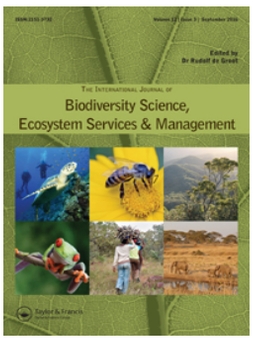

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Identifying key biodiversity areas in Turkey: a multi-taxon approach

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ABSTRACT

Key biodiversity areas (KBAs) are sites of global importance for biodiversity conservation. Their selection is based on standard criteria applied through a bottom-up, iterative process involving local stakeholders. This article presents the results of a study that applied the KBA methodology in Turkey. The KBA method uses four criteria: (1) globally threatened species; (2) restricted-range species; (3) congregations of species that concentrate at particular sites during some stage in their life cycle; and (4) biome-restricted species assemblages. In Turkey, we applied these criteria to 10,214 species of eight taxonomic groups: plants, dragonflies, butterflies, freshwater fish, amphibians, reptiles, birds and mammals. We identified 313 KBAs in Turkey, 303 of which trigger the KBA criteria for one or more taxonomic groups at the global scale. The remaining 10 sites trigger the KBA criteria at the regional scale only. These 303 globally important KBAs in Turkey cover 20,456,884 hectares, 26% of the country. Turkey's natural landscapes, holding globally important biodiversity, are under immense threat and declining rapidly, both in quality and quantity. The nationwide threat assessment of KBAs revealed that dams, irrigation and drainage projects (i.e. water policies) form the main threat to Turkey's biodiversity. Irrigation and drainage projects affect 225 KBAs and dams have an effect on at least 185 sites. KBAs raise attractive possibilities as being core areas where ecologically responsible governance models can be demonstrated, building on scientific and indigenous knowledge.

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1. Introduction

The key biodiversity area (KBA) methodology is a tool that helps to identify and conserve a global network of natural areas crucial to sustain the world's ecological diversity (Langhammer et al. 2007). KBAs are selected using globally applicable standard criteria, which inform conservation targets for ecological networks and the selection of protected areas (Eken et al. 2004). Furthermore, KBAs raise attractive possibilities for being core areas where ecologically responsible land use models can be demonstrated, building on scientific and indigenous knowledge (Foster et al. 2012).

The KBA methodology uses four site selection criteria, based on the presence of species for which site-scale conservation is appropriate (hereafter, these will be referred to as trigger species): (1) globally threatened species; (2) restricted-range species; (3) congregations of species that concentrate at particular sites during some stage in their life cycle and; (4) biome-restricted species assemblages (Langhammer et al. 2007).

The first criterion – threatened species – represents vulnerability, while the latter three are different facets of irreplaceability, a major consideration for planning networks of conservation sites (Margules & Pressey 2000). Each criterion is linked to threshold values associated with a list of trigger species (Bennun & Fishpool 2000).

KBA identification processes are now underway in many regions around the world. Eighty countries completed multi-taxon KBA assessments and 73 are in progress, some covering also freshwater and marine realms such as Africa, continental Europe and the Indo-Burma Biodiversity Hotspot for freshwater; and Philippines, Melanesia, Polynesia-Micronesia, and the Eastern Tropical Pacific for the marine realm (Foster et al. 2012). Turkey is among the first countries where a nation-wide multi-taxon KBA assessment has been completed (Eken et al. 2006).

Turkey, extending throughout the Anatolian Peninsula and Thrace, is located at the junction of three continents. Thus, the country has a very diverse topographical and geomorphological structure (Demirsoy 2002; Eken et al. 2005). With nearly 10,000 species of vascular plants and ferns, Turkey has the richest flora of any country in the temperate zone, with a level of endemism at 34% (Ekim et al. 2000). New plant species are still being discovered in Turkey at a rate of more than one species a week (Özhatay & Byfield 2003). Turkey is of outstanding value for threatened and

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migratory birds and holds several endemic insect and inland fish species (Demirsoy 2002; Darwall et al. 2014). The global map of biodiversity hotspot gives perhaps the best insight on Turkey's global importance for conservation. Three out of 34 biodiversity hotspots meet in Turkey: Caucasus, the Mediterranean and the Irano-Anatolian (Mittermeier et al. 2004).

Prior to a multi-taxon KBA assessment, a number of studies were conducted in order to identify site-scale conservation priorities in Turkey, based on key species information, such as the Important Bird Area and Important Plant Area inventories (Yarar & Magnin 1997; Özhatay & Byfield 2003; Kılıç & Eken 2004). The first multi-taxon assessment of Turkey's KBAs was published in Eken et al. (2006). In the present study, we reviewed and updated the species and site information underpinning Eken et al. (2006), based on 2013 data. We present here a multi-taxon assessment of Turkey's KBAs, covering eight taxonomic groups that are plants, dragonflies, butterflies, freshwater fish, amphibians, reptiles, birds and mammals, including their conservation status.

2. Methodology

The KBA standard provides a framework that combines existing methods of identifying important sites for biodiversity (IUCN 2016), building on more than 30 years of experience in identifying key sites for different taxonomic groups. In particular, this includes the Important Bird Areas approach developed and used by BirdLife International and its Partners (Foster et al. 2012). The KBA methodology uses a bottom-up, iterative process, involving local stakeholders, to maximize the usefulness and the potential of the resulting priorities (Langhammer et al. 2007). The IUCN World Commission on Protected Areas and Species Survival Commission Joint Task Force on Biodiversity and Protected Areas adopted the KBA method as a framework for a global site selection standard built on other methods for selecting important biodiversity areas (IUCN 2016).

We used an iterative process to identify the KBAs in Turkey and assess their conservation status. The main steps of this process are as follows: (i) developing the list of KBA trigger species; (ii) analysis of the population data against KBA criteria thresholds to locate potential KBAs; (iii) delineation of KBA boundaries based on species and habitat information; (iv) assessment of the conservation status of KBAs. We have actively involved species and biodiversity experts for the first two steps, while we worked in close cooperation with other key local and national stakeholders for the delineation of boundaries and conservation status assessment, the last two steps. Fifteen academics and 33 other experts supported this study. Details of this step-by-step methodology are given below.

2.1. Listing the trigger species

In this study, we assessed eight taxonomic groups to apply the KBA criteria, which are plants, dragonflies, butterflies, freshwater fish, amphibians, reptiles, birds and mammals. Any species of these taxonomic groups, meeting one or more KBA criteria is listed as a 'trigger species' for which site conservation is appropriate. Table 1 gives the overview of KBA criteria and thresholds we used in this study, of which the details are given below according to Eken et al. (2004).

2.1.1. Globally threatened species

This criterion applies to species listed as globally threatened on the IUCN Red List of Threatened Species, at www.redlist.org. Nevertheless, the suggestions of Eken et al. (2004) include sub-globally threatened species in KBA identification (a) where these assessments follow IUCN guidelines for regional application of the Red List; (b) where the species are endemic to the region of assessment; and (c) where the species has not been assessed globally. Therefore, Turkish endemic species that are not assessed globally but listed as threatened in national red lists (e.g. Ekim et al. 2000) are also covered under this criterion, along with species classified as globally threatened in www.redlist.org. This process also helped to broaden the AZE (Alliance for Zero Extinction) sites network to cover plants and some other taxa as suggested in Knight et al. (2007).

2.1.2. Restricted-range species

This criterion required two thresholds: one to define 'restricted-range' as species with global ranges of less than 50,000 km^2; the second to identify globally significant populations of these species to select a KBA, which we set as more than 5% of the global population. 50,000 km^2 was used across all taxonomic groups, including freshwater fish.

2.1.3. Congregatory species

To meet the criterion for congregatory species, a site must hold 1% of the global population of a congre-

Table 1. Key biodiversity area criteria and their thresholds.

Criterion	Threshold
1. Globally threatened species (CR and EN)	1 individual
1. Globally threatened species (VU)	30 individuals or 10 pairs
2. Restricted-range species	5% of the world population (or range) of species with a global range of less than 50,000 km^2
3. Congregatory species	1% of the world population of congregatory species
4. Bioregionally restricted assemblages	5% of the world population (or range) of species globally restricted to one biome

gatory species on a regular basis, based on the 1% thresholds in wide use under the Ramsar Convention (Birdlife International 2002). The congregation criterion is not relevant to sessile organisms such as plants.

2.1.4. Bioregionally restricted assemblages

This criterion is designed to cover species confined to a biome and it is built on species richness within a species assemblage that is restricted to a given biome (i.e. contextual species richness) (Eken et al. 2004). However, the analysis of contextual species richness (Eken et al. 2004) has proven to be not possible practically for non-avian species in our study. For many species assemblages and biomes, baseline information on their fine-scale distributions is not available. Therefore, we used a simple population threshold to identify sites for biome-restricted range species – i.e. 5% of the global population – to apply this criterion.

2.2. Analysis of population data against KBA criteria thresholds

Following the identification of trigger species of eight taxonomic groups, we collected distributional and population information to analyse which populations of trigger species exceed KBA criteria thresholds and to locate potential KBAs.

Seven hundred eighty-one papers and reports on these taxonomic groups as well as the KusBank (www.kusbank.org) bird database of Doğa Derneği (BirdLife in Turkey) were reviewed. All previously published priority site inventories in Turkey were used also for data collection and locating potential KBAs. These include the Important Bird Area and Important Plant Area inventories (Yarar & Magnin 1997; Özhatay & Byfield 2003; Kılıç & Eken 2004) as well as reports on key sites for monk seals (Savaş & Kıraç 1991), marine turtles (Oruç et al. 2003) and butterflies (Zeydanli et al. 2012). Furthermore, several experts contributed in this study with their unpublished data.

More than 120,000 data points from these sources were assessed, resulting in a database consisting of 10,961 distributional and population data for trigger species. Following this, population size data for a given area were evaluated against thresholds of KBA criteria. Where the population size of a species exceeds, or thought to exceed, the threshold of a criterion, a potential KBA is located. Population size estimates are based on literature data or on the opinion of species experts or site assessors.

2.3. Site selection and delineation

KBAs form a network of sites throughout the biogeographical range of each trigger species. If any of these sites is lost, the consequences may be disproportionately large, leading to significant gaps in the range or population of each trigger species (Eken et al. 2004). Therefore, each site should be large enough to support self-sustaining populations of the trigger species, and in the case of migrants, provide their requirements for the duration of their presence (Bennun & Njoroge 1999).

To delineate Important Bird Areas (IBAs), BirdLife International proposes three main principles: the sites should, as far as possible:

(1) Be distinct in character, habitat or ornithological importance from the surrounding area;
(2) Exist as an actual or potential protected area, or be an area that can be managed in some way for nature conservation; and
(3) Alone or with other sites, be a self-sufficient area that provides all the requirements of the birds (that it is important for) that use it during the time they are present (Grimmett & Jones 1989).

We established a group of site assessors for each KBA, formed from local experts as well as species and habitats specialists. This has helped to allow local stakeholders to partake in the iterative and bottom-up delineation process described below (Knight et al. 2007). Because there is no fine-scale vegetation map available covering the entire area of Turkey, a parallel study was carried out on Landsat-based vegetation classification in or around KBAs. This study is used as a key input of KBA boundary delineation and results for each site are presented in Eken et al. (2006).

The KBA boundaries were first shaped as agglomerations of areas of occupancy of each trigger species population in a given area as defined in Step 2 – Section 2.2. Vegetation classification maps (see above), biophysical features or most appropriate geographical data was used to estimate the area of occupancy of each trigger species. Where possible, we built the site delineation on previously selected priority areas (IBAs, IPAs, protected areas etc.), although, in many cases, this required substantial revision to cover the area of occupancy of all corresponding trigger populations. KBA boundaries could not be drawn for 57 local endemic species populations, as adequate data on their population size and distributions was not available.

2.4 Assessment of conservation status of KBAs

Following the delineation of sites, we assessed the main pressures on KBAs in Turkey. The primary threats acting on each KBA and their impact levels were evaluated through a scoring exercise. In order to carry out this evaluation, the impact of each threat was scored from one to three (Eken et al. 2006). If a given KBA is likely to return to its natural state without any conservation intervention, once the

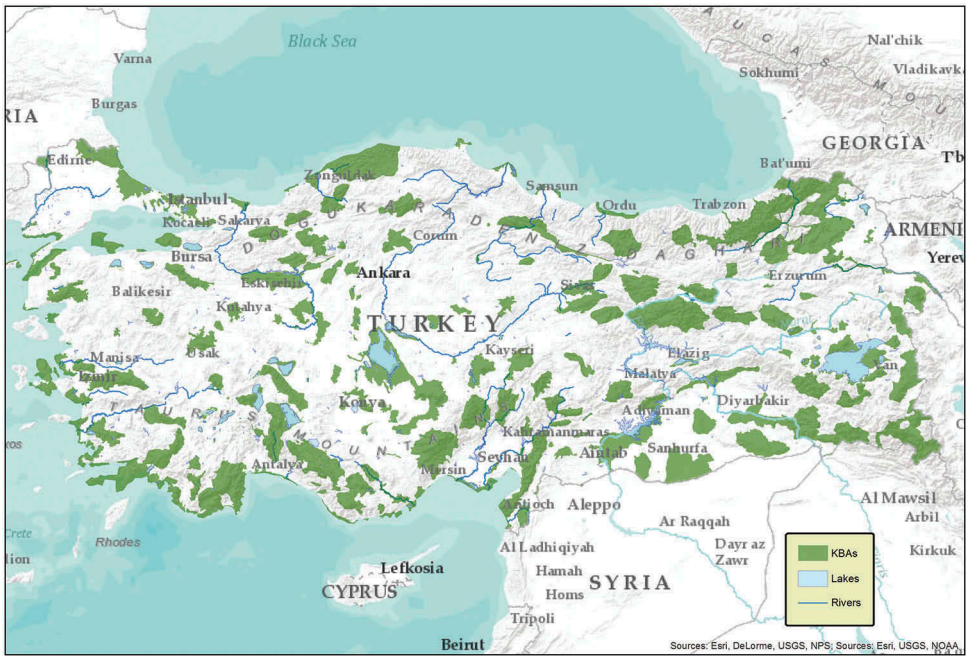

Figure 1. Key biodiversity areas identified in Turkey.

threat is removed, the impact of the threat was scored as one. If the area can return to its natural state only as a result of conservation intervention (e.g. habitat restoration), then the impact score was assigned as two. Finally, if there is no possibility that the area can return to its natural state even after the expiration of the threat, the impact was scored with three. Afterwards, each score was multiplied by the number of KBAs affected by a given threat, to develop a nationwide overall impact assessment of threats.

3. Results

We identified 313 KBAs in Turkey, 303 of which trigger the KBA criteria for one or more taxonomic groups at the global scale (Figure 1). The remaining 10 sites trigger the KBA criteria at the regional scale only. The globally significant 303 KBAs cover 20,456,884 hectares of Turkey, 26% of the country. Criterion 1 (globally threatened species) resulted in largest numbers of KBAs throughout eight taxonomic groups, followed by Criterion 2 (restricted range species).

3.1. Coverage and species richness

In Turkey, out of 10,214 species of eight taxonomic groups assessed, we identified 2312 species to trigger one or more KBA criteria based on redlist.org and regional inventories such as Ekim et al. (2000). These include 2096 plant, 73 freshwater fish, 35 bird, 33 reptile, 12 amphibian, 29 mammal, 26 butterfly and eight dragonfly species. Table 2 provides the overview of numbers of species triggering each KBA criterion per taxonomic group assessed. Among eight taxonomic groups, amphibians have the highest proportion of KBA trigger species (40%), followed by freshwater fish (36.5%), reptiles (27.5%) and plants (23.6%). Endemic species have a higher coverage of KBA criteria. Out of the 3334 endemic species in Turkey assessed in this research, 2152 triggered one or more KBA criteria. Endemics having a wide distribution and facing lower threat did not meet the KBA criteria.

Table 2. Number of species triggering each Key Biodiversity Area criterion per taxon group assessed.

	Vulnerability			Irreplaceability		
Higher taxon	CR	EN	VU	Restricted-range	Congregations/ aggregations	Biome-restricted
Birds	2	3	7	1	27	3
Mammals	1	1	10	11	19	14
Amphibians	2	5	4	10	0	9
Reptile	4	8	3	22	2	25
Freshwater fish	18	12	7	61	10	0
Butterfly	0	1	4	19	0	17
Dragonfly	0	1	5	19	0	4
Plants	206	705	897	1515	0	0
Total	233	736	937	1658	58	72

Plants have the highest representation under the restricted range species criterion (91% of all trigger species) due to their beta diversity and fine-grained distribution pattern. Nearly all of Turkey's endemic plants occur in areas of less than 50,000 km^2. 68% of these occur in areas less than 500 km^2 – and large proportion of these also triggers the first (threatened species) criterion. Over 70% of Turkish endemic and restricted-range plants are also covered by the threatened species criterion. In the main, the bird species trigger the congregatory species criterion (27 species), due to their migratory life cycle, along with two

reptile (marine turtles), 19 mammal (bats and dolphins) and 10 fish species that are also migratory. Limited numbers of KBAs were selected for 72 species under the biome-restricted assemblages criterion due to the extensive ranges of bio-regionally restricted species. These species are often also restricted-range species qualifying Criterion 2.

Most KBAs in Turkey were selected based on the criteria for plants – 223 sites in total, followed by reptiles and birds triggering 108 and 106 sites, respectively. For other groups, smaller numbers of sites triggered the KBA criteria: 95 KBAs were selected for mammals, 66 for butterflies, 61 for freshwater fish and 29 for amphibians and dragonflies. The pattern of KBAs considerably differs across taxonomic groups. For instance, the number of sites selected for plants is disproportionally low compared to the high number of KBA trigger plant species (223 sites for 2096 trigger species). Other taxonomic groups, however, have wider representation within the KBA network. For instance, 29 sites triggered the KBA criteria for eight dragonfly species (Table 3).

Three out of 303 areas (Bolkar Mountains, Yalnızçam Mountains and the Çoruh Valley) trigger the KBA criteria for seven taxonomic groups; 11 areas (the Köyceğiz Lake, Dalaman Plain, Fethiye, Baba Mountain, Tahtalı Mountains, Aladağlar, Amanons Mountains, South Van Lake coasts and Alacabük Mountain, Yüksekova, Datça and the Bozburun Penninsula, Northern Kaçkar) for six groups; 18 areas for five; 40 areas for four; 51 areas for three; 96 areas for two; and 86 areas for one species group only (Figure 2). The Amanos Mountains, the Bolkar Mountains and the Munzur Mountains are the richest KBAs of Turkey and respectively 175, 147 and 109 species trigger the KBA criteria in these sites.

393 species occur only at one KBA globally. Most of these species are plants (362 species) and mainly extend along the Taurus Mountain rim in southern Turkey. Additionally, two amphibian, 19 freshwater fish, three butterfly, three mammal and four reptile species occur at one site only. Forty-two KBAs in Turkey host single-site endemic species. Nevertheless, few KBAs in Turkey are listed as global

Table 3. Numbers of species triggering the Key Biodiversity Area criteria.

Taxon group	Numbers of species assessed	Trigger species	Number of KBAs selected
Plants	8897	2096	223
Birds	364	35	106
Mammals	160	29	95
Reptiles	120	33	108
Amphibians	30	12	29
Freshwater Fish	200	73	61
Butterflies	345	26	66
Dragonflies	98	8	29
TOTAL	10,214	2312	(303)

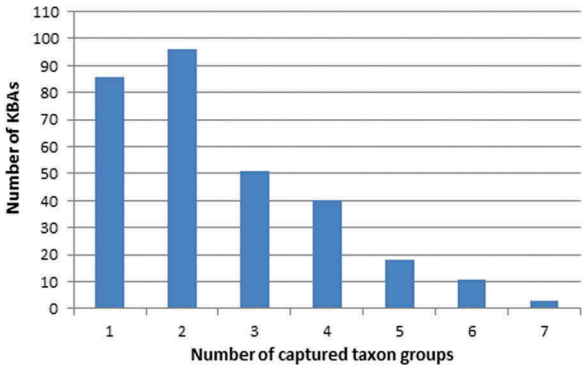

Figure 2. Numbers of taxon groups captured by key biodiversity areas in Turkey.

AZE sites because plants are not fully assessed against the global red-list criteria (Ricketts et al. 2005).

The retrospective analysis on various subsets of KBAs in Turkey indicated that the KBA analysis could be carried out with fewer numbers of taxonomic groups. Originally, we assessed eight taxonomic groups that resulted in the selection of 303 KBAs. However, subsets of two or three taxonomic groups can help to identify up to 95% of the entire network. Subsets with plants offer optimum conservation efficiency, having a high representation of KBAs. For instance, sites selected for plants and birds only correspond to 90% of the entire network of KBAs. If mammals complement this, the coverage of sites increases by up to 95%. The highest-ranking 10 combinations of subsets of two and three taxonomic groups are presented in Table 4. Amphibians represent very high coverage of other taxa at individual sites. All amphibian sites are globally important for at least one other taxonomic group, while more than 60% of KBAs for amphibians are important for four or more other groups.

We identified that grasslands (including steppes and farmlands) form the most extensive habitat type within KBAs, corresponding to 50% of the surface area of the entire KBA network. Forests and Mediterranean scrublands follow grasslands, covering over 30% of the surface area of KBAs. Alpine meadows, mountain steppes, forest transition areas and wetlands are other major habitats at Turkey's KBAs.

3.2. Conservation status of turkey's KBAs

The nation-wide threat assessment of KBAs has clearly shown that dams and irrigation and drainage projects (i.e. water policies) form the single most important threat on Turkey's biodiversity. Irrigation and drainage projects affect 225 KBAs and hydroelectric power plants and dams have an effect at least on 185 sites. In addition to water policies, development for tourism and urbanization in the Aegean and Mediterranean coasts has resulted, and continues to result, in the loss of biodiversity at many KBAs.

Table 4. Highest-ranking 10 subsets of two and three taxon groups and their coverage rate.

Taxon groups (two)	KBA number	Coverage	Taxon groups (three)	KBA number	Coverage
Plant and Bird	264	90%	Plant, Bird and Mammal	279	95%
Plant and Fish	245	83%	Plant, Bird and Reptiles	274	93%
Plant and Mammals	245	83%	Plant, Bird and Fish	271	92%
Plant and Reptiles	239	81%	Plant, Bird and Butterfly	268	91%
Plant and Butterfly	227	77%	Plant, Bird and Amphibian	266	90%
Plant and Amphibian	225	77%	Plant, Bird and Dragonfly	265	90%
Plant and Dragonfly	224	76%	Plant, Fish and Mammal	262	89%
Bird and Reptiles	182	62%	Plant, Fish and Reptiles	256	87%
Bird and Mammals	174	59%	Plant, Fish and Butterfly	249	85%
Bird and Butterfly	163	55%	Plant, Fish and Amphibian	247	84%

Road constructions and mining are among other major threats affecting the sites (Figure 3).

Because of their irreversible impact, dams form by far the most immediate threat on Turkey's biodiversity (Turkey Water Assembly 2011). As a result of Turkey's water policies, several rivers, wetlands as well as steppic KBAs have disappeared or their ecological integrity has severely deteriorated. Figure 4 shows the overlap between proposed dam projects and KBAs in Turkey. In many cases, dam projects overlap not only with KBAs but also with important protected areas such as Küre Mountains National Park and Çoruh Valley Wildlife Reserve reflecting the conflict of interest between water and nature conservation policies.

As a combined result of various threats on KBAs, at least one-fourth of the 303 KBAs face threats that may result in permanent loss of these sites. One hundred other sites are conservation dependent, meaning a significant part of these KBAs are under risk unless conservation action is taken urgently. The conservation status of two sites among the 303 KBAs (Hodulbaba Mountain and Nallıhan Hills) has improved over the past 10 years. The conservation status of 143 KBAs is thought to have not changed over the past 10 years, while 125 sites have partially lost their natural integrity. Only 26 KBAs do not face any threats.

4. Conclusions and discussion

The study in Turkey helped us to test the four KBA criteria throughout eight taxonomic groups. Although the regular occurrence of one individual of a Critically Endangered species is a practical threshold to select KBAs, in this study, this threshold was found rather low for some Endangered species. Species such as the Egyptian Vulture (*Neophron percnopterus*) are relatively widespread across their range, despite their high extinction risk. Therefore, we recommend a higher threshold for EN species that

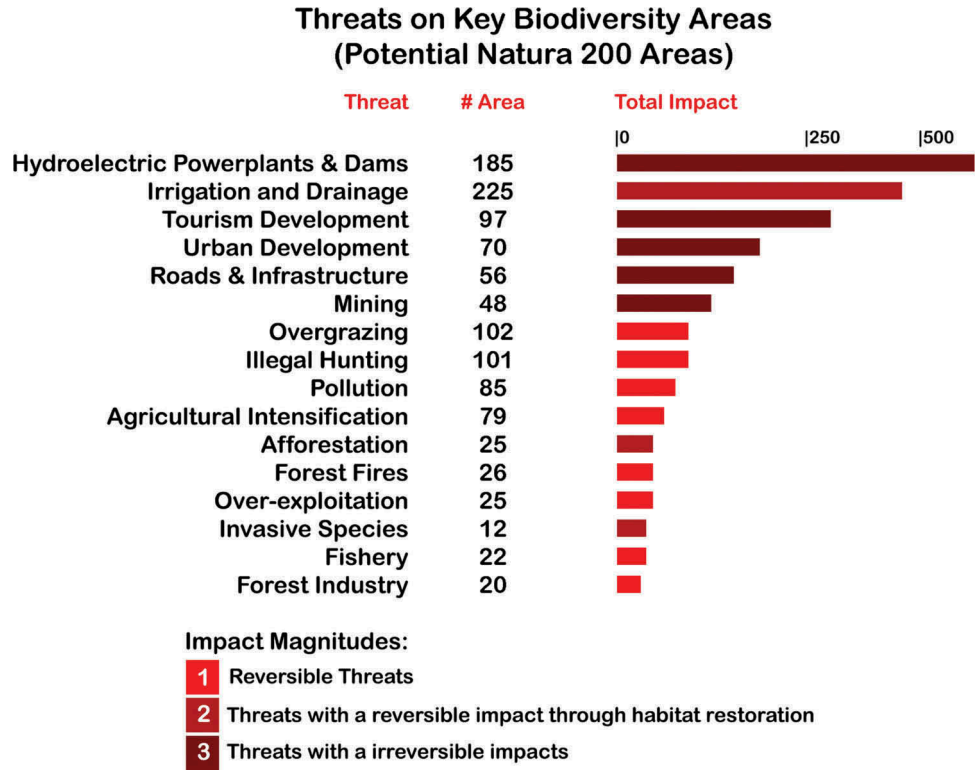

Figure 3. Threats on key biodiversity areas (KBAs) in Turkey. Each threat is ranked according to its overall impact on KBAs. Overall impact is measured by multiplying impact scores (from one to three) by the number of KBAs affected by a given threat.

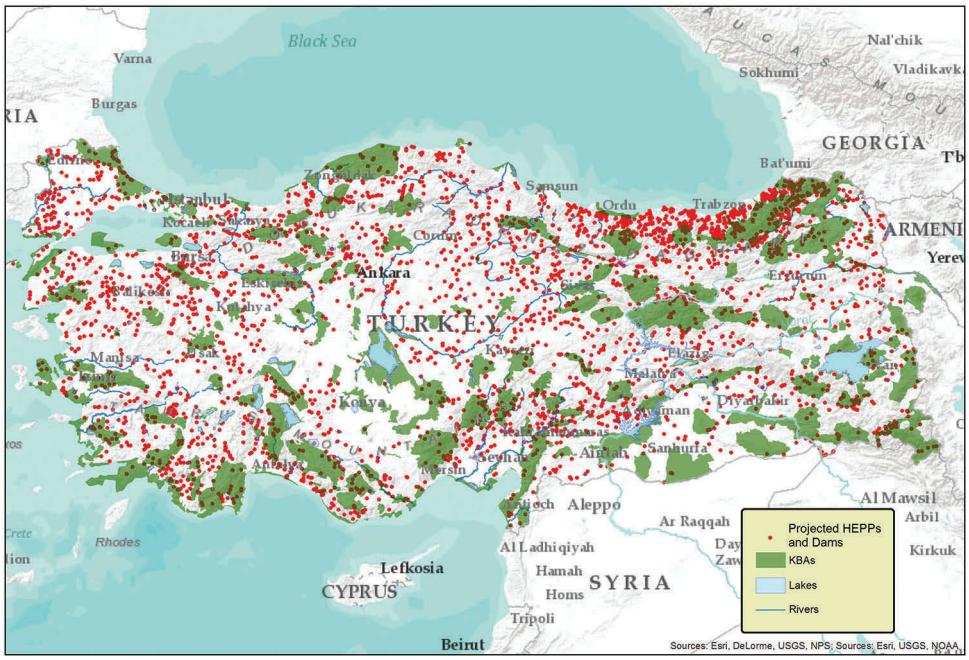

Figure 4. Overlap between key biodiversity areas and projected hydro-electrical power plants (HEPPs) and dams in Turkey.

meet the IUCN Red List sub-criterion A1, alone. For species classified as Vulnerable (VU), which meet only the Red List sub-criterion A1, even higher thresholds may be desirable. Nevertheless, in this study, we followed the thresholds in Eken et al. (2004).

Our study reflected that biogeographic ranges of many globally threatened species are adequately captured and represented by the network of KBAs. Figure 3 reflects the overlap between the biogeographic range of the globally threatened Great Bustard (*Otis tarda*) (listed as VU in the IUCN Red List) and the corresponding KBA network in Turkey. 21 sites in the KBA network of Turkey triggers Criterion 1 for Great Bustard (Figure 5).

Our research indicated that using KBA criteria for plants requires more detailed analysis due to large number of trigger species, especially in relation to restricted-range species criterion. Nearly all of Turkey's endemic plants occur in areas less than 50,000 km^2 and 68% of these occur in areas less than 500 km^2. Therefore, a smaller threshold may

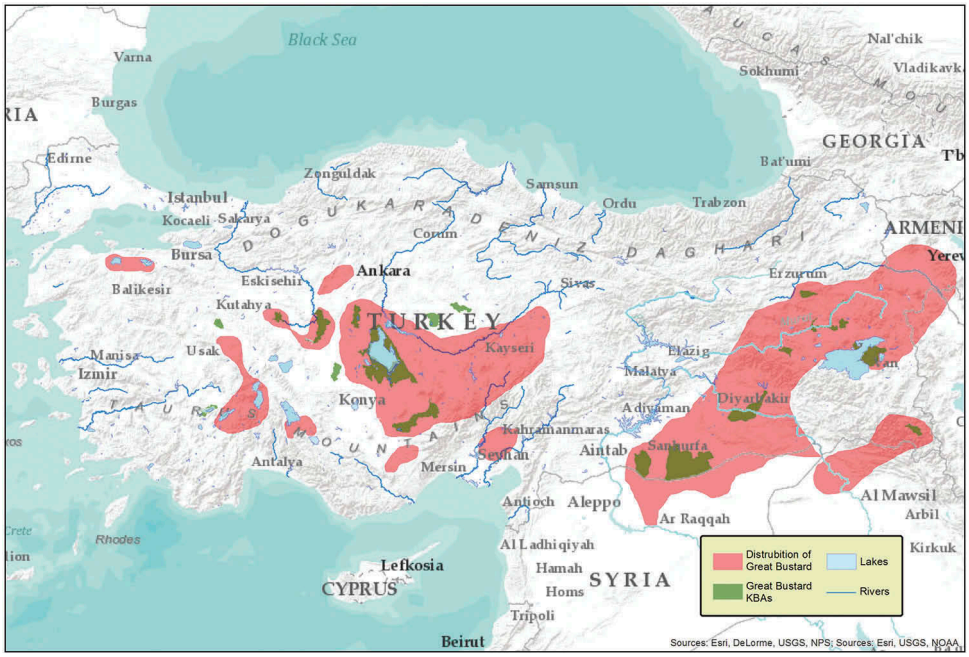

Figure 5. The range of Great Bustard (*Otis tarda*) and 21 key biodiversity areas selected for the species in Turkey (after Eken et al. 2006) .

be used for identifying restricted range plants, e.g. in Yahi et al. (2012).

Given the limitations of our knowledge of distributions and ecology of several species, contextual species richness approach for non-avian biome-restricted assemblages could not be used practically during our work. Based on our study, we recommend using the 5% of the global population threshold to capture the main source populations of a biome-restricted species.

The KBA study in Turkey indicated that using large numbers of taxonomic groups does not essentially reduce omission errors with site selection. For instance, sites selected for plants and birds correspond to 90% of the entire network of KBAs identified for eight taxonomic groups collectively. Nevertheless, increasing the number of assessed taxonomic groups significantly improve the quality of site delineation and conservation priority setting.

The study has shown that Turkey's globally important KBAs are particularly important for plants and freshwater fish, which have an exceptionally high rate of endemism in the small and closed basins of Anatolia. While global Red List assessments for plants and freshwater taxons are progressing, this importance is likely to be documented more clearly. Yet, documentation of species and conservation synthesis so far was sufficient to describe a new biodiversity hotspot extending from Central Anatolia, to Zagros Mountains, i.e. the Irano-Anatolian Hotspot (Eken et al. 2005, Mittermeier et al. 2005).

Rivers and other freshwater habitats form by far the most threatened habitats within KBAs in Turkey. As it currently stands, the government of Turkey plans to construct 1738 dams and hydroelectric power plants by 2023. However, nearly 2000 smaller dams are also underway, resulting in up to 4000 new interventions to natural flow of rivers in Anatolia. Similarly, irrigation water released for agriculture is planned to be increased at 143%, leaving far less water for functioning of freshwater ecosystems and associated KBA trigger species (Turkish Water Assembly 2011).

The results of the *Birds in Europe* publication of BirdLife international shows that the fastest rate of decline in bird populations is encountered in Turkey compared to other European countries. Data on Turkey's birds show that 55% of 319 bird species have severely decreased in number over the last decade due to the destruction of their natural habitats, primarily resulting from water projects (Birdlife International 2004).

We identified grasslands (including steppes and farmlands) to form the most extensive habitat type within KBAs, corresponding to almost half of the surface area of the entire KBA network. Yet they form the second most threatened habitats, primarily because of the conversion of rain-fed pastures and arable land to irrigated agricultural areas. In Turkey, the majority of bird and mammal species classified as globally threatened are associated with primary steppes or with other grassland types (Eken et al. 2006).

KBAs in Turkey are inadequately protected and the current protected areas network poorly represents Turkey's biodiversity, especially the steppic habitats, river valleys and Mediterranean scrublands. Seventy-one KBAs have one protection status and 52 others have more than one. One hundred seventy-six KBAs do not have any kind of protection. Eken et al. (2006) indicate that less than 14% of the surface area of KBAs in Turkey is legally protected (Figure 6). The Natural Site Areas that are under revision by the Ministry of Urban Development and Environment (Alıca 2012) are not included in the network of protected areas as their legal status is uncertain at this stage. In addition to formal protection, Eken et al. (in press) document that indigenous land use and community-based conservation programmes can, in many cases, function as effective means to manage and conserve KBAs.

The KBA study in Turkey has proven that scaling up the IBA network to other taxonomic groups can only be achieved via coordination between experts of various taxonomic groups and other stakeholders, connecting local, national and international conservation agenda (Bennun et al. 2007). The main research gaps of KBA science in Turkey involve the marine realm, which is currently not assessed. Moreover, freshwater taxons require finer analysis and expansion of taxonomic coverage. Plants form the richest taxonomic group among trigger species in Turkey, which are currently not assessed according to IUCN global Red List criteria. Global Red List assessment of plants is likely to significantly advance the comprehensiveness of the KBA network for plants in Turkey.

In general, the KBA criteria are simple and robust enough to be applied across multiple taxonomic groups. Their application does not require complete data sets, since the method is based on individual biological values and not on relative significance. Nevertheless, managing such large and fragmented data sets requires a collective data synthesis effort.

Along with Turkey, The KBA methodology is widely used across the globe to identify priorities for site conservation (Foster et al. 2012) and to prevent biodiversity loss being one of main drivers of ecosystem change (Hooper et al. 2012). The KBA method can potentially be applied in all countries achieving long-standing and self-sustainable conservation results and it is robust enough that they can be applied across multiple taxonomic groups and ecosystems. The KBA methodology gives a very clear

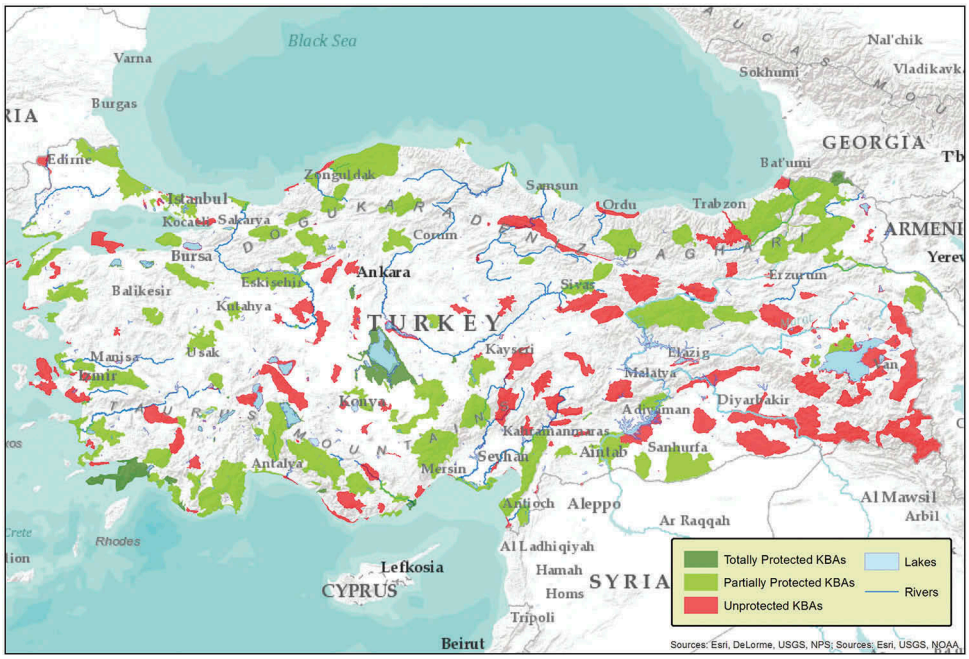

Figure 6. Key biodiversity areas and protected areas inadequately overlap in Turkey.

focus to national and international conservation stakeholders, about where and how to develop conservation strategies. The IUCN World Commission on Protected Areas and Species Survival Commission Joint Task Force on Biodiversity and Protected Areas adopted the KBA method as a framework for global site selection standard. A global network of KBAs could play a major role for the persistence of world's ecological integrity as well as the indigenous knowledge of nature (IUCN 2016).

Disclosure statement

No potential conflict of interest was reported by the authors.

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