

Although species diversity is related to area, the ratio of edge or perimeter to area is highly important. At some small size, all patches are edge. If the depth of the edge remains constant while the area increases, the ratio of edge to interior decreases as the

habitat island increases. When the island size becomes large enough to maintain interior conditions, an interior begins to develop. However, size alone is not the only determinant of edge/interior conditions. Configuration or shape of the island is also important.

Bird communities on edges are comprised of species from various sources. Some species found on edges are also those that are found within the forest and seldom move beyond the edge. A second set of species is nonforest species that colonize young second growth forests and rarely penetrate further into the forest than the edges. A third set is those forest species such as flock obligates that cross edges and move into open habitat while foraging. A fourth group is those forest gap specialists that utilize the land between patches and frequent patch edges (Stouffer and Borges, 2001).

An increase in the number of birds in forest fragments immediately following fragmentation is often observed, as birds from the cleared areas utilize the remnant patch. However, the number will eventually decrease to pre-fragmentation levels (Bierregaard et al., 2001). Fragmentation also leads to shifts in avian community composition as generalist species increase while specialist species decrease (Fraterrigo and Wiens, 2005). Additionally, larger patches hold a higher species richness of resident and migratory birds than do smaller patches (Castelletta et al., 2005). Stouffer and Borges (2001) indicate that those area-sensitive birds that are trapped in forest patches as a result of fragmentation either emigrate or perish within a few years after the fragmentation occurred.

The effects of forest fragmentation are long lasting. Castelletta et al. (2005) found that the density of forest birds was higher in old growth forest than in new growth forests. Stouffer and Borges (2001) found similar results indicating that few forest birds utilize young second growth forests. As the second growth forests develop, typically five to ten years after fragmentation, many birds begin to use the habitat.

Vergara and Simonetti (2004) indicate that forest birds are affected as their feeding niches are altered with forest fragmentation. They found that ground and understory birds increase in abundance with fragmentation while insectivores decrease in abundance with fragmentation. Souffer and Borges (2001) also indicate that insectivores, especially those that forage in mixed flocks or on the ground, are reduced in patches of less than 100 hectares.

Miller and Cale (2000) suggest that remnant patch area is the most important indicator of avian community structure as it is closely correlated with other variables such as patch diversity, isolation, and corridor connections. In addition, patch size is an important variable in the reproductive success of forest birds with smaller patches leading to lower reproductive success (Burke and Nol, 2000; Stouffer and Borges, 2001). One reason that reproductive success may be reduced in smaller patches is that, according to King et al. (1998), nest predation is greater at forest edges than in forest interiors. With edge area increasing as patch size decreases, it is logical that more nest predation would occur in smaller patches.

Fraser and Stutchbury (2004) suggest that many North American songbird populations are declining as a result of habitat fragmentation. They found several studies that suggest area-sensitive Neotropical migrant species of birds are especially sensitive to forest fragmentation. Area-sensitive birds experience lower reproductive and pairing success with a decrease in forest area, and are frequently absent in smaller forest fragments.

Castelletta el al. (2005) suggest that large reserves with mature forests are necessary to avoid species loss and to maintain forest bird diversity. Corridors could be useful in connecting isolated patches to enable the movement of forest birds with low densities and restricted distribution. Fraser and Stutchbury (2004) state that area-sensitive birds prefer to use corridors, and frequently avoid crossing open, non-forested areas.

When patch size becomes too small, corridors may be beneficial to species in the patch. A corridor is a habitat patch connecting two or more larger areas of habitat together that may be used for passage of individuals, or gene flow. Animals use corridors in various ways such as direct movement through the corridor from one patch to another or by temporary residence in a corridor—both allowing for gene flow and individual movement (Bennett, 1990). Bennett (1990) also states that the larger the distance between patches, the less likely that individual movement will occur. In this case, gene flow can still occur through the utilization of resident individuals within corridors. Beier and Noss (1998) found that corridors provide connectivity that improves the viability of populations in fragmented habitats connected by corridors.

In avian ecology, the concept of habitat-interior preference was applied through the development of a classification of forest bird species among four categories: (1) forest-interior specialists, (2) interior-edge generalists, (3) edge species, and (4) field-edge species. Forest-interior specialists are species that nest only within the interior of the forest and tend to avoid the edge. Interior-edge generalists are species that may have territories composed of only interior forest habitat, but may utilize the edge as well; or they may use more than one patch of forest as a single territory. Edge species are located primarily on the forest border. Field-edge species may nest in the forest border, or in the interior, but require open habitats for foraging (Whitcomb et al, 1981).

Given the importance of fragmentation and loss of interior forest habitats on bird populations, it is surprising that little is known regarding how far edge effects penetrate into forest patches. This means that estimates of remaining interior forest in fragmented landscapes may be highly inaccurate.

RESEARCH METHODOLOGY

Research was conducted over three field seasons in isolated eastern deciduous forest patches of three different sizes (~10, ~90, and ~300 hectares). During the summer months of 2005, 2006, and 2007, research was conducted in Loudoun County, Virginia (2005 and 2006) and Prince William County, Virginia (2007). Study locations in Virginia are pertinent as the state lost ~7284 hectares of forestland per year between 1992 and 2001, with the major causes of loss being urbanization, forest fragmentation and parcelization (Scrivani, 2003).

Mixed Deciduous Forests

The majority of the forests in the eastern United States are mixed deciduous forests (Figure 1). Loudoun County, Virginia and Prince William County, Virginia are in an area defined by Flemming et al. (2006) as the Piedmont Plateau. The vegetation of the Piedmont Plateau has been severely altered by a long history of clearing, agriculture, logging, and other anthropogenic disturbances. The authors suggest that both natural fires and fires deliberately ignited by native Americans to clear land and/or drive game maintained the original landscape of open, savanna-like woodlands and grasslands. Currently, the Piedmont Plateau is an area of pastures, fields, and secondary forests.

Lists of shrubs and trees generated by Banshee Reeks Park and Prince William Forest Park are presented in Appendices 4 and 5, respectively.

Most Piedmont forests have a history of repeated cutting, or have regenerated on former agricultural lands (as is the case with Banshee Reeks Park, the 2005 and 2006 study location). Recently disturbed Piedmont forests tend to have a large component of pines and shade-intolerant hardwoods such as Virginia pine (*Pinus virginiana*) and Yellow poplar (*Liriodendron tulipifera*), two species of trees observed at the research locations used in this study.

Study Locations (2005 and 2006)

In the summers of 2005 and 2006, research was conducted at Banshee Reeks Park in Loudoun County, Virginia. Banshee Reeks was established in 1999. The 281-hectare preserve is Loudoun County's only nature preserve. According to the Loudoun County Department of Economic Development's Annual Growth Summary for 2006, the county had a population growth of 31% making it the fastest growing county in northern Virginia over the previous six years. In addition, Loudoun County is projected to have a population increase of 39% from 2006 to 2016. The past and projected future decennial population trends of Loudoun County suggest that the population will grow by more than 55% over the next twenty years (in Figure 2) (Loudoun County Department of Economic Development, 2006).

A study by Fuller (2001) found that between 1963 and 1999, urbanization in Loudoun County led to increased fragmentation in forest cover and increased forest edges. Increased building and development leads to increased impermeable surfaces and increased forest fragmentation. These factors, along with increased automobile emissions, produce urban heat islands where ambient air temperature may be elevated 4-6°C. Increased air temperature produces changes in temperature-dependent processes such as respiration and photosynthesis.

The isolation of Banshee Reeks Park from public intrusion, in the middle of growing Loudoun County, provides an opportunity to study the succession from field to an eastern deciduous forest patch (www.bansheereeks.org). An aerial photograph of the forest patch where research was conducted at Banshee Reeks Park (Figure 3) shows the two separate research locations. The 2005 location was approximately 10 hectares, with the forest abutting open field at the edges. The 2006 study location is approximately 90 hectares, with an unpaved, one-lane road running through the patch. The northern edge of the patch has been deforested since this image was taken. Hence, the forest abuts open field at three edges, and a two-lane road along one edge.

Study Location (2007)

In the summer of 2007, research was conducted at Prince William Forest Park in Prince William County, Virginia. The ~6070-hectare park, established in 1936, is the largest protected natural area in the Washington, D.C. metropolitan region and the largest

Piedmont forest park in the National Park System. Two-lane roads on the southern and western edges of the park separate it from Quantico Marine Base, a base that encompasses ~24,281 hectares of forested land. The combination of Prince William Forest Park and Quantico Marine base is an area of 30,350+ hectares. The park also protects the Quantico Creek watershed and is a sanctuary for numerous native plant and animal species (http://www.nps.gov/prwi/index.htm).

Between 2000 and 2006, Prince William County was the third fastest growing locale in Virginia with a population growth rate of 31.5% (Weldon Cooper Center website). Development around the park, including the expansion of a major roadway (State Route 234) along the northern edge of the park, made this an interesting and pertinent study location. The park map (Figure 4) shows the size and layout of the Prince William Forest Park.

MATERIALS AND METHODS

Air Temperature and Photosynthetically Active Radiation

To determine how air temperature and photosynthetically active radiation (PAR) change from the edge towards the interior of a forest patch, air temperature and PAR were measured. This information was used in an attempt to determine the point at which temperature and PAR stabilize, presumably indicating the beginning of interior conditions.

Using HOBO pendant data loggers, air temperature and PAR were sampled. Data logger stations were composed of the HOBO pendant data logger attached to a 1.5-meter tall metal fence post. Data loggers were separated by set distances (25-, 50-, or 100 meters in 2005, 2006, and 2007, respectively) starting at the forest edge (Figure 5). The data gathered were downloaded from the pendant data loggers with an optic base station and analyzed using BoxCar software.

In addition, stand structure (species and diameter of species for trees and species and height for shrubs) was characterized within a 3-meter radius of each data logger site. The loggers were 0.9 meters off the ground. PAR intensity is described using lux, which is a

measurement of the PAR intensity falling on a surface that is equal to one lumen per square meter.

2005 Field Season

During the 2005 field season, data loggers were placed at twenty-four locations 0-, 25-, 50-, 75-, 100-, and 125 meters from the edge from four cardinal directions. Loggers were placed at each site in the forest patch on 23 May 2005. Initially, the northernmost logger was set up in the middle of the northern edge of the forest patch. Additional loggers were placed 25 meters apart heading south. A total of 12 loggers were erected along the north-south plane, reaching a southeast edge of the patch. The east-west loggers were started off the seventh logger placed on the north-south plane. The loggers reached a western and eastern edge of the patch. Twelve loggers were placed 25 meters apart, in addition to the seventh logger on the north-south plane, along the east-west plane. Data loggers began taking temperature and PAR measurements every thirty minutes starting at 2000 hrs on 23 May 2005, ending 12 weeks later after the final bird observations on 14 August 2007. All loggers were placed on the northern-facing edge of a fence post.

2006 Field Season

During the 2006 field season, data loggers were placed at twenty-five locations 0-, 50-, 100-, 150-, 200-, 250-, and 300 meters from the edge on a Northwest, Southeast, East and West plane. Loggers were placed at each site in the forest patch on 09 April 2006. Initially, the northwesternmost logger was set up on the northwestern corner of the forest

patch, at a clearing of a two-lane road. Additional loggers were placed 50 meters apart heading southeast. When initializing loggers on the northwest plane, seven loggers were set, reaching 300 meters from the edge. Data loggers were set up along the other planes in a similar manner, with the outermost loggers being located at edges abutting fields. These planes (southeast, east, and west) had six loggers each, reaching 250 meters from the edge. In total, 25 total loggers were initialized along four tracks. Data loggers began taking temperature and PAR measurements every thirty minutes starting at 0000 hrs on 10 April 2006, ending 20 weeks later at 2400 hrs on 26 August 2007. All loggers were placed on the northern-facing edge of a fence post.

2007 Field Season

During the 2007 field season, data loggers were placed at eighteen locations 0-, 100-, 200-, 300-, and 400 meters from the edge from four cardinal directions. Loggers were placed at each site in the forest patch on 28 April 2007. Initially, the northernmost logger was set up on the northern edge of the forest patch, which abutted a small wetland area, at a location that would ensure the ability to have nine total locations along the plane. Additional loggers were placed 100 meters apart heading south. A total of 9 loggers were erected along the north-south plane, with the southernmost logger located on an edge along a two-lane road. The westernmost logger was set up on the western edge of the forest patch, which abutted a field, at a location that would again ensure the ability to have nine total loggers along the plane. Additional loggers were placed 100 meters apart heading east. A total of 9 loggers were erected along the east-west plan, with the

easternmost logger located on an edge abutting a small wetland area. Data loggers began taking temperature and PAR measurements every thirty minutes starting at 0000 hrs on 29 April 2007, ending 15 weeks later at 2400 hrs on 10 August 2007. All loggers were placed on the northern-facing edge of a fence post.

Bird Surveys

To determine how numbers and species of forest birds change from the edge towards the interior of a forest patch, bird population counts (presence and relative abundance) were conducted.

In the eastern United States, forest bird communities are grouped into five main categories: (1) bark foragers such as Northern Flicker (*Colaptes auratus*), White-breasted Nuthatch (*Sitta carolinesis*), Downy Woodpecker (*Picoides pubescens*), and Hairy Woodpecker (*Picoides villosus*); (2) active gleaners feeding in the tree canopy such as Chickadees (*Parus* spp.), Tufted Titmouse (*Baeolophus bicolor*), and Red-eyed Vireo (*Vireo olivaceus*); (3) pursuers feeding in tree canopy with a sit-and-wait hunting strategy such as Flycatchers (*Empidonax* spp.) and Tanagers (*Piranga* spp.); (4) ground species associated with shrub and sapling layers such as Thrushes (family *Turdidae*), Eastern Towhee (*Pipilo erythrophthalmus*), and Ovenbird (*Seiurus aurocapillus*); and (5) species associated with dense growth of saplings and small trees such as Warblers (family *Parulidae*) (Sullivan, 1995).

Using the bird list compiled by Banshee Reeks Park (Appendix 6) or Prince William Forest Park (Appendix 7) as a rough reference, I catalogued the avian species observed visually or aurally. I conducted all bird observations. Species were catalogued while on approach to the site (located within approximately a 3-meter radius of the data logger) and while at the site during the three-minute period at each logger site (Hamel et al., 1996; Nichols et al., 2000).

2005 Field Season

Bird observations were made at each microclimate data location, beginning at various locations, on ten separate days. Observations were taken over the course of twelve weeks (28 May 2005 to 14 August 2005). Observations began on separate dates at each 0m site, each 50m site, and north 100m and south 100m. The observations started at these various locations to serve as a randomization in that the same starting location and/or sampling pattern was not used more than once. The sets of observations starting on the northern plane were taken from north to south, then west to east. The sets of observations starting at north 50m and north 100m concluded with north 25m and north 75m respectively. The sets of observations starting on the eastern plane were taken from east to west, then south to north. The set of observations starting at east 50m concluded with east 25m. The sets of observations starting on the southern plane were taken from south to north, then east to west. The sets of observations starting at north 50m and north 100m concluded with south 25m and south 75m respectively. The sets of observation starting on the western plane were taken from west to east, then north to south. The set of observations starting

at west 50m concluded with west 25m. Nine sets of observations were conducted starting at approximately 0700 hrs. One set of observations was conducted starting at approximately 1630 hrs.

2006 Field Season

Bird observations were made at each microclimate data location, beginning at various locations, on twelve separate days. Observations were taken over the course of sixteen weeks (30 April 2006 to 20 August 2006). Observations began on separate dates at each 0m site, each 250m or 300m (in the case of the northwest plane) site, at each 150m site. The observations started at these various locations to serve as a randomization in that the same starting location and/or sampling pattern was not used more than once. The sets of observations starting at each edge location were followed by observations going from the edge to the interior on each plane, in a clockwise pattern. The sets of observations starting at each interior location were followed by observations going from the interior to the edge on each plane, in a counter-clockwise pattern. The sets of observations starting at the 150m site along the east and west plane were followed by observations going from the edge to the interior on each plane, in a clockwise pattern. The sets of observations starting at the 150m site along the northwest and southeast plane were followed by observations going from the interior to the edge on each plane, in a counter-clockwise pattern. All observations were conducted starting between approximately 0645 hrs and 0800 hrs.

2007 Field Season

Bird observations were made at each microclimate data location, beginning at various locations, on ten separate days. Observations were taken over the course of eleven weeks (12 May 2005 to 29 July 2005). The first four sets of observations began on separate dates at each 0m site, and random locations thereafter. The observations started at these various locations to serve as a randomization in that the same starting location and/or sampling pattern was not used more than once. The sets of observations starting at each edge location were followed by observations going to the opposite edge of the patch along the plane, followed by observations starting at the counter-clockwise edge of the other plane with observations going from edge to edge on that plane. The other six observations started at random starting locations chosen using a random number generating program. Additionally, the direction into the forest patch was chosen randomly. These six observations began at South 200m, West 200m, East 300m, West 300m, West 100m, and South 400m. All observations were conducted starting at approximately 0630 hrs.

Forest Interior Conditions

The third objective of this study was to determine if the point within a forest patch where air temperature and PAR stabilize is a good indicator of interior forest conditions as measured by the presence of interior forest birds. Data collected from the HOBO pendant data loggers were used to determine where conditions of temperature, PAR,

canopy coverage, and stand structure stabilize. This information was then used as an indication of interior forest conditions. Using the four categories described by Whitcomb et al. (1981), avian species observed were categorized. The presence and relative abundance of each category of bird was compared to data generated from the data loggers to determine if there is a relationship between microclimate variables and the presence of interior forest birds.

Data Analysis

To determine how air temperature and PAR change from the edge towards the interior of a forest patch, Microsoft Excel was used. The daily minimum temperature, maximum temperature, average temperature, temperature difference between the minimum and maximum, and maximum PAR were determined. The data was analyzed to determine minimum temperature, maximum temperature, difference between minimum and maximum temperature, maximum PAR, and average weekly maximum PAR. The data was also analyzed to determine the overall minimum temperature, maximum temperature, average temperature, maximum PAR, and average maximum PAR throughout the course of each field season.

To determine how air temperature, PAR, and distance from the edge were related to the numbers of birds and numbers of species observed at each location, the Poisson Regression model was used. The program used to run the statistical evaluation was "R," a statistical package that is readily available on the Internet (R Development Core Team,

2005). The Poisson regression was chosen because the response variable, the number of birds observed, is integer-valued, with many of the counts being small (e.g., 0 or 1) and because of evidence of use in similar situations throughout the literature (Henderson et al., 2000, Purcell et al., 2005, Tharme et al., 2001, Royle and Wilke, 2005). A Poisson distribution is the probability distribution of the number of occurrences of a rare event that has several opportunities to happen (www.reference.com). The equation for the model used was $\log (E(B)) = B_0 + B_1 x$ where E(B) is the expected number of birds per observation period, B_0 is the intercept, B_1 is the coefficient of PAR, and x is the observed value of PAR.

To determine how numbers and species of forest birds change from the edge towards the interior of a forest patch, the readings taken at each site were analyzed. Poisson regression analysis was used to determine significance with p=0.05. Specifically, the tests were of the null hypothesis that the coefficient of PAR is 0 against the alternative that the coefficient is nonzero (which gives a relationship between PAR and the mean number of birds observed). Analysis was run on data from each observation taken over the course of the study. For example, the data used for statistical analysis of an observation done for birds from 0845 to 0848 on 25 July 2005 were the number of birds seen during that three-minute period and the temperature and PAR readings recorded nearest to that time period. Statistical analysis was run on the number of birds observed versus temperature, the number of birds observed versus PAR, the number of birds

observed versus distance into the patch, and all combinations of temperature, PAR, and distance.

Degree-days were also calculated for each field season. Degree-days are correlated to minimum total temperature requirements for different plant species to complete vegetative and reproductive cycles. For example, broadleaf deciduous forests require approximately 1600-2000 degree-days to complete their vegetative cycle, and approximately 2000-2800 degree-days to complete their reproductive cycle. Though temperature was not collected for the entire growing season, this degree-day calculation provides a good estimation of plant growth at each data collection site (Woodward, 1992).

RESULTS

2005 Field Season

Summaries of bird observations, trees catalogued, temperature readings, and PAR readings are presented in Appendix 1. Temperature and PAR data are presented in Appendix 1, Tables 1-24.

Thirteen species of birds were observed within 3 meters of the 24 data logger sites. Birds observed included Acadian Flycatcher (*Empidonax virescens*), American Crow (*Corvus brachyrhynchos*), American Robin (*Turdus migratorius*), Brown Thrasher (*Toxostoma rufum*), Eastern Towhee (*Pipilo erythrophthalmus*), Grey Catbird (*Dumetella carolinensis*), Hairy Woodpecker (*Picoides villosus*), Northern Cardinal (*Cardinalis cardinalis*), Ovenbird (*Seiurus aurocapillus*), Pileated Woodpecker (*Dryocopus pileatus*), Tufted Titmouse (*Baeolophus bicolor*), White-breasted Nuthatch (*Sitta carolinensis*), and Wood Thrush (*Hylocichla mustelina*). Average numbers of species of birds and average number of birds observed at each location into the woods (0-, 25-, 50-, 75-, 100-, and 125m) are presented in Figure 6.

As classified by Whitcomb et al. (1981), the Acadian Flycatcher, Hairy Woodpecker, Ovenbird, Pileated Woodpecker, and White-breasted Nuthatch are forest-interior specialists. The Eastern Towhee, Grey Catbird, Northern Cardinal, Tufted Titmouse, and Wood Thrush are interior-edge generalists. The Brown Thrasher is an edge species. The American Crow and American Robin are field-edge species.

The results of the 2005 field season indicate that birds observed during the study do not correspond well to the classifications described by Whitcomb et al. (1981). The forest-interior specialists were located throughout the forest, in the interior, on the edge, and in between. The Acadian Flycatcher was observed at 25-, 50-, 75-, 100-, and 125m from the forest edge. The Hairy Woodpecker was located at 25m from the forest edge. The Ovenbird was located at 0m from the forest edge. The Pileated Woodpecker was located at 0- and 75m from the forest edge. The White-breasted Nuthatch was located at 0- and 75m from the forest edge.

The interior-edge generalists were located primarily at the forest edge, with some observations throughout the forest. The Eastern Towhee, Grey Catbird, and Northern Cardinal were located only at 0m from the forest edge. The Tufted Titmouse was located at 0- and 75m from the forest edge. The Wood Thrush was located at all distances into the forest (0-, 25-, 50-, 75-, 100-, and 125m).

The Brown Thrasher, an edge species, was located only at the forest edge. The field-edge species were not located at the edge, but rather throughout the forest. The American Crow was located at 75m from the edge, though these observations only occurred in the forest canopy as the birds were presumably flying over the patch. The American Robin was located at 25-, 50-, 75-, 100-, and 125m into the forest.

Eleven species of trees were catalogued within 3 meters of 24 data logger sites. Trees observed included American Elm (*Ulmus americana* L.), Black Tupelo (*Nyssa sylvatica* Marsh.), Buckthorne Shrub (*Rhamnaceae* spp.), Common Persimmon (*Diospyros viriniana* L.), Hackberry (*Celtis occidentalis* L.), Northern Pin Oak (*Quercus ellipsoidalis* E. J. Hill), Red Maple (*Acer rubrum* L.), September Elm (*Ulmus serotina* Sarg.), Sugar Maple (*Acer saccharum* Marsh.), Washington Hawthorne (*Crataegus phaenopyrum* (L. f.) Medic.), and Yellow Poplar (*Liriodendron tulipifera* L.).

In general, temperature held fairly steady from the edge toward the interior of the forest patch and PAR decreased from the edge to the interior of the forest patch. The path running through the middle of the patch led to increased temperature and PAR readings at a few of the interior data logger sites. Average maximum and minimum temperatures, as well as overall average temperatures for the sites along the North to South transect are presented in Figure 7. Temperature data for the East to West transect are presented in Figure 8. The overall maximum PAR reading and the average daily maximum PAR

reading for the sites along the North to South Transect are presented in Figure 9. PAR data for the East to West transect are presented in Figure 10.

Degree-days were calculated for each site by averaging all temperatures for days where the mean temperature was over 0°C, and multiplying the average by the number of days of temperature collection (84). The results of the comparison of degree-days to distance into the patch indicate that temperature decreased from forest edge to forest interior (Figure 11).

Statistical analysis was conducted using a Poisson regression to determine the influence of temperature, PAR, and distance into the forest patch on the number of birds observed at each location. Poisson regression was performed using three separate models, one for each variable—temperature, PAR, and distance. Results of analyses indicated that there was statistical significance in the relation between birds observed and PAR ($p=0.02$). Statistical significance was not observed in the relation between birds observed and temperature ($p=0.40$) or between birds observed and distance into the forest patch ($p=0.10$).

2006 Field Season

Summaries of bird observations, trees catalogued, temperature readings, and PAR readings are presented in Appendix 2. Temperature and PAR data are presented in Appendix 2, Tables 25-49.

Twenty-three species of birds were observed within 3 meters of the 25 data logger sites. Birds observed included American Crow (*Corvus brachyrhynchos*), American Robin (*Turdus migratorius*), Blue Grey Gnatcatcher (*Polioptila caerulea*), Blue Jay (*Cyanocitta cristata*), Brown Thrasher (*Toxostoma rufum*), Carolina Chickadee (*Poecile carolinensis*), Downy Woodpecker (*Picoides pubescens*), Eastern Phoebe (*Sayornis phoebe*), Eastern Wood Pewee (*Contopus virens*), Great Crested Flycatcher (*Myiarchus crinitus*), Grey Catbird (*Dumetella carolinensis*), Hairy Woodpecker (*Picoides villosus*), Hermit Thrush (*Catharus guttatus*), Northern Cardinal (*Cardinalis cardinalis*), Northern Flicker (*Colaptes auratus*), Ovenbird (*Seiurus aurocapillus*), Pileated Woodpecker (*Dryocopus pileatus*), Red Tailed Hawk (*Buteo jamaicensis*), Scarlet Tanager (*Piranga olivacea*), Tufted Titmouse (*Baeolophus bicolor*), White-breasted Nuthatch (*Sitta carolinensis*), Wood Thrush (*Hylocichla mustelina*), and Yellow-billed Cuckoo (*Coccyzus americanus*). Average numbers of species of birds and average number of birds observed at each location into the woods (0-, 50-, 100-, 150-, 200-, 250- and 300m) are presented in Figure 12.

As classified by Whitcomb et al. (1981), the Hairy Woodpecker, Ovenbird, Pileated Woodpecker, Scarlet Tanager, and White-breasted Nuthatch are forest-interior specialists. One species, the Hermit Thrush, was not classified by Whitcomb et al. (1981), but was classified as an interior species by Hobson and Bayne (2000). The Blue Grey Gnatcatcher, Blue Jay, Carolina Chickadee, Downy Woodpecker, Eastern Phoebe, Eastern Wood Peewee, Great Crested Flycatcher, Grey Catbird, Northern Cardinal,

Northern Flicker, Tufted Titmouse, Wood Thrush, and Yellow-billed Cuckoo are interior-edge generalists. The Brown Thrasher is an edge species. The American Crow and American Robin are field-edge species. One species, the Red-tailed Hawk, was not classified as a forest bird by either Whitcomb et al. (1981) or Hobson and Bayne (2000). However, the Field Guide to the Birds of North America (National Geographic, 1999) describes the Red-tailed Hawk of inhabiting forests and open fields.

The results of the 2006 field season indicate that birds observed during the study correspond, for the most part, with the classifications described by Whitcomb et al. (1981). Two of the forest-interior species were located at 50m from the forest edge, and two were located at the forest edge. Additionally, all forest-interior species were located at least 100m from the forest edge. The Hairy Woodpecker was located at 50- and 100m from the forest edge. The Hermit Thrush was located at 200m from the forest edge. The Ovenbird was located at 250m from the forest edge. The Pileated Woodpecker was located at 150m from the forest edge. The Scarlet Tanager was located at 0-, 100-, 150-, 200-, and 250m from the forest edge. The White-breasted Nuthatch was located at 0-, 50-, 100-, 200-, and 250m from the forest edge.

The interior-edge generalists were located at all locations throughout the forest. The Blue Grey Gnatcatcher was located 150m from the forest edge. The Blue Jay was located at 0-, 50-, 100-, 150-, 250-, and 300m from the forest edge. The Carolina Chickadee was located 0 and 100m from the forest edge. The Downy Woodpecker was located at the

forest edge. The Eastern Phoebe was located at 150- and 200m from the forest edge. The Eastern Wood Peewee was located at 0-, 200-, and 250m from the forest edge. The Great Crested Flycatcher was located at 150-, 200-, and 250m from the forest edge. The Grey Catbird was located at 0- and 50m from the forest edge. The Northern Cardinal was located at the forest edge. The Northern Flicker was located at 250m from the forest edge. The Tufted Titmouse was located at 100- and 150m from the forest edge. The Wood Thrush was located at 0-, 50-, 100-, 150-, 200-, and 250m from the forest edge. The Yellow-billed Cuckoo was located 150m from the forest edge.

The Brown Thrasher, an edge species, was located only at the forest edge.

The field-edge species were located at the forest edge and at locations further into the forest. The American Crow was located at 0 and 250m from the edge. The American Robin was located at 0-, 50-, 100-, and 150m into the forest.

Twelve species of trees were catalogued within 3 meters of the 25 data logger locations. Tress observed included Bear Oak (*Quercus ilicifolia* Wangenh.), Chestnut Oak (*Quercus prinus* L.), Common Persimmon (*Diospyros viriniana* L.), Flowering Dogwood (*Cornus florida* L.), Northern Red Oak (*Quercus rubra* L.), Red Maple (*Acer rubrum* L.), Scarlet Oak (*Quercus coccinea* Muenchh.), September Elm (*Ulmus serotina* Sarg.), Virginia Pine (*Pinus virginiana* Mill.), Washington Hawthorne (*Crataegus phaenopyrum* (L. f.) Medic.), White Oak (*Quercus alba* L.), and Yellow Poplar (*Liriodendron tulipifera* L.).

In general, the average temperature held fairly steady throughout the forest patch. The minimum temperature increased from the edge to the interior of the forest patch while the maximum temperature was variable throughout the forest patch. Average maximum and minimum temperatures, as well as overall average temperatures for the sites along the Northwest to Southeast transect are presented in Figure 13. Temperature data for the East to West transect are presented in Figure 14.

The maximum and average daily PAR was variable throughout the forest patch. The overall maximum PAR reading and the average daily maximum PAR reading for the sites along the Northwest to Southeast Transect are presented in Figure 15. The maximum PAR reading was highest on the Southeastern edge of the transect. PAR was lowest at the interior of the forest patch on the East to West transect (Figure 16).

Degree-days were calculated for each site by averaging all temperatures for days where the mean temperature was over 0°C, and multiplying the average by the number of days of temperature collection (139). The results of the comparison of degree-days to distance into the patch indicate that temperature increased from forest edge to forest interior (Figure 17).

Statistical analysis was conducted using a Poisson regression to determine the influence of temperature, PAR, and distance into the forest patch on the number of birds observed at each location. Poisson regression was performed using three separate models, one for

each variable—temperature, PAR, and distance. Results of analyses indicated that there was statisitcal significance in the relation between birds observed and distance into the forest patch (p=0.04), with numbers of observations decreasing with distance from the forest edge. Statistical significance was not observed between birds observed and temperature (p=0.67) or between birds observed and PAR (p=0.81).

2007 Field Season (Prince William Forest)

Summaries of bird observations, trees catalogued, temperature readings, and PAR readings are presented in Appendix 3. Temperature and PAR data are presented in Appendix 3, Tables 50-67.

Twenty species of birds were observed within 3 meters of the 18 data logger sites. Birds observed included Acadian Flycatcher (*Empidonax virescens*), Carolina Chickadee (*Poecile carolinensis*), Eastern Phoebe (*Sayornis phoebe*), Eastern Towhee (*Pipilo erythrophthalmus*), Eastern Wood Pewee (*Contopus virens*), Field Sparrow (*Spizella pusilla*), Hooded Warbler (*Wilsonia citrina*), Least Flycatcher (*Empidonax minimus*), Louisiana Waterthrush (*Seiurus motacilla*), Ovenbird (*Seiurus aurocapillus*), Pileated Woodpecker (*Dryocopus pileatus*), Red-eyed Vireo (*Vireo olivaceus*), Red-tailed Hawk (*Buteo jamaicensis*), Ruby-throated Hummingbird (*Archilochus colubris*), Scarlet Tanager (*Piranga olivacea*), Song Sparrow (*Melospiza melodia*), Tufted Titmouse (*Baeolophus bicolor*), White-breasted Nuthatch (*Sitta carolinensis*), White-eyed Vireo (*Vireo griseus*), and Yellow-billed Cuckoo (*Coccyzus americanus*). Average numbers of

species of birds and average number of birds observed at each location into the woods (0-, 100-, 200-, 300-, and 400m) are presented in Figure 18.

As classified by Whitcomb et al. (1981), the Acadian Flycatcher, Hooded Warbler, Louisiana Waterthrush, Ovenbird, Pileated Woodpecker, Scarlet Tanager, and White-breasted Nuthatch are forest-interior specialists. The Carolina Chickadee, Eastern Phoebe, Eastern Towhee, Eastern Wood Peewee, Red-eyed Vireo, Ruby-throated Hummingbird, Tufted Titmouse, White-eyed Vireo, and Yellow-billed Cuckoo are interior-edge generalists. The Field Sparrow and Song Sparrow are edge species. One species, the Least Flycatcher, was not classified by Whitcomb et al. (1981), but was classified as an edge species by Hobson and Bayne (2000). One species, the Red-tailed Hawk, was not classified as a forest bird by either Whitcomb et al. (1981) or Hobson and Bayne (2000). However, the Field Guide to the Birds of North America (National Geographic, 1999) describes the Red-tailed Hawk of inhabiting forests and open fields.

The results of the 2007 field season indicate that birds observed during the study correspond, with the exception of the forest-interior specialists, with the classifications described by Whitcomb et al. (1981). The forest-interior specialists were located throughout the forest, with five of seven being located on the forest edge. The Acadian Flycatcher was observed at 0-, 100-, 200-, 300-, and 400m from the forest edge. The Hooded Warbler was located at 0- and 100m from the forest edge. The Louisiana Waterthrush was located at 0- and 400m from the forest edge. The Ovenbird was located

at 200- and 400m from the forest edge. The Pileated Woodpecker was located at 200- and 400m from the forest edge. The Scarlet Tanager was located at 0-, 100-, 200-, and 400m from the forest edge. The White-breasted Nuthatch was located at 400m from the forest edge.

The interior-edge generalists were located at all locations throughout the forest. The Carolina Chickadee was located at 0-, 100-, 200-, 300-, and 400m from the forest edge. The Eastern Phoebe was located at 200m from the forest edge. The Eastern Towhee was located at the forest edge. The Eastern Wood Peewee was located at 200m from the forest edge. The Red-eyed Vireo was located at 100-, 200-, and 400m from the forest edge. The Ruby-throated Hummingbird was located at the forest edge. The Tufted Titmouse was located at 0, 200-, and 300m from the forest edge. The White-eyed Vireo was located at 300m from the forest edge. The Yellow-billed Cuckoo was located at 0-, 100-, and 300m from the forest edge.

The edge species were found primarily at the forest edge. The Field Sparrow was located at the forest edge. The Least Flycatcher was located at 100m from the forest edge. The Song Sparrow was located at the forest edge.

No field-edge species were observed in the 2007 field season.

Sixteen species of trees were catalogued within 3 meters of the 18 data logger locations. Tress observed included American Beech (*Fagus grandifollia* Ehrh.), American Holly (*Ilex opaca* Ait.), Bear Oak (*Quercus ilicifolia* Wangenh.), Chestnut Oak (*Quercus prinus* L.), Common Persimmon (*Diospyros viriniana* L.), Eastern Cottonwood (*Populus deltoides* Bartr. ex. Marsh.), Eastern Red Cedar (*Juniperus silicicola* (Small) Bailey), Mountain Laurel (*Kalmi latifolia* L.), Northern Pin Oak (*Quercus ellipsoidalis* E. J. Hill), Northern Red Oak (*Quercus rubra* L.), Red Maple (*Acer rubrum* L.), Sassafras (*Sassafras albidum* (Nutt.) Nees), Shingle Oak (*Quercus imbricaria* Michx.), Sugar Maple (*Acer saccharum* Marsh.), White Oak (*Quercus alba* L.), and Yellow Poplar (*Liriodendron tulipifera* L.).

In general, temperature and PAR decreased from the edge to the interior of the forest patch (Figure 19). The 200m South data logger launched at the beginning of the season failed. The data logger was replaced and began recording six weeks into the season. All data prior to that point were lost. Therefore, temperature and PAR data for the 200m South logger are not included in the overall temperature and PAR trends. Individual results are presented in Table 56. Temperature data for the East to West transect are presented in Figure 20. The overall maximum PAR reading and the average daily maximum PAR reading for the sites along the North to South Transect are presented in Figure 21. PAR data for the East to West transect are presented in Figure 22.

Degree-days were calculated for each site by averaging all temperatures for days where the mean temperature was over 0°C, and multiplying the average by the number of days of temperature collection (104). The results of the comparison of degree-days to distance into the patch indicate that temperature decreased from forest edge to forest interior (Figure 23).

Statistical analysis was conducted using a Poisson regression to determine the influence of temperature, PAR, and distance into the forest patch on the number of birds observed at each location. Poisson regression was performed using three separate models, one for each variable—temperature, PAR, and distance. Results of analyses indicated that statisitcal significance was not observed in the relation between birds observed and temperature ($p=0.25$), between birds observed and distance into the forest patch ($p=0.61$), and between birds observed and PAR ($p=0.97$).

DISCUSSION

Bird Observations

In the 2005 field season, observations of forest birds were not closely related to the categories described by Whitcomb et al. (1981). Possible explanations for this may have been the size of the forest patch, the number of birds observed, or the distance between observation sites. If the patch was too small, birds may have needed to use more area for foraging and breeding. If the observation sites were further apart, some of the observations may have corresponded more closely with Whitcomb's categories.

To further investigate the relationship between birds observed and patch size, larger patch sizes and distances between observation sites were increased for the 2006 and 2007 field seasons. The results of the 2006 field season found that birds corresponded more closely to the categories of Whitcomb et al. (1981) than did the observations from the 2005 field season, with only two of six forest-interior specialists being located at the forest edge. The one edge species observed in the 2006 field season was observed only at the edge. The field-edge species were observed at the edge, and also at distances further into the patch. The result of the 2007 field season also found that birds corresponded well with the categories of Whitcomb et al. (1981), though the majority of the forest-interior specialists were also found at the edge of the forest patch. The edge species were found

only at 0- or 100m into the forest patch. These results would indicate that patches of ~100 hectares or larger are required for birds to establish their historical habitat gradients. These results correspond well to those of Stouffer and Borges (2001) who also found that patch sizes of 100 hectares and smaller are of little use to forest birds.

The 2005 field season results indicate that the number of species of birds observed was higher at the edge than the interior. However, there was not a strong pattern of decrease. The numbers of birds observed was higher at the edge than the interior, but the total number of birds observed at the edge of the forest patch was also the same number of birds observed half-way into the forest patch. There was not a strong pattern of decrease.

The 2006 field season results indicate that the number of species of birds observed was higher at the edge than the interior. However, there was not a strong pattern of decrease. The numbers of birds observed was higher at the edge than the interior, but there was not a clear pattern of decrease with increased distance into the patch, with the 100-, 150-, and 250m locations having nearly identical results in both average number and average species of birds.

The 2007 field season results indicate that both the number of birds and number of species were fairly evenly distributed throughout the forest patch. The highest average number of birds was observed 200m from the forest edge. The highest average number of species of birds was observed at 0- and 400m from the forest edge.

Seventy-seven birds were observed during the 2005 field season, ninety-nine during the 2006 field season, and seventy-six during the 2007 field season. However, the number of days of observations and the number of observation locations (data loggers) were not the same from year to year. When adjusted for the number of days of observations and the number of observation locations, the number of birds seen per day per location was the highest during the 2007 field season, followed by the 2006 field season, and the 2005 field season. On average, 0.42 birds were observed per day per location in 2007, 0.33 were observed per day per location in 2006, and 0.32 were observed per day per location in 2005.

Thirteen species of birds were observed during the 2005 field season, 23 during the 2006 field season, and 20 during the 2007 field season. When adjusted for the number of days of observations and the number of observation locations, the number of species of birds seen per day per location was the highest during the 2007 field season, followed by the 2006 field season, and the 2005 field season. On average, 0.11 species were observed per day per location in 2007, 0.08 species were observed per day per location in 2006, and 0.05 species were observed per day per location in 2005. The results of the number of birds and number of species observed indicate that a larger forest patch allows for more diversity and higher occupancy than smaller patches.

A graph of the number and species of birds, adjusted for the number of days of observations and the number of observation locations, is presented in Figure 24. The

results indicate that the average number of birds held steady from the edge to the interior, while the average number of species increased from the edge to the interior.

Four birds were observed in all three field seasons including three forest-interior specialist (Ovenbird, Pileated Woodpecker, and White-breasted Nuthatch) and one interior-edge generalist (Tufted Titmouse). All birds observed in the 2005 field season were also observed in the 2006 and/or 2007 field season. Six bird species were only observed in the 2006 field season including one forest-interior specialist (Hermit Thrush), and five interior-edge generalists (Blue Grey Gnatcatcher, Blue Jay, Downy Woodpecker, Great Crested Flycatcher, and Northern Flicker). Eight species were only observed in the 2007 field season including two forest-interior specialists (Hooded Warbler and Louisiana Waterthrush), three interior-edge generalists (Red-eyed Vireo, Ruby-throated Hummingbird, and White-eyed Vireo), and three edge species (Field Sparrow, Least Flycatcher, and Song Sparrow).

Data from this study correspond to that of Robbins et al. (1989), in which the authors conducted research on forest birds in western Maryland and northern West Virginia. They found that observations of American Robin and Grey Catbird decreased with increasing patch size, similar to observations from this study. They also found that observations of Acadian Flycatcher, Louisiana Waterthrush, Ovenbird, Red-eyed Vireo, and Scarlet Tanager increased with increasing patch size—again similar to the data from this study.

Stand Structure

The number of tree species catalogued over the course of the study increased with forest patch size. In general, the forest patch at Prince William Forest had larger trees and more oaks than the other patches. This is likely due to the fact that Prince William Forest was established in 1936 while Banshee Reeks Park was established in 1999. The succession of Banshee Reeks from field to forest is still fairly evident as several young trees, especially Yellow Poplar, are present in the forest.

The presence of specific trees or specific size trees had no bearing on the number or species birds observed at any one location. Overall, the fact that Prince William Forest had more interior forest birds than the other two patches could be related to the fact that the habitat was more suitable for these species, though there is no clear indication.

Microclimate

At the 2005 field site, temperature and PAR decreased with distance into the forest patch. Temperature and PAR readings were higher at the edges of the forest patch than the interior of the forest patch. There were a few interior locations with high temperature and PAR readings that can be attributed to a path running through the forest patch. In addition, degree-days were higher at the edge locations and decreased from the edge to the interior of the forest patch.

At the 2006 field site, the average temperature held fairly steady throughout the forest patch. The minimum temperature increased from the edge to the interior of the forest patch while the maximum temperature was variable throughout the forest patch. The maximum and average daily PAR was variable throughout the forest patch, with no clear trends observed. The variance in temperature could be related to gaps in the forest canopy as evidenced by high PAR readings at 150m from the eastern edge and 250m from the northwestern and southeastern edges. Degree-days increased from the forest edge to the interior, which appears to be due to a low reading from the data logger at the Southeast edge. A lake was located within 50m from the data logger, which may have led to lower average temperatures than expected.

The microclimate data from the 2007 Prince William site were similar to those of the 2005 field season, with temperature and PAR decreasing from the edge to the interior of the forest patch. Additionally, degree-days were higher at the edge locations and decreased from the edge to the interior of the forest patch.

Data Analysis

When Poisson regression was initially used to analyze data from the 2005 field season, the model did not fit well. In an attempt to find a model that did fit well, the data were transformed in several ways. The PAR, the log of PAR, temperature, the log of temperature, distance into the forest patch, and the square of distance into the forest patch were all analyzed separately and in combination. The results presented are from three

separate models, birds and temperature, birds and PAR, and birds and distance into the forest patch.

In analyzing data from the 2005 field season, the results of Poisson regression indicated that PAR and distance were the most significant factors in the analysis. Therefore, temperature was removed from the model. Analysis with PAR and distance into the patch indicated that if PAR is adjusted for, additionally adjusting for distance is not necessary. Therefore distance was removed from the model. The results indicated that the one set of afternoon observations taken on 08 June 2005 did not add value to the model. In addition, a PAR reading of 380.5 lux was determined to be an outlier because the reading was observed at the eastern edge location at one time point each day for four days during the course of a week, and was not consistent with other PAR readings in the area or at similar locations. The afternoon readings and the outlier reading were not included in the statistical analysis. Ultimately, analysis was performed on birds and PAR as PAR was the only statistically significant variable.

In analyzing data from the 2006 field season, the results of Poisson regression indicated that distance into the patch was the most significant factor in the analysis. Transformations of distance, PAR, and temperature, and combinations of the three factors did not add value to the model. Therefore, PAR and temperature were removed from the model leaving analysis of birds and distance into the patch as the only statistically significant variable.

In analyzing data from the 2007 field season, the results of Poisson regression indicated that temperture was the most significant factor in the analysis, though it was not statistically significant. Transformations of distance, PAR, and temperature, and combinations of the three factors did not add value to the model. Therefore, distance and PAR were removed from the model leaving analysis of birds and temperature. Since none of the response variables produced a statistically significant response, the data were further investigated to determine if there was a difference between the edge and the interior. A Poisson Regression was redone with distance replaced with a variable to indicate whether a distance was an edge or a non-edge loctions. The results of this analysis did not produce a statistically significant response.

Data from all three field seasons were examined to determine if locations of high responses of bird observations were due to specific microclimate variables or distance from the edge. The two locations with the highest number of bird observations from each field season were examined. For example, 15 birds were observed at the eastern edge during the the 2005 field season. However, this location did not have exceptionally high or low temperature or PAR readings. Overall, the high responses of birds observations examined did not show a trend with relation to microclimate variables or distance from the edge.

Data from all three field seasons were also examined to determine if the three most frequently observed species were significantly correlated to temperature, PAR, or

distance from the edge. Those birds were the Wood Thrush (forty-six observations), Acadian Flycatcher (twenty-eight observations), and White-breasted Nuthatch (nineteen observations). Poisson regression indicated that neither the Acadian Flycatcher nor White-breasted Nuthatch were significantly related to temperature, PAR, or distance from the edge. The Wood Thrush was significantly correlated to distance from the edge ($p=0.03$). This response indicates that the probability of observing the Wood Thrush decreases with increasing distance from the edge. In examining the data, this response is most likely due to the fact that no Wood Thrush was observed at a data logger location during the 2007 field season, the field season with observations at the greatest distance from the edge.

CONCLUSIONS

Data were collected over three summer field seasons from 2005 through 2007. The forest patch size (~10, ~90, and ~300 hectares) and distances between sensor locations (25, 50, and 100 meters) increased in distance from year to year. These data were used to address three separate questions.

There was not a precise decrease from the forest edge to the forest-interior of either temperature or PAR, as one would expect in an ideal situation. However, two of the three field seasons had general decreases in temperature and PAR. Both temperature and PAR decreased from the edge to the interior of the forest patch during the 2005 and 2007 field seasons, but held fairly steady throughout the forest patch at the 2006 field site. This variance may be due to gaps in the forest patch, or a lake located at the southeastern edge of the 2006 forest plot, which likely decreased the temperature reading at that location.

When all data were examined, the numbers of birds observed held fairly steady with increasing distance from the edge. The number of birds observed was significantly related to PAR in the 2005 field season, significantly related to distance into the forest patch in the 2006 field season, and was not significantly related to any of the variables

measured during the 2007 field season, in which the largest forest patch was used. The number of species of birds observed generally increased from the edge to the interior of the forest patch, though there were not strong patterns of increase in the number of species observed.

Adjustments to the data were made in an attempt to find an overall leading factor linked to bird observations. The two locations with the highest number of bird observations from each field season were examined. The high responses of birds observations examined did not show a trend with relation to microclimate variables or distance from the edge. In further analysis, the three most often observed species of birds were analyzed to determine if statistical significance existed between bird observations and temperature, PAR, and/or distance from the forest edge. The Wood Thrush, which was the most frequently observed species, was statistically linked to distance from the edge with numbers observed decreasing with increased distance from the forest edge.

The 2005 and 2006 field season results indicate that the number of birds and the number of species observed was higher at the edge than the interior though there was not a strong pattern of decrease from the edge to the interior for either. The 2007 field season results indicate that both the number of birds and number of species were fairly evenly distributed throughout the forest patch.

There was no clear indication of a stabilization of temperature (2005 and 2006) and PAR (2005, 2006, and 2007) with increased distance from the edge to the interior of the forest patch in the 2005 or 2006 field seasons. The 2007 field season did show stabilization in average temperature from forest edge to interior than did the other field seasons, though a slight increase was observed at the 300m East location. The results of the 2007 field season indicate that birds observed during the study correspond, with the exception of the forest-interior specialists, with the classifications of Whitcomb et al. (1981). Therefore, the results of this study do not indicate that the point within a forest patch where air temperature and PAR stabilize is a good indicator of interior forest conditions as measured by the presence of interior forest birds.

The number of forest-interior species increased with forest patch size (five in 2005, six in 2006, and seven in 2007). This is expected as increasing patch size allows for a higher percentage of interior forest habitat for birds to utilize. Bird observations in 2005 did not correspond to the categories of Whitcomb et al (1981), with those birds classified as forest edge birds and forest-interior birds located throughout the forest. The results at the larger 2006 field site indicate that birds observed during the study correspond with Whitcomb's classifications. The results of the 2007 field season at the largest forest site indicate that birds observed during the study correspond, with the exception of the forest-interior specialists, with Whitcomb's classifications. In 2007, the forest-interior specialists were located throughout the forest, with five of seven being located on the forest edge.

Data from this study correspond to that of Robbins et al. (1989), who found that observations of American Robin and Grey Catbird decreased with increasing patch size while observations of Acadian Flycatcher, Louisiana Waterthrush, Ovenbird, Red-eyed Vireo, and Scarlet Tanager increased with increasing patch size. In this study, neither the American Robin nor the Grey Catbird were observed in the ~300 hectare patch while the Louisiana Waterthrush and Red-eyed Vireo were observed solely in the ~300 hectare patch.

In comparing bird observations over the three field seasons, the number of birds seen per day per location was the highest during the 2007 field season, followed by the 2006 field season, and the 2005 field season. Hence, the largest forest patch had the highest percentage of bird observations. Since the median forest patch size in Virginia is 29.2 hectares, these results have important policy implications. Policy makers should be aware of these results when determining minimum remnant patch size when allowing forest fragmentation.

These results correspond with those of Stouffer and Borges (2001). The authors found that bird abundance was slightly reduced in 100-hectare fragments when compared to continuous forest and that 1 and 10 hectare patches hold less than 25% of the abundance of birds when compared to continuous forest. They indicate that most birds species in patches of 100 hectares and smaller are likely headed to extinction without regular

immigration of birds from larger patches as patches of fewer than 100 hectares have little conservation value for birds.

Development is currently underway on the land surrounding both Banshee Reeks Park and Prince William Forest Park. As development continues, as is expected from the projected population growth in northern Virginia, forest fragmentation will also continue. The likely results of this development include reduced numbers, local extinction, or even permanent extinction of forest birds.

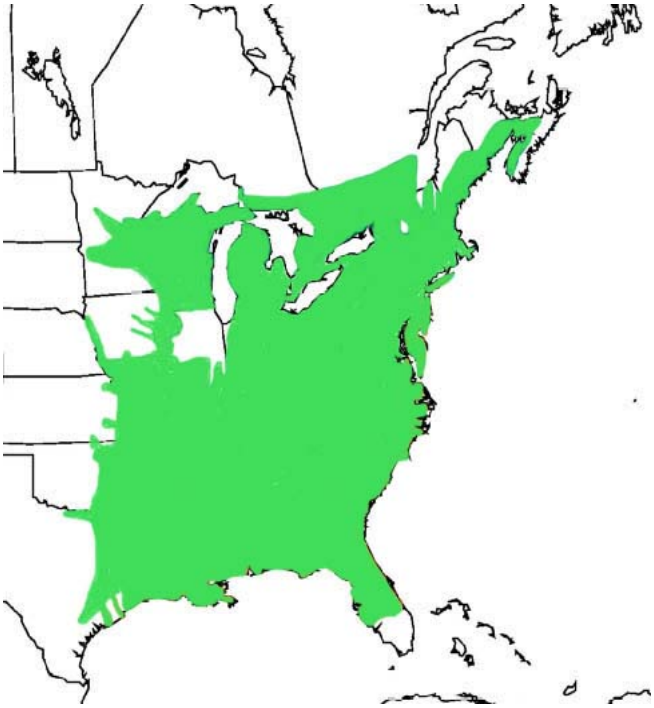


Figure 1—Distribution of eastern deciduous forests in the United States (Nearctica.com, Inc, 2001)

Year	1930[a]	1940[a]	1950[a]	1960[a]	1970[a]	1980[a]	1990[a]	2000[a]	2010[b]	2020[b]	2030[b]
Population	19,852	20,291	21,147	24,549	37,150	57,427	86,129	169,599	301,127	409,907	468,541
Percent Change	-3.5%	2.2%	4.2%	16.1%	51.3%	54.6%	50.0%	96.9%	77.6%	36.1%	14.3%

Figure 2—Decennial Population Trends, 1930-2030: Loudoun County, Virginia (Loudoun County Department of Economic Development, 2006).

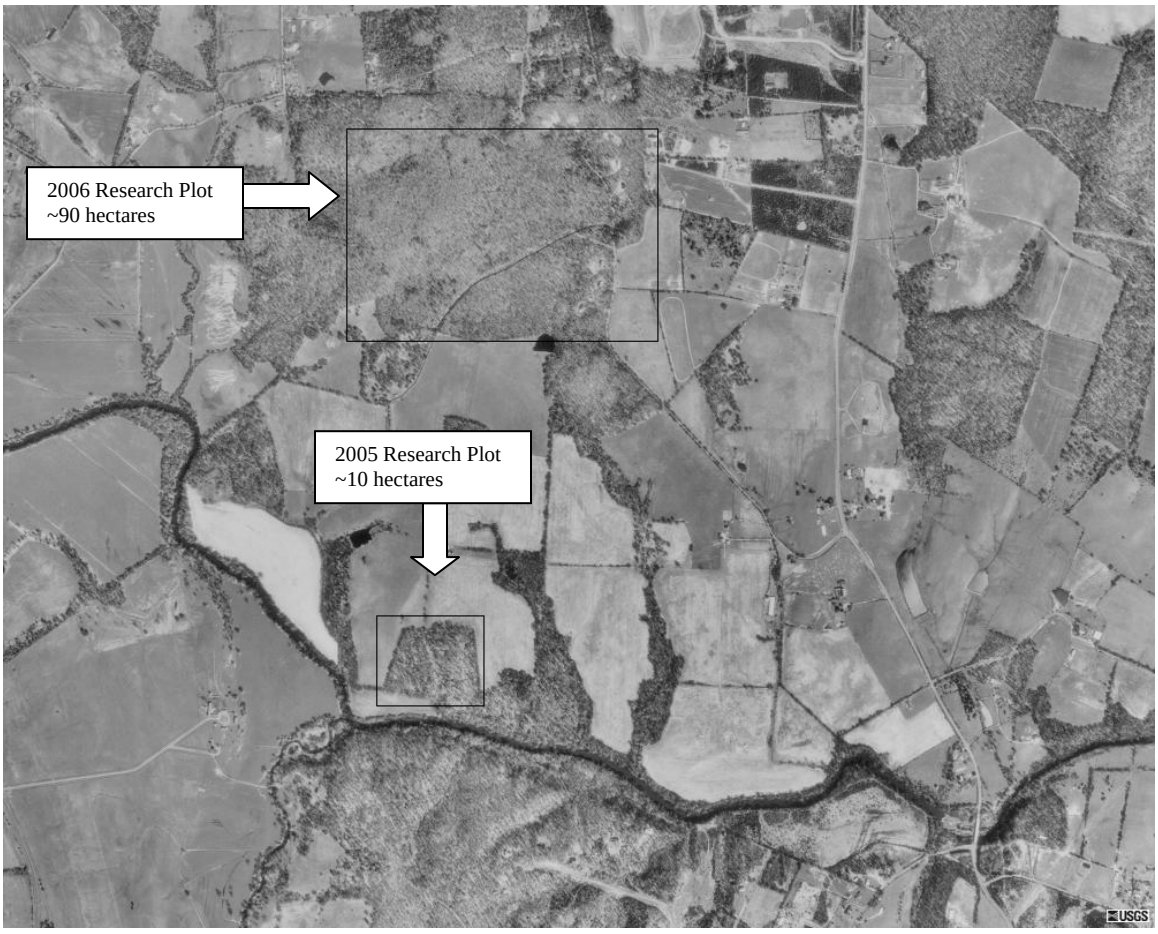


Figure 3—Banshee Reeks Park, Loudoun County, Virginia
(www.terraserver.microsoft.com)

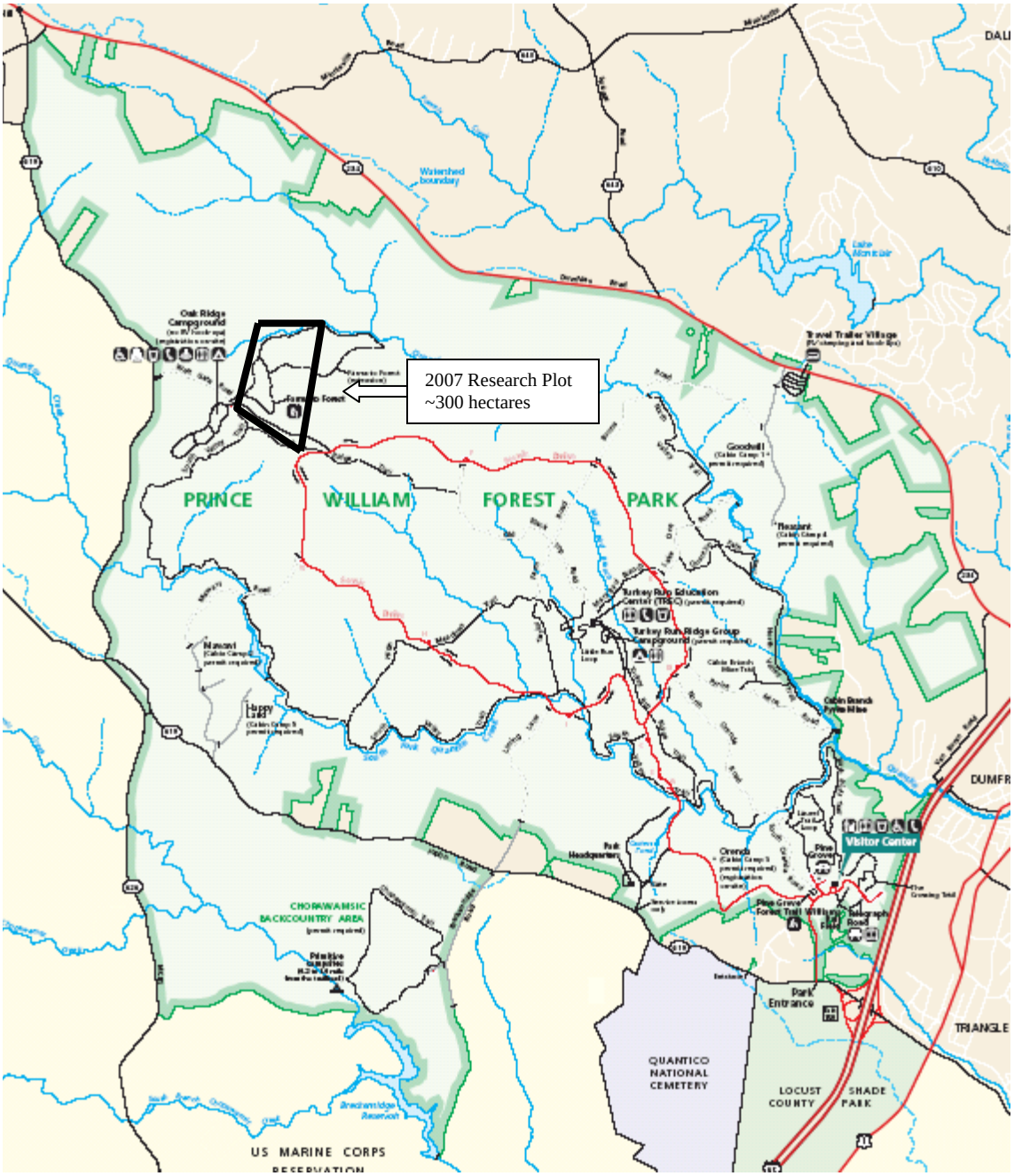
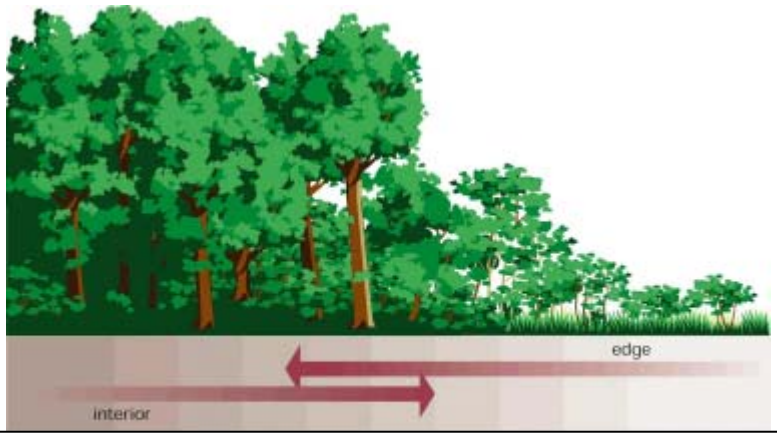


Figure 4—Prince William Forest Park, Prince William County, Virginia (http://www.nps.gov/prwi/index.htm)



125 m 100 m 75 m 50 m 25 m 0 m
(Adopted from The Federal Interagency Stream Restoration Working Group, 1998)

Figure 5—Sampling transect from forest edge to interior

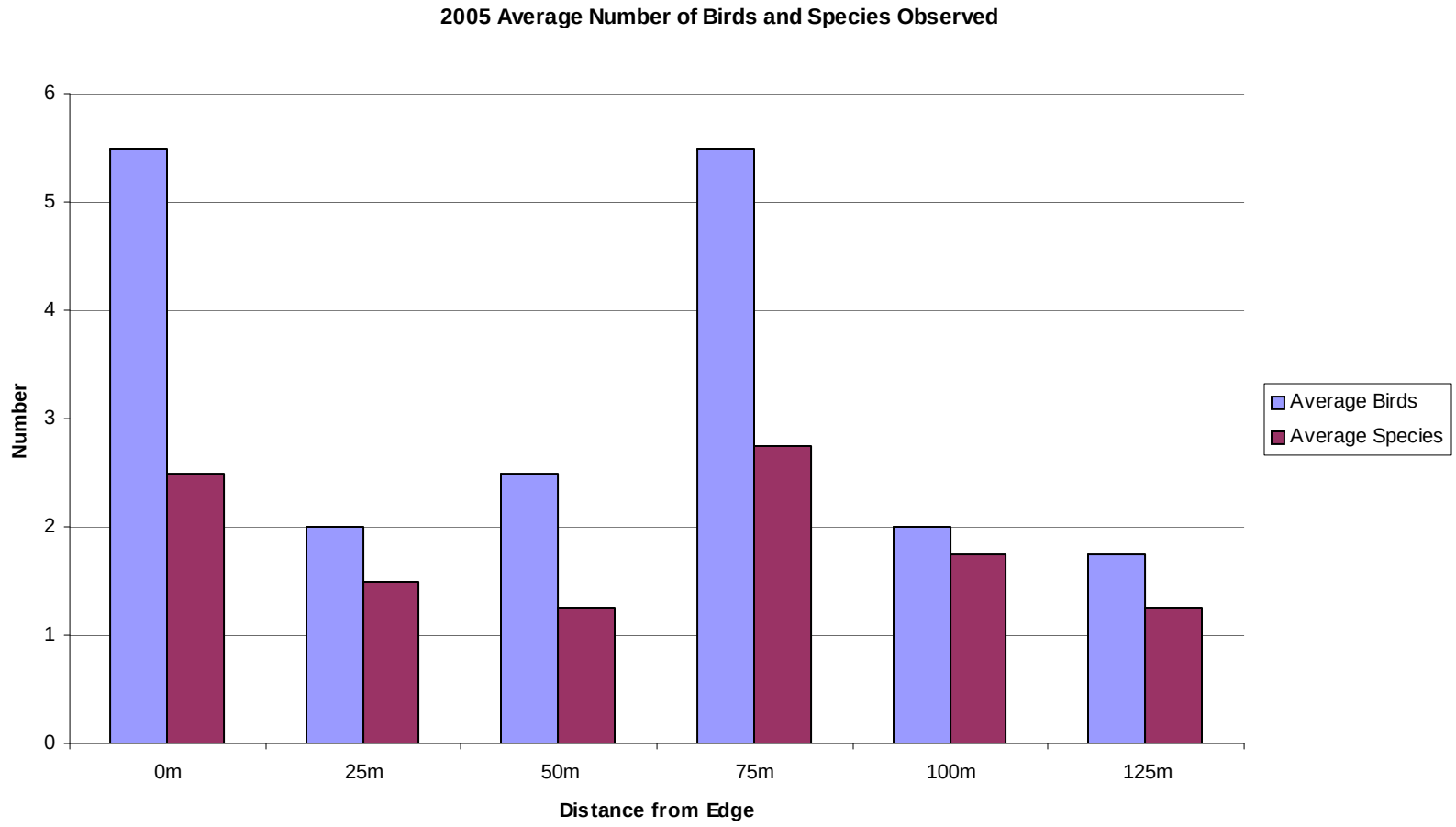


Figure 6—2005 Average Number of Birds and Species Observed

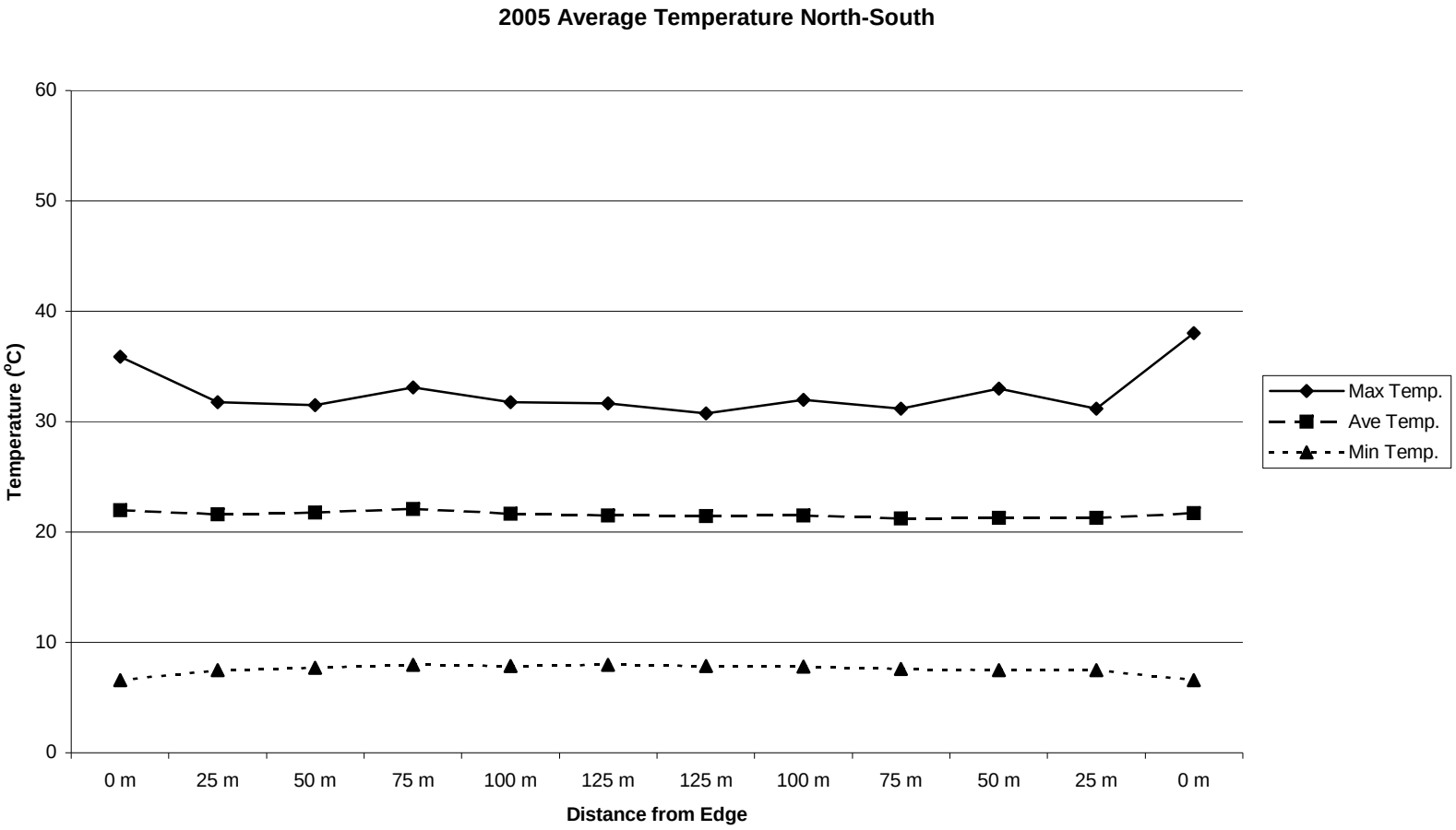


Figure 7—2005 Average Temperature North to South

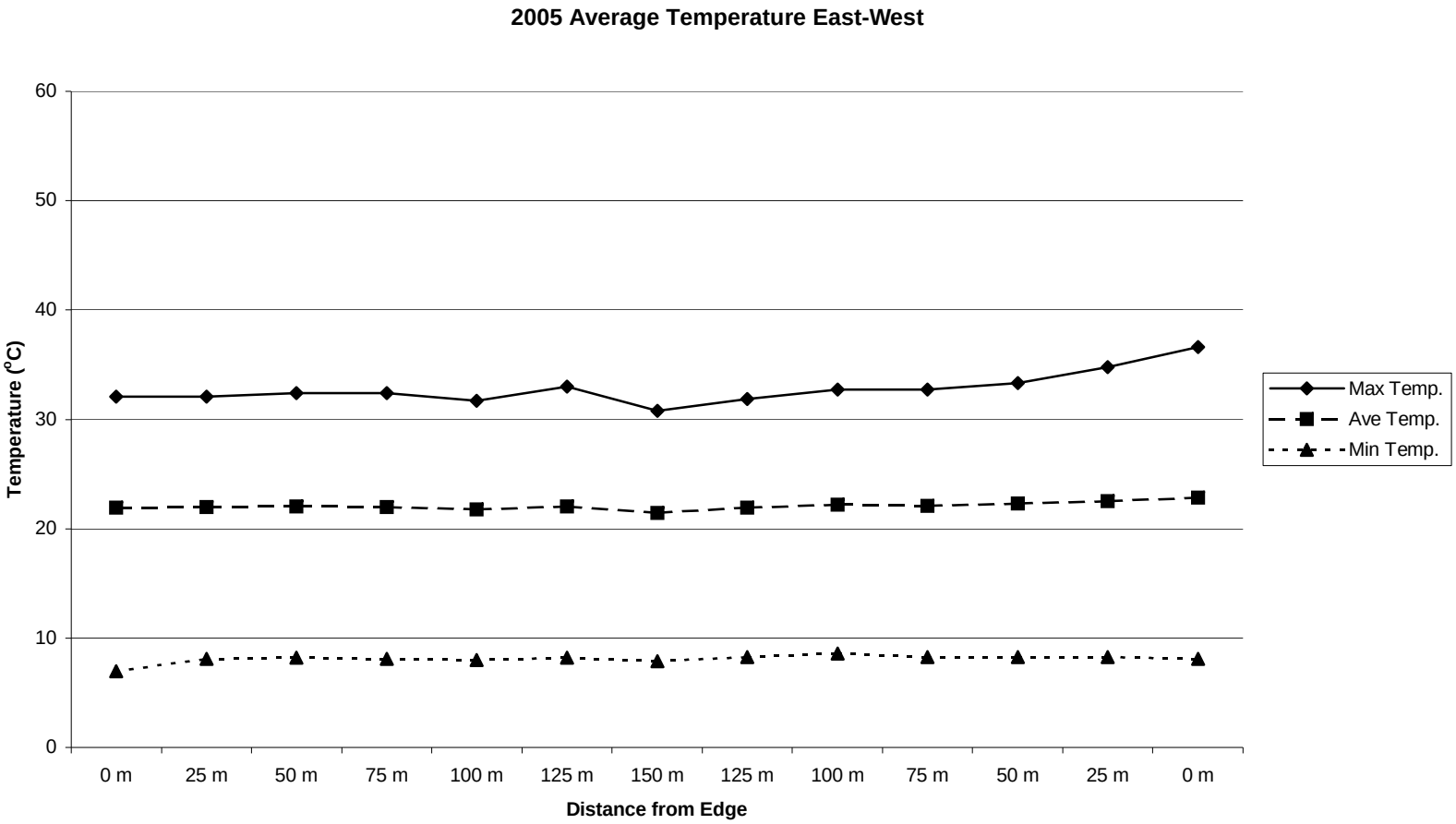


Figure 8—2005 Average Temperature East to West

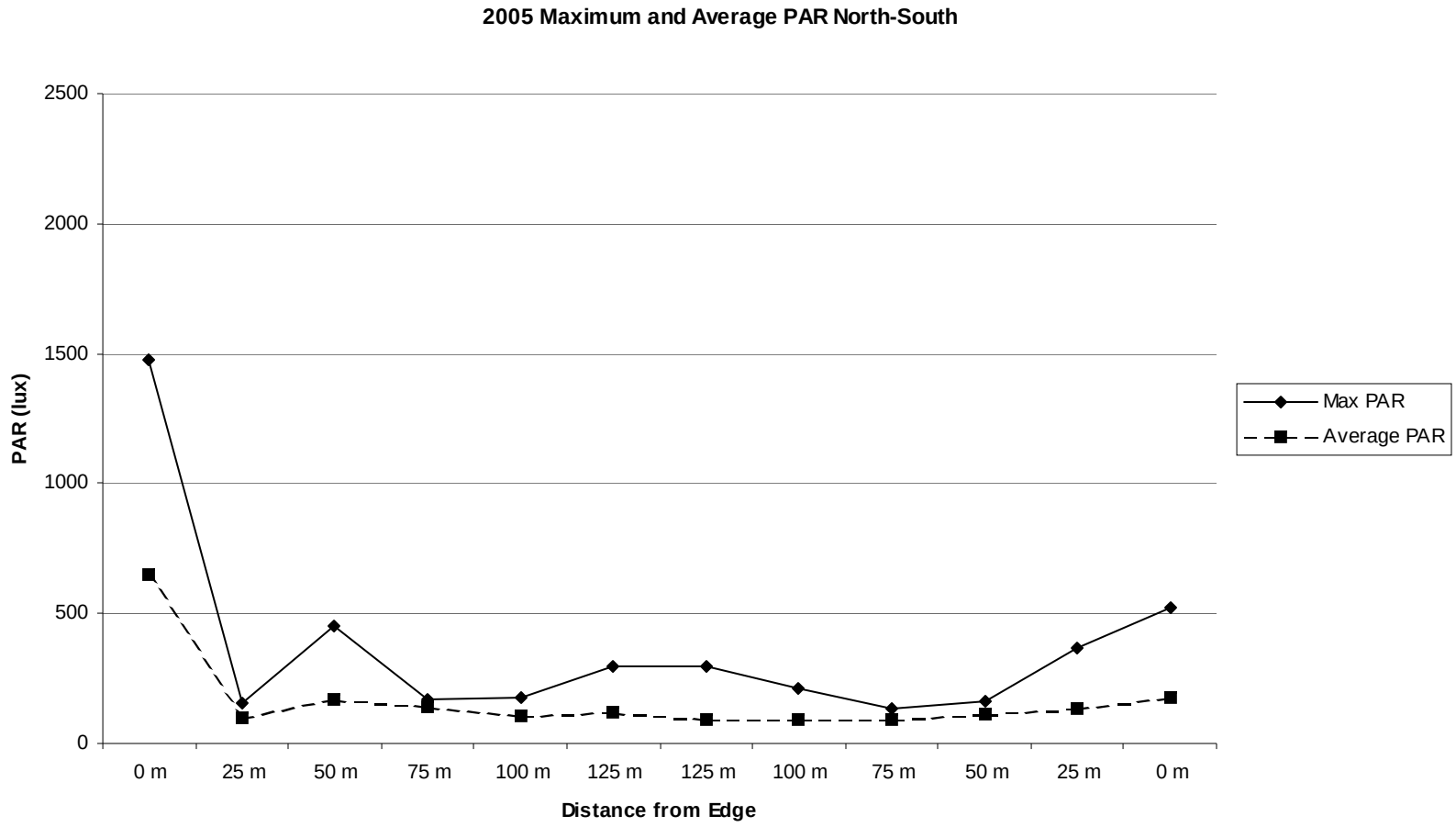


Figure 9—2005 Maximum and Average PAR Readings North to South

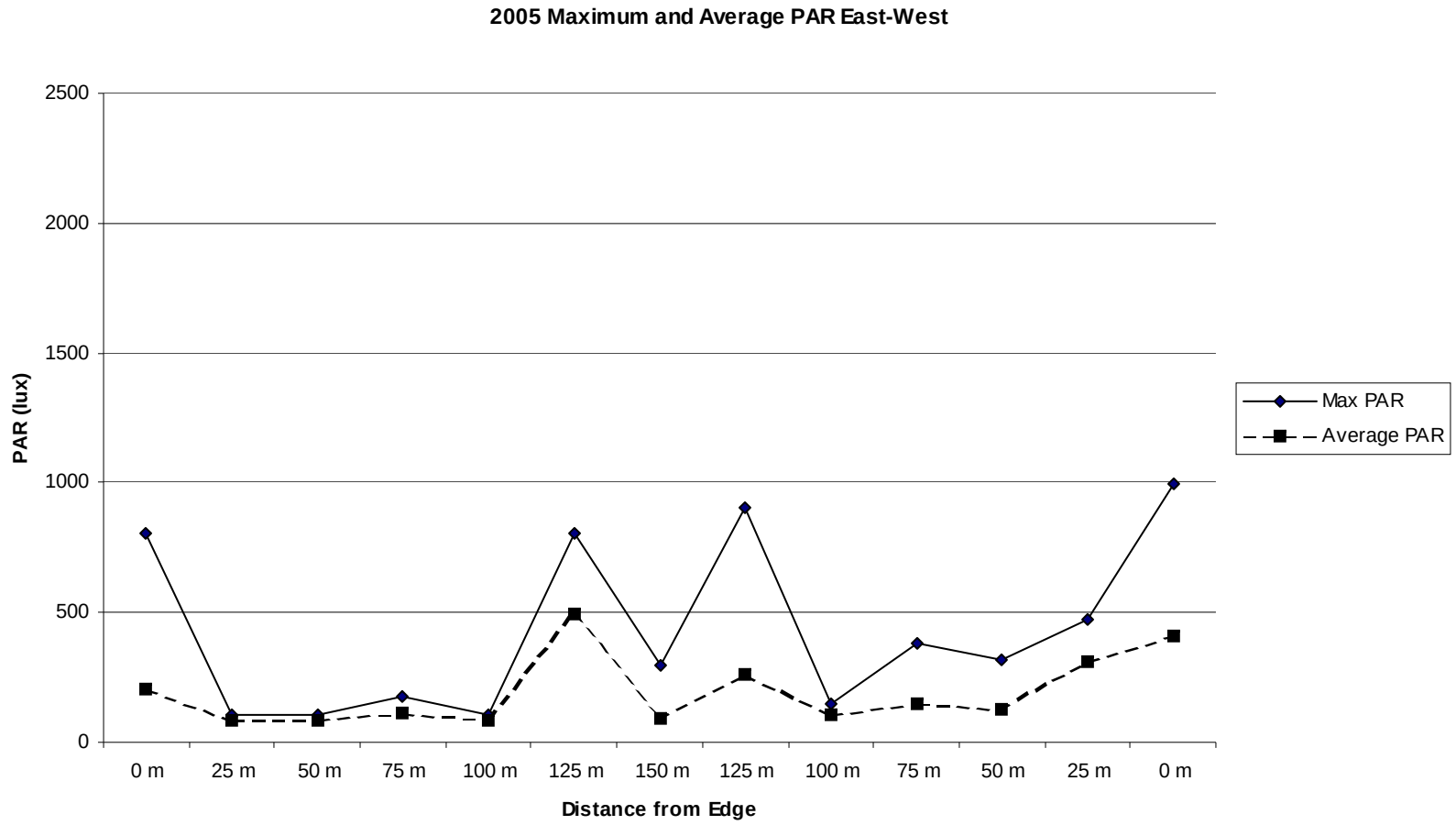


Figure 10—2005 Maximum and Average PAR Readings East to West

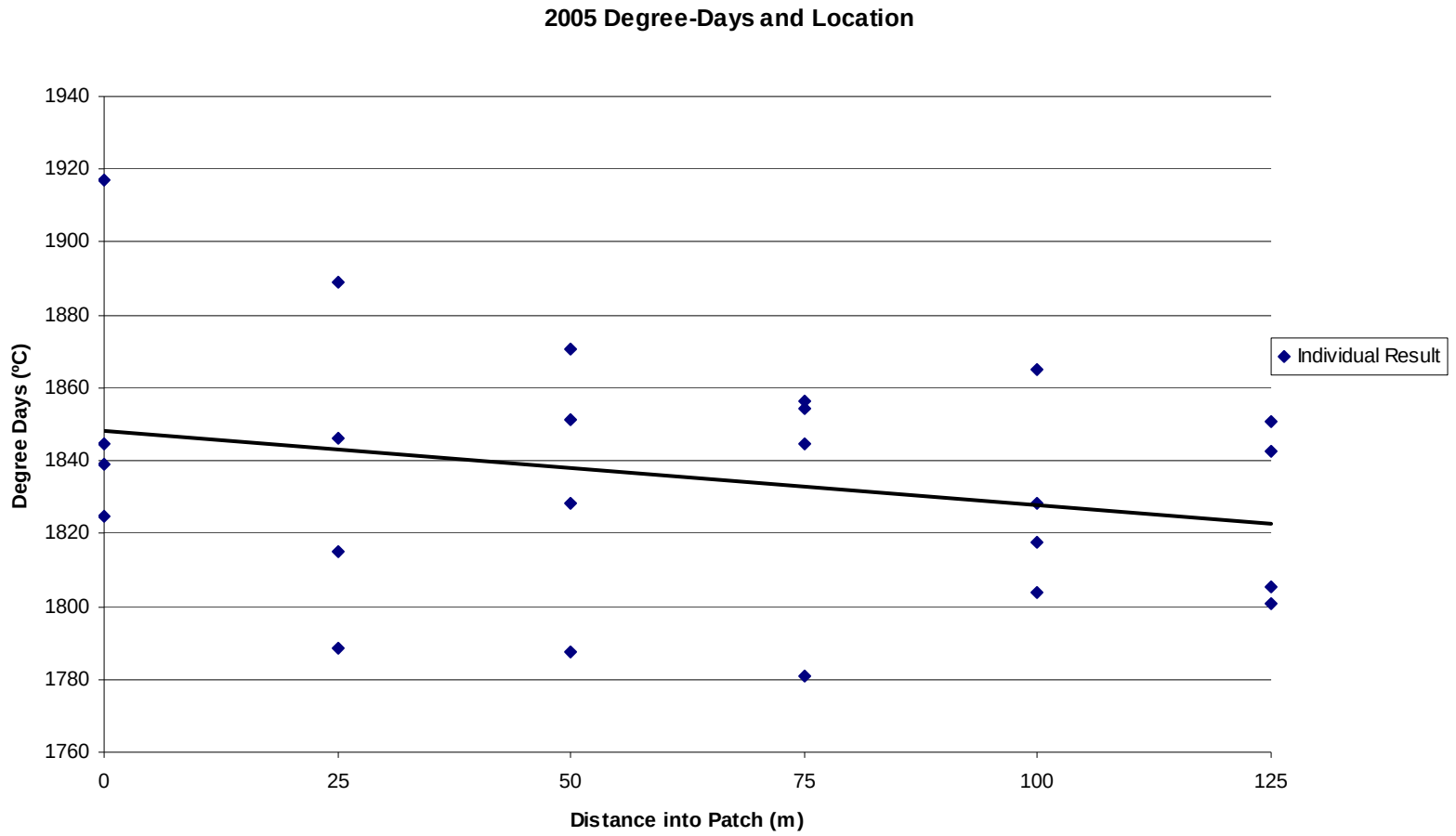


Figure 11—2005 Degree-Days and Location

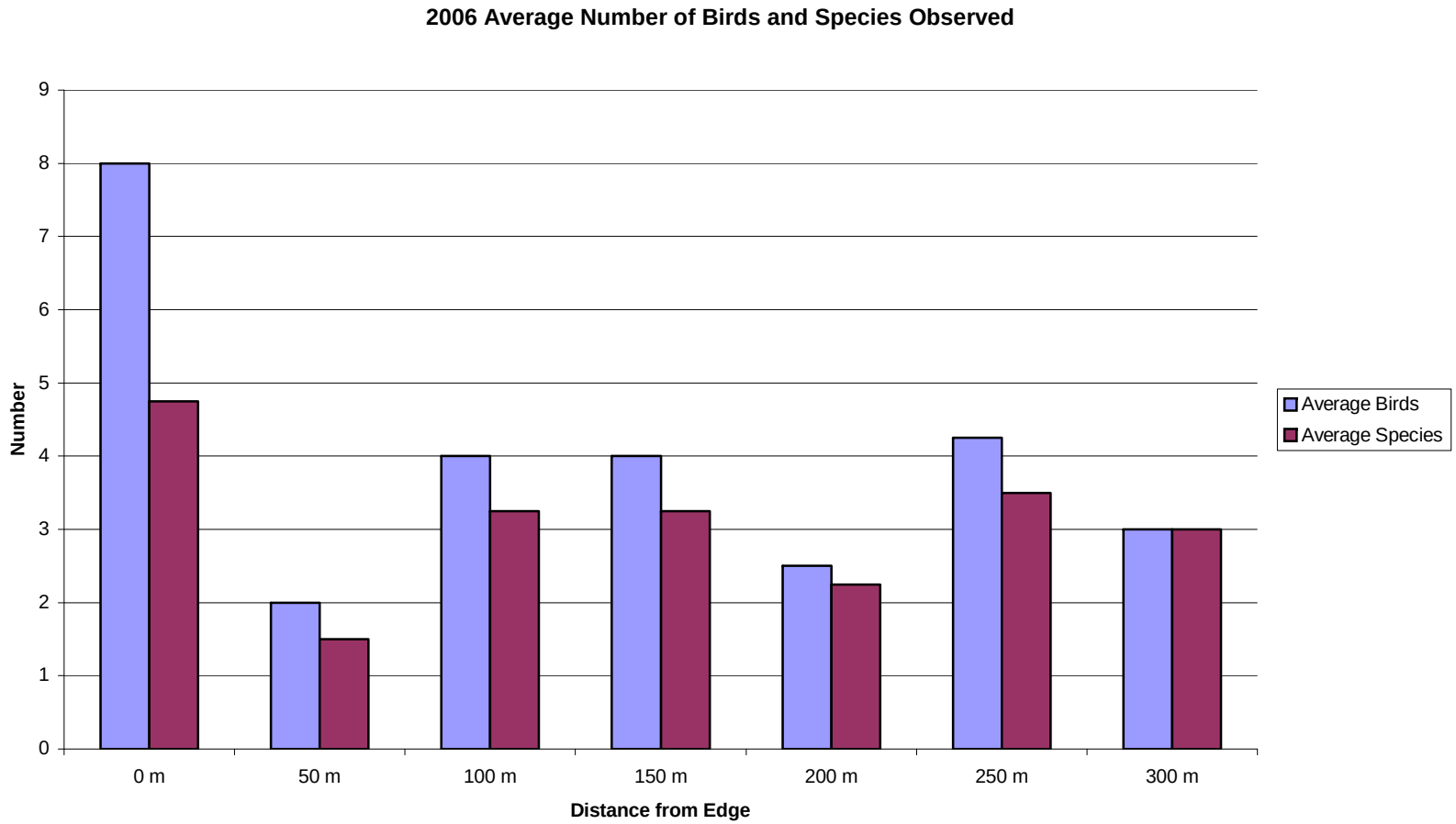


Figure 12—2006 Average Number of Birds and Species Observed

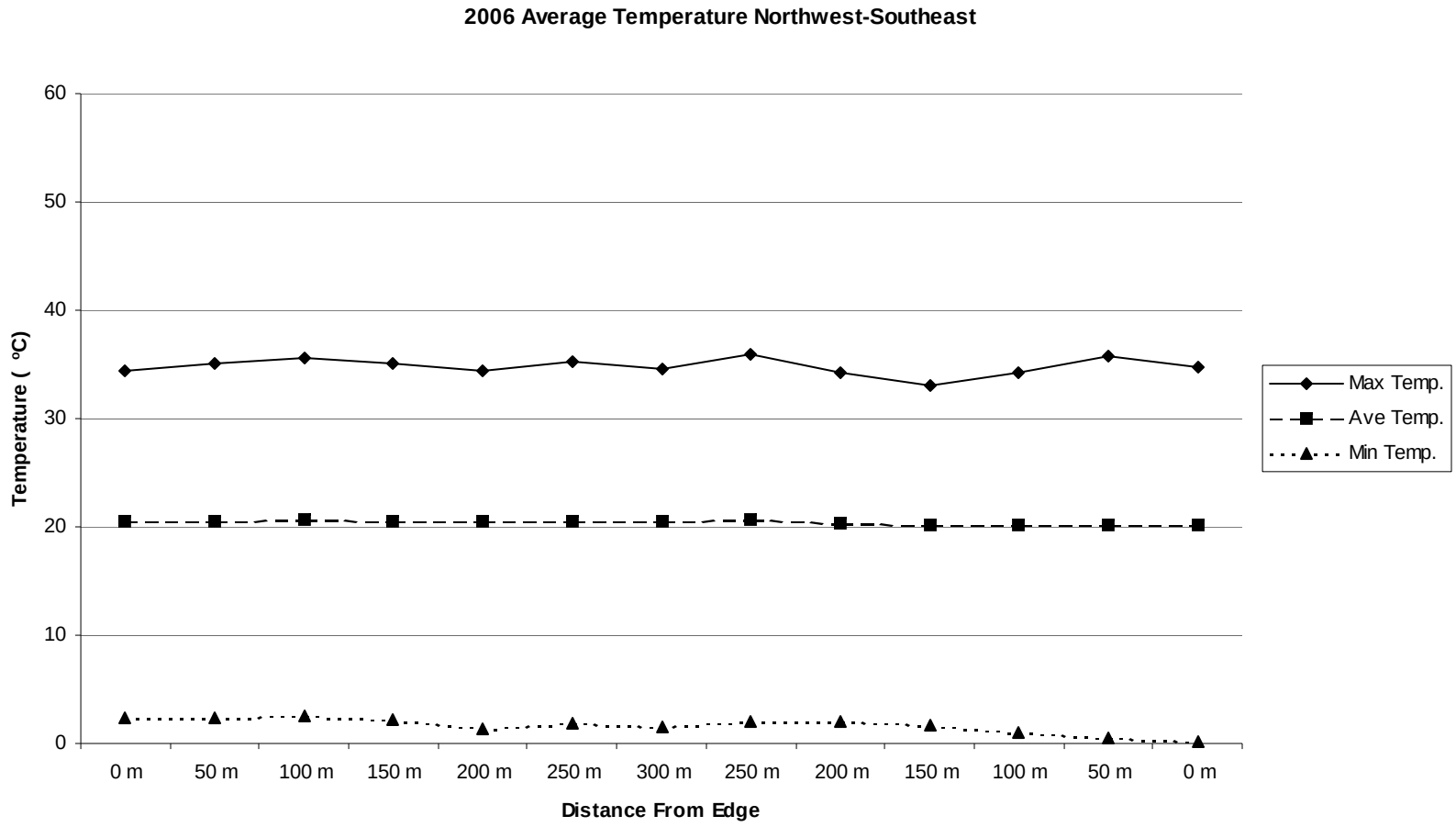


Figure 13—2006 Average Temperature Northwest to Southeast

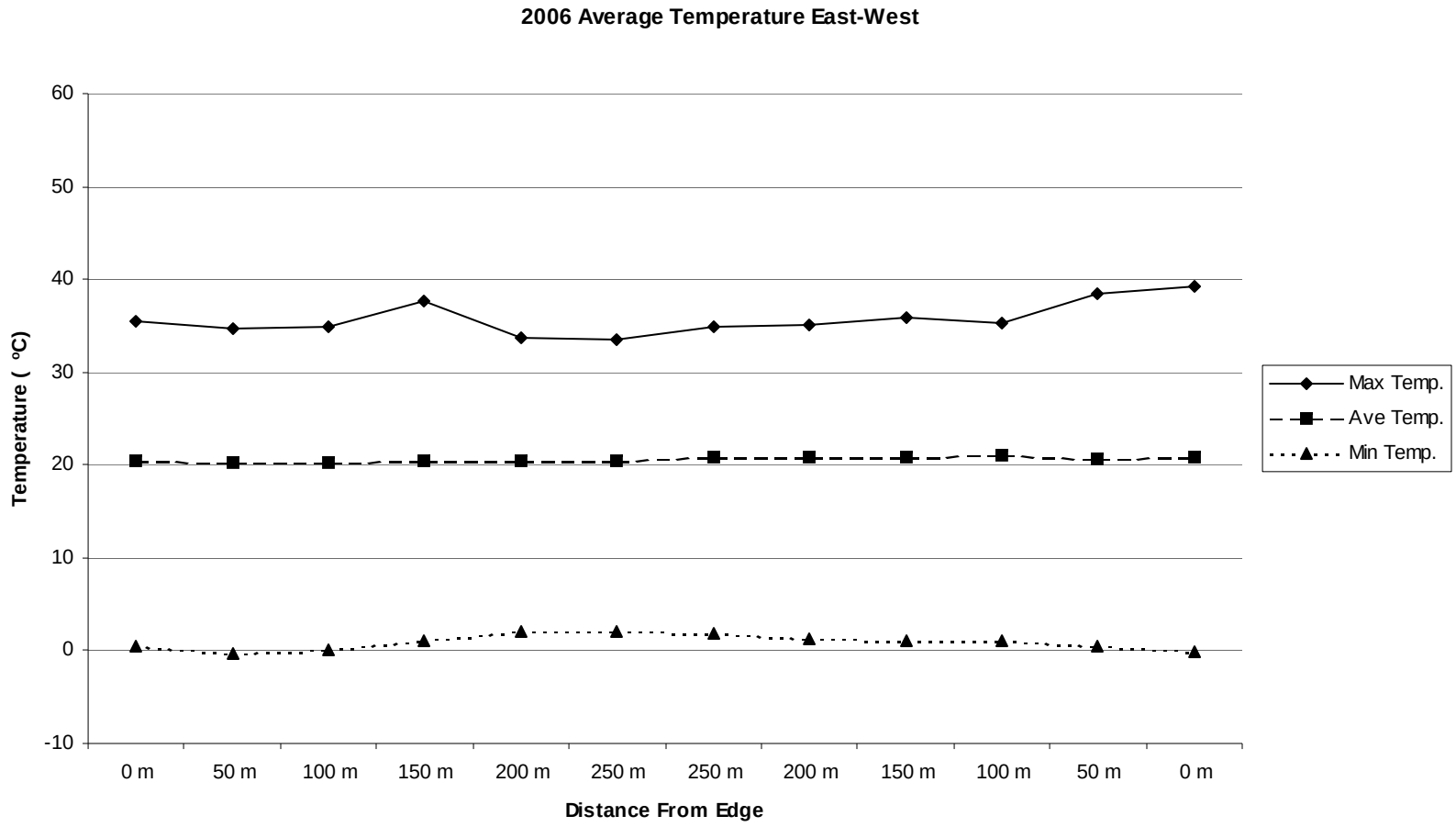


Figure 14—2006 Average Temperature East to West

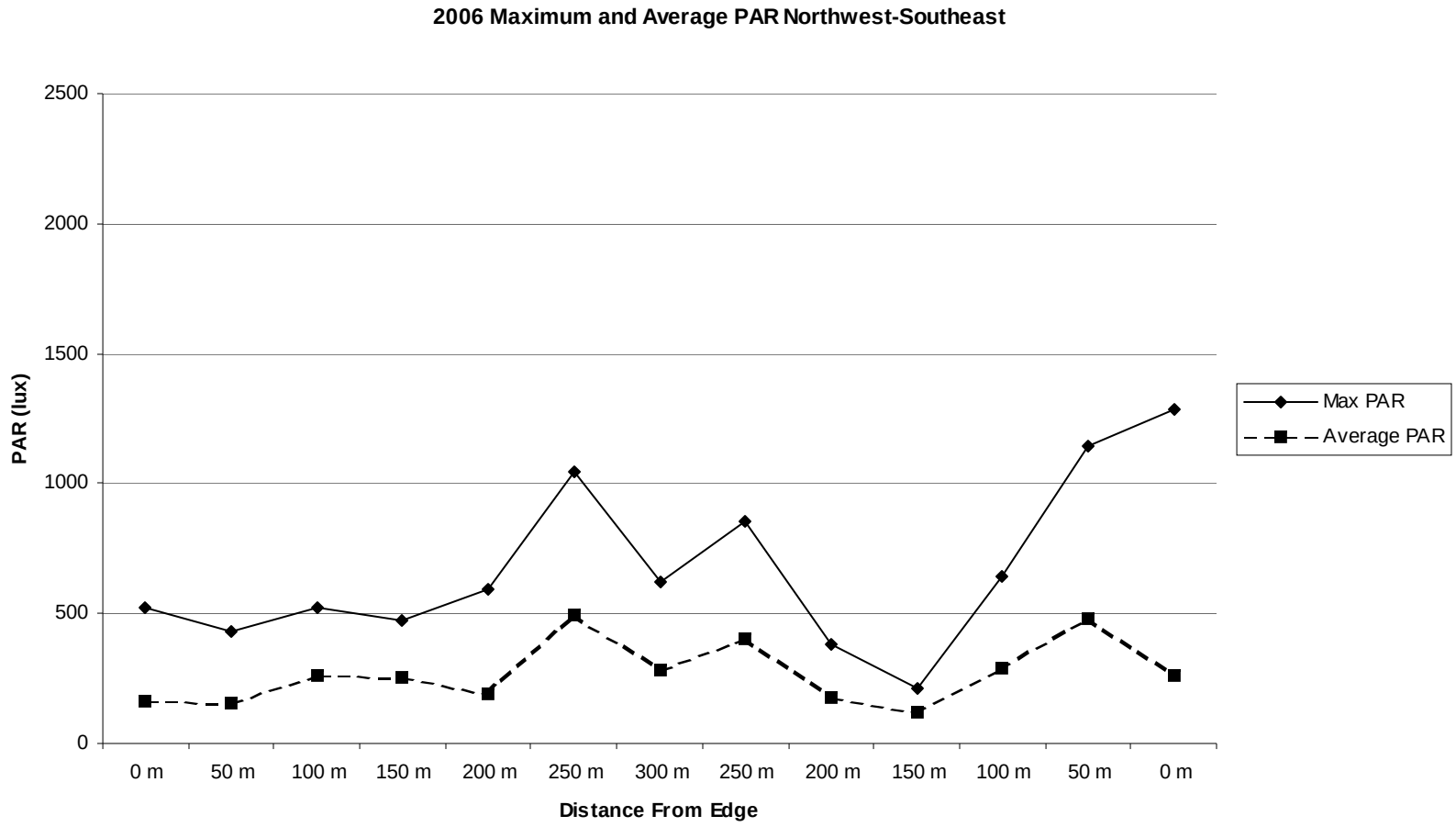


Figure 15—2006 Maximum and Average PAR Readings Northwest to Southeast

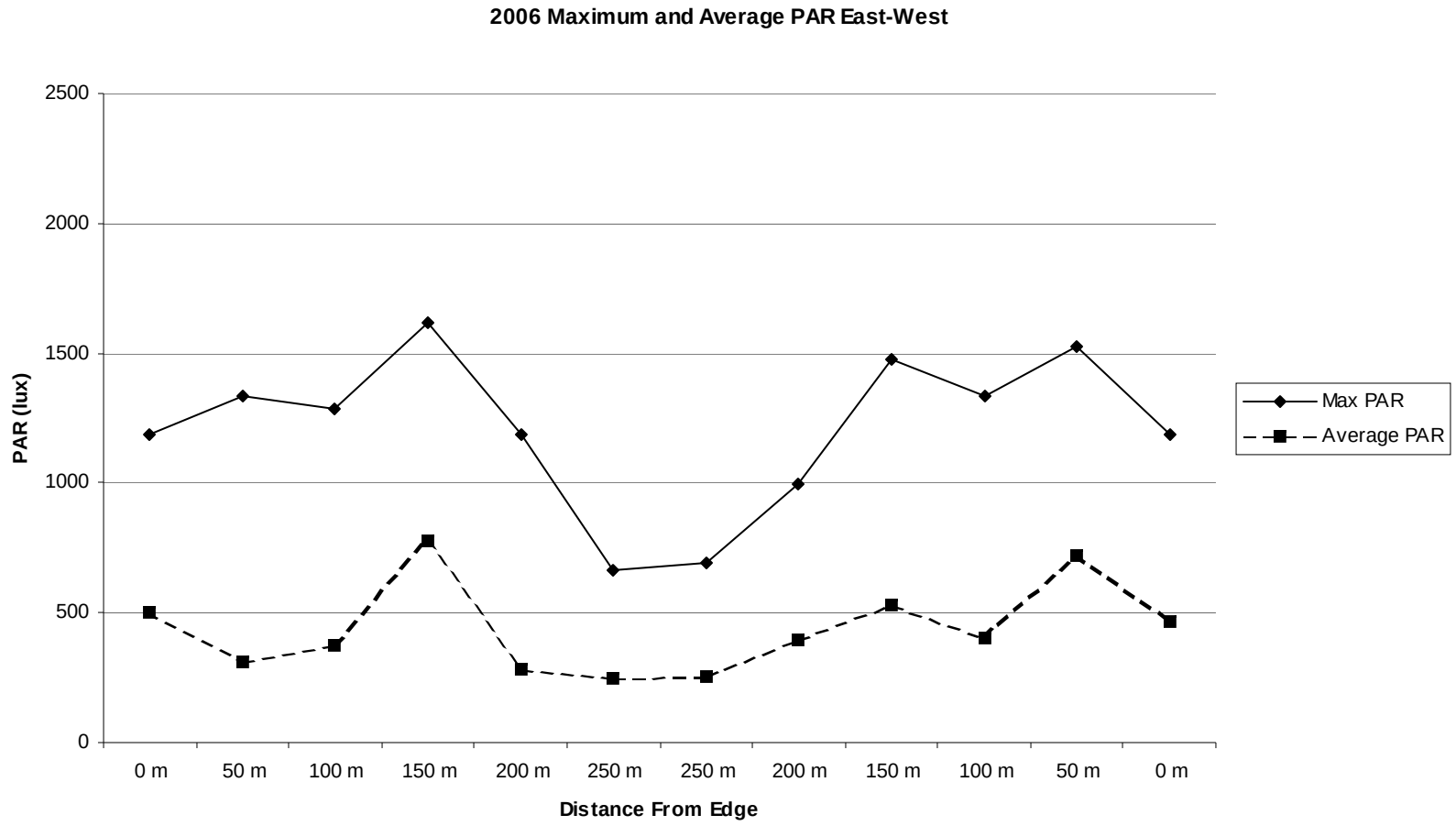


Figure 16—2006 Maximum and Average PAR Readings East to West

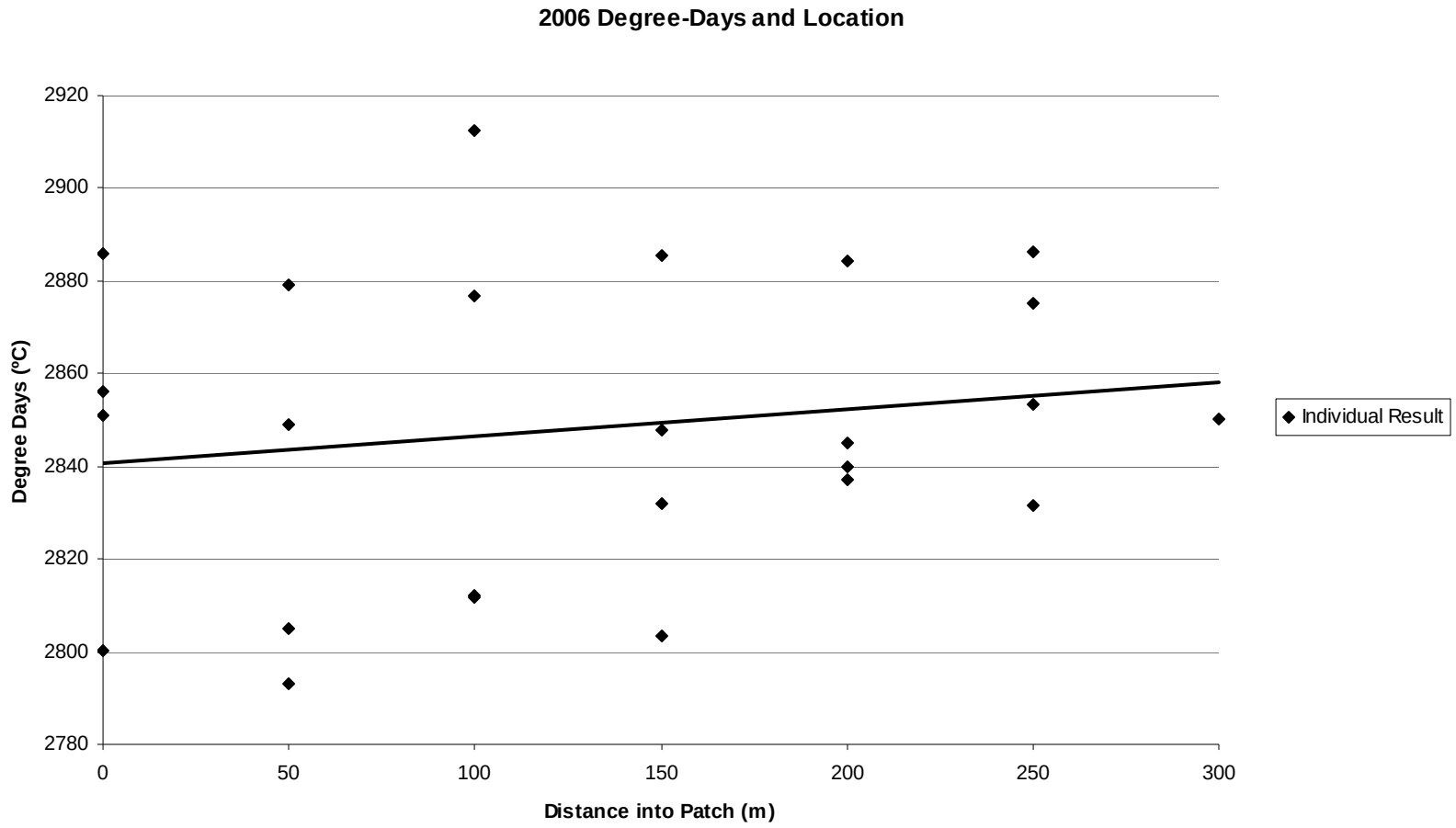


Figure 17—2006 Degree-Days and Location

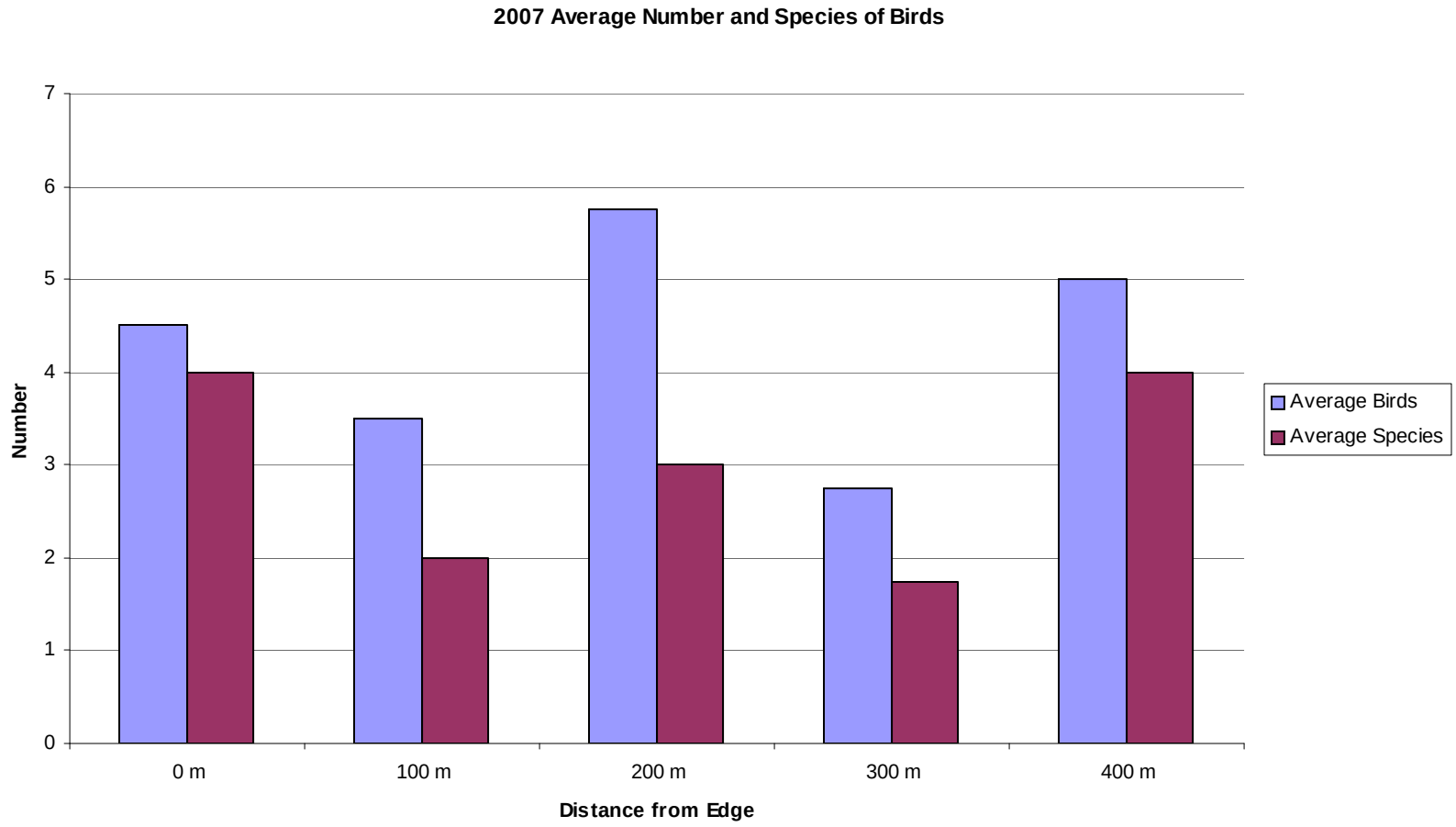


Figure 18—2007 Average Number of Birds and Species Observed

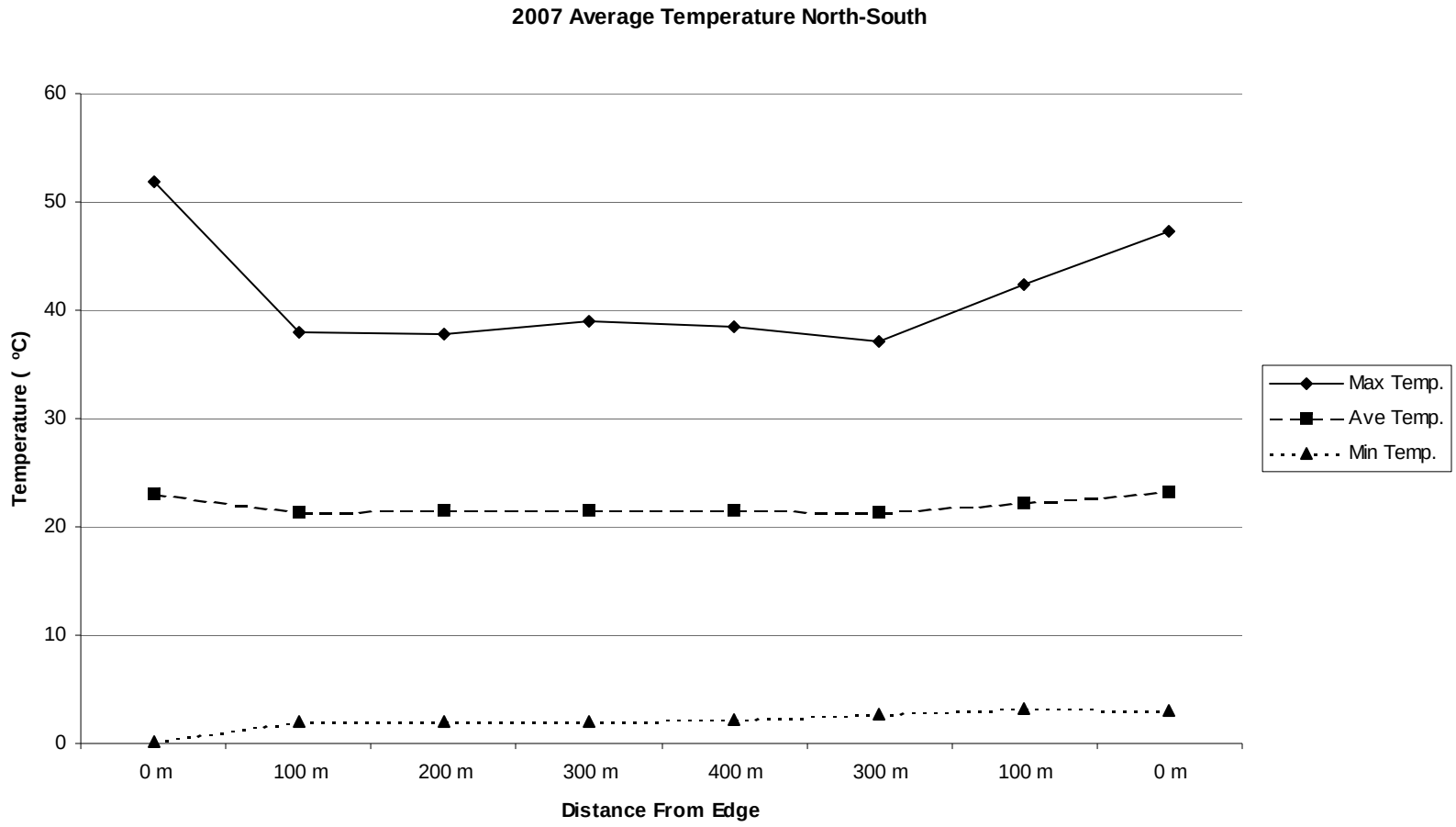


Figure 19—2007 Average Temperature North to South

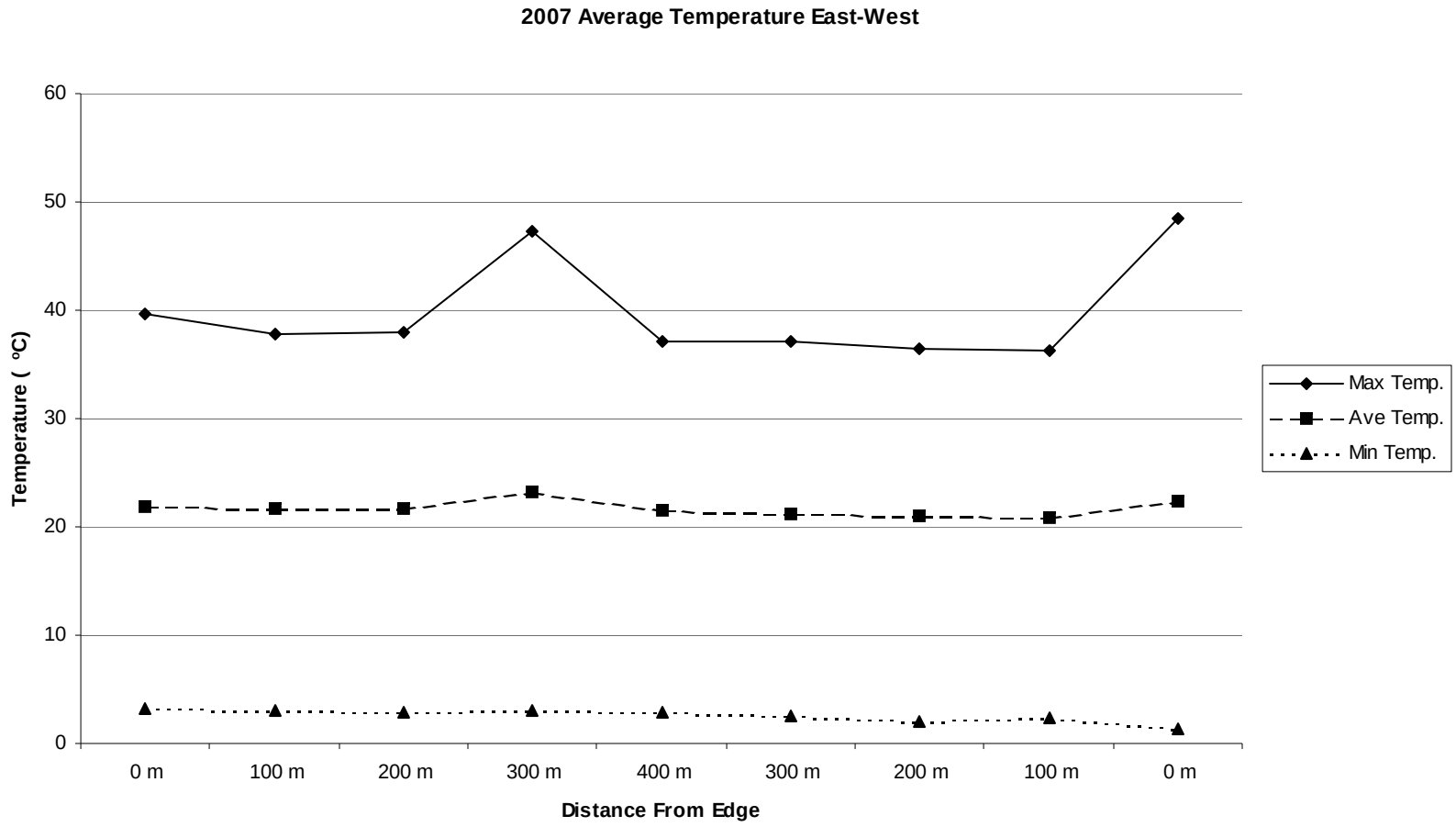


Figure 20—2007 Average Temperature East to West

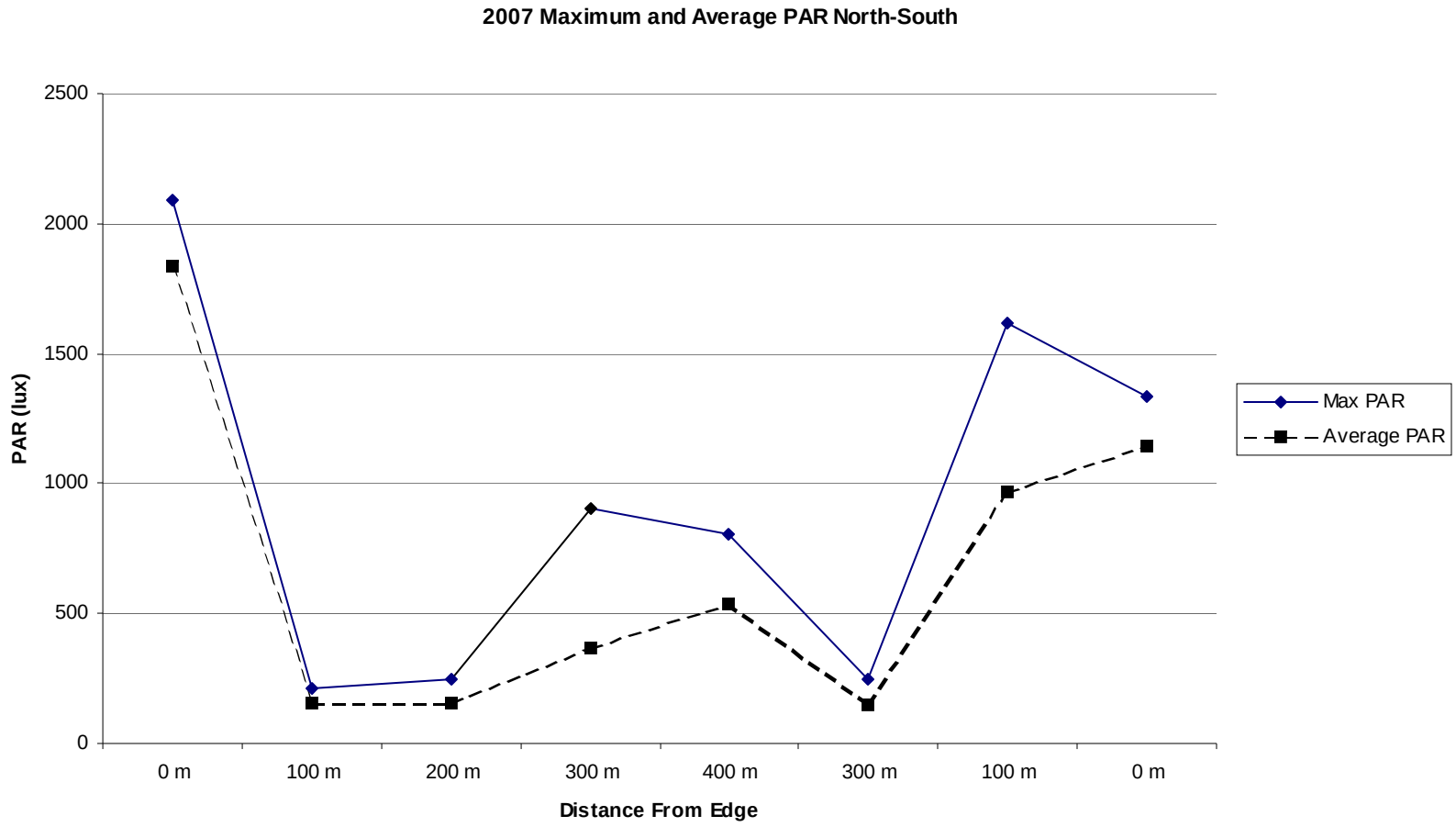


Figure 21—2007 Maximum and Average PAR Readings North to South

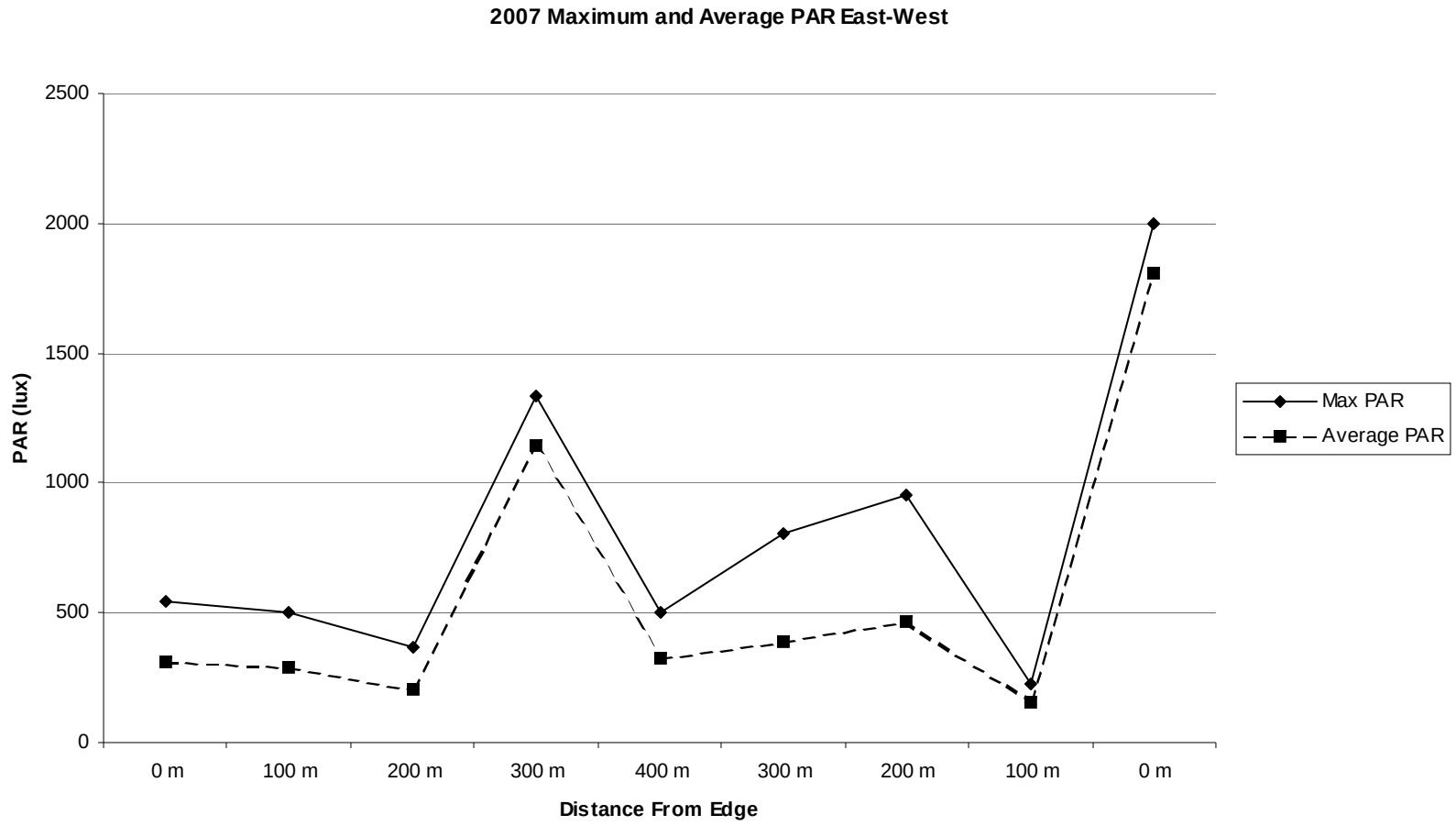


Figure 22—2007 Maximum and Average PAR Readings East to West

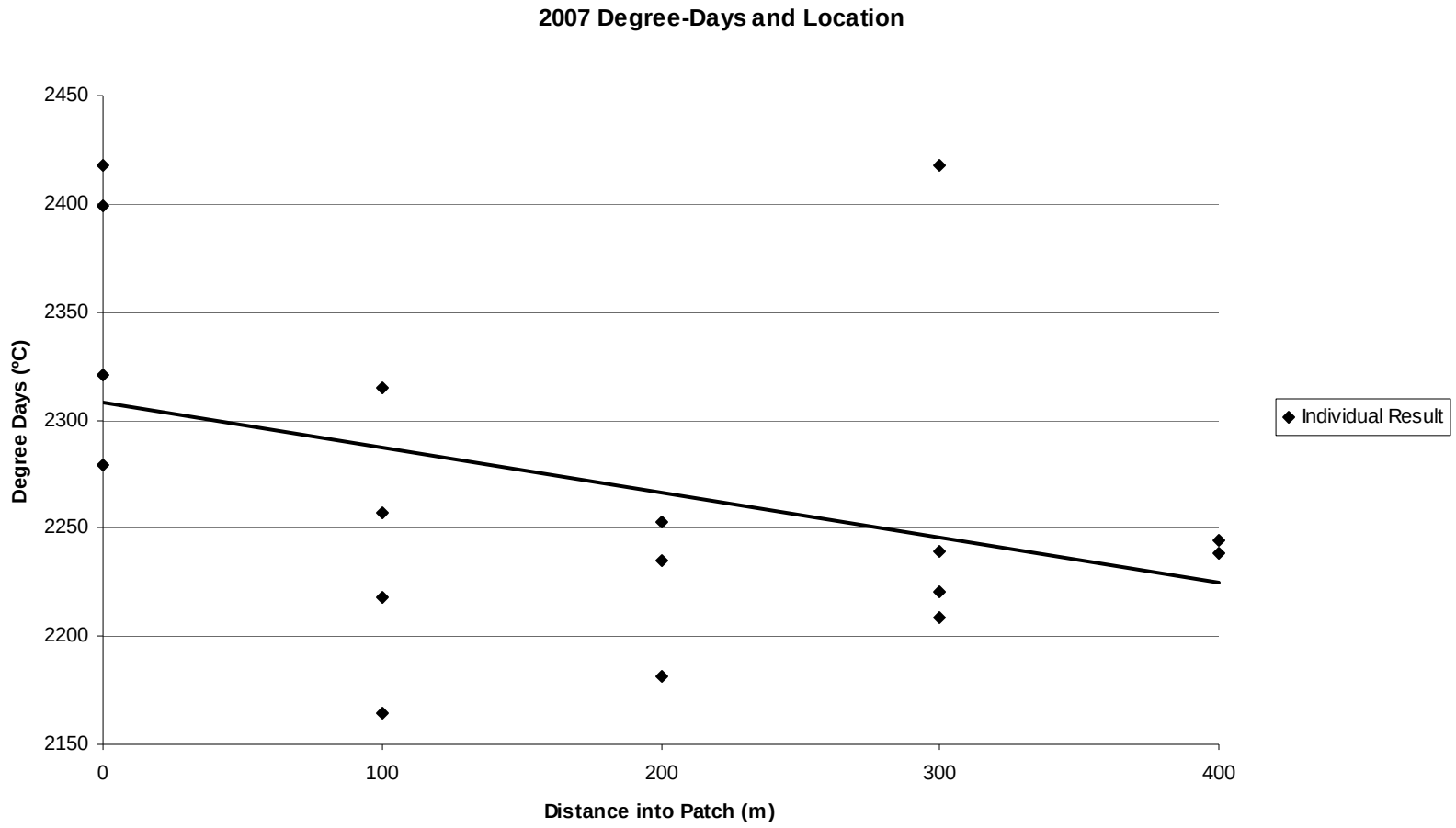


Figure 23—2007 Degree-Days and Location

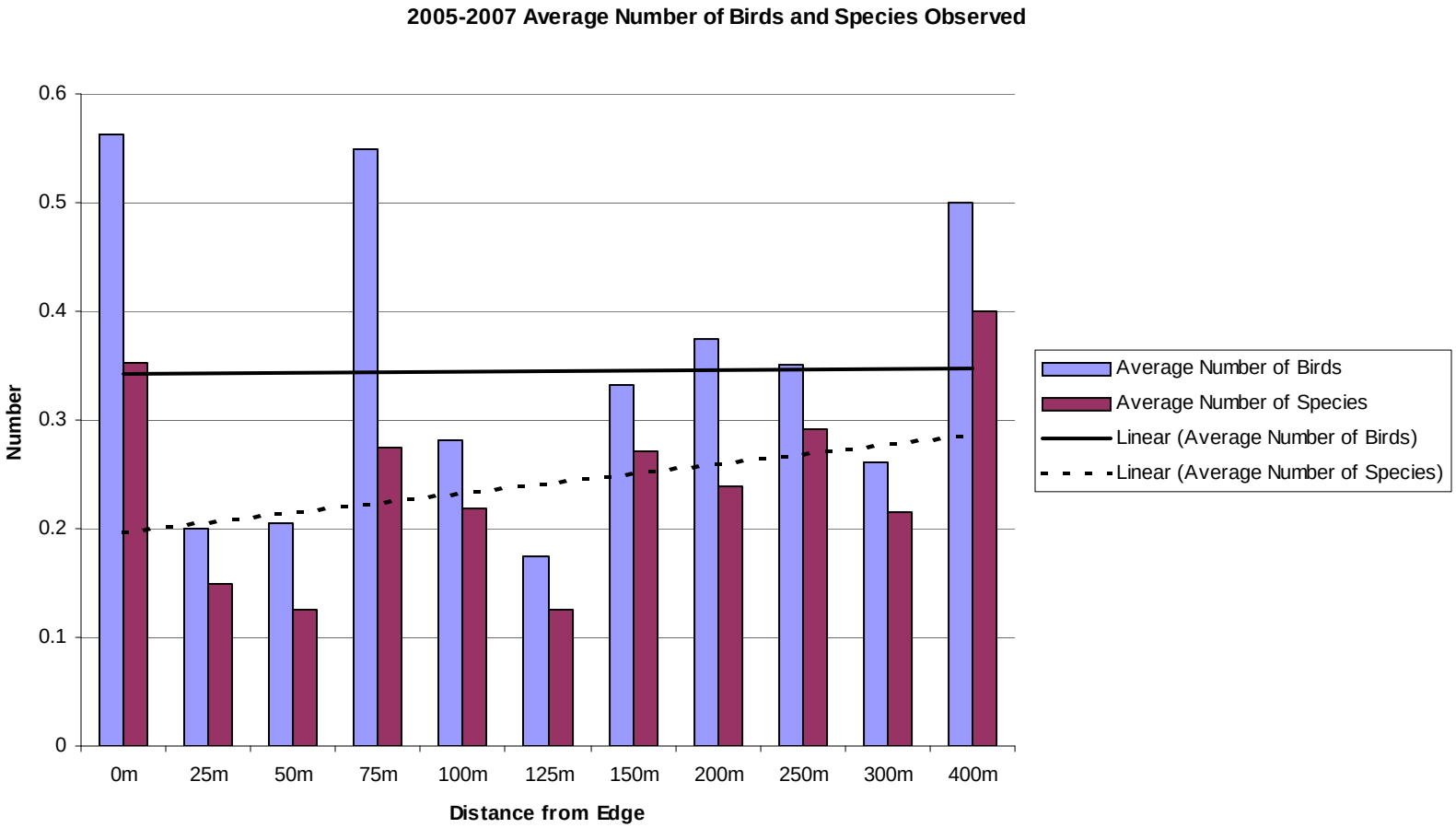


Figure 24—2005-2007 Average Number of Birds and Species Observed

APPENDICIES

Appendix 1: 2005 Microclimate Data

Data are separated into the following time periods:

Week 1: 22 May 2005 to 28 May 2005
Week 2: 29 May 2005 to 04 June 2005
Week 3: 05 June 2005 to 11 June 2005
Week 4: 12 June 2005 to 18 June 2005
Week 5: 19 June 2005 to 25 June 2005
Week 6: 26 June 2005 to 02 July 2005
Week 7: 03 July 2005 to 09 July 2005
Week 8: 10 July 2005 to 16 July 2005
Week 9: 17 July 2005 to 23 July 2005
Week 10: 24 July 2005 to 30 July 2005
Week 11: 31 July 2005 to 06 August 2005
Week 12: 07 August 2005 to 14 August 2005

North 0m

North 0m contained 6 Common Persimmon (*Diospyros viriniana* L.) (2 with width 0.2m, 4 ranging in height from 0.9m to 1.9m) and 1 Yellow Poplar (*Liriodendron tulipifera* L.) (width 1.5m) within 3m of the data logger.

Birds observed at within 3m of the data logger North 0m included 1 Brown Thrasher (*Toxostoma rufum*) and 2 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for North 0m are presented in Table 1. The minimum temperature reading was 6.57°C and maximum temperature reading was 35.9°C. The largest difference between the maximum and minimum temperature readings in a week was 26.4°C. The maximum PAR intensity was 1474.6 lux.

Table 1: 2005 Microclimate Data North 0m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	6.98	31.3	24.3	1189.2
2	6.57[b]	33.0	26.4[d]	1474.6[e]
3	14.7	32.5	17.8	856.2
4	10.4	32.6	22.2	856.2
5	10.0	32.2	22.2	1379.4
6	14.8	31.7	16.9	178.4
7	14.7	32.5	17.8	178.4
8	16.2	33.4	17.2	261.6
9	17.2	32.9	15.7	261.6
10	14.9	35.9[c]	21.0	499.4
11	17.7	35.8	18.1	499.4
12	18.7	31.0	12.3	160.5

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1730 hrs on 26 July 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1800 hrs on 31 May 2005).

North 25m

North 25m contained 1 American Elm (*Ulmus americana* L.) (width 0.4m), 13 Common Persimmon (*Diospyros viriniana* L.) (1 with width 0.2m, 12 ranging in height from 0.5m to 1.7m), and 1 Yellow Poplar (*Liriodendron tulipifera* L.) (width 1.9m) within 3m of the data logger.

Birds observed within 3m of the data logger at North 25m included 2 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for North 25m are presented in Table 2. The minimum temperature reading was 7.48°C and maximum temperature reading was 31.8°C. The largest difference between the maximum and minimum temperature readings in a week was 19.4°C. The maximum PAR intensity was 154.6 lux.

Table 2: 2005 Microclimate Data North 25m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	7.98	25.9	17.9	154.6[e]
2	7.48[b]	25.0	17.5	113.0
3	15.1	30.8	15.7	95.1
4	10.8	30.3	19.4[d]	142.7
5	10.5	29.1	18.6	95.1
6	15.4	30.1	14.7	118.9
7	15.5	27.7	12.2	80.3
8	16.6	29.6	12.9	80.3
9	18.3	29.8	11.4	89.2
10	15.9	31.8[c]	15.9	107.0
11	18.0	30.6	12.6	83.2
12	19.2	30.6	11.4	65.4

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1230 hrs on 27 July 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1130 hrs on 26 May 2005).

North 50m

North 50m contained no trees or shrubs within 3m of the data logger.

Birds observed within 3m of the data logger at North 50m included 5 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for North 50m are presented in Table 3. The minimum temperature reading was 7.68°C and maximum temperature reading was 31.5°C. The largest difference between the maximum and minimum temperature readings in a week was 19.4°C. The maximum PAR intensity was 451.9 lux.

Table 3: 2005 Microclimate Data North 50m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.38	26.2	17.8	380.5
2	7.68[b]	25.3	17.6	225.9
3	15.3	30.5	15.2	130.8
4	10.9	30.0	19.0	107.0
5	10.5	29.8	19.3[d]	83.2
6	15.7	30.6	14.9	92.2
7	15.7	27.5	11.8	71.3
8	16.6	29.9	13.2	80.3
9	18.6	30.0	11.3	249.7
10	16.0	31.5[c]	15.5	451.9[e]
11	18.0	30.8	12.7	65.4
12	19.5	31.2	11.7	65.4

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1700 hrs on 25 July 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1130 hrs on 24 July 2005).

North 75m

North 75m contained no trees or shrubs within 3m of the data logger.

Birds observed within 3m of the data logger at North 75m included 4 White-breasted Nuthatch (*Sitta carolinensis*) and 6 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for North 75m are presented in Table 4. The minimum temperature reading was 7.98°C and maximum temperature reading was 33.1°C. The largest difference between the maximum and minimum temperature readings in a week was 20.0°C. The maximum PAR intensity was 166.5 lux.

Table 4: 2005 Microclimate Data North 75m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.48	25.7	17.2	166.5[e]
2	7.98[b]	25.4	17.4	160.5
3	15.5	31.8	16.3	130.8
4	11.2	31.3	20.0[d]	124.9
5	10.7	30.5	19.8	130.8
6	15.8	31.0	15.2	154.6
7	16.0	28.8	12.7	124.9
8	16.9	30.7	13.8	142.7
9	18.8	30.4	11.6	124.9
10	16.1	33.1[c]	17.0	124.9
11	18.1	32.5	14.4	142.7
12	19.5	32.7	13.2	124.9

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0614 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1214 hrs on 27 July 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1144 hrs on 28 May 2005).

North 100m

North 100m contained 10 Common Persimmon (*Diospyros viriniana* L.) (8 ranging in width from 0.1m to 0.4m, 2 with a height of 1.0m) and 1 September Elm (*Ulmus serotina* Sarg.) (width 0.3m) within 3m of the data logger.

No birds were observed within 3m of the data logger at North 100m.

Microclimate data for North 100m are presented in Table 5. The minimum temperature reading was 7.88°C and maximum temperature reading was 31.8°C. The largest difference between the maximum and minimum temperature readings in a week was 21.6°C. The maximum PAR intensity was 178.4 lux.

Table 5: 2005 Microclimate Data North 100m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.48	25.3	16.8	113.0
2	7.88[b]	25.7	17.8	107.0
3	15.3	31.8[c]	16.5	113.0
4	11.0	30.2	19.1	95.1
5	10.5	30.6	20.1[d]	80.3
6	15.9	30.7	14.8	83.2
7	15.8	28.0	12.2	80.3
8	16.5	30.2	13.6	80.3
9	18.8	30.4	11.6	71.3
10	16.0	31.1	15.1	83.2
11	18.0	31.2	13.1	178.4[e]
12	19.4	31.4	12.0	148.6

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1430 hrs on 08 June 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1100 hrs on 05 August 2005).

North 125m

North 125m contained 8 Common Persimmon (*Diospyros viriniana* L.) (3 ranging in width from 0.1m to 0.8m, 5 ranging in height from 2.0m to 4.0m), and 3 September Elm (*Ulmus serotina* Sarg.) (ranging in width from 0.1m to 0.2m) within 3m of the data logger.

Birds observed within 3m of the data logger at North 125m included 2 Acadian Flycatcher (*Empidonax virescens*) and 1 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for North 125m are presented in Table 6. The minimum temperature reading was 7.98°C and maximum temperature reading was 31.7°C. The largest difference between the maximum and minimum temperature readings in a week was 19.3°C. The maximum PAR intensity was 297.3 lux.

Table 6: 2005 Microclimate Data North 125m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.58	24.4	15.8	92.2
2	7.98[b]	24.7	16.8	89.2
3	15.3	30.8	15.5	297.3[e]
4	11.2	30.0	18.7	202.2
5	10.5	29.8	19.3[d]	166.5
6	16.0	30.5	14.5	80.3
7	15.9	27.3	11.4	80.3
8	16.5	29.5	12.9	166.5
9	18.8	29.8	10.9	74.3
10	16.0	31.5	15.4	65.4
11	18.1	30.7	12.5	62.4
12	19.4	31.7[c]	12.3	65.4

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs and 0630 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1300 hrs on 12 August 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1230 hrs on 07 June 2005).

South 0m

South 0m contained 4 Common Persimmon (*Diospyros viriniana* L.) (ranging in height from 1.5m to 3.5m) and 1 Washington Hawthorne (*Crataegus phaenopyrum* (L. f.) Medic.) (width 0.5m) within 3m of the data logger.

Birds observed within 3m of the data logger at South 0m included 1 Ovenbird (*Seiurus aurocapillus*), 1 Tufted Titmouse (*Baeolophus bicolor*), and 2 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for South 0m are presented in Table 7. The minimum temperature reading was 6.57°C and maximum temperature reading was 38.0°C. The largest difference between the maximum and minimum temperature readings in a week was 24.7°C. The maximum PAR intensity was 532.2 lux.

Table 7: 2005 Microclimate Data South 0m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.18	32.3	24.1	178.4
2	6.57[b]	30.4	23.8	160.5
3	15.3	38.0[c]	22.8	523.2[e]
4	9.8	34.5	24.7[d]	190.3
5	9.6	32.1	22.5	148.6
6	15.0	32.7	17.7	148.6
7	14.6	29.8	15.1	124.9
8	15.6	31.0	15.4	118.9
9	17.4	31.6	14.2	107.0
10	14.9	32.4	17.5	130.8
11	17.3	31.9	14.6	101.1
12	18.7	31.8	13.1	160.5

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1500 hrs on 08 June 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1530 hrs on 08 June 2005).

South 25m

South 25m contained 1 Washington Hawthorne (*Crataegus phaenopyrum* (L. f.) Medic.) (width 0.4m) within 3m of the data logger.

Birds observed within 3m of the data logger at South 25m included 1 Acadian Flycatcher (*Empidonax virescens*), 2 American Robin (*Turdus migratorius*), and 1 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for South 25m are presented in Table 8. The minimum temperature reading was 7.48°C and maximum temperature reading was 31.2°C. The largest difference between the maximum and minimum temperature readings in a week was 20.4°C. The maximum PAR intensity was 368.6 lux.

Table 8: 2005 Microclimate Data South 25m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.8	25.0	16.4	113.0
2	7.48[b]	24.7	17.3	107.0
3	15.4	31.0	15.6	118.9
4	10.4	30.8	20.4[d]	113.0
5	10.2	29.8	19.6	92.2
6	15.7	30.9	15.2	321.1
7	15.4	27.7	12.3	89.2
8	16.0	29.0	12.9	80.3
9	18.1	29.3	11.1	74.3
10	15.8	31.2[c]	15.4	368.6[e]
11	17.7	30.0	12.3	74.3
12	19.1	30.6	11.5	95.1

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1230 hrs on 27 July 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1130 hrs on 26 May 2005).

South 50m

South 50m contained 6 Buckthorne Shrub (*Rhamnaceae* spp.) (ranging in height from 1.5 to 2.0m) and 2 Yellow Poplar (*Liriodendron tulipifera* L.) (1 with height of 2.0m, 1 with width of 0.2m) within 3m of the data logger.

Birds observed within 3m of the data logger at South 50m included 2 Acadian Flycatcher (*Empidonax virescens*), 1 American Robin (*Turdus migratorius*), and 1 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for South 50m are presented in Table 9. The minimum temperature reading was 7.48°C and maximum temperature reading was 33.0°C. The largest difference between the maximum and minimum temperature readings in a week was 20.5°C. The maximum PAR intensity was 160.5 lux.

Table 9: 2005 Microclimate Data South 50m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.68	27.3	18.6	154.6
2	7.48[b]	26.8	19.3	136.8
3	15.4	33.0[c]	17.6	160.5[e]
4	10.3	30.7	20.4	124.9
5	10.1	30.6	20.5[d]	95.1
6	16.0	31.4	15.4	89.2
7	15.4	28.2	12.8	92.2
8	16.0	29.2	13.1	101.1
9	18.2	29.3	11.0	107.0
10	15.8	30.9	15.1	92.2
11	17.6	31.4	13.8	92.2
12	19.1	31.6	12.5	92.2

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs and 0630 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1400 hrs on 08 June 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1400 hrs on 18 June 2005).

South 75m

South 75m contained 3 Buckthorne Shrub (*Rhamnaceae* spp.) (height 1.5m), 1 September Elm (*Ulmus serotina* Sarg.) (width 0.4m), and 2 Yellow Poplar (*Liriodendron tulipifera* L.) (width ranging from 1.1 to 1.3m) within 3m of the data logger.

Birds observed within 3m of the data logger at South 75m included 3 American Crow (*Corvus brachyrhynchos*), 1 American Robin (*Turdus migratorius*), and 1 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for South 75m are presented in Table 10. The minimum temperature reading was 7.58°C and maximum temperature reading was 31.2°C. The largest difference between the maximum and minimum temperature readings in a week was 19.6°C. The maximum PAR intensity was 130.8 lux.

Table 10: 2005 Microclimate Data South 75m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.78	24.7	16.0	113.0
2	7.58[b]	24.9	17.4	101.1
3	15.3	31.2[c]	15.9	92.2
4	10.5	30.1	19.6[d]	118.9
5	10.1	29.7	19.6[d]	101.1
6	16.0	30.7	14.6	95.1
7	15.5	27.8	12.3	130.8[e]
8	16.1	28.9	12.7	89.2
9	18.4	28.7	10.2	83.2
10	15.9	30.7	14.8	80.3
11	17.7	30.0	12.3	65.4
12	19.2	30.3	11.1	65.4

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0630 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1430 hrs on 08 June 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 0930 hrs on 06 July 2005).

South 100m

South 100m contained 4 September Elm (*Ulmus serotina* Sarg.) (2 with height of 3.0 and 5.0m, 2 with width of 0.3 and 1.8m) within 3m of the data logger.

Birds observed within 3m of the data logger at South 100m included 3 American Robin (*Turdus migratorius*).

Microclimate data for South 100m are presented in Table 11. The minimum temperature reading was 7.78°C and maximum temperature reading was 31.6°C. The largest difference between the maximum and minimum temperature readings in a week was 19.8°C. The maximum PAR intensity was 214.0 lux.

Table 11: 2005 Microclimate Data South 100m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.88	24.7	15.9	101.1
2	7.78[b]	25.2	17.4	89.2
3	15.4	31.2	15.8	214.0[e]
4	10.9	30.4	19.4	92.2
5	10.4	30.2	19.8[d]	83.2
6	16.0	31.1	15.0	95.1
7	15.7	27.5	11.8	74.3
8	16.3	29.4	13.0	83.2
9	18.7	30.0	11.2	83.2
10	16.0	31.6[c]	15.6	74.3
11	18.0	32.0	14.0	71.3
12	19.4	31.2	11.8	71.3

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs and 0630 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1330 hrs on 04 August 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1030 hrs on 08 June 2005).

South 125m

South 125m contained 5 September Elm (*Ulmus serotina* Sarg.) (1 with height of 2.5m, 4 ranging in width from 0.1m to 1.1m) within 3m of the data logger.

Birds observed within 3m of the data logger at South 125m included 1 American Robin (*Turdus migratorius*) and 2 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for South 125m are presented in Table 12. The minimum temperature reading was 7.88°C and maximum temperature reading was 30.8°C. The largest difference between the maximum and minimum temperature readings in a week was 19.2°C. The maximum PAR intensity was 297.3 lux.

Table 12: 2005 Microclimate Data South 125m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.78	24.2	15.4	101.1
2	7.88[b]	24.7	16.9	71.3
3	15.4	30.4	15.0	160.5
4	11.2	30.0	18.7	297.3[e]
5	10.5	29.7	19.2[d]	62.4
6	16.0	30.6	14.6	65.4
7	15.8	27.3	11.5	53.5
8	16.3	29.4	13.0	62.4
9	18.8	29.0	10.1	56.5
10	16.1	30.8[c]	14.6	56.5
11	18.0	30.2	12.2	53.5
12	19.4	30.6	11.2	47.6

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs and 0630 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1230 hrs on 27 July 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1100 hrs on 12 June 2005).

East 0m

East 0m contained 2 Common Persimmon (*Diospyros viriniana* L.) (width 0.8 and 1.4m), 1 Northern Pin Oak (*Quercus ellipsoidalis* E. J. Hill) (width 2.2m), and 1 September Elm (*Ulmus serotina* Sarg.) (width 0.1m) within 3m of the data logger.

Birds observed within 3m of the data logger at East 0m included 5 Eastern Towhee (*Pipilo erythrophthalmus*), 3 Grey Catbird (*Dumetella carolinensis*), 2 Northern Cardinal (*Cardinalis cardinalis*), 1 Pileated Woodpecker (*Dryocopus pileatus*), and 4 White-breasted Nuthatch (*Sitta carolinensis*).

Microclimate data for East 0m are presented in Table 13. The minimum temperature reading was 6.98°C and maximum temperature reading was 32.1°C. The largest difference between the maximum and minimum temperature readings in a week was 20.1°C. The maximum PAR intensity was 808.6 lux.

Table 13: 2005 Microclimate Data East 0m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	7.58	25.0	17.4	808.6[e]
2	6.98[b]	25.2	18.2	404.3
3	14.9	31.3	16.4	202.2
4	10.7	30.8	20.1[d]	321.1
5	10.0	30.1	20.1[d]	475.7
6	15.0	31.3	16.3	380.5
7	15.1	27.9	12.8	160.5
8	16.3	31.1	14.7	124.9
9	17.6	29.7	12.1	136.8
10	15.3	32.1[c]	16.8	249.7
11	17.5	31.2	13.7	761.1
12	18.8	31.6	12.8	380.5

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1230 hrs on 27 July 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 0930 hrs on 26 May 2005).

East 25m

East 25m contained 5 September Elm (*Ulmus serotina* Sarg.) (3 with width of 0.1m, 2 with height of 3.0m) and 2 Washington Hawthorne (*Crataegus phaenopyrum* (L. f.) Medic.) (width 0.1 and 0.4m) within 3m of the data logger.

Birds observed within 3m of the data logger at east 25m included 1 Hairy Woodpecker (*Picoides villosus*) and 1 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for East 25m are presented in Table 14. The minimum temperature reading was 8.08°C and maximum temperature reading was 32.1°C. The largest difference between the maximum and minimum temperature readings in a week was 19.5°C. The maximum PAR intensity was 107.0 lux.

Table 14: 2005 Microclimate Data East 25m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.38	25.2	16.8	107.0[e]
2	8.08[b]	25.2	17.1	95.1
3	15.4	31.2	15.8	89.2
4	11.4	30.8	19.3	95.1
5	10.7	30.2	19.5[d]	83.2
6	15.9	31.1	15.2	89.2
7	15.9	27.9	12.0	65.4
8	16.8	30.7	13.9	83.2
9	18.8	29.9	11.0	71.3
10	15.9	32.1[c]	16.2	74.3
11	18.0	31.9	13.9	71.3
12	19.5	32.1[c]	12.6	65.4

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1230 hrs on 27 July 2005 and at 1430 hrs on 13 August 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1330 hrs on 22 May 2005).

East 50m

East 50m contained 1 Northern Pin Oak (*Quercus ellipsoidalis* E. J. Hill) (width 1.3m), 2 September Elm (*Ulmus serotina* Sarg.) (width 0.4 and 0.8m), and 1 Sugar Maple (*Acer saccharum* Marsh.) (width 0.4m) within 3m of the data logger.

No birds were observed within 3m of the data logger at East 50m.

Microclimate data for East 50m are presented in Table 15. The minimum temperature reading was 8.18°C and maximum temperature reading was 32.4°C. The largest difference between the maximum and minimum temperature readings in a week was 20.1°C. The maximum PAR intensity was 107.0 lux.

Table 15: 2005 Microclimate Data East 50m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.68	25.4	16.7	107.0[e]
2	8.18[b]	25.6	17.4	92.2
3	15.6	31.7	16.1	92.2
4	11.2	31.0	19.7	107.0[e]
5	10.7	30.8	20.1[d]	89.2
6	16.4	31.4	14.9	89.2
7	16.0	28.1	12.1	74.3
8	16.8	30.9	14.1	74.3
9	18.8	30.2	11.3	74.3
10	16.0	32.2	16.2	80.3
11	18.1	32.1	13.9	65.4
12	19.6	32.4[c]	12.8	65.4

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0630 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1430 hrs on 13 August 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1400 hrs on 27 May 2005 and at 1400 hrs on 16 June 2005).

East 75m

East 75m contained 5 September Elm (*Ulmus serotina* Sarg.) (ranging in width from 0.1 to 0.2m) within 3m of the data logger.

Birds observed within 3m of the data logger at East 75m included 1 Acadian Flycatcher (*Empidonax virescens*), 1 American Robin (*Turdus migratorius*), 1 Pileated Woodpecker (*Dryocopus pileatus*), and 2 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for East 75m are presented in Table 16. The minimum temperature reading was 8.08°C and maximum temperature reading was 32.4°C. The largest difference between the maximum and minimum temperature readings in a week was 20.3°C. The maximum PAR intensity was 178.4 lux.

Table 16: 2005 Microclimate Data East 75m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.78	25.0	16.2	124.9
2	8.08[b]	25.5	17.4	118.9
3	15.6	31.8	16.2	107.0
4	11.2	30.7	19.4	118.9
5	10.5	30.8	20.3[d]	101.1
6	16.2	31.6	15.3	113.0
7	16.0	28.0	12.0	92.2
8	16.6	30.8	14.1	101.1
9	18.8	30.0	11.1	95.1
10	16.0	32.2	16.2	95.1
11	18.1	31.8	13.6	178.4[e]
12	19.5	32.4[c]	12.9	89.2

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0630 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1430 hrs on 13 August 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1130 hrs on 06 August 2005).

East 100m

East 100m contained 3 September Elm (*Ulmus serotina* Sarg.) (ranging in width from 0.2 to 1.4m, 1 with height of 4.0m) and 1 Red Maple (*Acer rubrum* L.) (width 0.2m) within 3m of the data logger.

Birds observed within 3m of the data logger at East 100m included 1 Acadian Flycatcher (*Empidonax virescens*).

Microclimate data for East 100m are presented in Table 17. The minimum temperature reading was 7.98°C and maximum temperature reading was 32.4°C. The largest difference between the maximum and minimum temperature readings in a week was 20.3°C. The maximum PAR intensity was 178.4 lux.

Table 17: 2005 Microclimate Data East 100m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.88	24.6	15.8	101.1
2	7.98[b]	25.3	17.3	89.2
3	15.5	31.3	15.8	92.2
4	11.1	30.4	19.2	107.0[e]
5	10.5	30.3	19.8[d]	92.2
6	16.0	31.1	15.0	74.3
7	15.9	27.9	12.0	80.3
8	16.4	30.4	13.9	83.2
9	18.8	29.8	10.9	74.3
10	16.0	31.5	15.4	80.3
11	18.0	31.4	13.3	62.4
12	19.4	31.7[c]	12.3	65.4

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs and 0630 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1230 hrs on 27 July 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1100 hrs on 12 June 2005).

East 125m

East 125m contained 2 Yellow Poplar (*Liriodendron tulipifera* L.) (width 0.7 and 1.1m) within 3m of the data logger.

No birds were observed within 3m of the data logger at East 125m.

Microclimate data for East 125m are presented in Table 18. The minimum temperature reading was 8.18°C and maximum temperature reading was 32.3°C. The largest difference between the maximum and minimum temperature readings in a week was 20.3°C. The maximum PAR intensity was 808.6 lux.

Table 18: 2005 Microclimate Data East 125m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.88	25.3	16.4	297.3
2	8.18[b]	25.4	17.2	499.4
3	15.6	33.0	17.4	737.3
4	11.4	31.5	20.0[d]	808.6[e]
5	10.7	30.3	19.6	737.3
6	16.1	31.3	15.1	428.1
7	16.0	27.8	11.8	237.8
8	16.6	30.7	14.0	237.8
9	18.9	30.0	11.1	713.5
10	16.2	32.3[c]	16.1	689.7
11	18.3	31.2	12.8	368.6
12	19.6	31.6	12.0	160.5

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs and 0630 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1100 hrs on 08 June 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1100 hrs on 15 June 2005).

West 0m

West 0m contained 2 Black Tupelo (*Nyssa sylvatica* Marsh.) (width 1.2 and 2.7m), 1 Common Persimmon (*Diospyros viriniana* L.) (height 1.5m), and 1 Washington Hawthorne (*Crataegus phaenopyrum* (L. f.) Medic.) (height 2.0m) within 3m of the data logger.

No birds were observed within 3m of the data logger at West 0m.

Microclimate data for West 0m are presented in Table 19. The minimum temperature reading was 8.08°C and maximum temperature reading was 36.6°C. The largest difference between the maximum and minimum temperature readings in a week was 22.7°C. The maximum PAR intensity was 998.9 lux.

Table 19: 2005 Microclimate Data West 0m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.68	28.4	19.7	998.9[e]
2	8.08[b]	27.1	19.0	903.8
3	15.8	32.1	16.3	225.9
4	10.8	33.5	22.7[d]	178.4
5	10.5	31.5	21.0	124.9
6	16.0	32.7	16.8	118.9
7	15.8	30.9	15.1	113.0
8	16.8	31.8	15.0	113.0
9	18.6	32.8	14.2	856.2
10	15.9	36.6[c]	20.8	856.2
11	18.0	34.6	16.5	190.3
12	19.7	33.4	13.8	249.7

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0530 hrs and 0600 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1000 hrs on 27 July 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1100 hrs on 26 June 2005).

West 25m

West 25m contained 1 Common Persimmon (*Diospyros viriniana* L.) (height 3.0m), 4 September Elm (*Ulmus serotina* Sarg.) (ranging in width from 0.6 to 1.0m), and 2 Washington Hawthorne (*Crataegus phaenopyrum* (L. f.) Medic.) (1 with width 0.2m, 1 with height 3.0m) within 3m of the data logger.

No birds were observed within 3m of the data logger at West 25m.

Microclimate data for West 25m are presented in Table 20. The minimum temperature reading was 8.28°C and maximum temperature reading was 34.8°C. The largest difference between the maximum and minimum temperature readings in a week was 21.0°C. The maximum PAR intensity was 475.7 lux.

Table 20: 2005 Microclimate Data West 25m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.78	26.3	17.5	190.3
2	8.28[b]	25.9	17.6	202.2
3	15.7	32.4	16.7	249.7
4	10.9	32.0	21.0[d]	285.4
5	10.3	31.3	21.0[d]	297.3
6	16.0	32.4	16.3	225.9
7	15.8	29.1	13.3	297.3
8	16.6	32.1	15.5	380.5
9	18.6	32.0	13.4	475.7[e]
10	15.8	33.4	17.7	380.5
11	17.9	34.8[c]	16.9	380.5
12	19.6	33.3	13.8	333.0

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0530 hrs, 0600 hrs, and 0630 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1400 hrs on 02 August 2005 and at 1400 hrs on 04 August 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1130 hrs on 23 July 2005).

West 50m

West 50m contained 2 September Elm (*Ulmus serotina* Sarg.) (width 1.0 and 1.2m), and 8 Washington Hawthorne (*Crataegus phaenopyrum* (L. f.) Medic.) (3 ranging in width from 0.2 to 0.3m, 5 ranging in height from 3.5 to 4.0m) within 3m of the data logger.

Birds observed within 3m of the data logger at West 50m included 1 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for West 50m are presented in Table 21. The minimum temperature reading was 8.28°C and maximum temperature reading was 33.3°C. The largest difference between the maximum and minimum temperature readings in a week was 20.4°C. The maximum PAR intensity was 321.1 lux.

Table 21: 2005 Microclimate Data West 50m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.78	26.4	17.6	148.6
2	8.28[b]	25.1	16.8	107.0
3	15.7	31.6	15.9	101.1
4	11.0	31.5	20.4[d]	321.1[e]
5	10.4	30.4	20.0	95.1
6	16.0	31.6	15.5	107.0
7	15.9	28.5	12.6	92.2
8	16.6	31.0	14.3	124.9
9	18.9	30.5	11.6	95.1
10	15.9	33.1	17.3	92.2
11	18.0	33.3[c]	15.3	83.2
12	19.7	33.0	13.4	148.6

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1500 hrs on 04 August 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1700 hrs on 16 June 2005).

West 75m

West 75m contained 6 Washington Hawthorne (*Crataegus phaenopyrum* (L. f.) Medic.) (height 4.0m) and 1 Yellow Poplar (*Liriodendron tulipifera* L.) (width 2.0m) within 3m of the data logger.

Birds observed within 3m of the data logger at West 75m included 1 American Crow (*Corvus brachyrhynchos*) and 1 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for West 75m are presented in Table 22. The minimum temperature reading was 8.28°C and maximum temperature reading was 32.7°C. The largest difference between the maximum and minimum temperature readings in a week was 19.9°C. The maximum PAR intensity was 380.5 lux.

Table 22: 2005 Microclimate Data West 75m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.88	25.7	16.8	136.8
2	8.28[b]	25.2	16.9	380.5[e]
3	15.7	32.0	16.3	380.5[e]
4	11.2	31.2	19.9[d]	118.9
5	10.6	30.4	19.8	74.3
6	16.2	31.2	14.9	83.2
7	16.0	28.2	12.1	71.3
8	16.6	30.7	14.0	118.9
9	19.0	30.8	11.8	74.3
10	15.9	32.7[c]	16.8	74.3
11	18.0	32.2	14.1	83.2
12	19.7	32.2	12.5	190.3

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs and 0630 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1530 hrs on 26 July 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1130 hrs on 30 May 2005 and at 1130 hrs on 07 June 2005).

West 100m

West 100m contained 11 Washington Hawthorne (*Crataegus phaenopyrum* (L. f.) Medic.) (6 ranging in width from 0.1 to 0.2m, 3 ranging in height from 0.2 to 4.0m) and 1 Yellow Poplar (*Liriodendron tulipifera* L.) (width 3.0m) within 3m of the data logger.

Birds observed within 3m of the data logger at West 100m included 1 Acadian Flycatcher (*Empidonax virescens*), 1 Tufted Titmouse (*Baeolophus bicolor*), and 1 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for West 100m are presented in Table 23. The minimum temperature reading was 8.58°C and maximum temperature reading was 32.7°C. The largest difference between the maximum and minimum temperature readings in a week was 19.9°C. The maximum PAR intensity was 380.5 lux.

Table 23: 2005 Microclimate Data West 100m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	9.08	24.9	15.9	142.7
2	8.58[b]	25.2	16.6	148.6[e]
3	15.9	31.3	15.4	107.0
4	11.6	30.6	18.9	124.9
5	10.9	30.1	19.1[d]	95.1
6	16.6	31.2	14.5	107.0
7	16.3	28.0	11.6	89.2
8	17.0	30.6	13.6	92.2
9	19.3	30.1	10.8	89.2
10	16.1	32.7[c]	16.6	89.2
11	18.3	31.9	13.6	89.2
12	19.9	32.0	12.1	80.3

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs and 0630 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1230 hrs on 27 July 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 0900 hrs on 29 May 2005).

West 125m

West 125m contained 1 Hackberry (*Celtis occidentalis* L.) (width 0.6m) and 4 Washington Hawthorne (*Crataegus phaenopyrum* (L. f.) Medic.) (ranging in height from 3.0 to 4.5m) within 3m of the data logger.

Birds observed within 3m of the data logger at West 125m included 1 Acadian Flycatcher (*Empidonax virescens*).

Microclimate data for West 125m are presented in Table 24. The minimum temperature reading was 8.28°C and maximum temperature reading was 31.9°C. The largest difference between the maximum and minimum temperature readings in a week was 19.1°C. The maximum PAR intensity was 903.8 lux.

Table 24: 2005 Microclimate Data West 125m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.88	24.6	15.8	499.4
2	8.28[b]	25.1	16.8	903.8[e]
3	15.7	30.9	15.2	202.2
4	11.4	30.2	18.7	249.7
5	10.7	29.9	19.1[d]	101.1
6	16.2	31.0	14.7	107.0
7	16.0	27.6	11.5	261.6
8	16.7	30.2	13.4	309.2
9	19.2	29.6	10.4	148.6
10	16.0	31.9[c]	15.8	214.0
11	18.2	31.1	12.8	92.2
12	19.6	31.4	11.8	83.2

[a] Temperature Difference = maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs and 0630 hrs on 29 May 2005).
[c] Maximum temperature (recorded at 1230 hrs on 27 July 2005).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 0900 hrs on 29 May 2005).

Appendix 2: 2006 Microclimate Data

Data are separated into the following time periods:

Week 1: 10 April 2006 to 16 April 2006
Week 2: 17 April 2006 to 23 April 2006
Week 3: 24 April 2006 to 30 April 2006
Week 4: 01 May 2006 to 07 May 2006
Week 5: 08 May 2006 to 14 May 2006
Week 6: 15 May 2006 to 21 May 2006
Week 7: 22 May 2006 to 28 May 2006
Week 8: 29 May 2006 to 04 June 2006
Week 9: 05 June 2006 to 11 June 2006
Week 10: 12 June 2006 to 18 June 2006
Week 11: 19 June 2006 to 25 June 2006
Week 12: 26 June 2006 to 02 July 2006
Week 13: 03 July 2006 to 09 July 2006
Week 14: 10 July 2006 to 16 July 2006
Week 15: 17 July 2006 to 23 July 2006
Week 16: 24 July 2006 to 30 July 2006
Week 17: 31 July 2006 to 06 August 2006
Week 18: 07 August 2006 to 13 August 2006
Week 19: 14 August 2006 to 20 August 2006
Week 20: 21 August 2006 to 26 August 2006

Northwest 0m

Northwest 0m contained 3 Flowering Dogwood (*Cornus florida* L.) (height 2m), 2 Red Maple (*Acer rubrum* L.) (1 with width 0.45cm, 1 with height 5m), 2 September Elm (*Ulmus serotina* Sarg.) (width 0.25 and 0.45m), and 1 Virginia Pine (*Pinus virginiana* Mill.) (width 1.3m) within 3m of the data logger.

Birds observed at within 3m of the data logger Northwest 0m included 1 Blue Jay (*Cyanocitta cristata*), 2 Carolina Chickadee (*Poecile carolinensis*), 6 Eastern Wood Pewee (*Contopus virens*), and 2 White-breasted Nuthatch (*Sitta carolinensis*).

Microclimate data for Northwest 0m are presented in Table 25. The minimum temperature reading was 2.30°C and maximum temperature reading was 34.4°C. The largest difference between the maximum and minimum temperature readings in a week was 29.5°C. The maximum PAR intensity was 523.2 lux.

Table 25: 2006 Microclimate Data Northwest 0m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	2.30[b]	31.8	29.5[d]	499.4
2	6.78	31.7	24.9	523.2[e]
3	3.16	27.6	24.4	451.9
4	5.76	28.5	22.7	172.4
5	7.28	25.2	17.9	142.7
6	8.78	23.6	14.8	142.7
7	6.57	28.3	21.7	124.9
8	13.0	33.0	20.0	118.9
9	10.6	27.1	16.5	107.0
10	12.2	31.8	19.6	118.9
11	17.1	31.3	14.2	92.2
12	16.0	32.0	16.0	83.2
13	14.5	32.5	18.0	92.2
14	17.3	31.2	13.9	89.2
15	18.6	33.4	14.8	83.2
16	17.4	32.2	14.8	89.2
17	18.8	34.4[c]	15.6	80.3
18	11.8	30.4	18.5	80.3
19	16.7	31.6	14.9	80.3
20	16.3	32.3	16.0	74.3

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0330 hrs and 0730 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1500 hrs and 1530 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 0930 hrs on 18 April 2006).

Northwest 50m

Northwest 50m contained 3 September Elm (*Ulmus serotina* Sarg.) (1 with width 0.15m, 2 with height 4m), 4 Washington Hawthorne (*Crataegus phaenopyrum* (L. f.) Medic.) (height 1 to 2m), 1 White Oak (*Quercus alba* L.) (width 0.5 m), and 2 Yellow Poplar (*Liriodendron tulipifera* L.) (0.2 and 0.35m) within 3m of the data logger.

Birds observed at within 3m of the data logger Northwest 50m included 2 White-breasted Nuthatch (*Sitta carolinensis*).

Microclimate data for Northwest 50m are presented in Table 26. The minimum temperature reading was 2.30°C and maximum temperature reading was 35.1°C. The largest difference between the maximum and minimum temperature readings in a week was 31.4°C. The maximum PAR intensity was 428.1 lux.

Table 26: 2006 Microclimate Data Northwest 50m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	2.30[b]	33.7	31.4[d]	380.5
2	6.37	31.7	25.3	184.3
3	3.05	27.4	24.3	428.1[e]
4	5.45	28.4	22.9	178.4
5	7.08	25.4	18.3	261.6
6	8.88	23.4	14.5	118.9
7	6.47	28.5	22.0	124.9
8	12.9	32.7	19.8	124.9
9	10.4	27.1	16.7	124.9
10	12.1	33.0	20.9	124.9
11	16.9	31.8	14.9	107.0
12	15.7	32.5	16.8	95.1
13	14.2	33.1	18.9	107.0
14	17.4	30.8	13.4	95.1
15	18.7	32.9	14.2	80.3
16	17.4	32.9	15.5	166.5
17	18.5	35.1[c]	16.6	80.3
18	11.7	30.8	19.0	130.8
19	16.6	31.7	15.1	95.1
20	16.3	32.2	15.9	65.4

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0730 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1530 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1000 hrs on 27 April 2006).

Northwest 100m

Northwest 100m contained 2 Red Maple (*Acer rubrum* L.) (1 with width 0.15m, 1 with height 1m), 1 September Elm (*Ulmus serotina* Sarg.) (width 0.45m), 3 Virginia Pine (*Pinus virginiana* Mill.) (ranging in width from 1 to 1.2m), 1 White Oak (*Quercus alba* L.) (width 1.3m) within 3m of the data logger.

Birds observed at within 3m of the data logger Northwest 100m included 1 Blue Jay (*Cyanocitta cristata*), 1 Scarlet Tanager (*Piranga olivacea*), and 1 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for Northwest 100m are presented in Table 27. The minimum temperature reading was 2.62°C and maximum temperature reading was 35.6°C. The largest difference between the maximum and minimum temperature readings in a week was 30.4°C. The maximum PAR intensity was 532.2 lux.

Table 27: 2006 Microclimate Data Northwest 100m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	2.62[b]	33.0	30.4[d]	285.4
2	6.47	31.1	24.6	214.0
3	3.16	27.6	24.4	428.1
4	5.66	28.6	22.9	297.3
5	7.28	25.8	18.5	225.9
6	9.08	23.6	14.5	344.9
7	6.47	29.7	23.2	404.3
8	12.9	33.2	20.3	166.5
9	10.2	28.8	18.6	428.1
10	12.3	33.0	20.7	333.0
11	17.1	32.2	15.1	237.8
12	15.3	32.7	17.4	261.6
13	14.3	33.2	18.9	190.3
14	17.5	31.9	14.4	154.6
15	18.6	33.5	14.9	249.7
16	17.4	33.3	15.9	523.2[e]
17	18.6	35.6[b]	17.0	136.8
18	11.8	31.3	19.4	95.1
19	16.5	32.0	15.5	113.0
20	16.4	32.4	16.0	92.2

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0330 hrs and 0730 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1330 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1130 hrs on 24 July 2006).

Northwest 150m

Northwest 150m contained 4 September Elm (*Ulmus serotina* Sarg.) (ranging in width from 0.1 to 0.25m) and 2 White Oak (*Quercus alba* L.) (width 1 and 2.7m) within 3m of the data logger.

Birds observed at within 3m of the data logger Northwest 150m included 2 Eastern Phoebe (*Sayornis phoebe*) and 2 Scarlet Tanager (*Piranga olivacea*).

Microclimate data for Northwest 150m are presented in Table 28. The minimum temperature reading was 2.20°C and maximum temperature reading was 35.0°C. The largest difference between the maximum and minimum temperature readings in a week was 30.0°C. The maximum PAR intensity was 475.7 lux.

Table 28: 2006 Microclimate Data Northwest 150m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	2.20[b]	32.2	30.0[d]	237.8
2	6.06	31.3	25.2	190.3
3	3.26	26.0	22.7	178.4
4	5.66	28.0	22.3	148.6
5	7.28	25.0	17.7	136.8
6	8.78	23.0	14.2	404.3
7	6.37	28.4	22.0	475.7[e]
8	12.7	32.6	19.9	475.7[e]
9	9.77	27.2	17.4	124.9
10	12.2	31.9	19.7	107.0
11	17.1	31.3	14.2	83.2
12	15.1	32.4	17.3	107.0
13	14.4	33.0	18.6	285.4
14	17.4	31.0	13.6	356.7
15	18.4	33.1	14.7	404.3
16	17.5	32.1	14.6	237.8
17	18.8	35.0[c]	16.2	451.9
18	12.0	30.1	18.0	273.5
19	16.5	31.6	15.1	83.2
20	16.4	31.7	15.2	285.4

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0730 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1330 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1100 hrs on 28 May 2006 and 1100 hrs on 29 May 2006).

Northwest 200m

Northwest 200m contained 5 September Elm (*Ulmus serotina* Sarg.) (4 with width ranging from 0.01 to 0.8m, 1 with height 4m) and 1 Yellow Poplar (*Liriodendron tulipifera* L.) (width 2.8m) within 3m of the data logger.

Birds observed at within 3m of the data logger Northwest 200m included 1 Eastern Phoebe (*Sayornis phoebe*), 1 Great Crested Flycatcher (*Myiarchus crinitus*), and 1 Scarlet Tanager (*Piranga olivacea*).

Microclimate data for Northwest 200m are presented in Table 29. The minimum temperature reading was 1.44°C and maximum temperature reading was 34.4°C. The largest difference between the maximum and minimum temperature readings in a week was 29.9°C. The maximum PAR intensity was 594.6 lux.

Table 29: 2006 Microclimate Data Northwest 200m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	1.44[b]	31.4	29.9[d]	380.5
2	5.86	31.4	25.5	333.0
3	3.26	26.7	23.4	333.0
4	5.76	28.4	22.6	225.9
5	7.28	25.5	18.2	136.8
6	8.48	22.7	14.2	594.6[e]
7	6.27	29.3	23.0	261.6
8	12.7	33.1	20.4	404.3
9	9.77	27.6	17.8	136.8
10	12.2	31.8	19.6	113.0
11	17.1	30.9	13.8	89.2
12	15.1	31.9	16.8	160.5
13	14.5	32.6	18.1	83.2
14	17.4	31.4	14.0	83.2
15	18.4	33.0	14.6	83.2
16	17.7	32.0	14.3	71.3
17	19.0	34.4[c]	15.4	71.3
18	12.1	30.2	18.0	65.4
19	16.6	31.5	14.9	80.3
20	16.4	32.0	15.6	74.3

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0700 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1330 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1030 hrs on 20 May 2006).

Northwest 250m

Northwest 250m contained 1 Common Persimmon (*Diospyros viriniana* L.) (height 3m), 1 Red Maple (*Acer rubrum* L.) (height 3m), 4 September Elm (*Ulmus serotina* Sarg.) (2 with width of 0.35 and 0.9m, 2 with height 3m), and 1 White Oak (*Quercus alba* L.) (width 2.4m) within 3m of the data logger.

Birds observed at within 3m of the data logger Northwest 250m included 1 American Crow (*Corvus brachyrhynchos*), 1 Blue Jay (*Cyanocitta cristata*), 1 Great Crested Flycatcher (*Myiarchus crinitus*), 1 Northern Flicker (*Colaptes auratus*), and 1 Red-tailed Hawk (*Buteo jamaicensis*).

Microclimate data for Northwest 250m are presented in Table 30. The minimum temperature reading was 1.87°C and maximum temperature reading was 35.3°C. The largest difference between the maximum and minimum temperature readings in a week was 30.6°C. The maximum PAR intensity was 1046.5 lux.

Table 30: 2006 Microclimate Data Northwest 250m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	1.87[b]	32.5	30.6[d]	570.8
2	5.96	35.3[c]	29.4	547.0
3	3.05	28.8	25.7	737.3
4	5.86	29.2	23.3	737.3
5	7.38	25.6	18.2	237.8
6	7.68	23.1	15.4	368.6
7	6.17	29.0	22.8	1046.5[e]
8	12.5	33.7	21.2	404.3
9	9.77	27.6	17.8	856.2
10	12.2	32.4	20.2	1046.5[e]
11	17.2	31.4	14.2	761.1
12	14.9	32.4	17.5	475.7
13	14.5	32.6	18.1	225.9
14	17.2	32.8	15.6	249.7
15	18.2	34.6	16.3	297.3
16	17.2	33.3	16.1	261.6
17	19.1	35.1	16.0	451.9
18	12.2	30.4	18.1	273.5
19	16.6	31.9	15.3	160.5
20	16.1	32.1	15.9	225.9

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0700 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1130 hrs on 20 April 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1200 hrs on 27 May 2006 and 1130 hrs on 13 June 2006).

Northwest 300m

Northwest 300m contained 1 Northern Red Oak (*Quercus rubra* L.) (width 0.5m), 2 Red Maple (*Acer rubrum* L.) (height 2m), 2 September Elm (*Ulmus serotina* Sarg.) (1 with width 1m, 1 with height 4m), 1 White Oak (*Quercus alba* L.) (1.6m) within 3m of the data logger.

Birds observed at within 3m of the data logger Northwest 300m included 3 Blue Jay (*Cyanocitta cristata*).

Microclimate data for Northwest 300m are presented in Table 31. The minimum temperature reading was 1.55°C and maximum temperature reading was 34.6°C. The largest difference between the maximum and minimum temperature readings in a week was 29.8°C. The maximum PAR intensity was 618.4 lux.

Table 31: 2006 Microclimate Data Northwest 300m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	1.55[b]	31.4	29.8[d]	618.4[e]
2	6.27	31.9	25.6	499.4
3	3.26	28.0	24.7	428.1
4	5.96	29.6	23.6	594.6
5	7.58	25.8	18.2	261.6
6	7.48	23.6	16.1	172.4
7	6.27	29.1	22.8	154.6
8	12.4	33.1	20.7	142.7
9	9.87	27.4	17.5	214.0
10	12.3	32.1	19.8	190.3
11	17.3	31.1	13.8	142.7
12	14.8	31.1	16.3	261.6
13	14.6	31.7	17.1	249.7
14	17.2	31.3	14.1	178.4
15	18.2	33.1	14.9	225.9
16	17.2	31.9	14.7	523.2
17	19.2	34.6[c]	15.4	273.5
18	12.2	30.3	18.0	249.7
19	16.6	31.3	14.7	118.9
20	16.1	31.8	15.6	113.0

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0400 hrs and 0700 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1300 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1030 hrs on 10 April 2006).

Southeast 0m

Southeast 0m contained 6 September Elm (*Ulmus serotina* Sarg.) (ranging in width from 0.15 to 0.9m) within 3m of the data logger.

Birds observed at within 3m of the data logger Southeast 0m included 1 Blue Jay (*Cyanocitta cristata*), 1 Brown Thrasher (*Toxostoma rufum*), 3 Grey Catbird (*Dumetella carolinensis*), 2 Downy Woodpecker (*Picoides pubescens*), 1 Eastern Wood Pewee (*Contopus virens*), 1 American Robin (*Turdus migratorius*), and 1 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for Southeast 0m are presented in Table 32. The minimum temperature reading was 0.121°C and maximum temperature reading was 34.7°C. The largest difference between the maximum and minimum temperature readings in a week was 32.3°C. The maximum PAR intensity was 1284.3 lux.

Table 32: 2006 Microclimate Data Southeast 0m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	0.121[b]	32.4	32.3[d]	1284.3[e]
2	4.93	30.5	25.5	856.2
3	2.41	26.5	24.1	761.1
4	4.00	27.5	23.5	761.1
5	6.27	25.4	19.1	237.8
6	8.28	23.0	14.7	113.0
7	6.17	28.1	21.9	107.0
8	12.6	31.7	19.1	89.2
9	9.57	26.5	16.9	83.2
10	11.5	32.3	20.8	124.9
11	16.0	31.3	15.2	62.4
12	15.1	32.3	17.2	107.0
13	13.5	32.3	18.8	83.2
14	16.6	30.6	13.9	53.5
15	18.6	31.6	13.0	62.4
16	16.9	32.5	15.6	56.5
17	16.7	34.7[c]	18.0	53.5
18	10.8	31.3	20.4	89.2
19	14.5	32.2	17.7	178.4
20	15.7	32.9	17.2	89.2

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0700 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1300 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 0900 hrs on 11 April 2006).

Southeast 50m

Southeast 50m contained 4 September Elm (*Ulmus serotina* Sarg.) (ranging in width from 0.1 to 0.35m) within 3m of the data logger.

Birds observed at within 3m of the data logger Southeast 50m included 1 Blue Jay (*Cyanocitta cristata*).

Microclimate data for Southeast 50m are presented in Table 33. The minimum temperature reading was 0.453°C and maximum temperature reading was 34.7°C. The largest difference between the maximum and minimum temperature readings in a week was 31.6°C. The maximum PAR intensity was 1141.6 lux.

Table 33: 2006 Microclimate Data Southeast 50m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	0.453[b]	32.1	31.6[d]	547.0
2	5.24	33.2	28.0	570.8
3	3.05	26.1	23.0	856.2
4	4.73	27.1	22.3	273.5
5	6.47	24.3	17.8	689.7
6	8.58	22.7	14.1	1141.6[e]
7	6.37	27.9	21.5	356.7
8	13.2	32.1	18.9	368.6
9	10.1	26.2	16.1	665.9
10	12.0	30.9	18.8	951.3
11	16.6	30.7	14.0	856.2
12	15.6	30.7	15.1	190.3
13	13.8	31.3	17.4	95.1
14	17.1	29.9	12.8	83.2
15	18.6	31.6	13.0	107.0
16	17.5	34.7[c]	17.2	547.0
17	17.4	35.8	18.4	547.0
18	11.5	29.0	17.4	214.0
19	15.2	31.4	16.2	190.3
20	15.9	31.1	15.2	356.7

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0700 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1130 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 0930 hrs on 18 May 2006).

Southeast 100m

Southeast 100m contained 1 Bear Oak (*Quercus ilicifolia* Wangenh.) (width 1m) and 2 September Elm (*Ulmus serotina* Sarg.) (width 0.2 and 0.4m) within 3m of the data logger.

Birds observed at within 3m of the data logger Southeast 100m included 1 Hairy Woodpecker (*Picoides villosus*) and 1 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for Southeast 100m are presented in Table 34. The minimum temperature reading was 1.00°C and maximum temperature reading was 34.3°C. The largest difference between the maximum and minimum temperature readings in a week was 32.0°C. The maximum PAR intensity was 642.1 lux.

Table 34: 2006 Microclimate Data Southeast 100m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	1.00[b]	33.0	32.0[d]	344.9
2	6.06	32.5	26.4	261.6
3	3.37	27.8	24.4	451.9
4	5.14	30.6	25.4	451.9
5	6.47	28.9	22.4	249.7
6	8.58	24.2	15.6	160.5
7	6.27	29.1	22.8	249.7
8	13.3	33.1	19.8	321.1
9	10.2	27.2	17.0	499.4
10	12.1	31.1	19.0	475.7
11	16.7	31.1	14.4	202.2
12	15.6	30.9	15.3	225.9
13	13.9	31.6	17.6	428.1
14	17.2	31.5	14.3	172.4
15	18.5	32.8	14.3	74.3
16	17.6	31.9	14.3	642.1[e]
17	17.6	34.3[c]	16.7	166.5
18	11.8	29.7	17.8	237.8
19	15.6	31.4	15.8	160.5
20	16.0	31.5	15.4	74.3

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0700 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1330 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1000 hrs on 29 July 2006).

Southeast 150m

Southeast 150m contained 2 September Elm (*Ulmus serotina* Sarg.) (width 0.1 to 0.2m), 4 Yellow Poplar (*Liriodendron tulipifera* L.) (ranging in width from 1.1 to 2m), and 1 White Oak (*Quercus alba* L.) (width 1.5m) within 3m of the data logger.

Birds observed at within 3m of the data logger Southeast 150m included 1 Blue Jay (*Cyanocitta cristata*), 1 Eastern Phoebe (*Sayornis phoebe*), 1 Tufted Titmouse (*Baeolophus bicolor*), and 2 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for Southeast 150m are presented in Table 35. The minimum temperature reading was 1.66°C and maximum temperature reading was 33.1°C. The largest difference between the maximum and minimum temperature readings in a week was 29.5°C. The maximum PAR intensity was 214.0 lux.

Table 35: 2006 Microclimate Data Southeast 150m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	1.66[b]	31.2	29.5[d]	214.0[e]
2	6.47	30.4	23.9	178.4
3	3.68	25.6	21.9	190.3
4	5.76	27.2	21.4	136.8
5	6.78	24.6	17.9	113.0
6	8.38	22.1	13.8	136.8
7	6.47	28.7	22.2	130.8
8	13.3	32.4	19.1	113.0
9	10.3	27.5	17.2	124.9
10	12.4	31.5	19.1	107.0
11	17.3	30.8	13.5	95.1
12	15.6	31.1	15.5	80.3
13	14.3	31.2	16.8	92.2
14	17.5	30.5	13.0	83.2
15	18.5	32.2	13.7	65.4
16	17.5	30.7	13.2	71.3
17	18.0	33.1[c]	15.1	56.5
18	12.2	29.2	16.9	56.5
19	16.1	30.9	14.7	184.3
20	16.5	30.9	14.3	172.4

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0700 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1330 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1100 hrs on 13 April 2006 and 0830 hrs on 16 April 2006).

Southeast 200m

Southeast 200m contained 3 September Elm (*Ulmus serotina* Sarg.) (width 0.15m) and 1 White Oak (*Quercus alba* L.) (0.6m) within 3m of the data logger.

Birds observed at within 3m of the data logger Southeast 200m included 1 Hermit Thrush (*Catharus guttatus*) and 1 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for Southeast 200m are presented in Table 36. The minimum temperature reading was 1.98°C and maximum temperature reading was 34.3°C. The largest difference between the maximum and minimum temperature readings in a week was 32.0°C. The maximum PAR intensity was 380.5 lux.

Table 36: 2006 Microclimate Data Southeast 200m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	1.98[b]	34.0	32.0[d]	380.5[e]
2	6.47	34.2	27.7	368.6
3	3.47	29.8	26.3	368.6
4	5.86	28.6	22.7	237.8
5	6.67	25.7	19.0	142.7
6	8.08	22.8	14.7	160.5
7	6.17	28.7	22.5	225.9
8	12.9	33.1	20.2	130.8
9	10.2	26.5	16.3	124.9
10	12.4	31.9	19.5	130.8
11	17.2	31.2	14.0	101.1
12	15.3	31.7	16.4	92.2
13	14.0	31.8	17.7	101.1
14	17.4	30.7	13.3	142.7
15	18.4	32.9	14.5	190.3
16	17.3	31.7	14.4	237.8
17	18.3	34.3[c]	15.9	95.1
18	12.0	30.0	17.9	124.9
19	16.5	31.7	15.2	89.2
20	16.3	31.8	15.4	89.2

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0330 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1330 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1530 hrs on 16 April 2006).

Southeast 250m

Southeast 250m contained 5 September Elm (*Ulmus serotina* Sarg.) (ranging in width from 0.1 to 0.4m) and 1 White Oak (*Quercus alba* L.) (width 1.5m) within 3m of the data logger.

Birds observed at within 3m of the data logger Southeast 250m included 1 Blue Jay (*Cyanocitta cristata*) and 1 Scarlet Tanager (*Piranga olivacea*).

Microclimate data for Southeast 250m are presented in Table 37. The minimum temperature reading was 1.98°C and maximum temperature reading was 35.9°C. The largest difference between the maximum and minimum temperature readings in a week was 32.2°C. The maximum PAR intensity was 856.2 lux.

Table 37: 2006 Microclimate Data Southeast 250m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	1.98[b]	34.2	32.2[d]	737.3
2	6.47	35.8	29.3	856.2[e]
3	3.47	31.8	28.3	665.9
4	5.86	31.3	25.4	856.2[e]
5	6.88	27.1	20.2	309.2
6	7.68	23.6	15.9	214.0
7	6.27	29.8	23.5	333.0
8	12.8	33.4	20.6	190.3
9	10.3	28.3	18.0	273.5
10	12.5	32.4	19.9	297.3
11	17.3	32.5	15.2	178.4
12	15.1	32.2	17.1	321.1
13	13.9	32.1	18.1	321.1
14	17.4	31.6	14.2	273.5
15	18.3	33.7	15.4	166.5
16	17.3	32.1	14.8	380.5
17	18.8	35.9[c]	17.1	499.4
18	12.2	34.0	21.7	333.0
19	16.9	35.2	18.3	160.5
20	16.4	34.5	18.1	618.4

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0330 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1200 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1000 hrs on 20 April 2006 and 1100 hrs on 01 May 2006).

East 0m

East 0m contained 4 September Elm (*Ulmus serotina* Sarg.) (ranging in width from 0.3 to 1.4m) within 3m of the data logger.

Birds observed at within 3m of the data logger East 0m included 1 Blue Jay (*Cyanocitta cristata*), 1 Eastern Wood Pewee (*Contopus virens*), 1 Northern Cardinal (*Cardinalis cardinalis*), and 1 Scarlet Tanager (*Piranga olivacea*).

Microclimate data for East 0m are presented in Table 38. The minimum temperature reading was 0.563°C and maximum temperature reading was 35.5°C. The largest difference between the maximum and minimum temperature readings in a week was 33.7°C. The maximum PAR intensity was 1189.2 lux.

Table 38: 2006 Microclimate Data East 0m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	0.563[b]	34.3	33.7[d]	1141.6
2	5.35	35.0	29.7	1189.2[e]
3	2.84	32.0	29.1	856.2
4	5.24	31.2	25.9	1141.6
5	6.67	26.3	19.6	297.3
6	8.68	23.3	14.6	178.4
7	6.06	29.4	23.3	642.1
8	13.2	33.8	20.7	237.8
9	10.3	27.9	17.6	285.4
10	11.9	32.5	20.6	333
11	16.6	32.1	15.5	225.9
12	15.4	32.4	17.0	249.7
13	13.7	32.6	18.9	225.9
14	17.1	31.6	14.5	160.5
15	18.5	33.4	14.9	136.8
16	17.2	32.7	15.5	172.4
17	18.2	35.5[c]	17.3	1189.2[e]
18	11.2	31.3	20.0	321.1
19	16.0	32.7	16.7	713.5
20	15.7	33.2	17.6	344.9

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0330 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1500 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1030 hrs on 18 April 2006 and 0900 hrs on 06 August 2006).

East 50m

East 50m contained 5 September Elm (*Ulmus serotina* Sarg.) (4 with width ranging from 0.15 to 3.4m and 1 with height 3m) within 3m of the data logger.

Birds observed at within 3m of the data logger East 50m included 2 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for East 50m are presented in Table 39. The minimum temperature reading was –0.325°C and maximum temperature reading was 34.7°C. The largest difference between the maximum and minimum temperature readings in a week was 34.8°C. The maximum PAR intensity was 1331.9 lux.

Table 39: 2006 Microclimate Data East 50m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	-0.325[b]	34.5	34.8[d]	1331.9[e]
2	4.62	34.7[c]	30.1	998.9
3	2.84	30.9	28.0	856.2
4	5.04	28.7	23.6	665.9
5	6.57	25.4	18.8	214.0
6	8.58	23.0	14.4	214.0
7	6.17	29.0	22.8	113.0
8	13.1	33.1	20.0	118.9
9	10.3	27.4	17.1	107.0
10	12.0	31.9	19.9	124.9
11	16.6	31.0	14.3	92.2
12	15.5	31.5	16.0	80.3
13	13.7	31.6	17.9	118.9
14	17.0	31.2	14.2	80.3
15	18.4	32.7	14.3	89.2
16	17.4	32.0	14.6	80.3
17	17.9	34.3	16.4	83.2
18	11.2	30.1	18.8	154.6
19	15.8	31.9	16.1	214.0
20	15.8	31.8	16.0	451.9

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0330 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1300 hrs on 20 April 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1200 hrs on 10 April 2006).

East 100m

East 100m contained 3 September Elm (*Ulmus serotina* Sarg.) (ranging in width from 0.15 to 1.9m) and 1 White Oak (*Quercus alba* L.) (width 2m) within 3m of the data logger.

Birds observed at within 3m of the data logger East 100m included 2 White-breasted Nuthatch (*Sitta carolinensis*).

Microclimate data for East 100m are presented in Table 40. The minimum temperature reading was 0.0100°C and maximum temperature reading was 34.9°C. The largest difference between the maximum and minimum temperature readings in a week was 33.4°C. The maximum PAR intensity was 1284.3 lux.

Table 40: 2006 Microclimate Data East 100m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	0.0100[b]	33.4	33.4[d]	1284.3[e]
2	5.04	34.0	28.9	1094.0
3	2.84	29.9	27.0	808.6
4	5.14	31.1	25.9	903.8
5	6.67	27.7	21.0	172.4
6	8.18	23.6	15.4	214.0
7	5.96	29.6	23.6	154.6
8	13.0	32.9	19.9	190.3
9	10.2	27.2	17.0	249.7
10	12.1	31.5	19.4	202.2
11	16.6	30.8	14.1	237.8
12	15.2	30.7	15.5	184.3
13	13.8	31.0	17.2	178.4
14	17.0	31.6	14.6	113.0
15	18.2	33.0	14.8	107.0
16	17.4	32.8	15.4	124.9
17	18.0	34.9[c]	16.9	107.0
18	11.3	30.6	19.2	475.7
19	15.9	32.5	16.6	380.5
20	15.6	34.1	18.5	309.2

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0330 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1500 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1100 hrs on 10 April 2006).

East 150m

East 150m contained 5 September Elm (*Ulmus serotina* Sarg.) (ranging in width from 0.1 to 0.25m) within 3m of the data logger.

Birds observed at within 3m of the data logger East 150m included 1 Great Crested Flycatcher (*Myiarchus crinitus*), 1 Pileated Woodpecker (*Dryocopus pileatus*), 1 Wood Thrush (*Hylocichla mustelina*) and 1 Yellow-billed Cuckoo (*Coccyzus americanus*).

Microclimate data for East 150m are presented in Table 41. The minimum temperature reading was 1.11°C and maximum temperature reading was 37.7°C. The largest difference between the maximum and minimum temperature readings in a week was 32.7°C. The maximum PAR intensity was 1617.2 lux.

Table 41: 2006 Microclimate Data East 150m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	1.11[b]	33.8	32.7[d]	1617.2[e]
2	6.27	37.7[c]	31.4	1427.0
3	3.37	29.7	26.3	1141.6
4	5.45	30.3	24.8	1617.2[e]
5	6.67	27.7	21.0	1141.6
6	8.08	22.8	14.7	761.1
7	5.96	29.1	23.1	1379.4
8	13.0	33.5	20.6	356.7
9	10.3	27.4	17.1	1284.3
10	12.2	32.1	19.9	178.4
11	16.9	31.0	14.1	130.8
12	15.3	30.9	15.6	1331.9
13	14.4	31.2	16.7	297.3
14	17.1	31.7	14.6	344.9
15	18.3	33.4	15.1	249.7
16	17.4	32.4	15.0	356.7
17	18.3	37.3	18.9	903.8
18	11.7	29.9	18.1	475.7
19	16.3	30.9	14.5	404.3
20	15.9	31.5	15.6	184.3

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0330 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1200 hrs on 20 April 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1030 hrs on 11 April 2006 and 1030 hrs on 02 May 2006).

East 200m

East 200m contained 5 September Elm (*Ulmus serotina* Sarg.) (ranging in width from 0.1 to 0.35m) and 3 White Oak (*Quercus alba* L.) (ranging in width from 0.6 to 1m) within 3m of the data logger.

Birds observed at within 3m of the data logger East 200m included 2 Eastern Wood Pewee (*Contopus virens*), 1 Great Crested Flycatcher (*Myiarchus crinitus*), 1 White-breasted Nuthatch (*Sitta carolinensis*), and 1 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for East 200m are presented in Table 42. The minimum temperature reading was 1.98°C and maximum temperature reading was 33.7°C. The largest difference between the maximum and minimum temperature readings in a week was 30.6°C. The maximum PAR intensity was 1189.2 lux.

Table 42: 2006 Microclimate Data East 200m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	1.98[b]	32.6	30.6[d]	642.1
2	6.57	31.6	25.0	761.1
3	3.79	26.9	23.1	903.8
4	6.06	28.8	22.7	1189.2[e]
5	7.08	26.1	19.0	190.3
6	8.28	22.9	14.6	142.7
7	6.47	30.4	23.9	136.8
8	13.2	33.6	20.5	124.9
9	10.5	27.2	16.7	124.9
10	12.6	32.3	19.7	124.9
11	17.6	31.4	13.8	95.1
12	15.5	31.6	16.1	92.2
13	14.6	31.6	17.0	101.1
14	17.4	31.9	14.5	92.2
15	18.5	33.4	14.9	124.9
16	17.6	32.0	14.4	368.6
17	18.9	33.7[c]	14.8	95.1
18	12.3	30.1	17.8	178.4
19	16.8	31.2	14.4	107.0
20	16.2	31.6	15.3	89.2

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0330 hrs and 0700 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1500 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 0930 hrs on 02 May 2006).

East 250m

East 250m contained 1 Red Maple (*Acer rubrum* L.) (width 0.5m), 7 September Elm (*Ulmus serotina* Sarg.) (ranging in width from 0.1 to 0.35m), and 2 White Oak (*Quercus alba* L.) (width 1.2 and 1.3m) within 3m of the data logger.

Birds observed at within 3m of the data logger East 250m included 2 Blue Jay (*Cyanocitta cristata*), 1 Ovenbird (*Seiurus aurocapillus*), 1 Scarlet Tanager (*Piranga olivacea*), 1 White-breasted Nuthatch (*Sitta carolinensis*), and 2 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for East 250m are presented in Table 43. The minimum temperature reading was 2.09°C and maximum temperature reading was 33.5°C. The largest difference between the maximum and minimum temperature readings in a week was 30.8°C. The maximum PAR intensity was 665.9 lux.

Table 43: 2006 Microclimate Data East 250m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	2.09[b]	32.9	30.8[d]	665.9[e]
2	6.47	31.8	25.3	570.8
3	3.58	28.9	25.3	618.4
4	6.06	29.6	23.5	190.3
5	6.98	26.0	19.0	184.3
6	7.98	23.2	15.2	148.6
7	6.27	28.8	22.5	142.7
8	13.0	33.0	20.0	178.4
9	10.3	27.1	16.8	190.3
10	12.3	32.0	19.7	160.5
11	17.5	30.8	13.3	142.7
12	15.2	31.9	16.7	172.4
13	14.2	31.7	17.4	214.0
14	17.2	31.1	13.9	124.9
15	18.3	33.2	14.9	148.6
16	17.3	31.6	14.3	80.3
17	19.0	33.5[c]	14.5	665.9[e]
18	12.2	30.1	17.8	178.4
19	16.6	31.2	14.5	83.2
20	16.2	31.4	15.1	80.3

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0700 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1330 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 0930 hrs on 15 April 2006 and 0930 hrs on 31 July 2006).

West 0m

West 0m contained 2 Chestnut Oak (*Quercus prinus* L.) (1 with width 0.2m, 1 with height 2m), 1 Flowering Dogwood (*Cornus florida* L.) (width 0.3m), and 4 September Elm (*Ulmus serotina* Sarg.) (ranging in height from 1 to 3m) within 3m of the data logger.

Birds observed at within 3m of the data logger West 0m included 1 American Crow (*Corvus brachyrhynchos*), 3 American Robin (*Turdus migratorius*), 2 Grey Catbird (*Dumetella carolinensis*), and 1 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for West 0m are presented in Table 44. The minimum temperature reading was –0.102°C and maximum temperature reading was 39.1°C. The largest difference between the maximum and minimum temperature readings in a week was 34.4°C. The maximum PAR intensity was 1189.2 lux.

Table 44: 2006 Microclimate Data West 0m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	-0.102[b]	34.3	34.4[d]	1189.2[e]
2	4.73	33.6	28.9	856.2
3	1.33	33.0	31.7	713.5
4	3.47	37.7	34.2	903.8
5	5.66	35.8	30.1	225.9
6	6.47	30.7	24.2	368.6
7	4.83	36.0	31.1	1189.2[e]
8	12.4	37.8	25.4	451.9
9	8.6	34.9	26.3	570.8
10	10.8	38.2	27.3	333.0
11	15.6	36.9	21.4	713.5
12	14.6	35.0	20.4	475.7
13	13.0	33.2	20.2	237.8
14	16.5	37.8	21.3	130.8
15	18.3	39.1[c]	20.7	154.6
16	16.2	36.7	20.5	142.7
17	16.0	39.3	23.2	154.6
18	10.4	35.3	25.0	154.6
19	14.2	36.7	22.5	142.7
20	15.1	37.8	22.7	154.6

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0700 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1700 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1100 hrs on 10 April 2006, 1100 hrs on 11 April 2006, and 1030 hrs on 23 May 2006).

West 50m

West 50m contained 5 Flowering Dogwood (*Cornus florida* L.) (ranging in height from 2 to 7m), 1 Red Maple (*Acer rubrum* L.) (height 6m), and 2 White Oak (*Quercus alba* L.) (width 0.35 and 0.9m) within 3m of the data logger.

Birds observed at within 3m of the data logger West 0m included 1 American Robin (*Turdus migratorius*), 1 Hairy Woodpecker (*Picoides villosus*), and 1 Northern Cardinal (*Cardinalis cardinalis*).

Microclimate data for West 50m are presented in Table 45. The minimum temperature reading was 0.563°C and maximum temperature reading was 38.5°C. The largest difference between the maximum and minimum temperature readings in a week was 33.8°C. The maximum PAR intensity was 1522.1 lux.

Table 45: 2006 Microclimate Data West 50m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	0.563[b]	34.4	33.8[d]	1522.1[e]
2	5.04	33.8	28.8	1046.5
3	1.98	31.1	29.1	713.5
4	4.42	31.7	27.3	1189.2
5	6.17	27.4	21.2	951.3
6	7.78	26.6	18.8	1522.1[e]
7	5.76	32.7	26.9	998.9
8	13.08	38.5[c]	25.4	1331.9
9	9.67	29.2	19.5	618.4
10	11.63	33.8	22.2	309.2
11	16.33	33.8	17.5	261.6
12	15.28	33.4	18.1	273.5
13	13.46	33.2	19.8	451.9
14	17.09	35.9	18.8	689.7
15	18.43	37.3	18.8	689.7
16	16.62	34.1	17.4	547.0
17	16.52	36.2	19.7	380.5
18	10.94	31.8	20.8	249.7
19	14.71	32.3	17.6	285.4
20	15.38	33.7	18.4	428.1

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0330 hrs and 0700 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1300 hrs on 30 May 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1100 hr on 10 April 2006 and at 1300 hrs on 20 May 2006).

West 100m

West 100m contained 3 Chestnut Oak (*Quercus prinus* L.) (ranging in width from 0.6 to 10.5m), 1 Flowering Dogwood (*Cornus florida* L.) (height 4m), 1 Red Maple (*Acer rubrum* L.) (height 2m), and 4 September Elm (*Ulmus serotina* Sarg.) (ranging in height from 1 to 2m) within 3m of the data logger.

Birds observed at within 3m of the data logger West 100m included 1 American Robin (*Turdus migratorius*), 2 Blue Jay (*Cyanocitta cristata*), 1 Carolina Chickadee (*Poecile carolinensis*), 1 Tufted Titmouse (*Baeolophus bicolor*), 2 Scarlet Tanager (*Piranga olivacea*), 1 White-breasted Nuthatch (*Sitta carolinensis*), and 1 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for West 100m are presented in Table 46. The minimum temperature reading was 1.00°C and maximum temperature reading was 35.2°C. The largest difference between the maximum and minimum temperature readings in a week was 33.8°C. The maximum PAR intensity was 1331.9 lux.

Table 46: 2006 Microclimate Data West 100m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	1.00[b]	34.8	33.8[d]	1331.9[e]
2	5.76	34.8	29.0	998.9
3	2.52	31.4	28.9	665.9
4	5.04	32.5	27.5	547.0
5	6.57	28.5	21.9	214.0
6	8.68	24.1	15.4	237.8
7	6.78	29.8	23.0	333.0
8	13.3	34.1	20.8	237.8
9	10.4	28.0	17.6	297.3
10	12.2	33.0	20.8	178.4
11	16.8	32.1	15.3	166.5
12	15.7	33.4	17.8	225.9
13	13.9	34.0	20.0	428.1
14	17.5	32.8	15.3	594.6
15	18.7	34.9	16.2	261.6
16	17.2	33.7	16.6	225.9
17	17.3	35.2[c]	17.9	190.3
18	11.7	31.9	20.2	178.4
19	15.5	33.8	18.4	356.7
20	16.0	32.7	16.7	428.1

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0330 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1500 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1030 hrs on 11 April 2006).

West 150m

West 150m contained 1 Chestnut Oak (*Quercus prinus* L.) (width 0.9m), 2 Flowering Dogwood (*Cornus florida* L.) (width 0.1 to 0.15m), 1 Scarlet Oak (width 1.1m), and 2 September Elm (*Ulmus serotina* Sarg.) (width 0.4 and 0.5m) within 3m of the data logger.

Birds observed at within 3m of the data logger West 150m included 1 American Robin (*Turdus migratorius*), 1 Blue Gray Gnatcatcher (*Polioptila caerulea*), and 1 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for West 150m are presented in Table 47. The minimum temperature reading was 1.00°C and maximum temperature reading was 36.0°C. The largest difference between the maximum and minimum temperature readings in a week was 33.1°C. The maximum PAR intensity was 1474.6 lux.

Table 47: 2006 Microclimate Data West 150m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	1.00[b]	34.1	33.1[d]	1474.6[e]
2	5.96	34.7	28.7	1379.4
3	2.52	29.7	27.1	903.8
4	4.83	29.0	24.1	321.1
5	6.57	26.1	19.5	380.5
6	8.78	23.8	15.0	285.4
7	6.57	29.6	23.0	190.3
8	13.0	33.8	20.9	225.9
9	10.3	27.9	17.6	178.4
10	12.1	32.8	20.7	903.8
11	16.7	33.2	16.5	951.3
12	15.5	33.7	18.3	903.8
13	13.8	33.0	19.2	309.2
14	17.4	32.5	15.1	136.8
15	18.5	34.1	15.5	130.8
16	17.1	33.0	15.9	160.5
17	17.3	36.0[c]	18.7	547.0
18	11.5	32.7	21.2	285.4
19	15.7	31.6	15.9	618.4
20	16.0	32.2	16.2	297.3

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0330 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1630 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1200 hrs on 10 April 2006 and at 1200 hrs on 11 April 2006).

West 200m

West 200m contained 2 Flowering Dogwood (*Cornus florida* L.) (width 0.2 and 0.25m), 1 Red Oak (*Quercus rubra* L.) (width 1.5m), and 1 September Elm (*Ulmus serotina* Sarg.) (width 0.5m) within 3m of the data logger.

No birds observed at within 3m of the data logger West 200m.

Microclimate data for West 200m are presented in Table 48. The minimum temperature reading was 1.33°C and maximum temperature reading was 35.0°C. The largest difference between the maximum and minimum temperature readings in a week was 33.4°C. The maximum PAR intensity was 998.9 lux.

Table 48: 2006 Microclimate Data West 200m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	1.33[b]	34.7	33.4[d]	998.9[e]
2	6.17	34.9	28.7	808.6
3	2.52	28.9	26.3	951.3
4	5.04	28.9	23.8	642.1
5	6.78	26.6	19.8	249.7
6	8.78	23.3	14.5	404.3
7	6.37	29.5	23.1	190.3
8	12.7	33.4	20.7	237.8
9	10.3	28.0	17.7	142.7
10	12.2	32.7	20.5	124.9
11	16.7	32.1	15.4	178.4
12	15.2	32.4	17.2	237.8
13	13.8	32.4	18.5	130.8
14	17.4	32.2	14.8	178.4
15	18.4	33.8	15.4	124.9
16	17.2	33.2	16.0	178.4
17	17.6	35.0[c]	17.4	547.0
18	11.6	31.6	19.9	356.7
19	15.8	32.8	17.0	951.3
20	16.0	32.3	16.2	249.7

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0330 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1100 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 0930 hrs on 12 April 2006 and at 0930 hrs on 15 April 2006).

West 250m

West 250m contained 1 Common Persimmon (*Diospyros viriniana* L.) (width 0.95m), 1 Flowering Dogwood (*Cornus florida* L.) (width 0.3m), 1 Red Maple (*Acer rubrum* L.) (height 1.5m), and 2 September Elm (*Ulmus serotina* Sarg.) (width 0.11 to 0.8m) within 3m of the data logger.

Birds observed at within 3m of the data logger West 250m included 1 Eastern Wood Pewee (*Contopus virens*) and 2 Wood Thrush (*Hylocichla mustelina*).

Microclimate data for West 250m are presented in Table 49. The minimum temperature reading was 1.87°C and maximum temperature reading was 34.8°C. The largest difference between the maximum and minimum temperature readings in a week was 30.4°C. The maximum PAR intensity was 689.7 lux.

Table 49: 2006 Microclimate Data West 250m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	1.87[b]	32.3	30.4[d]	665.9
2	6.88	33.4	26.6	665.9
3	3.05	28.8	25.7	689.7[e]
4	5.55	28.8	23.2	333.0
5	7.08	25.9	18.8	118.9
6	8.18	23.1	14.9	321.1
7	6.57	29.5	22.9	130.8
8	12.8	32.9	20.1	113.0
9	10.6	28.0	17.4	142.7
10	12.5	32.2	19.7	92.2
11	17.0	31.5	14.5	89.2
12	15.2	31.7	16.5	101.1
13	14.1	32.0	17.8	142.7
14	17.6	32.2	14.6	249.7
15	18.7	33.4	14.7	249.7
16	17.5	32.6	15.1	142.7
17	18.1	34.8[c]	16.7	190.3
18	11.9	31.2	19.2	83.2
19	16.3	31.9	15.5	101.1
20	16.4	32.7	16.3	404.3

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0330 hrs on 10 April 2006).
[c] Maximum temperature (recorded at 1600 hrs on 03 August 2006).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1030 hrs on 25 April 2006).

Appendix 3: 2007 Microclimate Data

Data are separated into the following time periods:

Week 1: 29 April 2007 to 05 May 2007
Week 2: 06 May 2007 to 12 May 2007
Week 3: 13 May 2007 to 19 May 2007
Week 4: 20 May 2007 to 26 May 2007
Week 5: 27 May 2007 to 02 June 2007
Week 6: 03 June 2007 to 09 June 2007
Week 7: 10 June 2007 to 16 June 2007
Week 8: 17 June 2007 to 23 June 2007
Week 9: 24 June 2007 to 30 June 2007
Week 10: 01 July 2007 to 07 July 2007
Week 11: 08 July 2007 to 14 July 2007
Week 12: 15 July 2007 to 21 July 2007
Week 13: 22 July 2007 to 28 July 2007
Week 14: 29 July 2007 to 04 August 2007
Week 15: 05 August 2007 to 10 August 2007

North 0m

North 0m contained no trees within 3m of the data logger.

Birds observed at within 3m of the data logger North 0m included 1 Acadian Flycatcher (*Empidonax virescens*), 1 Hooded Warbler (*Wilsonia citrina*), and 1 Louisiana Waterthrush (*Seiurus motacilla*).

Microclimate data for North 0m are presented in Table 50. The minimum temperature reading was 0.232°C and maximum temperature reading was 51.7°C. The largest difference between the maximum and minimum temperature readings in a week was 42.3°C. The maximum PAR intensity was 2092.9 lux.

Table 50: Microclimate Data North 0m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	6.37	44.6	38.2	1807.5
2	0.232[b]	42.5	42.3[d]	1902.6
3	2.94	44.7	41.8	1997.8
4	8.18	49.1	40.9	1807.5
5	13.0	48.4	35.4	1712.4
6	10.6	51.9	41.3	1902.6
7	12.4	47.4	35.0	1997.8
8	9.27	49.5	40.2	1807.5
9	11.7	49.6	37.9	1712.4
10	11.1	48.2	37.0	1997.8
11	13.6	51.7[c]	38.2	1807.5
12	13.3	49.5	36.2	1902.6
13	13.1	48.7	35.6	2092.9[e]
14	15.5	50.3	34.8	1522.1
15	20.7	50.2	29.5	1522.1

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0530 hrs on 08 May 2007).
[c] Maximum temperature (recorded at 1400 hrs on 08 June 2007).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1430 hrs on 23 July 2007).

North 100m

North 100m contained 3 Common Persimmon (*Diospyros viriniana* L.) (2 with width 0.17 and 0.32m, 1 with height 4m), 1 Northern Pin Oak (*Quercus ellipsoidalis* E. J. Hill) (width 1.10m), and 1 Sugar Maple (*Acer saccharum* Marsh.) (width 0.92m) within 3m of the data logger.

Birds observed at within 3m of the data logger North 100m included 2 Hooded Warbler (*Wilsonia citrina*), 1 Least Flycatcher (*Empidonax minimus*), and 2 Yellow-billed Cuckoo (*Coccyzus americanus*).

Microclimate data for North 100m are presented in Table 51. The minimum temperature reading was 1.98°C and maximum temperature reading was 37.9°C. The largest difference between the maximum and minimum temperature readings in a week was 28.1°C. The maximum PAR intensity was 214.0 lux.

Table 51: Microclimate Data North 100m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	7.78	32.3	24.5	190.3
2	1.98[b]	30.1	28.1[d]	190.3
3	4.42	29.7	25.2	202.2
4	9.27	31.9	22.6	214.0[e]
5	14.1	30.8	16.6	178.4
6	12.0	33.1	21.1	148.6
7	13.1	30.1	17.0	142.7
8	10.9	32.7	21.8	124.9
9	13.0	33.4	20.5	124.9
10	12.6	32.3	19.7	148.6
11	14.5	35.8	21.2	142.7
12	14.6	33.3	18.7	124.9
13	14.5	33.4	18.9	142.7
14	16.9	34.4	17.5	113.0
15	21.5	37.9[c]	16.5	107.0

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0500 hrs, 0530 hrs, and 0600 hrs on 08 May 2007).
[c] Maximum temperature (recorded at 1530 hrs on 08 August 2007).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1600 hrs on 20 May 2007).

North 200m

North 200m contained 3 Common Persimmon (*Diospyros viriniana* L.) (2 with width 0.35m, 1 with height 5m) within 3m of the data logger.

Birds observed at within 3m of the data logger North 200m included 1 Eastern Phoebe (*Sayornis phoebe*).

Microclimate data for North 200m are presented in Table 52. The minimum temperature reading was 2.09°C and maximum temperature reading was 37.8°C. The largest difference between the maximum and minimum temperature readings in a week was 28.1°C. The maximum PAR intensity was 249.7 lux.

Table 52: Microclimate Data North 200m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	7.98	35.2	27.2	249.7[e]
2	2.09[b]	30.2	28.1[d]	214.0
3	4.62	30.5	25.8	166.5
4	9.27	32.9	23.6	178.4
5	14.1	32.1	18.0	184.3
6	12.3	33.7	21.4	154.6
7	13.1	29.6	16.5	136.8
8	11.2	32.9	21.7	118.9
9	13.3	34.0	20.7	124.9
10	13.1	31.8	18.7	124.9
11	14.6	35.1	20.5	130.8
12	14.7	33.2	18.5	136.8
13	14.4	33.2	18.8	154.6
14	17.3	35.0	17.7	124.9
15	21.4	37.8[c]	16.4	136.8

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0500 hrs and 0530 hrs on 08 May 2007).
[c] Maximum temperature (recorded at 1430 hrs on 08 August 2007).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1430 hrs on 02 May 2007).

North 300m

North 300m contained 5 Common Persimmon (*Diospyros viriniana* L.) (ranging in height from 3 to 5m), 1 Northern Pin Oak (*Quercus ellipsoidalis* E. J. Hill) (width 0.81m), 2 White Oak (*Quercus alba* L.) (width 0.48 and 1.25m), and 1 Yellow Poplar (*Liriodendron tulipifera* L.) (width 0.58m) within 3m of the data logger.

Birds observed at within 3m of the data logger North 300m included 1 Yellow-billed Cuckoo (*Coccyzus americanus*).

Microclimate data for North 300m are presented in Table 53. The minimum temperature reading was 2.09°C and maximum temperature reading was 38.9°C. The largest difference between the maximum and minimum temperature readings in a week was 28.5°C. The maximum PAR intensity was 903.8 lux.

Table 53: Microclimate Data North 300m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.18	33.0	24.8	903.8[e]
2	2.09[b]	30.6	28.5[d]	856.2
3	4.73	30.9	26.1	428.1
4	8.28	30.6	22.3	321.1
5	14.2	33.1	18.9	202.2
6	12.3	34.3	22.0	380.5
7	12.9	30.5	17.6	202.2
8	11.7	33.6	21.9	344.9
9	10.9	35.0	24.1	178.4
10	13.1	31.3	18.2	285.4
11	14.4	37.4	23.0	344.9
12	15.2	34.4	19.2	190.3
13	14.5	34.6	20.1	285.4
14	17.2	35.2	18.0	321.1
15	19.5	38.9[c]	19.5	261.6

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0500 hrs on 08 May 2007).
[c] Maximum temperature (recorded at 1430 hrs on 08 August 2007).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1630 hrs on 04 May 2007).

South 0m

South 0m contained 1 Chestnut Oak (*Quercus prinus* L.) (height 2m), 9 Virginia Pine (*Pinus virginiana* Mill.) (ranging in height from 4 to 5m), and 1 White Oak (*Quercus alba* L.) (width 1.13m) within 3m of the data logger.

Birds observed at within 3m of the data logger South 0m included 1 Field Sparrow (*Spizella pusilla*), 2 Scarlet Tanager (*Piranga olivacea*), 1 Tufted Titmouse (*Baeolophus bicolor*), and 1 Yellow-billed Cuckoo (*Coccyzus americanus*).

Microclimate data for South 0m are presented in Table 54. The minimum temperature reading was 3.05°C and maximum temperature reading was 47.2°C. The largest difference between the maximum and minimum temperature readings in a week was 36.7°C. The maximum PAR intensity was 1331.9 lux.

Table 54: Microclimate Data South 0m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.68	39.6	30.9	903.8
2	3.05[b]	39.7	36.7[d]	951.3
3	5.76	40.8	35.0	1189.2
4	10.2	43.5	33.3	1284.3
5	14.9	42.3	27.4	1236.7
6	13.0	42.3	29.3	1236.7
7	13.1	42.5	29.4	1284.3
8	11.4	42.5	31.1	1284.3
9	13.6	44.8	31.3	1141.6
10	13.2	45.3	32.2	1284.3
11	15.2	47.2[c]	32.1	1141.6
12	14.7	44.8	30.1	1331.9[e]
13	15.8	45.6	29.8	1094.0
14	18.6	46.1	27.5	998.9
15	21.4	46.5	25.1	808.6

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs on 07 May 2007 and 0500 hrs and 0530 hrs on 08 May 2007).
[c] Maximum temperature (recorded at 1630 hrs on 08 July 2007).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1630 hrs on 21 July 2007).

South 100m

South 100m contained 1 Bear Oak (*Quercus ilicifolia* Wangenh.) (width 0.83m), 1 Common Persimmon (*Diospyros viriniana* L.) (height 4m), and 2 Sugar Maple (*Acer saccharum* Marsh.) (width 0.40 and 0.42m) within 3m of the data logger.

Birds observed at within 3m of the data logger South 100m included 2 Carolina Chickadee (*Poecile carolinensis*) and 2 Red-eyed Vireo (*Vireo olivaceus*).

Microclimate data for South 100m are presented in Table 55. The minimum temperature reading was 3.26°C and maximum temperature reading was 42.4°C. The largest difference between the maximum and minimum temperature readings in a week was 30.3°C. The maximum PAR intensity was 1617.2 lux.

Table 55: Microclimate Data South 100m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.78	35.2	26.4	475.7
2	3.26[b]	31.6	28.3	1522.1
3	6.27	31.4	25.1	499.4
4	10.2	40.4	30.3[d]	1094.0
5	15.2	37.3	22.1	998.9
6	13.3	38.0	24.8	1331.9
7	13.1	36.5	23.4	1379.4
8	11.9	37.7	25.8	642.1
9	14.0	37.8	23.8	737.3
10	13.8	39.2	25.4	998.9
11	15.6	42.4[c]	26.8	1189.2
12	15.2	39.2	24.0	1617.2[e]
13	15.8	38.4	22.6	1331.9
14	18.8	37.7	18.9	344.9
15	21.4	40.5	19.2	297.3

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0430 hrs and 0500 hrs on 08 May 2007).
[c] Maximum temperature (recorded at 1600 hrs on 09 July 2007).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1600 hrs on 21 July 2007).

South 200m

South 200m contained 6 Common Persimmon (*Diospyros viriniana* L.) (3 with width ranging from 0.17 to 0.32m, 3 with height ranging from 5 to 7m), and 1 Northern Pin Oak (*Quercus ellipsoidalis* E. J. Hill) (width 1.52m) within 3m of the data logger.

Birds observed at within 3m of the data logger South 200m included 2 Eastern Wood Pewee (*Contopus virens*), 1 Pileated Woodpecker (*Dryocopus pileatus*), 4 Red-eyed Vireo (*Vireo olivaceus*), and 3 Scarlet Tanager (*Piranga olivacea*).

The data logger launched at the beginning of the season failed, and all data was lost. The data logger was replaced and began recording six weeks into the season. Microclimate data for South 200m are presented in Table 56. The minimum temperature reading was 12.2°C and maximum temperature reading was 40.3°C. The largest difference between the maximum and minimum temperature readings in a week was 25.8°C. The maximum PAR intensity was 1427.0 lux.

Table 56: Microclimate Data South 200m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	--	--	--	--
2	--	--	--	--
3	--	--	--	--
4	--	--	--	--
5	--	--	--	--
6	--	--	--	--
7	17.9	29.0	11.1	428.1
8	12.2[b]	38.0	25.8[d]	1427.0[e]
9	14.1	38.2	24.0	642.1
10	13.8	34.9	21.1	475.7
11	15.6	40.2	24.6	1427.0[e]
12	15.3	36.8	21.6	1189.2
13	15.5	38.8	23.4	951.3
14	18.7	36.6	17.9	665.9
15	21.6	40.3[c]	18.7	951.3

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs on 23 June 2007).
[c] Maximum temperature (recorded at 1330 hrs on 08 August 2007).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1330 hrs on 21 June 2007 and 1230 hrs on 12 July 2007).

South 300m

South 300m contained 4 American Beech (*Fagus grandifollia* Ehrh.) (3 with width ranging from 0.13 to 0.28m, 1 with height 5m), 1 American Holly (*Ilex opaca* Ait.) (height 4m), 2 Common Persimmon (*Diospyros viriniana* L.) (1 with width 0.17m, 1 with height 4m), and 1 Sassafras (*Sassafras albidum* (Nutt.) Nees) (width 0.95m) within 3m of the data logger.

Birds observed at within 3m of the data logger South 300m included 2 Acadian Flycatcher (*Empidonax virescens*), 1 Carolina Chickadee (*Poecile carolinensis*), and 1 White-eyed Vireo (*Vireo griseus*).

Microclimate data for South 300m are presented in Table 57. The minimum temperature reading was 2.73°C and maximum temperature reading was 37.1°C. The largest difference between the maximum and minimum temperature readings in a week was 26.3°C. The maximum PAR intensity was 249.7 lux.

Table 57: Microclimate Data South 300m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.78	32.8	24.0	249.7[e]
2	2.73[b]	29.1	26.3[d]	202.2
3	5.35	29.2	23.8	154.6
4	9.87	32.0	22.1	160.5
5	14.8	30.9	16.1	124.9
6	12.9	32.9	20.0	160.5
7	13.3	29.1	15.8	142.7
8	11.6	32.6	21.0	124.9
9	13.7	33.1	19.5	142.7
10	13.4	30.9	17.5	124.9
11	15.2	34.9	19.7	124.9
12	15.0	32.5	17.5	148.6
13	15.1	32.7	17.6	124.9
14	17.7	33.7	16.1	101.1
15	21.7	37.1[c]	15.4	107.0

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0430 hrs and 0500 hrs on 08 May 2007).
[c] Maximum temperature (recorded at 1430 hrs on 08 August 2007).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1330 hrs on 02 May 2007).

South 400m

South 400m contained 2 American Beech (*Fagus grandifollia* Ehrh.) (1 with width 0.13m, 1 with height 1m), 1 American Holly (*Ilex opaca* Ait.) (height 2m), 1 Mountain Laurel (*Kalmi latifolia* L.) (height 4m), 1 Sassafras (*Sassafras albidum* (Nutt.) Nees) (width 0.20m), and 1 Virginia Pine (*Pinus virginiana* Mill.) (width 1.11m) within 3m of the data logger.

Birds observed at within 3m of the data logger South 400m included 3 Carolina Chickadee (*Poecile carolinensis*), 1 Ovenbird (*Seiurus aurocapillus*), and 1 Red-eyed Vireo (*Vireo olivaceus*).

Microclimate data for South 400m are presented in Table 58. The minimum temperature reading was 2.20°C and maximum temperature reading was 38.5°C. The largest difference between the maximum and minimum temperature readings in a week was 29.6°C. The maximum PAR intensity was 808.6 lux.

Table 58: Microclimate Data South 400m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.58	35.2	26.6	713.5
2	2.20[b]	31.8	29.6[d]	808.6[e]
3	4.83	31.3	26.4	808.6[e]
4	9.57	32.2	22.6	737.3
5	14.4	32.4	18.0	570.8
6	12.5	33.6	21.1	761.1
7	13.0	32.4	19.4	761.1
8	11.1	32.7	21.6	333.0
9	13.2	36.1	22.9	237.8
10	13.1	31.7	18.6	451.9
11	14.6	36.6	22.0	475.7
12	14.5	35.8	21.2	428.1
13	14.9	33.8	18.9	297.3
14	17.4	34.8	17.4	368.6
15	21.4	38.5[c]	17.1	297.3

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0500 hrs on 08 May 2007).
[c] Maximum temperature (recorded at 1200 hrs on 08 August 2007).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1130 hrs on 09 May 2007 and 1130 hrs on 13 May 2007).

East 0m

East 0m contained 3 Eastern Cottonwood (*Populus deltoides* Bartr. ex. Marsh.) (width ranging from 1.22 to 1.25m) and 3 Eastern Red Cedar (*Juniperus silicicola* (Small) Bailey) (width ranging from 0.52 to 0.90m) within 3m of the data logger.

Birds observed at within 3m of the data logger East 0m included 1 Song Sparrow (*Melospiza melodia*).

Microclimate data for East 0m are presented in Table 59. The minimum temperature reading was 2.26°C and maximum temperature reading was 39.6°C. The largest difference between the maximum and minimum temperature readings in a week was 27.5°C. The maximum PAR intensity was 547.0 lux.

Table 59: Microclimate Data East 0m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	9.37	33.1	23.7	475.7
2	3.26[b]	30.8	27.5[d]	547.0[e]
3	6.57	30.6	24.0	404.3
4	10.7	33.0	22.3	380.5
5	15.4	31.6	16.2	404.3
6	13.7	34.6	20.9	273.5
7	13.2	30.5	17.3	148.6
8	12.3	34.1	21.8	160.5
9	14.3	34.3	19.9	130.8
10	13.8	33.2	19.5	107.0
11	16.2	36.8	20.6	107.0
12	15.2	33.8	18.7	368.6
13	16.2	34.3	18.0	368.6
14	19.1	35.6	16.6	380.5
15	21.5	39.6[c]	18.1	428.1

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0500 hrs on 08 May 2007).
[c] Maximum temperature (recorded at 1230 hrs on 08 August 2007).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1200 hrs on 10 May 2007).

East 100m

East 100m contained 1 American Beech (*Fagus grandifollia* Ehrh.) (height 4m), 1 American Holly (*Ilex opaca* Ait.) (width 0.16m), 1 Common Persimmon (*Diospyros viriniana* L.) (width 0.14m), 3 Sassafras (*Sassafras albidum* (Nutt.) Nees) (width ranging from 0.13 to 0.28m), and 4 Virginia Pine (*Pinus virginiana* Mill.) (width ranging from 0.61 to 1.20m) within 3m of the data logger.

Birds observed at within 3m of the data logger East 100m included 1 Red-eyed Vireo (*Vireo olivaceus*).

Microclimate data for East 100m are presented in Table 60. The minimum temperature reading was 3.05°C and maximum temperature reading was 37.8°C. The largest difference between the maximum and minimum temperature readings in a week was 29.1°C. The maximum PAR intensity was 499.4 lux.

Table 60: Microclimate Data East 100m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	9.08	33.2	24.1	249.7
2	3.05[b]	32.2	29.1[d]	356.7
3	6.17	33.3	27.2	499.4[e]
4	10.4	32.8	22.5	368.6
5	15.3	31.4	16.1	249.7
6	13.4	33.7	20.4	297.3
7	13.1	29.4	16.3	148.6
8	12.3	32.8	20.5	202.2
9	14.0	33.7	19.7	214.0
10	13.5	32.6	19.1	380.5
11	16.0	35.9	19.9	190.3
12	15.1	33.3	18.2	225.9
13	16.0	34.0	18.0	380.5
14	18.7	35.4	16.7	428.1
15	21.4	37.8[c]	16.4	107.0

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0500 hrs on 08 May 2007).
[c] Maximum temperature (recorded at 1330 hrs and 1600 hrs on 08 August 2007).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1600 hrs on 13 May 2007).

East 200m

East 200m contained 1 Shingle Oak (*Quercus imbricaria* Michx.) (height 2m) and 1 White Oak (*Quercus alba* L.) (width 0.17m) within 3m of the data logger.

Birds observed at within 3m of the data logger East 200m included 2 Acadian Flycatcher (*Empidonax virescens*), 1 Carolina Chickadee (*Poecile carolinensis*), 2 Ovenbird (*Seiurus aurocapillus*), and 1 Tufted Titmouse (*Baeolophus bicolor*).

Microclimate data for East 200m are presented in Table 61. The minimum temperature reading was 2.84°C and maximum temperature reading was 37.9°C. The largest difference between the maximum and minimum temperature readings in a week was 26.8°C. The maximum PAR intensity was 368.6 lux.

Table 61: Microclimate Data East 200m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.68	32.4	23.7	237.8
2	2.84[b]	29.7	26.8[d]	249.7
3	6.06	29.8	23.7	368.6[e]
4	10.2	32.1	21.9	214.0
5	15.2	31.6	16.4	154.6
6	13.3	33.6	20.4	202.2
7	13.0	30.3	17.3	237.8
8	12.1	33.1	21.0	225.9
9	13.8	34.0	20.1	148.6
10	13.5	31.9	18.4	178.4
11	15.6	35.4	19.9	172.4
12	14.9	33.3	18.4	190.3
13	15.7	33.4	17.8	178.4
14	18.3	34.6	16.3	166.5
15	21.4	37.9[c]	16.6	160.5

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0500 hrs on 08 May 2007).
[c] Maximum temperature (recorded at 1430 hrs on 08 August 2007).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1730 hrs on 13 May 2007).

East 300m

East 300m contained 4 Common Persimmon (*Diospyros viriniana* L.) (width ranging from 0.15 to 0.45m) and 2 Red Maple (*Acer rubrum* L.) (width 0.38 and 0.53m) within 3m of the data logger.

Birds observed at within 3m of the data logger East 300m included 1 Tufted Titmouse (Baeolophus bicolor).

Microclimate data for East 300m are presented in Table 62. The minimum temperature reading was 3.05°C and maximum temperature reading was 47.2°C. The largest difference between the maximum and minimum temperature readings in a week was 36.7°C. The maximum PAR intensity was 1331.9 lux.

Table 62: Microclimate Data East 300m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.68	39.6	30.9	903.8
2	3.05[b]	39.7	36.7[d]	951.3
3	5.76	40.8	35.0	1189.2
4	10.2	43.5	33.3	1284.3
5	14.9	42.3	27.4	1236.7
6	13.0	42.3	29.3	1236.7
7	13.1	42.5	29.4	1284.3
8	11.4	42.5	31.1	1284.3
9	13.6	44.8	31.3	1141.6
10	13.2	45.3	32.2	1284.3
11	15.2	47.2[c]	32.1	1141.6
12	14.7	44.8	30.1	1331.9[e]
13	15.8	45.6	29.8	1094.0
14	18.6	46.1	27.5	998.9
15	21.4	46.5	25.1	808.6

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0600 hrs on 07 May 2007 and 0500 hrs and 0530 hrs on 08 May 2007).
[c] Maximum temperature (recorded at 1630 hrs on 08 July 2007).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1630 hrs on 21 July 2007).

East 400m

East 400m contained 1 American Beech (*Fagus grandifollia* Ehrh.) (width 0.14m), 6 Common Persimmon (*Diospyros viriniana* L.) (width ranging from 0.18 to 0.52m), and 1 Red Maple (*Acer rubrum* L.) (width 1.35m) within 3m of the data logger.

Birds observed at within 3m of the data logger East 400m included 1 Acadian Flycatcher (*Empidonax virescens*), 1 Louisiana Waterthrush (*Seiurus motacilla*), 1 Pileated Woodpecker (*Dryocopus pileatus*), 1 Scarlet Tanager (*Piranga olivacea*), and 1 White-breasted Nuthatch (*Sitta carolinensis*).

Microclimate data for East 400m are presented in Table 63. The minimum temperature reading was 2.84°C and maximum temperature reading was 37.2°C. The largest difference between the maximum and minimum temperature readings in a week was 26.8°C. The maximum PAR intensity was 499.4 lux.

Table 63: Microclimate Data East 400m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.58	32.6	24.0	380.5
2	2.84[b]	29.7	26.8[d]	499.4[e]
3	5.76	29.4	23.6	214.0
4	10.1	32.1	22.0	237.8
5	15.2	31.1	15.9	321.1
6	13.3	33.4	20.2	249.7
7	13.2	31.1	17.9	309.2
8	12.0	32.9	20.9	237.8
9	13.8	33.2	19.4	404.3
10	13.6	32.9	19.4	451.9
11	15.4	35.1	19.7	380.5
12	15.0	33.0	18.0	184.3
13	15.6	33.3	17.8	184.3
14	18.0	34.4	16.3	475.7
15	21.6	37.2[c]	15.6	368.6

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0500 hrs on 08 May 2007).
[c] Maximum temperature (recorded at 1330 hrs on 08 August 2007).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1130 hrs on 06 May 2007).

West 0m

West 0m contained 2 Sugar Maple (*Acer saccharum* Marsh.) (width 0.69 and 0.75m) within 3m of the data logger.

Birds observed at within 3m of the data logger West 0m included 2 Acadian Flycatcher (*Empidonax virescens*), 1 Carolina Chickadee (*Poecile carolinensis*), 1 Eastern Towhee (*Pipilo erythrophthalmus*), 1 Louisiana Waterthrush (*Seiurus motacilla*), 1 Red-tailed Hawk (*Buteo jamaicensis*), 1 Ruby-throated Hummingbird (*Archilochus colubris*), and 1 Tufted Titmouse (*Baeolophus bicolor*).

Microclimate data for West 0m are presented in Table 64. The minimum temperature reading was 1.33°C and maximum temperature reading was 48.6°C. The largest difference between the maximum and minimum temperature readings in a week was 40.5°C. The maximum PAR intensity was 1997.8 lux.

Table 64: Microclimate Data West 0m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	7.38	40.2	32.8	1807.5
2	1.33[b]	41.8	40.5[d]	1902.6
3	3.89	41.6	37.7	1997.8
4	8.88	44.7	35.8	1807.5
5	13.7	46.1	32.4	1807.5
6	11.5	45.1	33.5	1902.6
7	12.9	47.6	34.7	1997.8[e]
8	10.0	46.7	36.8	1902.6
9	12.5	45.6	33.1	1617.2
10	12.0	46.6	34.6	1997.8[e]
11	14.2	48.6[c]	34.3	1902.6
12	13.8	44.2	30.5	1997.8
13	14.1	45.2	31.1	1522.1
14	16.4	48.0	31.6	1617.2
15	21.2	46.2	25.0	1331.9

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0500 hrs on 08 May 2007).
[c] Maximum temperature (recorded at 1600 hrs on 08 July 2007).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1530 hrs on 19 May 2007 and 1600 hrs on 12 June 2007).

West 100m

West 100m contained 3 American Beech (*Fagus grandifollia* Ehrh.) (width 0.17m) and 1 Yellow Poplar (*Liriodendron tulipifera* L.) (width 1.90m) within 3m of the data logger.

Birds observed at within 3m of the data logger West 100m included 3 Acadian Flycatcher (*Empidonax virescens*) and 3 Scarlet Tanager (*Piranga olivacea*).

Microclimate data for West 100m are presented in Table 65. The minimum temperature reading was 2.30°C and maximum temperature reading was 36.3°C. The largest difference between the maximum and minimum temperature readings in a week was 27.6°C. The maximum PAR intensity was 225.9 lux.

Table 65: Microclimate Data West 100m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.08	35.6	27.6[d]	214.0
2	2.30[b]	29.2	26.8	107.0
3	4.73	28.8	24.0	184.3
4	9.37	31.6	22.2	124.9
5	14.2	30.8	16.5	107.0
6	12.3	32.3	20.0	124.9
7	13.0	28.9	15.9	142.7
8	10.8	32.1	21.2	178.4
9	13.1	32.7	19.6	160.5
10	13.0	30.5	17.5	214.0
11	14.6	34.8	20.2	124.9
12	14.5	32.4	17.9	142.7
13	14.5	32.5	18.0	148.6
14	17.0	33.5	16.5	225.9[e]
15	21.4	36.3[c]	14.9	107.0

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0430 hrs and 0500 hrs on 08 May 2007).
[c] Maximum temperature (recorded at 1430 hrs on 08 August 2007).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1330 hrs on 29 July 2007).

West 200m

West 200m contained 3 Common Persimmon (*Diospyros viriniana* L.) (height ranging from 4 to 5m), 1 Northern Red Oak (*Quercus rubra* L.) (width 0.21m), and 2 Yellow Poplar (*Liriodendron tulipifera* L.) (width 1.46 and 2.70m) within 3m of the data logger.

Birds observed at within 3m of the data logger West 200m included 3 Acadian Flycatcher (*Empidonax virescens*) and 1 Pileated Woodpecker (*Dryocopus pileatus*).

Microclimate data for West 200m are presented in Table 66. The minimum temperature reading was 1.98°C and maximum temperature reading was 36.5°C. The largest difference between the maximum and minimum temperature readings in a week was 27.6°C. The maximum PAR intensity was 951.3 lux.

Table 66: Microclimate Data West 200m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	7.98	32.5	24.5	451.9
2	1.98[b]	29.6	27.6[d]	594.6
3	4.62	29.4	24.7	951.3[e]
4	9.37	31.5	22.1	356.7
5	14.2	30.6	16.3	570.8
6	12.3	32.2	19.9	737.3
7	13.0	28.6	15.6	665.9
8	10.9	32.0	21.0	261.6
9	13.0	32.5	19.5	178.4
10	12.8	30.5	17.7	225.9
11	14.6	34.0	19.3	523.2
12	14.3	31.8	17.5	309.2
13	14.5	32.0	17.5	428.1
14	17.1	33.5	16.4	547.0
15	21.3	36.5[c]	15.2	142.7

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0500 hrs on 08 May 2007).
[c] Maximum temperature (recorded at 1430 hrs on 08 August 2007).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1000 hrs on 15 May 2007).

West 300m

North 0m contained 1 Common Persimmon (*Diospyros viriniana* L.) (width 0.25m), 1 Shingle Oak (*Quercus imbricaria* Michx.) (height 5m), and 1 Yellow Poplar (*Liriodendron tulipifera* L.) (width 1.55m) within 3m of the data logger.

Birds observed at within 3m of the data logger West 300m included 4 Acadian Flycatcher (*Empidonax virescens*).

Microclimate data for West 300m are presented in Table 67. The minimum temperature reading was 2.52°C and maximum temperature reading was 37.2°C. The largest difference between the maximum and minimum temperature readings in a week was 26.9°C. The maximum PAR intensity was 808.6 lux.

Table 67: Microclimate Data West 300m				
Week	Minimum Temperature (°C)	Maximum Temperature (°C)	Temperature Difference (°C)[a]	Maximum PAR Intensity (lux)
1	8.58	33.8	25.3	737.3
2	2.52[b]	29.5	26.9[d]	475.7
3	5.24	29.6	24.3	665.9
4	9.67	32.0	22.3	261.6
5	14.6	30.9	16.2	237.8
6	12.8	32.9	20.1	214.0
7	13.0	29.8	16.8	214.0
8	11.5	32.7	21.2	166.5
9	13.5	33.6	20.2	428.1
10	13.2	30.8	17.6	249.7
11	15.0	35.2	20.2	808.6[e]
12	14.7	32.8	18.1	190.3
13	14.9	32.9	18.0	380.5
14	17.5	33.8	16.4	380.5
15	21.3	37.2[c]	15.9	428.1

[a] Maximum temperature – minimum temperature.
[b] Minimum temperature (recorded at 0500 hrs on 08 May 2007).
[c] Maximum temperature (recorded at 1330 hrs on 08 August 2007).
[d] Largest temperature difference.
[e] Maximum PAR intensity (recorded at 1300 hrs on 08 July 2007).

Appendix 4: List of Shrubs and Trees Found at Banshee Reeks Park

Acer negundo L.
Acer rubrum L.
Acer saccharinum L.
Acer saccharum Marsh.
Ailanthus altissima (Mill.) Swingle
Alnus serrulata (Ait.) Willd.
Asimina triloba (L.) Dunal
Betula nigra L.
Carpinus caroliniana Walt.
Carya cordiformis (Wangenh.) K. Koch
Carya ovata (Mill.) K. Koch
Castanea dentata (Marsh.) Borkh.
Celtis occidentalis L.
Cephalanthus occidentalis L.
Cercis canadensis L.
Chionanthus virginicus L.
Cornus florida L.
Diospyros virginiana L.
Fagus grandifolia Ehrh.
Fraxinus americana L.
Fraxinus nigra Marsh.
Ilex opaca Ait.
Juglans nigra L.
Juniperus virginiana (Small) Bailey
Kalmia latifolia Muhl. ex Ell.
Liquidambar styraciflua L.
Liriodendron tulipifera L.
Maclura pomifera (Raf.) Schneid.
Nyssa sylvatica Marsh.
Paulownia tomentosa (Thunb.) Steud.
Pinus strobus L.
Pinus virginiana Mill.
Platanus occidentalis L.
Prunus serotina Ehrh.
Quercus alba L.
Quercus falcata Michx.
Quercus imbricaria Michx.
Quercus palustris Muenchh.
Quercus shumardii Buckl.
Quercus stellata Wangenh.
Quercus velutina Lam.
Rhus copallina L.
Rhus glabra L.
Robinia pseudoacacia L.
Salix nigra Marsh.
Sassafras albidum (Nutt.) Nees
Tsuga canadensis (L.) Carr.
Ulmus americana L.
Viburnum prunifolium L.

Appendix 5: List of Shrubs and Trees Found at Prince William Forest Park

Acer platanoides L.
Acer rubrum L.
Ailanthus altissima (Mill.) Swingle
Albizia julibrissin Durazzini
Alnus serrulata (Ait.) Willd.
Amelanchier arborea (Michx. f.) Fern.
Aralia spinosa L.
Asimina triloba (L.) Dunal
Betula nigra L.
Carpinus caroliniana Walt.
Carya cordiformis (Wangenh.) K. Koch
Carya glabra (Mill.) Sweet
Carya ovata (Mill.) K. Koch
Castanea dentata (Marsh.) Borkh.
Castanea pumila Mill.
Catalpa speciosa Warder ex Engelm
Celtis occidentalis L.
Celtis tenuifolia Nutt.
Cephalanthus occidentalis L.
Cercis canadensis L.
Chionanthus virginicus L.
Cornus florida L.
Diospyros virginiana L.
Fagus grandifolia Ehrh.
Fraxinus americana L.
Fraxinus pennsylvanica Marsh.
Gleditsia triacanthos L.
Hamamelis virginiana L.
Ilex opaca Ait.
Juglans cinerea L.
Juglans nigra L.
Juniperus virginiana (Small) Bailey
Kalmia latifolia Muhl. ex Ell.
Ligustrum sinense Lour.
Liquidambar styraciflua L.
Liriodendron tulipifera L.
Magnolia virginiana L.
Morus alba L.
Morus rubra L.
Nyssa sylvatica Marsh.
Oxydendrum arboreum (L.) DC.
Pinus echinata Mill.
Pinus pungens Lamb.
Pinus rigida Mill.
Pinus strobus L.
Pinus virginiana Mill.
Platanus occidentalis L.
Populus grandidentata Michx.
Prunus angustifolia Marsh.
Prunus avium (L.) L.
Prunus cerasus L.
Prunus serotina Ehrh.
Quercus alba L.
Quercus bicolor Willd.
Quercus coccinea Muenchh.
Quercus falcata Michx.
Quercus marilandica Muenchh.
Quercus palustris Muenchh.
Quercus phellos L.
Quercus prinus L.
Quercus rubra L.
Quercus stellata Wangenh.
Quercus velutina Lam.
Rhus copallina L.
Rhus glabra L.
Robinia pseudoacacia L.
Salix babylonica L.
Salix nigra Marsh.
Sambucus canadensis L.
Sassafras albidum (Nutt.) Nees
Staphylea trifolia L.
Tilia americana L.
Tsuga canadensis (L.) Carr.
Ulmus rubra Muhl.
Viburnum dentatum L.
Viburnum nudum L.
Viburnum prunifolium L.

Appendix 6: List of Birds found at Banshee Reeks Park

The following list of birds was compiled at Banshee Reeks Park in 2002 was obtained from www.bansheereeks.org.

Key:

s – spring; March -May
S – summer; June - August
F – fall; September - November
W – winter; December - February

C – common; likely to be seen in correct habitat
U – uncommon; present in correct habitat but not always seen
O – occasional; seen only a few times per season
R – rare; unlikely to be seen, occurs irregularly

* - confirmed or probable breeder

SEASONS	s	S	F	W
Red-throated Loon	r			r
Common Loon	o	r	o	
Pied-billed Grebe*	o	o	o	o
Horned Grebe	o		o	o
Double-crested Cormorant	o	o	o	
American Bittern	o		o	
Great Blue Heron*	c	c	c	c
Great Egret	r	u	o	r
Green Heron*	u	c	u	
Black-crowned Night-Heron	o	o	o	
Black Vulture*	u	u	u	u
Turkey Vulture*	c	c	c	c
Canada Goose*	c	c	c	c
Tundra Swan	o		o	o
Wood Duck*	c	c	c	o
Gadwall	o		o	o
American Wigeon	u		u	o
American Black Duck	o		o	o
Mallard*	c	c	c	c
Blue-winged Teal	u		u	
Northern Shoveler	u		u	o
Northern Pintail	o		o	o
Green-winged Teal	c		c	o
Canvasback	r		r	r
Redhead	r		r	r
Ring-necked Duck	u		u	o
Greater Scaup	r		r	r
Lesser Scaup	r		r	r
Bufflehead	o		o	o
Common Goldeneye	r		r	r
Hooded Merganser	o		o	o
Common Merganser	r		r	r
Red-breasted Merganser				r
Ruddy Duck	r	r	r	r
Osprey	o		o	
Bald Eagle	o	o	o	o
Northern Harrier	u		u	u
Sharp-shinned Hawk	u	o	u	u
Cooper's Hawk*	u	u	u	u

SEASONS	s	S	F	W
Red-shouldered Hawk*	c	c	c	c
Broad-winged Hawk	u	r	u	
Red-tailed Hawk*	c	c	c	c
American Kestrel*	u	u	u	u
Wild Turkey*	u	u	u	u
Ring-necked Pheasant	r	r	r	r
Ruffed Grouse	r	r	r	r
Northern Bobwhite*	o	o	o	o
Black Rail		r		
Virginia Rail*	u	u	u	
Sora	o		u	
Common Moorhen	o	o	o	
American Coot	o	o	o	
Black-bellied Plover			r	
American Golden-Plover			r	
Semipalmated Plover		o		
Killdeer*	u	u	u	o
Greater Yellowlegs	o	u		
Lesser Yellowlegs	o	u		
Solitary Sandpiper	u	c		
Spotted Sandpiper	u	c		
Upland Sandpiper		r		
Whimbrel	r			
Semipalmated Sandpiper	r	o		
Western Sandpiper		r		
Least Sandpiper	u	c		
White-rumped Sandpiper	o			
Baird's Sandpiper		r		
Pectoral Sandpiper	o	o		
Dunlin	r			
Stilt Sandpiper	r	r		
Buff-breasted Sandpiper			r	
Short-billed Dowitcher	o	o		
Long-billed Dowitcher		r		
Common Snipe	o		o	o
American Woodcock*	o	o	o	r
Wilson's Phalarope		r		
Ring-billed Gull	c	o	c	c
Herring Gull	o	o	o	o

SEASONS	s	S	F	W
Caspian Tern	r		r	
Common Tern	o		o	
Arctic Tern	r			
Forster's Tern	r		r	
Black Tern	r		r	
Rock Dove*	c	c	c	c
Mourning Dove*	c	c	c	c
Black-billed Cuckoo	r		r	
Yellow-billed Cuckoo*	u	u	u	
Barn Owl*	u	u	u	u
Eastern Screech-Owl*	u	u	u	u
Great Horned Owl*	u	u	u	u
Barred Owl*	u	u	u	u
Short-eared Owl				r
Northern Saw-whet Owl				o
Common Nighthawk	u		u	
Whip-poor-will	r	r		
Chimney Swift*	c	c	c	
Ruby-throated Hummingbird*	u	u	u	
Belted Kingfisher*	u	u	u	o
Red-headed Woodpecker*	u	u	u	u
Red-bellied Woodpecker*	c	c	c	c
Yellow-bellied Sapsucker	u		u	u
Downy Woodpecker*	c	c	c	c
Hairy Woodpecker*	u	u	u	u
Northern Flicker*	c	c	c	c
Pileated Woodpecker*	u	u	u	u
Eastern Wood-Pewee*	c	c	c	
Yellow-bellied Flycatcher	r		r	
Acadian Flycatcher*	c	c	c	
Alder Flycatcher		r		
Willow Flycatcher*	u	u	u	
Least Flycatcher	o		r	
Eastern Phoebe*	c	c	c	o
Great Crested Flycatcher*	c	c	c	
Eastern Kingbird*	u	u	u	

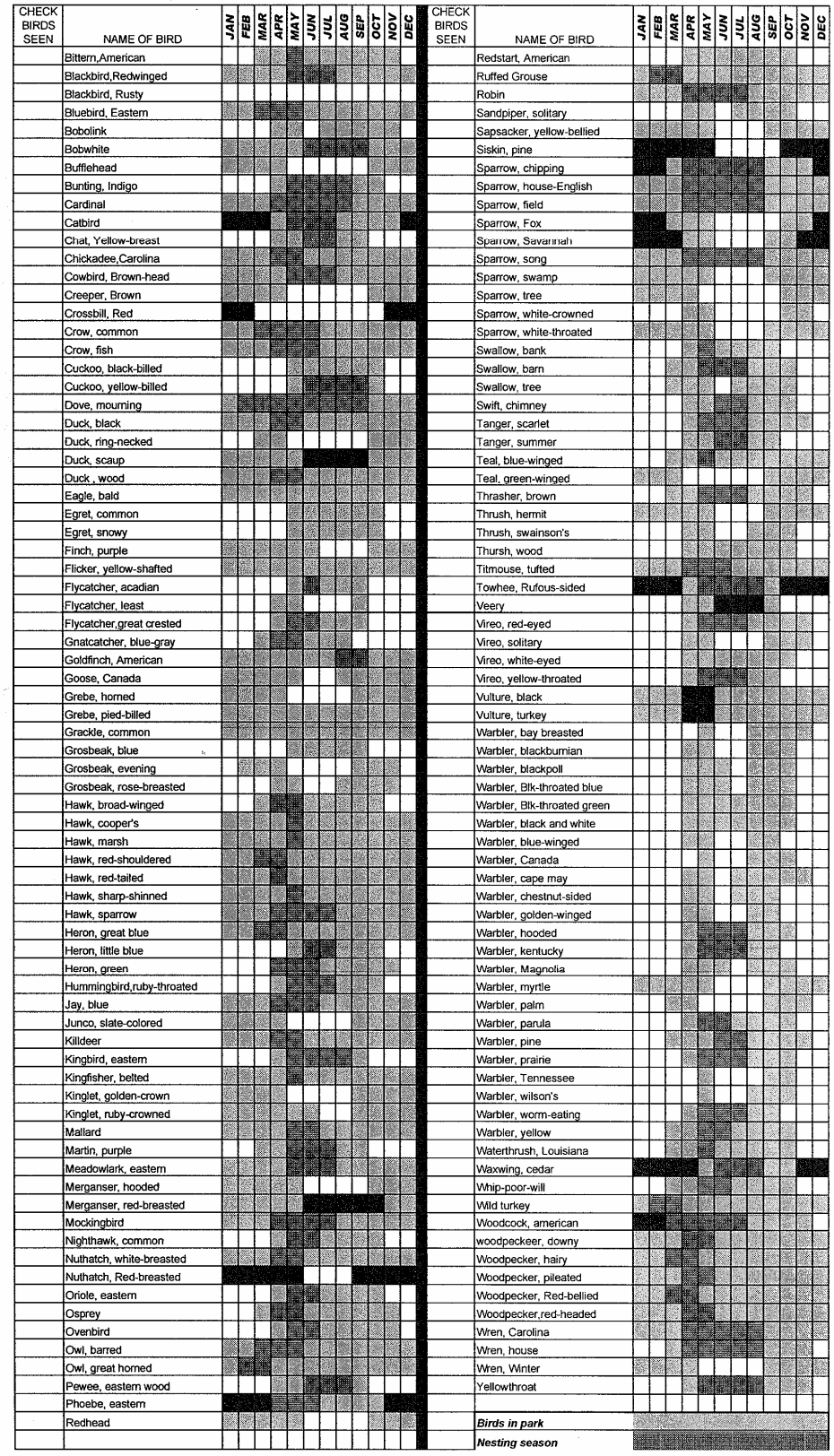
SEASONS	s	S	F	W
Loggerhead Shrike				r
White-eyed Vireo*	u	u	u	
Blue-headed Vireo	o		o	
Yellow-throated Vireo*	u	u	u	
Warbling Vireo*	o	o	o	
Philadelphia Vireo			o	
Red-eyed Vireo*	c	c	c	
Blue Jay*	c	c	c	c
American Crow*	c	c	c	c
Fish Crow*	u	u	u	u
Common Raven				r
Purple Martin*	u	u	u	
Tree Swallow*	c	c	c	
Bank Swallow	o		o	
Cliff Swallow	o		o	
No. Rough-winged Swallow*	u		u	
Barn Swallow*	c	c	c	
Carolina Chickadee*	c	c	c	c
Tufted Titmouse*	c	c	c	c
Red-breasted Nuthatch				o
White-breasted Nuthatch*	c	c	c	c
Brown Creeper	u		u	u
Carolina Wren*	c	c	c	c
House Wren*	c	c	c	
Winter Wren	o		o	u
Sedge Wren		r		
Marsh Wren	r	r	r	
Golden-crowned Kinglet	u		u	u
Ruby-crowned Kinglet	u		u	o
Blue-gray Gnatcatcher*	c	c	c	
Eastern Bluebird*	c	c	c	c
Veery	u		u	
Gray-cheeked Thrush	o		o	
Swainson's Thrush	u		u	

SEASONS	s	S	F	W
Hermit Thrush	u		u	u
Wood Thrush*	c	c	c	
American Robin*	c	c	c	c
Gray Catbird*	c	c	c	r
Northern Mockingbird*	c	c	c	c
Brown Thrasher*	c	c	c	
European Starling*	c	c	c	c
American Pipit	o		o	r
Cedar Waxwing*	u	u	u	u
Blue-winged Warbler	o		o	
Golden-winged Warbler			r	
Tennessee Warbler	o		o	
Nashville Warbler	o		o	
Northern Parula*	u	u	u	
Yellow Warbler*	c	c	c	
Chestnut-sided Warbler	u		u	
Magnolia Warbler	u		u	
Cape May Warbler	o		o	
Black-throated Blue Warbler	u		u	
Yellow-rumped Warbler	c		c	
Black-throated Green Warbler	u		u	
Blackburnian Warbler	o		o	
Pine Warbler*	u	u	u	
Prairie Warbler*	u	u	u	
Palm Warbler	o		o	
Bay-breasted Warbler	o		o	
Blackpoll Warbler	c		c	
Cerulean Warbler	o		r	
Black-and-white Warbler	u		u	
American Redstart	c		c	
Worm-eating Warbler*	o	o	o	
Ovenbird*	c	c	c	
Northern Waterthrush	o		o	
Louisiana Waterthrush*	u	u	u	
Kentucky Warbler	r	r		
Connecticut Warbler			r	
Mourning Warbler	r		o	
Common Yellowthroat*	c	c	c	
Hooded Warbler	o	o		
Wilson's Warbler	r		r	

SEASONS	s	S	F	W
Canada Warbler	o		o	
Yellow-breasted Chat*	u	u	u	
Summer Tanager	r			
Scarlet Tanager*	u	u	u	
Eastern Towhee*	c	c	c	o
American Tree Sparrow				u
Chipping Sparrow*	c	c	c	
Field Sparrow*	c	c	c	u
Vesper Sparrow	o		o	
Savannah Sparrow	u	o	u	o
Grasshopper Sparrow	u	u	u	
Le Conte's Sparrow			r	
Fox Sparrow	o		o	o
Song Sparrow*	c	c	c	c
Lincoln's Sparrow	o		o	
Swamp Sparrow	u		u	u
White-throated Sparrow	c		c	c
White-crowned Sparrow	u		u	u
Dark-eyed Junco	c		c	c
Northern Cardinal*	c	c	c	c
Rose-breasted Grosbeak	u		u	
Blue Grosbeak*	u	u	u	
Indigo Bunting*	c	c	c	
Bobolink	u		u	
Red-winged Blackbird*	u	u	u	o
Eastern Meadowlark*	c	c	c	o
Rusty Blackbird	o		o	r
Common Grackle*	c	c	c	c
Brown-headed Cowbird*	c	c	c	o
Baltimore Oriole*	u	u	u	
Orchard Oriole*	u	u	u	
Purple Finch	o		o	o
House Finch*	c	c	c	c
Common Redpoll				r
Pine Siskin				o
American Goldfinch*	c	c	c	c
Evening Grosbeak				r
House Sparrow*	c	c	c	c

Appendix 7: List of Birds found at Prince William Forest Park

The following list of birds was compiled at Prince William Forest Park and was obtained from www.nps.gov/prwi/index.htm.


CHECK BIRDS SEEN
NAME OF BIRD
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
Bittern,American
Blackbird,Redwinged
Blackbird, Rusty
Bluebird, Eastern
Bobolink
Bobwhite
Bufflehead
Bunting, Indigo
Cardinal
Catbird
Chat, Yellow-breast
Chickadee,Carolina
Cowbird, Brown-head
Creeper, Brown
Crossbill, Red
Crow, common
Crow, fish
Cuckoo, black-billed
Cuckoo, yellow-billed
Dove, mourning
Duck, black
Duck, ring-necked
Duck, scaup
Duck , wood
Eagle, bald
Egret, common
Egret, snowy
Finch, purple
Flicker, yellow-shafted
Flycatcher, acadian
Flycatcher, least
Flycatcher,great crested
Gnatcatcher, blue-gray
Goldfinch, American
Goose, Canada
Grebe, horned
Grebe, pied-billed
Grackle, common
Grosbeak, blue
Grosbeak, evening
Grosbeak, rose-breasted
Hawk, broad-winged
Hawk, cooper's
Hawk, marsh
Hawk, red-shouldered
Hawk, red-tailed
Hawk, sharp-shinned
Hawk, sparrow
Heron, great blue
Heron, little blue
Heron, green
Hummingbird,ruby-throated
Jay, blue
Junco, slate-colored
Killdeer
Kingbird, eastern
Kingfisher, belted
Kinglet, golden-crown
Kinglet, ruby-crowned
Mallard
Martin, purple
Meadowlark, eastern
Merganser, hooded
Merganser, red-breasted
Mockingbird
Nighthawk, common
Nuthatch, white-breasted
Nuthatch, Red-breasted
Oriole, eastern
Osprey
Ovenbird
Owl, barred
Owl, great horned
Pewee, eastern wood
Phoebe, eastern
Redhead
CHECK BIRDS SEEN
NAME OF BIRD
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
Redstart, American
Ruffed Grouse
Robin
Sandpiper, solitary
Sapsacker, yellow-bellied
Siskin, pine
Sparrow, chipping
Sparrow, house-English
Sparrow, field
Sparrow, Fox
Sparrow, Savannah
Sparrow, song
Sparrow, swamp
Sparrow, tree
Sparrow, white-crowned
Sparrow, white-throated
Swallow, bank
Swallow, barn
Swallow, tree
Swift, chimney
Tanger, scarlet
Tanger, summer
Teal, blue-winged
Teal, green-winged
Thrasher, brown
Thrush, hermit
Thrush, swainson's
Thursh, wood
Titmouse, tufted
Towhee, Rufous-sided
Veery
Vireo, red-eyed
Vireo, solitary
Vireo, white-eyed
Vireo, yellow-throated
Vulture, black
Vulture, turkey
Warbler, bay breasted
Warbler, blackburnian
Warbler, blackpoll
Warbler, Blk-throated blue
Warbler, Blk-throated green
Warbler, black and white
Warbler, blue-winged
Warbler, Canada
Warbler, cape may
Warbler, chestnut-sided
Warbler, golden-winged
Warbler, hooded
Warbler, kentucky
Warbler, Magnolia
Warbler, myrtle
Warbler, palm
Warbler, parula
Warbler, pine
Warbler, prairie
Warbler, Tennessee
Warbler, wilson's
Warbler, worm-eating
Warbler, yellow
Waterthrush, Louisiana
Waxwing, cedar
Whip-poor-will
Wild turkey
Woodcock, american
woodpeckeer, downy
Woodpecker, hairy
Woodpecker, pileated
Woodpecker, Red-bellied
Woodpecker,red-headed
Wren, Carolina
Wren, house
Wren, Winter
Yellowthroat
Birds in park
Nesting season

REFERENCES

REFERENCES

Ambuel, B., and Temple, S.A. (1983). Area dependent changes in the bird communities and vegetation of southern Wisconsin forests. Ecology 64 (5): 1057-1068.

Barlow, J., Peres, C.A., Henriques, L.M.P., Stouffer, P.C., and Wunderle, J.M. (2006). The responses of understorey birds to forest fragmentation, logging and wildfires: An Amazonian synthesis. Biological Conservation 128: 182-192.

Beier,P., and Noss, R.F. (1998). Do habitat corridors provide connectivity? Conservation Biology 12 (6): 1241-1252.

Bennett, A.F. (1990). Habitat corridors and the conservation of small mammals in a fragmented forest environment. Landscape Ecology 4 (2/3): 109-122.

Bierregaard, Jr., B.O., Gascon, C., Lovejoy, T.E., and Mesquita, R.C.G. (2001). *Lessons from Amazonia: The Ecology and Conservation of a Fragmented Forest*. Yale University Press, New Haven and London. 478pp.

Blake, J.G., and Karr, J.R. (1987). Breeding birds of isolated woodlots: area and habitat relationships. Ecology 68 (6): 1724-1734.

Brand, L.A., and George, T.L. (2001). Response of passerine birds to forest edge in coast redwood forest fragments. The Auk 118 (3): 678-686.

Bryant, D., D. Nielsen, and Tangley, L. (1997). *The Last Frontier Forests: Ecosystems and Economies on the Edge*. Washington, D.C.: World Resources Institute.

Brooks, T., Tobias, J., and Balmfor, A. (1999). Deforestation and bird extinctions in the Atlantic forest. Animal Conservation 2: 211-222.

Burke, D.M., and Nol, E. (2000). Landscape and fragment size effects on reproductive success of forest-breeding birds in Ontario. Ecological Applications 10 (6): 1749-1761.

Castelletta, M., Thiollay, J.M., and Sodhi, N.S. (2005). The effects of extreme forest fragmentation on the bird community of Singapore Island. Biological Conservation 121: 135-155.

Chiarello, A.G. (1999). Effects of fragmentation of the Atlantic forest on mammal communities in south-eastern Brazil. Biological Conservation 89: 71-82.

Cornelius, C., Cofré, H., and Marquet, P.A. (1999). Effects of habitat fragmentation on bird species in a relict temperate forest in southern Chile. Conservation Biology 14 (2): 534-543.

Desouza, O., Schoereder, J.H., Brown, V., and Bierregaard, Jr., B.O. (2001). Pp. 13-21 in Bierregaard, Jr., B.O., Gascon, C., Lovejoy, T.E., and Mesquita, R.C.G. (Eds.). A theoretical overview of the processes determining species richness in forest fragements. In *Lessons from Amazonia: The Ecology and Conservation of a Fragmented Forest*. Yale University Press, New Haven and London. 478pp.

Eastern Deciduous Forest website. Available: http://www.nearctica.com/biomes. Accessed 17 September 2007.

The Federal Interagency Stream Restoration Working Group (1998). Stream corridor restoration: Principles, processes, and practices. Figure 2.39

Fleming, G.P., Coulling, P.P., Patterson, K.D., and Taverna, K. 2006. The natural communities of Virginia: classification of ecological community groups. Second approximation. Version 2.2. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. Available: http://www.dcr.virginia.gov/ natural_heritage/ncintro.shtml. Accessed 22 September 2007.

Fraser, G.S., and Stutchbury, B.J.M. (2004). Area-sensitive forest birds move extensively among forest patches. Biological Conservation 118 (3): 377-387.

Fraterrigo, J.M., and Wiens, J.A. (2005). Bird communities of the Colorado Rocky Mountains along a gradient of low-density residential development. Landscape and Urban Planning 71: 263-275.

The Friends of Banshee Reeks website: http://www.bansheereeks.org. Accessed 19 February 2005.

Fuller, D.O. (2001). Forest fragmentation in Loudoun County, Virginia, USA evaluated with multitemporal Landsat imagery. Landscape Ecology 16: 627-642.

Gascon, C., Bierregaard Jr., R.O., Laurance, W.F., and Rankin-de Mérona, J. (2001). Pp. 22-30 in Bierregaard, Jr. B.O., Gascon, C., Lovejoy, T.E., and Mesquita, R.C.G. (Eds.). Deforestation and forest fragmentation in the Amazon. In *Lessons from Amazonia: The Ecology and Conservation of a Fragmented Forest.* Yale University Press, New Haven and London. 478pp.

Gascon, C., Lovejoy, T.E., Bierregaard Jr., R.O., Malcolm, J.R., Stouffer, P.C., Vasconcelos, H.L., Laurance, W.F., Zimmerman, B., Tocher, M., and Borges, S. (1999). Matrix habitat and species richness in tropical forest remnants. Biological Conservation 91: 223-229.

Hamel, P.B., Smith, W.P., Twedt, D.J., Woehr, J.R., Morris, E., Hamilton, R.B., and Cooper, R.J. (1996). A land manager's guide to point counts of birds in the Southeast. Gen. Tech. Rep. SO-120. U.S. Department of Agriculture, Forest Service, Southern Research Station. 39 p.

Harris, L.D., and Silva-Lopez, G. (1992). Forest fragmentation and the conservation of biological diversity. In *Conservation biology: the theory and practice of nature conservation preservation and management*. Chapman and Hall, New York.

Henderson, I.G., Cooper, J., Fuller, R.J., and Vickery, J. (2000). The relative abundance of birds on set-aside and neighboring fields in summer. Journal of Applied Ecology 37: 335-347.

Hobson, K.A., and Bayne, E. (2000). Effects of forest fragmentation by agriculture on avian communities in the southern boreal mixedwoods of western Canada. Wilson Bulletin 112(3): 373-387.

King, D.I., DeGraff, R.M., and Griffin, C.R. (1998). Edge-related nest predation in clearcut and groupcut stands. Conservation Biology 12 (6): 1412-1415.

Laurence, S.G., Stouffer, P.C., and Laurence, W.F. (2004). Effects of road clearings on movement patterns of understory rainforest birds in central Amazonia. Conservation Biology 18 (4): 1099-1109.

Lindenmayer, D.B., Cunningham, R.B., Donnelly, C.F., Nix, H., and Lindenmayer, B.D. (2002). Effects of forest fragmentation on bird assemblages in a novel landscape context. Ecological Monographs 72 (1): 1-18.

Little, E.L. *National Audubon Society Field Guide to North American Trees: Eastern Region*. New York: Alfred A. Knopf. 1980.

Loudoun County Department of Economic Development (2006). 2006 Annual Growth Summary: Loudoun County, Virginia.

Mac Nally, R., Bennett, A.F., and Horrocks, G. (2000). Forecasting the impacts of habitat fragmentation. Evaluation of species-specific predictions of the impact of habitat fragmentation on birds in the box-ironbark forests of central Victoria, Australia. Biological Conservation 95: 7-29.

McCollin, D. (1993). Avian distribution patterns in a fragmented wooded landscape (North Humberside, U.K.): the role of between-patch and within-patch structure. Global Ecology and Biogeography Letters 3: 48-62.

Miller, J.R., and Cale, P. (2000). Behavioral mechanisms and habitat use by birds in a fragmented agricultural landscape. Ecological Applications 10 (6): 1732-1748.

National Geographic. *Field Guide to the Birds of North America*. Third Edition. Washington D.C.: National Geographic Society. 1999.

National Park Service website. http://www.nps.gov/prwi/index.htm. Accessed 10 July 2006.

Nichols, J.D., Hines, J.E., Sauer, J.R., and Fallon, F.W., et al. (2000). A double-observer approach for estimating detection of probability and abundance from point counts. The Auk 117 (2): 393-408.

Purcell, K.L., Mori, S.R., and Chase, M.K. (2005). Design considerations for examining trends in avian abundance using point counts: examples from oak woodlands. The Condor 107: 305-320.

R Development Core Team (2005). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org.

Reed, R.A., Johnson-Barnard, J., and Baker, W.L. (1996). Contribution of roads to forest fragmentation in the Rocky Mountains. Conservation Biology 10 (4): 1098-1106.

Reference.com webiste. http://www.reference.com. Accessed 11 November 2005.

Robbins, C.S., Dawson, D.K., and Dowell, B.A. (1989). Habitat requirements of breeding forest birds of the Middle Atlantic States. Wildlife Monographs 103. The Wildlife Society.

Rockwood, L.L. (2006). *Introduction to Population Ecology*. Blackwell Publishing, Malden, Massachusetts. 339pp.

Rosenblatt, D.L., Heske, E.J., Nelson, S.L., Barber, D.M., Miller, M.A., and MacAllister, B. (1999). Forest fragments in east-central Illinois: islands or habitat patches for mammals? American Midland Naturalist 141 (1): 115-123.

Royle, J.A., and Wilke, C.K. (2005). Efficient statistical mapping of avian count data. Environmental and Ecological Statistics 12: 225-243.

Sampson, N., and DeCoster, L. (2000). Forest fragmentation: implications for sustainable private forests. Journal of forestry 93 (3): 4-8.

Scrivani, J.A. (2003). Virginia's forest resource trends. Presented at Virginia Chapter of the Wildlife Society's 2003 Winter Meeting. Available: http://www.dof.virginia.gov/resources/ri-Wildlife-Society-2003-03-27.ppt. Accessed 15 November 2005.

Stevens, S.M., and Husband, T.P. (1998). The influence of edge on small mammals: evidence from Brazilian Atlantic forest fragments. Biological Conservation 85: 1-8.

Stouffer, P.C, and Borges, S.H. (2001). Pp. 248-261 in Bierregaard, Jr. B.O., Gascon, C., Lovejoy, T.E., and Mesquita, R.C.G. (Eds.). Conservation recommendations for understory birds in Amazonian forest fragments and second-growth areas. In *Lessons from Amazonia: The Ecology and Conservation of a Fragmented Forest*. Yale University Press, New Haven and London. 478pp.

Sullivan, J. 1995. Oak-hickory forest. In: Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Available: http://www.fs.fed.us/database/feis/. Accessed 20 February 2005.

Terbrough, J. (1992). *Diversity in Tropical Rainforest*. Scientific America Library, William Freeman, New York.

TerraServer-USA website. http://www.terraserver.microsoft.com. Accessed 22 July 2007.

Tharme, A.P., Green, R.E., Baines, D., Bainbridge, I.P., and O'Brien, M. (2001). The effect of management for red grouse shooting on population density of breeding birds on heather-dominated moorland. Journal of Applied Ecology 38: 439-457.

Tigas, L.A., Van Vuren, D.H., and Sauvajot, R.M. (2002). Behavioral responses of bobcats and coyotes to habitat fragmentation and corridors in an urban environment. Biological Conservation 108: 299-306.

Turner, I.M. (1996). Species loss in fragments of tropical rain forest: a review of the evidence. Journal of Applied Ecology 33: 200-209.

Vergara, P.M., and Simonetti, J.A. (2004). Avian responses to fragmentation of the Maulino Forest in central Chile. Oryx 38: 383-388.

Wade, T.G., Riitters, K.H., Wickham, J.D., and Jones, K.B. (2003). Distribution and causes of global forest fragmentation. Conservation Ecology 7 (2): 7.

Weldon Cooper Center, University of Virginia, Demographics and Workplace Section. Available: http://www3.ccps.virginia.edu/demographics/estimates/2006/0-main.html Accessed 16 April 2007.

Whitcomb, R.F., Lynch, J.F., Opler, P.A., and Robbins, C.S. (1976). Island biogeography and conservation: Strategy and limitations. Science 193: 1030-1032.

Whitcomb, R.F., Robbins, C.S., Lynch, J.F., Whitcomb, B.L., Klimkiewics, M.K., and Bystrak, D. (1981). Pp. 125-205 in Burgess, R.L., and Sharpe, D.M. (Eds.). Effects of forest fragmentation on avifauna of the eastern deciduous forest. In *Forest Island Dynamics in Man-dominated Landscapes*. Springer Valeg, New York. 311pp.

Woodward, F. I. (1992). Pp. 105-123 in Peters, R.L., and Lovejoy, T.E. (Eds.). *A Review of the Effects of Climate on Vegetation: Ranges, Competition, and Composition*. In Global warming and biological diversity. Yale University Press, London. 386pp.

CURRICULUM VITAE

Christopher S. Farabaugh was born on 01 July 1979, in Pittsburgh, Pennsylvania. He graduated from Floyd E. Kellam High School, Virginia Beach, Virginia, in 1997. He received his Bachelor of Science in Biology from The College of William and Mary, Williamsburg, Virginia, in 2001. He received his Master's of Science in Environmental Science and Public Policy from George Mason University, Fairfax, Virginia, in 2005. He is employed as a toxicologist in drug development research.