Bluebell Case Study

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A bluebell woodland carpet is a popular and cherished image of British springtime. The attractive appearance of the bluebell makes it a popular garden plant and the consequent planting of the larger non-native bluebell Hyacinthoides hispanica in gardens close to woodland areas has led to the spread of the alien to areas previously dominated by only the native bluebell, Hyacinthoides non-scripta. It is thought that this must be combatted through quick and efficient conservation in order to prevent rapid decline in the native species, Hyacinthoides non-scripta (Rix, 2004; Sheffield and Rotherham Wildlife Trust, 2015; The Star, 2016).

Existing bluebell records in Sheffield, shown in figure 1, are not abundant and often of a low resolution, only being attributed to a 10km grid square. Many records are several decades old, with recorded dates given as within a 10-year period.

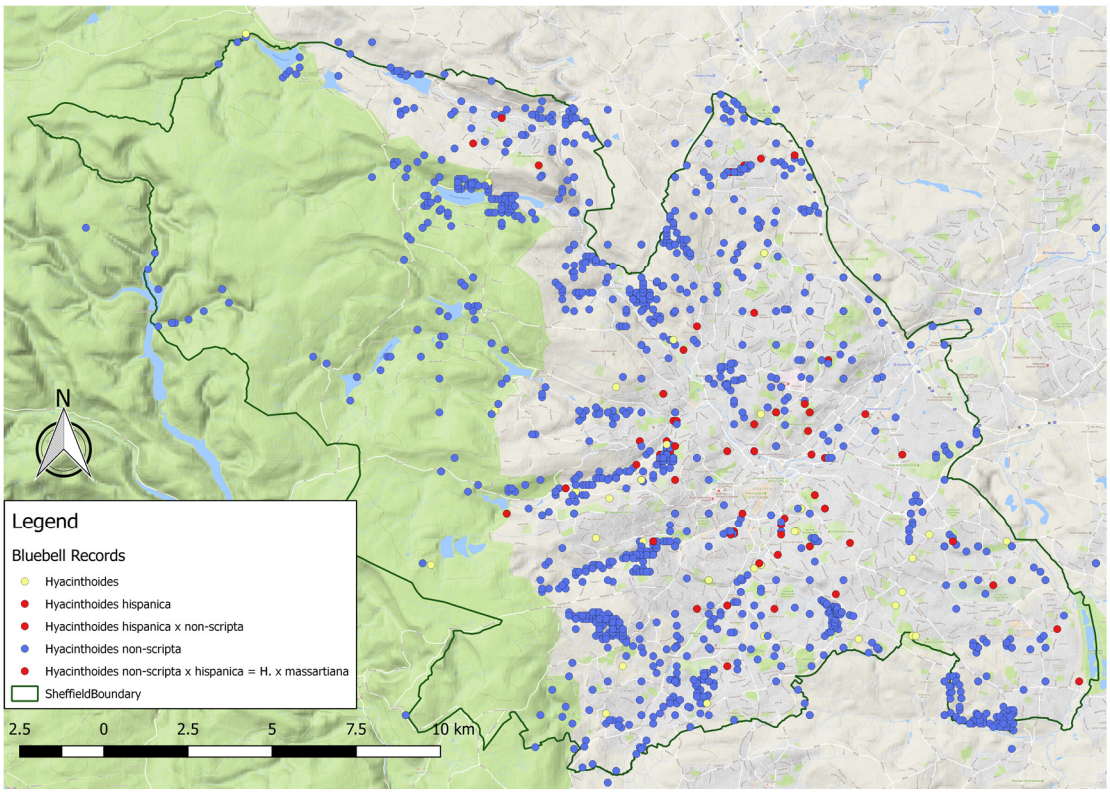

Figure *1: A map of existing bluebell records in Sheffield supplied by the Sheffield Biological Records Centre on a backdrop map of Google Landform Map (©Google 2017) (Contains National Statistics data © Crown copyright and database right [2017] Contains OS data © Crown copyright [and database right] (2017))*

The aims of the study undertaken were to provide a snapshot image of the state and distribution of the bluebell native and non-native bluebell populations in Sheffield. Woodlands were the main focus of primary data collection as they are the common habitat of H. non-scripta and the species is often used as an ancient woodland indicator. Data was collected by walking a transect through each of the 36 sites visited, stopping every 50 metres to observe the abundance of native or non-native bluebells if present.

This was done using similar, but more simplified methods and objectives than those carried out by Kohn et al. (2009) in Scotland:

1. How widespread and abundant are alien bluebells compared to natives?

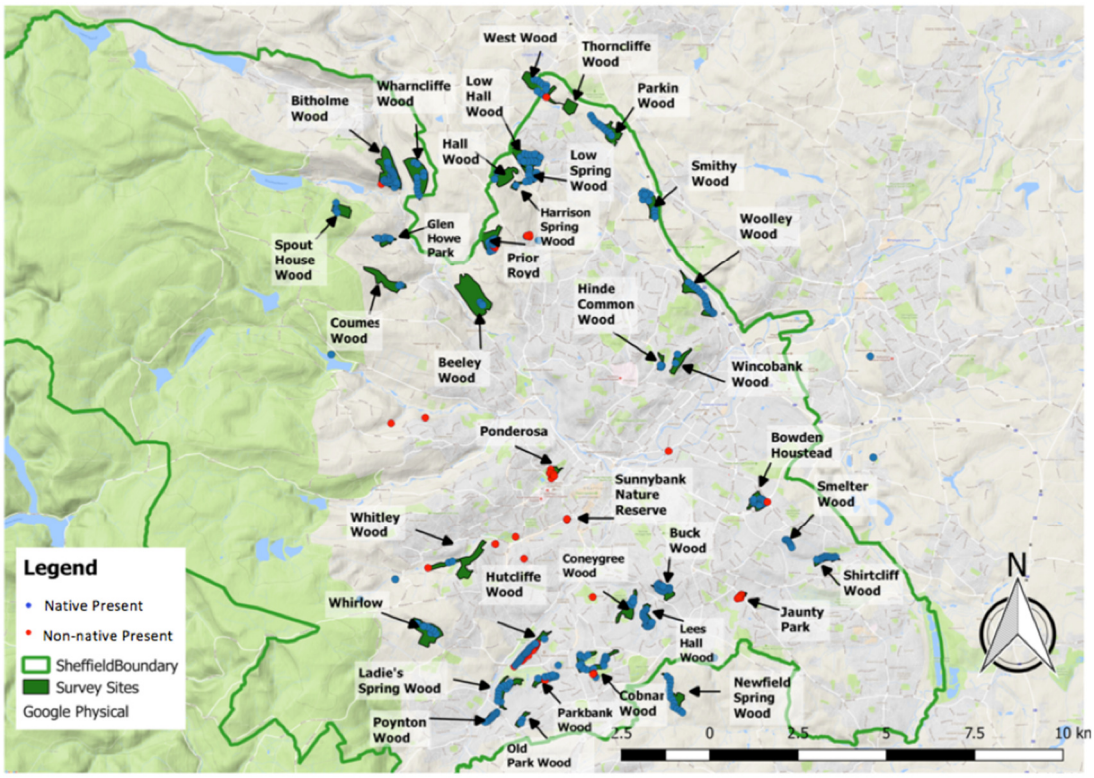

Figure *2: A map including all data collected during the study using Google Physical Backdrop Map Map (©Google 2017) (Contains National Statistics data © Crown copyright and database right [2017] Contains OS data © Crown copyright [and database right] (2017))*

Figure 2 illustrates all 363 data points found through primary and secondary data collection from April to June 2017. Because secondary data did not include a measure of abundance, in order to utilise all data available, analysis was accomplished by converting the abundance data to presence points only, thus allowing the secondary data to be comparable. This means that each point records the presence of native or non-native bluebells but does not into account the abundance of each.

Figure 3 illustrates the much higher number of native bluebells than non-native, with 87% of all records being native.

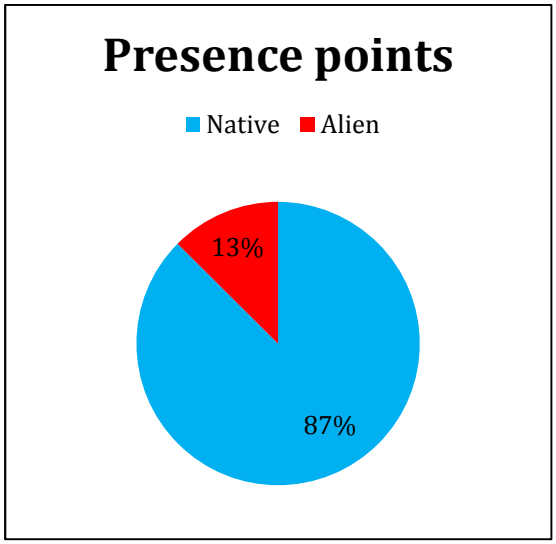

Figure 3: A pie chart of the abundance of bluebells using all data reduced to presence only

2. To what extent do natives and aliens co-occur?

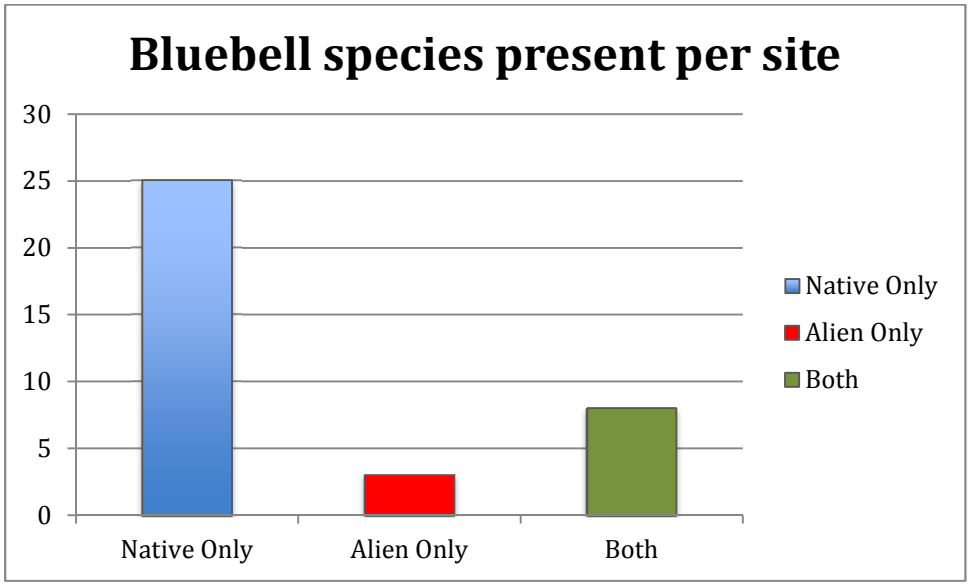

Figure 4: A bar chart showing the co-occurrence of native and non-native bluebells at the 36 sites visited

Of the 36 sites surveyed during primary data collection, 25 included only records of native bluebells while 3 included only non-native bluebells, as shown in figure 4. Both species were found in 8 of the sites present, confirming that the similarity between the niches of the native and non-native bluebell species is enough for them to coexist within close proximity and within an individual woodland habitat.

3. Are aliens primarily associated with anthropogenic habitats?

There was no significant difference between the number of native bluebell and non-native bluebell records found within 25m of anthropogenic influences (figure 5). However, when the data is split between those records within and not within 25m of gardens, there is a visible difference between the number of native records found, as shown in figure 6. Although some of the sites surveyed were rural and large, so many sample points were unlikely to be within 25m of a residential garden, those that were had equal numbers of native and non-native bluebell records. Since only 13% of the records from the entire study were non-native, for the number of records between the two species to be equal within 25m of gardens would suggest some anthropogenic influence in the form of encroachment from gardens or the dumping of garden waste. This is to be expected, as the non-native H. hispanica is not naturally occurring in the UK so must be present in woodlands due to human influence.

It was observed during the site visits that non-native bluebells were often on the outskirts of woodlands but not in the centre. These records were usually found close to dumped garden waste close-by gardens and fly tipping. There are other instances of non-native bluebells which do not appear to be close enough to a garden or dumped waste to be evidence of encroachment, but may be the result of deliberate planting.

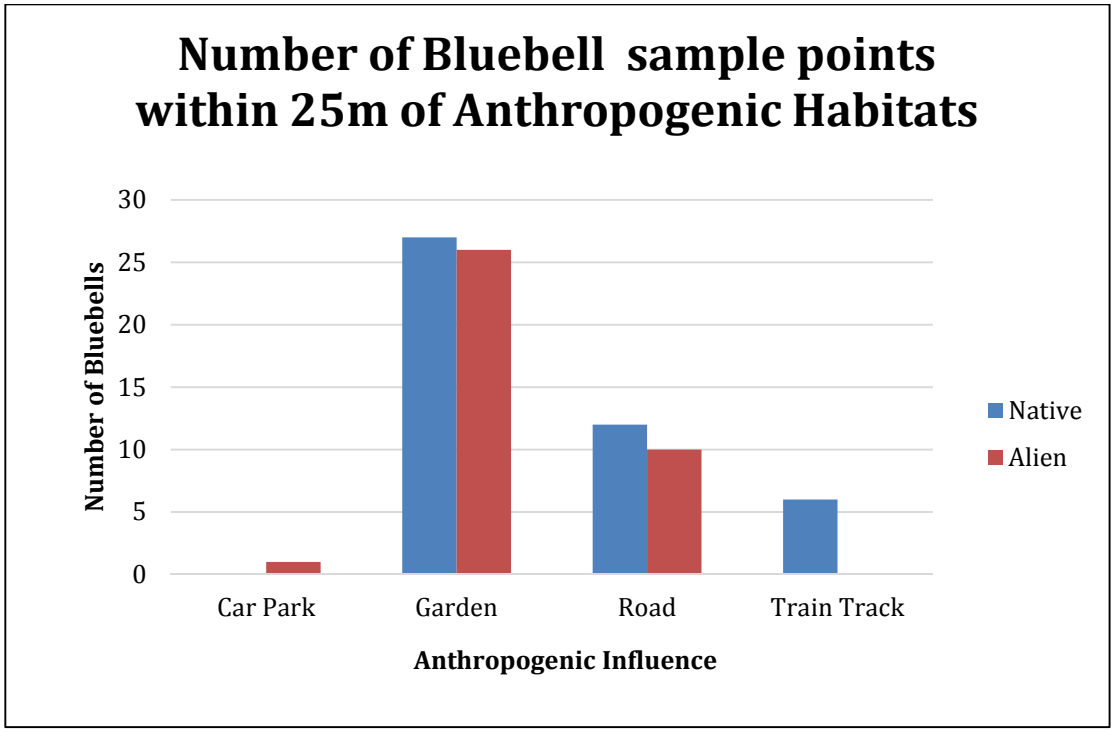

Figure 5: A bar chart of the 82 bluebell point records within 25m of anthropogenic influence

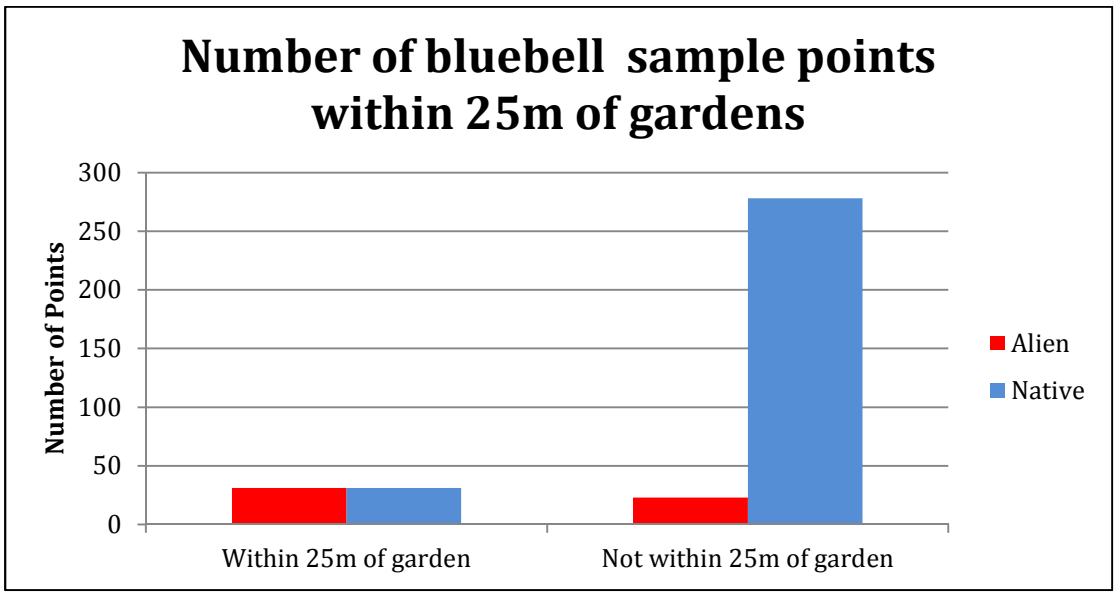

Figure 6: A bar chart of the bluebell point records showing numbers within and not within 25m of gardens

4. Do natives and aliens occupy different niches with respect to habitat?

Elevation

Although the sample size of sites is smaller due to the simplified nature of the study, the results found with regard to elevation are the same as those from Kohn et al. (2009), which found that aliens were 'significantly associated' with lower elevations. This strengthens the conclusions drawn for this study in Sheffield.

Aspect

Kohn et al., found that all aspects contained both species, as was found in this investigation, so it was not examined in depth. However the Sheffield data displays a trend which may have some significance. The south-east facing aspect shows interesting results of few native bluebells but is one of the aspects with greater abundance of alien bluebells. A south-east facing aspect is in sunlight in the late morning so will be warm and humid but not will not experience the more extreme heat of a south facing slope (where there were the fewest aliens). Further study with a larger dataset and a long-term study examining climate data would be useful to further support or contradict these results.

Spatial Location

By using vector analysis, mean centre and standard distance were found in QGIS, these act as average and standard deviation of spatial analysis. The native only and combined species data are very similarly spread, while the alien species shows a tighter standard distance to the mean with a more southerly mean. This, similar to other analysis methods, is affected by the low sample size and can most likely be attributed to the high alien presence at three sites which are in the more central and southern regions of the total survey area.

Habitat Type

Since the primary data collection was not randomised, the use of statistical analysis of the most common habitat type present would be ineffective. Although the main habitat of bluebells, native especially, is likely to be broadleaved woodland, this would be better studied using a larger sample taken over a more diverse area, using a randomised search method. However, this would require greater time and person-power resources than were available in this study.

The threat to H. non-scripta in the Sheffield region is primarily anthropogenic, and can be attributed to habitat loss and the sharing of habitat with invasive species such as H. hispanica. Although several of the ancient woodlands surveyed have non-native bluebells present, they are yet to show signs of large-scale encroachment. Because of this, active management of woodlands is suggested in order to remove the non-native species. This would need to take place on an annual basis, but based on the trends seen during woodland visits for the collection of primary data in Spring 2017, the removal of only a small number of alien specimens could change the status of the area from co-occurrence to entirely native. Despite this, there are some woodlands which would require more intensive management and more importantly, the dumping of garden waste to cease. In order to achieve this, there must be a substantial shift in the public opinion of garden waste disposal. Any conservation to take place would be reactive rather than proactive as the necessary conditions for encroachment and hybridisation are already in place; conservation would be unsuccessful and greatly hindered by continued placement of non-native bluebells into woodlands.

Further study into the habitats of native and alien bluebells is recommended to better understand the impact of climate and encroachment over time. In order to understand this effectively, the comparable studies should be repeated over several years, making more detailed observations of areas of co-occurrence in order to better predict future trends.

References

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The Star. (2016, November 1). Plan to bring 'shady areas' of Sheffield park into bloom by planting 3000 bluebells. Retrieved February 20, 2017, from The Star, http://www.thestar.co.uk/news/plan-to-bring-shady-areas-of-sheffield-park-into-bloom-by-planting-3000-bluebells-1-8211338

Mapping Data

Land Cover Map 2015 [TIFF geospatial data], Scale 1:250000, Tiles: GB, Updated: 24 March 2017, CEH, Using: EDINA Environment Digimap Service, <http://digimap.edina.ac.uk>, Downloaded: 2017-09-04 06:45:13.204
Office for National Statistics (2011). 2011 Census: boundary data (England and Wales) [data collection]. UK Data Service. SN:5819 UKBORDERS: Digitised Boundary Data, 1840- and Postcode Directories, 1980-. http://discover.ukdataservice.ac.uk/catalogue/?sn=5819&type=Data%20catalogue, Retrieved from http://census.ukdataservice.ac.uk/get-data/boundary-data.aspx. Contains public sector information licensed under the Open Government Licence v3.

OS Terrain 5 [ASC geospatial data], Scale 1:10000, Tiles: se00ne,se00se,se10ne,se10nw,se10se,se10sw,se20ne,se20nw,se20se,se20sw,se30ne,se30nw,se30se,se30sw,se40ne,se40nw,se40se,se40sw,se50ne,se50nw,se50se,se50sw,se60nw,se60sw,sk07ne,sk07se,sk08ne,sk08se,sk09ne,sk09se,sk17ne,sk17nw,sk17se,sk17sw,sk18ne,sk18nw,sk18se,sk18sw,sk19ne,sk19nw,sk19se,sk19sw,sk27ne,sk27nw,sk27se,sk27sw,sk28ne,sk28nw,sk28se,sk28sw,sk29ne,sk29nw,sk29se,sk29sw,sk37ne,sk37nw,sk37se,sk37sw,sk38ne,sk38nw,sk38se,sk38sw,sk39ne,sk39nw,sk39se,sk39sw,sk47ne,sk47nw,sk47se,sk47sw,sk48ne,sk48nw,sk48se,sk48sw,sk49ne,sk49nw,sk49se,sk49sw,sk57ne,sk57nw,sk57se,sk57sw,sk58ne,sk58nw,sk58se,sk58sw,sk59ne,sk59nw,sk59se,sk59sw,sk67nw,sk67sw,sk68nw,sk68sw,sk69nw,sk69sw, Updated: 30