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## Conservation in Saudi Arabia; moving from strategy to practice

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## ABSTRACT

Conservation in the Kingdom of Saudi Arabia is relatively young, yet have made considerable gains in conservation through strategic proclamation and reintroductions. Changes in land use, illegal hunting and competition with domestic stock has decimated the native ungulates, meaning that the survival of the native ungulate species is now completely dependent on protected area network. The challenge is to sustain this network to make meaningful conservation impact into the future. We review the status of ungulate conservation in Saudi Arabia and highlight that the conservation strategy is well developed. The major challenge faced in conservation in Saudi Arabia now is to implement what has been sanctioned.

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Formal conservation in the Kingdom of Saudi Arabia is relatively young, yet has made considerable gains in securing biodiversity. The challenge is to sustain this network to make meaningful conservation impact into the future. In this short communication we review literature and gather evidence from conservation practitioner to present the generalized status of ungulate conservation in Saudi Arabia, and discuss the strategic challenges facing ungulate conservation.

The Saudi Wildlife Authority (SWA) was established in 1986, with a mandate to establish a national network of protected areas and to seek the restoration of native endangered species (Abuzinada, 2003, 1994). In twenty-nine years the SWA has designated 16 protected areas covering 86,582.4 km<sup>2</sup> and a further 22 areas planned, covering a total area of 208,356 km<sup>2</sup>, 10.42% of the Kingdom.

A challenge for the SWA is that the efficacy of hunting has been greatly enhanced with the increased availability of high powered

rifles and 4 × 4 vehicles over the last 50 years. Illegal hunting, combined with the hyper-arid conditions, drought and resource competition from livestock, has resulted in population declines, fragmentation and extirpation of most of the Kingdom's indigenous larger fauna. Pressure on remaining resources is amplified by the erosion of traditional conservation practices. The collapse of traditional reserves known as *hima* and the inviolable zones surrounding the cities of Makkah and Al-Madinah has contributed to the decline of environmental ethics, degradation of rangelands and wildlife populations. The result is that extant native ungulates, namely Arabian Oryx (*Oryx leucoryx* Pallas 1777), Arabian Gazelle (*Gazella arabica* Lichtenstein 1827 = *G. gazella*, Pallas 1766), Sand Gazelle (*Gazella marica* Thomas, 1897) and Nubian Ibex (*Capra nubiana* Cuvier, 1825) are now completely dependent on conservation management within the Protected Area (PA) network.

Conservation in Saudi Arabia has been focused on proclaiming strategically placed PAs and reintroducing extirpated species (Abuzinada, 2003). For example; the Ibex Reserve and Al-Tubaq reserve were established to protect remaining populations of Nubian Ibex. The Arabian Oryx, declared extinct in the wild in 1972 (Henderson, 1974), have been successfully reintroduced into two protected areas. Arabian and Sand Gazelle have also been reintroduced into two and three protected areas respectively from captive breeding programs in Saudi Arabia, run from two captive breeding centers. One at King Khalid Wildlife Research north of Riyadh and, the Prince Saud al-Faisal Wildlife Research Center (previously the National Wildlife Research Centre) near Taif.

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**Table 1**

List of case studies presented in the manuscript pertaining to ungulate populations within the protected area of Saudi Arabia.

Species	Natural or reintroduced population	Conservation area	Current population trend
<i>Gazella marica</i>	Reintroduced	'Uruq Bani Ma 'arid	Population persists- unknown trend
<i>Gazella marica</i>	Reintroduced	Mahazat as-Sayd	Population persists
<i>Gazella marica</i>	Natural	Al Khunfah	Extirpated
<i>Gazella marica</i>	Natural	Harrat al-Harrah	Extirpated
<i>Gazella marica</i>	Natural	Rhub al Khali-Omani border	Extirpated
<i>Oryx Leucoryx</i>	Reintroduced	Mahazat as-Sayd	Sustained
<i>Oryx Leucoryx</i>	Reintroduced	'Uruq Bani Ma 'arid	Declining
<i>Gazella arabica</i>	Reintroduced	'Uruq Bani Ma 'arid	Population persists- unknown trend
<i>Gazella arabica</i>	Reintroduced	Ibex Reserve	Declining
<i>Gazella arabica</i>	Reintroduced	Mahazat as-Sayd	Population persists
<i>Capra nubiana</i>	Natural	At Tubaq	Extirpated
<i>Capra nubiana</i>	Natural	Ibex Reserve	Declining

There are marked conservation successes in Saudi Arabia. The only fenced PA, Mahazat as-Sayd successfully conserves reintroduced Arabian Oryx, Sand Gazelle and Arabian Gazelle. Elsewhere however, intensive poaching pressure, resource competition and an ineffective legal structure that undermines the ability for conservation agencies to deter illegal activities threatens conservation investment (Table 1).

In 'Uruq Bani Ma 'arid, in the Empty Quarter for example, after reintroducing 174 Arabian Oryx since 1995, populations reached an estimated 210 individuals in 2010 (Islam et al., 2011). In 2015 the population was estimated at <35 Oryx (Barichiev, pers. obs based on extensive field work with field rangers who follow known herds, track the source of footprints, and an extensive camera trap survey). Illegal hunting is a known driver; with six individuals (>20%) of the population being killed since mid-2014, 4 in a matter of days (Alagaili, Hamad-Hady pers. obs).

Arabian Gazelle were reestablished into the Ibex Reserve in 1991 and peaked in 1995 at approximately 200 individuals (Dunham, 2001). The population has since decreased to less than ten observed individuals in 2015 (Barichiev and Sandouka, 2015). Illegal hunting is again a major driver; in a supplementary reintroduction in 2013 all animals were killed by hunters within a short period (estimated less than two weeks).

Naturally occurring populations incorporated into the PA network have fared no better than reintroduced ones. The historically widespread Sand Gazelle was reduced to remnant populations in two protected areas in Saudi Arabia and one population on the Omani border (Dunham et al., 2001). In 1996 it was estimated that >1000 individuals lived in Harrat al-Harrah, and in 1995 an estimated 150 Gazelles lived in Al-Khunfah (Wacher, pers. comm.). These three natural populations are now considered extirpated (Saif, pers. comm; Spalton, pers. comm). All known wild Sand Gazelles in the Kingdom are now limited to two reintroduced sub-populations within the PA network found in Uruq Bani ma' Arid and Mahazat as-Sayd. The naturally occurring population of Nubian Ibex in the Ibex Reserve has declined 75% since 2005 (Barichiev and Sandouka, 2015) and the population in Al-Tubaq has been extirpated (Tami, pers. comm 2015). Sparse populations of Arabian Gazelles and Nubian Ibex are known outside of the PA network, but have little formal protection and surveys have not been made to estimate population status (Llewellyn, pers. comm., 2015).

SWA has successfully designated a comprehensive PA network and conserved a number of threatened species. Efforts to tackle main drivers of population declines are now required. Deterrence of criminal activity requires the certainty, celerity and severity of sanctions (Paternoster, 2010). Despite commendable efforts by field personnel, the implementation of legal sanctions when perpetrators are apprehended has been ineffective. A number of reviews have highlighted the need for political reforms to enable increased deterrence of illegal hunting in PA's (Cunningham and Wacher, 2009; Cunningham and Wronski, 2011; Dunham, 2001; Wronski

et al., 2012). Competing socio-political constraints have generated a scale-mismatch in which social priority does not support the maintenance of protected area objectives (Cumming et al., 2006; Maciejewski et al., 2014). For instance, allowing access to camel grazers for forage is at direct odds with conservation of the Nubian Ibex (Barichiev et al., unpublished data). However, exclusion of communities of natural resources is not without political ramifications. Solutions to such scale mismatches require institutional changes at multiple levels, social learning and flexibility within institutions (Cumming et al., 2006). Society would need to value the persistence of Ibex more than the value for the local grazing and, self-regulate the chronic grazing and hunting pressure. The legal framework and strategies are in place, the challenge for conservation practitioners is implementation and enforcement of sanctions.

Recently, changes in SWA conservation strategy have been implemented that may address this mismatch. Long term; the SWA is investing heavily in the next generation. Awareness and training campaigns are in development by national authorities, and a wilderness leadership curriculum tailored to the Arabian Peninsula is under preparation (Llewellyn, pers. obs). A decision has been taken to open certain protected areas to ecotourism. *Himas* have been recommended as community conservation areas, but have yet to be accepted (Abdallah, 2014). A new environmental police force with jurisdiction outside the protected areas has been approved by the government. International collaborations for training from partners to improve law enforcement and social outreach is being developed. These longer term strategies, if implemented successfully, bode well for sustainability.

To mitigate short-term losses, increased sanctions were implemented in 2015 which may increase deterrence; field rangers are now armed, and infrastructure development continues. However, the effectiveness of this will only be seen in time.

The SWA and collaborators should be applauded for positive strategy. Recent strategic progress bodes well for conservation within the Kingdom, with measures set to address the lack of law enforcement that undermined conservation agencies ability to effect conservation management. Efforts are being made to address a lack of societal value of the PA system that entrenches a feedback loop that drove overexploitation. The key to success for conservation in Saudi Arabia now is the meaningful implementation of the positive rhetoric, and a shift in focus toward management and maintenance of PAs as opposed to purely delineation thereof.

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