Socotra Archipelago

2020 Conservation Outlook Assessment

SITE INFORMATION

Country: Yemen
Inscribed in: 2008
Criteria: (x)

Socotra Archipelago, in the northwest Indian Ocean near the Gulf of Aden, is 250 km long and comprises four islands and two rocky islets which appear as a prolongation of the Horn of Africa. The site is of universal importance because of its biodiversity with rich and distinct flora and fauna: 37% of Socotra’s 825 plant species, 90% of its reptile species and 95% of its land snail species do not occur anywhere else in the world. The site also supports globally significant populations of land and sea birds (192 bird species, 44 of which breed on the islands while 85 are regular migrants), including a number of threatened species. The marine life of Socotra is also very diverse, with 253 species of reef-building corals, 730 species of coastal fish and 300 species of crab, lobster and shrimp. © UNESCO

SUMMARY

2020 Conservation Outlook

Finalised on 02 Dec 2020

Socotra’s values are exceptional on a global scale and have been comparatively well preserved until very recently, within a historical local context (Van Damme and Banfield, 2011). Nonetheless, much is currently at stake in order to conserve the site values, as the island is undergoing rapid development that brings about unprecedented pressures and threats (Attorre and Van Damme, 2020), and critical conditions associated with political turmoil could negatively affect the archipelago. Current and potential threats to Socotra’s values are increasing rapidly. Infrastructure development, invasive species, land use change and unsustainable natural resource management (following the deterioration of traditional management) are already affecting the island. The latest research compiling 20 years of data indicates the deterioration of key species or rapidly changing areas, with a prediction of further deterioration. The threats remain of significant concern and the pending joint UNESCO/IUCN reactive monitoring mission will enable further clarification on the overall state of conservation and whether the threats to the OUV constitute a need to inscribe the site on the List of World Heritage in Danger. The management regime of Socotra needs to be strengthened (in terms of legislative basis, cross-sector mainstreaming, capacity, science-based decision making and use of traditional knowledge), in order to promote sustainable development, and effectively manage pressures and threats into the future.
FULL ASSESSMENT

Description of values

Values

World Heritage values

► Complex assemblage of unique ecosystems

Eight unique main types of vegetation/ecosystems with rich endemic biota. Part of the CI global biodiversity hotspot “Horn of Africa” (CI, 2013) and of the WWF Global 200 priority eco-region “Socotra Island xeric shrubland” (WWF, 2013). Various other designations are outlined in Van Damme and Banfield (2011). This isolated and until recently well-preserved island lying between three biogeographic regions, Afrotropical, Oriental and Palearctic, is a living museum which has preserved several intact and unique terrestrial ecosystems and their species with a traditional culture living in balance with them (UNEP-WCMC, 2011).

► Endemic flora and vegetation

At least 310 endemic plant species (+35%), 15 endemic genera, with more species continuing to be described, contribute to the Archipelago’s status as a Global Centre of Plant Diversity (WWF & IUCN, 1994; Repka and Lvoncik, 2017; Thulin, 2020; IUCN Consultation, 2020). Of particular significance is the Dragon’s Blood Tree Forest and Woodland, which is globally unique (IUCN Consultation, 2020).

► Endemic reptiles with their habitats

Rich overall herpetofauna, with 30 known terrestrial reptile species, of which 28 (93%) are endemic to the archipelago (World Heritage Committee, 2008; IUCN Consultation, 2020).

► Endemic and endangered birds with their habitats

The site harbours 11 endemic bird species (Gill, Donsker & Rasmussen, 2020), 2 of which are globally threatened (BirdLife International, 2020) in addition to another two non-endemic globally threatened species. The archipelago also represents an important breeding site for birds, with at least 41 species breeding on the islands, out of a total of 182 species recorded (BirdLife International, 2013a). The archipelago is also an Endemic Bird Area (BirdLife International, 2013a) with 21 Important Bird Areas (Porter & Suleiman, 2016).

► Endemic invertebrates with their habitats

High invertebrate endemism in land snails with 96 species (95%), isopods (73%) and arachnids (ca. 60%) reported at the time of inscription (World Heritage Committee, 2008).

► Coastal/marine biodiversity and habitats

High marine diversity and some regional endemism. In total, between 830 and 890 species of fish are estimated to occur in the coastal waters of the Socotra Archipelago (Zajonz et al., 2019), along with a reported 253 species of coral, two nesting species of sea turtle, 300 species of crab, lobster, shrimp, and many whale and dolphin species in the vicinity (World Heritage Committee, 2008). Nine species of seabird breed in the archipelago, eight of which are considered to have globally important breeding populations (Porter & Suleiman 2014).

Other important biodiversity values
Rich culture and history of sustainable use of the land and sea

Rich cultural traditions and lifestyles, including the ancient unwritten language of "Sacatri", and a wealth of poetry and folklore, passed down through generations. Semi-nomadic pastoralists have a strong ethic of environmental stewardship, carefully managing rangeland and fodder trees to avoid overuse; and tribal regulations regarding sustainable harvesting from the wild are well respected (Cheung & DeVantier, 2006).
To a lesser extent, the same cultural practices apply to the use of sea resources including community managed coastal reserves and tribal fishing regulations.
Among several others addressing the islands' sustainability, a specialized community-based organization (CBO) was established in 2013 to protect and promote the Socotri culture, language, and indigenous knowledge, and the Socotri governorate intends to adopt regulations to protect tangible and intangible heritage (State Party of Yemen, 2016).

Assessment information

Threats

Current Threats

Having been relatively well-protected by its isolation until the end of the 20th century, Socotra is now undergoing rapid development, resulting in high threats from increased natural resource use and infrastructure development, as well as growing threats related to climate change, alien and invasive species and habitat degradation (Attorre and Van Damme, 2020). It is important to note that in 2018 the World Heritage Committee expressed its utmost concern about the multiple reported threats to the Outstanding Universal Value (OUV) of the property, resulting from uncontrolled developments, unsustainable use of natural resources, and the absence of adequate biosecurity measures to avoid the introduction of invasive alien species (IAS), and considered that all these factors represent a potential danger to the OUV (UNESCO, 2018; IUCN, 2018). Since 2016, a Reactive Monitoring mission is to be undertaken to assess the threats to the site and support the State Party in identifying priorities for rehabilitation and management activities (UNESCO, 2016; 2017; 2018; 2019), however security logistics have inhibited this mission, and high concerns over the threats to the property remain.

Logging/ Wood Harvesting

(Wood Harvesting for cooking and construction.)

Recent population increase on the island due to immigration and improved standards of life have concurrently increased demand for building material. Outside the site, this results in areas of Croton-Jatropha shrubland being cleared for building and used for firewood (sometimes, but rarely, for charcoal production for export). Whilst inside the site, wood harvesting is carried out for use as mainly fuel, rarely timber (IUCN Consultation, 2020). Socotra has become increasingly isolated and import prices increased due to political conflict. As a result, fuel supplies have decreased and/or prices increased, leading to a local increase in wood collection (UNESCO SOC 2016), however imported fuel supplies have always been unreliable, especially during monsoon times when access to the island is largely cut off for about half a year each year (IUCN Consultation, 2020). The State Party states that only fallen wood is collected, and cutting down or damaging trees is not carried out (UNESCO SOC 2015), however anecdotal evidence suggests that live wood is occasionally collected as well (IUCN Consultation, 2020). An assessment of impact of wood harvesting suggests it could adversely affect several endemic bird species (Porter & Suleiman 2013; 2016; IUCN Red List assessments of Socotra endemics); timber harvesting is a possible threat in one IBA (Porter & Suleiman 2016). The dragon's blood tree Dracaena cinnabari Balf.f. is already considered an umbrella species on Socotra Island, therefore the decrease in these species numbers will be an inevitable result of the Dragon Blood trees decline (Tamar, K. et al., 2019). Other vertebrates such as the endemic reptiles can be affected by such loss of vegetation, as several species are strongly associated with bushes and trees (Fasola et al. 2020). Land use changes outside the site (Hadiboh...
Area), including clearing of shrubland, has affected also aquatic invertebrates (Van Damme et al. 2020). The extent of wood harvesting in general however, and which plant and animal species are most affected, is not studied, but this is a primarily cultural shift linked to the breakdown of traditional land use practices, and the increased pressure on local resources linked to the economical situation of the country (IUCN Consultation, 2020).

### Habitat Shifting/ Alteration, Storms/Flooding

(Destruction of vegetation including the endemic Boswellia and Dracaena species.)

Vegetation including stands of Boswellia and Dracaena suffered a significant impact from the cyclones that hit in November-December 2015 and in May 2018. A detailed study has shown that the cyclones of 2015 destroyed 38% of all B. elongata trees (already a weakened population due to overgrazing) in the largest population in Homhil Nature Sanctuary, followed by loss of an additional 29% in the next two years (Lvoncik et al. 2020). Likely as a result of such vegetation loss in higher areas of Socotra island and valley slopes, soil erosion and landslides linked to a combination of overgrazing and such extreme weather events lead to a lower vegetation productivity according to satellite data and may compound existing threats to the endemic flora and fauna of the site (Maděra et al., 2019b; IUCN Consultation, 2020; Rezende et al. 2020; Attorre and Van Damme, 2020). Loss of vegetation by storms can affect endemic reptiles (Fasola et al. 2020), birds (Porter and Suleiman, 2016) and endemic invertebrates associated with the vegetation, and even the hydrological cycle of the island in which the trees play an essential role (Kalivodova et al. 2020; Attorre and Van Damme, 2020). The dragon’s blood tree Dracaena cinnabari Baif.f. is already considered an umbrella species on Socotra Island, therefore the decrease in these species numbers will be an inevitable result of the Dragon Blood trees decline (IUCN Consultation, 2020; Tamar, K. et al., 2019).

### War, Civil Unrest/ Military Exercises


The property is increasingly vulnerable due to the security situation in Yemen resulting from political instability. Whilst the archipelago’s distance from mainland Yemen has allowed it to avoid conflict in the past, recently active conflict has spread to the island. In June 2020, the UAE-backed Southern Transition Council (STC) separatist group, which had declared self-rule in the south of Yemen in April 2020, seized control of government facilities and military checkpoints on Socotra driving out the forces of the Saudi-backed internationally recognised Yemeni government, which condemned the action as a coup (Al Jazeera, 2020; Guardian, 2020). Although the direct impacts on Outstanding Universal Value of Socotra are yet unclear and the effects may be localised, there may be an indirect temporary impact on the effective functioning of management and potentially on biodiversity monitoring activities (IUCN Consultation, 2020). Political upheaval and social transformation in Yemen are linked to conservation and management of the WH site, and the interaction of these processes affects local livelihoods and conservation/development donor involvement (Van Damme, 2011; Peutz, 2018). More generally, there is a likelihood of recurring fuel shortages (and price shifts), sociopolitical conflicts, and potentially conflicts and changes of ownership related to land and sea tenure, in addition to lack of implementation of local laws and controls (e.g. invasive species). However, despite the political shifts, several conservation projects are able to continue in 2020, and also ground surveys through local teams throughout the political shifts; at present all biodiversity conservation projects on Socotra are in partnership with the legitimate Government of Yemen, who continues to facilitate nature and culture conservation despite a difficult situation in the country (IUCN Consultation, 2020).

### Water Pollution, Agricultural effluents, Solid Waste

(Insecticide use and solid waste)

The use of pesticides has increased in recent years in the site including Temephos in anti-malaria campaigns since 2000, the recent treatment of coastal lagoons with insecticides from small aircrafts in April 2019 (Van Damme et al. 2020), against the will of the local government, and large scale spraying of date plantations becoming a norm in practice (IUCN Consultation, 2020). Localised effects on
invertebrate fauna have been observed (Van Damme & Banfield, 2011), and although no effects beyond localised areas inside the site have been observed to date (Van Damme et al. 2020), are likely to have increased. These issues could affect endemic predators that depend on invertebrates (endemic bats; Benda et al., 2018). In particular with the advent of new alien species in date palm plantations (Witt et al. 2020) against which insecticides are used, effects on local aquatic and terrestrial fauna can be predicted, as previously suggested (Van Damme and Banfield 2011). In addition, the amount of solid waste in Socotra, in particular plastic waste, has visibly increased in coastal areas and mainly in the development areas; how this may affect the biodiversity of the site is unclear, however this has stimulated a culture of waste appearing all over; in particular in coastal lagoons, which harbour a rich biodiversity, this trend is very visible (see aforementioned references for photographs) (IUCN Consultation, 2020).

**Crops (Agriculture development)**

Commercial crop production has increased, albeit very localised, in recent years on the island (IUCN Consultation, 2020), resulting in locally increased water demand, biocide pollution, and the unwanted import of exotic plants and pests (Witt et al. 2020; IUCN Consultation, 2020). Even though most of the current agriculture is limited to date palm farming, homegardens and one or two larger vegetable production sites (outside the site but on Socotra island), there are strong associations with the import of crops (Witt et al. 2020). A new large food security project for Socotra (FAO) with the aim to establish large-scale agriculture activities and plots on the island, should take the vulnerability of the biodiversity of the site (also the buffer zone) into account in any of its future planning, as even the coastal lowlands, considered less biodiversity rich, still contain globally unique ecosystems and many endemics. At present the threats from agriculture are low, but without proper development planning and communication between all stakeholders, this can become a high risk for Socotra's endemic fauna, flora, and the cultures associated with traditional agriculture (date palm, millet farming) (IUCN Consultation, 2020).

**Hunting and trapping, Fishing / Harvesting Aquatic Resources (Illegal hunting of sea turtles, collection of plants, reptiles, invertebrates, sea cucumber, squid, octopus, lobsters and shark fins for trade)**

Localized illegal hunting of sea turtles, collection of sea cucumbers, lobsters and shark fins have been recently reported as well as newly established markets such as squid and octopus export. Some of these activities are driven by international markets (Cheung and DeVantier 2006), however some other activities may be very localised and driven by local poverty or local disagreements. Some collection of endemic plants and reptiles for international trade has been shown before (Van Damme & Banfield, 2011) and remains a realistic threat. The problem is exacerbated by an increase in security problems in the Indian Ocean and limited law enforcement capacities of Socotra authorities to respond (Abulhawa et al, 2013). In addition, although this data exists, the lack of transparent marine data sharing by former partners of the State Party complicates the planning of conservation measures (e.g. understanding the size of the populations in nature of the hunted species, the markets, etc.). Recent illegal hunting of sea turtles increased around the breeding season in 2020, however the illegal activities were met by a rapid response of the EPA Chairpersons (both in Yemen and Socotra branch) to stop the deliberate hunting and sales, even amidst a most politically fragile time when the Socotra Governorate was barely functioning (coup STC). The latter indicates both the concern and the will of EPA to continue to protect the site under the most difficult conditions (IUCN Consultation, 2020).

**Roads/ Railroads (Habitat destruction and fragmentation through road construction)**

There has been more than 900 km of roads constructed on Socotra Island since 2001 (Van Damme & Banfield, 2011). A decree to sustainably manage road construction in 2008 and political crisis since 2011 have temporarily reduced this pressure. Road construction may resume in the future (Abulhawa &
Abdulhalim, 2013), and some new roads have been constructed recently (but not asphalted) from Daneghan to Adho di Melho road which runs through a highly sensitive area with many endemics (IUCN Consultation, 2020). In the past, these effects were strongly emphasized (Cheung and DeVantier, 2006), in some areas such as Erlish, affecting both biodiversity and culture (Van Damme, 2018), and road networks increase access in most areas of the island (see maps on distance-cost in Riccardi et al. 2020). Indirect effects include habitat and hydrological fragmentation, potentially wildlife mortality, solid waste and invasive species dispersal, disturbance, enhanced access for natural resource use and the facilitated transport of grazers to new areas increasing grazing pressure and access to wood for fuel (Van Damme & Banfield, 2011). The controversial Qarya-Hegher and Hai Al Salam-Nojed roads have been completed, albeit without asphalt (IUCN Consultation, 2020). No maintenance program is in place for the large road network, which increases post construction impacts causing soil erosion, habitat destruction and fragmentation, downstream pollution and contributes to the perceived need for construction of new roads (Abulhawa el al 2013). Review of Porter & Suleiman (2016) suggests that fragmentation through road building and associated development could impact on several (8) IBAs. A detailed overview of road networks and their potential ranges of impact (heatmaps) are presented in Riccardi et al. (2020), however this latter study has shown that currently the vicinity to roads on tree vegetation in Socotra is not significant in comparison to governing climate and soil characteristics. As no new roads are planned in the near future on Socotra, road impacts form an existing development threat, although the threat level in itself is less (as most roads are now already constructed) (IUCN Consultation, 2020).

Livestock Farming / Grazing

(Grazing/Fodder Use)

Very High Threat
Inside site, throughout(>50%)
Outside site

Grazing and fodder use are now reportedly at unsustainable levels, with excessive grazing levels evident, and has now been attributed as the primary factor in the population decline (lack of regeneration) of Dracaena and Boswellia trees (Madéra et al, 2019a; 2019b; Lyoncik et al., 2020) and compounds other threats such as landslides, soil erosion and habitat degradation (Van Damme and Banfield, 2011; UNESCO, 2016). Overgrazing has been attributed, in combination with climate change (vegetation loss+rains/floods), to the loss of vegetation productivity in valley slopes and areas in the mountains (Attorre and Van Damme, 2020; Rezende et al. 2020). In particular in times of drought, the grazing has an enormous impact on regeneration of the natural vegetation, for example the Boswellia trees (Lyoncik et al., 2020). There is insufficient cooperation with traditional pastoralists to develop a sustainable grazing regime (Abulhawa et al., 2013), which was traditionally present (Miller and Morris, 2004), therefore this is predominantly a result of a cultural and economical shift (Van Damme and Banfield, 2011). Although the landscape and unique vegetation of Socotra have evolved with goats for millennia, and have traditionally been managed sustainably, a number of factors including the loss of traditional land management practices and increasing numbers of goats in response to increased demand from the islands growing population have begun to create overgrazing and overbrowsing (Scholte et al., 2008; Van Damme and Banfield, 2011). The livestock grazing activity is deeply anchored in local history and traditional practices, however, the dramatic socioeconomic transformation of the island by cash based and market based approaches already since the 1950s-1960s, have resulted in major alteration of the traditional lifestyle related to grazing (Miller and Morris, 2004; Scholte et al., 2008; Van Damme and Banfield, 2011), such that it is no longer a subsistence based activity, rather has evolved as a primarily commercial one. However also this is again shifting, as with development and new business in Socotra (more immigration), the types of economic activities have diversified (not only fish, date palm and livestock production). The overgrazing and its effects on the lack of regeneration of the vegetation and on soil erosion, can be considered as one of the main threats to the terrestrial environment of Socotra (Attorre and Van Damme, 2020).

Storms/Flooding

(Infrastructure Damage, Limitations in Access to the Archipelago, Habitat Destruction)

Very High Threat
Inside site, widespread(15-50%)
Outside site

Due to the cyclones that hit in November 2015 and May 2018, there was infrastructure damage, including increased soil erosion around roads (UNESCO SOC 2016). The storms also resulted in limited access inside the property, and habitat destruction to trees, terrestrial biodiversity, and the marine
environment (State Party Report, 2016). More recent studies show the impacts of climate change effects on the environment, leading to an accelerated loss of vegetation in certain areas (Attorre and Van Damme, 2020; Lvoncik et al., 2020; Rezende et al., 2020).

**Invasive Non-Native/ Alien Species**

*(Threats of invasive mammals to native and endemic fauna)*

Beyond the effects of introduced livestock, there are several introduced mammals on Socotra which are known invasives and which may affect local and endemic faunas (Van Damme and Banfield, 2011). Three of the outlying islands in the archipelago with internationally important populations of breeding seabirds have been colonised by rats. This is only/mainly relevant in Darsa, where there is no human population and rats are the dominant mammals. Rats are a known threat to nesting seabirds. There have been so far no direct studies of their impact in the Socotra archipelago, and surveys to the outer islands are very sporadic and rare. On the main island, the effects of the presence of rats, cats and civet cats on the endemic birds, reptiles and invertebrate faunas are unstudied; as these invasives have been on the island centuries, the ecosystems may have found a new equilibrium of which they are part; however roads and other changes may help spread these invasives to areas that were before fairly little exposed (Van Damme and Banfield, 2011). A similar situation exists for the presence of the Arabian Toothcarp in aquatic ecosystems in Socotra, of which populations were introduced through anti-malaria campaigns (Van Damme and Banfield, 2011; Van Damme et al., 2020). All of the above are vertebrate invasives that are known to have a strong effect on native faunas elsewhere in the world, therefore, although assessed as Data Deficient locally, the threat of these invasives, in accordance to data from other insular ecosystems, is high by extrapolation (Van Damme and Banfield, 2011).

**Potential Threats**

In addition to a further aggravation of current threats, continued and extended development in the future are likely to lead to habitat destruction for construction and further potential unsustainable tourism infrastructure particularly in areas of high scenic and biodiversity value, potentially bringing a dramatically increased risk of invasive alien species, and increased waste production (Van Damme and Banfield, 2011). However, large tourism waves are for now on hold due in the current context due to the ongoing conflict and COVID-19 outbreak. The potential threat from climate change to the property’s values is now backed up by scientific models showing scenarios with and without climate change impacts (Attorre and Van Damme, 2020). The presence and future presence of invasive species is also shown by recent discoveries, and therefore a high current and potential threat (Witt et al., 2020). The continuation of the political instability and weak governance systems are likely to accelerate and magnify the impacts of potential threats, although there are positive efforts through various projects to strengthen the capacity of the local management to deal with these threats, met with strong commitment and goodwill by the State Party as represented by EPA for the site.

**Tourism/ Recreation Areas**

*(Unsustainable tourism)*

Prior to the conflict situation and the outbreak of COVID-19, tourist numbers had increased exponentially (more than 30-fold since 2000) but absolute numbers were still considered low (ca. 5,000 in 2009) (Van Damme & Banfield, 2011). Since then, tourism numbers have not been well monitored, as the tourism also has slightly shifted (more regional tourism) depending on access and types of flights. Although tourism is likely to halt in the short to medium term due to the ongoing conflict levels and COVID-19, the lack of tourism development planning, concentration of tourists at high natural value sites, increase in road/infrastructure development, water and timber demand, accelerated breakdown of traditional land management and other cultural erosion, increased risk of invasive species (Abulhawa & Abdulhalim, 2013; Van Damme and Banfield, 2011) are all potential risks associated with increasing tourism. Due to political instability, tourism numbers have dropped from 4,000 visitors in 2010 to less than 200 in 2015 (State Party Report, 2016). Accelerating trend, strong international investor interest, and likely secondary threats related to infrastructure development in the absence of a strong regulatory framework, warrant classification as a high potential threat in spite of current low overall tourism.
numbers. Once the situation on the mainland is more stable, and if no sustainable tourism management plans have been set in place on the island to control illegal activities and destruction of sensitive sites, tourism may have a high adverse impact. Currently, it is of little relevance, however impacts on local sites such as sensitive caves (Hoq) which contain important archeological remains and biodiversity, are evident (Cheung and DeVantier, 2006) and have been reported also more recently.

**Solid Waste**

(Pollution/waste)  
High Threat  
Inside site, scattered(5-15%)  
Outside site

There was a 25% increase in macro-waste production estimated until 2015 (Van Damme & Banfield, 2011), which is thought to have continued and now effects a larger proportion of the site, however no studies have been carried out to assess the size and effect (IUCN Consultation, 2020). The solid waste problem is mainly concentrated in the general use zone including the development nodes and corridor between Hadibu (the capital) and Qalansyia, the second largest town, yet spreads strongly along asphalted roads throughout the island. This includes the airport, the sea port and the transportation corridor linking them. Plastic waste is an increasing issue due to the increased import of plastic products, and lack of national funds for effective waste management, compounded by oceanic plastic transported to the island from outside (IUCN Consultation, 2020). Some effects are visible in the aquatic habitats, such as the coastal lagoons, which merit a higher protection status (Van Damme and Banfield, 2011; Van Damme et al. 2020).

**Droughts**

(Climate change)  
Data Deficient  
Inside site, throughout(>50%)  
Outside site

Increasingly dry conditions are expected, but exact predictions are still impossible (Attore et al., 2007). Coastal areas are sensitive to sea level rise, flooding and coastal erosion, and extreme weather events such as the cyclones that impacted Socotra, are exacerbated globally due to climate change and pose an ongoing potential threat. See Van Damme and Banfield (2011) for general notes on impacts of drought and other climate events in combination with other threats, and the case study of Boswellia in Homhil (Attorre and Van Damme, 2020; Lvoncik et al., 2020). Also coral bleaching has been established (Cheung and DeVantier, 2006), although no long term monitoring data has been comprehensively shared with the State Party to take the right conservation measures.

**Invasive Non-Native/ Alien Species**

(Invasive species, mostly terrestrial.)  
Very High Threat  
Inside site, widespread(15-50%)  
Outside site

To date, 135 introduced or invasive species have been recorded on the Socotra archipelago, according to the Global Register of Introduced and Invasive Species - Soqotra, Yemen (van Harten et al., 2018). However some have been eradicated in the past, such as a few accidental specimens of the Indian House Crow eradicated a decade ago (Suleiman et al., 2010), or a population of the invasive cactus Opuntia and the tree Prosopis (CABI, 2018). The local capacity to deal with strategic management of invasive species in Socotra remains currently still insufficient and import of goods which brings invasive pests and other pathways may have increased, apparent by the recent discovery of the Red Palm Weevil (IUCN Consultation, 2020; Witt et al., 2020). Phytosanitary measures, quarantines and capacity, are currently not in place yet, which allow exotics to enter undetected at present (Witt et al., 2020). Native vertebrates such as birds and reptiles may be adversely affected by the invasive vertebrates (cats, rats, civet cats) as shown in other islands in the world, although no specific studies have been carried out in Socotra to determine the role of these invasives in the food chain (Van Damme and Banfield, 2011).

**Fishing / Harvesting Aquatic Resources**

(Overfishing, including loss of control over offshore external fishing activities.)  
High Threat  
Inside site, widespread(15-50%)  
Outside site

Overfishing by large boats and international fishing fleets is a continuous threat, and is exacerbated by an increase in security problems in the Indian Ocean and limited law enforcement capacities of Socotra
authorities to respond (Abulhawa et al, 2013). Pressure has decreased from local communities due to fuel shortage and reduction of ability to export (UNESCO, 2016).

**Shipping Lanes**
*Grounded Cargo Ships*

Two cargo ships were grounded west of Hawlaf Harbor, with potential to lead to damage to the marine environment (UNESCO SOC 2016). One of the wrecks has been removed, and the fuel of the other has also been removed (IUCN Consultation, 2017), however ships continue to become stranded, there is no management or action plan for such events, which may indeed increase in frequency along with growing number and severity of cyclones due to climate change (IUCN Consultation, 2020).

**Hunting and trapping**
*Export of Native Species*

Export of native species is sometimes checked in the airport by locals, however capacity is insufficient and due to the changing political situation, responsibilities shift between groups in control of the port and airport (IUCN Consultation, 2020). Export of species was mentioned in Van Damme and Banfield (2011) and recent reports also indicate export of endemic bird species for falconry (Socotra Buzzard) as suggested before (Porter and Kirwan, 2010). This also includes the export of dead coral from the north-west coastal areas for commercial use in the Gulf Countries as well as for local use in building materials.

**Logging/Wood Harvesting**
*Charcoal Production*

Production and export of charcoal remains a potential threat as such production could impact Socotra's endemic tree species, associated fauna, and contribute to further environmental pollution (IUCN, 2014). According to the latest information, charcoal production is no longer active (IUCN Consultation, 2017; 2020), however, the potential impact of charcoal production on Socotra's endemic flora remains a valid concern. The arrival of foreign investment in charcoal production on the island prior to 2014 has lead to concerns relating to the sustainable wood collection techniques traditionally practiced on the island (UNESCO, 2015).

**Hunting and trapping**
*Trapping and illegal sale of birds*

The endemic, globally threatened (Vulnerable status) Socotra Buzzard population might be affected by an increase in the taking of young birds from nests and trapping of adults for sale and export with the aim to be used (mistakenly) in Falconry in abroad (in the region); this was reported in literature for the Socotra Buzzard in the past (Porter and Kirwan 2010) and recently (2019) observed again, where animals for export were successfully confiscated by EPA Socotra at the airport. The observations were included in a new assessment of the status of Red Listed species for BirdLife International in 2020 (AS Suleiman, RF Porter & K Van Damme in litt, 2020). Additionally, there could potentially be a threat with relation to the catching of birds for food in the outer islands (this practice is not known from Socotra Island in the past decades). It is known that the globally threatened (Vulnerable status) Abd al Kuri Sparrow could be captured for food and this could impact on its population (AS Suleiman & RF Porter in litt, 2020), but no evidence (anecdotal or not) that this has happened in recent years (IUCN Consultation, 2020).
Changes in traditional ways of life and knowledge systems that result in negative impact, identity/social cohesion/changes in local population and community that result in negative impact

(Increased loss of connection between the local communities and their environment)

Since half a century, the link between human and the environment on Socotra is waning, although a strong cultural and traditional resource management basis is present and well known (Miller and Morris, 2004; Van Damme and Banfield, 2011). This process, through the potential future disappearance of the local Socotri language (on the list of endangered languages as recognised by UNESCO), associated description of the environment (Van Damme and Banfield, 2011) and local practices, is accelerating as younger generations may disconnect from the environment through ongoing cultural shifts. Efforts to protect the link between humans and their environment on Socotra, stimulating the local language, are key to any conservation activity. Local management and local sustainable resource use are priorities in several ongoing projects, and the local community involvement should be strongly adhered. Recent events such as hunting of turtles, or export of the endemic buzzards, increased overgrazing, and wood collection, all indicate a cultural shift and erosion of the environmental link (IUCN Consultation, 2020).

Dams/ Water Management or Use

(Water Management/Use)

Water is a valuable resource on Socotra, of which the management is in need of evaluation due to changes in the environment (climate change expressed in droughts and torrential rains, changing waterways and causing natural dams in some areas). Extraction of water from certain areas may lead to saltwater intrusion, suboptimal drinking water conditions for human use, and alterations of aquatic environments. Some links to local biodiversity in inland and coastal waters are suggested in Van Damme and Banfield (2011) and Van Damme et al. (2020). Also, the loss of Dragon’s Blood Trees is linked to the hydrological cycle of the island, as these trees capture a large amount of water (Kalivodova et al., 2020). The actual threat of water extraction has not been studied in detail so far, as this would require a specific study.

Mining/ Quarrying

(Localised quarrying, digging and stone collection)

As the population increases in Socotra and more houses are built, local resources are used for building, such as stones and sand. Sand quarries are present outside the site in Hawlaf (however, the dune is a geologically important phenomenon), and in localised areas such as near Ayhaft. Throughout the site however, there is increased digging and collection of stones for building - this seems to be now increasingly common, and would affect ground-rooting plants that germinate between stones to escape grazing, invertebrates, and their predators (e.g., birds). Reptiles are also strongly linked to such substrates (Fasola et al., 2020). At present, this threat seems limited, but should be monitored closely over following years - quarrying and mining in the national park is not allowed according to the SCZP (UNDP-GEF, 2000).

Tourism/ visitors/ recreation, War, Civil Unrest/ Military Exercises, Other Activities

(Sensitive Cave Systems)

Very sensitive cave systems rich in endemics (100% endemism in cave invertebrates of Socotra; Fransen & Van Damme, 2018) and in archeological remains (Cheung and DeVantier, 2006) are under threat of lack of management, awareness, and visitors. In particular Hoq Cave has been visited frequently, but unsustainably, with pollution in the area and looting of archeological remains that affect the rich culture of the Socotri. The local authorities are doing strong efforts to protect their cultural heritage, however caves deserve a specific merit (for their rich biodiversity and sensitivity) (IUCN
**Overall assessment of threats**

Current and potential threats to Socotra's values are increasing rapidly. Infrastructure development and unsustainable natural resource management (following the increasing abandonment of traditional management) are already affecting the islands and accelerated by climate change effects. Additional future threats are numerous, well known in other areas in the world, and include further habitat destruction, invasive species, impacts from climate change, soil erosion, hunting, unsustainable resource use, loss of cultural link with the environment, pollution and uncertainty of the political climate. It is important to note that in 2018 the World Heritage Committee expressed its utmost concern about the multiple reported threats to the Outstanding Universal Value (OUV) of the property, resulting from uncontrolled developments, unsustainable use of natural resources, and the absence of adequate biosecurity measures to avoid the introduction of invasive alien species (IAS), and considered that all these factors represent a potential danger to the OUV. Since 2016, a Reactive Monitoring mission is to be undertaken to assess the threats to the site and support the State Party in identifying priorities for rehabilitation and management activities (UNESCO, 2016; 2017; 2018; 2019), however security logistics have inhibited this mission, and high concerns over the threats to the property remain.

**Protection and management**

**Assessing Protection and Management**

▶ **Management system**

At present, there are virtually no management plans for the protected areas (PA) in Socotra. Except for a few specific areas, there are also nearly no local NGOs established to allow for local management in the PAs. Completed management plans discussed by local communities for all PAs is part of the ongoing UNE-GEF project at the site (IUCN Consultation, 2020). A first assessment of the PA management has been completed (Van Damme and Saad, 2018). Buffer zone management is not sufficiently aligned with core zone management, and boundaries of the core zone are not clear or indicated in the site. A Socotra Conservation Zoning Plan (SCZP) was approved in 2000 (UNDP-GEF, 2000). A revision of the SCZP is one of the activities of the UNE-GEF project that is co-executed by EPA (State of Conservation Report, 2020). The updated SCZP will take into account all new data and suggested designations, but as a priority the local community engagement. The capacity of EPA representation at Socotra to manage the site has been limited. In 2013, the government declared the Socotra Archipelago as an independent governorate, and in 2016 appointed a deputy governor for the Environment, however this step did not lead to improved management of the site. Due to instability in mainland Yemen, adequate human and financial resources could not be delivered and the establishment of a separate management unit or independent management authority under the EPA has not been possible (State Party of Yemen, 2020).

New appointments in EPA and planning now rapidly increase the capacity building in collaboration with international donors and institutes, and support of the GoY, which is a positive movement forward. Capacity building and improving management of the site is one of the main priorities of the ongoing conservation projects. A major challenge here is to secure sustainable funding for conservation so that the management can continue into the long term.

▶ **Effectiveness of management system**

Detailed assessment of all the terrestrial protected areas in Socotra have been recently carried out assessing all threats and includes an adapted RAPPAM method (Van Damme and Saad, 2018; IUCN Consultation, 2020), but reportedly there is still insufficient capacity for effective management as well as a significant reduction of management staff on-site between 2008 and 2012 (Abulhawa & Abdulhalim, 2013). Marine site revision of PA management has not been successfully performed or
IUCN World Heritage Outlook: https://worldheritageoutlook.iucn.org/
Socotra Archipelago - 2020 Conservation Outlook Assessment

shared with GoY (State Party Report 2020). Many groups of animals, plants, habitats, resources, livelihoods and cultural aspects, lack integrated management plans. Appointment of a new EPA Chair in Yemen in 2019 strongly increased positive efforts for management of the Site, in support of ongoing and new projects in capacity building and conservation (IUCN Consultation, 2020).

**Boundaries**

The boundaries and buffer areas defined in the SCZP are inadequate, which serve as the basis for the UNESCO property definition (National Park and Nature Sanctuaries together correspond to the Core Area). These may need to be revised in the future as biodiversity data and local stakeholder input are compiled, but in general, the suggestions are clear from different data layers to expand the areas needing stronger protection of biodiversity and sustainable land management. Revision of the SCZP started with the ongoing UNE-GEF project, and making progress in the Terrestrial part. There are indications of land use pressures in the buffer zones, particularly adjacent to core areas, and a growing issue of land grabbing. This represents a harmful trend leading to land conversion into residential, tourism, and other land uses at the expense of more sustainable local development and expansion. Furthermore, a lack of demarcation or signage of the buffer zones makes it difficult for land users to recognize the limits of the World Heritage site (Abulhawa et al, 2013; State Party of Yemen, 2020). The revision of the SCZP should take into consideration the effective management of all existing and potential threats in the different zones.

**Integration into regional and national planning systems**

Socotra was established as an independent governorate in 2013. The Governor has full authority over the decision-making processes and budget management; recent political dynamics have complicated the functioning of the governorate under the legitimate Government of Yemen, however, conservation activities continue. Despite the ongoing political conflict, Socotra has maintained civil peace for much of its history. The legitimate government of Yemen recognizes the special status of the archipelago and its position on the World Heritage List, and the importance of adhering to obligations of the World Heritage Convention (State Party of Yemen, 2016-2020). Environmental considerations are embedded in the activities and planning of all NGOs and Community-Based Organizations on the island (IUCN Consultation, 2017). Protection of the site is integrated in the National Strategic Planning documents, in line also with CBD and Aichi targets (see State of Conservation Report 2020). Capacity of local authorities to deal with the site management is limited, and ongoing projects are aiming to build capacity and provide sustainable funding mechanisms. Additional efforts are done by the newly structured EPA Yemen to integrate all planning and connectivity across projects (IUCN Consultation, 2020).

**Relationships with local people**

Insufficient mainstreaming of sustainable development among all stakeholders (e.g., local people and traditional users, line ministries, tourism industry) is a key obstacle to effective conservation management (Abulhawa and Abdulhalim, 2013). A recent project (UNDP) aimed to improve functioning of CBOs and local government has been adopting a policy to include CBO representatives in decision making. There were training programs from 2013-2016 implemented by EPA, local government, UNDP, and GIZ (State Party Report, 2016) and more recently by the UNEP-GEF project on the Island (State Party Report, 2020). There are several civil society organizations which are dedicated to protect Socotra’s natural and cultural heritage, and strengthen the political and social representation of the local people on the national and international levels (Abulhawa et al, 2013). Indigenous people’s rights and access to benefits should be actively integrated in existing projects. Intensive involvement of national and international scientists in demarcation and management planning, should include local communities. Local stakeholders, who have been stewards and managers of the area for centuries, need to be properly involved and should benefit directly, e.g., from tourism development. Local stakeholders are not sufficiently informed on the benefits of World Heritage designation for conservation (IUCN Consultation, 2020). There is a need for empowering local communities and local institutions and entities to enable them to manage the site and implement conservation projects. Efforts have been made by several organizations where local communities
initiate, implement and manage conservation projects themselves, without top-down control, for example in the successful Mangrove Replantation Project of the Socotri Al Tamek Association funded by Friends of Soqotra (FoS) and ARC-WH (IUCN Consultation, 2020). Large international donor projects may run into issues with local people relationships due to land ownership during conservation activities, or by overspending for small activities - recent turtle hunting by local communities who were discontent with management of a larger project, a dispute that had to be settled by EPA, is an example of the need for more sustainable solutions. Specific efforts are therefore done by local authorities and EPA to remediate such issues, however international donors should take the local communities as a priority at all times to avoid conservation activities being suboptimal. Examples of best practice exist, for example in the Ghubbah Mangrove site (FoS & ARC-WH), and the Keybani Dragon's Blood Nursery in Shibehon, where local associations take the lead, and request technical support when needed (IUCN Consultation, 2020).

**Legal framework**

The land is government property, but outside of Hadibo and Qalansyya its resources are owned by tribal groups that manage them according to long proved customs (UNEP-WCMC, 2011), however illegal land sale outside of the main cities now is quite common (IUCN Consultation, 2020). A basic legal framework is in place, but the need for strengthening the legal framework and enforcement capacity was noted in Committee Decision 32 COM 8B.5. A Conservation and Zoning Plan (CZP, 2000) and Cabinet Decrees No. 45-49 of 2008 set the legal framework for the protection, management, and sustainable development of the Archipelago. However, the responsibility for SCZP implementation (both EPA and Ministry of Public Works and Roads) remains unclear. The legal status of Socotra Administration itself (no archipelago wide conservation authority) is a major obstacle to conservation enforcement (Abulhawa & Abdulhalim, 2013; Van Damme & Banfield, 2011). Updating and streamlining the legal framework is part of ongoing projects (UNE-GEF).

**Law enforcement**

The fact that there is no archipelago-wide conservation authority with defined tasks, results in a major obstacle to conservation enforcement due to limited capacity (Abulhawa et al 2013). The capacity of EPA in combination with local communities has been limited due to the war and limited resources for the GoY. A legislative framework was reportedly being designed which would increase the effectiveness of law enforcement capacities related to environmental violations and crimes (State Party Report, 2016), however it is unclear whether such a legislative framework was ever designed or implemented (IUCN Consultation, 2020). At present, capacity of local management is not large enough to enforce the national laws and decrees, e.g., as defined in the SCZP.

**Implementation of Committee decisions and recommendations**

The implementation of Committee decisions and recommendations has varied (see State Party of Yemen, 2020). Various decisions and recommendations are being implemented (e.g. in response to Decision 39 COM 7B.6, a Deputy Governor for Environment and Development was appointed and initiatives were taken to strengthen the EPA’s role in the management of the property (SOC, 2016)). However, it is noted that threats to the property remain, and that the appointment has not helped the management of the site nor dealing with threats, e.g. all road construction projects have gone ahead (IUCN Consultation, 2020) against the request of the Committee, and overall, the response to Committee decisions and recommendations has been slow and not keeping up with the emergence of new threats. The State Party's consideration, in its 2020 SOC report to the Committee, of all previous Committee Decisions via a matrix, allows the opportunity for a more strategic review and implementation of all Committee decisions in its management going forward. A specific concern that has not been addressed, is the need for more rigorous management of exotic species (quarantine, exotic species management plan, phytosanitary measures) which have also been recommended by international partners and EPA (Witt et al. 2020). The difficulty of establishing these measures are related to the control over the port and airport during political instability, nevertheless, some solutions between stakeholders could be achieved and should be actively procured (IUCN Consultation, 2020).
Sustainable use

Grazing and fodder use throughout the property is currently unsustainable and a threat to native flora (Madéra et al., 2019a; 2019b; Lvoncik et al., 2020), as provisions to deal with the overgrazing challenge in the 2008 decree on the property are not being implemented (Abulhawa & Abdulhalim, 2013). The same is true for marine resources use including inside marine core areas. Whilst there is some marine research with species numbers (Zajonz et al., 2019), no proper marine distribution and monitoring data is shared with government and management authorities which delays conservation planning by local decision makers (IUCN Consultation, 2020). Terrestrial data has been shared by various institutes, in detail. Some small scale positive examples of sustainable resource use exist, particularly bee-keeping and homegardens (Van Damme and Banfield, 2011; Abulhawa & Abdulhalim, 2013). Regarding road construction, a policy should be adopted by the Yemeni government to cancel all previous decisions to expand the main access roads within the property. This was to be in force by mid-2016 (State Party of Yemen, 2016), however was never implemented as all road construction projects have gone ahead (IUCN Consultation, 2020). Although current EIA legislation is suspended in Yemen, the local government plans to adopt an interim EIA mechanism (State Party Report, 2016), however again this was not carried out (IUCN Consultation, 2020). In 2020, the government reports that any infrastructure works projects/activities that might have an impact on the OUV of the site require EIAs, but that local EIA training for staff is required (State Party of Yemen, 2020). Sustainable land management planning is also a part of the ongoing UNE-GEF project.

Sustainable finance

Sustainable financing remains a challenge and is still largely donor dependent, with several donors (UNDP, GIZ, Italian Development Cooperation, FFEM/France, GEF) that have been committed provide support in previous, and some for the coming years, to varying degrees. Currently GEF is the largest funder of conservation-related projects. Increased funding to meet the long-term needs for maintaining the World Heritage site is part of the UNE-GEF project, and an internationally supported endowment fund is being sought. Sustainable long-term financing from State budget or other long-term sources are not secured, although since the establishment of Socotra as an independent governorate in 2014, fiscal allocation in the national budget for the archipelago tripled by 2016 (State Party of Yemen, 2016). In 2020, sustainable financing remains a challenge due to the political crisis on mainland Yemen, limiting the delivery of adequate human and financial management resources, and whilst the government has plans to establish a conservation fund for Socotra, previous attempts have not been sustainable and a sustainable financing strategy/business plan remains to be implemented (State Party of Yemen, 2020). In 2020, local sustainable resources for conservation activities, such as ecotourism, are hindered by COVID-19 travel restrictions (IUCN Consultation, 2020).

Staff capacity, training, and development

Staff of EPA have received considerable capacity building support during previous years, but practical applicability and implementation reportedly is not always effective. Reduction of staff after discontinuation of large donor projects is a continued challenge, however the ongoing GEF project on the Island is implementing staff training programs and would focus more on capacity building in the 2nd Phase (IUCN Consultation, 2020). The EPA's capacity to manage the property successfully will depend on educating, training and winning the support of local people. Training has been carried out for guides, territorial, marine and archaeological, diver guides, drivers, including training in foreign languages (UNEP-WCMC, 2011), but due to shifts in economical priorities and the ongoing war, some concern exists that former investments are partially lost (IUCN Consultation, 2020).

Education and interpretation programs

Education and interpretation activities and materials were previously virtually absent, with the World Heritage status of property not being appropriately communicated. A special outreach campaign was to be launched in 2016, and an interpretation system at the airport was to be completed by the end of 2016 (State Party Report, 2016), however there is little evidence to suggest this was ever carried out (IUCN Consultation, 2020). More education and interpretation programs could be easily carried out in...
collaboration with State Party partners.

**Tourism and visitation management**

Limited local visitor management at places of particular interest has led to damage. Lack of overall tourism and visitor management is a major future challenge if there would be a rapid increase in tourism, which currently is not regulated, after normalization of the political situation. Although tourism has dropped significantly since the start of the political situation in 2015 and is currently non-existent, especially in light of the COVID-19 outbreak, a comprehensive tourism carrying capacity assessment is required for future tourism and the current tourism operating in Socotra, which is recognized to provide little benefit to the local Socotri people (State Party of Yemen, 2020), requires review.

**Monitoring**

There is some ad-hoc monitoring of the conservation status of the site such as turtle monitoring (State Party of Yemen, 2020) and a RAPPAM was carried out under the UNE-GEF project and completed in 2017 (Van Damme and Saad, 2018), however monitoring is almost entirely carried out under donor-funded projects and therefore capacity-building is required towards this. Several trainings were conducted which included information on monitoring. Monitoring programs were reportedly underway for mangroves (State Party Report, 2016), however it is unclear if these were implemented (IUCN Consultation, 2020). Some sporadic monitoring for birds is present every few years (e.g., Porter and Suleiman, 2016) and updates are provided but no temporal trends in decline, increase or shifts in populations that would allow to assess threats in an empirical manner. Overall, besides the activities of the most recent UNE-GEF project, no active monitoring systems are established and the capacity of EPA staff remains too low to undertake monitoring and deal with priority challenges (State Party of Yemen, 2020). More effort should be done towards ensuring monitoring systems, and training and materials are available, for example for dragonflies (Van Damme et al. 2020). The State Party is aware of these issues and actively promotes solutions through attracting donor funding for capacity building (State Party of Yemen, 2020).

**Research**

The islands are living laboratories of evolution, and the flora has been well researched since the late 1800s. In the late 1990s, a major multidisciplinary expedition was led, and a series of detailed studies began and continued through the following decades. A multidisciplinary zoological and botanical expedition began in 1999 to systematically inventory the whole fauna of the archipelago, and started investigations into the terrestrial vegetation and people, bird populations and fish and underwater habitats, marine turtle nesting, fishing and meteorology, and fauna of the extensive cave systems. Currently, terrestrial and freshwater faunas are increasingly well documented (Bezděk, & Hájek, 2017; Van Damme et al., 2020), as well as reptiles, bats and other groups (Razzetti et al. 2011; Benda et al., 2017) and updates on birds may be underway. Very little data has appeared on the marine environments, which hampers conservation. Knowledge on conservation status (IUCN Red List) needs to be urgently updated for plants, birds and reptiles, and more invertebrates need to be listed. There is a need for more management-orientated knowledge generation and use and applied research linked to conservation interventions. There is some erosion of traditional knowledge about environmental management among the local population which should be revived where possible. Research has been complicated at times due to the limited accessibility, and limited local capacity for independent monitoring and research, something that should be remediated in the future. However, research has continued and provides now a good baseline for conservation priorities and strategies (Attorre and Van Damme, 2020).

**Overall assessment of protection and management**

The protection and management of the Socotra Archipelago falls under the responsibility of the EPA; management should be improved, through sustainable funding mechanisms, and capacity building, to deal with the rapidly increasing pressures and threats to the archipelago’s values, including projected...
further increases in tourism (albeit currently uncertain due to the political climate and COVID-19), infrastructure development, exotic species, pollution, and unsustainable natural resource use and climate change and combined and related effects (Van Damme and Banfield, 2011; Attorre and Van Damme, 2020). Priority areas could include the creation of an archipelago-wide management system that is adequately supported and that includes key stakeholders, an updated management plan (SCPZ) that responds to emerging threats, visitor management and the participation of local people in management, including schemes to promote sustainable natural resource use where possible. The impacts of continued insecurity in mainland Yemen, and more recently also Socotra, on ensuring adequate management capacity and sustainable financing remains of high concern. Ongoing and future conservation and development projects should take into consideration the vulnerability of the site, the importance of local culture and language, and aim for only sustainable outputs that remain after the lifetime of each activity; recent examples have shown that some activities are highly unsustainable (e.g., turtle monitoring) due to aims for short term outputs, but not long term biodiversity conservation. In addition, and unfortunately, there are no specific management plans yet for specific biotopes such as aquatic habitats and lagoons (Van Damme et al., 2020), caves, or other unique ecotopes that deserve special attention and are tied into general highly relevant resources (e.g., water).

Assessment of the effectiveness of protection and management in addressing threats outside the site

There is an urgent need for improved management of external pressures from resource use (including marine resources outside the property), sustainable tourism development and infrastructure development (including roads), and particularly port/airport systems for invasive alien species (IAS) (Van Damme & Banfield, 2011; Witt et al. 2020). The increasing demand on land acquisition by foreign investors remains a major potential threat particularly in coastal areas of high scenic value (e.g. north east coast) (Abulhawa et al, 2014). The areas around Hadiboh are changing most rapidly, which is also visible in decline of biodiversity in aquatic species and the presence of pollution and insecticides (Van Damme et al. 2020). Therefore, threats outside the site, in these development zones, should be strongly monitored and some areas outside the site may need a formal protection here (e.g., the Hadiboh and Sirihin Lagoons; Van Damme et al., 2020).

Best practice examples

Empowering local communities to acquire a leading role in the management of their natural heritage within an effective collaborative management approach to biodiversity conservation and sustainable management of natural resources: After the termination of the SCDP program and decline of EPA capacity, at least five local associations were created with support from EPA and SCDP to oversee the management of the pilot Protected Areas established in mid 2000s. The local associations decided unilaterally to maintain the management programs for their respective areas regardless of the level of follow up and support provided by EPA, and subsequently maintained commendable levels of protection and maintenance (Abulhawa et al, 2013). However, in the current crisis (war and covid-19), the priorities have slightly shifted and local benefits of protected areas should be reframed. The current changes in local governance system have recognised the role of local communities in decision making and effective management of the islands (State Party Report, 2016), however with current political shifts, such roles may have to be redefined. It is clear that some examples of successful NGOs have been instrumental in providing champions for conservation, and which, with limited support, are able to produce long term conservation outputs. One such Best Practice Example is the Al Tamek Association for the restoration of the Mangrove Tree, who in collaboration with FoS and ARC-WH, locally led and established/replanted mangrove trees in the north coast (Van Damme, 2019). Other examples include the honey cooperative which is one of the most successful sustainable activities on the island (linking livelihoods to ecology) which have been active over a longer period (Cheung and Devantier, 2006), the Woman Association who are instrumental in local education and awareness activities, and the local management (and maintenance of traditional fishing rules) in the marine protected area Rosh by local communities. Finally, eradication activities of Opuntia were met with strong enthusiasm of local communities,
predominantly led by women (CABI, 2018), and the Dragon's Blood Tree Nursery supported Mendel University but entirely implemented and led by a local family (Keybani), is unique in the world, and provides the first artificially grown Dracaena cinnabari trees of 15 years in Socotra. Such local champions should be continuously sought as they are the true managers and owners of the land, for generations to come. In addition, high efforts of several organisations (FoS, CABI, BirdLife International, UNESCO) to increase awareness and show best practice examples of the site, have strongly positive effects and international engagement to help local communities in their requests to manage local resources and biodiversity. One such example recently is the connect2socotra campaign (UNESCO-FoS; https://en.unesco.org/connect2socotra) and conferences on Socotra biodiversity and culture (Van Damme and Livadiotti, 2020).

State and trend of values

Assessing the current state and trend of values

**World Heritage values**

▸ **Complex assemblage of unique ecosystems**

Socotra is relatively pristine in comparison to other islands, but increasingly affected by degradation of vegetation, soil erosion through overgrazing, fragmentation, and coastal areas acquisitions including marine resource use; recent scientific evidence points towards a decline in populations of key species (trees) through a combination of decades of overgrazing and the impacts of climate change (Van Damme and Banfield, 2011; Abulhawa & Abdulhalim, 2013; Abulhawa et al, 2014; Attorre and Van Damme, 2020). Little data is available for marine ecosystems, and all such data should be shared with GoY for conservation planning.

▸ **Endemic flora and vegetation**

Only a few species have been lost in the 20th century (Van Damme and Banfield 2011). Some key species continue to decline (e.g. Draceana cinnabari and Boswellia, which may go extinct within the next centuries under business as usual scenarios) (Madera et al., 2019b; Attorre and Van Damme, 2020; Lvoncik et al., 2020). 157 plant species are listed as critically endangered, endangered or vulnerable, but the list needs updating (UNEP-WCMC, 2011). Stands of Boswellia and Dracaena, already affected by lack of regeneration because of overgrazing, suffered a significant impact from the cyclones that hit in November 2015 and May, 2018, resulting in the loss of 38% of all mature Boswellia trees in some places and an additional 29% in the following years (IUCN Consultation, 2020; Lvoncik et al., 2020). Intensive grazing, aimed collection, invasive plant and animal species, soil erosion, impacts of wood collection and impacts of roads and other development represent ongoing threats to terrestrial habitats and flora (Van Damme and Banfield, 2011; Abulhawa et al, 2014, Madéra et al., 2019a; 2019b; Attorre and Van Damme, 2020; Rezende et al., 2020). At present however, the (current) distribution of trees for example is mainly governed by natural, not human factors (Riccardi et al., 2020). In addition, the decline of local resource use of the environment and cultural link with the ecosystems may lead to further impacts on the vegetation (Van Damme and Banfield, 2011).

▸ **Endemic reptiles with their habitats**

No endemic reptile species are reported lost since the 20th century, which is remarkable in comparison to other islands in the world (Van Damme & Banfield, 2011). In fact, several species were described as new in the last decades. All terrestrial reptiles on Socotra Island have now been assessed and appear on the IUCN Red List, some have an area of occupancy less than 10 km². The habitats of the terrestrial reptiles are under serious threat as most of the species are closely related to vegetation ee previous
value) and other substrates for foraging (Fasola et al., 2020). Therefore, wood collection, stone collection, loss of trees through storms, habitat fragmentation through development, decline of food (insecticides/pollution), decreased quality of all shrubland and woodland habitats in the island have all been identified (IUCN Red List assessments, 2020; IUCN Consultation, 2020). The current conservation Zoning Plan is inadequate to protect the diversity, including high genetic diversity, of the Socotra reptiles (Vasconcelos et al., 2018; 2020). There are currently no studies that compare former distributions and species richness with the current situation to assess decline. However, considering the suggestions of decline of natural plant populations, impacts of climate change, and developments in coastal zones, the endemic reptiles associated with these areas should be considered as high concern.

The dragon’s blood tree Dracaena, as well as other flora species, is considered vital for the existence of some of the endemic reptiles, therefore, the deterioration of some of these trees means the losing these reptiles is an inevitable result of the Dragon Blood (IUCN Consultation, 2020).

Endemic and endangered birds with their habitats

No endemic bird species has been lost since the 20th century, which is remarkable in comparison to other islands in the world (Van Damme and Banfield, 2011). Three endemic species are classified as vulnerable, one as near-threatened, and six as least concern on the IUCN Red List of threatened species (IUCN, 2013; BirdLife International, 2020). This may require updating following the current Red List review (BirdLife Intl, 2020). In addition to the endemic species, the Egyptian Vulture is endangered and the Jouanin’s Petrel near threatened (BirdLife International 2020). Considering the aforementioned combined long term effects of overgrazing and direct effects of climate change impacts, and decline of vegetation productivity in biodiversity-rich areas in particular in the mountains (Rezende et al., 2020), among other effects such as increased (and expected future increase of) insecticide use, endemic bird species should be considered at low concern at present, but should be monitored closely as their environment is deteriorating. In particular, the worrying trend of capture of the Socotra Buzzard for export, indicates a disruption between local people and their link to endemic and endangered birds, which should be met with awareness activities. There is currently no information whether populations are deteriorating or stable, because there is not enough data/monitoring (IUCN Consultation, 2020).

Endemic invertebrates with their habitats

Recent studies have provided comprehensive data on the invertebrate taxa on Socotra (Bezděk & Hájek, 2017; Purchart et al., 2020), including sensitive cave crustaceans (Fransen and Van Damme, 2018). The conservation status of invertebrates in general is not assessed (except dragonflies, freshwater crabs and endemic freshwater molluscs). No endemic mollusc species are known to be lost since the 20th century, however two freshwater molluscs have not been recorded since they were discovered (Van Damme & Banfield, 2011). One recent study indicates that invertebrate species richness in some areas in Socotra are declining, even including the extinction of one (native but not endemic) species, in a case study of dragonflies as flagship species for the aquatic environment; the decline in the Hadiboh area, over 50 years, is attributed mainly to urbanisation, loss of vegetation and pollution (Van Damme et al., 2020). With the current loss of vegetation (overgrazing, climate change), stone collection and wood collection, it is likely that invertebrate species (both terrestrial and subterraneous) are affected as well. For most groups, very little comparison of trends over time is available. For the dragonflies at least, we can say the trend is deteriorating in some areas (in the buffer zone).

Coastal/marine biodiversity and habitats

Marine communities reportedly are somewhat unclear due to the lack of data shared with the GoY, but likely to be deteriorating (IUCN Consultation, 2020). The species richness of the archipelago remains higher than in any of the adjacent Arabian ecoregions (Zajonz et al., 2019). Increasingly, they are affected by unsustainable use in some areas already since a while (Van Damme and Banfield, 2011). Increasing pressures in land acquisition in coastal areas present a serious threat to associated marine ecosystems and adjacent terrestrial ones (Abulhawa and Abdul Halim, 2013). Reports on commercial export of fish, squid, octopus, sea cucumber, shark, although known before the nomination of the WH
Site (Cheung and DeVantier, 2006), are worrying. The deliberate hunting of sea turtles during nesting season is an example of a loss of connection between local people and their environment, and unsustainable approaches to their conservation which need to be remediated as soon as possible. Positive here is that EPA on Socotra is strongly engaged to support conservation of marine species, however challenges are large. In addition, plastic and solid waste pollution (both brought in by currents and from Socotra) is increasing, but no aimed studies are known (IUCN Consultation 2020).

Summary of the Values

Assessment of the current state and trend of World Heritage values
High Concern
Trend: Deteriorating

Most of the existing key values enjoyed a relatively stable and satisfactory conservation status until the end of the 20th Century, mainly due to Socotra's isolation and the traditional governance and management systems found on the archipelago, leading to the typical Socotran cultural landscapes. Examining trends over the last twenty years reveals an even higher biodiversity, than was known in 2008 in terrestrial (Bezděk, & Hájek, 2017; Neubert and Bochud, 2020; Razzetti et al., 2011), aquatic (Van Damme et al., 2020) and marine environments (Zajonz et al., 2019). Some studies indicate that the current protection measures (from 2000) may be inadequate to conserve the main biodiversity, as most of the biodiversity data was not compiled at the time, and threats have increased (Porter and Suleiman, 2016; Vasconcelos et al., 2018; Madera et al., 2019; Fasola et al., 2020; Lvoncik et al., 2020; Van Damme et al., 2020). The latest research, compiling data of the last 20 years, indicates (Attorre and Van Damme, 2020) that deterioration is visible in key species or rapidly changing areas, in particular accelerated by climate change impacts (Maděra et al., 2019a; 2019b; Lvoncik et al., 2020; Van Damme et al., 2020). The conservation status of reptiles and invertebrates is of concern due to climate change effects, the threats of exotic species, and deterioration of the woodlands/vegetation (IUCN Consultation, 2020), considering the current trends (Attorre and Van Damme, 2020). The status of ecosystems and endemic flora, has also begun to deteriorate (e.g., decline of vegetation in the mountain areas; Rezende et al., 2020), with further deterioration predicted, following rapid ongoing changes that affect the terrestrial environment (Maděra et al., 2019a; 2019b; Lvoncik et al., 2020; Attorre and Van Damme, 2020). Unfortunately, not much information is available or shared concerning trends in the marine environment over the last decades, however there is enough circumstantial evidence to suggest that the marine and coastal environments are impacted. During a most complex political situation in particular in the last two years, the State Party, through the local authorities and EPA, has shown strong engagement to tackle threats, while having limited capacity. As the trends are substantiated by scientific data and across terrestrial, aquatic and marine environments, therefore the assessment of the current state of World Heritage values is to be of High Concern.

Assessment of the current state and trend of other important biodiversity values
High Concern
Trend: Deteriorating

The biodiversity-related cultural values, language related to environment, traditional knowledge and practices (including ethnobotanical practices and traditional resource use) are increasingly deteriorating due to socioeconomic transformations, political instability, external pressures, and challenged by the difficulty in aimed conservation on this aspect of the human-nature link. These values, knowledge and practice are critical for the long term sustainability of the islands natural heritage.

Additional information

Benefits

Understanding Benefits
**Livestock grazing areas**

Strong traditional livestock economy based on goats, as well as cattle and sheep to a lesser extent (Morris, 2002), with a strong contribution to local livelihoods.

Factors negatively affecting provision of this benefit:
- Climate change: Impact level - High, Trend - Increasing
- Pollution: Impact level - Low, Trend - Continuing
- Overexploitation: Impact level - Very High, Trend - Continuing
- Invasive species: Impact level - Low, Trend - Continuing
- Habitat change: Impact level - High, Trend - Decreasing

The socioeconomic transformations as well as infrastructure development (e.g. road construction) are increasing local users access to remote resources and changing their patterns of use in terms of distribution and duration.

**Collection of genetic material**

The rich endemic biota of the property offer the opportunity to exploit genetic materials of potential economic use.

Factors negatively affecting provision of this benefit:
- Climate change: Impact level - High, Trend - Increasing
- Pollution: Impact level - Low, Trend - Continuing
- Overexploitation: Impact level - Very High, Trend - Continuing
- Invasive species: Impact level - Very High, Trend - Continuing
- Habitat change: Impact level - High, Trend - Continuing

Research efforts on documentation and collection of genetic resources have been drastically declining due to weak governance and lack of financial and human resources. The conditions are foreseen to improve under the new UNEP implemented project (State Party Report, 2016).

**Direct employment**

Although staff numbers have decreased by 75% since 2008, the property provides ca. 25 jobs for its management (Abulhawa & Abdulhalim, 2013). In addition, there is a potential for a significant number of additional jobs (hundreds to thousands of jobs in tourism) to indirectly benefit from the attractiveness of the OUV and biodiversity of the property.

**Fishing areas and conservation of fish stocks**

The coastal waters around Socotra contribute greatly to the diet and livelihood of the local population and have the potential to support a considerable sustainable fishing industry, if managed wisely (Cheung & DeVantier, 2006). The current trend in marine resources is moving rapidly into less sustainable practices due to lack of proper management, monitoring and law enforcement.

Factors negatively affecting provision of this benefit:
- Climate change: Impact level - High, Trend - Increasing
- Pollution: Impact level - High, Trend - Continuing
- Overexploitation: Impact level - High, Trend - Continuing
- Invasive species: Impact level - Low, Trend - Continuing
- Habitat change: Impact level - High, Trend - Increasing

Coastal habitats destruction due to land acquisition and infrastructure development and over-exploitation of marine resources due to economic transformations, lack of good governance, and weak management and law enforcement represent major threats to the marine ecosystems services associated with the provision of food (Abulhawa and Abdul Halim, 2014).

**Importance for research, Contribution to education, Collection of genetic material**

The site has contributed to traditional knowledge, the scientific understanding of island biogeography,
conservation biology, climate change and other subject areas, and continues to support relevant scientific research and publications (UNEP-WCMC, 2011). The site provides an outdoor learning environment for local communities, researchers, and visitors to the islands. It offers a mosaic platform for exchange of knowledge and experiences among inhabitants, users and interest groups.

Factors negatively affecting provision of this benefit:
- Climate change: Impact level - High, Trend - Increasing
- Pollution: Impact level - Low, Trend - Continuing
- Overexploitation: Impact level - Very High, Trend - Continuing
- Invasive species: Impact level - High, Trend - Continuing
- Habitat change: Impact level - High, Trend - Continuing

The continuation of the factors negatively affecting this benefit will lead to successive erosion of knowledge and learning derived form the site thus negatively impacting traditional practices related to the sustainable utilization of the land and sea and their resources.

Wilderness and iconic features,
Cultural identity and sense of belonging

Although the limited accessibility and unfavorable framework conditions have precluded strong tourism development in the past, the iconic wilderness values and unique biota of the island have great potential benefits, including for tourism.

Factors negatively affecting provision of this benefit:
- Climate change: Impact level - Moderate, Trend - Increasing
- Pollution: Impact level - Low, Trend - Continuing
- Overexploitation: Impact level - High, Trend - Continuing
- Invasive species: Impact level - High, Trend - Continuing
- Habitat change: Impact level - Very High, Trend - Continuing

The inter-linkages between cultural values, traditional knowledge and practices and the conservation of natural heritage are weakened by the accelerating trends of socioeconomic transformations in the islands and continuing political instability in Yemen.

Tourism-related income,
Provision of jobs

Presently, tourism to Socotra is basically non-existent, but is foreseen to increase in the future. The potential economic benefits of sustainable tourism are not clearly understood among stakeholders, despite the fact that there is a potential for a significant number of jobs as a result (Abulhawa et al, 2014). Ecotourism-associated activities such as handicrafts and bee-keeping could provide alternatives to excessive grazing and over-fishing (State Party Report, 2016). To date, the site provides the main source of income to the majority of its inhabitants through the utilization of land and sea resources (e.g. livestock rearing and fishing). These are by far the main sources of income on the islands.

Factors negatively affecting provision of this benefit:
- Climate change: Impact level - High, Trend - Increasing
- Pollution: Impact level - Very High, Trend - Continuing
- Overexploitation: Impact level - Very High, Trend - Continuing
- Invasive species: Impact level - High, Trend - Continuing
- Habitat change: Impact level - Very High, Trend - Continuing

Habitat destruction and over-exploitation represent the main threats to the site's capacity to provide income to most of its inhabitants. The potential of tourism and other alternative activities remain of marginal economic impact. Political instability is the underlining factor leading to the decrease in tourism. Pollution is mainly outside the property, however concentrated in access points and main tourism related facilities (e.g. around airport and the capital of Hadibu)

Traditional agriculture

Cultivation of date palms has been carried out for hundreds of years, and are an integral part of many Socotrans' livelihoods and culture. Dates are an important part of the diet, and are preserved to be
eaten throughout the year. Almost the entire date palm is used as food for people or cattle, for building,
weaving, or as fuel (Cheung & DeLevantier, 2006)

Factors negatively affecting provision of this benefit :
- Climate change : Impact level - Moderate, Trend - Increasing
- Pollution : Impact level - Moderate, Trend - Continuing
- Overexploitation : Impact level - Moderate, Trend - Continuing
- Invasive species : Impact level - Very High, Trend - Continuing
- Habitat change : Impact level - Moderate, Trend - Continuing

The site has limited capacity for horticulture development due to scarcity of water resources, harsh
climatic conditions and lack of traditional knowledge and practices associated with it.

Summary of benefits
Apart from its tremendous global conservation value, the Socotra archipelago also supports significant
traditional natural resource based economies such as livestock rearing and fishing which represents the
main sources of local communities income. It is argued that the site will always have these economic
activities as the main driver of local economy. Nonetheless, it has a potential for further knowledge
generation and wilderness based, responsible tourism. Overall, The current sociopolitical and economic
trends are negatively impacting the site's capacity to provide sustainable economic growth for its people.

Projects

Compilation of active conservation projects

<table>
<thead>
<tr>
<th>№</th>
<th>Organization</th>
<th>Brief description of Active Projects</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Friends of Socotra (charity)</td>
<td>Various small research and conservation projects, past and ongoing, and annual scientific Socotra conferences focusing on awareness, conservation, biodiversity and culture. The non-profit, non-governmental organisation is entirely run by volunteers in support of conservation activities and publications. One of the most recent on-the-ground activities (small funds), ongoing, is a mangrove replantation plot on the north coast of Socotra (started with ARC-WH and together with EPA and implemented by the local Al Tamek Association for the Protection of the Mangrove). Recent wide awareness activities for biodiversity and threats were organised jointly in the UNESCO-FoS campaign connect2socotra.</td>
<td><a href="http://www.friendsofsoqotra.org/Connect2socotracampaign">http://www.friendsofsoqotra.org/Connect2socotracampaign</a> - <a href="https://en.unesco.org/connect2socotra">https://en.unesco.org/connect2socotra</a></td>
</tr>
<tr>
<td>2</td>
<td>GIZ, UNDP, IFAD, UNEP, FRC</td>
<td>Since 2012, several projects and initiatives (including the GIZ project) were signed between the Yemeni government and international partners. Several of these projects addressed the restructuring and empowerment of the EPA (State Party Report, 2016), currently one is ongoing (GEF-UNE #5347), no ongoing projects now in Socotra by GIZ.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>(Green Climate Fund)</td>
<td>Not currently active, however the Yemeni government is negotiating access to funds from the Green Climate Fund in collaboration with UNEP and international partners (State Party Report, 2016).</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>UNE-GEF Project #5347</td>
<td>GEF-funded project executed by RSCN to support the Government of Yemen (from the GoY side, executed by EPA and Ministry of Water and Environment of Yemen) under the guidance of UN Environment in coordination with local NGOs and international partners/institutes (Sapienza, CABI, Mendel, Ghent University, etc) for technical support. The project focuses on tackling major issues, primarily related to Biodiversity and Protected Area Management, Invasive Alien Species, Sustainable Land Management and local Capacity Building and Training. Until 2023 with potential extensions.</td>
<td><a href="https://www.thegef.org/project/support-integrated-program-conservation-and-sustainable-development-socotra-archipelago">https://www.thegef.org/project/support-integrated-program-conservation-and-sustainable-development-socotra-archipelago</a></td>
</tr>
<tr>
<td>№</td>
<td>Organization</td>
<td>Brief description of Active Projects</td>
<td>Website</td>
</tr>
<tr>
<td>---</td>
<td>--------------</td>
<td>------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>5</td>
<td>Franklinia Boswellia Project</td>
<td>The Franklinia Boswellia Project in Socotra (January 1st, 2020-Dec 31st, 2022) has a small budget entirely devoted to local capacity building, replantation and training to protect the endangered endemic Boswellia species of the Socotra Archipelago. The project goal is to achieve adequate conservation for at least eight endemic Boswellia species occurring on Socotra Island and to protect their ecosystems. The Boswellia trees on Socotra Island are under threat (lack of regeneration because of overgrazing, and destruction by climate change effects), therefore this small project answers a joint call from EPA, the local authorities, the local communities and scientists to take the necessary conservation measures. The proposal was specifically designed by several institutes to provide some species-oriented support and local training. Socotri based in Brno and on Socotra steer the project, with technical support by other conservationists.</td>
<td><a href="https://worldheritageoutlook.iucn.org/">https://worldheritageoutlook.iucn.org/</a></td>
</tr>
<tr>
<td>8</td>
<td>The Arab Regional Centre for World Heritage funded by the World Heritage Fund (WHF)</td>
<td>Mitigation of hurricane impacts on endemic and threatened plants of Socotra Archipelago. The project targets two main tree species the Frankincense trees (Boswellia socotrana Balf. f.) which is a vulnerable species reference to the IUCN Red List assessment, and the Dragon Blood trees (Dracaena cinnabari) for building nurseries and plots to enhance the conservation and protection of those 2 main targeted species and the fence is going also to protect the new plants from goats and eventually, natural regeneration.</td>
<td><a href="http://www.arcwh.org">www.arcwh.org</a></td>
</tr>
</tbody>
</table>
### REFERENCES

<table>
<thead>
<tr>
<th>№</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>№</td>
<td>References</td>
</tr>
<tr>
<td>----</td>
<td>------------</td>
</tr>
</tbody>
</table>
## References


<table>
<thead>
<tr>
<th>No.</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>№</td>
<td>References</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>