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Identification of Prime Butterfly Areas in Turkey using systematic conservation planning: Challenges and opportunities

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ABSTRACT

Butterflies are among the most sensitive groups to environmental changes and are prime subjects for many conservation studies. It is essential to conserve butterflies through identifying important sites, namely "Prime Butterfly Areas" (PBAs). Using distribution data of 358 butterfly species, we have identified 65 PBAs in Turkey. Selection of important sites for a single taxon is generally performed using a scoring based system, yet in this study we have adopted Systematic Conservation Planning (SCP) approach. The efficiency of SCP approach, the explicit site prioritization process it provides, and the presence of an established SCP system in Turkey has led to this decision. However, regardless of the system used, to secure effective implementation, conceptual and operational subjects should be considered simultaneously. In majority of the cases, the emphasis is given to the methodological details of conservation assessments and effective tools for implementation are not produced. Therefore, while determining PBAs, rather than following the SCP procedure in a strict manner, we have incorporated elements of other site selection approaches into our study for the adoption and use of the outputs by stakeholders. With this study, we discussed how different stages of the PBA identification process (e.g. setting conservation targets, scoring species, determining the initial and optimal site sets and prioritization) should be handled to ensure implementation.

1. Introduction

Turkey is home to 381 species of butterflies, of which 45 are endemics (Karaçetin and Welch, 2011), while in all of Europe a total of 482 species exist (van Swaay et al., 2010). After a period of rapid economic development with widespread negative consequences for many species and habitats during the last decade (Şekercioğlu et al., 2011), Turkey needs to develop a conservation rationale for the persistence of its butterflies. The recently published national butterfly Red List (Karaçetin and Welch, 2011) revealed that 26 butterfly species in Turkey are threatened with extinction (CR, EN and VU), 11 species are near threatened (NT) and 57 are Data Deficient (DD). Thus, the proportion of species threatened or near threatened with extinction is 11.4% of all recorded butterflies in Turkey (with a range from 9.7% to 24.7%). A follow-up study assessed the major threats against butterflies (e.g. natural system modifications, residential and commercial developments, intensive agricultural practices) and recommended possible conservation actions to mitigate those threats (Karaçetin et al., 2011). Although these threats are present throughout the country, given the limited time and resources allocated to conservation, it is necessary to select and prioritize sites where efforts are to be concentrated for the continued existence of this sensitive group.

A first step to challenge the threat of species extinctions is the identification of priority sites and the development of a conservation rationale in them (McNeely, 1994; Groombridge and Jenkins, 2002; Zafra-Calvo et al., 2010). Although approaches for selection of priority sites are numerous, most can be assembled into two groups: scoring-based approaches and complementarity-based approaches (Gaston et al., 2001; Abellan et al., 2005; Fattorini, 2006). Scoring based systems identify the value of a site according to a set of selected criterion (i.e. species richness, rarity, endemism and threat status, Vane-Wright et al., 1991; Williams et al., 1996; Orme et al., 2005; Balletto et al., 2010). Hotspots (Myers et al., 2000), Important Bird Areas (IBAs, Heath and Evans, 2000), Important Plant Areas (IPAs, Anderson, 2002) and Prime Butterfly Areas (PBAs, van Swaay and Warren, 2003) are the best known examples

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of this approach. IBA, IPA, PBA and similarly identified sites will hereafter be called Important Taxon Areas (ITAs, a taxon is used to mean an easily identifiable – usually monophyletic – group of species that appeal to a certain group of stakeholders).

Selection of the important sites for a single taxon is generally performed using a scoring based system. Although methodological assessments based on the complementarity approach for a single taxon exist, these remain mostly as academic exercises (e.g. Hortal and Lobo, 2006; Girardello et al., 2009).

Complementarity expresses the notion of sites complementing each other with respect to biodiversity content. Complementarity based approaches (extensively called as Systematic Conservation Planning, SCP) are used for delineating sites of conservation priority for multiple taxa through a multi-criteria optimization process (Margules and Pressey, 2000; Cowling et al., 2003; Pierce et al., 2005).

Various studies comparing SCP and scoring-based approaches exist (Pressey and Nicholls, 1989; O'Dea et al., 2006), which usually consider the efficiency of SCP approaches as their best advantage. The efficiency offered by SCP makes it particularly attractive to the governmental institutions responsible from conservation ("governmental institutions" hereafter), as long as it is coupled with accountability (Margules and Pressey, 2000; Sarkar et al., 2006; Stewart et al., 2007). Similarly, the algorithm based procedure of SCP, and the fact that it is a multi-criteria decision making process involving objective criteria, broadens its acceptance by the academia. The ITA selection approach, on the other hand, comes closer to capitalizing on the mainstream interest in species groups such as birds, plants and butterflies, while striving to retain the objectivity. However, the relative inefficiency of the site selection using this approach creates an obstacle for those responsible for conservation implementation (Prendergast et al., 1999; Bonn and Gaston, 2005; Knight et al., 2006a, 2006b).

On the other hand, ITA or similar scoring based approaches carry the advantage of having a network of caretakers interested in selected important areas (Evans, 1999; Kuria, 2004). This major advantage of ITA approach has not been specifically mentioned in the scientific literature. Such a network is totally absent for sites identified through SCP – unless they overlap with an ITA. Explaining the logic of complementarity based analysis and the significance of each priority site to the layman and funding bodies is usually not that straightforward (Theobald et al., 2000; Opdam et al., 2008). This in turn makes it difficult to form a network of volunteer caretakers monitoring the selected priority sites.

Both approaches have been accepted and widely used by governmental organizations, NGOs and academic institutions in Turkey (e.g. Welch, 2004; Ambarlı et al., 2011). The SCP approach is adopted by the General Directorate of National Parks and Nature Protection for use in the process of identifying Turkey's Natura 2000 sites. Based on this fact, Nature Conservation Centre, a representative of the Butterfly Conservation Europe and responsible for the facilitation of effective conservation of butterflies in Turkey, has decided to use SCP as the basis of its priority area selection process.

There is a need for a protocol that allows the government, conservation and management organizations to select sites that represent a conservation priority for butterflies of Turkey. To address this need, we have explored combining different approaches by giving emphasis to ease of implementation. We have taken the multi-criteria SCP approach as the basis of our approach to produce a portfolio of Prime Butterfly Areas (PBAs), and then incorporated the strengths of the ITA approach. Here we evaluate our findings and discuss their implications for site selection in Turkey and the rest of the world.

2. Materials and methods

2.1. Study site

Located at the intersection of Asia, Africa and Europe, Turkey hosts a wide diversity of geographical and biological features. The country is a peninsula surrounded by the Mediterranean, Aegean and the Black Sea, has a surface area of 759,290 km^2, and >8000 km of coastline. Turkey contains a high diversity of ecosystems owing to its geographical location and past geological and climatic processes. Three different phytogeographical regions, namely the Mediterranean, Irano-Turanian and Euro-Siberian, meet in Turkey. This diversity has led to the evolution of an outstanding richness in butterflies and other taxa (Davis, 1971; Hesselbarth et al., 1995; Mittermeier et al., 2004; Baytaş, 2007).

2.2. Methodology for selection of the PBAs

We have based our selection procedure on SCP. Since ease of implementation has been one of our concerns, we also integrated aspects of the scoring approach into the procedure. In order to build up an effective methodology for selecting Turkey's Prime Butterfly Areas (PBAs), we incorporated conclusions drawn from previous SCP studies in Turkey; our experiences from working together with governmental and other conservation and management organizations (Welch, 2004; Zeydanlı et al., 2006; Ambarlı et al., 2011; Turak et al., 2011) and from the review of scientific literature (Margules and Pressey, 2000; Cowling et al., 2003; Pierce et al., 2005).

We also employed other comparable methods for selecting PBAs in order to discuss the efficiency of different approaches.

2.2.1. Putting together the dataset

For species to be used in selecting the PBAs, we have followed the same dataset and the taxonomy used for the Turkish Red List in Karaçetin and Welch (2011). During the Red List assessments, the validity of records and their locations (of especially old ones) were checked by experts and the cutoff date for old records was set as 1980. We used the outcomes of this assessment to compile our dataset except for eight species whose records were at a resolution coarser than the resolution used in this study (i.e. province records). The final list used in the analysis includes 358 species.

Resolution for the analysis was fixed as 100 km^2. The 10×10 km UTM grid system was set as the analysis standard, and also used as the unit for candidate sites. Using grid squares will contribute towards the compatibility of this study with other priority area selection studies in the country, since they also constitute the standard mapping units employed in the finalized and ongoing SCP studies in Turkey.

There are a total of 8405 of the 10×10 km UTM grid squares in Turkey, although some squares around the borders and at convergence zones have smaller areas then 100 km^2. After assembling the dataset, we assigned data from records documented at higher resolutions to these grid squares. A total of 32,532 records, in the form of one record per species per grid square, were used in the analysis. The number of grid squares where a species has been recorded ranged from one to 760, with an average of 90.84. The number of species per grid square ranged between one and 160.

The data was comprehensive in the sense that it represented all species and geographical regions. 1720 grid cells were found to contain butterfly data (20% of the squares). This ratio for coverage is lower than most European countries, and inevitably will have an effect in shaping the outcome. However, Turkey has a large land area and expecting a better coverage is unrealistic. Also, this is what is available at the present juncture, and with the present rate at which threats are elevating, waiting for additional data will not serve the purpose of butterfly conservation.