A CLASSIFICATION METHOD OF POWER LINES TO PREVENT FOREST FIRES CAUSED BY BIRD ELECTROCUTION

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ABSTRACT

Bird electrocution on power lines is an important problem, not only from a conservation point of view. It also becomes a frequent cause of forest fires and consequently an important source of economic losses to electric companies and to costumers. In order to mitigate these problems, a classification method was developed to identify dangerous pylons in the field. The process involved an initial fieldwork necessary to obtain the cartography and the description of every pylon using their electro technical characteristics, the surrounding habitat parameters and the presence of raptors or relevant bird populations in the study area; after an analysis of the data to obtain a classification of the pylons in four different categories of electrocution risk and of correction priority (unnecessary, optional, necessary and urgent) on the base of the above mentioned variables; and finally a preparation of maps to facilitate the identification and location of the pylons needing correction. This methodology was used to classify distribution electricity pylons in Barcelona pre-littoral sierras, Catalonia (NE Spain). In the study area, 17.527 pylons were characterised. A 6 % of these pylons were given the maximum electrocution risk score, and our method predicted that the correction of these pylons classified as *urgent* would produce a 70% reduction of casualties. If the second level of priority pylons were also corrected (urgent + necessary), 20% of the total of pylons detected, the electrocution would be reduced in 97%. These data indicate that a reduced number of pylons accumulate most of electrocution incidents. The precise detection of the most dangerous pylons is urgently needed to facilitate and optimize the application of cost-effective mitigation actions. This classification method is currently employed by some power companies operating in Catalonia. First experiences indicate that it can be an efficient tool to resolve bird electrocution and contributing as well to reduce the number of forest fires originated by electrocution of birds.

RESUM

L'electrocució d'aus en línies elèctriques és un greu problema, no només des del punt de vista de la conservació, sinó també perquè pot originar incendis forestals i conseqüentment ocasionar importants pèrdues econòmiques, tant a les companyies elèctriques com a propietaris I a la societat civil en general. Per tal de solucionar aquest problema, s'ha desenvolupat un mètode per classificar els suports elèctrics perillosos presents al territori. Aquesta metodologia implica un treball de camp inicial per cartografiar i descriure cadascun dels suports emprant les seves característiques tècniques, els paràmetres de l'hàbitat circumdant i la presència de poblacions de rapinyaires o altres espècies d'aus rellevants en l'àrea d'estudi. A partir de l'anàlisi d'aquestes variables s'obté un nivell de risc d'electrocució dels suports que permet classificar-los en quatre categories de prioritat de correcció (innecessària, opcional, imprescindible i urgent). Finalment s'elabora una cartografia que faciliti la identificació i localització dels suports que requereixen ser corregits. Aquesta metodologia ha estat utilitzada per classificar suports elèctrics de línies de distribució presents al sector pre-litoral de la província de Barcelona, Catalunya. En aquesta àrea s'han caracteritzat 17.527 suports. Un 6% d'aquests han obtingut el grau més alt de risc d'electrocució. El nostre mètode prediu que la correcció d'aquests suports, classificats com a urgents, permetria reduir en un 70% les electrocucions d'aus. Si el segon nivell de suports perillosos també es corregissin (urgent + imprescindible), un 20% del total dels suports detectats, les electrocucions es reduirien fins a un 97%. Aquestes dades indiquen que un reduït nombre de suports acumulen la majoria de casos d'electrocucions. Per tant es considera molt urgent poder detectar de manera precisa els suports realment perillosos per tal d'optimitzar l'aplicació de mesures correctores efectives amb el menor cost econòmic possible. Aquesta metodologia està sent utilitzada ja per varies de les companyies elèctriques que operen a Catalunya. Els resultats preliminars indiquen que pot esdevenir una eina de treball eficaç de cara a resoldre el problema de l'electrocució d'aus, contribuint Aixa a reduir el nombre d'incendis forestals originats per aus electrocutades.

INTRODUCTION

The electrocution in power lines is an important conservation problem and one of the principal causes of mortality of many threatened species of birds (Bevanger, 1994); (Bayle, 1999); (Real et al. 2001). In Catalonia (NE Spain), it has been estimated that approximately 3000 birds die electrocuted per year (Mañosa, 1995). In addition, bird electrocution can bear also other negative aspects, since it is the cause of numerous power cuts and in certain cases, it has been proved that the electrocuted bird can originate forest fires when falls down on the vegetation (Tintó et al. 2001).

The objective of this work is to prevent the conservation problems and the economic losses associated to the forest fires caused by bird electrocutions. Previous works indicated that most electrocution casualties are concentrated on a small percentage of pylons with a specific

technical design and surrounding habitat combinations (Janss & Ferrer 2001); (Mañosa, 2001). For these reason we develop a classification method to identify precisely dangerous pylons, in order to facilitate and to optimize the application of cost-effective mitigation actions (Tintó et al. 2001).

Figure I: Steel power pole that has very high risk of electrocution for the birds, placed in an area affected by forest fires. Bages (Barcelona).

Figure II: Bonelli's Eagle (*Hieraaetus fasciatus*) electrocuted on a steel power pole.

Figure III: Detail of burned feathers of an electrocuted Bonelli's Eagle.

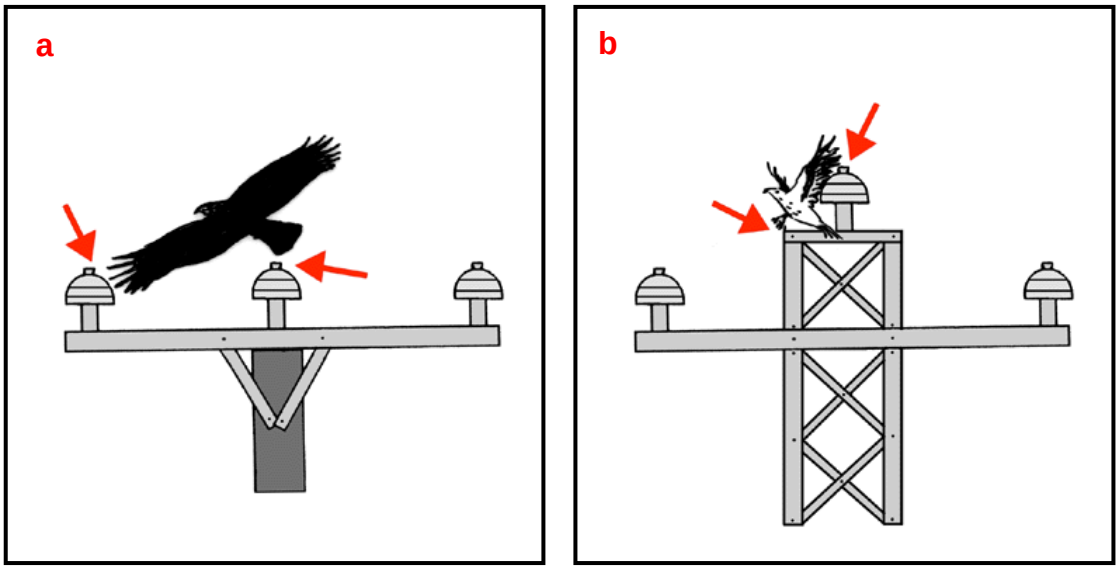

Figure IV: The electrocution affects principally to birds of big or medium size, such as raptors or crows that use the electrical pylons as a perch. In certain supports, the bird may touch very easily two conductive wires (a) or do mass between the tower and one of the wires (b), so that it falls down victim of an electrical discharge. Modified from (Janss & Ferrer, 1999).

STUDY AREA AND METHODS

The study comprised the Barcelona prelittoral area, between sierras of Montserrat and Montseny (Figure V). This area has approximately 2100 km^2, and includes Natural Parks (Montserrat, Sant Llorenç del Munt i l'Obac, Montseny), other protected zones (Gallifa, Cingles de Bertí) and the unprotected adjacent areas, recently affected by important forest fires. This area provides refuge to breeding population of endangered raptors like Bonelli's Eagle (*Hieraaetus fasciatus*) or other protected species like Short–toed Eagle (*Circaetus gallicus*), European Buzzard (*Buteo buteo*), Northern Goshawk (*Accipiter gentilis*) or Eagle Owl (*Bubo bubo*). In this area we have obtained also some data about bird electrocutions that caused small fires.

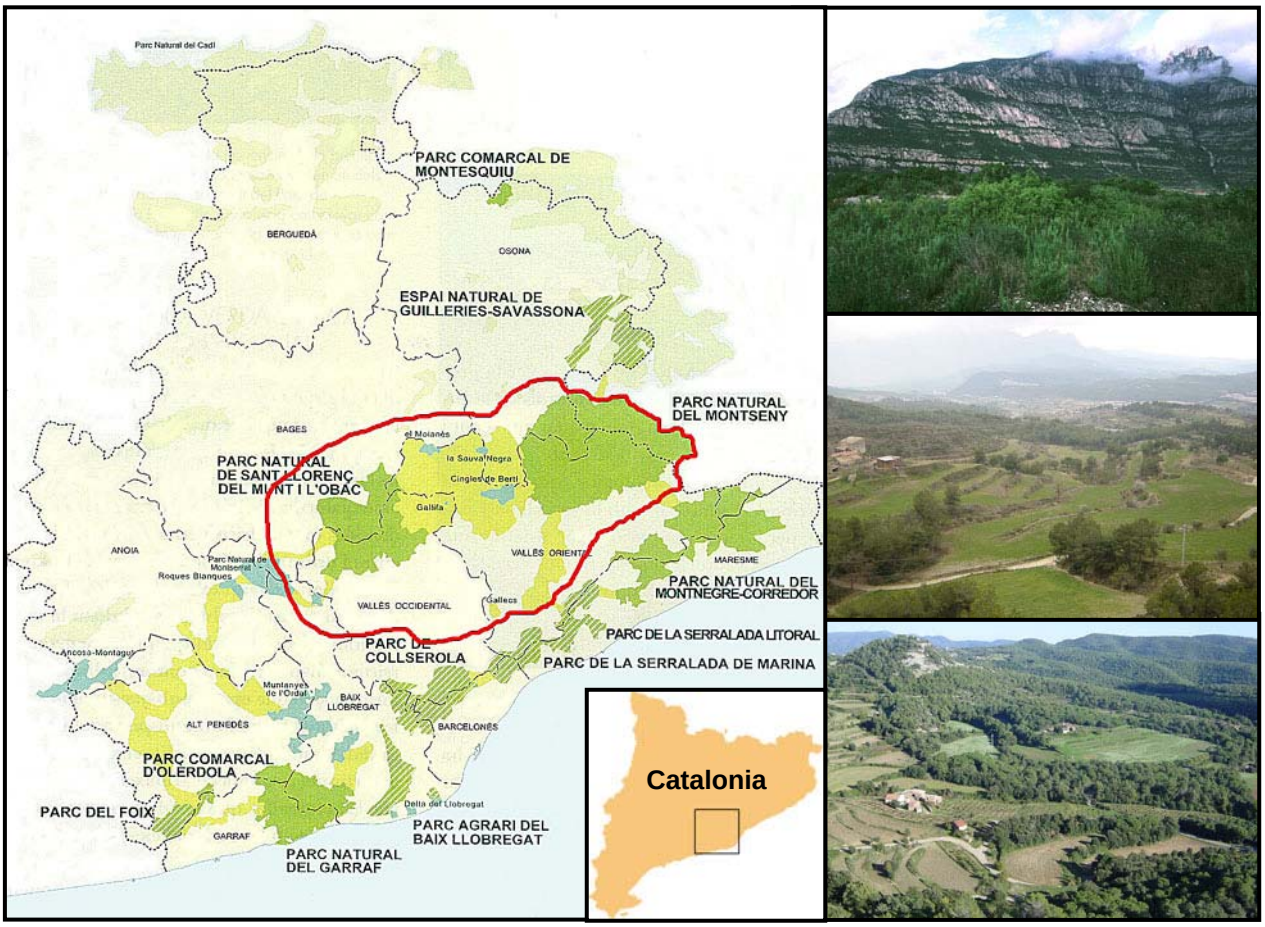

Figure V: The study area of this work (red line) is situated on the central-east part of Barcelona province (Baix Llobregat, Bages, Osona, Vallès Occidental and Vallès Oriental). Natural Parks and other protected areas are green In the map. Modified from Àrea d'Espais Naturals de la Diputació de Barcelona.

The study was carried out between 1999 and 2004, and involved four different methodological steeps:

1) An initial fieldwork necessary to obtain the cartography and the description of every pylon using their electro technical characteristics, the surrounding habitat parameters and the presence of raptors or relevant bird populations in the study area.

2) Preparation of a pylon data base. The analysis of the data to obtain a classification of the pylons in four different categories of electrocution risk and of correction priority (unnecessary, optional, necessary and urgent) on the base of the above mentioned variables (Table I).

3) Preparation of maps to facilitate the identification and localization in the field of the pylons needing correction (G.I.S. computer programs: ArcView v.3.1, Miramon v.4.4dt) (Figure VI).

4) A final fieldwork visiting a sample of pylons to find the presence of carcasses. Identification of the carcasses: specie, age, sex and age of death estimation. Analysis of these data and estimation of the mortality associated to the different categories of correction priority.

Table I: Combination of electro technical design and habitat categories used to obtain electrocution risk of pylons analysed. Priority correction categories associated to the different levels of electrocution risk.

HABITAT	ELECTRO TECHNICAL DESIGN			
	Very save pylons	Fairly unsafe pylons	Unsafe pylons	Very unsafe pylons
Refused	○	○	○	○
Little used	○	●	●	●
Fairly used	○	●	●	●
Selected	○	●	●	●

ELECTROCUTION RISK	CORRECTION
Very low or not dangerous pylons	○ UNNECESSARY
Low dangerous pylons	● OPTIONAL
High dangerous pylons	● NECESSARY
Very high dangerous pylons	● URGENT

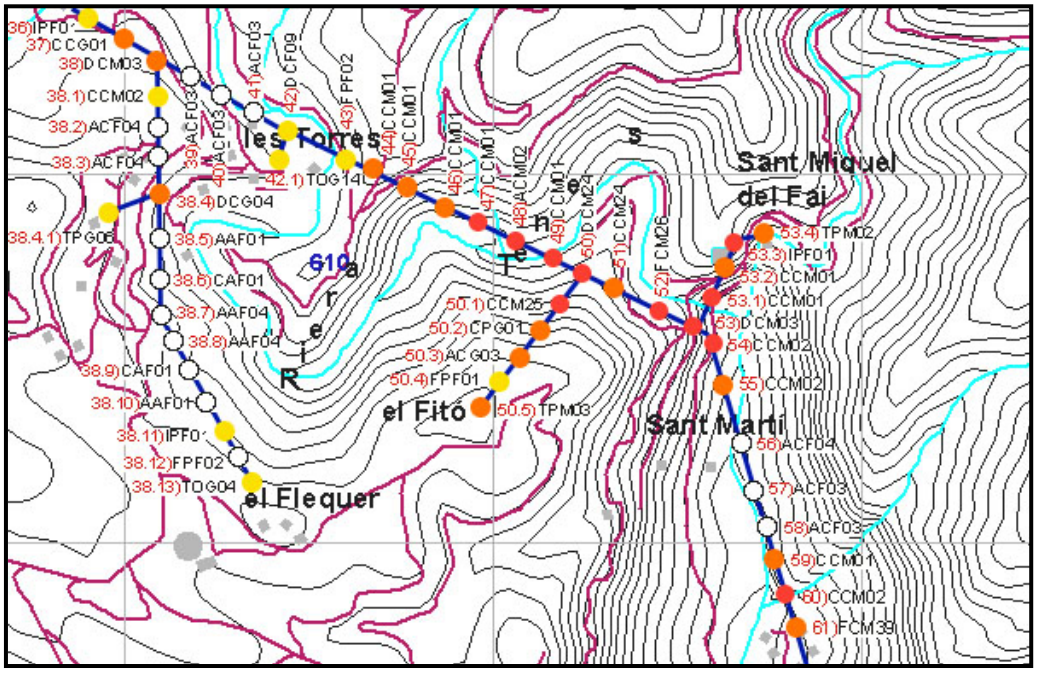

Figure VI: Example of a map presented to the power companies. The electrocution risk of the pylon is indicated by the colour of the point, pylon identification code is indicated in red and technical design code of the pylon is indicated in black.

RESULTS

In the study area 17.527 pylons were characterised. The results indicated that the correction of 11.219 pylons (64%) was unnecessary because they were safe or have very low electrocution risk for the birds. The 972 pylons (6%) that obtained the maximum electrocution risk score were included on the urgent priority of correction category, the following 2.527 dangerous pylons (14%) on the necessary category, and the rest of pylons 2.809 (16%) on the optional (Table II).

A sample of 1.824 pylons was checked for the presence of electrocuted birds. We found 50 carcasses: 24 diurnal raptors, 9 owls, 11 crows and 6 other bird species (Figure VII). There was a killing rate of 1 casualty per every 36 pylons prospected. The data obtained allowed to evaluate the mortality associated to each correction category, and consistently the potential reduction in bird electrocution which could be achieved after the application of correction actions. We estimated that the neutralization of electrocution risk of the 6% of the pylons included in the highest dangerous category would involve a 70% reduction of bird mortality. And the correction of all the pylons included in two most dangerous categories (urgent + necessary) (20%) would produce a reduction of 97% of mortality (Figure VIII).

Table II: Number and percentage of pylons classified in every priority correction categories.

CORRECTION PRIORITY	PYLONS
URGENT	972 (6%)
NECESSARY	2.527 (14%)
OPTIONAL	2.809 (16%)
UNNECESSARY	11.219 (64%)
TOTAL	17.527

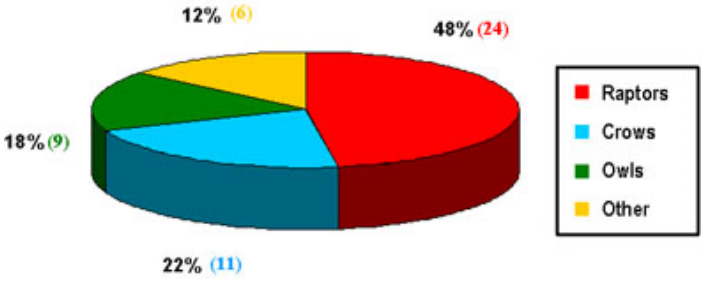

Figure VII: Number and percentage of the different typologies of birds found electrocuted.

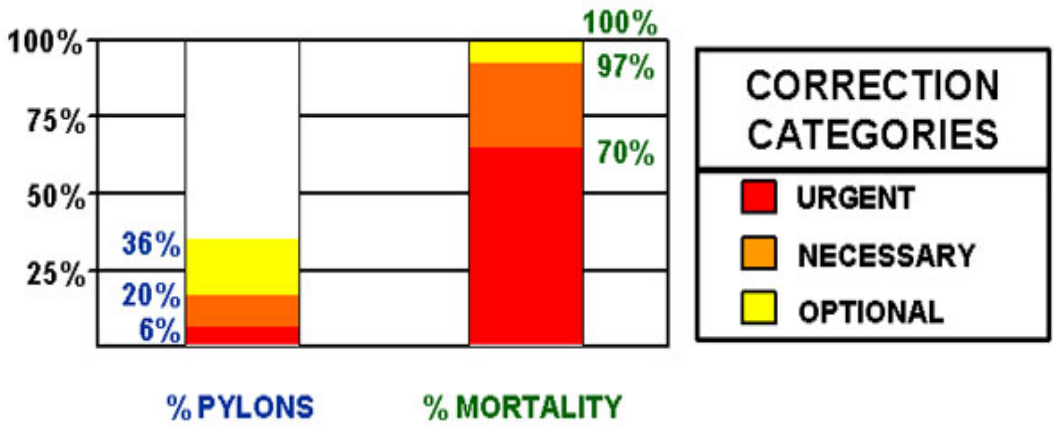

Figure VIII: Percentage mortality (green) associated to the percentage of pylons included on each correction category (blue).

DISCUSSION

The results indicate that a reduced number of pylons (6% in the study area) accumulate the larger part of mortality caused by electrocution (70%). These are principally steel pylons placed in open areas with plenty of prey species for raptors.

The classification method developed allows to identify these “hot spots” and to optimize the application of cost-effective mitigation actions. The precise detection of the dangerous pylons could be a useful tool to reduce the mortality of many endangered and protected species, and consequently to prevent forest fires occasioned by bird electrocution.

In order to facilitate the application of measures to resolve electrocution problems in distribution power lines, the Barcelona Provincial Council (Diputació de Barcelona) has promoted some partnership agreements with the Universitat de Barcelona and different power companies operating in Catalonia. The classification method presented is being employed successfully in all of these projects. During the last four years 315 dangerous pylons have been corrected suitably (Figures IX, X). Under these pylons no more electrocuted birds are found.

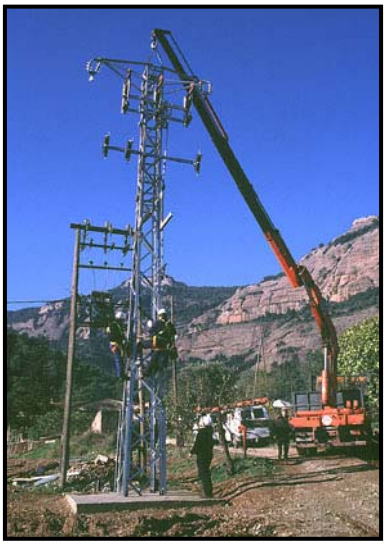

Figure IX: Application of corrective measures against bird electrocution. Substitution of a dangerous pylon (Sant Llorenç del Munt, 2002).

Figure X: Save pylon with a “Canadian” cross arm configuration (Sant Llorenç del Munt, 2002).

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REFERENCES

BAYLE, P. 1999. Preventing birds of prey problems at transmission lines in western Europe. *Journal of Raptor Research* 33: 43-48

BEVANGER, K. 1994. Bird interactions with utility structures: collision and electrocution, causes and mitigation measures. *Ibis* 136: 412-425

JANSS, G.F.E. & FERRER, M. 1999. Avian electrocution on power poles. European experiences. In: FERRER, M. & JANSS, G.F.E. (eds). Birds and power lines. Collision, Electrocution and Breeding, 145-159. Editorial Quercus, Madrid

JANSS, G.F.E. & FERRER, M. 2001. Avian electrocution mortality in relation to pole design and adjacent habitat in Spain. *Bird Conservation International* 11: 1-10

MAÑOSA, S. 1995. Electrocució d'ocells: Primer seguiment de línies elèctriques a les comarques de Lleida. Departament de Biologia Animal de la Universitat de Barcelona.

MAÑOSA, S. 2001. Strategies to identify dangerous electricity pylons for birds. *Biodiversity and Conservation* 10: 1997-2012

REAL, J., GRANDE, J.M., MAÑOSA, S. & SÁNCHEZ-ZAPATA, J.A. 2001. Geographic variation of the causes of death of Bonelli's eagle *Hieraaetus fasciatus* in Spain. *Bird Study* 48, 221-228

TINTÓ, A., REAL, J. & MAÑOSA, S. 2001. Avaluació del risc d'electrocució d'aus en línies elèctriques situades a Sant Llorenç del Munt i rodalies. V Trobada d'estudiosos de Sant Llorenç del Munt i l'Obac. Monografies 35: 129-133

Congreso: II Internaicional Conference on prevention strategies of fires of Southern Europe. 2005.

Publicación: http://www.ctfc.es/confeinfor/articles/posters/PAPER%20TINTÓ.pdf