Effects of Habitat Patch Size on Occupancy and Reproductive Success of a Forest-Dependent Songbird in an Urban Landscape

Prepared by:

Dianne Hali Robinson[1]
Dr. Michael Morrison[2]

October 2012

[1] Research Assistant, Department of Wildlife & Fisheries Sci., Texas A&M University, College Station, TX 77843-2258; diannehd@gmail.com
[2] Professor, Caesar Cleburg Chair in Wildlife Ecology and Conservation, Department of Wildlife & Fisheries Sci., Texas A&M University, College Station, TX 77843-2258; mlmorrison@nature.tamu.edu

EXECUTIVE SUMMARY

Habitat fragmentation can lead to habitat loss and isolation, which for birds may result in decreased occupancy and reproductive success. This can be particularly problematic for area-sensitive species, especially those inhabiting urban environments where suitable habitat is exceptionally limited. Past research on the golden-cheeked warbler (*Setophaga chrysoparia*) has shown decreased occupancy near more urban environments, as well as negative effects associated with distance to edge and habitat fragmentation. Additionally, past research in rural environments has indicated that a minimum patch-size threshold for reproductive success exists for this warbler. However there has been no research on a reproductive threshold for this warbler in an urban landscape. I surveyed 4 Balcones Canyonlands Preserve properties (Barton Creek Wilderness park, Gaines Creek greenbelt, Dick Nichols park, and Steck Valley Park) in 2012 to determine a minimum patch size threshold for territorial male occupancy, pairing success, and reproductive success in an urban landscape. I detected no male warblers on these 4 properties during my surveys.

INTRODUCTION

There has been an increasing amount of research in the last thirty years on ecological thresholds, defined as a relatively rapid change occurring from one condition to another (Huggett 2005). This increase in research has occurred in part due to a growing amount of habitat loss and fragmentation. Habitat loss from urban, transportation, and agricultural development significantly threatens biodiversity (Collinge 1998, Miller & Cale 2000). Andrén (1994) determined that habitat fragmentation is often equal to habitat loss for a variety of birds and mammals. However Andrén (1994) also pointed out that landscape's with highly fragmented habitat display a compounded effect from patch size and isolation, and the loss of species or population decline will be greater with effects from habitat fragmentation and loss, than from habitat loss alone. Past research has found neotropical migrant birds decrease in diversity and abundance as adjacent development increased, and specifically forest-dwelling passerines were more abundant in habitat adjacent to lower density housing developments than higher density housing developments (Friesent *et al.* 1995, Kluza et al 2000). Radford *et al.* (2005) found strong evidence supporting a species-richness threshold response on a landscape level. Denoël and Ficetola (2007) found significant thresholds for landscape composition and configuration in 3 newt species (*Triturus alpestris, T. helveticus, T. vulgaris*), although these thresholds were highly variable across the species.

Most research on threshold levels in passerine systems has studied occupancy levels, rather than abundance or reproductive success (Donnelly and Marzluff 2004, Radford and Bennett

2004, Betts *et al.* 2007). Donnelly and Marzluff (2004) found lower species richness thresholds in smaller habitat patches. Radford and Bennett (2004) determined minimum occupancy thresholds in relation to patch isolation and amount of habitat for the white-browed treecreeper (*Climacteris affinis*). Betts *et al.* (2007) found significant occupancy thresholds for amount of habitat in 14 of 15 songbird species. Only two of the 15 species, the black-throated blue warbler (*Dendroica caerulescens*) and the ovenbird (*Seiurus aurocapilla*), displayed a significant occupancy threshold in relation to minimum habitat patch size. Burke and Nol (2000) researched reproductive success for 4 forest-dwelling passerines, the ovenbird (*S. aurocapilla*), wood thrush (*Hylocichla mustelina*), rose-breasted grosbeak (*Pheucticus ludovicianus*), and veery (*Catharus fuscens*), and found lower reproductive success in smaller habitat patch fragments. However Burke and Nol (2000) did not determine any minimum patch size thresholds for these 4 passerines.

It is important, when establishing species-specific management goals, to know how much habitat a species needs to successfully reproduce. Wahl *et al.* (1990) and Beardmore *et al.* (1996) recommend protecting large tracts (>100 ha) of land for area-sensitive species. However, this recommendation does not specify species, and thus is not reliable across the animal kingdom. The golden-cheeked warbler (*Setophaga chrysoparia*), an area-sensitive, federally endangered, songbird (U.S. Fish and Wildlife Service 1990, Beardmore *et al.* 1996, Groce *et al.* 2010), has been monitored on many habitat patches ≥100 ha across Texas (Jette *et al.* 1998, Anders and Dearborn 2004, Cooksey and Edwards 2008, City of Austin 2009). However there have been few studies monitoring the golden-cheeked warbler in habitat patches <100 ha (Benson 1990, Arnold *et al.* 1996, Butcher *et al.* 2010). Benson (1990) found golden-cheeked warblers occupying patches as small as 0.66 ha. Arnold *et al.* (1996) found the golden-cheeked warbler consistently occupied patches >23 ha, although some birds were found in patches as small as 6.5 ha. Butcher *et al.* (2010) found a minimum patch size threshold for golden-cheeked warbler reproductive success between 15 and 20 ha in a rural landscape in east-central Texas. There have been no other studies looking at golden-cheeked warbler minimum patch size threshold.

The breeding range of the golden-cheeked warbler encompasses large amounts of urban and rural landscapes throughout Texas. The U.S. Fish and Wildlife Service originally listed this warbler in part due to the assumption that 67% of the breeding population occurred in counties on the eastern Edwards Plateau, where large amounts of urban development exists, and development continues to increase (Groce *et al.* 2010). Across the breeding range, human population rates and building permit activity continues to increase (Groce *et al.* 2010). Sperry (2007) compared different land use types adjacent to habitat patches, and found habitat patches adjacent to housing developments had the lowest golden-cheeked warbler occupancy, in comparison to a habitat patches adjacent to utility easements and

woodland meadows. Occupancy of neotropical migrants declines as distance to urban development decreases (Friesen *et al.* 1995, Kluza *et al.* 2000), and productivity of forest-dwelling passerines declines in smaller habitat patches, common in urban areas (Burkes and Nol 2000). Research on golden-cheeked warblers has shown similar declines near development and smaller habitat fragments. Maas (1998) found reproductive success of golden-cheeked warblers decreased with increased habitat fragmentation. Coldren (1998) found a decrease in golden-cheeked warbler reproductive success as distance to the edge of a habitat patch decreased, and low occupancy in patches near urban areas.

OBJECTIVES

I will determine the minimum patch-size threshold for warblers for territorial male occupancy, territory establishment, pairing success, fledging success, and number of fledglings. I hypothesize the minimum patch-size thresholds will be as follows; territorial male occupancy patch-size threshold < territory establishment patch-size threshold < pairing success patch-size threshold < fledging success patch-size threshold < number of fledglings patch-size threshold. I will determine the specific potential habitat patches used in my study based on characteristics such as landscape type, canopy cover, patch size, distance from residential areas, edge:area ratio, and landscape composition. I will define in detail all characteristics in my Methods section. I will then compare my urban results of minimum patch-size thresholds for territorial male occupancy, territory establishment, pairing success, and fledging success to rural results of minimum patch-size thresholds from Butcher et al. (2010). I hypothesize minimum patch-size thresholds in urban areas will be larger than minimum patch-size thresholds in rural areas for territorial male occupancy, territory establishment, pairing success, and fledging success.

METHODS

I conducted this study on 4 different Balcones Canyonlands Preserve (BCP) properties, at Barton Creek Wilderness park, Gaines Creek greenbelt, Dick Nichols park, and Steck Valley Park. I also conducted this study on a number of private properties surrounding Austin, TX. I surveyed along parallel transects established ~150 m apart. Number of transects per study site, and length of transect were determined by patch-size. Observers walked along each transect, stopping for 2-3 minutes every ~100 m to record the GPS coordinates of any warblers located (Morrison et al. 2008). If a golden-cheeked warbler was not located after six visits over a six week time period, I considered the patch unoccupied, and concluded site visits.

RESULTS AND CONCLUSION

I visited each BCP property six times over six different weeks, between 12 March and 16 April, 2012. During these six visits, we did not locate any singing golden-cheeked warblers on the property. Because of the small number of study sites sampled for BCP, final results were not determined. I will explain and discuss data gathered from all 63 habitat patches surveyed (private and public properties, combined) in my thesis, available for distribution in May, 2013.

LITERATURE CITED

Anders, A. D., and D. C. Dearborn. 2004. Population trends of the endangered golden-cheeked warbler at Fort Hood, Texas, from 1992–2001. The Southwestern Naturalist 49:39–47.

Andrén, H. 1994. Effects of habitat fragmentation on birds and mammal in landscapes with different proportions of suitable habitat: a review. Oikos 71:355-366.

Arnold, K. A., C. L. Coldren, and M. L. Fink. 1996. The interactions between avian predators and golden-cheeked warblers in Travis County, Texas. Texas Transportation Institute. Texas A&M University. College Station, Texas, USA.

Beardmore, C. J., J. Hartfield, and J. Lewis, editors. 1996. Golden-cheeked warbler population and habitat viability assessment report. U.S. Fish and Wildlife Service, Austin, Texas, USA.

Benson, R. H. 1990. Habitat area requirements of the golden-cheeked warbler on the Edwards Plateau. Texas Parks and Wildlife Department, Austin, Texas, USA.

Betts, M. G, J. G. Forbes, and A. W. Diamond. 2007. Thresholds in songbird occurrence in relation to landscape structure. Conservation Biology 21:1046-1058.

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

Butcher, J. A., M. L. Morrison, D. Ransom Jr., R. D. Slack, and R. N. Wilkins. 2010. Evidence of a minimum patch size threshold of reproductive success in an endangered songbird. Journal of Wildlife Management 74:133-139.

City of Austin. 2009. Golden-cheeked warbler (*Dendroica chrysoparia*) and black-capped vireo (*Vireo atricapilla*) monitoring program. Balcones Canyonlands Preserve Annual Report, Fiscal year 2008-09. City of Austin Water Utility, Wildland Conservation Division, and Balcones Canyonlands Preserve Program.

Collinge, S. K. 1998. Spatial arrangement of habitat patches and corridors: Clues from ecological Weld experiments. Landscape and Urban Planning 42:157-168.

Cooksey, M. L., and S. M. Edwards. 2008. Monitoring of the golden-cheeked warbler and the black-capped vireo on Camp Bullis, Texas: 2008 field season report. Fort Sam Houston.

Denoël, M., and G. F. Ficetola. 2007. Landscape-level thresholds and newt conservation. Ecological Applications 17:302-309.

Donnelly, R. and J. M. Marzluff. 2004. Importance of reserve size and landscape context to urban bird conservation. Conservation Biology 18:733-745.

Friesen, L. E., P. F. J. Eagles, and R. J. Mackay. 1995. Effects of residential development on forest-dwelling neotropical migrant songbirds. Conservation Biology 9:1408-1414.

Groce, J. E., H. A. Mathewson, M. L. Morrison, and R. N. Wilkins. 2010. Scientific Evaluation for the 5-year status review of the golden-cheeked warbler. Texas A&M Institute of Renewable Natural Resources, College Station, Texas, USA.

Huggett, A. J. 2005. The concept and utility of 'ecological thresholds' in biodiversity conservation. Biological Conservation 124:301-310.

Jette, L. A., T. J. Hayden, and J. D. Cornelius. 1998. Demographics of the golden-cheeked warbler (*Dendroica chrysoparia*) on Fort Hood, Texas. U.S. Army Corps of Engineers Technical Report 98/52.

Kluza, D. A., C. R. Griffin, and R. M. DeGraaf. 2000. Housing developments in rural New England: effects on forest birds. Animal Conservation 3:15-26.

Maas, D. S. 1998. Factors influencing demographics of golden-cheeked warblers (*Dendroica chrysoparia*) at Fort Hood Military Reservation, Texas. Thesis, University of Oklahoma, Norman, Oklahoma, USA.

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

Morrison, M. L., W. M. Block, M. D. Strickland, B. A. Collier and M. J. Peterson. 2008. Wildlife Study Design. Second edition. Springer, New York, New York, USA.

Radford J. Q., and A. F. Bennett. 2004. Thresholds in landscape parameters: occurrence of the white-browed treecreeper *Climacteris affinis* in Victoria, Australia. Biological Conservation 117:375-391.

Radford, J. Q., A. F. Bennett, and G. J. Cheers. 2005. Landscape-level thresholds of habitat cover for woodland-dependent birds. Biological Conservation 124:317-337.

Sperry, C. Influences of borders on golden-cheeked warbler habitat in the Balcones Canyonlands Preserve, Travis county, Texas. Thesis, Texas State University, San Marcos, Texas, USA.

U.S. Fish and Wildlife Service. 1990. Endangered and threatened wildlife and plants; emergency rule to list the golden-cheeked warbler as endangered. Federal Register 55:18844-18845.

Wahl, R., D. D. Diamond, and C. D. Duncan. 1990. The golden-cheeked warbler: a status review. U.S. Fish and Wildlife Service, Ecological Services, Fort Worth, Texas, USA.