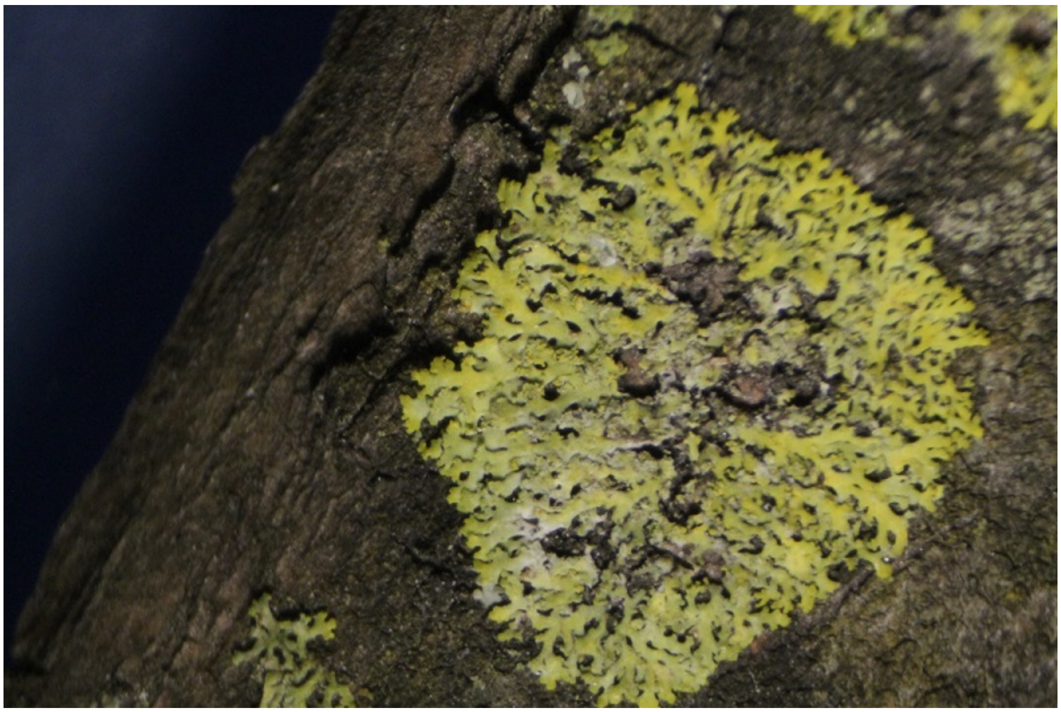
Lichen Survey of Wapanocca National Wildlife Refuge



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ABSTRACT: A preliminary survey of lichens was conducted at the Wapanocca national wildlife refuge in order to establish baseline data for the species that are present there.

INTRODUCTION

Lichens are a symbiotic organism that is a mutualism of fungi and algae. They are found growing on trees, rocks, soil, and many man made items including road signs, tombstones, and home foundations. Knowledge of lichen distributions and geographic occurrences vary across North America. Many surveys of lichen biodiversity have been conducted in Eastern North America including in the Appalachian Mountains (Hodkinson 2010), North Carolina (LaGreca 2018; Perlmutter 2008; Perlmutter et al. 2017), the southeast (McCune et al. 1997), Pennsylvania (Bauer and Krayesky 2018; Opdyke and Daugherty 2016), New Jersey (Waters and Lendemer 2019), and Coastal Maine (Seaward et al. 2017). Lichen surveys have also been conducted in the Pacific Northwest (Haldeman 2018, Lehmkuhl 2004; Smith and Rausch 2015) and the southwestern US (Bates et al, 2012), just to name a few. Much is known regarding the lichens found in these areas and the community structure of the lichens are much better known. There are geographic areas however, where less is known about the lichen communities and often these areas are understudied because of a perceived lack of diversity. One such area is the Mississippi River valley. Only recently have lichen surveys been conducted in the mid-south region of the United States, and both were conducted in Western Tennessee an area that is adjacent to the Mississippi River (Miller and Sullivan 2015, 2017).

Unlike plants, lichens do not possess a waxy cuticle and therefore readily absorb substances from their surroundings. Nutrient uptake occurs through surface absorption as does uptake of pollutants. This attribute of lichens makes them a good indicator of environmental health. (Freitas, et al. 2007; Loppi and Bonini 2000). The use of lichens to study pollution is well documented (Cristofolini, et al. 2008; Miller and Brown 1999; Nimis et al. 2001). By examining biodiversity of lichens at a particular site, an understanding of potential air pollution and ecosystem health is possible (Pinho, et al. 2004, 2011; Will-Wolf et al. 2018). Changes in environmental pollution are reflected in lichens (Showman and Hendricks 1989). For example, some pollutants damage the lichens by damaging the chlorophyll in the algae (Chettri et al. 1998). Also, some lichens are pollution tolerant and others are pollution sensitive. Knowing the species that are present will indicate environmental condition. Additionally, changes in climate can be studied using lichens (Giodani and Incerti 2008). Community composition and changes that may occur can directly be the result of changes in climate. Therefore establishment of baseline data of lichen species that are present at Wapanocca will serve as a comparison for future studies.

STUDY AREA

Wapanocca national wildlife refuge is approximately 2220 ha (5,484 acres) located on the western bank of the Mississippi River in Northeast Arkansas. It is a wetland area that it surrounded by farmland outside of the refuge boundaries. Mixed hardwoods dominate the areas that surround the lake.

Lichens were collected at 6 locations (Fig. 1). Collection locations were chosen based on lichen growth and access to sunlight through the canopy.

METHODS

Collection methods included removal of representative lichens from tree trunks in accessible areas and collection of canopy lichens from fallen limbs and trees. Lichens were removed using a hammer and wood chisel. The collected lichens were placed in labeled bags with date and location data for processing in the lab. Specimens were identified in the lab using a Leica CME stereoscope and a Nikon compound microscope. Standard chemical tests were used in the identification of most lichens to species.

RESULTS

A total of 225 lichen specimens have been identified. The lichens were collected at 6 separate sites on the refuge property. Lichens are divided by type, crustose, foliose, or fruticose (Fig. 2) with foliose being the most frequently collected and identified. Of the 225 lichens identified, there are 39 species, 22 genera, representing 12 different families (Table 1).

The most frequently encountered lichen species was *Candelaria fibrosa* which was identified from 25 specimens. Other species which were frequently encountered include *Physcia pumilior* (21 specimens) and *Hyperphyscia syncolla* (20 specimens).

DISCUSSION

Many of the species collected at Wapanocca are the same as those collected at the sites in Western Tennessee (Miller and Sullivan, 2015; 2017). Several of these are pollution tolerant, such as *C. concolor, C. fibrosa, Parmotrema reticulatum, Ph. milligrana, Pyxine subcinerea*, and *Xanthomendoza weberi*. Pollution sensitive lichens which were collected include *Ramalina americana* and *Usnea strigosa*. Specimens from each of these species were small in size and in all likelihood being affected by air pollution. Possible pollution sources that might be affecting the refuge area include industrial air pollution from the city of Memphis, automobile emissions from nearby I-55, emissions from trains traveling along the tracks adjacent to the refuge, and emissions from barge traffic along the Mississippi river. The types of air pollution that affect many lichens include heavy metals that are in the atmosphere and acid rain caused by nitrates and sulfates that are volatized. The pollution tolerant lichens that have been found at Wapanocca are capable of withstanding the lower pH that occurs are a result of acid rain.

Future studies should continue to monitor the types of lichens present. Increase in numbers and health of the pollution sensitive lichens would be an indicator of improved environmental health. This will take several years before these measures are apparent.

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DATA APPENDIX OR SUPPLEMENTAL INFORMATION

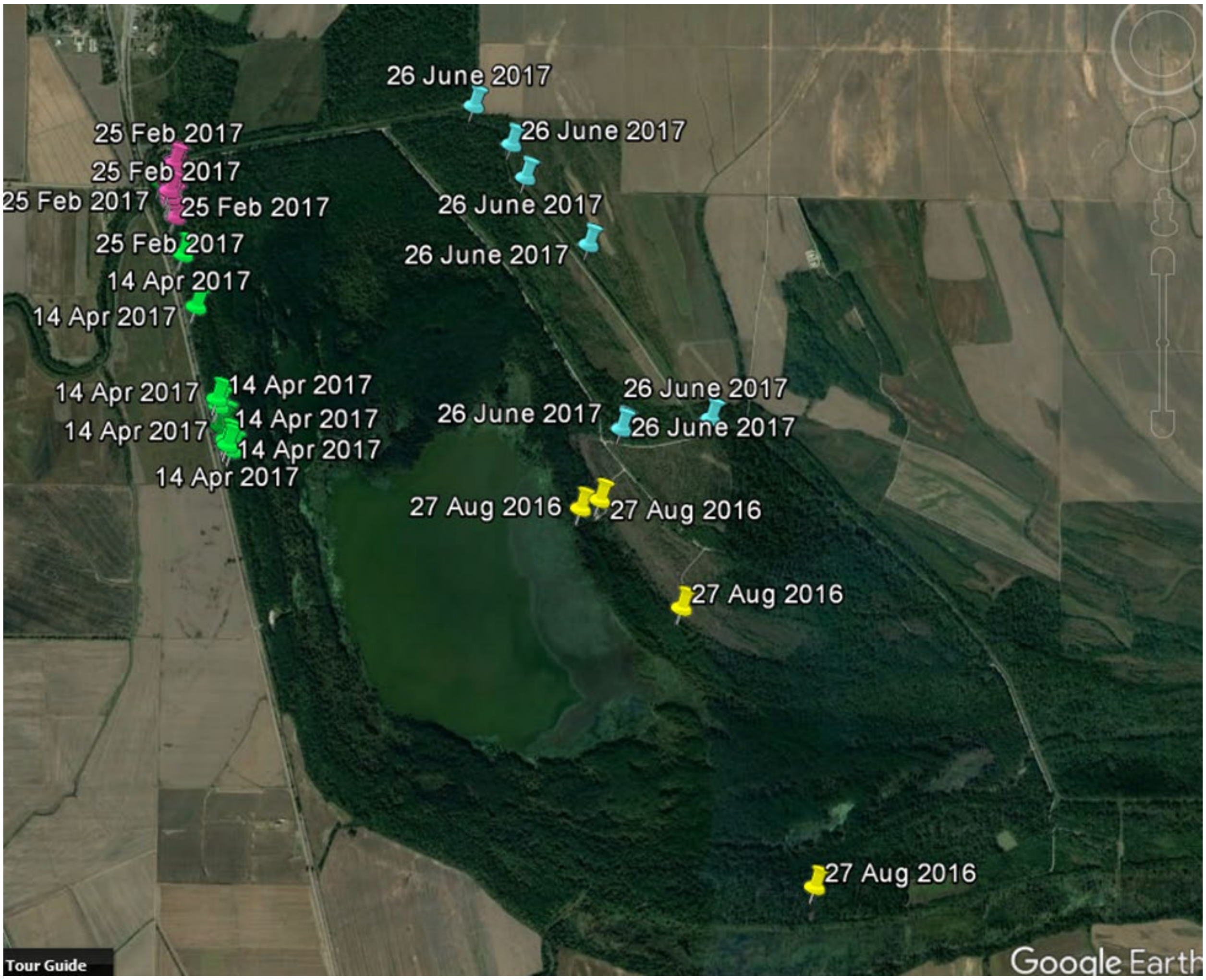

Figure 1, Sites within Wapanocca Wildlife Refuge in which specimens were collected.

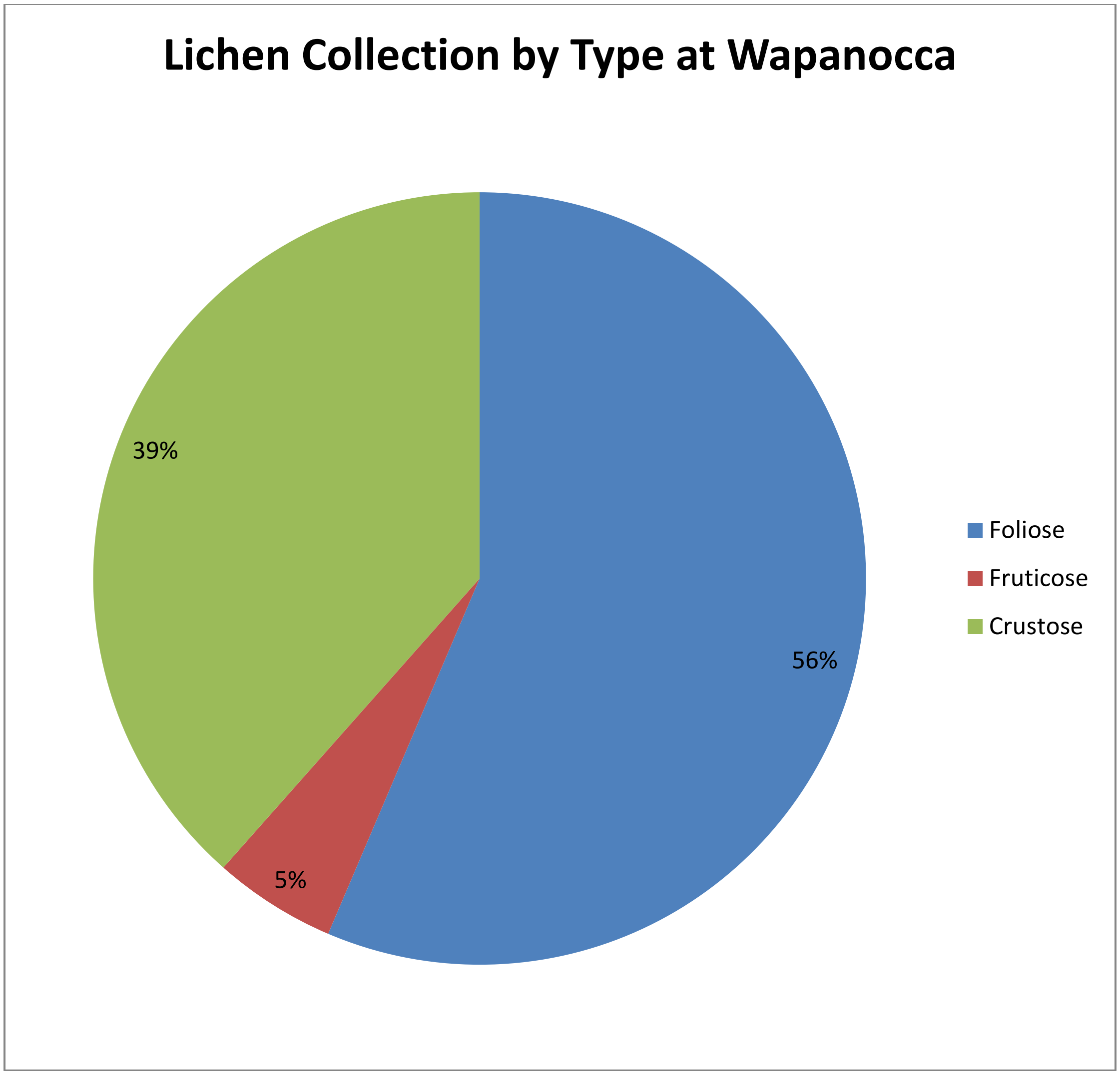

Fig. 2. Distribution of lichen type by species. A total of 39 species have been identified.

Table 1. A list of all lichen species collected and identified along with the growth type that they represent.

Lichen Species	**Growth Type**
Amandinea milliaria	Crustose
Arthonia atra	Crustose
Arthonia rubella	Crustose
Buellia stillingiana	Crustose
Caloplaca camptidia	Crustose
Caloplaca cerina	Crustose
Caloplaca pyracea	Crustose
Candelaria concolor	Foliose
Candelaria fibrosa	Foliose
Canoparmelia texana	Foliose
Chrysothrix caesia	Crustose
Chrysothrix xanthine	Crustose
Flavoparmelia caperata	Foliose
Graphis scripta	Crustose
Heterodermia albicans	Foliose
Hyperphyscia syncolla	Foliose
Lecanora hybocarpa	Crustose
Lecanora strobilina	Crustose
Ochrolechia Africana	Crustose
Ochrolechia pseudopallescens	Crustose
Parmotrema austrosinse	Foliose
Parmotrema hypoleucinum	Foliose
Parmotrema hypotropum	Foliose
Parmotrema margaritatum	Foliose
Parmotrema perforatum	Foliose
Parmotrema perlatum	Foliose
Parmotrema reticulatum	Foliose
Pertusaria subpertusa	Crustose
Phaeophyscia ciliate	Foliose
Phaeophyscia hispidula	Foliose
Phaeophyscia rubropulchra	Foliose
Physcia millegrana	Foliose
Physcia pumilior	Foliose
Punctelia graminicola	Foliose
Punctelia missouriensis	Foliose
Punctelia rudecta	Foliose
Pyxine subcinerea	Foliose
Ramalina Americana	Fruticose
Usnea strigose	Fruticose
Xanthomendoza weberi	Foliose