A Wildlife Survey of the Lower Buffalo River Area of Concern, Buffalo, Erie County, New York

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1. INTRODUCTION

The Buffalo River flows east-west through western New York prior to emptying into Lake Erie. As a major river system with a direct hydrologic and physical connection to the Great Lakes, its historic value as a rich natural resource for humans is well documented (Daloglu et al 2012, Sierszen et al 2012, Trebitz et al 2009). The great Seneca Nation of American Indians thrived in this landscape for centuries hunting, fishing, and gathering by seasonally moving through large tracts of riparian forest, managed meadows, expansive freshwater wetlands, and both riverine and lacustrine aquatic environments as seasonal harvest would dictate (Ganter 2009, Drewes and Silbernagel 2012, Ellis et al 2011).

Shortly following European settlement in the late 1700's, extensive logging, livestock management, and new agricultural practices imposed new ecological stressors to this environment and altered the socio-ecological system (Hristov 2012, Ireland and Booth 2012, Vadeboncoeur et al 2012). Robust industrial growth beginning in the late 1800's resulted in the re-shaping of the river's banks and significant, sustained deleterious impacts to both the terrestrial and aquatic ecosystems within the Lower Buffalo River. As a bustling metropolis, residential housing developments abut industrial development, leaving little space which is not graded, paved, or bulkheaded within the historic bounds of the Lower Buffalo River and its adjacent habitats. The decline of industrial manufacturing in the AOC has left numerous industrial sites abandoned which are now available for re-colonization by plants and animals to various degrees, generating an urban ecology setting. Under these conditions the Lower Buffalo River ecosystem exists today.

1.1. Project Background

The primary objective of this project is to develop a baseline assessment of the current abundance, diversity, and relative distribution of three vertebrate faunal assemblages (herpetofauna, avifauna, and mammals) within the Lower Buffalo River Area of Concern (AOC). The data collected, survey design and methods will aid in valuing ongoing and future efforts to improve ecosystem health within the AOC via comparative analysis.

The Buffalo River AOC, along with 42 other designated AOCs, was established due to the signing of the amended Great Lakes Water Quality Agreement (GLWQA) in 1987. This agreement engages both the USA and Canada in cooperative measures to protect water quality of the Great Lakes (usepa.gov). New amendments were singed into this agreement on September 7, 2012 related to ecological harm, climate change, nearshore environments and aquatic invasives (usepa.gov).

Under the Great Lakes Legacy Act (GLLA), a comprehensive approach to identifying, quantifying, and remediating ecological, toxicological, and sociological stressors to the contributing watersheds of the Great Lakes Ecosystem is supported. Remedial Action Plans (RAP) were generated for each designated AOC. The Buffalo River Remedial Action Plan (BRAP) (BNR 2008) calls out location-specific issues (i.e. contaminated sites) as well as resultant impairments to human and wildlife use within the AOC. The metrics for quantifying these issues are measured in Beneficial Use Impairments (BUIs) which detail particular overarching degradations within or upon ecological and sociological function. BUIs relevant to this project are #s 3 & 14, *Loss of Fish and Wildlife Populations* and *Loss of Fish and Wildlife Habitat*, respectively.

Delisting criteria[1] are as follows:

[1]Delisting criteria language from the International Joint Commission's website (www.ijc.org)

- For BUI #3 - *When environmental conditions support healthy, self-sustaining communities of desired fish and wildlife at predetermined levels of abundance that would be expected from the amount and quality of suitable physical, chemical and biological habitat present. An effort must be made to ensure that fish and wildlife objectives for Areas of Concern are consistent with Great Lakes ecosystem objectives and Great Lakes Fishery Commission fish community goals. Further, in the absence of community structure data, this use will be considered restored when fish and wildlife bioassays confirm no significant toxicity from water column or sediment contaminants.*
- For BUI #14 - *When the amount and quality of physical, chemical, and biological habitat required to meet fish and wildlife management goals have been achieved and protected.*

To date, millions of dollars have been invested in habitat and green infrastructure projects currently underway that promise to greatly restore the Buffalo River AOC's ecosystem. Included are significant shoreline restoration efforts supported by the GLLA.

Currently, no formal scientific data set exists to record the populations of birds, reptiles, amphibians, or mammals specifically within the Lower Buffalo River AOC. Some pre-existing data does exist for birds (BOC 2006, Crewe et al 2006), mammals (Makarewicz et al 1982) and herpetofauna (Crewe et al 2006), but much of it is anecdotal or designed with other intentions, providing no statistical strength to support trends in the Lower Buffalo River AOC terrestrial wildlife populations moving forward. This project has created a standardized and repeatable survey design to merit changes in wildlife populations over time within the Lower Buffalo River AOC, using peer-reviewed, scientifically valid data collection methods. Tied into the larger context, as ecological restoration and enhancement projects are implemented with the intention of delisting various BUIs, (alongside variables inherent with an urban ecosystem, such as industrial and residential development activity) this baseline data set will serve to compare any faunal responses to implemented habitat improvement efforts and may aid in determining locations and appropriate restoration activities within the AOC.

1.2 Project Area

Adhering with the boundaries of the Area of Concern, the project location spans 6.2 linear miles of the Lower Buffalo River (including the ship canal) and immediately adjacent terrestrial landscape (Appendix 1 - Map 1). In addition to the AOC, two survey locations (totaling 5 sampling points) were established to document faunal activity immediately east and west (Seneca Bluffs restoration site and coastal Lake Erie, respectively) of these bounds for comparative analysis and regional connectivity.

1.3 Quality Assurance Project Plan

In compliance with USEPA fund allocation requirements, a Quality Assurance Project Plan (QAPP) was generated for the project. The purpose of the QAPP is to help ensure that the data collected will be well documented and scientifically valid. Following two review and revision periods, the final approved QAPP for the Buffalo River AOC Wildlife Survey was approved on October 30, 2012 (Appendix II). This comprehensive project plan enabled funding sources (USEPA), regulatory bodies (USEPA, NYSDEC), grant administrators (BNR), and consultants (AES) to formally agree upon project-specific goals, review and approve methods for data collection and record keeping, and appropriate personal responsibilities for timely and efficient project execution.

2. METHODS AND MATERIALS

2.1 Survey Methods

A combination of peer-reviewed and scientifically valid field survey methods were employed to collect data on three vertebrate faunal assemblages (avifauna, herpetofauna, and mammals). Survey methods were selected to adequately sample target fauna while remaining within budgetary and temporal constraints. Another key factor in determining survey method selection and intensity of survey effort (i.e. number of sampling locations) was repeatability. This project is framed as a baseline biological assessment and has been designed with the expressed intention of achieving comparative analysis of collected biological data over time to develop a faunal performance metric in direct correlation with BUI #3. Sampling points were selected in stratified random fashion, ensuring adequate representation of all available habitat types for target fauna (Boitani and Fuller 2000). Stratifying sampling efforts by land cover with specific knowledge of target fauna natural history is proven to increase precision of population estimates (Thompson 2002). A total of 20 points were ultimately selected within the selected habitat types, 15 within the AOC (study area) and 5 within neighboring locations (reference area) (Map 2). In-river and in-lake aquatic habitats (benthic, pelagic, upper water column, etc.) were excluded from the scope of this project and were therefore excluded from survey point allocation efforts. However, target fauna observed at the surface of aquatic systems were documented (ex. loafing or foraging waterfowl, swimming mammals, basking turtles, etc.) and visual access to both the Buffalo River and coastal Lake Erie were intentionally incorporated.

In addition to representative sampling points, generalized comprehensive survey methods were employed as a supplement to each of the respective faunal search efforts. Selected search methods are not only cost-effective but are excellent methods for reflecting diversity and relative abundance (Tiebout 2003, Siegel and Doody 1996). During these surveys, observations of non-target fauna, primarily invertebrates, were also documented (see Section 3.5 Anecdotal Observations).

This wildlife survey represents year one (baseline data) of a multi-year survey effort designed to assess population trends (abundance, diversity, and distribution) in three vertebrate faunal assemblages within the Lower Buffalo River AOC over time. Subsequent execution of survey efforts to this extent are not within the scope of this project. Statistical power of the overall study will be determined by typical animal ecology constraints, primarily detection probabilities of target fauna, number of sample points, years of comparable data collected, and surveyor bias. Strict adherence to the original survey methods (described below), temporal and spatial execution (also described below), and adequate repetition of total survey effort over time will decrease controllable variability and, thusly, increase the probability of detecting actual population trends (Gibbs et al. 1998). To encourage adherence to the original survey methods for future surveyors, literature associated with various survey methods are hyperlinked within relevant sections (hold “Ctrl” and click on underlined links to access literature) and data sheets for re-use are found in Appendix III.

2.1a Habitat

General Habitat Characterization – Although not required, a general habitat characterization was completed at all survey points as part of the stratified random process. Characterizations were based upon Reschke 1990 and Edinger et al. 2002 (Document Link) to effectively classify vegetative strata and plant community types. Descriptions and associated photographs can be found in section 3a.Habitat Descriptions. The purpose of this exercise was to allow future observers to identify major changes in the ecological condition of survey locations which may correlate to changes in faunal activity over time.

Representative plant species are mentioned, but accurate documentation of floral species was not conducted (beyond the scope of project).

Phase I Bat Habitat Assessment – A qualified New York bat biologist visited the site and assessed the structural features (both biotic and abiotic) to determine the potential habitat available for resident and migratory bat species. Characterizations are related to structural and ecological life history requirements of the extant resident and migratory bat species in western New York (e.g. roost trees, water sources, foraging conditions, etc.).

2.1b Avifauna

Point Count Survey – Unlimited distance single-observer point counts were conducted at pre-determined survey locations (Map 2) following Ralph et al. 1995 (http://www.fs.fed.us/psw/publications/documents/wild/gtr149/gtr_149.html).

Counts were 5 minutes long during the breeding season and extended to 10 minutes during wintering and migratory seasons. Intervals of 0-3, 3-5, and 5-10 minutes were documented for future statistical power in data analysis. Data variables include direction from observer, behavior, height, flight pattern, and New York State Breeding Bird Atlas Code observations (http://www.dec.ny.gov/animals/7308.html).

2.1c Herpetofauna

Calling Anuran Survey – Calling amphibian surveys were conducted at each pre-determined sampling location (Appendix I, Map 3). This is an extremely valuable, non-intrusive, and cost-effective means of determining critical habitat, species diversity/richness, and loosely defined relative abundance estimates. Protocol followed nationally implemented methodology to provide maximum comparability to other and future data sets (Crewe et al. 2006; Weir and Mossman, 2005) (NAAMP Protocol Link). Essentially, this involves site visits during the anuran calling activity season in western New York (March-July) on warm, humid nights. Observers approached potential breeding pools and waited ~5 minutes for acclimation. The observer(s) then documented each species of anuran as identified by calling males. Relative abundance is estimated by the calling intensity of the chorus. Climatic and weather conditions are recorded, including wind speed, temperature, and precipitation.

BNR has actively engaged in the Marsh Monitoring Program (Crewe et al.2006). The methods used here coincide with the Marsh Monitoring Program's protocol, allowing for direct data comparison.

2.1d Mammals

Acoustic Bat Monitoring - 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.

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.

Sherman Live (small mammal) Trapping Survey – Small mammal traps can be effective for sampling small mammal populations in terrestrial landscapes (DeSa et al 2012). Clustered arrays of Sherman live traps (3"x3.5"x9" LFA Folding Trap) were positioned near onsite refuse piles, dirt mounds, and forest floors in 6 selected locations (Map 6) using pre-existing methods (DeBondi et al 2011, Eulinger and Burt 2011, and Williams and Braun 1983). Traps were pre-baited with a peanut butter/oatmeal mix and left open for one night prior to trapping to attract resident small mammals. Trap doors were then set and trapping occurred over two consecutive nights. Survey efforts occurred twice during the season (spring/summer and fall). Under NYSDEC law, this activity is regulated under a Scientific Collection Permit. Please refer to Appendix IV.

2.1e General

Time- and Area-Constrained Searches (TCS) – Using methods in Campbell and Christman 1982, Applied Ecological Services (AES) and Conservation Connects (CC) biologists targeted peak activity seasons and times of day to traverse pre-established spatial polygons throughout the AOC. After a rapid reconnaissance, polygons were strategically selected (Map 4) include onsite features which may be attractive to extant vertebrate wildlife, and/or expose key potential habitat, including basking structures, nesting mounds, surface cover (refuse piles and coarse woody debris), foraging habitat, and overwintering habitat for herpetofauna; burrows, middens, and scat/tracks for mammals; and pockets of migrant passerine in wood lots, old fields and wetlands. TCS was employed for all three target faunal assemblages and survey events targeted key activity periods and optimal climatic conditions within these periods for the appropriate group. Time-constrained searches are most useful for determining presence or absence of species and for providing initial data on the types of microhabitats occupied by individual species (Corn and Bury 1990)

Transect Searches – Walking and driving/road transects were established during the study design phase. These transects were walked/driven searching for any target fauna while noting opportunistically observed invertebrates as well. Due to site access limitations certain proposed walking transects were unable to be accessed. Walking transect search methods involved carefully and methodically advancing along pre-determined routes, searching for individuals or evidence of individuals within target faunal assemblages. Observers were allowed to leave the walking route to investigate potential observations and/or catch herpetofauna for confirming identification. To minimize bias, a specific assemblage was targeted each event (e.g. migratory birds in April, snakes and basking turtles in late June, mammal tracks in winter, etc.), but all vertebrate fauna observed during transect search events were documented, regardless of the intended target group.

Random Opportunistic Searches - This scientifically valid survey method is not limited by temporal or spatial constraints and is largely dependent upon the discretion of the observer. The observer may exploit unforeseen encounters with optimal basking locations, potential nesting grounds, surface concealment cover, or other structural habitat attractive to snakes, turtles, or amphibians while conducting other activities onsite. Additionally, when an observer encounters heightened bird activity, regardless of what duties are being performed, he/she may opportunistically document the observation. This search method is best employed by experienced field biologists, as a keen sense for changes in climatic conditions during certain seasons and times of day or other subtleties associated with the landscape are opportunities for this method to be successful.

Reference Site Selection – As part of the project a reference location was selected to compare study area faunal populations to. The selection of a reference location for this project proved difficult due to land use restrictions within the AOC (highly urbanized setting) and geographic distance to a comparable ecosystem which reflects true reference area conditions. "A reference site in the broadest sense is an ecosystem that serves as a model for restoring another ecosystem. This implies that:

> *(1) The reference site has more intact, autogenic ecological processes, higher functionality, more complex structure, and greater diversity than the system to be restored.*
>
> *(2) The biophysical site conditions of the reference site closely match those of the restoration site."*(excerpt from University of Washington memo hyperlinked below)

For additional information on reference siting in ecological restoration, please read this brief but informative memo prepared by the University of Washington (Reference Site Memo Link).

For highly degraded sites, such as the urbanized landscape within the Buffalo River AOC, a "true reference" location may not provide significant value since the gap between autogenic ecological processes and the restoration potential of the study area may be too great or set unrealistic restoration goals. For this reason, a reference location may be used more for suggestive, rather than prescriptive purposes. Remaining within the Lower Buffalo River watershed and finding a location which represents onsite habitats in an improved state drove the decision to use the ~34 acre Seneca Bluffs restoration site as the reference location for this project. Additionally, the Seneca Bluffs restoration site is the nearest area which has remnant native soils (39% Hamlin silt loam and 9% Fluviquents and Udifluvents, native floodplain alluvium soils) (http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx).

The selected reference area currently does not suffer from many of the ecological impairments within the AOC (invasive species are controlled, native plant diversity is maintained, the river exhibits a back channel/point bar, floodplain forest exhibits referencial structure, some native soils exist, an emergent marsh cove is present, and 'softer' edges to the river exist in general) and is within the same watershed. Since the management of invasive species does not constitute an autogenic ecological process, this reference location is not a true reference site, but can still aid in determining future AOC restoration activity.

The additional reference location, coastal Lake Erie, was chosen due to its hydrological connectivity to the AOC and its inherent influence on the site. Coastal Lake Erie was included to ensure that data associated with the lake edge was in the original data. While this doesn't represent onsite goals (no lake in the AOC), the Lower Buffalo River is intimately connected to the Lake and the animals that use it (in all seasons). Future restoration can be aided by understanding what animals move through the site that may directly benefit from river-associated restoration efforts (e.g. migrating and breeding waterfowl and raptors, nesting gulls and terns, wintering birds, riverine turtle re-colonization, etc.). All data associated with this reference location may or may not be included in future analysis, but our team found it important to have the data included within the baseline assessment.

2.2 Materials

Primary field investigation equipment is listed below. Specialized equipment (such as Sherman live traps and Acoustic monitoring equipment) is detailed within the above sections:

- 10.5 x roof prism Kowa Series Binoculars
- 60 x Optical Zoom Kowa TSN Spotting Telescope and Manfrotto Tripod (for TCS and Transects)
- Thermo hygrometer (Digital Temperature and Relative Humidity Gauge)
- Relevant Field Data Sheets and Metal Case Clipboard
- Field Observation Notebook
- Digital Camera
- GPS Unit
- Brimmed Hat, Pants, & Long Sleeves
- Sturdy ¾ Boots
- Bug Spray, Sunscreen and Other Personal Protective Equipment
- Letter of Permission/Intent to Collect Scientific Data (Provided by BNR)
- NYSDEC Scientific Permit (during Sherman Trapping Events)
- Water, Protein Snacks
- Cell Phone (with Local/Relevant Emergency and Project Contact Sheet)
- Site Navigation Maps and Relevant Field Identification Guides

3. RESULTS

The following sub-sections provide survey locations, summary data and comparative analysis of the collected data per faunal assemblage (Avifauna, Herpetofauna, Mammals, and Anecdotal).

3.1 Habitat Descriptions

A total of 20 sites were selected (15 onsite, 5 offsite). Table 1 briefly describes each survey point location. More information on the various habitat types which were observed present within the AOC are detailed thereafter. Rows highlighted in purple are defined as reference areas, rows in white (no color) are within the AOC (study area), and rows highlighted in gray were removed/merged with data from another point location. Due to the relatively small patch sizes of all naturalized locations within the AOC, the documentation of primary, secondary and, sometimes tertiary habitats are noted.

The survey point ID codes correlate to all original data sheets and are used to refer to observational notes within the report body. Common names for site locations are included in the notes column. Please use Table 1 as a reference for site ID, name, and habitat type correlation while reviewing this report.

Table 1. Point Count Site Location Descriptions

Survey Point ID	GPS #	Latitude (Northing)	Longitude (Westing)	Dominant Habitat Type	Secondary Habitat Type(s)	Notes
BUF101	54	42 52.066	78 52.944	Open Water (Lake)	Grassland (short)/ Developed (industrial)	Coastal Lake Erie Off of Fuhrman Blvd.
BUF102	55	42 51.918	78 52.626	Grassland (short)	Open Woodland/ Developed (industrial)	Field Near Coastal Lake Erie Off of Fuhrman Blvd.
BUF103	56	42 51.559	78 52.165	Open Water (Ship Canal)	Hedgerow/Developed (industrial)	Ship Canal Head (access via underpass)
BUF104	57	42 51.973	78 52.104	Riparian Woodland (park)	Open Water (River)/ Developed (industrial)	Buffalo River - Ohio St Public Fishing Access
BUF105	58	42 52.289	78 52.178	Old Field (shrub)	Developed (industrial)	Miami Street Abandoned Lot
BUF106	59	42 51.981	78 51.333	Riparian Forest	Developed (residential)	Woods east of Katherine and O'Connell Streets
BUF107	60	42 51.386	78 51.561	Riparian Forest	Developed (industrial)/ Old Field	End of Katherine St (**Merged with BUF 109**)
BUF108	61	42 51.431	78 51.357	Riparian Forest	Old Field (grassland tall)/ Open Water (river)	Katherine Street Peninsula SE
BUF109	62	42 51.437	78 51.478	Old Field (grassland tall)	Riparian Forest/ Developed (industrial)	Katherine Street Peninsula SC
BUF110	63	42 51.820	78 51.102	Open Woodland	Wetland (Pond)/ Open Water (river)/ Riparian	End of Smith Street Park
BUF111	64	42 51.478	78 50.242	Open Woodland	Developed (residential)/ Grassland (short)	North of Abbey St along Riverbend Fence (**Merged with BUF 120**)
BUF112	65	42 51.596	78 49.805	Riparian Forest	Open Water (river)/ Developed (residential)	Bailey Woods Payson Ave behind Shopping Center on Fishing Trail
BUF113	66	42 51.674	78 49.581	Riparian Forest	Open Water (river)/ Developed (commercial)	Bailey Peninsula. Park at Top Knotch Auto (Scott)
BUF114	67	42 51.626	78 49.501	Open Water (river)	Developed (commercial)/ Riparian Forest (edge)	Bailey Street Bridge Across Street from BUF113
BUF115	68	42 51.824	78 49.216	Open Woodland	Open Water (river)/Developed (residential)	Seneca Bluffs Entrance Meadow/Woodland
BUF116	69	42 51.936	78 49.167	Old Field (tall, managed)	Riparian Forest/Open Water (river)	Seneca Bluffs Tip

BUF117	70	42 51.929	78 49.024	Riparian Forest	Floodplain Wetland/Old Field (grassland tall)/ Open Water (river)	Seneca Bluffs SE
BUF118	71	42 51.854	78 49.094	Old Field (grassland tall)	Successional Upland Forest	Seneca Bluffs S
BUF 119	110	42.51.377	78.50.086	Old Field (successional upland forest)	Riparian Forest/ Open Water	Porkpie
BUF 120	107	42.51.298	78.50.201	Old Field (grassland tall)	Successional Upland Forest Emergent Wetland	Riverbend S
BUF 121	108	42.51.232	78.50.340	Old Field (grassland short)	Open Water	Riverbend W
BUF 122	109	42.51.377	78.50.393	Old Field (grassland short)	Open Water	Riverbend E
Purple = Reference Sites (off site) **Gray** = Locations Removed or Merged (see notes) **White** – Study Area (on site)						

3.1a Old Field – Old fields are previously cleared areas of land which have been left fallow (little or no active management), allowing for natural vegetative succession to dictate colonization of the space. These can vary in site history (farm field, parking lot, forest, etc) and site conditions (soil chemistry, soil compaction, pollution, seed bank, disturbance regime, etc). On site, we observe 3 general types of old field distinguished by vegetative structure: grassland (short), grassland (tall) and early seral stage forest.

Grassland (short) –Canopy is open and minimal woody plants are present, if any. Vegetation height rarely exceeds 16" in these areas. Short grassland locations onsite are old industrial sites where a mixture of compacted non-native soils and crumbling concrete/asphalt allow colonization by hearty cool season grass (e.g. fescue and timothy) and aggressive forb species (e.g. clover), with intermittent patches of bare soil/grave/concrete (Figure 1). Vegetative density and composition may vary throughout these locations, creating heterogeneity. Three survey points exist within this habitat type.

Figure 1. Short grassland habitat at Riverbend Site. Note patchy nature of the grasses, forbs, and bare spots. Photo by Michael J. McGraw on May 10, 2012.

Grassland (tall) – Similar to the short grasslands, these are sections of land where there is no tree canopy. The understory layer may consist of some woody species (sapling trees and shrubs), but is largely comprised of taller herbaceous vegetation, including switchgrass (*Panicum virgatum*), mugwort (*Artemisia vulgaris*), and Canada goldenrod (*Solidago canadense*) (Figure 2).

Figure 2. A barn swallow (*Hirundo rustica*) is observed gleaning insects (center) over a tall grassland patch at Katherine Street Peninsula. Photo by Michael J. McGraw on May 10, 2012.

Early Seral Stage Forest – Canopy is open in onsite successional forest/old fields. Here, significant woody vegetation is colonizing the understory and is mainly comprised of young cottonwood (*Populus deltoides*) trees (Figure 3). Height of vegetation varies from 3-15'. Shrub species found here include multiflora rose (*Rosa multiflora*) and blackberry sp. (*Rubus* sp.)

Figure 3. A doe white-tailed deer (*Odocoileus virginianus*) observed browse-foraging in the successional forest patch dominated by cottonwood trees at Porkpie. Photo by Michael J. McGraw on November 10, 2012.

3.1b Forests/Woodlands – Only small tracts of forested habitat remain within the AOC. Of these, most are highly degraded and typically are linear in shape, bordering property lines and the Buffalo River.

Riparian Forest –Few remnant riparian forest ecosystems remain within the AOC. Canopy trees are dominated by black willow (*Salix nigra*), with red maple (*Acer rubrum*), and cottonwood (*Populus deltoides*) present. These forests typically border the river, especially in locations where there is a natural connection/gradation to the river. Three onsite locations (Bailey Woods, Bailey Peninsula, and Katherine Street Peninsula) and one offsite location (Seneca Bluffs) harbor small, but intact willow-dominated riparian forests (Figure 4). Understory is typically dominated by invasive species, specifically Japanese knotweed (*Fallopia japonica*) and mugwort.

Figure 4. An adult male Cooper's hawk (*Accipiter cooperii*) perched near its nest in the riparian forest at Bailey Woods. Understory here is a monoculture of Japanese knotweed. Photograph by Michael J. McGraw on May 11, 2012.

Open Woodland (Upland) – Numerous small tracts of forest are present within the AOC which are managed as parkland, residential/yards, or open space where tree canopy is moderate and varies from 25-60' in height, depending upon age. Tree species found here include cottonwood, red maple, black willow, and black walnut (*Juglans nigra*). Understory is sparse to non-existent with mowed lawns, Japanese knotweed colonies, or mugwort/goldenrod patches in the herb layer. Older cottonwood trees exist in groves at the offsite locations (Seneca Bluffs and Coastal Lake Erie) as well as the Ohio Street Boat Launch. Younger woodlands are present at the south portion of the Riverbend site and Smith Street Pocket Park.

Figure 5. An adult male rose-breasted grosbeak in a cottonwood-dominated woodland patch at Riverbend. Photo by Michael J.

3.1c Wetlands – No natural wetlands remain within the AOC besides open water habitat (Buffalo River) and, possibly, a small river-connected section within Bailey Woods. However, some pocket wetlands and a created pond do exist and are worthy of mention.

Buffalo River – The Buffalo River course through the heart of the AOC. This is a shipping channel which is dredge-managed for navigability (Landers 2011), causing a near total loss in littoral shelve and shallow water habitat (Figure 6). Small submerged aquatic vegetations beds were observed at Bailey Street Woods and Katherine Street Peninsula.

Figure 6. A westerly view of the Buffalo River as it flows past the Smith Street Pocket Park. Photo by Michael J. McGraw on November 20, 2011.

Smith Street Pond – A small linear pond has been created at the Smith Street Pocket Park (Figure 7). This water body is bordered by planted shrubs, such as red osier dogwood (*Cornus sericea*) and viburnum (*Viburnum* sp.). Common reed (*Phragmites australis*) is invading the north bank. Fragrant water lily (*Nymphea odorata*), cattail (*Typha* sp.) and duck potato (*Sagittaria latifolia*) are present in the small, but present, emergent zone.

Figure 7. The north bank of the Smith Street Pocket Park Pond. Eastern painted turtles (*Chrysemys p. picta*) were frequently observed basking here. Note the common reed re-growth invading red-osier dogwoods along the bank. Photo by Michael J. McGraw on May 10, 2012.

Pocket Wetlands – Despite non-natural settings, water has been accumulating over time in disjunct, isolated locations on the site. Water sources are precipitation/runoff and possibly, groundwater in some instances. The most pocket wetlands observed were within the Riverbend site. With surface water being seasonal/ephemeral, wetland plant species and soil queues distinguish these subtle depressions from adjacent upland habitats, such as Joe-pye weed (*Eupatorium maculatum*), cattail (*Typha* sp.), common reed[2], and hydric soils. Created wetland depressions exist offsite at Seneca Bluffs.

Figure 8. A northern brown snake (*Storeria d. dekayi*) captured in a trash pile within a pocket wetland at Riverbend. Note the Phragmites and white grass (*Leersia viriginica*) in the background. Photo by Michael J. McGraw on May 10, 2012.

Floodplain Wetland – Wetlands influenced directly by river water levels (within the floodplain) are potentially non-existent in the AOC. At Bailey Woods a small common reed-choked depression exists which flows at-grade to the Buffalo River. This depressed area is fed by a stormwater culvert from South Park and Payson Avenues. Despite culverting immediately above the wetland within its watershed and the resultant erosion and channelization, this area may have historically been a forested floodplain wetland based upon surrounding topography.

3.1d Disturbed/Urban – All onsite habitats are influenced by anthropogenic disturbances. Those which are not naturalized enough to be classified within a natural community type (above descriptions) fall within this category. This includes abandoned and active parking lots, buildings, rail lines and roads where the dominant land features are non-natural (Figure 9).

Figure 9. An abandoned loading dock along Miami Street in the AOC (BUF105). Photo by Michael J. McGraw on November 21, 2011.

[2] AES recognizes that *Phragmites australis*, although preferential to wet conditions, may thrive in upland settings and, therefore, no wetland determinations were made by singular observations of Phragmites. Hydric soils, hydroperiods, and/or the observance of wetland obligate plant species (or any combination thereof) constitute these designations.

3.2 Avifauna

Figure 10. An adult ring-billed gull foraging over coastal Lake Erie. This was the most commonly observed bird species. Photo by MJM.

Point Counts – A total of 14 point count survey events were conducted (2 winter, 3 spring, 3 summer, and 6 fall) at 20 survey points (Appendix III). Map 2 displays the distribution of survey point locations within the study area. This effort includes 280 data sets and 4,300 active survey minutes, totaling 17,446 individual birds observed. The most frequently observed species during point count surveys were ring-billed gull (*Larus delawarensis*) (20.43% of total observations), rock pigeon (*Columba livia*) (13.28% of total observations), red-breasted merganser (*Mergus serrator*) (12.35% of total observations), and European starling (*Sturnus vulgaris*) (7.55% observations).

A total of 169 bird species were observed during the survey effort in 2012 (Appendix IV). Of these, 124 were observed within the AOC and the remaining 45 were observed within the reference locations (coastal Lake Erie and Seneca Bluffs) but not in the study area. Sixteen (16) species comprised over 85% of all point count bird observations.

A total of 63 species were observed as confirmed or probable breeding status within the project location (please refer to the methods section for a link to breeding bird code definitions). An additional 3 species (great horned owl, yellow-billed cuckoo, and orchard oriole) were confirmed breeding within the reference locations but not the study area.

Figure 11. An adult male yellow warbler (*Setophaga petechia*) on territory in the Bailey Woods riparian forest. Photo by MJM.

A total of 98 species were observed during migration survey efforts within the study area. An additional 32 species were observed migrating through the area in reference locations (immediately west or east of the AOC), but not observed within the AOC/study area.

A total of 34 species were observed wintering within the AOC. This includes migrants (7) and resident birds (27). One additional species (snowy owl) was observed using nearby resources during the winter but were not observed within the AOC. That said, a local news channel covered an attempted rescue of a snowy owl from a chimney located within the AOC, proving these species was present (but died, sadly) within the AOC.

Time- and Area-Constrained Searches for Avifauna – A total of 19.25 hours were invested in avifaunal TCS activity (Appendix V). Dates selected primarily targeted passerine, waterfowl, and shorebird migrations since the highly mobile nature of migrant foragers is best sampled by moving around versus standing in one location. A total of 138 bird species were observed during TCS activity. Of these, 14 species were only observed via this method (not observed during point counts). Map 3 shows the TCS areas.

Transect Searches – No additional bird species were identified using this method. See Appendix V for time and dates of transect search efforts. Map 4 shows transect routes.

Regulatory Status of Observed Bird Species – Table 2 details the observed New York State Listed Endangered, Threatened, and Special Concern bird species observed during the 2012 baseline faunal assessment. Underlined species are hyperlinked to NYSDEC Species Profile Sheets. In addition to state-listed species, a total of 36 Species of Greatest Conservation Need were observed onsite (NYSDEC 2005). Of these, 6 were confirmed or probable breeders within the AOC (American woodcock, brown thrasher, Cooper's hawk, grasshopper sparrow, horned lark, and willow flycatcher).

Table 2. New York State Protected Species Observed During 2012 Wildlife Survey

Species		NYS Endangered	NYS Threatened	NYS Special Concern	Onsite?	Offsite?	Breeding?
Common Name	**Taxonomic Binomial**						
Black Tern	*Chlidonias niger*	**X**				X	N
Peregrine Falcon	*Falco peregrinus*	**X**			X		N
Pied-billed Grebe	*Podilymbus podiceps*		**X**		X		N
Bald Eagle	*Haliaeetus leucocephalus*		**X**		X	X	N
Common Tern	*Sterna hirundo*		**X**		X	X	Y - Offsite
Common Loon	*Gavia immer*			**X**		X	
Osprey	*Pandion haliaetus*			**X**	X	X	N
Sharp-shinned Hawk	*Accipiter striatus*			**X**	X	X	N
Cooper's Hawk	*Accipiter cooperii*			**X**	X		**Y**
Common Nighthawk	*Chordeiles minor*			**X**	X	X	Unknown
Horned Lark	*Eremophila alpestris*			**X**	X		**Y**
Vesper Sparrow	*Pooecetes gramineus*			**X**	X		N
Grasshopper Sparrow	*Ammodramus savannarum*			**X**	X		**Y**

note: Underlined Species are hyperlinked to NYSDEC Species Profile Sheets (hold "Ctrl" and click to view)

Comparative Assessment of Bird Data

Figure 12 details the abundance of individual birds observed within the AOC during point counts. Densities were highest at the Field by Lake Erie (BUF102 = 1388 obs.), Katherine Street Peninsula Forest (BUF 108 = 981 obs.), Riverbend Pocket Wetland/Woodland (BUF120 = 638 obs.), and Bailey Woods Peninsula Floodplain Forest (BUF 113 = 601 obs.).

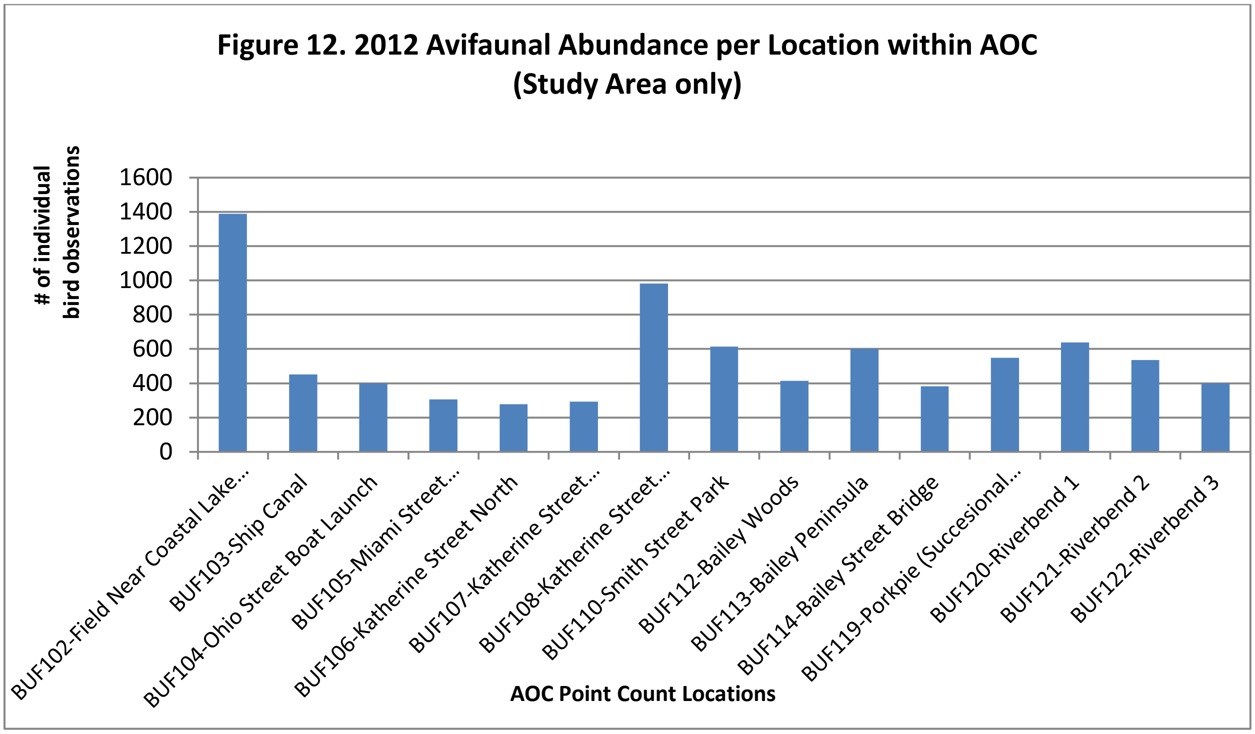


Figure 13 details avifaunal abundance for all surveyed locations. By far, the highest density of observed avifauna was at coastal Lake Erie (BUF 101 = 5080 obs.). Daily activity by ring-billed gulls, common tern nesting colony foraging behavior, and waterfowl migration largely contributed to the high number of birds observed here.

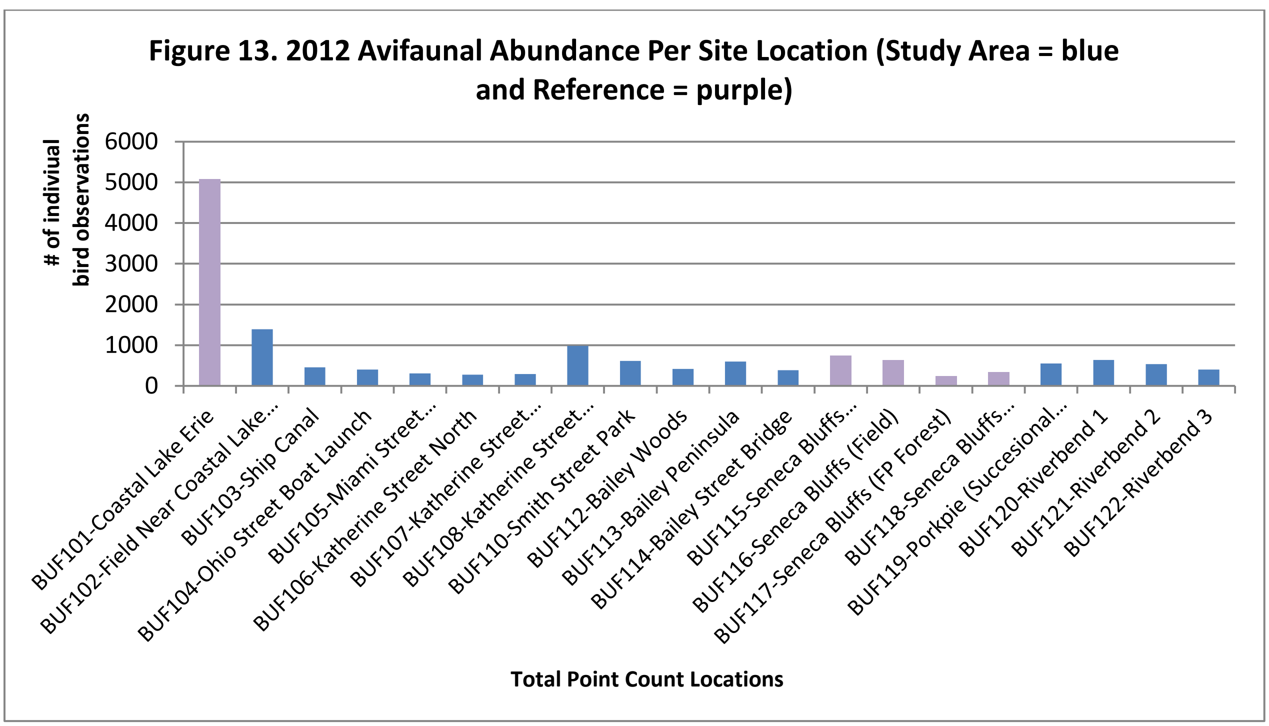
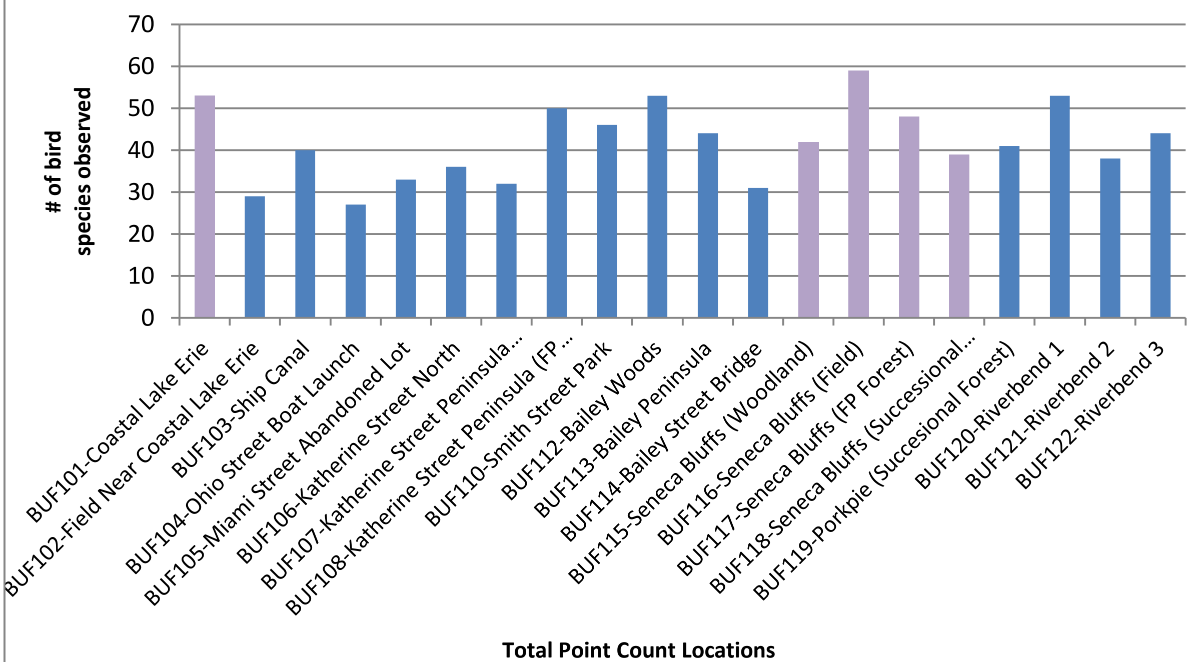


Figure 14 compares the avifaunal species diversity observed at all locations. Within the AOC, both BUF 108 (Katherine Street Peninsula Floodplain Forest) and BUF 120 (Riverbend Pocket Wetland/Woodland) were the most speciose locations with 53 species observed. In the Reference Area, the greatest species diversity was observed at BUF 116 (Seneca Bluffs Floodplain Forest/Old Field) with 59 species followed by BUF 101 (Coastal Lake Erie) with 53 species.

Figure 14. 2012 Bird Species Richness per Site Location (Study Area = blue and Reference = purple)



3.3 Herpetofauna

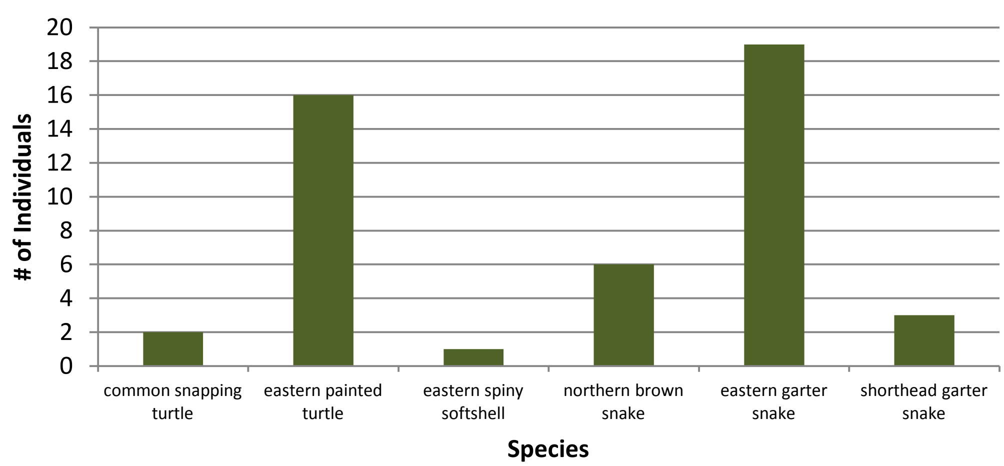
Time and Area-Constrained Searches – TCS was the primary survey method used to identify reptiles and amphibians on site. Over 17 site visits, a total of 57.5 surveyor search hours were expended. Time was relatively evenly distributed between the established TCS areas (Map 3). A total of 6 reptiles and 6 amphibians were observed within the AOC (Table 3). No additional species were observed outside of the AOC.

Calling Anuran Surveys – Three formal CAS events were conducted on April 4, April 27, and May 3. A total of 5 species were observed during these events (American toad, northern green frog, northern leopard frog, spring peeper and bullfrog). One additional anuran species (northern gray treefrog) was observed opportunistically while conducting other survey methods on site, typically calling from vegetation intermittently during daylight hours in summer and fall seasons.

Table 3. Herpetofauna Observed During 2012 Wildlife Survey		
Faunal Assemblage	**Common Name**	**Taxonomic Binomial**
Reptiles	common snapping turtle	*Chelydra serpentina*
	eastern painted turtle	*Chrysemys p. picta*
	eastern spiny softshell	*Apalone s. spinifera*
	northern brown snake	*Storeria d. dekayi*
	eastern garter snake	*Thamnophis s. sirtalis*
	shorthead garter snake	*Thamnophis brachystoma*
Amphibians	American toad	*Anaxyrus americana*
	northern spring peeper	*Pseudacris c. crucifer*
	northern gray treefrog	*Hyla versicolor*
	northern leopard frog	*Lithobates pipiens*
	northern green frog	*Lithobates clamitans melanota*
	bullfrog	*Lithobates catesbeiana*

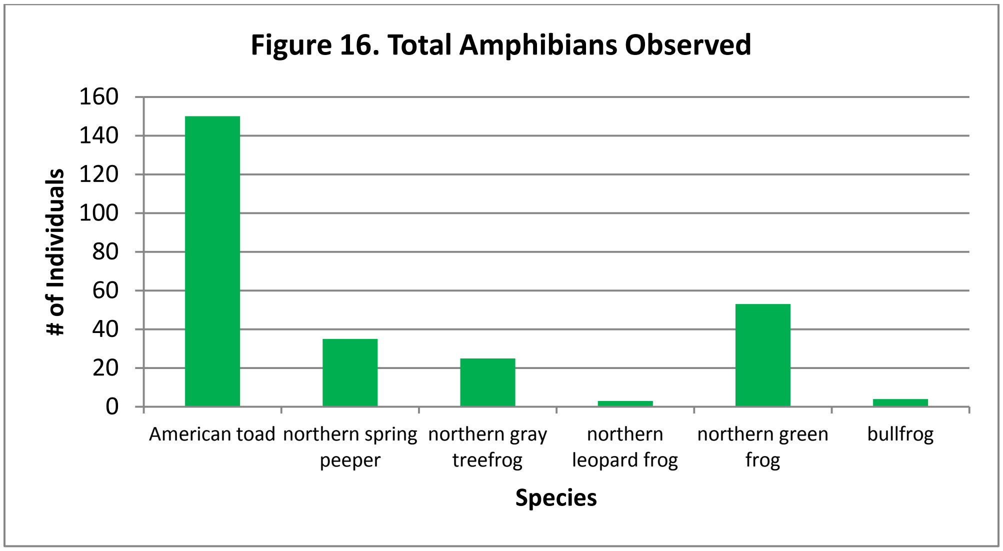
The most commonly observed reptile species was eastern garter snake (n=19) followed by eastern painted turtle (n=16) (Figure 15). Sites which contained a mixture of habitats (field, forest, and wetlands) produced the most reptile observations.

Figure 15. Total Reptile Observations



The most commonly observed amphibian species were American toad (n=~150 calling males) followed by northern green frog (n=13 individuals + ~40 calling males) (Figure 16). Calling spring peepers[3] and northern gray treefrogs were observed more so after the breeding season (summer and fall), calling from vegetation within 100M of water, especially offsite at Seneca Bluffs, but also on site within areas containing floodplain forest and the Riverbend site. No salamander species were observed during the data collection effort (see discussion).

[3] Northern spring peeper abundance data provided in the RAC presentation was erroneous/mistakenly over-estimated. The data provided here accurately reflects the original data sheets.



Regulatory Status of Observed Herpetofauna – Below is a table (Table 4) detailing the observed New York State Listed Endangered, Threatened, and Special Concern bird species observed during the 2012 baseline faunal assessment. In addition to state-listed species, a total of 2 Species of Greatest Conservation Need (eastern spiny softshell and short-head garter snake) (Figure 17) were observed onsite (NYSDEC 2005). Interestingly, neither of these species are considered within the Lake Erie Basin ecological region (see Discussion).

Table 4. New York State Protected Herpetofauna Species Observed During 2012 Wildlife Survey

Species		NYS Endangered	NYS Threatened	NYS Special Concern	Onsite?	Offsite?	Breeding?
Common Name	Taxonomic Binomial						
eastern spiny softshell	*Apalone spinifera*			X	x		?

Comparative Assessment of Herpetofauna Data

Figure 18 compares the abundance of all herpetofauna (reptiles and amphibians combined) observed per designated TCS area. Abundance was highest in the Riverbend location (TCS area #5) due to the highest density of observed breeding American toads during CAS and individual snakes (Figure 20) captured during TCS, followed by Smith Road Park (TCS area #4) due to breeding Lithobatids and an eastern painted turtle (Figure 21) population in the created pond.

Figure 17. A neonate shorthead garter snake found in a roof shingle pile at Riverbend. This confirms active breeding within the AOC for this unique species. Photo by MJM.

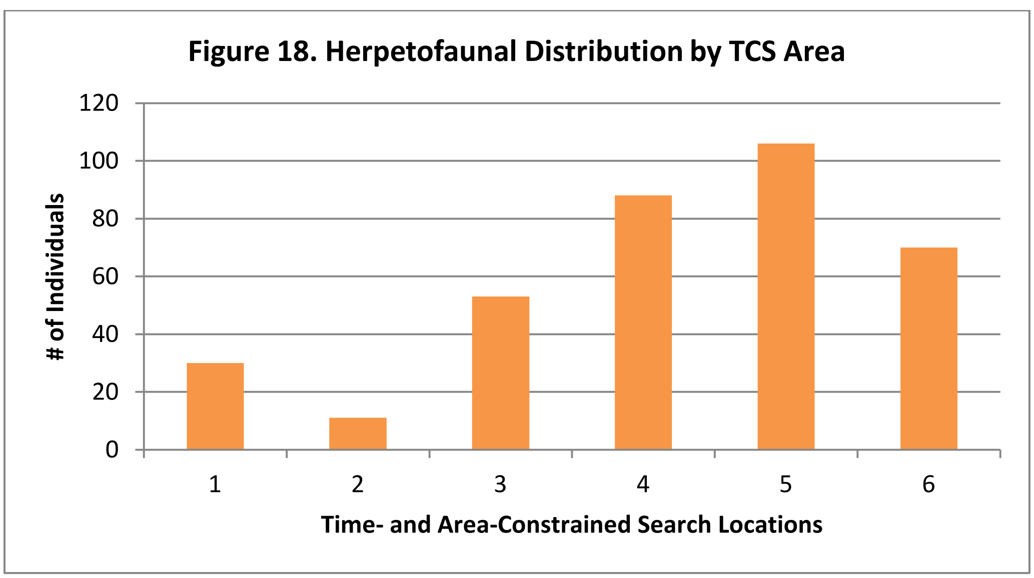


Figure 19 displays the above abundances by faunal assemblage, highlighting the weighted use of TCS areas by both reptiles and amphibians. Again, locations with habitat heterogeneity revealed higher abundance and diversity of herpetofauna.

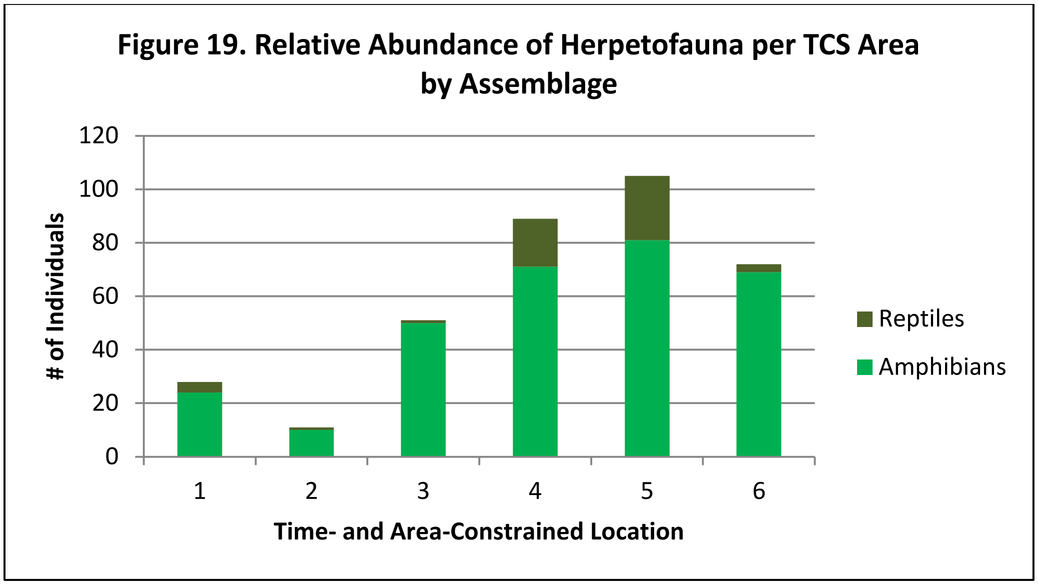


Figure 20. An adult eastern garter snake in-situ as revealed concealed under a wooden board at Riverbend. Photo by MJM.

Figure 21. An adult painted turtle basking on the north bank of the Smith Street pocket park. Photo by MJM.

3.4 Mammals

A total of 20 mammal species were confirmed/ observed within the AOC (Table 5). Four (4) methods were used to compile these observations.

Table 4. Total Mammal Species Observed within LBR AOC in 2012

Common Name	Taxonomic Binomial	Notes
eastern red bat	*Lasiurus borealis*	Riverbend, Porkpie, Bailey Woods & Reference Site
hoary bat	*Lasiurus cinereus*	Riverbend, Porkpie, Bailey Woods & Reference Site
house mouse	*Mus musculus*	at locations close to residential development
white-footed/ deermouse	*Peromyscus sp.*	abundant in fields
short-tailed shrew	*Blarina brevicauda*	fields and forest near buildings
meadow vole	*Microtus pennsylvanicus*	fields
eastern chipmunk	*Tamias striatus*	Bailey Peninsula & Reference Site
eastern gray squirrel	*Sciurus carolinensis*	abundant
eastern cottontail rabbit	*Sylvilagus carolina*	common in shrubby fields throughout site
American mink	*Mustela vison*	along naturalized shorelines (tracks, burrows) at Bailey Woods & Reference Site
muskrat	*Ondatra zibethicus*	in Smith Street created pond
American beaver	*Castor canadensis*	recent evidence (tree girdling) at Reference Site
opossum	*Didelphium virginianum*	4 DOR on South Park Ave.
striped skunk	*Mephitis mephitis*	Porkpie
groundhog	*Marmota monax*	numerous
raccoon	*Procyon lotor*	abundant on site, tracks on naturalized shorelines
red fox	*Vulpes vulpes*	den near BUF 102
eastern coyote	*Canis latrans* var.	scat and tracks at Riverbend
white-tailed deer	*Odocoileus virginianus*	abundant, mostly Riverbend, Porkpie, and Katherine St.
feral cat	*feral cat*	abundant

Time- and Area-Constrained Searches – A total of 7.5 hours were expended focusing primarily on mammals while conducting TCS (1.25 hrs/TCS area). Many of these observations consisted of evidence of recent mammal presence/activity (ex. beaver chewing, coyote scat, raccoon tracks, etc.). A total of 14 species were observed during TCS activity. Two species, meadow vole and short-tailed shrew, were only observed during Sherman live trapping.

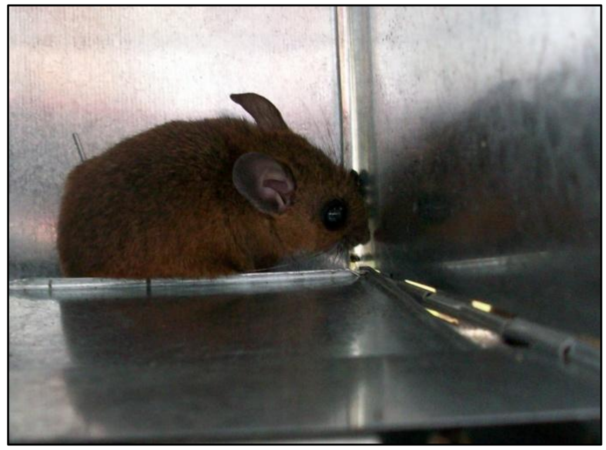
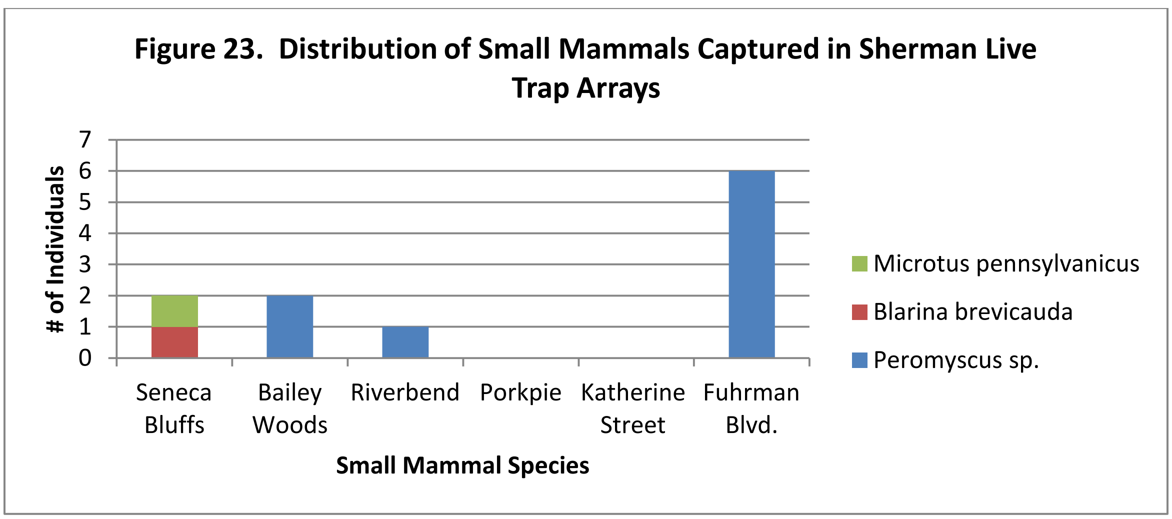


Figure 22. A *Peromyscus* complex mouse species captured in a Sherman live trap at Riverbend. Photo by Nathan Grosse.

Sherman Live Trapping – Two trapping events were conducted on 7/31-8/2 and 10/16-18 for a total of 2880 trap hours over 6 trapping locations (Seneca Bluffs, Bailey Woods, Porkpie, Riverbend, Katherine Street, and Fuhrman Boulevard). Eleven (11) captures were documented consisting of 3 species (Peromyscus complex sp., short-tailed shrew, and meadow vole) (Figures 22 & 23). Some traps seem to have been predated (evidence of tampering and some blood on/in the traps) at the Seneca Bluffs array. Additionally, at 4 of 6 sites some traps were 'triggered' (trap door closed) with bait consumed and scat left inside, but no was animal captured.



Transect Searches – Driving transects revealed nocturnal mammal activity as well as locations where mammals were being killed along roads. Eight (8) species were observed during driving transects. The highest density of road-killed and live mammal observations during driving transects was along South Park Avenue (north and south). The most commonly observed road-killed species was gray squirrel (n=21), followed by opossum (n=4) and raccoon (n=2). Not all proposed walking transects were able to be accessed due to private property/lack of permission. Walking transects were most productive in conjunction with TCS efforts when active investigation of findings could be pursued. A total of 16 species were observed during walking transects. The highest densities of observed mammals during walking transects were white-tailed deer (n=43), gray squirrel (n=19), groundhog (n=14), and red fox (n=7). Please note that individual animals are likely repeatedly counted (ex. herd of ~7 deer at

Riverbend/Porkpie were observed on numerous site visits). One species, house mouse was only observed during walking transects.

Phase I Bat Habitat Assessment **-** Several different natural communities are present at the Buffalo River Project. Most of the remaining natural areas within the project limits are influenced heavily by urban activities. A more detailed supplemental bat survey report can be found in Appendix VII. The following is a description of natural communities present:

1. 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 Riverbend, Pork Pie, 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.

2. 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 (*Nymphea 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 pocket park. 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.

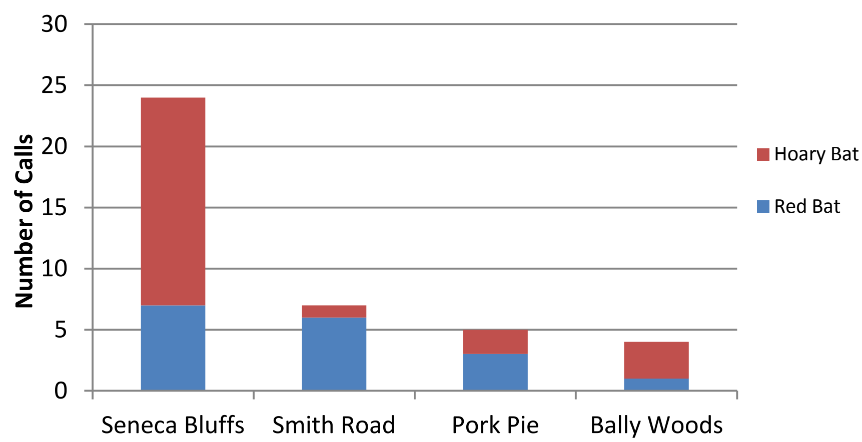
3. Floodplain Forest: This natural community is defined as an area that occurs on mineral soils on low terraces of river floodplains. These natural areas are characterized by the flood regime, typically flooding in spring and drying out in late summer. Species observed in this natural community include 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.), viburnum (*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 Bailey Street Woods, Bailey Peninsula, Katherine Street Peninsula, 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.

4. 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.

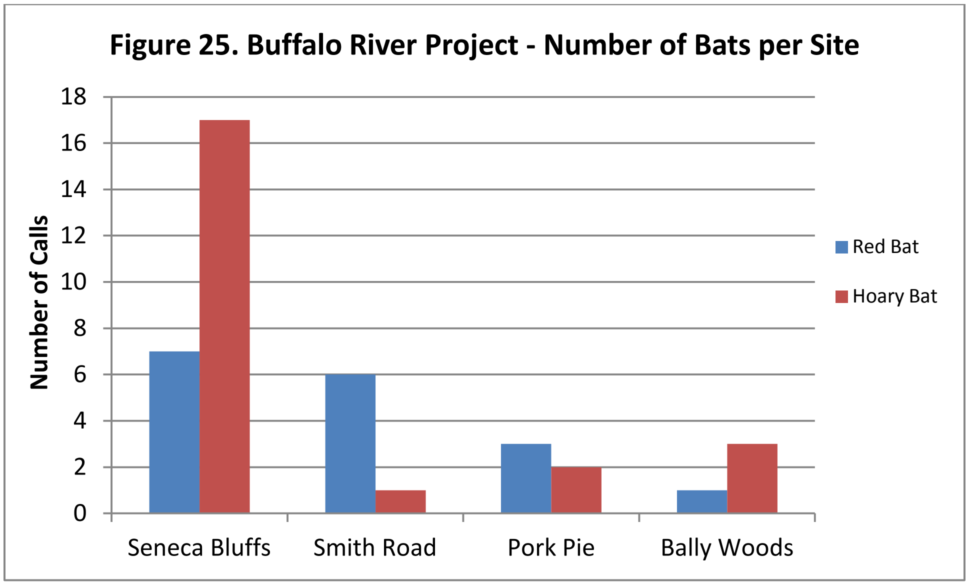
Precipitation is the primary water supply for these areas, and they often dry out in summer months. Characteristic herbaceous species in these communities include water plantain (*Alisma plantago-aquatica*), beggar-ticks (*Bidens frondosa*), horsetail (*Equisetum arvense*), spikerush (*Eleocharis* spp.), 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.

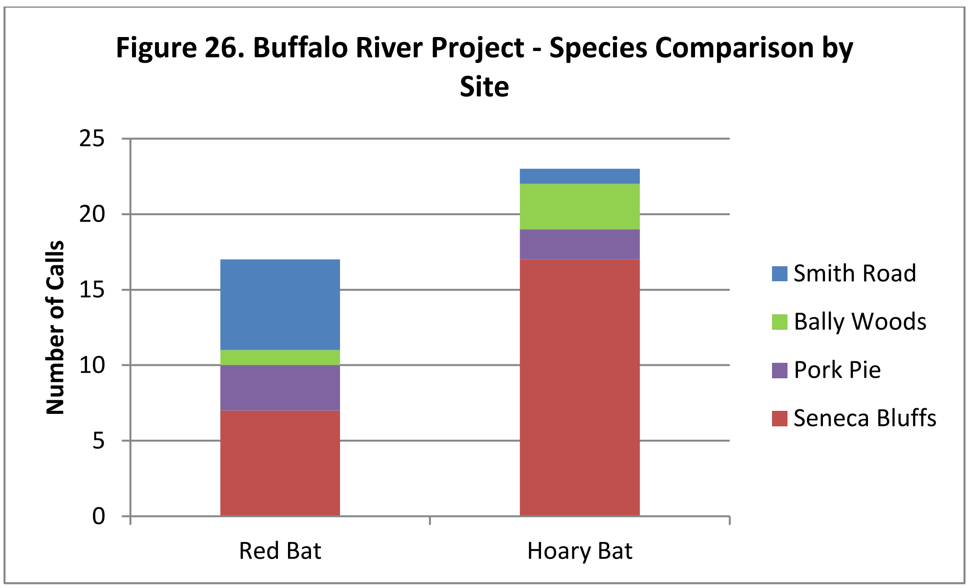
<u>Active Acoustic Monitoring for Bats</u> – AES conducted acoustic bat surveys on four different sites located throughout the Buffalo River Project site. We recorded a total of 40 bat passes during acoustic bat surveys representing two species of bats. The Hoary Bat (*Lasiurus cinereus*) was the most 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.

Figure 24. Buffalo River Project - Total Bats per Site



Bat activity varied among monitoring locations (Figures 24 & 25). 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).





The Seneca Bluffs site recorded the highest amount of bat passes (60% of all calls recorded) (Figure 26). 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. Figures 27 & 28 are example sonograms from the collected bat acoustic data collection effort.

Figure 27. **Hoary Bat (*Lasiurus cinereus*) at the Seneca Bluffs Site.**

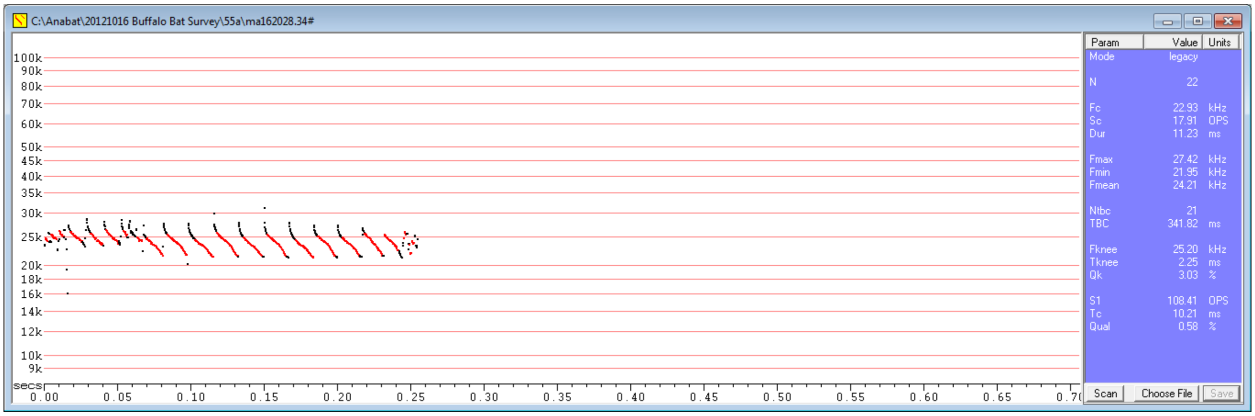


Figure 28. **Eastern Red Bat (*Lasiurus borealis*) at the Pork Pie Site.**

<u>Rodents, Soricomorphids (moles and shrews), and Didelmorphids (opossums)</u> – A total of 6 rodent species were observed during the study effort (Peromyscus sp. mouse, house mouse, meadow vole, eastern chipmunk, gray squirrel, and North American beaver). One Soricomorphid (short-tailed shrew) was observed and one Didelmorphid (Virginia opossum) were documented (primarily dead on roads). Two of these species were observed only at the reference site (meadow vole and short-tailed shrew) and one species (house mouse) was only observed within the study area.

North American beaver was documented as a recently present species due to 'fresh' girdling and tree base gnawing observed at the references site near BUF118 ('fresh' suggests within ~6 months of observation). No beaver lodges were located during mammal surveys. Older girdling suggestive of beaver activity was observed at the Ohio Street Boat Launch (BUF104). A paucity of adequate habitat within the urbanized river ecosystem likely limits this species' presence within the AOC, although many accounts of 'urban beavers' are documented in urbanized river-associated ecosystems (mostly in ponded areas) in New York City, Chicago, and Philadelphia.

<u>Non-natives</u> - Although likely present within the study area, we did not document any rat species. House mouse seems to be restricted to areas near residential developments within the study area. There is a population of feral house cats within both the reference and study areas which may currently impact reptile, amphibian, and ground-nesting bird species.

Mesocarnivores – A total of 4 mesocarnivore species were observed during the study (eastern coyote, red fox, raccoon, and striped skunk). Of these, coyote was not observed at the reference site. The other three species were observed within both the study area and the reference site. The presence or absence of particular mesocarnivores can have significant implications regarding general ecological health due to their hunting requirements and preference for both plant and animal food sources. All observed mesocarnivores are generalist species which are highly adaptive to human influences so their presence within the AOC is not unexpected. That said, eastern coyote prefers larger prey items and may rely upon the onsite eastern cottontail population.

Carnivores - American mink is the only true carnivore observed during this study effort. On two occasions our team observed mink tracks (paired, five toe marks with nails and irregular toe pad, ~1 ½" x 1 ¼"). Along the river bank at the reference site these tracks led directly to a burrow. No live minks were observed during our survey effort. Although anecdotal, our observations (including repeated searches of the river banks for tracks and other animal evidence) suggest that any mink population within the study area and nearby reference site is a low-density population. Despite an adequate prey base (rodents, fish, amphibians, and reptiles), populations may be limited by available stream bank habitat/burrow sites, habitat fragmentation, and water quality/chemical pollution. Recent accounts of American mink populations on the ice-break walls in Coastal Lake Erie near the mouth of the Buffalo River are documented. Here, the presence of mink has caused problems for nesting colonies of common terns.

3.5 Anecdotal (non-Target) Observations

A variety of invertebrates species were observed during the course of this investigation. This is not a complete list and these observations are of an anecdotal/opportunistic nature, however, worthy of mentioning. Formalized invertebrate surveys (for respective groups) should be considered if a comprehensive list is desired.

Figure 29. A female black swallowtail (*Papilio polyxenes*) observed at Riverbend. Photo by MJM.

Table 6. Anecdotally Observed Invertebrates During 2012 AOC Widllife Study

Faunal Group	Common Name	Taxonomic Binomial	Notes
Butterflies and Skippers (Lepidoptera)	black swallotwail	*Papilio polyxenes*	Riverbend
	cabbage white	*Pieris rapae*	Multiple Sites
	clouded sulphur	*Colias philodice*	Multiple Sites
	orange sulphur	*Colias eurytheme*	Multiple Sites
	American copper	*Lycaena phlaeas*	Riverbend
	eastern tailed blue	*Cupido comyntas*	Riverbend
	spring azure	*Celastrina ladon*	Riverbend
	grerat spangled fritillary	*Speyeria cybele*	Ship Canal
	pearl crescent	*Phycoides tharos*	Multiple Sites
	question mark	*Polygonia interrogationis*	Bailey Woods Edge
	mourning cloak	*Nymphalis antiopa*	Riverbend
	painted lady	*Vanessa atalanta*	Seneca Bluffs
	red admiral	*Vanessa cardui*	Riverbend, PorkPie
	common buckeye	*Junonia coenia*	Riverbend
	monarch	*Danaus plexippus*	Seneca Bluffs
	common wood-nymph	*Cercyonis pegala*	not confirmed
	common ringlet	*Coenonympha tullia*	not confirmed
	silver-spotted skipper	*Epargyreus clarus*	Seneca Bluffs
	cloudywing spp.	*Thorybes spp.*	Seneca Bluffs
	European skipper	*Thymelicus lineola*	Seneca Bluffs
	skipper spp.	*Hesperia spp.*	Seneca Bluffs
Dragonflies and Damselflies (Odonata)	darner	*Aeshna sp.*	Riverbend, Seneca Bluffs
	eight-spotted skimmer	*Libellula forensis*	Riverbend, Seneca Bluffs
	common whitetail	*Plathemis lydia*	Riverbend, Seneca Bluffs
	eastern pondhawk	*Erythemis simplicicollis*	Riverbend, Seneca Bluffs
	dragonfly spp		Riverbend, Seneca Bluffs
	damselfly spp.		Riverbend, Seneca Bluffs
Orthoptera	grasshopper spp.		fields, especially Riverbend
Coleoptera	numerous beetle species		entire site
Unionids	Asiatic clam	*Corbicula fluminea*	Invasive, In-River at Bailey Woods
	zebra mussel	*Dreissena polymorpha*	Invasive, In-River at Bailey Woods
Arthropoda	pillbug	*Armadillidae*	abundant
	centipede spp.		in areas with other insects
Araneae	many spider spp.		abundant, speciose
Gastropoda	English garden snail	*Cepaea nemoralis*	brilliantly colored, ringed shells. Highly variant. Abundant at Riverbend, but present throughout AOC
Other	earthworms		invasive, abundant

4. Discussion

4.1 Habitat

All habitats observed on site are previously (or actively) disturbed by human use. Small, relict sections of native floodplain forest exist. Invasive species, primarily Japanese knotweed, are degrading these forested sections. Additionally, high human traffic has led to soil compaction, trash/dumping, disturbance during breeding seasons, and propagation of invasives. Dredging activity has and continues to deepen the Buffalo River channel, causing slumping/wasting of the littoral shelf (Landers 2011) resulting in reduced wildlife habitat. Planned dredging of the Buffalo River within the GLLA plan will improve water quality and ecological conditions within the Buffalo River aquatic ecosystem (by removal of contaminated sediment) over time and may play a large role in restoring the ecology of the AOC as a whole (both aquatic and terrestrial), due to the important role of the aquatic ecosystem for fish, insects, and terrestrial animals, such as water fowl, shorebirds, mammals, and herpetofauna.

In an effort to provide readers with a general spatial layout, estimated acreages of each habitat type are provided below. This assumes a rectangular AOC (15,300 ft x 8,000 ft) which encompasses 6.2 linear miles of the Lower Buffalo River and adjacent terrestrial landscape and totals ~2810 acres (see Appendix I - Map 1 extent). Although not formally quantified, estimated percentages and acreages of total AOC habitat composition are as follows:

1. Grassland (low) – approximately 4% or 113 acres
   Limited acreage/patch size is likely a limiting factor for faunal response to this habitat type.
2. Grassland (high) – approximately 7% or 197 acres
   Small acreage lots and lack of native plant species limits use of this habitat by tall grass-breeding birds
3. Successional Field – approximately 2% or 56.5 acres
   As a dynamic and temporary habitat type, limited overall acreage of forested habitat and suppressed natural disturbance factors limit the long-term continuity of this habitat type within the AOC. Forest restoration/creation will create 2+ decades of successional forest habitat value.
4. Woodland (Upland) – approximately 2% or 56.5 acres
   Most upland woodlands in the AOC are currently residential lawns and parks (mowed lawn understory). Significant potential to increase breeding bird diversity exists in upland forest/woodland restoration activity.
5. Woodland (Riparian) – approximately 7% or 197 acres
   Small patch size and narrow configuration (corridors paralleling the River) limit the value of onsite riparian woodlands. Significant potential exists to increase riparian forest acreage via restoration activity. A restored/enhanced riparian woodlands/forest complex in the AOC would be capable of supporting a notable increase in abundance and diversity of avifauna.
6. Open Water (River) and Shoreline – approximately 13% or 365 acres
   Due to the maintenance of the Buffalo River as a navigable waterway, much of its shallow water habitat zones are depleted by dredging activity. An increase in migratory bird diversity is anticipated as a result of well-conceived shoreline restoration and submergent aquatic vegetation bed restoration.
7. Open Water (Coastal Lake Erie) – 0%
8. Urban/Highly Disturbed – approximately 65% or 1,826 acres

This is the dominant land use. Urbanization is characterized by keystone species such as house sparrow and rock pigeon. Efforts to minimize the acreage of urban/highly disturbed habitat should be considered.

9. Emergent Marsh - < 0.1% (less than ¼ acre)
Nearly non-existent in the AOC, this habitat type should be considered for restoration and/or creation within the AOC. High potential to increase biodiversity within the AOC exists as a result of emergent marsh/shallow water wetland creation.

4.2 Avifauna

It is clear that the diversity and abundance of breeding and migratory bird species within the AOC will be a determining factor for assessing wildlife habitat and wildlife populations related to BUI delisting criteria. Therefore, below are some reviews of the gathered baseline data to aid in understanding the current conditions per habitat available within the AOC/study area. I have also included bird species which may be found in migration or foraging during the breeding season within the respective habitat types. Since our reference locations provided marginal (but real) value, additional columns which list potential breeding and migratory bird populations within respective habitat types in western New York are provided.

Table 7. Comparison of Observed Breeding and Migratory Bird Diversity in the Study Area vs "Reference" Areas vs Regional Potential by Habitat Type

Habitat Type (Currently Present or Lacking/Proposed)	Study Area Points per Habitat Type	"Reference" Area Points per Habitat Type	Total Study Area/AOC		Total Reference Area		Within Region/ Potential*	
			Confirmed or Probable Breeding Status**	Observed Foraging/Non-Breeding (excluding breeding species)	Confirmed or Probable Breeding Status**	Observed Foraging/Non-Breeding (excluding breeding species)	Potential to Breed	Potential to Forage (excluding breeding species)
Grassland (low)	121, 122	None	6	28	N/A	N/A	13	43
Grassland (high)	102, 107/109, 120	116	10	29	14	43	16	50
Successional Field	119	118	18	29	27	10	27	68
Woodland (upland)	105, 110, 120	115, 118	39	25	24	13	68	45
Woodland (riparian)	106, 108, 112, 113	116, 117	52	26	49	24	80	49
Open Water (River) and Shoreline	103, 104, 110, 114	115, 117	20	31	11	19	21	65
Open Water (Lake Coast)	None	101	N/A	N/A	7	47	10	51
Urban/Highly Disturbed	105	None	11	22	N/A	N/A	N/A	N/A
Emergent Marsh	None	None	N/A	N/A	N/A	N/A	30	55

* - This list was compiled by reviewing Sibley 2000 and life history information for all North American bird species.

** - Per NY State Breeding Bird Atlas Behavior Codes Documented During this Survey Effort which are associated with each habitat type

NOTE - Total acreage of Reference location habitat types are smaller compared to total Study Area, limiting overall carrying capacity

Based upon the observed versus potential data in Table 7 there is potential to increase the diversity of breeding birds within the study area (AOC) through habitat enhancement, restoration, and creation. When considering the finite space available for restoration activity within the AOC, realistic goals should be set regarding target faunal responses, especially for interior forest-breeding animals.

Direct Comparisons to Reference Area Data

Comparison of similarly sized reference and study area points can be extrapolated from the data. For example, Bailey Woods (study area) and Seneca Bluffs (reference area) both contain <10 acre floodplain forest tracts. When comparing observed bird species within these two floodplain forests, the reference area data revealed 10 more species in overall abundance. However, when evaluating habitat associations of the native species observed, 9 forest-associated species were observed at Bailey Woods (study area) which were not observed at Seneca Bluffs (reference area) while 23 forest associated species were observed at Seneca Bluffs but not at Bailey Woods. If you isolate the species which breed within floodplain forests in the region from the above sub-population (native forest-associated species which were observed only at one of the two compared locations) there are 5 at Bailey Woods and 14 at Seneca Bluffs, suggesting a potentially significant difference.

A similar comparison may be achieved for the Katherine Street Peninsula floodplain forest/field complex (study area) and the Seneca Bluffs floodplain forest/field complex (reference area). Both sites contain forested and field locations of similar acreage and both have survey points which incorporate sight lines to the Buffalo River (open water habitat). In this comparison, the reference area data revealed 13 more species in overall abundance (66 at the collective Katherine Street points and 79 at the collective Seneca Bluffs Points). However, when evaluating habitat associations of the species observed, the difference in forest-associated birds (within the subset of native species observed at only one of the two locations) is potentially significant (11 total, 5 breeding at Katherine Street and 25 total, 16 breeding at Seneca Bluffs). Comparisons of open water and old field birds within this subset are negligible.

Low-height grasslands and successional fields cannot be adequately compared to reference locations due to a lack of suitable reference habitat within the region. Grassland sites within the AOC, specifically the Riverbend location, contribute greatly to the diversity of breeding bird species, resident mammals, and herpetofauna in the study area. Successional fields are extremely valuable for migratory birds, cottontail rabbits, small mammals, and allows the potential for shrubland/successional field habitat-specific breeding birds, such as chestnut-sided warbler, blue-winged warbler, eastern towhee, and field sparrow to establish breeding populations in the AOC.

Below are some suggested bird species whose current presence or absence within preferred habitat types may serve as indicators of ecosystem health and, therefore, aid in determining if delisting criteria have been met within the AOC.

Table 8. Proposed Target Avifauna per Habitat Type for Gauging Ecosystem Health

Habitat Type	GOALS Breeding Birds	GOALS **F**orage/**M**igration/**W**intering
Grassland (low)	grasshopper sparrow, savannah sparrow, horned lark American woodcock	vesper sparrow (M), upland sandpiper (M), short-eared owl (W)
Grassland (high)	eastern meadowlark, bobolink, eastern bluebird	wild turkey (F), Nashville warbler (M), American woodcock (M)
Successional Field	field sparrow, chestnut-sided warbler, blue-winged warbler	mourning warbler (M), Lincoln's sparrow (M), American tree sparrow (W), orange-crowned warbler (M)
Woodland (upland)	wood thrush, ovenbird, black-and-white warbler pileated woodpecker	15+ neotropical warbler species (M), blue-headed vireo
Woodland (riparian)	scarlet tanager, American redstart, veery, yellow-billed cuckoo	20+ neotropical warbler species (M), winter wren (M,W), red-shouldered hawk (M,W)
Open Water (River) and Shoreline	American black duck, spotted sandpiper	gadwall (M), pintail (M), bufflehead (M,W), ringneck duck (M), lesser yellowlegs (M), semipalmated sandpiper (M)
Emergent Marsh	common moorhen, American bittern, marsh wren, blue-winged teal	swamp sparrow (M), common snipe (M), black-crowned night heron (M), great blue heron (M,W)
Open Water (Lake Coast)	N/A	N/A
Urban/Highly Disturbed	N/A	N/A

NOTE - Some of these species are already confirmed present. Maintaining these populations is important

Notable Rarities - Overall, species observed were typical for the region and dominant land use (urban). Highly generalist omnivorous species, such as ring-billed gulls, pigeons, and starlings are most abundant. However, some rare bird species were observed during the survey effort which are worthy of mention, as they are rarely or only occasionally observed within the region. Bird migration is a highly varied phenomenon, with many variables influencing where a particular bird may appear (migratory patterns, weather conditions, experience, stopover conditions, food/resource fluctuation, etc.). Along the eastern shore of Lake Erie the potential to observe displaced birds is high, with a long history of vagrant/aberrant observations documented. In 2012, rare gulls, particularly little gull (*Larus minutus*), black-headed gull (*Larus ridibundus*), and Sabine's gull (*Xema sabini*) were all observed at different times mixed in with hundreds of other foraging/soaring gulls (mostly ring-billed and Bonaparte's gulls). Another rare but regular winter visitor to the Buffalo shore of Lake Erie is the snowy owl (*Nyctea scandiaca*). 2012 was considered an irruptive year for this arctic inhabitant, with large numbers of individuals moving south along a broad front (continent-wide) and overwintering in open fields and along large water bodies within the continental United States, with one individual documented as far south as Oklahoma. A total of three separate snowy owls were observed along the Lake Erie coast during the winter survey effort (Figure 30).

Figure 30. A wintering snowy owl observed at BUF101 on January 22, 2012. Photo by MJM.

Figure 31. Migrating mergansers along coastal Lake Erie. Photo by Michael McGraw.

4.3 Herpetofauna

Similar to the bird community, the majority of reptiles and amphibians observed within the AOC are highly adaptive and can be found in urbanized settings with the exception of 1 species, eastern spiny softshell (*Apalone s. spinifera*). This species is typically intolerant of poor water quality, specifically low-oxygen conditions (Ernst et al. 1994). Due to its soft shell, osmoregulatory capabilities are very different from other species resulting in higher permeability (Bentley and Schmidt-Nielsen 1970) and, thus, higher susceptibility to external conditions. Both fish and aquatic insects appear to be critical food sources for spiny softshells (Cochran and McConville 1983). Structural requirements include soft river bottoms, aquatic vegetation beds, mud flats/sandy banks, and submerged trees with limbs. Additionally, it requires specific river bank substrate, aspect, and canopy densities to successfully nest. Nesting occurs in May-June. Since nesting sites are typically river banks, disturbance in urbanized locations by people (fishermen and others) during this time may inhibit use of otherwise suitable nesting locations. NYSDEC is aware of the occurrence of eastern spiny softshell and is currently investigating the status of spiny softshells in the lower Buffalo River AOC via radiotelemetry (Roblee, personal communication). Nesting habitat has already been included in shoreline restoration plans for at least one location in the AOC.

Salamanders were not observed during this survey effort. Two species, blue-spotted salamander (*Ambystoma laterale*) and eastern redback salamander (*Plethodon cinereus*) are documented in adjacent habitats to the AOC. A known population of blue-spotted salamanders exists in the Tifft Nature Preserve, located southwest of the Riverbend site. This species requires a robust organic layer (O horizon), significant woody debris at varying decayed states, and contiguous forested upland (foraging/overwintering) and fishless/ephemeral ponds (breeding/egg-laying) habitats (Petranka 1998). This species typically does not inhabit urbanized landscapes and the presence of this species within the greater Buffalo urban area is an important contribution to local natural history. No typical habitat for blue-spotted salamanders is currently present within the AOC boundary. Detection probabilities of salamanders are relatively low (Bailey et al. 2004) and, therefore, may require a more intensive survey effort to confirm presence/absence of these species within the AOC. That said, considerable effort was made to locate these species within the AOC in 2012, suggesting an inhibition of colonization, likely due to a wide range of potential inhibitive biotic and abiotic variables, such as predation, incompatible soils/soil compaction, lack of woody debris, corridor fragmentation (CSX rail yards, roads, etc.), and a lack of suitable egg-laying pools (for *A. laterale*). Numerous rail lines and maintenance roads run parallel to each other creating a considerable barrier/inhospitable conditions between Tifft NP and the Riverbend site for terrestrial salamanders which likely currently inhibit colonization from the Tifft population into the AOC. Access to other immediately adjacent land within the AOC (CSX property) was not accessible during this study (Appendix I, Map 7).

Eastern redback salamanders are a more adaptive species, in that they do not require a water body to lay eggs, and therefore have a much wider range of tolerable habitat conditions. However, a critical requirement is decaying/downed woody debris for laying eggs (Petranka 1998), which is largely absent from most AOC habitat types (with the exception of forested floodplain sections). Habitat fragmentation and predation (by birds, small mammals, and mesocarnivores) are also potentially inhibitive variables.

The known geographic range of shorthead garter snakes is within northwestern Pennsylvania and extreme southwestern New York. This species prefers meadow, fields, and hillsides within the Allegheny Plateau (Tennant 2003). They have a strict diet preference for earthworms, but have also been documented predating frogs, insects, and salamanders (Tennant 2003). It is unlikely that the Buffalo population is native. Historical coal freighting from northwestern PA likely translocated a breeding population which has persisted in the region for the past 5+ decades (Roblee, NYDSEC, personal communication). Shorthead garter snakes have been documented in numerous locations surrounding the large CSX rail yard, which is succinct with this speculation. Current NYSDEC range maps do not reflect this population but do recognize an introduced population in Binghamton, NY (NYSDEC Range Map Link). Although the AOC population is likely a non-native range expansion it is a harmonious contribution to local natural heritage and at this point should be recognized formally. The first shorthead garter snake observed during the survey effort was on May 10, 2012. The animal was found dead (recently killed) along the steep bank of the ship canal near BUF103. Puncture marks behind the head and along the mid-body were suggestive of raptor or house cat predation. The fact that this species was observed was a seemingly abnormal occurrence (not within the documented geographic range) so morphological observations were documented to confirm identification (Appendix XI). The specimen was then taken to NYSDEC Buffalo office where Ken Roblee, NYSDEC Herpetologist documented it as a voucher specimen.

When considering herpetofauna as related to delisting criteria, the best opportunities exist with amphibian and riverine turtle populations. Creation of isolated wetlands (specifically ephemeral pools), reducing habitat fragmentation (by increasing natural area connectivity), and improving in-river aquatic ecosystems (via dredging contaminated soils, restoring submerged aquatic vegetation beds, and creating shallow water/cove emergent marshes) are key critical habitat enhancements which should be included in AOC restoration activities

4.4 Mammals

Small Mammal Trapping – Highest small mammal abundance and density documented via Sherman traps were found within off site locations (Coastal Lake Erie and Seneca Bluffs, respectively). The diversity is likely correlated to the diversity of plant species and habitat types available at Seneca Bluffs. TCS efforts revealed high densities of Peromyscus sp. on site, especially at the Riverbend and Porkpie sites, which was not accurately reflected in the Sherman live trapping effort. Also, short-tailed shrews were observed onsite during TCS at Bailey Woods, Riverbend, and Smith Street, but only documented during the small mammal trapping effort at Seneca Bluffs. By restoring forests and fields and creating emergent marsh wetlands within the study area to reflect more diverse, native vegetative communities free of invasive plant species will improve the probability of a wider distribution of native small mammals.

Mink – American mink is considered a keystone species because of its ability to influence small mammal and other prey source populations. Although native, overpopulations of mink within an area can have significant negative impacts to extant faunal populations. As an adaptable swimmer and efficient predator, mink have been responsible for island-nesting bird colony failures by voraciously predating nests and chicks (an ongoing issue which is documented at a common tern nesting colony on the ice break wall in Lake Erie just west of the AOC). In the Lower Buffalo River watershed this species is native and its presence is encouraged. The results of this study suggest a low-density population of mink that currently occur within the AOC. That said, use of the AOC may be currently limited to foraging and travel corridor use, since no burrows or other evidence of denning were observed in the study area. A probable den site was located at the reference location which could reasonably support the very same animal(s) whose tracks were observed along the riverbank within the study area (the two observations are less than ½ mile from each other). A key limiting factor for the disbursal and subsequent population growth of American mink within the AOC may be the lack of suitable shoreline habitat and/or the distances between adequate shoreline habitat (since mink will use the River as hunting grounds and as a travel corridor). Long sections of dredged river with no natural shoreline are likely inhospitable for this species. Based upon these observations and resultant inferences, it is likely that improvement of the riverine aquatic ecosystem and shoreline habitat within the AOC will result in an increase of American mink within the study area.

Bats – The two of eight potentially present bat species were documented onsite. The natural history of these animals suggests a good population of flying insect prey base in the AOC. This preliminary bat assessment suggests that a more robust bat survey may be worth investing in moving forward. This study was unable to assess the role of abandoned buildings for roosting bats within the AOC due to site access issues. However, it is a highly reasonable assumption that bats utilize abandoned buildings within the AOC. European studies have shown that some bat species regularly choose human constructions over available tree roosting sites (Mazurska and Ruczynski 2008). Several U.S. studies have also found that large, abandoned buildings taller than surrounding structures providing warm, stable internal temperatures create ideal day and night bat roosting areas (Mazurska and Ruczynski 2008; Rhodes and Johnson 2006; Entwistle et al. 1997; Mager and Nelson 2001; Neubaum et al. 2007; Vander Pol 2012). When considering delisting criteria, efforts to leave roost trees (dead trees, live shagbark hickory) within the AOC should be included where possible. Bat boxes can be erected in locations where buildings are removed to encourage the retention of site use by bats. There is also an opportunity to incorporate urban ecology features which may provide value for bats (e.g. building ruins which may remain as part of a site design).

Squirrels – There is an overpopulation of gray squirrels within forested areas in the AOC. Ecological restoration will aid in balancing this population, such as restoring the groundstory and understory strata of degraded and park-like woodlands (currently impacted by either invasive species or mowed lawns) and increasing the patch size of onsite woodlots. Residents and businesses within the AOC should be encouraged to squirrel-proof their trash cans. Increasing predation by raptors, specifically by encouraging more nesting pairs of red-tailed hawks within the AOC, may not be effective due to the ease of foraging in nearby higher squirrel densities and highway edges.

Deer – A breeding population of white-tailed deer exist in the AOC (Figure 32). Deer in urbanized settings pose a risk for vehicular traffic and likely influence vegetative composition within the AOC from browse and grazing activity. Efforts will need to be made to deter herbivory at restoration sites, especially in the eastern portion of the AOC (from Katherine Street Peninsula eastward).

Figure 32. A nearly pure albino white-tailed deer observed during the survey effort at an undisclosed location. Photo by Nathan Grosse.

5. Recommendations

Below are generalized, bullet-listed recommendations for ecological restoration, existing landscape maintenance, and sustained scientific documentation to promote continued and/or increased wildlife diversity within the Buffalo River AOC. These recommendations are prioritized by order of occurrence in the report (first being highest priority). More detailed recommendations for specific locations within the AOC can be provided separately from this report if requested, based upon the ecological understandings gained from this study.

- ***Restore/create native riparian forest wherever possible***

  The highest diversity of onsite wildlife in 2012 was observed within riparian forest remnants. Increasing patch size of existing riparian forest and dedicating new/historic areas to this intended ecological target will increase abundance and diversity of vertebrate wildlife as well as many other ecological functions. A prioritizing factor for targeting riparian forest restoration is adjacency to existing or potential forest (riparian or upland) to create contiguous forest blocks and corridors within the AOC.

- ***Increase wetland acreage within the AOC by creation of river-associated and isolated wetlands, both emergent and forested, if possible.***

  - Consider evaluating the Bailey Woods wetland remnant for restoration to a river-associated emergent marsh

  - Identify locations where excavations (to at least the river's high water mark) can be made within the historic floodplain of the Buffalo River as created wetland sites

  -Engage volunteers in removal of invasive species/native planting within pocket wetlands onsite to encourage suitability for breeding amphibians and wetland associated passerine.

- ***Increase littoral shelf and land/river connectivity wherever possible***

  A lack of shallow river areas from dredging activity has reduced submergent aquatic vegetation beds within the River. Improving, restoring, and re-creating this structural component will likely promote an increase in the abundance and diversity of riverine trophic web biomass-contributing organisms.

- ***Maintain current low-height grassland habitats within the AOC***

  Onsite low-height grassland locations currently support numerous grassland and barren land breeding bird populations. Many of these species are in regional and even global decline. Additionally, these open-canopied habitats are supporting the onsite snake and native small mammal populations as well as ample insect populations/primary consumers (thusly, a strong trophic web). A loss in grassland habitat will likely result in a reduction of all target faunal assemblage diversity (reptiles, amphibians, birds, and mammals).

- ***Design locations where successional forest habitat may be a dominating land use type for approximately 20 years (end use = mature forest) as well as potentially considering designing shrubland patches within the AOC landscape***

Many bird species prefer the high vegetative production within successional and shrubland landscapes, including species in regional and global decline. Shrubland/Successional Field habitat type is nearly non-existent currently in the AOC (with the exception of PorkPie). Consider pairing these locations with existing or future forest habitats to ultimately increase size and quantity of forest blocks in the AOC as well as 'softening' edges of forest/non-forest ecotones.

- ***Establish prioritized, site-specific invasive species management plans for various locations using volunteers, grants, and City Parks staff resources including;***

  - Mechanical and chemical removal of Japanese knotweed within riparian landscapes

  - Chemical treatment of invasives/non-native species paired with native warm-season grass seed planting of onsite mugwort-invaded meadows

  -Removal on non-native trees via stump treatment and/or drill-and-fill methods (the latter leaving standing snags as wildlife habitat)

- ***Increase basking locations for riverine turtles.***
  Consider using felled/anchored trees (preferably with submerged branches/crowns) and cultural/artistic elements (building ruins, re-purposed materials, etc.)
- ***Conduct follow-up wildlife surveys in years 3, 5, 10, 15, and 20, or consecutive (years 1-10) to maximize the value of this data set and generate a robust understanding of the vertebrate fauna inhabiting the Buffalo River AOC.***
- ***Consider generating articles for publishing using gathered biological data.***

6. Conclusions

Vertebrate fauna observed within the Buffalo River AOC in 2012 consists largely of generalist and urban-adapted species. Evidence of habitat preferences by other wildlife (ex. grassland and riparian forest birds) suggests that land use planning (conserving, acquiring, and maintaining spaces for wildlife habitat) and active ecological restoration can increase species richness and alter abundance composition to better reflect naturalized communities and achieve target BUI delisting goals.

Avifauna - The hydrologic connectivity to Lake Erie and intense avifaunal migration events lend the Buffalo River location to a wide array of potential faunal diversity increases associated with specific ecological restoration and land use compatibility. For example, it is perceivable that many waterfowl species whose geographic breeding ranges overlap the Buffalo area could potentially begin nesting on site by increasing the land/river connection (to accommodate the part land/part water territories of many dabbling duck species) and by increasing the amount of emergent wetland acreage and submergent aquatic vegetation beds within the AOC. Also, passerine migration through the site is strong and opportunistic males whose geographic breeding ranges overlap the AOC will surely set up territories in restored fields, forests, and wetlands when preferred condition are available. Specific bird species should be selected at targets aligned with relevant restoration plans to serve as a performance standard and aid in achieving BUI delisting criteria.

Herpetofauna – The presence of shorthead garter snake and eastern spiny softshell populations are notable. Monitoring the progress of a potential re-colonization of spiny softshell to the lower Buffalo River may serve as a valuable metric for water quality, riverine ecosystem quality, and river bank habitat condition, as this can be considered an 'umbrella' species for riverine ecosystems. No blue-spotted salamanders were observed during the 2012 study. Migration of nearby blue-spotted salamander populations into restored landscapes with a direct connection to Tifft Nature Preserve is possible and exists as a good restoration opportunity to promote this species within the AOC. The creation of breeding pools for amphibians will likely result in a measurable increase in frog and toad populations, which are a critical food source for many other animals. Due to their role in the trophic web, increases in amphibian populations have been previously correlated with increases in diversity and abundance of bird and mammal species.

Mammals – Improved ecological connectivity and condition will likely increase site mammal diversity. Improvements to water quality of the Buffalo River could potentially increase the mustelid population onsite. Norway rats were not observed in fallow/naturalized spaces within the AOC (typical in most urban lots) but are likely present within the AOC. Other than mink, management of other mammal species should be considered through a holistic ecosystem restoration approach (improve native autogenic ecosystem function and populations will adjust accordingly). For mink, specific actions to improve preferred river and shoreline conditions may be worth investing in.

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8. Appendices

Appendix I – Site Maps
- Map 1. Site Context and Project Boundary
- Map 2. Avifaunal Point Count Survey Locations
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- Map 4. Time- and Area-Constrained Search Polygons
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Appendix II – Quality Assurance Project Plan (QAPP)

Appendix III – Survey Data Sheets
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- TCS/ROS/Transect Sheet
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Appendix IV - NYSDEC Scientific Collection Permit #1829

Appendix V - Survey Effort Spreadsheet

Appendix VI – Total Bird Species List

Appendix VII – Bat Survey Supplemental Report

Appendix VIII – Original Data Sheet Scans
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Appendix IX – Bi-Monthly Progress Reports

Appendix X – Other
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Appendix XI – Comments and Responses from Draft Final Review