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Threat analysis for a network of sites in West Bank (Palestine): An expert-based evaluation supported by grey literature and local knowledge

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ABSTRACT

This study names, assesses and ranks the indirect and direct threats into a network of eight focal sites of high value ecological value located in West Bank (Palestine). A panel of local experts followed IUCN standards, reviewed local literature and used a Delphi approach to assign scores to each threat in each site assessing: (1) its magnitude (significance analysis) and (2) its level of knowledge (knowledge analysis). Threats with the greatest averaged magnitudes were intensive grazing (code IUCN 2.3), (water and soil) pollution (code 9.1, 9.2, 9.3), collecting wild plants (code 5.2), recreation (code 6.1), fire (code 7.1) and urbanization (code 1.1). The sites with the greatest mean magnitude threat scores were Bani Naim, Wadi Al Quf, Siris and Wadi Qana. The level of knowledge of threats was lowest for reforestation (code IUCN 2.2), active quarries (code 3.2), collecting wild plants (code 5.2) and hunting (code 5.1); research into these threats is necessary to evaluate their magnitude, scopes and intensity. Threat magnitude and knowledge of a threat were directly and significantly correlated (i.e., well-known threats were also observed to have a greater magnitude). We did not observe a significant correlation between mean threat magnitude and site population density. Among threats, intensive grazing is a historical long-term disturbance. Differently, pollution, collecting wild plants, fire and urbanization recently increase due to socio-economic driving forces (unsustainable activities, increasing population density, and poverty) consequent to a critical political status and related conflicts. When field information is lacking, uncertainty and urgency are high and threat-specific data are difficult to obtain in crisis context of conservation concern, expert knowledge from specialists with local backgrounds could be useful in defining priorities for conservation management strategies. However, experts should be aware of possible bias in their evaluations induced by different perspectives and lack of local knowledge.

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1. Introduction

Although relatively small in area, Palestine includes a large number of landscapes with varying topographies and associated climates (ranging from Mediterranean ecosystems to deserts): it makes this area a recognized biodiversity hot spot of the Middle East (Isaac & Gasteyer, 1995; Environment Quality Authority, 2010; Ghattas, 2011).

However, Palestine is also globally known as an area in political crisis, a situation resulting from the division of Palestinian accessible areas, land confiscation and political conflicts (Isaac, 2000a,b; Applied Research Institute, 2007; Environment Quality Authority, 2010; Abdallah & Swaileh, 2011). Consequently, as in other geographic areas threatened by wars and political conflicts, the biodiversity of this region is largely threatened (Hanson et al., 2009). Un-planned urban settlement, overgrazing, habitat fragmentation, deforestation, desertification and drought, presence of invasive species, pollution in agriculture and urban areas, hunting and collecting wild plants are the main local driving forces and threats acting both at landscape and patch scale (Gutman & Seligman, 1979; Applied Research Institute, 2007; Ghattas, 2011). Furthermore, the lack of environmental legislations possesses a significant legal constraint to biodiversity conservation and management efforts. All of these factors have resulted in direct changes to wild plant and animal species composition, richness, distribution and density and are leading to the loss of a valuable ecological her-

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itage (Applied Research Institute, 1997, 2007; Environment Quality Authority, 2010).

It is crucial to both list and measure human-induced disturbances (hereafter, threats) to sites of conservation concern and crisis to establish management priorities that address their mitigation and, hopefully, their eradication (Soulé, 1986; Groom, Meffe, & Carroll, 2006; IUCN-CMP, 2006; Kiringe & Okello, 2007; Balmford et al., 2009). In this sense, the field of threat analysis emerged out of the disturbance ecology arena to address these issues (White, 1979; Sousa, 1984; White & Pickett, 1985).

A threat can be defined as a factor or process that has caused, is caused, or may cause the destruction, degradation and/or impairment of biodiversity and/or natural processes (Salafsky, Margoulis, Redford, & Robinson, 2002; Salafsky, Salzer, Ervin, Boucher, & Ostlie, 2003; IUCN-CMP, 2006). If a site (or a network of sites) of conservation concern is to be actively and efficiently managed, we must identify with urgency how many, what types, and to what extent (e.g., the scope and intensity of the threat on a specific target) threats are present (Hobbs & Huenneke, 1992; Gershman, 2000; Sutherland, 2000; Salafsky et al., 2003). Such a priority list of threats, ranked in a decreasing order of impact (e.g., magnitude), could facilitate the formation of site specific strategies to minimize threats in critical areas of concern (Latour & Reiling, 1994).

However, the establishment of these priorities can be a difficult task (Margoulis & Salafsky, 1998). Indeed, each threat may require specific measurements and metrics, and comparisons between threats may prove problematic. Salafsky et al. (2003) provided a standard organized hierarchical nomenclature of threats (threat taxonomy), as well as systems for measuring the magnitude of each threat and for comparing several independent threats acting concurrently on target system. They measured various threats by assigning continuous or categorical values to a set of selected variables using an expert-based approach. Of the variables considered in their model, magnitude was identified to be one of the most comprehensive in term of assessing the impact of threats to local biodiversity targets, because this variable includes two relevant threat attributes, scope and intensity (Salafsky et al., 2003). As a result, this approach may be useful in defining management strategy priorities to be adopted in specific contexts, especially those that are situated in human altered, multiple-disturbance contexts that lack data and where uncertainty and urgency is high (see also Margoulis, Stem, Salafsky, & Brown, 2009).

In developing a list of threats to a study area, it is important to rank the various threat types in a manner that allows managers to act on priority threats first, and then to address less important threats. However, because many conservation agencies have limited access to funds, priority is often given to charismatic and easily perceivable threats (facing a "flagship" target) rather than assigned on objective, experience-based criteria that identify the most critical threats to biodiversity targets (Groom et al., 2006; Battisti, Luiselli, & Teofili, 2009). Adopting an expert-based scored evaluation to identify priority threats may help reduce these discrepancies (Salafsky et al., 2003).

Even though many researchers have focused on documenting threats and their extents over large geographical areas in North America (e.g., CAP program; TNC-WWF, 2006) and Africa (Kiringe & Okello, 2007), data for medium to small sites of conservation interest are still scanty in other geographic regions, including the Mediterranean and Middle East (see Battisti, Luiselli, Pantano, & Teofili, 2008; Battisti et al., 2009). Nevertheless, ecosystem threat analysis is a priority issue in this wide region, recently called a "full world" (Farina, Johnson, Turner, & Belgrano, 2003), where long-term historical human presence has heavily transformed and modelled ecosystems and landscapes (Blondel & Aronson, 1999).

In this study, we apply this approach to a set of poorly studied remnant sites in West Bank, Palestine, a context of high eco-biogeographic interest and conservation concern, embedded in anthropized landscapes characterized by complex political and ecological crisis. In particular, the aim of this paper are: (1) to define a check-list of human-induced threats to a set of medium to small-sized focal sites, grouped according to taxonomy proposed by Salafsky et al. (2003) and IUCN-CMP (2006); (2) to assess the magnitude of each threat using a 'significance analysis' based on an expert screening of the available local grey literature; (3) to rank each threat magnitude and identify priority threats at the network level; and, (4) to assess the local level of knowledge to determine which threats require further research (Cole, 1994). We correlated the magnitude of each threat with the population density of each site to prove a hypothesized direct correlation between the two. Furthermore, we tested whether threats with higher magnitudes were also better known by the experts. To our knowledge, this is the first threat analysis performed for sites of conservation concern in the Middle East.

2. Materials and methods

2.1. Study area

Palestinian wildlife is distributed across 16 bio-geographical areas, indicating its high environmental heterogeneity belonging to the Mediterranean hotspot (Environment Quality Authority, 2010; CEPF, 2016). In particular, the vegetation of Palestine comprises a variety of plant formations ranging from dense forests to small patches of desert herbs (2076 plant species have been recorded, including 60 native tree species, 90 native bush species, and up to 636 endangered species, of which 90 are very rare and 15 are endemic taxa; Zohary, 1962, 1972; Al sheikh & Salman, 2000; Applied Research Institute, 2007). These plants can be grouped into the following communities and associations: coniferous and broadleaved mixed forests, evergreen park-maquis, deciduous steppe-maquis and steppe-forests (dominant species: *Pistacia atlantica, Crataegus azarolus* and *Amygdalus communis*), deciduous thermophilous scrubs (predominantly, *Ziziphus lotus*), halophytic forests (*Tamarix* spp. and *Suaeda* spp.), riparian woods (*Salix* spp., *Populus* spp.), savannah forests (including tropical trees such as *Ziziphus spina-christi*, *Moringa aptera* and *Salvadora persica*), Mediterranean batha or garigue (genus *Cistus*, *Phlomis*, *Salvia* and *Thymus*), dwarf shrub steppes (*Artemisia herba-alba*, *Noea mucronata* and *Helianthemum* spp.), leaf and stem succulent dwarf shrub formations (*Salsola* spp. and *Atriplex* spp.) and rush and reed vegetation (Zohary, 1962, 1972; Al sheikh & Salman, 2000).

Palestinian terrestrial fauna includes 427 bird species, 92 mammal species (5 endemism taxa mainly belonging to the genus *Spalax*; Wilson & Reeder 2005), 81 reptile species (1 endemic taxa: *Acanthodactylus beershebensis*; Uetz & Hošek, 2013) and 7 amphibian species (2 endemic taxa: *Discoglossus nigriventer* and *Hyla heinzsteinitzi*; Isaac & Gasteyer, 1995 and unpublished data).

West Bank is divided into four major phyto-geographical, geomorphologic and topographical regions: (i) The Jordan Valley, a semi-arid region that lies east of the West Bank highlands, between the eastern slopes and the mountains of Moab in Jordan; it is a continuation of the African Rift Valley; (ii) Eastern Slopes ("Jerusalem wilderness"), an area that runs from Jenin in the north to Hebron in the South. The eastern slopes host greatest number of Palestine's wild fauna and much of its native flora; (iii) Central Highlands, a region approximately 3500 km^2 that includes the mountainous portion of the West Bank. The elevation in this area reaches slightly more than 1000 m a.s.l.; (iv) Semi-Coastal Region (Jenin and Tulkarem districts), an extension of the land inside the Green Line (1967 border; Environment Quality Authority, 2010). The climate in this

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