London's Small Parks and Squares — A Place for Nature?

Whitehall Gardens, Thames Embankment, *photograph by C. Gannaway*

A report from the London Biodiversity Partnership's Habitat Action Plan for Parks and Squares on a survey of more than 290 green spaces in central London

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Commissioned by the London Parks and Greenspaces Forum

Executive Summary

Small parks and squares represent the nearest patch of green landscape for many Londoners. But how far do these often formal or semi-formal landscapes also represent access to nature, and what kinds of management, which are compatible with the sites' overall ethos, are associated with the richest wildlife interest?

In the summer of 2004 the London Parks and Greenspaces Forum's Biodiversity working group commissioned a survey of almost 300 small open spaces in central London. The survey formed part of the London Biodiversity Action Plan for parks and squares. Its main aims were:

- to improve our understanding of the contribution of small parks and squares to sustaining biodiversity in the city centre
- to find out whether particular styles of gardening were associated with a richer variety of bird life
- from this to develop best practice guidelines for improving public open spaces with lower biodiversity interest, and hence improve access to nature
- to inform landscape restoration proposals being undertaken through grants from the Heritage Lottery Fund and
- to promote the importance of squares and other small greenspaces in sustaining biodiversity in London.

The survey recorded 31 species of birds, the highest number at any one site being 14 species. The bird species fell broadly into two groups: those which prefer an open landscape such as feral pigeon, starling and carrion crow, and those which require a more wooded habitat, for example robin, wren, great tit and long-tailed tit. The key factors for the second group appear to be an abundance of tree and shrub cover, the presence of some tall and dense shrubbery, and a landscape structure which so far as possible mimics the character of a woodland. A relaxed approach to garden management, allowing ivy-clad trees, retention of dead wood, where possible, and wild flowers under shrubberies is also likely to help. In general it was found that the best-managed gardens for people, with a rich, well vegetated and well-maintained landscape, were also likely to be good for birds. The findings are also proving helpful in developing an approach to shrubbery management which balances wildlife and security issues.

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A message from the London Parks and Gardens Trust

The Trust very much welcomes this report, as, firstly, it emphasises the importance of London's green spaces as wildlife habitats and, secondly, it provides valuable evidence and information, which will facilitate the publication of good practice guidelines for managers of both public and private green spaces to consider.

Contents

1. Introduction

1.1 The genesis of the project

This project was initiated as a result of discussions within the London Parks and Greenspaces Forum's Biodiversity Working Group. One of the principal functions of this group is to develop best practice for biodiversity in London's parks and green spaces. The project forms part of London Biodiversity Partnership's Habitat Action Plan for parks and squares.

It became apparent that there was a lack of relevant information concerning the wildlife value of small, formal and semi-formal parks, garden squares and public gardens in the inner city. London has the greatest concentration of garden squares of any city in the world, with over 600 surviving at the present time, and there are many other small public parks and gardens of a similar scale within the central area – some of them are former churchyards and burial grounds, others have been developed on bomb sites after the Second World War. How far do these small green spaces function as oases for wildlife, or as stepping stones within the built environment as identified in PPG17?

The Mayor's Biodiversity Strategy[i] seeks to improve opportunities for contact with nature by Londoners. It was felt to be useful to see how far lessons could be learned from the design and management of the best sites for wildlife to improve the biodiversity value of some of the ecologically less interesting examples, whilst respecting the overall ethos and functions of the garden. In addition, many small parks and squares are currently undergoing extensive restoration and re-planting aided by the Heritage Lottery Fund. It was thought to be helpful to develop a greater understanding of the way the existing habitat functions for wildlife to inform this process.

Garden squares have been subject to a variety of threats in recent years. This led to the *Campaign for London Squares*, launched by English Heritage in May 2000. The campaign was successful in raising awareness of the historic value of London's squares but new threats, such as inadequate maintenance and increasing wear and tear leading to pressure for paving over green space have now become increasing concerns. English Heritage was particularly concerned to discover whether these issues also carry implications for biodiversity.

The launch of the Government's 'Cleaner, safer, greener' [ii] programme has highlighted issues of security in public open space. Shrubberies may be perceived as a threat to security or as a problem in litter control, and are often removed without regard to their wildlife value. It was therefore felt to be timely to examine the role of shrubberies as wildlife habitat and to investigate what measures can be taken where shrubbery and security appear to be in conflict.

The group therefore decided to seek funding for a study of London squares and similar-sized parks and gardens of a formal or semi-formal character, focussing particularly on the management of woody vegetation and birds.

1.2 Acknowledgements

We are most grateful to the Bridge House Estates Trust for awarding a grant to support this project. The project was also supported financially by English Heritage, The Royal Parks, the Grosvenor Estate and the Metropolitan Public Gardens Association. The Welcome Trust, the Portman Estate, many private square associations, The Royal Parks, the Church Commissioners, London University, Peabody Estates, the Corporation of London and other local authorities gave permission for their sites to be surveyed and also provided information. The Royal Society for the Protection of Birds agreed to produce a booklet summarising the results of the survey, and offering guidance on habitat management drawn from the results of the survey. Special thanks are due to Patrick Hewlett and Dr Peter Shaw for expert help with the data analysis, to Rodney Carr for the use of his regression analysis programme, to Dr Dave Dawson for much useful discussion and advice, to Greenspace Information for Greater London (GiGL) for extensive work on the database and especially to Jenny Coverdale for many hours voluntary assistance with data inputting.

1.3 Aims and scope of the survey, plus site selection

The remit of the study, as defined by the Forum's Biodiversity Group, was to try to determine whether small parks and garden squares and similar semi-formal gardens make a real contribution to London's biodiversity and, if so, to investigate which habitat factors and features were important to birds. The surveyors concentrated on collecting information on the habitat and landscape management, together with recording the birds seen or heard during each site visit. Birds were chosen as the easiest animal group to record and as a likely good indicator of overall biodiversity in these sites, due to their position near the top of the food chain. Being among the most visible forms of wildlife, they are one of the more important groups for public appreciation of nature.

It was decided to concentrate on sites in the Central London area, where the contribution of small public gardens and squares to public enjoyment of nature could be expected to be greatest, due to the comparative lack of other green open space. However, a few sites were included from a little further out (but within the inner London Boroughs) in order to make as complete a picture as possible of the role of such sites. The selected sites all fell within the London Boroughs of Camden, Islington, Hackney, Tower Hamlets, Hammersmith and Fulham, Lambeth, Lewisham, Southwark, and Wandsworth, the Royal Borough of Kensington and Chelsea, the City of London and the City of Westminster, and within a rectangle defined by easting TQ2200-4000 and northing TQ7400 –8600 (see map on page 14).

It was originally intended to cover an even distribution of sites across the whole of the survey area, but this proved impossible in practice, due to the actual distribution of potential sites being irregular. The majority of London squares and similar communal gardens were laid out during a relatively restricted period, from the late Georgian to early Victorian areas. Some small parks have been created since, generally from previously built-on sites which became derelict, or from church grounds which have been made available as public parks. The few

modern squares and gardens recorded are of particular interest as they represent different styles of landscaping.

The sites surveyed were of various types, heavily vegetated or of open aspect, busy or secluded, formally managed or more relaxed in style, and located within a central London or inner suburban setting. Some served primarily as ornamental gardens, while others had tennis courts, play areas, cafes or other facilities. A number of private (communally owned and used) gardens and squares were included in the survey, the comparison between open and restricted access sites being of some interest. A further reason for including these sites was that if they were found to support greater bird diversity, or a higher incidence of desirable species, lessons could be drawn from the habitat management which might be applied elsewhere in seeking to improve the wildlife value of public but ecologically poorer sites. Over the survey as a whole, 73% of the sites had full or de facto public access, 23% restricted access (e.g. either open to the public only at certain times or only to particular residents or other groups) and 4% were housing estates. The latter included six social housing estates (e.g. local authority estates and housing trusts such as the Peabody Estates Trust) and four private estates. A full list is attached in Appendix 1.

The lower size limit was set at 0.1 ha and the upper limit at 3.0 ha. This range was selected so as to include almost all of the formal London squares, (only Vincent Square is larger than 3 hectares and hence was not included in our survey), and hardly any London squares are smaller than 0.1 Ha (although there are some historic churchyards and public gardens in this size range). This size range corresponds with Local Parks and public open spaces in The London Plan.

As the survey was concerned primarily with amenity landscapes, sites with a specific nature conservation maintenance regime were excluded, though communal gardens with some management geared towards nature conservation were included. Sites managed solely for sport, or as active burial grounds were also excluded, although some redundant graveyards and church grounds that had passed into use as public parks were included in the survey. Derelict or 'brownfield' sites were outside the scope of the survey.

1.4 Survey management

The Forum appointed the London Wildlife Trust (LWT) to act as contractor, under the supervision of Jan Hewlett, as chair of its Biodiversity Group. Denis Vickers had overall management responsibility of the London Wildlife Trust team and Peter Sibley was appointed to coordinate the project. Chris Gannaway and Kevin Morgan, both skilled ornithologists, were recruited as the field surveyors and undertook the recording.

2. Methodology

Full details of the fieldwork methodology are given in the survey specification (Appendix 2). A summary is presented here.

Sites were selected by the coordinator and allotted to the surveyors in batches. Each site was named and given a specific number to identify it within the survey and grid co-ordinates were determined.

2.1 Recording forms

A standard form for recording information was developed, based on tried and tested recording sheets in use by LWT and the GLA Biodiversity Group, adapted to meet the requirements of the survey (see appendix 3). This was tested, reviewed and refined to make it robust, easy to use and flexible enough to include all significant information, without becoming unwieldy. A section provided for notes allowed extra information or explanation of unclear features to be made. Joint site recording visits of the survey coordinator and each of the field surveyors, in which assessments and estimates were compared, ensured that as far as possible, the data from the two field workers would be consistent in quality.

2.2 Timing of fieldwork

The survey was conducted between the 7th May and 8th July 2004, a period chosen as the soonest possible time after funding became available, and when the birds would be active and vocal and breeding activity would be observable.

Ideally fieldwork would have been carried out early in the morning and in uniform weather conditions, since birds tend to sing more early in the day, at dusk and during fine weather. However, for practical reasons, fieldwork had to be spread through the working day and in any suitable weather. On some sites traffic noise made hearing bird song difficult.

Each site was visited once only during the course of the survey. The survey therefore represents a 'snapshot' of each site rather than an in-depth study. Its strength lies rather in the number of sites which could be compared. It is appreciated that for the previously noted reasons, the birds and other wildlife of individual sites were likely to be under-recorded both in species and number of individuals present. Figures for each should therefore be regarded as conservative estimates, and taken as an indication of the relative richness of each site rather than a comprehensive record of its avifauna.

2.3 Site Visits

At each site, the surveyor was asked to walk slowly around the site, recording birds and other wildlife information onto the recording form. He was also required to record habitat information, to map the boundaries of the site, and to take one or more digital images to illustrate the habitat.

Birds were identified by sight and sound, and any evidence of breeding was noted. Any other wildlife seen or reported by garden personnel was also noted. Only birds clearly associated with the site (perched, feeding, etc.) were included in the survey, birds merely flying overhead were not. Swifts were included only if they were observed feeding close over the site.

On average about 40 minutes was spent on each site, but larger sites required more time than smaller sites. Although to an extent it is to be expected that a greater number of birds will be seen the longer a surveyor spent on site, in opposition to this, larger sites tended to be more structurally complex with obstructed sight lines, meaning that parts of the site would not be visible at any one time during the visit.

Habitat features, such as shrubbery, tree cover, surfacing, water features, herbaceous planting and various types of grassland were recorded as percentages of the site area. It should be noted that each layer of vegetation (tree canopy, smaller trees and shrubs, and herbaceous flora) was estimated separately, so the total of the percentage areas occupied by each component could add up to more than 100%. For the trees and shrubs, the proportion of native versus exotic, and evergreen versus deciduous, varieties were also estimated. In addition, for shrubbery, an estimate of the proportion which could be classified as low (<1m), medium (1-2m) and tall (>2m) was required as well as a rough indication of the proportion which could be regarded as sparse, medium or dense (the latter was recorded by placing up to three ticks in each of three boxes). For hedges an estimate of height was required, together with an indication of whether it was composed of native or exotic species and single species or mixed. Other environmental factors recorded included the number of ivy-covered trees, vegetated walls, wild flowers under shrubberies, bird boxes, feeders, tubs or planters, fountains and whatever management information could be gathered.

A piece of data requested on the form but which proved difficult to assess was whether shrubbery was associated with trees or not and if so to what extent. Almost all sites had some shrubs associated with trees and some not, and the height of both the tree canopy and shrubbery was also very variable, ranging from sparse, dwarf shrubs under large, high canopy trees, (e.g. *Pyracantha* under mature London planes) to tall, dense shrubs whose canopy merged into that of small trees, (e.g. lilac under cherry).

It was expected that most sites would have multiple uses, and information was recorded as to whether specific play or sport facilities were available on site. An assessment of the type of site or its general character was also required. Generally it was easy to determine whether the principal role of a site was as a civic square, a park, community garden or churchyard, but inevitably some sites shared characteristics of more than one type. Facilities for disabled access were also collected. The presence or absence of lighting features was also noted; however, as the survey was conducted during daylight hours, the period of use (if any), and their brightness or area of illumination was not available.

Where possible, information was gathered from managing committees, gardeners, user groups, managing agents etc. on other species present and management

regimes. These last varied greatly, but information gathered was incomplete as many of the managers were not available for consultation.

A few pieces of information were added subsequently: planning status (e.g. whether covered by London Squares Act 1931); site area; and distance to the nearest large park (i.e. a green space > 30Ha). The latter was used to give an indication of whether the individual site was close to other substantial areas of green space, or relatively isolated within the built up area. For this purpose a cemetery or other green open space of 30 Ha or more would count as a 'large park', but a water body, (a reservoir or the Thames) would not. For simplicity, narrow linear features such as railway lines were also excluded in this analysis, although it is recognised that they may serve as green corridors through the built up area.

2.4 Data Analysis.

The data were entered into Excel spreadsheets by Greenspace Information for Greater London. Preliminary analyses were carried out in Excel, with further analyses using SPSS v.11. Analyses were as follows:

- The percentage of sites in various categories where each bird species was recorded was calculated (tables 1 and 7).

- The number of bird species seen or heard on each site was plotted against the site area (graph 1). Regression lines were then drawn up: (a) taking data for all the sites together (graph 2); and (b) creating separate regression lines for public and restricted access sites, using a programme, kindly provided by R. Carr, which enables comparison between two sets of numerical data (graph 7). In the regression analysis, where two (or in some cases three) parcels of land could be perceived to function as parts of one larger site, with little geographical separation other than a building or a quiet, narrow road between them, and similar character and management, the parcels were amalgamated as one site.

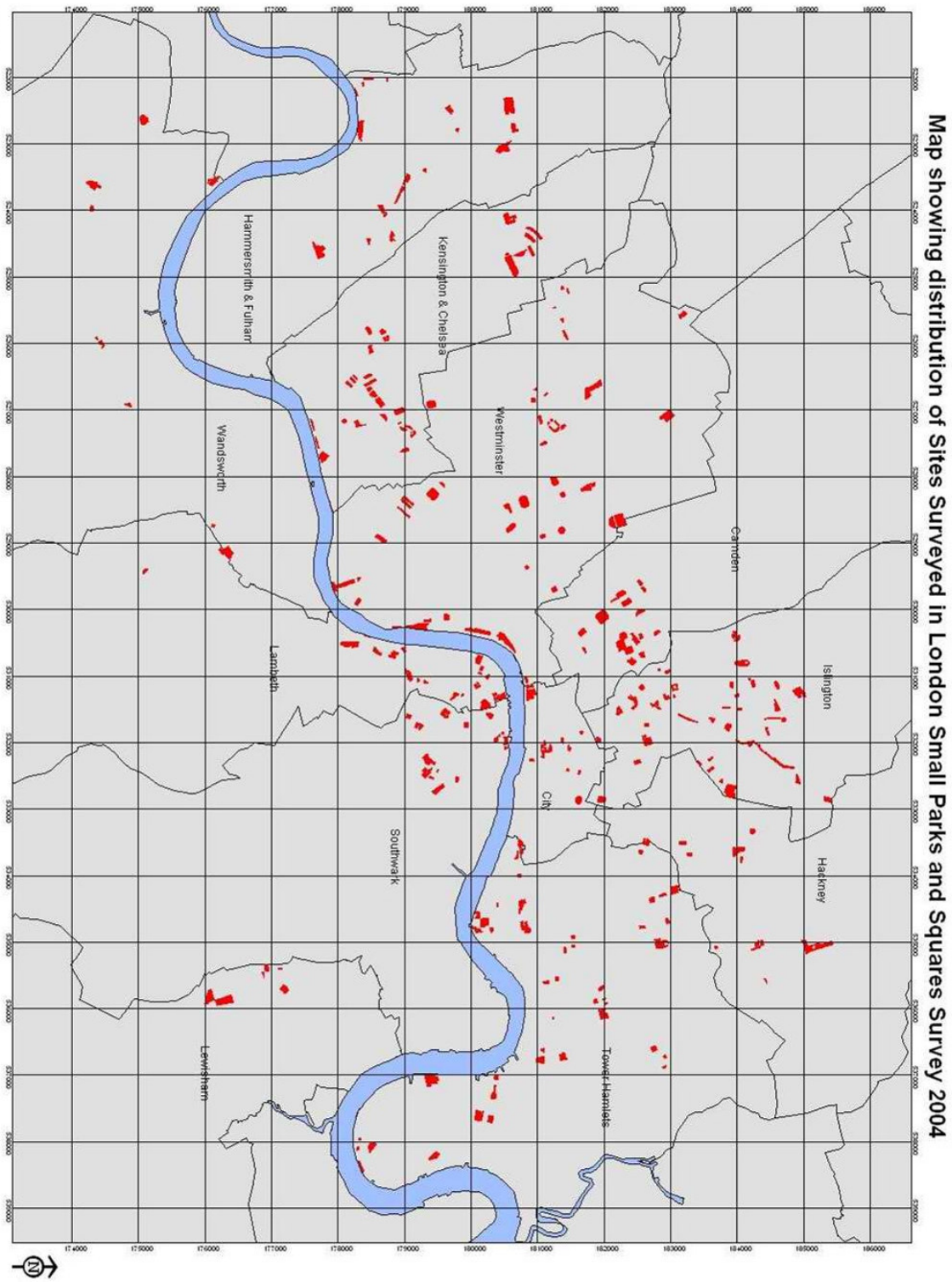
- Exploratory analysis of the habitat preferences of individual bird species was carried out using Excel pivot tables, and based upon the percentage of sites where each species was recorded in relation to a range of habitat factors, such as the extent of shrubbery plus hedges, height of shrubbery, density of shrubbery, and numbers of ivy-clad trees (graphs 3a, 3b, 4 and 5 and table 3).

- A correlation matrix was then prepared using Pearson's correlation coefficient to establish which habitat factors appear to be most strongly associated with overall species diversity, and to clarify problems of multi-co-linearity (which can make it difficult to separate the influence of individual habitat variables from one another or indeed also from site area) – see table 2a. In table 2b, the correlation matrix is extended to examine the correlation between the numbers of individual birds of each species recorded per site and each of the main habitat variables.

- On the survey form, ivy-clad trees were recorded in four categories rather than as a continuous variable (0, 1-4, 5-10 and 11+ ivy-clad trees). Analysis based on parametric methods was therefore unsuitable and Spearman's Rank Order correlation index was used instead.

- The effects of nest boxes, bird feeders, dead wood, mowing regime and whether or not the site had full public access were investigated using Levene's test for equality of variance followed by or t-test, Anova or Kruskal-Wallis (non-parametric test) to establish whether numbers of individual bird species differed significantly between sites where these factors were present or absent.

- The dataset was then further examined using Multiple Linear Regression (MLR), Principal Components Analysis (PCA) and Canonical Correspondence Analysis (CCA).



Map showing distribution of Sites Surveyed in London Small Parks and Squares Survey 2004

3. Results

Results are presented for a total of 293 sites (or 286 for the species number/ site area analysis in which 2-3 parcels were combined for some sites).

3.1 Frequency of individual bird species

The total number of bird species recorded was 31, though some of these were recorded only in very small numbers or in a few cases as single sightings only. The average number of species per site was 5.05. The average number of birds recorded per site was approximately 23.

Predictably, the most numerous species was the feral pigeon, found on 71% of sites, and representing 40% of all the birds encountered in the survey. The wood pigeon was the third most common species in the survey, both in the number of sites and number of individuals recorded. The bird found on the greatest number of sites (87%) was the blackbird, which also had the second highest number of individuals. Other thrushes are currently much less common in inner London, the mistle thrush being encountered on ten sites and the song thrush on only six.

The house sparrow, once London's commonest bird, is now scarce in many localities; it was recorded on only 9% of sites, with a total of only 96 individuals. The previously common starling was recorded in less that 25 % of sites, though on a few sites flocks of more than 20 birds were noted. In contrast, the strongly territorial robin was fewer in number but was found on 35% of sites.

Blue tits were the most commonly recorded member of the tit family, found on 3–4 times as many sites as the great tit (the 2nd most common tit species). The long-tailed tit was the 3rd most frequent tit species, found on 11 sites, compared with the coal tit, seen on just four sites.

The blackcap was the only warbler species to be recorded. It was found on two sites - remarkably one of these was the open land around Dickens Square in Bermondsey and the other Ladbroke Square Gardens, in Kensington. The Dickens Square site was also notable for the survey's only record of green woodpecker. The great spotted woodpecker was found at two sites, Ladbroke Square Gardens and Evelyn Gardens in Kensington.

Of the crow family, the carrion crow was the most frequently seen, normally in ones or twos, but on a few sites flocks were seen. Magpies were often encountered, usually singly or in pairs, with a maximum of eight birds seen on one site. The jay was recorded at only six sites, as one pair and five individual birds.

Finches are relatively uncommon (compared with, say, the blackbird) in central London; the most frequent is the greenfinch, found on twice as many sites as the chaffinch and in much greater number. The only other finch observed was the goldfinch, found in six sites.

Table 1. Summary – Frequency of bird species recorded – all sites

Species	All sites		
	Total no of birds	No of sites	% of sites
Blackbird	868	256	87
Feral pigeon	2717	208	71
Wood pigeon	438	182	62
Blue tit	387	165	56
Wren	148+	111	38
Robin	196	105	36
Carrion crow	169	85	29
Starling	304	70	24
Magpie	104	64	22
Great tit	102	48	16
Greenfinch	89	30	10
Dunnock	40	28	10
House sparrow	96	27	9
Chaffinch	24	14	5
Long-tailed tit	52	11	4
Mistle thrush	14	10	3
Pied wagtail	8	8	2.7
Song thrush	6	6	2.0
Jay	7	7	2.4
Goldfinch	15	6	2.0
Swift	12	6	2.0
Coal tit	11	5	1.7
Mallard	23	5	1.7
Blackcap	3	2	0.7
Sparrowhawk	2	2	0.7
Gt .sp. woodpecker	2	2	0.7
Green woodpecker	1	1	0.3
Grey wagtail	1	1	0.3
Grey heron	1	1	0.3
Moorhen	1	1	0.3
Herring gull	1	1	0.3
Total	**6712 birds**	**293 sites**	

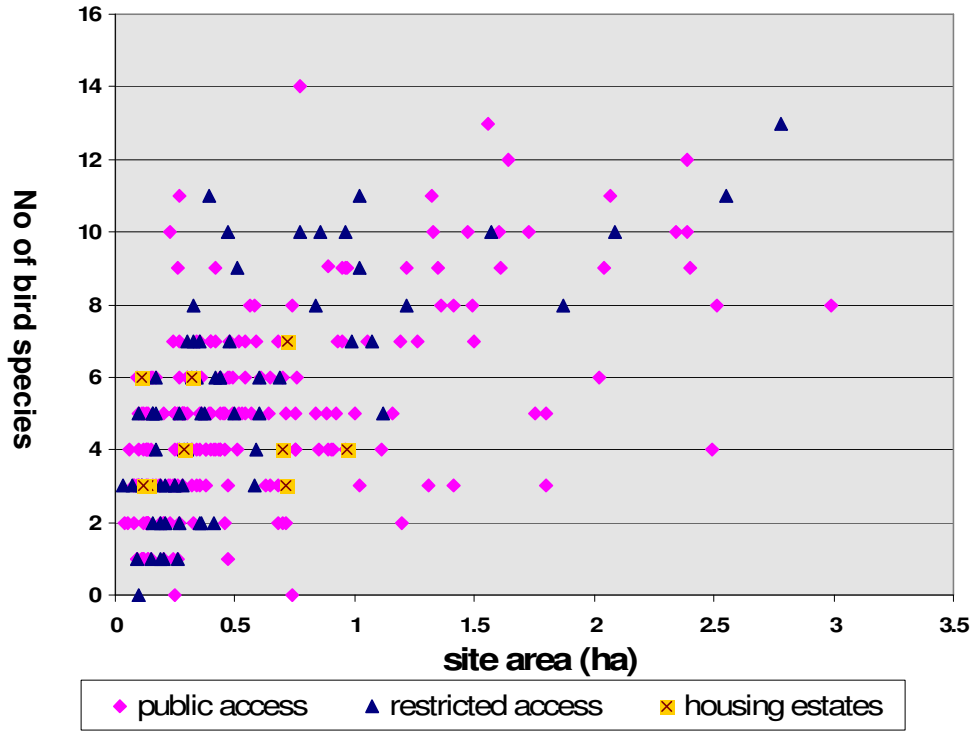
3.2 Species diversity and site area

In graph 1, the number of species recorded per site is plotted against the site area. The three colours on the graph represent data from three main categories of sites: those with full or de facto public access, those with restricted access and housing estates.

From the graph, it is clear that the number of species recorded tended to increase with the size of the site. This is to be expected as it is consistent with 'Island biogeography' theory, regarding the individual sites as 'islands' of green space within a built-up 'ocean'. However, there is wide variation around

this overall trend. In one of the largest sites at just under 2.5 ha only four species were recorded, whereas at one of the smaller sites less than 1ha in size, Leader's Garden in Wandsworth, a total of 14 species was found. This was in fact the highest number for any site in the survey. In three sites no bird species at all were found. These were all less than 1ha in size.

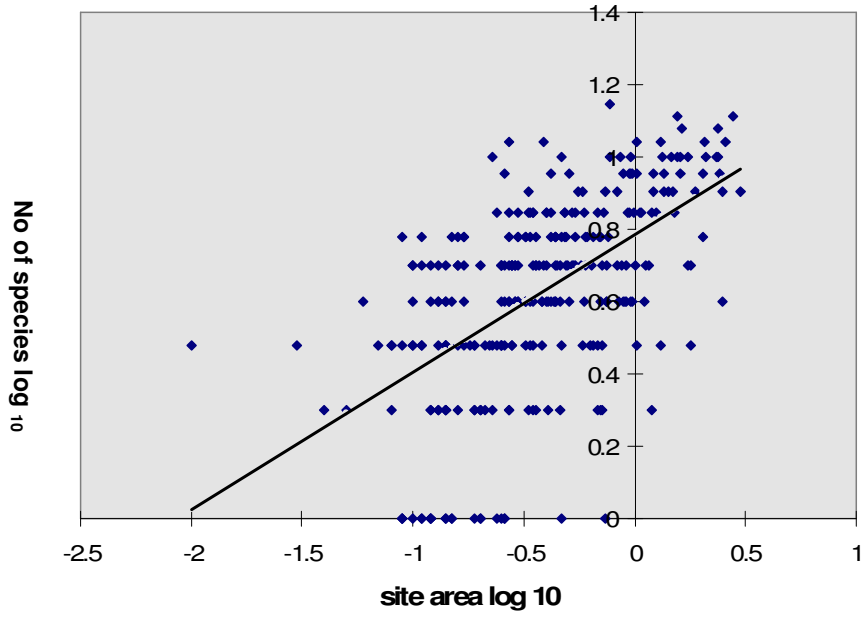
Graph 1 Relationship between number of bird species & site area



When the data on both axes were plotted on a logarithmic scale, the relationship between size and number of species recorded became clearer. It is evident that site area is a major factor in determining the species richness of each site. Assuming that the slope of the best fit line given in graph 2[1] is reasonably representative of the trend, one can broadly predict that for every time the site area is doubled, an average increase in the number of species recorded of 1.29 can be anticipated. In practice of course other factors such as the proportion of various habitats within the site will also influence the species diversity, and it is clear from graphs 1 and 2 that there is wide variation around the trend. It should also be borne in mind that the areas of individual habitats within each site will tend to increase with the area of the site, hence we cannot rule out that the species/area relationship may represent a relationship with the area of the site as a whole or with the area of one (or more) of its main habitats.

[1] Trend line determined in Excel

Graph 2. Relationship between the number of bird species & site area (ha), log_{10} scales on both axes



3.3 Identifying key habitat factors for birds

Table 2a explores the relationship between species richness, site area and a range of habitat variables through a correlation matrix. Pearson's correlation co-efficient was used to see how far species richness was correlated with each of the main habitat factors and also to see how far each of the main habitat factors was correlated with the others.

The first column of figures in table 2a shows the correlations between species richness and individual habitat factors. The higher the Pearson's coefficient, the stronger the correlation. In each case, levels of probability for the apparent correlation being due to chance alone are also given. For clarity, statistically significant[2] positive correlations are shown in red, negative correlations in blue. It will be seen that the correlation coefficients for species richness with site area and with the area of trees plus shrubs plus hedges are very close. A strong positive correlation is also apparent between species richness and a) the areas of trees; b) the area of shrubs; and c) the area of amenity grass, taking each individually. Each of these factors in turn is positively correlated with site area (see column 2).

Significant negative correlations were found between species richness and a) the distance to a large park (i.e. sites close to a large park tended to have higher species richness); b) the proportion of the shrubbery which is low (i.e. a higher proportion of low shrubbery tended to be associated with reduced species richness); and c) the proportion of the site made up of bare artificial

[2] The correlation is weakly significant where P=<0.05, and highly significant where P=<0.01

surface[3]. It should be noted that each of these factors in turn is negatively correlated, albeit at a weaker level of significance, with site area. Where a small site is isolated within the built up area, the birds are more dependent upon that individual 'patch' to meet their needs, whereas if such sites lie close to one another or to a large park, there is more opportunity to move freely between one site and another in search of food. It could also be anticipated that small sites which lie close to a large site are more likely to become colonised by 'surplus' birds dispersing from the larger site.

The correlation matrix also serves to clarify how far each of the main habitat variables is statistically linked to others, and hence whether our interpretation of the data is affected by problems of multi-colinearity. The remaining columns in table 2a serve this purpose. Unfortunately multi-colinearity has proved to be a major problem in the analysis, and various methods are employed later in the report, which seek – at least partially – to overcome the problem.

Table 2b extends the process further by looking at the correlations between numbers of individual bird species and the various habitat factors. Again statistically significant positive correlations are shown in blue, negative correlations in red.

This table brings out marked differences between species. For example, the robin, wren, dunnock, great tit and long-tailed tit show a strong correlation with the area of shrubbery, with a higher Pearson's value for this factor than for site area, whereas the feral pigeon shows no such trend, indeed it shows a negative correlation with shrubbery when this is expressed as a percentage of site area. Blackbird, robin, wren, dunnock, blue tit and great tit showed positive correlations with the proportion of the shrubbery which was tall, but negative correlation with the proportion which was low. All species except for feral pigeon, starling and house sparrow show a negative correlation with an increase in the proportion of the site made up of artificial hard surface.

[3] Significance levels as follows: distance to large park, and proportion of shrubbery which is low P<0.001;
proportion of site which is bare artificial habitat P=0.002

Table 2a: Species richness and habitat correlation	2-tailed P values. * P<0.05 weakly significant, ** P<0.01 strongly significant Positive relationship Negative relationship	no of bird species	site area	dist. to nearest >20ha park	% trees	% shrubs + hedgerow	% trees + shrubs + hedgerow	% amenity grassland	area of trees	area of shrubs	area of shrubs + trees+hedgerow	area of amenity grassland	% of trees native	% of trees evergreen	% shrubs evergreen	% shrubs native	%shrubbery - low	%shrubbery - medium	%shrubbery -tall	area low shrubbery	area medium shrubbery	area tall shrubbery	% neutral short turf	% long grassland	% flower beds	% native broadlvd woodland	% non-native broadlvd woodland	% scrub
Site Area	Pearson's r value	0.594**																									
	P value (sig. level)	<0.001																									
Dist. to nearest >20ha park	Pearson's r value	-0.211**	-0.156**																								
	P value (sig. level)	<0.001	0.008																								
% Trees	Pearson's r value	-0.002	-0.067	-0.126*																							
	P value (sig. level)	0.974	0.254	0.031																							
% shrubs + hedgerow	Pearson's r value	0.144*	-0.03	-0.029	0.151**																						
	P value (sig. level)	0.014	0.609	0.619	0.01																						
% trees +shrubs +hedgerow	Pearson's r value	0.064	-0.069	-0.117*	0.891**	0.584**																					
	P value (sig. level)	0.271	0.241	0.045	<0.001	<0.001																					
% Amenity Grassland	Pearson's r value	0.059	0.167**	-0.230**	0.027	-0.365**	-0.145*																				
	P value (sig. level)	0.313	0.004	<0.001	0.645	<0.001	0.013																				
Area of trees	Pearson's r value	0.556**	0.828**	-0.220**	0.345**	0.074	0.317**	0.132*																			
	P value (sig. level)	<0.001	<0.001	<0.001	<0.001	0.205	<0.001	0.023																			
Area of shrubs	Pearson's r value	0.537**	0.652**	-0.157**	0.056	0.514**	0.283**	-0.075	0.638**																		
	P value (sig. level)	<0.001	<0.001	0.007	0.338	<0.001	<0.001	0.201	<0.001																		
Area of shrubs + trees +hedges	Pearson's r value	0.601**	0.841**	-0.221**	0.254**	0.254**	0.326**	0.065	0.950**	0.843**																	
	P value (sig. level)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.264	<0.001	<0.001																	
Area of amen. grassland	Pearson's r value	0.503**	0.924**	-0.186**	-0.067	-0.147*	-0.123*	0.420**	0.736**	0.465**	0.703**																
	P value (sig. level)	<0.001	<0.001	0.001	0.251	0.012	0.036	<0.001	<0.001	<0.001	<0.001																
% of trees native	Pearson's r value	0.067	-0.039	0.053	-0.120*	-0.068	-0.130*	-0.051	-0.052	-0.037	-0.052	-0.043															
	P value (sig. level)	0.251	0.501	0.365	0.04	0.247	0.026	0.387	0.375	0.526	0.376	0.464															
% of trees evergreen	Pearson's r value	0.036	-0.027	<0.001	0.012	0.076	0.045	-0.003	-0.019	0.025	-0.003	-0.024	0.226**														
	P value (sig. level)	0.537	0.641	0.999	0.835	0.196	0.444	0.965	0.741	0.675	0.96	0.678	<0.001														
% shrubs evergreen	Pearson's r value	0.013	-0.072	0.021	0.035	0.107	0.078	-0.152**	-0.028	0.037	-0.004	-0.119*	-0.097	0.033													
	P value (sig. level)	0.83	0.218	0.717	0.549	0.069	0.184	0.009	0.633	0.525	0.944	0.042	0.097	0.577													
% shrubs native	Pearson's r value	0.231**	0.199**	-0.095	-0.018	0.041	0.004	0.075	0.149*	0.139*	0.159**	0.243**	0.156**	-0.016	-0.041												
	P value (sig. level)	<0.001	0.001	0.104	0.757	0.488	0.949	0.199	0.011	0.017	0.006	<0.001	0.008	0.782	0.486												
%Shrubbery - LOW	Pearson's r value	-0.202**	-0.118*	0.113	-0.11	-0.155**	-0.162**	-0.074	-0.130*	-0.154**	-0.153**	-0.11	0.02	-0.034	0.043	-0.094											
	P value (sig. level)	<0.001	0.044	0.054	0.06	0.008	0.006	0.207	0.026	0.008	0.009	0.06	0.738	0.564	0.462	0.11											
%Shrubbery -MEDIUM	Pearson's r value	0.104	0.019	0.034	0.002	0.121*	0.057	0.036	-0.02	0.017	-0.007	0.042	-0.014	0.085	0.198**	0.101	-0.402**										
	P value (sig. level)	0.077	0.744	0.566	0.979	0.039	0.332	0.541	0.735	0.772	0.906	0.475	0.811	0.149	0.001	0.083	<0.001										
%Shrubbery -TALL	Pearson's r value	0.239**	0.127*	-0.144*	0.168**	0.423**	0.332**	-0.064	0.190**	0.338**	0.265**	0.063	-0.133*	0.015	0.065	0.102	-0.383**	-0.133*									
	P value (sig. level)	<0.001	0.03	0.014	0.004	<0.001	<0.001	0.275	0.001	<0.001	<0.001	0.279	0.022	0.793	0.268	0.08	<0.001	0.023									
Area low shrubbery	Pearson's r value	0.333**	0.465**	-0.059	0.006	0.378**	0.179**	-0.107	0.504**	0.689**	0.620**	0.308**	-0.06	-0.062	-0.011	0.001	0.279**	-0.152**	0.081								
	P value (sig. level)	<0.001	<0.001	0.312	0.919	<0.001	0.002	0.067	<0.001	<0.001	<0.001	<0.001	0.306	0.29	0.845	0.984	<0.001	0.009	0.166								
Area medium shrubbery	Pearson's r value	0.553**	0.646**	-0.105	0.035	0.452**	0.237**	-0.045	0.584**	0.859**	0.749**	0.501**	0.007	0.057	0.047	0.203**	-0.261**	0.306**	0.225**	0.516**							
	P value (sig. level)	<0.001	<0.001	0.072	0.548	<0.001	<0.001	0.443	<0.001	<0.001	<0.001	<0.001	0.901	0.334	0.419	<0.001	<0.001	<0.001	<0.001	<0.001							
Area tall shrubbery	Pearson's r value	0.394**	0.451**	-0.169**	0.071	0.448**	0.265**	-0.092	0.471**	0.875**	0.679**	0.265**	-0.052	0.023	0.065	0.096	-0.165**	-0.091	0.488**	0.493**	0.639**						
	P value (sig. level)	<0.001	<0.001	0.004	0.223	<0.001	<0.001	0.117	<0.001	<0.001	<0.001	<0.001	0.374	0.696	0.267	0.1	0.005	0.122	<0.001	<0.001	<0.001						
% Neutral Short Turf	Pearson's r value	0.105	0.018	-0.001	-0.002	-0.087	-0.042	-0.211**	0.011	-0.029	-0.004	-0.061	0.092	-0.027	-0.130*	0.016	-0.088	-0.119*	-0.043	-0.024	-0.026	-0.02					
	P value (sig. level)	0.073	0.759	0.986	0.968	0.138	0.476	<0.001	0.856	0.618	0.942	0.3	0.116	0.643	0.026	0.779	0.135	0.042	0.458	0.684	0.657	0.732					
% Long Grassland	Pearson's r value	-0.028	-0.008	0.056	-0.137*	-0.083	-0.151**	-0.224**	-0.056	-0.052	-0.059	-0.049	-0.029	-0.046	-0.03	-0.005	0.001	0.02	0.031	-0.04	-0.055	-0.029	0.003				
	P value (sig. level)	0.628	0.898	0.342	0.019	0.157	0.01	<0.001	0.344	0.379	0.313	0.4	0.627	0.429	0.611	0.935	0.99	0.734	0.592	0.496	0.347	0.617	0.962				
% Flower Beds	Pearson's r value	0.068	-0.007	-0.086	0.004	0.104	0.052	-0.158**	0.019	0.107	0.055	-0.056	-0.04	0.03	0.084	0.004	0.097	-0.029	0.042	0.125*	0.063	0.098	0.004	-0.079			
	P value (sig. level)	0.247	0.907	0.144	0.94	0.075	0.379	0.007	0.742	0.068	0.344	0.343	0.499	0.606	0.15	0.941	0.098	0.624	0.477	0.032	0.279	0.095	0.943	0.178			
% Nat. Broadlvd wdl	Pearson's r value	0.062	0.045	0.016	-0.095	-0.079	-0.114	0.052	-0.037	-0.034	-0.038	0.06	-0.029	-0.026	-0.074	-0.034	-0.032	-0.013	0.09	-0.035	-0.038	-0.014	0.092	0.012	-0.039		
	P value (sig. level)	0.29	0.443	0.782	0.105	0.179	0.051	0.377	0.531	0.564	0.515	0.304	0.624	0.656	0.206	0.564	0.586	0.826	0.126	0.555	0.512	0.806	0.117	0.836	0.51		
% Non-Native Broadlvd wdl	Pearson's r value	0.092	0.068	-0.054	-0.094	0.058	-0.05	-0.183**	0.03	0.083	0.058	-0.02	-0.029	-0.034	-0.105	0.022	-0.099	-0.111	0.179**	-0.007	0.055	0.134*	0.259**	0.052	-0.069	0.049	
	P value (sig. level)	0.116	0.246	0.353	0.109	0.32	0.391	0.002	0.607	0.154	0.326	0.739	0.615	0.559	0.073	0.709	0.092	0.058	0.002	0.905	0.349	0.022	<0.001	0.371	0.24	0.402	
% Scrub	Pearson's r value	0.041	0.138*	-0.058	-0.071	0.022	-0.049	-0.069	0.005	0.046	0.018	0.143*	0.065	0.031	-0.139*	0.211**	-0.096	0.052	0.044	-0.055	0.104	0.031	0.257**	0.054	0.025	-0.008	-0.014
	P value (sig. level)	0.48	0.019	0.323	0.223	0.712	0.407	0.239	0.939	0.435	0.764	0.014	0.265	0.594	0.017	<0.001	0.103	0.373	0.456	0.347	0.075	0.592	<0.001	0.358	0.672	0.893	0.809
% Bare artificial habitat	Pearson's r value	-0.179**	-0.135*	0.269**	-0.076	-0.141*	-0.127*	-0.607**	-0.146*	-0.176**	-0.172**	-0.278**	0.065	-0.118*	0.156**	-0.107	0.227**	-0.079	-0.236**	-0.057	-0.189**	-0.146*	-0.056	-0.05	-0.089	-0.058	-0.104	-0.049
	P value (sig. level)	0.002	0.021	<0.001	0.193	0.016	0.029	<0.001	0.012	0.003	0.003	<0.001	0.266	0.044	0.007	0.066	<0.001	0.175	<0.001	0.335	0.001	0.013	0.338	0.397	0.129	0.32	0.076	0.408

Table 2b Habit correlations for individual bird species (based on nos of birds seen)	2-tailed P values. * P<0.05 weakly significant, ** P<0.01 strongly significant Positive relationship Negative relationship	Site Area	Dist. to nearest >20ha park	% Trees	% shrubs+ hedgerow	%trees + shrubs + hedgerow	% Amenity Grassland	% Bare Artificial habitat	Area of trees	Area of shrubs	Area of shrubs + trees + hedgerow	Area of amenity grassland	Area of artificial hard surface	% of trees native	% of trees evergreen	% shrubs evergreen	% shrubs native	%Shrubbery - LOW	%Shrubbery -MEDIUM	%Shrubbery -TALL	Area low shrubbery	Area medium shrubbery	Area tall shrubberry	% Neutral Short Turf	% Long Grassland	% Flower Beds	% Native Broadlvd woodland	% Non-Native Broadlvd woodland	% Scrub
Feral pigeon	Pearson's r value	0.268**	0.176**	-0.036	-0.205**	-0.124*	0.084	0.059	0.224**	-0.001	0.155**	0.260**	0.279**	-0.017	-0.069	0.021	-0.001	0.127*	-0.038	-0.127*	0.114	-0.02	-0.055	-0.032	0.023	0.027	0.075	-0.052	-0.068
	P value (sig.level)	<0.001	0.002	0.543	<0.001	0.035	0.15	0.318	<0.001	0.989	0.008	<0.001	<0.001	0.774	0.239	0.725	0.984	0.029	0.512	0.03	0.051	0.727	0.351	0.582	0.691	0.648	0.201	0.374	0.245
Wood Pigeon	Pearson's r value	0.426**	-0.123*	0.029	0.044	0.044	0.085	-0.101	0.394**	0.314**	0.403**	0.390**	0.202**	0.003	0.018	0.097	0.046	-0.068	0.065	0.071	0.237**	0.316**	0.209**	-0.011	0.012	-0.001	0.099	-0.038	-0.014
	P value (sig.level)	<0.001	0.035	0.619	0.458	0.453	0.147	0.086	<0.001	<0.001	<0.001	<0.001	<0.0001	0.96	0.765	0.098	0.432	0.248	0.269	0.228	<0.001	<0.001	<0.001	0.848	0.833	0.982	0.089	0.518	0.813
Carrion Crow	Pearson's r value	0.240**	0.039	-0.049	-0.064	-0.07	-0.055	-0.066	0.185**	0.122*	0.173**	0.148*	0.110	-0.029	0.008	-0.042	0.046	-0.087	-0.053	0.032	0.061	0.122*	0.088	0.322**	-0.027	-0.047	0.01	0.409**	-0.01
	P value (sig.level)	<0.001	0.501	0.399	0.274	0.232	0.348	0.262	0.001	0.037	0.003	0.011	0.059	0.618	0.897	0.477	0.428	0.14	0.366	0.581	0.297	0.037	0.133	<0.001	0.649	0.427	0.858	<0.001	0.866
Starling	Pearson's r value	0.130*	0.167**	-0.053	-0.01	-0.048	0.045	0.021	0.08	0.05	0.074	0.132*	0.150**	0.004	-0.009	-0.06	-0.056	0.053	-0.027	-0.058	0.08	-0.022	-0.024	-0.04	0.042	-0.072	-0.024	-0.042	-0.038
	P value (sig.level)	0.026	0.004	0.368	0.86	0.412	0.438	0.721	0.172	0.396	0.206	0.023	0.009	0.95	0.873	0.309	0.341	0.369	0.648	0.322	0.172	0.711	0.686	0.491	0.469	0.222	0.686	0.47	0.519
House sparrow	Pearson's r value	-0.011	0.003	-0.138*	-0.051	-0.137*	0.073	0.01	-0.047	-0.019	-0.037	-0.001	0.001	.369**	<0.001	-0.013	0.028	0.013	0.001	-0.104	0.01	0.019	-0.053	-0.021	-0.022	-0.083	-0.015	-0.027	-0.025
	P value (sig.level)	0.846	0.962	0.018	0.387	0.019	0.215	0.871	0.425	0.746	0.524	0.987	0.869	<0.001	0.998	0.829	0.639	0.826	0.988	0.075	0.869	0.752	0.362	0.717	0.712	0.158	0.795	0.641	0.664
Magpie	Pearson's r value	0.136*	-0.092	-0.061	-0.069	-0.082	0.036	-0.138*	0.115*	0.087	0.115*	0.128*	-0.001	-0.01	0.014	-0.027	0.031	-0.003	0.038	-0.019	0.142*	0.078	0.053	0.066	0.416**	-0.07	-0.029	0.037	-0.028
	P value (sig.level)	0.02	0.116	0.297	0.241	0.163	0.536	0.018	0.049	0.137	0.049	0.029	0.988	0.858	0.817	0.643	0.598	0.955	0.514	0.751	0.015	0.183	0.368	0.26	<0.001	0.231	0.622	0.533	0.633
Blackbird	Pearson's r value	0.416**	-0.038	0.052	0.105	0.091	0.066	-0.126*	0.387**	0.373**	0.420**	0.337**	0.225**	0.032	0.037	0.063	0.170**	-0.175**	0.129*	0.189**	0.143*	0.386**	0.269**	-0.002	-0.075	-0.018	0.077	0.015	-0.052
	P value (sig.level)	<0.001	0.517	0.375	0.073	0.121	0.261	0.031	<0.001	<0.001	<0.001	<0.001	<0.001	0.585	0.526	0.279	0.003	0.003	0.027	0.001	0.014	<0.001	<0.001	0.971	0.201	0.754	0.187	0.798	0.371
Song Thrush	Pearson's r value	.209**	-0.027	-0.032	-0.005	-0.029	0.064	-0.068	0.071	0.1	0.083	0.251**	0.011	-0.015	0.093	-0.091	0.143*	-0.064	0.088	0.024	0.034	0.174**	0.037	-0.018	-0.012	-0.011	-0.01	-0.018	0.242**
	P value (sig.level)	<0.001	0.645	0.58	0.934	0.622	0.278	0.246	0.223	0.087	0.158	<0.001	0.852	0.799	0.113	0.12	0.015	0.272	0.135	0.685	0.563	0.003	0.533	0.761	0.843	0.851	0.865	0.761	<0.001
Robin	Pearson's r value	0.147*	-0.125*	0.146*	0.311**	0.263**	-0.078	-0.175**	0.228**	0.317**	0.280**	0.058	-0.005	-0.032	0.066	0.014	0.067	-0.227**	0.066	0.358**	0.114	0.315**	0.301**	0.003	-0.036	0.088	0.009	0.182**	-0.028
	P value (sig.level)	0.012	0.032	0.013	<0.001	<0.001	0.183	0.003	<0.001	<0.001	<0.001	0.318	0.926	0.59	0.263	0.808	0.254	<0.001	0.262	<0.001	0.052	<0.001	<0.001	0.957	0.544	0.132	0.876	0.002	0.628
Wren	Pearson's r value	0.405**	-0.197**	0.057	0.214**	0.145*	-0.016	-0.133*	0.383**	0.454**	0.454**	0.360**	0.047	0.018	0.066	-0.025	0.269**	-0.220**	0.089	0.195**	0.231**	0.449**	0.323**	0.062	-0.051	0.118*	-0.042	0.077	0.122*
	P value (sig.level)	<0.001	0.001	0.334	<0.001	0.013	0.784	0.023	<0.001	<0.001	<0.001	<0.001	0.419	0.764	0.259	0.672	<0.001	<0.001	0.129	0.001	<0.001	<0.001	<0.001	0.294	0.38	0.044	0.469	0.191	0.037
Dunnock	Pearson's r value	0.286**	-0.128*	0.026	0.193**	0.11	0.029	-0.123*	0.287**	0.437**	0.381**	0.227**	0.012	-0.007	0.039	0.051	0.049	-0.147*	0.086	0.159**	0.160**	0.455**	0.377**	-0.004	-0.042	0.150*	-0.02	0.088	-0.033
	P value (sig.level)	<0.001	0.028	0.653	0.001	0.059	0.627	0.036	<0.001	<0.001	<0.001	<0.001	0.836	0.899	0.509	0.388	0.401	0.012	0.142	0.006	0.006	<0.001	<0.001	0.944	0.474	0.01	0.733	0.132	0.569
Blue Tit	Pearson's r value	0.298**	-0.196**	0.145*	0.220**	0.221**	0.06	-0.174**	0.353**	0.387**	0.399**	0.254**	0.060	-0.001	0.075	0.053	0.154**	-0.211**	0.133*	0.210**	0.144*	0.371**	0.327**	-0.018	-0.051	0.077	-0.018	0.04	-0.023
	P value (sig.level)	<0.001	0.001	0.013	<0.001	<0.001	0.306	0.003	<0.001	<0.001	<0.001	<0.001	0.308	0.987	0.202	0.37	0.008	<0.001	0.023	<0.001	0.013	<0.001	<0.001	0.761	0.385	0.187	0.765	0.495	0.696
Great Tit	Pearson's r value	0.231**	-0.165**	0.098	0.202**	0.173**	-0.084	-0.063	0.278**	0.401**	0.356**	0.116*	0.030	0.01	0.134*	0.053	0.013	-0.127*	0.04	0.216**	0.210**	0.340**	0.436**	-0.01	-0.034	0.102	-0.025	0.07	-0.031
	P value (sig.level)	<0.001	0.005	0.094	0.001	0.003	0.153	0.285	<0.001	<0.001	<0.001	0.047	0.610	0.869	0.021	0.365	0.824	0.029	0.5	<0.001	<0.001	<0.001	<0.001	0.862	0.565	0.081	0.672	0.231	0.595
Long-Tailed tit	Pearson's r value	0.255**	-0.065	0.03	0.194**	0.114	-0.033	-0.067	0.315**	0.398**	0.377**	0.175**	0.045	-0.015	-0.029	0.005	-0.006	-0.077	-0.062	0.259**	0.176**	0.291**	0.478**	-0.016	-0.025	0.031	-0.012	0.120*	-0.02
	P value (sig.level)	<0.001	0.27	0.61	0.001	0.052	0.575	0.252	<0.001	<0.001	<0.001	0.003	0.443	0.801	0.616	0.931	0.912	0.19	0.289	<0.001	0.002	<0.001	<0.001	0.79	0.668	0.595	0.838	0.041	0.733
Coal Tit	Pearson's r value	0.118*	-0.128*	-0.022	0.004	-0.016	0.08	-0.078	0.1	0.105	0.108	0.142*	-0.023	0.007	0.053	-0.044	0.055	-0.019	-0.024	0.101	0.143*	0.061	0.095	-0.005	-0.016	0.041	-0.008	-0.013	-0.013
	P value (sig.level)	0.043	0.029	0.704	0.94	0.782	0.17	0.184	0.086	0.072	0.064	0.015	0.702	0.911	0.37	0.449	0.349	0.744	0.68	0.084	0.014	0.295	0.106	0.935	0.788	0.48	0.898	0.818	0.831
Greenfinch	Pearson's r value	0.271**	-0.008	-0.005	-0.002	-0.005	0.001	-0.036	0.227**	0.105	0.196**	0.231**	0.252**	-0.005	0.019	-0.062	0.068	-0.066	0.081	0.015	0.111	0.122*	0.053	0.048	-0.003	0.014	0.064	0.022	0.052
	P value (sig.level)	<0.001	0.893	0.93	0.974	0.931	0.998	0.542	<0.001	0.073	0.001	<0.001	<0.001	0.926	0.745	0.292	0.244	0.261	0.166	0.804	0.057	0.037	0.368	0.412	0.958	0.805	0.277	0.705	0.379
Chaffinch	Pearson's r value	0.246**	-0.092	-0.04	-0.029	-0.046	0.075	-0.009	0.145*	0.132*	0.152**	0.270**	0.103	0.051	0.042	-0.068	0.302**	-0.112	0.051	0.109	-0.013	0.174**	0.068	0.005	-0.024	-0.036	-0.013	-0.023	0.154**
	P value (sig.level)	<0.001	0.115	0.492	0.627	0.43	0.202	0.882	0.013	0.024	0.009	<0.001	0.078	0.38	0.469	0.246	<0.001	0.056	0.386	0.062	0.825	0.003	0.246	0.927	0.683	0.541	0.825	0.693	0.008
Goldfinch	Pearson's r value	0.245**	-0.072	-0.08	0.039	-0.048	0.059	-0.084	0.132*	0.239**	0.189**	0.227**	0.0292	0.034	-0.003	-0.066	0.053	-0.086	0.09	0.028	0.049	0.370**	0.123*	0.029	-0.016	0.032	0.136*	0.019	-0.015
	P value (sig.level)	<0.001	0.22	0.17	0.504	0.413	0.314	0.154	0.024	<0.001	0.001	<0.001	0.619	0.559	0.96	0.257	0.367	0.144	0.126	0.637	0.405	<0.001	0.035	0.62	0.78	0.59	0.02	0.751	0.801
Blackcap	Pearson's r value	0.233**	-0.04	-0.018	0.091	0.027	-0.084	-0.069	0.204**	0.415**	0.315**	0.095	<0.001	-0.022	0.002	-0.044	-0.023	-0.063	-0.062	0.073	0.149*	0.362**	0.458**	0.196**	-0.011	-0.008	-0.005	0.464**	-0.009
	P value (sig.level)	<0.001	0.492	0.763	0.12	0.641	0.151	0.241	<0.001	<0.001	<0.001	0.105	0.992	0.705	0.969	0.455	0.689	0.284	0.294	0.213	0.011	<0.001	<0.001	0.001	0.847	0.887	0.926	<0.001	0.878
Gt Spotted Woodpecker	Pearson's r value	0.149*	-0.059	-0.019	0.094	0.028	0.005	-0.078	0.137*	0.330**	0.233**	0.082	-0.017	-0.026	0.001	0.01	0.019	-0.056	0.004	0.104	0.112	0.292**	0.365**	-0.01	-0.012	-0.006	-0.006	0.156**	-0.01
	P value (sig.level)	0.01	0.316	0.751	0.109	0.635	0.936	0.184	0.019	<0.001	<0.001	0.163	0.769	0.662	0.988	0.87	0.747	0.339	0.942	0.074	0.056	<0.001	<0.001	0.862	0.838	0.914	0.922	0.007	0.871
Green Woodpecker	Pearson's r value	0.049	0.025	-0.04	-0.083	-0.071	-0.132*	-0.06	0.009	-0.039	-0.01	-0.05	-0.040	-0.029	-0.016	-0.093	-0.029	-0.061	-0.102	-0.043	-0.036	-0.043	-0.02	0.453**	-0.008	-0.042	-0.004	0.580**	-0.007
	P value (sig.level)	0.408	0.665	0.494	0.157	0.225	0.023	0.307	0.872	0.51	0.868	0.396	0.492	0.62	0.79	0.112	0.625	0.298	0.083	0.466	0.536	0.466	0.732	<0.001	0.885	0.477	0.945	<0.001	0.909
Jay	Pearson's r value	0.063	-0.134*	0.140*	0.1	0.161**	0.024	-0.097	0.169**	0.095	0.150*	0.059	-0.037	0.016	-0.023	0.061	0.009	-0.087	-0.019	0.114	-0.007	0.051	0.095	-0.018	-0.01	0.026	-0.01	<0.001	-0.017
	P value (sig. evel)	0.285	0.022	0.016	0.088	0.006	0.688	0.097	0.004	0.106	0.01	0.318	0.528	0.784	0.691	0.299	0.872	0.135	0.746	0.051	0.91	0.383	0.106	0.753	0.87	0.657	0.861	0.996	0.77
Mistle Thrush	Pearson's r value	0.159**	-0.109	-0.032	-0.008	-0.03	0.036	-0.032	0.128*	0.144*	0.140*	0.126*	0.091	-0.054	-0.06	0.017	-0.055	0.066	-0.072	0.019	0.240**	0.074	0.121*	-0.021	0.022	0.058	-0.012	-0.021	-0.019
	P value (sig.level)	0.006	0.063	0.58	0.887	0.603	0.536	0.581	0.029	0.014	0.017	0.031	0.119	0.354	0.305	0.777	0.346	0.263	0.218	0.74	<0.001	0.209	0.038	0.722	0.707	0.326	0.842	0.722	0.74

3.4 The importance of shrubbery

Graphs 3a and 3b bring out more clearly the relationship between the understorey vegetation (i.e. the proportion of the site occupied by shrubbery plus hedges) and the occurrence of various bird species. For this analysis, the sites were divided into four categories, representing those with <10%; 10-19%; 20-29% or 30% or higher cover by understorey vegetation. The bird data are expressed as the percentage of sites in which each species was found.

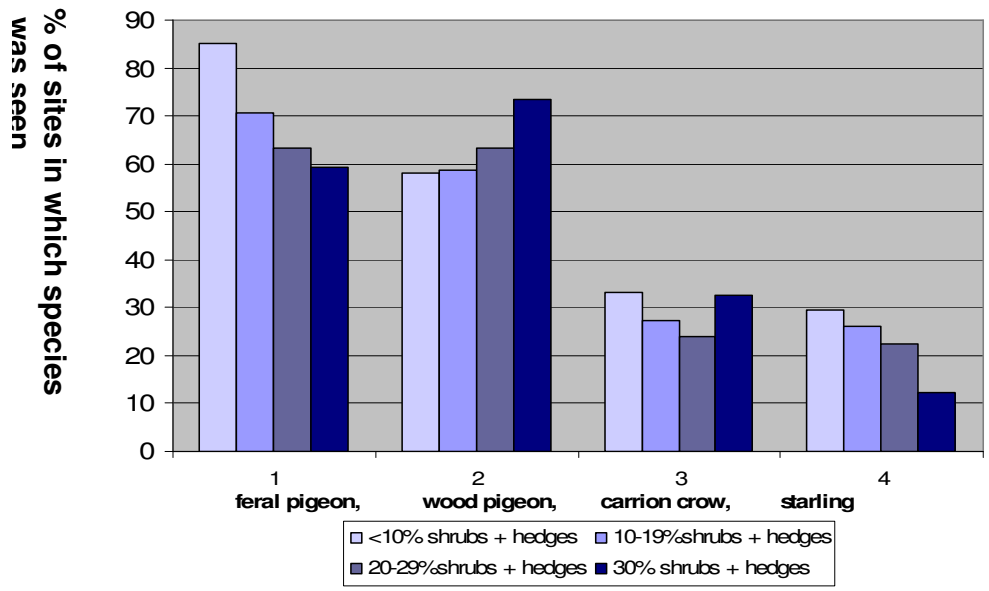
In graph 3b, an increase in the frequency of robin, wren, dunnock and long-tailed tit is seen as the amount of cover increases, and a similar pattern applies, though to a lesser extent, in the great tit. By contrast, in graph 3a both the feral pigeon and starling occurred more commonly in the more open sites than those with plenty of shrubbery, the wood pigeon occurred only a little more frequently as the amount of cover increased, and crows showed no preference at all.

These trends were shown to be statistically significant for robin, wren, dunnock, great tit and long- tailed tit, (with similar trends for blackbird and blue tit which are not illustrated in the graph) – all positively correlated with an increase in shrubbery, whilst feral pigeon is significantly negatively correlated with increase in shrubbery[4]. As noted earlier, in interpreting this data it is important to take account of multicolinearity, including the correlation between the amounts of shrubbery and tree cover which is indicated in table 2a. However, in table 2b it can be seen that the correlation co-efficients for robin, wren, dunnock, great tit and long-tailed tit with the percentage cover by shrubbery and hedges is substantially higher for than that for trees.

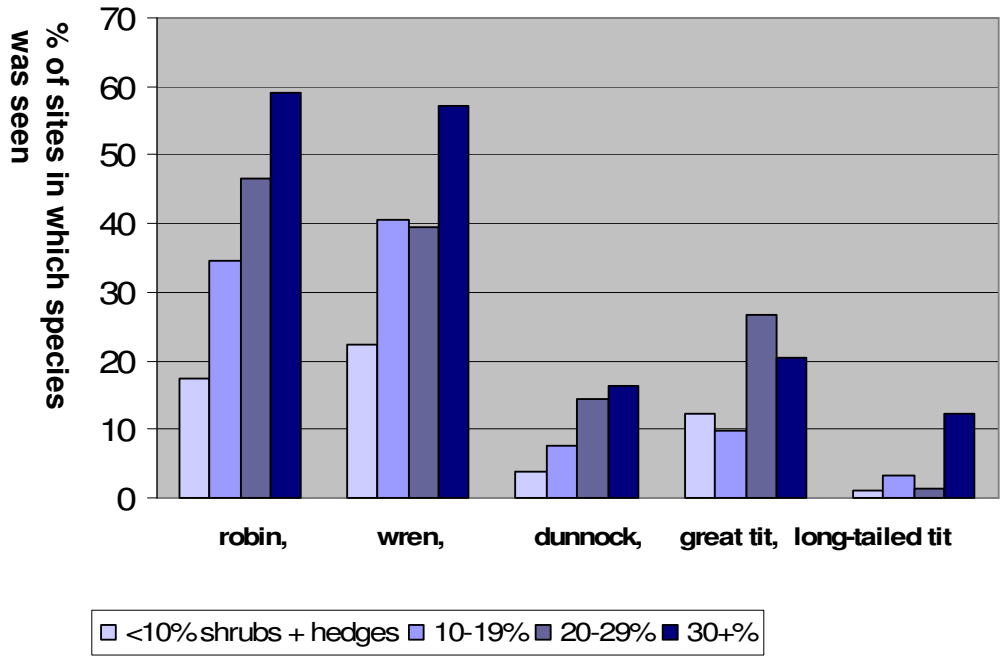
The results can be related to the feeding and nesting habits of the birds. Starlings often forage on short grassland and feral pigeons are also primarily ground feeders. Both species tend to forage in open areas, seldom close to cover that may conceal ground predators. Robin, wren and dunnock tend to feed in or near areas of cover. The great tit and long-tailed tit also feed mainly among trees or bushes, though sometimes in the tree canopy. Great tits also forage on the ground near trees and bushes, but not in open grassland.

Nesting habitat is also likely to be a key factor. Crows nest mainly in the canopy of tall trees offering a wide view of the surroundings. Wood pigeons tend to nest more often in the tree canopy rather than shrubs. Feral pigeons nest mainly on built structures. All three species are relatively large birds, accustomed to flying considerable distances to feed, and therefore able to utilise feeding habitat some way from their nesting site. By contrast robin, wren and dunnock typically nest no more than 3-4m above the ground. Long-tailed tits tend to nest in tall shrubbery.

[4] based on analysis in Anova, which examined the number of each species recorded in sites with varying % cover by shrubbery and hedges, significant differences were found as follows: P<0.001 feral pigeon (more abundant in sites with less shrubbery and hedges); P<.0.001 robin; P=0.0019 wren; P=0.031 dunnock, P=0.014 great tit; P=0.004 blue tit; P=0.021 long tailed tit, P=0.009 blackbird (more numerous in sites with more shrubbery and hedges)



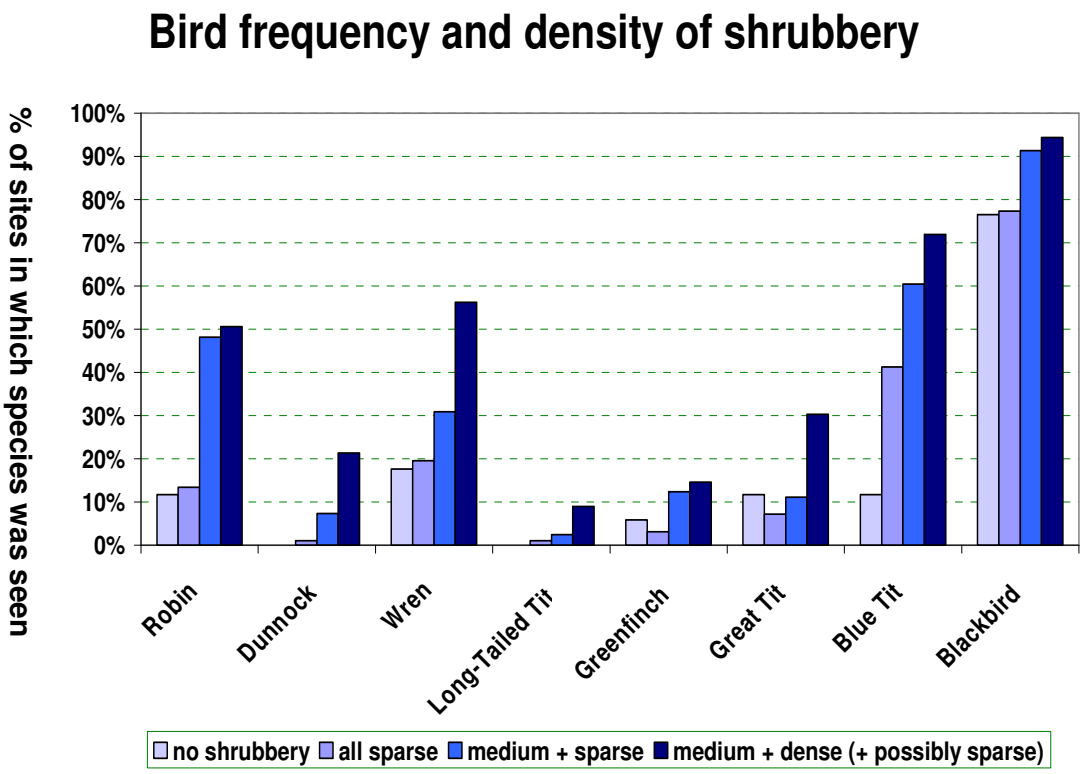
Graph 3a Percentage of sites where feral pigeon, wood pigeon, carrion crow and starling were recorded, with sites grouped in four categories in relation to % cover by shrubbery and hedges (<10%, 10-19%; 20-29% & 30% or more)



Graph 3b Percentage of sites where robin, wren, dunnock, great tit and long-tailed tit were recorded, with sites grouped in four categories in relation to % cover by shrubbery and hedges (<10%, 10-19%; 20-29% & 30% or more)

3.5 Height and density of shrubbery

Graph 4 explores the value of shrubbery density. The recorders were asked to indicate by up to three ticks in each category, the proportion of the shrubbery which could be regarded as sparse, medium or dense. In this analysis, sites are divided into those with no shrubbery, sparse shrubbery only, medium and sparse shrubbery mixed, or medium with some pockets of dense shrubbery (and perhaps also some sparse shrubbery). It will be appreciated that these habitat divisions are at best only rough classifications. None the less it is clear from graph 4, that there is a general trend for most of the eight species featured to show some preference towards medium or denser growth. The difference is particularly marked for the wren and dunnock, which tend to nest in dense cover.

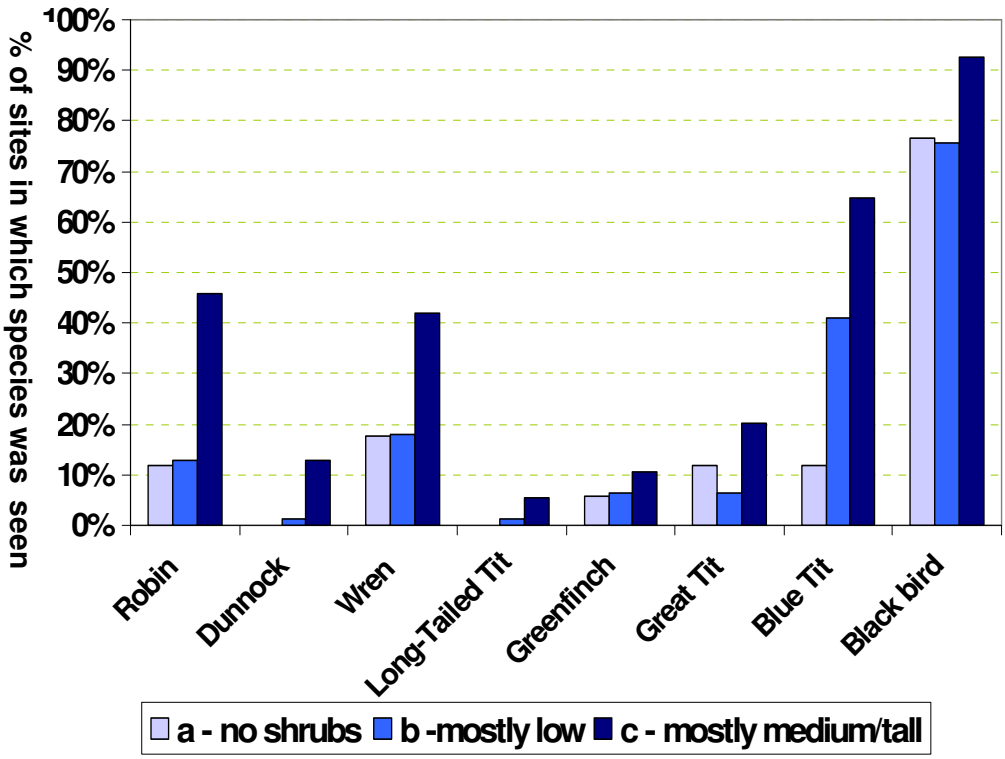


Graph 4. Frequency of certain bird species in relation to density of cover

The difference was least marked in the blackbird. This species is undoubtedly one of the most successful colonists of London squares. Although typically nesting in shrubbery, it has proved to be remarkably adaptable, and where such cover is minimal or absent, it will adopt unusual nest sites, such as window boxes or crevices behind drainpipes.

Further details of the data in graph 4 are given in appendix 4. It should be noted that denser shrubbery is more likely to occur in sites with plenty of shrubs.

In graph 5, the percentage of sites where individual bird species were recorded is expressed in relation to height of shrubbery. For this analysis the sites were grouped into three categories: no shrubs; 50% or more of the shrubbery lower than 1m; and over 50% of shrubbery 1m or taller. Again it should be stressed that the recording of shrub height represents only a rough estimate from a simple visual appraisal of the proportion of the shrubbery which fell into each of three height bands (low =<1m; medium=1-2m, and tall=>2m).



Graph 5. Frequency of robin, wren, dunnock, blackbird, greenfinch, blue tit, great tit and long-tailed tit in relation to height of shrubbery

It can be seen that robin, dunnock, wren, long-tailed tit, great tit and blue tit occurred more commonly in sites in which more than 50% of the shrubbery was classified as medium or tall. Levels of significance are given below[5] . The results are broadly in agreement with the data for these species in the correlation matrix, table 2b, in which blackbird, robin, wren, dunnock, blue tit and great tit showed a statistically significant negative correlation with the % of shrubbery which was low, and positive correlation with the proportion of shrubbery which was tall. The long-tailed tit also showed a strong positive correlation with taller shrubbery.

[5] Analysis in Anova based on numbers of each species recorded in relation to three categories of sites: no shrubbery; 50% of shrubbery <1m and at least 50% of shrubbery >1m showed a statistically significant trend towards higher bird numbers in sites with a greater proportion of taller shrubbery at the following levels: robin, wren, blue tit, blackbird, highly significant P<0.01; great tit, dunnock, significant P<0.05

3.6 Ivy-covered trees

Ivy covered trees were given special attention within the survey. The recorders were asked to place each site in one of four categories: (i) no ivy-clad trees; (ii) 1 – 4 ivy-clad trees; (iii) 5 – 10 ivy-clad trees; (iv) 11 + ivy-clad trees. Table 3 shows the percentage of sites in each of the four categories where each species was found.

Table 3. Frequency of individual bird species in relation to ivy-clad trees
Note ** = strongly significant P≤0.01

	Category – number of ivy clad trees						
% of sites seen	**0**	**1 - 4**	**5 - 10**	**11 +**	**% across all sites**	**Spearman's Rho for ivy-clad trees**	**Significance level**
Feral pigeon	68%	77%	82%	100%	71%		
Wood pigeon	59%	65%	88%	100%	62%		
Carrion crow	23%	47%	41%	50%	29%		
Starling	22%	28%	29%	100%	24%		
House sparrow	9%	9%	12%	50%	9%		
Magpie	20%	23%	35%	50%	21%		
Blackbird	83%	95%	100%	100%	86%	0.230(**)	<0.001
Song thrush	2%	4%	6%	0%	2%	0.082	0.162
Mistle thrush	3%	4%	6%	0%	3%	0.021	0.717
Robin	29%	47%	71%	50%	35%	0.249(**)	<0.001
Wren	26%	46%	82%	100%	34%	0.293(**)	<0.001
Dunnock	5%	14%	41%	50%	9%	0.255(**)	<0.001
Blue tit	50%	68%	88%	50%	56%	0.253(**)	<0.001
Great tit	11%	21%	47%	100%	16%	0.255(**)	<0.001
Long-tailed tit	2%	7%	18%	0%	4%	0.182(**)	0.002
Coal tit	1%	0%	6%	50%	2%	0.069	0.236
Greenfinch	10%	11%	12%	50%	10%	0.042	0.476
Chaffinch	4%	5%	12%	50%	5%	0.103	0.079
Goldfinch	1%	0%	18%	0%	2%	0.11	0.061
Blackcap	0%	2%	6%	0%	1%	0.150(**)	0.01
Sparrowhawk	1%	0%	0%	0%	1%	-0.049	0.407
Gt sp. W'dpecker	0%	0%	6%	0%	1%	0.063	0.285
Grn woodpecker	0%	2%	0%	0%	<1%	0.089	0.127
Mallard	1%	2%	6%	0%	2%	0.05	0.389
Jay	1%	2%	18%	0%	2%	0.196(**)	0.001
Swift	2%	2%	6%	0%	2%	0.03	0.608
No of sites in each category	**217**	**57**	**17**	**2**	**293**		

Only 76 sites (26% of the total) had ivy-covered trees, and only two sites had more than ten ivy-clad trees, but none the less a clear trend is apparent for many species. Further analysis using Spearman's Rho rank order correlation, based on counts of individual species, was used to see whether the apparent association was statistically significant. This demonstrated a significant positive correlation between overall species diversity and ivy covered trees

(P<0.01) and a particularly marked trend in blackbird, robin, wren, dunnock, blue tit, great tit, blackcap and jay.

Ivy represents good nesting habitat for many species. It also offers cover from predators and adverse weather. It harbours a rich insect fauna and therefore represents good feeding habitat, for example for wren and dunnock. In winter the berries provide an additional food supply for birds; these are particularly favoured by blackcap. In addition to these direct benefits for birds, it is likely that the presence of ivy on trees is also indicative of a relaxed, ecologically-sensitive style of garden management, in which vegetation is allowed to mature naturally (within the limits of garden design) and areas of undisturbed cover are encouraged (see also table 4 below).

3.7 Dead wood

The surveyors were asked to record the presence of dead wood by a simple yes/no record, whether it was found in the tree canopy or undergrowth.

Dead wood was noted in 68 sites (23% of the overall total). The average number of species per site in these sites was 5.9, compared with an average of 4.5 species in the 225 sites where dead wood was not recorded. Grouping the sites in four bands according to the number of species recorded (table 4, columns 1-3 below) it can be seen that as the diversity of bird species increases (column 1),dead wood was recorded in a higher proportion of sites (column 3).

Table 4. Bird diversity in relation to presence of dead wood and other bird-friendly features

No of bird species in each site	No of sites in each category	% of sites with dead wood	% of sites with wild flowers	% of sites with ivy-clad trees	% of sites with bird feeders
0-3	96	8.30%	11.50%	13.50%	0%
4-6.0	121	20.7%	24.8%	21.50%	8.30%
7-9.0	50	42%	42%	40%	14%
10.0-14.0	26	57.7%	73.10%	61.50%	26.90%

Analysis which compared the mean number of birds of each species in sites with or without a record of dead wood, showed that the blackbird, robin, dunnock, wren, blue tit and great tit were present in significantly higher number in sites with dead wood than those where none was recorded[6]. As

[6] based on analysis of variance in numbers of birds recorded, using Levene's test for equality of variance followed by comparison of means using t-test; blackbird, robin, wren, blue tit and great tit were present in significantly higher number in sites with dead wood, at P<0.01; for carrion crow and dunnock, P<0.05.

with ivy-clad trees, we cannot, of course, attribute this trend simply to dead wood habitat. From table 4 it can be seen that sites with dead wood were also more likely to have other bird-friendly features such as ivy-clad trees, bird feeders or wild flowers under the shrubbery. Using a chi-squared test, dead wood was shown to be significantly associated with both bird feeders and nest boxes. Dead wood is, of course, specifically important for species which feed on the associated invertebrates of decaying timber, such as woodpeckers. In two out of the three sites where woodpeckers were recorded (green woodpecker in open land by Dickens Square, Bermondsey and great spotted woodpecker in Ladbroke Square and Evelyn Gardens, Kensington) dead wood was also recorded. In 2003, great spotted woodpeckers nested in Thurloe Square, a well vegetated site next to the Cromwell Road, which is managed on wildlife-friendly lines, including some dead wood habitat.

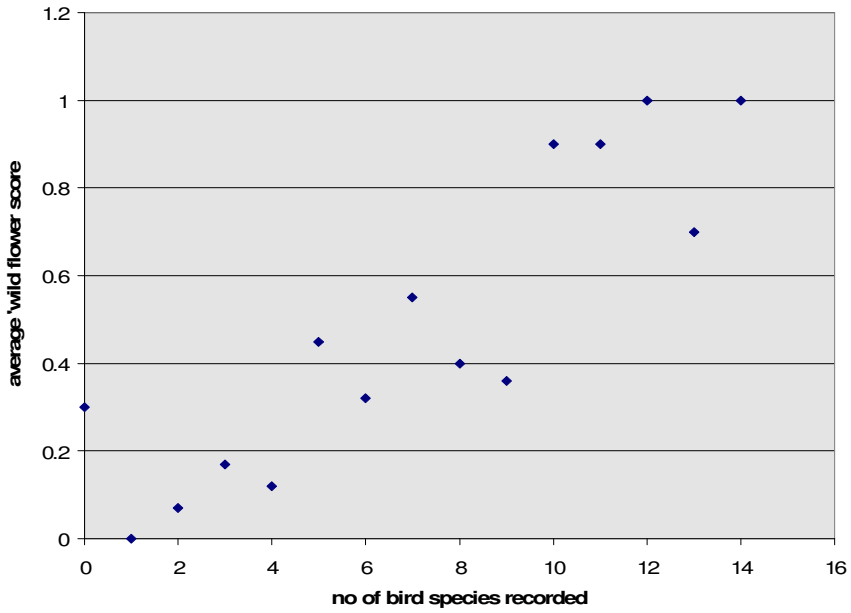
3.8 Wild flowers under shrubberies

The recorders were asked to indicate whether wild flowers were allowed to grow up under shrubberies, allocating up to three ticks to indicate the relative quantity. These might include naturalised garden bluebells, or common wild flowers such as various species of willowherb, garlic mustard, bittersweet, enchanter's nightshade, hedge woundwort, cow parsley, chickweed etc. In some gardens these plants are treated as weeds and routinely sprayed out, or wood chip mulches are applied which tend to suppress their growth, whereas in others the shrubberies are treated more as woodland, with wild flowers left to colonise naturally, within reason, appropriate to the style of the garden.

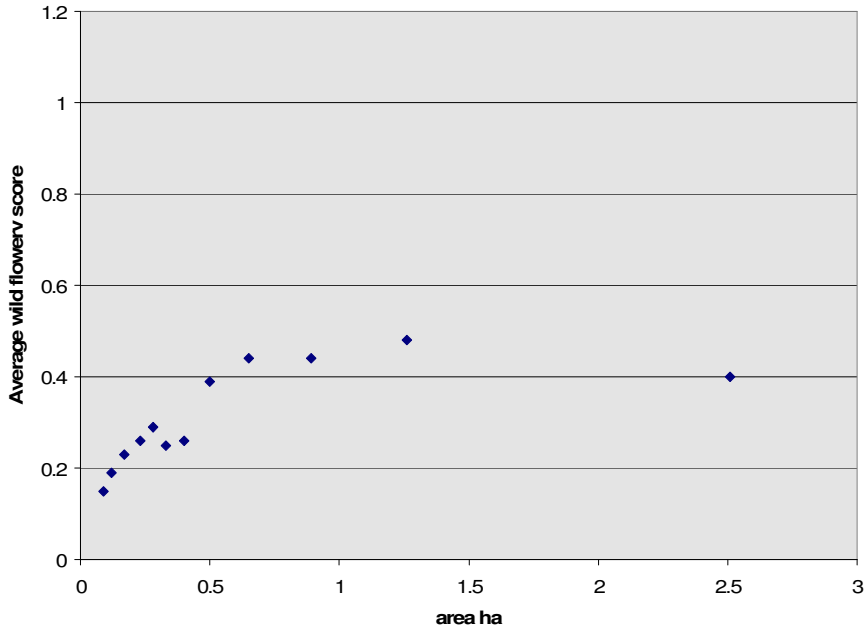
Wild flowers under shrubberies were noted in a total of 81 sites. From table 4, column 4, it is clear that sites with wild flowers tended to be those with a good diversity of bird species. In graph 6a, the average score for wild flowers under shrubbery (0, 1, 2 or 3) is calculated separately for sites with differing numbers of bird species recorded. A remarkable correlation is apparent between the average wild flower score and number of bird species recorded. It might be considered that this represents no more than a reflection of the species richness/area relationship, however, in graph 6b where the average wild flower score is plotted against site area[7], it can be seen that the wild flower score/site area 'association' is less clearcut than the wild flowers/bird species 'association', at least in the larger sites.

[7] For graph 6b, sites were grouped into 12 bands according to area, and the data plotted represents the 'wild flower score' averaged across all the sites in each band, plotted against the median area for that band.

Graph 6a Wild flowers under shrubbery vs bird species richness



Graph 6b Wild flower score v site area



3.9 Nest boxes and bird feeders

Table 5 below examines the frequency of selected species in relation to nest boxes and/or bird feeders. Sites are grouped into those with or without nest boxes, with or without bird feeders, and with both nest boxes and feeders.

	No Nest Box		Nest Box		No Bird Feeders		Bird Feeders		Nest Box + Feeder	
	No of sites where species was found	% of sites	No of sites where species was found	% of sites	No of sites where species was found	% of sites	No of sites where species was found	% of sites	No of sites where species was found	% of sites
Blackbird	258	**88**	31	**89**	233	**87**	23	**96**	16	**94**
Blue Tit	139	**54**	25	**71**	146	**54**	18	**75**	13	**76**
Great Tit	31	**12**	15	**43**	38	**14**	8	**33**	5	**29**
Long-Tailed Tit	10	**4**	1	**3**	9	**3**	2	**8**	1	**6**
House Sparrow	24	**9**	3	**9**	26	**10**	1	**4**	1	**6**
Robin	88	**35**	12	**34**	93	**35**	11	**46**	7	**41**
Wren	86	**33**	13	**37**	90	**33**	10	**42**	6	**35**
Greenfinch					23	**9**	6	**25**	3	**18**
Jay					3	**1**	3	**13**	4	**24**
no of sites in each category	258		35		269		24		17	

Table 5: Frequency of blue tit, great tit, long-tailed tit, house sparrow, robin, wren, greenfinch and jay in relation to nest boxes and feeders

From the table, it can be seen, as might be expected, that the percentage of sites where blue tits and great tits occurred was substantially higher where nest boxes were provided. Long-tailed tits did not appear to be influenced by nest boxes, which was to be expected as this species typically nests in tall shrubbery, weaving an elegant pendant nest rather than seeking a nest hole. Where bird feeders were provided, blue tit, great tit, robin, wren, jay, blackbird and greenfinch were recorded in a higher proportion of sites. Although blackbirds do not use hanging bird feeders, they often pick up food which falls to the ground below. Both greenfinch and jay are common visitors to bird feeders where larger seeds and nuts are provided.

When the results are examined for statistical significance[8], the association of nest boxes with numbers of blue tit and great tit was shown to be highly significant, and bird feeders were significantly associated with higher numbers of blue tit, great tit, blackbird, robin and wren. Feeders appeared to make little difference to house sparrow numbers in this study, but as noted above, sparrows were so scarce over most of the survey area it is difficult to draw strong conclusions. Geographic location seemed to be a stronger influence.

[8] Means were compared using a used Levene's test for equality of variance followed by a t test (equal or unequal variance models as appropriate) for significance of difference in means. Note that this analysis is based on numbers of birds seen at each site rather than the % of sites where birds were recorded (which is shown in table 5) and also that some species, e.g. tits, tend to flock around feeders, whereas others, e.g. greenfinch and jay, are more likely to be seen as single individuals. The following levels of significance were found: nest boxes - highly significant, $P<0.01$, for blue tit, great tit (and wren and feral pigeon – the latter two are assumed to reflect some other statistically linked factor); weakly significant ($P<0.05$) for blackbird, robin and house sparrow. Feeders were statistically highly significant for blackbird, robin, blue tit, great tit and wren. For jay $P= 0.07$ (just above significance level) and for greenfinch feeders were not significant.

As noted earlier, it should be borne in mind that a site which has nest boxes or bird feeders is also likely to have other bird-friendly features. So the apparent preference for feeders may to an extent reflect a general attractiveness of the site for birds. Birds using nest boxes or feeders are also easily seen, which may increase the recording rate. Nevertheless, it seems safe to conclude that nest boxes and feeders increase the attractiveness of a site for some species.

3.10 Geographical relationships.

Some species showed a bias in their distribution across the survey area – see table 6 below.

Table 6. The percentage of sites according to borough where house sparrow, song thrush, mistle thrush, long-tailed tit and great tit were recorded.

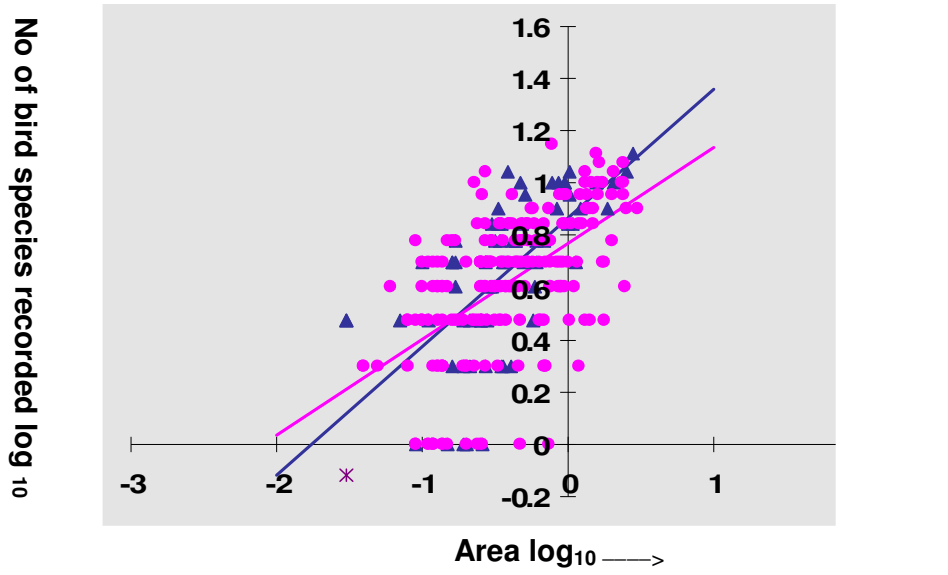
	House Sparrow		**Song Thrush**		**Mistle Thrush**		**Long-Tailed Tit**		**Great Tit**		**no of sites surveyed per borough**
Borough	no of sites	% of sites	no of sites	% of sites	no of sites	% of sites	no of sites	% of sites	no of sites	% of sites	
Tower Hamlets	10	20	0	0	1	2	0	0	6	12	51
Hackney	2	13	0	0	1	7	0	0	1	7	15
Islington	5	11	1	2	0	0	1	2	2	4	46
City	0	0	0	0	1	8	0	0	2	15	13
Camden	0	0	0	0	2	13	0	0	1	7	16
Westminster	0	0	1	2	3	6	6	12	13	25	51
Kens. & Chelsea	1	0	2	6	1	3	3	9	13	38	34
Hamm. & Fulham	1	7	1	7	0	0	1	7	1	7	15
Lewisham	1	17	1	17	0	0	0	0	2	33	6
Southwark	3	14	0	0	0	0	0	0	4	14	21
Lambeth	2	13	0	0	1	7	0	0	0	0	16
Wandsworth	2	22	0	0	0	0	0	0	3	33	9
total no of sites where seen	**27**		**6**		**10**		**11**		**48**		**Total 293**

The house sparrow, although substantially diminished in number across most of London, remained relatively more common in the east and south-east (Tower Hamlets, Hackney, Islington and Southwark), with a few records from Lambeth and Wandsworth and from single sites in Hammersmith and Fulham, Kensington & Chelsea and Lewisham. This pattern closely reflects the results of the London Biodiversity Partnership's public participation house sparrow survey in 2002[iii].

In contrast, the great tit and long-tailed tit were reported more frequently in sites in Westminster, Kensington & Chelsea, and Hammersmith & Fulham. Such small numbers of song thrush and mistle thrush were recorded in the survey that trends are difficult to determine, but the song thrush was also recorded a little more frequently in the western boroughs.

3.11 Public and private sites compared

The survey included 67 sites (aside from housing estates) where access was restricted. These were principally communal gardens associated with particular properties, but also a number of privately managed sites where the public have entry at certain times e.g. Inner Temple and Chelsea Physic Gardens. In graph 7 below, which shows the numbers of species recorded (log_{10}) in relation to site area (log_{10}), separate regression lines are fitted for the public and restricted access sites (using a programme designed to examine two numerical variables – species number and site area – and one categorical variable – public or restricted access – kindly provided by R. Carr). As in graph 1, data for public sites are shown in pink, restricted access sites blue.



Graph 7. Comparison between sites with public or restricted access – number of bird species log_{10} in relation to area (ha, log $_{10}$).

It can be seen that the slope for the restricted access sites is a little steeper than the public sites. Where the regression lines cross the vertical axis, there is a difference of 1.5 species per site between the restricted access sites and the public sites. However, across the whole range of sites, the restricted access sites had just 0.48 more species recorded on average than the public sites (average 5.4 species in restricted access sites v 4.92 species in public sites). This difference is not statistically significant.

As emphasised earlier in this report, the data show a high degree of variation around the overall trend, and in sites over 1ha, the public sites showed substantially wider variation than the restricted access sites in terms of numbers of species recorded. The best public sites were well within the range of the private sites. Indeed the site with the longest species list was a public site and four of the five top sites for numbers of species were public sites.

In Table 7, below, the frequency of individual species is set out in relation to the access category of the sites. Both the feral pigeon and starling were substantially more common in public than private sites. Both species prefer a fairly open habitat, and they are also able to take advantage of food provided by people in the public sites. The chaffinch was also recorded at a higher number of public than private sites. However, several of the species with a stronger affiliation for woodland, for example robin, wren, great tit and dunnock, were recorded in a significantly higher proportion of private than public sites[9]. The blackcap, jay and great spotted woodpecker were also recorded in a higher number of private sites, but in these cases the differences were not statistically significant (reflecting the low number of records). Amongst the thrushes, the mistle thrush, which favours a relatively open habitat with tall trees, was recorded in a higher % of public than private sites, but the song thrush was recorded in a higher % of private than public sites, although it was generally very scarce in all types of site. In a previous survey of the City of Westminster[vii] in 1995 when it was more widespread, this species was much more common in private than public sites.

Some differences in habitat composition were apparent between public and restricted entry sites. On average, the latter had a slightly larger percentage cover by trees, shrubs and hedges, particularly in the larger sites, and a higher proportion of their shrubbery was tall, whereas the public sites had a higher percentage of bare artificial hard surface and a higher proportion of their shrubbery was low. These differences were statistically significant[11]. None the less there were many individual examples of public sites with well developed vegetation cover. Perhaps it is true to say the public sites were more variable, some with very open landscapes and an emphasis on amenity, and others more secluded and well vegetated, whereas amongst the private gardens those which were managed in a more traditional historic garden style tended to be more similar to one another.

It is also likely that birds in the restricted access sites experience lower levels of disturbance than in the public sites – this will be particularly relevant for birds which feed on the ground, e.g. thrushes. Where the site is open to the public only at certain times, e.g. the Temple Gardens (which are open at lunch time) the birds have an undisturbed period in the afternoon when the garden closes.

[9] Using a T-test these differences were significant in the following species at the levels given: feral pigeon P<0.001, chaffinch P= 0.015, more numerous in public sites; robin P<0.001; wren P= 0.046; dunnock P=0.015; blue tit P= 0.004; great tit P=0.001 more numerous in restricted access sites.

[11] On average, public sites had a significantly higher % bare artificial habitat, P<0.001; a lower % cover by trees, P=0.001; a lower % cover by shrubbery, P=0.012; a lower % of their shrubbery was tall, P=0.02; and a higher % of their shrubbery was low, P= 0.012, in comparison with the restricted access sites.

Table 7. Frequency of bird species in relation to site access category

Species	All sites		Public sites		Restricted access sites		Housing estates	
	No of sites	% of sites	No of sites	% of sites	No of sites	% of sites	No of sites	% of sites
Blackbird	256	87	187	**87**	59	**88**	10	**83**
Feral pigeon	208	71	169	**79**	29	**43**	9	**75**
Wood pigeon	182	62	132	**62**	45	**67**	6	**50**
Blue tit	165	56	118	**55**	45	**67**	2	**17**
Wren	111	38	78	**36**	32	**47**	2	**17**
Robin	105	36	67	**31**	38	**57**	1	**8**
Carrion crow	85	29	60	**28**	23	**34**	3	**25**
Starling	70	24	58	**27**	8	**12**	4	**33**
Magpie	64	22	42	**20**	20	**30**	2	**17**
Great tit	48	16	23	**11**	23	**34**	2	**17**
Greenfinch	30	10	23	**11**	7	**10**	0	**0**
Dunnock	28	10	15	**7**	13	**19**	0	**0**
House sparrow	27	9	21	**10**	3	**4.5**	3	**25**
Chaffinch	14	5	13	**6**	1	**1.5**	0	**0**
Long-tailed tit	11	4	6	**3.3**	5	**7.5**	0	**0**
Mistle thrush	10	3	9	**4.2**	1	**1.5**	0	**0**
Pied wagtail	8	2.7	7	**3.3**	1	**1.5**	0	**0**
Song thrush	6	2.0	4	**1.9**	2	**3.0**	0	**0**
Jay	7	2.4	3	**1.4**	4	**6**	0	**0**
Goldfinch	6	2.0	5	**2.3**	1	**1.5**	0	**0**
Coal tit	5	1.7	5	**2.3**	0	**0**	0	**0**
Mallard	5	1.7	4	**1.9**	1	**1.5**	0	**0**
Blackcap	2	0.7	0	**0**	2	**3.1**	0	**0**
Sparrowhawk	2	0.7	1	**0.5**	1	**1.5**	0	**0**
Gt .sp. woodpecker	2	0.7	0	**0**	2	**3.1**	0	**0**
Green woodpecker	1	0.3	0	**0**	1	**1.5**	0	**0**
Grey wagtail	1	0.3	1	**0.5**	0	**0**	0	**0**
Total no of sites	**293**		**214**		**67**		**12**	

3.12 Housing estates

Many of the sites in the survey were associated with nearby areas of housing, although typically separated from the buildings by a road. Open spaces which clearly lay within housing developments are considered as 'housing estates' for the data in table 7 and graph 1 (page 17). These included six mainly social housing sites and four relatively modern private developments (though for the data in table 7, the two sections of the Peabody Blackfriars Estate and White House Estate are treated as separate sites, making 12 parcels in total).

The average number of bird species per site was 4.0, which is a little lower than overall average for the survey, although these sites fell towards the lower end of the size range. Not surprisingly, the commonest species were those which were commonest across the survey generally, i.e. feral pigeon, wood pigeon and blackbird. Starlings were recorded in 33% of sites and crows and

house sparrows in 25% (three sites each). Species which require a more wooded landscape were relatively uncommon, with wren noted in two sites and robin in just a single site. The record of great tit at Peabody Blackfriars is thereby notable. The site with the highest number of species recorded was Newman Prospect Estate, Southwark, with seven species. This site had an unusually high degree of tree cover (70%) – including many native species – plus a recently planted area of native shrubbery as well as some older, evergreen shrubbery, and areas of long grass and wild flowers under trees and ivy-clad walls. An unusual private residential development, the Water Gardens in Paddington, also proved to be interesting. It is built around a series of ponds which attracted mallard, moorhen and heron.

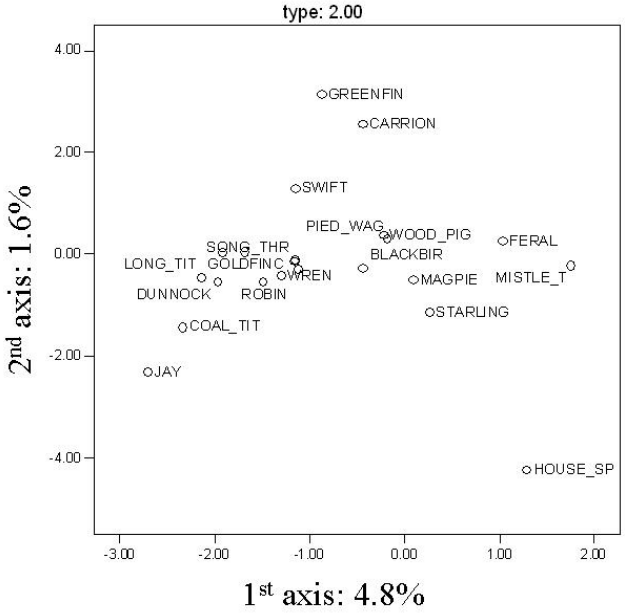
Although quite variable in character, on average the housing estates showed a higher percentage of bare artificial habitat than either public or the other restricted access sites; a significantly higher proportion of their shrubbery was low (<1m) and a significantly lower proportion tall (>2m) than in the other types of sites. It is likely that their ornithological value could be enhanced by increasing the area of shrubbery, including some taller shrubs, encouraging areas of long grass and wild flowers under trees, and by greater use of ivy and other climbing plants. Bird feeders could help but it may be necessary to take precautions to discourage rats and excessive numbers of feral pigeon.

3.13 Further statistical analysis on birds

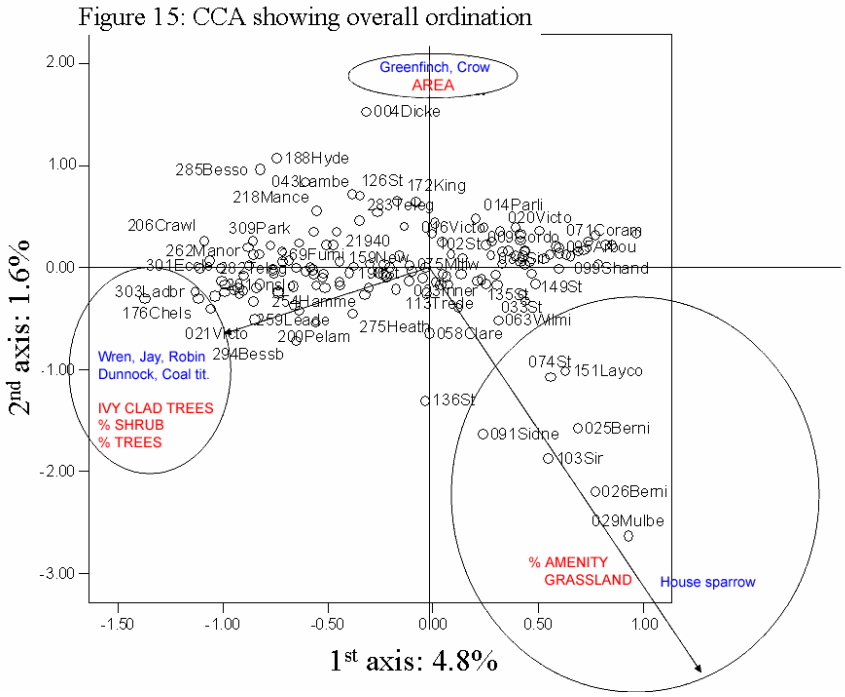
The data were then analysed by an external consultant, Dr Peter Shaw, of Roehampton University, using Multiple Regression, Principle Components Analysis (PCA) and Canonical Correspondence Analysis (CCA) multivariate analysis. A first step was to repeat the species/area analysis to identify 'residual variation' which was unlikely to be linked to area alone and which might therefore be attributable to the various habitat factors recorded in the survey. One objective was to clarify whether there is any clustering of species or habitat factors which behave in a similar way within the dataset.
Multiple regression analysis was employed to investigate a small number of factors which appear to be relatively independent of site area. (The method cannot handle co-linear data satisfactorily). This included a further examination of ivy-clad trees, which were again shown to be highly significant. It was this analysis which first drew our attention to the apparent link between species richness and wild flowers under shrubberies, which was explored in section 3.8. Another somewhat surprising finding was a statistically significant 'link' between house sparrows and native species of trees.

In the PCA analysis, the sites fell broadly around two axes. The first represents increasing percentage of amenity grassland in one direction and increasing shrubbery at the other. The second features ivy, nest boxes and bird feeders, which appear to be linked to each other, in one direction, and the percentage of bare artificial habitat and proportion of low shrubbery at the other. Species richness tended to be associated with the ivy, nest boxes and bird feeders direction of this axis. The analysis brings out a cluster of species which appear to relate to a more wooded habitat, including dunnock, great tit, long-tailed tit, blackcap and great spotted woodpecker, whereas mistle thrush and chaffinch appeared to favour larger sites with >25% amenity grassland.

Graph 8 below from the CCA analysis brings these trends out further, with a cluster of woodland species towards the left; feral pigeon, mistle thrush and house sparrow preferring more open habitat towards the right, and blackbird and magpie in an intermediate position.



Graph 8. CCA birds ordination (from Dr Peter Shaw)



Graph 9 CCA overall ordination.

These graphs illustrate the trends of association with the variables underlying the data and the clustering of bird species. In graph 8, the first axis shows a clear trend from woodland species typically associated with shrubs and trees (left side of the graph) to more urban species associated with low shrub and amenity habitats on the right. Graph 9 shows the same data as in Graph 8 with the study sites added on the same axes. However, the data are generally noisy and the 1st axis accounts for only 4.8% of the total variance in the bird data.

3.14 Mammals.

Mammals were rare with the exception of the grey squirrel, of which 90 individuals were seen on 49 sites. Domestic cats were seen on 5 sites. Foxes were reported by gardeners on almost all sites where they worked, and signs of fox presence were noted on five sites, including Victoria Tower Gardens, next to the Houses of Parliament.

Apart from these, the only other mammals seen were a dead house mouse in Egerton Place and a single brown rat, (but rats almost certainly occur at least at times on many other sites). Other surveys have discovered mice in several squares. In 2003, researcher Alison Brighton used cage traps to sample the small mammals in several sites managed by the Grosvenor Estate. She found populations of both house mice and wood mice in Belgrave Square, though only house mice in Chester Square. The heavy traffic around Belgrave Square may deter cats. Wood mice are also reliably reported to live in Eaton Square. House mice have been seen in Christchurch Gardens, Victoria Street, SW1, occupying holes in the grass and emerging at night to feed on scraps left by visitors (personal observation JH). There were no reports of hedgehogs, shrews or voles from any of the sites surveyed. Rabbits were not seen, but a single rabbit was recorded a few years ago in Park Crescent, which is linked by a tunnel under Euston Road to the neighbouring Park Square and thence to Regents Park (personal observation JH). It is likely that some of the sites are used by foraging bats, but night time recording was outside the scope of the survey.

3.15 Amphibia

The only amphibia noted were smooth newts in Corams Fields and Besson Street Community Gardens, and frog tadpoles at the Calthorpe Project. No other amphibia or reptiles were recorded. Ponds or pools were recorded in about 30 sites, and although many were primarily ornamental features, with little or no marginal vegetation, others offered suitable habitat for the more common amphibia, and it is possible these animals have been under-recorded. The survey did not allow time for pond sampling. It seems likely that common frogs and perhaps common toads are to be found in at least a few squares and community gardens, but other than the three records noted above, no reports were received.

3.16 Invertebrates.

Invertebrate records were principally of conspicuous insects in flight. These included several butterfly species, for example small tortoiseshell, peacock,

painted lady, holly blue, orange tip and comma. The most frequently reported was the small white, though 11 holly blues were recorded from a total of six sites. The main food plants for this attractive little butterfly are holly (for the first brood of caterpillars each year) and ivy for later broods. The species will also utilise several other ornamental shrubs which are commonly planted in garden squares.

Hoverflies were frequent, as were several kinds of bee. Bee species included buff-tailed and red-tailed bumble bees, honey bees and carder bees. Damselflies were reported from two sites and a hawker dragonfly from another. Cockchafers were reported from two sites. Midges and pond invertebrates were also noted. A green banded snail was reported from one site. It is recognised that this list is extremely limited and that a great range of invertebrates must occur within the sites surveyed, but only those noticed in the course of the survey visit were reported, no special effort being made to find them.

4. Comparison with other surveys

4.1 British Trust for Ornithology (BTO) London Birds Project[iv]

Between 2001 and 2003 the BTO carried out an ornithological survey of about 300 London's greenspaces, using a large number of volunteers, who visited each site several times over a 2-3 year period. The range of sites was wider than the present survey (including parks up to 80 Ha.) and the geographical distribution spanned the whole London area. The survey also followed a somewhat different methodology from the present study. The recorders visited each site on up to six occasions throughout the year, whereas the present survey involved only a single visit, during May-July. None the less the two surveys have 14 sites in common and a comparison of the data from the two surveys for these sites was felt to be useful, particularly in validating the results of the present study.

In these 14 sites, the average number of bird species found was 7.8 species in the BTO survey and 5.6 in the present survey. As the BTO recorders made six sets of observations rather than single visit by our recorders, a higher species count would be expected. It was more likely to pick up non-resident, visiting birds which are using the sites as 'stepping stones' through the urban environment than a 'one off' survey. In addition, the chance of a resident species being missed owing to behaving in an inconspicuous way on a particular occasion is less likely to arise with multiple visits. However, the overall picture of which sites supported larger or smaller numbers of bird species was similar in the two surveys. The maximum species count for an individual site was15, for both the BTO survey and the London small parks and squares survey: this was for the same site, Telegraph Hill (north and south parts combined for our data for this purpose).

The BTO survey appears to confirm the low numbers of house sparrow, song thrush and mistle thrush in central London identified in the present survey. The song thrush was recorded in both surveys at only one of the common sites, Telegraph Hill Park. The mistle thrush was also recorded at only one of the 14 common sites in each survey, although this was at different sites. The house sparrow was recorded at two of the 14 sites in the present survey, but only one (a different site) in the BTO survey.

The BTO survey undoubtedly draws a wider picture of birds in London's greenspaces than the present study and it builds up a more complete record of the ornithological value of individual sites. From its overall results, the organisers identified the presence of bushes as a key factor for supporting a diversity of birds. The present survey strongly supports this finding. By focussing on a narrower suite of sites, it is able to examine the relationship between bird diversity and habitat structure in formal gardens in greater depth.

4.2 Wildlife Conservation in garden squares. Brighton 2004[v]

In 2003, an in depth study of nine garden squares was carried out as part of an MSc thesis by Alison Brighton of the University of Surrey. Four of the sites overlapped with this survey (Belgrave Square, Eaton Crescent, Wilton Crescent and Chester Square – all in the Grosvenor Estate). Brighton's survey involved up to four visits to each site, and birds were recorded by point counts. Her survey revealed an average of 50% more species per site, which was particularly marked for the two smaller sites, confirming our suspicion of under-recording. None the less it is interesting to note than even where the present survey found fewer species than Brighton, it still recorded some widespread species which were not picked up in her survey of the same site. This suggests considerable mobility of birds between sites. It is likely that the smallest sites in both surveys are too small to make up a full feeding territory for some species and that they form part of a group of sites used by each pair of birds.

4.3 The Breeding Bird Survey [vi] *(BTO)*

The BTO Breeding Bird survey is a yearly survey covering England, Scotland, Wales and Northern Ireland. It is divided into regions and gives a specific set of figures for the London area. It records birds along a line transect walked across a randomly selected 1 kilometre square. As the survey has now been performed for ten years, changes in bird numbers can be assessed over this period. This is the most accurate guide to national and regional population trends. A comparison with these was felt to be helpful for the present survey, particularly for species that were recorded in unexpectedly low numbers. The latest published figures available are from 2004. Results for the London region are shown below (but note that population changes are only calculated for species appearing in 30 or more 1Km squares per year in each region).

Species	% change 1994-2004	No. of sites for which data are available
Feral Pigeon	-19	49
Wood Pigeon	113*	54
Collared Dove	80*	35
Swift	0	42
Wren	56*	48
Dunnock	26	48
Robin	85	50
Blackbird	-11*	54
Song Thrush	-10*	35
Blue Tit	62*	53
Great Tit	139*	47
Magpie	40	52
Crow	83*	54
Starling	-34*	54
House Sparrow	-60*	51
Greenfinch	121*	37

Table 8. BBS London trends (from Raven *et al* 2004). *indicates a statistically significant result.

The population trends reported by the BBS are largely reflected in the London small parks and squares survey, with most of the increasing species (wood pigeon, wren, robin, blue tit, great tit, magpie and greenfinch) all found in substantial numbers. Despite the decline in the blackbird identified by BBS, the present survey indicates that this species remains widespread in central London. The fact that the song thrush was reported from only seven sites in our survey reflects the decline of this species in London and the East of England; this is explored further in section 4.4 below. The low numbers of house sparrow are indicative of the great reduction in numbers that this species has suffered in recent decades.

4.4 City of Westminster Nature Conservation Survey, 1995[vii]

This survey, carried out by the London Ecology Unit in 1995, recorded the birds encountered in a survey of 118 small green spaces in the City of Westminster. The data provide a useful reference point in tracing changes in bird populations on central London since 1995. Note that the table contains data for 100 Westminster sites which would have met the criteria for the present survey, but the right hand column represents the percentage of sites where each species was recorded in the London small parks and squares survey across the whole of the survey area.

The results of the two surveys are broadly similar in terms of the percentage of sites where individual species were recorded, with a few notable exceptions. The major differences reflect the decline in house sparrow and to a lesser extent starling numbers noted above. However, the difference in song thrush numbers between the two surveys is greater than might be expected from the BBS trend. In 1995 it was found in 10% of sites in Westminster, but in 2004 it was recorded in only one out of the 51 sites surveyed in that borough. This may reflect the fact that the present survey featured fewer of the private garden squares than the earlier survey, or a sharper decline in central London than across the region as a whole. No song thrushes were recorded in the present survey from four sites, which were common to both 1995 and 2004 surveys, and in which the song thrush had been recorded in 1995, although a bird was seen at one 'new' site, Paddington Green open space. The lower number of sites where dunnock was recorded in the present survey (6/51 sites within Westminster in 2004 compared with 30/100 in 1995) goes against the BTO regional trend and may represent a restricted local area population change or perhaps a degree of under-recording in this markedly inconspicuous species. However, it is notable that the species was not recorded in any of the 14 sites in the 2003 BTO London Birds Project or the four sites from Brighton's survey which were common with the London small parks and squares survey.

In drawing comparisons, it should also be noted that in the 1995 Westminster survey only about half of the sites had public access, whereas the present survey focused more strongly on public sites. (Public sites made up 75% of sites across the survey as a whole and 61% of those within Westminster).

Species	1995 Westminster survey: no. of sites where each species was recorded	Squares survey: % of all sites where the species was recorded
Blackbird	89	87
Feral Pigeon	74	70
House Sparrow	60	9
Blue tit	57	55
Starling	54	24
Wood pigeon	53	62
Robin	38	35
Crow	34	28
Dunnock	30	9
Wren	19	34
Magpie	18	21
Great tit	12	16
Song thrush	10	2
Greenfinch	8	10
Mallard	3	2
Blackcap	3	1
Mistle thrush	3	3
Chaffinch	2	5
Kestrel	2	0
Coal tit	2	2
Long-tailed tit	2	4
Jay	2	2
Pied wagtail	0	4
Goldfinch	0	2
Swift	0	2
Spotted Flycatcher	2	0
Willow Warbler	1	0
Grey Wagtail	0	1
Sparrowhawk	0	1
Gt. Spot. Woodpecker	0	1
Green Woodpecker	0	<1
Heron	0	<1
Moorhen	0	<1
Herring Gull	0	<1

Table 9. Comparison of bird records from 100 sites in the 1995 City of Westminster survey with the London small parks and squares project

4.5 LNHS, Birds of small open spaces in inner London, 1987-88[viii]

This survey coordinated by Helen Baker and conducted by members of the London Natural History Society, provides a further interesting historical

comparison. It covered 20 small sites in central London, 11 of which were also covered in the London Small Parks and Squares Survey. 75% of the sites had public access, 25% restricted access. Each site was visited at least nine times, and most of them many more times. In all, 37 species were reported, including a number of winter visiting species and passage migrants.

It is notable that house sparrows and starlings were recorded in 100% of sites, and dunnock and song thrush in 90% and 65% respectively. Taken together with the 1995 Westminster survey, the data provide further evidence of a long-term decline of these four species in central London.

5 Conclusions

5.1 The value of small parks and squares

The survey has demonstrated the importance of small parks and garden squares to wildlife in inner London. City squares vary across a spectrum from bare paved 'piazzas' where little but feral pigeons and occasional starlings and crows can be seen, through 'urban savannah' of amenity grassland and scattered trees, to sheltered, well-vegetated garden squares, where people can enjoy a sense of escape from the hard urban landscape and a good range of common woodland birds can be seen. The relative richness of bird species in each site, and particularly of species which prefer a more wooded landscape, seems to depend largely on where in this spectrum each site lies.

Whether the landscape is essentially formal, semi-formal or more naturalistic in style, it is clear that well-vegetated gardens have the potential to support a wide range of bird species. The survey highlights the over-riding importance of the vegetation structure, especially the understorey vegetation, i.e. shrubbery and hedges. Maintaining the garden with multi-layered vegetation not only means that birds which feed at a variety of different levels can be accommodated, but also that the garden should support a greater biomass of invertebrates, which will enhance the food base for birds. The data indicate that height and density of shrubs are key factors. Tall shrubbery has been shown to be important for several species, whereas a variety of different statistical approaches have brought out the negative effect on bird diversity of a high proportion of low shrubbery (<1m). The value of ivy-clad trees has been brought out strongly. The data also seem to indicate that a suite of bird-friendly measures, which are associated with a relaxed style of garden management, can help to make the site attractive to birds. These include allowing natural regeneration by wild flowers under shrubberies, retention where possible of dead wood, and the provision of nest boxes and feeders.

However, bird species vary in their requirements. The analysis brings out one group of species which associate more strongly with the 'woodland' end of the spectrum, for example blackcap, long-tailed tit, great spotted woodpecker, robin and wren, and another which prefer a more open landscape, for example crow, starling and feral pigeon, the latter also congregating on hard surface piazzas, where they are fed by the public. The blackbird and wood pigeon seem to occupy an intermediate position, being found on a high proportion of sites, whether or not they contained shrubbery. Two less common species which seem to prefer a somewhat more open landscape were greenfinch and mistle thrush.

These results reflect the birds' feeding habits. Some species, such as blue tit, feed frequently in or near the tree canopy, whereas others, such as great tit and long-tailed tit, more often forage amongst small trees and tall shrubs, whilst the dunnock feeds mainly at lower levels or even on the ground, but typically under the cover of bushes. The blackbird, thrushes and starling feed mainly on the ground, using trees and bushes for cover and song posts, although they also take fruit at certain times of year. The greenfinch feeds partly on tree seeds.

The scarcity of mammals and amphibians and the total lack of reptiles in the survey reflects the fact that the methodology was not designed to pick up these species, however, road traffic in the surrounding streets is likely to be a major deterrent. Only foxes and grey squirrels (and of course house mice and brown rats) appear to be 'street-wise' enough to travel between London's small parks and squares on a regular basis. The survival of wood mice in Belgrave Square is noteworthy; they may be regarded as an 'island population', existing in isolation, although we have received also a report of woodmice at nearby Eaton Square. There were no reports of hedgehogs, although within the past 10-15 years we have heard of this species at Ladbroke Square and in St George's Gardens, Bloomsbury.

A small range of butterfly species was recorded in the survey, with small white the commonest species followed by the holly blue. Both of these species should be able to find suitable food plants for their caterpillars in many garden squares. Other species occur mainly as occasional visitors. Formal gardens tend to lack areas of stinging nettles, tall grasses and wild flowers which are needed as breeding habitat for butterflies, although some species could be encouraged by minor changes in management e.g. orange tip (by planting crucifers such as honesty), speckled wood (by leaving some areas of longer grass), and brimstone (through introducing buckthorn *Rhamnus sps* into shrubberies).

5.2 What makes a good site for birds?

As we have seen, most of the small birds associated with London's smaller parks and squares are originally species from a woodland or woodland edge habitat. The closer the landscaping can get to a woodland structure, with canopy trees, smaller trees and shrubs of varying heights, grading down in stages from just below the tree canopy to the herbaceous layer, the better. Providing a square or garden contains a high percentage of trees, hedgerows and shrubbery, including some taller shrubs and pockets of denser growth, it is likely to attract a good range of breeding birds.

The presence of evergreen or other dense cover appears to improve the attractiveness of the site. Many small bird species require secure, thick cover for breeding or roosting. This may take the form of bushes, or also include undisturbed corners of natural vegetation, as well as ivy or other species of climbers and creepers, over walls or tree trunks. Creeper-clad walls are particularly favoured as nest sites by the spotted flycatcher, an uncommon species in central London. Although it was not recorded in the present survey, it has been recorded as nesting in several garden squares and similar gardens, including the Inner Temple Gardens in 2000 and 2001[ix] and a pair was seen feeding young there again in 2005 (PS personal observation).

The survey did not generally bring out a strong link between bird diversity and the presence of native trees and shrubs, with the notable exception of the house sparrow as brought out in the Multiple Regression analysis. However, it should be emphasised that the proportion of native species in the tree canopy of typical small parks and squares in central London tends to be small, partly because many of the most mature trees date from a period when it was difficult to establish

some of our native trees in the polluted air of Victorian London. Also the emphasis in site selection was the more traditional gardens rather than the more recently-created, dedicated 'wildlife gardens'. Native tree planting has become more popular as part of general parks landscaping in recent years, and in some of the sites with a good proportion of native species these trees have not yet reached maturity, hence may not yet have achieved their full potential as wildlife habitat. None the less, the overall results appear to indicate that for traditional gardens, vegetation structure is more important than species composition in determining bird diversity. The presence of shrubs or trees with edible fruits e.g. holly, cherry, elder etc, whether or not they are the native form, is likely to be significant for fruit-eating species.

Areas of short grassland are valuable for ground feeding birds such as blackbird, song thrush, mistle thrush, starling and wood pigeon. In larger sites, allowing some of the grass to grow to its full height could encourage additional butterfly species such as the speckled wood, which breeds among coarse grasses in sheltered, sunlit glades. It is notable that the only site where green woodpecker was recorded, the open land by Dickens Square, had a substantial area of informal grassland rather than close mown turf.

The presence of a water body on site can add to the interest for people as well as attracting species like pied wagtail, grey wagtail, moorhen and mallard to the site. Mallards may nest some distance from the water, e.g. amongst shrubbery in garden squares which do not have a pond, or even in balconies and roof gardens, the parents leading the ducklings to water once they have hatched. If the pond is managed in a wildlife-friendly way, with plenty of aquatic plants and marginal vegetation, it should attract dragonflies and damselflies and possibly species of amphibia.

Nest boxes and bird feeders are likely to boost numbers of blue tit, great tit, robin, jay and perhaps greenfinch. Sadly, the results indicate that feeders will not on their own bring back house sparrows, once they have disappeared from a large area (though where house sparrows survive, nest boxes and feeders may help them to maintain their numbers). In inner city areas, it is important to adopt good hygiene in maintaining feeders, to prevent the spread of infection. Feeders can be obtained which deny access to feral pigeons (and at least aim to do so for grey squirrel). In some cases it is also necessary to take precautions against rats.

It is likely that many other aspects of garden management will influence the wildlife value of the site. For example, composting of leaf litter could improve the invertebrate communities in shrubberies and herbaceous areas. Unfortunately the survey did not provide adequate data to demonstrate a significant effect on bird life. This is partly because information on soil management was not always available, but also because the bird species which were thought to be most likely to benefit from improved soil conditions (song thrush and mistle thrush) were too scarce for meaningful comparison.

5.3 Some of the best sites for birds in the 2004 survey

Leaders Garden, Wandsworth	14 species
Ladbroke Square, Kensington and Chelsea	13 species
Heathbrook Park, Wandsworth	13 species
Telegraph Hill (north), Lewisham	12 species
St John's Wood Churchyard, Westminster	12 species
Park Square Gardens, Westminster.	11 species
Hyde Park Square, Westminster	11 species
King Square, Islington	11 species
St Thomas' Recreation Ground, Hackney	11 species
Dickens Square, Southwark	11 species
Sir John McDougall Gardens, Tower Hamlets	11 species.

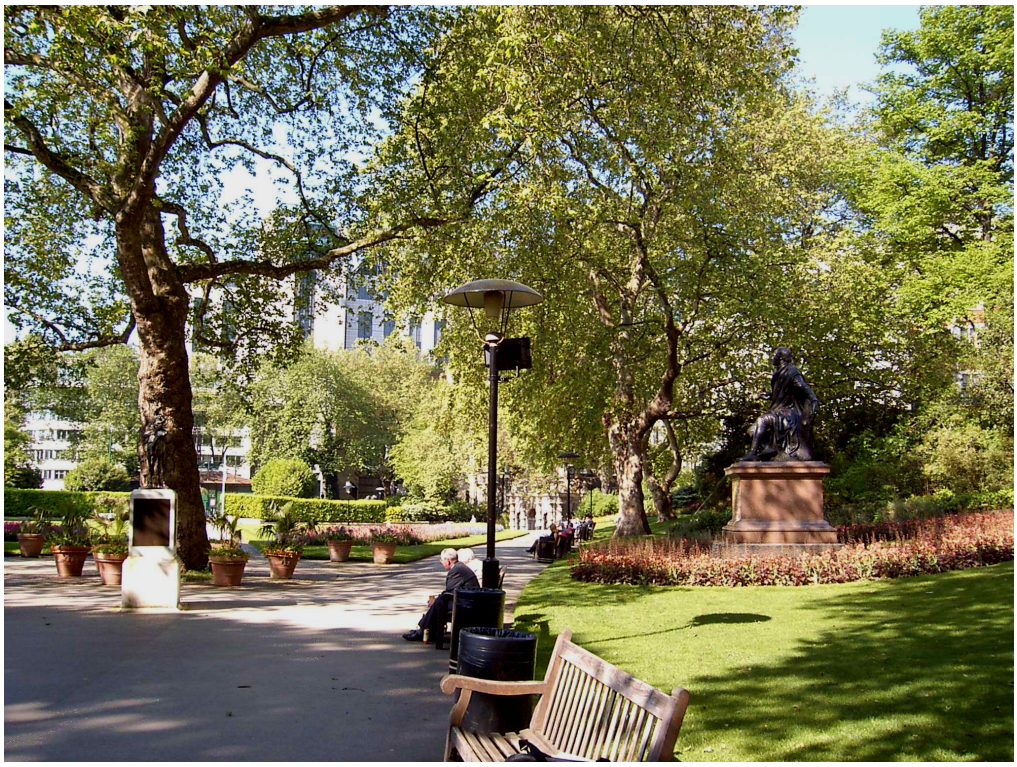
Eleven other sites had 10 species recorded and seven had 9 species.

The 11 sites listed above range over several boroughs and are of varying characteristics: seven are public sites, four are private or offer limited access. They range in size from 0.27ha (St Thomas's Rec.), to 2.78ha - Ladbroke Square. Ladbroke Square was notable for having a high proportion of the more uncommon species, including long-tailed tit and goldfinch and two species which were recorded only on two sites, blackcap and great spotted woodpecker.

For some of the sites, associations with nearby sites may help to explain their species richness. Ladbroke Square is the largest of a group of 15 private communal gardens in the Ladbroke Grove area, which collectively add up to the area of a medium-sized park. Hyde Park Square is close to Hyde Park and Park Square Gardens and St John's Wood Church Grounds are close to Regent's Park. Sir John McDougall Gardens in Tower Hamlets and Leaders Garden in Wandsworth are both on the banks of the Thames and Leaders Garden is also close to Barn Elms Playing Fields. Telegraph Hill (north) is half of a larger pairing, with Telegraph Hill (south), which together total more than four hectares.

Of the remaining sites on this list, the open land around Dickens Square in Bermondsey was remarkable for supporting both breeding blackcap and visiting green woodpecker. For green woodpecker this was the only record in the survey and the blackcap was otherwise recorded only at Ladbroke Square. St Thomas' Recreation Ground, Hackney is small at 0.27 Ha, but adjoins St Thomas' Garden and St Thomas' Square, again making a larger grouping. It was notable for the presence of mistle thrush and jay. Heathbrook Park in Wandsworth is next to some railway land and relatively close to Battersea Park, and at 1.56 hectares is large enough to support several bird territories. The remaining site, King Square at 1.32 ha is one of the largest squares in Islington and reasonably close to several others.

All of these sites, though differing in management style, are varied and visually interesting pieces of landscape.



Victoria Embankment Gardens, a well-used public garden offering good cover for birds *Photo C. Gannaway*

Open land around Dickens Square near Elephant and Castle, wild area where green woodpecker and blackcap were found. *Photo C. Gannaway.*

Gibson Square, Islington, a traditional garden square offering plenty of cover and ivy-clad trees. *Photo C.Gannaway*

Sir John McDougall Gardens, Tower Hamlets – new landscaping offering views of the Thames and good cover for birds. *Photo C.Gannaway*.

Very poor sites for wildlife were a minority in the survey; on three sites no birds at all were recorded, with one species only in 17 sites, two in 27 sites, three in 42 sites. In some cases, undoubtedly, the low score reflected a degree of under-recording, but this is unlikely to be true in every case. Species-poor sites tended to be small, isolated and examples of 'urban savannah', mostly containing short mown grass and high canopy trees, often London Plane. They also frequently contained large areas of hard surfacing and what planting there was tended to be limited and low. These sites also tended to be visually uninteresting and lacking in amenities. They were mostly tidily managed but often rather dull places to visit.

There would appear to be no one formula for a small park or square which makes the site good for wildlife whilst also meeting the needs of the people who use it. As we have seen, bird species vary in their habitat requirements and people vary in the ways they use open space. Both the public and private sites included some examples with a good diversity of birds and others which had little to offer. Small sites are at a disadvantage, particularly if they are isolated and not large enough on their own to provide a feeding territory for a pair or two of various species. None the less good management can often make them more attractive to wildlife than larger, plainer sites. Gardens where the shrubbery is reduced to a regime of minimal-maintenance, low block planting are unlikely to offer the same range of niches for nesting birds as those with a more varied landscape.

One of the more striking findings of the survey is that some of the most intensively used public gardens, such as the Victoria Embankment Gardens at Savoy Place and Whitehall Place, are highly attractive to birds, with nine species recorded in each (and further species recorded by the BTO survey). This reflects their large areas of trees and shrubbery, which offer nesting and feeding habitat and a degree of seclusion for birds (whilst also helping to screen out traffic noise from the surrounding streets for people). Both gardens are well-managed, structurally diverse and attractive landscapes with a wide variety of deciduous and evergreen trees and shrubs, of varied heights, including some berry-bearing and nectar-rich species, together with colourful herbaceous planting. Both are regularly used by large numbers of people, for whom they represent an oasis of calm in an extremely busy part of town. By contrast the garden outside the Ministry of Defence nearby is a bleak place of short grass and tall London Plane trees, where traffic noise is ever apparent and no more than three species of birds were found.

Whilst we have emphasised in this report the value of aiming as closely as possible to a woodland style of planting, we acknowledge that this will not be achievable on every site. For example, it is obvious that an open landscape is essential outside the M.O.D. Most small parks and squares have to serve a variety of functions for people, and a balance is needed between competing needs. On some sites, local social problems may act against a well-vegetated landscape, and a more open habitat must be sought. On others the need for active play facilities for children may take priority. But there is still scope to develop an interesting garden, with attractive and colourful planting, selected so that it can be managed using sustainable practices. Where extensive shrubbery is not an option, an alternative approach to enhancing wildlife value can be through creating wild flower meadows and enhancing cover through the use of creepers and climbers.

Victoria Embankment, garden outside the Ministry of Defence. A lack of understorey vegetation means there is little cover for birds and no screening against traffic noise from the adjoining road. *Photo C Gannaway*.

Generally speaking, a garden which is attractive to people is also attractive to birds; people also appreciate screening bushes and diverse plantings. Good horticultural management is closely allied to good biodiversity management. Cheap, short term, heavily chemical-dependent management is bad horticulture and bad for biodiversity.

The main conclusions of this report will be captured in a leaflet by the RSPB, which will offer further guidelines on how to manage small parks and garden squares so they offer the greatest possible benefit both to people and wildlife.

6. References and further reading

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7. Contact for access to records

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Appendix 1.

Site no.	SiteName	Borough
1	Nelson Square	Southwark
2	Trinity Church Square	Southwark
3	Newington Gardens	Southwark
4	Dickens Square- surrounding areas	Southwark
5	Merrick Square	Southwark
6	Euston Square Gardens	Camden
7	Cartwright Gardens (Crescent)	Camden
8	Tavistock Square	Camden
9	Gordon Square	Camden
10	Woburn Square	Camden
11	Russell Square	Camden
12	Bloomsbury Square Gardens	Camden
13	Red Lion Square	Camden
14	Parliament Square	Westminster
15	Jewel Tower Green	Westminster
16	Victoria Tower Garden	Westminster
17	Victoria Tower Gardens (South)	Westminster
18	Victoria Embankment Gardens (MOD)	Westminster
19	Victoria Embankment Gardens	Westminster
20	Victoria Embankment Gardens/Savoy Place	Westminster
21	Victoria Embankment Gardens (Temple)	Westminster
22	Middle Temple Gardens	City of London
23	Inner Temple	City of London
25	Bernie Spain Park (North)	Lambeth
26	Bernie Spain Park (South)	Lambeth
27	Tate Modern (Riverside)	Southwark
27a	Tate Modern (rear)	Southwark
28	Christchurch Garden	Southwark
29	Mulberry Square	Southwark
30	Coin Street Community Builders	Southwark
31	White House Apartments 1	Southwark
32	White House Apartments 2	Southwark
33	St John the Evangelist	Southwark
34	Waterloo Millenium Green	Lambeth
35	Emma Cons Garden	Lambeth
36	Hatfields	Lambeth
37	St Marys Garden (Museum of Garden History)	Lambeth
38	St Marys Garden (public)	Lambeth
39	Albert Embankment Triangle	Lambeth
40	Vauxhall Gardens Estate	Lambeth
41	Pedlars Park	Lambeth
42	Pedlars Park Extension	Lambeth
43	Lambeth High St Recreation Ground	Lambeth
44	China Walk Estate	Lambeth
45	Briant Estate	Lambeth
46	William Blake Estate	Lambeth
47	West Square Garden	Southwark
48	Newman/Prospect House (housing estate)	Southwark
49	Peabody Blackfriars Estate (Squares)	Southwark
50	Peabody Blackfriars (Blocks)	Southwark
51	Newington Gardens Annex	Southwark
52	Tabard Gardens	Southwark
53	St George's Garden	Southwark
54	Argyle Square	Camden
55	Calthorpe Project	Camden
56	Percy Circus	Islington
57	Holford Gardens	Islington

Site no.	SiteName	Borough
58	Claremont Square	Islington
59	Claremont Close Garden	Islington
60	St Mark's Garden	Islington
61	New River Head	Islington
62	Spa Green Gardens	Islington
63	Wilmington Square	Islington
64	Spa Fields Extension	Islington
65	Spa Fields Garden	Islington
66	West Smithfield	City of London
67	Charter House Square	Islington
68	St James Garden	Islington
69	St Andrews Garden	Camden
70	Brunswick Square Gardens	Camden
71	Coram Fields	Camden
72	St George's Garden	Camden
73	Regent Square	Camden
74	St John's Park	Tower Hamlets
75	Millwall Park (part of)	Tower Hamlets
76	Island Gardens	Tower Hamlets
77	Fraser Court	Tower Hamlets
78	St David's Square	Tower Hamlets
79	Barquentine Gardens	Tower Hamlets
80	Sir John McDougal Gardens	Tower Hamlets
81	Westferry Circus	Tower Hamlets
82	West India Avenue	Tower Hamlets
83	Cabot Square	Tower Hamlets
84	Canada Square	Tower Hamlets
85	Jubilee Gardens	Tower Hamlets
86	Trinity Square Gardens	Tower Hamlets
87	Wakefield Gardens	Tower Hamlets
88	Tower Gardens (north)	Tower Hamlets
89	Tower Gardens (south)	Tower Hamlets
90	Jubilee gardens	Tower Hamlets
91	Sidney Square	Tower Hamlets
92	Ford Square	Tower Hamlets
93	York Square	Tower Hamlets
94	Albert Gardens	Tower Hamlets
95	Arbour Square Gardens	Tower Hamlets
96	Beaumont Square Gardens	Tower Hamlets
97	Trafalgar Gardens	Tower Hamlets
98	Shandy Street Squares	Tower Hamlets
99	Shandy Park	Tower Hamlets
100	Brickfields Garden	Tower Hamlets
101	Limehouse	Tower Hamlets
102	St Ann's Churchyard, Limehouse	Tower Hamlets
103	Sir Thomas More Court	Tower Hamlets
104	Pier Head Gardens	Tower Hamlets
105	St John's Church Yard	Tower Hamlets
106	Waterside Gardens Annex	Tower Hamlets
107	Waterside Gardens	Tower Hamlets
108	Wapping Gardens	Tower Hamlets
109	Wapping Lane Green	Tower Hamlets
110	St George's Garden	Tower Hamlets
111	Wellclose Street Park	Tower Hamlets
112	Swan Passage	Tower Hamlets
113	Tredegar Square Gardens	Tower Hamlets
114	Guerin Square	Tower Hamlets
115	Bethnal Green Garden (museum garden) Main	Tower Hamlets
116	Museum of Childhood	Tower Hamlets

Site no.	SiteName	Borough
117	Bethnal Green Gardens (annex)	Tower Hamlets
118	Corfield Street Green	Tower Hamlets
119	Estate Green (Squirries Street Green)	Tower Hamlets
120	Warner Place Garden	Tower Hamlets
121	Ion Square Gardens	Tower Hamlets
122	Old Bethnal Green Road Green	Tower Hamlets
123	Finsbury Circus	City of London
124	Finsbury Square	Islington
125	Arnold Circus (Boundary Gardens)	Tower Hamlets
126	St Leonard's Gardens	Hackney
127	Geffrye Museum Garden	Hackney
128	St Mary's Community Garden (THRIVE)	Hackney
129	De Beauvoir Square	Hackney
130	Albion Square	Hackney
131	Stonebridge Gardens	Hackney
132	Clapton Square Gardens	Hackney
133a	St John's Garden (upper)	Hackney
133b	St John's Garden (middle)	Hackney
133c	St John's Garden (lower)	Hackney
134	St Thomas's Square Gardens	Hackney
135	St Thomas's Garden	Hackney
136	St Thomas's Recreation Ground	Hackney
137	Cassland Crescent	Hackney
138	Christchurch Square	Hackney
139	Mecklenburgh Square Gardens	Camden
140	Bingfield Park	Islington
141	Thorn Hill Crescent	Islington
142	Thornhill Square Recreation Ground	Islington
143	Thornhill Road Gardens	Islington
144	Barnsbury Square Gardens	Islington
145	Mountfort Terrace	Islington
146	Lonsdale Square	Islington
147	Gibson Square Gardens	Islington
148	Milner Square	Islington
149	St Mary Magdalene Garden	Islington
150	Arundel Square	Islington
151	Laycock Open Space	Islington
152	Compton Terrace Garden	Islington
153	Canonbury Square West	Islington
154	Canonbury Square East	Islington
155	Highbury Corner Roundabout	Islington
157	St Paul's Shrubbery	Islington
158	New River Walk (section A)	Islington
159	New River Walk (section B)	Islington
160	Canonbury 'D' Site	Islington
161	New River Walk (Section C)	Islington
162	St Mary's Church Gardens	Islington
163	Islington Green Gardens	Islington
164	Packington Square Gardens	Islington
165	Arlington Square	Islington
166	Wilton Square	Islington
167	Rosemary Gardens	Islington
168	Arlington Play Area	Islington
169	Colebrooke Row (Section 1)	Islington
170	Colebrooke Row (Section 2)	Islington
171	Northampton Square	Islington
172	King Square	Islington
173	St Luke's Garden	Islington
174	Embankment Gardens (Chelsea) 'A'	Kensington & Chelsea

Site no.	SiteName	Borough
175	Embankment Gardens (Chelsea) 'B'	Kensington & Chelsea
176	Chelsea Physic Garden	Kensington & Chelsea
177	Dovehouse Green	Kensington & Chelsea
178	St Luke's Park & Garden	Kensington & Chelsea
179	Norfolk Crescent	Westminster
180	Cambridge Square	Westminster
181	Hyde Park Crescent	Westminster
182	Oxford Square	Westminster
183	Sussex Gardens (Public)	Westminster
184	Talbot Square Gardens	Westminster
185	Water Gardens	Westminster
186	Connaught Square	Westminster
187	Sussex Square Gardens	Westminster
188	Hyde Park Square	Westminster
189	Paddington Green Open Space	Westminster
190	St John's Wood Church Ground	Westminster
191	St Paul's Churchyard	City of London
192	Festival Gardens	City of London
193	25 Cannon St	City of London
194	Carter Lane Gardens	City of London
195	Cleary Gardens	City of London
196	Postman's Park	City of London
197	Christchurch Greyfriars	City of London
198	St Alphage's/Salters garden	City of London
199	St Mary Aldermanbury	City of London
200	Pelam Crescent	Kensington & Chelsea
201	Onslow Gardens (Square)	Kensington & Chelsea
202	Onslow Square (West)	Kensington & Chelsea
203	Onslow Gardens (Medium)	Kensington & Chelsea
204	Onslow Gardens (Small)	Kensington & Chelsea
205	Onslow Gardens (Large)	Kensington & Chelsea
206	Crawley Gardens	Kensington & Chelsea
207	Evelyn Gardens (Middle)	Kensington & Chelsea
208	Evelyn Gardens (Small)	Kensington & Chelsea
209	Evelyn Gardens (Large)	Kensington & Chelsea
210	Egerton Crescent	Kensington & Chelsea
211	Egerton Gardens	Kensington & Chelsea
212	Egerton Place	Kensington & Chelsea
213	Egerton Place (Rear)	Kensington & Chelsea
214	Lennox Gardens	Kensington & Chelsea
215	Cavendish Square	Westminster
216	Paddington Gardens (South)	Westminster
217	Paddington Gardens (North)	Westminster
218	Mancehester Square Gardens	Westminster
219	40 Tree Green (Randolph Gardens)	Westminster
220	Porchester Square	Westminster
221	Westbourne Gardens	Westminster
222	Portman Square	Westminster
223	St Stephen's Garden	Westminster
224	Shrewsbury Road Garden	Westminster
225	Kildare Gardens	Westminster
226	Peabody Estate Stamford St	Southwark
227	Thurloe Square	Kensington & Chelsea
228	Alexander Square	Kensington & Chelsea
229	Princes Gardens	Westminster
230	Bramham Gardens	Kensington & Chelsea
231	Gledhow Gardens	Kensington & Chelsea
232	Courtfield Gardens (East)	Kensington & Chelsea
233	Courtfield Gardens (West)	Kensington & Chelsea

Site no.	SiteName	Borough
234	Green of Howcroft House	Tower Hamlets
250	Grosvenor Square Gardens	Westminster
251	Mount St Gardens	Westminster
252	Berkeley Square Gardens	Westminster
253	Avondale Park	Kensington & Chelsea
254	Hammersmith Park	Hammersmith & Fulham
255	White City Community Park	Hammersmith & Fulham
256	Wormholt Park	Hammersmith & Fulham
257	Cathnor Park	Hammersmith & Fulham
258	Godolphin Road Community Gardens	Hammersmith & Fulham
259	Leaders Garden	Wandsworth
260	The Pleasance	Wandsworth
261	Heath Rise	Wandsworth
262	Manor Fields	Wandsworth
263	Normand Park	Hammersmith & Fulham
264	Gwendwr Memorial Gardens	Hammersmith & Fulham
265	Marcus Garvey Park & Play Area	Hammersmith & Fulham
267	Brook Green	Hammersmith & Fulham
268	Loris Road Community Gardens	Hammersmith & Fulham
269	Furnival Gardens	Hammersmith & Fulham
270	Uppermall Open Space/Riverside Gardens South	Hammersmith & Fulham
271	North Verbena Gardens	Hammersmith & Fulham
272	St Peter's Square	Hammersmith & Fulham
273	Westcroft Square	Hammersmith & Fulham
274	Crescent Grove	Lambeth
275	Heathbrook Park	Wandsworth
276	Montefiore Gardens	Wandsworth
277	Spencer Park (road junction adjacent to...)	Wandsworth
278	St Ann's Churchyard	Wandsworth
279	Borrowdale Road (Green Space)	Wandsworth
282	Telegraph Hill South	Lewisham
283	Telegraph Hill North	Lewisham
284	Eckington Gardens	Lewisham
285	Besson St Community Gardens	Lewisham
286	Hatcham Gardens	Lewisham
287	Montague Gardens	Lewisham
288	Soho Square	Westminster
289	Golden Square Gardens	Westminster
290	Hanover Square Gardens	Westminster
291	St George's/Moreton St Area	Westminster
292	St George's Square Gardens	Westminster
293	Pimlico Gardens	Westminster
294	Bessborough Gardens	Westminster
295	Belgrave Square	Westminster
296	Wilton Crescent	Westminster
297	Eaton Square (South Central)	Westminster
298	Eaton Square (North Central)	Westminster
299	Chester Square/West	Westminster
300	Chester Square/East	Westminster
301	Eccleston Square	Westminster
302	Riverside Copse	Kensington & Chelsea
303	Ladbrooke Square Gardens	Kensington & Chelsea
304	Arundel & Ladbrook Gardens	Kensington & Chelsea
305	Elgin/Lansdowne Gardens	Kensington & Chelsea
306	Stanley Crescent Gardens	Kensington & Chelsea
307	Hillcrest Gardens	Kensington & Chelsea
308	Elgin/Blenheim Gardens	Kensington & Chelsea
309	Park Square Gardens	Westminster
310	Park Crescent Gardens	Westminster

Appendix 2.

Survey specification: Small parks and garden Squares, a place for wildlife?

Purpose:

- To carry out a survey of London's small parks, garden squares and similar historic gardens, plus a sample of housing estates, in the Inner London boroughs.
- To investigate the contribution of garden squares and similar historic gardens to London's biodiversity, especially birds.
- To investigate the relationship between garden design and management and diversity of bird life.
- To promote an interest in the natural history of garden squares and encourage positive communication between garden square proprietors and the biodiversity community.
- Produce a report summarising the findings of the survey.

Timing of Field work:

This should commence as soon as possible after funding becomes available and should be completed by 30th June 2004 or as agreed with the project manager.

Coverage

Small parks, squares and similar historic gardens covered by the London Squares Preservation Act 1931 between 0.1 and 3.0 ha in size, together with other public gardens within the same size range and within the 14 Inner London boroughs, plus a sample of gardens in housing complexes in the same area. The total will be not less than 250 and not more than 300 sites. The Area of Search is defined by a rectangle limited by northing 7400 to 8600 and easting 2200 to 4000.

The selected sites will represent a sample of the whole range of sites which fall within the definition above, and should be chosen to represent a diversity of size, landscape quality (e.g. from hard surface with trees through to landscapes with extensive tree cover and shrubberies) and useage (e.g. public or private garden, play area, informal sports). Purely paved areas without any green landscaping are excluded. Nature reserves and dedicated ecology parks are also excluded unless they form part of a site covered by the 1931 Act.

Identification of sites:

The first task is to identify a list of possible sites for survey, from which the actual selection will be made. It is suggested that contact be established with the London Parks and Gardens Trust, English Heritage, GLA, local authorities and other land managers in Inner London, for example the Royal Parks Agency, University of London (for some squares in Bloomsbury) and Bankside Open Spaces Trust, plus Peabody Trust and Notting Hill Housing Trust for housing estates. A list of sites covered by the 1931 Act will be a starting point but it is expected that a range of other public gardens and squares will also be identified, particularly in areas where few sites are protected by the 1931 Act, plus a sample of housing estates.

The sites selected for survey should then be plotted on an Ordnance Survey map at a suitable scale and identified with a site number. Where a site is divided into sections separated by roadway, use a separate survey sheet for each section.

Access

In the case of publicly accessible sites, contact should be made with the relevant borough or land manager as a courtesy. In the case of private land, the contractor will be

responsible for making contact with the garden square proprietors and negotiating access. Details of who gave permission to enter the site should be recorded on the survey sheet. Surveyors should not enter private land without permission from an authorised person.

The survey

The survey methodology will be based on GLA Habitat survey but adapted for the present study, with particular emphasis on habitat requirement for birds. Survey sheets will be provided which represent a modification of the GLA habitat survey, but with a separate recording form for birds. Minor amendments to the specification as set out here may be considered provided they are agreed between the GLA and the contractor before commencement of fieldwork.

Completing the survey forms

Area – This can be obtained through the GIS system.

Distance to nearest large park – This can be estimated through GIS or from the base map for the whole survey, indicating the distance to the nearest park of **20ha** or more (i.e. at least District level of importance as public open space).

Weather – record cloud cover, rain and wind strength (use scales adopted by BTO BBS survey). Field work should not be undertaken during significant rain.

Time spent – Note time of start and finish (24 hour clock) and total time taken. The latter should represent the whole time spent surveying the site, but not time spent e.g. conversing with gardener in site office.

Location – give sufficient information so that together with the grid ref there can be no doubt as to the identity of a site.

Permission to enter – it is essential to record this for privately owned sites.

Species recording

Walk slowly around the site, close to any hedgerow or shrubbery, and note any birds which are **heard or seen**. The tree canopy and lawns should be inspected with binoculars. All areas of shrubbery should be approached closely to look for birds and listen for nests with young. Numbers of birds should be noted (numbers above 10 can be estimates). Evidence of breeding should be recorded as indicated on the bird recording form. The highest category of breeding is the observation which most closely indicates breeding occurs in or very close to the site:
Top category – adult carrying food, occupied nest, or very young fledglings –score 1
2nd category – nest seen but occupation not confirmed,
3rd category – birds seen mating
4th category – birds singing
5th category, older fledglings or young birds which may have dispersed from nest site elsewhere
Surveyors are also expected to record grey squirrels, cats and any other visible mammals (or signs of mammalian life e.g. mole hill or fox earth) and any readily identifiable invertebrates (at least butterflies and dragonflies) which they encounter. Information provided by gardeners or local residents should be recorded in the box provided, so that they can be readily distinguished from actual observations by the surveyor, e.g. hedgehog, reported by gardener.

Habitat Recording

The GLA habitat survey form has been modified for this study, with emphasis is on vegetation structure as habitat for birds. In determining the percent cover by various forms of vegetation, a layered approach should be employed. The percentage cover of

each layer (trees; shrubs plus understorey trees and/or hedgerow; grassland and various forms of ground cover) is to be recorded separately, so the total may be more than 100%.

First estimate the percent cover by the tree canopy. This represents the taller trees e.g. London plane, common lime etc. Hawthorn, Judas tree, crab apple and similar small trees could be counted as part of the understorey, and grouped with the shrub layer.

Next estimate the % occupied by shrubbery, including understorey trees. Within this an estimate of the proportion in various height categories is required. For overall density, tick the box which best represents an indication for shrubbery across the site as a whole. If the site contains both dense pockets of shrubbery and sparse areas, tick each relevant box, with up to 3 ticks per box, according to the proportion of each category in the shrubbery as a whole.

Information is also requested on the relative proportion of native species amongst the trees and shrubbery. Hybrids which are known to incorporate a combination of native and non-native ancestry should be counted as non-native. Evergreen and deciduous trees and shrubs should also be distinguished.

Ivy-clad trees – see code on survey sheet

Hedgerow should be recorded where shrubs are managed as a distinct hedge, rather than simply a perimeter row of shrubs. The approximate height should be indicated (<1m, 1-2m or >2m). Low hedges less than 0.5m used to enclose flower beds, as in parterre gardens, should not be counted as hedgerow. Tick one box for mainly native or mainly non-native and normally one box for single species or mixed.

Woodland should be recorded where an area of trees and shrubs is more natural in quality, with a majority of the understorey comprising natural vegetation such as bramble, elder, hawthorn, ivy etc. Inevitably the cut off between shrubbery with trees and woodland is difficult and a degree of judgement should be used.

Scrub is expected to be an uncommon habitat, but this may be recorded where a plot of recently planted native trees and shrubs has not yet achieved a woodland quality, or where banks of bramble, buddleia etc occur as natural cover.

Grassland – short turf dominated by a single species, frequently Italian rye-grass, should be recorded as amenity turf. Where the turf is more varied with a fair proportion of finer grasses (such as *Agrostis capillaris, Festuca rubra, Cynosurus cristatus and Anthoxanthum oderatum*) and a good proportion of wild flowers (such as thyme-leaved speedwell, lady's bedstraw, bird's foot trefoil, lesser stitchwort and *Carex hirta*) this should be classified as semi-improved short turf.

Longer grass should be recorded as semi-improved neutral grassland, unless it is simply an overgrown rye-grass sward. If the grassland shows strongly acidic qualities, rather than just a few acid grassland species here and there in predominantly neutral grassland, list as 'other habitat' with a % figure in 3rd column.

Herbaceous flora - Much of this is likely to be in ornamental flower beds, tubs and planters. Some ornamental herbaceous flora may be intermingled with shrubbery. A rough estimate of the percentage of the garden which is occupied by this type of vegetation will suffice.

Woodland wild flowers or naturalised flowers, including hybrid bluebells, growing under shrubberies should be recorded as ground flora. Ivy may also be recorded as ground flora, but this should also be specified in the notes.

Open water - can be classified as a pond (more naturalistic structures), or ornamental pool (more formal, with concrete or stonework basin and negligible greenery). The % of marginal vegetation represents the proportion of the pond, not the whole site.

Management summary This information may be evident from the site visit, or through conversation with the gardener or garden committee representative.

Notes

This section should contain a brief description of the habitat:

- 2-3 lines to capture the overall nature of the site
- 2-3 lines indicating main tree species, any special quality (e.g. exceptionally old or fine trees)
- shrubbery – e.g. classical Victorian shrubbery dominated by evergreens incl holly, spotted laurel, cherry laurel; or shrubbery with good mix of flowering and berry bearing varieties. Note any items which are likely to be important for birds.
- If any of the habitat is recorded as scrub, indicate whether this is planted or naturally colonised, and the main species.
- Herbaceous flora - indicate broad types of planting e.g. herbaceous border or bedding plants. For wild flowers list the main species. If ferns or lower plants are particularly abundant this should also be noted. However, a full species list is not required. The emphasis should be on capturing the quality of the habitat, particularly for birds.

Page two covers various items linked to statutory planning, as recorded in the GLA Habitat Survey. Tick one principle land use (note churchyards used as a park score as parks), and any number of additional uses and facilities.

Tick the most appropriate box for public access. For restricted access, note whether it is for key holders only, or open to the public at certain times, if so give details.

Wheelchair access score 0-2

0 = no access to people in wheelchairs (steps at entrances, steep sloped or very narrow, rough or soft paths);

1 = limited access for people in wheelchairs, i.e. some but not all entrances wide enough and without steps, only parts of the site suitable for wheelchairs, or path condition less than ideal;

2 = good wheelchair access, with most if not all entrances suitable and access to most of the site on an extensive network of well-designed paths.

Maps

Only a site outline is required.

GIS/Database:

The contractor will be expected to input data to computer as follows:

a) Boundaries of all sites with access points on suitable GIS
b) All information from survey forms to be input to two Excel spreadsheets - one for habitat and one for birds and other animal life.

Deliverables:

- Completed survey forms for all sites
- GIS maps showing boundaries and access points for all parcels.
- Two Excel spreadsheets showing sites, ranked against size, access, habitat variables, and species of birds and other wildlife recorded.
- Report summarising findings of survey, in hard copy and electronic form. A good quality digital image of each.

Contact: Dr Jan Hewlett, Senior Policy Adviser (Biodiversity), Policy & Partnerships, Greater London Authority, City Hall, The Queen's Walk, London SE1 2AA.
Tel: 020 7983 4314, fax 020 7983 4706, e-mail jan.hewlett@london.gov.uk

SQUARES SURVEY 2004

Site & parcel no._____/_____

Site name_____

Location_____

Owner / Manager_____

Access / view from_____

Permission to enter from_____

Access gained to **all** ☐ **part** ☐ **viewed from outside** ☐

Grid ref. _____

Surveyor/s _____

Borough _____

Area _____**ha**

Distance to nearest large park _____**km**

Date _____

Time of visit _____ **Time spent** _____

Weather **cloud** ____ **wind** ____ **rain** _____

Trees

_____ % **Scattered trees**

_____ % of trees native species

_____ % of trees evergreen

------- ivy clad trees (✓=1-4, ✓✓ 5-10 ✓✓✓11+)

Shrubbery

_____ % **Planted shrubbery**

_____ % of all shrubs evergreen

_____ % of all shrubs native sps

% of shrubs ☐ <1m ☐ 1-3m ☐ >3m

overall density ☐ sparse ☐ average ☐ dense

Hedges

____ %**Hedgerow** ☐ mainly native ☐ non- native

☐ single sps ☐ mixed

height ☐ 0.5-1m ☐ 1-2m ☐ >2m

Grassland and lawn

_____% Amenity grassland

_____% Neutral grassland (semi-improved, short turf)

_____% Neutral grassland (semi-improved long grass)

Other herbaceous flora

_____% Flower beds

_____ Tubs/raised planters (- = none ✓= a few , **✓✓=lots)**

_____ Wild flowers/naturalised ground flora below shrubbery (- = none, ✓= a few , ✓✓=lots)

_____ Wild flowers/Tall herbs on open ground (- = none, ✓= a few , ✓✓=lots/large area)

Woodland and scrub

_____ % Native broadleaved woodland

% Non-native broadleaved woodland

Arrangement of trees and shrubbery

Most shrubbery associated with canopy trees ☐ Shrubbery mostly separate from canopy trees ☐

Pond or water features

___% **Pond**

___ Wet marginal vegetation (- = none, ✓= some , ✓✓=lots)

___ Formal pool plus fountain (- =no, ✓=yes)

Vegetated walls, tombstones

_____ - = none, ✓= some , ✓✓=lots

Bare ground & hard surface

_____ % Bare soil

_____ % Bare artificial habitat

Other habitat (specify)_____%_____

Management for birds

_____ Nest boxes (Yes or No)

_____ Bird feeders (Yes or No)

_____ Dead wood present (Yes or No)

Management summary

Grass frequently mown ☐ Infrequently mown ☐ cuttings removed Y/N ☐

Watering regime automated watering system ☐ regular hose use when needed ☐ rarely or never ☐ unknown ☐

Leaf litter composted on site ☐ collected and composted off site ☐ removed to landfill ☐ left in situ ☐ unknown ☐

NOTES

Site and parcel no: **date:**

NOTES (cont).

Information provided by garden personnel

Principal land use

- ☐ Civic square (Hard surface)
- ☐ Park
- ☐ Formal garden
- ☐ Community garden
- ☐ Churchyard
- ☐ Landscaping around premises (housing)
- ☐ Play space
- ☐ Recreation ground

Additional land uses and facilities - tick as appropriate

- ☐ Play equipment:
- ☐ Operational toilet
- ☐ Seats
- ☐ Refreshments
- ☐ Litter bins
- ☐ Facils for disabled
- ☐ Dog litter bins/areas
- ☐ Sculptures/monuments
- ☐ Historical features
- ☐ Wildlife interpretation
- ☐ Other Information
- ☐ Other (specify): ----------
- ☐ Tennis
- ☐ Football
- ☐ Bowls
- ☐ Other pitches
- ☐ Floodlit surfaces
- ☐ All weather surface

Level of disturbance - score 1 secluded, 2 average, 3 most disturbed ☐

Planning Status

- ☐ 1931 London Squares Act
- ☐ SINC or equivalent
- ☐ LNR
- ☐ MOL
- EH Register
- ☐

Level of use

- ☐ Regular use by large nos
- ☐ Used by moderate nos
- ☐ Not or hardly used

Public access

- ☐ Free
- ☐ De facto
- Restricted (describe restrictions):
  _____
- ☐ _____
  _____

Wheelchair access ☐

Nature conservation value and potential for enhancement

_____
_____
_____

Contacts

_____

_____
_____
_____
_____
_____
_____

LONDON SQUARES SURVEY Bird Recording form

Site & parcel no._____/_____

Site name_____

Location_____

Access / view from_____

Permission to enter from_____

Grid ref. _____

Surveyor/s _____

Borough _____

Area _____**ha**

Distance to nearest large park _____**km**

Date _____

Time of visit _____ **Time spent** _____**hrs**

Weather sun ----- wind ---- rain -------

Bird Species	**Score / as each individual seen or approx no in individual group**	**Evidence of breeding** **cf carrying food m mating s song** **fl /y young fledglings** **fl /o older fledglings** **n nest n /oc occupied nest** **cn carrying nesting material**	**Total number seen**	**Highest category of breeding**
Feral pigeon				
Wood pigeon				
Carrion crow				
Starling				
House sparrow				
Magpie				
Blackbird				
Songthrush				
Robin				
Wren				
Dunnock				
Blue tit				
Great tit				
Long tailed tit				
Coal tit				
Greenfinch				
Chaffinch				
Goldfinch				
Chiffchaff				
Blackcap				
Willow warbler				
Sparrowhawk				
Kestrel				
Gt spot.woodpecker				
Green woodpecker				
Mallard				
Jay				
Collared dove				
House martin				
Swift				
Other - specify				

	Number seen	*Other species*
Butterflies and other insects		
Mammals		

Nest sites – note here nest sites which have been located, including approx height of shrubs, and whether evergreen, with name if known

Species	*Nest site*
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Appendix 4. Birds and shrubbery - relative density and height data

(derived from pivot table analysis)

	Density of shrubbery						Standard errors				Confidence intervals			
Frequency (% of sites recorded)	**a - no shrubs**	**b – all sparse**	**c- mixed but no dense**	**d - mixed with dense**	**not classified**	**grand total**	**a - no shrubs**	**b – all sparse**	**c- mixed but no dense**	**d - mixed with dense**	**a - no shrubs**	**b – all sparse**	**c- mixed but no dense**	**d - mixed with dense**
Robin	12%	13%	48%	51%	44%	35%	2.5%	1.2%	2.8%	2.75%	6.7-16.8%	11.0-15.8%	42.6 - 53.7%	45.3 - 55.9%
Dunnock	0%	1%	7%	21%	11%	9%	0.0%	0.1%	0.86%	1.8%	. - .%	.8 - 1.2%	5.9 - 8.9%	17.8 - 24.9%
Wren	18%	20%	31%	56%	33%	34%	3.5%	1.6%	2.47%	2.6%	10.6 - 24.7%	16.4 - 22.8%	26.1 - 35.6%	51. - 61.4%
Long-Tailed Tit	0%	1%	2%	9%	0%	4%	0.0%	0.1%	0.37%	0.97%	- .%	.8 - 1.2%	1.9 - 3.%	7.3 - 10.7%
Greenfinch	6%	3%	12%	15%	22%	10%	1.3%	0.3%	1.2%	1.3%	3.2 - 8.6%	2.5 - 3.7%	9.9 - 14.8%	12. - 17.3%
Great Tit	12%	7%	11%	30%	11%	16%	2.5%	0.78%	1.1%	2.2%	6.7 - 16.8%	5.9 - 8.6%	8.9 - 13.3%	25.9 - 34.8%
Blue Tit	12%	41%	60%	72%	89%	56%	2.5%	2.5%	2.7%	2.1%	6.7 - 16.8%	36.3 - 46.2%	55.2 - 65.8%	67.6 - 76.2%
Black bird	76%	77%	91%	94%	89%	87%	4.4%	1.8%	0.98%	0.6%	67.7 - 85.2%	73.8 - 80.9%	89.6 - 93.1%	93.3 - 95.5%
No of Sites in sample	**17**	**97**	**81**	**89**	**9**	**293**								

	Height of shrubs: low, medium, high					Standard errors				Conf intervals			
Frequency	**a - no shrubs**	**b -50% or more low**	**c – more than 50%medium/tall**	**not classified**	**All sites**	**a - no shrubs**	**b -50% or more low**	**c – more than 50% medium/tall**		**a - no shrubs**	**b -mostly low**	**c - mostly medium/tall**	
Robin	12%	13%	46%	50%	35%	2.52%	1.27%	1.81%		6.7 - 16.8%	10.3% - 15.4%	42.1% - 49.4%	
Dunnock	0%	1%	13%	20%	9%	0.00%	0.14%	0.81%		.% - .%	1.% - 1.6%	11.1% - 14.4%	
Wren	18%	18%	42%	40%	34%	3.52%	1.67%	1.78%		10.6 - 24.7%	14.6% - 21.3%	38.5% - 45.6%	
Long-Tailed Tit	0%	1%	5%	0%	4%	0.00%	0.14%	0.37%		.% - .%	1.% - 1.6%	4.6% - 6.1%	
Greenfinch	6%	6%	11%	30%	10%	1.34%	0.68%	0.69%		3.2 - 8.6%	5.1% - 7.8%	9.3% - 12.%	
Great Tit	12%	6%	20%	10%	16%	2.52%	0.68%	1.18%		6.7 - 16.8%	5.1% - 7.8%	17.9% - 22.6%	
Blue Tit	12%	41%	65%	70%	56%	2.52%	2.74%	1.66%		6.7 - 16.8%	35.5% - 46.5%	61.6% - 68.2%	
Blackbird	76%	76%	93%	80%	87%	4.36%	2.09%	0.50%		67.7 - 85.2%	71.5% - 79.8%	91.5% - 93.6%	
No of Sites in sample	**17**	**78**	**188**	**10**	**293**								

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