Assessing the biodiversity of a Swansea street planting

Biodiversity & Ecosystem Services

ACNA4002

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1. Introduction

Biodiversity can be a challenging concept to define. The term was first used by several different scientists in the 1980s (Sarkar, 2021), and at the time was used to refer to species diversity, with the counting of present species being the primary tool used to assess the state of biodiversity in a given study site. Nowadays, it is suggested that other concepts, such as ecosystem layout and genetic makeup, are also important in the measurement and therefore the conservation of biodiversity (Cassetta, Marques da Silva & Vecchi, 2019, pp. 4-6).

The site chosen to assess is a street planting bed approximately 10 by 15 metres, located by the bus stop on Orchard Street, as shown below, figure 1. This site was selected due to its location. It is next to a well used road, leading into Swansea city centre, and there are tall buildings on either side of it. The bus stop causes human traffic to regularly pass through the area.



Figure 1 - Site outlined in red. Source: Google Maps, 2022.

In 2021, the population of Swansea county numbered at 230,500, out of the total population of Wales, which numbered at 3,107,500 (Swansea Council, 2021). The United Nations (2018)

suggest that 68% of the world's population could live in urbanised areas by 2050, and Aronson *et al* (2014) found that cities around the world support significantly lower densities of bird and plant species than non-urban areas do, in comparison. Therefore, the monitoring of urban biodiversity is an important topic, as the climate crisis continues to worsen, faster than some scientists expected that it would (Tollefson, 2022).

By conducting tests on the water and soil, and identifying plant species present on the site, this study would aim to assess the condition of biodiversity present in this site by addressing multiple aspects present. Reducing biodiversity to a single dimension limits the ways the information can be interpreted, leaving out often crucial parts of what makes an ecosystem function. To create a long lasting, sustainable management plan, a thorough assessment should be performed (Purvis and Hector, 2000).

This approach also includes identifying factors that may be limiting the biodiversity of the area, such as pollution from nearby roads. Figure 2 demonstrates the layout of roads and buildings around the site.



Figure 2, site outlined in red. Source: Digimaps, 2022.

2. Methodology

Prior to any tests being conducted, the health and safety risks and ethical implications of the study need to be assessed (Wheater et al, 2020). A street bed planting does not have any steep drops or uneven ground, and care should be taken to wash hands prior and after sampling. The site is, however, next to a road, so care must be taken to watch for traffic at all times, and if any surveying takes place after dark, high visibility clothing should be worn. For this study, no organisms will be removed or introduced to the site, and observation and visual cataloguing will be primarily used.

The testing regime is designed to evaluate the biodiversity of the Orchard Street planting bed previously identified, and would consist of a series of tests in three different areas. First, a number of quadrats, which are square frames, subdivided into 100 smaller squares, would be placed on the site, and all vegetation species found within would be counted and recorded in a consistent manner across the site. Using more quadrats leads to the data collected being more reliable (Field Studies Council, n.d) and for this site specifically, 10 quadrats of 1 metre each would be used (see figure 3, shown left), and placed in a random manner, as the site is small. A measure of either species cover or species frequency could be taken. A species cover test is a count of how many squares of the quadrat any given plant is present in, and a species frequency count is the counting of the number of individual species present in the quadrat. For this study, a species frequency count would be undertaken, to ascertain the variety of species on the site.



Figure 3, 1m quadrat.
Source: Moses, R. 2022.

The next set of tests focus on soil. Soil plays a vital role in ecosystems, and proper managing of damaged soils and protection of undamaged soil is crucial in allowing ecosystems to continue functioning optimally (Smith et al, 2021). To assess the quality of the soil present on the Orchard Street site, several tests should be undertaken. The initial one would be a test to ascertain the texture of the soil. As a street bed, there are lots of opportunities for compaction, and certain types of soils compact more easily than others. Clay soils in particular are vulnerable to compaction if walked on when wet, whereas sandy textures are more prone to erosion in rain (Royal Horticultural Society, n.d). This test can be undertaken by filling a jar with lightly sieved soil collected from the site, adding water, shaking thoroughly, and leaving it to settle. The settling reveals the different components of the soil, as they become visible in layers (Jeffers, 2018). This means you can identify the proportions of differently textured soils present, and work out which one dominates using a soil texture chart.

The pH of a soil affects in a large number of ways the plants that will be able to establish themselves and then continue to grow healthily in that area (Bickelhaupt, 2022), because the pH

of a soil can limit the plant's ability to absorb certain nutrients. Different plants prefer to grow in different soil pHs, so a pH test provides useful information about the kind of biodiversity that can be expected. This can be tested using a test kit, sampling the soil and checking the colour that appears on the test paper.

There are no bodies of water present on the site, so water testing would need to be conducted on rainwater. Measuring the amount of rainfall that reaches the site in question would provide information that would further support the pH of soil data in determining which plants could grow there. The annual average rainfall in Swansea county in 2019 was estimated at being 1321mm (Climate Data, 2019).

The way rainwater is managed in urban settings will play a crucial role as the climate crisis worsens. The correct management of these systems, such as the creation of green roofs and using permeable pavers in construction, could benefit local biodiversity greatly. Biodiversity must be incorporated into all levels of urban water management, from the local to the global, for the most effective outcomes to be achieved (Pille, L., and Säumel, I., 2021).

Street plantings, such as the street tree shown opposite (Figure 4), are beneficial in a number of ways to both increasing biodiversity and improving the living conditions of the human population in urban areas. They provide a number of ecosystem services including habitat provision, lowering of temperatures, carbon mitigation, lowering of noise pollution, and improving the physical and mental health of people around them (Forest Research, n.d.; Woodland Trust, n.d). However, to reach the full biodiversity potential of the plantings, as with water management regimes, biodiversity needs to be a focus from the planning stage to implementation. Liu and Slik (2022) conducted a study of cities around China, and found that many cities have a limited range of species used as their street trees, and many of these species are not native to the area, which implies that they might have a limited use in attracting or increasing biodiversity. A local, situational approach needs to be foregrounded to support biodiversity in urban planning.



Figure 4: Berlin street tree. Source: Nekoranec, 2018.

Using plant identification keys and guidebooks, such as the Collins Tree Guide (Johnson, 2006) the plants on the site should be identified and recorded. Using online resources, such as the Royal Horticultural Society's Find a Plant database (2022), information about the plants present should be gathered to use in analysis of the biodiversity of the site. The apparent health of plant specimens noted should also be recorded, as well as any obvious limiting factors, such as visible sources of pollution, rain shadow effects from nearby buildings, or pest infestations.

3. Results and Discussion



Figure 5: The site.
Source: Moses, 2022.

Due to limited access to laboratory space, it was not possible to conduct many of the suggested tests above at this time. Expected results of soil testing, however, would include finding a heavier soil, with contaminants present from Swansea's industrial history. The British Geological Survey (2001) discusses the coal mining that took place in Swansea, and the subsequent copper, zinc and lead mining and processing that continued up until the 1970s, and describes the rock type underlying the Swansea area as Carboniferous era sedimentary.

Present on the site is one specimen of the Field Maple, *Acer campestre.* This tree is native to the UK, and is a valuable food source for aphids, and therefore the predators that feed on aphids, such as ladybirds, supporting the food web onwards. The other tree specimen present was the Sycamore, *Acer pseudoplatanus,* which supports a similar range of wildlife as *A. campestre* (Woodland Trust, n.d).

These two tree species are closely related, being in the same genus, and a wider variety of plant species could enable Swansea street plantings to support a corresponding wider range of wildlife. It can be challenging to introduce variation in sites with constraints like the kind that street plantings often have, but it can be accomplished by being inventive. In 2022, the Wildlife Trusts partnered with a media company named Clear Channel to create bus shelters that have green roofs to encourage pollinators and help increase community and local council involvement with the environment (Wildlife Trusts, 2022).

The grass on the site was identified as primarily being Perennial Ryegrass *(Lolium perenne).* There was some presence of Dandelion *(Taraxacum sp.)* and Wild Geranium *(Geranium maculatum),* but a near monoculture with regards to the grass species present was found. The introduction of native wildflowers such as Eyebright *(Euphrasia sp.)* and Yellow Rattle *(Rhinanthus minor)* would greatly benefit pollinators, and, as both plants are semi-parasitic, partially feeding off tougher grass species, they would help control grass growth during summer, keeping levels under control and lessening the need for mowing, while keeping a busy street accessible to everyone.



Figure 6: Site grass.
Source: Moses, 2022

4. Limitations of Study

The impact of the urban management of Swansea city centre on biodiversity merits considerably more study. A longer term, wider scope interrogation of organisms present, with data from soil, water and air quality tests collected would provide more information about the area and therefore how to manage the site in the most effective way to increase biodiversity in a focused, locally appropriate manner. Key input from inhabitants should be gathered, and the management plans of nearby counties such as Carmarthenshire should be observed and taken into consideration. This regime was designed during November, tests all year round will yield different results and provide different testing opportunities.

5. Conclusion

Throughout this study, a potential testing regime to examine the biodiversity of a street planting site in Orchard Street, Swansea has been outlined. The study has highlighted the pattern of similar species being planted into the bed in close proximity, and how the factors of historically polluted soil and heavy rainfall could impact the potential management of the site.

Creating a unified approach across county lines and throughout different parts of Swansea will be crucial to creating a continuous ecosystem. Swansea has a long legacy as an industrial city, and the traces of that past will continue to impact the efforts to improve biodiversity here. Constrained by busy roads and high footfall, managing street plantings will take planning and coordination with the local authority and the community. However, there is lots of potential for a positive, more biodiverse future for sites such as these.

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