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EXOTIC PINE PLANTATIONS AND THE CONSERVATION OF THE THREATENED RED KITE *MILVUS MILVUS* IN GIPUZKOA, NORTHERN IBERIA

PLANTACIONES EXÓTICAS DE PINO Y CONSERVACIÓN DEL MILANO REAL *MILVUS MILVUS* EN GIPUZKOA, NORTE DE ESPAÑA

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SUMMARY.—We describe red kite *Milvus milvus* nesting habitat in Gipuzkoa (Basque Country, northern Spain), a region under high human pressure where the traditional countryside has been extensively substituted by Monterey pine *Pinus radiata* plantations. All nests were 10-30 m up in Monterey pine stands 20-40 m tall. Forest patches were mono-specific and most comprised from 100 to over 1,000 trees. Vegetation cover around the nests was typical of the region, with a mosaic of meadows and forests, including exotic tree timber plantations. The fact that the red kite in Gipuzkoa breeds in Monterey pine plantations does not mean that this habitat constitutes a priority for its long-term conservation. However, its replacement by native forest should entail a gradual substitution of the old pine stands to guarantee the availability of sufficient tall, mature trees offering good conditions for red kite nests.

Key words: countryside, forest policies, Gipuzkoa, Monterey pine *Pinus radiate*, raptor conservation.

RESUMEN.—El objetivo de esta nota es describir el hábitat de cría del milano real *Milvus milvus* en Gipuzkoa (País Vasco, norte de España), una región con una alta densidad de población donde, además, el paisaje de campiña ha sido intensamente sustituido por plantaciones forestales de pino de Monterey *Pinus radiata*. Hallamos todos los nidos a 10-30 m de altura, en pies de pino de Monterey que tenían una altura de 20-40 m. Los pinos donde hallamos estos nidos estaban en parches mono-específicos. El hábitat del entorno de cada nido reflejó un paisaje de campiña formado por mosaico de prados y bosque, incluyéndose las plantaciones de pino de Monterey. La política actual en el territorio de Gipuzkoa es subvencionar la tala de estos pinos para promover la plantación de especies autóctonas. Puesto que especies con un alto interés para la conservación, como el milano real y también otras rapaces, crían en estos pinos viejos, consideramos que la gestión de los pinares debería basarse en la

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no actuación (no tala), de tal manera que se permita que el bosque nativo se desarrolle naturalmente, conforme los pinos más viejos mueren y caen. Este proceso natural evitaría un reemplazamiento súbito de pinos viejos donde actualmente están criando especies como el milano real por árboles nativos jóvenes sin interés para rapaces forestales.

Palabras clave: campiña, conservación de rapaces, Gipuzkoa, pino de Monterrey *Pinus radiata*, política forestal.

The protection of suitable breeding habitats is one of the main direct measures available to safeguard species of conservation concern. In birds, the protection of nests and their surrounding habitat is essential to promoting breeding success and guaranteeing sufficiently high productivity in particular populations (Zuberogoitia *et al*., 2008; Newton, 2013).

Afforestation of traditional countryside with exotic tree plantations has been one of the main causes, alongside industrialisation and urbanisation, that account for biodiversity loss in many regions (Sohngen *et al*., 1999; Foley *et al*., 2005), including northern Iberia (Carrascal and Tellería, 1990; Tellería and Galarza, 1990). In response to this phenomenon, and alongside the drop in wood price of some tree species, current environmental policies in some regions involve removing such plantations with the aim of replacing them with native tree species. At the same time, it is known that endangered birds may breed in timber plantations (e.g., Woolaver *et al*., 2015). In Europe, some old plantations of Monterey pine *Pinus radiata*, a tree originating from central California and Mexico, can host nests of birds of conservation concern, including such raptors as booted eagles *Hieraaetus pennatus*, Eurasian hobbies *Falco subbuteo* and red kites *Milvus milvus* (Aierbe *et al*., 2001; Zuberogoitia and Martínez, 2011).

The red kite has an almost entirely European distribution (Cramp and Simmons, 1980). It is one of the most severely declining bird species on the continent and is globally listed as Near-threatened (Tucker and Heath, 2004); in Spain it is classified as Endangered (Madroño *et al*., 2004). In most of Spain and elsewhere, it breeds in forest patches in farmland habitats (Cramp and Simmons, 1980). All along the coast of northern Iberia, however, this habitat has changed dramatically, mostly due to the plantation of exotic tree plantations of Monterey pine and several species of eucalyptus (*Eucalyptus* spp.), among others (Carrascal and Tellería, 1990; Tellería and Galarza, 1990). Recent prospection to find breeding red kites in Gipuzkoa, a region in northern Spain, has detected the use of the Monterey pine areas for nesting (M. Olano, pers. obs). Research on how the red kite exploits this new habitat for breeding is important from a conservation standpoint and to evaluate the impact of exotic tree plantations on the conservation of this and other threatened raptors.

This study describes the red kite breeding habitat in Gipuzkoa (Basque Country, northern Spain), a region under high human pressure where the traditional countryside has been extensively replaced by Monterey pine plantations (Rodríguez, 2006). Gipuzkoa province was surveyed for all possible red kite breeding pairs during the breeding seasons of 2014 and 2014. Start and finish dates were 20 March 2014 and 25 June 2015 respectively. The province is very mountainous and kite breeding densities are estimated to be low (Madroño *et al*., 2004; Cardiel, 2006). Thus, the road-transect census method frequently used in areas of Spain with medium to high red kite breeding densities cannot be applied (Viñuela, 1997;

Cardiel, 2006). Our survey instead consisted of looking for kites (breeding pairs and their nests) from elevated vantage points. In total, we used 158 fixed survey points which were visited 2.6 times (SD = 3.4) on average during the study periods (fig. 1). The mean survey time within the points was 74.5 minutes (SD = 42.2; range: 10-300). We consider that this variation in effort between sites did not affect the survey since we did not invest more effort on points closer to pine plantations. We also collected data from over 150 additional points (casual points) from which possible breeding kites were seen. The mean survey time within these casual points was 78.8 minutes (SD = 52.6; range: 1-285). Overall, nine observers who invested more than 150 hours were involved in this work.

To following variables were used to describe the characteristics of each nest: (1) nest height; (2) nest tree height; (3) forest patch size; (4) nest tree species; (5) dominant tree species within the forest patch. A GIS was used to describe the main vegetation cover within a 0.5-km buffer zone around each nest. This employed the EUNIS database for the Basque region provided by

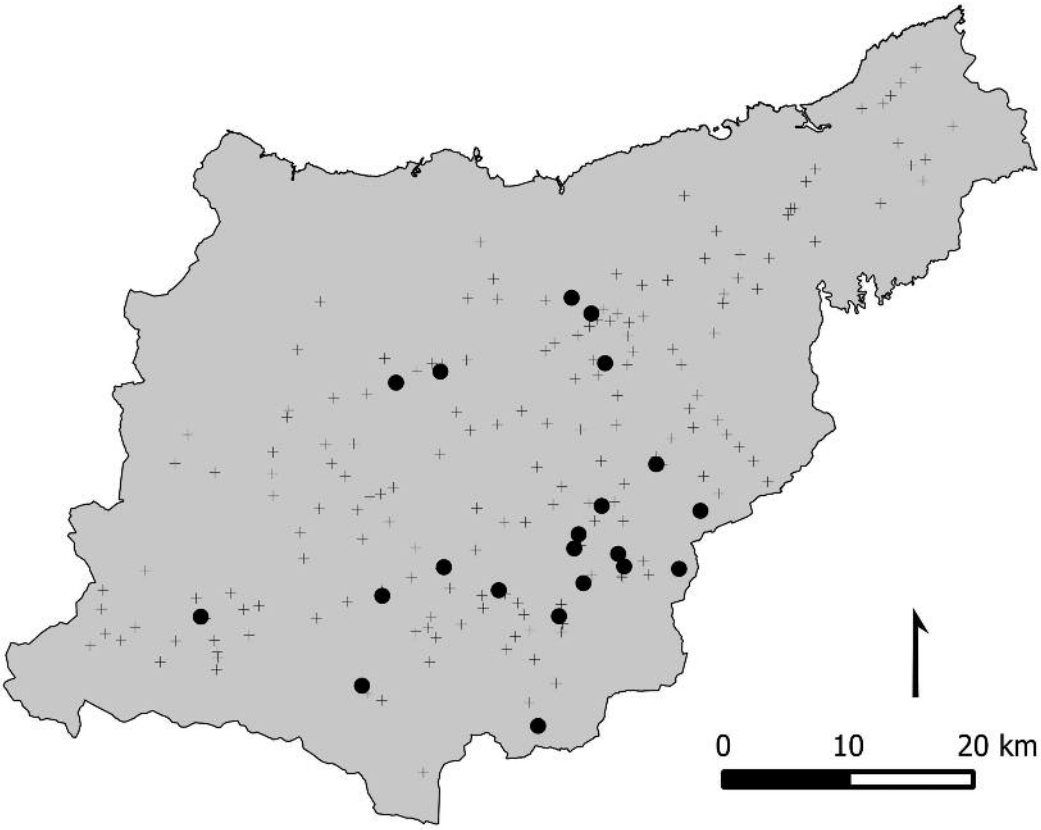

FIG. 1.—Locations of the survey points (crosses) and red kite nests (dots) found in 2014-2015.
[Localización de puntos fijos de censo (cruces) y nidos (puntos) ocupados de milano real en Gipuzkoa durante el periodo 2014-2015.]

the Basque Government (source: www.geo.euskadi.net). Original vegetation cover was grouped into five categories: PLA1, tree plantation (species unknown); PLA2, Monterey pine plantation; MEAD, Atlantic mosaic of meadow areas and crops (countryside); OAKS, native oak forest; REST, other habitat types (including farmland, roads, villages, etc.).

All nests were found in pine plantations. Thus, to test whether kites located their nests in pine patches of certain size we used a one-sample *t*-test to compare whether the mean size of pine patches where the nests were detected differed from the mean size of such patches in Gipuzkoa.

Vegetation cover within the 0.5-km buffer zone around the nests was compared with 100 random points situated in pine plantations, since these were the only substrate where the birds bred. Comparisons employed a bootstrap procedure. For this, we used a *t*-test to compare each habitat area (PLA1, PLA2, MEAD, OAKS, REST) within the buffer zone both around the nests and around the random points ($n = 20$ in each case, with replicates). This procedure was repeated 10,000 times. Statistical tests were done using R software (R Core Team, 2014).

We found a total of 21 nests: nine in 2014 and 12 in 2015. Five of the nests used in 2014 were also used in 2015. These nests are not included within the sample of 12 nests found in 2015. The minimum nearest-neighbour distance was 1 km (mean ± SD = 4.0 ± 3.2 km).

All nests were between 10 and 30 m up (10-20 m: 11 nests; 21-30 m: 10 nests), in Monterey pines ranging between 20 and 40 m tall (20-30 m: 13 nests; 31-40 m: 8 nests). Tree stands were monospecific and most comprised 100-1,000 + trees (< 100 trees: 3 nests; 100-500 trees: 8 nests; 501-1,000 trees: 6 nests; > 1,000 trees: 4 nests).

The mean area of the nesting forest patches was 12.4 ha (±SE = 3.5; range: 0.70-52.42 ha), significantly larger than the available mean size of Monterey pine patches in Gipuzkoa (4.4 ± 0.2 ha; $t = 38.879$, $df = 8085$; $P < 0.001$).

Vegetation cover within 0.5 km around each nest did not vary in relation to that found around random points also situated in pine plantations (*P*-values: MEAD, $P = 0.986$; OAKS, $P = 0.744$; PLA1, $P = 0.347$; PLA2, $P = 0.971$; REST, $P = 0.270$). Vegetation cover around the nests was typical of the Atlantic coastlands, with a mosaic of meadows and forests. In particular, ca. 30% of the habitat comprised exotic tree plantations, a significant proportion of which were Monterey pine (fig. 2). Another 30% con-

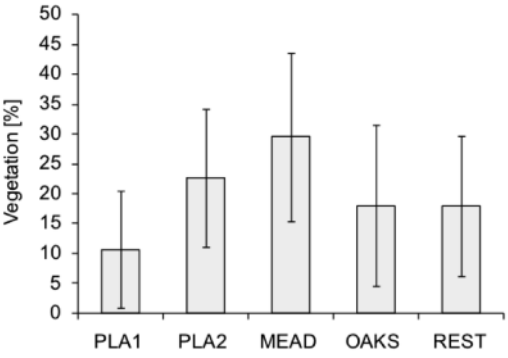

FIG. 2.—Mean (±SD) vegetation cover (%) within a buffer-area of 0.5 km around the studied red kite nests (source: EUNIS). Abbreviations: PLA1, tree plantation (species unknown); PLA2, Monterey pine plantation; MEAD, mosaic of meadow areas and crops (countryside); OAKS, native oak forest; REST, other habitat types (including farmlands, roads, villages, etc.). *[Cobertura de vegetación (media ± SD; fuente: EUNIS), en porcentaje, en un área de 0,5 km de radio en torno a los nidos de milano real en Gipuzkoa. Abreviaciones: PLA1, plantación forestal (especie arbórea no conocida); PLA2, plantación de pino de Monterey; MEAD, mosaico de campiña con prados y cultivos; OAKS, robledal nativo; REST, otro tipo de hábitats (carreteras, caseríos, núcleos urbanos, etc.).]*

sisted of meadow areas and crops, typical of the smallholdings of the region. About 20% of the habitat was native oak forest, mostly of *Quercus robur*. A diversity of other habitat types comprised the remaining 20%.

Red kite nests were found in plantations of Monterey pine, a very common exotic in Gipuzkoa and other nearby areas in northern Iberia (Rodríguez, 2006). Nests were spaced out, i.e. we did not find breeding colonies, as reported in other nearby areas in Spain (Viñuela, 2003). Probably Gipuzkoa does not offer suitable conditions for denser breeding aggregations, since the habitat of the Atlantic coastlands of northern Iberia is regarded as suboptimal for the species (Viñuela, 2003).

A large majority of the nests were in plantations of 100-1,000 trees, with a mean area of 12.4 ha. Red kites seem to breed in large pine patches, since pine plantations in Gipuzkoa have a mean area of 4.4 ha. It may be that small patches are too exposed to disturbance (nests may be too visible), although this requires further investigation into habitat use and the spatial ecology of this raptor within the region.

It is interesting to see that the red kite did not select oaks for nesting even though native oak forests are relatively abundant around nests. The taller height of the pines and their dense evergreen foliage may influence nest site selection. Nevertheless, the fact that the red kite and other raptors (Aierbe *et al*., 2001) in Gipuzkoa breed in Monterey pine plantations does not mean that this habitat should be regarded as essential for their long-term conservation. Current policies within Gipuzkoa tend to subsidise the cutting of mature Monterey pine plantations in order to plant native trees. Given that native tree species grow naturally within the old pine plantations, it would be best not to fell the pine stands and instead allow native forest to replace the plantations gradually. It remains to be seen when and whether the red kite in Gipuzkoa begins to nest in patches of native forest. Actions to encourage this transition will be of key importance to maintaining good numbers of local breeding pairs.

Woodland apart, whether native or exotic, nests were found to be surrounded by the meadow areas and crops of the smallholdings that constitute traditional countryside within the region. This landscape is by far one of the most endangered in the Basque Country, especially in the Atlantic coastland area (Tellería and Galarza, 1990). Its preservation would benefit red kites and also other raptors of conservation concern, such as the Egyptian vulture *Neophron percnopterus* (Hidalgo *et al*., 2005; Álvarez *et al*., 2009).

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