Do nest-boxes encourage the recovery of bird populations after fire? A field experiment with tits in a Mediterranean forest

Marc Anton, Sergi Herrando & Javier Quesada

After natural or man-induced disturbances, management practices are frequently applied to accelerate the recovery of ecosystems. A very particular case is the placing of nest-boxes in recently burnt forests in order to maintain or increase hole-nesting bird populations. However, the usefulness of this technique has to date never been fully evaluated. In August 2003 a large wildfire burnt 4,589 ha of evergreen Mediterranean forest in Sant Llorenç del Munt Natural Park (Barcelona, north-east Iberian Peninsula) where a transect-based monitoring programme was instigated in 2002. In spring 2005 we placed 135 nest-boxes in part of the burnt area and continued censuses of their tit populations; at the same time we began tit censuses in burnt areas without nest-boxes. Nest-box occupancy rose progressively from 17% to 30%, mainly by Great *Parus major* and Blue Tits *Cyanistes caeruleus*, and exceptionally by Crested Tit *Lophophanes cristatus* and Wryneck *Jynx torquilla*. Tits mainly occupied boxes located in living tall trees standing in clumps. Finally, tit abundance was higher in 2007 in burnt areas with nest-boxes than in burnt areas without nest-boxes. Overall, Great and Blue Tit populations did not undergo significant population changes after the fire, whereas Crested Tit numbers (the species using fewest nest-boxes) decreased dramatically. These facts suggest that the placement of nesting boxes benefited tit populations and in particular those of Great and Blue Tits. Therefore, our study shows that placing nest-boxes in Mediterranean burnt areas seems to be an effective management practice that can stabilise or increase hole-nesting parid populations.

Key words: nest-boxes, burnt areas, tits, management, fire.

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Decision-makers, scientists and the general public now recognize that there is an urgent need to restore forest ecosystems after decades of human-induced disturbances (Hobbs & Harris 2001, DellaSalla *et al.* 2003, Mitsch & Jørgensen 2004). Over the years, a myriad of restoration methods and techniques, all with different degrees of success, have been developed to tackle the restoration of forest ecosystems (DellaSalla *et al.* 2003). In the case of the Mediterranean region, forest fires are considered one of the most important factors shaping biodiversity (Blondel & Aronson 1999) and in light of this conservation managers often promote habitat-restoration practices after fires. The placement of nest-boxes is a clear example of a restoration practice aimed at aiding species recolonisation or stabilisation (Caine & Marion 1991, Moreno-Rueda 2003, Mänd *et al.* 2005). This is because usually after a forest fire burnt trees fall or are logged, thereby reducing the availability of cavities for hole-nesting birds (White & Seginak 2000). However, the usefulness of this management practice has yet to be fully evaluated (Mänd *et al.* 2005).

Despite the evident positive effect of providing nesting places (Baucells *et al.* 2003, Moreno-Rueda 2003), resources other than nests may in fact be more important limiting factors in burnt areas and dramatic changes in vegetation structure and food availability might make the placement of nest-boxes redundant. Likewise, alternative nesting substrata such as crevices and holes between rocks or stones may even be exposed by fires, thereby also making the use of nest-boxes unnecessary.

We conducted a field experiment in a large burnt Mediterranean area to explore this unresolved question and analyse the variables that affect the use of nest-boxes by tits (Paridae). Specifically, we aimed 1) to describe the patterns of occupation of nest-boxes; 2) to test whether some environmental variables are determinant for nest-box occupancy and, finally, 3) to determine whether the provision of nest-boxes benefits tit populations.

Material and methods

Study area

In August 2003 a forest fire in the Sant Llorenç del Munt Natural Park (41°45'N, 02°01'E-41°41'N, 02°06'E, Barcelona, north-east Spain), burnt 4,589 ha of mediterranean pine (*Pinus halepensis, P. sylvestris, P. nigra*) and oak (*Quercus ilex, Q. cerrioides*) forest. Fire drastically modified the landscape, with much of the forest being converted into a large extension of burnt trees without undergrowth (Lobo *et al.* 2007).

We were able to take advantage of the circumstances to design an experiment aimed at achieving the abovementioned objectives. In 2002 the Catalan Ornithological Institute (ICO) had set up the Catalan Common Bird Survey (SOCC; www.ornitologia.org/monitoratge/socc.htm), based on yearly linear transects and designed to monitor common bird populations in Catalonia (NE Iberian Peninsula). Initially, 11 SOCC transects were established in the Sant Llorenç del Munt Natural Park. In August 2003, however, a forest fire affected an important portion of this SOCC-monitored area, although monitoring has continued regardless. In February 2005, we placed 135 nest-boxes along the five SOCC transects within the burnt area to be able to compare tit populations from before and after the fire. In addition, we used the rest of burnt area as a control to study the evolution of tits in an area affected by fire but without nest-boxes. Data recording in the control area was conducted using the SOCC sampling method, but as part of the project Dynamics of the Distribution of Birds in Mediterranean Landscapes Mosaic Affected by Large Forest Fires (DINDIS), and was carried out by the same observers as for the SOCC transects.

Nest-boxes and occupation patterns

The wooden nest-boxes employed were especially designed for tits by Parusater S.L.™ following Baucells *et al.* (2003) and measured 29 x 19 x 13 cm and had a 33-mm diameter hole. We monitored nest-boxes occupation for three consecutive breeding seasons (2005, 2006 and 2007) following Barba & Gil-Delgado (1990). We visited nest-boxes three times each breeding season (from March to July) to record their use as nest sites. We assessed how many nest-boxes were occupied by birds (or other animals) and by which species. Following Baucells *et al.* (2003), occupied nest-boxes were cleaned after breeding (mid July-August) to prevent any proliferation of parasites.

Nest-box choice and environmental parameters

As per previous knowledge of variables influencing nest-box occupation, we recorded the following data for each nest-box: its height in the tree (HEIGHT; Barba & Gil-Delgado 1990), the species of tree (SPECIES; Moreno-Rueda 2003), whether the tree was alive (SUPPORT; Martin *et al.* 2004), the percentage of forest area in a 100 m-radius (FOREST) and the distance to the nearest unburnt area (DISTANCE; Willner *et al.* 1983, Smith *et al.* 2007). FOREST was estimated in the field using the reference chart given by Prodon & Lebreton (1981) and DISTANCE was calculated with the GIS Arcview 3.2 using georeferenced positions of nest-boxes and aerial pictures of the study area.

To explore the effect of environmental variables on nest-box occupancy we conducted Generalised Linear Models (GLMs; McCullagh

& Nelder 1989) in which the dependent variable was the occupancy (yes/no) and the independent variables were the predictor set mentioned above. We carried out a GLM with a binomial distribution (Occupied-Not occupied) for the dependent variable, with a logit link function, sigma-restricted estimation method and all effects model building. Type 3 results are shown. Since some nest-boxes were lost during the study period, we considered occupation as a percentage of the remaining boxes.

Influence of nest-boxes in burnt areas on tit populations

The 135 nest-boxes were placed along the five 6-km transects included in the SOCC project (EXPERIMENTAL). Transects were subdivided into six 500-m sections and nine boxes were placed along three non-consecutive sections (Figure 1); within sections, the boxes were placed between 50 and 100 m from one another to minimise intra- and interspecific competition (Baucells *et al.* 2003), although it is likely that we failed in this sense (see below). Despite being part of the same transect, we considered each section with nest boxes to be independent, because the sections were always more than 200 m apart (note that the transects were not always completely lineal; Figure 1) (Bibby *et al.* 1992) and breeding territories did not extend more than 100 m beyond nest-sites (Krebs 1971).

To evaluate tit abundance in burnt areas with and without nest-boxes, we used data collected during 2007 in experimental transects and compared them with control transects included in the DINDIS project (CONTROL). All transects were linear with sections c. 500-m long. To minimise biases related to slight differences in the section length, we calculated the number of birds observed per kilometre line (KAI) as the most comparable estimate of bird abundance.

One important difference between experimental and control transects was the period of study of the original projects. Thus, while the

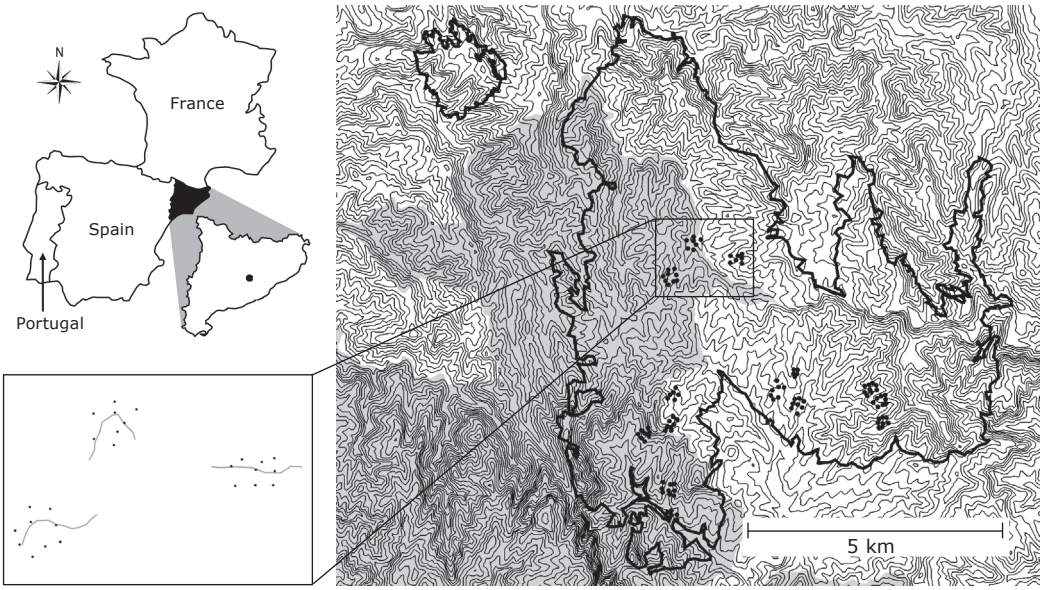

Figure 1. Study area (Sant Llorenç del Munt i l'Obac Natural Park, grey shadowy, in the Iberian Peninsula) and experiment design. Black dots show the location of the 135 nest-boxes inside the area burnt in 2003 (black perimeter in right-hand box). Below left: the box shows as an example the position of 27 nest-boxes in the three non-consecutive sections in one of the SOCC transects (L'Otzet).
Àrea d'estudi (Parc Natural de Sant Llorenç del Munt i l'Obac a la península Ibèrica, ombrejat en gris) i disseny experimental. Els punts negres mostren la localització de les 135 caixes-niu a l'àrea cremada el 2003 (perímetre negre a la dreta). El gràfic de baix a l'esquerra mostra la disposició de les 27 caixes-niu en tres seccions no consecutives en un dels transsectes SOCC (L'Otzet) com a exemple.

Figure 2. Distribution of the experimental transects with nest-boxes (dotted lines) and control transects without nest-boxes (solid lines) in the burnt area of the Natural Park of Sant Llorenç del Munt i l'Obac.
Distribució dels transsectes experimentals amb caixes-niu (línies de punts) i els transsectes control sense caixes-niu (línies contínues) a l'àrea cremada del Parc Natural de Sant Llorenç del Munt i l'Obac.

SOCC censuses were conducted twice during the breeding season, the DINDIS transects were conducted only once. Hence, we only used data from the second SOCC census, which coincided temporally with that of the DINDIS project.

To avoid the nest-boxes having any effect on tit numbers in the control transects, we only considered data from those control transects that were over 1 km from a experimental transect (Figure 2). Finally, we discarded data from some experimental transects that were not wholly within the burnt area (Figure 2). In total, we analysed data from 24 control transects and 12 experimental transects.

To control the possible effect of forest cover on the comparison between tit abundances in burnt and unburnt areas, we evaluated this parameter within a radius of 100 m around the beginning and the end of each transect section. These evaluations of forest cover were obtained using the reference chart given by Prodon and Lebreton (1981). According to these authors, this method produces data that are reliable to ±90%. Data from experimental and control transects were compared using GLMs (with Statistica 7.0) and the effect of forest cover as a covariate was also analysed. We used a Poisson distribution for the dependent variable (KAI), with a logit link function, sigma-restricted estimation method and all effects model building. Type 3 results are shown. We only considered tit species which breed in nest-boxes (Great and Blue Tits).

Finally, we calculated population trends of the three tit species that used the nest-boxes (Great, Blue and Crested Tits) in the area with nest-boxes for the period 2002-2007. These analyses were conducted with the TRIM software (Pannekoek & van Strien 2007), which estimates annual indices of population sizes using observed counts and analyses trends in indices over time.

Results

Occupation patterns

Nest-boxes were occupied mainly by birds (Paridae and Picidae), but also by mammals (bats: *Pipistrellus sp.* and rodents: *Elyomis quercinus* and *Apodemus sylvaticus*) and wasps. Nest occupa-

Table 1. Environmental parameters that influence nest-box occupation. See text for explanations of the variables. *= p< 0,05 and p>0,005, **= p<0,005 and p>0,001, ***= p<0,001.
*Paràmetres ambientals que influeixen en l'ocupació de les caixes niu. Vegeu al text el significat de les variables. *= p< 0,05 and p>0,005, **= p<0,005 and p>0,001, ***= p<0,001.*

	2005		2006		2007	
	Estimates	p	Estimates	p	Estimates	p
Intercept	-2,91	*	-2,85	**	-4,51	***
Distance	0,00	0,41	0,00	0,61	0,00	0,88
Height	0,54	0,15	0,73	*	1,25	**
Forest	0,01	0,71	-0,01	0,61	0,04	*
Species	-0,50	0,15	-0,19	0,51	-0,12	0,71
Support	0,99	**	1,18	***	1,18	**

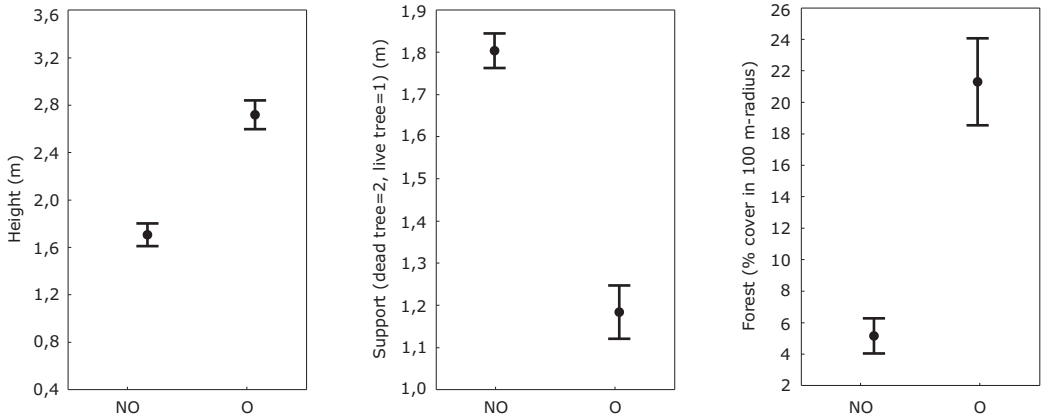

Figure 3. Mean and standard errors of the three environmental variables (Height, Support and Forest) that significantly affected nest-box occupation in 2007 (NO= unoccupied nest-boxes; O=occupied nest-boxes). *Mitjana i error estàndard de les tres variables ambientals (alçada, tipus de suport i quantitat de cobertura arbòria) que van afectar l'ocupació de les caixes-niu durant l'any 2007 (NO= caixes niu no ocupades; O=caixes-niu ocupades).*

tion by birds showed a continuous increase throughout the study period: in 2005, 17% (22 out of 129) nest-boxes had some evidence of breeding activity (at least nest building); in 2006, this increased to 21% (28 out of 126 boxes) and reached 30% occupation (38 out of 127 boxes) in 2007. The main species occupying the nest-boxes were Great *Parus major* ($n = 27$) and Blue *Cyanistes caeruleus* ($n = 25$) Tits. A pair of Crested Tits *Lophophanes cristatus* occupied one nest-box and Wrynecks *Jynx torquilla* two boxes. Nest-box occupation by Great/Blue Tits was as follows: 3/5 in 2005, 10/10 in 2006 and 14/10 in 2007. Neither second nor replacement clutches were observed in the study.

Nest-box choice and environmental parameters

The number of environmental variables included in the model of nest-box occupancy increased steadily each year due to the permanency of variables from previous years and the addition of new ones (Table 1). In 2005, breeding activity was positively related to the location of nest-boxes in living trees (Table 1). In 2006, a positive association was found with the height at which the box was located (Table 1). Finally, in 2007, a third variable became significant in the model as tits significantly occupied boxes surrounded by high values of forest coverage (Table 1, Figure 3). In this year, nest-boxes occupied by tits were placed at 646 ± 403 m (mean ± standard deviation) from the perimeter of the burnt area, at 2.0 ± 1.0 m above ground, preferably in living trees, and in either deciduous or evergreen trees. Forest cover around each box varied between 0 and 60%.

Influence of nest-boxes in burnt areas on tit populations

Tit abundance in locations with nest-boxes was significantly higher than in locations without boxes (Figure 4). Moreover, the percentage of forest coverage was important for tit abundance, that is, the greater the forest coverage, the greater the abundance of tits (Nestbox effect: Wald = 29.44, $p < 0.001$; Canopy area: Wald = 20.97, $p < 0.001$; $n = 36$). In locations with nest-boxes, population trends during the period 2002-2007 were stable or even slightly positive for both Great and Blue Tits (+7% and +5%, respectively), whereas Crested Tits experienced a significant ($p < 0.01$) population decrease of -23% (Figure 5).

Discussion

Our results show a heterogeneous effect of nest-boxes on the different bird species, and the spe-

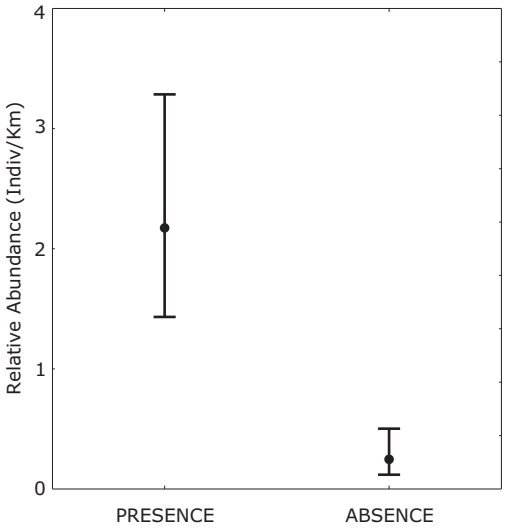

Figure 4. Mean and standard errors of the Relative abundance (Kilometre Abundance Index, KAI) of tits in burnt areas with (PRESENCE) and without nest-boxes (ABSENCE). We only considered species of tit that occupied the nest boxes (*Parus major* and *Cyanistes caeruleus*).
Mitjana i errors estàndards d'abundància relativa (índex kilomètric d'abundància, IKA) de mallerengues en zones cremades amb caixes niu (PRESENCE) i sense aquestes (ABSENCE). Només es van considerar aquelles espècies que van ocupar les caixes nius (Parus major *i* Cyanistes caeruleus).

cies favoured were those that use nest-boxes most (i.e. Great and Blue Tits). Nest-box occupation increased during the study period and was related to habitat features. Overall, our results show that nest-boxes are a potentially interesting tool for strengthening hole-nester populations in areas that have been damaged by fires. This effect will probably be particularly positive for those species who readily accept nest-boxes as nesting sites.

Species that occupy nest-boxes

In hole-nesting birds such as tits, hole diameters and nest-box design are variables that have a significant effect on occupancy (Baucells *et al.* 2003, Moreno-Rueda 2003), while factors such as interspecific dominance hierarchies affect which species occupy nest-boxes. Previous studies have demonstrated that Great Tits are dominant over Blue and Crested Tits (Minot & Perrins 1986). Moreover, Baucells *et al.* (2003) have reported that where the habitat favours a dominant species, this species ends up by occupying a high percentage of the available nest-boxes. This may be the case in our study area since Great Tits will inhabit Mediterranean habitats that are suboptimal for the other tits (Estrada *et al*. 2004), which may explain the reported gradual substitution of Blue Tits by Great Tits in the occupied boxes.

Interestingly, nest-boxes were also occupied by a pair of Wrynecks, a species catalogued as Near Threatened in Catalonia (Estrada *et al.* 2004) and considered to be declining across most of its European range (BirdLife International 2004). Wrynecks may be favoured by fires when these disturbances create mosaics of open areas and forests (Herrando & Brotons 2002) and probably the hole diameter of the boxes provided in our study was also appropriate for this species (Barba & Gil-Delgado 1990). Therefore, it would be especially interesting to study in detail whether nest-boxes favour this species in other areas affected by fire.

Nest-box occupation rates in burnt areas

In our study area nest-box occupation during the breeding season increased progressively from 17% in 2005 to 30% in 2007. These values are relatively low in comparison with those obtained in other forest environments, but are similar to the occupation percentages found in open areas such as parks, gardens and agricultural environments (Baucells *et al.* 2003) and as such suggest that burnt areas in the Sant Llorenç Natural Park are a suboptimal area for breeding tits.

Environmental parameters influencing nest-box occupation

The characteristics of the habitat surrounding nest-boxes are key to understanding their occupation. We detected an interesting annual evolution in the model of nest-box occupancy: each year one further factor was incorporated into the model and joined those variables already included in previous years. The most important factor for nest-box occupation was the box's situation in a living tree. This was determinant in all study years. As well, the height at which the boxes were placed seemed to be an important element after the first year of study,

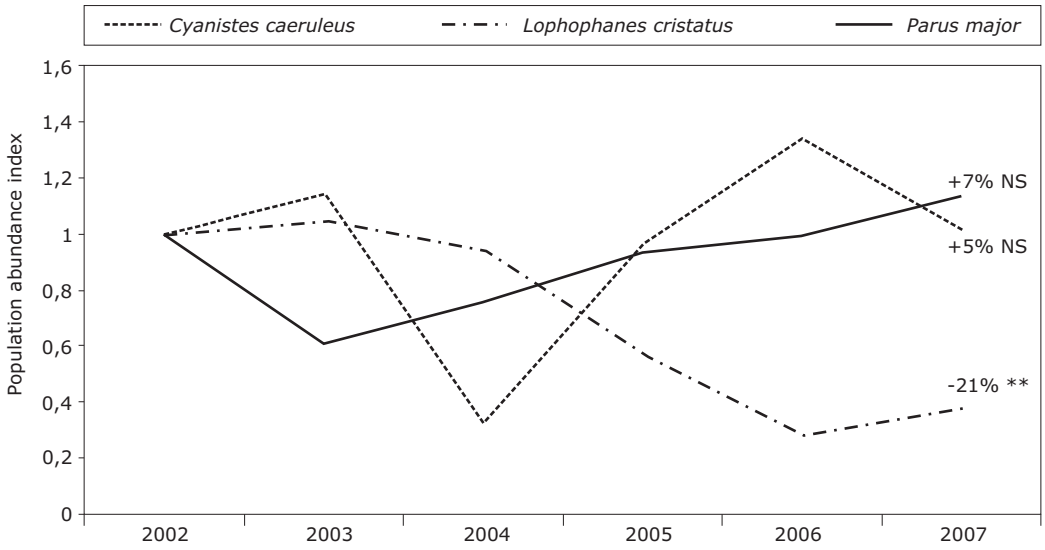

Figure 5. Trends in tit populations in the burnt area in the period 2002-2007 (2002, reference year = 1). The fire occurred in 2003 and nest boxes were placed in 2005.
Tendències de les poblacions reproductores a la zona cremada al llarg del període de 2002-2007 (2002, any de referència =1). El foc va ocórrer el 2003 i la col·locació de les caixes niu es va fer el 2005.

with higher nest-boxes being preferentially selected by tits. Finally, in the final year, a new significant variable was detected: boxes placed in those areas with greater forest coverage were preferentially selected to the detriment of those surrounded by scarcer vegetation. This temporal evolution in the results of the analyses could be a by-product of the increasing number of birds occupying the nest-boxes, although it may also – at least partly – respond to biological processes. For instance, it is possible that the occupation of nest-boxes in the first years was highly influenced by the site fidelity of the individuals that inhabited the zone before the fire (Prodon *et al.* 1987), whereas in subsequent years tits would select more specifically the most suitable boxes, tending to occupy those located in taller trees and in zones with greater forest coverage. A more detailed study should help to clarify these hypotheses.

Value of using nest-boxes in post-fire management

Our results strongly suggest that nest-boxes benefit tit populations. First, bird populations were larger in the areas with than without nest-boxes (even after controlling for forest cover). Second, while Great and Blue Tit populations seemed to be unaffected by the fire, Crested Tit populations decreased dramatically. An explanation is that Great and Blue Tits used more nest-boxes than Crested Tits, as has been found in previous studies (Cramp & Perrins 1994). Thus, nest-boxes may increase cavity availability for Great and Blue Tits but not for the Crested Tit.

After a fire, landscapes undergo major changes that may leave breeding sites unsuitable for many forest species (Bock & Fleck 1995, Huhta & Jokimaki 2001, Smith *et al.* 2007). In this context, a lack of nesting cavities may constrain tit abundance. Our data suggest that this could be the case in Mediterranean burnt areas since the addition of nest-boxes increased tit populations. Similar effects have been registered for other bird species in unburnt areas (Bock & Fleck 1995, Pöysä & Pöysä 2002). However, although placing nest boxes may *a priori* be a good management technique for favouring bird populations by increasing cavity availability, a longer-term view raises several questions about the suitability of this management practice. First, the addition of a new element into a habi-

tat may act as an inappropriate cue for habitat choice and lead some species to fall in an "ecological trap". Poor environments which have been altered by human activity to favour bird populations (i.e. via the placing of nest-boxes) may falsely indicate an area of high quality (high availability of nest sites), when in fact other important elements for survival and reproduction are absent (abundant food, low predation rate) (Schlaepfer *et al.* 2002). In these situations, birds could be 'trapped' by their evolutionary responses. A study which has dealt with this aspect in tits has shown different patterns of results for low and high quality habitats (Mänd *et al.* 2005): in high quality forests (deciduous forests) the placing of nest-boxes led to over-optimal occupation and low breeding success, whereas in low-quality areas (coniferous forests) after the placing of nest-boxes breeding performance and survival were higher than in the high-quality area. It is impossible to say whether or not this is the case of burnt areas, although we did find that tits breeding in nest-boxes had a high breeding success that was comparable with other high quality habitats (unpublished data), likewise supporting the hypothesis that these nest-boxes are not an ecological trap. The fact that in high quality habitats the supply of nest-boxes implies excessive occupation and consequent low breeding success raises other important questions regarding this management practise: is there an optimal number of nest-boxes that can be placed in each area and habitat (Pöysä & Pöysä 2002). If this is not known, important breeding parameters such as breeding success and survival may be affected. Thus, further studies should aim to study the relationship between reproductive parameters and survival and nest box density in Mediterranean areas in different types of habitat (i.e. burnt areas).

It has been shown that the successive yearly addition of nesting material into a box by birds may be detrimental to their breeding success (*e.g.* reduced nest box size, parasites; Møller 1989, Merino & Potti 1995, Baucells *et al.* 2003). Thus, the breeding success detected by our study could have been affected if we had not removed old nesting material every year. For this reason and as a conservationist measure, nest boxes should be periodically cleaned to assure their success as a means of stimulating the recovery of bird populations.

In summary, our study shows that placing nest-boxes in a burnt Mediterranean forest produced an increase in those tit species that occupied the nest-boxes (Great and Blue Tits) in comparison with control zones without nest-boxes. Thus, we suggest that placing nest-boxes in burnt areas may be a meaningful management practice for favouring certain forest birds, but that they should be cleaned periodically and located high up in living trees and as close as possible to unburnt areas.

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Resum

Ajuden les caixes niu a recuperar les poblacions d'ocells després d'un incendi? Un experiment de camp amb mallerengues en un bosc mediterrani

Després de pertorbacions naturals o induïdes per l'acció de l'home, és freqüent aplicar pràctiques de gestió encaminades a accelerar la recuperació dels ecosistemes afectats. Un cas molt particular és la col·locació de caixes-niu en boscos recentment cremats amb la finalitat de mantenir i afavorir les poblacions d'ocells que nien en els forats dels arbres. No obstant això, la utilitat d'aquesta pràctica no ha

estat encara plenament avaluada. L'agost de 2003 un gran incendi forestal va cremar 4.589 hectàrees al Parc Natural de Sant Llorenç del Munt (nord-est península Ibèrica). A la primavera de 2005 vam col·locar 135 caixes-niu a l'àrea cremada i, paral·lelament, vam realitzar censos de la població de pàrids a l'àrea on es van col·locar les caixes, així com en zones cremades en les quals no es van col·locar caixes-niu. Els censos es van realitzar aprofitant programes de seguiment anteriors al foc. Concretament, vam estudiar 1) els models d'ocupació de caixes-niu pels pàrids; 2) quines variables ambientals van ser determinants en l'ocupació de les caixes; i, finalment 3) si l'oferta de la caixes-niu a la zona cremada va beneficiar la població de pàrids. Els nostres resultats indiquen que l'ocupació de les caixes-niu va augmentar al llarg dels tres anys d'estudi passant d'un 17% a un 30%. D'altra banda, les caixes van ser ocupades principalment per la Mallerenga Carbonera *Parus major* i la Mallerenga Blava *Cyanistes caeruleus* i, de manera excepcional, per la Mallerenga Emplomallada *Lophophanes cristatus* i el Colltort *Jynx torquilla*. A més, vam trobar que les mallerengues ocupaven principalment les caixes situades a major alçada, en arbres vius i en les zones amb major cobertura vegetal. Finalment vam trobar una diferència significativa en el nombre de mallerengues a l'hora de comparar els censos de les àrees cremades amb caixes-niu amb aquelles en les quals no se'n van col·locar. Al mateix temps les poblacions de Mallerenga Carbonera i de Mallerenga Blava no van mostrar canvis significatius a la zona de estudi després dels incendis, mentre que la de Mallerenga Emplomallada va disminuir dràsticament. Aquests fets suggereixen que la col·locació de caixes-niu va beneficiar les poblacions d'aquelles espècies de mallerenga que accepten nidificar en aquest tipus de substrat fàcilment, en el nostre estudi, la Mallerenga Carbonera i la Mallerenga Blava.

Resumen

Ayudan las cajas nido a recuperar las poblaciones de aves después de un incendio? Un experimento de campo con páridos en un bosque mediterráneo

Tras la acción de perturbaciones naturales o inducidas por el hombre, se suelen aplicar prácticas de gestión con la finalidad de acelerar la recuperación de los ecosistemas afectados. Un caso muy particular es la colocación de cajas-nido en bosques recientemente quemados con el objetivo de mantener o incrementar las poblaciones de aves que anidan en los huecos de los árboles. Sin embargo, la utilidad de esta práctica no ha sido plenamente evaluada hasta la fecha. En agosto de 2003 un gran incendio forestal quemó 4.589 hectáreas en el Parque Natural de Sant Llorenç del Munt (Barcelona, nordeste Península Ibérica). En la primavera de 2005 colocamos 135 cajas-nido en el área quemada y, paralelamente, llevamos a cabo censos de la población de páridos en el área en la que se colocaron las cajas, así como en zonas quemadas en las que no se colocaron cajas-nido. Los censos se realizaron aprovechando programas de monitoreo previos al fuego. Concretamente, estudiamos 1) los patrones de ocupación de las cajas-nido; 2) las variables ambientales que rigieron dicha ocupación; y, por último, 3) si las cajas-nido habían beneficiado o no a las poblaciones de páridos. Nuestros resultados indican que la ocupación de las cajas-nido fue en aumento a lo largo de los tres años de estudio pasando desde el 17% al 30%. Las cajas fueron ocupadas principalmente por el Carbonero Común *Parus major* y el Herrerillo Común *Cyanistes caeruleus* y, excepcionalmente por el Herrerillo Capuchino *Lophophanes cristatus* y el Torcecuello *Jynx torquilla*. Además, encontramos que los páridos ocupaban principalmente las cajas situadas a mayor altura, en árboles vivos y en las zonas con mayor cobertura vegetal. Por último, encontramos una diferencia significativa en el número de páridos al comparar los censos de zonas quemadas con cajas-nido y los que no tenían cajas. Al mismo tiempo las poblaciones de Carbonero Común y Herrerillo Común no mostraron cambios significativos en la zona de estudio después de los incendios, mientras que la de Herrerillo Capuchino disminuyó drásticamente. Estos hechos sugieren que la colocación de cajas-nido benefició las poblaciones de páridos que aceptan fácilmente anidar en este tipo de sustrato, en nuestro estudio el Carbonero Común y el Herrerillo Común.

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