

Original Paper

Exploring the Ecological Benefits of Dead Wood and the Opportunities of Interpreting Dead Wood to the Public

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Abstract

According to the Practice Guide of Managing deadwood in forests and woodlands, all types of dead and dying trees of 10 cm or more in diameter are recognised as deadwood. Dead wood is very important to the health of the forest, and this is increasingly recognized by environmentalists and ecologists. Dead wood is thought to be vital to the health of a wood or forest because it can help to reduce soil erosion and create stability (Gamekeeperstrust, 2019). Not only is it an aspect of the nutrient cycling process, it provides a stable, slow-release nitrogen source and is thought to play an important role in carbon storage. Falling logs can also increase the soil stability of the woodland (Pupplet, n.d.). Although every forest and woodland are different, and owners and managers have different management objectives, deadwood should be considered in most situations. Current evidence suggests that, over the long term, deadwood should amount to roughly 20 m³ per hectare averaged across the forest management unit. Some management actions are general to all woodlands, but there are others which are specific to woods or areas of higher ecological value. This approach requires that areas of high ecological value be identified during management planning. The public as the target users of our future design, their attitude is also essential to integrate the characteristics of dead wood into the design of urban environment landscape.

Keywords

Dead wood, Choice of dead wood location in the city, Dead wood in the urban context.

1. Introduction

Dead wood is always simply considered as standing obstacles or fallen dead tree materials and logs (Buglife, 2011). Because of threats and untidiness from the perspective of landscape design, it has only recently received the attention and recognition of ecological benefits by some experts and forest managers. In my opinion, dead wood not only has high ecological, but also has educational significance for future environmental protection aim, especially if it can be applied to urban landscape.

2. Overview of Dead Wood Research

According to the Practice Guide of Managing dead wood in forests and woodlands, all types of dead and dying trees of 10 cm or more in diameter are recognised as dead wood (Rotherham, 2013) (Figure 1). However, some experts believe that the term dead wood encompasses all woody material in forests that is no longer living, but except for dead wood parts of living trees. Therefore, dead wood is divided into 4 categories, which does not include the first type in Figure 1 (Harmon & Sexton, 1996).

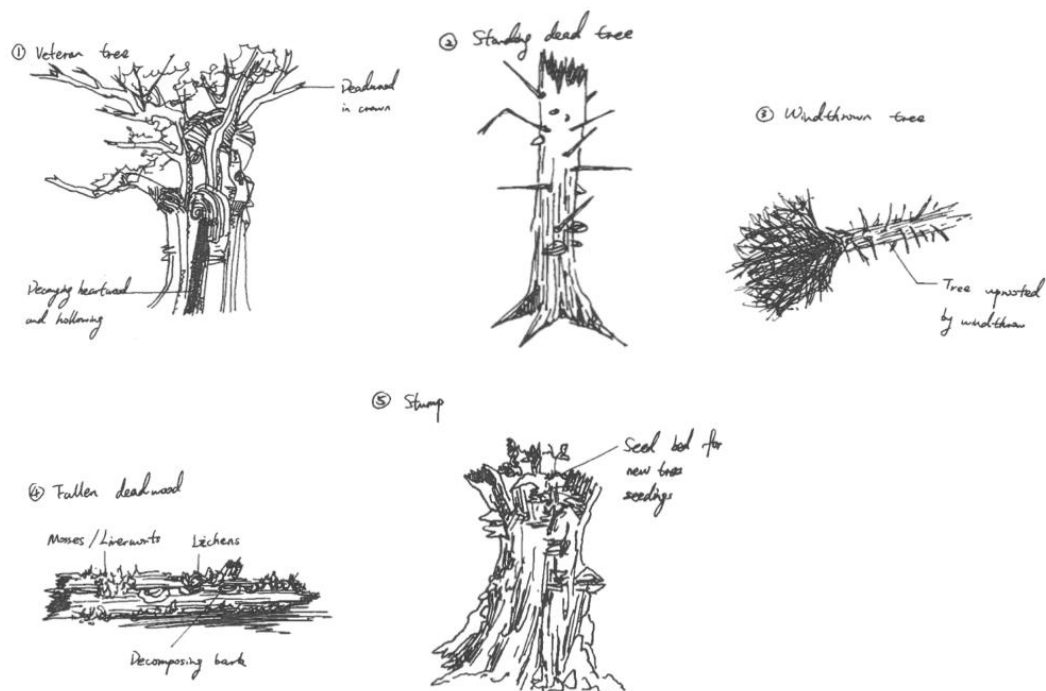


Figure 1. Dead Wood Types

However, no matter which part of the tree, including the fallen dead branches and the fallen trunk, the dead wood plays an important role in the forest ecosystem and has a high ecological value. According to a study, dead wood can account for more than 30% of the entire woody biomass in healthy wild forests (Pupplet, n.d.). They have made significant contributions to the creation of wildlife habitats, the

consolidation of ecosystems and the improvement of river stability. They will be explained separately in the following part.

2.1 The Value of Dead Wood

2.1.1 The Value of Dead Wood to Plants

Firstly, a wide variety of plant and animal species depend on dead or dying wood habitats mostly as a source of food. It can be said that dead wood is the cradle of life, which maintains the ecological balance of the entire forest community, and the decaying trunk is an ideal place to establish a “microhabitat”. In another word, dead wood is a temporary habitat that decays over time, forming decaying holes in branches and hollow trunks. Many birds and bats use these holes as nesting places. At the same time, it also supports a large and diverse range of invertebrates, which can also serve as food for nesting animals (Peterken, 1996). Furthermore, because of the growth of epiphytes and fungus on dead wood, many insects depend on the growth of this kind of vegetation. At the same time, some birds and bats also need plants and insects, which forms an ecological community (Figure 2). According to the data, nearly 40% of forest organisms, including various rot-dependent vertebrates and invertebrates, rely on this “microhabitat” (Clydeandavonvalley.org, 2017).

In addition, dead wood is also particularly valuable for epiphytic plants such as lichen, moss and moss plants (Figure 2). These groups are particularly rich on old open-growing branches or fallen trunks because these trees provide a good uncovered surface. However, since these groups have a slow inheritance rate, it may take decades to develop a wealthy community (Fletcher et al., 2001). In addition, these trees are also important for fungi that break down dead wood. First, fungi and tree roots are symbiotic, and fungi depend on dead wood for survival. Also, the fungus feeds directly on most of the other species in this ecosystem, which feed on their fruiting bodies or hyphae and indirectly feed them by softening the dead wood to allow it to be digested by other species (Selva, 2014). Off all the species mentioned above, the characteristics increase the diversity of the microhabitat provided by the tree, and increase the diversity of wild animals it can accommodate as well. Therefore, while enriching biodiversity, this interdependent relationship also helps to enhance the stability of the dead wood ecosystem.

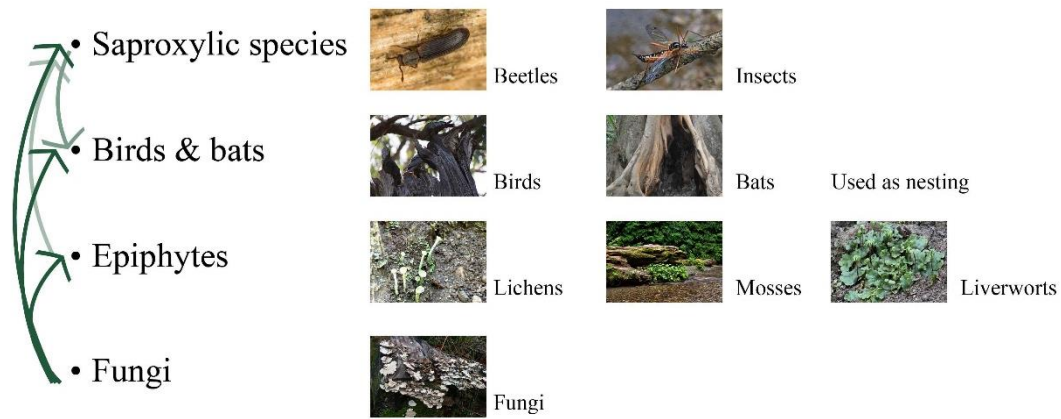


Figure 2. Biodiversity in the Dead Wood (Google.co.uk, 2019)

2.1.2 The Value of Dead Wood to Animals

At the same time, many invertebrates depend on dead wood habitats. A recent study of sub-fossil beetle fauna, a species formed in the last Ice Age, shows that nearly 47% of beetle species are saproxylic species (Alexander, 2016). At least 40% of the lives of the saproxylic species depend on dead or decaying wood. They are one of the most threatened invertebrate communities in Europe (Söderström et al., 1992). Since they not only live in the rather remote habitats of today, but they can only grow in a limited space. According to a survey, one-third of the 45 British wood beetles have ceased to exist, and the only remaining ones are rare (Clydeandavonvalley.org, 2017). However, some of them can still be found in some undestroyed or inaccessible woodlands. For example, in Dalkeith woodland, four nationally rare beetles and five regionally rare beetles were found in the country (DALKEITH OAKWOOD SSSI SITE MANAGEMENT STATEMENT, 2010). In addition to beetles, some insects that depend on fungi can also be found in dead wood. For example, the black tinder fungus beetle living in the fruiting bodies of the *Fomes fomentarius* can be found in the dead wood, although the *Fomes fomentarius* is not good for trees (Figure 3). In addition, other species can also be found in dead wood, such as *Pyrochroa serraticornis*, *Agrilus biguttatus*, *Dasytes plumbeus* and *Lucanus cervus* (Figure 3).

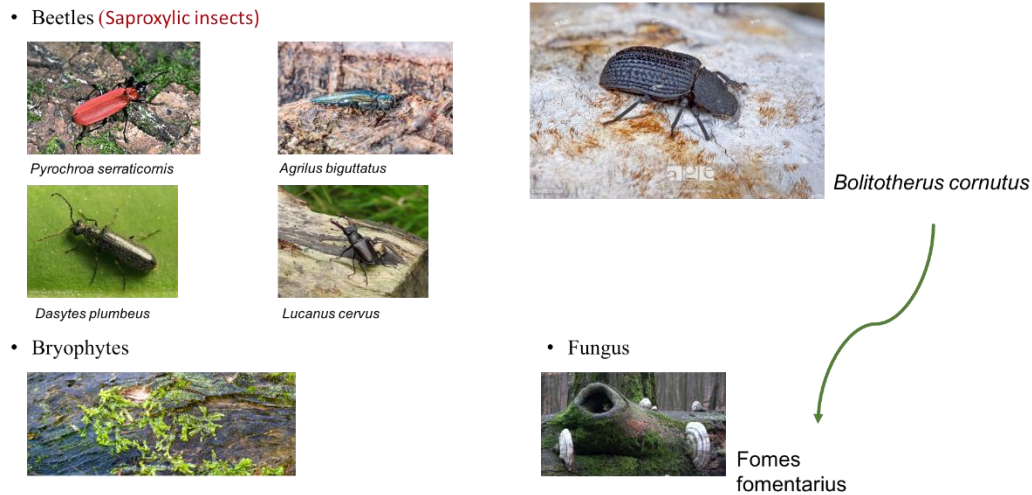


Figure 3. Species Living in Dead Wood (Google.co.uk, 2019)

2.1.3 The Value of Dead Wood to the Environment

In terms of stabilizing rivers, it is a common practice to use dry trunks on the banks of the river to stabilize the riverbank, and then place dead wood over the creek to help some small animals migrate. In addition, coarse woody debris is a newer application because it can be applied to urban river landscapes. The woody debris of urban aquatic habitats may not effectively reduce urban runoff, but it can reduce the amount of sediment entering the river.

2.2 Choice of Dead Wood Location

There are two examples of good dead wood locations (Figure 4). As can be seen from Figure 4, these two examples are Cadzow Oaks and Earthworks and Dalkeith Country Park. Both places are located on the outskirts of Edinburgh and dead wood is only found in the woods. Among them, in Dalkeith Oak Woodlands, the dead ancient cadzow Oak was discovered. This site has not experienced any fire or mechanical cleaning, maintaining a complete natural dead wood landscape (Rotherham, 2013). Also, as can be seen in the fieldtrip in Dalkeith, this place has a certain distance from the surrounding residential area. Although some human activities can be seen during the fieldtrip, such as walking the dog and strolling, the place still feels sparsely populated. As can be seen from the above two examples, dead wood is basically distributed in forests that have not been seriously developed, and there are few related signs of this plant alongside. Moreover, in the city, people rarely see dead wood, so there is little understanding of dead wood. This will be the focus of my focus in the second part, and some solutions are proposed.

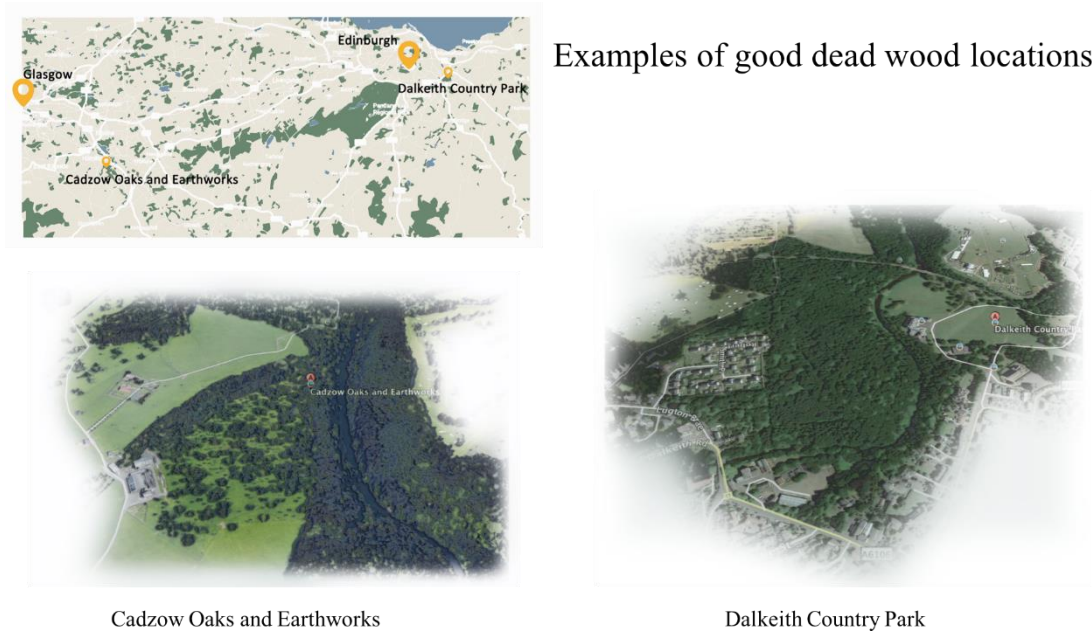


Figure 4. Examples of Good Dead Wood Locations

2.3 Management of Dead Wood

Normally, dead wood is present in the woodland, and the relative management methods are also based on the forest. Although the situation is different for each forest and woodland, owners and managers have different management objectives, but in most cases, consideration should be given to retain and increase the habitat of dead wood. Specific management actions to increase dead wood can be divided into four categories: working with natural processes, protecting and increasing the value of existing dead wood, creating and expanding dead wood habitats, and improving the links between dead wood habitats (Humphrey & Bailey, 2012). The authors suggest that management recommendations for dead wood should be considered along with other aspects of biodiversity and combined with other priorities such as safety, wood, wood fuel and recreational activities.

2.4 Author's Suggestion

Dead wood may not be the most attractive place in the landscape. After all, there are some safety hazards and cleaning problems in the dead wood. In contrast, visitors gravitate to see a “clean and tidy” landscape. Therefore, the usual management practice is to remove any dead tree immediately in order to protect people’s lives and the cleanliness of the landscape. However, we cannot ignore the ecological benefits and educational significance of the landscape. For example, according to Werminger et al. (2007), the protection of saproxylic insects, especially beetles, depend on the quality and quantity of dead wood in the landscape. More importantly, in the landscape, the educational significance of dead wood to people is underrated. The public responds to environmental education and supported dead wood after they understand its importance (Gundersen & Frivold, 2011). Similarly, another study shows that it can effectively improve the public’s attitude towards dead wood if people could recognize the ecological

value of it (Tyrväinen et al., 2003). Therefore, I think that although changing the public's perception of dead wood is a challenge, it is necessary to try to make people understand dead wood and accept it by integrating dead wood into the future urban landscape design.

2.4.1 Applying Dead Wood to the Urban Context

Normally, Firstly, it makes sense to apply dead wood in the urban context. Based on the distribution of forest resources around Edinburgh (Figure 5 inventory map), it can be seen that the trees in Scotland are very rich in resources, mainly Conifer. More importantly, the proportion of Felled wood ranks second in the overall forest resources, indicating that the resources of dead wood are very rich. Further narrowing the scope to Edinburgh and its surrounding areas, it can be seen from the estate map (Figure 6) that the forest resources around Edinburgh are mainly distributed around 30 km away. Therefore, at present, people who want to understand dead wood must drive a long distance. Therefore, it is meaningful to introduce the dead wood landscape into the city so that people can understand the dead wood for educational purposes.

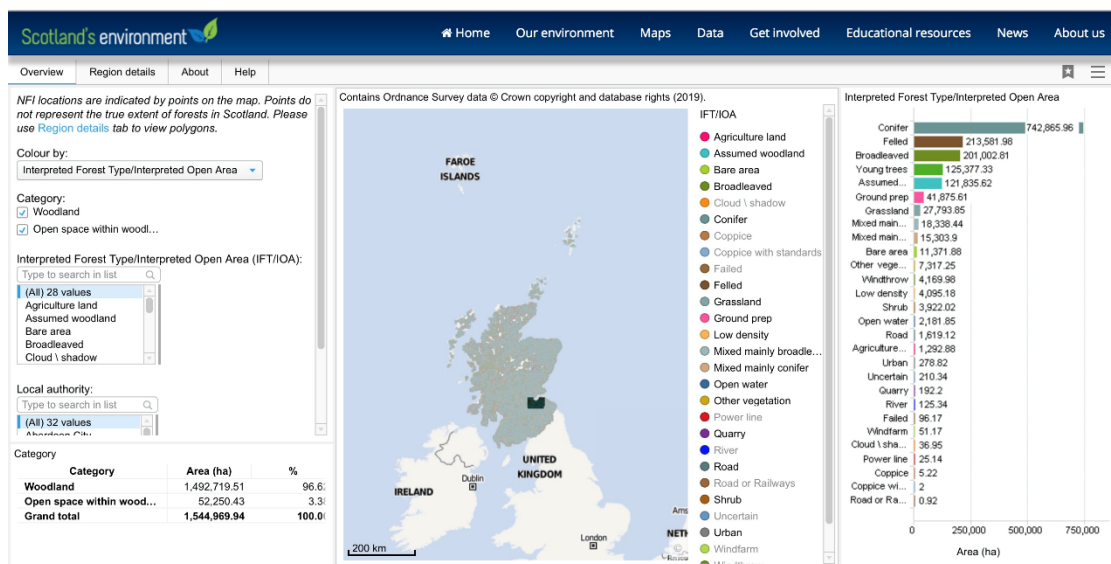


Figure 5. Distribution of Forest Resources in Scotland (National Forest Inventory, 2019)

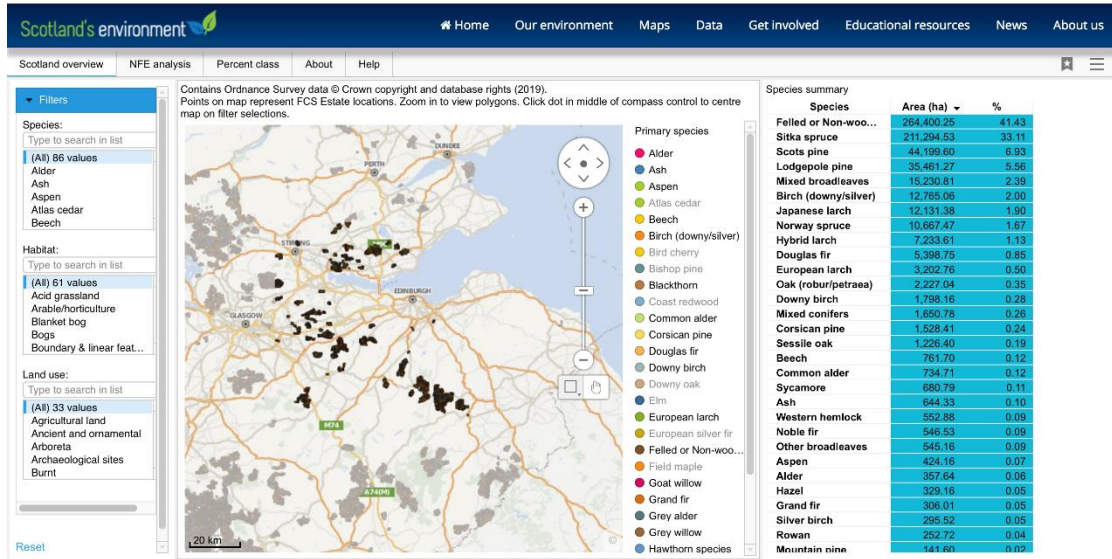


Figure 6. Distribution of Forest Resources in Edinburgh (National Forest Estate, 2019)

As mentioned above, letting people understand the benefits of dead wood can effectively improve the public’s attitude towards dead wood. This is the reason why the population density map in Edinburgh (Figure 7) is selected as a reference. Also, according to Tyrväinen et al. (2003), it can be effective in convey the environmental benefits of dead wood to younger generations. As a result, the Age 0-15 population density map (Figure 8) is chosen. Based on that, I combined those two maps and the attractions in Edinburgh together and then designed a new map (Figure 9) to highlight the high opportunities sites of educational purposes.

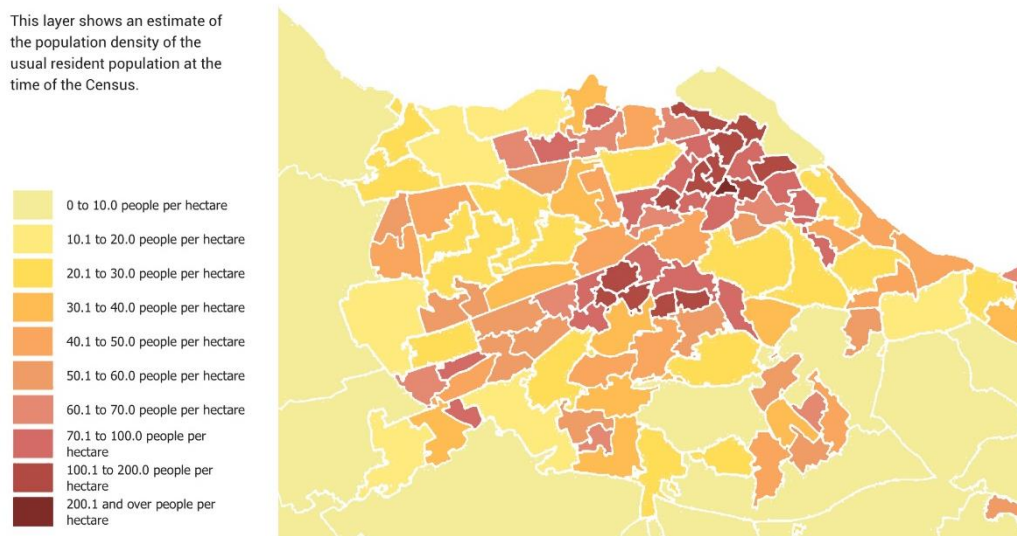


Figure 7. Population Density Map in Edinburgh (Digimap.edina.ac.uk, 2019)

This layer shows the percentage of the population that we aged 0 to 15 years on Census day 27th March 2011.

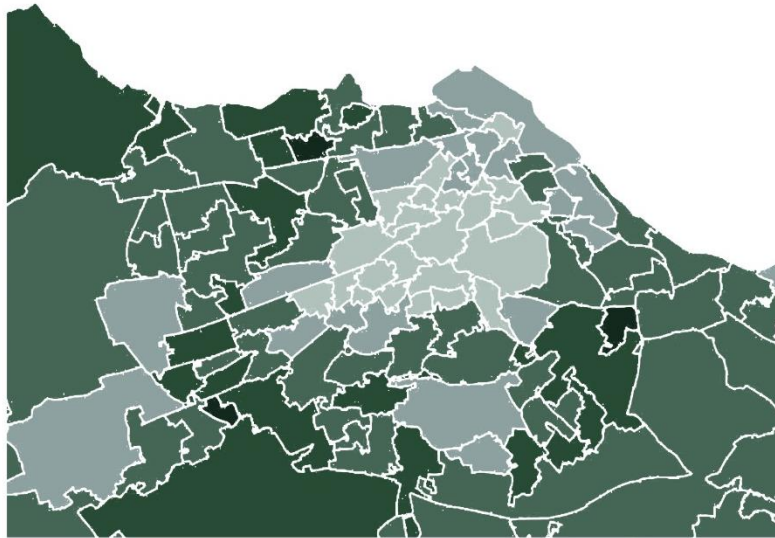
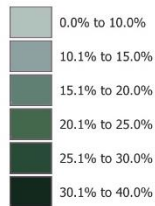


Figure 8. Age 0-15 Population Density Map in Edinburgh (Digimap.edina.ac.uk, 2019)

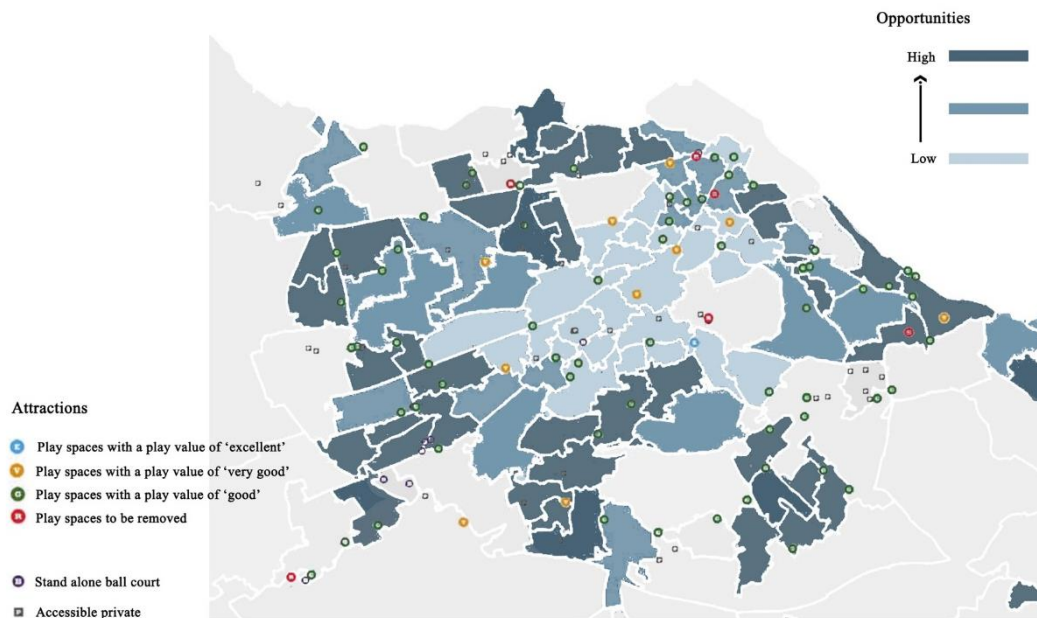


Figure 9. High opportunities Sites of Educational Purpose

According to Figure 9, I designed a map (Figure 10) with satellite map to figure out the proposal 'dead wood' sites where people, especially for the young, have got more opportunities to know dead wood. In addition, the possible direction of dead wood transportation and flow direction have been shown in the map. From this map, it can be seen that although the locations of dead wood in the future are still not in the central area of Edinburgh, people would not take too long to see the dead wood. Furthermore, there are more schools in the spots shown on the map so that more children can be given the opportunity to get

to know the dead wood at an earlier age. This has a very positive effect on dead wood conservation projects in the future.



Figure 10. Proposal 'Dead Wood' Sites

2.4.2 Activities Associated with Dead Wood That Can Be Generated

More specifically, for the activities related to dead wood in the urban context, I summed up the following points of the opportunities of interpreting dead wood to the public (Figure 11). As can be seen from Figure 11, in addition to the conventional removal of dead wood on the ground which negatively affects the saproxylic fauna (Ricarte et al., 2009), dead wood has more possibilities to participate in the urban landscape. Especially for urban plazas and schools, it can be seen that such places have more possibilities for using dead wood in the urban context such as exhibitions, benches and surfacing materials.

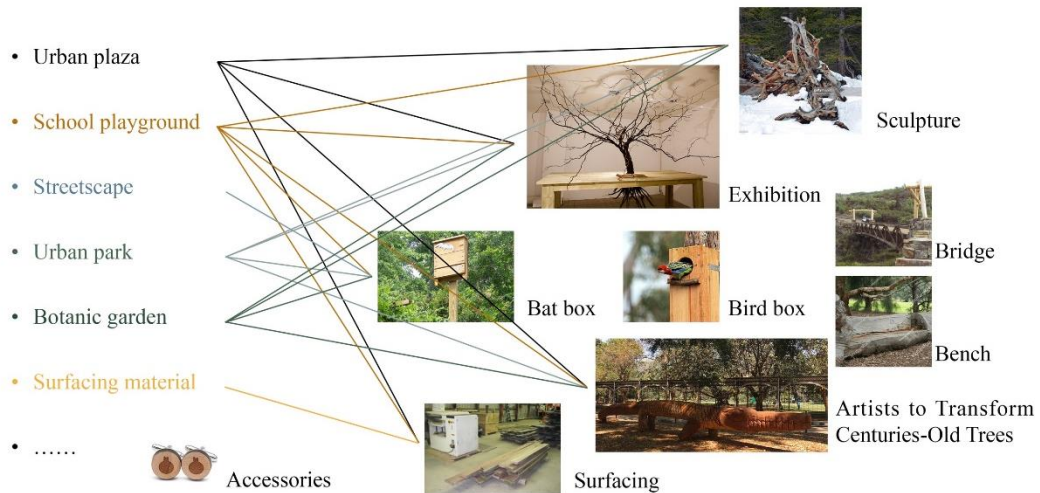


Figure 11. The Opportunities of Interpreting Dead Wood to the Public. (Google.co.uk, 2019)

3. Conclusions

In summary, dead wood has a very high ecological value, whether it is in the forest or in the city. In addition, although some experts are now focusing on the protection of dead wood, the public still needs education about the protection of dead wood and ecological values to make them have a more positive attitude towards dead wood. This educational significance, especially for children and young people, is more important in the future protection of dead wood. We hope you find the information in this template useful in the preparation of your submission.

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