



Subject Review

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Mammals lost and at risk of extinction in Jordan: historical analysis of constitutions and hunting laws

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Summary

Jordan's mammalian fauna has experienced significant declines due to intensified hunting since the early twentieth century, leading to the extinction of six species and threatening 39% of the remaining species. This research evaluates the evolution of Jordan's hunting laws across three historical stages – the Ottoman period, the establishment of Jordan and the modern era – highlighting their impacts on mammalian diversity and identifying legislative gaps contributing to species declines. Using Arabic-based legal databases and historical archives, we found that inadequate legal frameworks, political instability, economic pressures and weak enforcement often accelerated species depletion. Notably, the 1957 Hunting Law permitted hunting of vulnerable species with a licence and of predators without a licence, worsening species decline. Although the 1962 Defense Law aimed to protect nature, its expiration hindered progress. The 1966 Hunting Law largely duplicated the 1957 law, perpetuating these problems, and then hunting regulations were absorbed into agricultural law, undermining conservation efforts. Despite these legal shortcomings, Jordan's modernization vision provides hope for reform, including the potential restoration of the Hunting Law under the Ministry of Environment and incorporating the right to a healthy environment into Jordan's constitution to help prevent a mass extinction of mammals.

Introduction

Hunting is integral to Jordan's cultural-historical heritage and societal fabric (Maher et al. 2012). The country's location at the junction of three continents (Eid & Handal 2018, Eid et al. 2020) and the existence of the Fertile Crescent in its northern regions (Jaradat & Aleppo 1998) support diverse ecosystems that host, or have hosted, species that are or were important for hunters, such as ungulates (including gazelles, deer, ibex, oryx and onagers), hares, hyrax, porcupines and others. Osteoarchaeological research has revealed large aggregations of game animals, particularly gazelles, during the Epipalaeolithic period, but overhunting of many ungulates in the Southern Levantine Mediterranean zone occurred at that time (Stutz et al. 2008). In the eastern desert of Jordan, including Kharaneh and Wadi Jilat, there were large aggregations of Arabian sand gazelles (*Gazella* spp.) and other game species during the Late Pleistocene, attributed to the availability of permanent water sources such as lakes and marshes, particularly the Azraq wetlands (Rolston 1982, Martin et al. 2010). Archaeological remains from this region are generally identified as *Gazella subgutturosa* rather than *Gazella marica* based on horncore morphology. However, distinguishing these species is challenging due to their paraphyletic maternal origins and ongoing maternal gene introgression from *G. marica* to *G. subgutturosa*, indicating natural gene flow between them. Evidence of shifting population ranges further complicates species identification in historical contexts (Murtskhvaladze et al. 2012).

There were intensive food processing activities, as evident from gazelle carcasses as well as the remains of other large game from the Middle Epipalaeolithic in the Azraq Basin, which was a rich and extensive wetland area within a semi-arid steppe and desert landscape (Maher et al. 2012). Archaeological evidence also indicates the presence of wild sheep (*Ovis orientalis*) in the Harra at Shubayqa during the Late Pleistocene and Early Holocene (Yeomans et al. 2017). Several species have been recorded from their bones, including cape hare (*Lepus capensis*), European badger (*Meles meles*), onager (*Equus hemionus hemippus*), wild boar (*Sus scrofa*), red deer (*Cervus elaphus*), Persian fallow deer (*Dama dama mesopotamica*), roe deer (*Capreolus capreolus*), aurochs (*Bos primigenius*), Arabian sand gazelle (*Gazella marica*), mountain gazelle (*Gazella gazella*), wild goat (*Capra nubiana*) and wild sheep (*Ovis orientalis*) in the Basta area near Petra in southern Jordan; the dominant species (31% of each) according to the bone remains were the wild goats and gazelles. Biodiversity richness in Jordan is also evident from rock art and mosaics in churches and castles (Almagro 1995).

Dogs have accompanied humans in hunting since ancient times, which is clear from the rock art in Wadi Rum, southern Jordan (E Eid, personal observation 2021) and north-western Saudi



Arabia rock art dated to the seventh or perhaps eighth millennium BCE (Guagnin et al. 2018). Dogs may have been used in hunting during the early and late Pre-Pottery Neolithic A period in the eastern desert of Jordan (Yeomans et al. 2019). The desert kites (stone enclosures with trailing walls) in the eastern desert of Jordan (Betts & Burke 2015) have been interpreted as tools for the mass hunting of gazelles in the Natufian culture, a Late Epipaleolithic culture of the Neolithic prehistoric Levant (Bar-Oz et al. 2011, Abu-Azizeh & Tarawneh 2015, Barge et al. 2016); dogs were possibly used to guide herds of gazelles into the kites (Bar-Yosef 2001, Picalause et al. 2004, Betts & Burke 2015, Yeomans & Richter 2018, Yeomans et al. 2019). However, new hunting techniques, including the employment of machine guns and four-wheel drive vehicles in the modern era, have significantly contributed to species loss in Jordan (Mountfort 1964, Fitter 1967, Harrison & Bates 1991, Macdonald 2001, Martin et al. 2010, Eid et al. 2020).

Significant depletion and extinction of several species have occurred from the early 1900s. The last record of the roe deer (*C. capreolus*) was from this period (Mountfort 1964, Fitter 1967, Eid et al. 2020). Other species, including the onager (*E. h. hemippus*) and the fallow deer (*D. mesopotamica*), were eradicated during the 1920s. The Arabian oryx (*Oryx leucoryx*) is believed to have become extinct in the 1940s (Fitter 1967, Qumsiyeh et al. 1996, Eid et al. 2020, Eid & Mallon 2021), although the last wild oryx might have been shot in the early 1960s near Qatraneh, c. 75 km south of Amman (Mountfort 1965). The Nubian ibex (*Capra nubiana*) population has also drastically decreased. Mountfort (1964) noted that Arabian sand gazelle and dorcas gazelle (*Gazella dorcas*) numbers rapidly declined in Jordan in the 1950s, although they were still abundant then. There were then only eight wild Arabian sand gazelles east of Azraq; the calves were sold by Bedouins for five Jordanian dinars (Mountfort 1965). Significant numbers of gazelles were killed by unlicensed hunters from Arabian Gulf countries in Wadi Araba and the eastern desert of Jordan (Eid & Handal 2018). All wild Bovidae species are Critically Endangered in Jordan, mainly due to hunting, including the Arabian sand gazelle (*G. marica*), mountain gazelle (*G. gazella*), dorcas gazelle (*G. dorcas*) and roe deer (*C. capreolus*; Eid et al. 2020). The Nubian ibex (*C. nubiana*) is classified as Endangered, and the Arabian oryx (*O. leucoryx*) is Regionally Extinct (Eid et al. 2020).

Hunting has severely impacted carnivores, causing the extinction of the cheetah (*Acinonyx jubatus*) and the Arabian leopard (*Panthera pardus nimr*) in the early 1920s and 1962, respectively. A leopard reported shot in the eastern desert in the 1930s (Betts 1986) was probably a cheetah. The Syrian bear (*Ursus arctos syriacus*) was last observed in 1941 (Mountfort 1964, Fitter 1967). The population of the wolf (*Canis lupus arabs*) has drastically decreased (Fitter 1967) since the 1940s, as has that of the golden jackal (*Canis aureus syriacus*), probably due to habitat destruction and competition with the red fox (Lewis et al. 1968). Clarke (1976, 1979) stated that the status of several species in Jordan is uncertain, and, at best, they must be regarded as locally endangered, including the wolf, striped hyaena, caracal, leopard, cheetah, ibex, mountain gazelle, dorcas gazelle, Arabian sand gazelle and Indian crested porcupine. Hunting in Jordan has various purposes, including for food, folk medicine and sorcery; 14 mammal species are hunted for traditional medicine or other non-consumptive uses (Aloufi & Eid 2016).

The significant decline in mammalian species, particularly carnivores and ungulates, and the deterioration of many other populations have driven the need for legislative instruments to control hunting across various stages of Jordan's establishment.

This study is the first to comprehensively review the legislative landscape of hunting in Jordan, spanning from the Ottoman period (1881–1931) through the introduction of specific hunting laws (1933–1972) to the enactment of agricultural laws (1973–present). We evaluate the effectiveness of these legislative frameworks and their impacts on the conservation status of mammalian species. By identifying legislative shortcomings and their ecological consequences, we aim to support Jordan's modernization vision by providing insights that could improve the protection of and sustain species populations at risk of mass extinction and inform legislative reforms that address ongoing species declines.

Methods

We reviewed Jordan's hierarchical legislative pyramid concerning hunting, which comprises multiple levels. Laws implement constitutional provisions drafted by the government or 10 parliament members and require parliamentary approval, a Royal Decree and publication in the Official Gazette. Bylaws, prepared by ministries and finalized by the Legislation and Opinion Bureau, implement laws and can be amended by the issuing authority without legislative oversight. Regulations enacted to enforce laws or bylaws are drafted and approved by governmental bodies and published in the Official Gazette; they do not require legislative or ministerial approval. At the base of this legislative pyramid, decisions guide daily administrative work, offering flexibility and frequent updates under the authority of higher legislation.

A comprehensive review of hunting-related laws, bylaws, regulations and decisions in Jordan was conducted using two primary Arabic legal platforms: Qistas (<https://qistas.com/en>), which provides a wide range of Arabic legal materials; and Qarark (<https://qarark.com/login>), affiliated with the Jordanian Lawyers Association, offering a database of Jordanian legislation. A systematic electronic search retrieved relevant documents organized by issuance period and legal hierarchy. The comparative analysis assessed the progression and effectiveness of hunting regulations, their alignment with conservation goals and their impacts on mammalian biodiversity, identifying legislative gaps, inconsistencies and ecological consequences.

To ensure a complete dataset was obtained, primary documents for each law, bylaw or regulation were verified through cross-checking and additional searches as needed. Keywords such as 'hunting', 'extinction', 'law', 'biodiversity', 'wildlife', 'mammals', 'threatened', 'nature reserves' and 'ministry' were used to refine the search. Historical archives from the Royal Hashemite Documentation Center and the Jordanian Legislative Council, along with political books and documents on Jordan's establishment, were reviewed. The findings stem from a systematic categorization and comparative analysis of the legislative documents, offering a detailed evaluation of the progression and effectiveness of hunting laws.

Results

We identified 37 legal documents related to hunting, reflecting three key stages in developing hunting law in Jordan. Our comprehensive analysis highlighted legislative trends, enforcement challenges and their direct impacts on Jordan's mammalian species.

The three constitutions issued for Jordan – the Basic Law of 1928, the Constitution of 1946 and the Constitution of 1952 (which remains in effect today) – do not include any provisions referring to environmental rights or specific articles related to nature and biodiversity.

Stage 1: the Ottoman period (1881–1931)

During the Ottoman period, which ended in 1924, hunting was mostly unregulated and relied on simple, traditional methods such as trained hounds and raptors and basic weapons such as bows, swords and spears. The introduction of the 1876 Ottoman Code of Civil Law marked the first formal attempt to regulate hunting, leading to the issuance of the Ottoman bylaw for Terrestrial and Marine Hunting/Fishing in 1299 AH (equivalent to 1881 CE), which remained in effect until 1931. This bylaw categorized hunting into terrestrial and marine activities and required individuals to obtain a non-transferable licence costing half a Majidi riyal (an Ottoman coin). The law also criminalized damaging birds' nests, carrying a fine of 5 Majidi riyals. In 1882, the bylaw was amended to include an additional fee of 5 malats (an Ottoman coin equivalent to 1.5 piasters) per pound of fish caught, regardless of species.

The Emirate of Transjordan, established in 1921 under British mandate, enacted its Basic Law and Election Law in 1928, which laid the foundation for its first legislative council election in 1929. In 1931, a bylaw was issued to suspend the Ottoman-era hunting regulations, marking the beginning of a new legislative stage.

Stage 2: transformation and issuance of hunting laws (1933–1972)

Two years later, in 1933, the first hunting law specific to Jordan was issued. The Hunting Law of 1933 in Transjordan banned hunting of cape hare (*L. capensis*) from late February to early September and prohibited the use of hooks, nets, traps and other hunting tools. The law was revised in 1934, maintaining the original articles while adding gazelles (*Gazella* spp.) to the list of protected species. In 1936, two appendices were introduced under the 1934 Hunting Law: Appendix I imposed a 5-year hunting ban on cheetahs (*A. jubatus*) in eastern Jordan and Nubian ibex (*C. nubiana*) in south-western regions of Jordan, and Appendix II extended protection to the Arabian oryx (*O. leucoryx*). Despite these regulations, certain species, such as the oryx and cheetah, became extinct, and populations of Nubian ibex and gazelles continued to decline.

Hunting Law No. 28 of 1957 replaced earlier hunting legislation and granted the Minister of Agriculture authority to enforce its provisions. The Minister was empowered to determine hunting seasons, designate hunting areas and establish bag limits for game species; gazelles, Nubian ibex and other game animals (excluding the cape hare) were classified as game species. Using military rifles for hunting was generally prohibited, except under licensed conditions for Nubian ibex and wild boar. Special permits allowed the hunting of gazelles during a limited season between August and October, with a restriction of two male gazelles per hunting period and a maximum of six annually per hunter. A significant shortcoming of the 1957 law was its explicit allowance for killing predatory species without a licence, which probably contributed to the extinction of apex predators such as the Arabian leopard (*P. p. nimr*). In 1958, three bylaws were introduced under this law: one restricted gazelle hunting to specific regions in eastern Jordan (Al-Jafr and Al-Wesad) and required a licence, while the other two addressed regulations for bird hunting.

Defense Order No. 23 of 1962 banned all hunting activities using any methods until further notice. This ban also included selling wild animal meat, whether raw or cooked, in restaurants and markets.

Hunting Law No. 8 of 1966 was accompanied by four supporting legal instruments: temporary amendments to Hunting Law No. 68, hunting bylaws 98 and 99 and a temporary amendment to the Hunting Law, Law No. 86, enacted on 24 September. The 1966 Hunting Law retained much of the content from the 1957 law but introduced notable changes concerning mammalian species. It permitted the hunting of mountain gazelles (*G. gazella*) with military rifles, Nubian ibex and wild boars. Permission to hunt predatory animals without a licence continued to be granted. The 1966 law also imposed restrictions that had been absent from previous legislation, including a ban on using machine guns, nets, traps, calling devices and camouflage made from animal skins and hunting with falcons. Furthermore, the 1966 law expanded the enforcement framework by involving army personnel, public security officials and village leaders in implementing and overseeing hunting regulations. On 3 August 1966, three supporting legal instruments were issued, specifically designating areas for hunting particular bird species:

- (1) Temporary Law No. 68 revised Law No. 8 by adding the text 'Whoever represents the Minister'. It also allocated fees and fines collected under the law to an entity designated by the Minister.
- (2) Hunting Bylaw No. 98 established designated bird hunting areas and seasons.
- (3) Hunting Bylaw No. 99 amended Article 4 of the original law by removing Paragraph C and introducing new bird regulations.

On 24 September 1966, Temporary Law No. 86 further amended the hunting regulations to include new provisions regarding fees for carrying rifles, integrating these into the existing framework of fees and fines.

Amendments to Hunting Law No. 3 of 1968 were issued, and these were considered an integral part of Hunting Law 1966. The amendments included a specific article directing all fees to the Jordanian treasury. Hunting Bylaw No. 34 of 1968 also repealed the previous amendments to Hunting Regulation No. 98 of 1966, specifically addressing hunting locations and seasons for some birds.

Law No. 3 of 1972 largely replicated the provisions of Hunting Law No. 8 of 1966 but introduced new measures, notably prohibiting killing of predator species without a licence from the Minister. The law imposed fines for hunting specific animals: JOD 15 for desert gazelle, JOD 10 for each ibex, boar or mountain gazelle and JOD 3 for other animals. Additionally, it marked the first instance of allowing hunting for scientific purposes and permitted certain institutions to hunt animals with ministerial approval. Hunting Regulation No. 47 of 1972, issued under Article 8 of Hunting Law No. 3 of 1972, established a hunting licence fee and organized hunting areas and seasons according to the Minister's decisions. It prohibited hunting in the desert area east of the Hejaz Railway, except in the Azraq region, where hunting was permitted based on ministerial authorization. The regulation included a list of game species (Table 1). Enforcement was managed by various authorities, including the army, public security officials and Ministry of Agriculture rangers.

Table 1. Game species bag limits as per Hunting Bylaw No. 47 for the year 1972.

Game species		Bag limit per trip	Number of trips per year permitted
Common name	Scientific name		
Wild boar	<i>Sus scrofa</i>	1	2
Nubian ibex	<i>Capra nubiana</i>	1 (male)	2
Mountain gazelle	<i>Gazella gazella</i>	1 (male)	2
Cape hare	<i>Lepus capensis</i>	3	Several
Hyrax	<i>Procavia capensis</i>	3	Several
Common badger	<i>Meles meles</i>	1	3
Indian crested porcupine	<i>Hystrix indica</i>	1	3
Arabian sand gazelle	<i>Gazella marica</i>	Not allowed	

In 1973, Royal Society for the Conservation of Nature (RSCN) Announcement No. 1 stated that several areas were closed to hunting.

Stage 3: the evolution of the agriculture law (1973–present day)

The law has progressed through three phases: Agriculture Law No. 20 of 1973, followed by Interim Agricultural Law No. 44 in 2002 and culminating in Agriculture Law No. 13 of 2005, which is currently in effect.

Agriculture Law No. 20 of 1973 integrated 12 hunting-related provisions (Articles 144–155) into a comprehensive 202-article agricultural law. These provisions gave only limited attention to animal species other than birds. The law maintained the requirement for a Ministry-issued hunting licences for wild animals and allowed exceptions for scientific purposes. It prohibited using automatic rifles for hunting, except with ministerial permission. The Minister was empowered to establish a Hunting Committee to guide hunting areas, times and species.

Following Agriculture Law No. 20 of 1973, four key decisions were issued to regulate hunting across Jordan. Decision No. 1 of 1984 established six designated hunting zones within Jordanian territory (Fig. 1 & Table 2).

Hunting was prohibited in designated protected areas and municipalities, with certain zones explicitly restricted from hunting activities. The Jordanian desert area east of the Hejaz Railway was closed to hunting, except for a 4-km radius around the Azraq oasis, where hunting was permitted under the supervision of the RSCN. Decision No. 2 of 1988, along with Decisions No. 3 and No. 4 of 1989 and 1990, reaffirmed these regulations without changes; each decision included tables specifying allowed species, hunting seasons and bag limits. Of the mammalian species permitted for hunting under Article 147 of Agriculture Law No. 20 of 1973, only three were explicitly mentioned in these decisions (Table 3).

Following this, the Minister of Agriculture annually released tables outlining permitted hunting species, their bag limits and their designated seasons. Almost the same information on mammals as in Table 3 was presented in the most recent table in 1992.

The Interim Agricultural Law Number 44 of 2002, with 73 articles, addressed hunting regulations and wildlife protection, specifically in Article 57 through eight sub-articles. This legislation, while retaining elements of previous laws, expanded its scope to include a broader range of animal species than birds. It prohibited

the killing, possession, transportation, sale or offering for sale of wildlife. Predator hunting was reintroduced but was restricted to cases in which the Minister granted permission. The law mandated the exclusive use of hunting rifles for hunting activities. It categorized mammals into three protection levels, with penalties for violations varying according to the appendix to which the species belongs (Table 4).

Regulation No. Z/34 of 2003 was issued to regulate the hunting and trade of wild animals per Article A of the Interim Agricultural Law. It outlined the requirements for obtaining a hunting licence, with the RSCN designated as the managing authority. It required the Minister of Agriculture to announce hunting areas and seasons based on recommendations from a competent committee. The Regulation also prohibited hunting east of the Hejaz Railway, except in specific ministerially authorized areas, and banned the mummification, possession, trade or introduction of live or aquatic specimens without prior ministerial approval, in alignment with international agreements. The subsequent Regulation No. 43 of 2008 further categorized wild animals based on their level of protection, following Article 57, Paragraph E of Agriculture Law No. 44 of 2002. These Regulations divided wild animals into three appendices based on their rarity, importance and vulnerability to overexploitation. The first category included the rarest species and those at risk of overhunting, the second category comprised species at moderate risk and the third category consisted of those at lower risk but still requiring regulation to prevent potential threats (Table 4).

Agriculture Law No. 13 of 2005 mirrors Interim Agricultural Law Number 44 of 2002, with minor differences, notably in assigning hunting regulations to Article 56 instead of to Article 57.

Stages in the development of hunting laws in Jordan

Hunting in Jordan has been regulated through the Ottoman period (1881–1931), Jordan's establishment (1931–1972) and the evolving agricultural law (1973–present; Fig. 2). The most significant species losses occurred during the second period, with the extinction of several species, including roe deer, onager, fallow deer, cheetah, Arabian oryx, Arabian leopard and Syrian bear. Populations of other species, such as Nubian ibex, three gazelle species (Arabian sand gazelle, mountain gazelle and dorcas gazelle), wolves and golden jackals, also saw drastic declines. This period also witnessed uncertainty in the population status of other species, including the striped hyaena, caracal and Indian crested porcupine. Today, 39% of Jordan's mammalian species are threatened and 6% are near-threatened (Fig. 2).

Discussion

Hunting has been a major driver of mammalian species decline in Jordan, affecting 73% (17 species) of those recorded within the carnivores, artiodactyls, hyracoids and lagomorphs (Amadouy 1993, Qumsiyeh et al. 1996, Eid et al. 2020). However, environmental degradation caused by livestock grazing and habitat loss has also significantly reduced wild fauna (Amadouy 1993, Qumsiyeh et al. 1996). Additionally, species depletion has been exacerbated by various factors, including human population growth, urbanization, infrastructure development, land-use changes, agricultural expansion, deforestation and weak governance in biodiversity conservation (Qumsiyeh et al. 1996). While these pressures are globally recognized as significant drivers of wildlife decline (Tuyet 2001, Brooks-Moizer et al. 2009,

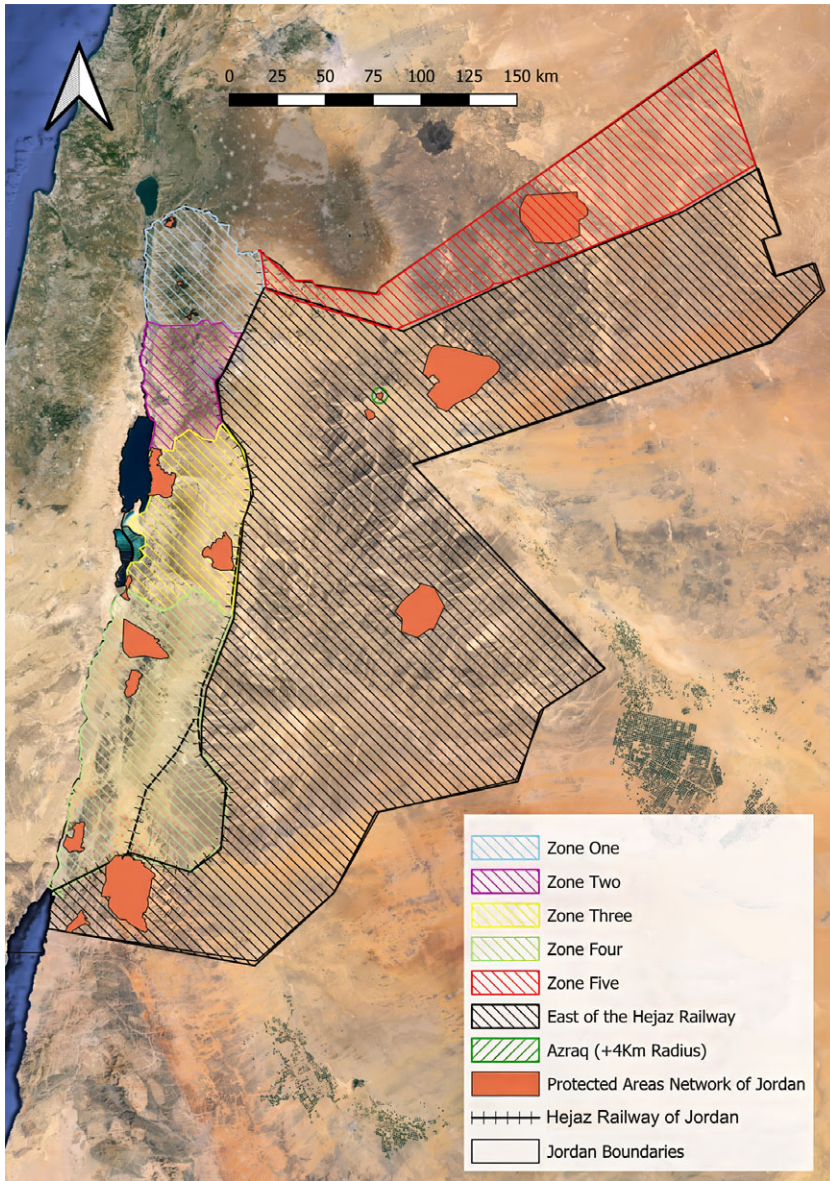


Figure 1. Hunting zones in Jordan according to Agriculture Law No. 20 of 1973.

Table 2. Hunting zones in Jordan according to Agriculture Law No. 20 of 1973.

Zone	Extent
Zone 1	The Yarmouk River in the north to the Zarqa River boundaries in the south
Zone 2	The Zarqa River to Wadi Zarqa Mai'en in the south
Zone 3	Wadi Zarqa Mai'en to Wadi Hassa in the south
Zone 4	Wadi Hassa to the southern tip of the Gulf of Aqaba
Zone 5	Northern Jordan along the Mafraq-Safawi road to the border with Iraq
Zone 6	East of the Hejaz Railway, excluding Zone 5 and the Azraq region within a 4-km radius

Table 3. Mammalian species permitted to be hunted according to Agriculture Law No. 20 of 1973.

Decision numbers	Common name	Species name	Season	Bag limit
1, 2, 3, 4	Red fox	<i>Vulpes vulpes</i>	All year round	Unlimited
1, 2, 3, 4	Wild boar	<i>Sus scrofa</i>	All year round	Unlimited
1, 2	Cape hare	<i>Lepus capensis</i>	1 June–31 December	2
3, 4	Cape hare	<i>Lepus capensis</i>	1 Oct–30 November	2

Nguyen 2017, Van Khuc et al. 2018, Janssen & Indenbaum 2019, Challender et al. 2020, Ngo et al. 2020), Jordan's situation is notably concerning due to persistent political instability in the region, economic limitations and exacerbation by ongoing refugee influxes. These factors have led to a de-prioritization of biodiversity conservation, resulting in diminished government interest and reduced support from policymakers. This, in turn, has contributed

to the development of an unstable legislative framework for regulating hunting and conserving wildlife. Our review provides a novel analysis of the impact of Jordan's evolving legal hunting frameworks on the current status of mammalian species, highlighting the anticipated risk of mammalian mass extinction.

The Ottoman Empire's hunting regulations laid the groundwork for early wildlife management. However, evaluating the

Table 4. Mammalian species listed in the three appendices of Regulation No. 43 of 2008.

Common name	Scientific name
<i>Appendix I. (fines of up to JOD 2000 and imprisonment for up to 4 months)</i>	
Asiatic jackal	<i>Canis aureus</i>
Wolf	<i>Canis lupus</i>
Sand fox	<i>Vulpes rueppelli</i>
Caracal	<i>Caracal caracal</i>
Jungle cat	<i>Felis chaus</i>
Sand cat	<i>Felis margarita</i>
European otter	<i>Lutra lutra</i>
Honey badger	<i>Mellivora capensis</i>
Nubian ibex	<i>Capra ibex</i>
Dorcas gazelle	<i>Gazella dorcas</i>
Goitred gazelle	<i>Gazella subgutturosa</i>
Arabian oryx	<i>Oryx leucoryx</i>
Arabian leopard	<i>Panthera pardus</i>
<i>Appendix II (fines up to JOD 1000 and imprisonment for up to 3 months)</i>	
Blanford's fox	<i>Vulpes cana</i>
Wild cat	<i>Felis silvestris</i>
Egyptian mongoose	<i>Herpestes ichneumon</i>
Striped hyaena	<i>Hyaena hyaena</i>
Stone marten	<i>Martes foina</i>
Eurasian badger	<i>Meles meles</i>
Marbled polecat	<i>Vormela peregusna</i>
Rock hyrax	<i>Procavia capensis</i>
Indian crested porcupine	<i>Hystrix indica</i>
<i>Appendix III (fines of up to JOD 100 and imprisonment for up to 1 month)</i>	
East European hedgehog	<i>Erinaceus concolor</i>
Long-eared hedgehog	<i>Hemiechinus auritus</i>
Desert hedgehog	<i>Paraechinus aethiopicus</i>
Lesser white-toothed shrew	<i>Crocidura suaveolens</i>
Savi's pigmy shrew	<i>Suncus etruscus</i>
Egyptian fruit bat	<i>Rousettus aegyptiacus</i>
Long-fingered bat	<i>Myotis capaccini</i>
Natterer's bat	<i>Myotis nattereri</i>
Egyptian desert pipistrelle	<i>Pipistrellus ariel</i>
Cape hare	<i>Lepus capensis</i>
Asian garden mouse	<i>Eliomys melanurus</i>
Persian squirrel	<i>Sciurus anomalus</i>

effectiveness of these regulations is difficult due to the lack of comprehensive historical records. The political instability of the early 1900s, characterized by frequent wars and revolutions, probably shifted focus away from hunting and biodiversity conservation, further complicating assessments of the regulations' long-term impacts on mammalian species. Nevertheless, the simplicity of hunting methods, the limited regulatory framework of the time and the restricted access to certain areas suggest that the impacts on species diversity were relatively minor (Velioglu & Elvan 2021).

The Jordanian government's efforts during the British Mandate period, including issuing the Hunting Laws of 1933 and 1934, were intended to protect vulnerable species such as gazelles, ibex, oryx and cheetahs. Yet this period was marked by the extinction of several ungulates, including oryx, roe deer, addax, onager and fallow deer, as well as carnivores like the Arabian leopard, cheetah and Syrian bear, alongside declines in Nubian ibex, gazelles, wolves and golden jackals (Eid et al. 2020, Eid & Mallon 2021). This period represents a critical phase in Jordan's history, probably having a lasting and detrimental impact on the country's large mammalian biodiversity. This can be attributed to several factors directly linked to British influence on national policies and the prevailing political climate (Nasasra 2015). The instability and transformative changes in governance during this era led to continuous shifts in governmental priorities, which, in turn, undermined effective wildlife protection (Amadouny 1993, Schayegh & Arsan 2015,

Bradshaw 2016). Notably, establishment by the British Army in the early 1930s of a mobile strike force equipped with trucks and machine guns for desert policing played a significant role in wildlife degradation. This force, primarily aimed at maintaining order in the eastern desert, inadvertently facilitated widespread hunting and poaching, leading to the decline and extinction of several species (Qumsiyeh et al. 1996).

The eastern desert of Jordan, with its sparse human population, harboured the richest mammalian diversity (Hurewitz 1956, Amadouny 1993). However, British policies permitting the unprecedented influx of villagers and cultivators into this region for winter grazing severely disrupted these ecosystems. The resultant habitat destruction and overgrazing by livestock further constrained the survival of native species (Khalaf 1991, Bradshaw 2016). Additionally, British-driven infrastructure development and agricultural expansion, while contributing to economic growth, also increased accessibility to previously isolated regions rich in biodiversity. This led to the conversion of wildlands into farmlands, further fragmenting natural habitats and reducing the availability of critical ecosystems for many species. The cumulative effect of these actions, whether through direct hunting, habitat destruction or policy-driven human encroachment, exacerbated the decline in mammalian biodiversity during this period. While instrumental in modernizing the region, the British Mandate facilitated environmental degradation, highlighting the complex interplay between colonial policies and their unintended ecological consequences.

Although the Hunting Law of 1957, 11 years after Jordan gained its independence, aimed to implement stricter measures for protecting threatened mammalian species, it ultimately fell short of its objectives. The law allowed the hunting of all gazelle species, with an annual limit of six gazelles per hunter, despite the severe depletion and confinement of gazelle populations to marginal habitats at the time (Fitter 1967, Qumsiyeh et al. 1996, Kiwan et al. 2001, Eid & Mallon 2021). The decline of gazelles had already accelerated in the 1950s due to motorized hunting by raiding parties from neighbouring oil states across the Jordanian desert and wealthy individuals from Amman and army officers shooting exhausted animals from vehicles (Mountfort 1964). Additionally, the hunting laws of this period were poorly enforced (Mountfort 1964). The regulation permitted hunting from August to October, which did not align with the varied breeding seasons of gazelles, some of which reproduce year round (Sempéré et al. 2001). The timing and limits set by the law were inadequate to protecting the remaining gazelle population. This ineffectiveness was further exacerbated by issues with enforcement, including the number of licensed and unlicensed hunters.

The law's provisions also seriously impacted the Nubian ibex and cape hare; the provisions were similarly flawed, permitting the hunting of these species with military rifles without spatial or temporal restrictions or bag limits, thereby exacerbating the strain on their populations. This lack of restriction undermined any benefits from other aspects of the law and exposed significant shortcomings in its design. The most concerning aspect of the 1957 law was its failure to regulate predator hunting, especially since it allowed the killing of these animals without requiring any form of license. This lapse in conservation measures may have contributed to the extinction of apex predators such as the Arabian leopard by the late 1950s (Fitter 1963, Eid et al. 2020). By neglecting the needs of these critical species, the law not only failed to prevent their decline but may also have accelerated their extinction and disrupted the ecological balance.

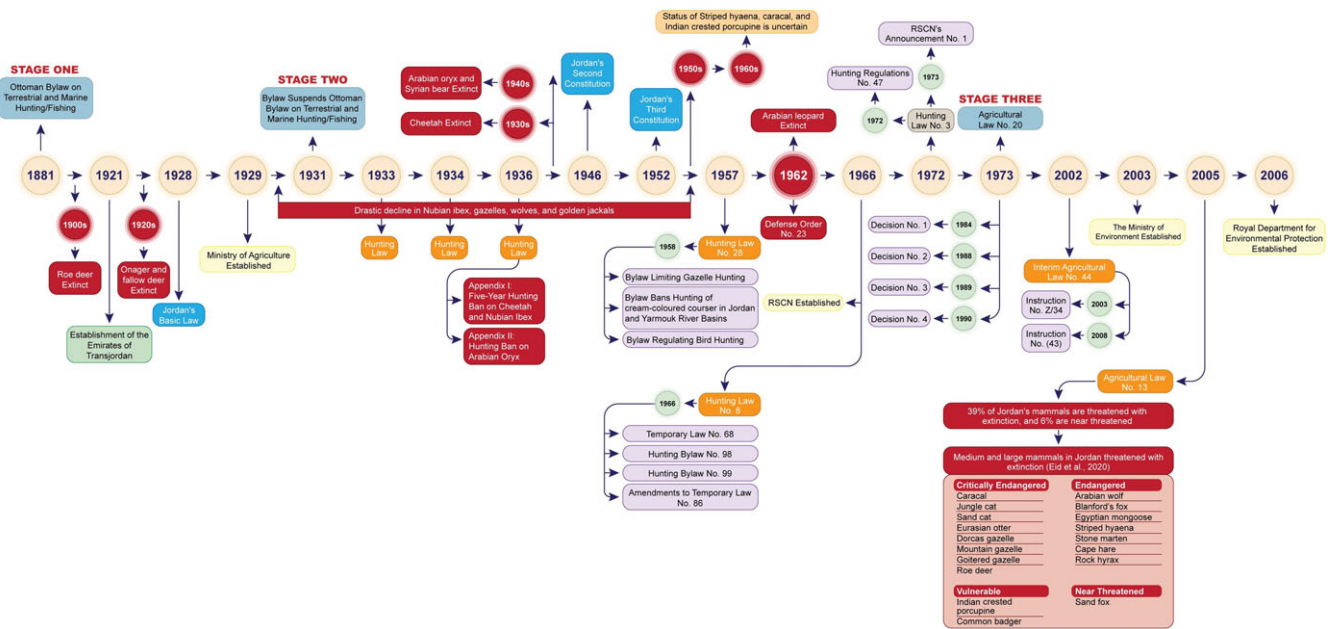


Figure 2. Overview of the development of hunting laws and species losses and threats in Jordan (1881–present day). RSCN = Royal Society for the Conservation of Nature.

Regrettably, successive hunting laws issued in Jordan up to 1972 perpetuated the same problematic principles established by the 1957 law. These subsequent regulations not only perpetuated the flaws of their predecessor but also introduced new issues, notably the permitting of the hunting of the mountain gazelle (*G. gazella*) using military rifles, a Critically Endangered species believed now to be extinct in Jordan (Eid et al. 2020, Eid & Mallon 2021). The continued authorization of such hunting practices underscored a profound failure in wildlife management and conservation during this era, as these laws did not effectively address the urgent need for species protection and habitat preservation. Instead, they exacerbated the threats to already vulnerable populations, reflecting a significant oversight in addressing the pressing conservation needs of Jordan’s wildlife. One of the positive aspects of Hunting Law No. 3 of 1972 is the prohibition of killing predators without a permit from the Minister. However, a significant shortcoming is that the Minister of Agriculture has been granted broad authority since 1957 to determine the areas, seasons, game species and quotas for hunting without providing legislative control measures. This lack of oversight could lead to incorrect or biased decisions influenced by social or political factors.

The shortcomings of previous legislation regarding protecting species probably prompted the issuance of what is considered one of the boldest decisions for biodiversity conservation made by any Jordanian government: the Defense Law of 1962, enacted by then-Prime Minister Wasfi al-Tall. This law elevated biodiversity issues to the level of crises and catastrophes, as per the constitutional definition of the Defense Law. Accordingly, it banned all hunting and prohibited the sale of wild animal meat in restaurants, which are considered significant steps towards addressing the wildlife crisis in Jordan. It supports our hypothesis regarding the critical status of mammals in Jordan during this period and illustrates how the previous legal framework had been insufficient to halt this degradation.

Despite the significant impact of the Defense Law, which was in effect for 4 years, the issuance of the Hunting Law of 1966 and the subsequent legislative measures up to 1968 were major disappointments. This legislation largely reiterated previous regulations,

focusing primarily on fee collection and bird hunting areas rather than implementing comprehensive conservation measures for all species, including mammals. Even more disheartening is the missed opportunity for the government to enhance biodiversity conservation, particularly given the direct and influential support from His Majesty the late King Hussein bin Talal, the honorary president of the Jordanian Hunting Club, which later became the RSCN (Fitter 1967).

This transformative approach, headed by the late King Hussein bin Talal, was the birth of institutionalized nature conservation in Jordan (Fitter 1967). He called for four expeditions in 1963 (Clarke 1976), two in 1965 (Mountfort 1965, Hemsley & George 1966) and one in 1966 (Boyd 1967, Clarke 1979, IUCN 1975) to explore Jordan’s ecosystems and biodiversity, laying the groundwork for the concept of establishing the country’s protected areas network. In 1965, Azraq was identified as a priority area for conservation. On 26 July 1965, the late King Hussein bin Talal issued an intent letter to found the Azraq Desert National Park (Mountfort 1965, Hemsley & George 1966, Boyd 1967, Clarke 1979, IUCN 1975). The expeditions to the eastern desert and the focus on the Azraq wetland as a critical wildlife habitat probably afforded some protection to mammalian species at that time. All of these expeditions highlighted the severe decline of mammalian species, with the status of several species being questioned, which initiated the proposal of a protected area network to mitigate their deterioration (Clarke 1976). The RSCN was granted several powers, most notably over establishing and managing nature reserves. In 1973, the Minister of Agriculture empowered the RSCN to issue decisions on hunting seasons and locations, as well as to issue violations in collaboration with forestry rangers and village mukhtars, which were submitted to the court (Fitter 1967, Kiwan et al. 2001). In 2015, the RSCN’s mandate was restricted to conducting joint patrols with the Royal Department for Environmental Protection (RDEP) and submitting reports to the security centre in cases in which the RDEP was not involved in the enforcement process.

The RSCN faced substantial challenges that hindered its effectiveness in managing hunting regulations. While temporarily

authorized to enforce hunting laws, its primary focus on establishing and managing protected areas diverted resources and attention away from addressing hunting-related issues. Additionally, limited financial and human resources further restricted its ability to implement effective measures. The RSCN's limited technical capacity and advocacy efforts were evident in its minimal influence on shaping stronger hunting laws. This was particularly clear in the incorporation of hunting regulations into the broader Agriculture Law No. 20 of 1973, which reduced them to 12 vague articles with inadequate penalties and a narrow focus on birds, overlooking the critical decline in mammalian populations. This limitation persisted: Interim Agricultural Law No. 44 of 2002 further weakened hunting regulations by reducing them to a single article. While Regulation No. 43 of 2008 categorized species by protection status, it remained subject to ministerial amendment. Similarly, Agriculture Law No. 13 of 2005, closely mirroring the Interim Law, failed to enhance species protection, contributing to ongoing declines in population sizes, diversity and distributions.

Despite the RSCN's pioneering efforts to reintroduce species such as the Arabian oryx, onager, Arabian sand gazelle, Nubian ibex and roe deer (Eid et al. 2020, Eid & Mallon 2021), significant challenges persist. The roe deer released in Ajloun Forest Reserve is now classified as Critically Endangered and is probably extinct (Eid & Ananbeh 2009, Eid & Ananbeh 2010, Eid et al. 2020). Similarly, the Nubian ibex, released in Mujib Biosphere Reserve, faces severe hunting pressures and declining numbers (Eid et al. 2020, Eid & Mallon 2021). Eid and Handal (2018) revealed the killing of 117 ibex and 23 Arabian sand gazelles, alongside other mammals, underscoring the ongoing effects of hunting and the inadequacy of current conservation laws and enforcement levels. Hunting pressure has infiltrated even protected reserves, driven by weak legislation and ineffective enforcement mechanisms, compounded by limited financial and human resources and insufficient government prioritization of biodiversity. The RSCN has shifted its focus from translocation programmes intended to reinforce wild populations and reintroduce extinct species to seeking foreign funding and promoting so-called 'eco-tourism' to meet the costs of protected area – a shift necessitated by the limited budget allocated by the Jordanian government. Regrettably, recent laws, particularly Reserves and National Parks Bylaw No. 29 of 2005 under Environmental Protection Law No. 1 of 2003, have failed to protect reserves effectively. Instead, these laws have indirectly isolated reserves, leaving them vulnerable to hunting and other threats, threatening species that may represent the last strongholds of wildlife in Jordan.

Species conservation in Jordan faces significant challenges beyond legislative gaps, including weak law enforcement due to insufficient judicial system capacity, inadequate resources for the RDEP and poor coordination among stakeholders. Jordan's diverse geography and cultural traditions surrounding hunting further complicate monitoring and enforcement efforts. Additionally, public awareness, attitudes and practices related to biodiversity conservation remain insufficient, reducing community engagement and support for conservation initiatives. These challenges, compounded by competing national priorities such as economic development and socio-political issues, overshadow species conservation efforts. Overcoming these barriers requires more robust legal frameworks, greater resources and capacity-building and improved collaboration and public awareness.

It is crucial to note that linking biodiversity conservation with hunting under the Ministry of Agriculture is fundamentally flawed,

mainly because its vision and mission need to encompass biodiversity conservation. Although no ministry was explicitly dedicated to biodiversity in Jordan when the Ministry of Agriculture was assigned this responsibility, establishing the Ministry of Environment in 2005 presented an opportunity to rectify this misalignment; however, this opportunity was missed.

Conclusion

Although the hunting legislation of 1933 in Jordan was a promising start, its effectiveness was undermined by the political instability during the British Mandate, which increased access to wildlife areas and caused habitat destruction. This led to significant declines in species, especially predators and ungulates. The 1957 Hunting Law, which permitted the hunting of vulnerable species and allowed the unlicensed killing of predators, further exacerbated this decline. The 1973 integration of hunting laws into broader agricultural regulations diluted their effectiveness due to the Ministry of Agriculture's limited expertise and mandate in biodiversity.

Two key opportunities for improvement have been the 1962 Defense Law, which made wildlife conservation a national priority, and the support of the late King Hussein bin Talal, who laid the groundwork for conservation efforts. The modernization vision led by His Majesty King Abdullah II bin Al-Hussein represents a crucial chance for Jordan to enhance its conservation efforts. By amending the constitution to include environmental rights and reinstating effective hunting laws under the Ministry of Environment, Jordan is in a better place to address the risk of the potential mass extinction of Jordan's mammals.

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