



Conservation and Best Practices for the Egyptian Vulture

- Lessons from the LIFE Rupis Project -

ANNEXES

MAVA LEARNING AND SHARING GRANT

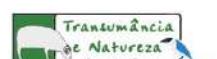
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Conservation and Best Practices for the Egyptian Vulture

- Lessons from the LIFE Rupis Project -

Sharing experience for a successful approach to the Egyptian Vulture conservation through three short documentaries, focusing on different issues to help conservationists working with this species.

Summary of Good-practice measures

This document is a complement for the videos produced dealing with threats and conservation actions for the target-species Egyptian vulture, *Neophron percnopterus*, and Bonelli's Eagle, *Aquila fasciata*, in the Douro Internacional/Arribes del Duero protected Areas(Portugal/Spain). Here we summarize good practises that were the result of LIFE Rupis project and present useful documents in annex.

Supplementary feeding

Managing artificial feeding stations and promotion of "natural" food sources (wild and domestic).

Necrophagous bird species have a very important role in the elimination of corpses of domestic and wild animals in ecosystems and, due to this, they are essential to prevent the spread of many diseases, among many other functions. Unfortunately, its state of conservation is becoming worrying since it is almost impossible for them to find food naturally. The main cause of this decrease in the availability of food, it is the reduction of the biodiversity and the management of carcass recollection. In recent years, almost all bovine carcasses and around 90% of sheep and goats' carcasses have been withdrawn from the natural environment preventing their availability for scavengers, although also protecting them from the ingestion of poisons and other polluting products.

Due to this, one of the key tools to improve the feeding situation of Necrophagous birds are the controlled feeding areas. The use of these feeding grounds for scavenger has for years made it possible to meet the trophic needs of these birds, while minimizing public health and environmental risks. Since the animal by-products that are used come from different meat operations such as slaughterhouses, butchers, cutting rooms, etc. with health status B3 or B4, and qualified as suitable for human consumption, these sub-products can be used safely for feeding wild species.

Despite these advantages of the feeding areas, some disadvantages have also been detected at the demographic and behavioural level of these birds, such as: predictability of their location (temporal

and spatial), increased intra and interspecific competitiveness, variation in migratory patterns, conditioning of reproduction areas, etc.

Therefore, it is necessary to implement some effective practices to avoid these negative effects, such as creating complementary areas to the network of feeding fields and promoting the natural behaviour of necrophagous birds.

To maintain natural behaviour, it is sometimes advisable to reduce the amount of food provided, as well as to scatter and hide it as much as possible. This will avoid habituation and excessive dependence on controlled feeding areas, in addition to promoting their natural behaviour in the ecosystem. It has been referred that the regular availability of food, in small quantities and early in the day, alternate deposition site and in alternate days, are successful strategies in the feeding of Egyptian vulture. A specific strategy for the Egyptian vulture was developed (Annex 1) to maximize the benefits for this species and reduce the effect for the griffon population that is increasing in the region in the last decades.

As for the additional points or areas, they consist of disposal places outside the feeding fields and / or within the livestock farms themselves, that can receive category 1 materials, that is, entire carcasses or pieces of dead animals without risks for the health of these birds. These complementary points will significantly avoid the possible negative effects of the feeding fields and will facilitate the Egyptian vultures to have enough food, since the carcasses (within the feeding station) will distract and feed the rest of the vultures, Griffon and Cinereous vultures.

In order to carry out these complementary actions to the feeding fields, it is necessary that the livestock farms have a license to carry it out.

But, the main problem identified for establishing a common transboundary supplementary feeding strategy was the differences in legislation and procedures developed in each of the countries (Annex 2). In the case of Spain, livestock producers are allowed to use both the feeding stations and depositions in the field (outside feeding stations), within livestock production areas according to their needs. This has no possible control on preferred periods of the year for vulture feeding, minimum quantities (only maximum) and frequency of food depositions, as well as there is no monitoring of the feeding behaviour and frequency of the target species. The Spanish setup for the feeding stations has some advantages which it is important to point out: it is more sustainable, because it is run by providers, and, with the possibility of depositions in the field, outside vulture feeding stations, the food is provided in a more natural way.

In Spain, management feeding areas for necrophagous birds is supported by special legislation that promotes the abandonment of carrion in the field (within the extensive livestock farms) and on a timely basis. Information collected within the period 2013-2016, indicate a total of 102 sheep carcasses being abandoned in ZPAENs located in Zamora during 2016. In addition, agreements were signed with livestock producers' associations to keep a regular supply of food (i.e.: meat residues from rabbit and pig producing farms) in Spanish feeders.

The food supplied in Portuguese stations was mainly composed of offal, fats and bones of cows and pigs. There were some exceptions and local preferences (logistical reasons) that became consistent in the total period of the project.

In the northernmost Portuguese stations of the project, bovine subproducts were more abundant, usually complemented with common quails. On the feeding stations managed in the south there was a balance between pig and bovine sub products, complemented with chickens and domestic rabbits. On the feeding stations managed by Junta de Castilla y Leon all carcasses were deposited whole, either of Equine, Porcine, Ovine or Rabbits.

The use of feeding stations by the Egyptian vultures is very regular and it is possible to see that the number of food depositions with the presence of this species is very high. It was possible to understand the differences between the several stations. Penedo Durão and Almofala are close to the breeding areas and the breeding pairs that are located close to these stations defend the area and this reduces the number of birds using the site. Escalhão and Bruçó are located farther away from the cliffs, and they have more birds present there and for longer periods. This is relevant to understand where more effort may be needed and the use of these sites (fix or temporary) to specific breeding pairs. The results of the monitoring also showed that the sites were used by the other target species: Cinereous Vultures and Red Kites.

	2017	2018	2019
<i>Total birds</i>	10328	12120	12409
<i>Total Egyptian vulture</i>	745	1021	1186
<i>Egyptian vulture per session</i>	2,77	2,50	2,63
<i>Cinereous vulture per session</i>	0,49	0,44	0,67
<i>Red kite per session</i>	0,52	0,60	0,42
<i>Grieffon vulture per session</i>	48,55	41,45	34,61

It was possible to confirm that Egyptian Vulture continue to use the sites in the days after the food depositions (ex. Bruçó each session provided food for an average of 2,89 days). This is very important to understand because these operations are quite demanding (human resources, cars, available food) and to optimize the number of sessions it is crucial to know how effective they are. Several factors influenced the number of total depositions: an early or late start in depositions, disturbance caused by attempts to capture Egyptian vultures for the action D6, fence repairs.

In Spain, as explained in the Supplementary Feeding Strategy document, the management of feeding areas for necrophagous birds is supported by special legislation that promotes the abandonment of carrion in the field (within the extensive livestock farms). Agreements with livestock producers' associations will allow to keep a more regular supply of food in feeding stations and more important in the field.

Due to the fires that affected the project's area, supplementary feeding continued during the winter at the feeding stations close to the Cinereous Vulture's breeding area (Penedo Durão, Bruçó, Aldeadávila). This work and results were a good example how these stations and a dedicated feeding strategy can be used as emergency/ temporary solutions for specific sites/breeding pairs/species.

The good results achieved with the number of birds using the feeding stations and the lack of accidents or food poison episodes contributed decisively to promote the necessity of a national wide coordinated feeding station network in Portugal. The possibility to control the number of Griffon vultures using the specific feeding strategy developed also changed the opinion of many conservation specialists about these methods. This is particularly important in a time that growing Griffon vulture colonies threaten to displace other cliff breeding species and reported interaction with livestock breeders had increased in local communities.

The experience in Spain with ZEPAEN and the possibility for deposition of carcasses in private properties increased awareness for the good results of these procedures. This has contributed for legislation breakthroughs in the Portuguese side.

Regarding the monitoring of feeding habits and behaviours of the target species. Monitoring schemes were aimed to collect information on the use of feeding stations (permanent and temporary) by the Egyptian vulture using wide-angle camera trapping devices, which are setup inside each feeding station, registering all the feeding activity, and thus the success of the supplementary feeding strategy.

These results continue to show the dominance of the griffon vulture in the study area, but also suggest the efficiency of these supplementary feeding stations as a tool for the conservation of Egyptian Vulture, Cinereous Vulture, Golden Eagle and Red Kite. They were used for the optimization of feeding strategies oriented to these species. Analysis suggests that the type of food used is the most important variable to increase the availability for the Egyptian vultures. This information can be used together with the mobile feeding stations to increase the food available for specific areas/territories with low productivity.

The monitoring allows increasing the knowledge on feeding habits of target species and secondary target species in the region and about information on the effectiveness of the feeding strategy depending on the location of the vulture feeding stations. The data analysed help to validate and improve the feeding strategy developed.

The images obtained in the supplementary feeding and complementary actions, helped to raise interest and awareness, locally and nationally. The good results obtained sustain necessary public discussions on the importance of ecosystem services provided by scavengers.

The threat of poisoning

Egyptian vulture is often a secondary victim of poisoning. Crime against vultures is one of the main threats to adult survival across the flyway for classical reasons – predator-control – and new – fears of predation on new-born cattle from vultures. This is an issue that needs to be addressed for all distribution area.

The poisoning crimes are very difficult to investigate, there are no witnesses to what happens and in most cases no suspect. Necropsies and analyses are frequently inconclusive, due to the old age of the remains or due to the insufficient amount of samples to perform all analyses needed to understand the cause of the death. Still, several best practices and measures to avoid these crimes can be implemented.

The patrolling carried out within the framework of Life Rupis has brought the preventive and reactive capacity to deal with cases of species poisoning in nature and has also enabled the identification of “hot spots” with higher incidence of this criminal practice, facilitating consequential criminal investigations.

LIFE Rupis Project and LIFE imperial project, both with the participation of governmental organizations, GNR and ICNF, have opened the way to the revaluation the Antidoto protocol in Portugal. ICNF has taken a revision process with some contributions from all relevant NGO's and set up a new design for the handling of poison suspect cases with wildlife, and new agreement between judicial authorities, environmental police, and nature conservation authority, which should ensure a more coordinated approach to poison cases since 2019.

The actions carried out by both the poison detection binomials and the support patrols were essentially based on three components:

1 - Preventive: detecting situations of illegal use of poisons, namely the presence of poisoned baits. In such situations, the use of dogs allows for monitoring very extensive and sometimes hard-to-access areas.

2 - Reactive: verifying situations with carcasses or live specimens of wild or domestic animals, displaying evidence of poisoning.

3 - Criminal: opening of criminal proceedings with a greater amount and higher quality of material proof, in proceedings conducted by the same body (detection and investigation), increasing the probability of identifying and punishing those responsible.

Various patrol actions enabled GNR/SEPNA to identify and survey areas and locations where poisoning has taken place, with a view to better planning, making the most of the existing means and avoiding dispersion.

An Operational Protocol (annex 3) was developed for the situations when the presence of poisons, baits and/or carcasses are detected, apart from prospecting of the area where the incident takes place, if the carcass corresponds to an animal species with conservation status, the following measures will be immediately furthered: the competent judicial technical inspection of the site and the collection of the carcass and its associated trace elements assessed as relevant for the investigation, safeguarding the evidence chain of custody by all technical investigating bodies involved and ensuring that the appropriate official paperwork is drawn up, endeavouring to provide transportation to the location designated for toxicological and forensic analyses.

Two protocols were developed for taking samples in the field from dead animals (presumably poisoned) for toxicological analysis (annex 4) and for taking biological samples in the field from live birds, for toxicological and parasitological analysis (annex 5). The implementation of these protocols allows to produce better results for investigation, but a regular follow-up is very important to understand if all the steps are being followed and where problems might be occurring.

Therefore, a good articulation between investigation bodies, such as the environmental police, the dog-teams and the criminal police body is desirable, to the achievement of good results in the ground investigation. Besides this, the collection of proof from the ground has been object to an operational protocol for the collection of proof and relevant data for dead animals, in order to ensure the adoption of approved protocols for both field and laboratory procedures.

Dangerous powerlines

Egyptian vulture is a victim of electrical powerlines, but also windfarms. We have acquired a solid knowledge about powerline impact and mitigation that can help reduce this threat along the flyway.

Good-practices against collision and electrocution in powerlines.

Electrocution happens when a bird that perches on the cross-arms makes contact between two phases of the conductor parts, or between Earth and a conductor. The bigger the wingspan, the highest the risk of electrocution. Here we will talk about some examples of measures and recommendations in Portugal and Spain to avoid these risks which may serve as a basis for putting them into practice in other countries (more details Annex 6).

In Portugal, ICNF has set up a classification of wildlife sensitive areas for power lines depending on the type of danger and on the species vulnerability to incidents in power lines: the risk categories are: Very Critical Areas of for Electrocution and/or Collision: the characteristics and mitigation actions are explained in the table 1.

Sensitivity	Electrocution	Collision	Mitigation measures
Very Critical	<p>< 1 km from nests/important areas from:</p> <p>Endangered priority species</p> <ul style="list-style-type: none"> - Bonelli's Eagle, Golden Eagle, Imperial Eagle, Egyptian Vulture, Cinereous Vulture, Lesser Kestrel, Marsh Harrier, Montagu's harrier, Hen Harrier, Honey Buzzard, Goshawk, Hobby, Peregrine falcon <p>Necrophagous Birds Feeding Camps</p>	<p>Areas for Little Bustard leks</p> <p>Priority areas for summer and Winter concentration and flight corridors for Little Bustard and Great Bustard</p> <p>< 500 m from:</p> <p>Damp zones important for aquatic birds</p> <p>< 1 km from:</p> <ul style="list-style-type: none"> - Great Bustard leks - Feeding areas, post-nuptial concentrations, nests and priority areas of Black Stork - Crane roosts and corridors that link roosts and feeding areas - Ramsar Areas; - red-billed Chough roosts. 	Exclusion / burying
Critical	<ul style="list-style-type: none"> - >1 km , <5 km, from nests/important areas for Endangered priority species listed above - <2 km, from nests of eagle Owl - <5 km, from nests of griffon vulture - Settlement places for raptors with high threatened species (CR, EN, VU) e high risk of electrocution, whenever exact nest locations are not well-known - migration corridors with recognized importance. - Area >1 km , <5 km from necrophagous birds feeding camps 	<ul style="list-style-type: none"> - Well preserved habitat steppeland (pastures and fallows) and >50ha - Feeding areas for cranes - < 1 km away from important aquatic habitats and dispersion corridors for these species - < 1 km from dispersion corridor for raptor species (river valleys) - Important migration and dispersion corridors relevant for threatened species (CR, EN, VU) and with high collision risk; - Area >1 km , <5 km, within necrophagous birds feeding camps 	<p>Collision prevention: Reduce no. of wire plans Anti-collision devices: fireflies</p> <p>Electrocution prevention measures</p>
Sensitive	All Classified Areas (Protected Areas, Natura 2000 Network, IBA's) wherever crossing areas with suitable habitat for the bird species that they were designated for		<p>Collision prevention: Anti-collision devices Electrocution prevention measures</p>

The anti-collision devices are attached to the cables to facilitate their remote viewing by birds. For avoid collisions, all new lines should be provided with bird-guards or visual markers, when so determined by the competent body, ICNF.

In Spain there are several different anti-collision devices and protectors against electrocution.

The anti-collision devices are:

- Bird saving spirals: PVC spiral of different colours, with a minimum size of 30 cm in diameter and 1 meter in length. Not recommended in Spain (Castilla y León province), because it has a low efficiency.
- Bird saving Strips in Xs: Device made up of two strips of neoprene or other plastic material crossed and held by a polyurethane staple with luminescent tapes, its minimum size is 5 x 35 cm. Installation process of strips in Xs arranged alternately between conductors in electrical line Strips in Xs detail.
- Bird saving Rotating blades: Devices made up of three sheets with reflectors on a rotating bolt, it produces a remarkable visual effect, and its effectiveness is high.

Regarding of protection against electrocution, there are different useful elements too:

- Insulators: External anti- electrocution device placed on the ends consisting of a coated or non-woven rope made of plastic with different elements to insulate the areas of possible contact.
- Increase of insulator chains: Anti-electrocution measure that consists of increasing the insulator chains of the crosshead in order to increase the distances between areas of possible contact.
- Increased length of mooring chains: Anti-electrocution measure that consists of increasing the distance between the crosshead and the beginning of the chain 25 insulator in order to increase the distances between the areas of possible contact.
- Perching and nesting deterrent: External device placed on the crosspieces to increase the distance to the cables, preventing birds from landing or making nests.

Good-practices against collision with wind towers.

Mitigating wind-farm impacts, starts in the planning phase with the choice of the construction site and this has been dealt with in various ways.

Macro-siting:

The first phase deals with macro-siting and typically is done in the scoping phase of the project, prior to the Environmental Impact study or the Strategic Environmental Planning.

Wind farms should be located away from classified areas, as conservation areas, and in areas with low resistance (free of movements of sensitive species, such as migratory routes) and have a criterious choice of siting avoiding high value habitats for sensitive groups of species.

Strategic planning at local or regional levels should be based on animal populations, their preferred habitats and flight paths, and sensitive topographic locations.

Micro-siting:

Once the macro-siting is set up, based on geographical and topography characteristics, the micro-siting phase should follow. Similarly to the macro-siting, the recommendations are mostly based on observations rather than on sound data and research evidence.

Even though , the best recommendations have been:

For birds, need to study understand flight corridors prior during micro-siting planning in order to avoid these areas, choose corridors between the clusters of turbines and avoid turbine alignment that cross these flight paths, e.g. have alignment of turbines parallel with main flight routes. And be away from mountain ridge edges since these areas have an uplift effect that is used by many flying species (raptors and bats), as well as away from the top of the hills.

Other measures:

Other mitigation measures and criteria should be adopted, depending on the site, on the environmental impact assessment and most apply to the pre-construction or construction phase, functioning phase or decommissioning phase. These kind of measures are too specific and hence do not belong to the scope of this action. Further discussion should be done taking in account data studies on fauna available for the particular site.

Good-practices for Solar power Plants.

In Portugal, the environmental guidelines for solar energy was not planned in the beginning of the F3 Action, but the most recently announced Solar energy targets for Portugal to reach until 2020, turned solar power into the spotlight.

Even at international level, there are few studies and even fewer data on the possible impacts of solar power production in species and habitats. However, these industries have been growing ra-

pidly near several protected areas in mainland Portugal, including the Douro Area, due to the solar potential of the region, and therefore recommendations apply.

Most of the studies about the impact of Solar Energy focus on the mining and production of the solar power panels themselves rather than on the in situ impacts. Even though an extensive review of data from the USA's National Photovoltaic Environmental Research Center (Turney & Fthenakis, 2011), states that:

"The majority impact to wildlife and habitat is due to land occupation by the power plant itself. The power plant is typically enclosed by a fence, limiting movement by animals. Some fences have openings to allow small animals to enter the facilities. With or without these openings, the habitat of the land changes significantly. Hiding spots, preying strategy, food availability, will all be affected. The soil is sometimes scraped to bare ground during construction and kept free of vegetation with herbicide, while in other cases the vegetation is allowed to grow but is mowed frequently to keep it below a few feet tall. In either case, a significant alteration to the vegetation occurs. The PV panels themselves will cast shadows and change the microclimate, causing an unstudied effect on vegetation".

The same authors refer to the possibility of positive impacts to wildlife, too, giving the examples like, keeping off the off-road vehicles, ecosystem restoration for endemic species or eliminating invasive species.

Srinivasan et al (2019) recommend as a mitigation measure as the plantation of sun-sensitive mosses or bushes, in the area shadowed by the solar panels.

Mitigation and prevention of impacts area should, therefore, be present since the early planning phases and should take in account the following considerations (Prinsen et al. 2011 and De Vault et al, 2014, 2015 in Zapata-Sanchez et al., 2016; Gehring et al. 2009, Manville 2005, 2009, 2013 and Fenton 1997 in Jenkins et al., 2017; Hernandez et al, 2014):

- Bringing power generation closer to users and humanized areas to avoid disturbing natural landscapes and indirect impacts (minimizing the need for transmission and distribution powerlines);
- Use of degraded and unused parcels (like old airports, old infrastructure sites, with bare soil surfaces)
- Use of human structures already in place, such as roofs, terraces and other artificial bare surfaces,
- Avoid any areas with ecological value (corridor, foraging, resting or breeding areas),
- Minimize use of outdoor lighting at the solar facility, to avoid confusing migrating birds, or attract insects that in turn attract bats and birds;³¹
- If the perimeter of the solar project is fenced, utilize systematic fence marking to reduce avian collisions with fences;
- On-site landscaping using native plants and soil amendments can add to ecosystem service provisioning (e.g., soil stability, C sequestration) without the use of additional water and fertilizer inputs;
- Co-locations with agriculture, building synergies between both activities (e.g. coexistence of grazing habitat for livestock, such as sheep and goats, may curtail the need for vegetation removal and maintenance, or both, and limit erosion, while supporting both energy and food/fiber production).

Support:



ESTRATÉGIA TRANSFRONTEIRIÇA DE ALIMENTAÇÃO ARTIFICIAL PARA O BRITANGO (*Neophron percnopterus*)

Rede de campos de alimentação de aves necrófagas do Parque Natural do Douro Internacional e Parque Natural Arribes del Duero para a conservação da população de Britango



Documento final

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1. Introdução

Os restos de cadáveres de gado doméstico são uma parte vital da dieta das aves necrófagas na Europa.

Historicamente, as espécies necrófagas têm tido um papel importante papel na eliminação de cadáveres de animais domésticos e selvagens. Por essa razão, estas espécies contribuem para a diminuição do risco de transmissão de doenças das espécies de gado, da fauna silvestre e do Homem.

O aparecimento das Encefalopatias Espongiformes Transmissíveis (EETs) permitiu verificar as consequências do uso indevido de alguns subprodutos animais para a alimentação do gado e os seus efeitos negativos para a saúde pública e animal, a segurança da cadeia alimentar e a confiança dos consumidores. Isto deu lugar a alterações legislativas sem precedentes, em especial a aprovação do Regulamento (CE) 1774/2002, revogado pelo Regulamento (CE) 1069/2009 de 21 de Outubro, destinados a evitar o contágio destas doenças, classificando os subprodutos animais e classificando os subprodutos animais e definindo a sua gestão. Para diminuir o risco de dispersão, os subprodutos animais, salvo raras excepções, devem ser recolhidos, transportados e transformados ou eliminados, em instalações autorizadas.

A aplicação destes regulamentos implicou a obrigatoriedade de retirar do campo os cadáveres de gado doméstico, com especial atenção os ruminantes que possam conter material de risco. Actualmente, quase a totalidade dos bovinos e cerca de 90% de ovinos e caprinos são recolhidos, não ficando disponíveis no campo para o consumo por aves necrófagas, salvo em zonas remotas, onde o acesso pelos serviços de recolha é praticamente impossível.

Considerando esta redução da disponibilidade alimentar, mas igualmente considerando o facto de algum desse alimento não ser seguro para as aves, devido ao uso de venenos ou outro tipo de contaminação, a implementação de locais de alimentação controlados tem surgido como uma ferramenta chave na gestão das espécies necrófagas. Grande parte das estratégias de conservação para aves necrófagas incluem como acção prioritária a criação de estações de alimentação suplementar.

O uso de campos de alimentação de aves necrófagas permitiu durante anos, cobrir as necessidades tróficas destas aves, reduzindo ao mínimo os riscos sanitários e ambientais. No entanto, têm sido detectados vários efeitos negativos ao nível demográfico e de comportamento das aves necrófagas, designadamente: redução e concentração da disponibilidade alimentar; previsibilidade de localização (temporal e espacial), o que resulta em maior competição intra e interespecífica; domínio e monopólio dos recursos tróficos pelo Grifo (*Gyps fulvus*); variação de padrões migratórios; condicionamento do processo de reprodução em áreas próximas dos campos de alimentação, especialmente para o Grifo e Britango (*Neophron percnopterus*).

No entanto, a utilização de campos de alimentação continua a ser necessária, quer em Portugal, quer em Espanha, existindo também informação sobre os benefícios da

alimentação suplementar para o Britango, mas também para outras espécies, como o Milhafre-real (*Milvus milvus*) e o Abutre-preto (*Aegypius monachus*). Os resultados obtidos em Espanha mostram que a presença de uma rede de campos de alimentação não é, por si só, suficiente para garantir a estabilidade da população de Britango, mas tem um efeito positivo no seu sucesso reprodutor, e no aparecimento de locais de dormitório.

A eficácia dos campos de alimentação na espécie-alvo depende de um número de factores, incluindo o tipo de alimento fornecido, o período e frequência de deposição, o horário, a distância aos territórios de nidificação e o tipo de coberto vegetal. Frequentemente, estes locais são geridos de tal forma que não têm um efeito de conservação positivo nas espécies de tamanho mais reduzido, acabando por ser dominado por espécies maiores, como o Grifo, que impedem o acesso ao alimento às espécies como o Britango e o Milhafre-real.

Em Espanha, devido a alterações na legislação (Real Decreto 1632/2011, de 14 de Novembro; Real Decreto 1528/2012, de 8 de Novembro), como complemento à rede de campos de alimentação (muladares), é já possível proceder à deposição fora dos campos de alimentação e dentro das próprias explorações pecuárias de materiais de categoria 1, ou seja, carcaças inteiras ou partes de animais mortos que possam conter material de risco no momento da eliminação, para alimentação de espécies de aves necrófagas protegidas e outras espécies necrófagas presentes no meio natural. Para tal, basta a exploração pecuária estar licenciada para o fazer. Em 2015, dentro do Parque Natural Arribes del Duero, existiam 43 explorações pecuárias autorizadas a efectuar deposição de carcaças.

A estratégia de alimentação suplementar aqui apresentada estabelece um programa de alimentação suplementar para o Britango, através da implementação de uma rede de campos de alimentação de aves necrófagas no NE Portugal e regiões adjacentes em Espanha e define os seus modos de funcionamento, tendo em conta a legislação e as práticas em vigor em cada um dos países.

2. Objectivo da estratégia

Esta estratégia pretende implementar um **programa de suplementação alimentar dirigido à população nidificante de Britango da ZPE Douro Internacional e Vale do Águeda e ZPE Arribes del Duero**, com o objectivo de aumentar da produtividade dos casais de Britango.

Adicionalmente pretende-se aumentar a disponibilidade alimentar para o Abutre-preto e o Milhafre-real.

3. Âmbito territorial

Esta estratégia será implementada nas seguintes áreas classificadas: Douro Internacional e Vale do Águeda SPA (PTZPE0038) e Arribes del Duero SPA (ES0000118) (Figura 1).

Podem também beneficiar da implementação da estratégia as populações de Britango presentes nas seguintes áreas classificadas: Rios Sabor e Maçãs (PTZPE 0037), Vale do Côa (PTZPE0039), Ribera de los ríos Huebra y Yeltes (ES0000247).

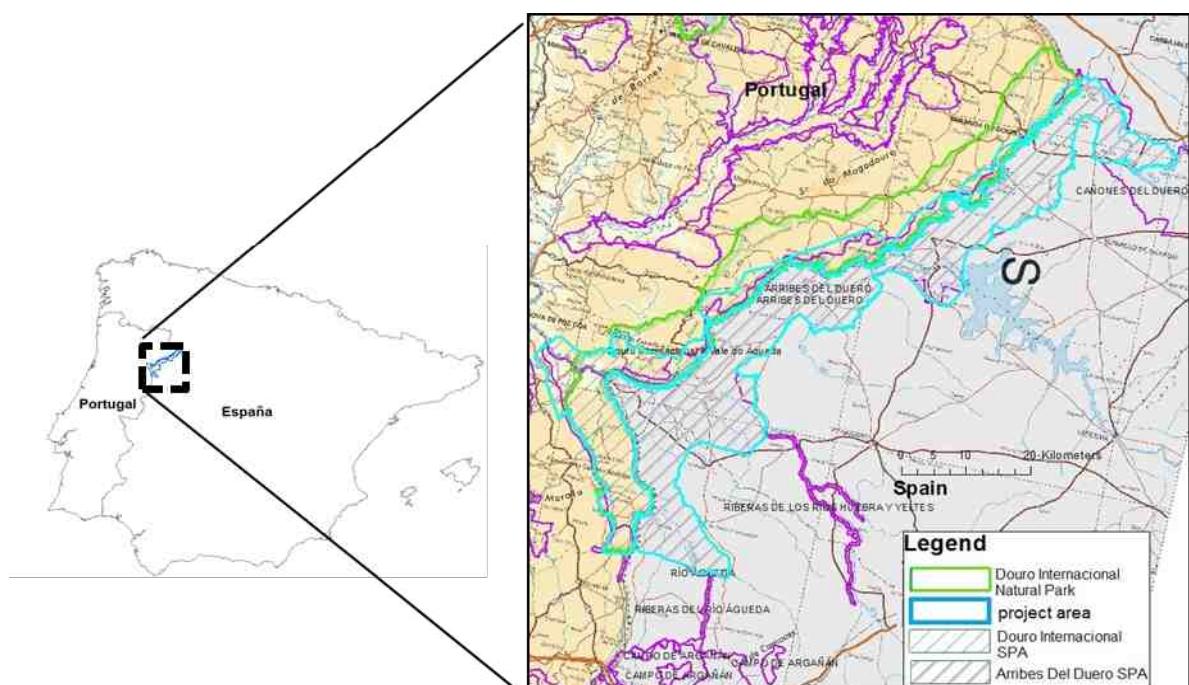


Figura 1. Área de implementação da Estratégia Transfronteiriça de Alimentação Artificial para o Britango (linha azul), Parque Natural do Douro Internacional (linha verde), ZPE Douro Internacional e Vale do Águeda e ZPE Arribes del Duero (tracejado).

Com base nas acções de seguimento da espécie, em curso desde 1996, foram definidos sectores de 10 a 15 km, coincidentes com a localização das barragens ao longo dos canhões fluviais internacionais do rio Douro e Águeda (Figura 2), designadamente, de norte para sul: Miranda, Picote, Bemposta, Aldeadávila, Saucelle, Poiares e Águeda Internacional. Existem ainda sectores não fronteiriços, em Portugal, Douro Nacional, e em Espanha, de norte para sul Villalcampo, Castro, Uces, Huebra e Águeda Nacional.

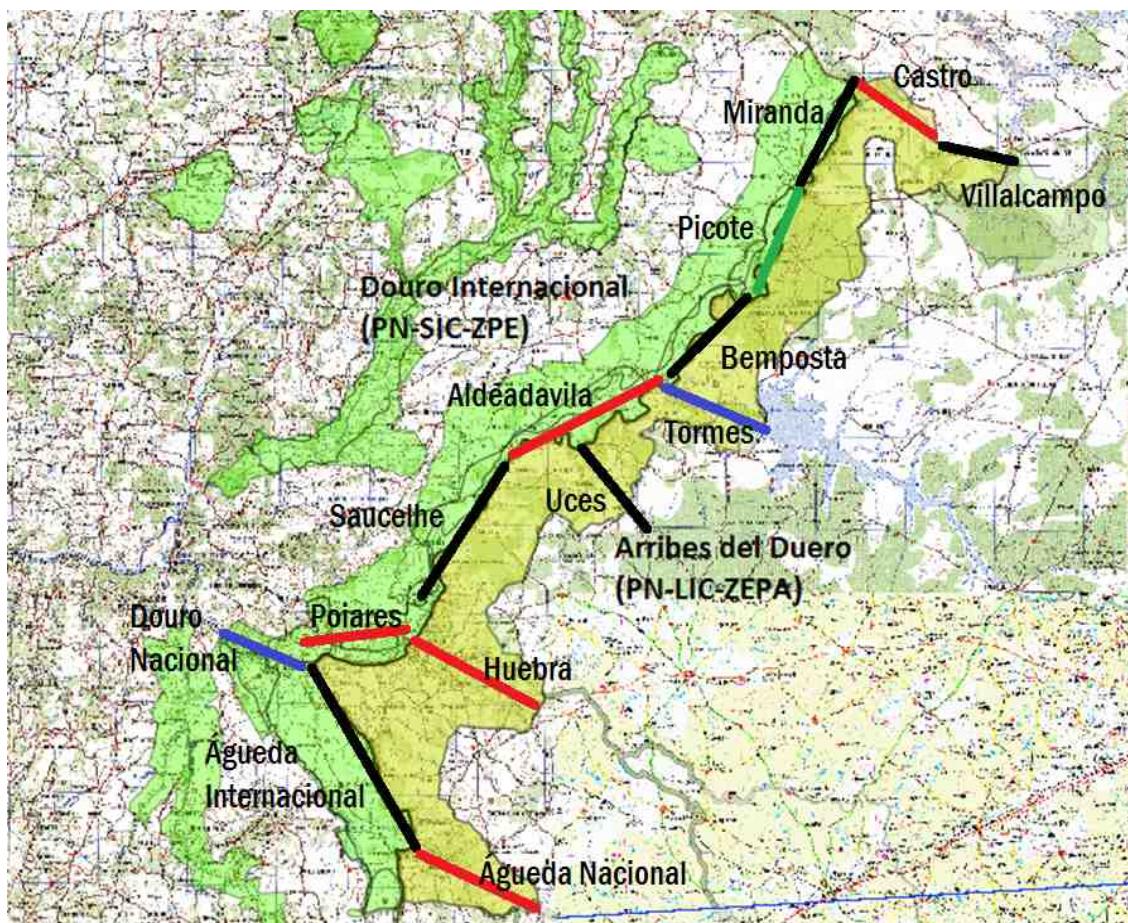


Figura 2. Áreas classificadas e sectores na área de implementação da Estratégia de Alimentação Artificial de Britango.

4. Britango

4.1. Diagnóstico da população

A área de intervenção da Rede de Campos de Alimentação de Aves Necrófagas do Douro Internacional / Arribes del Duero abrange uma população de 121 a 135 casais (dados de 2016).

Nesta área, de acordo com os dados de censo (ICNF/JCyL), o Britango encontra-se numa situação negativa em termos demográficos, verificando-se uma redução em número de casais (157 casais em 2006 para 116 em 2013, redução de 35%) e na área de distribuição.

Os valores dos parâmetros reprodutores do Britango apresentam também uma tendência de diminuição, progressiva, ao longo dos últimos 15 a 20 anos.

No âmbito de um relatório efectuado pelo ICNF, tendo como base os dados populacionais recolhidos entre 1996 e 2014, foram identificados os sectores em que se verifica um decréscimo populacional, identificando-se desde já como sectores prioritários para a implementação da presente estratégia.

Sectores com decréscimo populacional entre 20 a 50%: Bemposta, Tormes, Águeda Internacional, Huebra

Sectores com decréscimo populacional superior a 50%: Águeda Espanhol, Uces

No entanto, no referido relatório (ICNF-JCyL) também ficou claro o carácter provisório destes dados, visto que alguns sectores foram seguidos de forma deficiente, situação que foi corrigida com o presente projecto LIFE Rupis durante 2016. Nos resultados obtidos em 2016, o somatorio do numero de casais em Miranda, Picote, Bemposta, Aldeadávila, Saucelhe, Poiares, Águeda Internacional e Duoro Nacional, perfaz um total de 84 casais confirmados e 12 casais possíveis, presentando um aumento potencial de 2 casais nesta área em comparação com dados recolhidos em anos anteriores (83 casais confirmados e 11 casais possíveis; Monteiro, 2013).

4.2. Regime e comportamento alimentar

O Britango é uma espécie generalista, podendo alimentar-se de cadáveres, mas também de detritos orgânicos, caçando esporadicamente pequenas presas, sobretudo répteis, anfíbios, e insectos (*Orthoptera, Isoptera, Coleoptera*). Os cadáveres inteiros de ruminantes domésticos constituem a sua principal fonte de alimento durante o período de nidificação.

Apesar de ser uma espécie territorial em termos de nidificação, efectua a prospecção de alimento em conjunto com outros indivíduos da sua espécie e também com outras aves

necrófagas, como o Grifo. Em geral prospecta áreas num raio de 5 a 20 km a partir do ninho, sendo que o território não tem um formato circular. Mostra grande fidelidade tanto a locais de nidificação, como a locais de alimentação, ao longo dos anos (Pascual Lopez, com. pess.)

A necessidade alimentar diária de um indivíduo de Britango é de 200 a 300 g.

Do ponto de vista comportamental, o Britango parece evitar as espécies maiores e dominantes, como o Grifo, procurando prospectar o local antes do Grifo. Enquanto o Grifo se alimenta arrancando pedaços de carne que estão agarrados aos ossos, o Britango procura pequenos pedaços de carne que ficaram espalhados no local de alimentação, sendo definida como uma espécie “picadora” (Donazar & Ceballos 1988; Meretsky & Mannan 1999).

O Britango destaca-se também por efectuar transporte de alimento para fora do local de alimentação, eventualmente para o ninho. De facto os indivíduos usam esta estratégia predominantemente nos meses imediatamente anteriores e seguintes à eclosão das crias, o que permite concluir que este alimento estará de facto a ser transportado para o ninho.

4.3. Disponibilidade trófica

Na área de intervenção, a alimentação do Britango depende maioritariamente da disponibilidade de cadáveres de gado doméstico, não havendo grande disponibilidade de cadáveres de ungulados selvagens.

Em Portugal, os dados do Instituto Nacional de Estatística, no âmbito do Recenseamento Agrícola efectuado em 1989, 1999 e 2009 em Miranda do Douro, Mogadouro, Freixo-de-Espada-à-Cinta e Figueira de Castelo Rodrigo (municípios que integram o Parque Natural do Douro Internacional), mostram uma redução do efectivo pecuário de um total de 113.968 cabeças de gado em 1989 para 94.311 em 2009 (-17%), sendo a redução mais acentuada nos caprinos e equídeos (-61 e -78% respectivamente). No caso dos bovinos e ovinos, a redução é de cerca de -4 e -2% respectivamente. O município com a maior redução de efectivo pecuário é Freixo-de-Espada-à-Cinta (-35%), seguido de Mogadouro (-22%), Miranda do Douro (-12%) e Figueira de Castelo Rodrigo (-8%). Figueira de Castelo Rodrigo destaca-se como o único município da área de intervenção, do lado português onde o efectivo pecuário (bovinos e ovinos) aumentou de 1989 para 2009 (+15% e +3% respectivamente).

Só em Portugal, considerando o efectivo pecuário total em 2009, e uma taxa de mortalidade média de 4% para bovinos e 6% para ovinos, poderia haver na área do Parque Natural do Douro Internacional mais de 4000 carcaças disponíveis por ano para alimentação das aves necrófagas.

No entanto, em Portugal e Espanha, actualmente, quase a totalidade dos bovinos e cerca de 90% de ovinos e caprinos são recolhidos, não ficando disponíveis no campo para o consumo

por aves necrófagas, salvo em zonas remotas, onde o acesso pelos serviços de recolha é praticamente impossível.

No caso de Espanha, em Castilla y León, com a aplicação do novo Decreto, a percentagem de disponibilidade de cadáveres de gado bovino, ovino e caprino no campo aumentou já cerca de 10%.

5. Enquadramento legal para a alimentação artificial de espécies necrófagas em Portugal e Espanha

5.1. Legislação Europeia

Regulamento (CE) n.º 1069/2009, de 21 de Outubro, define as regras sanitárias relativas a subprodutos animais e produtos derivados não destinados ao consumo humano e revoga o Regulamento (CE) n.º 1774/2002 (regulamento relativo aos subprodutos animais).

Regulamento (CE) n.º 1774/2002, de 3 de Outubro, permite aos Estados-membros a autorização da utilização de matérias de Categoria 1, nomeadamente cadáveres de ruminantes contendo matérias de risco especificadas, na alimentação de espécies ameaçadas ou protegidas de aves necrófagas que vivam no seu habitat, para a promoção da biodiversidade.

Decisão n.º 2003/322/CE, de 12 de Maio, alterada pela Decisão n.º 2005/830/CE, de 25 de Novembro, derrogação permanente para a utilização de matérias de categoria 1, na alimentação de determinadas espécies de aves necrófagas em zonas específicas (Portugal, Espanha, Grécia, França, Itália e Chipre).

Regulamento (CE) n.º 142/2011, de 25 de Fevereiro define as regras de aplicação do Regulamento (CE) n.º 1069/2009, de 21 de Outubro, enquadrando no seu Anexo VI a alimentação de diversas espécies em risco ou protegidas, quer em campos de alimentação, quer fora dos campos e revogando a Decisão n.º 2003/322/CE, estabelecendo as condições em que a autoridade competente o pode permitir

5.2. Portugal

Decreto-Lei n.º 204/90, de 20 de Junho, estabelece medidas de protecção de animais selvagens, necrófagos e predadores.

Decreto-Lei n.º 387/98, de 4 de Dezembro, restringe a utilização de produtos de origem bovina, ovina e caprina na alimentação humana e animal.

Decreto-Lei n.º 26/2006, de 10 de Fevereiro, altera o Decreto-Lei n.º 387/98, de 4 de Dezembro, por forma a adequar as suas disposições às novas medidas de protecção contra as encefalopatias espongiformes transmissíveis, à definição comunitária da classificação dos subprodutos de origem animal, bem como às regras sanitárias que regulam o seu transporte, armazenamento, transformação, aproveitamento ou destruição, e revoga o Decreto-Lei n.º 211-A/2001, de 31 de Julho.

Decreto-Lei n.º 122/2006, de 27 de Junho, visa assegurar a execução e garantir o cumprimento no ordenamento jurídico nacional das obrigações decorrentes do Regulamento 1774/2002 (entretanto revogado pelo Regulamento 1069/2009).

5.3. Espanha

Real Decreto 1632/2011, de 14 de noviembre, por el que se regula la alimentación de determinadas especies de fauna silvestre con subproductos animales no destinados a consumo humano, establece el marco básico para la aplicación de estas normas, fundamentándose en el deber de conservación de las especies necrófagas, pero sin suponer un incremento del riesgo para la salud pública, la sanidad animal, la cadena alimentaria y el medio ambiente.

Real Decreto 1528/2012, de 8 de noviembre, por el que se establecen las normas aplicables a los subproductos animales y los productos derivados no destinados al consumo humano, cuyo objeto fundamental ha sido establecer disposiciones específicas de aplicación en España del Reglamento (CE) n.º 1069/2009 del Parlamento Europeo y del Consejo, es otra de las normas que deben ser tenidas en cuenta.

Decreto 17/2013, de 16 de mayo, por el que se desarrolla en Castilla y León el uso de determinados subproductos animales no destinados al consumo humano para la alimentación de especies necrófagas de interés comunitario. El presente decreto se dicta por tanto en el ejercicio de las competencias de desarrollo normativo y ejecución de la normativa estatal, que la comunidad autónoma tiene en materia de protección del medio ambiente y sanidad animal, de conformidad con lo dispuesto en el artículo 71.1 apartados 7.º y 9.º respectivamente del Estatuto de Autonomía de Castilla y León.

6. Rede de Campos de Alimentação para Aves Necrófagas do Douro Internacional / Arribes del Duero

6.1. Objectivo

A Rede de Campos de Alimentação para Aves Necrófagas do Douro Internacional /Arribes del Duero tem como principal objectivo garantir a implementação de um programa de suplementação alimentar dirigido à população nidificante de Britango. Pretende-se simultaneamente reforçar a disponibilidade alimentar para o Milhafre-real e Abutre-negro, garantindo a minimização de alimentação artificial pelo Grifo.

Pretende-se igualmente que a rede permita apoiar produtores pecuários interessados, com explorações na área de implementação, através da disponibilidade da rede de CAAN para eliminação selectiva de cadáveres de gado doméstico, de acordo com a legislação em vigor.

6.2. Rede de fornecedores dos CAAN

A rede de campos de alimentação será apoiada pela constituição de uma rede de fornecedores (explorações pecuárias, cinegéticas, entre outros), que se constituirão como parceiros na estratégia de alimentação artificial do Britango. Esta rede tem como base a lista de fornecedores aprovados pela Direcção Geral de Alimentação e Veterinária (DGAV) durante o processo de licenciamento dos CAAN e que estão disponíveis e autorizados a fornecer subprodutos de origem animal.

A rede actualizada de fornecedores encontra-se disponível no ANEXO 1, assim como as minutas de protocolo de fornecedor para explorações pecuárias e salas de desmancha ou talhos (ANEXO 2).

6.3. Tipologias de CAAN

6.3.1. Portugal

6.3.1.1. CACAN – Campo de Alimentação Comunitário de Aves Necrófagas

Local vedado onde se pode depositar subprodutos animais não destinados ao consumo humano de diferentes fornecedores (explorações pecuárias, cinegéticas, entre outros). Estes campos implicam a utilização e transporte de subprodutos de diversas proveniências até ao campo de alimentação.

6.3.1.2. CAMAN – Campo de Alimentação Móvel de Aves Necrófagas

Local dentro de explorações autorizadas para tal, onde é instalada uma vedação temporária, no interior da qual se podem depositar cadáveres e subprodutos de animais não destinados ao consumo humano, procedentes exclusivamente da exploração pecuária onde seja instalada. Promovem um fornecimento de alimento mais próximo do natural, sem necessidade de instalação de uma infra-estrutura permanente dentro de cada exploração. Torna-se também uma opção preferencial na área de implementação da estratégia, em que as explorações são caracterizadas por terem áreas de pastagem dispersas, muitas vezes arrendadas pelo produtor e não propriedade sua, onde o pastoreio de percurso é prática dominante.

Esta solução pretende ser também um modelo experimental intermédio, que permita verificar a possibilidade futura de realizar, em áreas prioritárias para as aves necrófagas, acções de alimentação artificial fora de CAAN, garantindo as condições sanitárias previstas pela legislação europeia e nacional.

6.3.2. Espanha

6.3.2.1. ZPAEN Muladores - Zonas de Alimentación de Aves Necrófagas (ZPAEN)

Local vedado onde se pode depositar subprodutos animais não destinados ao consumo humano de diferentes fornecedores (explorações pecuárias, cinegéticas, entre outros). Estes campos implicam a utilização e transporte de subprodutos de diversas proveniências até ao campo de alimentação.

6.3.2.2. ZPAEN - Zonas de Alimentación de Aves Necrófagas (depositión de carroñas em campo)

Local não vedado onde são depositados subprodutos animais não destinados ao consumo humano procedentes exclusivamente da exploração pecuária autorizada para tal. Promovem um fornecimento de alimento próximo do natural.

6.4. Situação inicial

6.4.1. Portugal

No início de 2016, em Portugal e na área do Parque Natural do Douro Internacional, os 3 campos de alimentação (CACAN) existentes estão desactivados e não existe um programa de alimentação artificial para aves necrófagas em curso. As carcaças de gado doméstico e os restos das salas de desmantha de matadouros e talhos são recolhidas para incineração.

6.4.2. Espanha

No início de 2016, em Espanha e na área do Parque Natural Arribes del Duero, existem 5 campos de alimentação (ZPAEN muladares) em pleno funcionamento, que recebem de 3000 a 6000 kg de subprodutos de origem animal por ano, estando 104 explorações pecuárias autorizadas a utilizar estes campos de alimentação durante todo o ano. Estas autorizações foram dadas a partir de 2008, no entanto, actualmente os produtores que levam subprodutos animais aos campos de alimentação é muito menor (3-4 fornecedores por campo em média). A utilização dos campos é feita de forma autónoma pelos produtores, recorrendo ao município (ayuntamiento) para recolha e uso do veículo de transporte de subprodutos animais e da chave do campo de alimentação. Adicionalmente, a legislação espanhola permite a deposição de carcaças fora dos campos de alimentação (ZPAEN), em 43 explorações pecuárias dentro dos limites do Parque Natural Arribes del Duero.

6.5. CACAN – Campo de Alimentação Comunitário de Aves Necrófagas (PT) / ZPAEN Muladares - Zonas de Alimentación de Aves Necrófagas (ZPAEN) (ES)

6.5.1. Lista de CACAN/ ZPAEN Muladares no Douro Internacional e Arribes del Duero

Em 2016, a área de implementação possui 8 CAAN/ZPAEN Muladares que integram a estratégia de alimentação artificial (Tabela 1 e Figura 3).

Com base na análise dos dados de censo de Britango e definição de sectores com registo de regressão populacional, foi considerada a necessidade de reforço da rede de CAAN, através da **construção de 3 novos CACAN** em Portugal. Um quarto CACAN (Ifanes, sector de Miranda) está em estudo.

No âmbito desta estratégia e estando prevista a criação de uma rede de parcerias com produtores pecuários de ovinos e caprinos, está igualmente prevista uma acção experimental de instalação de **CAMAN** para testar sessões de alimentação artificial fora de alimentadores no interior de explorações pecuárias.

Tabela 1. Lista de CACAN/ZPAEN Muladares na área de implementação da Estratégia Transfronteiriça de Alimentação Artificial para o Britango.

Nome	Tipo	Sector	País	Legalização concluída?	Em funcionamento?	Tipo de subprodutos utilizados	Autorizados N.º fornecedores	Quantidade de subprodutos / ano	Período de funcionamento	Acção Britango/Programa de	Entidade responsável
VILLARDIEGUA	ZPAEN MULADARES	Miranda	ES	Sim	Sim	Porcino equino	Y 35	4000 Kg (1000 kg de Março-Agosto)	Todo o ano		JUNTA CASTILLA Y LEÓN
FARIZA/COZCURREITA	ZPAEN MULADARES	Picote	ES	Sim	Sim	Porcino, equino cúnicoila	Y 18	7000 Kg (3000 de Março-Agosto)	Todo o ano		JUNTA CASTILLA Y LEÓN
Duas Igrejas	CACAN	Miranda /Picote	PT	NOVO		Subprodutos animais provenientes de matadouros, salas de desmancha ou talhos		2000 a 3000 kg de subprodutos por ano	Março-Agosto	Sim	PALOMBAR

LAMOSO	CACAN	Bemposta	PT	NOVO	Subprodutos animais provenientes de matadouros, salas de desmancha ou talhos	17	2000 a 3000 kg de subprodutos por ano	Março-Agosto	Sim	PALOMBAR	
Nome	Tipo	Sector	País	Legalização concluída?	Em funcionamento?	Tipo de subprodutos utilizados	Authorizados N.º fornecedores	Quantidade de subprodutos / ano	Período de funcionamento	Ação Britango/Programa de	
BRUÇÓ	CACAN	Aldeadávila	PT	Sim	Fase experimental	Subprodutos animais provenientes de matadouros, salas de desmancha ou talhos	19	2000 a 3000 kg de subprodutos por ano	Março-Agosto	Sim	PALOMBAR
ALDEADÁVILA	ZPAEN MULAD ARES		ES	Sim	Sim	Porcino, equino, avícola	37		Todo o ano		JUNTA CASTILLA Y LEÓN
SAUCELLE	ZPAEN MULAD ARES		ES	Sim	Sim	Porcino cúnícola	11		Todo o ano		JUNTA CASTILLA Y LEÓN
PENEDO DURÃO	CACAN	Saucelle /Poiaraes	PT	Sim	Fase experimental	Subprodutos animais provenientes de matadouros, salas de desmancha ou talhos	24	2000 a 3000 kg de subprodutos por ano	Março-Agosto	Sim	ASSOCIAÇÃO TRANSUMÂNCIA E NATUREZA
ALMOFALA	CACAN	Águeda Internac ional	PT	Sim	Fase experimental	Subprodutos animais provenientes de matadouros, salas de desmancha ou talhos	8	2000 a 3000 kg de subprodutos por ano	Março-Agosto	Sim	ASSOCIAÇÃO TRANSUMÂNCIA E NATUREZA
FIGUEIRA/ESCALHÃO	CACAN	Águeda Internac ional	PT	NOVO	Subprodutos animais provenientes de matadouros, salas de desmancha ou talhos		2000 a 3000 kg de subprodutos por ano	Março-Agosto	Sim	ASSOCIAÇÃO TRANSUMÂNCIA E NATUREZA	
SAN FELICES DE LOS GALLEGOS	ZPAEN MULAD ARES	Águeda Nacional	ES	Sim	Sim	Porcino, equino, avícola	3		Todo o ano		JUNTA CASTILLA Y LEÓN

LIFE Rupis

Location of existing vulture feeding stations



Figura 3. Localização dos CACAN na área de implementação da Estratégia de Alimentação Artificial de Britango, em 2016. Localização dos 3 novos CACAN na área de implementação da Estratégia de Alimentação Artificial de Britango.

6.5.2. Critérios para a implementação de novos CACAN

Tendo em conta a **segurança das aves necrófagas** que se alimentam nos campos de alimentação, a localização dos novos CACAN deve:

- **Garantir uma distância mínima de 500 m a instalações de linhas eléctricas de média ou alta tensão, e de 1 km a parques eólicos, para além de outras infra-estruturas já assinaladas;**
- Possuir, preferencialmente no interior da área vedada, uma **zona de maior elevação onde as aves necrófagas possam pouso antes e depois de se alimentarem**, para experimentarem segurança, acelerar o processo de acomodação e facilitar a saída do campo ao levantar voo;
- Garantir a existência de um declive de forma a facilitar a saída das aves do CAAN;
- **Evitar zonas com potencial perturbação** por parte de pessoas, em actividades lúdicas ou agrícolas.

De forma a garantir a utilização dos novos CACAN pelos vários casais de Britango presentes em determinada área de acção, a localização e construção dos campos deve cumprir os seguintes **requisitos ecológicos**:

- Assegurar uma **distância mínima de 2 km ao território de nidificação de Britango mais próximo**, para evitar o efeito de territorialismo;
- Assegurar uma **distância mínima de 2 km às arribas**;
- Assegurar uma **distância máxima de 10 km ao território de nidificação de Britango mais próximo**, de modo a garantir a rápida localização do alimento pelos indivíduos e o máximo de transportes de comida por parte dos adultos para o ninho, no período posterior à eclosão;
- Garantir uma **distância mínima de 5 km ao campo de alimentação mais próximo já instalado**, de forma a garantir a alimentação do máximo número de indivíduos adultos possível, assim como potenciar a alimentação de indivíduos imaturos, que poderão ocupar novos territórios ou substituir indivíduos de casais existentes;
- Garantir uma **distância mínima de 5 km ao ponto central de territórios de espécies com elevado comportamento territorial, como a Águia-real (*Aquila chrysaetos*) ou a Águia-de-Bonelli (*Aquila fasciata*)**, de forma a evitar confrontos interespécíficos que podem reduzir a eficácia do programa de alimentação artificial, colocando em risco a estabilidade e produtividade das espécies não-alvo.

Finalmente listam-se critérios relacionados com a **saúde pública e logística**:

- Assegurar uma **distância mínima de 500 m até ao curso de água superficial mais próximo**;
- Assegurar uma distância mínima de **500 m a zonas habitadas**;
- Assegurar uma **distância mínima de 500 m de estradas alcatroadas**, no entanto com **acesso razoável**.

6.5.3. Desenho de novos CACAN

De seguida, apresentam-se as características técnicas para a construção de novos CACAN.

Tabela 3. Características técnicas para a construção de novos CACAN.

Tipo de vedação	Deverá impedir o acesso de mamíferos carnívoros terrestres , de forma a evitar a dispersão de subprodutos animais
Altura da vedação	Mínimo 1,7 m , sempre que possível enterrada 0,3 m
Área/Superfície	Entre 0,5 e 1 hectares , dependendo da orografia do local e das espécies às quais é destinado. Em Espanha recomenda-se uma área de mais de 0,5 hectares
Acesso restrito	Acesso limitado a pessoas e veículos autorizados , não se permitindo a deposição de materiais não autorizados. Em Espanha deve haver uma única entrada e saída de veículos e/ou pessoas.
Placa informativa	Colocada à entrada do CACAN (ex.: CAMPO DE ALIMENTAÇÃO COMUNITÁRIO PARA AVES NECRÓFAGAS “nome escolhido”. Proibida a entrada a pessoas não autorizadas. Proibido depositar qualquer material não autorizado).
Vegetação	Sempre que possível, manter uma faixa de vegetação tanto no interior como no exterior , de largura total entre 1 e 2 metros, de forma a evitar a potencial perturbação por parte de pessoas; Devem ser deixadas algumas manchas de vegetação no interior dos campos de alimentação , para esconder pedaços de alimento para uma alimentação mais eficaz por parte do Britango (Figura 6).



Figuras 4 e 5. Fotografias ilustrativas do tipo de construção necessária para funcionamento de um CACAN (Palombar – CAAN Bruçó).

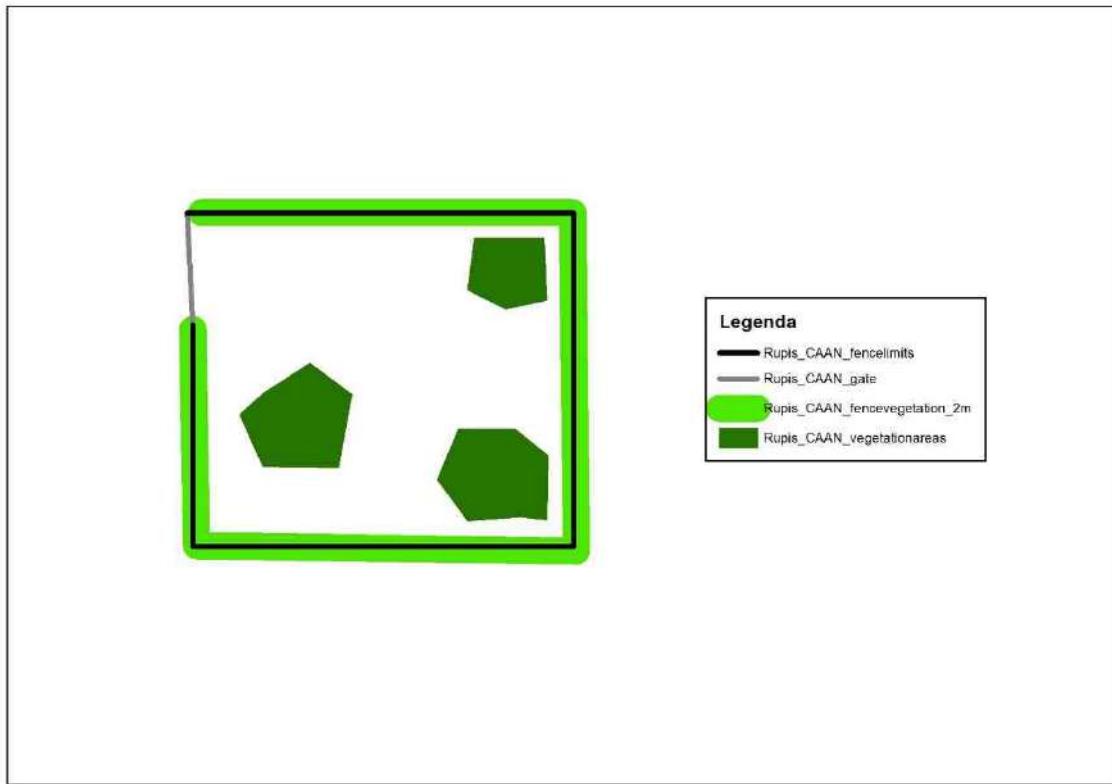


Figura 6. Modelo ilustrativo das áreas de vegetação a preservar nos campos de alimentação.



Rede de Campos de Alimentação de Aves Necrófagas e Zonas de Protecção de Alimentación de Espécies Necrófagas do Douro Internacional e Arribes del Duero

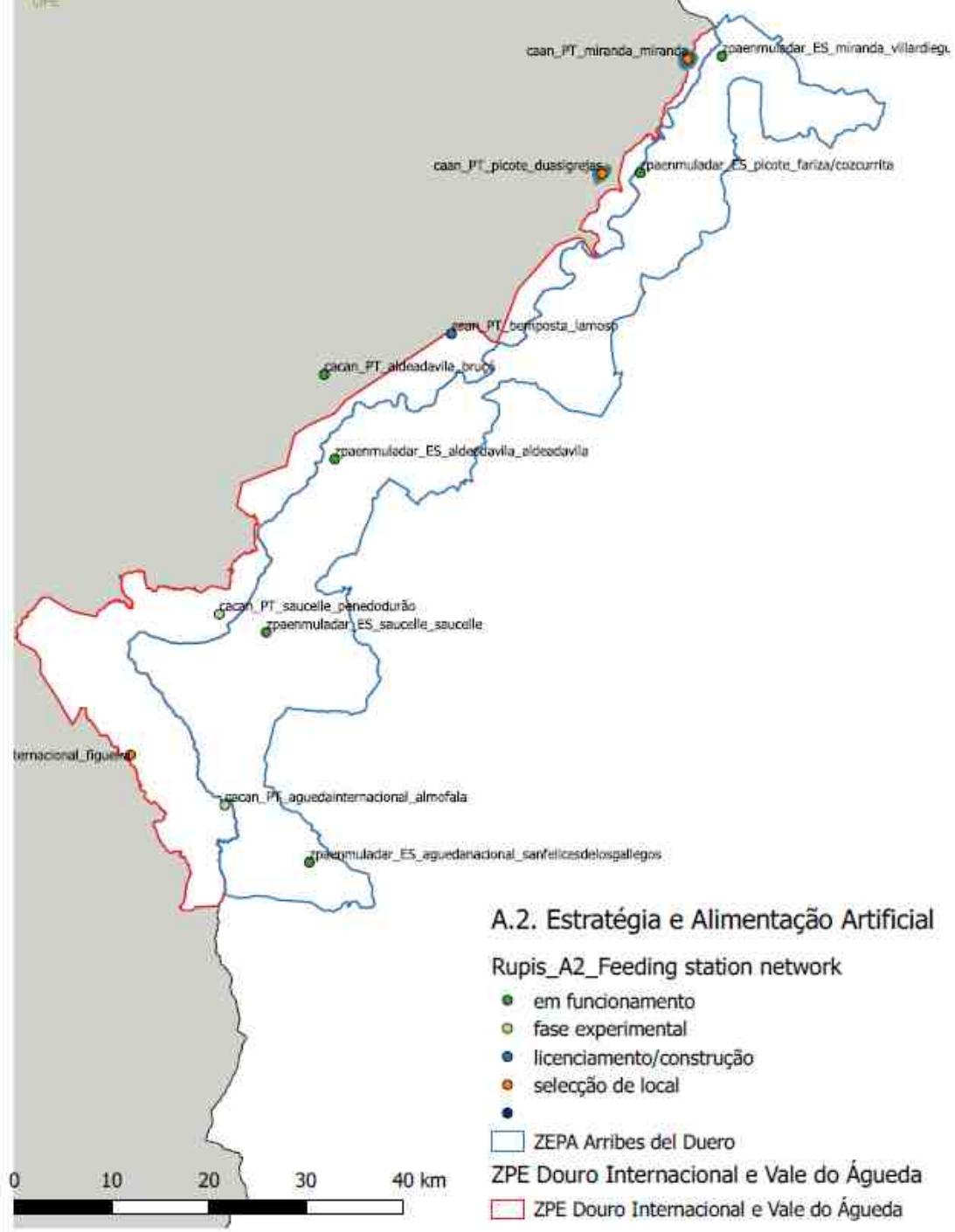


Figura 7. Rede de Campos de Alimentação de Aves Necrófagas e Zonas de Protecção de Alimentação de Espécies Necrófagas do douro Internacional e Vale do Águeda e Arribes del Duero. A verde - CAANs em funcionamento, a verde claro – em fase experimental, a azul - em processo de licenciamento ou construção e a laranja – possíveis localizações para construção dos CAANs previstos.

6.5.4. Processo de licenciamento de novos CACAN

A documentação (consultar ANEXO 3) deve ser enviada ao Instituto de Conservação da Natureza e Florestas (ICNF), que avalia sobre os **requisitos de biodiversidade e preservação de espécies**. O ICNF envia o processo à Direcção Geral de Alimentação e Veterinária (DGAV) para emissão de parecer sobre requisitos higiosanitários. Finalmente, o ICNF comunica à DGAV a autorização do CAAN, que o regista e divulga na lista disponível no portal online.

6.5.5. ZPAEN - Zonas de Alimentación de Aves Necrófagas (deposición de carroñas em campo) (ES)

6.5.6. Lista de ZPAEN autorizadas em Arribes del Duero

Até ao início de 2016 existiam no Parque Natural Arribes del Duero 43 ZPAEN autorizadas (Tabela 4 e Figura 8), número que tem vindo a aumentar anualmente com novos pedidos de autorização, sendo assim provável que no final de 2016 se chegue a ultrapassar as 50 explorações pecuárias autorizadas.

Tabela 4. Pedidos de autorização e autorizações concedidas por município para ZPAEN por explorações pecuárias entre 2013-2015, no Parque Natural Arribes del Duero.

Ano	2013		2014		2015		
	Municípios	Pedidos	Autorizadas	Pedidos	Autorizadas	Pedidos	Autorizadas
San Felices	1	1					
Hinojosa	3	0					
Villar de Buey			2	2			
Villalcampo			1	1			
Torregamones			1	0	1	1	
Lumbrales			1	1	1	0	
Vilvestre					1		
Mieza					1	1	

Sobradillo					1	1
Saucelle					1	1
Ahigal					1	1
Fariza					33	29
Fermoselle					3	3
Moralina					1	1
Totais	4	1	5	4	44	38

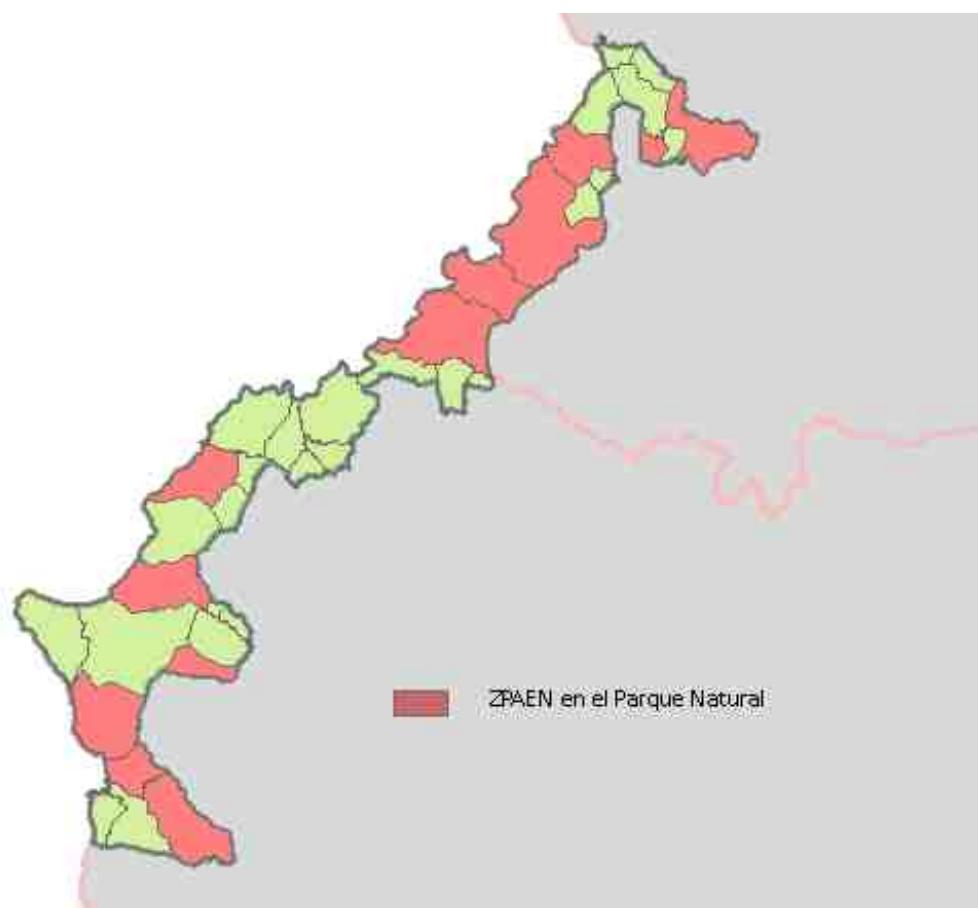


Figura 8. Municípios com autorizações concedidas para ZPAEN por explorações pecuárias entre 2013-2015 (vermelho), no Parque Natural Arribes del Duero.

6.5.7. Critérios para a implementação de ZPAEN

As explorações pecuárias que solicitem autorização para implementar uma ZPAEN devem obedecer aos seguintes critérios:

- Localizarem-se num dos municípios com áreas declaradas como zonas de protecção para alimentação das espécies necrófagas de interesse comunitário em Castilla y León, critério que é cumprido na totalidade da superfície do Parque Natural de Arribes del Duero;
- Estarem inscritas no Registo Oficial de Explorações Pecuárias (*Registro Oficial de Explotaciones Ganaderas - REGA*) em situação de alta;
- Não desenvolverem um regime de pecuária intensiva;
- Cumprirem a normativa em matéria de gestão, saúde e bem-estar animal que lhe seja aplicada;
- Cumprirem o programa de vigilância das encefalopatias espongiformes transmissíveis dos animais (EET), e em concreto, as provas previstas no Anexo II do Real Decreto 3454/2000, de 22 de Dezembro.
- Estarem sujeitas a vigilância periódica dos serviços veterinários oficiais e contem com uma classificação sanitária que não ponha em risco a saúde pública e a saúde animal e que estejam sujeitas ao controlo e vigilância de programas nacionais ou das autonomias de controlo, erradicação ou vigilância de doenças;
- Terem um sistema de gestão de cadáveres conforme a legislação que esteja em vigor a cada momento.

6.5.8. Processo de licenciamento de ZPAEN

Os pedidos de autorização podem ser apresentados por via electrónica ou em qualquer dos lugares que se mencionam no artigo 38.4 da Lei 30/1992, de 26 de Novembro, do Regime Jurídico das Administrações Públicas e do Procedimento Administrativo Comum. O modelo de pedido está disponível em <http://www.tramitacastillayleon.jcyl.es>.

Uma vez recebido o pedido, este será analisado pela Direcção Geral do Meio Natural y/o pelos responsáveis de saúde animal da Junta de Castilla y León. O prazo máximo para decisão e notificação da decisão é de 6 meses, e a notificação far-se-á por via postal.

A vigência das ZPAEN é indefinida, podendo ser suspensa ou revogada por incumprimento das condições estabelecidas no artigo 16 do Decreto 17/2013.

Os motivos que podem levar à suspensão cautelar ou revogação são:

- Se existe suspeita ou confirmação de transmissão de EET (Encefalopatias Espongiformes Transmissíveis) numa exploração pecuária, rebanho ou área autorizada, até que o risco seja eliminado;
- Se existe suspeita ou confirmação de presença de uma doença transmissível a pessoas ou animais numa exploração pecuária, rebanho ou área autorizada, até que o risco seja eliminado;

- Em caso de incumprimento de qualquer das normas previstas no Real Decreto 1632/2011, de 14 de Novembro e no Decreto 17/2013;
- Se se observam efeitos negativos sobre as populações de espécies necrófagas como electrocussões, colisão com linhas eléctricas, acidentes com aerogeradores ou outros efeitos negativos sobre o meio ambiente, a saúde animal ou a saúde pública;
- Se se observa um desequilíbrio relevante entre os cadáveres depositados e os consumidos pelas necrófagas por excesso de deposições ou por modificação das populações necrófagas na zona;
- Por mudança ou perda de condições sanitárias e zootécnicas das explorações pecuárias autorizadas.

6.6. -CAMAN – Campo de Alimentação Móvel de Aves Necrófagas (PT)

6.6.1. Critérios para a implementação de novos CAMAN

Tal como no caso dos CACAN, existem, no âmbito da presente estratégia, critérios para a implementação de CAMAN, nomeadamente tendo em conta a segurança das aves necrófagas que aí se alimentam. Assim, a escolha da localização de instalação temporária de CAMAN deve:

- Garantir uma **distância mínima de 500 m a instalações de linhas eléctricas de média ou alta tensão**, e de **1 km a parques eólicos**, para além de outras infra-estruturas já assinaladas;
- Possuir, preferencialmente no interior da área vedada, **uma zona de maior elevação onde as aves necrófagas possam pouso antes e depois de se alimentarem**, para experimentarem segurança, acelerar o processo de acomodação e facilitar a saída do campo ao levantar voo;
- Garantir a **existência de um declive** de forma a facilitar a saída das aves do CAMAN;
- Evitar zonas com potencial perturbação por parte de pessoas, em actividades lúdicas ou agrícolas.

De forma a garantir a utilização dos CAMAN pelos vários casais de Britango presentes em determinada área de acção, a localização deve cumprir os seguintes requisitos ecológicos:

- Garantir uma **distância mínima de 5 km ao ponto central de territórios de espécies com elevado comportamento territorial**, como a Águia-real ou a Águia-de-Bonelli, de forma a evitar confrontos interespecíficos que podem reduzir a eficácia do programa de alimentação artificial, colocando em risco a estabilidade e produtividade das espécies não-alvo.

Finalmente listam-se critérios relacionados com a saúde pública e logística:

- Assegurar uma **distância mínima de 500 m até ao curso de água superficial mais próximo**;
- Assegurar uma **distância mínima de 500 m a zonas habitadas**;

- Assegurar uma **distância mínima de 500 m de estradas alcatroadas**, no entanto com acesso razoável.

6.6.2. Processo de licenciamento de CAMAN

Em Portugal, serão implementadas pelo menos dois CAMAN em modo experimental, um em Miranda do Douro (sector Miranda) e outro em Fornos (sector Saucelle), sem sobreposição com a rede de CACAN. O processo de licenciamento para estes alimentadores é o mesmo que com o resto dos CACAN, dependendo da aprovação do ICNF e DGAV.

As explorações propostas pelas organizações ao ICNF para este efeito serão alvo de registo como operadores que utilizam subprodutos animais; as explorações onde irão ser disponibilizados cadáveres de animais às aves necrófagas fora de campo de alimentação serão objecto de um **protocolo entre o proprietário da exploração, o ICNF e a DGAV**.

Apenas serão aceites pedidos relativos a explorações que tenham um **médico veterinário responsável**, devendo constar do pedido uma declaração de compromisso do mesmo.

São elegíveis para esta finalidade **explorações de pequenos ruminantes em regime extensivo**, mediante avaliação prévia por parte da DGAV no que se refere ao **estatuto sanitário** em relação a doenças como a brucelose e as EET, que cumpram os **programas sanitários** em vigor; podem ainda ser consideradas para este efeito, **explorações de suínos em regime extensivo**, classificadas como em saneamento ou indemnes no âmbito do PCEDAujeszky.

O acompanhamento da situação sanitária das explorações registadas para este efeito cabe à DSAVR respectiva, a qual, caso ocorra alteração da elegibilidade por motivos sanitários ou outros, deve notificar de imediato o proprietário da exploração da suspensão da autorização concedida, informando deste facto o ICNF e ficando de imediato revogado o protocolo estabelecido.

Independentemente da espécie animal, **apenas podem ser utilizados os cadáveres dos animais da própria exploração**, não podendo ser transportados cadáveres de uma exploração para outra.

No caso de cadáveres de ovinos e caprinos, se provenientes de animais com menos de 18 meses, não é necessário serem testados para despiste de EET; se provenientes de animais com mais de 18 meses de idade, 4% dos mesmos são necessariamente testados com resultado negativo para despista das EET.

O proprietário da exploração é o responsável pelos custos da colheita do material, e pelo encaminhamento da amostra para o laboratório autorizado; a DGAV assegura o pagamento da realização da análise ao laboratório.

Por motivos do âmbito da preservação de espécies deve ter previamente o aval do ICNF.

A exploração mantém actualizado o **modelo 1025/DGAV**, onde regista todas as deposições de cadáveres, cuja cópia remete ao ICNF com periodicidade semestral; os modelos, devidamente preenchidos, devem ser guardados durante, pelo menos, dois anos. O ICNF enviará semestralmente à DGAV, via correio electrónico, um relatório sobre os cadáveres utilizados fora dos campos de alimentação que será cruzado com os dados fornecidos pelos proprietários das explorações ao SNIRA.

A DGAV, através das DSAVR, valida o estatuto sanitário das explorações autorizadas para a alimentação de aves necrófagas fora dos CAAN e procede aos necessários controlos oficiais; o ICNF procederá à supervisão do cumprimento dos procedimentos do âmbito das suas competências.

7. Manual de funcionamento da rede de CACAN/CAMAN (PT) para a alimentação artificial do Britango

O protocolo que aqui se apresenta irá ser implementado em Portugal.

7.1. Período de funcionamento

O programa de alimentação artificial dirigido ao Britango será executado entre 2016 e 2019, nos meses em que a espécie-alvo está presente na área de implementação, ou seja, de **Março a Agosto**. Poderá ser feito um **esforço complementar**, se se verificar necessário, na **última quinzena de Fevereiro**, período em que os indivíduos regressam aos territórios e na **primeira quinzena de Setembro**, até os adultos partirem novamente em migração.

7.2. Frequência e horário de deposição de alimento

Estão planeadas **50 sessões de alimentação artificial por ano em cada campo de alimentação**. De modo a garantir este número será necessário fornecer alimento **em média duas vezes por semana**, considerando o período incluído de Fevereiro e Setembro.

Recomenda-se que o fornecimento de alimento não ocorra em dias consecutivos, deixando um **intervalo de 2 a 3 dias entre sessões de alimentação**, de modo a espaçar a disponibilidade de alimento ao longo da época e para que a distância entre dias de alimentação não seja demasiado alargada.

O fornecimento de alimento pode não ser estritamente regular ao longo da época; é **plausível que a frequência de alimentação seja aumentada a partir da segunda metade da**

época, aquando do nascimento das crias e quando se verifica uma maior necessidade de alimentação e transporte de comida por parte dos adultos para o ninho.

De igual modo é importante **não efectuar o fornecimento de alimento sempre nos mesmos dias** aos mesmos campos, de modo a evitar previsibilidade nos fornecimentos, e potenciar o comportamento natural na busca de alimento e reduzir ao máximo a habituação.

Recomenda-se que os fornecimentos sejam feitos **preferencialmente nas horas iniciais do dia**, o mais próximo do nascer do Sol que for possível, para que os indivíduos de Britango cheguem primeiro ao campo de alimentação, aproveitando a sua maior actividade e capacidade de voo, não tão dependente das condições climatéricas como o Grifo.

No entanto, pode ir-se variando ligeiramente o horário dos fornecimentos, para favorecer o comportamento natural da espécie na busca de alimento, especialmente dentro dos territórios de Britango abrangidos por cada campo.

7.3. Tipo e quantidade de produtos a utilizar

Numa fase inicial de adaptação dos indivíduos aos campos de alimentação, devem ser usados **subprodutos animais provenientes de matadouros, salas de desmancha ou talhos ou e cadáveres de ovinos e caprinos, de idade não superior a 18 meses**.

Em casos excepcionais, poderão ser utilizadas na deposição de alimento carcaças de **grandes herbívoros** complementadas com deposição dispersa de restos e subprodutos animais provenientes de matadouros ou salas de desmancha. As carcaças de grandes herbívoros poderão desempenhar um papel de aglomeração dos Grifos a comer e a desmanchar o cadáver, deixando disponível os restos dos matadouros e salas de desmancha para os Britangos. Deixando peças inteiras implica que os Grifos demorarão mais tempo a alimentar-se, no cadáver - pela dificuldade de despadaçamento da cadáver - deixando os restos dispersos para o Britango. Por outro lado, contribui para a solução de diversos produtores de equideos no que diz respeito à eliminação dos cadáveres, já que neste momento, e com a alteração da legislação, a eliminação de cadáveres de equídeos pelo SIRCA acarreta custos para os proprietários.

A **quantidade de alimento** a fornecer deve ser adequada ao número de indivíduos de Britango que frequenta um determinado CAAN, devendo ser em geral limitada entre **40 e 60 kg por sessão** (2000 a 3000 kg de subprodutos por ano, incluindo ossos), de modo a ser suficiente para alimentar o número médio de indivíduos de Britango que se alimentem em cada campo. A quantidade de alimento necessário pode ser calculada com base numa média de **200 gramas de matéria comestível por dia por indivíduo**.

Reduzindo a quantidade de alimento fornecida por sessão também é possível manter o comportamento natural das aves necrófagas e o seu papel no ecossistema, evitando uma habituação e dependência excessiva destas espécies aos campos de alimentação e obrigando-as a prospectar outras áreas ao longo do dia.

De modo a privilegiar a alimentação por parte do Britango e do Abutre-negro **devem ser usados pedaços de alimento mais pequenos**.

Aconselha-se a **dispersão e ocultação do alimento no campo de alimentação**, sobretudo pedaços pequenos de carne, **usando manchas de vegetação ou pedras** no interior do campo de alimentação, permitindo ao Britango caminhar pelo campo, explorando estes pedaços mais pequenos, que são ignorados por outras espécies maiores.

7.4. Origem

Os subprodutos animais para deposição nos campos de alimentação são provenientes de talhos locais, matadouros e salas de desmancha ou de explorações com estatuto sanitário B3 ou B4, classificados como adequados para consumo humano.

7.5. Procedimentos previstos para o controlo de riscos sanitários derivados da deposição de subprodutos animais não destinados a consumo humano (Decreto-Lei 204/90, Regulamento CE 1069/2009, Regulamento EU 142/2011)

O controlo sanitário e a emissão dos certificados sanitários serão realizados pelo médico veterinário responsável do campo de alimentação, sendo este autorizado para tal pela autoridade competente, neste caso a DGAV.

7.6. Transporte e deposição

No caso do uso em CACAN, os subprodutos animais serão recolhidos nos locais definidos, transportados em contentor estanque e depositados no interior do campo de alimentação, seguindo todos os procedimentos de segurança jurídica e sanitária. A deposição do alimento será feita por técnicos com experiência em alimentação artificial destas espécies.

Nas sessões de alimentação, os técnicos encarregados pela deposição do alimento deverão ter em consideração os seguintes aspectos:

- a) Usar equipamento de protecção pessoal, de forma a mitigar qualquer risco de contaminação com agentes patogénicos, podendo para o efeito usar fato, luvas e máscara.
- b) Após entrada e saída do recinto de alimentação, garantir sempre o fecho dos portões, para evitar a entrada de outros animais carnívoros e de pessoas alheias;
- c) Na recolha dos subprodutos confirmar e garantir a desinfecção prévia das caixas de transporte; para o efeito poderão deslocar-se ao matadouro ou local de desinfecção mais próximo. Nestes locais será emitida uma folha de desinfecção que deverá ser entregue à entidade que fornece os subprodutos ou cadáveres.

Deverá ter-se em conta todas as precauções para garantir o bom estado sanitário dos subprodutos animais a despositar nos CAAN.

7.7. Registo de informação previsto (documentação sanitária dos subprodutos animais a depositar e mecanismos de informação à autoridade competente)

Será executado um registo dos depósitos e da sua documentação sanitária, assim como o mecanismo de informação à autoridade competente mediante o “Livro de Registos do CAAN”, apresentado em anexo neste documento (ANEXO 4).

7.8. Plano de Monitorização

A monitorização da alimentação das aves necrófagas será feita através de **armadilhagem fotográfica com câmaras grande-angular**, de forma a permitir a recolha de dados sobre a quantidade e tipo de comida fornecida, assim como sobre uso do campo de alimentação pelas diferentes espécies.

Deve registar-se **todas as espécies presentes em cada sessão de alimentação, o seu número e idade, principais comportamentos e sucesso das estratégias de alimentação aplicadas**.

De forma complementar, serão realizadas **sessões de monitorização presenciais** para registar comportamento adicional das aves em voo sobre os campos de alimentação.

O protocolo de monitorização e recolha de dados está descrito no ANEXO 5.

8. Manual de funcionamento da rede de ZPAEN Muladares / ZPAEN (ES) para a alimentação artificial do Britango

O protocolo que aqui se apresenta é implementado em Espanha.

8.1. Período de funcionamento

O programa de alimentação artificial é implementado durante todo o ano quer para ZPAEN Muladares, como para ZPAEN.

8.2. Frequência e horário de deposição de alimento

A deposição de subprodutos animais pode ser feita pelo fornecedor com qualquer frequência, dentro dos limites de cadáveres estabelecidos, e em qualquer horário.

8.3. Tipo e quantidade de produtos a utilizar

A resolução da Direcção Geral estabelecer um número máximo de cadáveres cuja deposição é autorizada no campo para cada exploração pecuária.

8.4. Origem

Os subprodutos animais para deposição em ZPAEN Muladares e ZPAEN são provenientes apenas das explorações autorizadas.

8.5. Transporte e deposição

Permite-se apenas a utilização de ZPAEN a explorações pecuárias em regime extensivo, que devem deixar os cadáveres no campo, sem ser exigido qualquer transporte dentro da exploração até uma zona concreta.

8.6. Registo de informação previsto (documentação sanitária dos subprodutos animais a depositar e mecanismos de informação à autoridade competente)

Os responsáveis pelas ZPAEN Muladares e os titulares de explorações pecuárias acolhidas no âmbito do programa de alimentação de necrófagas em zonas de protecção devem, fornecer a seguinte informação sobre as operações realizadas no ano anterior, antes do dia 31 de Janeiro de cada ano, à Direcção Geral competente em matéria de conservação de fauna silvestre, de acordo com o Anexo VIII do Decreto 17/2013:

- Espécies necrófagas de interesse comunitário a que se destinam as deposições;
- Número de registo e/ou localização geográfica do Muladar autorizado e da zona de protecção para alimentação de espécies necrófagas de interesse comunitário;
- Estabelecimentos ou explorações de origem, especificando aqueles que são fornecedores de subprodutos categoria 1;
- Resumo anual de deposição ou não recolha de subprodutos num livro de registo, incluindo dados de biomassa total (em quilogramas), separados por espécie animal e por categoria de subproduto segundo o Regulamento (CE) n.º 1069/2009 do Parlamento Europeu, de 21 de Outubro de 2009.

Do mesmo modo, dever-se-á fornecer os dados de resultados de provas rápidas de detecção de EET, quando necessário, e que inclua o número de testes realizados para cada espécie.

A Direcção Geral do Meio Natural mantém um registo actualizado com as autorizações concedidas conforme os artigos 7 y 9, do decreto 17/2013, o qual inclui a seguinte informação:

- Dados do pedido de autorização para ZPAEN Muladares;
- Informação anual remetida obrigatoriamente pelo utilizador;
- As explorações localizadas nas zonas de protecção para alimentação de espécies necrófagas de interesse comunitário e que estão autorizadas.

As autoridades competentes em matéria de conservação de fauna silvestre e de saúde animal, no exercício das suas competências, velarão pelo cumprimento dos requisitos e obrigações dos titulares, responsáveis e instalações, realizando inspecções oportunas para comprovar o cumprimento da lei.

9. Revisão da estratégia

A presente estratégia será revista, com base nos dados existentes sobre a sua implementação, durante o primeiro trimestre de 2018 e, de novo durante o segundo trimestre de 2019.

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“Egyptian Vulture and Bonelli’s Eagle Conservation in Douro/Duero Canyon”

LIFE14 NAT/PT/000855

-Action A3-

REVIEW REPORT

Analysis of biological and economic results of current implementation of EU sanitary regulations, and development of recommendations

August 2017

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Project:

Egyptian Vulture and Bonelli's Eagle Conservation in Douro/Duero Canyon - LIFE14NAT/PT/000855

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- EDP Distribuição – Energia, S.A
- Fundación Patrimonio Natural de Castilla y León
- Guarda Nacional Republicana (GNR)
- Instituto da Conservação da Natureza e das Florestas
- Junta de Castilla y León
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BACKGROUND

The Egyptian vulture is Europe's most threatened vulture species – classified as “Endangered” at global level. While the three others European vulture species are registering positive trends across Europe, Egyptian vultures continue to decline in most regions in the continent (and elsewhere).

The LIFE RUPIS project is tackling the most important threats to Egyptian vultures, namely food shortages, degradation of the habitat, electrocution risk and the illegal use of poison.

Egyptian vultures are part of the detrital food web of ecosystems and they provide the important ecological service of recycling carrion to prevent the accumulation of dead biomass, thereby contributing to waste removal, disease regulation, and nutrient cycling.

At the start of the 21st century, European avian scavenger communities were one of the few exceptions to the global decline in Old World avian scavenger birds. Asian and African vulture populations declined or are still declining dramatically as a consequence of ingestion of veterinary drugs (Asia) or due to illegal, indiscriminate and widespread poisoning (Africa). On the contrary, European vulture populations maintained or increased their numbers, partly due to conservation investment and effort, with the only exception being the Egyptian vulture, that is still declining.

However, between 1996 and 2000 the appearance of bovine spongiform encephalopathy swiftly became one of the most serious public health and political crises concerning food safety ever experienced in the European Union (EU). Subsequent sanitary legislation (Regulation CE 1774 / 2002) that greatly restricted the use of animal by-products not intended for human consumption led to profound changes in the management of livestock carcasses (i.e. the industrial destruction of around 80% of all animal carcasses), thereby threatening the last remaining healthy scavenger populations (vultures and other scavenging birds of prey) of the Old World and thus contradicting the EU environmental and conservation policies.

Several warning signs such as a decrease in breeding success, an increase in mortality in young vulture age classes and an apparent increase in the alleged number of cases of vultures “attacking” cattle, as well as a halt in population growth, suggest that the decrease in the availability of food resources has had harmful effects on vulture populations, and probably also on other scavenging raptors.

This led the EU to relax a bit the regulations and between 2003 and 2009 a number of dispositions to the EU regulations (322/2003, 830/2005 and 1069/2009) enabled conservation managers to adopt rapid solutions (i.e. the creation of vulture restaurants) aimed at satisfying the food requirements of vultures. However, these conservation measures may seriously modify habitat quality and may also have indirect detrimental effects on the sustainability and composition of avian scavenger populations and communities (favouring the larger species dominant at vulture feeding stations over the smallest ones – namely the Egyptian vulture – incidentally, because of this we have developed in this project a supplementary feeding strategy that favours the Egyptian vulture, see Action A2).

Pressure from conservation groups has forced further changes and a new regulation was finally adopted in 2011 (142/2011) that allows for some animal carcasses to be left out in the open for

vultures and other scavengers. This regulation is a complex compromise where the needs of carcass management, sanitary laws and food for avian scavengers are supposedly met. The resulting legislation is still very restrictive and leads to ambiguities and occasionally contradictions, and has been implemented in different ways at national or even regional levels, and in all cases only recently. In some countries (like Portugal) this most recent regulation has not yet been implemented, even though there are new procedures in final stage of implementation.

As part of LIFE RUPIS we had proposed to review the current practice on the implementation of the latest EU regulation on carcass disposal (Regulation 142/2011) in different regions in Spain (so far 10 autonomous regions have transposed this legislation, including Castilla y Leon), and their linkages to vulture feeding areas, and compare it with the situation in Portugal. The idea was to look at issues such as

- current legislative framework
- comparison of the transposition-adaptation of the latest relevant regulation, and its practical implementation, and identification of best practice.
- impact on vultures and other scavenging species (like the red kite) and on the network of vulture restaurants: practices and situation
- economics of the implementation of the 2011 regulation at national and/or regional level (cost, costs savings, etc.), when compared with the previous situation where carcasses had to be collected from the fields and destroyed (still being implemented in Portugal).

This action links partially with Action C2 (artificial feeding for Egyptian Vulture and black vulture) but mainly with Action C9 (Artificial feeding for vultures "outside feeders"). It will also link with action E2 (International Workshop on best practice and main issues on the transposition and national regulations of the relevant EU directives on carcass disposal and sanitary measures in the countryside).

In Portugal, the recent EU regulations have not yet been adequately implemented. We hope that this evaluation can contribute to the debate and help shape future national procedures.

INTRODUCTION

The recovery of European populations of avian scavengers was mainly due to the end of legal persecution in the 1960s and 1970s, and the ban on the use of poison implemented during the 1980s and 1990s. Moreover, in the 1990s and at the beginning of 2000s, the European Union (EU) introduced policies to bolster the conservation strategies used in the management of scavenger populations. Thus, the existence of breeding nuclei of these species became a basic criterion for defining Special Protection Areas for Birds (SPAs) and Sites of Community Importance (SCIs) (Donald et al. 2007). Within this framework, the EU-financed LIFE-Natura programmes were designed to directly manage and conserve local populations of threatened scavenger species, investing at least €57 million in 38 projects (<http://ec.europa.eu/environment/life>). Over 90% of European vultures live in EU member states. Of all European countries, Spain boasts the most important breeding populations of these scavenger species.

Between 1996 and 2000 the appearance of bovine spongiform encephalopathy swiftly became one of the most serious public health and political crises concerning food safety ever experienced in the European Union (EU). Subsequent sanitary regulations (EC 1774/2002) led to profound changes in the management of livestock carcasses (i.e. the industrial destruction of around 80% of all animal carcasses), thereby threatening the last remaining healthy scavenger populations of the Old World and thus contradicting the long-term environmental policies of the EU. Several warning signs such as a decrease in breeding success, an apparent increase in mortality in young age classes of vultures and an increase in the number of cases of vultures attacking and killing cattle, as well as a halt in population growth, suggest that the decrease in the availability of food resources has had harmful effects on vulture populations. Between 2002 and 2005, a number of dispositions to the EU regulations (2003/322/CE & 2005/830/CE) enabled conservation managers to adopt rapid solutions (i.e. the creation of vulture restaurants) aimed at satisfying the food requirements of vultures. However, these conservation measures may seriously modify habitat quality and have indirect detrimental effects on avian scavenger populations and communities.

Conservation managers and policy-makers need to balance the demands of public health protection and the long-term conservation of biodiversity. The regulations concerning carrion provisioning need to be more flexible and there needs to be greater compatibility between sanitary and environmental policies. We advocate policies that authorize the abandonment of livestock carcasses and favours populations of wild herbivores to help maintain populations of avian scavengers. Conservation strategies should be incorporated into new European Commission regulations, should aim to make public health and carcass-related ecological processes more compatible, thereby permitting scavenger species to benefit as before from extensive animal husbandry and, when necessary, supplementary feeding. This new regulation started to be effective in 2011 and is the main subject in this report.

In Europe, after the outbreak of bovine spongiform encephalopathy, a restrictive sanitary regulation (EC 1774/2002) prohibited the abandonment of dead livestock in extensive farming (extensive livestock breeding) in the field, which led to negative consequences for scavengers. As an attempt to mitigate this negative impact, in 2011 a new regulation was approved ([EC 142/2011](#)) to allow farmers to leave some carcasses of cattle raised in extensive systems in the so-called ‘Protection areas for the feeding of necrophagous species of European interest’ (PAFs).

LEGISLATIVE FRAMEWORK

European Union legislation:

- Regulation (EU) No 142/2011 of 25 February 2011 laying down detailed rules for the implementation of Regulation (EC) No 1069/2009 of the European Parliament and of the Council on the rules applicable to animal by-products and derived products not intended for human consumption, and Council Directive 97/78/EC as regards certain samples and units exempt from veterinary checks at the border
- Regulation (EC) No 1069/2009 of the European Parliament and of the Council of 21 October 2009 laying down sanitary rules concerning animal by-products and derived products not intended for human consumption and repealing Regulation (EC) No 1774/2002 (Regulation on animal by-products)
- Regulation (EC) No 853/2004 of the European Parliament and of the Council of 29 April 2004 laying down specific hygiene rules for food of animal origin
- Regulation (EC) No 322/2003 (12 May), changed by Regulation (EC) No 830/2005 (25th November), with a permanent derogation for the use of materials of category 1 in feeding some scavenging species in specific zones (Portugal Spain, Greece, Italy and Cyprus)
- Regulation (EC) No 1774/2002 of the European Parliament and of the Council of 3 October 2002 laying down sanitary rules concerning the use of animal by-products not intended for human consumption (category 1) for feeding necrophagous species
- Regulation (EC) No 999/2001 of the European Parliament and of the Council of 22 May 2001 laying down rules for the prevention, control and eradication of certain transmissible spongiform encephalopathies

Spanish National legislation:

Real Decreto 1528/2012, de 8 de noviembre, por el que se establecen las normas aplicables a los subproductos animales y los productos derivados no destinados al consumo humano, cuyo objeto fundamental ha sido establecer disposiciones específicas de aplicación en España del Reglamento (CE) n.º 1069/2009 del Parlamento Europeo y del Consejo, es otra de las normas que deben ser tenidas en cuenta.

- Royal Decree 1632/2011 of 14 November, regulating the feeding of certain species of wild fauna with animal by-products not intended for human consumption
- Royal Decree 664/2007, of 25 May, regulating the feeding of necrophagous raptors with animal by-products not intended for human consumption
- Royal Decree 1098/2002 of 25 October, regulating the feeding of necrophagous raptors with certain dead animals and their products

Spanish Regional legislation:

- Spanish Decree 68/2009, of 24 March, which regulates the specific provisions for the application of the community and state regulations in the matter of animal by-products not destined for human consumption in the **Autonomous Community of Andalusia**
- Decree 120/2012, of 07/26/2012, which creates the network of feeding necrophagous species of Castilla-La Mancha and regulates the use of animal by-products not intended for human consumption to feed certain wildlife species in the territorial area of **Castilla-La Mancha**
- Decree No. 90/2010, of 7 May, which creates the “Muladares Network” for Necrophagous Raptors Birds managed by the **Autonomous Region of Murcia**
- Decree 102/2009, of 26 May, of the Government of Aragon, which regulates the authorization of the installation and use of feeders for the feeding of necrophagous raptors with certain animal by-products not intended for human consumption, and network of feeders of **Aragon**
- Order of May 2, 2012, jointly by the Ministries of Agriculture and Fisheries and Environment, which develop standards for the control of animal by-products not intended for human consumption and animal health, in game hunting of **Andalusia**
- Order GAN/30/2012, of May 4, regulating the feeding of certain species of wildlife necrophagous with animal by-products not intended for human consumption from livestock farms in the protection zones, in the Autonomous Community of **Cantabria**
- Foral Order 259/2006, of June 27, of the Councillor for the Presidency, Justice and Interior, which creates a network of carrion bird feeders of the Foral Community of **Navarra** and rules are set for its operation
- Order AAM / 387/2011, of 23 November, concerning the feeding of species necrophages of Community interest (**Catalonia**)
- Resolution No. 489, dated 22 May, of the Councillor for Agriculture, Livestock and Environment, which delimits the protection zones for the feeding of necrophagous species of community interest (**La Rioja**)
- Resolution of June 18, 2012 of the Directorate General of Natural Environment, which delineates the protection zones for the feeding of necrophagous birds (**Comunidad Valenciana**) Regional legislation

Decreto 17/2013, de 16 de mayo, por el que se desarrolla en Castilla y León el uso de determinados subproductos animales no destinados al consumo humano para la alimentación de especies necrófagas de interés comunitario. El presente decreto se dicta por tanto en el ejercicio de las competencias de desarrollo normativo y ejecución de la normativa estatal, que la comunidad autónoma tiene en materia de protección del medio ambiente y sanidad animal, de conformidad con lo dispuesto en el artículo 71.1 apartados 7.^º y 9.^º respectivamente del Estatuto de Autonomía de Castilla y León.

Portuguese National legislation:

Regulation (Decreto-Lei) n.º 122/2006 (27th June), aims to secure an adequate execution and secure the legal requirements from the obligations imposed by Regulation 1774/2002 (in the meantime revoked by Regulation 1069/2009).

Regulation (Decreto-Lei) n.º 26/2006 (10th February), changes the regulation n.º 387/98, to adapt to the new measure of protection against transmissible spongiform encephalitis, and to the EU's classification of the sub-products of animal origin, as well as to the sanitary rules about their transport, stocking, transformation, use or destruction, annulling the regulation n.º 211-A/2001 (31st July)

Regulation (Decreto-Lei) n.º 387/98 (4th December), restricting the use of some products of bovine, ovine and caprine origin in the human and animal food

Regulation (Decreto-Lei) n.º 204/90 (20th June), established measures of protection of wildlife, including scavengers

ADOPTION OF THE RELEVANT REGULATION IN SPAIN

This legislation (EC 142/2011) was applied in Spain through the Royal Decree 1632/ 2011, which urged every autonomous community (region) to design their own PAF network, with implementation in 2013 as responsibility and competence of the Autonomous Regional Spanish Governments. The PAFs must be included in Natura 2000 with the presence of necrophagous species of European interest, areas devoted to conservation plans of such species and/or important areas for the feeding of these species. The design criteria for establishing the PAFs are established by the Autonomous Regional Spanish Governments so they are variable between the different regions. In continuation, you find a table summarizing those criteria by autonomous region (**Table 1**).

Once PAFs are approved, every farm within their limits must apply for permission to abandon carcasses in the field; also, farms have to meet several technical (e.g. only livestock in extensive farming) and sanitary requirements (see [Royal Decree 1632/2011](#) for more details). This new regulation was well received among conservationists and wildlife managers (Margalida et al. 2012).

This Royal Decree contributes in the vulture feeding in several aspects:

- Delimitation of protection zones for feeding necrophagous species of EU interest;
- Feeding at feeding sites or muladares*;
- Feeding on extensive farms included in protection areas, without previous collection of corpses,
- Feeding with category 3 hunting by-products (Article 18.1 of Regulation EC 1069/2009 and Articles 4, 5 and 8 of the Royal Decree).

Table 1. criteria for the establishment of PAFs per Spanish Autonomous Region

Region	Design criteria
Andalusia	<i>Distribution area of scavengers Gypaetus barbatus, Gyps fulvus, Aegypius monachus, Neophron percnopterus and partially Aquila chrysaetos, Aquila adalberti, Milvus milvus and Milvus migrans</i>
Aragon	<i>List of relevant municipalities+</i>
Asturias	NA
Basque Country	<i>Special Protection Areas (SPAs) and Sites of Community Importance (SCIs) of the Natura 2000 and other protected areas and lands above 500 or 700 metres altitude (depending on the region)</i>
Cantabria	<i>Public Utility Forest</i>
Castile La Mancha	<i>List of regions and relevant municipalities</i>
Castile and Leon	<i>List of relevant municipalities</i>
Catalonia	<i>Public forests or other lands above 1400 metres</i>

* Spanish traditional large feeding sites

+ Where the authorities deem that there are necrophagous species

	<i>altitude and list of relevant municipalities</i>
Extremadura	<i>All municipalities of the Region</i>
Galicia	<i>NA</i>
La Rioja	<i>List of municipalities fully or partially included in the Natura 2000 and municipalities not included in the Natura 2000</i>
Madrid	<i>NA</i>
Murcia	<i>NA</i>
Navarre	<i>All municipalities, except those within the area of influence of the Pamplona-Noáin airport</i>
Valencian Community	<i>Special Protection Areas (SPAs) of the Natura 2000</i>

IMPLEMENTATION OF THE RELEVANT REGULATION IN SPAIN

Establishment of the PAFs

By the end of 2015, thirteen of the 17 autonomous communities (Andalusia, Aragon, Cantabria, Castilla-La Mancha, Castilla y León, Catalonia, Valencia, Extremadura, La Rioja, Murcia, Navarra and the Basque Country) had officially approved PAFs where some carcasses could be left on the ground. As a result, the percentage of autonomous communities with their own rules delimiting the protection zones for the feeding of necrophagous species reaches 76.4%.

Figure 1. Map of regions of peninsular Spain, indicating if they have approved or drafted specific regulations regarding PAFs*.



* Data source: MAGRAMA Report 2015. *Evaluación del cumplimiento del R.D. 1632/2011, de 14 de noviembre, por el que se regula la alimentación de determinadas especies de fauna silvestre con subproductos animales no destinados a consumo humano.*

Authorization of supplementary feeding sites

13 autonomous communities that are outlined in the following table (**Table 2**) have sent updated information regarding the supplementary feeding sites authorized for the years 2014 or 2015.

Table 2. Number of authorized supplementary feeding sites, biomass supplied (in kg) and number of authorized providers of animal by-products not intended for human consumption in different Autonomous Communities.

Autonomous Communities	Nº Feeding sites	Kg Supply per year	Nº Suppliers of corpses
Aragon	49	1.597.163	2.896
Baleares	0	0	0
Cantabria	0	0	0
Castilla-La Mancha	39	353.673	118
Castilla y León	54	500.435	438
Cataluña	17	166.080	
Comunidad Valenciana	4	117.085	26
Extremadura	23	68.107	
Galicia	0	0	0
La Rioja	5	33.900	12
Madrid	0	0	0
Murcia	1	0	0
Navarra	16	316.189	
TOTAL	208	3.152.632	3.490

Number of authorized extensive farms for the abandonment of carcasses

In 2015, eight autonomous communities have granted authorizations to extensive livestock farms for feeding of necrophagous species without the need for removal of carcasses, although precise data are not available for Catalonia. The total number of farms in Spain is 7,005, as reflected in the following table (**Table 3**).

Table 3. Number of authorized farms to feed necrophagous species of EC interest with livestock carcasses, without prior removal, in PAFs, authorized biomass (in kg) of deposit and biomass (in kg) finally contributed in authorized farms, in different autonomous communities. * Authorized for implementation in 2016.

Autonomous Communities	Nº Authorized farms	Annual biomass prevision at the authorized farms (kg)	Actual biomass prevision at the authorized farms (kg)
Andalusia	2.439 (2013 data)		
Aragon	6		
Baleares	0	0	0
Cantabria	0	0	0
Castilla-La Mancha	940	1.829.795	529.881
Castilla y León	1.273	1.101.030	
Comunidad Valenciana	0	0	0
Extremadura	876*	792.014	
Galicia	0	0	0
La Rioja	337	116.509	116.509
Madrid	0	0	0
Murcia	0	0	0

Navarra	1.134	826.000	
TOTAL	7.005	4.665.348	

Authorization of the use of category 3 by-products coming from hunting

At least five Autonomous Communities (Andalusia, Castile-La Mancha, Castile and Leon, Catalonia and Extremadura) have granted limited permits for the deposit of category 3 animal by-products during the hunting season of 2014-2015. Most of these by-products have gone to authorized supplementary feeding sites.

It is necessary to indicate that in the different Autonomous Communities of the center, east and north of Spain, the system of collection animal by-products does not apply to the management regulations of SANDACH. That is, only rests of hunted animals not intended for sale, the carcasses of which are intended for consumption in small quantities by people. This is the case of Castilla y León, where the remains of these hunted animals may be available to feed necrophagous species without legal requirements, without prejudice to compliance with good hunting practices.

Trophic requirements of necrophagous species in Spain

Table 4 shows an estimate of the biomass needs of necrophagous species in Spain, based on scientific and technical publications examined by the General Sub-directorate of the Natural Environment of MAGRAMA, on individual daily requirements, the proportion of carrion in their diet and population size (see bibliographic references for the various superscripts listed).

Table 4. Estimated individual and population trophic requirements, in kg, for the different priority necrophagous species according to Royal Decree 1632/2011, of February 14, following bibliographical references indicated in the corresponding section (end of document).

Species	Daily individual requirements (kg biomass)	Nº pairs	Nº territorial individuals approx.	Floating population approx.	Total estimate individuals Nº	Percentage of carrion in diet	Days per year of presence	Total biomass (kg/year)
Bearded Vulture	0,4 ¹	134 ⁸	290	200	490	1,0	365	71.540
Griffon Vulture	0,52 ¹	24.609 ⁹	49.218	15.000	64.218	1,0	365	12.188.576
Black Vulture	0,57 ²	2.068 ¹⁰	4.136	1.000	5.136	1,0	365	1.068.544
Egyptian Vulture	0,2 ¹	1.452 ¹¹	2.904	200	3.104	1,0	200	124.160
Imperial Eagle	0,26 ³	409 ¹²	818	300	1.118	0,04 ¹⁸	365	5.304
Golden Eagle	0,3 ⁴	1.553 ¹³	3.106	600	3.706	0,05 ¹⁹	365	20.290
Red Kite	0,2 ⁵	2.176 ¹⁴	4.352	800	5.152	0,05 ²⁰	365	18.804
Kite	0,17 ⁵	10.300 ¹⁵	20.600	1.500	22.100	0,1 ²¹	200	75.140
Wolf	1,7 ⁶				2.000 ¹⁶	0,4 ²²	365	496.400
Bear	15 ⁷				275 ¹⁷	0,07 ²³	310 ²⁴	90.750
Total								14.159.508

According to the above table, the estimate of the biomass needs of the necrophagous species in Spain, would be around 14,000 MT/year.

According to the distribution of the breeding population of necrophagous species among the autonomous communities, **Table 5** presents a proposal for the distribution of annual trophic requirements. Based on the information on animal by-product contributions made by the 13

autonomous communities (where information available), the table has assessed the level of adequacy of the biomass requirements of these species. In this sense, it is necessary to take into account that necrophagous species consume carrion from sources other than those derived from official food programs, both from domestic cattle (approximately 65-80%, 40%, 25-43% and (35-20%, 60%, 75-57% and 72% for Black vulture, Griffon vulture and Bearded vulture respectively, 2, 24, 25, 26, 27, 28), so the needs coverage data need to be carefully evaluated.

Table 5. Trophic requirements of the necrophagous species covered in the framework of feeding programs managed or supervised by the different Autonomous Communities.

Autonomous Communitie	Biomass needs (kg)	% of the total needs	Kg. supplied food	% of the needs fulfilled
Andalusia	1.635.006	11,5	No data	No data
Aragon	2.515.901	17,8	1.597.163	63,5
Asturias	233.070	1,6	0	0,0
Baleares	136.484	1,0	0	0,0
Canarias	2.483	0,0	No data	No data
Cantabria	142.877	1,0	0	0,0
Castilla-La Mancha	1.459.375	10,3	883.554	60,5
Castilla y León	3.344.842	23,6	1.601.465	47,8
Cataluña	526.712	3,7	166.080	31,5
Extremadura	1.497.755	10,6	860.121	57,4
Galicia	131.117	0,9	0	0,0
Madrid	304.640	2,2	0	0,0
Murcia	1.157	0,0	0	0,0
Navarra	1.361.407	9,6	1.142.189	83,9
País Vasco	372.027	2,6	No data	No data
La Rioja	369.559	2,6	150.409	40,7
Com. Valenciana	125.096	0,9	117.085	93,6
Total Spain	14.159.508		6.518.066	46,0

As a conclusion of the above table, Aragon, Castilla-La Mancha, Extremadura, Navarra and Valencian Community, have all values of over 50% on the estimated coverage of necrophagous species foraging needs covered by the livestock sanitary policies implemented (either through supplementary feeding sites or through abandonment of carcasses in extensive farms). In general, there is a positive progress in all the autonomous communities that develop official programs for the feeding of necrophagous species, in relation to the fulfilment of their nutritional needs.

Figure 2. Spatial distribution of carrion biomass availability (t) per 10 x 10 km grid per year and protection areas for the feeding of necrophagous species (PAFs) in peninsular Spain. [Figure can be viewed at wileyonlinelibrary.com].

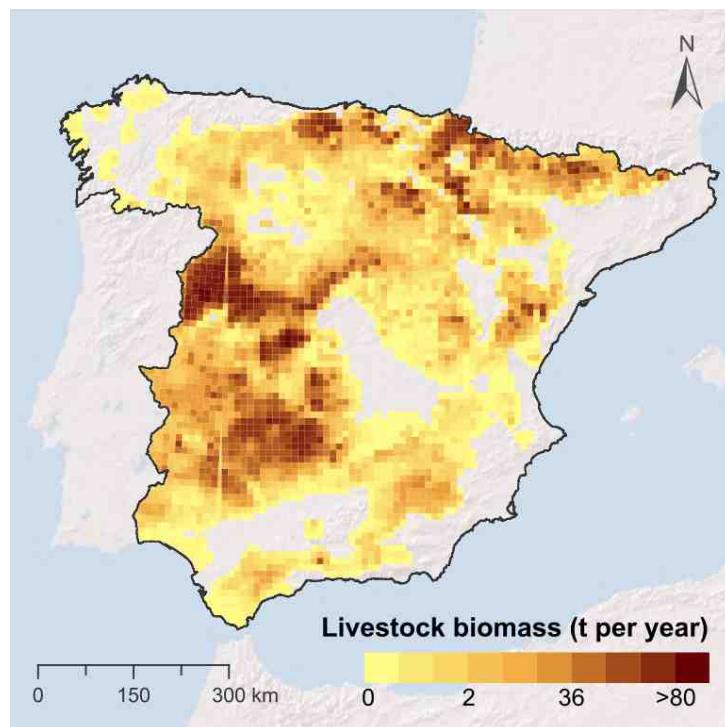
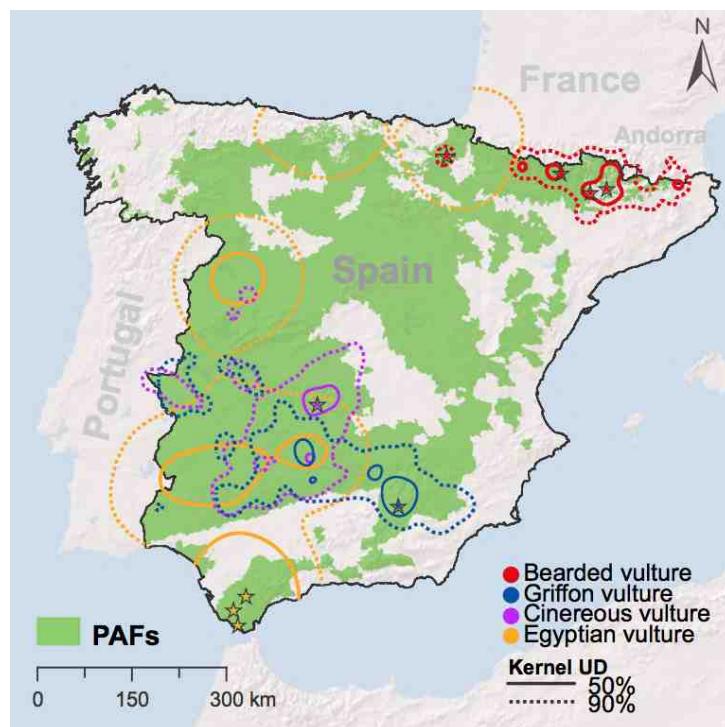


Figure 3. Spatial distribution of home ranges (k50% and k90% UD) of vultures and protection areas for the feeding (PAFs) of necrophagous species in peninsular Spain. Stars show places of capture. [Figure can be viewed at wileyonlinelibrary.com].



IMPACT ON VULTURES AND OTHER SCAVENGING SPECIES

In order to know the effects of different regulations on the management of animal by-products not intended for human consumption on vulture populations in Spain, several variables could be considered:

- Population size and evolution of reproductive indexes;
- Negative effects in individuals more sensitive to the availability of food (eg juvenile specimens less expert in the search and acquisition of food),
- Interactions with economic farming activities in the rural areas.

Population size and reproductive parameters could be revealed with updated data on censuses of species of vultures and other necrophagous species at national level. Unfortunately, this information is not available, as the national census for the Griffon vulture, Black vulture and the Egyptian vulture have not been carried out since 2008 – the next griffon national census is now planned for next year (2018).

Entrance of necrophagous birds in wildlife recovery centers

In relation to the effects on the health status of individuals, data on the temporal evolution of the registration of individuals in official recovery centers can be used as a proxy to know the impacts of the policies impacting on food availability on the populations of necrophagous birds. To do this, we can use the data on entrance of black and griffon vulture in recovery centers due to causes related to a possible lack of food (malnutrition, dehydration, inexperience, disorientation, ...), and compare it with other causes (intoxication, trauma, shooting, etc.), in two different periods in six autonomous communities (before -2002-2007- and after -2010-2015- the entry into force of EC Regulation 1069/2009 and Royal Decree 1632/2011, **Figure 4**). The results of entrances of vultures for five Autonomous Communities with data only for the period 2010-2015 are also presented (**Figure 5**).

Figure 4. Temporal evolution of the number of incoming Black and Griffon vulture in official recovery centers of the Autonomous Communities of Castile and Leon, Catalonia, Extremadura, Murcia, Navarra and Comunidad Valenciana, due to causes related to a possible food shortage, prior to the entry into force of Regulation CE1069/2009 and after.



Figure 5. Temporal evolution of the total number of incoming Black and Griffon vulture in official recovery centers of the Autonomous Communities of Aragon, Baleares, Cantabria, Galicia and Madrid, for the period 2010-2015 (after entry into force of the Regulation CE1069 / 2009). For the year 2015, only the data for Aragón are included until September.



Claims of damages by “attacks” of necrophagous species on live cattle

In the last few years, with the increase in some populations of scavenging birds, and with the changes in the policies affecting the availability of their food, some claims started to appear that some obligatory scavenging species like griffon vulture were starting to “attack” cattle. The VCF has recently published a position paper on this issue (see in the Annex).

In this sense, claims of “attacks” by vulture species on live cattle can be indicative of both changes in feeding behaviour of these species and social perception factors on the acceptance of these species. For this reason, **Figure 6** shows the evolution of data submitted by eight autonomous communities in relation to the total number of complaints received from “attacks” (spotted or untested, checked or discarded) from vultures to live cattle. The data are shown for two different

periods: before 2002-2007 and 2010-2015, after the entry into force of Regulation EC 1069/2009 and Royal Decree 1632/2011.

Figure 6. Temporal evolution of the number of complaints received in the autonomous communities of Aragon, Balearic Islands, Castile and Leon, Catalonia, Extremadura, Murcia, Navarra and Comunidad Valenciana by attacks on live cattle by vultures (Griffon vulture and/or Black vulture), for the periods 2002-2007 (before the Regulation EC1069 / 2009) and 2010-2015 (after the Regulation EC1069 / 2009).

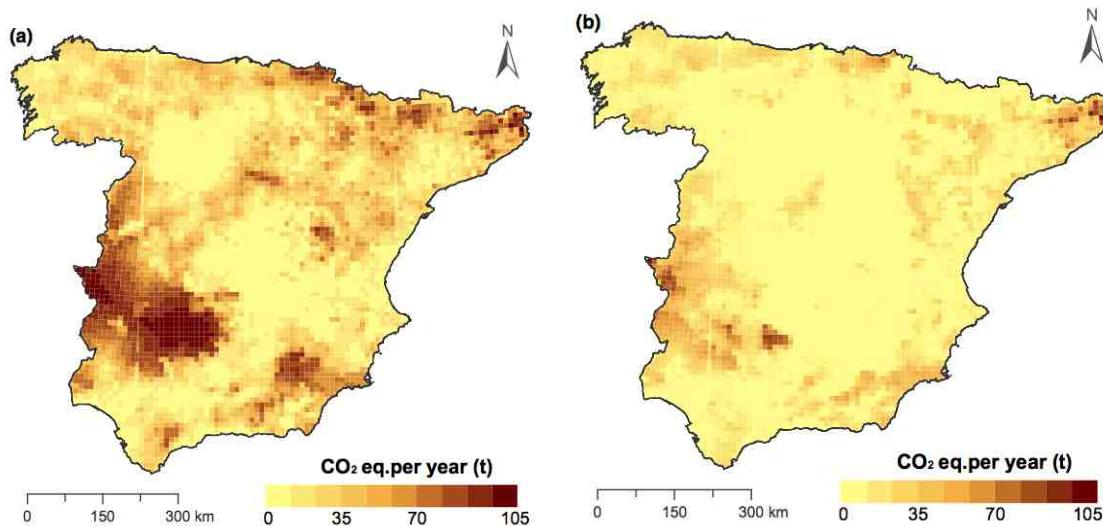


ECONOMICS OF THE IMPLEMENTATION

COLLATERAL BENEFITS OF PAFS – SAVINGS OF GREENHOUSE GASES EMISSIONS

The transport of dead livestock from farms to authorized plants after the new regulation (considering both the livestock outside of PAFs and the livestock species that must be collected inside PAFs according to each regional rule) represents a minimum emission of 34 300 metric tons of CO₂ equivalents (greenhouse gas emission or GHG) to the atmosphere per year. The south-western and north-eastern extremes of peninsular Spain show the highest levels of GHG emissions (Fig. 7a). Considering that the GHG emissions in the pre-PAF scenario was 77 344 metric tons of CO₂ equivalents to the atmosphere per year (Morales-Reyes et al. 2015), the post-PAF scenario (Fig. 7b) means a potential reduction of c. 55 7% in GHG emissions/year. The percentage of reduction in GHG emissions ranged between 23% and 95 7% (mean = 44.7%, SD = 30 7%) depending on the region considered.

Figure 7a & 7b. GHG emissions (in metric tons of CO₂ eq. per 10 x 10 km grid per year) before (a) and after (b) the implementation of the protection areas for the feeding (PAFs) of necrophagous species in peninsular Spain. [Colour figure can be viewed at wileyonlinelibrary.com].



DISCUSSION AND CONCLUSIONS

The PAFs created specifically to ensure areas for the feeding of necrophagous species after the new European sanitary regulation (EC 142/ 2011) have resulted in significant improvements in relation to the previous regulation based on the percentage of the breeding distribution of the targeted species covered by these areas and the amount of feeding resources available within them.

Importantly, the breeding distribution of priority species, particularly vultures, are better represented in PAFs than the distribution of other facultative scavengers not included as targeted species. In this sense, Spanish PAFs may meet their purpose reasonably well. However, there are still populations of targeted species outside PAFs. Efforts to protect these populations should be especially encouraged in the case of the most endangered species at the national and global scales, i.e. *N. percnopterus*, *A. adalberti* and *M. milvus*.

As expected, a consequence of the application of the new European regulation permitting the disposal of carrion in the field was a significant increment in the availability of food resources for scavengers (measured as tons of carrion) within these areas. This may alone imply a significant step in the conservation of the Spanish and, by extension, European vulture populations. In particular, the Spanish PAF network could potentially provide c. 4–6 times the carrion needed annually by the whole Spanish vulture population (Margalida & Colomer 2012).

Moreover, to predict the carrying capacity of these areas to maintain healthy populations of vultures and other facultative scavengers in Spain, it is important to simultaneously assess the role played by wild ungulate carcasses as another source of food for these species (Mateo-Tomás et al. 2015).

Also, the implementation of the new regulation potentially leads to a considerable reduction in the GHG emissions associated with artificial carcass disposal.

How can be the PAF network improved?

Non-targeted facultative scavengers can also benefit from the resources available within PAFs. For example, the application of the previous EU sanitary regulation led to changes in the diet of wolves (e.g. increased large domestic ungulate consumption; Lagos & Barcena 2015; Llaneza & Lopez-Bao 2015), possibly affecting their role in the ecosystem (Lagos & Barcena 2015) and exacerbating human–wolf conflicts (Llaneza & Lopez-Bao 2015). Regarding *U. arctos*, carrion is an important resource for this species (Clevenger & Purroy 1991; Naves et al. 2003; Mateo-Tomás et al. 2015), which is critically endangered (CR) in Spain. Its inclusion as a priority species in PAFs might significantly contribute to improving its conservation status.

The most important failure of current PAF design is probably their focus on the breeding distribution of scavengers. Vultures are soaring birds that can travel several hundreds of km daily from breeding to foraging areas across physical and political boundaries. In these cases, conservation strategies that consider movements outside of breeding areas are highly desirable (Lambertucci et al. 2014). This clearly highlights another important avenue for the improvement of the new sanitary regulation, which should recognize the combination of breeding and foraging areas.

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OPERATIONAL PROTOCOL FOR POISONING INCIDENTS IN THE RUPIS PROJECT AREA

This protocol is prepared as part of the Life Project Rupis (LIFE14 NAT/PT/000855), within action A5: Preparation of adequate field protocols for toxicological identification of direct (poison) and indirect (heavy metals, antibiotic) contaminants in the target species.

Introduction

Protocol objective

Identify right stockholders and establish official procedure for collection and analyses of presumably poisoned animals found in the field per the national regulations in order to improve the detection of poisoned animals in the nature.

Due to the differences in national regulations, already established practices and experience was not possible to provide common protocol or scheme that can apply to the entire Rupis project area (Portuguese and Spanish side). Therefore, this operational protocol provides different recommendations specific for each sub-project area (Portuguese and Spanish side).

The operational protocol includes two technical protocols for sampling (annexed):

- *Protocol for taking samples from dead animals for toxicological analyses (Annex I).*
- *Protocol for taking biological samples from live birds for toxicological and parasitological analyses (Annex II).*

These two protocols provide detailed information on collection, conservation and transport of biological materials per the EU regulation. The objective of these protocols is to secure adequate handling, conservation and quality of samples.

Both protocols are applicable for Portuguese and Spanish side from the Rupis Project area.

Detection and collection of presumably poisoned animals and biological samples

For Portugal

The only responsible authorities according to the Portuguese regulation to collect dead animals, samples or baits (evidences for presumably poisoning case) is **SEPNA (Serviço de Proteção da Natureza e do Ambiente)**.

All other entities (Rupis project team or any other entity or person) should inform SEPNA in case dead animal or other indication for poisoning is detected in the field. Nobody except SEPNA can handle or collect samples or evidence!

SEPNA telephone number for environmental crime is SOS Ambiente 808200520, which works 24/24,

Note: It will be useful if the Rupis project team can raise some publicity for this telephone number and explain to the public what should be done in case presumably poisoning incident is detected in the field.

The collected evidence (dead animals, samples and baits) must be delivered also by SEPNA to the necropsy centres (wildlife recovery centres).

* We highly recommend the use of the technical protocol for sampling of dead animals (Annex I) to secure good quality of samples.

Responsible entity for collection of samples and transport to the necropsy centre: SEPNA within action C7 from the Rupis Project.

For Spain (CyL)

There is already well established practice on detection and collection of samples, dead animals or poisoned baits. The responsible authorities on Spanish side are the **environmental agents** from the regional government (in this case the Junta de Castilla y Leon) and the special unit for environmental crime from the national police (Guardia Civil) called **SEPRONA** (Servicio de Protección de la Naturaleza).

There is already established 24/7 free telephone number on national level for reporting of poisoning cases, called SOS VENENO: 900 713 182.

* We highly recommend the use of the technical protocol for sampling of dead animals (Annex I) to secure good quality of samples.

Responsible entity for collection of samples and transport to the necropsy centre: Environmental agents – Junta de Castilla y Leon and SEPRONA. No costs for the Rupis Project.

Forensic necropsy

For Portugal

There are two necropsy centres identified in the Rupis project area that can assume the responsibility for performing the forensic necropsy:

- CERVAS - Centro de Ecologia, Recuperação e Vigilância de Animais Selvagens
- LHAP-UTAD - Laboratório de Histologia e Anatomia Patológica da Universidade de Trás-os-Montes e Alto Douro

Important notes:

- Samples collected in North Duero must be delivered to LHAP-UTAD, and from the South Duero to CERVAS.
- Dead domestic animals (presumably poisoned) from the entire Rupis area should be delivered to LHAP-UTAD
- LHAP-UTAD and CERVAS will perform the forensic necropsy with no charge to the Rupis Project.

For Spain (CyL)

According to the Spanish regulation (and already established practice in Castilla y Leon) the recovery wildlife centre from Valladolid CRAS (Centro de Recuperación de Animales Silvestres) is the relevant authority that can perform the forensic necropsy. They are also responsible for preparing and sending the samples to the toxicology lab.

Responsibly entity for forensic necropsy: CRAS Valladolid (Centro de Recuperación de Animales Silvestres) – Junta de Castilla y Leon. No costs for the Rupis Project.

Toxicological analyses

For Portugal

The referent laboratory for Portugal that could perform the toxicological analyses is FMU - Faculdade de Medicina Veterinária from Lisbon.

Therefore, after the necropsy performed in CERVAS or LHAP-UTAD samples for toxicological analyses has to be delivered to FMV.

Sampling, packaging and transport should be done according to the protocol for dead animals (Annex I). Responsible entities for preparing the samples to be send to FMV are: CERVAS and LHAP-UTD.

The transport of the samples should be done by official carrier (MRW, Tel. 232 415 527).

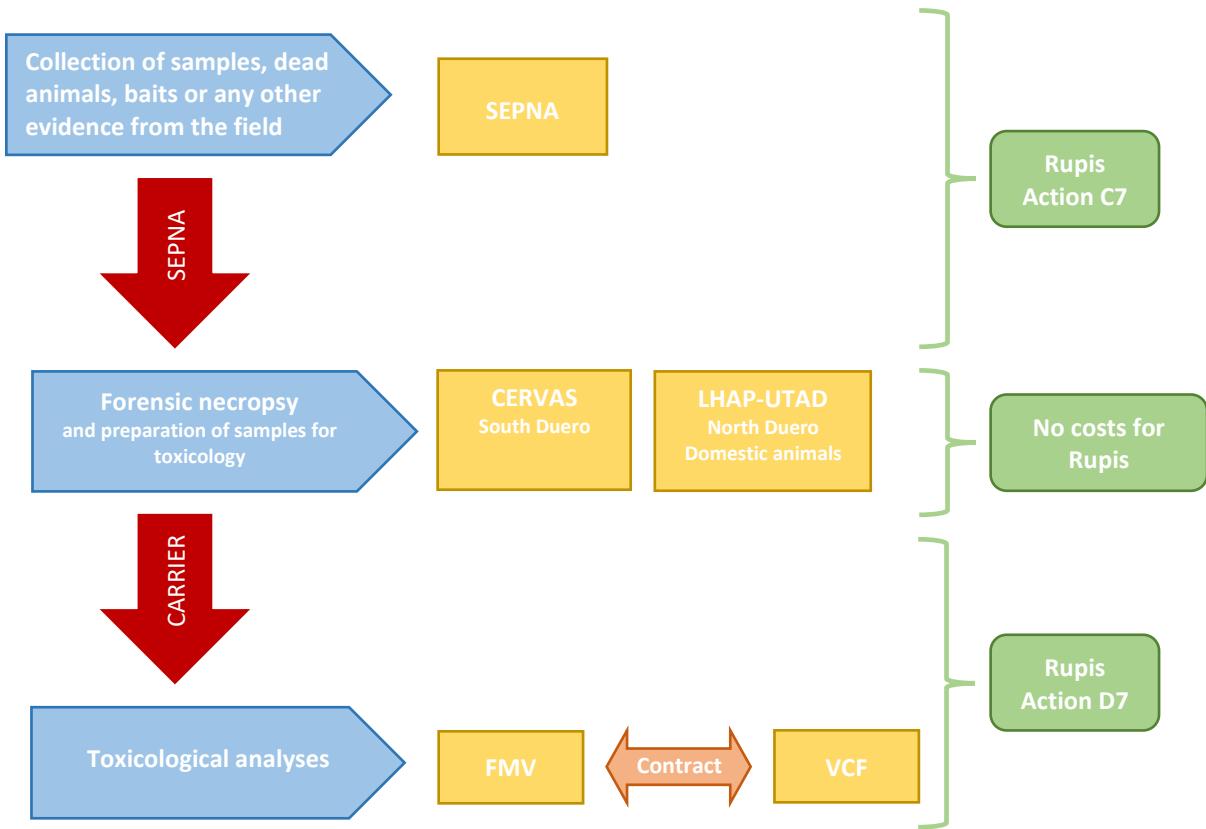
Responsible entity for performing the toxicological analyses is FMV within contract established with the VCF (action D7).

For Spain (CyL)

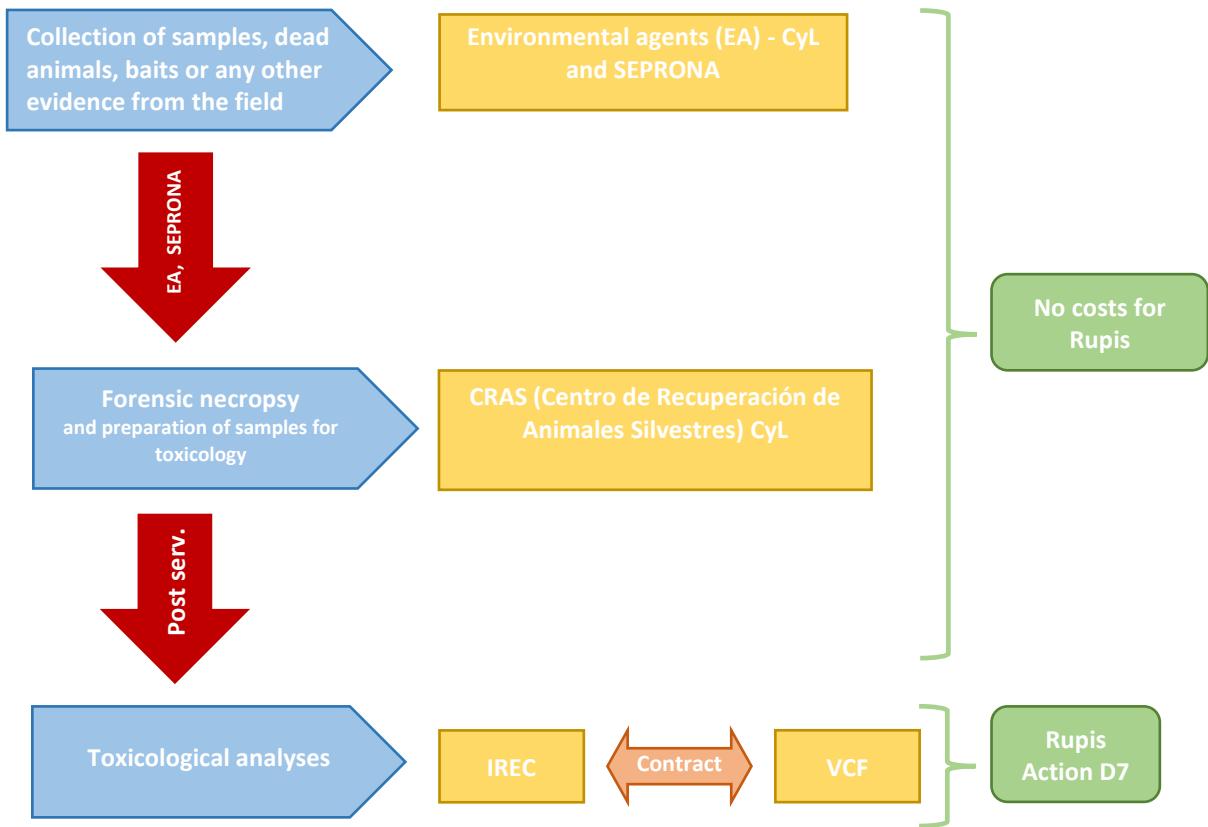
The identified toxicological laboratory for the samples collected on Spanish side is IREC -Spanish Institute of Game and Wildlife Research.

Responsible entity for performing the toxicological analyses is IREC within contract established with the VCF (action D7).

1. Scheme chart – operational protocol on Portuguese side



2. Scheme chart – operational protocol on Spanish side



ANNEX I

PROTOCOL FOR TAKING SAMPLES IN THE FIELD FROM DEAD ANIMALS (PRESUMABLY POISONED) FOR TOXICOLOGICAL ANALYSIS

INTRODUCTION

The protocol is offering recommendations and guidelines for taking biological samples from dead animals, whole carcasses, suspicious poison baits or any other material from the environment that could help in the determination of a poison case or identification of the poison substance used.

This protocol also includes information regarding conservation, packaging and transport of the samples to the laboratory where the analysis will be performed.

1.1 COLLECTION OF SAMPLES

The products used for poison baits are often highly toxic insecticides. In general, the finding of any artificial food piece in the environment should lead to suspicion of it being poisoned bait.

The discovery of dead animals does not always mean that the cause of death was poisoning, however, the cadaver should be collected, whether it is classified as species of interest, common species or domestic animal (**all species, or parts of them are relevant for detection of a poisoning case**).

First we must remember that the products used are highly toxic so care should be taken in their collection. It is very important to collect all baits and dead animals found since it can be important evidence for the investigation process of the presumably poisoning incident.

It is strongly recommended sending the whole body to the lab because that is where the best samples in the search for a possible poison are selected. If not possible, then a veterinarian with experience in wildlife necropsy should perform the necropsy following the instructions of the corresponding section.

COLLECTION OF POISON BAITS, CARCASSES, AND OTHER SAMPLES FROM THE NATURAL ENVIRONMENT

Handling the toxic baits or poisoned dead animals can be dangerous, and besides, if samples are incorrectly taken one may invalidate any administrative or judicial action later one. In order to avoid that the following instructions must always be respected:

- **For collection of samples always wear nitrile gloves and mask FP3.** The products used have a high toxicity and may act through the skin or be inhaled (Image 1).
- All baits and cadavers that are found in the inspection area must be collected. All can be evidence of a crime and very important for any eventual judicial case. Removing of the poison baits or cadavers from the field is also important to avoid new cases of poisoning.
 - **Bait:** wrap each piece in aluminium foil (do not use plastic, especially when poison is observed at the exterior of the bait, as it can interfere with the toxicological analysis) (Image 2), and insert it in a plastic container or plastic bag (one for each bait) (Image 3). Label/number each container, put it in a bag (see section 1.3) and seal. If several samples/baits are collected they can be placed into the same bag for transport to the laboratory (Image 4).
 - **Toxic substances:** Often poison bags or bottles can be found during the inspections, mainly in indoor inspections. These compounds/substances should be collected and a portion should be sent to the laboratory for analysis. Use a closed container (Image 3). Label and number it, put it in a bag (see section 1.3) and seal.
 - **Corpse:** regardless whether it is a fresh or skeletonized (Image 5 and 6) corpse, packaging must be double (see section 1.3): the corpse should be placed in a bag (Image 4) (one per corpse) and this bag into another to prevent the accidental release of fluids from the corpses autolysis. Then labelled/numbered and sealed.
 - If some residues are observed: baits or vomiting in the mouth or beak (Image 13), it is recommended to collect in aluminium foil and include it then in a closed container (procedure like for baits) (Image 7). It is also possible to cover the head with aluminium foil; in this way it is avoided to handle the remains found in the mouth.
 - **Soil sample:** if suspicious substances (poison alike) are observed on the ground (e.g. vomiting or toxic residues) (Image 16), collect and insert the material in plastic container (Image 7), number (see section 1.3) and seal.

It is also advisable to collect soil samples under the corpse, 5 cm deep. (Image 8).

- **Entomofauna:** insects consume the corpse, so they are very important for the toxicological analysis, as they can contain the poison ingested by the animal inside. Collect insects (Image 9) in a closed container (Image 7). Number, pack (see section 1.3) and seal.
- **Vomit:** same as bait, put it in a container or plastic bag. (Image 16). Number each container, put it in a bag (see section 1.3) and seal.

1.2 SAMPLES FROM NECROPSY

It is strongly recommended to submit the whole body (corpse) to the lab, as this is where the best samples for the detection of poisons are selected accordingly. There are special cases or circumstances (very large animals) in which it is not possible to send the whole body to the lab. Only in these cases the necropsy should be performed by a veterinarian with experience with wildlife and forwarded the following samples to the laboratory (securely packaged in tightly closed cans (Image 7), labelled and sealed (see section 1.3)):

- **Stomach contents (complete):** the most important part for the detection of poison sample. Place it in a tightly sealed container. (Image 10).
- **Brain tissue (Encephalon):** Preferably the entire cranial content (frozen!) in plastic box or bag.
- **Liver and kidney (complete):** place them separately in tightly closed containers (Image 11 and 12).
- **Oral content, oesophagus (generally different samples of stomach digestive system):**
 - If remains of baits or vomit in the mouth are present, collect in foil and include in a container then close.
 - Scrape the entire digestive tract, from the mouth into the oesophagus and put it in a container.
 - For birds: collect the contents of the ventricle-proventriculus (Image 14), and place in a closed container. If content cannot be observed scratch as in the previous case.
- **Claws:** The claws may contain traces of possible bait, so collection is recommended. Cut full claws (**don't try to open them**) wrap in foil and then in a container (Image 15).

1.3 LABELING AND PACKAGING OF SAMPLES AND THEIR SUBMISSION BY THE FOR TRANSPORT OF HAZARDOUS TOXIC AND BIOLOGICAL MATERIAL ACCORDING TO THE NATIONAL LAW

All samples should be frozen as soon as possible - prior to transport (to the lab) to avoid possible degradation of the poison, thus facilitating its detection, identification and quantification in the laboratory.

As indicated in each section, all samples must be labelled. These numbers or codes will be the same that appears in the records (field forms) and in the chain of custody.

To meet the requirements for transport of material with toxic / infectious risk category B, according to the P650 of existing European legislation these steps for the packaging of the samples have to be respected:

- All samples must be sent in **double green bag tightly closed and all these have to go into the sealed container (big one)** (Image 18).
- On the bottom of the container, there must be an **absorbent material** (if there is a spill). Paper towels can be used for example.
- The container on the outside must have white "diamond" shaped sticker saying: "**Exempt Animal Specimen**".

The green bags and the container should be properly sealed (Image 4 and 18). These seals must also be recorded in the records (forms) and chain of custody that accompany the samples.

DETAILED INFORMATION ON PACKAGING, LABELLING AND DOCUMENTS FOR SUBSTANCES "CATEGORY B (infectious)"

The packaging must meet the requirements of P650:

- a) Packaging / containers must be of good quality, strong enough to withstand shocks and loadings during the transport, including transhipment between cargo units and between transport units for manual or mechanical handling. Packaging / containers have to be made and closed in way not be deform under normal conditions of transport (pressure, vibrations or change in temperature or humidity).

Packaging / container must consist of three elements: 1) a primary container, 2) a secondary packaging; and 3) external packaging of which either the secondary packaging / well packaging / external packaging has to be rigid. At least one

surface of the packaging / external packaging must have a minimum size of 100mm x 100mm.

- b) The primary containers are placed in a secondary package. Under normal conditions of transport the primary container shouldn't break or leak contents into the secondary packaging. The secondary packaging shall be secured in the external packaging with suitable softening material.
- c) For liquid substances:

Primary containers and secondary packaging must be water-resistant. The primary receptacle or the secondary packaging must withstand without leakage, an internal pressure of 95 kPa (0.95 bar).

If several fragile primary receptacles are placed in a single secondary packaging, the primary container shall be individually wrapped or separated to prevent contact between them. Absorbent material between the primary containers and secondary packaging is also needed. The absorbent material shall be in sufficient quantity so that it can absorb the entire contents of the primary containers so that the release of the liquid substance will not compromise the integrity of the softening material of the external package.

- d) For solid substances:

Primary containers and secondary packaging must be leak-proof.

If several fragile primary receptacles are placed in a single secondary packaging, the primary receptacles shall be individually wrapped or separated to prevent contact between them.

When in doubt about the presence of residual fluid in the primary receptacle during transport, packaging suitable for liquids, including absorbent materials should be also used.

- e) Labelling:

The name, address and phone number of the recipient

Requirements for storage temperature (optional).

The proper shipping name ("BIOLOGICAL SUBSTANCE, CATEGORY B") next to the following rhomboid mark:



Figures/images

Image 1. Basic personal protective equipment (nitrile gloves, masks FP3)



Image 2. Bait in aluminium foil.



Image 3. Bait in aluminium foil and sealed plastic bag and container



Image 4. Sealed bag for transfer of corpses and containers with samples



Image 5. Fresh corpse



Image 6. Skeletonized corpse



Image 7. Containers for submission of samples



Image 8. Entomofauna and soil below the cadaver



Image 9. Entomofauna



Image 10. Stomach contents



Image 11. Liver



Image 12. Kidneys



e.g. Egyptian Vulture necropsy

Liver



Kidneys

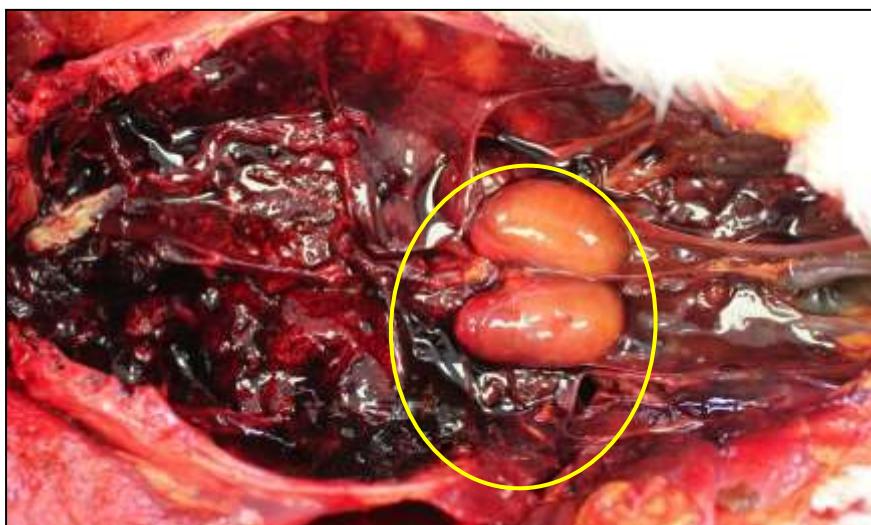


Image 13. Remains of bait in the peak



Image 14. Ventricles



Image 15. Claws



Image 16. Vomit



Image 18. Sealed container (the big one).



ANNEX II

PROTOCOL FOR TAKING BIOLOGICAL SAMPLES IN THE FIELD FROM LIVE BIRDS, FOR TOXICOLOGICAL AND PARASITOLOGICAL ANALYSIS

INTRODUCTION

Although the project foresees only toxicological analysis we consider it to be important to include also parasitological samples/analysis that can also be easily collected while sampling for toxicology (only small additional effort is needed and the cost of these analyses is nearly insignificant compared to the cost of the toxicological analyses).

The results of the toxicological and parasitological analysis can provide important information regarding the physical condition of the animal but could also identify some unknown threat/problem.

The protocol is offering recommendations and guidelines for taking biological samples from birds (target species: Egyptian Vulture and Bonelli's Eagle) while capturing adults/immature or marking of juvenile birds at nests and provides information on the proper conservation and transport of these samples to the lab where the analysis will be performed.

* A different protocol will be prepared for collecting samples from dead animals (birds).

IMPORTANCE OF THE QUALITY OF THE SAMPLES AND MEDICAL HISTORY

The most important for the laboratory analysis is the sample. From a well-selected sample in sufficient quantity, well preserved and sent in a correct time to the lab, all information related to the health of the animal (clinical condition, pathological and toxicology) can be obtained.

GENERAL RULES

Sampling:

- The staff responsible for sampling must use (be provided with) **personal protective equipment (PPE)** during the sampling process (at least gloves and masks, disposable overalls is also recommended).
- It is essential to collect **samples aseptically** especially for microbiological analysis due to possible interference with the isolates. Avoid contact between the soil and the samples (very important for toxicological analysis).
- Samples **must be individually identified** (labelling, seal, sticker, etc.) clearly indicating the material (tissue, organ, etc.), animal species and sampling date and location, before sending to the lab.

Conservation:

- **Freezing** of samples should be done immediately after the sampling. Recommended freezing temperature is -20 °C. For samples such as:
 - blood in heparin for toxicological analyses
 - blood in EDTA (to study various microorganisms by molecular diagnosis PCR),
 - clean plasma and serums (after centrifugation of the blood samples)
 - swabs in virus medium
- **Refrigeration** of samples can be used for not more than 24-48 hours until the shipment:
 - 24 hours: blood in EDTA and heparin if it is for toxicological, haematological or biochemical analysis.
 - 24-48 hours: swabs in conservation medium for microbiology (Amies) and virology (specific medium for virus).
 - 24-48 hours: faeces.

* Also check table 1 at the end of this document.

SAMPLING PROCEDURES

1. Collection of samples by swabs from cloaca in Amis medium and virus medium

- Use the swab to collect cloacal and / or oropharynx samples. Insert and turn the swab in rubbing effort to obtain content.

- Number of swabs: ideally 1 per organism (bacteria) for study

- Analysis:

- Conservation in Amies medium (blue swab):
- Microbiology: diverse bacteria species: *Salmonella*, *Campylobacter*, *Escherichia coli O157*.
- Conservation in virus medium (pink swab):
- Virology (molecular diagnostics PCR, virus cultivation). Different viruses.



Collection of samples from cloaca with swab in Amies medium (blue)



Collection of samples from cloaca with swab in virus medium (pink)



Collection of samples from oropharynx with swab in virus medium (pink)

* Also check table 1 at the end of this document.

2. Sample collection: FAECES

- Collect fresh faeces. Try to discard the urea phase (the white or yellow content).
- Use a sealed, sterile container.
- Possible analysis:
 - Parasitology.
 - Microbiology: diverse bacteria species: *Salmonella*, *Campylobacter*, *Escherichia coli O157*.



3. Sample collection: BLOOD IN EDTA AND HEPARIN

- Take the sample by venepuncture, previously disinfect the area with 70% alcohol and wait at least 30 seconds.
- Fill in the sample tube with blood. Overturn smoothly 3-4 times for mixing the blood and the EDTA / heparin, to prevent lyse (blood cell destruction) of the erythrocytes.
- Recommended volume: 1 tube of 1 ml heparin to study toxicology: heavy metals, Non Steroid Anti-Inflammatory Drugs (NSAIDs), antimicrobials and pesticides; 1 tube of 1 ml EDTA to study molecular diagnostics (PCR); 1 tube EDTA for haematology and sex determination (few blood drops in alcohol can also do); 1 tube heparin for biochemistry and proteinogram.
- Analysis from EDTA:
 - Sex determination
 - Molecular diagnostics (PCR): different microorganisms (bacteria, virus, parasites).
 - Metals: lead, cadmium.
 - Non-steroid anti-inflammatory NSAIDs
 - Antimicrobials
 - Pesticides
- Analysis from heparin: In this case it is recommended to centrifuge the tube and recover the blood plasma. This plasma can be refrigerated if the shipment is carried out frozen.
 - Biochemistry
 - Proteinogram (serum protein profile)



IMPORTANT NOTES:

In practice it is difficult to extract big quantities of blood from relatively small animals (Egyptian Vultures or Bonelli's Eagle) therefore we need to think about priorities. The most important blood samples are the ones collected in 1ml tube with heparin, meant for the toxicological analysis.

- **Proceed filling the other 1ml tubes only if you have taken sufficient quantity in the 1ml heparin tube for toxicology!**

Following this protocol we are suggesting total blood extraction quantity of 3 ml, which is much smaller amount considering the maximum of blood quantity that can be extracted for this species (Egyptian Vulture and Bonelli's Eagle) that can be up to 20ml (about 10% of the body weight).

4. Sample collection: SERUM

- Take blood into a tube for serum.
- To facilitate clot retraction leave reverse or leaning tube at room temperature about 30 minutes. If possible centrifuge (2500 rpm 10 minutes), and collect the clean serum in other tube aside. It can be frozen until its shipment to the lab. If there is no centrifuge available please just extract the serum after the clot retraction.
- Recommended volume: 0,2-0,5 ml of clean serum for each analysis.
- Analysis: detection of antibodies against different microorganisms.



Decanting and passage of the clean serum in new tube (eppendorfs or other containers can be used for maintaining the serum, for

5. Sample collection: FEATHERS

- Collect the feathers from the nest of below the nest (during ringing or marking of juvenile birds). Store in paper or plastic sealable bags.
- Analysis that can be performed:



- Heavy metals and metalloids (lead, mercury, zinc, cadmium, selenium and arsenic)
- Non-steroid anti-inflammatory NSAIDs, Antimicrobials and Pesticides – difficult to detect.

6. Sample collection: Eggshell/s or eggs

- Collect the Eggshells from the nest (during ringing or marking of juvenile birds), if whole egg found in late breeding season please also collect. Store in paper bag or paper box (even better to avoid breaking to smaller pieces).
- Analysis that can be performed:
 - Heavy metals (lead, zinc, cadmium)
 - Pesticides



Table 1: Specific details about the conservation and transport preparation of all different samples

Sampling procedure, C section	Sample	Conservation medium	Analysis	Conservation by refrigeration (4°C)*	Conservation by freezing (-20°C; -80°C)	Comments
1	Swab	Amies	Microbiological	24-48 hours	No	
1	Swab	Virus	Virus study (PCR/ cell cultivation)	24-48 hours	-80°C (recommendable)	Freezing to can interfere with the viability of some viruses (e.g. Influenza)
2	Faeces	No medium	Parasitological Microbiological	24-48 hours	No	Freezing is not recommended, but some parasites and bacteria are viable after freezing on -20°C to -80°C
3	Blood	EDTA	PCR	Until 3 days	Yes	
			Metals (lead, cadmium)	Until 3 days	Yes	
			Sex (PCR)	Until 3 days	Yes	
			Lead, antibiotics, NSAIDs	24-48 hours	Yes	
		Heparin	Proteinogram Biochemical	24 hours	No	The plasma can be frozen after centrifugation. Should not be hemolysate (destroyed erythrocytes)
4	Serum	No medium	Immunological (antibodies)	Until 3 days	Yes	Is recommended to freeze if not immediate shipment
5	Feather	Paper bag/- no medium	Heavy metals and pesticides	24-48 hours	Yes	Important to note: please avoid humidity, samples must be dry.
6	Eggshells	Paper bag/box - no medium	Heavy metals and pesticides	24-48 hours	Yes	Important to note: please avoid humidity, samples must be dry.

* Only when really necessary

Conservation and Best Practices for the Egyptian Vulture in a transborder natural area – Lessons from the LIFE Rupis Project

Good-practice guide for building powerlines, windfarms and agro-industrial Units in sensitive areas.



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Methodology

Portugal

1. Sensitivity maps for collision against windtowers

There are many available studies about mapping and predicting the risk of windfarms to birds, based on the collision hazard with wind turbines. The methodological approach ranges from concentration of high conservation value species vulnerable to wind towers (and powerlines) (Bright *et al.*, 2008), to the building of models for the uplift potential for flight for soaring bird flights (Péron *et al.*, 2017). The methodological approach to collision risk prediction also depends on the kind of data available and on the spatial resolution required.

Two maps were developed to express the sensitivity of species to different infrastructure: wind turbines, powerlines and these maps can overlap to show the overall bird sensitivity.

Both maps have a common methodological reasoning. The approach that has been chosen follows the methodology of the Ireland Bird Sensitivity Mapping (Birdwatch Ireland, 2014), with some adjustments.

The following parameters were used to build a database suitable for the mapping:

- a) evaluation of the species value. we have taken in account all species that are recorded in the species list of Douro Internacional Natural Park and their Species Ecological Value (VEE- Valor Ecológico Específico), which states the species value in Douro International Natural Park, as stated in the management Plan (Erena/Biodesign, EcoStatus, Hidroprojecto, 2001). This evaluation follows a common methodology adopted by ICN for all Management Plans in mainland Portugal and includes biological and ecological factors inherent to each species, like Bird Directives Annexes, Conservation Status according to Portuguese Vertebrate Red Book (SPRCN, 1989), Biogeographic parameters, rarity, local threatening status, reproductive strategy, singularities...)
- b) each species was classified according to its ecological/behavioural characteristics which may influence their vulnerability to collision with wind towers or collision with powerlines (see annex);
- c) the sensitivity map is designed upon sensitivity classes: Species Sensitivity Index between 0 and 4 .
- d) initial selection of the species that are included in class SSI > P75 (percentile 75), which account for 43 species in Douro Internacional
- e) final selection: only species include in SSI > P90, which account for 16 species in Douro Internacional (See table 1)
- f) introduction of the additional criteria: baseline information on the distribution of each species in the P90 percentile in the Douro Internacional (study area), which account for only 7 species: Cinereous vulture, Egyptian vulture, Golden Eagle, Griffon vulture, Bonelli's eagle and Black Stork; other two high sensitivity species, Great Bustard and

- Lesser kestrel, were discarded since there is no recent record for these species in Douro.
- g) This methodology can be easily applied and transferred for other regions and time scale.
 - h) map drawing avoided 3 primary colours on purpose (red, yellow and green), since they point out what is “wrong” or “right”; instead a scale of brown is used, to show growing sensitivity for collision with wind towers.

2. Electrocution and collision soaring birds sensitivity maps

Electrocution sensitivity maps have been put forward by several authors. They differ significantly from electrocution risk maps, since they do not enter with the powerline factor. Therefore sensitivity Maps are built as an aid tool for planning of new lines, even though they can also provide information for existing powerlines – whether they cross high sensitivity areas and should be monitored and to consider retrofitting in those high-sensitivity areas.

There are several models to determine their vulnerability and influencing factors for electrocution in power lines, like Bonelli's Eagle (Rollan *et al.*, 2010), or selected species of raptors (Hernandez-Lambrano *et al.*, 2018). Other authors have put forward a combination of risk models, that is, including the existing powerlines and the respective risk for birds, with sensitivity maps, which are based on indicator species nesting, foraging and dispersal areas (Pérez-García *et al.*, 2017).

Species selection

For the selection of species official guidelines from ICNF were followed (Almeida *et al.*, 2019).

According to this publication, species selection lists species that are a priority for conservation and sensitive to electrocution and/or collision with power lines as follows:

Selected species for electrocution

- Bonelli's Eagle, Golden Eagle, Imperial Eagle, Egyptian Vulture, Cinereous Vulture, Lesser Kestrel, Marsh Harrier, Montagu's harrier, Hen Harrier, Honey Buzzard, Goshawk, Hobby, Peregrine falcon, Eagle Owl, Griffon Vulture;

Selected species for collision

- Little Bustard and Great Bustard, aquatic birds, Black Stork, Crane, red-billed Chough, necrophagous raptors (Vultures)

Moreover the following items and classified areas should be considered:

- Necrophagous birds feeding station, Important wetlands, migration corridors for endangered birds, important dispersal river for endangered birds, Ramsar Areas.

For the electrocution sensitive species and species sensitivity rank to collision sensitive species, we gathered data on soaring bird electrocution and collision in the area of Douro Internacional Natural Park and SPA, , recurring to own databases from a 10-year mortality series: 2003-2012 (Infante & Neves, 2005, Neves & Infante, 2008, Costa *et al.*, 2011, Costa *et al.*, 2012) and data from sensitive species in this area (Monteiro A. & M. Rodriguez, 2015; 2017, Rodriguez M. & Monteiro, A.,2018). For the assessment of collision risk, several works deal with models in powerlines, more often for transmission lines (D'Amici *et al.*, 2019).

For those species that do not have mortality data in Douro area due to powerlines, we recurred to available literature and national-level data base to assess their level of vulnerability to electrocution and collision with powerlines. This is the case for Cinereous Vulture, which does not have regional or national data on electrocution mortality in powerlines, but that has been documented from various other sources (<https://www.4vultures.org/raptor-electrocution-deaths-including-vultures/>, <https://amfcr.ma/en/phoenix-electrocuted-egyptian-vulture/>, <https://www.rewinding-rhodopes.com/life-vultures-news/electrocution-caused-the-death-of-a-rare-black-vulture/>).

Table 1 shows final selection of species that were used to build the sensitivity maps for electrocution, which corresponds to all species that had distribution data available. Mortality Data comes from PNDI (Parque Natural do Douro Internacional), except for the Egyptian Vulture data, which comes from PNAD (Parque Natural de Arribes del Duero).

Table 1 - Data on selected species for sensitivity maps on electrocution/collision on powerlines.

Species (common name)	Species (scientific name)	observed electrocution (1)	TME annual (2)	average number of couples (3)	score VEE (4)	Douro área (5)	Distribution data available
Cinereous Vulture	<i>Aegypius monachus</i>	-		1	49	X	yes
Egyptian Vulture	<i>Neophron percnopterus</i>	2	0,46	103	53	X	yes
Golden Eagle	<i>Aquila chrysaetos</i>	2	0,46	22	31	X	yes
Bonelli's Eagle	<i>Aquila fasciata</i>	2	0,46	9	40	X	yes
Eagle Owl	<i>Bubo bubo</i>	2	0,46		26	X	yes
Black Stork	<i>Ciconia nigra</i>	3	0,69	83	25	X	yes
Griifon vulture	<i>Gyps fulvus</i>	11	2,53	726	27	X	yes
Peregrine falcon	<i>Falco peregrinus</i>	-	-	-	22	x	yes
Lesser Kestrel	<i>Falco naumannii</i>	-	-	n.d.	41	no	no
Montagu's harrier	<i>Circus pygargus</i>	-	-	n.d.	34	X	No
Hen Harrier	<i>Circus cyaneus</i>	-	-	n.d.	39	X	No
Honey Buzzard	<i>Pernis apivorus</i>	-	-	n.d.	38	X	No
Goshawk	<i>Accipiter gentilis</i>	1	-	n.d.	16	X	No
Hobby	<i>Falco subbuteo</i>	-	-	n.d.	20	X	No
Little Bustard	<i>Tetrax tetrax</i>	-	-	n.d.	42	?	No

Great Bustard	<i>Otis tarda</i>	-	-	n.d.	45	no	-
red-billed Chough	<i>Pyrrhocorax pyrrhocorax</i>	-	-	n.d.	41	x	no

(1) Douro Internacional /Arribes del Duero area (2003-2012); (2)TME – Estimated yearly mortality for project area; (4) VEE species specific value (from Erena et al, 2001); (5) for PNDI (Douro Internacional).

3. Solar energy power plants

Solar energy production is taking a rapid development in Portugal, since the Solar Energy Auctions have started, in 2019. Another auction in Aug. 2020, has completed the former and together made available two GigaWatt renewable energy in Portugal. Promoters are, therefore, starting to propose solar powerplants and looking for places, and the northeast region has received some intentions.

This document tries to propose a good-practise approach to the installation of solar energy units in the Douro region, based on the recent technical and scientific literature available on solar energy impact on wildlife.

4. Agro-industrial units and Intensive tree crop

Agro-industrial units have been joined together with monoculture tree crops, even though they represent different impacts. Agro-industrial units main problem resides on the power supply that is needed to them and therefore their placement should also comply with the same best practices that apply to power lines. Monoculture tree crops and other kinds of intensive agriculture are now suffering an increase in northeast region and their impacts are related essentially with loss of habitats and intensive-agriculture practises, like irrigation and chemical treatments. For this, best practice recommendations are based in the most recent scientific and technical studies available.

Spain

The methodology for good-practice follows the legislation applicable in Spain and in the Castilla-León autonomous region.

On September 13th, 2008, the Royal Decree 1432/2008 was published, which establishes measures for the protection of birds against collision and electrocution in lines of high voltage (Annex II), which revoked Royal Decree 263/2008, previously published.

The Royal Decree urges the Autonomous Communities to designate Protection Zones where they are obliged to correct dangerous lines for birds due to electrocution and collision and do an inventory of electrical lines that cause a significant and documented mortality by collision of birds, especially those included no Spanish Catalog of threatened Species (CEEA). According to the Royal Decree, the established protection Zones will be:

- 1) the Special Protection Areas for Birds (SPAs),
- 2) the areas included in our Conservation Plans or threatened Species Recovery Plans, and
- 3) the Priority Zones, which will be designated from two locations of feeding, reproduction, dispersal or concentration of cataloged species. These last ones are the only ones that will be specifically delimited by each Autonomy to correct dangerous electrical lines.

The Royal Decree applies to new high voltage aerial lines, located in Protection Zones, as well as extensions or modifications to existing ones, and establishes protection measures against electric shock and collision:

Technical measures of prevention against electrocution (Article 6):

- 1) lines must be built with suspended insulator chains, avoiding a cross-arms in rigid position in the alignment pylons.
- 2) pylons with bridges, disconnectors, fuses, distribution transformers, derivations, mooring chains, special, and end-of-line, will be built in a way such that elements in tension do not surpass cros-arms or semi-crossarms width. The bridges union between the elements in tension will be insulated.
- 3) In Canadian cross-arms the distance between the lower half-cross and the upper conductor will be greater than 1.5 m.
- 4) In cross-arms in dome, the distance between the head of the main axis and the central conductor must not be less than 0.88 m, or the central conductor must be insulated 1 m for each side of the fixing point.
- 5) All different cross-arms configurations must meet the minimum safety distances stated in the previous number 4.
- 6) The extension to be installed on the mooring cross-arms must be designed in a way that prevents birds from perching.
- 7) If the extended cross-arm configuration for mooring chain pylons are used by birds to perch or there are any electrocutions, it is established that minimum safety distances will not include the aforementioned extension.
- 8) In the case of different cross-arm configurations other than specified in and in numbers 5-7, the minimum safety distance applicable will be the one that corresponds to the most similar cross-arm configuration shown in figure 1 table.

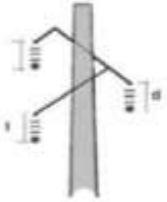
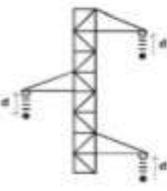
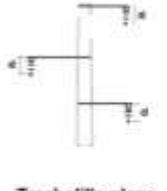
Tipo de cruceta	Distancias mínimas de seguridad en las zonas de protección
 Canadiense	cadena en suspensión $d = 478 \text{ mm}$ cadena de amarre $d = 600 \text{ mm}$
 Tresbolillo atirantado	cadena en suspensión $d = 600 \text{ mm}$ cadena de amarre $d = 1.000 \text{ mm}$
 Tresbolillo plano	cadena en suspensión $d = 600 \text{ mm}$ cadena de amarre $d = 1.000 \text{ mm}$
 Bóveda	cadena en suspensión $d = 600 \text{ mm}$ y cable central aislado 1 m a cada lado del punto de enganche. cadena de amarre $d = 1.000 \text{ mm}$ y puente central aislado.

Figure 1 – Reference table extracted from REAL DECRETO 1432/2008, de 29 de agosto, por el que se establecen medidas para la protección de la avifauna contra la colisión y la electrocución en líneas eléctricas de alta tensión, *in* BOE núm. 222, pags. 37481-37486, 13rd september 2008.

Data treatment and Results

Sensitivity maps for collision against wind towers

According to the methodology followed, a database was set up, containing the relevant characteristics of the higher conservation valued species, as Figure 1 shows. This database includes all species listed in the 1st phase reports of the Douro Internacional Natural Park Regulatory Plan (Erena/Biodesign/ EcoStatus/ Hidroprojeto, 2001). From this list, there was a first selection of the species with VEE (Species Ecological Value) in the upper 75% percentile (VEE top 22 species), a second selection of the species on the upper 50% percentile (VEE top 11 species) and a third and last selection of the the upper 25% percentile (VEE top 8 species, which were extended to the 9th species, because it is a soaring species – Black Stork).

	estatuto conserv	estatuto biogeog	VEE	flight manoeuvreability	soaring	aerial foraging	ranging behaviour	flocking	nocturnal flight activity	aerial display	site fidelity	range DI	sensitivity to displacement	habitat preference	availability of preferred habitat	mortalidade (Thaxter et al)	mortalidade (score)	dados da distribuição
																score VEESSI		
Abutre-preto	29	20	49	4	4	3	4	0	0	0	4	4	4	4	0 no data	4	4,2 sim	
Britango	29	24	53	3	4	3	4	0	0	1	4	4	4	4	0 0,0015333	1	4,26 sim	
Águia-real	21	10	31	2	4	3	4	0	0	2	4	3	2	4	0 0,3178832	4	4,26 sim	
Grifo	17	10	27	4	4	3	4	2	0	0	2	4	0	4	0 0,21995	4	4,25 sim	
Águia-perdigueira	23	17	40	1	4	3	4	0	0	0	2	4	4	4	0 no data	4	4,24 sim	
Milhafre-real	27	13	40	1	3	3	4	0	0	2	4	4	2	4	0 0,119447	3	4,24 sim	
Franceitinho	27	14	41	2	2	3	3	0	0	1	4	4	4	4	2 no data	4	4,24-	
Abetarda	29	16	45	4	0	0	3	2	0	0	4	4	4	4	2 no data	4	2,2-	
Cegonha-preta	19	6	25	4	4	0	1	0	0	0	4	4	4	1	2 0,002	1	4,21 sim	
Tartaranhão-cinzento	23	16	39	1	3	3	3	0	0	2	2	2	2	4	0 0,0252236	3	4,21 n	
Águia-calçada	17	9	26	3	3	3	3	0	0	2	2	1	0	4	0 0,02178	2	4,19 n	
Búlio-vespeiro	19	19	38	1	3	3	3	0	0	2	2	2	2	4	0 0,0005	1	4,19 n	
Milhafre-preto	13	5	18	1	3	3	3	0	0	2	2	1	0	4	0 0,0344964	4	3,19 n	
Águia-cobreira	17	3	20	2	3	3	4	0	0	2	2	1	0	4	0 0,0189875	2	3,19 n	
Águia-caçadeira	21	13	34	2	2	3	3	0	0	1	2	1	0	4	2 0,006	2	4,19 n	
Gralha-de-bico-vermelho	21	20	41	2	0	0	3	1	0	1	2	3	4	4	2 no data	4	4,19 n	
Rolleiro	27	16	43	2	0	0	3	0	0	0	4	3	2	4	2 no data	4	4,17-	
Abibe	2	9	11	4	2	0	3	2	2	0	1	1	0	2	0 0,63802	4	2,16 n	
Ógea	11	9	20	2	2	3	3	0	0	2	2	1	0	2	0 0,161904	3	3,16 n	

Figure 1 – Database for calculating the Species Sensitivity Index for wind turbines (top species)

For the top 22 species in the primary list, their vulnerability to wind farms was assessed, recurring to a database built upon extensive literature (Thaxter *et al*, 2017), as well as the key-characteristics needed to classify each species on 4 sensitivity scores [to collision with wind towers] (See Annex 1).

For each of the top species data about sensitivity areas around nests was researched – most data comes from extensive review found in Working Group of German State Bird Conservancies (2014).

The sensitivity map was to be built selecting the species with higher VEE and higher wind farm sensitivity scores. The last condition was that the species concerned needed to have distribution data available. This was true for the top 8 species: Cinereous vulture, Egyptian vulture, Golden eagle, Griffon Vulture (breeding colonies), Bonelli's Eagle, Redkite and Black Stork (Monteiro A. & M. Rodriguez, 2015; 2017, Rodriguez M. & Monteiro, A.,2018). For all species data concerns their breeding sites Peregrine Falcon, but as its order was only the 22th, it was not considered in the species selection. Another structure was added given its importance to the top 4 species: Vulture feeding stations. These places can attract high densities of birds, hence increasing the risk of collision with existing structures and they were considered with a 10 km buffer around.

Table 1 gives the values for Species Ecological Value (VEE), Species Sensitivity Indexes (SSI) and influence buffer around nests or concentration areas, for species included in the mapping analysis.

Table 1 - Species Ecological Value (VEE), Species Sensitivity Indexes (SSI) and influence buffer around nests or concentration areas.

Species		VEE (1)	Windfarm Species sensitivity Index	Influence buffer (km)	Data availability
Cinereous vulture	<i>Aegypius monachus</i>	49	2,8	10	Yes

Egyptian vulture	<i>Neophron percnopterus</i>	53	2,6	3,3	Yes
Golden Eagle	<i>Aquila chrysaetos</i>	31	2,6	3	Yes
Grieffon vulture	<i>Gyps fulvus</i>	27	2,5	10	Yes
Bonelli's eagle	<i>Aquila fasciata</i>	40	2,4	3	Yes
Red kite	<i>Milvus milvus</i>	40	2,4	1,5	Yes
Lesser kestrel *	<i>Falco naumanni</i>	41	2,4		No
Great Bustard *	<i>Otis tarda</i>	45	2,1	3	No
Black stork	<i>Ciconia nigra</i>	25	2,1	3	Yes
Hen Harrier	<i>Circus cyaneus</i>	39	2,1	1	No
European Honey-buzzard	<i>Pernis apivorus</i>	38	1,9	1	No
Booted Eagle	<i>Hieraetus pennatus</i>	38	1,9	-	No
Black kite	<i>Milvus migrans</i>	18	1,9	1	No
Short-toed-Eagle	<i>Circaetus gallicus</i>	20	1,9	-	No
Montagu's harrier	<i>Circus pygargus</i>	34	1,9	1	No
Red-billed Chough	<i>Pyrrhocorax pyrrhocorax</i>	20	1,9	-	No
Roller *	<i>Coracias garrulus</i>	43	1,7		No
northern lapwing	<i>Vanellus vanellus</i>	11	1,6	0,5	No
Eurasian Hobby	<i>Falco subbuteo</i>	20	1,6	0,5	No

* only known from old records; (1) – “Valor Ecológico Específico”.

The Study area for the mapping of the sensitivity is set as the project area a buffer zone of 10 km around these boundaries. The map area was subdivided into UTM square grid 1km x 1km and each square polygon was given a value which equals the sum of each species SSI whose territories exist there, following the respective buffers. Each species has a layer in the map that is summoned up to other layers. Annex 2 shows the underlying shapefiles used to build the final Sensitivity map (Map. 1).

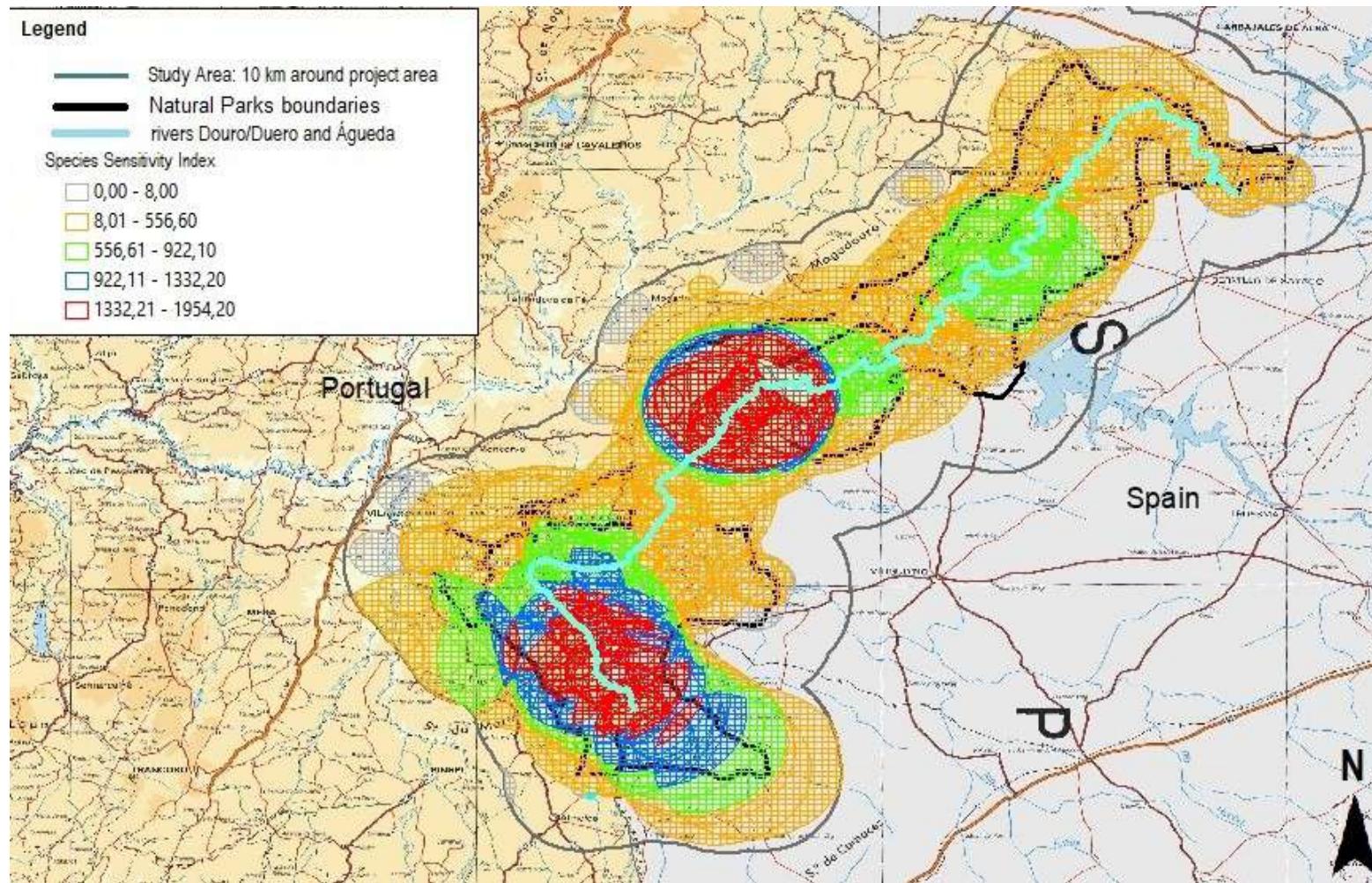


Figure 2 – Species Sensitivity map to windfarms for top priority species: Cinereous Vulture, Egyptian Vulture, Golden eagle, Griffon Vulture, Bonelli's eagle, Red Kite and Black Stork.

Discussion and conclusions

The goal of this action was to provide the International Douro SPA and protected area a tool for evaluating soaring species sensitivity to aerial energy infrastructures, in particular overhead powerlines , wind towers and Solar power plants.

Some guidance is given also on the siting and instalation of new agro-industries and intensive monoculture tree crops.

As the Bern Convention Bureau meeting states “In several countries, and many European regions and localities, sensitivity maps have been used in official locational guidance for developers, and to inform strategic spatial plans and associated strategic environmental assessments” (RSPB, Birdlife International, 2013). These tools are also designed for developers to help them select the best places and should easily available.

Northeast Portugal is a region with medium potential for wind power at a national level, according to some works (P. Costa, 2004), and thus can be attractive for developers, in view of the new renewable energy targets until 2030 (80% of energy consumption from renewable sources).

It is furthermore a rural region with high aptitude for cattle-raising and agricultural activities that need electric power supply, which include, in most cases a medium tension powerlines, which have a risk for electrocution for collision.

The existing Hydroelectrical power Dams in Douro and tributaries, imply that there are many routes for Transportation Lines, Very High tension lines which have a risk for collision.

This is a non-official document that intends to deliver technically supported recommendations, to be made available to developers, decision makers, nature and environmental authorities, so as to help and assist their decisions and options. As stated by Mitchell-Jones, 2004 in Gartman et al. (2016), measures recommended from official guidelines can be beneficial for developers enabling them to minimise additional permits or licenses, or be required to carry out additional working practices or necessary precautions. Therefore this document can also be taken as a technical basis for future good-practice official guidelines and it aligns with existing guidelines, whenever they have been set (powerlines).

The first part of this Good-practice guide is develop a sensitivity mapping of Douro soaring species to aerial energy infrastructures will be the basis for the good-practice guide that can be applied to any building or device that is using or providing electrical energy through aerial cables.

This sensitivity mapping and good-practice guide is intended as a support document for developers, consulting companies and authorities - it does not substitute any bird survey or environmental and risk assessment for the infrastructures.

This sensitivity mapping can also be useful to identify priority areas within cross-border river Douro region, to intervene with collision mitigation measures.

The Sensitivity Index to wind farms for selected species has a cumulative structure that relies on each species individual sensitivity score and its Specific ecological value. This map does not apply to Arribes del Duero Natural Park, since there are regulations that exclude this protected area from wind farms, this is not the case in Portugal, and in particular in Parque Natural do Douro internacional. The building of the map allows for more information to be added, either from new species or for new locations. The resulting classes of sensitivity should be considered relative to each other and not compared to a quantified index or probability of collision. All the top conservation value species in Douro Internacional could be mapped and contribute to the final map.

The sensitivity map shows that all the classified area has a high sensitivity to wind farms – due to high value species, their concentration and their high vulnerability to collision with wind towers. The results are as expected, being highest along river Douro and River Águeda where most breeding sites are located.

Even though this is not the perfect map it gives a clear picture of the relative degree of sensitivity in the protected area and across its boundaries and this can be further optimized, given new information, better coverage and a broader spectrum of species. It may be a useful tool to assess previously the high-risk zones in the region and can therefore contribute to future regulations within the natural park and the SPA area.

The second part of this document is about good-practice orientations for the planning of windfarm location studies, the building of new powerlines. Additionally, this report can be used as a guide to prioritize mitigation or avoidance interventions on existing lines.

Good-practices against collision with wind towers

Mitigating wind-farm impacts, starts in the planning phase with the choice of the construction site and this has been dealt with in various ways. Gartman *et al* (2016) has done an extensive review of scientific and grey literature, to systematize what has been done in recent years and categorizes mitigating strategies as shown in Figure 3.

Planning & Siting	Macro Siting	▷ Use Areas of Low Spatial Resistance ▷ Avoid Sensitive Areas
	Micro Siting	▷ Turbine Arrangement & Placement
	Facility Characteristics	▷ Facility Design & Size ▷ Increased Visibility
	Noise Reduction	▷ Sound Barriers
Construction	Absence of Animals	▷ Restrictions During Specific Periods ▷ Physical Barriers ▷ Deterrence
	Avoid Attraction	▷ Temporal & Spatial Land Management ▷ Lighting Intensity
	Luring	▷ Habitat Enhancement ▷ Habitat Replacement
	Deterrence	▷ Acoustic, Visual & Electromagnetic
Operation	Curtailment & Cut-in Speed	▷ During High Abundance ▷ During High Risk of Collision
	Decommissioning	▷ Dismantling & Restoration
	Repowering	▷ Dismantling & Relocation ▷ Phased Development
Decommissioning		

Figure 3 – Mitigation measure Classification (from Gartman *et al.*, 2016).

Macro-siting

The first phase deals with macro-siting and typically is done in the scoping phase of the project, prior to the Environmental Impact study or the Strategic Environmental Planning . Wind farms should be located away from classified areas and in areas with low resistance (several authors in Gartman *et al.*, 2016) and have a criterious choice of siting avoiding high value habitats for sensitive groups of species. Low resistance areas are free of movements of sensitive species, such as migratory routes. It is considered common knowledge that wind farms should be planned away from conservation areas and this is underlined by several authors (Manville II, 2005; Drewitt and Langston, 2006, Drewitt et al, 2006 in Gartman *et al*, *op.cit*). This precautionary principle belongs to the administrative regulations for Arribes del Duero but not in Portugal and particularly in Douro Internacional.

Strategic planning at local or regional levels should be based on animal populations, their preferred habitats and flight paths, and sensitive topographic locations. Protected areas that have high species or animal abundance, or where threatened species or those likely prone to collision are present and it is in protected areas that have the highest densities (Marques et al., 2014); This is especially true for Douro internacional, that aggregates nationally and internationally important populations of sensitive species: vultures, big raptors (golden eagle, Bonelli's eagle, red kite, ...) and Black Stork.

The buffers drawn on the sensitivity map clearly show that buffer zones, as recommended in international literature. The buffers used in this sensitivity map reflect the minimum buffer

zones around known breeding or concentration places exceed the boundaries of the project area;

We divide the map into two main zones:

1 – no siting zone: all areas within the highest rank to the lowest rank should be avoided, since they represent either a high probability of collision with the blades of the wind towers or a significant disturbance that can affect the species breeding and/or foraging ability.

2 – study zone: all areas where there is no colour; where there is no buffer does not mean that there is not any concentration, breeding or movement of sensitive species in the area; the reason for the blank spaces in the 10 km buffer around the project area may be due to the fact that there is not good knowledge on the species that use those habitats and territories (data on sensitive species is better studied within the protected areas, than outside). In the planning stage, all vulnerable groups must be taken into account, from bats, to birds to the wolf, and exclusion buffers should be strictly avoided; displacement routes, such as important river beds, short-distance migration corridors,

Micro-siting

Once the macro-siting is set up, based on geographical and topography characteristics, the micro-siting phase should follow. Similarly to the macro-siting, the recommendations are mostly based on observations rather than on sound data and research evidence. Even though the best recommendations have been:

For birds, need to study understand flight corridors prior during micro-siting planning in order to avoid these areas, choose corridors between the clusters of turbines and avoid turbine alignment that cross these flight paths, e.g. have alignment of turbines parallel with main flight routes (Drewitt and Langston, 2006; Hüppop et al., 2006; Smallwood and Thelander, 2004 in Gartman et al., 2016).

For bats, displacement corridors should be avoided, such as riversides, forests woodland areas, where they concentrate their activity, woodland edges and hedges; as well from breeding, hunting concentration (which can include also wetlands and artificial dams) and winter roosts;

For bats and birds, wind towers should be away from mountain ridge edges since these areas have an uplift effect that is used by many flying species (raptors and bats), as well as away from the top of the hills (De Luca et al., 2008).

Other measures

Other mitigation measures and criteria should be adopted, depending on the site, on the environmental impact assessment and most apply to the pre-construction or construction phase, functioning phase or decommissioning phase. These kind of measures are too specific and hence do not belong to the scope of this action. Further discussion should be done taking in account data studies on fauna available for the particular site.

Good-practices against collision and electrocution in powerlines

Portugal

Guidelines regarding the placement of power lines, follow the methodology employed in several other good-practice guides, especially those published by the National Nature Conservation and environmental Authorities, ICNF (Almeida, 2019) and APA guides for environmental Evaluation of Impacts, in Portugal and from legal dispositions in Spain. The principle used is that the restrictions to the implementation of such projects, either Distribution or transmission powerlines, will grow with the sensitiveness of the area where they are to be located and placed and the mitigation measures will strengthen as well.

Table 1 shows conditions and mitigation measures that should apply to distribution powerlines, Table 2 mitigation measures to transmission powerlines in Portugal and Table 3, the rules that apply to both transmission and distribution powerlines Map 1 and Map 2, show the cartographic distribution of the sensitivity zones in the project areas.

According to ICNF classification raptor species with threatened status at national level are considered the most critical to electrocution in powerlines, due to their conservation value. Electrocution happens when a bird that perches on the cross-arms makes contact between two phases of the conductor parts, or between Earth and a conductor. The bigger the wingspan, the highest the risk of electrocution.

Very Critical areas are defined by 1 km buffer around known nests: Golden Eagle, Bonelli's Eagle, Imperial Eagle, Eagle Owl, Egyptian Vulture, Cinereous Vulture, Griffon Vulture, Montagu's Harrier, Hen Harrier, Honey Buzzard, Goshawk, Hobby and Peregrine Falcon set the most restrictive zones,. In these areas new powerlines should be avoided or, if not possible, then buried. Adding to these, are the 1 km buffers around active necrophagous birds feeding Stations.

Equally **Vey Critical**, but towards collision, are the 1 km buffer areas around Black Stork nests.

Critical Areas for electrocution are selected species, new powerlines should be equipped with mitigation measures in order to prevent accidents with priority species of birds in the line (and other species, as a consequence): insulations of conductors, safe cross-arms types, anti-perching or anti-nesting devices – using best available solutions employed by Distribution System Operators.

For **Critical Collision areas**, such as corridors or buffers around riversides and aquatic habitats or within 5 km radius around Vulture feeding stations, mitigation measures are obligatory in any new line: Bird-flight Diverters (BFDs) and the reduction of the number of levels of wires to collide with (fig. 1).



Figure 1 – Examples of three types of line typology, with different levels bird collision

There are several types of BFD's and their used depends on the country, the company and the manufacturer (Fig. 2). The type of BFD's is also important, because they have got different efficiencies:

- simple spirals (or pigtails) have been discarded due to low efficiency.
- Double spirals - are broader and longer than simple spirals and usually applied alternating colours – red and white to make them more visible;
- Fireflies -The fireflies usually employed in Portugal /Spain have two main types: Firefly Bird Flapper (FBFs), with a rotating panel and another with neoprene straps, that is attached to each wire with a reflective and luminescent clip. Both these devices are strongly recommended for new lines that cross **Critical Areas for collision**.



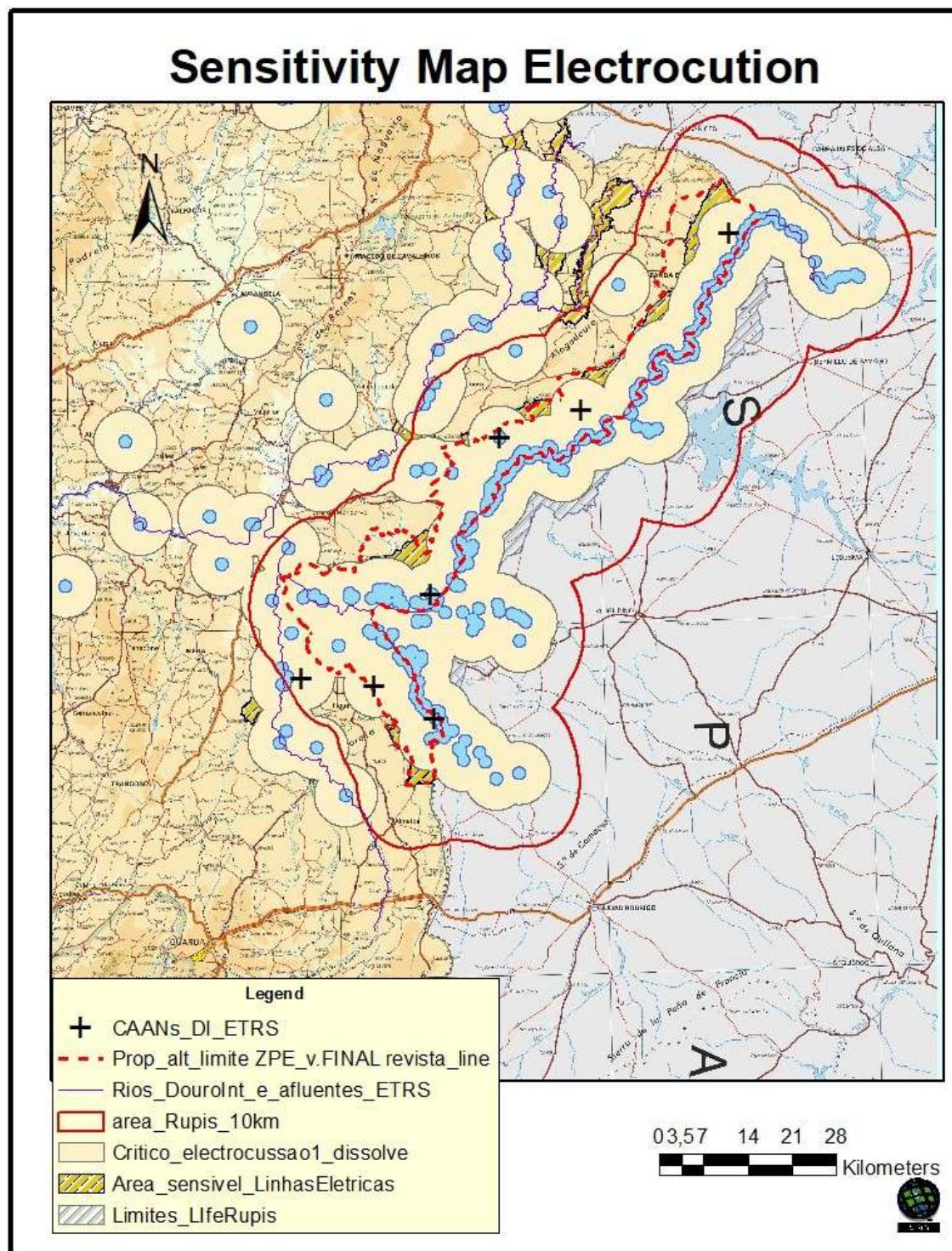
Figure 2 - Bird-flight Diverters: from left to right: simple spirals, double spiral, neoprene straps firefly, FBF (Firefly Bird Flapper).

Sensitive areas are defined as any classified area designated for the priority species mentioned above and provided the line crosses suitable habitats for those species. It implies that new powerlines should be installed with mitigation measures: electrocution and collision for Medium Tension lines and anti-collision measures for Medium, High and Very High Tension lines.

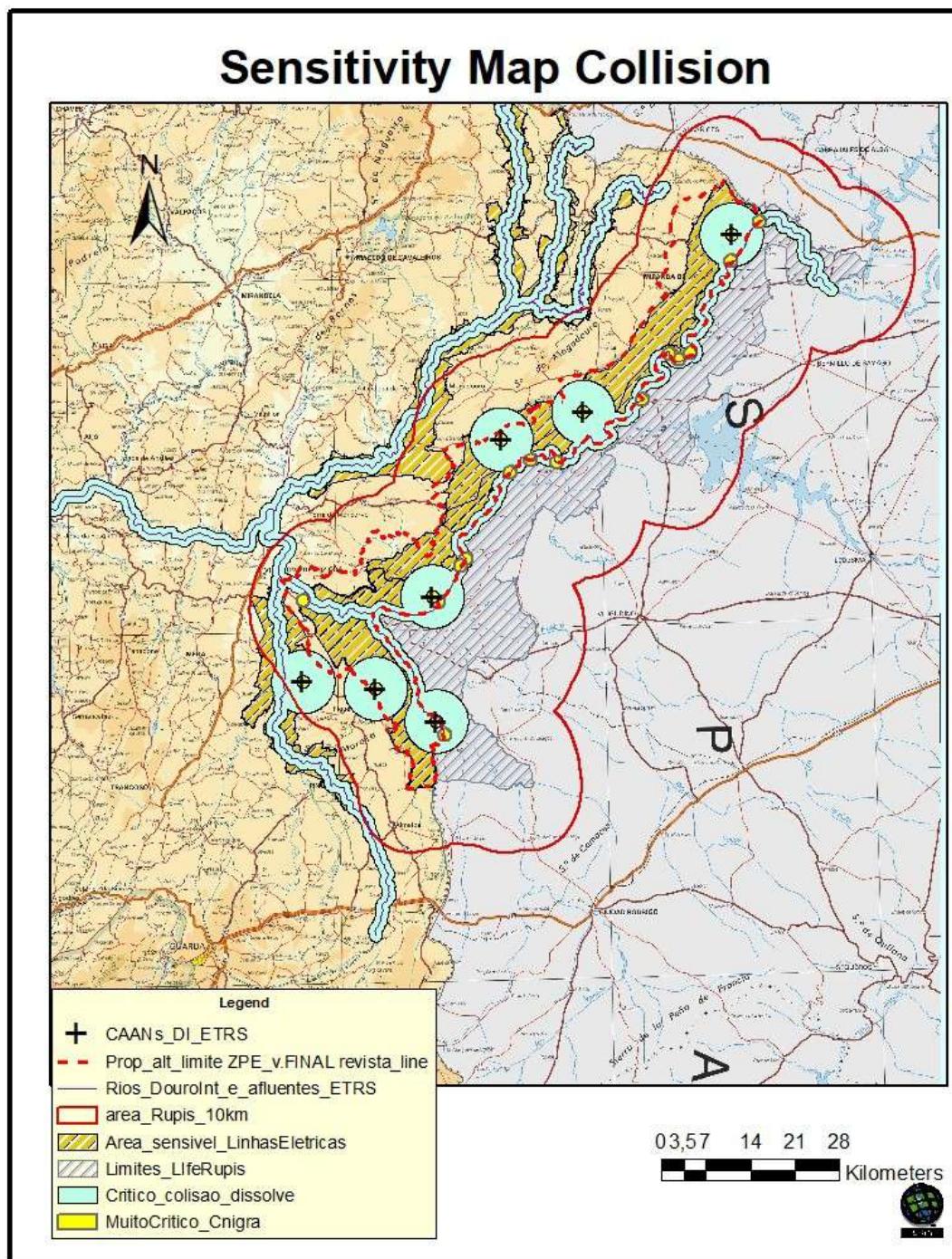
Table 1 – Mitigation Measures to Distribution powerlines (adapted from Almeida, J., 2019).

Sensitivity	Electrocution	Collision	Mitigation measures
Very Critical	<p>< 1 km from nests/important areas from:</p> <p>Endangered priority species</p> <ul style="list-style-type: none"> - Bonelli's Eagle, Golden Eagle, Imperial Eagle, Egyptian Vulture, Cinereous Vulture, Lesser Kestrel, Marsh Harrier, Montagu's harrier, Hen Harrier, Honey Buzzard, Goshawk, Hobby, Peregrine falcon <p>Necrophagous Birds Feeding Camps</p>	<p>Areas for Little Bustard leks</p> <p>Priority areas for summer and Winter concentration and flight corridors for Little Bustard and Great Bustard</p> <p>< 500 m from:</p> <p>Damp zones important for aquatic birds</p> <p>< 1 km from:</p> <ul style="list-style-type: none"> - Great Bustard leks - Feeding areas, post-nuptial concentrations, nests and priority areas of Black Stork - Crane roosts and corridors that link roosts and feeding areas - Ramsar Areas; - red-billed Chough roosts. 	Exclusion / burying
Critical	<ul style="list-style-type: none"> - >1 km , <5 km, from nests/important areas for Endangered priority species listed above - <2 km, from nests of eagle Owl - <5 km, from nests of griffon vulture - Settlement places for raptors with high threatened species (CR, EN, VU) e high risk of electrocution, whenever exact nest locations are not well-known - migration corridors with recognized importance. - Area >1 km , <5 km from necrophagous birds feeding camps 	<ul style="list-style-type: none"> - Well preserved habitat steppeland (pastures and fallows) and >50ha - Feeding areas for cranes - < 1 km away from important aquatic habitats and dispersion corridors for these species - < 1 km from dispersion corridor for raptor species (river valleys) - Important migration and dispersion corridors relevant for threatened species (CR, EN, VU) and with high collision risk; - Area >1 km , <5 km, within necrophagous birds feeding camps 	<p>Collision prevention: Reduce no. of wire plans Anti-collision devices: fireflies</p> <p>Electrocution prevention measures</p>
Sensitive	All Classified Areas (Protected Areas, Natura 2000 Network, IBA's) wherever crossing areas with suitable habitat for the bird species that they were designated for		<p>Collision prevention: Anti-collision devices Electrocution prevention measures</p>

Map 2 – Powerline Sensitivity Map. Very Critical, Critical and Sensitive Areas for Electrocution.



Map 10 – Powerline Bird Sensitivity Map. Very Critical, Critical and Sensitive Areas for Collision.



Spain

In Arribes del Duero the mitigation of the impact of powerlines on birds are regulated by the national and regional legislation, the ROYAL DECREE 1432/2008, of August 29, which establishes measures for the protection of birds against collision and electrocution on high-voltage power lines and Law 42/2007, of December 13, on the natural heritage and biodiversity.

The following guidelines apply either to either high-tension or medium tension lines, for collision or electrocution problems. Next, the main elements against collision and electrocution in power lines are exposed. The preparatory document prepared by García and Rodríguez (2009) has been followed. for a more detailed explanation of the fundamentals of birds mortality in power lines see the Fundación Patrimonio Natural de Castilla y León F3 report - Ação F3-Elaboração de um guia de boas práticas para a correção e sinalização de linhas elétricas, para reduzir a morte por colisão ou eletrocução da avifauna no Parque Natural Arribes del Duero - in spanish or portuguese language, from which the following guidelines section is taken.

Elements of protection against collision

There are different anti-collision devices that are attached to the cables to facilitate their remote viewing by birds. In accordance with R. D. 1432/2008, all new lines must be provided with bird-guards or visual markers, when so determined by the competent body of the Autonomous Community. They are installed in the earth cable, and if these do not exist, in the lines in which there is only one conductor per phase, directly on the conductors whose diameter is less than 20 mm.

The bird guards or markers will be made of opaque materials and will be arranged every 10 meters (if the ground cable is single) or alternately, every 20 meters (if they are two parallel ground cables or, where appropriate, in the conductors). The signaling on conductors is carried out in such a way that it generates a visual effect equivalent to a signal every 10 meters, for which it is arranged alternately on each conductor and with a maximum distance of 20 meters between adjacent signals on the same conductor. In those more dangerous sections due to the presence of fog or limited visibility, the administration may recommend reducing the established maximum distances.

There are several different anti-collision devices, as follows:

- Bird saving spirals. PVC spiral of different colors, with a minimum size of 30 cm in diameter and 1 meter in length. Not recommendable. Low efficiency, (Figure 3).



Figure 3 - Bird saving spiral.

- Bird saving Strips in Xs. Device made up of two strips of neoprene or other plastic material crossed and held by a polyurethane staple with luminescent tapes, its minimum size is 5 x 35 cm. Installation process of strips in Xs arranged alternately between conductors in electrical line Strips in Xs detail (Figure 4).



Figure 4 - Bird saving Strips in Xs. placement on the line and device.

- Bird saving Rotating blades. Device made up of three sheets with reflectors on a rotating bolt, it produces a remarkable visual effect, and its effectiveness is high (Figure 5).



Figure 5 - Bird saving Rotating blades.

Elements of protection against electrocution

Insulators - External anti- electrocution device placed on the ends consisting of a coated or non-woven rope made of plastic with different elements to insulate the areas of possible contact (Figure 6).



Figure 6 - Insulators against bird electrocution.

- Increase of insulator chains - Anti-electrocution measure that consists of increasing the insulator chains of the crosshead in order to increase the distances between areas of possible contact (Figure 7).



Figure 7 – Increase of insulator chains.

- Increased length of mooring chains - Anti-electrocution measure that consists of increasing the distance between the crosshead and the beginning of the chain

insulator in order to increase the distances between the areas of possible contact (Figure 8).

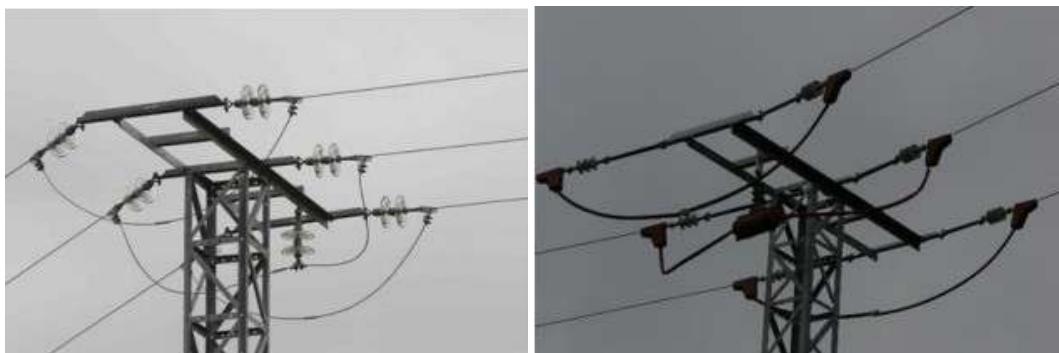


Figure 8 - Detail of the increase in the length of the mooring chains and subsequent insulation.

Perching and nesting deterrent - External device placed on the crosspieces to increase the distance to the cables, preventing birds from landing or making nests (Figure 9).





Figure 9 – Several types of perching and nest deterrents.

Maintenance of power lines

According to RD 1432/2008 during the nesting, reproduction and recreating season, work is prohibited maintenance on parts of power lines that support nests or that nest in their vicinity birds included in the List of Wild Species in Special Protection Regime (Law 42/2007, of December 13, on Natural Heritage and Biodiversity).

Exceptionally, repairs can be authorized when correcting faults that disrupt the normal supply of energy, or for urgent reasons to guarantee the quality or continuity of electricity supply. The competent body of the autonomous community must be informed and may require the adoption of concrete measures to ensure that the execution of repairs does not put birds at risk (Figure 10).



Figure 10 - White stork nest over inactivated electric line structure. Arenas de San Pedro. The village. Valle del Tiétar SPA (ES0000184). March 2019. Photo: E. Soto-Largo.

Defective fixes

The old prevention and protection devices that were not maintained at all, sometimes made with materials of poor quality and durability, can register incidents over time or even cases of mortality occur again. Sometimes the design or the execution of remedial measures they are not suitable and do not offer total protection against accidents. Therefore, it is advisable to review the old modified facilities located in especially sensitive locations, or black spots, to check your condition and correct it if the situation advises (Figure 11).



Figure 11 - Common buzzard perched on a cross with umbrella-like deterrent elements on the 20 kV power line. ZEPA Valle del Tiétar Lanzahita, Ávila. July 2019. Photo: Photo: R. Sánchez / Grupo Eco

The most common deficiencies are (Martín *et al* 2017):

- 1 - Use of non-durable material that has lost its effectiveness. Usually due to the fact that the tape used as an insulator to be broken and expose a metallic element, which can cause the electrocution of a bird if land on the metal support and have the misfortune to touch that exposed element.
- 2 - Ineffective insulating elements due to poor installation performance. clamps that cover the element installed incorrectly, exposing metal elements or cable sections. Sleeves used for insulation separated from the clamp due to improper installation and have been displaced.
- 3 - Insulation installed without taking into account the risk of electrocution due to contact with excrement. The excrement of a medium or large bird of prey can cause electrocution due to its projection, length and reach with the non-insulated metallic elements far from the point where it is perching.

4 - Non-isolated transformers. Transformers without cover or insulating sleeve at the junction point conductors are at risk of electrocution if a bird perches on the metal element and touches the conductors.

5 - Non-isolated disconnectors. The cross-arms with disconnectors where the connection of the conductors with disconnector is not insulated, the risk of electrocution persists.

6 - Insecure anti-perching deterrents. Metal anti-perching devices with inadequate design and arrangement, present risks of electrocution due to contact with excrement or because they partially limit the perching of the birds.

7 - Ineffective anti-collision devices. Anti-collision measures include the installation of devices that are visible for birds. Choosing an appropriate design is very important, as some designs were found to be ineffective. The effectiveness of the spirals is low or nonexistent, since it was found that collisions continue to occur in addition to birds risks of being stuck in the anti-collision element.

8 - Unfortunate electrocution. There may be cases of unfortunate electrocutions that occur with large species due to the connection line produced by the semi-liquid droppings of the perched bird and a conductor or insulator. The accumulation of excrement in the conductors can cause cuts power line and deteriorate the insulation system materials. On rainy days, or when the bird has wet plumage, what is called an electric arc can occur due to the difference of electrical potential. The air can become an electrical conductor and an electrical discharge occurs between the bird and the cable.

Good-practices for Solar power Plants

Portugal

The environmental guidelines for solar energy was not planned in the beginning of the F3 Action, but the most recently announced Solar energy targets for Portugal to reach until 2020, turned solar power into the spotlight.

Even at international level, there are few studies and even fewer data on the possible impacts of solar power production in species and habitats. However, these industries have been growing rapidly near several protected areas in mainland Portugal, including the Douro Area, due to the solar potential of the region (Fig. 12), and therefore recommendations apply.

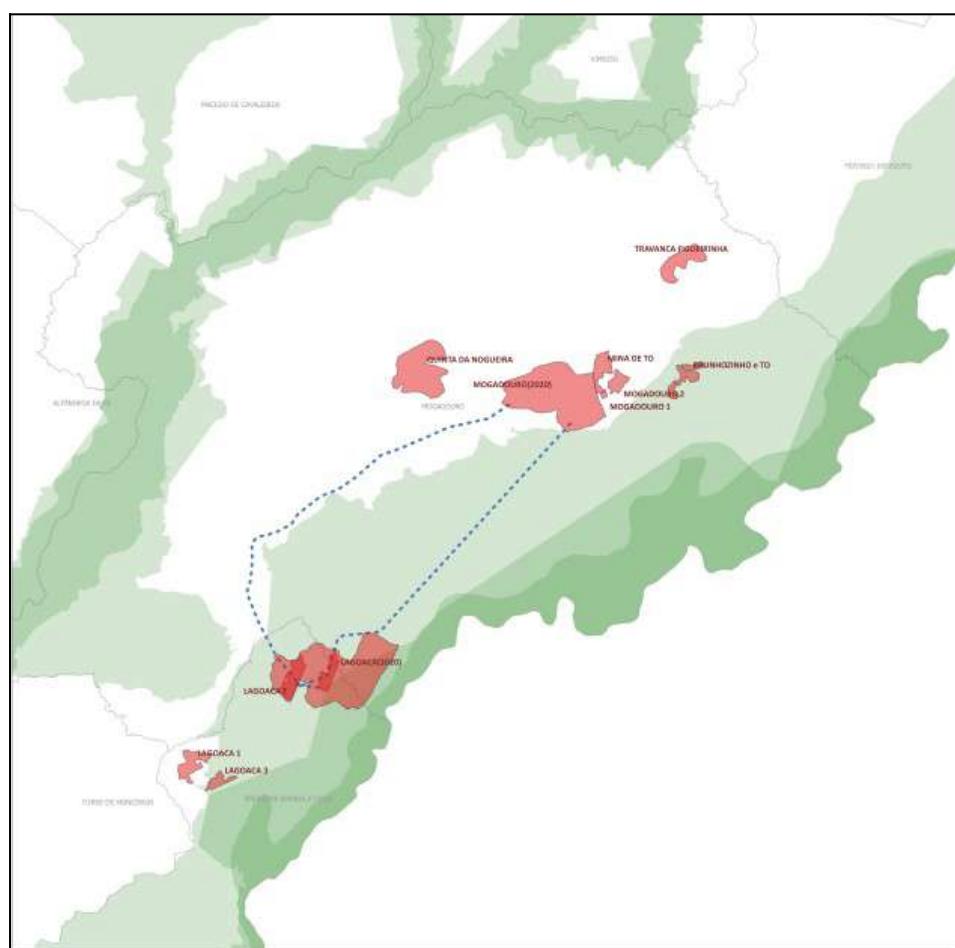


Fig. 12 – Solar power plants proposed in the Douro area and associated high/medium tension power lines (source: ICNF).

Most of the studies about the impact of Solar Energy focus on the mining and production of the solar power panels themselves rather than on the *in situ* impacts. Even though an

extensive review of data from the USA's National Photovoltaic Environmental Research Center (Turney & Fthenakis, 2011), states that:

"The majority impact to wildlife and habitat is due to land occupation by the power plant itself. The power plant is typically enclosed by a fence, limiting movement by animals. Some fences have openings to allow small animals to enter the facilities. With or without these openings, the habitat of the land changes significantly. Hiding spots, preying strategy, food availability, will all be affected. The soil is sometimes scraped to bare ground during construction and kept free of vegetation with herbicide, while in other cases the vegetation is allowed to grow but is mowed frequently to keep it below a few feet tall. In either case, a significant alteration to the vegetation occurs. The PV panels themselves will cast shadows and change the microclimate, causing an unstudied effect on vegetation".

The same authors refer to the possibility of positive impacts to wildlife, too, giving the examples like, keeping off the off-road vehicles, ecosystem restoration for endemic species or eliminating invasive species. Srinivasan *et al* (2019) recommend as a mitigation measure as the plantation of sun-sensitive mosses or bushes, in the area shadowed by the solar panels.

Shortly, most frequent causes of impact for wildlife are identified as follows (USA Fish and WildLife Service, 2018; Hernandez *et al.*, 2014):

- Loss, degradation and fragmentation of habitat;
- water consumption required to cooling and washing dust off panels;
- environmental toxicants required for operation (e.g., dust suppressants, rust inhibitors, antifreeze agents, herbicide);
- direct mortality, due to birds collision with panels because of its reflective surfaces; some technologies, namely those that concentrate solar beams (e.g. in Californian desertland), are known for burning birds, bats and insects, and flights disturbance through intense light reflection ((Turney & Fthenakis, 2011).
- avoidance of the area because of human occupation and disturbance.

Mitigation and prevention of impacts area should, therefore, be present since the early planning phases and should take in account the following considerations (Prinsen et al. 2011 and De Vault et al, 2014, 2015 in Zapata-Sanchez et al., 2016; Gehring et al. 2009, Manville 2005, 2009, 2013 and Fenton 1997 in Jenkins et al., 2017; Hernandez *et al*, 2014):

- bringing power generation closer to users and humanized areas to avoid disturbing natural landscapes and indirect impacts impacts (minimizing the need for transmission and distribution powerlines);
- use of degraded and unused parcels (like old airports, old infrastructure sites, with bare soil surfaces)
- use of human structures already in place, such as roofs, terraces and other artificial bare surfaces,
- avoid any areas with ecological value (corridor, foraging, resting or breeding areas),
- Minimize use of outdoor lighting at the solar facility, to avoid confusing migrating birds, or attract insects that in turn attract bats and birds;

- If the perimeter of the solar project is fenced, utilize systematic fence marking to reduce avian collisions with fences;
- On-site landscaping using native plants and soil amendments can add to ecosystem service provisioning (e.g., soil stability, C sequestration) without the use of additional water and fertilizer inputs;
- co-locations with agriculture, building synergies between both activities (e.g. co-existence of grazing habitat for livestock, such as sheep and goats, may curtail the need for vegetation removal and maintenance, or both, and limit erosion, while supporting both energy and food/fiber production).

Good-practices for Agro-Industrial Units and intensive agriculture plots

Portugal

The analysis and recommendations for good-practices for Agro-industrial units were mostly proposed not only because they can occupy high-value habitat area, but because they also depend on electricity supply, in most cases implying a new medium-tension powerline.

In the same scope, it was decided to add to these good-practice guidelines, the evaluation of intensive agricultural projects. The reason is that, this is a type of agriculture that was not usual in the northeast Portugal, is nowadays growing fast, taking advantage of favourable market conditions and new production techniques for traditional cultures (e.g. almond groves, olive groves) and these can have very disruptive effects at the landscape and ecosystem level.

At world level, loss of habitat and changing of traditional agriculture systems is the most important sole factor that is affecting wildlife and biodiversity in general and that is mostly due to land reclamation for agricultural areas. Even though agricultural land is a productive system, these systems cannot be considered apart from nature and some of them, in fact, represent a high value for wild communities. This is mostly true in the Mediterranean regions, where the millennial occupation of mankind shaped the territory and allowed for a complex network of functions and interdependence of man activities and wild species. In this project, this historic heritage is underlined by several actions, devoted to the promotion of cattle grazing, dovecots and habitat management, restoring the traditional habitat mosaic that favours prey-species for priority species, such as the Bonelli's eagle. The promotion of traditional habitat also implies that conserving natural vegetation refugees, such as natural woodland, wood edges, riparian vegetation, water sources, among others, are essential for the maintenance of wildlife communities and ecosystem services, whose top predators and scavengers contribute to and depend upon.

Impacts of intensive agriculture include, among others (McLaughlin & Mineau, 1995; Emmerson *et al.*, 2016, Sutherland *et al.*, 2019):

- Land reclamation – disturbing or destroying the traditional mosaic of habitats and wildlife refuges ;

- loss of biodiversity, by controlling spontaneous weeds and with negative consequences on insect pollinators, pollination ecosystem service and prevention of soil erosion
- increased consumption of water, either from dams or underground water resources – risk of lowering the groundwater level and drying natural springs, leading to increased water stress for natural vegetation and faunal communities and acute drought phenomena ;
- increased input of fertilizers, with powerhouse gas emissions, and other chemicals – pesticides, herbicides.
- increased soil erosion and increased terrain frame (due to soil tillage, removal of all weeds);
- increasing of terrain frame, creating a modification of relief and soil, that will not be reverted in the end of the occupation.

Several studies and projects have dealt with the good-practices within monoculture tree crop (Proietti & Regni, 2019) or their impact on ecosystems function (Saunders, 2013, 2016), but few give recommendations for the siting of new investments.

Nevertheless, the reclaiming of natural vegetation areas remain the first impact on wild communities and the management practices of the orchards are secondarily important and can have very relevant implications for the productivity of these cultures. Table 2 intends to summarize the importance to nature of several natural green infrastructures and some management techniques for monoculture tree crops that have proven beneficial for natural communities and biodiversity.

Table 2 – Good-practices for land-use and farmland management in Douro Internacional .

Typical Green structures	Main Benefits	Groups/species that dwell/feed/breed	Threats	Good-practices	reference
Natural Woodland	Climate impact mitigation Pollinator species/pest-control biodiversity	Arthropoda, bats, mammals, birds (e.g. deer, Red kite, turkey dove, insectivorous passerines)	Clear-cutting, wildfires, cutting removal of dead trunks and organic matter	retain wooden patches in farmland Thinning trees in forests; Retaining forested corridors in logged areas	Sutherland et al., 2019
Wooden hedgerows	Erosion control Flood control; Pollinator species/pest-control biodiversity	Arthropoda, bats, Birds, mammals	Clear-cutting, cutting removal of dead trunks and organic matter	Retain; plant new	Heath et al., 2017
Riparian a vegetation	Erosion control Flood control biodiversity	All groups	Clear-cutting	Retain; riparian vegetation restoration	Sutherland et al., 2019; Domer et al., 2019
Natural River and stream buffer zones	Pollinator species/pest-control	All groups	Land reclaiming	Buffer protection zones; riparian vegetation restoration	Sutherland et al., 2019;
Water points - springs	Drought mitigation	All groups	Water reclaiming for livestock /agricultural uses; pollution	Buffer protection zones;	
temporary or permanent artificial/natural ponds	Drought mitigation	Arthropoda, amphibians, reptiles, birds, mammals (incl. bats)	Water reclaiming for livestock /agricultural uses; pollution	Buffer protection zones;	Sutherland et al., 2019
Artificial islands or floating rafts in waters reservoirs	Drought mitigation biodiversity	birds	-	Seeding / planting natural vegetation	Williams et al., 2012
Natural pastures/fallouts	Pollinator species /pest-control	Arthropoda, birds, mammals (e.g. partridges, rabbits)	Land reclamation for intensive agriculture	Retain/ Leave unmanaged /seed	Traba&Morales, 2019

Typical Green structures	Main Benefits	Groups/species that dwell/feed/breed	Threats	Good-practices	reference
Uncultivated field margins /wild flowers edges	Pollinator species /pest-control	Arthropoda, birds, mammals (e.g. partridges, rabbits)	Land reclamation for agriculture	Leave unmanaged / seed wildflowers	Sutherland et al., 2019
In-field trees	Pollinator species/pest-control biodiversity	Arthropoda, Bats, birds,	Clear-cutting	Retain	Sutherland et al, 2019
Green cover (existing orchards)	Drought mitigation, erosion control, pollinator/pest-control	Arthropoda, Bats, birds,	Removal with herbicide or tillage/harrowing	Seed or leave spontaneous growth / mechanical cutting; leave green cover	Proietti & Regni, 2019
Cliffs	Erosion control biodiversity	Birds (rupicolous species – from rock dove to griffon vulture), reptiles	disturbance	Buffer protection zones;	-
Old structures, walls, or ruins, caves	Climate impact mitigation biodiversity	reptiles, Bats, birds	Destruction or fencing (for cave entrances)	Leave in place ; close entrance but leave space for small animals to enter/exit	Sutherland et al, 2019

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ANNEX 1 – Calculations and tables

Annex I

Calculation of species sensitivity Index (SSI)

VEE – Taken from previous studies underlying management Plan for Parque Natural do Douro Internacional;

Ecological parameters in 5 categories:

- flight manoeuvre ability (capacidade de manobrabilidade do voo)
- Soaring (comportamento de planadoras)
- aerial foraging (procura de alimento em voo)
- ranging behaviour (comportamento dispersivo)
- Flocking (voo em bandos)
- nocturnal flight activity (actividade de voo nocturna)
- aerial display (voos nupciais, territoriais)
- site fidelity (fidelidade aos locais de repouso, reprodução)
- range DI (distribuição pelo Douro)
- sensitivity to displacement (vulnerabilidade ao deslocamento)
- habitat preference (preferência de habitat)
- availability of preferred habitat (disponibilidade do habitat preferencial)

Mortality in wind turbines

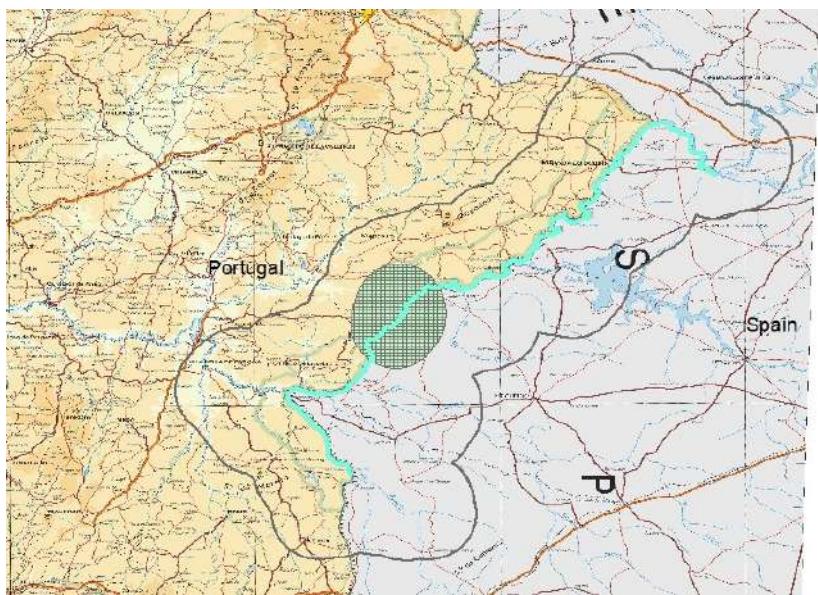
- mortalidade em turbinas eólicas (Thaxter et al, 2014)

ANNEX 2 – Maps underlying the building of the sensitivity map for soaring birds.

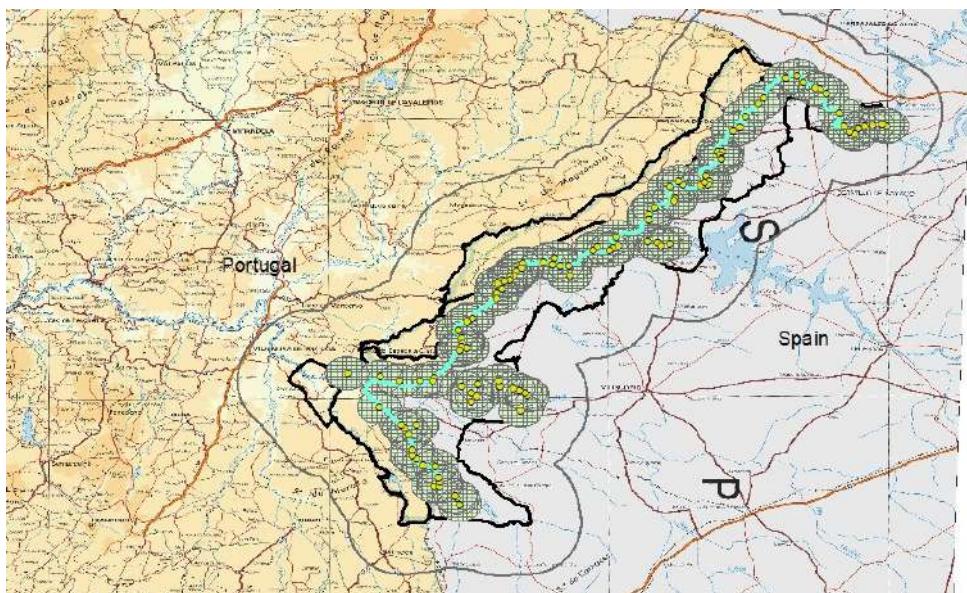
Map 1. Windfarm Bird Sensitivity Map: project area, map area and 1 km x 1 km UTM grid.

Grelha 1x1km

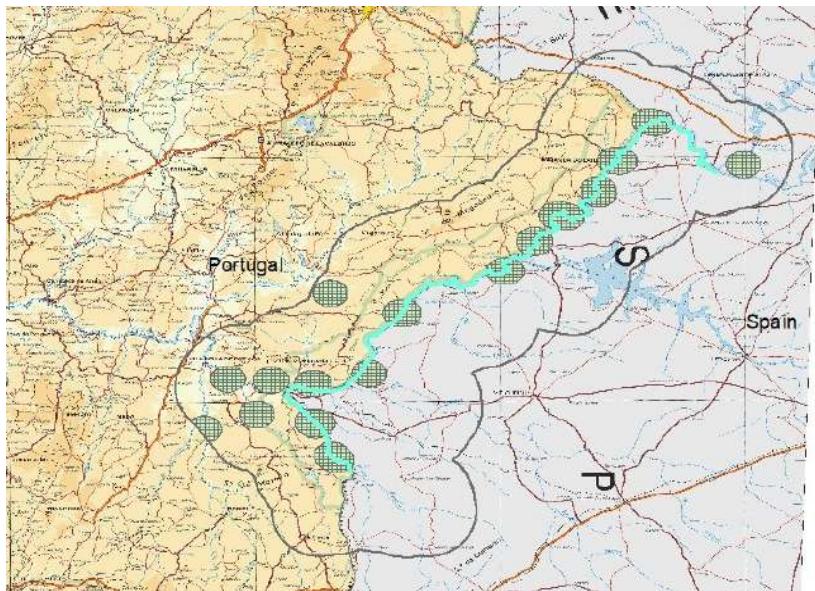
Map 2. Windfarm Bird Sensitivity map.Cinereous vulture buffers



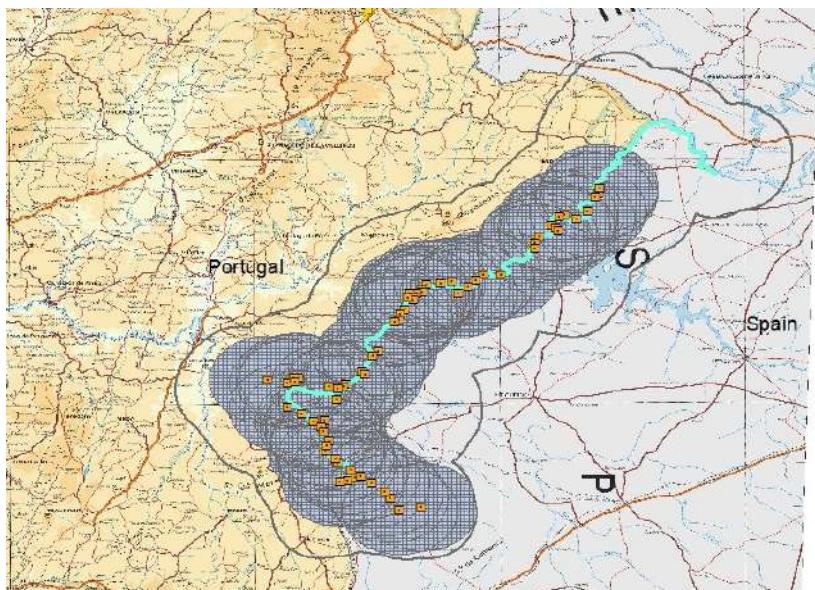
Map 3. Windfarm Bird Sensitivity Map, Egyptian vulture buffers



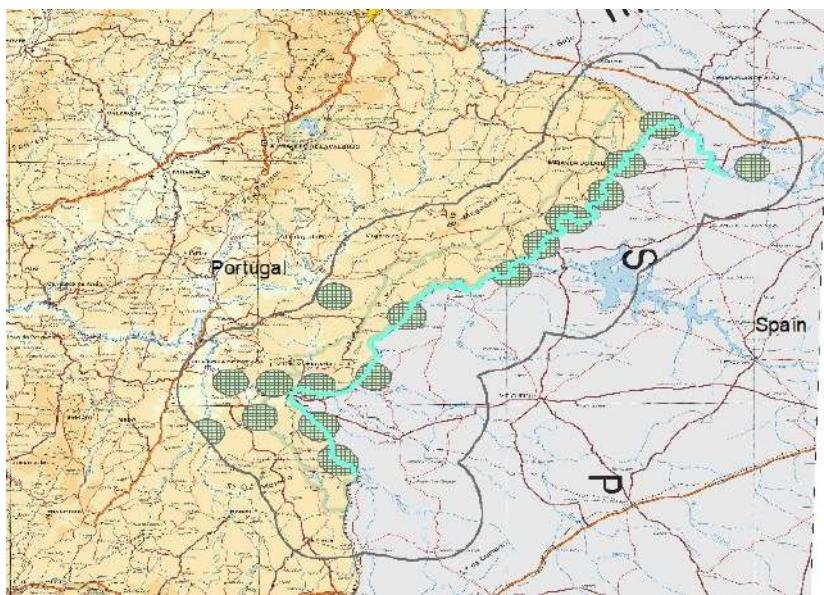
Map 4. Windfarm Bird Sensitivity Map, Golden eagle buffers



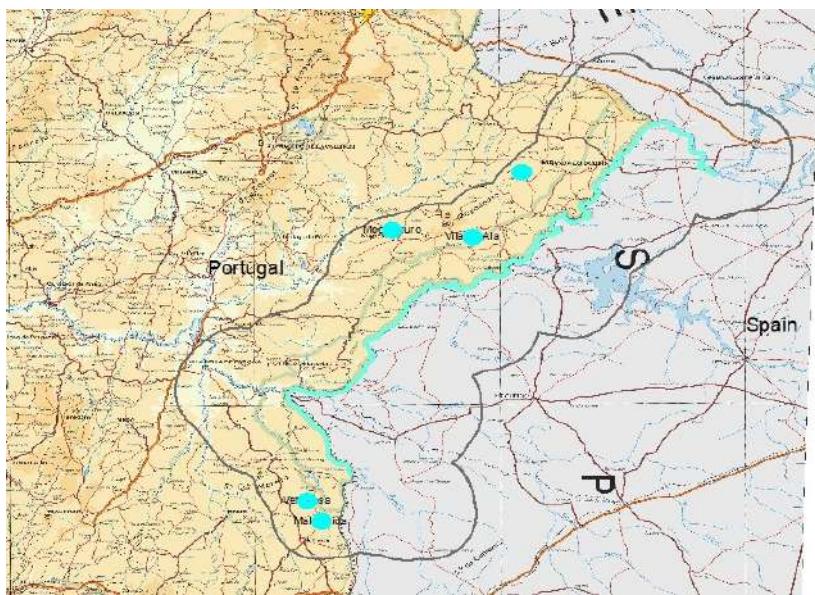
Map 5. Windfarm Bird Sensitivity Map, Griffon vulture buffers



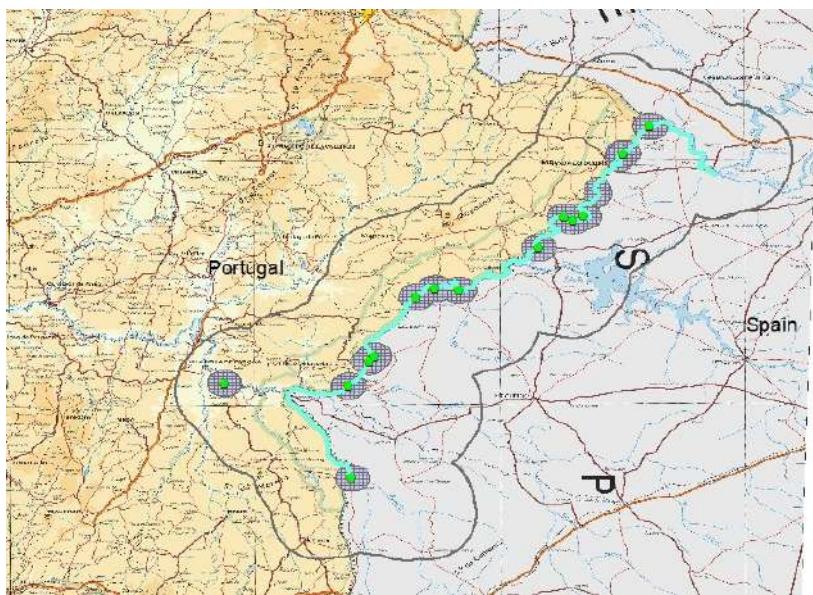
Map 6. Windfarm Bird Sensitivity Map, Bonelli's eagle Buffers.



Map 7. Windfarm Bird Sensitivity Map, Red Kite roosts buffers



Map 8. Windfarm Bird Sensitivity Map, Black Stork buffers.



Map 8. Windfarm Bird Sensitivity Map, Vulture Feeding stations buffers.

