

**Guideline on Predator Control Strategies for the Conservation
of the Great Bustard (*Otis tarda*)**

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1. Introduction

Wildlife management within Great Bustard habitats

The Great Bustard is inherently linked to agricultural areas throughout its life cycle. Rare and sensitive species, such as the strictly protected Great Bustard are more adversely impacted by the changes resulting from environmental and agricultural transformations. As the Great Bustard is a ground-nesting species, characterised by relatively slow development (incubation and chick rearing lasts for 4 months), both eggs and chicks are heavily exposed to predatory pressure. Eggs are most often consumed by the red fox, the carrion crow and the raven while chicks routinely fall prey to foxes as well as predatory birds. Alien predators, mainly raccoons and raccoon dogs play a significant role in predation in some regions such as Germany. For these reasons, game management practices play an important role in Great Bustard protection.

Biodiversity loss is way beyond the scope of a single profession, namely, nature conservation. As such, Great Bustard protection is a multisectoral issue with many stakeholders involved: besides nature conservation officers and wildlife managers working within Great Bustard habitats, farmers, water management professionals and power suppliers must also cooperate to achieve common goals.

The predation of Great Bustards is linked to both protected and game species, which makes the conservation measures to reduce predation on bustard habitats even more complex. Managing predation covers several tasks and needs thorough cooperation between conservationists and gamekeepers.

Management of predators includes the management of Great Bustard habitats. Bustards need vast, open areas. Each kind of fragmentation is detrimental for the species but may support predatory species on the other side. Windbreaks of poplars or other tree species for example may be used for breeding (corvids) or as perches (birds of prey, corvids). Additionally, they form migration lines for ground predators. Power lines also serve as perches for opponent species and, additionally, cause direct mortality. Terrestrial reed fields or areas overgrown with bushes are beneficial for wild boar or predatory mammals but also pheasants as a quarry species for hunting - this may be a point of conflict between hunting and conservation. High and dense vegetation unsuitable for bustards is supported by overloads of nitrogen.

Beyond predators and habitats, the Great Bustard itself as the target species is part of the complex food web in different ways. Hungry chicks in unsuitable habitats are begging much more than chicks with a full stomach, therefore they become more susceptible to predation. Also for reintroductions or reinforcement projects it is clear that young birds of perfect fitness and behaviour are needed for release in order to improve their survival. Birds with less weight proved to be fitter than heavier birds.

Besides habitat management, predator control strategies, as part of game management, are the key and prior measures to reduce predation in Great Bustard habitats. The management is carried out by gamekeepers as the key target group of this document, therefore all relevant activities of game management affecting Great Bustard are included in this guideline.

The effects of protected predatory species (e.g large eagles) also need to be considered, however the management of protected species is out of the scope of this document.

The indicator of location-specific, sustainable management

The Great Bustard is, in fact, the indicator of sustainable agricultural practices that, for centuries, provided livelihoods for rural communities while preserving their natural environment. The local extinction of Great Bustard populations or their dwindling is a symptom. The Great Bustard originally inhabited spacious, open grasslands (steppes). These ecosystems became more and more fragmented with time, and were partly converted to cropland. Bustards did adapt to the transformed landscape and today include alfalfa, cereal and rape fields alternating with grasslands within their home ranges. Our natural environment – including the Great Bustard as a building block and an indicator – is most often harmed on behalf of the economy. However, Great Bustards are more characteristic of agri-ecosystems inappropriate for intensive cultivation and thus, supporting extensive farming in these biodiversity-rich regions also benefits economic interests.

An umbrella species

The Great Bustard is a ground-nesting bird characterised by huge home ranges, slow development and a high sensitivity to disturbance. Consequently, it can only be efficiently protected by providing large, relatively undisturbed grasslands, croplands or temporary wetlands throughout a lengthy period of its life cycle. Thereby, Great Bustard protection also benefits a wide range of other plant and animal species. There is ample evidence that Great Bustard habitats are richer in insect and bird species than conventionally cultivated agri-ecosystems. Higher biodiversity, more species form much more stable ecosystems, that is, semi-natural habitats are better equipped against extreme environmental impacts and other external effects than intensively cultivated, quasi ‘sterile’ fields.

2. Game management practices within Great Bustard habitats

The role of game management in Great Bustard protection

Predatory species, including the huntable predators, are part of natural ecosystems. A healthy and stable ecosystem is characterised by predators on the top levels of their food pyramids. However, their populations may increase rapidly in an unnatural way due to human influence. This can be rabies immunisation of foxes or the release (deliberate or not) of invasive alien species from fur farms. Predators have a significant impact not only on Great Bustards, but also on other prey species, many of which are protected by nature conservation. In general, the combined presence of huntable and protected predators within agri-ecosystems negatively affects the reproductive success of ground-nesting birds, including the Great Bustard. As empirical evidence shows, by the efficient and ecologically balanced control of huntable species the negative effect can be largely mitigated. Population size of a predatory species is affected by a number of factors and every area has one or more dominant predatory species or group of species.

Local extirpation of predators is neither the task, nor the target of game management, however, their proficient control is a significant element both of efficient small game management and successful nature conservation. Keeping the number of native, huntable predatory animals at a low level is a general goal, especially throughout the spring and summer seasons, is a general goal for game management, but also for nature conservation when trying to safeguard small or

remnant populations of threatened species. With exact data on population sizes, an adequately low number of territorial families can be targeted and the efficiency of control can also be easily monitored by regular field visits. Inefficiency will apparently be signalled, for example, by routinely observed carrion crow fledglings or young foxes, a high density of reproductively active fox dens, or numerous flocks of pillaging carrion crows. In case of non-establishment of exotic predatory species, the immediate culling of any observed individuals, or ideally, the extirpation of the entire population is a professionally justified intervention.

Damage to nature conservation assets resulting from predation may be significantly lessened by the efficient control of huntable predator populations, while collaterally benefitting small game and roe deer populations. In other words, ecologically balanced population control of huntable predators is beneficial both from the nature conservation and Great Bustard preservation as well as from the game management viewpoint.

Via game meat production, game management plays a role in our food supply chains: a quality diet includes quality game meat, too. Measures implemented to protect the Great Bustard are greatly beneficial for brown hare and roe deer populations, too.

2.1. Huntable species relevant to Great Bustard conservation and their reproductive habitat

2.1.1. Huntable predatory species relevant to Great Bustard conservation

Carrion Crow (*Corvus corone*)

Regarding the taxonomic treatment of Hooded Crow and Black Crow (subspecies of one species or two separate species) there still is no widely agreed approach in the scientific literature. In these guidelines, both taxa are covered by the term Carrion Crow as we see no difference regarding the predatory effect on Great Bustards nor in potential management measures between these two forms and their hybrids. At least in some parts of the Great Bustards Central European range both forms and their hybrids occur side by side, form mixed pairs or feeding flocks and therefore can be considered as one management issue.

The Carrion Crow is a corvid dominantly feeding on animal proteins. This gives the carrion crow a much higher significance for wildlife management and thus it is to be distinguished from the protected rook. Especially within the chick-rearing period, carrion crows routinely prey on chicks and eggs of other species, besides consuming carcasses. Their strong beak is capable of picking even Great Bustard eggs open.

Its population control is most efficiently carried out by territory-based trapping, as well as by habitat reconstruction and habitat management methods suited for Great Bustard habitats.

Red Fox (*Vulpes vulpes*)

Probably the most important huntable predator relevant to Great Bustard protection. By efficiently controlling its population, those of the hare, the pheasant, or the roe deer will be supported in appropriate habitats.

Its population control is most efficiently carried out by a combination of territory-based trapping and shooting, as well as by habitat reconstruction and habitat management methods suited for Great Bustard habitats.

European Badger (*Meles meles*)

This species has been on the rise recently in most range states, in Hungary approx. half of the total amount of dens (sets) are occupied by badgers in open lowland habitats. As a generalist carnivore, the badger is a potential threat to all ground-nesting birds including the Great Bustard, but also, it can be easily controlled.

Its population control is most efficiently carried out by territory-based trapping, as well as by habitat reconstruction and habitat management methods suited for Great Bustard habitats.

Golden Jackal (*Canis aureus*)

This species has been on the rise for decades and its range is still radically expanding. It establishes stable populations in shrubs as well as in woodlands and thus mostly vagrant or commuting individuals appear in Great Bustard habitats. However, a jackal population established in a woodland flanking a Great Bustard habitat may well cause serious game and conservation management problems.

Its population control can primarily be carried out by habitat management methods suited for Great Bustard habitats.

Wild Boar (*Sus scrofa*)

The wild boar is present in every type of lowland habitats, including Great Bustard habitats. While it only becomes fully established where habitat types are suboptimal for bustards, it is capable of visiting a foraging site from great distances. It mainly damages ecosystems by rooting grasslands and fallows, but as a generalist with a dominantly animal-based diet it is a threat to all natural assets within its reach.

It prefers feeding in grasslands and fallows (especially if its favourites, such as the tuberous pea is present) and cereal croplands (oat, wheat, rye, or maize – otherwise unfavourable for the Great Bustard).

Its population control can primarily be carried out by habitat management methods suited for Great Bustard habitats.

Alien animal species and stray domestic animals

In terms of the preservation of steppe ecosystems, the presence of alien species, including those domesticated and kept as pets, is unwanted. Non-native (alien) species are potentially or actually harmful not only within Great Bustard habitats, but as a general rule, in every native ecosystem. Their populations should be continuously controlled, their expansion or increase avoided by all lawful means. Problematic alien species within Great Bustard habitats: stray dogs (*Canis familiaris*), stray cats (*Felis catus*), raccoons (*Procyon lotor*), raccoon dogs (*Nyctereutes procyonoides*), nutrias (*Myocastor coypus*), American minks (*Neovison vison*) and muskrats (*Ondathra zibethicus*). Close and efficient cooperation on behalf of game management and conservation management sectors is needed to resolve issues connected to these species.

- **Raccoon (*Procyon lotor*) and Raccoon Dog (*Nyctereutes procyonoides*)**

These alien species are already firmly established in some range states (e.g. Germany). Their populations are currently growing and spreading into further areas. Even if their influence on the Great Bustard has not yet been finally clarified, they definitely have the potential to harm the Great Bustard population as well as other ground-nesting birds. Therefore, intensive hunting of these species is necessary.

Its population control is most efficiently carried out by territory-based trapping, as well as by habitat reconstruction and habitat management methods suited for Great Bustard habitats.

Species with a significant role in predation, that are protected in some range states:

- **Common Raven (*Corvus corax*):** Ravens are common breeding birds in almost all Great Bustard areas (especially in Germany). As they use even the smallest wood patches, tree rows and pylons of power lines, there are hardly any “remote” areas not accessible for ravens. Predation includes eggs as well as chicks and is done by local breeders and additionally flocks of non-breeders. The raven’s bill is large enough not only to open the eggs easily, but also to carry the great eggs away for hiding. This was revealed as relevant in attempts to include Conditioned Taste Aversion (CTA) in the management strategy as the active ingredient of bait eggs decomposed within some days. Gradually, the predation pressure decreases with growing vegetation and after the ravens’ offspring leave the nests.
- **Large eagles, such as Eastern Imperial Eagle (*Aquila heliaca*) and White-tailed Eagle (*Haliaeetus albicilla*):** both species are protected in all range states and are listed in Annex I of the EU Birds Directive and protected by several other international agreements. They do direct predation on chicks and adult Great Bustards as well, but their effect on disturbance and influence on site selection of Great Bustards is more relevant. The eagle-bustard conflict is not discussed in this document.

2.1.2. Non-predatory huntable species related to hunting activities on Great Bustard habitats

This chapter is listing the species relevant to hunting activities on Great Bustard habitats in general. These game species benefit from the Great Bustard conservation, so the conservation measures taken on predation result in a growth of these game populations, as a prior motivation of the hunting society.

Roe Deer (*Capreolus capreolus*)

It is one of the most significant big game species characteristic of Great Bustard (and small game) habitats. Its protection, management and utilisation can be easily coupled with bustard protection measures, but familiarity with both these measures and the area, as well as the cooperation with conservation managers is inevitable.

By the control of red foxes and other predators, coupled with appropriate habitat management practices, roe deer populations should increase. As for roe deer hunt, two activities are relevant for the Great Bustard: spring buck hunts should not be carried out within lekking and nesting sites and does should not be hunted within rape fields frequented by bustards.

Bustard protection measures are, in general, favourable for the roe deer, too.

European Brown Hare (*Lepus europaeus*)

One of the main ‘beneficiaries’ of Great Bustard protection and the game management practices included therein, is the hare. Based on empirical evidence, adequate habitat protection measures are most effective for hares as well as other natural assets, when they are coupled with appropriate game management (and especially: predator management) practices.

Common Pheasant (*Phasianus colchicus*)

As a non-native species, the pheasant is not as highly valued as the hare for biodiversity, but both for small game management and for indicative purposes, it is still a priority species in Great Bustard habitats.

The pheasant is also a ‘winner’ of bustard protection measures, as it prefers non-cultivated patches within the agricultural matrix (such as baulks, canal banks, outbuildings and farmsteads etc.).

Grey Partridge (*Perdix perdix*)

Unfortunately, today there are hardly any persistent natural populations and the grey partridge has thus lost its importance for small game management. Hence, wherever it still occurs, it must be managed with utmost care. Even though the partridge benefits from bustard protection measures included in agricultural and game management practices, its low dispersal ability prevents new populations getting spontaneously established in improved habitats. The preservation and reinforcement of extant populations is a high priority both for small game management and nature conservation.

Any releases disadvantageous for the survival, expansion or establishment of grey partridge populations (especially those of the alien red-legged partridge, *Alectoris rufa*) are to be avoided, as well as directly shooting grey partridge.

One of the German Great Bustard conservation projects (Zerbster Land, Great Bustard reintroduction) is coupled with a Grey Partridge project. Joint conservation approaches are highly recommended in almost all Great Bustard habitats, where the appropriate habitat management and the effective, ecologically balanced predator control strategies are realised at the same time and location.

2.1.3. Breeding habitats of huntable predatory species

Suppressing predatory populations in Great Bustard habitats is mainly based on significant reduction of reproductive individuals within the area, that is, trapping red foxes, badgers and carrion crows. In order to do this efficiently, trapping must be planned on the basis of an annually updated map of active dens and nests involving the entire game management unit. Based on observations and several years of field experience on predator control practices carried out to protect the Great Bustard, we present a description of the reproductive habitats of predators below.

1. Dens

The map of dens is a database to be updated from year to year. Once a den is located, the place must be visited as a potential breeding site each year onwards, with the exception of those sites where the habitat is drastically changed, e.g. by reconstruction and thus has become inappropriate for a den. Such transformation can be the elimination of dykes, canals, revitalization and reconstruction of farmsteads etc.

It is also important to identify the so-called ‘alpha dens’, i.e. centrally located dens that may serve as appropriate shelter each year for a huntable mammalian predator. Trapping at such dens results in very efficient control, even if nothing else is done to lower predator numbers.

Types of dens based on their location:

- a. higher elevation grass- or croplands: these dens cannot be eliminated, but with careful mapping, they can be located and controlled on an annual basis.
- b. dykes, canal and ditch banks: significant mainly in low-lying, open sites. Dens in canal banks may become available / inappropriate with changing water levels within the canal.

- c. farmsteads: abandoned farmsteads are preferred sites. As they are usually located at higher elevations, these dens are often alpha dens.
- d. bale stacks: an increasingly common breeding site for mammalian predators. On account of the livestock and other domestic animals present, control is most efficiently carried out by live-trapping.

2. Carrion **crow and raven nests**

Great bustard habitats are typically open, treeless landscapes. The lack of trees efficiently limits the abundance of carrion crows that otherwise occur wherever they can find appropriate nesting trees. However, there are instances when removal of trees is not possible in otherwise suitable Great Bustard habitats (e.g. the trees provide habitats for other protected species). Carrion crow nest sites can be categorised as follows:

- a. solitary individuals of native tree or bush species
- b. small woodlots, forest edges
- c. lines of trees: the most typical breeding sites of carrion crows and ravens, such as the poplar plantations flanking canals. Nests in these sites are built very high up the trees, their control is risky and difficult, but the birds can be easily trapped.
- d. other constructions: carrion crows and ravens have been observed nesting on power pylons and other anthropogenic structures, even on high stands routinely used for hunting.
- e. database about carrion crow nest locations must be created and updated yearly as a basic information for territory-based trapping

Some corvid nests or dens can be detected easily, but some are difficult to find, especially the ones far from easy to access places, busy roads. The effectiveness of predator control highly depends on the professionalism, the attitude and the activity of the staff dedicated to predator management.

For an external observer (without having detailed information about the level of predator density of the particular site), the high number of active dens and nests in the proximity of frequently used roads or in other, easily detectable locations can be a sign of inadequately planned or executed game management. The same can be said for the high number / large bag of young foxes, or apparent carrion crow flocks after mid-summer (or all year round), or observations of large numbers of carrion crows in their winter nocturnal roosts that call for the revision of the applied predator management practices, in order to discourage carrion crows from staying at the site and, similarly to foxes, becoming a potential threat to the eggs and young chicks of great bustards

2.2. Hunting methods, techniques and installations

The aim of biodiversity-oriented wildlife management is to include effective, sustainable, and generally applicable predator control practices. For this reason, nature conservation officials must cooperate with hunting societies operating in Great Bustard habitats.

Main principles of biodiversity-oriented wildlife management:

- compliance with national and (for EU member states) EU legislation when deciding whether to intervene in order to protect natural values, considering the aspects of autochthonous predatory species when predator control is necessary
- animal protection principles (target species, 'useful species', 'helper species')

- protection of natural assets
- considering all available resources
- efficient predator management: controlling target species during their sensitive periods (between 1 March and 30 June, in general), focusing on reproductively active populations within a given location. This also goes hand in hand with a more successful protection of protected species in their breeding period. (It has to be kept in mind that territories where the territory-owners have been removed will get more attractive for (younger) non-breeders that occupy such territories quickly (e.g. carrion crows).
- trapping log
- photodocumentation coupled with GIS data

Main attributes of conservation-oriented predator management:

- easily applicable in practice
- efficient, lawful and humane
- complies with nature conservation and with game management goals while taking into account national and (for EU member states) EU legislation concerning autochthonous predatory species
- focussed on reproductively active individuals
- based on trapping combined with culling
- territory-based
- with a regional scope

2.2.1. Hunting methods

With adequate planning and careful execution, game management and hunting are easily adapted to Great Bustard protection principles. As hunting is a potential disturbance to bustards, the most sensitive periods (lekking, incubation and chick rearing and overwintering) should be duly observed when planning the timing of hunts. First, it must be evident where the bustards are. This information can be sought from nature conservation officials.

Great Bustard protection considerations relevant to the different hunting techniques:

A. Individual hunting techniques

- a. Still hunting, tracking and hunting from carriage: selecting the optimal stand or route is essential, as is the compliance with temporal limitations.
- b. Calling (for roe deer): from the end of July to the beginning of August it can be carried out without a substantial conflict of interest, as this is outside the sensitive periods of bustards.
- c. Tracking: a potentially significant method to avoid the establishment of wild boars in a bustard habitat. Tracking a fresh trail is rarely a problem for bustard protection, but crossing open landscapes during the breeding period should be avoided.
- d. Trapping: generally used for predator species combined with territory-based mapping, as one of the most effective way of controlling them.

As for professional hunters carrying out their annual tasks: the timing of end-of-winter / early spring population censuses and that of the spring hunt of roe deer bucks is critical for the protection of lekking sites.

For breeding sites, pedestrian commute between 15 April and 15 July is a potential threat. Flushing an incubating female from the nest almost always leads to breeding failure as the Great Bustard is highly sensitive to this type of disturbance.

Throughout doe hunting, overwintering and nocturnal roost sites of bustards should be avoided. Sparing nocturnal roosts can be implemented via regular consultation with nature conservation officials.

B. Hunting parties

- a. Wild boar drive: it typically does not take place within bustard habitats, as adequate management prevents wild boars from getting established there. However, conservation management officials must be included in the planning phase.
- b. Beat-hunting small game: as it falls outside the sensitive periods, only overwintering and / or nocturnal roost sites must be considered for Great Bustard protection. Flushed bustards can lose considerable energy, especially in cold, adverse weather. Furthermore, poor visibility (e.g. on foggy days) significantly increases the risk of collision with power lines. For this reason, cooperation with local nature conservation managers is recommended from planning to implementation to best include biodiversity aspects.

Summarising the above, the protection of Great Bustards necessitates:

- During the sensitive periods of Great Bustards, i.e. between 15 April and 15 July, any activities potentially lowering their reproductive success should be avoided in their habitats. Open landscapes (grasslands, fallows and croplands) must not be crossed neither on foot nor by car. Females flushed from their nest rarely ever return, and for this reason all interventions must be planned for the remaining 9 months of the year.
- Hunting parties, wintertime drives or hind and doe hunts must avoid wintering and other frequented sites (rape and alfalfa fields, nocturnal roost sites etc.).

2.2.2. Hunting and game management installations

1. high stands: landscape and biodiversity protection reasons justify the installation of stands right beside trees or small patches of bushes or trees, farmsteads or canals. Access routes must also be considered carefully for each placement. The use of stands within bustard habitats may be temporally restricted if they present a disturbance to the birds.
2. feeding troughs: their implementation and operation may be justified within bustard habitats if they are to prevent the establishment of wild boar populations. There are other nature conservation aspects to be considered, too and their creation within or next to valuable grasslands should be avoided.
3. feeding and salt grounds: only justified for native small game and roe deer. Large game feeding cannot be operated within bustard habitats. Access routes should also be selected carefully in order to avoid disturbance and harm to biodiversity.
4. watering pits and wallows: attract a concentration of large game and thus can only be created alongside other hunting installations within Great Bustard habitats where the wild boar occurs. Nature conservation aspects must be observed for the entire operation.
5. small game releasing devices: from the conservation point of view, only grey partridge release can be justified within bustard habitats. Rearing and releasing non-native game should absolutely be avoided here. Pheasant release is not justified from a conservation viewpoint. Carefully planned and executed predator management as well as the reinforcement of natural populations should be targeted instead. This not only provides

a more sportsmanlike hunting experience, but is also more favourable for protected species in general.

6. traps¹: efficient devices of predator control, their application is highly justified in Great Bustard habitats.

Game management instalments and devices should be located so as to comply with nature conservation aspects during their operation. From access through use and maintenance, both direct disturbance and indirect damage (e.g. trampling) must be avoided. Their location as well as the concentration of game must be considered and justified.

Before installing any of the above-mentioned hunting facilities, the legal requirements of the respective country must be taken into account.

Trap types

Depending on the legal regulations of the respective state², the following types of traps can be used for game management in great bustard conservation areas:

Devices for trapping birds:

1. Four-compartment crow traps: mainly for carrion crows, but probably the most universally applicable live trap that can also be used for badgers and foxes. Made of metal, easy to transport, and with careful placement and regular relocation provides a highly efficient means of predator control.
2. Ladder traps: appropriate for catching large numbers of carrion crows, especially newly fledged juveniles. They must be applied as a complementary action. Like box trapping, the method can be applied along the boundaries of a habitat or where large flocks are routinely observed. However efficient, this cannot substitute territory-based trapping during the breeding season. In order to release protected bycatch unharmed, it must be controlled on a daily basis. Also, when traps are temporarily out of operation, safety must still be ensured.
3. Other devices: e.g. Swedish traps, box traps. Any device that may be lawfully applied.

Devices for trapping mammals:

4. Swan necks: often raises animal protection objections, especially on behalf of dog owners. However, when professionally used, the swan neck is amongst the most efficient fox traps. Its selectivity depends fully on placement locality and mode, which makes it the most 'demanding' trap type regarding precision, proficiency and conscientiousness.
5. Body grip traps (with a rotating clip): a highly efficient trap type mainly for badgers. Good-quality equipment must be used and besides efficiency, animal welfare aspects must also be considered.
6. Restraint cables: an alternative for quick-kill traps that, with appropriate skills, can be used for effective predator control.
7. Cubic metre box traps: especially useful for trapping foxes and badgers in sites where traps cannot be placed right by the den (e.g. in farmsteads and livestock farms). Inhabitants or staff can also be charged with trap controls, as part of good communications and to ensure daily controls.

¹ In EU member states the use of non-selective traps is prohibited by EU legislation. Derogations of this prohibition may be granted for certain reasons (eg. in the interest of protecting wild fauna) if there is no other satisfactory solution.

² The use of certain trap types might be completely banned in some range states or regions.

8. “Kozárd Trap” and other artificial dens: a concrete pipe trap with rocker mechanism is very suitable for live trapping of adult foxes, badgers, raccoons and raccoon dogs, construction requires increased effort but it is very durable.

2.3. The efficient and lawful practice of trapping

There is no such active hunting activity that could surpass trapping in efficiency, success rate and precision. Trapping in known territories or other breeding sites radically decreases the abundance of huntable predatory species. Keeping their abundance low requires an ever-decreasing input from year to year – but it does necessitate annual interventions.

The first and maybe the most important task in the planning phase of trapping is an accurate mapping of target species (huntable predators) within an area with detailed information on their spatial and temporal patterns. In order to achieve this, an annually updated cadastre of dens and nests should be created including all species that must be controlled.

Trapping activities must be adjusted so that the ecological needs of Great Bustards are adequately considered. Ideally, territory-based trapping can start at the end of the winter-beginning of the spring first in the lekking sites, then in the nesting sites and then be expanded to the rest of the area (not used by Great Bustards).

By significantly reducing reproductively active individuals in the spring, the number of predatory offspring that year will be radically lowered that consequently creates very low predation pressures during the breeding seasons of Great Bustards, other protected species and small game, even if only regionally and temporally so. Trapping in territories shall also limit the number of reproductively inactive individuals that show a decreasing tendency due to regional cooperation anyway.

The following game management and hunting methods and principles may be applied to achieve efficient control of predatory target species relevant for Great Bustard protection:

1. Carrion Crows:

- a. trapping within territories is the most efficient method for their control. Trapping should be carried out in the vicinity of known active nests
- b. the four-compartment crow trap is the most efficient trap type, but other live-traps can also be applied (e.g. Swedish traps)
- c. traps must be relocated on a regular basis within the territory. This requires some experience, but radically increases trapping success
- d. decoy birds must be provided varied, protein-rich diets in captivity (raw egg, meat and cereal) as well as fresh water on a daily basis
- e. known nests should be monitored as apart from catching the adults, their offspring should also be trapped
- f. ladder traps used outside territories can result in large bags, but their efficiency cannot match that of within-territory trapping during the nesting season
- g. every other hunting method (e.g. shooting) can only be regarded as a complementary activity
- h. in compliance with the EU Birds Directive 2009/147/EC prohibiting the killing of native bird species in general and hunting of huntable species during the rearing season or during the various stages of reproduction trapping carrion

crows within active territories during the breeding season may only be carried out by derogation issued by the relevant authority.

2. Red Foxes:

- a. a regularly updated map of the dens that covers the entire game management unit is essential for efficient population control. Dens located earlier must be visited at the end of the winter/early spring to check whether intervention is needed.
- b. Swan neck traps and restraint cables are also efficient, but with foxes, their use requires more experience and care. Adult foxes may be trapped with large (size 70) swan necks, while for cubs and juveniles a smaller (size 50) is more efficient.
- c. as fox control is the most effective by quick-kill traps, early morning trap controls are essential on a daily basis
- d. shooting foxes can be an important complementary action in fox control, especially in areas where trapping is too difficult (e.g. near settlements)
- e. With the fox, it is even more important to focus on reproductively active adult individuals, ideally culling them already at the beginning of the mating season. Obviously, every surplus individual that is culled later, contributes to the better protection of natural assets
- f. female foxes should be culled as early as possible, however, their elimination does not necessarily guarantee the loss of the entire brood as males are capable of raising older cubs on their own

3. Badgers:

- a. maybe (beside racoon) the easiest mammalian predator to be trapped
- b. the most effective means for badger control is the large (size 330) body grip trap. Badger traps must be made of high strength metal, as weaker substances raise animal welfare issues (do not comply with the principles of humane trapping), decrease trapping success as well as the durability of the device
- c. for mixed dens (used both by badgers and foxes), the application of body grip traps is not recommended, as adult foxes shall circumvent this type of trap (dig a new exit) and abandon the den
- d. every exit of a badger set should be either fitted with a trap or appropriately blocked otherwise
- e. shooting can be an important complementary action for game management
- f. the hunting season of badgers is regulated by the Bern Convention on the Conservation of European Wildlife and Natural Habitats

4. Golden Jackal:

- a. On account of its habits (hunting and moving in close-knit family packs), there is no known method that would work well for the golden jackal. Occasional culls may be made by swan necks or other devices, but controlling established packs within a region is a real challenge for game managers
- b. shooting can be an important complementary action for game management, especially in the vicinity of carcass deposits or in nighttime call-hunts
- c. As the Golden Jackal is listed in Annex V of the EU Habitats Directive 92/43/EEC EU members states are required to secure a favourable conservation status of this species.

5. Wild Boar:
 - a. its establishment within Great Bustard habitats must be prevented by adequate habitat management practices. Once it occurs, however, it necessitates immediate intervention
 - b. control is mainly done by culling
 - c. population monitoring must be constant (by finding tracks, rootings, wallows etc.) and is especially efficient by regular nighttime field visits
 - d. wherever abundances are high, live trapping is justified as an efficient method for wild boar control

Important note: the hunting season of each species, and all other country-specific hunting regulations (e.g. restrictions of Birds Directive in EU member states) must be considered before planning predator control strategy and hunting activities in general.

2.4. Practical tips for trapping

- Trapping of predators is an unquestionably efficient method for the protection of Great Bustards, just like the small game and roe deer populations if it is carried out with sufficient intensity. However, it must always be carried out responsibly, and operated on a daily basis. It also requires careful planning, an adequate provision of human and material resources that will pay off multiply both for game management and for nature conservation.
- After successful trapping at a den, all exits should be thoroughly blocked. Thus, re-occupation may be prevented and any activities at the blocked entrances (fresh scratches etc.) can be immediately detected.
- Trapping carrion crows is most efficiently done during their breeding season. Trapping beside nests freshly built will radically lower the number of reproducing adults and, on the side, secondary species (that do not build stick nests for themselves) can take empty nests over for their own breeding purposes (e.g. hobbies, kestrels, long-eared owls and red-footed falcons).
- Trapping outside the breeding season / farther away from active nests or dens is always a risky action with doubtful efficiency. Nest /den cadastres of target species are fundamental for efficient trapping that results in radically lowered predator densities in the breeding season of the species to be protected by trapping.
- Age categories of target species in the order of their importance for predator management:
 - a. adults: reproductively active individuals
 - b. adults (bird species): second-year individuals, that typically do not reproduce as yet
 - c. juveniles: offspring born/hatched within the given year
 - i. capable of surviving alone (left their natal territories)
 - ii. not capable of surviving alone (still within their natal territories)
 - d. cubs / chicks: offspring still living within the den / nest

2.5. Timing of predator control activities

Population control of huntable predatory species is most effectively done within their breeding (sensitive) seasons, while complying with the relevant regulations.

Evidently, predator numbers within a region are undulating as a result of population control interventions. Predator management can be regarded as successful if populations lows are timed

for the sensitive seasons of species to be protected as limited predator populations are less likely to cause serious harm in protected populations.

2.6. The importance of regional cooperation

Game management units were often delineated arbitrarily and thus their boundaries do not represent actual boundaries, and as such, are truly permeable for birds and other species with good dispersal abilities (e.g. the wild boar) or those that are highly adapted for anthropogenic environments (e.g. the red fox). Thus, even though effective predator control within a unit is a significant achievement, it is inadequate in itself for keeping predator numbers low in the long term. Even in units with lower densities, immigration from habitat patches with higher predator densities will necessitate constant, high intensity control interventions on behalf of the local hunting association or others responsible for hunting activities.

2.7. Ethical considerations

- Predator control must always be proficient and lawful. Illegal actions are unacceptable (such as the use of poisoned bait) even if they lead to radically lowered predator densities. Such interventions are not selective and induce uncontrollable processes while threatening natural assets as well as human health.
- Habitat management, reconstruction and conversion must always be carried out in compliance with relevant regulations. It must be checked whether permissions and statements are available for any given intervention. Uncontrollable actions (such as burning) cannot be initiated without the involvement of the relevant authorities. In case protected natural assets are involved, a preliminary declaration should be issued by the local conservation management body.
- In general, the rearing and release of non-native species that potentially threaten our native flora and fauna is to be avoided.
- Respect for game animals traditionally is duly paid by hunters towards ‘useful’ game species. However, predatory species are an inherent part of a healthy ecosystem and thus should also be paid due respect even during control activities.
- Predator control (and hunting in general) is aimed at sentient beings with highly developed nervous systems making them capable of feeling pain etc. Thus, animal welfare principles are applicable for all the species discussed in this document. Decoy birds kept as bait for live traps require the same level of care and attention as any domesticated livestock or household pet. If these individuals are regarded as our useful partners and helpers, compliance with animal protection principles shall become self-evident.

3. Preconditions for the hunting regulation on Great Bustard sites

- 3.1. The regulation must be based on accurate monitoring data of huntable predator species, updated from time to time, especially their breeding population, dynamics and distribution
- 3.2. The regulation must fulfil the requirements to reduce the density of huntable predatory species and to keep it in a low level during the sensitive period of the Great Bustard
- 3.3. The regulation must fulfil the requirements to avoid disturbance of hunting activity on Great Bustard habitats, especially during the reproductive period and during wintertime
- 3.4. The regulation must be applicable by hunters, and must be effective and legal.

3.5. Predator management techniques and practices must fulfil the requirements of animal welfare.

4. References

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5. Annexes

5.1. Hungary

ANNEX I: Management planning at Kiskunság National Park Directorate

Kiskunság National Park Directorate (KNPD) has prepared the following management plan, compliant with these guidelines and, based on external feedback, implemented without any significant conflicts of interest. Application of the management plan can thus be recommended as a good practice outside the KNPD, wherever Great Bustards occur.

Elements of the management plan implemented by the KNPD:

General conservation regulations

1. The amount, location and functionality of hunting and game management installations must be revisited. Both extant and planned installations must be consulted by the local conservation managers and permitted by conservation authorities.
2. Placing hunting and game management installations in Natura 2000 grasslands requires the permission of the hunting authority with a previously issued declaration from the conservation manager.
3. Both in protected and Natura 2000 sites, hunting and game management installations must be made of natural materials and be located in compliance with landscape protection principles.
4. Feeding or watering troughs, feeding or salt grounds etc. cannot be created in grasslands (whatever their land use classification).
5. Any kind of water management intervention (e.g. water drainage, inundation) and the establishment of wells in protected and Natura 2000 sites requires a permit.
6. During hunting and game management activities (including access to sites), protected natural assets and habitats must not be disturbed, threatened or harmed.
7. Waste material resulting from hunting and game management (incl. ammunition cases) must be removed from protected areas.
8. The populations of huntable predatory species must be controlled by all legal means in order to achieve nature conservation goals and for successful game management purposes.
9. Wild boar numbers must be kept to a minimum in protected and Natura 2000 sites.
10. Small game rearing and release sites cannot be carried out within protected areas. Extant establishments must be eliminated.
11. The spread and establishment of invasive and alien species must be prevented and their populations controlled by all lawful means.

General regulations for Great Bustard habitats

1. Hunting and game management activities to be carried out in bustard habitats between 15 March and 30 June, including those connected to roe deer buck hunting, must be preceded by consultation with the conservation manager.
2. The following predatory species must be limited to the minimum within Great Bustard habitats: badgers, foxes, golden jackals, carrion crows, magpies and feral or stray dogs and cats.
3. Regulations on the control of huntable predatory species:
 - 3.1. Control should primarily be carried out between 15 March and 30 June by territory-based methods (den-hunting, trapping, etc.).

- 3.2. Control in open landscapes (grasslands, croplands) must be terminated by 15 April. Any intervention later than this date must be carried out alongside linear structures (roads, canals, line of trees etc.) or in the vicinity of tall, vegetated patches (reedbeds, woodlots) to avoid crossing open spaces.
4. Permanent establishment of wild boars must be prevented.
5. Preliminary consultation with the conservation managers must precede nighttime population censuses or shootings.
6. When planning the locations and routes for wintertime activities (including hunting parties, crossing open landscapes etc.), Great Bustard presence must be considered and avoided, especially on foggy days.
 - 6.1. Locations of hunting parties must be selected by a consultation with the conservation manager before the hunting season.

General regulations for priority wetlands

1. Within priority wetlands, a certain part of the area must be dedicated where shooting waterfowl is forbidden. Such parts should be indicated by landmarks apparent and known for all party members.
2. The following predatory species must be limited to the minimum within priority wetlands: badgers, foxes, golden jackals, carrion crows, magpies and feral or stray dogs and cats.
 - 2.1. Control should primarily be carried out between 15 March and 30 June by a territory-based method (den-hunting, trapping, etc.).
3. Permanent establishment of wild boars must be prevented.
4. The use of lead shot is prohibited within and in the vicinity of priority wetlands.
5. The use of live decoy birds and electric acoustic devices designed to attract wildlife is prohibited during hunts.

Cooperation opportunities

The cooperation amongst stakeholders involved in wildlife management (i.e. game managers, nature conservation bodies and farmers) is essential for the achievement of many nature conservation goals. The three sectors are inherently linked with several ties and may cooperate for their mutual benefit. The guideline recommends the consideration of the following three opportunities:

1. Predator management

The high densities of huntable predator species (red foxes, badgers, golden jackals, carrion crows and magpies) present in an area often lead to significant damage in small game populations and in natural assets.

Hunting methods mainly based on trapping can successfully limit predator populations within an area.

However, efficiency in territory-based trapping focusing on reproductively active individuals can only be guaranteed by regional cooperation that includes as many game management units as possible. For out-of-season hunting of certain small huntable predators (i.e. the badger, the carrion crow and the magpie), a permission from the hunting authority is required.

Cooperation opportunity

As part of the Great Bustard protection programmes, it is well worth familiarising stakeholders with nature conservation-oriented predator control methods, presenting the methods and devices applied and even preparing and signing agreements with partners.

2. Raptor poisoning

Unfortunately, mass killing of raptors as a result of deliberate poisoning still occurs. The highest risk posed by poisoning is that it initiates uncontrollable processes that can easily have dire consequences for human health much farther away from the actual placement of poisoned baits.

Nature conservation organisations apply established best practices (satellite tracking, search dogs) to investigate such illegal actions that shed a negative light on predator management. For this, cooperation with the hunting associations is essential. A poisoned raptor may show the following symptoms: loss of shyness, abnormal mobility and spasmodic posture. Wherever more than one carcass is discovered, the reasonable suspicion is that poisoning took place. In such cases, it is equally important for the hunting association to alert relevant authorities (the police, official veterinarians) as well as the nature conservation manager immediately.

Cooperation opportunity

Cooperation can involve the implementation of effective predator control practices (the lack of which being the cause of most poisoning actions), as well as the prompt communication of such issues towards search teams and authorities.

3. Location of hunting and game management installations

Installations used for hunting and game management (e.g. high stands, game feeders) must be located and operated in compliance with not only game management, but also with nature conservation aspects.

Within protected and Natura 2000 sites, both extant and planned installations require permission. During the permitting procedure, permissions both from nature conservation and hunting authorities are required for the establishment or the permanence of an installation. The application must contain detailed information on the exact location, type, timing of operation of the installation / device, preferably for the entire duration of the actual management period.

Cooperation opportunity

The local conservation manager can be a useful partner in the preparation of the permit application.