

ASPECTS OF PASSERINE BIRD POPULATIONS IN CADIZ PROVINCE, SPAIN, AND THEIR RELATIONSHIP TO LAND USE.

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INTRODUCTION.

There have been many studies around the world that have estimated bird populations using a variety of censusing techniques. These studies have usually been used to compare the use of different habitats by different groups or species of birds.

Similarly in many areas land use statistics are routinely prepared, often for planning purposes.

In Andalucia the Consejeria de Agricultura y Pesca, in its Plan Forestal Andaluz (Andalusian Forestry Plan) (1989), published maps and tables showing the current distribution of habitats in Andalucia and its provinces and projected the intended situation in 2048.

The main purpose for which the Plan Forestal was drawn up was to halt of the loss of vegetated areas through desertification and erosion, largely caused by wildfires and over-grazing, and to ensure the conversion of scrub and marginal agricultural land into more economically profitable woodland. While re-afforestation in Spain is generally considered to be positive for wildlife, experience in other countries (e.g. Scotland) has shown that developing woodland can have adverse effects on bird species diversity and density.

In view of the importance for birds of the area of the Straits, of the province of Cadiz and of Andalucia as a whole, an assessment of the impact of forestry changes on the bird life is overdue.

THE IMPORTANCE OF THE STRAITS FOR MIGRANTS.

There is little doubt that converging coastlines combined with the region's mountains direct migration towards the Straits of Gibraltar and its habitats. While much of the diurnal migration passes overhead and makes relatively little use of the habitats in the area, the habitats of the Straits are important as fattening areas, or stopover sites, for nocturnal migrants, during both northward and southward migration for both trans-Saharan and Mediterranean-wintering species.

Comunicaciones

Unfortunately it is difficult to measure the numerical incidence of night migrants using these habitats. Intense censusing is necessary in particular in the more densely vegetated habitats which are those that, in the autumn at least are likely to be the most important as food resources. And because the timing of the movement of the different species is so precise (Cortes 1995), it would require regular censusing continuously throughout the year to be certain to cover all the species. Censusing of migrants in the habitats of the area has therefore tended to be intensive for short periods (Telleria, 1981) or, most popularly, in winter when the populations are most stable (e.g., Herrera, 1980; Telleria, 1981; Fernandez Pasquier, 1982; Costa, 1984; Suarez & Muñoz Cobo, 1984; Carrascal & Telleria, 1985; Jordano, 1985; Santos & Telleria, 1985.).

Winter work has confirmed the importance of the area for Mediterranean-wintering species. Species that favour woodland and scrub invade the area, often relying largely on fruit for food. Species involved include robin *Erithacus rubecula* and blackcap *Sylvia atricapilla*. Jordano (1985) showed that the importance of these habitats for wintering frugivores increased with decreasing latitude and showed the particular importance of habitats in the extreme south of the Iberian peninsula, with over 50% being frugivores not present during the summer. Santos & Telleria (1985) found that in Iberia bird densities in winter were highest in the meso- and thermo-Mediterranean zones of the south of the Peninsula and in their review Telleria *et al.* (1988) showed that these birds originate from central Europe (especially finches) and as far north as Scandinavia (e.g. the thrushes).

During this time of year the open, less stable habitats, the grasslands and marginal agriculture become important sources of food, following the arrival of the seasonal rains, which generally coincide with the arrival of the wintering species. The increase in productivity of these relatively simple habitats makes them capable of accepting a greater number of winter residents than the more stable woodlands. The wintering birds of the grasslands are notably *Alauda arvensis*, *Anthus pratensis*, *Miliaria calandra* and the Fringillidae.

Breeding birds include the true residents and also summer visitors from sub-Saharan wintering grounds. These include birds of woodland (e.g. *Muscicapa striata*) and of open ground (e.g. *Lanius senator*).

METHODS.

The United Kingdom in particular is fortunate in the large number of volunteers who, largely through the British Trust for Ornithology regularly census birds and provide regular updates which allow population trends to be recorded and even predicted. In the absence of BTO-style data, other less accurate methods have been used here to provide an idea of the order of magnitude of bird populations in the different habitats of the region.

Relatively few census studies have been undertaken in Andalucia, fewer still in Cadiz, and only a handful in the Campo de Gibraltar. Because the majority of studies that have estimated bird densities in Andalucia have been carried out in winter, the most reliable of the estimates that follow therefore refer to populations during this season, chiefly in December and January. Data from Finlayson (1991) have been used for the nesting period.

Estimates of vegetation cover by habitat have been taken from the Plan Forestal Andaluz (1989), both as existing in 1989 (Table 1) and predicted for 2048 (Table 4). Estimates of populations of wintering passerines and near-passerines have been arrived at by multiplying densities in similar habitats by the estimated surface area of the habitat. This has been done for Andalucia as a whole and specifically for Cadiz. The following studies have been selected as those covering habitats which appear from proximity or description to approximate those in the Campo de Gibraltar and addressing the species and habitats most likely to occur in the zone:

Winter - Total birds: Herrera, 1980; Arroyo & Telleria, 1984; Costa, 1984; Suarez & Muñoz Cobo, 1984; Winter - Birds by species: Arroyo & Telleria 1983; Nesting season: Finlayson 1991.

Only Arroyo & Telleria (1984) were found to have sufficient detail to consider birds by species, and then only in three habitats, pooled together as pastures, matorral (scrub) and cork woods. No source was found that could be used to estimate numbers in some of the less common habitats, including poplar, eucalyptus, and sweet chestnut groves. Pine habitats were all treated together and wetlands were excluded in view of their very different characteristics and constituent bird species. Finlayson (1991) has been used as a source of data for birds in the nesting season. Data here have also had to be pooled, using personal knowledge of Finlayson's methodology and sites, considering Ojen as pasture, Carnero and Manilva as matorral, and Almoraima and Valdeinfierno as cork woods. These data have only been used to estimate total numbers of birds.

There are clearly a number of limitations as to the accuracy of the data as presented. The estimates rely firstly on the accuracy of the source material. At least in one case (Finlayson 1991) sample sizes were often small. Pooling of material will also have its inherent error. Also a large number of different habitat types fall into such broad categories as "matorral" and "grassland", each with differing densities of different species, both of vegetation and birds, and there will be variations within seasons and between years. Other trends, such as the effect on bird populations (and indeed on vegetation) of global warming, will clearly not be taken account of using these methods. Also excluded from these studies for example is the incidence of birds of prey.

Clearly habitats vary widely in detail between areas. In particular zones far from where the studies in question have been carried out can have local characteristics which will again limit the value of the density calculations. It is comforting, however, that calculations using both Arroyo & Telleria (1984) and the other authors, and again Finlayson (1991) have yielded results which are close in their order of magnitude. The results are sufficient to allow discussion of the different habitats and their management proposals.

RESULTS AND DISCUSSION.

Table 1 gives the surface area by natural and semi-natural habitat for Cadiz province and Andalucia, while Figure 1 illustrates the proportions of the different habitats as defined by the Plan Forestal in 1989. Abbreviations used for habitats are detailed in Appendix I

Habitat type	Cadiz	Andalucia
<i>Quercus</i> (mixed)	39.600	160.963
<i>Quercus ilex</i>	18.300	845.682
<i>Quercus suber</i>	93.300	183.587
<i>Pinus</i> + <i>Quercus</i>	2.000	131.520
<i>Castanea</i>		9035
<i>Olea</i>	17.300	19.089
<i>Eucalyptus</i>	3.500	267.269
<i>Populus</i>	200	4.017
<i>Pinus</i>	11.800	759.689
Conifers (other)	400	4396
Matorral	72.500	1.180.993
Grassland	92.100	426.949
Wetlands	16.300	23.743
Marginal agriculture	12.500	623.165

Source: Plan Forestal Andaluz

Table 1. Surface area by habitat, Cadiz and Andalucia, 1989 (ha).

Appendix I. Abbreviations used in Figures. Page 160.

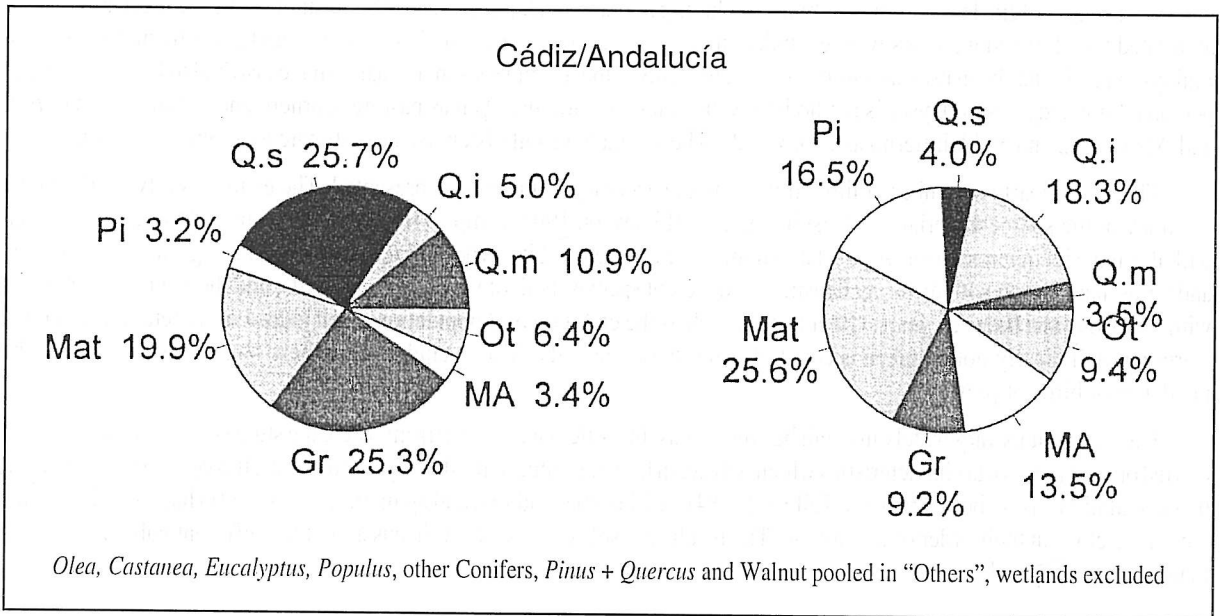


Figure 1. Surface area by habitat: 1989.

In Cadiz oak woodland makes up over 39% (151 200 ha). Of these, 93 300 ha are of cork oak *Quercus suber*. Grassland makes up just over 25% in Cadiz but 9.2% in Andalucia as a whole. Marginal agriculture makes up 3.4% in Cadiz and 13.5% in Andalucia. Taken together these stress the importance of the open habitats in Cadiz.

Habitat type	Cadiz	Andalucia	Sources
<i>Quercus</i> (mixed)	199.188	809.644	Suarez & Munoz Cobo, 1984
<i>Quercus ilex</i>	64.599	2.985.258	Herrera 1980
<i>Quercus suber</i>	1.044.960	2.056.174	Arroyo & Tellería, 1984
Castanea			
Olea	81.483	899.092	Suarez & Munoz Cobo, 1984
Eucalyptus			
Populus			
Pinus	45.548	293.240	Costa, 1984
Conifers (other)			
Matorral	754.000	12.282.327	Arroyo & Tellería, 1984
Grassland	2.444.334	11.331.227	Arroyo & Tellería, 1984
Wetlands			Arroyo & Tellería, 1984
Marginal Agriculture	331.750	16.538.799	Arroyo & Tellería, 1984
TOTAL	4.973.582	47.703.418	

Table 2. Numbers of passerines and near passerines in habitats in winter, 1989.

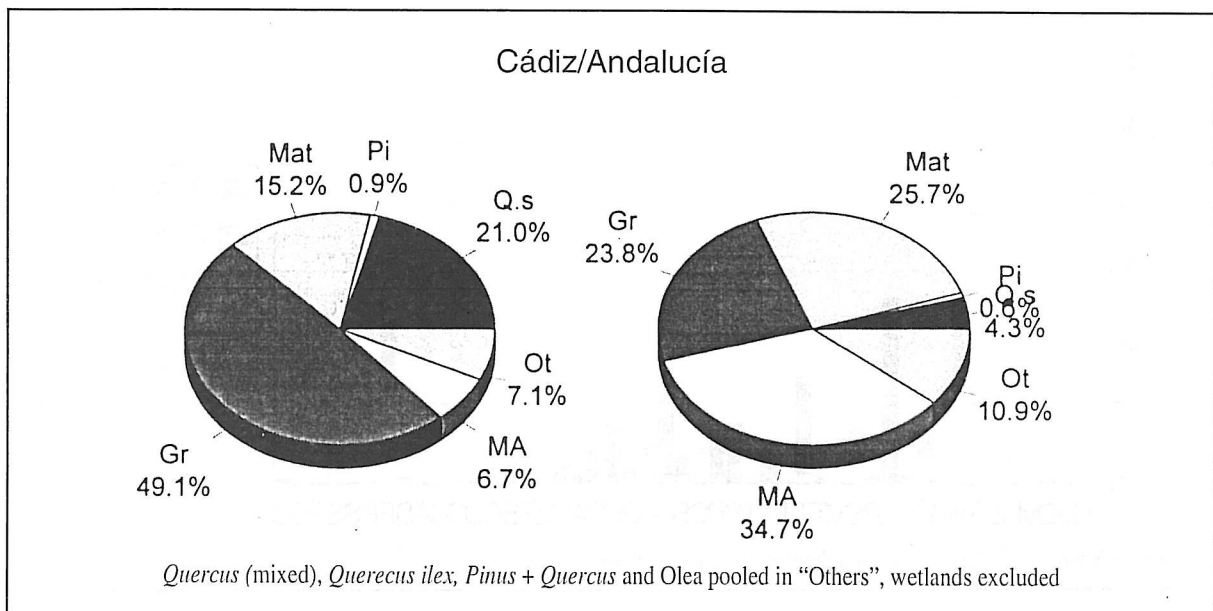


Figure 2. Wintering birds in habitats, 1989.

Table 2 shows the estimated numbers of passerine and near-passerines using the habitats in winter and Figure 2 illustrates these as percentages. Sources of bird density data are given in Table 2 and the densities given below are taken from the named sources.

Grassland pastures hold the highest densities of wintering birds in the area (226 bird/10ha), compared with scrub (60 birds/10ha) and cork woods (48 birds/10ha). Species that occur exclusively in winter or whose populations are augmented by winter visitors make up 85%, 58% and 43% of birds in these habitats respectively. This supports the observation that the open areas of ground are opened up to visitors after the rains whereas the more stable woodland habitats have greater year-round uniformity.

The Table at Appendix II and Figure 3 (adapted from Arroyo & Telleria, 1984) show individual species considered by three selected habitats, grassland ("pastizal" in Arroyo & Telleria, 1984), matorral and cork oak woodland. The abbreviations in Figure 3 follow the sequence of species in Appendix II. Clearly, some species feature more in some habitats than in others. In grassland, and of the winter visitors, *Alauda arvensis* (41.17/10ha), *Anthus pratensis* (56.77/10ha) and the Fringillidae, notably *Carduelis carduelis* (64.93/10ha) and *Acanthis cannabina* (31.04/10ha) are the most important. But the more developed habitats are the winter refuge in particular of *Erithacus rubecula* (14.61/10ha and 16.85/10ha respectively in scrub and cork oak woods), *Regulus ignicapillus* (8.88/10ha in cork woods), *Phylloscopus collybita* (2.04 and 6.97/10ha in scrub and cork woods) and *Fringilla coelebs* (12.7/10ha in the woodland). *Prunella modularis*, although found in low densities (1.02 and 0.90/10ha in the two respective habitats) is exclusively a winter visitor as are *Turdus philomelos* (9.91 and 6.85/10ha) and *Turdus iliacus* (0.31 and 0.34/10ha). These figures are likely to be underestimates.

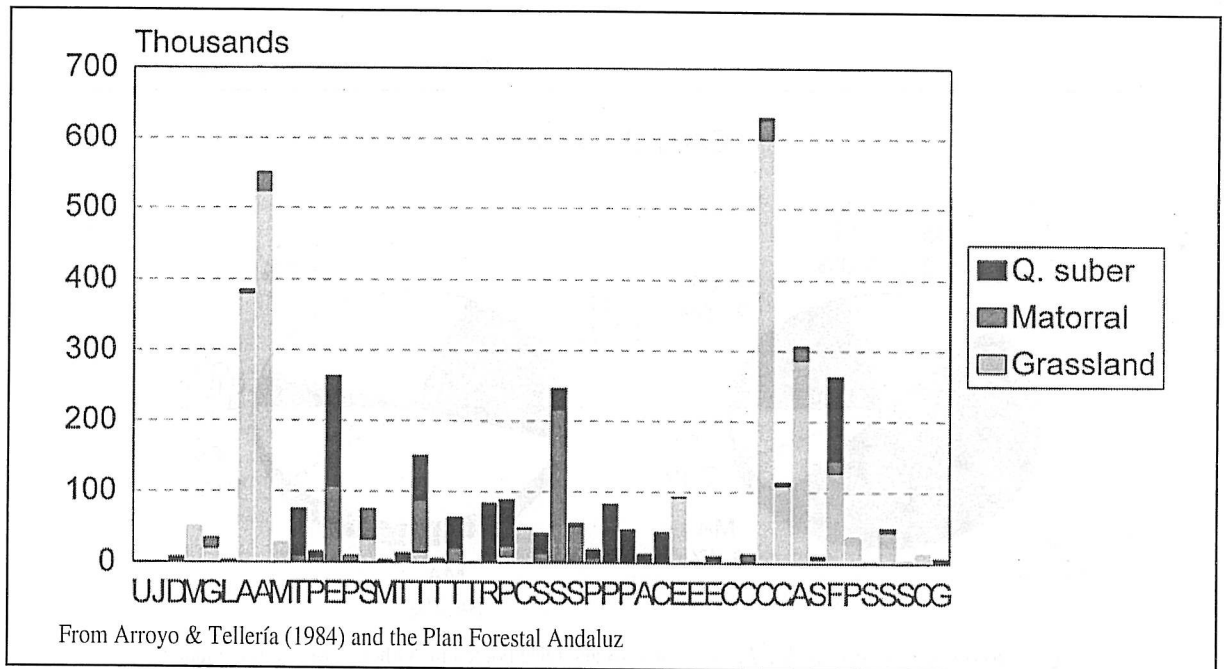


Figure 3. Wintering birds in three habitats (Cadiz, 1989).

The total number of birds of the species in question estimated in this way for the winter in Cadiz province is just over 4 million, of which nearly 2.5 million are found in the grasslands and just under 1 million are found in cork woods. Of the total over 2.5 million are of species that are exclusively or predominantly winter visitors to the area. In the cork woods over half a million are predominantly winter visitors.

Table 2 shows that in Andalucia as a whole marginal agricultural land is most important (over 16.5 million birds) followed by Mediterranean scrub (over 12 million birds) and grasslands (over 11 million birds). In Cadiz, grassland remains the most important (almost 2.5 million birds) but cork woodland is next (over 1 million birds by this calculation) with forest with oak together accounting for about 1 300 000 birds in 153 200 ha, of which cork forest accounts for 60%. The predominantly wooded nature of the province is one of its salient features, with its consequent importance, relative to Andalucia as a whole, for those birds that favour this habitat in the winter (and, evidently during passage and nesting periods for which unfortunately few data exist). These figures are indeed disproportionate when compared to Telleria et al.'s (1988) estimates of 300 000 000 birds for Iberia: In the cork woods, for example, 0.15% of the national area holds 0.33% of the birds.

Finlayson (1991) provides some estimates of birds in selected habitats in the area of the Straits of Gibraltar during the nesting season. Once again grassland provide the highest densities (163 birds/10ha) followed by marginal agricultural land (143.4 birds/10ha) and then cork oak woods (138.3 birds/10ha). Other woodland habitats and scrub follow closely. These densities are converted into estimates of actual numbers in Table 3, shown as percentages in Figure 4. For Andalucia as a whole the estimate of breeding birds is nearly 52 million, while for Cadiz it is nearly 5 million. In Cadiz the most birds are found in grassland (1.5 million), followed by cork woodland (nearly 1.3 million).

Habitat Type	Cadiz	Andalucia
<i>Quercus</i> (mixed)	328.284	1.334.383
<i>Quercus ilex</i>	210.450	9.725.343
<i>Quercus suber</i>	1.290.339	2.539.008
<i>Pinus</i> + <i>Quercus</i>	21.440	1.409.894
<i>Castanea</i>		
<i>Olea</i>	145.320	160.348
<i>Eucalyptus</i>		
<i>Populus</i>		
<i>Pinus</i>	118.354	7.619.681
Conifers (other)		
Matorral	780.825	12.719.294
Grassland	1.501.230	6.959.269
Wetlands		
Marginal agriculture	179.250	8.936.186
TOTAL	4.575.492	51.403.405

Source: Finlayson, 1991

Table 3. Numbers of breeding passerines and near passerines in habitats, 1989.

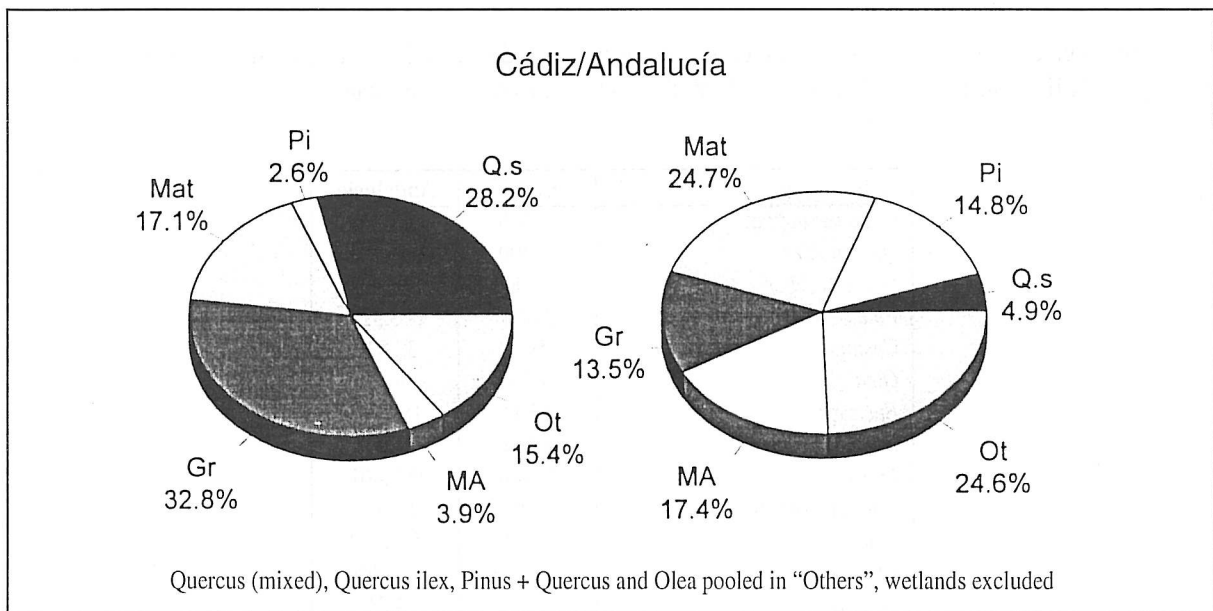


Figure 4. Nesting birds in habitats, 1989.

Figures 5 and 6 compare nesting and wintering bird numbers by habitat in Andalucia and Cadiz respectively. As expected the woodlands are more important in the nesting season with a higher number of birds, the scrub varies little between the seasons, while grassland and marginal agriculture greatly increases in importance in the winter.

Comunicaciones

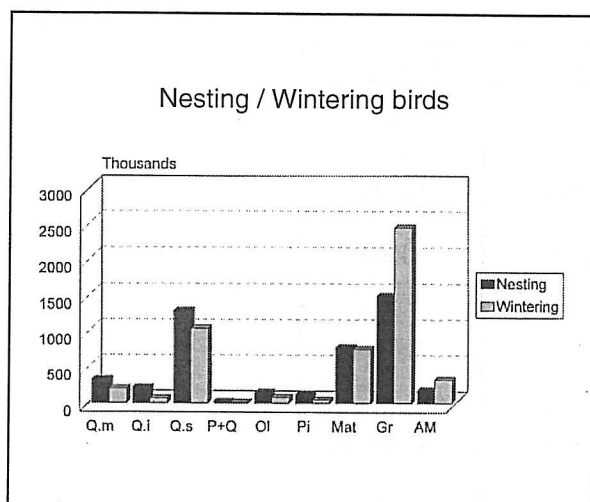


Figure 5. Cadiz, 1989, nesting and wintering birds in habitats.

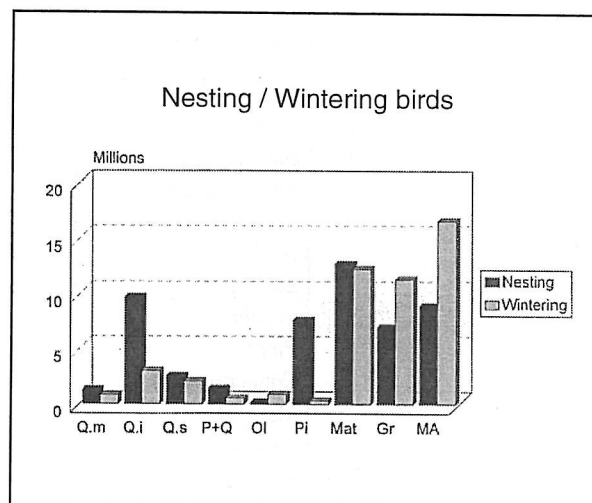


Figure 6. Andaluca, 1989, nesting and wintering birds in habitats.

Tables 4 gives estimates of the proposed surface area by habitat in 2048, Table 5 (winter) and Table 6 (nesting season) and Appendix III (winter) give estimates of the birds that would be using those habitats.

Habitat Type	Cadiz	Andaluca
<i>Quercus</i> (mixed)	52.700	600.269
<i>Quercus ilex</i>	18.300	934.233
<i>Quercus suber</i>	100.900	236.023
<i>Pinus + Quercus</i>	2.000	663.329
<i>Castanea</i>	500	37.830
<i>Olea</i>	17.300	19.489
<i>Eucalyptus</i>	4.500	183.017
<i>Populus</i>	1.300	19.904
<i>Pinus</i>	23.900	902.401
Conifers (other)	700	17.972
Matorral	43.600	561.199
Grassland	100.300	471.801
Wetlands	16.300	34.743
Marginal agriculture	0	41.667
Walnut	500	12.000
Fast-growing pine	2.000	16.500

Source: Plan Forestal Andaluz

Table 4. Surface area by habitat, Cadiz and Andaluca, 2048 (ha).

Habitat Type	Cadiz	Andalucia	Sources
<i>Quercus</i> (mixed)	265.081	3.019.353	Suarez & Munoz Cobo, 1984
<i>Quercus ilex</i>	64.599	3.297.843	Herrera, 1980
<i>Quercus suber</i>	1.130.080	2.643.458	Arroyo & Tellería, 1984
<i>Pinus</i> + <i>Quercus</i>	7.720	2.560.450	Costa, 1984
<i>Castanea</i>			
<i>Olea</i>	81.483	91.793	Suarez & Munoz Cobo, 1984
<i>Eucalyptus</i>			
<i>Populus</i>			
<i>Pinus</i>	92.254	3.483.470	Costa, 1984
Conifers (other)			
Matorral	453.440	5.836.470	Arroyo & Tellería, 1984
Grassland	2.661.962	12.521.599	Arroyo & Tellería, 1984
Wetlands			Arroyo & Tellería, 1984
Marginal agriculture		943.758	Arroyo & Tellería, 1984
Walnut			
Fast-growing pine	7.720	63.690	Costa, 1984
TOTAL	4.764.339	34.461.682	

Source: Plan Forestal Andaluz

Table 5. Numbers of passerines and near passerines in habitats in winter, 2048.

Habitat Type	Cadiz	Andalucia
<i>Quercus</i> (mixed)	463.883	4.976.230
<i>Quercus ilex</i>	210.450	10.743.679
<i>Quercus suber</i>	1.395.447	3.264.198
<i>Pinus</i> + <i>Quercus</i>	21.440	7.110.887
<i>Castanea</i>		
<i>Olea</i>	145.320	163.708
<i>Eucalyptus</i>		
<i>Populus</i>		
<i>Pinus</i>	239.717	9.051.082
Conifers (other)		
Matorral	469.572	6.044.113
Grassland	1.634.890	7.690.356
Wetlands		
Marginal agriculture		597.505
Walnut		
Fast-growing pine	20.060	165.495
TOTAL	4.600.779	49.807.253

Table 6. Numbers of nesting passerines and near passerines in habitats, 2048.

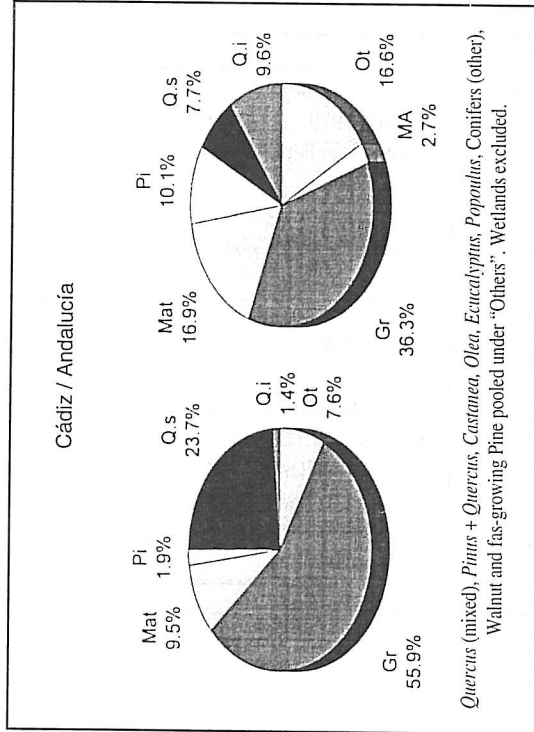
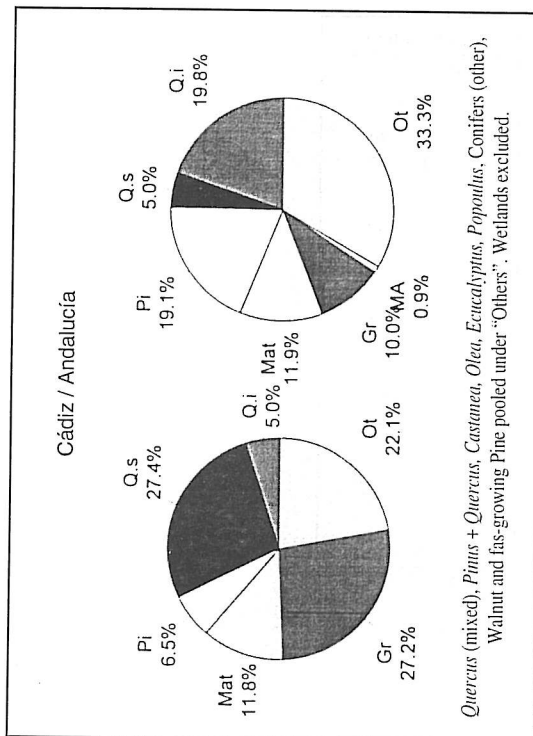
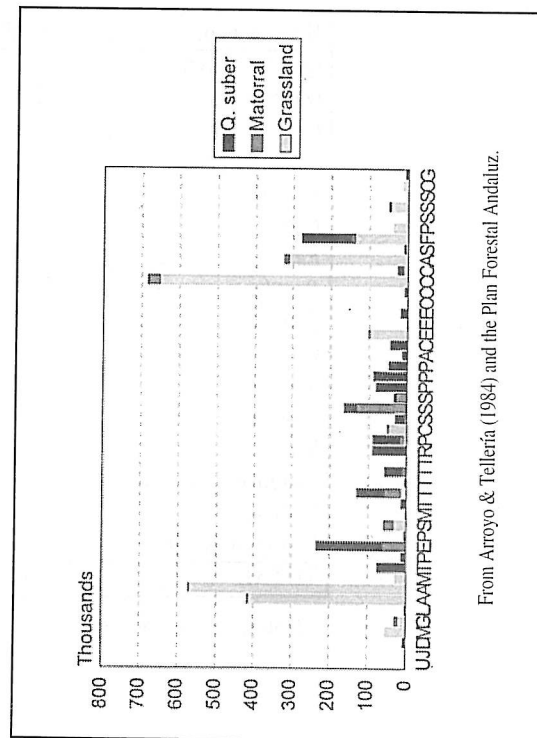


Figure 7. Surface area by habitat: 2048.



From Arroyo & Tellería (1984) and the Plan Forestal Andaluz.

Figure 9. Wintering birds in three habitats (Cádiz, 2048).

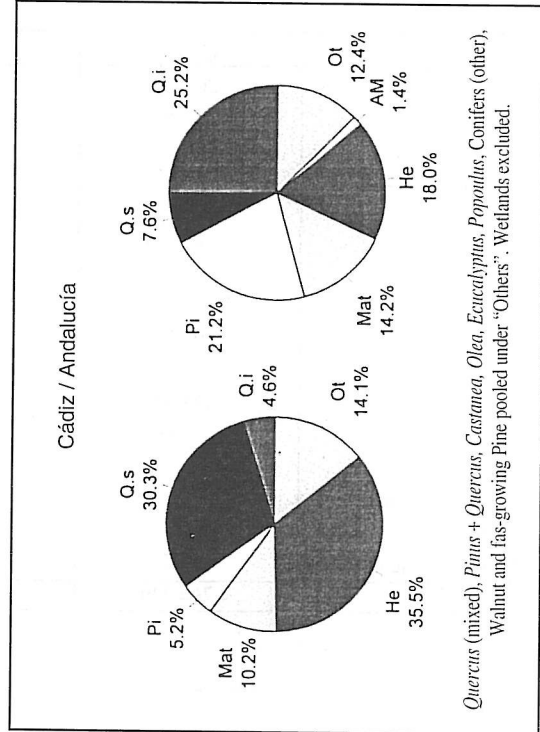


Figure 8. Wintering birds in habitats, 2048.

Figure 10. Nesting birds in habitats, 2048.

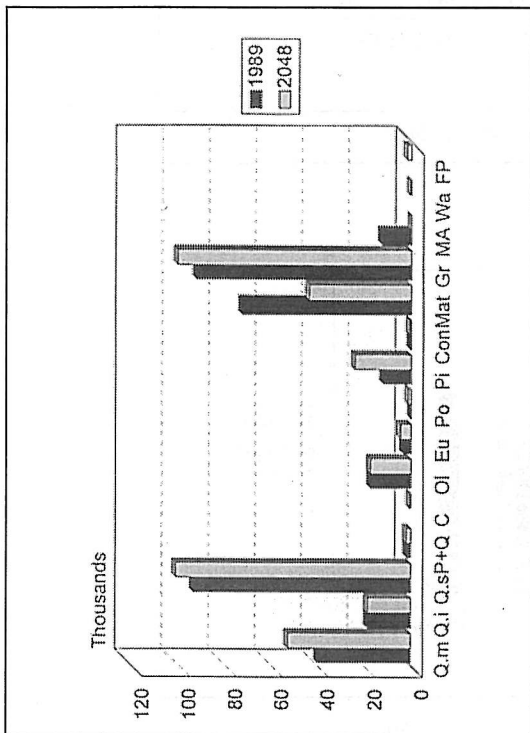


Figure 11. Extent of habitat, in hectares: Cadiz, 1989 and 2048.

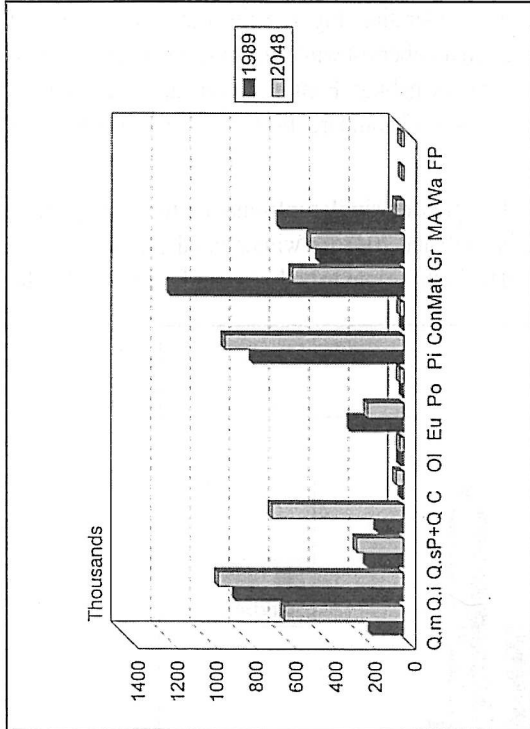


Figure 12. Extent of habitat, in hectares: Andalusia, 1989 and 2048.

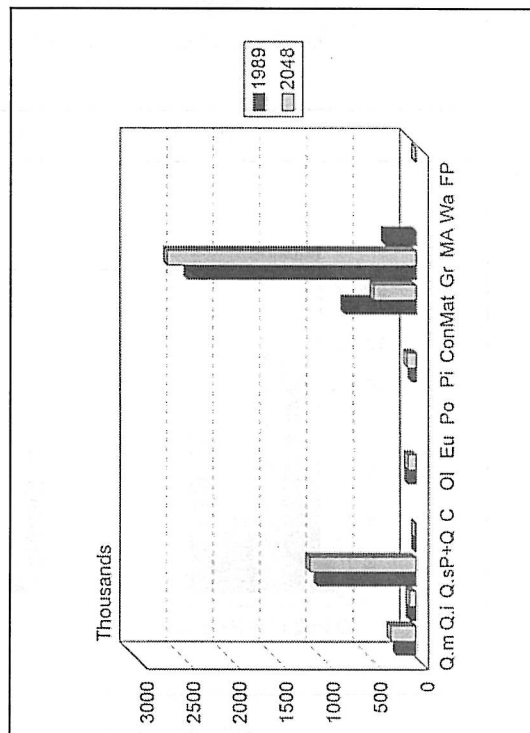


Figure 13. Wintering birds in habitats in Cadiz, 1989 and 2048.

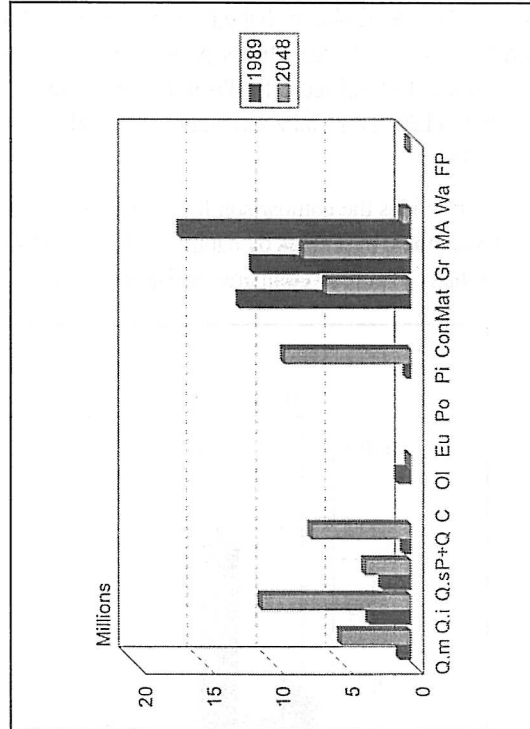


Figure 14. Wintering birds in habitats in Andalusia, 1989 and 2048.

Comunicaciones

Figure 7 shows, for 2048, the habitats as percentages of those under consideration. Figure 8 illustrates percentages of total wintering birds in 2048 (see sources in Table 5). Figure 9 shows expected numbers of wintering birds by species in 2048 (Arroyo & Telleria, 1984). Figure 10 illustrates proportions of nesting birds by habitat. Figure 11 compares the extent of habitats in 1989 and 2048 for Cadiz and Figure 12 does this for Andalucia. Figure 13 compares bird totals for winter in Cadiz in 1989 and 2048.

Figure 14 provides the comparison for Andalucia . Figures 15 and 16 provide similar information for nesting birds. Tables 7 and 8 compare bird totals by habitats in Cadiz and Andalucia in 1989 and 2048 for winter and the nesting season respectively. Finally, Figure 17 compares total numbers of birds estimated for both regions in both seasons for 1989 and 2048.

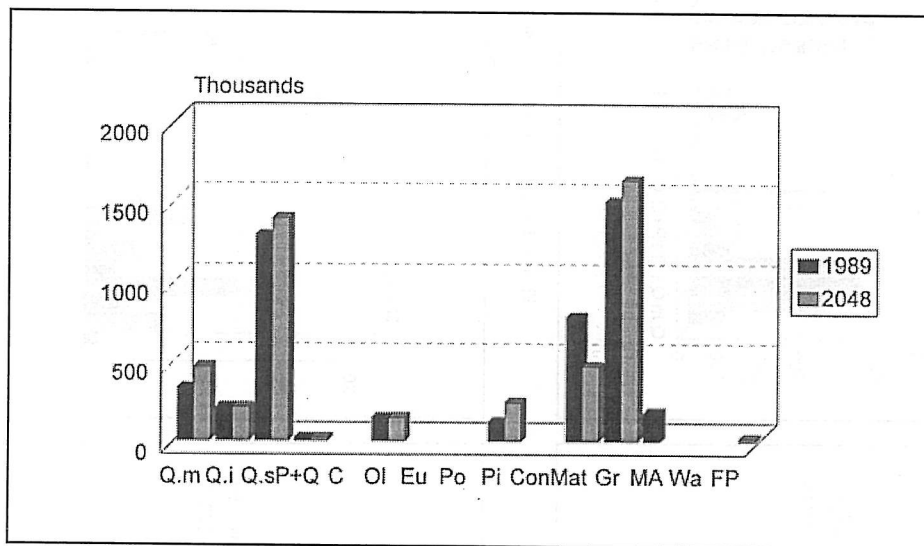


Figure 15. Nesting birds in habitats in Cadiz, 1989 and 2048

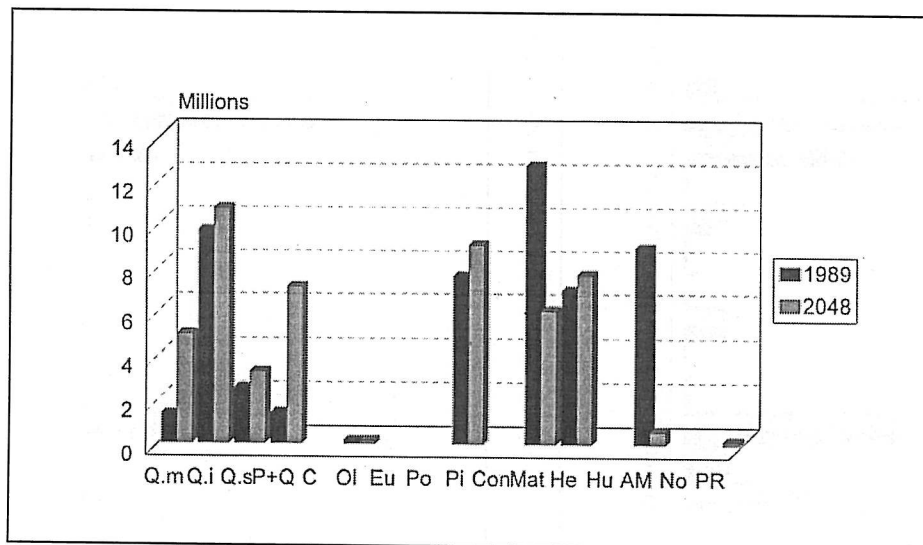


Figure 16. Nesting birds in habitats in Andalucia, 1989 and 2048

	Winter Cadiz 1989	Winter Cádiz 2048	Winter Andalucia 1989	Winter Andalucia 2048
<i>Quercus</i> (mixed)	199.188	265.081	809.644	3.019.353
<i>Quercus ilex</i>	64.599	64.599	2.985.258	3.297.843
<i>Quercus suber</i>	1.044.960	1.130.080	2.056.174	2.560.450
<i>Pinus</i> + <i>Quercus</i>	7.720	7.720	507.667	2.560.450
<i>Castanea</i>				
<i>Olea</i>	81.483	81.483	899.092	94.793
<i>Eucalyptus</i>				
<i>Populus</i>				
<i>Pinus</i>	45.548	92.254	293.240	3.483.268
Conifers (other)				
Matorral	754.000	453.440	12.282.327	5.836.470
Grassland	2.444.334	2.661.962	11.331.227	12.521.599
Marginal agriculture	331.750	0	16.538.799	943.758
Fast-growing pine		7.720		63.690
TOTAL	4.973.582	4.764.339	47.703.418	34.461.682

Table 7. Winter bird populations estimated by habitats in 1989 and 2048.

	Nesting Cadiz 1989	Nesting Cádiz 2048	Nesting Andalucia 1989	Nesting Andalucia 2048
<i>Quercus</i> (mixed)	328.284	463.883	1.334.383	4.976.230
<i>Quercus ilex</i>	210.450	210.450	9.725.343	10.743.679
<i>Quercus suber</i>	1.290.339	1.395.447	2.539.008	3.264.198
<i>Pinus</i> + <i>Quercus</i>	21.440	21.440	1.409.894	7.110.887
<i>Castanea</i>				
<i>Olea</i>	145.320	145.320	160.348	163.708
<i>Eucalyptus</i>				
<i>Populus</i>				
<i>Pinus</i>	118.354	239.717	7.619.681	9.051.082
Conifers (other)				
Matorral	780.825	469.572	12.719.294	6.044.113
Grassland	1.501.230	1.634.890	6.959.269	7.690.356
Wetlands				
Marginal agriculture	179.250	0	8.936.186	597.505
Fast-growing pine		20.060		165.495
TOTAL	4.575.492	4.600.779	51.403.405	49.807.253

Table 8. Nesting bird populations estimated by habitats in 1989 and 2048.

The sixty year Plan Forestal Andaluz aims to rationalise the exploitation of Andalucia's forest resources partly by diversifying some of the economic uses of the land but largely by increasing the financial benefits of woodland. It has been promoted as aiming to achieve the sustainable use of natural resources in keeping with the World Conservation Strategy. The ultimate aim on inception, which will be subject to variation in the light of experience and available finances, is to achieve 100,000 ha more of forested area by 2048, increasing the forest from 51.3% to 76.6% of the total.

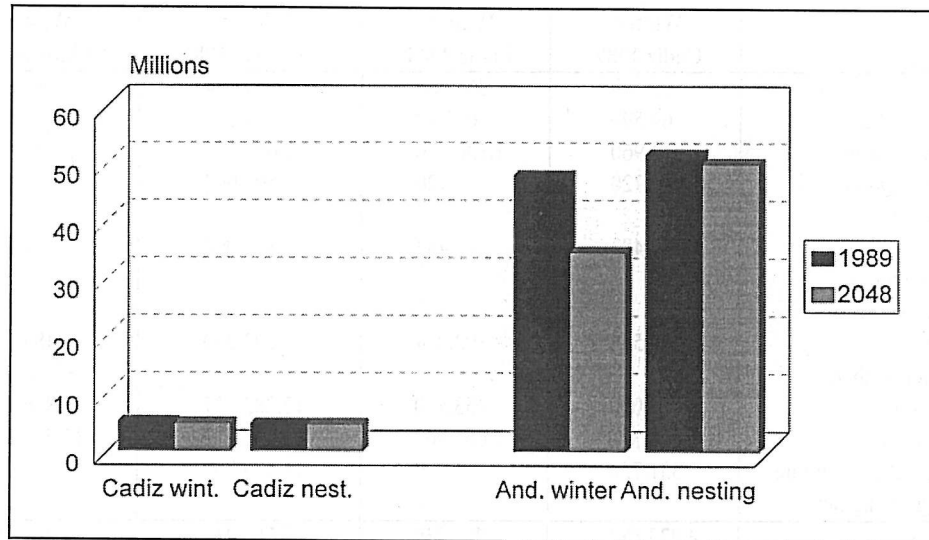


Figure 17. Total estimates of wintering birds in Cadiz and Andalusia, 1989 and 2048.

The main plan aims at planting or encouraging mainly oaks and pines while reducing the cover of Eucalyptus by 32%.

If ultimately carried out, the main effect in vegetation terms will be to reduce the amount of marginal agricultural land and Mediterranean scrub while increasing pine plantations and, to a lesser extent, cork. The increase in cork woodland is to be welcomed, but the loss of 13% of the marginal agriculture and scrub to be replaced with pine is not beneficial to the bird life. The marginal habitats are important for wintering birds and although few studies exist, probably also for long-distance migrants. Based on the existing studies, Pinus dominated habitat has a low density of birds (30.6/10ha), even lower in winter than during the nesting season. The plan therefore to increase pine at the expense of matorral (104 birds/10ha) will not be beneficial to birds and should be borne in mind when planning which areas are to be forested with these species. The wiping out of marginal agricultural land in Cadiz is another cause for concern as is the general loss of open ground over the whole of Andalusia.

In winter, both for Cadiz and more markedly for Andalusia, the effect of the Plan Forestal will be a decline in the use of the land surface by passerines and near-passerines in the 60 year period. For nesting birds, numbers in Andalusia are expected to fall also, while in Cadiz a slight increase is expected due to the increase here of cork woodland and grassland.

CONCLUSIONS.

The Plan Forestal Andaluz did not take account of the densities of birds using the various habitats that will be affected. This study provides a broad indication of the numbers of birds involved, especially in winter, in Andalusia and Cadiz and provides important background information on how the plans can affect the populations of birds using the territory. This should allow compensatory action to be taken in order not to prejudice birds, above all birds of open ground. These considerations should be borne in mind as the years progress and the forestry plan is amended through experience. It would for example make more sense to replace Eucalyptus and pine with oak (especially cork oak on suitable soils) than plant cork on matorral, grassland or marginal land before removing Eucalyptus. Similarly a change in the quality of the woodland would be preferable to replacing open ground with woodland.

Whereas it is true to say that any adverse effect on birds would in this case be largely on common species, the need to emphasise protection of habitats given impetus recently by BirdLife International in Habitats for Birds in Europe (Tucker & Evans, 1997) shows the importance of protecting the habitats of common birds. The habitats which would be most affected by afforestation fall into Tucker & Evans' classification of Mediterranean scrub and agricultural and grassland habitats, and within the latter arable and improved grassland and pastoral woodland. Table 9 shows the Priority A and Priority B species in these habitats that regularly occur within Cadiz province .

Mediterranean	PRIORITY A <i>Aquila adalberti</i> <i>Oenanthe hispanicus</i> <i>Sylvia undata</i>	PRIORITY B <i>Alectoris rufa</i> <i>Otus scops</i> <i>Picus viridis</i> <i>Galerida theklae</i> <i>Lullula arborea</i> <i>Oenanthe leucura</i> <i>Monticola solitarius</i> <i>Sylvia hortensis</i> <i>Lanius senator</i> <i>Emberiza hortulana</i>
Pastoral Woodland	<i>Aquila adalberti</i> <i>Lanius senator</i>	<i>Ciconia ciconia</i> <i>Otus scops</i> <i>Picus viridis</i> <i>Lullula arborea</i>
Arable/improved grassland	<i>Alectoris rufa</i> <i>Otis tarda</i> <i>Emberiza hortulana</i>	<i>Streptopelia turtur</i> <i>Tyto alba</i> <i>Otus scops</i> <i>Athene noctua</i> <i>Picus viridis</i> <i>Galerida cristata</i> <i>Alauda arvensis</i> <i>Hirundo rustica</i> <i>Oenanthe hispanicus</i>

Table 9. Priority A and B birds in three habitats (after Tucker & Evans, 1997).

These priority species can be expected to decline in numbers as the habitats in question are replaced by more closed forested areas. Changes in a region so important for receiving wintering birds can have consequences on the birdlife of many other parts of Europe.

While it is important to halt the desertification process in Andalucia that is caused by over grazing and particularly by fire, wide ranging afforestation must be considered not as an end in itself, but in the light of populations of all the affected organisms. Thus the effect on birds, as a group of important indicator species in any wildlife habitat, should be considered before final plans are laid out. This paper calls on the environmental agencies within the Junta de Andalucia to consider their afforestation plans in the light of the likely effects on bird populations. It is essential that where data, however crude, are

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available, they should be utilised when considering major changes to the landscape. Although not a main consideration of this paper, it cannot be forgotten that the dangers faced by the cork woods from forest fire and disease do pose a significant threat to a proportion of Spain's birds. Any management plan must incorporate appropriate measures to control both of these threats.

Clearly there is also a need for obtaining much more detailed census data for our region. These are few and totally lacking in some of the habitats. Use of the data in this study has had to make many assumptions which would not be acceptable if more detailed information were available. It is regrettable that many of the resources which are being provided by the Junta de Andalucía and the European Union are being dedicated to continuing studies in relatively well known areas and not to obtaining information which is lacking and has deeper implications on conservation and land use.

Thus the many resources being directed for example towards MIGRES, a project to monitor migration across the Straits of Gibraltar, dedicated in the first season to bird of prey migration, could have been used to begin to obtain information on the smaller members of the avifauna about which so little is accurately known.

In view of the importance of the habitats of the area for migrating birds, it is important that any action that is going to impact on these habitats bear in mind their bird populations. In recognition of the fact that many of these birds do not nest in the region, nor even in Spain, and that therefore the regional and national authority of this country have a wider responsibility towards them, such a major environmental plan as the Plan Forestal Andaluz required at its inception, and indeed still does, consideration of the impact of the proposed changes in vegetation on wildlife in general.

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	1989 Pastizal	Matorral	Alcornocal		2048 Grassland	Matorral	Q. suber
<i>Upupa epops</i>		725		<i>Upupa epops</i>		436	
<i>Jynx torquilla</i>		725		<i>Jynx torquilla</i>		436	
<i>Dendrocopos major</i>			7370	<i>Dendrocopos major</i>			7971
<i>Melanocorypha calandra</i>	50379			<i>Melanocorypha calandra</i>	54864		
<i>Galerida theklae</i>	19802	14065		<i>Galerida theklae</i>	21565	8459	
<i>Lullula arborea</i>		2973		<i>Lullula arborea</i>		1788	
<i>Alauda arvensis</i>	379176	5905		<i>Alauda arvensis</i>	412935	3575	
<i>Anthus pratensis</i>	522852	27403		<i>Anthus pratensis</i>	569403	1640	
<i>Motacilla alba</i>	27262			<i>Motacilla alba</i>	29689		
<i>Troglodytes troglodytes</i>		9643	65030	<i>Troglodytes troglodytes</i>	5799	70323	
<i>Prunella modularis</i>		7395	8397	<i>Prunella modularis</i>		4447	9081
<i>Erithacus rubecula</i>		105923	157211	<i>Erithacus rubecula</i>		63700	170017
<i>Phoenicurus ochruros</i>	829	8918		<i>Phoenicurus ochruros</i>	902	5363	
<i>Saxicola torquata</i>	31406	42920		<i>Saxicola torquata</i>	34202	25811	
<i>Monticola solitarius</i>		3698		<i>Monticola solitarius</i>		2224	
<i>Turdus viscivorus</i>			13622	<i>Turdus viscivorus</i>			14731
<i>Turdus philomelos</i>	14828	71848	63910	<i>Turdus philomelos</i>	16148	43208	69117
<i>Turdus iliacus</i>		2248	3172	<i>Turdus iliacus</i>		1352	3431
<i>Turdus merula</i>		20735	41892	<i>Turdus merula</i>		12470	45304
<i>Turdus spp.</i>			1026	<i>Turdus spp.</i>			1110
<i>regulus ignicapillus</i>			82850	<i>regulus ignicapillus</i>			89599
<i>Phylloscopus collybita</i>	8289	14790	65030	<i>Phylloscopus collybita</i>	9027	8894	70327
<i>Cisticola juncidis</i>	46234	1450		<i>Cisticola juncidis</i>	50350	872	
<i>Sylvia atricapilla</i>		13340	27019	<i>Sylvia atricapilla</i>		8022	23812
<i>Sylvia melanocephala</i>	1658	214020	30416	<i>Sylvia melanocephala</i>	1805	128707	32893
<i>Sylvia undata</i>		49590	5225	<i>Sylvia undata</i>		29822	5650
<i>Parus caeruleus</i>		6945	12308	<i>Parus caeruleus</i>		3575	78198
<i>Parus major</i>		1450	80705	<i>Parus major</i>		872	87279
<i>Parus cristatus</i>			46090	<i>Parus cristatus</i>			49845
<i>Aegithalos caudatus</i>			13622	<i>Aegithalos caudatus</i>			14731
<i>Certhia brachydactyla</i>		725	41892	<i>Certhia brachydactyla</i>		436	45304
<i>Emberiza calandra</i>	91732	725		<i>Emberiza calandra</i>	99899	436	
<i>Emberiza cirius</i>		725	1026	<i>Emberiza cirius</i>		436	1110
<i>Emberiza cia</i>		4422	5318	<i>Emberiza cia</i>		2660	15841
<i>Coccothraustes coccothraustes</i>			1026	<i>Coccothraustes coccothraustes</i>			1110
<i>Carduelis chloris</i>		2487	10362	<i>Carduelis chloris</i>	2708	6235	
<i>Carduelis carduelis</i>	598005	30388	2053	<i>Carduelis carduelis</i>	651248	30302	2220
<i>Carduelis spinus</i>	107757			<i>Carduelis spinus</i>	11735		15841
<i>Acanthis cannabina</i>	285878	20010		<i>Acanthis cannabina</i>	311331	12034	
<i>Serinus serinus</i>	5802	1450	3172	<i>Serinus serinus</i>	6311	872	3431
<i>Fringila coelebs</i>	126545	17763	118491	<i>Fringila coelebs</i>	137812	10682	128145
<i>Passer domesticus</i>	36380			<i>Passer domesticus</i>	39619		
<i>Sturnus vulgaris</i>	829	725		<i>Sturnus vulgaris</i>	903	436	
<i>Sturnus unicolor</i>	42090		6251	<i>Sturnus unicolor</i>	45837	6760	
<i>Sturnus spp.</i>	4145			<i>Sturnus spp.</i>	4514		
<i>Corvus monedula</i>	13170			<i>Corvus monedula</i>	14343		
<i>Garrulus glandarius</i>			7371	<i>Garrulus glandarius</i>			7971
Totals	2417534	714004	916813	Totals	2527150	440841	1071150
GR.TOTAL			4048351	GR.TOTAL			4039141

Appendix II. Estimates of wintering bird populations in Cadiz in 1989 (based on Arroyo & Telleria, 1984).

Appendix III. Estimates of wintering bird populations in Cadiz in 2048 (based on Arroyo & Telleria, 1984).

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Appendix I. Abbreviations used in Figures:

Q.m	<i>Quercus</i> (mixed)	Mixed oak woodland
Q. i	<i>Quercus ilex</i>	Holm oak woodland
Q.s	<i>Quercus suber</i>	Cork oak woodland
P + Q	<i>Pinus + Quercus</i>	Mixed pine and oak woodland
C	<i>Castanea</i>	Sweet Chestnut
Ol	<i>Olea</i>	Olive scrub
Eu	<i>Eucalyptus</i>	Eucalyptus plantations
Po	<i>Populus</i>	Poplar groves
Pi	<i>Pinus</i>	Pine woodland, usually <i>Pinus pinea</i> or <i>P. pinaster</i>
Con	Conifers (other)	Conifers other than pine (e.g. <i>Abies pinsapo</i>)
Mat	Matorral	Mediterranean scrub; can be very diverse
Gr	Grassland	Areas of herbaceous vegetation, including arable
MA	Marginal agriculture	
Wa	Walnut Groves	
FP	Fast-growing Pine	
Ot	Others	