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Small wetlands lost: a biological conservation hazard in Mediterranean landscapes

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Summary

In Spain, it is estimated that 60% of wetlands have disappeared in the last 50 years. The present study aimed to describe the relationships between loss of wetlands and land-use change in Azuaga County, Central-western Iberian Peninsula where during the period 1896–1996, 94% of the original wetlands disappeared. Forest, scrub, holm oak *dehesas* and olive groves have become fragmented or disappeared completely, having been substituted by eucalyptus plantations in areas of low productivity and by dry cultivation of herbaceous crops, mainly cereals, in more productive areas. These substitutions have resulted in a homogeneous, coarse-grained landscape with low diversity and high dominance. The type of land-use has depended on the evolution of demographic processes, with high human immigration rates toward the end of the nineteenth century and beginning of the twentieth century, and high emigration rates during the 1960s and 1970s. The mechanization of agriculture and transition from closed to market economy in the second half of the twentieth century also played an essential role in the landscape changes described.

Keywords: wetland loss, land-use change, ecological history, agricultural intensification, Extremadura, Spain

Introduction

Mediterranean landscapes have been subject to strong human influence largely driven by the exploitation of forests and agricultural soils and the presence of cattle for millenia (Naveh & Lieberman 1994). The transformation of agricultural landscapes, moving from extensive to intensive farming, has accelerated during this century, inducing a progressive loss in spatial heterogeneity at the local and regional scales (Fernández Alés *et al*. 1992), and creating extensive areas where barely any natural vegetation remains. This situation has resulted in landscapes where the species diversity has diminished considerably (Fernández Alés *et al*. 1992; Medley *et al*. 1995), and where, due to the change in the landscape patterns, ecosystem processes have been highly modified by alterations of energy, nutrient and water fluxes (Naveh 1987; Ryszkowski & Kedziora 1987; Turner 1989; Turner & Gardner 1991; Hobbs 1993; Hobbs *et al*. 1993; Medley *et al*. 1995).

Wetlands are the natural systems that have been most altered in the creation and development of agricultural landscapes. Wetlands are ecosystems which play an important role in the maintenance of the biological diversity and in the conservation of endangered species (González Bernáldez 1987; Bernáldez *et al*. 1989). Despite their great intrinsic value, wetlands have been losing ground to systems under human use, so that most wetlands in Europe, and the Mediterranean in particular, have been lost (Hollis 1995). In Spain, it is estimated that more than 60% of wetlands have disappeared in the last 50 years (Casado de Otaola & Montes del Olmo 1995). Demand for agricultural land caused by crop irrigation has been the most important factor explaining the disappearance of inland wetlands (González Bernáldez 1992; Bernáldez *et al*. 1993; Casado de Otaola & Montes del Olmo 1995; Hughes 1995). Also, the changes in hydrology caused by over-exploitation have impaired the capacity for aquifer recharge leading to permanent wetland losses (Llamas 1988).

These processes of wetland disappearance have usually been associated with changes in the structure of the landscape, which, in turn, are related to changes in social and economic factors and to technological development (Iverson 1988; Fernández Alés *et al*. 1992; Douglas & Johnson 1994; Burel & Baundry 1995; Medley *et al*. 1995). In agricultural regions, the ecological processes have a limited role in landscape changes and the decisions in planning land-uses and management practices have been taken according to local agro-ecological characteristics, within hierarchies of social, economic and technical constraints (Burel & Baundry 1995).

In this paper, we aimed to measure wetland loss in one part of the Mediterranean landscape and assess factors which may have contributed to this. For small wetlands, the modest size of each area means that individual losses are likely to remain unnoticed, even if the areas constitute a significant portion of the regional landscape. This condition vividly contrasts with the large wetlands of the Iberian Peninsula, such as the Ebro Delta, Daimiel & Doñana National Parks, which have gained international recognition and the threats to them have caused public concern. In our study, we wished to document the loss of small wetlands during the period 1896–1996, and relate these to associated landscape changes at the local scale.

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Methods

Study area

The study was carried out in the north of Azuaga County (38°20′N, 5°40′W), which is located south-east of the Region of Extremadura and to the north of the Sierra Morena ranges (Fig. 1). The study area comprised 25 000 ha, most of which consisted of plain situated at 550–600 m above sea level. Continental Miopliocenic deposits of clays predominate in the area, and they are located mainly over an impervious layer of Carboniferous and Devonic materials, which surface occasionally (IGME 1985*a*, *b*). The plain is situated on the southern border of the watershed of the Guadiana River (Fig. 1). The drainage network is formed by small intermittent water courses that cross the zone with small slopes (under 0.3%) making small incisions in the landscape. The only important water course is the Matachel River (Fig. 1), a direct tributary of the Guadiana River to the north. Under this plain, only local aquifers exist, which are superficial and narrow but lead to the presence of wetlands in this area which extend beyond into neighbouring counties (IGME 1985*a*, *b*; Junta de Extremadura 1987).

The climate is Mediterranean with hot, dry summers (26 °C on average in July) and mild, wet winters (7 ºC on average in January). The mean annual rainfall is 550 mm, 80% of it occurring from October to March (Ministerio de Agricultura 1979). There is a high interannual variation in precipitation with periods of 5 to 7 years of wet or dry cycles.

Agriculture, in particular cereal cultivation, has been practised for centuries in the area, since Roman times (second century B.C.). Based on sixteenth to eighteenth-century sources (Ensenada 1752; Gallego Fernández & García Novo 1997), the area is known to have been largely devoted to the cultivation of cereals, pasture land in seminatural grasslands, holm oak forests (*Quercus rotundifolia* Lam.) and holm oak *dehesas*. The dehesas are traditional management practices of selective tree clearing to enhance the growth of annuals and provide a regular yield of edible, high-quality acorns for cattle (Montserrat & Fillat 1990). Some areas of dehesas were ploughed either to sow cereals or to remove shrubs to promote herb growth. The farm density is 2.1 farms/km^2, although most of them are now abandoned and farmers live in towns. Nowadays, the major land-use is intensive cultivation of wheat, barley and sunflowers. Other land-uses are plantations of olive groves and dehesas with intensive forage cultivation. In marginal areas with steep slopes and poor soils, there exist areas with eucalyptus (*Eucalyptus camaldulensis* Dehnh.) afforestation and secondary Mediterranean shrubs.

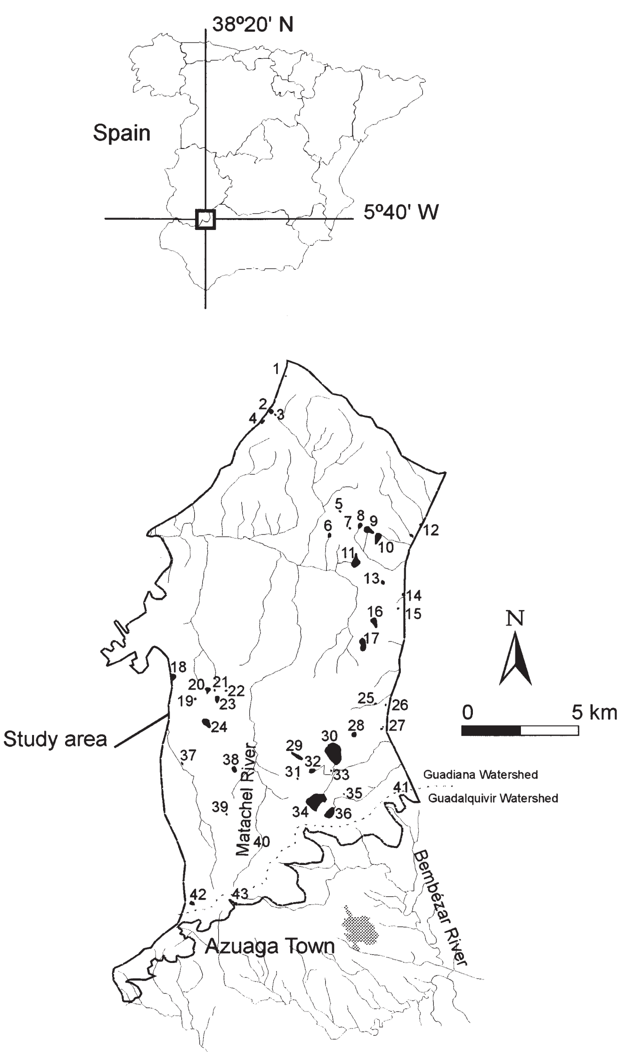

Figure 1 Location of the study area in the northern half of Azuaga County. The 43 wetlands inventoried for the study are numbered, and drainage networks of the Guadiana and Guadalquivir watersheds are shown.

Wetland inventory

Information sources utilized (Table 1) in order to inventory the wetland areas in the north of Azuaga County between 1896 and 1996 were (1) all available cartographic data in the zone at scales ≥ 1:50 000; (2) black and white panchromatic air photos for 1956, 1978 and 1987 and (3) field surveys.

For each wetland found, its location was recorded in geographic coordinates (UTM) and its state was described for 1896, 1956, 1978 and 1996. Dimensions, surface area, and maximum and minimum diameters were calculated based on the photographs of 1956. The present state of each wetland was determined by recording in situ all of the impacts (ploughing, drainage, re-excavation, modification by infrastructure and some other impacts) which each site has undergone and the current land-use of each area.

Land-use and landscape pattern

The changes in the use of the land that have taken place in the north of Azuaga, and the manner in which these changes occurred, were determined for 1896, 1956, 1978 and 1996. For this purpose, the extent of each of nine land-use/land-cover categories was calculated, namely (1) crop land, (2) olive groves, (3) grazed holm oak dehesas, (4) cultivated holm oak dehesas, (5) holm oak forest, (6) Mediterranean scrub, (7) eu-

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Table 1 Aerial photography and cartographic maps used in this study

Year	*Scale*	*Type*	*Commissioning agency*
1956	1:33 000	Black and white panchromatic	Servicio Geográfico del Ejercito
1978	1:18 000	Black and white panchromatic	IRYDA
1987	1:20 000	Black and white panchromatic	Azimut S.A. Enterprise
1896	1:25 000	Topographic map	Instituto Geográfico Estadístico
1950	1:50 000	Topographic map	Instituto Geográfico Catastral
1974	1:50 000	Topographic map	Instituto Geográfico Catastral
1983	1:50 000	Topographic map	Servicio Geográfico del Ejercito
1984	1:50 000	Topographic map	Servicio Geográfico del Ejercito
1979	1:50 000	Land-use map	Ministerio de Agricultura

calyptus plantation, (8) cork oak (*Quercus suber* L.) plantation, and (9) wetlands. The land area subject to each use for each date was obtained by the digitization at 1:50 000 scale, the digitized polygons were gridded into a matrix of 42 × 42 m picture elements (i.e. pixels) using IDRISI v.4.0 program (Eastman 1992) and the information derived from the cartographic maps and aerial photographs utilized.

Two indices based on information theory were used to quantify landscape patterns and compare patterns through time, namely the Shannon-Wiener diversity, $\mathbf{H' = -\Sigma\ p_i * lnp_i}$, and evenness, $\mathbf{E = H'/lns}$. These indices were calculated to compare changes in richness and landscape apportionment, where $\mathbf{p_i}$ represented the proportion of total area in category **i** of each land-use and **s** represented the total number of categories involved (O'Neill *et al.* 1988). Using IDRISI spatial analyses for pooled or individual land-use/land-cover categories (Donn *et al.* 1991), we focused on total areas and the number of landscape elements in 1956, 1978 and 1996. The data from 1896 were not utilized, since the accuracy of cartographic data were much lower than that obtained from the aerial photographs; the 1896 cartographic data were retained as independent evidence of the status of the wetlands and the land-use pattern.

Socio-economic situation

In order to document social, economic and technical change underlying development of the landscape and disappearance of wetlands, demographic data for the County of Azuaga were gathered for the period 1845–1994. Fluctuations in the population were compared to changes in local and regional economic activities during the same time period. Data on the availability of agricultural machinery and the number of tractors were also gathered.

Results

Change in wetland areas

Thirty-five wetlands within the northern limits of the County of Azuaga were detected as having been present during 1986–96. The aerial photographs indicate another eight wetland sites which may have disappeared prior to the study period. Forty-three wetlands were therefore inventoried (Appendix 1). The wetlands included in the inventory (Fig. 1) can be divided into two groups according to their human or natural origin. The first group was composed of small diverted channels of the streams which were and still are in use to store water for cattle or for irrigation of small plots; the size of ponds was very small, 0.1–0.5 ha (sites 12 and 37 in Fig. 1). The second was composed of a large group of ponds with shapes ranging from circular to pear-shaped and of varied size. Most of these ponds had a surface area of 5–20 ha, the two largest being 61 and 68 ha in size. These ponds were shallow, less than 1 m deep, and only had open water during the winter and spring of wet years. According to Alonso (1987), this second group of wetlands may be classified as 'temporary fresh water ponds (conductivity 100–300 μS cm^{-1}), with moderate to high turbidity'. Those depressions which had lost their original structure or vegetation due to agriculture were not considered as wetlands, even if they held water in wet periods.

The number of wetlands diminished considerably during the century, from 35 sites in 1896 to 6 in 1996. The remaining wetlands were temporary ponds (numbered 2, 3, 8 and 43 in Fig. 1), and diverted branches of the river (sites 12 and 37 in Fig. 1).

During the first half of the twentieth century, relatively few (approximately 20%) wetland sites were evidently lost. However, over the same period, most of the wetland area was lost, amounting to over 60% of the 1896 wetland area (Fig. 2).

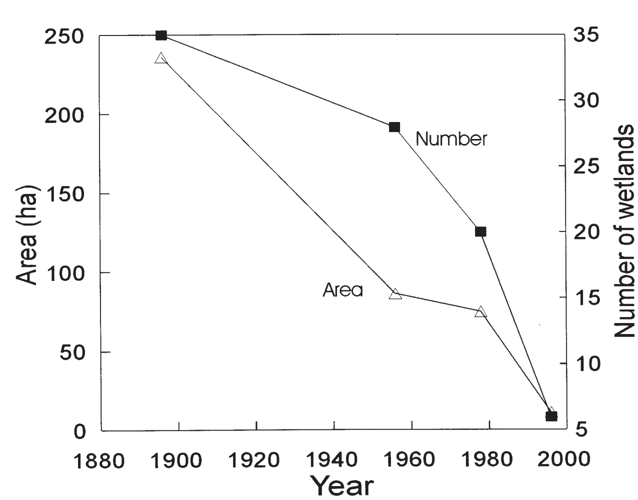

Figure 2 Changes in the number and area of wetlands during the 1896–1996 period.

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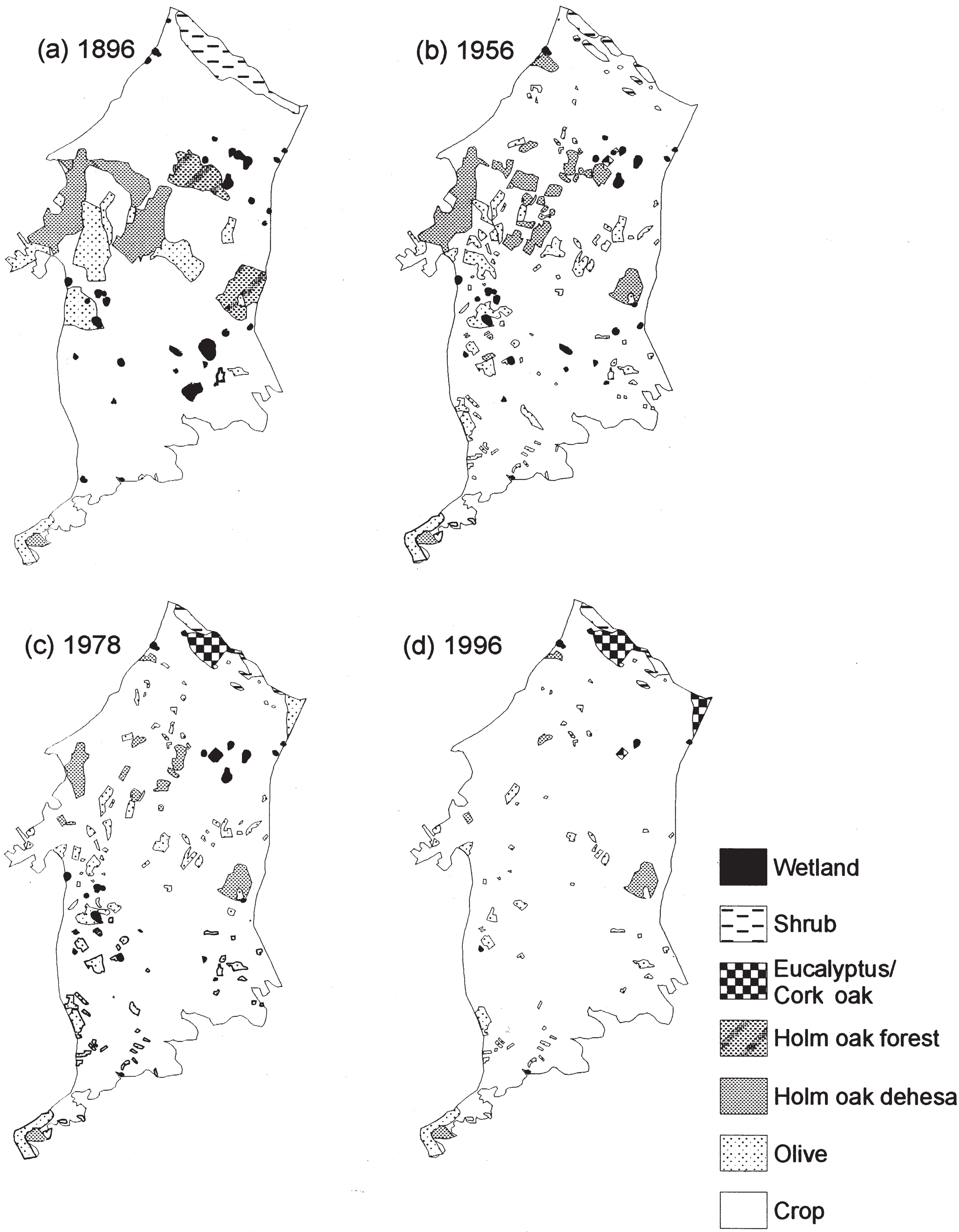

Figure 3 Land-use maps of the north of Azuaga County in (a) 1896, (b) 1956, (c) 1978 and (d) 1996.

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Table 2 Human impacts and number of wetlands affected. One wetland could be affected by more than one impact.

Disturbances	*Number*
(Total) Ploughing	25
Drainage works	11
Re-excavations	4
(Partial) Ploughing	3
Road building	3
Artificial water-holes	1
Electrical line post	1

Table 3 Current land-uses of the wetland areas.

Land-use	*Number*
Agricultural	34
Drinking trough	11
Artificial water-hole	4
Road	2

During these early years, the wetlands with the largest area were lost, such as sites 30 and 34 in Figure 3. Madoz (1850) described how pond number 30, Laguna de las Tres Marías, was always cultivated except during wet years. In the second half of the twentieth century, the number of wetlands continued to decrease, so that at present there are scarcely more than 10 ha, barely 6% of the original area as recorded in 1896 (Fig. 2).

The causes of the disappearance of these ponds and their precarious conservation status is attributable to direct human impact upon these zones. The impacts that stand out are those produced by the total or partial destruction of these wetlands for agricultural use, as well as the building of infrastructure for their drainage (Table 2). The predominant land-use in the zones surveyed was crop cultivation, mainly cereal (Table 3). Utilization as reservoirs of drinking water for cattle was also a significant activity occurring in the wetlands that still retained open water. Herds of sheep and goat graze on stubble-fields in summer, and in wet years cattle herds concentrate on wetland basins until they dry up. Old wetlands which have lost all of their original vegetation and have turned to arable land may still store water in wet periods and be used for cattle herds.

Change in land-use and landscape pattern

With the exception of new uses that appeared during the century, namely cork oak (planted by a private owner in the 1930s) and eucalyptus plantation (promoted by the public administration in the 1960s), other traditional land-uses have diminished substantially while agricultural land-use has increased (Table 4). Two distinct periods of change can be identified. The first period, between 1896 and 1956, corresponds to the disappearance of the holm oak forest and the reduction in the surface area of wetland and scrub, which declined by 53% and 59%, respectively; the only new land-use was a little cork oak afforestation (Table 4). In the second period, between 1956 and 1996, afforestation with eucalyptus increased considerably, wetland and scrub areas continued to decrease, although at a slower pace, and the surface area of olive groves and dehesas declined by 59% and 82%, respectively. The reduction of olive groves and dehesas constituted the most significant change of this second period that promoted the increase in agricultural land, which in 1996 amounted to 92.5% of the study area (Table 4). During this period, the rate of change was not uniform; in particular, it has been higher within the last 20 years.

Landscape diversity (H′) and evenness (E) have decreased considerably over the study period (Table 4), due to the increase in dominance of lands subject to intensive agriculture, mainly at the expense of the olive groves and the dehesas, and the complete disappearance of one of the land-use categories, the holm oak forest, in the first half of this century.

The changes have been produced through a process of fragmentation of olive groves and holm oak dehesas, especially during the first half of this century (Fig. 3*a*, *b*). Fragmentation of olive groves and dehesas continued after 1956 (Fig. 3), and there has been a reduction in patch size which was greatest in the case of the olive groves (Fig. 4). By 1978, large olive grove patches (>1000 ha in area) had disappeared, and those of medium size (100–1000 ha) had declined

Table 4 Land area distribution of nine land-use categories in the north of Azuaga County, together with three measures of landscape diversity.

Land-use category	*Land area (ha)*			
	1896	*1956*	*1978*	*1996*
Wetland	264	123	98	16
Shrubs	861	357	260	239
Eucalyptus	0	0	441	441
Cork oak	0	24	24	24
Olive groves	1949	2039	1685	833
Dehesa	1838	1914	807	351
Holm oak	917	0	0	0
Cereal crops	19 256	20 626	21 770	23 187
Total	*25 084*	*25 084*	*25 085*	*25 091*
Richness	6	6	7	7
Shannon (H′)	0.88	0.65	0.56	0.37
Evenness (E)	0.49	0.37	0.29	0.19

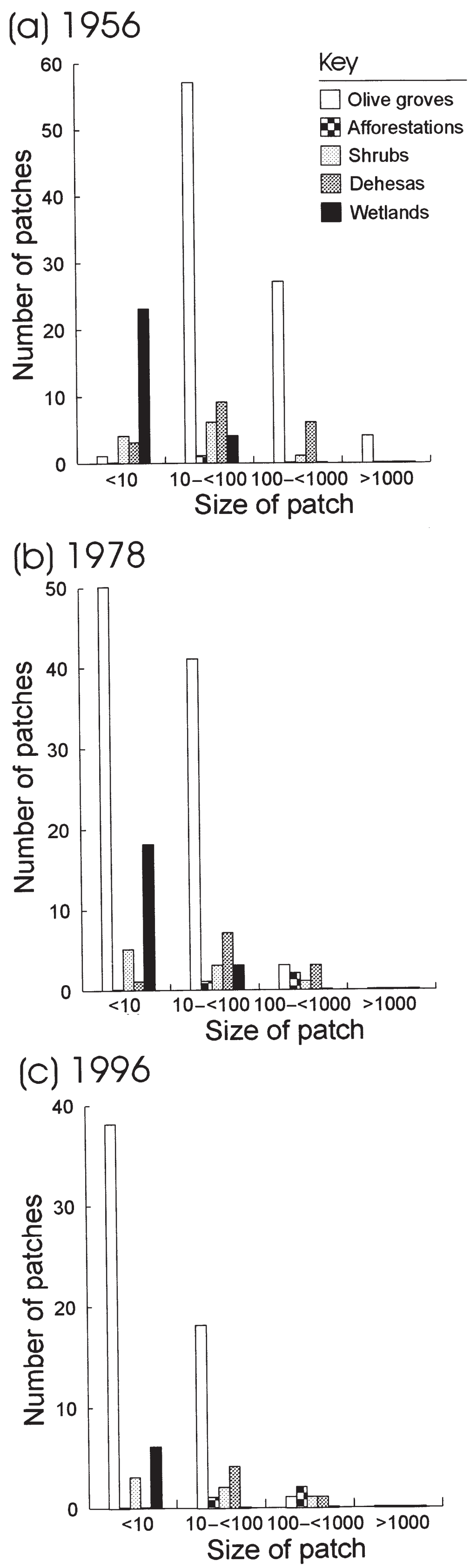

Figure 4 Size (ha) and number of patches with different land-uses in (a) 1956 (b) 1978 and (c) 1996.

considerably (Fig. 4). The result was a large increase in the exploitation of small patches (less than 10 ha). There has been a large decrease in the total area of olive groves, dehesas, and wetlands, which is evinced by a general decline in the number of patches, from a total of 146 in 1956 to only 77 in 1996 (Fig. 5).

Change in socio-economic variables

Underlying socio-economic factors at both local and regional scales have influenced the land-use changes and the disappearance of wetlands.

After the end of the nineteenth century, a noticeable increase in olive groves occurred in the region (Fig. 3*a*, *b*) and this was linked to the increased oil price, and attributable also to expanding local demand. Olive expansion was accomplished at the expense of grassland and dehesas (Pérez Díaz 1989). It was later, in the 1950s, when the Azuaga population declined, that olive-grove area was lost, giving room to cereal crops. Since 1998, new olive groves have been planted as a consequence of European Union agricultural policies. The area allocated to herbaceous crops in the north of Azuaga County increased during the period 1896–1996. Crop expansion in the 1940s was strongly promoted by the Spanish Government to meet the urgent demands of a starving population at the end of the 1936–39 Spanish Civil War (Pérez Díaz 1989).

Demographic growth took place in the County of Azuaga until the 1950s (Fig. 6). Marked growth in the population began in 1870 due to the importance the area gained through mining activities, mainly for the production of lead (Calvo Pérez *et al.* 1991). Between 1870 and 1900, 76 mines were opened in Azuaga just to the south of the study area (Gallego Fernández *et al.* 1991). By 1900, the population had doubled,

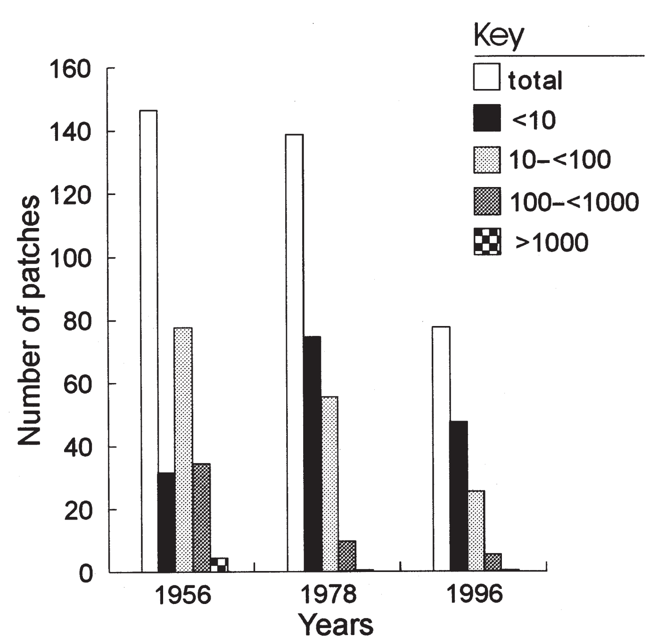

Figure 5 Distribution of patch sizes for 1956, 1978 and 1996.

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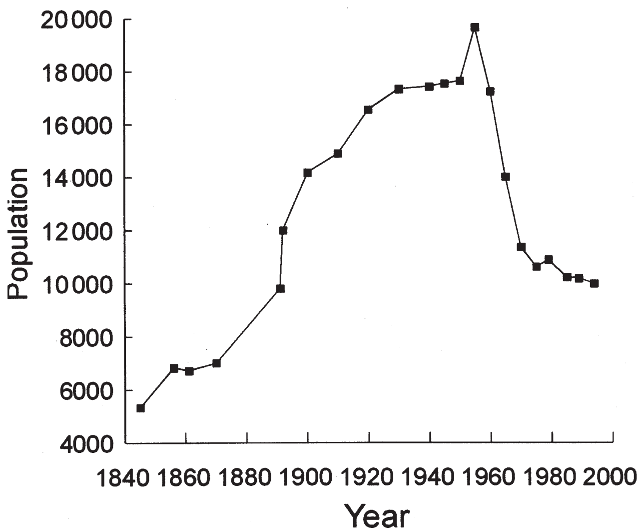

Figure 6 Demographic evolution of the County of Azuaga over the last 150 years.

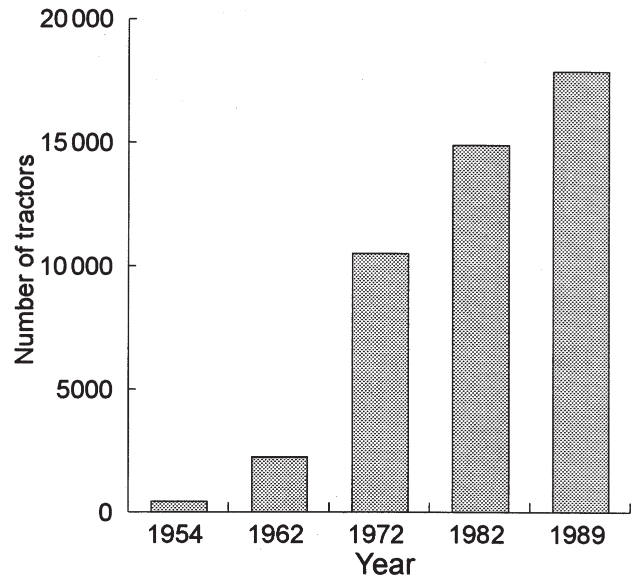

Figure 7 Number of tractors in the province of Badajoz in the Census of 1954, 1962, 1972, 1982 and 1989.

from 7024 inhabitants registered in the 1870 census to 14 192 in the 1900 census. The population peaked in the census of 1950–60, and was subject to an abrupt decrease driven by a high emigration during the 1960s and 1970s, as a result of generalized mine closure. The characteristics of the population growth curve in the last 20 years are attributable to a reversion to rural, and predominantly agricultural, activities. The containment of emigration has probably been the result of the introduction of agricultural subsidies, which are reflected in the maintenance of the remaining population in the last two decades (Fig. 6), and, at present, the incorporation of new economic activities.

Recently, with easy access to chemical fertilizers and agricultural equipment, there has been a new increase in the land area dedicated to herbaceous crops; before the 1960s, mechanization of agricultural tasks was negligible throughout the region (Pérez Díaz 1989). At present, there is machinery available (Fig. 7) that allows the ploughing of zones such as wetlands that previously could barely be used for agriculture. As a consequence of this availability of means and the decline of mining activity, the entire County of Azuaga experienced an increase in the ploughed surface area of over 10 000 ha between 1950 and 1982.

Discussion

Ninety-four per cent of the wetland area in northern Azuaga County was lost in the last century. These wetlands, as well as other systems characteristic of the semiarid areas of Spain, have little capacity to regulate their environment and experience significant hydrological variability both seasonally and interannually (Custodio 1987). These are zones of great biological interest. Particular adaptations are required of the organisms that inhabit them (Williams 1987), including resistance to severe natural fluctuations of climatic and edaphic conditions to which these systems are exposed (Alonso 1987; Margalef 1987; Comín *et al.* 1992). Nevertheless, these systems have not resisted the pressure of human activity and have lost ground to agricultural purposes. This disappearance has been favoured by the fact that this wetland type, when dry, permits access to machinery to construct drainage channels and makes possible the deep ploughing of the ground. This process, repeated through the recurrent drought periods which are a characteristic of the local climate, has caused the disappearance of the wetlands. This is the same process that has affected most wetlands of the Iberian Peninsula. The fact that these wetlands are located in flat zones and are exposed to seasonal and irregular cycles has prompted their destruction and transformation into cultivated areas (Casado de Otaola & Montes del Olmo 1995).

The disappearance of these wetlands has not been an isolated event in the landscape of the north of Azuaga. The intensification of agricultural activity has produced a marked change in the landscape causing the disappearance of natural systems in the zone, the holm oak forests, and a profound modification of the existing semi-natural systems (dehesas), which have declined considerably in number and patch size. Semi-natural systems have practically disappeared through an initial process of fragmentation, which occurred during the first half of this century, and a later reduction of their area in favour of herbaceous crops, mainly cereals due to agricultural intensification.

The changes in the landscape spatial patterns throughout this century have been associated with local and regional socio-economic factors, including an increase in the local population, due to massive immigration of the mining workforce. This increment produced a higher pressure on the exploitation of other resources, such as through agriculture,

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and this was translated into an increase in land area dedicated to intensive exploitation at the expense of semi-natural systems of lesser production in forests and marginal zones such as wetlands.

There is currently a natural restoration of the four temporary ponds that still remain as functional wetlands. The high precipitation of the three winters of 1995–98 has resulted in more than 80% of the wetland zones surveyed now having open water, which has prevented their cultivation during the period. Over the last three years, these water bodies have been naturally recolonized by aquatic organisms already present in the ponds at drought-resistant or dormant stages or by those dispersed and reintroduced by aquatic birds.

The plant communities have increased in size and species richness. Macrophytes are now represented by helophytes such as *Alisma plantago-aquatica*, *Carum verticillatum*, *Eryngium corniculatum*, *Cyperus longus*, *Eleocharis palustris*, *Juncus heterophyllus* and *Glyceria declinata*. Hydrophytes including Charophytes, *Chara connivens* and two species of the gender *Nitella*, and vascular plants such as *Myriophyllum alterniflorum*, *Ranunculus peltatus* subsp. *peltatus, Elatine hexandra, Illecebrum verticillatum, Isoetes setaceum* and *I. histrix* have also become more common. Both *I. setaceum* and *I. histrix* belong to plant communities whose habitats are protected all over the European Union (EU-Habitats Directive 1992).

The fauna is characterized by macroinvertebrates which are commonly considered to be part of ephemeral freshwater ecosystems such as *Triops cancriformis*, *Cyzicus grubei* and *Streptocephalus torvicomis* (Williams 1987). Recorded amphibians include *Pleurodeles waltl*, *Triturus marmoratus*, *Pelodytes punctatus*, *Bufo calamita*, *Hyla meridionalis* and *Rana perezi*.

Scarcity of ponds in the area has evidently increased the importance of these wetlands as a refuge or resting area for the recorded bird species (*Ardea cinerea*, *Ciconia ciconia*, *Egretta garzetta*, *Anser anser*, *Anas penelope*, *Anas clypeata*, *Anas crecca*, *Vanellus vanellus*, *Gallinago gallinago*, *Recurvirostra avosetta* amongst others [Gallego Fernández, unpublished data 1998]). Breeding of *Anas platyrhynchos, Gallinula chloropus*, *Fulica atra, Vanellus vanellus* and *Himantopus himantopus* has also been recorded (Gallego Fernández, unpublished data 1998).

The population of crane (*Grus grus*) overwintering in Spain is considered to be the greatest of those in Europe; its size oscillates between 50 000 and 60 000 individuals (Díaz *et al.* 1996). Of these, 40 000 individuals winter in the province of Badajoz, in the Azuaga-Peraleda complex (Sánchez Guzmán *et al.* 1993). Our study area is the second main wintering area of the region, holding an average of 4395 birds (Sánchez Guzmán *et al.* 1993). The importance of this wintering area for the cranes resides not only in their preference for wetlands, but also in the great availability of cereal crops in the area, as a main dietary source of grains and seedlings (Sánchez Guzmán *et al.* 1993).

Despite the singularity of these ecosystems, wetlands in Azuaga lack any legal protection, either at local or regional level. Natural restoration of some of these wetlands is still possible.

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Appendix

Appendix 1 Local names, locations (UTM coordinates and altitude, surface areas [S] and maximum [D] and minimum [d] diameters of ponds inventoried).

Number	*Wetland name*	*UTM*	*Altitude (m)*	*S (ha)*	*D (m)*	*d (m)*
1	Fuente Viñuela	30STH634631	580	0.33	80	80
2	Laguna Chica	30STH626616	560	4.11	240	200
3	Laguna Chica	30STH628614	560	1.11	80	120
4	Laguna Gaitero	30STH624611	580	0.88	180	60
5	Laguna Campana	30STH656569	560	1.10	80	80
6	Laguna Tres Gatitos	30STH651559	550	4.88	300	220
7	Laguna Campana	30STH660562	550	5.33	280	180
8	Lagunas de Hueco	30STH665564	550	5.44	340	180
9	Lagunas de Hueco	30STH669561	550	16.43	620	340
10	Laguna Tres Chicas	30STH673557	550	13.43	600	340
11	Lagunas Lentiscal	30STH663546	550	22.64	480	720
12	Laguna de Juan Andres	30STH694562	540	0.10		
13	Laguna del Bicho	30STH674537	550	2.55	160	120
14	Laguna de Juan Andres	30STH683532	550	0.10		
15	Laguna de Tivero o Chivero	30STH682525	550	0.10		
16	Paloma	30STH664510	550	8.33	480	280
17	Laguna La Nao	30STH671518	550	7.66	480	220
18	Laguna del Moro	30STH579498	570	5.66	340	220
19	Laguna Ratón	30STH589487	570	1.00	100	100
20	Laguna Ratón	30STH595491	570	4.22	280	260
21	Laguna Ratón	30STH599491	570	0.78	100	80
22	Laguna Ratón	30STH604489	570	0.78	100	80
23	Laguna Ratón	30STH599487	570	6.55	320	260
24	Laguna Ratón	30STH593477	570	0.10		
25	LLera	30STH669483	560	0.10		
26	LLera	30STH674482	560	1.11	80	80
27	Laguna Rebañales	30STH672472	560	0.67	100	60
28	Laguna El Candelar	30STH659469	560	2.89	200	180
29	Laguna de La Pipa	30STH634459	580	6.55	500	180
30	Laguna de Placidito	30STH649460	560	68.27	1180	800
31	Laguna de La Pipa	30STH634449	580	0.44	30	20
32	Laguna de La Pipa	30STH640453	580	6.88	400	300
33	Lagunillas	30STH649453	560	0.44	80	40
34	Laguna de las Tres Marías	30STH641440	600	61.61	1020	780
35	Mina Jerte	30STH653443	600	0.56	80	40
36	Costuero	30STH647435	600	17.98	640	380
37	Laguna de la Muda	30STH582458	560	0.56	60	40
38	Laguna del Quejigal	30STH605455	580	0.10		
39	Laguna Figolera	30STH602435	600	0.44	80	40
40	Laguna del Gordo	30STH624418	600	0.44	80	40
41	Laguna de Arenas Gordas	30STH684442	600	0.78	80	80
42	Laguna de La Osa	30STH605396	600	0.22	40	40
43	La Sombrerera	30STH585397	600	0.67	1180	40