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Accessible natural greenspace in towns and cities

A review of appropriate size and distance criteria

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Accessible natural greenspace in towns and cities: A review of appropriate size and distance criteria

Guidance for the preparation of strategies for local sustainability

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Preface

In 1992 English Nature asked the UK Man and the Biosphere Committee's Urban Forum to produce and publish a discussion paper giving targets and guidelines to be used in providing adequate accessible natural greenspace in urban areas.

This paper (Box and Harrison 1993) suggested two minimum targets:

- An urban resident should be able to enter a natural greenspace of at least 2 hectares within 0.5 kilometres of their home.

- Provision should be made for Local Nature Reserves in every urban area at the minimum level of 1 hectare per thousand population.

In addition to these targets, guidelines were suggested for: at least one 20 hectare site within 2 kilometres of all residents; at least one 100 hectare site within 5 kilometres of all residents; and at least one 500 hectare site within 10 kilometres of all residents.

Accessible natural greenspace in towns and cities: a review of appropriate size and distance criteria was commissioned to explore the figures suggested and to see whether, and if so with what degree of confidence, guidelines over size and distance criteria were supported by evidence from natural and from social sciences. The emphasis here is, intentionally, on the human aspects but a summary is given of ecological factors.

The findings are important in the context of strategies for local sustainability and need taking into account in the design and management of natural greenspace in urban areas.

Summary

1. Definitions of natural greenspace in urban areas are provided. Common features are natural surfaces: earth, water and living things.

2. Trends in species richness of natural spaces in urban areas are described.

3. Species/area relationships are reviewed for different natural areas in towns and cities.

4. Strong correlations between site size and species richness are reported.

5. Descriptions are provided for typical sites in urban areas including site sizes of 1 hectare, 10 hectares and 100 hectares.

6. A brief introduction to the potential role sites of differing sizes might play in coping with urban pollution is provided.

7. Recommendations are made for survey procedures designed to identify the full range of natural greenspaces present in towns and cities.

8. Physical and severance factors serving to constrain public access to natural greenspaces are examined.

9. Straight line distances conventionally used to define accessible sites or site catchment areas are found to overestimate the distance people are able, or prepared to walk under present day urban conditions.

10. Recommendations are made about revising conventional distance/time criteria used to identify accessible natural areas and Areas Deficient in Accessible Greenspace. These criteria take account of physical and severance factors constraining use.

11. The influence of physical and severance factors on children's range behaviour in urban areas is reviewed.

12. Conventional distance and time criteria used to define accessible play space are found to overestimate children's freedom to wander in urban and suburban areas.

13. The implications of children's reduced range behaviour for identifying natural greenspace are examined and recommendations made about appropriate distance/time criteria.

14. Social and cultural constraints on the use of natural spaces are reviewed. Fear of crime is shown to be a major constraint on the behaviour of women, children and people of colour.

15. Recommendations are made about design and management strategies for reducing fear of crime and increasing the accessibility of natural areas.

Contents

1. Introduction

Recent planning guidance (Department of the Environment 1994) recognises the important contribution nature in cities and towns makes to social and economic well-being. Likewise, sustainable development by prioritizing quality of life rather than material consumption and economic growth prompts a reappraisal of natural spaces as indicators of local sustainability. The purpose of this report is to help Local Authorities develop policies which acknowledge, protect and enhance the contribution natural spaces make to local sustainability.

Three aspects of natural spaces in cities and towns are discussed:

- their biodiversity;
- their ability to cope with urban pollution;
- ensuring natural spaces are accessible to everyone.

The report aims to show how size and distance criteria can be used to identify the natural spaces which contribute most to local sustainability. The implications of these findings for planners in central and local government, and people in private practice who design the main elements of urban areas are discussed briefly at the end of Chapters 3 and 4 and in Chapter 5.

1.1 What is natural greenspace?

Following the convention adopted by several researchers and agencies in this country (see for example, Cole 1987, Goode 1989, Harrison *et al* 1989, Countryside Commission 1991 and English Nature 1994) and the definition of 'nearby nature' used by Kaplan & Kaplan (1987) in their review of North American studies, **natural greenspace** is defined as:

'Land, water and geological features which have been naturally colonised by plants and animals and which are accessible on foot to large numbers of residents'.

This definition includes:

- sites awaiting redevelopment which have been colonised by spontaneous assemblages of plants and animals;
- land alongside water-ways, transport and service corridors which although perhaps once deliberately landscaped or planted are now mixtures of planted and spontaneous assemblages;
- tracts of 'encapsulated countryside' such as woodlands, scrub, heathlands, meadows, and marshes which through appropriate management continue to support essentially wild plant and animal assemblages. Often these natural areas exist within the framework of formally designated public open space;
- ponds, ditches, rivers, lakes and reservoirs;

- the less intensively managed parts of parks, school grounds, sports pitches, golf courses , churchyards and cemeteries;
- incidental pocket-sized plots along residential and commercial roads, pathways, car-parks and property boundaries, including walls and built structures which are often spontaneously colonised by plants and animals;
- allotments, orchards and gardens.

The common factor uniting all these areas is that the surface is predominantly natural: earth, water and living things.

The characteristics of natural greenspace are described in section 2 in terms of:

- settlement size, habitat diversity and species richness;
- size-class range of urban habitats;
- species/area relationships of urban habitats;
- species/area relationships for a selection of habitats;
- factors other than size affecting biodiversity;
- habitat isolation;
- species-area characteristics of selected site sizes;
- ability of natural areas of different sizes to cope with pollution.

Recommendations about survey procedures designed to detail the extent, distribution, biodiversity, and access status of natural greenspace are made in section 3.

1.2 Access and accessibility

Access refers to certain rights of approach, entry or use that are legally or conventionally defined; **accessibility** refers to the extent to which these rights can be exercised in particular places, at particular times and by particular people. Determining whether or not natural places are accessible therefore involves thinking not only about site ownership and access rights but also of physical and social considerations which constrain the extent to which access rights can be exercised.

In the context of urban areas, two factors are shown to be critical for assessing accesibility, namely :

- **Physical constraints**: including distance from the home, severance factors such as roads, and the degree of independent mobility enjoyed by particular groups of adults and children.

These physical constraints are analysed in section 4.1 of the report and recommendations made about how distance criteria acknowledging these constraints can be determined.

- **Social and cultural factors**: including the fear of crime associated with public spaces and their effect on people's willingness and ability to use and enjoy natural places perceived to be 'risky'. These social and cultural factors are described in section 4.2.

Recommendations about the role design and management strategies have for improving the accessibility of natural greenspace in urban areas are provided in section 4.3.

2. Biodiversity of urban areas

The wildlife of towns and cities is very diverse. Although indigenous species and species long established in the wild occur throughout the built up area many are endangered relics of formerly rural areas or are ruderal species. To these are added species relatively recently established in the wild, many of which are virtually confined to urban areas, and ephemeral species which have not yet formed viable wild populations. In addition plants cultivated in parks and gardens may add to urban biodiversity by giving a food source to invertebrates formerly restricted in their distribution because the food-plant was localised, eg the fauna of juniper.

2.1 Settlement size, habitat diversity and species richness

Several studies note the strong correlation between settlement size and city floras. Pyšek's (1993) comprehensive study of urban floras of continental Europe corroborates the findings of an earlier study by Klotz (1990). Both authors attribute high species densities to an increase in the number of small habitat parcels associated with large settlements. These European studies reveal that up to 50% of species in inner areas are part of an urban flora common to many cities.

Many of these common species are synanthropic species indicative of habitats associated with human habitation. Many are species recently established in the wild. In urban areas these species co-occur with indigenous and long established introduced species to form distinctive and consistent plant communities with weak relationships to rural ones (Gilbert 1989, Kowarik 1990).

Small, new sites in the urban area will be dominated by generalists and synanthropic species; larger and older sites can be expected to support more specialist or relict species characteristic of former rural habitats. Even where new habitats have the right conditions for a species to survive, organisms which are poor dispersers may not be able to reach them.

In general, outer suburbs have a more extensive range of habitats than either inner suburbs or city centres and reflect lower building densities encountered on city outskirts.

The rural-inner city gradient in building densities is reflected in a decline in species numbers. Significant negative correlations between invertebrate species density and distance from the urban edge are reported. Davis (1978), for example, notes a 60% reduction in central areas. Similar reductions are encountered for breeding birds (Cousins 1982, Sukopp and Werner 1983). In London the number of birds per 10 km^2 declines from 77 in outer London, to 50 in inner suburbs and 43 species in central London. However, the biomass for birds in central areas is high. Similar reductions are encountered for plants. For example, Polish studies show a decline in plant species per unit of urban area from 305 species on the outskirts of the city to 178 species in the inner city (Kowarik 1990).

Large open spaces embedded in the city counter this inner city decline in species. For example, Jokimaki and Suhonen (1993) working in Finland found that the number of breeding birds in city parks was higher (12.1 species)than in city centres (6.8 species) and other city-wide studies confirm this moderating effect of open spaces (Cousins 1982).

2.2 Size-class range of urban habitats

Detailed habitat inventories confirm that overall, small sites predominate throughout urban areas.

Urban wasteland plots in Liverpool, Birmingham and London range in size between 0.001 and 0.5 hectares with the majority of sites being less than 0.02 hectares. Sites supporting grassland and woodland are generally larger than these wasteland plots.

For example, 40% of ancient and semi-natural woodland sites in London are 2-5 hectares in size and account for approximately 10% of the total woodland area. Sites between 6 and 10 hectares account for 30% of sites and for 13% of the area. Fewer than 4% of sites are larger than 50 hectares. The size range of all woodland types, including those which have been planted is similar (GLC 1984).

Cemeteries and burial grounds vary in size from small inner city cemeteries of 0.126 hectares to extensive suburban grounds of 150.00 hectares. Most sites are of the order of 6.00 hectares (Clark pers.comm.)

Formal open spaces and parks which include sports pitches and mown grassland also have a wide size range.

Domestic gardens in new suburban developments are small but gardens in older suburbs are more extensive. Davis (1978) studied gardens along an urban-rural transect in London and included gardens ranging from 0.0075 hectares to 0.17 hectares. The Owen's much studied garden in Leicester is 0.06 hectares.

2.3 Species/area relationships of urban habitats

Site size is one of several criteria employed by both local authorities and conservation organisations to select sites of local nature conservation importance. Although never used as the sole criterion upon which selection is made, increasing site size is positively correlated with the number of species of plants and animals present.

Sites which have been designated as of Importance for Nature Conservation in Local Plans include a wide range of site sizes. Some of the smallest are Gillespie Park in Islington (1 hectare) and the Tump (2 hectares) in Greenwich. Some of the largest are Trent Park in Enfield (227 hectares), Chasewater, Walsall (300 hectares) and Ashton Court , Bristol (350 hectares).

A number of studies (Elliott 1986, Dickman 1987, Jokimaki and Suhonen 1993, Luniak 1983) have examined the species /area relationships for a range of habitats encountered in urban areas - including small parcels of unofficial greenspace. Few studies have examined the extent to which habitat fragmentation, isolation and location along a gradient from inner city to outer suburbs impinge on this relationship.

So far as encapsulated rural habitats go the general rule is that these tend to support fewer vertebrate species than equivalent areas of the same habitat in the countryside. For invertebrates and higher plants the situation is complicated by the presence of species not found in rural situations and ones encouraged by increased disturbance which compensate in terms of numbers for the absence of species unable to survive the pressures of urbanisation.

Even less is known about the species/area relationships of unofficial natural greenspaces and truly urban assemblages. Often detailed species inventories have yet to be completed for habitats such as wasteland and derelict land, cemeteries, allotments, ponds, ditches, boundary walls and hedges. Not all plant or animal groups have been surveyed and many small sites have yet to be described.

Of course there are considerable differences in species numbers between equal areas of different habitats. For example, a hectare of heathland holds fewer species than a hectare of chalk grassland. This becomes a factor to bear in mind when considering the intimate habitat mosaic on many urban sites.

Where species inventories of urban sites have been completed, they provide, not surprisingly, strong evidence for a positive relationship between species number and site size.

2.4 Species/area relationships for a selection of urban habitats

For a given habitat, the number of species increases rapidly with increasing site area but eventually reaches a point where few new species are added. The strength of this relationship can be examined by statistical analysis. Significant relationships may have predictive power and allow the findings of one study to be applied to other sites with the same geographic, vegetational and structural characteristics..

Significant correlations between species and area are reported for several species and from several habitats. For example, on urban wasteland sites the number of ruderal species is significantly correlated with site area over a site range of 0.001 to 0.519 hectares. Site age is also correlated with species number but is less significant than that for area (Elliott 1986). These studies are supported by that of Crowe (1979) for vacant lots in North America.

Studies in Warsaw reveal strong correlations (but no significance values) for bird species richness and area from three habitat groups - open areas dominated by grassland, allotments and wooded areas (Luniak 1983). Renman and Morberg (1994) found a strong positive relationship for bird species and area in Stockholm. On average, green spaces of 13 hectares are inhabited by 13 bird species and spaces of 20 hectares by 40 species.

Dickman's (1987) study of amphibia and reptiles shows a strong positive correlation between species richness and area. His study of small mammals also shows a positive but weaker relationship. In this latter case, stronger correlations were found with other dimensions of habitat character such as vegetation density.

In comparison with rural areas, the home ranges of large mammals such as fox, are smaller in size (Harris 1986). Low housing densities and the presence of open space, together with good food availability in gardens and refuse heaps, favour small territories. The highest densities of 5.0 family groups per 100 hectares were encountered in outer suburban areas. Mean densities ranged from 0.188-2.035 with densities being significantly affected by the number of stray dogs recorded.

The combined findings of these studies suggest that there is some relationship between species richness and site area but it is moderated, especially at intermediate and larger site sizes by effects of management, site age, history of disturbance, the presence of particular habitat features and, in some cases, the presence of competitors or predators.

2.5 Factors other than site size

Factors such as site history, including site age and continuity, disturbance events and past management practices, influence both species richness and the size of plant and animal populations.

For example, studies in Oxford of small mammals such as woodmouse, bank and field vole and common shrew, show that species presence and population size are strongly correlated with the density of vegetation 21-50 cm above the ground. Management which affects the height and continuity of plant cover provides a better explanation of species number than patch size in the 0.17-20 hectare sites examined.

Similar relationships hold for birds in urban woodlands subject to disturbance by visitors and their dogs. Luniak (1983) reports that provision of refuge areas (shrubs and inaccessible recesses)increased the number of breeding birds. The number of layers in the vegetation , its density and the number of old trees also have a positive effect on species numbers.

Experience with the success of nesting boxes in raising populations of some woodland birds in urban parks, suggests that it is possible to improve the species diversity of impoverished and isolated city habitats. For example, a twelve year study reported by Luniak (1992) showed that the use of nest boxes in new parks with young trees proved to be responsible for introducing 2-5 new bird species and increased the general breeding population by up to 100%. In old parks, nest boxes increased population density rather than species number with increases of up to 60 pairs per 10 hectares being recorded. Luniak concludes that there are demonstrable benefits of using bird-boxes to increase bird species diversity in urban parks.

2.6 Habitat isolation

Dawson's (1994) full review cautions against accepting uncritically the assumption that wildlife corridors serve as conduits along which species migrate. However, he does advocate the precautionary principle of protecting existing corridors. Proof of the validity and effectiveness of this precautionary approach lies in the future but it seems particularly important in urban areas.

The small size of most urban habitat patches coupled with the potential impact of severance factors such as roads, buildings, hard and sealed surfaces, serve to isolate pieces of similar habitat. The fragmentation and isolation of habitat patches, means that some species may have difficulty in colonising or recolonising sites - even if sites are quite large. Species which are poor dispersers and those with narrow tolerance ranges are likely to be most affected by severance factors and isolation. Food shortage at critical stages in the colonising process, lack of moisture in inner city environments, together with the lethal effects of traffic, trampling and mechanical cutting, are likely to mean that severance and isolation effects put these species at particular risk (Mader *et al* 1990).

More motile and mobile organisms are able to recolonise sites successfully. Plant species which are easily dispersed by wind and human agency such as on car tyres and in domestic and industrial waste, are unlikely to be affected by either habitat fragmentation or severance factors. Likewise, the more mobile animals capable of wide dispersal will be least affected even when sites are small. For example, Dickman (1987) suggests that a network of small (>0.65 hectares) patches of woodland allows recolonisation by small mammals.

The practical implications for nature conservation of ideas on fragmentation and wildlife corridors are discussed in Kirby (1995) who supports the idea of a close mosaic of small sites to connect isolated blocks as opposed to a single thin corridor.

2.7 Species/area relations of selected site sizes

2.7.1 1 hectare site

Plant species richness: the site is at the higher end of the size range studied for wasteland and derelict sites. It can be expected to support between 50-90 plant species (Elliott 1986). If maintained as a grassland area, species counts would be lower: 11-24 species according to the work of Kubicka *et al* (1986) and Muller (1990).

Animal species richness: a wooded site of this size is larger than the 0.65 hectare habitat patch suggested by Dickman (1987) in which at least four species of small mammal could be encountered. Population densities of small mammals of between 30-60 have been recorded for sites of this size. If located in outer suburbs, the site might also fall within the home ranges adopted by urban foxes and badgers.

A wooded site of this size could be expected to contain between 10 and 20 bird species breeding there, although in linear plots of equivalent area, disturbance coupled with the absence of safe refuges would limit bird and small mammal numbers. Species habituated to human presence and disturbance would predominate.

Realistic numbers for butterflies are 1-5 species although with selective management of food sources and habitat structure to ensure successful growth of both larval and adult stages, higher figures could be expected. The varied garden habitat provided by Owen (1992) supported 21 butterfly species.

A small pond or water body of 0.55 hectares could support up to four species of amphibia.

The main limitation of a site of this size is that it is too small to be likely to develop more than a few different habitats on it.

2.7.2 10 hectare site

Plant species richness: wasteland sites of this size can be expected to support between 200-300 plant species, especially if abandoned 5-10 years ago (Gilbert 1992). As mown grassland, species numbers are unlikely to exceed those of smaller sites. A habitat mosaic including scrub and woodland as well as mown grassland would see plant species numbers rising to between 60 and 80 (Kubicka *et al* 1986, Muller 1990).

Animal species richness: dense, tall grassland favours small mammals. Maximum population densities of between 300-600 have been recorded for bank and field vole, woodmouse and shrew when dense vegetation of 0.5 m is maintained. Larger mammals, including fox and badger have been recorded from sites of this size, but permanent natural populations of either could not be supported solely on a site this size.

A woodland site this big can support most specialist woodland birds , including birds of prey such as tawny owls. A 10 hectare site could potentially contain around 20 breeding bird species (Renman & Mortberg 1994). The presence of refuge habitats and nearby food sources in gardens can be expected to raise bird population sizes and biomass. Luniak (1983) suggests that these conditions could increase population size by 2-4 times and biomass by 2-6 times.

Old trees, decaying wood and leaf litter would allow some of the more specialist relict invertebrates to survive (Kirby 1994; Davis 1982). With a well-developed ground cover and rich herbaceous vegetation, at least 10-25 butterfly species could be expected. Butterfly species numbers are likely to be influenced strongly by management regime and short term climatic fluctuations.

At this size, most urban habitats would support both specialist and generalist species. Successional habitats supporting scrub and woodland habitats would contain an increasing proportion of indigenous and long established species. Top carnivores may not breed on site but with high population densities of small mammals and birds, people could expect to enjoy encounters with wildlife on a regular basis - including woodland specialists such as woodpeckers. Wasteland sites of this size, especially those containing small water bodies provide some of the most colourful and diverse herbaceous communities.

2.7.3 100 hectare site

The benefits of a site this size over and above those provided by the 10 hectare site, are connected with the territorial size of large mammals and woodland raptors, and from the increased buffering effect provided by dense vegetation.

Disturbance effects will be minimised for compact blocks. Luniak (1983) concluded that woodland blocks of 100 hectares could support between 40-50 species bird species. A high perimeter:area ratio would have unpredictable effects on some species and their breeding success (Hinsley *et al* 1994) especially where accompanied by disturbance from visitors and nearby roads and traffic (Van der Zande *et al* 1984).

A site of 100 hectares could hold the home range of a fox or badger. If disturbance levels were low, a small resident population could also be established.

At this site size most specialist members of a woodland ecosystems are supported. Raptors may be few, but people could enjoy a 'total' woodland experience.

2.8 Site size: microclimate and pollution attenuation

2.8.1 Microclimate

The influence of greenspaces on local microclimates has been recognised for some time. Chandler's (1964) early study of London's climate pointed to the distinctive local climates of urban green spaces such as Hyde Park. In comparison to the surrounding area, the micro-climate of parks exhibits lowered temperatures, higher humidities and reduced turbulence.

More recent studies by von Stulpnagel (1987) and von Stulpnagel *et al* (1990) provide predictive equations for calculating temperature effects in relation to size of greenspace and the relative impermeability of the surrounding area. Using climatic data collected from 32 green spaces in West Berlin which ranged in size from 6-3200 hectares, von Stulpnagel calculates that the most significant differences with area are achieved for sites of >300 hectares.

A strong positive relationship with size of greenspace was reported in respect of:

- mean annual temperature 1961-1980;
- mean annual temperature for 1982;
- average temperature for three calm and almost cloudless nights;
- temperature on the evening of 9.7.1982 (calm and cloudless).

Differences of between 1.5°C and 4°C were recorded for sites of 10 hectares and 100 hectares respectively. Data for sites less than 10 hectares were not available.

The percentage of sealed surface in the surrounding neighbourhoods has little effect on these relationships, except at the larger sites.

2.8.2 Pollution attenuation

Few systematic studies have been conducted on improvements to air quality associated with the use of naturalistic settings. Most pollution attenuation studies are based on the effectiveness of coniferous species (Coppin & Richards 1990). Likewise, these studies do not examine the effects of pollutants on wildlife itself. In moving towards more sustainable policies designed to improve air quality, these reciprocal effects would need to be taken into account.

Carbon sequestration: A number of North American studies have begun to examine the contribution urban forests might make to local carbon balances (Rowntree & Nowak 1991; Nowak 1993). So few studies of carbon budgets have been completed on a city scale that it is difficult to assess the contribution forests might make through carbon sequestration.

Crude estimates of carbon sequestration provided by these authors suggest a range of storage capacities for different landuses in Oakland, California: 28 tons/hectare, for 'wildland': 13 tons/hectare for residential land: 0.5 tons/hectare for commercial land and 0.7 tons/hectare for transport corridors. The contribution of street trees was estimated at 1,700 tons overall.

Particulate Interception: Few studies have looked at this issue. Brown (1993) citing Bernatzky (1974) provides indicative figures for interception of dust particles for different locations in Frankfurt. A striking decrease in total particulate pollution was recorded on roads with street trees and in city parks. Sukkop and Werner (1982) mention that coniferous trees are able to reduce dust pollution by 10-20%.

These studies focus on larger particles in the size range 0.4 - 17μ. Little is known about the smaller sizes recently implicated in the high incidence of respiratory problems encountered in urban areas.

Noise Attenuation: The presence of vegetation can produce noise attenuation levels of between 1.5 dB-30 dB per 100 m (Bache and Macaskill 1984). Dense vegetation in full leaf has a muffling effect of 2-3 dB(A) per 100 m and thick plantations of coniferous trees perform even better at 5-10 dB(A). Narrow belts of trees may provide some psychological advantage in ameliorating the perceived noise levels but their physical effect is virtually zero.

Practical suggestions for securing effective reductions in noise levels include planting wide buffers as close to the pollution source as possible. Tree heights should be graded so that the tallest trees are further away from the source. Trees should be planted as close together as possible, and should be maintained to allow foliage to grow down to ground level. Only is these circumstances are the highest attenuation levels of 30 dB likely to be achieved.

Water retention: Water retention in urban areas is regarded as desirable because it reduces both the volume and rate of run-off and helps to recharge groundwater supplies. In urban catchments prone to flash flooding both the reduced volume and increased delay in run off can prove useful to catchment managers.

Coppin and Richards (1990) describe runoff in terms of the percentages of received rainfall. Percentages for surfaces with trees and grass are 10 -20%, for cultivated areas 30 -40% and for urban areas 60-70%.

Site size and attenuation: Pollution attenuation is highly dependent on tree cover, planting density and site configuration. Linear sites would provide the least effective controls. Maximum noise attenuation rates are likely to be at best 3 dB(A) and would demand dense block planting of evergreen conifers. For a range of reasons discussed below, especially those concerned with fear of crime and woodland settings, tree planting schemes would need to be handled carefully in urban settings.

In the absence of further work which throws light on both the ability of natural areas to cope with pollution and the damage pollution causes, it is not possible to draw meaningful conclusions about their potential role in improving air quality and the most efficient sizes in this context for sites. It is, of course, clear that small sites are less valuable here than large ones, other factors being equal.

2.9 Conclusions

Urban areas contain a lot of small natural greenspaces, many of which support a rich wildlife. Inner city sites are likely to hold fewer species in general, and certainly fewer indigenous species, than ones in the suburbs. The habitat mosaic provided by a city supports a large number of species and large settlements hold more species than smaller ones do.

Although there seems to be some correlation between species number and site size the underlying reasons for this may have more to do with habitat diversity, management and use, site history, vegetation structure, topography and location than with size *per se*. This is certainly the case at the smaller end of the size range.

Support for the idea of a close mosaic or interlinked network of sites and the function of linear habitats and conduits for wildlife is reviewed elsewhere (Dawson 1994) and the practical implications of thinking on fragmentation and connectivity as issues in nature conservation discussed in Kirby (1995). We support their conclusions that fragmentation is to be avoided and connectivity encouraged even in urban situations.

Some aspects of microclimate and pollution attenuation can be related to site size with precision. However, here again vegetation structure, and particularly the presence or absence of trees may be more important than sheer size.