Impact of Basement Development on Biodiversity

Partial Review of the Core Strategy

THE ROYAL BOROUGH OF
KENSINGTON AND CHELSEA

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The potential impact of basement excavation on biodiversity

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1. Background

1.1 There is an increasing trend for domestic basement extensions in the Borough. The current policy allows a maximum extent of basements to under 85% of the garden. This results in digging up virtually the entire back garden with ensuing loss of soil and vegetation.

1.2 The Royal Borough is proposing a new policy to restrict basement development to a maximum of 50% of back gardens and no more than a single storey. The Borough's Planning department has asked the Ecology Service for its views on how the excavation of a large proportion of garden space, in accordance with existing policy, may impact on biodiversity.

2. The importance of gardens for biodiversity

2.1 Private gardens associated with residential zones (domestic gardens) may contribute the greatest proportion of urban green space. Estimates for United Kingdom cities suggest that domestic gardens comprise 19-27% of the entire urban area. A study of five UK cities showed that domestic gardens covered more than 20% of the urban area, and ranging from 35% in Edinburgh to 47% in Leicester (Loram, et al, 2007). In London, 37,900 hectares (ha), approximately 24% of the city, is comprised of private, domestic garden. Of that garden land, 57% or 22,000ha is vegetated cover (lawn, tree canopy and other vegetation). Therefore, approximately 14% of London is garden greenspace (Smith, 2010).

2.2 Urban green spaces, such as domestic gardens, are becoming increasingly important refuges for native biodiversity (Goddard, et al. 2010), and play an important part in maintaining biodiversity in urban areas. Some of the different factors are discussed below:

2.3 **Ecological value:** this is a generally under-researched area but available evidence suggests that domestic gardens, as opposed to other types of green space, offer an extensive, unique and undervalued resource for enhancing urban biodiversity (Goddard, et al. 2010). In particular gardens play an important role in supporting diverse wildlife populations. Gardens in the UK are becoming increasingly important for particular species such as common frog (Carrier & Beebee, 2003), hedgehog song thrush and bumblebee (Goulson, et al, 2002) (as the quality of wider countryside deteriorates). However, the benefit to wildlife will depend on the composition of the garden, such as differing landcovers e.g. grass lawn, paved patio, cultivated flower beds, etc. (Smith, 2005).

2.4 **Ecological function:** domestic gardens can form extensive, inter-connected tracts of green space. Benefits of individual gardens arise from them acting as isolated patches, as components of a landscape that includes other vegetation, or as corridors through the urban matrix. Researchers are arguing that it is increasingly imperative that gardens are not viewed as separate entities at the individual scale, but instead managed collectively as interconnected patches or networks of green space acting at multiple scales across the urban landscape (Goddard, et al. 2010).

2.5 **Size:** A study of 61 gardens in Sheffield, UK, showed that garden size plays an overwhelming role in determining garden composition: larger gardens support more landcovers, contained greater extents of three-quarters of the recorded landcovers, and were more likely to contain trees taller than 2m, vegetable patches, and composting sites (Smith, 2005). All categories of vegetation canopy increased with garden size, and large gardens supported disproportionately greater cover above 3m and thus contribute more to ecosystem services.

2.6 Garden area partly determines the availability of particular landcovers and thus the presence of potential habitat for wildlife (Smith, 2005).

2.7 **Invertebrate species richness:** Vegetation, especially tree cover, is the garden feature most likely to provide benefits for the widest range of invertebrate taxa (Smith, 2006). The number of trees greater than 2m high in a garden explained 73% of the total variation in leaf-miner species richness (more than 10 times the variation as for other factors) in a study examining environmental correlates of invertebrate species richness in 61 urban domestic gardens in Sheffield.

3. The decline of gardens in London

3.1 A recent report (Smith, 2010) investigating gardens in London shows that garden composition is changing dramatically, largely due to changes in garden design and management. The area of vegetated land present in 1998-99 had dropped 12% in 2006-08, a loss of 3,000ha. The amount of hard surfacing in London's gardens increased by 26% or 2,600ha. The area of garden buildings increased in area by 55% or 1,000ha. The amount of lawn decreased by 16% or 2,200ha. Overall vegetation in gardens decreased by 12% or 3,000ha (Smith, 2010).

3.2 The research also looked at residential housing developments on garden land that required planning permission and had been implemented over a three year period between April 2005 and March 2008. Unsurprisingly, there is a significant difference between land cover before and after housing developments granted planning permission are completed on garden land. Prior to development there is proportionately more vegetated land cover (tree canopy, lawn, other vegetation) than there are hard features (patios, side passages, buildings). After development, the proportion of vegetated land decreases, and hard features increase. There is an average increase in hard-surfacing and buildings (including the house footprint) of 210m^2 per development. This, coupled with an average loss of

200m^2 greenspace per development (remaining loss was of miscellaneous surfaces), represents a loss of wildlife habitat and permeability to water. On average 500 garden trees are removed each year due to development of houses on gardens. This means that 1.5 garden trees are lost on average per development project.

3.3 At a London-wide scale these impacts may not be significant, but on a local scale, the impact may be profound in terms of wildlife resources, flood drainage and climate change adaptation.

3.4 While this London wide decline may not be linked to basement development. It is considered that in this Borough constructing basements under a maximum of 85% of gardens will involve excavating almost the entire garden. This can change the composition of the gardens permanently and contribute to the further decline in vegetation.

4. The biodiversity impact of excavating gardens to create basements

4.1 The two biological elements of back gardens to be affected are the soil, or garden substrate, and the vegetation. Both these play a crucial role in supporting and providing a number of ecosystem functions, including the provision of habitat (shelter and forage) for a range of wildlife.

During construction:

4.2 During excavation works it is likely that almost the entire garden area, minus the perimeter buffer, will be dug up and removed offsite. Depending on the size of the garden, and the planned extent of the basement, it is likely that almost all the vegetation (except perhaps on the far perimeters) will be removed. This will leave the site bare for the duration of the works.

4.3 From an ecological perspective, the main consequence in the short-term (during construction) will be the removal of habitat for micro-organisms, invertebrates, birds, reptiles, amphibians and small mammals. Most gardens are surrounded by other gardens, so it could be assumed that the mobile species could move and be supported temporarily. However, some animals are territorial and this will create knock-on effects on local populations. If the works occurred during breeding or nesting season, the removal of the nesting sites could result in a lost generation and/or severe stress on the breeding animal if they have to reproduce again in the same season. Such disturbance could also result in the breeding pairs abandoning the site never to return. Likewise, in the winter season, the works could disturb hibernating animals (this includes overwintering insects as well as small mammals). The energetic costs of being roused from hibernation are often lethal for the animal as they generally cannot replenish their reserves in the winter months.

4.4 The removal and relocation of the soil has a more permanent impact on its micro-organisms and invertebrate populations. If the soil is taken away and redistributed to other sites, potentially in other regions, this will impact on the natural distribution of those animals, which could either lead to their death (if outside their preferred climatic zone) or more worryingly, could lead to introducing them to areas where they will out-compete local fauna. These impacts can be partially mitigated if the same soil that is removed is used to re-cover the same site.

4.5 These impacts may not seem significant if considered for one individual property in a local area. However, if more than 4 properties out of ten undertook large-scale basement excavations at a similar time, then the cumulative impacts on local biodiversity could become significant.

Table 1 Ecological impact table – during construction

Factor	Action	Likely impact	Duration	Significance
Soil	Complete removal	Loss of micro-organisms and invertebrates local to the site	Permanent	Moderate to High
Vegetation	Complete/partial removal	Loss of feeding sites Loss of nesting sites Permanent relocation of breeding animals Disturbance/ death to hibernating animals	Temporary/ Permanent	Moderate to high High

Post construction:

4.6 After excavation, the ecological impacts largely depend on what and how much is placed back. Generally 1m of soil is required to be placed on top of the new basement. A 1m soil depth will be adequate for most types of vegetation to re-establish, however that soil depth will be severely limiting for the growth of large trees. Most homeowners will also avoid planting trees near to the building to avoid disturbance to the ground works from tree roots. If most of the garden is off-limits to large trees this leaves a very restricted amount of space for large trees to grow.

4.7 Although we cannot dictate what homeowners should grow in their private gardens, this action removes the future option and possibility of planting large trees. Large mature trees are fundamental for proper ecosystem functioning, biodiversity and future resilience. Due to their size and stature, large species trees are particularly effective in urban areas in regulating the microclimate, attenuating and filtering water, attenuating noise and improving air quality and sequestering carbon. Mature trees also provide a significant habitat resource, enriching biodiversity in urban areas and promoting access to nature. A report looking at the benefit of large species trees in urban landscapes found that on average the annual net benefit of planting large species trees is 44 per cent greater than for a medium species trees and 92 per cent greater than for a small species trees (Armour, et al, 2012).

4.8 If homeowners re-landscape their gardens in such a way that the habitats previously there are not replaced, or such that vegetative complexity is not re-introduced, then the temporary impacts from pre-construction become permanent. Once again, these impacts may not be severe on a site by site basis but when considered cumulatively, for example, if all plots in a local area were to excavate 85% of their gardens, then the ecological impacts escalate.

Table 2 Ecological impact table – post construction

Factor	Action	Likely impact	Duration	Significance
Soil	1m covering of soil from a different location	Permanent removal of local species Potential introduction of non-local species Reduced drainage options	Permanent	Moderate Moderate High to severe
Vegetation	Replacement with fewer, smaller specimens	Reduction in wildlife feeding opportunities Reduction in habitats Loss of species diversity and abundance (invertebrates, birds) Reduction in cooling and climate mitigation Reduction in surface-water retention	Permanent	Low to moderate Moderate to high Moderate to high High to severe High to severe

5. Conclusion

5.1 In a changing world we should be cautious about removing options that could offer significant benefits in terms of resilience and adaptability. The construction of a basement is a fairly permanent feature; difficult to undo. Considering the acknowledged impacts that large-scale basements have on the ecology of garden sites, particularly the limitations to grow large trees, measures to restrict/limit basement extents are recommended and deemed prudent.

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