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Wind farms in Thrace

Updating the proposal for proper site selection

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EXECUTIVE SUMMARY

The region of Thrace, in northeastern Greece, is of exceptional ornithological importance as it hosts habitats that are of European-wide significance mainly due to the presence of large birds of prey and aquatic birds, most of which are under protection and some of them are globally endangered.

Indicative of the ornithological value of the region of Thrace is the presence of 3 out of 4 vulture species found in Europe. More specifically, (I) the last remaining breeding collony of the Black Vulture (*Aegypius monachus*) in the Balkans can be found in the Dadia-Lefkimi-Soufli National Park (from here on Dadia National Park) in the Regional Unit (RU) of Evros, (II) the most important breeding collony of the Griffon Vulture (*Gyps fulvs*) in mainland Greece is located in the southern part of the RU of Evros, and (III) more than half of the last remaining breeding pairs of the Egyptian Vulture (*Neophron percnopterus)* in Greece are located inside the RUs of Evros and Rodopi.

Alarge part of the region has been selected as priority area for the development of wind energy sources as it is one of the areas with the highest wind capacity in mainland Greece. Specifically, the biggest part of the RU of Evros and a part of the RU of Rodopi have been delineated as Wind Priority Area 1 (WPA 1) under the National Renewable Energy Spatial Plan framework. Within this area a significant number of wind farms (WFs)is already in operation. This number will increase considerably if the WFs that are at the planning stage areincluded.

WWF Greece (2013) believes that the development of renewable energy sources (RES) is important so that Greece can participate inthe global efforts to mitigate climate change, to achieve a degree of energy safety and independence, as well as to enhance the wellbeing of people in the country. At the same time, WWF Greece emphasises the need for a careful WF site selection process based on certain prerequisites so as to avoid the potentially negative consequences on wildlife, especiallyon birds. As noted by the European Commission (EC 2010) and the IPCC (Wiser et al 2011) WFscan have a significant negative impact on birds, especially when WF site selection falls within areas of increased ornithological interest, such as the Special Protection Areas (SPA) of the EU Birds Directive(2009/147/EU).

The WPA 1 overlaps with 5 SPAs located in the RUs of Evros and Rodopi. All five of these SPAs are crucial habitats for large birds of prey, while two of them have been designated also National Parks.

In an effort to determine the conditions that can lead to the sustainable development of WFs in Thrace, WWF Greecedrew up a proposal for the proper site selection of WFs inside the WPA 1 (WWF Greece 2008[b]).The 2008 proposal acknowledged the need to base WF development in the region on vigorous planning at a strategic level. In this direction WWF Greece, by using the best available at the time data, mapped the most crucial avifauna habitats and proposed specific requirements according to the significance of these habitats to the endangered bird species of the region (WWF

Greece 2008[b]). Such an approach, as stated by the European Commision (EC 2010), is an important procedure which ensures that WF development will have the least possible impact on wildlife.

With the present report the 2008 proposal is updated. The update is necessary given new facts that are now available based on recent research conducted by WWF Greece in the region, as well as because of changes in the national environmental legislation that introduced important measures for the protection of the bird fauna and in general biodiversity. The research findings point to the undisputed conclusion thatthe development of WFs in the RUs of Evros and Rodopi must be drastically reconsidered in order to ensure the survival of the bird species and safeguard the region's ecological integrity, which is both legally and ecologically mandatory. The new proposal aims to be **the best possible guide** for the installation of WFs in the region of Thrace while at the same time assist in the enforcement of recent legislative additions.

The current proposal establishes two zones: (I) the Exclusion Zones, which are areas where WF installation must be excluded, and (II) Increased Protection Zones, which are areas where WF installation could be permitted based on certain prerequisites.

More specifically it is proposed that WF installation should be prohibited in areas where WFs would threaten the quality and connectivity of habitats, crucial for the reproduction and survival of endangered bird species. The Exclusion Zones include: (I) the hot spots of activity of the Black Vulture, (II) the 2 National Parks ofthe region, that is, the Dadia-Lefkimi-Soufli Forest and the Evros Delta, (III) the area of the Griffon Vulture colony inthe south of the RU of Evros, (IV) the Loutros pine forest, important nesting area for territorial birds of prey like the White-tailed Eagle and (V) the nesting areas of territorial raptor birds and the Black Stork. The designation of these Exclusion Zones constitutes the primary measure proposed so as to ensure the successful conservation of the essential protected characteristics of the area.

Furthermore, it is proposed that WF installation could be allowed in the Increased Protection Zones depending on specific prerequisites that resolve around the need for comprehensive and scientifically solidenivronmental impact assessments (EIA). These Zonesnclude not only parts of Thrace's SPAsbut also specific areas outside SPAs, necessary to safeguard the integrity of bird populations that move outside the limits of designated protected areas. It is proposed that a compulsory and scientifically sound Ornithological Study (OS) be done before any WFs are located inside the Increased Protection Zone.

Despite the new limitations put forward with this new proposal, WWF Greece has sought to identify also areas suitable for wind development o strengthening the country's efforts to tackle climate change.

1. INTRODUCTION

Mitigating climate change and conserving biodiversity are two undeniably important goals in the efforts to protect the environment and constitute global priorities for WWF.

The current report is an update of the proposal published in 2008 by WWF Greece, for the proper site selection ofwind farms (WFs) in Thrace. Thrace is a region in northern Greece of special ecological value due mostly to the rich bird fauna found there (WWF Greece 2008[b]). The report of 2008 anticipated this update, which is necessary as in nature nothing is static while research constantly produces new facts. Additionally, the current study considers and assists in the implementation of recent additions to the national legislation regarding biodiversity protection, in particular measures and procedures aimed at the preservation of the wild avifauna.

WWF Greece has for some years now noted the need for caution in the installation of WFs in the central area of the RUs of Evros and Rodopi and emphasized the need for a drastic reconsideration of the way WFs are plannedand installed. This proposal shows the need to define strict land planning in Thrace in order for the installation of additional WFs to be done in places where the possible impact on raptor species and other bird species will be lower.

The first chapter constitutes a short review of the challenges faced by the development of WFs in Thrace. The second chapter presents the results of research done by WWF Greece on the impacts of WFs in Thrace and the conclusions based on new and old facts on the ecological parameters of the area. Subsequently, the new proposal for the proper site selection of WFs is presented in detail. The proposal concludes by noting where the areas that are deemed as most suitable for the exploitation of the wind energy are located.

1.2 Mitigating climate change and the promotion of renewable energy sources

Climate change is an indisputable fact and tackling this challenge requires brave and immediate actions. In this context, renewable energy sources (RES) have a fundamental role. WWF believes that the use of sustainable RES can almost entirelycover the global need for energy starting from 2050 (WWF Greece 2013[a]).

Greece, as a member of the international community is committed to participate in this global challenge by undertaking certain obligations that will strengthen the need of RES development in the country[1]. While WWF Greece acknowledges RES as a crucial tool for:mitigating climate change, reducing the use of fossil fuels, achieving a degree of energy safety and independence and enhancing the wellbeing of people in

[1]Greece's obligations in regard to the international agreement is to take measures that willensure the minimization of temperature increase to a maximum of 2°C, the reduction of greenhouse gas emmisions of the EU by 80-95% by 2050 and the increase of RES participation in the final energy consumption by 20% until 2020 (WWF Greece 2013[a])

the country, it also recognizes the significant problems that their development faces in the country. Consequently, WWF Greece stresses the need to structure a clear and unwavering national plan for RES. This plan must be founded on a firmspatial planning strategy, which should include well-mapped exclusion zones, and has to be based on coded legislation and a significant improvement of the parameters that define the quality of EIAs (WWF Greece 2013[a]).

At the same time because RES are works of strategic importance for the development of Greece's rural areas, any such investment must be accompanied by thorough public participation procedures. In countries like Britain and Denmark, public participation and timely briefing of civilians is considered to be a duty of the investors and public authorities. In Greece, access to information is limited to making late announcements regarding investors' plans, a situation that pushes local communities into a defensive stance (WWF Greece 2013[a]). This situation can become, in many circumstances, a serious obstacle to the long-term support of these investments, and be something that can probably lead to a medium and short-term impediment in the efforts to tackle climate change.

On the contrary, the proper function of the framework for the development of RES will promote the realization of the benefits that can accrue from these investments. These benefits include minimizing the country's dependency on polluting and/or imported conventional energy sources, improving environmental conditions, developing a domestic RES industry (if there is proper planning), distributing economic benefits across society and last but not least participating effectively in the efforts to combat climate change (WWF Greece 2013[a]).

1.3 The impacts of wind farms on birds

Wind energy is one of the most mature RES, both technologically and financially. However, aside from the benefits, RES alsohave negative impacts, as do all constructionand infrastructure activities. As noted by the European Commission (EC 2010) and the IPCC (Wiser et al 2011) the most important concern arising from WF operations istheir effects on birds, especially when WF site selection falls within areas of increased ornithological interest, such as the Special Protection Areas (SPA) of the EU Birds Directive (2009/147/EU).

The potentially negative consequences of WFs on birds, which were noted in WWF's Greece 2008 proposal, have been recorded in numerous reports produced by the international scientific community (Drewitt and Langston 2006, Whitfield and Madders 2006, De Lucas et al. 2007, Percival 2007, Ferrer et al. 2011). The most important are the following:

- Increased mortality due to collisions with the moving blades, towers or associated infrastructure, such as suspended power transmission lines.
- Creation of obstacles that impede bird movements, thus restricting the ecological connection between areas of vital importance for the life cycle of the birds (eg

between feeding areas, breeding areas, wintering areas, etc.) This problem is likely to be aggravated when an area that is critical to bird movement also hosts a high number of WFs (cumulative impact).

- Possible change of habitat use and habitat loss due to the installation of WFs and other interventions that occur during construction. Increase in disturbance and accessibility in areas that were inaccessible in the past may lead to the displacement or exclusion of birds from important areas.

Considering especially the case of territorial birds, the presence of WFs in the vicinity of their nests increases the risk both of collisions with wind turbines and the possibility that the reproductive couples will abandon their nest in search of a new nest in a suboptimal location. If alternative nesting sites are not available, the reproductive couples will possibly remain at the initial site but without completing their reproductive activities. Both cases end with an increase of reproductive failures, leading to significant impacts on the size and dynamics of the species populations (Langston and Pullan 2003, Fielding et al. 2006).

Nevertheless, the impacts of WFs can be predicted and proactively confronted via a proper planning strategy. This planning strategy should cover the site selection, construction and operation stages of the WFs. Minimizing environmental impacts of WFs is a priority of vital importance for bird species in areas where there is an increased interest in WF development, due to the considerable wind energy potential.

This is the reason that both the European Commission (EC 2010) and the Greek national legislation recognize the possibility of WF development in ecologically sensitive areas if certain requirements are met; noting, however, that these requirements can result in the exclusion of some WFs. Such terms and limitations are considered in the Special Physical Planning and Sustainable Development Framework on Renewable Energy Sources (RES land plan).Some specific areas are characterized as incompatible with WF development, as stated in article 6 of the RES land plan[2], in law 3937/2011 on biodiversity conservation and in the more specific provisions of the joint ministerial decree 8353/276/E103 of 2012 on defining measures and procedures for the conservation of wild birds and their habitats (from now on JMD 8353)[3].

Especially for bird species, these terms and limitations can be applied not just in designated protected areas but also in neighbouring areas that are considered to be

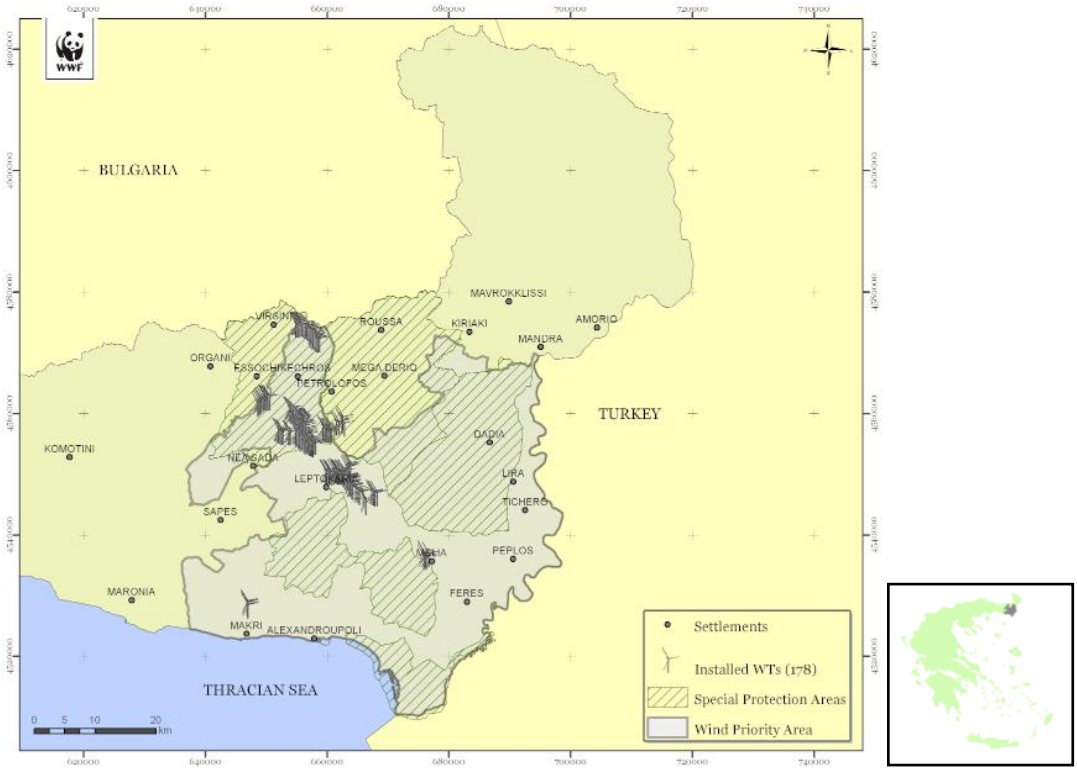
[2] these areas are the following: designated monuments of global cultural heritage, designated archaeological protection A zones, strict nature reserves, nature reserves, Ramsar wetlands, the core areas of national parks, of natural monuments and of aesthetic forests, priority habitats belonging to Sites of Community Interest of the Natura 2000 network, areas within urban planning zones and settlements dating before 1932, settlements with less than 2000 residents, integrated tourist development areas included in article 29 of Law 2545/1997, organised development areas in productive activities of the tertiary sector included in article 10 of Law 2742/1999, thematic parks, tourist ports,specific swimming coastal areas, parts of surface excavation zones.

[3]these areas are the following: SPAs with borders identical to Ramsar sites (in cases where an SPA is bigger than the Ramsar site RES should not be developed in a distance less than 3 klm from the limits of the wetland), around nesting sites of specific trigger bird species

part of the birds' territory.

1.4 The region of Thrace

Thrace is an area of greatecological value that exceeds national boundaries due mostly to the endangered bird species that can be found there. At the same time, according to the RES land plan, a big part of the region of Thrace and in particular parts of the RUs of Evros and Rodopi is designated as WPA 1 leading to an increase of WF installation in the wider region. Consequently, the broader area of the WPA 1 is a typical case of an area that combines ornithological and wind energy development value (Map 1).



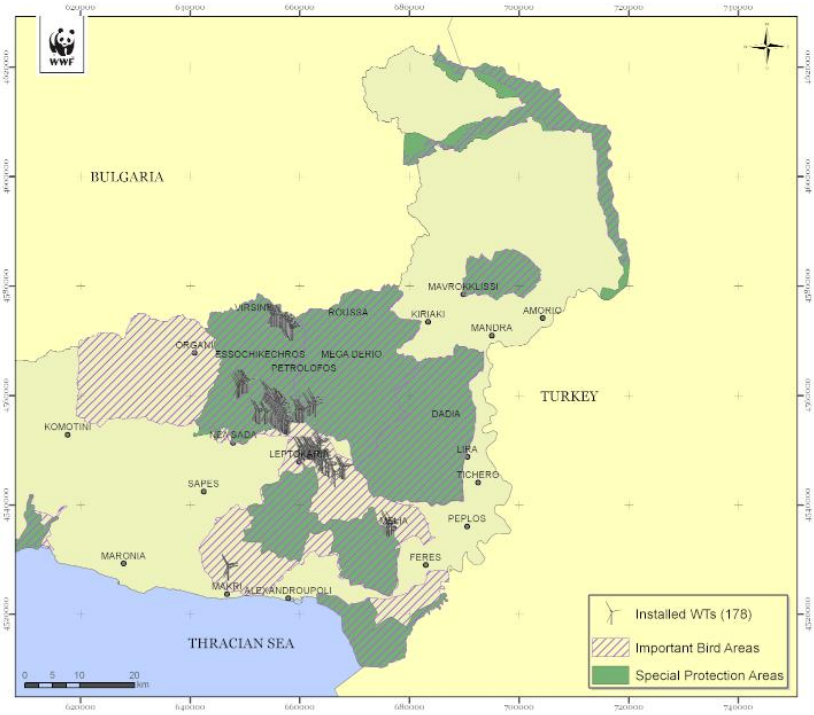
Map 1. Wind Priority Area 1, Special Protection Areas and installed Wind Turbines

1.5 The ornithological value of Thrace

The broader area covering the central and northern part of Evros RU, the northern part of Rodopis RU and part of the Xanthi RU is of utmost importance for birds of prey in Greece and it is certainly one of the most significant regions in Europe. The ornithological value of Thrace is clearly shown by the five SPAs located there, two of which have been designated as National Parks. Additional areas are designated asSpecial Areas of Conservation (SAC) of the Habitats Directive (92/43/EEC).

The Dadia National Parkhas been characterised, rightfully, as «the land of the birds of prey», with 36 out of Europe's 38 diurnal birds of prey having been observed in the area. Approximately 100 individuals of the last remaining Black Vulture (*Aegypius monachus*) population in SE Europe use the wider region to forage for food while

they reproduce within the Dadia National Park. The area is also important for the Egyptian Vulture (*Neophron percnopterus*), which is classified as globally "Endangered" and as "Critically Endangered" in Greece and for the Griffon Vulture (*Gyps fulvs*), which is classified as "Critically Endangered" in mainland Greece (Λεγάκις&Μαραγκού 2009). Other important species that occur here include birds of prey like the Imperial Eagle (*Aquila heliaca*), the White-tailed Eagle (*Haliaeetus ablicilla*), the Greater Spotted Eagle (*Aquilla clanga*), the Golden Eagle (*Aquila chrysaetus*), the Long-legged Buzzard (*Buteo rufinus*), the Peregrine Falcon (*Falco peregrinus*), the Booted Eagle (*Hieraaetus pennatus*), the Lesser Spotted Eagle (*Aquila pomarina*), Eleonora's Falcon (*Falco eleonorae*) as well as the Black Stork (*Ciconia nigra*).All of the species mentioned above are included in Annex I of the Birds Directive (2009/147/EU) and several of them are characterized as under threat in the Red Book of Endangered Animals in Greece. The Dadia National Park overlaps, almost entirely, with the borders of the SAC "Vouna Evrou" (GR1110005) and the SPA "Dasos Dadias-Soufli" (GR1110002).



Map 2. Special Protection Areas and Important Bird Areas

An important factor that adds ornithological value to the region is the presence of the Evros Delta National Park. This is a wetland of great importance to wintering waterbirds and also to those species that use it as a migratory stopover. Present in the area are species classified in Greece as "Vulnerable", such as the Tundra Swan (*Cycnus columbianus*) and the Dalmatian Pelecan (*Pelecanus crispus*), species classified as "Endangered", like the Greater Spotted Eagle and species classified as "Critically Endangered", like the Lesser White-fronted Goose (*Anser erythropus*), the White-tailed Eagle and the Imperial Eagle (Management Body of Evros Delta National Park 2012). The National Park incorporates the SPA "Delta Evrou" (GR1110006) and the SAC "Delta Evrou kai Dytikos Vrachionas" (GR1110007). It is noted that Evros Delta is a designated Wetland of International Importance

according to the Ramsar Convention.

The mosaic of areas of significant ornithological value issupplemented by the remaining 3 SPAs, all of which are included in Important Bird Areas (IBAs)[4]; the network of areas designed by Birdlife International (Map 2). Among the most significant species occurring in the SPAs "Notio Dasiko Symplegma Evrou" (GR1110009), "Oreinos Evros - Koilada Dereiou" (GR111010) and "Koilada Filiouri" (GR1130011) are the Black Vulture, the Griffon Vulture, the Egyptian Vulture, the White-tailed Eagle, the Golden Eagle, the Long-legged Buzzard, the Peregrine Falcon and the Eurasian Eagle Owl (*Bubo bubo*).

Table 1. Birds of prey in Annex I of Directive 2009/147/EU that can be found in the broader WPA 1, followed by their protection status (including the Black Stork, on grounds of its rarity).

Species	Season	Annex I 2009/147/EU	SPEC[5]	Greek Red Book (2009)
Imperial eagle *Aquila heliaca*	Wintering	I	1	Cr. Endangered
White tailed eagle *Haliaeetus albicilla*	Breeding, migration, wintering	I	1	Cr. Endangered
Golden eagle *Aquila chrysaetos*	Wintering, local movements	I	3	Endangered
Osprey *Pandion haliaetus*	Migration	I	-	Least concern
Greater spotted eagle *Aquila clanga*	Wintering, local movement	I	1	Endangered
Lesser spotted eagle *Aquila pomarina*	Breeding, migration	I	2	Endangered
Steppe eagle *Aquila nipalensis*	Migration	-	3	Not evaluated
Short-toed eagle *Circaetus gallicus*	Breeding, migration	I	3	Near threatened
Egyptian vulture *Neophron percnopterus*	Breeding, migration	I	3	Cr. endangered
Black vulture *Aegypius monachus*	Breeding, local movements	I	1	Endngered
Griffon vulture *Gyps fulvus*	Breeding, local movements	I	-	Vulnerable/Cr. Endangered
Booted eagle *Hieraaetus pennatus*	Breeding, migration	I	3	Cr. endangered
Honey buzzard Pernis apivorus	Breeding, migration	I	-	Least concern
Black kite *Milvus migrans*	Breeding, wintering, migration	I	3	Cr. endangered
Red kite *Milvus milvus*	Wintering	I	1	Data deficient
Hen harrier *Circus cyaneus*	Wintering	I	3	Not evaluated
Marsh harrier *Circus aeruginosus*	Breeding, wintering	I	-	Vulnerable
Pallid Harrier	Migration	I	1	Data deficient

[4]The data regarding the IBAs were provided by the Data Base of the Hellenic Ornithological Society. June 2013.

[5] The SPEC (SpeciesofEuropeanConservationConcern) categories of Birdlife International according of which the european bird species are categorized depending on their population status on a european and global level (data from 2004): SPEC 1 – Species of global conservation concern, i.e. classified as globally threatened (meaning CR, EN, VU), near threatened (NT) or data deficient (DD), SPEC 2 – Species concentrated in Europe and with an unfavourable conservation status, SPEC 3 – Species not concentrated in Europe but with an unfavourable conservation status (Portolou et al. 2009)

Circus macrourus				
Common buzzard *Buteo buteo*	Breeding, local movements	-	-	Not evaluated
Long-legged buzzard *Buteo rufinus*	Breeding, local movements	I	3	Vulnerable
Rough-legged buzzard *Buteo lagopus*	Wintering	-	-	Data deficient
Goshawk *Accipiter gentilis*	Breeding	I	-	Data deficient
Sparrowhawk *Accipiter nisus*	Breeding, wintering	I	-	Data deficient
Levant sparrowhawk *Accipiter brevides*	Breeding, migration	I	2	Data deficient
Common kestrel *Falco tinnunculus*	Breeding, local movements	-	3	Data deficient
Lesser Kestrel *Falco naumanni*	Breeding	I	1	Vulnerable
Merlin *Falco columbarius*	Wintering	I	-	Data deficient
Hobby *Falco subbuteo*	Breeding, migration	-	-	Data deficient
Red-footed falcon *Falco vespertinus*	Migration	I	3	Data deficient
Peregrine falcon *Falco peregrinus*	Breeding	I	-	Least concern
Eleonora's falcon *Falco eleonorae*	Migration	I	2	Least concern
Saker *Falco cherrug*	Migration	I	1	Cr. endangered
Black stork Ciconia nigra	Breeding, migration	I	3	Endangered

1.6 Wind farms in Thrace

There is a strong investment interest for the development of WFs in the region of Thrace. Currently, 178 WTs are operating already, both within and beyong the WPA 1. According to the RES land plan the carrying capacity of the WPA 1 is determined at 480 WTs (approximately 960 MW). It is not clear whether existing WTs, prior to the adoption of the 2008 RES land plan, are included in this number (Map 1).

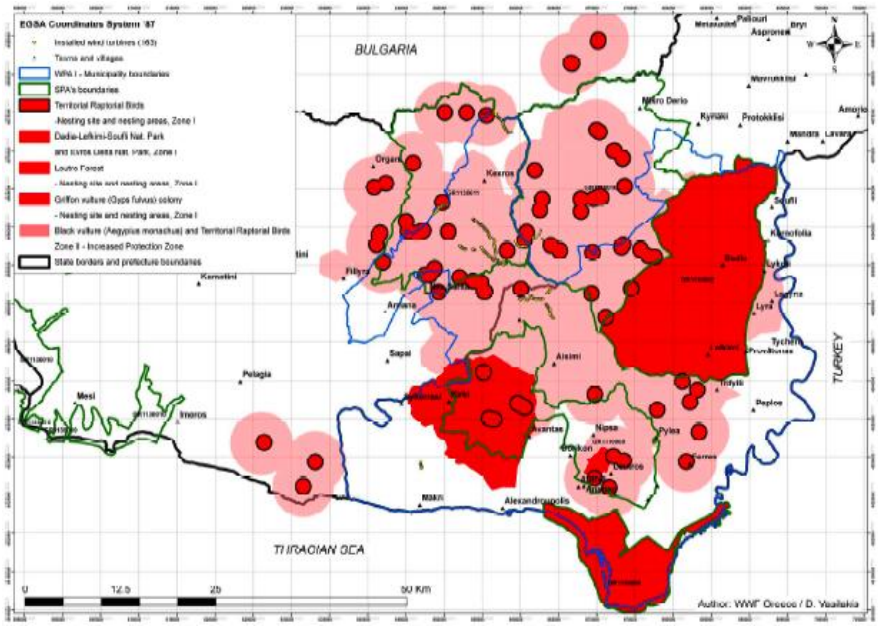
Any evaluation of the prospective WF development in the region must acknowledge that the progress of the wind energy market is directly linked to the economic crisis (HWEA 2012). This is clearly shown by the fact that since 2010 there has not been any new installation of WTs[6]. Additional reasons that inhibit WF development should be also noted: the constant policy rollback regarding RES; the lack of appropriate tools for robust planning; theaccumulated funding difficulties; the insecurity arising from endless changes in the institutional framework (WWF Greece 2013[a]). Nonetheless, according to the Regional Authorities of Eastern Macedonia and Thrace, there are 9 WFs under consideration in the region at the moment (Ministry of Environment 2012).

[6]8 new WTs became operational in January of 2014

1.7 Actions of WWF Greece

WWF Greece, based on its long and constant presence in Thrace[7],has stressed repeatedly the need for a proactive solution to the negative consequences of the cumulative installation of WFs in the region. Such an approach must be based on sound scientific evidence that considers the ecological links between the ecosystems and can lead to specific proposals according to the precautionary principle. In order to minimize the pressure on the invaluable bird-fauna and more generally the extraordinary natural and anthropogenic environment of the region, the above is a condition that must be met. In addition, it will prove advantageous for the further development of WFs as it will enhance the environmental, economic and societal benefits that ensue.

In this direction the organization has submitted its position both at the public consultation prior to the adoption of the RES land plan as well as after its publication, pinpointing the issues that are fundamental for the conservation of the birds in Thrace (WWF Greece 2007, 2009). Furthermore, WWF Greece reported on the issue of bird collision with WTs in July 2008, emphasizing the fact that the National Parks of Dadia and Evros Delta are included in the WPA 1,expressing serious fears for the installation of WFs in areas of considerable ornithological importance and appealing to theMinistry of Environment, Physical Planning and Public Works to take appropriate measures (WWF Greece 2008[a]).



Map 3. The Exclusion Zones and the Increased Protection Zones as proposed in the 2008 proposal of WWF Greece for the proper site selection of WFs in Thrace (WWF Greece 2008[b])

WWF Greece, having promptly detected the consequences of an inadequately planned WF development in Thrace, compiled later in 2008 a proposal for the proper site selection of WFs in the WPA 1 based on the organization's knowledge (WWF

[7]WWF Greece has been active in the region of Evros since 1979. Since 1992 a scientific team of the organization has been based permanently in Dadia.

Greece 2008[b]). The proposal established Exclusion Zones, within which WF installation should be excluded, and Increased Protection Zones, in which WF installation could be allowed based on certain prerequisites (Map 3).

The two zones were determined based on available, at that time, scientific data regarding the region and the WFs, as well as specific rare species. For species like the Black and Griffon Vulture, the proposal was based on data derived from long-standing scientific observation programmes, implemented by the permanent scientific team of WWF Greece in the area. Regarding bird species such as the Golden Eagle, the Long Legged Buzzard, the Peregrine Falcon and the Black Stork the organization's team located the largest possible number of nests both within and outside the WPA 1, beyond the two National Parks, on the basis of all historical observations (Alivizatos 1996, Bourdakis 2003) and a field survey done during the summer of 2008. Based on this information the areas of high sensitivity for birds regarding the presence of WFs were determined and the two zones were delineated.

The 2008 proposal aimed to contribute to the broader discussion for a more comprehensive WF development in Thrace. It is important to acknowledge that the proposal has been used on different occasions by investors, EIA specialists and the authorities responsible for the environmental permits of the investments. However, it did not lead toa more general institutional involvement towards a new map for WF development in Thrace that could find a balance between the need for addressing climate change and the need to protect biodiversity.

WWF Greece has continued to pursue a better site selection of WFs in the region by consistently monitoring the permit process and by intervening with *ad hoc* positions and proposals. Even though numerous investors and other entities have reacted positively towards the proposal, some WFsreceived Environmental Permit even though they are to be installed inside the critical bird fauna zones. Moreover, many more WFs planned within the same zones are also at an advanced stage in the licensing procedures.

In recent years important developments have been noted in the national legislation regarding biodiversity conservation and particularly measures for the conservation of wild birds. These development reflects to an extent the proposals submitted by WWF Greece as well as other organizations regarding the need to take immediate steps that would safeguard bird fauna against the impacts of WFs. Yet, especially in Thrace, installation of WFs continues in ways that do not strengthen the conservation of wild bird species. The current proposal aims to contribute both to a more comprehensive implementation of new and supplementary regulations and to Greece's efforts to comply with the country's obligations.

Subsequent to 2008, WWF Greece continued to monitor the Black Vulture population and to locate the nesting sites of territorial birds of prey. These research activities produced new data regarding the status of the bird species in the region.

Due to the immense value of Thrace for birds, WWF Greece has monitored the impacts of WFs from the moment the first WTs were installed there (Ruiz et al. 2005). More recently,and because of the RES land plan, the organization completed a research programme specifically targeted at evaluating the impacts of 9 WFs on birds of prey. The research was done in two separate phases, the first in 2008-2009 and the second in 2009-2010, and produced new, significant, but also alarming data regarding the extent of the impacts of WFs.

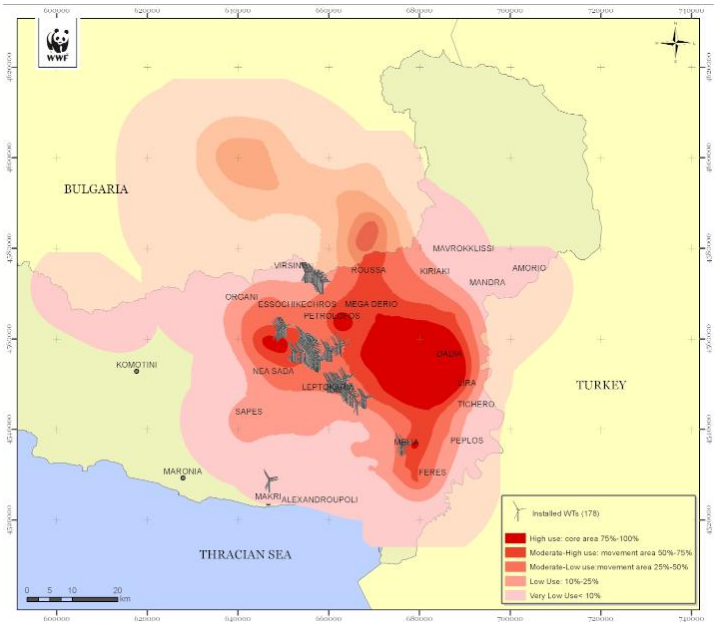
When the new data were combined with the pre-existing data from the long-term monitoring activities, the derived conclusions led to the need to update WWF Greece's 2008 proposal on the proper site selection of WFs.

2. NEW SCIENTIFIC FACTS

In this chapter we present the results produced by the post 2008 research activities of WWF Greece in Thrace that confirmed the need to update the framework for WF installation in the area. The detailed scienitifc results and analysis have already been published and are available online[1]. As a consequence we present only briefly the results in the following pages, emphasizing the ways they have supplemented our knowledge since 2008.

2.1 Spatial use of the Black Vulture population

During 2007-2009 WWF Greece recorded the movements of the Black Vulture populationvia satellite telemetry. This research was in progress when the 2008 proposal was published and at that time only a small part of the primary results was available. The results presented briefly in this section are now complete and published (Noidou & Vasiliakis 2011).



Map 4. Relative amounts of Black Vulture movements based on the resutls of satellite telemetry on 7 individuals during the year 2007-2009. The red area (75%-100%) signifies the core areas, while the orange (50%-75%) area the most common flight movement corridors.

Satellite telemetry revealed crucial dataregarding the magnitude of the Black Vulture's movements in the region, together with the particular characteristics of the spatial use of this species within, but most importantly, beyond the Dadia National Park (Map 4). The data analysis led to the conclusion that the area in which the Black Vulture is daily activeoccupies the central part of Evros RU, a significant part of

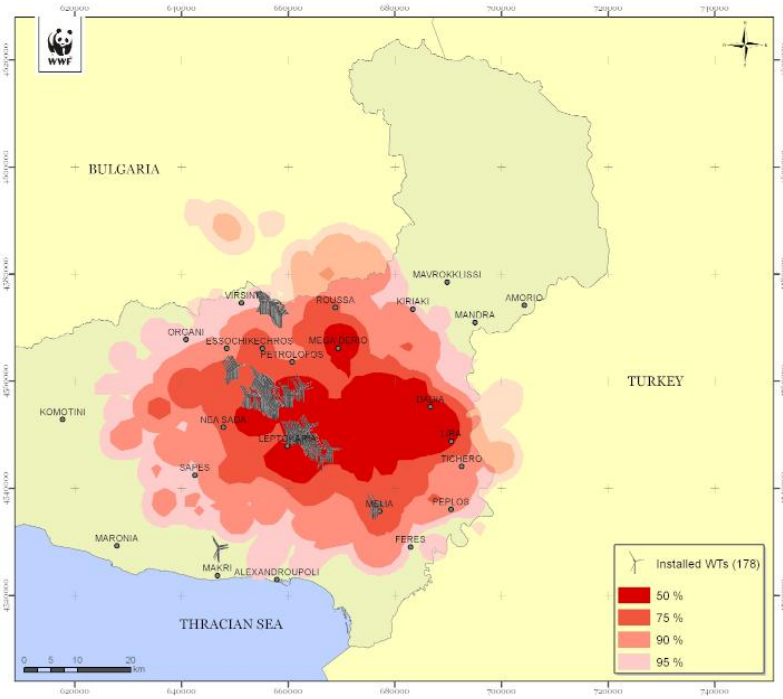
[1] Carcamo, B., Kret E., Zografou, C. & Vasilakis, D. 2011. Assessing the impacts of 9 Wind Farms on the birds of prey of Thrace. Technical report done for WWF Greece: http://www.wwf.gr/images/pdfs/WWF-aiolika-arpaktika2011.pdf - Doutau, B., Cafkaletou-diaz, A. Cαrcamo, B., Vasilakis, D., & Kret, E. 2011. Impacts of Wind Farms on the birds of prey of Thrace. Annual Technical Report August 2009-August 2010. WWF Greece: http://www.wwf.gr/images/pdfs/WWF-aiolika-arpaktika2011-etisio.pdf Georgiakakis, P. & Papadatou, E. 2011. Impacts of the WFs of Thrace on bats during July 2008-August 2010. Report for WWF Greece: http://www.wwf.gr/images/pdfs/WWF-aiolika-nyhterides2011.pdf

Rodopis RU and part of southeast Bulgaria.

The Black Vulture does not utilize the entire area in the same way as its behaviour differentiates significantly among different areas. High use areas for the birds include those of significance for breeding and foraging activities of the population, roosting sites and important surveillance sites, in addition to those areas where the vultures gain the necessary kinetic energy for their locomotion through suitable upward moving wind currents. Equally important, although with less activity, are the areas used by the Black Vulture population as flight corridors that link mostly the foraging areas with the breeding grounds. The latter are found exclusively inside the borders of the Dadia National Park (Noidou & Vasilakis 2011).

Taking into account the topography and land use in the south and south-east flat areas thepattern of land use presented previously can be explained. The population avoids the intensively cultivated lowland areas, where the absence of strong thermal lifts and the intensive human presence make these areas less suitable for foraging (Vasilakis et al. 2008).

The use of satellite telemetry led also to an estimation of the flying height of the Black Vultures. The vultures spend most of their flying time (68%) at heights between 30 and 110 m. The moving blades of the WTs installed in Thrace rotate at these heights, a situation thatreinforces the need for immediate measures to safeguard this vulnerable species from the risk of collision with WTs (Vasilakis & Akriotis 2009).



Map 5. Relative amount of Black Vulture presence based on the results of the radio telemetry on 13 individuals during 2004-2007. The red area (50%) signifies the core area of the population.

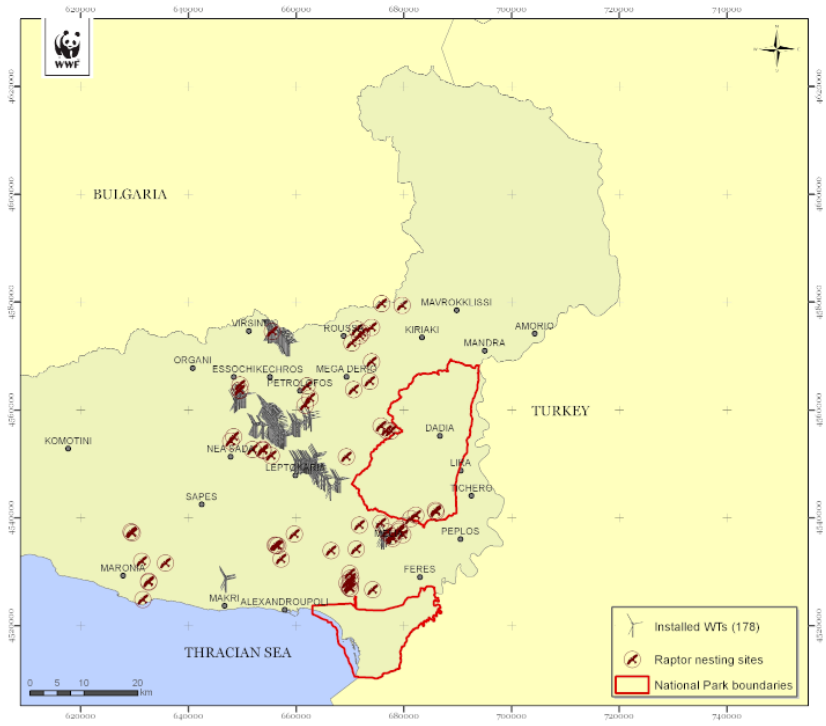
Following the publication of the 2008 proposal WWF Greece also completed the spatial use study based on data produced in earlier research activities (2004-2007) that aimed to monitor the Black Vulture population via radio-telemetry. The analysis

of the new data led to an updated spatial use map (Map 5), which does not differ much from the previously published map that was based on the data collected up to 2006 (Vasilakis et al 2008).

A combination of the two monitoring methods (satellite and radio telemetry) substantiates the case that the Black Vulture population is systematically active during the entire year, not just inside the Dadia National Park but also outside. Here it is important to note that the Griffon Vulture,in all probability, has a similar spatial use pattern as it has similar foraging behaviour. This can only augment the need for a more comprehensive approach to WF development in Thrace.

2.2 Nesting sites of territorial birds of prey

A new survey of the nesting sites of territorial birds of prey outside the Dadia National Park was carried out in the summer of 2010.



Map 6. Raptors' and Black Stork's nesting sites.

The survey not only gave the opportunity to validate the use of previously known nesting sites but led to the discovery of new nesting sites both for species that had already been recorded but also for raptor species that were not recorded during the survey of 2008. This survey resulted in the location of nesting sites for the following species: Golden Eagle, White-tailed Eagle, Egyptian Vulture, Lesser Spotted Eagle, Booted Eagle, Peregrine Falcon, Long Legged Buzzard, the Eurasian Eagle Owl and the Black Stork. The latter even though it is not a raptor it is a rare and "Endangered" species (Legakis & Maragou 2009). The nesting sites are shown in Map 6.

2.3 Mortality due to collision

As stated before, WWF Greece has, since the first WT was installed in the region, monitored the impacts of WFs on the raptors of the region. More recently,and because of the RES land plan, WWF Greece completed a specific research programme in order to evaluate the impacts of 9 WFs on birds of prey. The research was done in two separate phases, the first in 2008-2009 and the second in 2009-2010. The research producednewand significant, but also alarming data regarding the extent of theimpacts of WFs[2]. The methodology used in this research specifically focused on locating carcasses of bird species killed due to collision with WTs, without providing insightsinto the other recognized impacts of WFs. The research findings havealready been published, so the main results will be presented briefly in the following section.

The following facts constitute theessential reasons for reconsidering the framework of WF planning and operating in Thrace.

During 2008-2009 127, out of the 163 operational WTs at the time, were inspected every 14 days. The overall number of carcasses found (Carcamo et al. 2011)was:

- 5 raptors (4 Griffon Vultures and 1 Booted Eagle)
- 11 birds of other species
- 8 bats

During the second period (2009-2010) 88 out of the 163 operational WTs were inspected daily. The inspected WTs where selected based on the information of WWF Greece regarding the spatial use of the region's raptors arising from the research of 2008-2009 and the initial research of 2004-2005. The number of carcasses found (Doutau et al. 2011)was:

- 9 raptors (1 Black Vulture, two Short-toed Eagles, 1 Marsh Harrier, 3 Common Buzzards, 1 Sparrowhawk and 1 Goshawk)
- 73 birds of other species (most of the carcasses were from the following species: the Common House Martin *Delichon urbica*, the Wood Lark *Lullula arborea*, the Eurasian Blackbird *Turdus merula* and the Northern Wheatear *Oenanthe oenanthe*)
- 186 bats (of the species: *Nyctalus leisleri, Pipistrellus pipistrellus, Pipistrellus pygmaeus, Pipistrellus nathusii, Hupsugo savii, Nyctalus noctula, Vespertilio murinus, Nyctalus lasiopterus, Eptesicus serotinus, Myiotis mystacinus*)

The above results led to significant conclusions. They confirm that raptor species use the same space occupied by WFs and that they are directly affected from the presence of both the WFs and their associated infrastructure. Equally important is the fact that bird and bat species listed as endangered, vulnerable and near threatened in Greece

[2] WWF's two-year systematic research regarding the impacts of WFs was completed in 2010. However, collision incidents continue. For example in the autumn of 2010 two more vulture were found; a dead Black Vulture and an alive but permanently disabled Griffon Vulture, due to its amputated wing after it collided with a WT.

but also globally were found amongst the carcasses. Moreover, the fears regarding impacts of WFs became tangible, comparable with other cases internationally and substantiated by experts on the subject who examined the data.

More specifically, based on the data from the first monitoring period (2008-2009) the occurrence of mortality incidents due to collision was estimated at 0.152 raptors per WT per year.Data from the second monitoring period (2009-2010) gave an estimate of 0.15 or 0.173 raptors per WT per year, depending on the statistical model used. The estimations of the second period are considered more reliable and accurate as each WT was searched daily thus minimising the probability of a lower estimationdue to unrecorded losses because of carcass decomposition (especially for bats) and removal by scavengers and/or humans.

The cumulative impacts of the WFs in the long-term survival especially of the rare vulture species of the region are considered worrisome. In case the total 960 MW of wind capacity is installed in the WPA 1 it would lead to at least 300 more WTs than are present today. Based on the estimate of 0.173 raptors per WT per year, using the second and more systematic record of mortality due to collision, and under the hypothesis that the impact due to collision is the same for all WTs, the totalmortality incidents is expected to reach 80 raptors per year, out of which about 10 will be vultures. This number will seriously threaten the survival of a significant number of birds of prey. In addition there will be hundreds of bat mortalities per year.

These mortality rates offer clear indications of the scale of the impact of WFs and its significance for the bird fauna of the region, as many species affected are large, long-lived with low annual productivity and slow maturity. These characteristics, in combination with the small populations of these bird species, especially in Greece, render the birds vulnerable even with a small increase in mortality rate (Langston & Pullan 2004). In light of the scale of the planned WF development the situation is alarming.

Even though WWF Greece investigated the impacts of WFs on birds during the surveys, as it has become from above, a significant number of bat carcasses was found. The limited available data, especially regarding the population size of bats in the region, do not allow for a reliable evaluation of the long-term effectson bats from WFs in Thrace. Nonetheless, increased mortality rates due to WFs can have a considerable effect on their population as bats have a low annual productivity and also because we consider the number of mortality incidents mentioned above to be an underestimation. Finally, it is crucial to note that apart from direct mortality WFs can cause serious harm to bats through disturbance, displacement and habitat destruction (Georgiakakis & Papadatou 2011).

All bat species whose carcasses were discovered, with the exception of the Common Pipistrelle *Pispistrellus pipistrellus* are included in Appendix II of the Bern Convention with the strictly protected fauna species, while all of them are included in Annex II of the Bonn Convention with the migratory species that require

international cooperation. In addition bat species are listed in the Standard Data Forms of the SACs "Treis Vryses" (GR1110003) and "Vouna Evrou" (GR1110005). In order to prevent the decline of their populations specific measures must be taken in areas with high or medium bat mortality (Arnet et al. 2011), even if data regarding population sizes of the species in the region are lacking (Georgiakakis et al. 2012). Consequently, in the case of Thrace protecting bat populations from the effects of WFs needs to be carefully considered.

At this point we would like to note that, as far as we know, this research project of WWF Greece is the most intensive investigation ever completed in Greece of the consequences of WFs presence on birds, involving such a large number of WTs and over such a long period of time.

2.4 Ongoing research

WWF Greece has been present in Thrace, and more specifically in Dadia, for more than 20 years. Although, some of the research activities, for example the monitoring of WFs, have been completed, other field surveys, such as the Black Vulture monitoring programme, continue while new ones commence, such as the participation in conservation efforts to protect other species. These allow WWF Greece to further enhance its knowledge and strengthen its proposals concerning the protection of the natural environment of the region.

In particular, the monitoring programmes of the Black Vulture in the Dadia National Park and the Griffon Vulture in the RUs of Evros and Rodopi continue and provide us with new data about the behaviour of these two important bird species.

At the same time WWF Greece participates in the LIFE Project "Urgent measures to secure the survival of the Egyptian Vulture (*Neophron percnopterus*) in Bulgaria and Greece" (LIFE10 1NAT/BG/000152)[3]. In the context of this project WWF Greece is investigating the broader WPA 1 area, which is utilized by this species during its spring and autumn migration and also for nesting and foraging during the breeding season.

The Egyptian Vulture is listed globally as "Endangered" whereas in Greece it is listed as "Critically Endangered" (Legakis & Maragou 2010). In 2012, less than 20 pairs were recorded in Greece, more than half of which were located in Thrace and more specifically in the regions of Kompsato, Nea Santa, Mega Dereio and the Dadia National Park (Map 7). Thus, Thrace is the last remaining strongholdfor this species (approximately 60% of the Greek population) making every loss of an individual a determining factor in the survival of the species not only in Greece, but also in the Balkans. The Greek population, together with the populations in Bulgaria (29 pairs)[4], Albania (7 pairs) and FYROM (21 pairs), are safeguarding the presence of the Egyptian Vulture in the Balkan peninsula, as the species has become extinct to the rest of the Balkan countries.

[3]For details of the project visit: http://lifeneophron.eu/en/index/html

[4]Unpublished data produced by the LIFE+ project «The return of the Neophron»

Finally, during 2012 the second raptor monitoring programme in Dadia National Park was completed (Ruiz & Pomerade 2012). This study, which was carried out 7 years after the previous systematic investigation of these species, revealed a quite dense use of the entire area of the National Park. A notable discovery involves the area of the park that was significantly affected by the wildfire in 2011 that ultimately burned 9.2% of the National Park as several birds of prey were recorded exhibiting territorial behaviour even inside the burned area (Ruiz & Pomerade 2012).

Map 7. The nesting sites of the Egyptian Vulture in Thrace.

3. PROPOSED AREA DELINEATION

The facts detailed above point to the undisputed conclusion that in order to protect the survival of bird species, which is both legally and ecologically mandatory, and safeguard the region's ecological integrity, the development of WFs in the RUs of Evros and Rodopi must be drastically reconsidered. During 2011, in a memo to the relevant public authorities WWF Greece emphasized the need for a new approach that must be based on the following elements:

1. Strict limits on the number of new WFs in the area.
2. Establishment of rigorous site selection criteria to ensure the minimum impact of any new WFs.
3. Introduction of monitoring systems to record the impact of previously installed WFs on birds and bats. The cost of the installation and operation of such systems can be covered through the compensatory fees paid by wind energy companies. At the same time, the state must be required to impose corrective measures when shown to be necessary by the monitoring results.
4. Immediate implementation of proven technical solutions that minimize the impacts of WFs on bats (WWF Greece 2011[a]).

With the current proposal we aim to bring the above to fruition and also to assist in the implementation of recent additions to the environmental legislation that to a large extent takes into consideration these suggestions. More specifically, the current proposal uses a scientifically vigorous and scrupulous approach to focus on the first two priorities, regarding the site selection of WFs in the region. This was our approach from the start, when in 2008 we published our first proposal for a proper site selection of WFs in Thrace. We now return to the issue, emphasizing the need for an immediate implementation of the relevant recent additions to the legislation. This is especially true for Thrace, which is a region of great significance for raptors and other threatened bird species. Additionally, we pinpoint the remaining gaps that need to be addressed so that harnessing wind energy will have a minimum possible impact on the valuable avifauna of the region, the survival of which is at risk.

Taking into account the new information and conclusions, presented briefly above, we judge that the areas where WF development should be excluded must be expanded and the areas that fall into the second, i.e. the increased protection, zone need to be re-evaluated in order for the investments located there to be assessed in the most efficient way possible. This proposal once more delineates the two following zones, which will be analysed in the next sections through the presentation of the distinct components that in the end form the overall map[1] (Map 13). The two zones are as follows:

1. **Exclusion Zones**: areas from which WF installation must be excluded, and
2. **Increased Protection Zones**: areas in which WF installation could be allowed based on certain prerequisites.

[1] As the Black Vulture crosses the Greek-Bulgarian borders the maps depict the information regarding their movements in the neighboring country as well. However, our proposal is limited only to the installation of WFs inside Greek territory.

These zones must be implemented via the state's legal tools in the framework of the national and regional land planning, the environmental permit procedures, but also the measures instigated for the conservation of biodiversity and more specifically the wild avifauna. In this proposal we put forward the need to determine this type of zonation, without promoting a specific channel for its implementation. In any case the zones can be used by any stakeholder whether they be, national or regional agencies, researchers and investors. Regarding WWF Greece, these zones form the foundation on which the organization will base its future position on the subject, acknowledging though the value of new information.

3.1 Exclusion Zones

It has been argued above that the most crucial measure to preserve the population integrity of the birds of prey in the RUs of Evros and Rodopi is the prohibition of WF installation in certain areas. These are areas where the presence of WFs threatens the spatial and ecological link and therefore the coherense of habitats essential for breeding and the survival of the species. As a consequence these areas are included in the exclusion zones of the current proposal. These zones, both inside and outside SPAs, are the most significant tools capable of contributing to the conservation of the protected species of the region. This is an obligation that arises from the Bird Directive (2009/147/EU) and its corresponding implementation decision into the national legislation (JMD 37338/1907/E.103).

We emphasize the need for a comprehensive approach instead of only a case-by-case assessment of investment proposals. Such an approach is not only ecologically valid but also economically efficient because it anticipates the probable expenses of future investors as well as the public sector, which has to evaluate these proposals.

The proposed exclusion zones include areas where the current legislation prohibits the installation of RES and therefore prohibits the installation of WFs. So with the new proposal we contribute also to the implementation of existing restrictions and regulations. In the cases where we identify shortcomings in the existing legal framework we seek to assist in addressing them.

The areas that form the exclusion zones in Thrace are analysed in the following sub-chapters (3.1.1-3.1.5), depicted in the maps provided, and are shown cumulatively and marked with red, in Map 13.

3.1.1 Black Vulture high use areas

As detailed above, the data produced by the satellite telemetry shows that Black Vultures and thus Griffon Vultures exhibit high levels of activity in certain areas. These are:

1) the areas that comprise the core area of the species in the region, meaning the places where the vultures spend most of their time and which are characterized as high use (75-100%) areas in the corresponding map (Map 4) and
2) the areas that comprise the most common flight corridors for the vultures and which are characterized as medium-high use (50-75%) areas (Map 4) (Noidou & Vasilakis 2011).

As noted previously, the satellite telemetry data on the spatial use of the Black Vulture enhanced our knowledge of the species behavior, relating to both its presence and its mobility in the region. It is now evident that the Black Vulture utilizes daily, or at least frequently, an expanse significantly larger than the Dadia National Park. This area, where the Black Vulture is most frequently active, is highly important because it also includes the night roosting sites of the species. Furthermore, the analysis of the data produced from the radio-telemetry monitoring of the Black Vulture confirms that there are areas outside Dadia National Park where the Black Vulture frequently occurs. The core areas of the Black Vulture (with 50% of recorded presence) were presented in Map 5. This crucial high use zone expands outwards from the outer limits of the Black Vulture's colony inside Dadia National Park and exhibits a north-western orientation.

The most significant difference of this proposal from the 2008 proposal is the expansion of the exclusion zone in order to include the most critical habitats of the Black Vulture in Thrace. The data from previous monitoring and research programmes illustrated the importance of the broader area of Thrace for the species. For this reason the estimated home range of the species was included in the Increased Protection Zones of 2008. Taking into account the most recent findings on the behaviour of the Black Vulture as well as the disturbing calculations regarding the impacts of the WFs on the birds of prey of the area, these areas are put forward as WF exclusion zones under the current proposal.

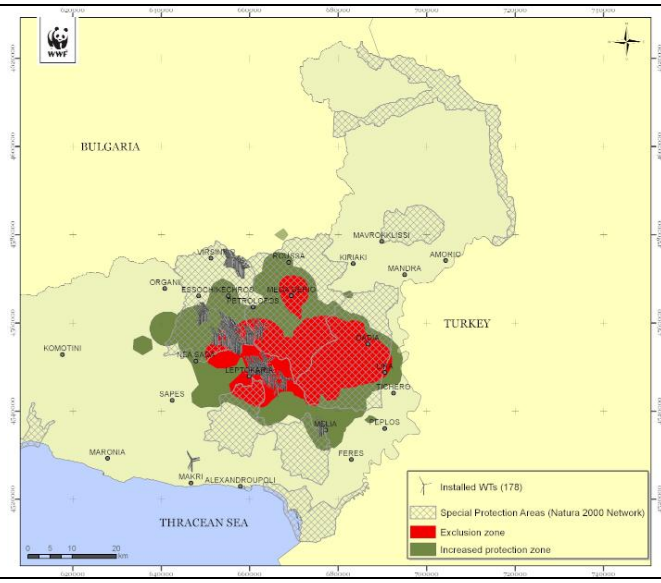
Current legislation provisions (article 5(β)3 of the JMD 8353) state that during the environmental licensing procedures (law 4014/2011) for the development of WFs inside SPAs exclusion zones should be defined around nesting sites and/or colonies of specific trigger species depending on, among other factors, information for foraging areas and flight patterns. Studies by WWF Greece have shown that the areas demarcated as areas of high use by the Black Vulture outside the Dadia National Park are the primary foraging areas of the species and the areas demarcated as areas of medium-high use, are the most frequently used flight corridors. The majority of these areas (73.4%) is located inside SPAs (GR1110009, GR1110010, GR1130011) for which the Black Vulture is a trigger species.

Consequently, we recommend this area to be delineated as a WF exclusion zone.

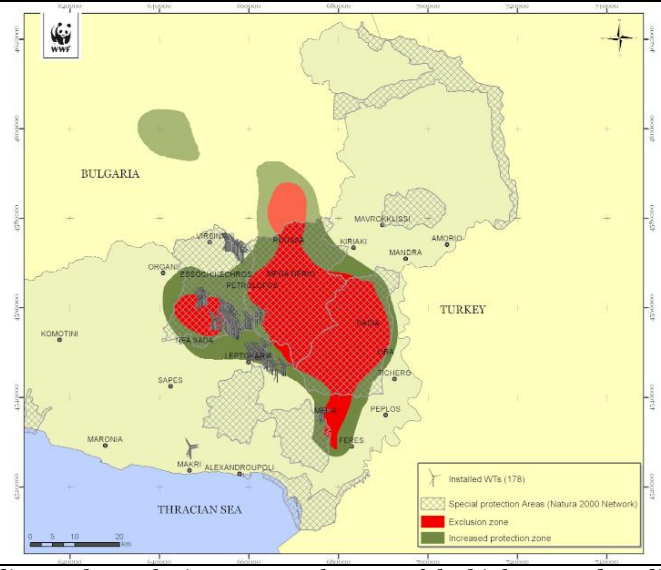
Based on the available data and considering the criteria outlined by article 5(β)3, this broad approach is the best measure for safeguarding the endangered Black Vulture.

Apart from delineating an exclusion zone inside SPAs, this proposal also puts forward an expansion of this zone in areas outside SPAs. This is because these areas have been clearly documented by the monitoring studies to be part of the crucial home range of the Black Vulture; a species for which Greece has a legal obligation to protect. In the context of these obligations and in order to safeguard a protected species, the country must make every effort to «*avoid pollution or deterioration of habitats outside the limits of the SPAs*» (article 5(5) of JMD 37338/1807/E.103).

The areas that must form the WF Exclusion Zone based on the spatial use of the Black Vulture are presented in Maps 8 and 9.



Map 8. The red zone indicates the Exclusion Zone as the high use area of the Black Vulture and the green area indicates the Increased Protection Zone as the medium use area, based on the results of the radio-telemetry.



Map 9. The red zone indicates the Exclusion Zone as the sum of the high use and medium-high use areas of the Black Vulture and the green area indicates the Increased Protection Zone as the medium-low use area, based on the results of the satellite telemetry.

3.1.2 The National Parks of Dadia & Evros Delta

The National Parks of Dadia and of the Evros Delta are of high ornithological value due to their bird diversity and density they host. These National Parks must remain undisturbed areas, acting as a refuge for the rare species of bird fauna and be free of large-scale construction interventions that would disrupt the structure and function of their ecosystems (Map 10). As we have pointed out in the 2008 proposal and before the delineation of WPA 1 the two National Parks must become exclusion zones for WF installations.

In addition to promoting the two National Parks as WF exclusion zones on the ground of their obvious bird richness, the stipulation of exclusion zones also derives from the standing legislation.

Based on certain law clauses, a large part of the Dadia National Park is already an exclusion zone. More specifically a large part of the park (Zone A) has been characterized as nature protection zone and thus is a WF exclusion area according article 6(1)β of the RES land plan. Furthermore, the entire park is a SPA. Consequently, the provisions of article 5β(3) of the JMD 8353 apply for the totality of the park, including the B Zones. The legal conditions required to exclude the entire National Park from WF installation are met by the following criteria: (a) the recorded presence (confirmed by the 2012 monitoring) of nesting sites of the species mentioned in article 5β(3), (b) the Park hosts the last colony of the Black Vulture in the Balkans and (c) has the biggest number of Egyptian Vulture nests in a single SPA in Greece.

An additional reason for including Dadia National Park in the exclusion zone is the fact that priority habitats are found within its borders, leading to the designation of the Dadia National Park also as a SAC ("Vouna Evrou" – GR1110005). In particular, the following priority habitat types: 91E0, 9530, 6220[2] of the Habitats Directive 92/43/EEC are found within the Dadia National Park. According to Greece's Biodiversity Law (article 5(β), Law 3937/2011), RES development is prohibited in the parts of National Parks and Natura 2000 sites that are priority habitat types.

Regarding the Evros Delta National Park, a considerable part of its area is already a WF exclusion zone due to certain legal clauses. More specifically, current legal provisions provide for the prohibition of WFs in Wetlands of International Importance (i.e. Ramsar sites) (article 6(γ)1 of the RES land plan), as well as in a radius of 3 kilometres from the border of the site, if it is at the same time a SPA that exceeds the limits of the wetland (artical 5(β)1 of the JMD 8353). These provisions apply to the case of the Evros Delta, which is one of Greece's Ramsar site. Moreover, both the Ramsar site and the SAC "Delta Evrou kai Dytikos Vrachionas" (GR1110007) contain priority habitat types of the Habitats directive: 1150, 1510[3], for which the

[2] These are the priority habitats: 91E0 "Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)", 9530 "(Sub-) Mediterranean pine forests with endemic black pines" and 6220 "Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea"

[3] These are the priority habitats: 1150 "coastal lagoons" and 1510 "mediterranean salt steppes (Limonietalia)"

exclusion of article 5(8) of law 3937/2011 and article 6(ε)1 of the RES land plan applies. Additionally, a high percentage of the park (zones A,B,C) is characterized as a nature protection zone and thus is an WF exclusion area according of article 6(β)1 of the RES land plan.

The area that is not included in the above exclusion zone is less than half the area of the park. It comprises parts of the park that are delineated as SPA, parts of zone H and the peripheral zone. However, based on existing legal clauses protective measures can apply to neighbouring areas that are parts of a broader protected area. In this case, expanding the exclusion zone to cover the entire park does not pertain only a neighbouring to a SPA area, but parts of a SPA, the peripheral and additional zones of a National Park, which was instituted mainly because of its bird fauna of global value.

Additionally, article 5(β)5 of the JMD 8353 states that, because the Evros Delta apart from being a SPA (GR1110006) is also a migratory route – bottleneck, every WF installed there should be equipped with a "system of automatic pausing of the WTs and activation of deterrence means". Given that the area is not only a migratory route but also an area where bird species are found permanently, such a system would lead any WF being in essence, constantly inoperative.

Based on the above, as well as the exceptional importance of Evros Delta National Park, we propose the total incorporation of the Park in the WF exclusion zone.

3.1.3 The pine forest of Loutra

The pine forest of Loutra is a forest-covered area (11.27 km^2) north of the village of Loutra in Evros, mostly occupied by mature *Pinus brutia* trees[4].

In this forest, trees with perches of White-tailed Eagle have been observed, as have active nests of White-tailed Eagle, Long-legged Buzzard and Black Stork (Management Body of Evros Delta National Park 2013, unpublished data). In addition, the pine forest is used as a roosting site of the Greater Spotted Eagle, with the highest ever recordings in years 2003 (41 individuals), 2007 (32 individuals) and 2008 (47 individuals) (Gutner et al. 2005, Alivizatos et al. 2006, Ioannidis 2007, Ioannidis 2008).

As the pine forest is part of the SPA "Notio Dasiko Symplegma Evrou" (GR1110009) the clauses of article 5(β)3 apply here as well. Based on these clauses, exclusion zones are required to be delineated for the trigger species that nest inside its limits and are mentioned in this article. These conditions are met for the Long-legged Buzzard that has two active nests inside the pine forest. In addition, the White-tailed Eagle, the Greater Spotted Eagle and the Black Stork are all included in Annex I of the Directive 2009/147/EU, according to which their survival and reproduction must be ensured.

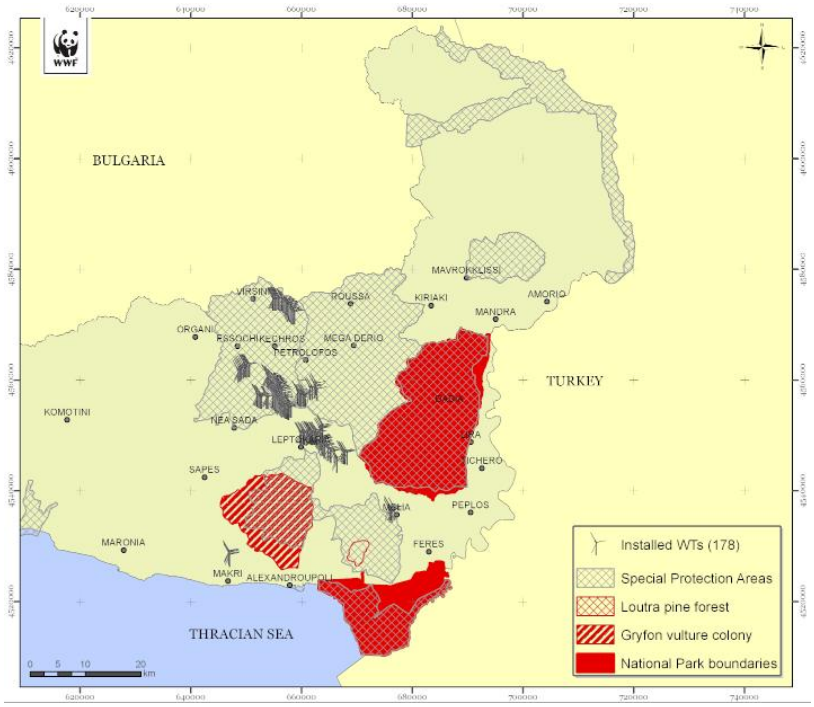
Given the importance of the Loutra forest to bird fauna, it has to be included in those

[4] The habitat «(Sub-) Mediterranean pine forest with endemic black pines» (9530) is a priority habitat in the Habitats Directive 92/43/EEC

areas from which wind farm installation must be excluded (Map 10).

3.1.4 Griffon Vulture colony

The Griffon Vulture is a large scavenger bird of prey and as mentioned above it is extremely vulnerable to collision (Barrios & Rodríguez 2004, Barrios & Rodríguez 2007). The Griffon Vulture uses the same areas of high use as the Black Vulture as well as Dadia National Park where it also nests. In addition to protecting these areas it is also essential to protect the colony of the species in south Evros. The colony is located inside the SPA "Notio Dasiko Symplegma Evrou" (GR1110009) and more specifically between the valleys of Kirki and Agioi Theodoroi, where rock formations are used as nesting sites by the Griffon Vultures. Even though it is included in the standard data form of the SPA, the clauses of article 5(β)3 of the JMD 8353 do not apply to the Griffon Vulture inside the "Notio Dasiko Symplegma Evrou" because it is not considered to be a trigger species. However, the colony of the Griffon Vulture there is the most crucial nesting habitat of the species in mainland Greece (13 reproductive couples in a total of 41 in 2011 and 24 in 2012). Consequently, incorporating those areas in the WF exclusion zone is considered to be a precondition for the conservation of this species in the country.



Map 10. The National Parks of Dadia and Evros Delta, the pine forest of Loutra and the colony of the Griffon Vulture form part of the WF exclusion zone

Based on visual observations, international literature, and experience, the limits of the smallest possible area that would allow for the preservation of the colony of Griffon Vultures in southern Evros have been drawn. With this exclusion zone an attempt has been made to create a safety zone around nests where Griffon Vulture flights are frequent during both the breeding and non-breeding periods, when additional individuals - including those from other colonies - gather to perch. Moreover, it aims to ensure that communication will be maintained between this colony and other colonies to the west, northwest, and north, as well as with potential

foraging grounds and with the Dadia National Park. Additionally, in this area nesting sites of the Golden Eagle and the Peregrine Falcon have been recorded, and it is also a dispersal zone of non-reproductive, both mature and immature, Egyptian Vultures that are attracted to the area because of the presence of other vulture species (Map 10).

3.1.5 Nesting sites of territorial birds of prey

The protection of nesting sites of territorial birds of prey from the direct effect of WTs is a necessary precondition for safeguarding their survival. Together with protecting their reproductive activities, protecting the nesting sites ensures to some degree, the integrity of a crucial part of their home range, inside of which these birds are most frequently active (Bright et al. 2006). The safest way to protect these bird species from the effects of WFs is delineating exclusion zones around their nests.

This approach was adopted in the 2008 proposal by utilizing the information existing at that time. The JMD 8353 has since then instituted, via article 5(β)3, this approach for specific bird species inside SPAs.

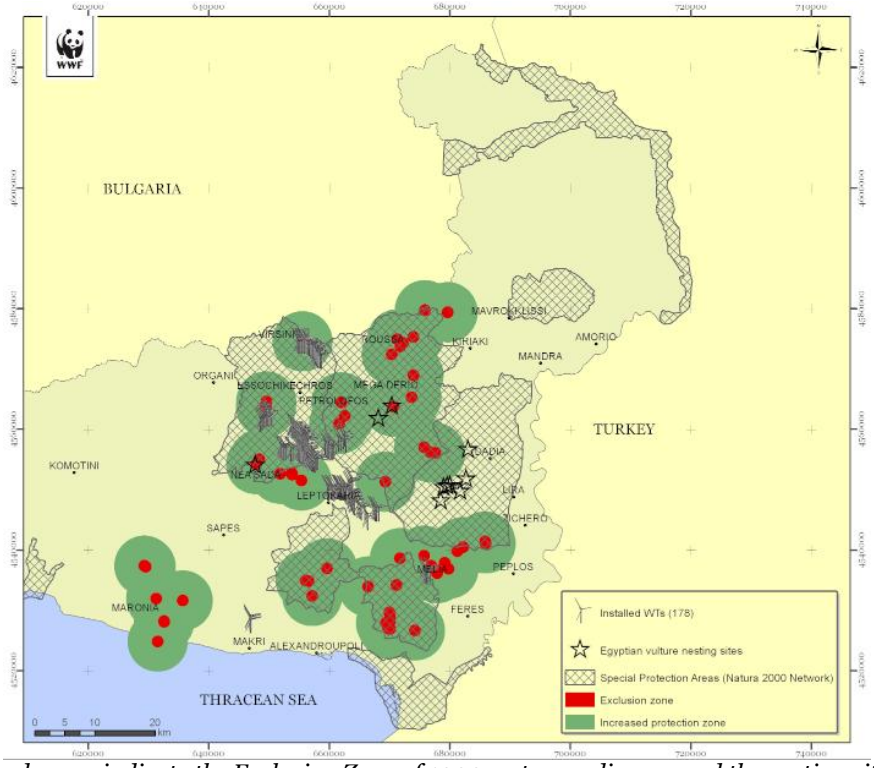
In the case of Thrace though, due to its great importance for the conservation of the bird fauna and based on data produced on the 2010 nest recordings, WWF Greece proposes the application of article 5(β)3 of JMD 8353 to the known active nests outside, as well as inside, the SPAs, and for species that do not meet the criteria of the JMD 8353 but are included in Annex I of the Directive 2009/147/EU (Table 1). For these species Greece is obliged to take all appropriate measures "in order to ensure their survival and reproduction". During the recording efforts of 2010 new nests were detected both of previously recorded species as well of species not detected during the 2008 recording efforts. It is important to note that all recorded nests (apart from the Black Stork) belong to trigger species for neighbouring SPAs. Consequently, they fall under the jurisdiction of article 4(4) of law 3937/2011 according to which protection measures can be extended to neighbouring, to the protected areas, zones. This also applies to RES installations, as stated in article 5(8) of the same law.

Table 2. Nesting sites of territorial birds of prey and the Black Stork, outside the Dadia and Evros Delta National Parks, according to the existing institutional framework.

Species	No of nests within SPAs where clauses of JMD 8353 apply	No of nest within SPAs where clauses of JMD 8353 do not apply	Number of nests outside SPAs
Golden Eagle	8	10	11
Lesser Spotted Eagle	3	-	3
Booted Eagle	-	-	1
Eurasian Eagle Owl	-	1	1
Egyptian Vulture	2	-	-
Peregrine Falcon	-	2	-
Long-legged Buzzard	1	1	3
Black Stork	-	3	3

We note that in the exclusion zones around nesting sites of territorial birds of prey and of the Black Stork within the Dadia and Evros Delta National Parks are not included because they are treated as cohesive units in the relevant part of this proposal.

Finding the proper radius of the exclusion zone around the above sites is a rather difficult task as it depends to a great extent on distinct parameters for each species and individual. The sensitivity of individual birds regarding this impact type is proportional to: (a) the value of the area occupied by a WF for the species that is active there; (b) the distance of this area from other suitable areas; (c) the energy being invested by the bird in the area and (d) is inversely proportional to the habituation of the bird to other disturbance sources (i.e. human presence, vicinity of roads) (Richardson and Miller 1997, Bright et al. 2006). The global literature has various proposals regarding the size of the WF exclusion zones and for general human activities around nesting sites of birds of prey. The proposed zones range from 300 metres to 15 km, depending on the species and the area (Meyburg 1997, Richardson and Miller 1997, McGrady and Petty 2005, Bright et al. 2006, Ruddock and Whitfield 2007, Zuberogoitia et al. 2008, Carrete et al. 2009, Stickland 2011, Espen et al. 2012). For Greece the Hellenic Ornithological Society proposes WF exclusion zones with a radius of 2 or 5 km depending on "the activity (home range) of the species around the nesting site" (Dimalexis et al. 2010).



Map 11. The red areas indicate the Exclusion Zone of 1000 metres radius around the nesting sites of birds of prey and the Black Stork, while the green zones indicate the Increased Protection Zones of 5000 metres radius around the same sites.

Acknowledging the difficulty of identifying the appropriate size of the exclusion zone around nesting sites, WWF Greece proposes a horizontal zone of a 1000 metres radius for all the species to be the minimum WF exclusion zone needed to protect the reproductive activities of the birds of prey in the region. This proposal does not rule out the possibility of expanding the zone, depending on the species and the specific characteristics of each area. Such a decision will be taken based on analysing the impacts of each planned investment inside the framework of the proposals that follow in the chapter of the Increased Protection Zones. On Map 11 the red zones

indicate the exclusion zones of 1000 metres radius around the nesting sites found during the monitoring of 2008 and the updated and enhanced monitoring of 2010.

At this point, we need to note that these zones could require updating in the future. The need for update would arise both in case new monitoring activity locates additional nests and if continuous monitoring efforts provide evidence that a nest can be deemed inactive. However, sites must be treated as of great importance for at least five years following the last recording of nesting activities.

An exemption to the above is the Egyptian Vulture because, as mentioned before, its population, both in Greece but also in the broader region of the Balkans, is in a dire situation and requires immediate measures capable of protecting the species in the country. The structuring of a Greek action plan for the species is already under way in the context of the LIFE + project "Urgent measures to secure the survival of the Egyptian Vulture (*Neophron percnopterus*) in Bulgaria and Greece" (LIFE10 1NAT/BG/000152).

The specific ecological requirements of this species in the country will be acknowledged in the completion of the action plan, which is expected to result in a proposal of WF exclusion zone around the nesting sites of the species. Consequently, this exclusion zone will be adopted by this proposal.

3.2 Increased Protection Zones

Apart from delineating WF exclusion zones, as presented in the previous chapter, the ecological uniqueness of the region requires the delineation of increased protection zones, where WF installation will be allowed depending on certain preconditions that arise from structuring comprehensive and scientifically vigorous impacts assessments.

In this framework and considering the relative legal clauses, the increased protection zones are categorized into two categories:

1) increased protection zones within SPAs
2) increased protection zones beyond SPAs

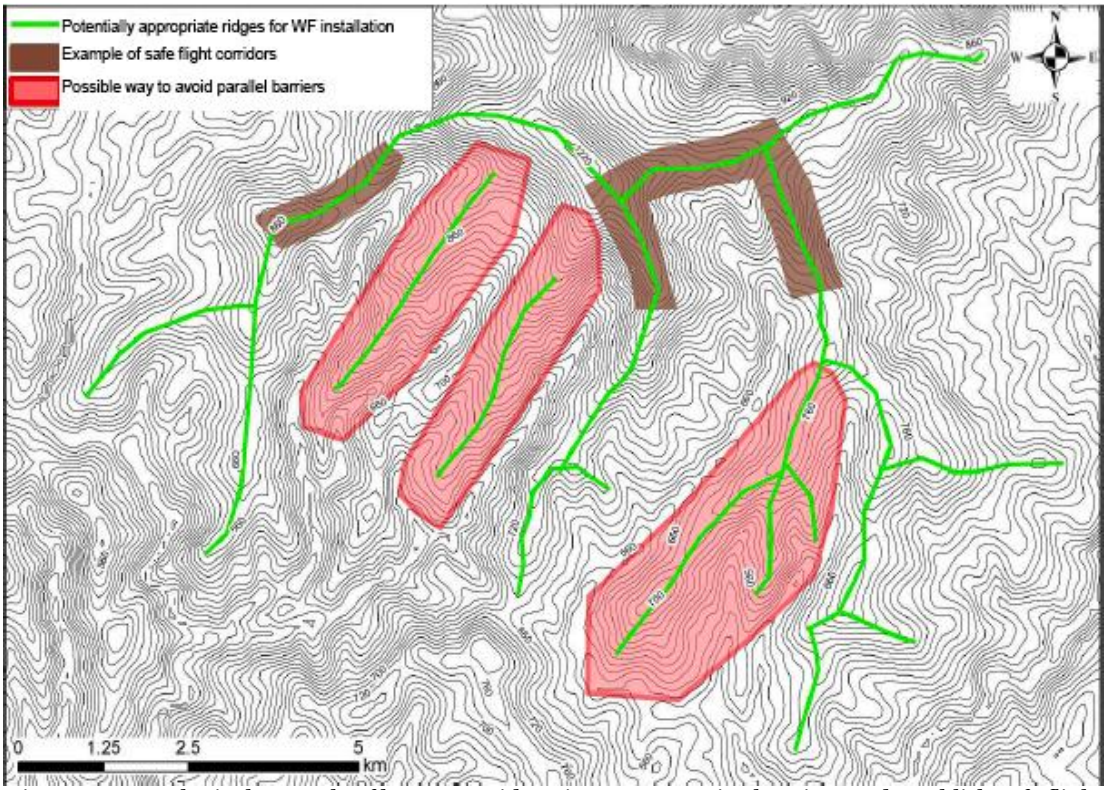
These zones are indicated with green in maps 8, 9 and 10, as well as in the final map of the proposal for proper site selection (map 13).

3.2.1 Increased Protection Zones within SPAs

The areas that are included in this zone category are those areas of Thrace that have been characterized as SPAs and qualify because legal provisions (article 6(3) of the RES land plan) instituted the obligatory Ornithological Study (OS) of WFs inside SPAs.

At this point we need to emphasize that for all five SPAs of the region covered in this proposal, the clauses of article 5(β)3 of JMD 8353 apply as each SPA hosts territorial and/or migratory trigger species, mentioned in the article.

Additionally, we note that the installation and operation of WFs inside SPAs is determined by the conditions set by article 5(β)4 of JMD 8353, requiring: (a) that the electric power transmission infrastructures must be either subterranean or, should this be technically impossible, they may be above ground level, provided that they are properly insulated, (b) that the area of the WF monitored systematically (weekly or even more frequently) and (c) that animal carcasses are removed from the area, so as not to attract scavenger bird species. Additionally, the article requires that the possibility must be examined for installing audio, optical or other types of warnings, depending on the layout of the WF, its distance from cliff edges and nesting, foraging and roosting sites, as well as its scale and size.



Picture 1. Hypothetical example of how to avoid setting up successive barriers and establish safe flight corridors. Red-coloured ridges are left free of WTs so as not to create successive barriers to bird species movements. Furthermore, brown-coloured ridge areas are left free of WTs so as to create a flight corridor, allowing birds to pass in-between potential WFs.

Furthermore, the special requirements of WF operation that are defined by the standard environmental liabilities of WFs determine that it is obligatory for systematic monitoring of possible impacts to the bird fauna of the area based on the internationally established methodology.

The above measures were to a large extent included in the proposal put forward by the organization in 2008. The remainder of the 2008 measures continue to apply. However, the measure that must receive the greatest attention is the one according to which WF installation must be avoided on parallel hill ranges (ridges) so as not to create successive obstacles to the movement of bird species. Consequently, it is advisable to encourage WF installation in groups (instead of continuous lines, e.g. in short successive lines), so as to ensure the availability of communication pathways

(flight corridors) that will act as safe zones through which birds will be able to travel. The region has many long ridges stretching out in various branches. Thus, it is recommended to leave one ridge and its branches, as well as a minimum flight corridor, free of WFs to allow for the crossing of the ridges (Picture 1) (WWF Greece 2008[b]).

3.2.2 Increased Protection Zones beyond SPAs

The value of Thrace for the bird fauna has been presented in the previous chapter. The recordings of nesting sites in 2008 and 2010 confirm the presence of protected species inside the WPA 1 that move beyond the borders of the instituted protected areas. Furthermore, recent studies by WWF Greece on the impacts of WFs on birds in areas of Thrace that are outside SPAs, confirm and reinforce our considerations regarding the dangers of installing and operating WFs in those areas.

Based on the standing procedures of acquiring an environmental permit in areas outside SPAs, an environmental impact assessment (EIA) is required only when the project is listed as a category A project based on the Ministrerial Decision for scoring projects[5]. But, even in such a case, when a project is not located inside a SPA there is no obligation to carry out an evaluation of its impacts specifically on the bird fauna of the area.

In order for this important gap to be addressed, it is proposed that the obligation to complete an Ornithological Study (OS) should be extended to specific areas outside SPAs that form part of the increased protection zones of this proposal. In this way the integrity of bird populations that move beyond instituted protected areas will be safeguarded. This proposition is based on the conclusion of our studies that the impacts of WFs are not restricted within the SPAs and the other protected areas of Thrace but affect protected species beyond their borders. As a consequence, in the Increased Protection Zones, we judge as necessary the application of article 10(5) of law 4014/2011. For any project located outside a Natura 2000 site that nonetheless is likely to affect the site on its own, or cumulatively with other projects, the provision for completing an OS applies (as stipulated by artical 10(5) of Law 4014/2011), after the justified demand of the licensing authority, in order for the project's impacts on the protected areas to be appropriately assessed.

The Increased Protection Zone outside SPAs consists of: (a) the areas of medium-low use by the Black Vulture as determined from the results of the satellite telemetry (Map 4), (b) the areas of medium use by the Black Vulture (Map 5), as determined from the results of the radio-telemetry and (c) the areas with a 5 km radius around the nesting sites of the birds of prey and the Black Stork (Map 6).

In the previous chapter we proposed the need to delineate exclusion zones around the recorded nesting sites of birds of prey and the Black Stork outside SPAs.

[5] There are three categories (A1, A2, B) of projects depending on the scale of their environmental impacts. In the A category are listed projects that are likely to lead to significant environmental impacts. Regarding WFs, they are listed as A category if sited within Natura 2000 sites or if they have a generation capacity larger than 5MW.

Consequently, we propose the delineation of an increased protection zone for the 22 nesting sites (of the following species: Golden Eagle, Long-legged Buzzard, Booted Eagle, Lesser Spotted Eagle, Eurasian Eagle Owl, and Black Stork) that are located outside SPAs. A 5 km radius is a well-founded zone for assessing the probable impacts of a WF in areas with an established ornithological interest. All the above species, apart from the Black Stork, are trigger species for neighbouring SPAs. As a result the clauses of article 4(4) of law 3937/2011 that makes possible the expansion of protective measures to locations adjacent to protected areas, apply here as well.

The new map for the proper site selection of WFs in the wider region of the WPA 1 is presented in Map 13. It results from the combination of all the geographical information that was presented previously. This map is the final result of the update to the previous proposal and is also the foundation for the evaluation of EIAs for WFs both inside and surrounding the WPA 1.

3.2.3 Quality of studies

The role of the EIAs and their evaluation is pivotal inside the increased protection zones. It is important to pinpoint that in order for the studies to facilitate substantially the prediction of the environmental threats and the promotion of the best possible solutions, based on the precautionary and the preventive principle, the EIAs should (WWF Greece 2013[b]):

1) be based on field studies using suitable time durations, vantage points, methodologies and scientific personnel,
2) document every distinct characteristic of the WF, during all stages of its life cycle,
3) assess the magnitude of cumulative impacts,
4) utilize local knowledge and experience,
5) assess effectively possible alternative sites for the WF installation,
6) assess collision risk based on information for bird movements at the scale of the future location of the WFs, and
7) insure the credibility of their findings by carrying out an assessment using the Before-After-Control-Impact (BACI) design, with the post-construction studies incorporating a second period of monitoring, 3-5 years after the beginning of the WF operation (Cárcamo et al. 2011) and utilizing the same methods used in the pre-construction studies.

3.3 Areas suitable for the installation of wind farms in Thrace

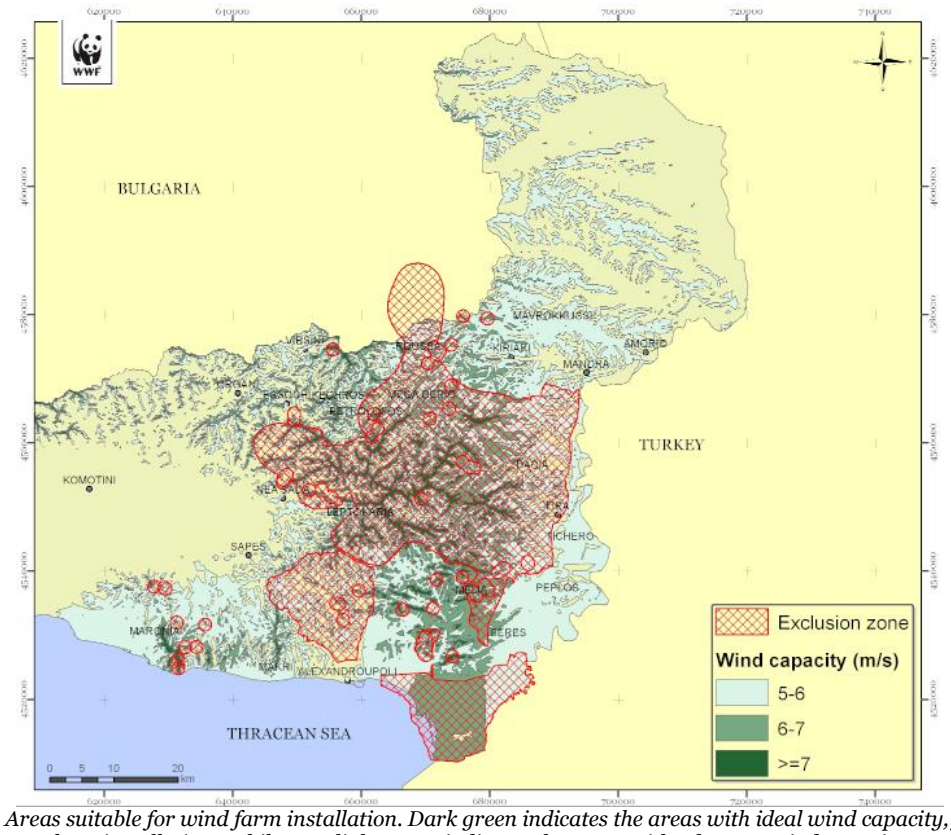
By delineating the above exclusion and increased protection zones in Thrace we do not want to declassify the area from wind priority area. It is obvious that the region has a significant wind capacity, as proven by the presence of many raptors that utilize exactly this capacityfor their movements. To complement the presentation of areas that are defined as exclusion or increased protection zones, due to their environmental and more specifically ornithological value, we also present areas that are considered suitable for WF installation. From this it becomes evident that despite the exclusion of WFs from areas of increased significance for the avifauna, there are still areas capable of supporting the exploitation of the wind energy in Thrace.

These areas are identified by the combined depiction of the exclusion zones and the wind capacity of the region during 1998-2001 (CRES 2012). According to a report by the Directorate General for Energy of the European Commission (EC 2009) in order for a site to be suitable for WF installation its wind capacity should be at least higher than 5.1 m/s. In Map 12, the areas of Thrace with wind capacity higher than 5.1 m/s are shown, in combination with the exclusion zones presented above. At this point, it is important to emphasize that due to advances in WT technology their ability to exploit lower wind capacities is expected to increase, which will expand the size of the suitable areas in the future. Simultaneously it is noted that the recorded wind capacity was calculated at a height of 40 metres above ground surface, while the height at which the rotor of the WTs is usually located is between 30 and 125 metres. According to a 2012 report of the International Renewable Energy Agency (IRENA), the wind capacity at the rotor height can double for every five-fold increase of the WT height. Consequently the exploitable wind capacity is possibly considerably greater at the sites presented in Map 12, while it is also possible that more sites with adequate wind capacity exist.

This capability is confirmed even more when the investment interest for WF development in the region is taken under consideration. The current investment interest can be seen by the number of WFs that are already in some stage of the assessment procedure as shown by the information available from the Regulatory Authority for Energy (RAE). For estimating the total number of the WFs that should not be installed under the new exclusion zone, we removed from RAE's map[6] all the WFs that are already operational, those that have been declined permission and those that, apart from one, are sited in the same location. In this way we attempted to present a realistic number for the capacity of the WFs finally allowed.

The results show that in case WWF's Greece proposal is adopted, the WFs that will be excluded in the wider region of the WPA 1, due to the need to protect the sensitive bird fauna of the area, have a total capacity of 1520 MW. On the other hand the WFs allowed have a total capacity of 1620 MW. For the whole of Greece, the total installed WF capacity in October of 2012 was 1740 MW (HWEA 2012), while the national target for 2014 is 4000 MW and for 2020 is 7500 MW (Ministry of Environment 2010).

[6] http://www.rae.gr/geo/



Map 12. Areas suitable for wind farm installation. Dark green indicates the areas with ideal wind capacity, for wind farm installation,, while very light green indicates the areas with adequate wind capacity.

The RES land plan in the WPA 1 proposes the installation of WFs with a total capacity of approximately 960 MW. Map 12 substantiates the claim that the WPA 1 is capable of contributing to the attainment of the national targets for the RES development, without however, adding further burden on the natural environment of the region. Despite the restrictions proposed the region has the capability to contribute significantly to the national effort to address climate change and promote clean energy sources.

4. EPILOGUE

With the present proposal WWF Greece pinpoints once more the need for a radical reconsideration of the development of WFs in Thrace. Having the aspiration to contribute to the needed readjustment and promotion of cooperation between all stakeholders involved we propose, on the basis of scientifically credible criteria, the delineation of areas where WF installation should be excluded or allowed following certain requirements.

Our goal is to support the efforts made by Greece to fulfil its international and European obligations to participate in mitigating climate change and promoting the conservation of biodiversity.

The studies of WWF Greece regarding the impacts of WFs revealed significantly increased mortality rates for the bats of the area. Consequently the proposal must be enhanced in the future with propositions regarding areas of high sensitivity areas for bats.

The behaviour of every bird species presents a certain degree of uncertainty. Therefore it cannot be implied that the adoption of this proposal will drop the collision episodes to zero or that there will be no impact on the populations of these rare bird species due to alterations of their habitats and from increase energy expenditure in their movements. The same is valid for the areas outside the zones put forward in this proposal. Consequently, it is expected that this proposal may need updating as additional infromation becomes available.

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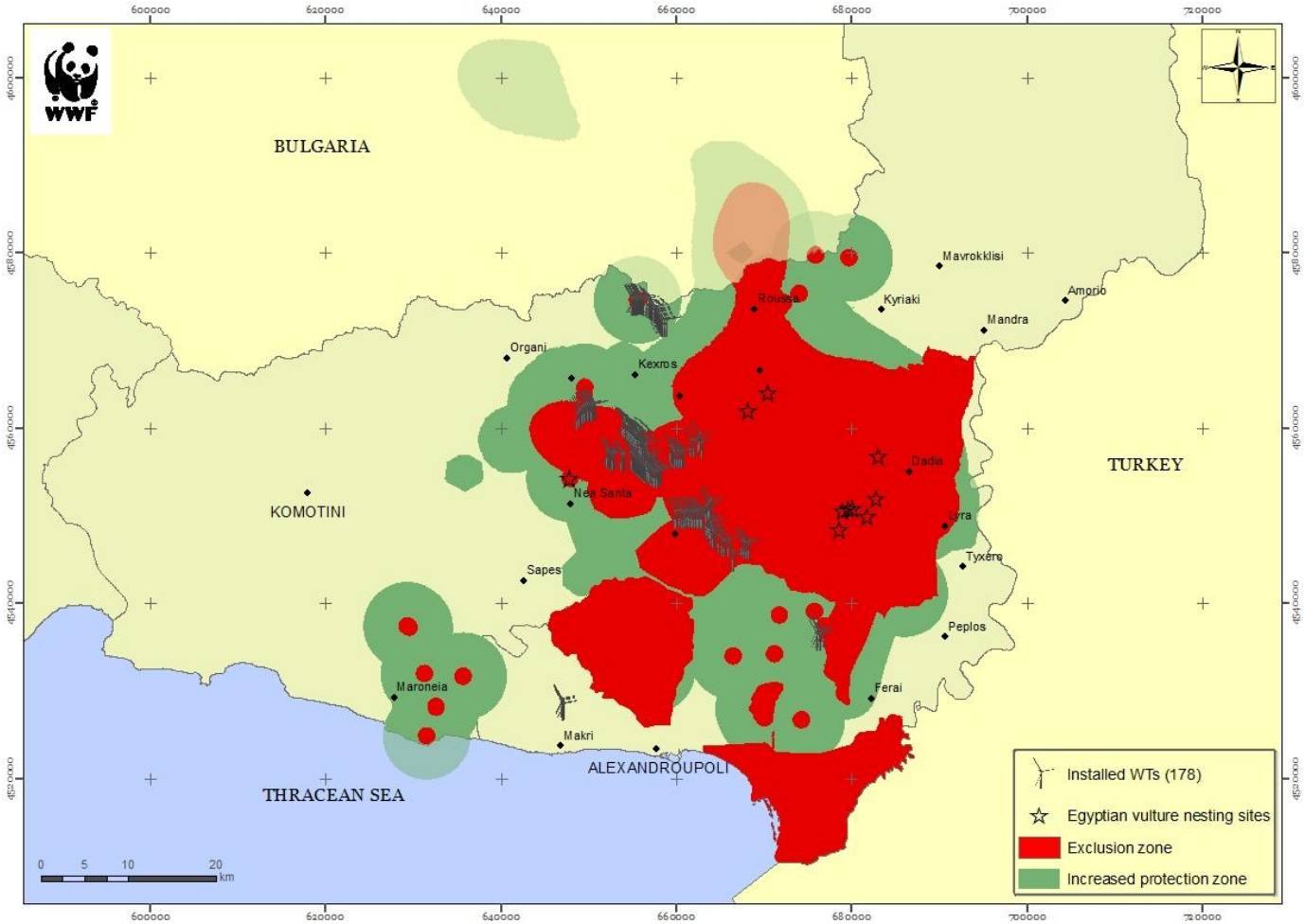
MAP OF THE NEW PROPOSAL FOR THE PROPER SITE SELECTION OF WIND FARMS IN THRACE



Map 13. The new proposal for the proper site selection of wind farms in Thrace. The red areas indicate the Exclusion Zone as the combination of: (i) areas of high and medium-high use by the Black Vulture according to the results of the satellite telemetry, (ii) areas of high use by the Black Vulture according to the results of the radio-telemetry, (iii) the National Parks of Dadia and Evros Delta, (iv) the pineforst of Loutra, (v) the Griffon Vulture colony and (vi) areas of 1000 metres radius surrounding the nesting sites of birds of prey and the Black Stork. The green areas indicate the Increased Protection Zone as the combination of: (i) areas medium-low use by the Black Vulture according to the results of the satellite telemetry, (ii) areas of the medium use by the Black Vulture according to the results of the radio-telemetry and (iii) areas of 5000 metres radius surrounding the nesting sites of birds of prey and the Black Stork.

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