**Introduction**

Parakeets are an invasive species that are widespread across Europe. The British population is one of the largest in Europe, in 2015 there was 8,600 breeding pairs and 31,000 individuals [Pârâu, 2016].

Parakeets are cavity nesters and rely on cavities dug out by woodpeckers, they can however enlarge existing cavities [Newson, 2011], [Orchan, 2013]. Cavities are usually a limited resource [Orchan, 2013] and throughout western Europe natural cavities have been substantially reduced due to land management [Strubbe, 2007]. Parakeet numbers have been shown to be heavily correlated to cavity density which suggests that cavities may be a limiting factor to parakeet numbers [Strubbe, 2007].

Invasive species enter an existing community of native and other alien species [Orchan, 2013]. Cavity-nesting birds are a clearly defined community that potentially use and interact over the same resource – the nesting cavities [Orchan, 2013]. Parakeets are entering the community of cavity-nesting birds, the effects of this has been widely studied by inconclusive. Parakeets have been found to reduce nuthatch numbers in Belgium [Strubbe, 2007] but no correlation was found in a similar study in London [Newson, 2011]. Strong correlation has been found with reduced number of noctules but not with cavity-nesting birds in Tel-aviv [Hernández-Brito, 2018]. Parakeets have also been found to increase the amount of time tits spend being vigilant rather than feeding which potentially affects their fitness [Lord, 2014]. Common species may nest next to parakeets so as to benefit from parakeets’ aggression towards potential predators [Hernández-Brito, 2013].

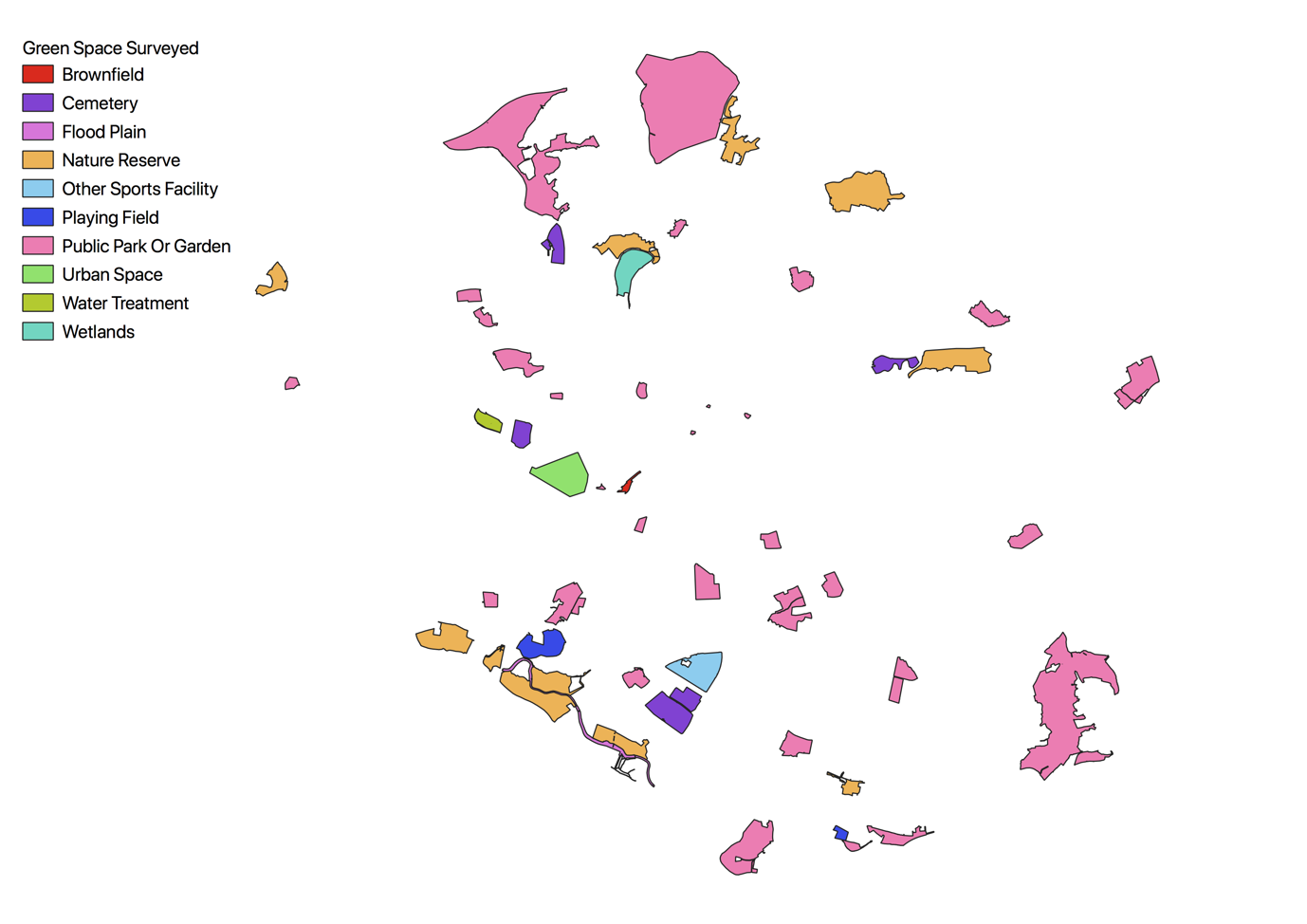
Parks are important hot-spots for diversity and are also losing many native species due to increased exotic species [Nielsen, 2014]. This project will study the effect of parakeets on the cavity-nesting bird community within the parks and green spaces of Manchester.

**Hypothesis**

1. There is a significant difference in the cavity-nesting birds community make up between green space with parakeets and those without.
2. There is a significant correlation in the cavity-nesting species richness of a green space and the number of parakeets.
3. There is a significant difference in the cavity-nesting bird community composition between green spaces with parakeets and those without.

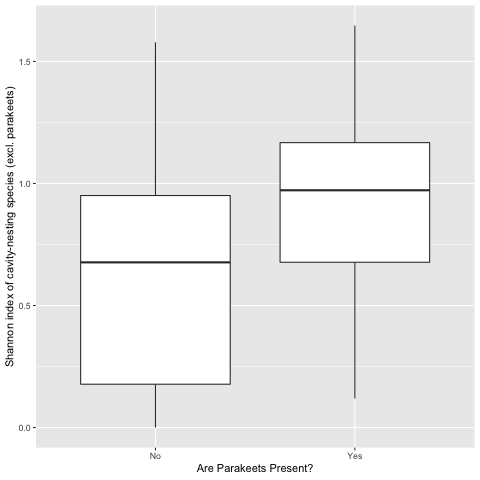
**Methods and Data**

56 green spaces in Manchester were visited and comprehensively surveyed. Each hectare of a green space was entered, and each site was searched for 5 minutes per hectare. Every sighting or call of a cavity-nesting bird was recorded.

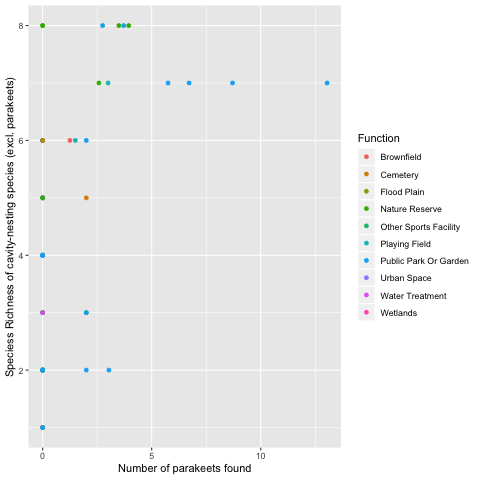


**Data Analysis**

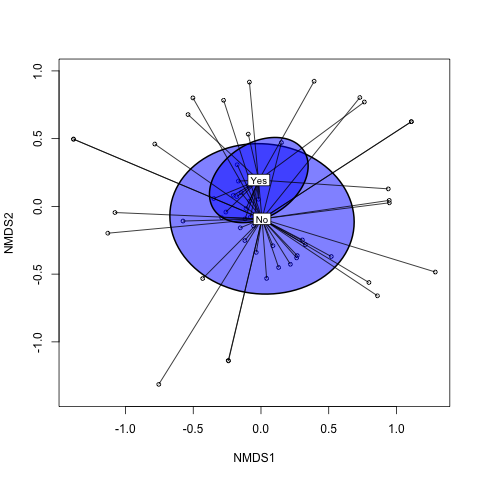
The Shannon index was calculated for each site for the cavity-nesting birds found excluding parakeets. A Mann-Whitney U test was done to test parakeet presence against the this Shannon index. The test showed there was a significant difference in the Shannon index of cavity-nesting birds between sites with parakeets (mean±sd; 0.99±0.40) and sites without parakeets (mean±sd; 0.64±0.47) (p = 0.013).

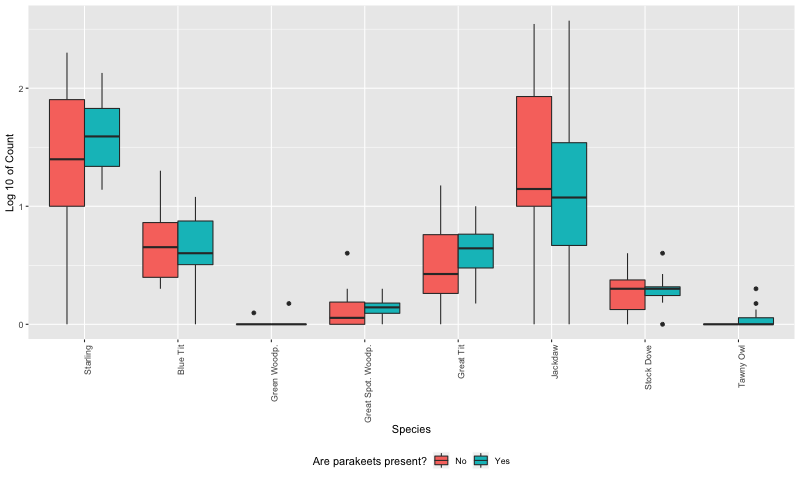


The species richness of each site was also calculated for cavity-nesting birds excluding parakeets. A Spearmans test was done to test correlation between the number of parakeets and this species richness. The test showed there is a positive correlation between the number of parakeets and the species richness of a site (n = 56, p < 0.01, rho = 0.53).



An NMDS was created using the cavity-nesting birds abundance excluding parakeets. This showed that the cavity-nesting birds community with parakeets was a subset of the communities without parakeets. An Analysis of Similarity was performed on the same data and this found that the composition difference was not significant (ANOSIM statistic R = 0.09076, p = 0.976).





Spearman’s correlation against parakeet numbers:

|  |  |  |  |
| --- | --- | --- | --- |
| **Species** | **p-value** | **rho** | **Power (n = 56)** |
| Starling | 0.15 | 0.19 | 0.30 |
| Blue Tit | 0.09 | 0.23 | 0.40 |
| Green Woodpecker | 0.02 | 0.30 | 0.62 |
| Great Spotted Woodpecker \*\*\* | < 0.01 | 0.42 | 0.90 |
| Great Tit | 0.08 | 0.24 | 0.42 |
| Jackdaw \*\*\* | < 0.01 | 0.38 | 0.84 |
| Stock Dove | < 0.01 | 0.36 | 0.79 |
| Tawny Owl \*\*\* | < 0.01 | 0.58 | 0.997 |

**Effect Size**

[Hernández-Brito, 2018] surveyed a single park from 1992 to 2017 to record the impact of parakeets on noctules, this created 25 years of data.

[Strubbe, 2007] surveyed 44 different sites across the Brussels region when a negative correlation was found between nuthatch and parakeet numbers.

[Newson, 2011] surveyed 180 sites across London when no negative correlation was found between parakeet numbers and other cavity-nesting species.

The 56 sites in Manchester are not as numerous as the number of sites from the London survey, however, they are in line with the two other surveys.

A power analysis was done for the correlation test which showed a power of 99% for the 56 sites with a significance level of 0.05 and the calculated rho of 0.53.

**Bibliography**

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