Appendix VII – Bat Survey Supplemental Report

Bat Activity at the Buffalo River Project: Draft Report

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Submitted to:

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TABLE OF CONTENTS

TABLES

APPENDICES

1. INTRODUCTION

Bat conservation and management have received recent attention due to both real and perceived population declines that have been attributed to numerous human-induced environmental changes and degradation (Fenton 1997; Pierson 1998; O'Shea et al. 2003). Although human population growth with simultaneous land use changes such as urbanization undoubtedly have had an impact on bat populations, community compositions, and habitat use of bats through modification or loss of roosting substrates, foraging habitats, and insect prey availability (Kurta and Teramino 1992; Pierson 1998; Ghert and Chelsvig 2003, 2004; Avila-Flores and Fenton 2005). Recent research indicates different bat species vary in their response to urbanization (Kurta and Teramino 1992; Ghert and Chelsvig 2004). Although some species such as big brown bats (*Eptesicus fuscus*) exploit urban areas as roosting and foraging habitats (Everette et al. 2001; Menzel et al. 2001), other species such as Indiana myotis (*Myotis sodalis*) are more sensitive to urbanization (Duchamp et al. 2004; Sparks et al. 2005). Within urbanized landscapes, many bat species use remnant forest patches, as their high mobility allows them to utilize patches in otherwise unsuitable surroundings (Clergeau et al. 2001; Ghert and Chelsvig 2003).

Bat habitat selection may occur as a hierachical series of decisions, beginning at the geographic or landscape scale and ending at the local or home-range scale (Johnson 1980; Ford et al. 2006; Loeb and O'Keefe 2006). Differences in bat community composition at the distributional and landscape scales have been attributed to natural influences, including summer roost diversity, proximity to winter hibernacula, topography, latitude, and climate conditions (Humphrey 1975; Graham 1983; Furlonger et al. 1987; Patten 2004) as well as human-induced land use changes, such as urbanization and deforestation (Ghert and Chelsvig 2003, 2004; Duchamp et al. 2004; Owen et al. 2004; Sparks et al. 2005). At the local scale, habitat use likely is a consequence of day-roost preferences and availability, presence of water sources, and foraging preferences, which are largely dictated by morphological and echolocation adaptations (Barclay 1986; Aldridge and Rautenbach 1987; Kalcounis and Brigham 1995; Ford et al. 2005, 2006).

Our objective was to determine if bat species distributions and activity levels were affected by different vegetation cover and canopy densities in the project area. Specifically, we examined species-specific and overall bat activity throughout the project site, with representative stations occurring in different natural communities with few containing varying degrees of forest fragmentation.

2. STUDY AREAS

Prior to conducting the acoustic bat surveys, we inventoried natural areas of the Buffalo River Project and adjacent land areas. The natural areas within the project limit ranged in size from ~1 – 50 acres, all with varying degree of human disturbance. Natural areas and surrounding habitats were characterized as successional old field, pond, floodplain forest, and wet meadow. Descriptions of each natural community are listed below.

Successional Old Field: This natural community is dominated by forbs and grasses and occurs on sites within the project area that have been cleared or used for development, and then abandoned. Species observed in these areas include goldenrods (*Solidago* spp.), bluegrasses (*Poa pratensis* and *P. compressa*), timothy (*Phleum pretense*), quackgrass (*Agropyron repens*), brome (*Bromus inermis*), orchard grass (*Dactylis glomerata*), common evening primrose (*Oenothera biennis*), cinquefoil (*Potentilla* spp.),

calico aster (*Aster lateriflorus*), New England aster (*Aster novae-angliae*), wild strawberry (*Fragaria virginiana*), Queen-Anne's lace (*Daucus carota*), ragweed (*Ambrosia artemisiifolia*), and dandelion (*Taraxacum officinale*). Few scattered shrubs and trees were present in these communities, and included dogwood species (*Cornus* spp.) and cottonwood saplings (*Populus deltoides*). Areas that would be classified as a successional old field include River Bend, Pork Pig, and portions of the Seneca Bluffs site. These areas are not as advantageous for bats due to decreased insect availability, but could be used in transit to other areas of the project.

Pond: This natural community is dominated by forbs and grasses, and occurs on sites within the project area that are currently used for recreational purposes. Species observed in this natural community included duckweeds (*Lemna minor, L. trisulca*), waterweed (*Elodea canadensis),* pondweeds (*Potamogeton* spp.), and white water-lily (*Nymphawa odorata).* These ponds may be slightly eutrophic, and could include several different species of fishes and macroinvertebrates. Areas in the project location that would be classified as a pond include the Smith Road site. These areas can be advantageous for bats due to high insect availability and ease of maneuverability if ponds are relatively free of floating vegetation for drinking water purposes.

Floodplain Forest: This natural community is defined as an area that occurs on mineral soils on low terraces of river floodplains. These natural areas are characterized by the flood regime, typically flooding in spring and drying out in late summer. Species observed in this natural community include willow (*Salix* species), butternut and black walnut (*Juglans cinera, J. nigra*), oaks (*Quercus bicolor, Q. palustris*), and box elder (*Acer negundo*). Several other tree species may also occur. Shrub species observed in this community included dogwoods (*Cornus* spp.), viburnums (*Viburnum* spp.), and honeysuckles (*Lonicera* spp.). Herbaceous vegetation observed in this community included sensitive fern (*Onoclea sensibilis*), ostrich fern (*Metteuccia struthiopteris*), goldenrods (*Solidago* spp.), jewelweeds (*Impatiens capensis, I. pallida*), and abundant Japanese knotweed (*Polygonum cuspidatum*). Areas in the project location that would be classified as a floodplain forest include Bally Street Woods and portions of Seneca Bluffs. These areas can be advantageous for bats due to high insect availability and ease of maneuverability if little understory is present.

Wet Meadow: This natural community is defined as an area that occurs in poorly drained areas such as low-lying depressions and in the areas between water bodies and upland areas. Precipitation is the primary water supply for these areas, and they often dry out in summer months. Characteristic herbaceous species in these communities include water plantain (*Alisma plantago-aquatica*), beggar-ticks (*Bidens frondosa*), horsetail (*Equisetum arvense*), spikerush (*Eleocharis* spp.), phragmites (*Phragmites australis*), and bulrushes (*Scirpus* spp.). Tree species include scattered cottonwood (*Populus deltoides*) and sycamores (*Platanus occidentalis*). Areas in the project location that would be classified as a wet meadow include portions of the Seneca Bluffs site. These areas can be advantageous for bats due to high insect activity and ease of maneuverability due to little canopy cover.

3. MATERIALS AND METHODS

Bat activity data were collected using broadband acoustic detectors (AnaBat SD-2 zero-crossing ultrasonic detectors, Titley Electronics Pty. Ltd., Ballina, NSW Australia). AnaBat detectors record the frequency of bat echolocation calls over time to compact flash cards (CF cards). Four detectors were deployed for a one night study on October 16, 2012. The AnaBat detectors were all located at or slightly above (<1 foot) ground level.

Deployment locations were selected based on a previous site assessment and bat habitat suitability. All detectors were located in different urban landscapes, with varying herbaceous cover types and percent of tree/shrub cover.

All microphones were positioned directly up to create the maximum zone of reception for collecting data. The detectors were powered by 4 – AA batteries. The detectors were turned on at deployment and were powered down when sampling concluded. Detector sensitivity was calibrated prior to field deployment according to Larson and Hayes (2000).

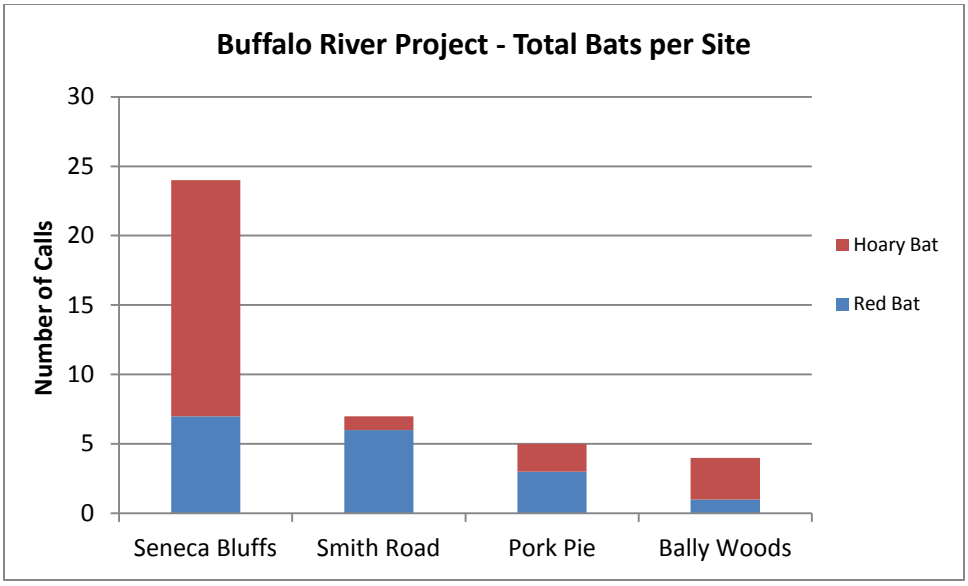
Bat acoustic monitoring data were downloaded after field investigations. Each data file was downloaded using a computer application program, *cfcread.exe*, designed for downloading and processing AnaBat data. Once the data were downloaded, they were transferred for later analysis to a folder with the site name, card number and date of download. Each card was given a specific number which correlated to the monitoring location and unit number.

Data from detectors was downloaded and processed following field investigations. Prior to summary and analysis, all irrelevant noise was eliminated from the data using filters in the AnaBat analysis program, Analook. The clean bat calls were placed in previously labeled bat call files with monitoring location, CF card number and date of download. We defined a bat call as a series of ≥2 echolocation calls with duration of ≥10 ms (Hayes 1997; Thomas 1988; Weller 2007). Each call file was visually inspected to determine whether it was a bat pass. Bat passes were then identified to species, comparing minimum frequency and call shape to a library of vocal signatures (O'Farrell et al. 1999). Unidentifiable calls were labeled as being produced by high (≥35 kHz) or low (<35 kHz) frequency echolocating bats, based on their minimum frequency. Voucher calls are reported in Appendix 2.

4. RESULTS

We conducted acoustic bat surveys on four different sites located throughout the Buffalo River Project site. We recorded a total of 40 bat passes during acoustic bat surveys representing two species of bats. The Hoary Bat (*Lasiurus cinereus*) was the most frequently recorded species during the survey (57.5 % of all calls). The Hoary Bat is the largest bat and is also one of the most widespread species in the U.S. Hoary bats typically emerge late in the evening, hunting at higher elevations over treetops, clearings, fields, and over streams. The Red Bat (*Lasiurus borealis*) was also recorded at all sites and comprised 42.5% of all calls. The Red Bat is a medium-sized bat with long pointed wings and short rounded ears. This bat emerges early in the evening, commonly feeding below streetlights, among trees, and over water.

Table 1. Total number of bat passes recorded at each monitoring location.



Bat activity varied among monitoring locations (Tables 1 and 2). The Seneca Bluffs site had the greatest activity with a total of 24 recorded bat passes during the field investigations (17 Hoary, 7 Red Bats), followed by the Smith Road site, 7 passes (1 Hoary, 6 Red Bats), the Pork Pie site, 5 passes (2 Hoary, 3 Red Bats), and Bally Street Woods site, 4 passes (3 Hoary, 1 Red Bat).

Table 2. Total number of bat passes by species recorded at each monitoring location.

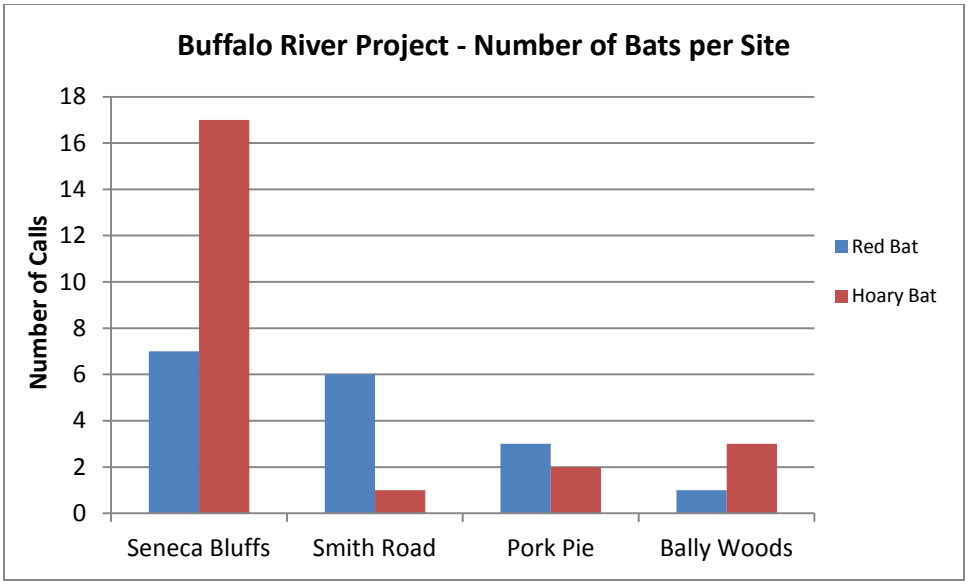
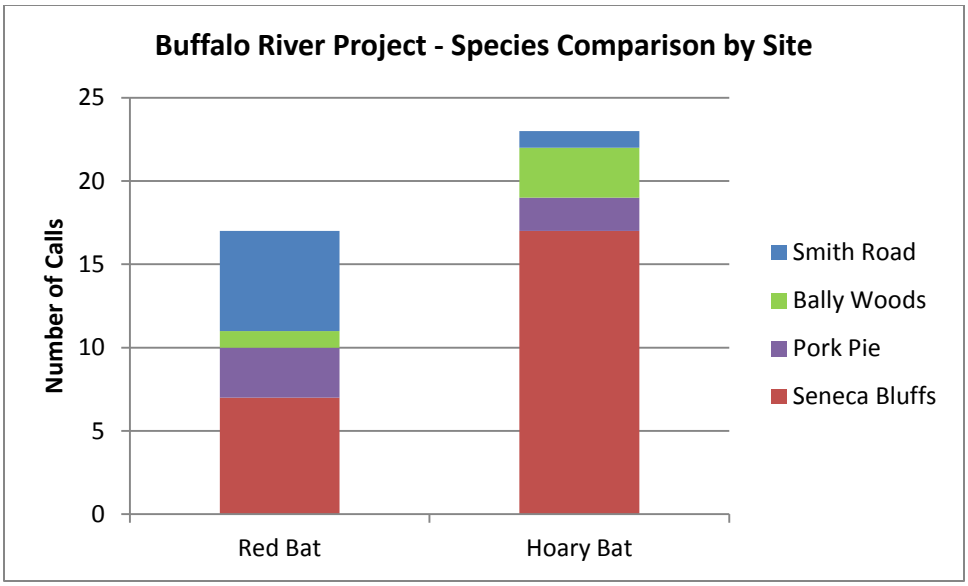


Table 3. Species comparison by site location.



The Seneca Bluffs site recorded the highest amount of bat passes (60% of all calls recorded) (Table 3). This site is characterized as a restored prairie with sedge meadow inclusions along the Buffalo River. The Smith Road site also had a higher amount of calls (17.5% of all calls) and is described as an open-pond area surrounded by fragmented tree canopy with a recreational walking trail. The Pork Pie site is characterized as a successional old field with scattered young cottonwood saplings and totaled 12.5% of all recorded passes. The remaining site, Bally Woods, recorded a total of 4 of 40 total calls (10%). Bally Woods is a floodplain forest site with large cottonwood, willow, oak, and walnut, with a relatively closed canopy.

5. Discussion

We positively identified two of the eight bat species that could potentially occur within the project boundaries (BCI 2012); both Red and Hoary Bats are considered common in this region.

The results of this study agree with theories on the effects of species morphology on the structure of foraging bat communities and habitat use (Fenton 1990, Menzel et al. 2005, Norberg and Ryaner 1987, Saunders and Barclay 1992). Flight activity levels of large-bodied bat species, with faster but less maneuverable flight (i.e. big brown, red, and hoary bats), was significantly less in closed-canopy, cluttered habitats, compared to less-cluttered, open-canopy habitats (Table 3).

In addition, many bats drink from, and forage directly over, water sources (Kunz & Fenton 2003, Hayes 2004, Korine & Pinshow 2004, Menzel et al. 2005a). Bats prefer large, open, calm bodies of water (Mackey & Barclay 1989, Warren et al. 2000, Siemers et al. 2001). Riparian zones generally have higher insect abundance due to the addition of emerging aquatic insects to terrestrial systems (Jackson & Fisher 1986, Jackson & Resh 1989). Calm water produces less ultrasound interference and this facilitates hearing returning echoes used to detect prey (Mackey & Barclay 1989, Warren et al. 2000, Siemers et al. 2001). Water with low habitat complexity creates an environment that enables bats to navigate and detect prey (Mackey & Barclay 1989). Water sources, such as rivers and streams,

can also be used as corridors for flight. Upon emerging from roosts, bats navigate to foraging grounds by flying along streams (Kalcounis & Brigham 1995, Sleep & Brigham 2003).

Given the success of this preliminary survey, we believe additional bat research in the project area is warranted. Continued and more extensive acoustic surveys (time and space), are needed to affirm these findings and to determine if and where additional species occur in the Buffalo River Site. Restored open-space areas would appear to support an abundant and rich bat community.

6. LITERATURE CITED

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APPENDIX 1. SITE PHOTOS

Photo 1. River Bend Site (old field). **Photo 2. River Bend Site (old field).**

Photo 3. Bally St. Woods (floodplain forest). **Photo 4. Bally St. Woods (floodplain forest).**

Photos 5 and 6. Seneca Bluffs (wet meadow/floodplain forest).

Photo 7. Pork Pie Site (old field).

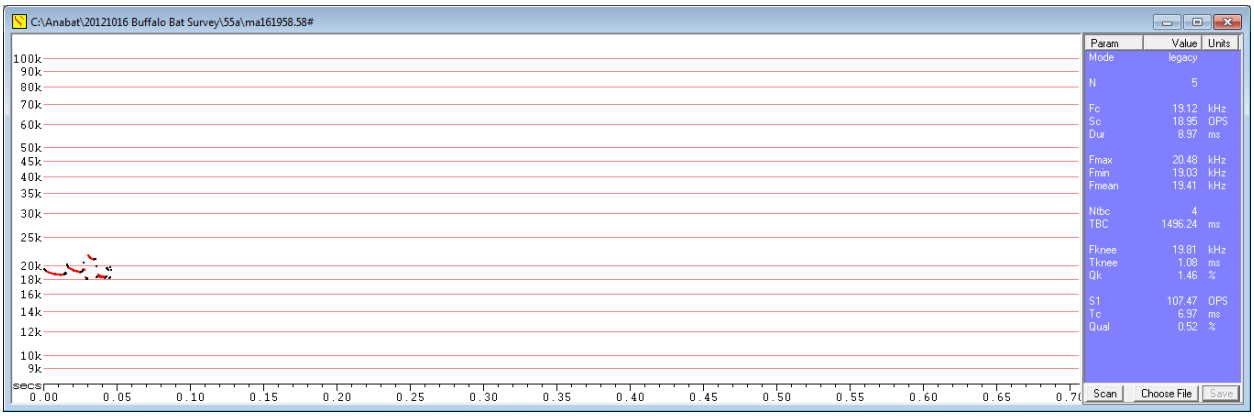
Photo 8. Pork Pie Site (old field).

Photo 9. Smith Road Site (pond).

Photo 10. Smith Road Site (pond).

APPENDIX 2. VOUCHER CALLS

1. Hoary Bat (*Lasiurus cinereus*) at the Seneca Bluffs Site.



2. Hoary Bat (*Lasiurus cinereus*) at the Seneca Bluffs Site.

3. Eastern Red Bat (*Lasiurus borealis*) at the Pork Pie Site.

4. Eastern Red Bat (*Lasiurus borealis*) at the Seneca Bluffs Site.