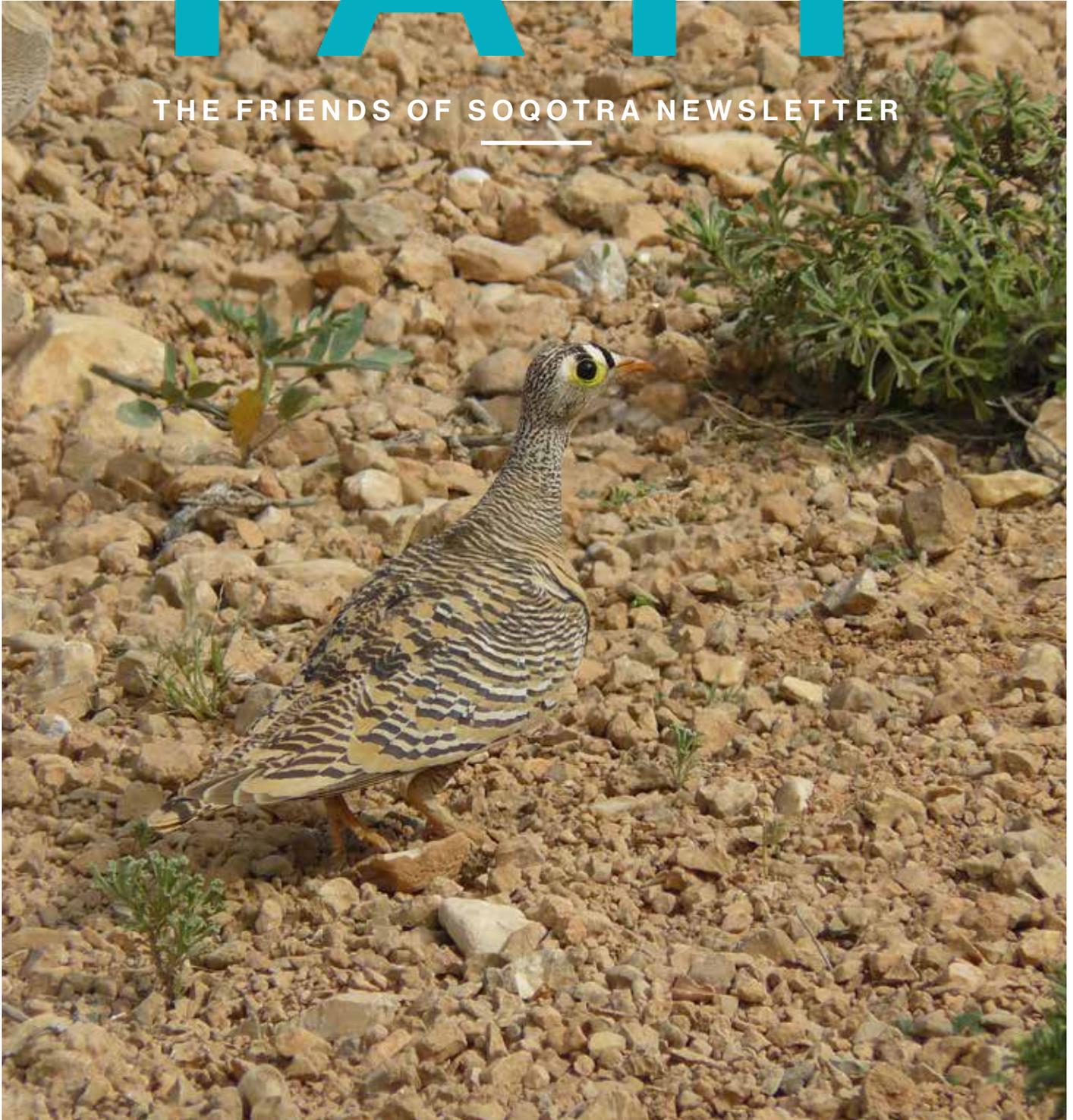


TAYF

THE FRIENDS OF SOQOTRA NEWSLETTER



Lichtenstein's Sandgrouse (Pterocles lichtensteinii). Photo by Francesca Pella, Socotra Island.

Conservation of turtles

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EDITORIAL

Dear Reader of Tayf,

our charity has been active in promoting awareness and sharing exciting news about the unique culture and nature of the Socotra Archipelago, since FoS was established in 2001. This newsletter is the only publication in the world that is dedicated to sharing news annually about the unique assets of the Socotra Archipelago.

The new issue includes the latest about scientific research in Socotra, some key activities of FoS and local news from the islanders. We share some images and content of the 22nd annual conference of FoS, which took place in September 2023 in Poznan (Poland), thanks to our kind hosts Dr Konrad Celiński and Dr Justyna Wiland-Szymanska on behalf of the Adam Mickiewicz University. As in previous years, there was great support and enthusiasm by colleagues of Mendel University in Brno to organise the meeting, for which many thanks. The conference was very pleasant, filled with interesting scientific talks and discussions about Socotra's fascinating nature.

A highlight in this newsletter is the article by Wagdi about his home area, Halah, the north-eastern coastal stretch of Socotra. It is written with the same enthusiasm as when Wagdi is talking about his home in person, a beautiful area with an amazing local community of fishermen and herders, welcoming to responsible visitors with respect for culture and nature. I've known Wagdi for many years, and I consider him a friend, always with a heart for nature and very knowledgeable about Socotra's sea, land and the mysterious Hoq Cave.

Other articles in this newsletter include research and conservation of endangered trees by local teams and local authorities working with international scientists, a great example of

cooperation, aimed to protect endemic, and often culturally relevant, woody plant species. I wish to ask your attention for a short article that highlights a negative trend in Socotra - fire and overtourism in Firmihin. These trends add to the risks affecting the endemic species living in the Dragon's Blood Tree forest ecosystem, on top of overgrazing and extreme climate effects.

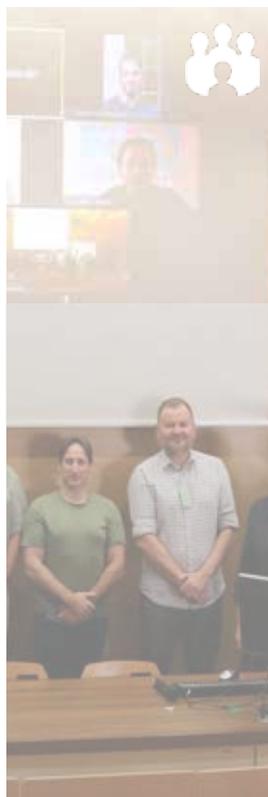
I would like to ask every reader of this issue, to please help take care of these unique ecosystems, by spreading awareness about their importance for biodiversity, for science, for people and in general, for the world. Nature in Socotra is more than just a touristic asset, it is more than a nice background of a selfie: on this island, nature sustains life, including life and culture of the people there, so please treat this place with the utmost care.

Enjoy reading, and I hope you find the contents interesting,

Your FoS Chairperson,

Dr Kay Van Damme

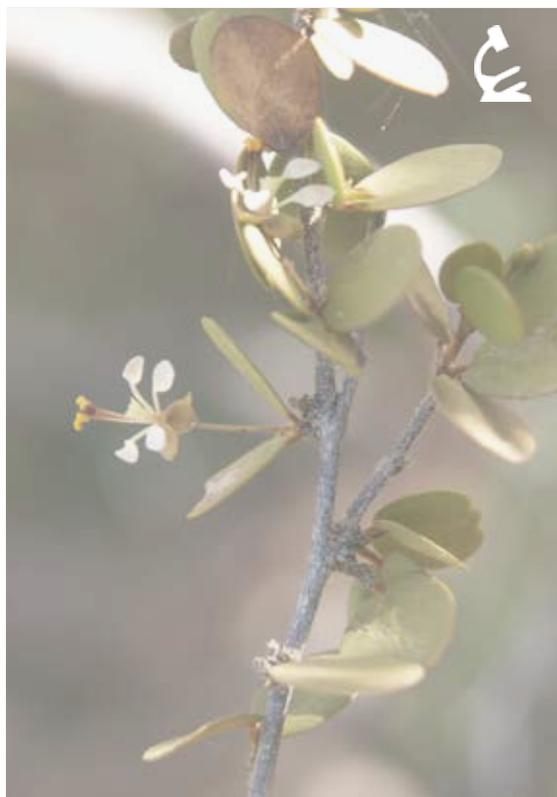
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THE 22ND SOCOTRA CONFERENCE AND AGM OF FOS IN POZNAŃ, POLAND

By Kay Van Damme, photos by KVD and Hana Habrová

In the beautiful setting of the Polish city of **Poznan**, the **22nd conference** and AGM of FoS took place from the 15th to the 17th of September, 2023. It was the first time in the history of our Charity that a scientific meeting was organised in Poland, organised by **Dr Konrad Celinski** and **Dr Justyna Wiland-Szymanska** on behalf of the Adam Mickiewicz University. Scientists of the university are connected to Socotra mainly through the amazing flora, in particular through their collaborations with other universities with members in FoS, as part of a larger group studying the many aspects of the fascinating Dragon's Blood Tree.

THE 2023 CONFERENCE

The meeting was organised by the **Botanical Garden** and the Faculty of Biology and Faculty of Modern Languages and Literatures

of **Adam Mickiewicz University**, Poznań (Poland) in cooperation with Friends of Socotra, Mendel University in Brno (Czech Republic), Ghent University (Belgium) and La Sapienza/Botanical Garden of Rome

(Italy). As in previous years, Mendel University provided a large part of the organisational support for the meeting. On Friday (15th of September 2023), there was an informal welcome and a guided tour of the Botanical Garden,



Attendees of 22nd FoS AGM and Socotra Conference in Poznań, September 2023



Live music performance of traditional Yemeni music



Guided tour of the Botanical Garden



Presentation by P. Madera on the *Boswellia* project



as well as live music performance. Several copies of the most recent Tayf newsletters were distributed among the attendees.

The Saturday (16th of September, 2023) was packed with presentations (each about 15 minutes with 5 minutes of questions), after an opening presentation by Prof.

Dr Justyna Wiland-Szymańska about the history and richness of the University's Botanical Garden. The meeting was available online throughout the entire time using Zoom, which went smoothly, thanks to the amazing technical support of the Czech and Polish colleagues. In total, 18 attendees joined in person, including one scientist from Socotra (Salem Hamdiah), and another 15 people joined intermittently online.

Socotra-themed presentations started with Prof. Dr Petr Madera, who showed the results of three years of intensive teamwork with tangible results on the ground of the ***Boswellia* conservation project** funded by the Franklínia Foundation (Phase I) (see Tayf n° 19).

The project is now in Phase II, expanded to the conservation of more endangered tree species. Updates on the IUCN SSC grant (2022-2024) on conservation of the **freshwater habitats in Socotra** were provided by Dr Kay Van Damme, including workshops in Detwah Lagoon, cleaning events, celebration of World Wetlands Day, and direct conservation

efforts towards the Socotran wetlands, and their biodiversity (see Tayf n° 20). Dr Hana Habrová presented about the analysis of decades of data on the **climate** of Socotra, followed by PhD students Natálie Holešová on the effects of **hydro-absorbents** on the growth of *Boswellia* seedlings in



A tour to the historic center of Poznań, which was partly being renovated

Socotra, Jana Tulková on chemical compositions of *Boswellia elongata* resin in two different seasons, and Lukáš Karas on germination of different taxa of Socotran *Boswellia*. In the afternoon, Lucie Bauerová presented on the age estimation of *Dracaena cinnabari*, Konrad Celiński on the application of new molecular techniques for sequencing of DNA to protect fauna and flora, and finally Salem Hamdiah from Socotra, about the effects of overgrazing on the natural general of *Boswellia* species in





Socotra Island. This study by Hamdiah et al. (2024), as part of his PhD degree, was published in the Journal of Forest Science in 2024, indicating that grazing has a strong effect on seedling survival. The meeting finished around 4pm and was followed by a general discussion on scientific progress and outputs, projects and generally about conservation efforts in Socotra. After that, the attendees joined a tour with a special city guide to the historic center of Poznań, which was partly being renovated.

THE ANNUAL GENERAL MEETING

On the Sunday (17th of September, 2023), the AGM of FoS was held at the same venue in the Botanical Garden,

attended online and in person by the FoS Committee and interested FoS members. The activities of the year were presented and discussed (since the AGM in Rome in 2022). The meeting minutes and financial reports of 2023 are now available at www.friendsosqotra.org (including the June and September 2023 meetings).

We thank the hosts from Adam Mickiewicz University and the support by the team from Mendel University for another successful Socotra conference. Another good year for FoS activities was therefore completed, with a productive AGM (and a new Treasurer in 2023),



presenting work by interested scientists with a heart for Socotra, and a number of activities of FoS towards awareness and conservation of the unique culture and nature of the Socotra Archipelago.



TAYF NEWSLETTER ON SOCOTRA

Text & photos by Kay Van Damme, September 2024

In September 2024, a batch of prints of the most recent Tayf issues (Arabic and English versions) were brought to Socotra, reaching people high and low, from coast to mountains. People were happy with the copies, interested in reading the articles about nature, culture and science from Socotra presented in Tayf, including the governor. Each year, printed versions of Tayf are brought to Socotra twice, in spring and in summer/autumn, with support of Mendel University and the Franklinia project, and distributed among indigenous communities, educational centres and local authorities. In Hadramouth College in Hadiboh, students use the English Tayf for practicing languages: teachers told us they choose an article that they need to read and understand, and discuss it in front of the class.



Tayf issues were delivered at the library in Hadramouth College in Hadiboh (with the editor of the English version of Tayf, Dr Hana Habrová)



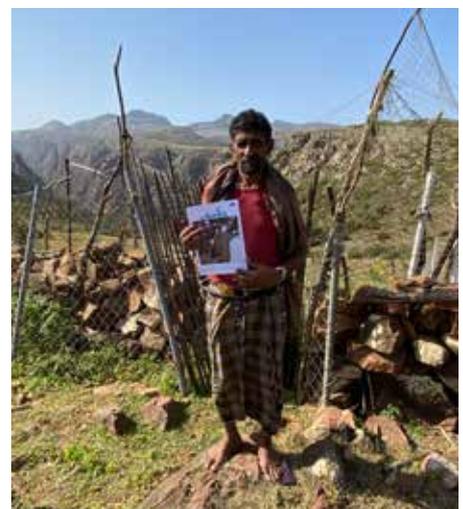
Wagdi Omar Ali Ahmed at the coastal Halah area



Governor and Deputy Governor of the Socotra Archipelago with Tayf



Ahmed Adeeb and his father (Adeeb Abdullah Hadid) in Socotra's only Botanical Garden, near Hadiboh



Ahmed Mohamed, a very strong and good-hearted mountain man, at his home and garden up high the Hageher mountains



NATURAL TREASURE OF SOCOTRA - INVENTORY OF SELECTED THREATENED ENDEMIC TREES AND SHRUBS

By Petr Madera and Franklina Project Team

In 2020, a project supported by the Franklina Foundation began with a primary focus on *Boswellia* and *Commiphora* species (see Tayf 19, pages 14-17). The project received a very positive evaluation, and based on another application, **Phase II** had started involving other extremely rare woody species.

Our distribution records and threats assessment of **all *Boswellia* species from Socotra** was published this year in the high-impact journal *Plants, People, Planet* (DOI: 10.1002/ppp3.10563). As a part of this effort, we also finalised the **IUCN Red List** assessments for these species, which was highlighted by IUCN as one of the best assessment ever. It is important to note that these assessments fully acknowledge the indigenous members of the local team by name (who did a huge amount of fieldwork).

To collect distribution data of new target species, we used the **same approach** which we applied earlier to surveys of *Boswellia* and *Commiphora*, i.e., using our custom-made GIS server and an application with specifically designed data collection, installed on the team members' mobile phones. The **inventory** of these special species based on both, field and drone mapping, started in the first year of Phase 2 and it strongly increased this year.

These species include the extremely rare and **endangered endemics *Dirachma socotrana*, *Cadaba insularis* and *Angkalanthus oligophyllus***, of which only a few records were known from literature before our efforts in this project. For these species, the team conducted full surveys in person in the field, often asking local communities (using photographs) whether they know of these special plants. All historical and herbarium records of these selected species were uploaded in the database, in order to assess their accuracy (or in fact, presence) in the field. All historical localities have been

checked during the field surveys 2024, and many new localities were found. Two **Socotri botanists** (Ahmed Adeeb and Ahmed Issa bin Afrar) who are part of our team since 2023, continue to look for these plants during the year together with other on-site members including Mohamed Amer, Salem Keybani and Mohamed Shenaighan, as well as the international team, also helped jointly with the local team in the surveys during the two field missions.

Instead of the few records these special plants were known from, we now have a **much better idea of their distribution and threats**. E.g., *Angkalanthus oligophyllus* a species with a very small distribution range within Socotra (Fig. 1) for which we found 104 records (less than 10 records were known before our surveys). *Cadaba insularis* seems more widespread but is also very rare (also, less than 10 records were known before our surveys), and we now have 97 records; this plant was used in the past for timber and firewood which might have played a role in its decline (Fig. 2); *Dirachma socotrana* is also extremely rare (only 3 records were known) and we have now 70 records (Fig. 3). For *Sterculia africana*, we now have 2180 records (Fig. 4). However, it is certain that there are more, so we will continue surveys and awareness efforts (Fig. 5) for these species in 2025.

Although we have found many times more individuals than previously known, the numbers are still very low and these rare species are at risk of extinction in the near future unless their regeneration is effectively supported.



Figure 1. Our current inventory of *Angkalanthus oligophyllus* contains 104 records (unpubl. data). It is a species with globally a truly very limited distribution in only one long wadi of Socotra Island.



Figure 2. We recorded 97 individuals of *Cadaba insularis* which is widespread but not common. It is a species that has been used in the past by local people for firewood and timber, occurring in various altitudes; it occurs in some lowland areas with extremely high development pressures (tourism, infrastructure works) (unpubl. data). Without this project and some aimed awareness and recovery strategies, this endemic species is found in areas with high intensity of grazing and has a very high chance of going extinct.



Figure 3. We counted 70 individuals of *Dirachma socotrana*, a rare endemic which is mainly a highland species (unpubl. data).

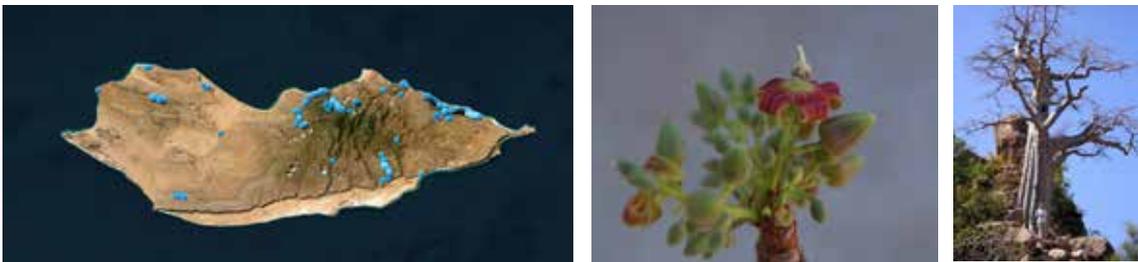


Figure 4. We counted 2180 records of *Sterculia africana* var. *socotrana*, combining on-site surveys on foot as well as remote sensing (UAV) (unpubl. data). This conspicuously large species is relatively widespread and it is of high cultural importance locally.



Figure 5. Thanks to Ahmed Adeeb, one of our team's indigenous Socotri botanists, we could survey the endemic *Cadaba insularis* in several places. Most of these plants are inconspicuous, growing as a shrub inside other shrubs. Some of the lowland areas where it is found, are under high development and browsing pressure, like Dihamri, and people are unaware that there is a highly endangered endemic plant inside some of these shrubs. Photo by PM, September 2024.

ACKNOWLEDGEMENT

We would like to thank the Franklinia Foundation for support





HOW IMPORTANT IS SOQOTRA FOR THE **CONSERVATION OF TURTLES** IN A GLOBAL CONTEXT?

Francesca Pella, photos of Martin Rejzek

During an environmental awareness workshop supported by FoS in Soqotra, one of the students asked me whether the ocean ecosystem would be affected if the marine turtles went extinct. I was struck by this direct and challenging question. How many of us know the incredible role that a marine turtle has in their ecosystem? How many of us realise the incredible implications that local negative impacts can reverberate on a global scale? This was a great question indeed.

Sea turtles are air-breathing reptiles with streamlined bodies and large flippers. They are well-adapted to life in the ocean, in which they live most of their life, inhabiting tropical and subtropical ocean waters throughout the world. There is only a short time window when the females come to land, and this is of course when they lay their eggs on the beaches. Their migrations between the feeding grounds and their nesting locations are incredible, they cover hundreds to thousands of kilometres every year. The reader can grasp the magnitude of their movements from the map (Figure 1): loggerhead turtles (*Caretta caretta*) are amongst the most highly migratory animals on earth, travelling as many as 15,000 kilometres or more each year.

There are seven sea turtle species in the world, of which four have been recorded in Soqotra: the green sea turtle (*Chelonia mydas*) (Figure 2), the hawksbill sea turtle (*Eretmochelys imbricata*) (Figure 3), the olive ridley sea turtle (*Lepidochelys olivacea*), and the species previously introduced, the loggerhead sea turtle (*Caretta caretta*).

So, why are sea turtles important for their ecosystems? First, they protect coral reefs and seagrass beds. For example, hawksbill turtles play a vital role in coral reefs. Reefs rely on sea sponges to recover and recycle key nutrients, but if allowed to overgrow, sea sponges can suffocate corals, causing them to die. By eating sea sponges, hawksbills help

prevent them from overgrowing and protect precious coral reefs.

Seagrass beds provide habitats and food, and act as nurseries for several commercial fish species, offering them protection from predators. Green turtles mainly eat seagrass and algae, hence helping to maintain ecosystem health and productivity. Without green turtles, there is the risk of negative repercussions on fish production that humans rely on for food and trade.

Sea turtles also boost the diversity of life on beaches and sea sediments. When female turtles lay their eggs on beaches, they provide important nutrients for sand and vegetation. Unhatched eggs and empty eggshells act as a fertiliser for dune vegetation and beach grasses, encouraging growth which helps stabilise dunes and protect them from coastal erosion. Loggerhead turtles feed on hard-shelled prey, crushing the shells with their strong jaws and discarding the fragments; this causes the shells to disintegrate more quickly, helping to recycle and distribute important nutrients to the ocean floor sediments.

Another important function of turtles is their provision of shelter, transport, and food. Marine turtles embark on extremely long journeys, migrating hundreds and even thousands of kilometres through the oceans. Many marine organisms join them on their travels, using turtles as a form of transport and protection. Turtles also act as a food source for many animals which prey on them – both in and out of the ocean. Crabs, birds, fish, and land mammals such as foxes feed on hatchlings, while larger sea creatures like

sharks, saltwater crocodiles, and orcas prey on adult turtles.

From a Socotra livelihood's point of view, marine turtles could become an important source of income for coastal residents through turtle-watching ecotourism. Many places rely on turtle watching or diving for jobs. Plus, there are emotional benefits to seeing a sea turtle in the wild. An essential warning, though: human disturbance can create unbelievable stress and damages to the wildlife; to avoid negative impacts on the turtles, nesting individuals and nests, the involvement of experienced scientists and conservation practitioners, to help design and implement these ecotourism initiatives, is fundamental.

Worldwide, all seven species of sea turtles are listed as endangered by CITES (the Convention on International Trade in Endangered Species of Wild Flora and Fauna), while the IUCN Red List of Threatened Species (International Union for Conservation of Nature and Natural Resources) classifies six of them

as threatened with extinction. Why? There are numerous reasons.

At a global level, these magnificent reptiles face significant threats including: bycatch (=unintentional catch) in commercial and recreational fisheries; loss and degradation of nesting and foraging habitats due

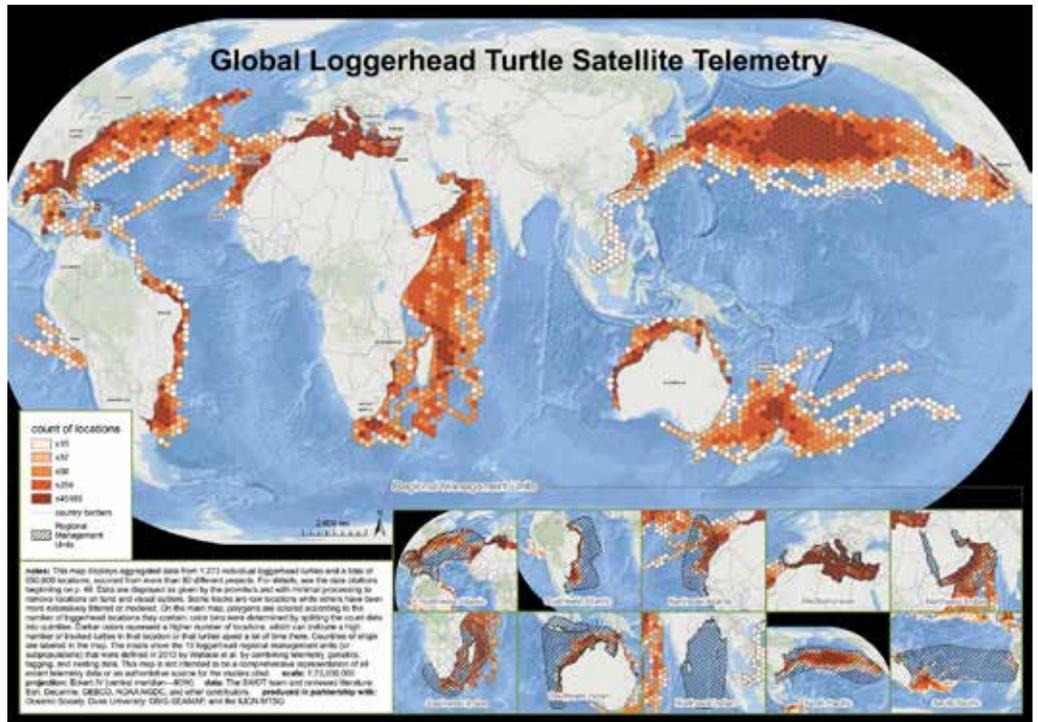


Figure 1 - Map extracted from SWOT Report, Vol. XV (2020). (Chapter "Indian Ocean Loggerhead", by Ronel Nel, Mayeul Dalleau, Diane Le Gouvello, Michael G. Hart-Davis, Tony Tucker, Alan F. Rees, Andrea D. Phillott, and Scott Whiting, and Sabrina Fossette; pages 32 and 33).



Figure 2 - Green turtle (Chelonia mydas); photo Martin Rejžek



Figure 3 - Hawksbill turtle (*Eretmochelys imbricata*); photo Martin Rejžek

to coastal development, pollution, oil spills, and climate change; entanglement in marine debris and internal organs' damages caused by ingesting plastic; vessel strikes; light pollution, direct human disturbance; feral predators (on beaches); in some areas, killing of turtles and collection of eggs for consumption. For all these reasons and their naturally slow reproductive rates, sea turtles are nowadays protected by international laws, agreements and national laws in many local governments and countries.

In several countries, mainly in Central America and Asia, the conservation efforts are conflicting with traditional consumption of sea turtles' meat and their eggs by local indigenous communities. Giving priority to the species' conservation by banning their hunting and egg collection, many countries are trying to provide better protection to these sea reptiles. In 2006, Yemen enacted a law to protect the marine turtles as well (Law 2, Article 52). Unfortunately, the illegal hunting of the turtles continues to be recorded in the country, including Soqatra (Figure 4). An article published in February 2024 reported 31 animals killed on the island (<https://almushahid.net/122863/>).

The FoS committee has been advocating for an awareness campaign aimed at disseminating information regarding the importance of turtles for ecosystems and all nesting sites. It is not only crucial to raise awareness about the turtles' conservation among school pupils, including Yemen's environmental and wildlife laws; moreover, it is essential to highlight the key role that

Soqotra plays as a nesting and feeding site on a global perspective.

For these reasons, our Charity coordinated with the Soqotra turtles' association to jointly plan and carry out an awareness campaign in some of the local schools (see pages 16-18 of this Tayf. Every little help matters. If conservation actions and environmental awareness campaigns are implemented at key locations such as Soqotra, the conservation benefits for the species may potentially be as huge as the home ranges of these splendid global travellers. So, if someone is asking "why should I have to care if turtles are gone?", I hope that you have found a few valid reasons to properly answer here in this article.



Photo 4 - Martin Rejžek



UAV INVENTORY OF THE LAST REMAINING DRAGON TREE FOREST ON EARTH

By Petr Vahalík & Hana Habrová

Roqeb di Firmihin (further “Firmihin”), is a limestone plateau surrounded by deep canyons in the centre of Socotra. The canyons create a relatively isolated area just south of the higher granite mountains. The plateau is gently inclined to the south and is covered by a typical karstic surface of an average altitude of 638 m. a.s.l. According to a recent study, this small plateau occupies only 2% of the total suitable area currently occupied by the endemic *Dracaena cinnabari* of Socotra, yet it hosts more than 40% of the population.

The *Dracaena* forest of Firmihin was inventoried in March 2021 using georeferenced aerial imagery as part of the Franklinia project, acquired by the use of a tandem of drones. A series of orthophoto images with high spatial resolution was created to cover the entire area of interest (14.9 km²). All flights were managed “by hand” and the trajectories were oriented in a W–E and N–S direction. In total, 12 flights were made.



Dracaena cinnabari forest in Firmihin. Photo Hana Habrová 2024

Aerial images were assembled into an orthophoto mosaic. In total, 4849 georeferenced photos were produced and processed. We used ArcGIS Pro to

conduct a detailed tree inventory of the Dragon Tree forest of Firmihin. All crowns of Dragon Trees were vectorized using an object-based classification applied to the orthophoto image. Pre-processing of the data was carried out using histogram contrast stretching, which customizes a contrast stretch of various parts of the studied area. The resultant inventory included automated errors such as potential mutual contact of a few trees growing close to each other, which were misclassified as a single tree. All errors were corrected manually by the team members, by visually checking the automated object-based classification and redrawing (vectorizing) the exact crown contour in case of erroneous delineation.

The spatial age distribution of the Firmihin Dragon Tree forest was evaluated based on the tree crown projection areas based on the size of the crowns as estimated from the orthophoto, the number of branch sections was calculated for every single tree, which was then used to extrapolate the age of the trees. The spatial structure of the age distribution of the Firmihin forest was calculated as the average age of the trees per hectare of the area of interest.

During the survey, the number of dead – uprooted trees was also counted and evaluated. The arid weather conditions on the Firmihin plateau significantly slow down the



Figure 1 - Uprooted *Dracaena* trees in the study area were visually identified and vectorized manually. Red lines indicate the direction of each fallen tree, added as linear vector layers.

decomposition of uprooted trees. Most of the dead trees are a direct result of extreme weather events when cyclones hit Socotra in November 2015, affecting the Firmihin forest; the remnants of a fallen Dragon Tree will stay on the ground for years. Dead uprooted trees were identifiable from our high spatial resolution orthophoto image (Figure 1). We manually added a linear vector layer for each dead tree, oriented from the root section to the crown section, to indicate the direction of the fall.

The entire study area was divided using a grid with a square size of 1×1 hectare. The number of dead trees and their average direction of orientation to the cardinal points were evaluated for every single square of the grid.

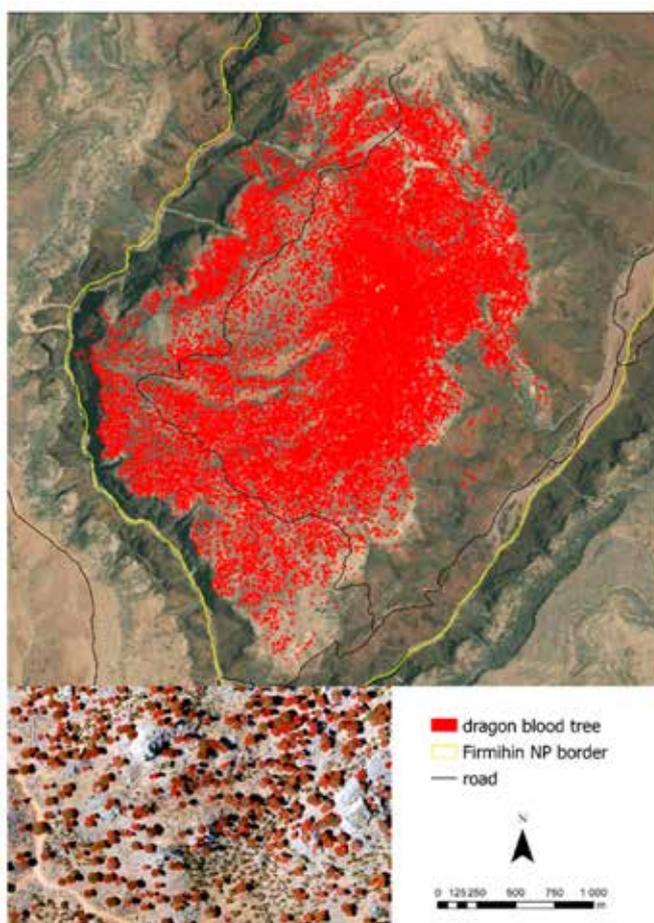


Figure 2 - Firmihin forest inventory and detail of a group of inventoried *Dracaena cinnabari* trees showing vectorized crowns, each red dot representing an individual (living) tree.

In total, 35,542 individual living *Dracaena* trees were inventoried (Figure 2). When compared to the estimation of the entire population of *Dracaena cinnabari*, reaching ca. 80,000 individuals, Firmihin hosts more than 40%.

The spatial distribution of the *Dracaena* tree density within the entire plateau is variable. Tree density (number of individual trees per hectare) varies, ranging from a few to, maximally, 239 trees/ha. The densest parts of the forest are in the central-eastern section and in a few areas in the southern section of Firmihin.

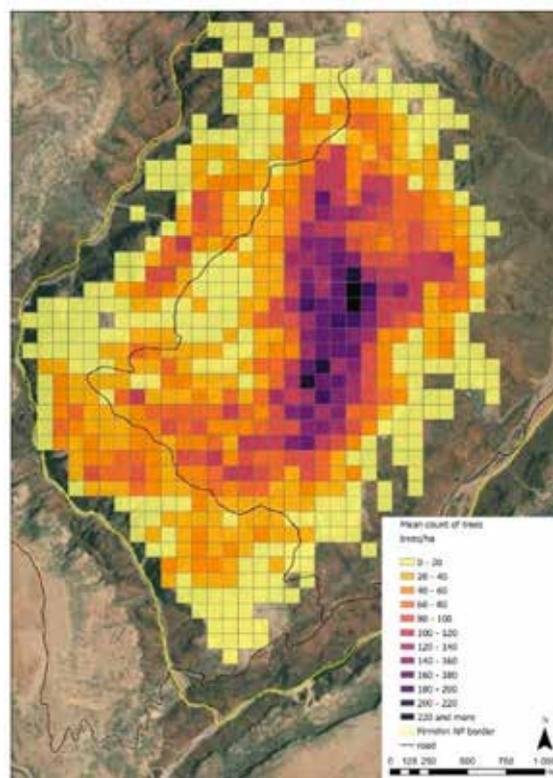


Figure 3 - Spatial distribution of *Dracaena* tree density in Firmihin (individual trees/ha).

The Firmihin *Dracaena* forest has an old structure in general (Figure 4 and Figure 5).

The spatial variability of the age structure indicates that less dense parts of the forest are older, these parts with the older trees are located in the southeastern and northwestern sections surrounding the road crossing the Firmihin plateau (Figure 4). The largest continuously dense area in the central-eastern section (Figure 3), with ca. 120 to 220 trees/ha, contains the cohorts of the relatively youngest trees, estimated at approximately 150–300 years old.

Using UAVs, we provide a cost-effective method to generate a high-resolution georeferenced dataset to study the largest population of a culturally relevant and vulnerable endemic tree of Socotra Island, *Dracaena cinnabari*. Our analysis of the drone inventory, the first ever published for Dragon Tree population studies, allows new insights into the

population structure and highlights once again the importance, as well as the vulnerability, of this area for the conservation of this relict species. Using crown age estimations, our study confirms that overmaturity is a typical feature of this forest, which is, on average, ca. 300 years old, and that the effects of overgrazing must have intensified in the last 2 centuries. We suggest a wind-tree correlation between the direction of the 2015 cyclones that affected Socotra and the dominant direction of a significant proportion of fallen (dead) trees, constituting 5.6% of the Firmihin population. We identified areas that are relatively more vulnerable to wind forces and local extinction, such as mainly the western half of the plateau,

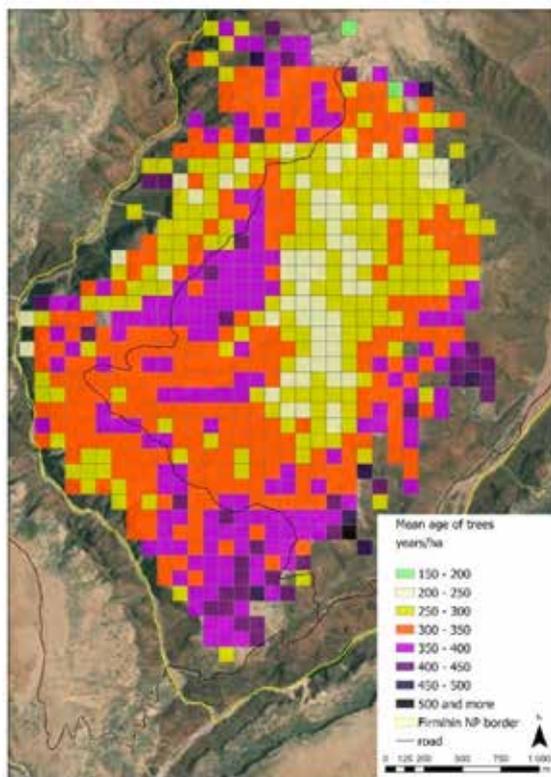


Figure 4 - Spatial distribution of *Dracaena* estimated tree ages in Firmihin (tree ages/ha).

which contains the older trees. The remaining living population of 33,419 standing trees of Firmihin constitutes up to 40% of the total number of all *Dracaena cinnabari* trees estimated for the island. This high proportion illustrates the urgent need for the establishment of a well-managed (i.e., in collaboration with local communities) nature reserve for Firmihin and urgent conservation action to protect the last Dragon Tree forest on our planet.

Further Reading

Vahálík, P.; Van Damme, K.; Nėtek, R.; Habrová, H.; Tulková, J.; Lengálová, K.; Zejdová, L.; Avoiani, E.; Maděra, P. UAV Inventory of the Last Remaining Dragon Tree Forest on Earth. *Forests* 2023, 14, 766. <https://doi.org/10.3390/f14040766>

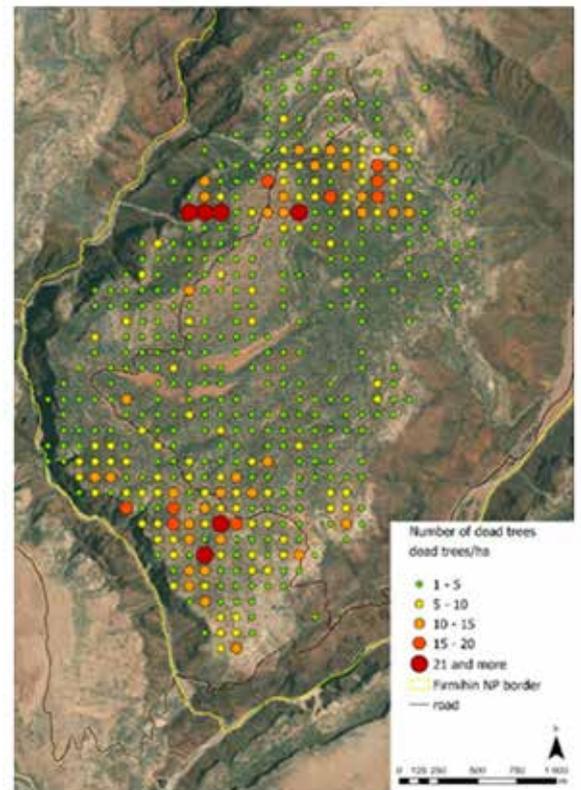


Figure 5 - Spatial distribution of the number of uprooted *Dracaena* trees (number of dead trees/ha) in Firmihin, Socotra Island.

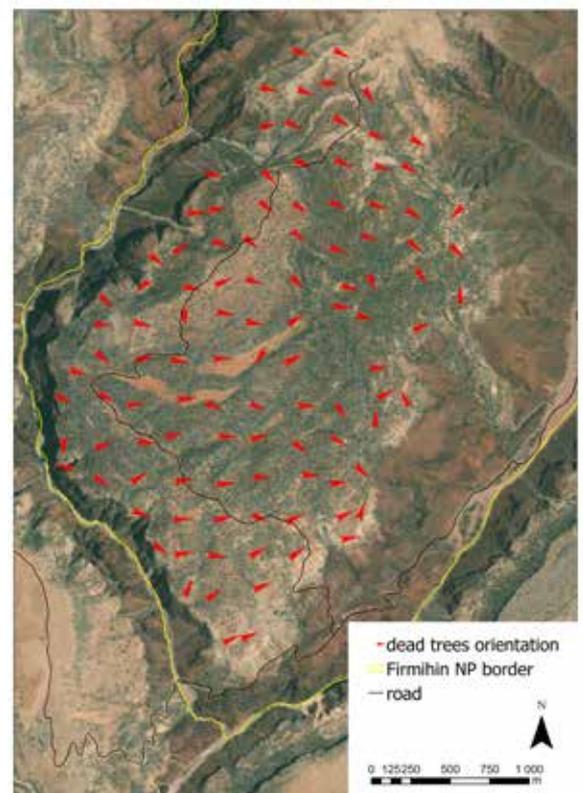


Figure 6 - General orientation of uprooted *Dracaena* trees (directions from stem base to crown) in Firmihin, Socotra Island.

LITTLE DOESN'T HAVE THE SAME MEANING AS SMALL: WHEN CHILDREN MAKE THE DIFFERENCE

By Francesca Pella, photos F. Pella and Soqotra Turtles' Association

Eco-anxiety is a way of describing how people feel when they hear bad news about our planet and the environment. In the last years a general sense of anxiety about environmental topics, in particular about climate change, was recorded among many young people (especially Gen-Z). But... How to prevent these negative feelings among the youngest generation (Generation Alpha)? How can we help children to convert their fear into energy to contribute to protecting their own future? Often, we think that we need spectacular actions; it is not always true. Let me tell you a story.

In 2022 I was lucky enough to return to Soqotra, being involved in environmental awareness sessions, joining the team of the Franklinia project coordinated by Mendel, Ghent and Sapienza Universities, with links to FoS. Once back in the UK, I received an invitation from the teacher of my son to introduce our Charity and its activities to his class. The 23rd of January (2023) the pupils listened to the presentation, in which the key message sounded like “don't be scared about the environmental crisis. It is alright to be concerned, but every one of us can make a difference in many ways, such as being informed and discussing nature's subjects, studying and researching topics that help conserving the biodiversity, volunteering”. I must have said something right, because class 3 of Froxfield CE Primary School chose Friends of Soqotra as the charity that they wanted to support.

The children and the teachers came up with the idea to create bracelets, and to sell these handcrafts at school to fundraise for FoS. By June, the pupils created so many bracelets and

advertise the sale so well (Figures 1 and 2) that, despite each bracelet costing 50p and the sell being limited only to two days, they reached the incredible amount of 120£!



Figure 3

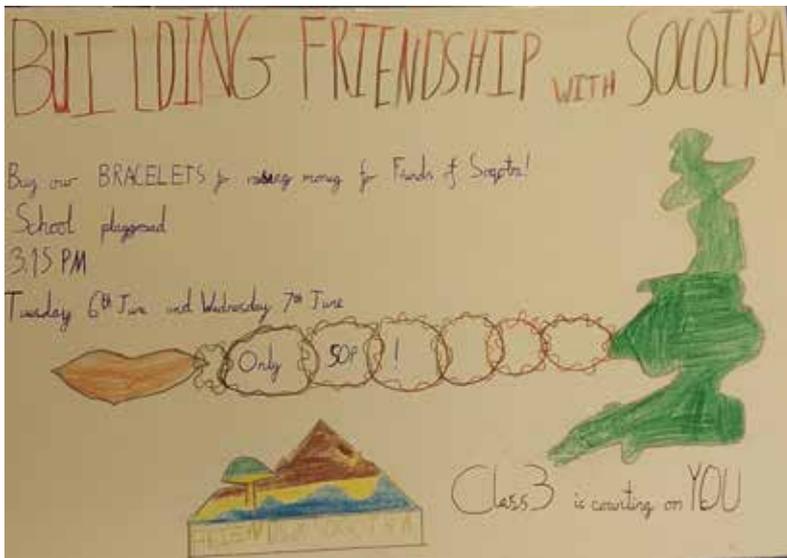


Figure 1

We were all ecstatic; it was very satisfactory going to school to collect the money (Figure 3). The next step was to think about how to use it, what kind of project we could carry out? After discussions within the FoS Committee, one of the options included the preparation of environmental awareness material (the choice of the topic and its justifications are outlined in the article “How important is Soqatra for the conservation of turtles in a global context?”, published in this same issue). And then, how could we send the funds to Soqatra? In March 2024, the FoS Chairman Dr Kay Van Damme and other FoS members were in Socotra to carry out field surveys for the Franklinia Project. Kay



Figure 2

was able to reach out to the new coordinator of the Soqatra Turtles' Association, Mr Abdullah Lam, informing him about the efforts of the pupils at Froxfield School. He was also asked if the Soqatra Turtles' Association would welcome awareness material about sea turtles, which he



Figure 4



Figure 5

confirmed. Furthermore, Mr Abdullah suggested to use the donation to print the material on the island and to fill the tank of the car that would be needed to reach some of the local schools for the awareness campaign. In the following weeks, I prepared the slides which took into consideration the necessities expressed by the Turtles' Association Coordinator: outlined information about the biology and the conservation status of the species, their roles in the ecosystems and their threats. The campaign was carried out shortly after the slides were reviewed by the FoS committee and reached the island, with successful and lively participation, involving both

The 2nd of May (2024) I returned to the class of Froxfield School to justify how the money was spent, showing the children the video that Mr Abdullah so kindly did to thank them, and the pictures of his seminars in the schools of Soqatra. The pupils were genuinely interested and happy that their efforts were reinvested in nature conservation and education.

This was a rewarding and constructive experience, a real team-work project, where several people gave time, expertise, energy for the noble cause. A massive "Thank you" to all the contributors; I would recommend the readers to think about similar ideas and try to put them into practise in their own local areas. If you would like to share your thoughts or ideas with us, or other potential similar initiatives, we are happy to interact! You can contact FoS through the email address of the Secretary (fos.secretary@gmail.com).



Figure 6

classes for girls and boys (Figures 4 and 5; Photo 6, Mr Abdullah Lam during one of the events). This campaign was the first step to - we hope - helping to stop the poaching activity of the sea turtles on the beaches of Soqatra.

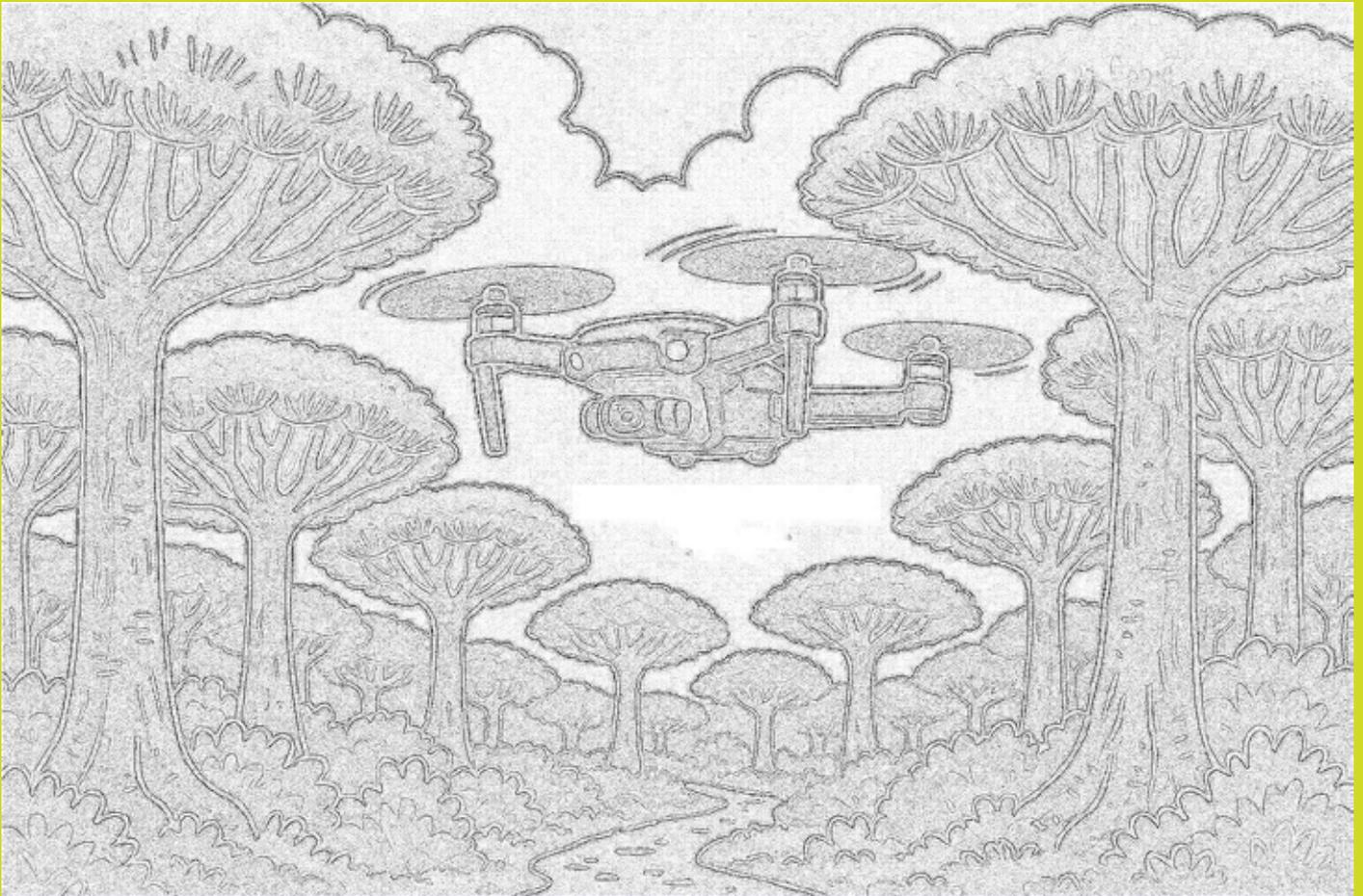


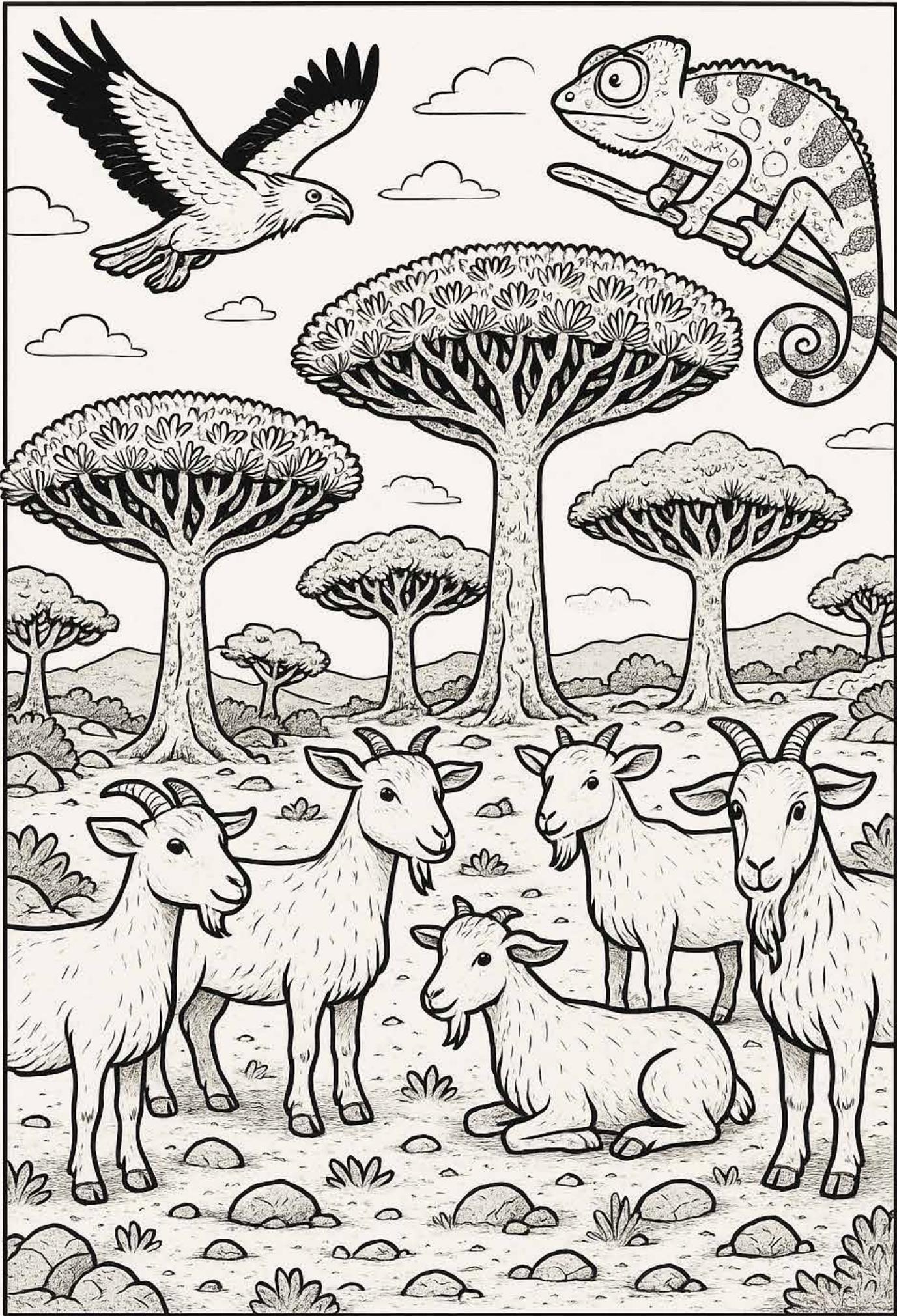
Courtesy Dr Paige Strudwick, Coral Nurture Program, University of Technology, Sydney

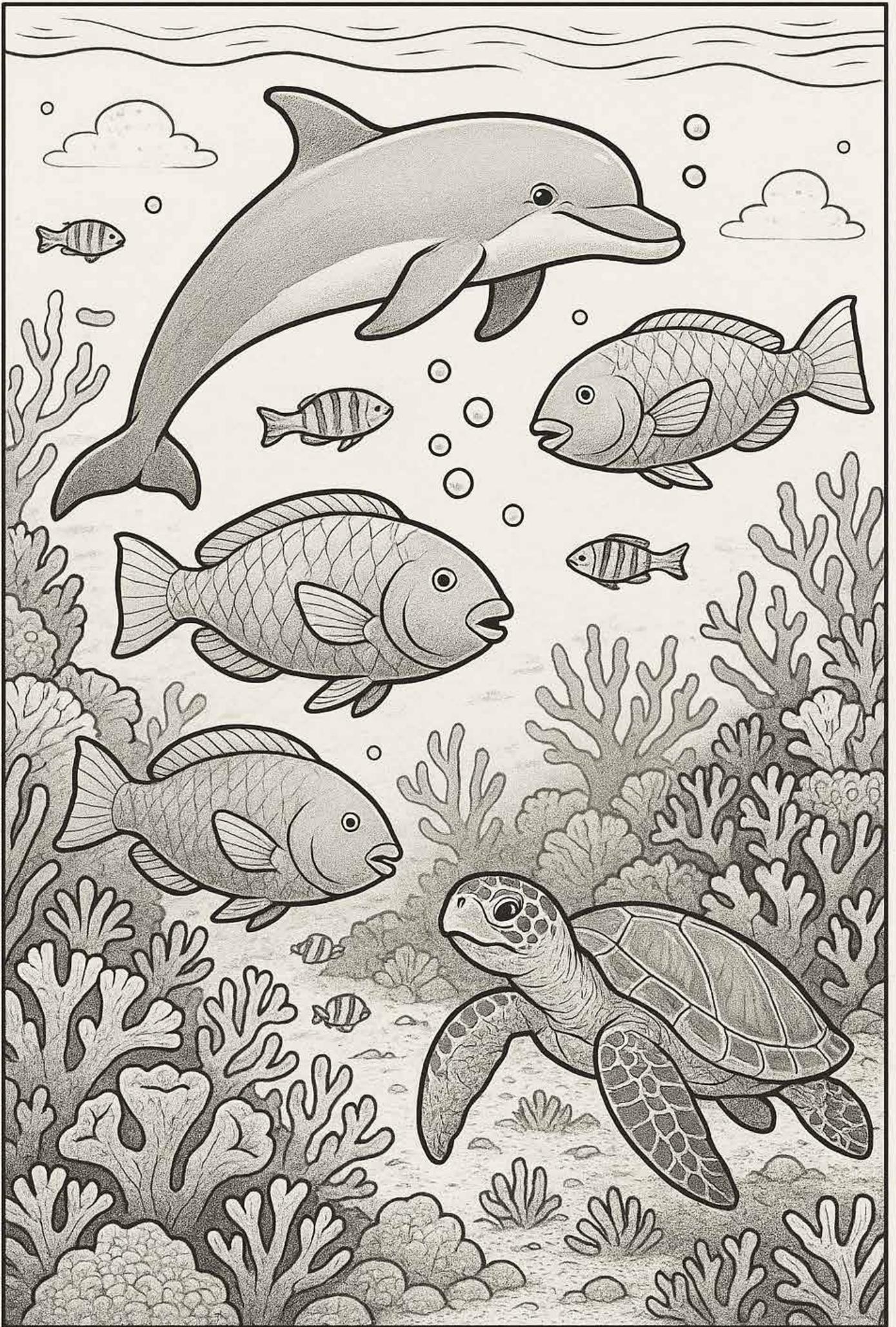


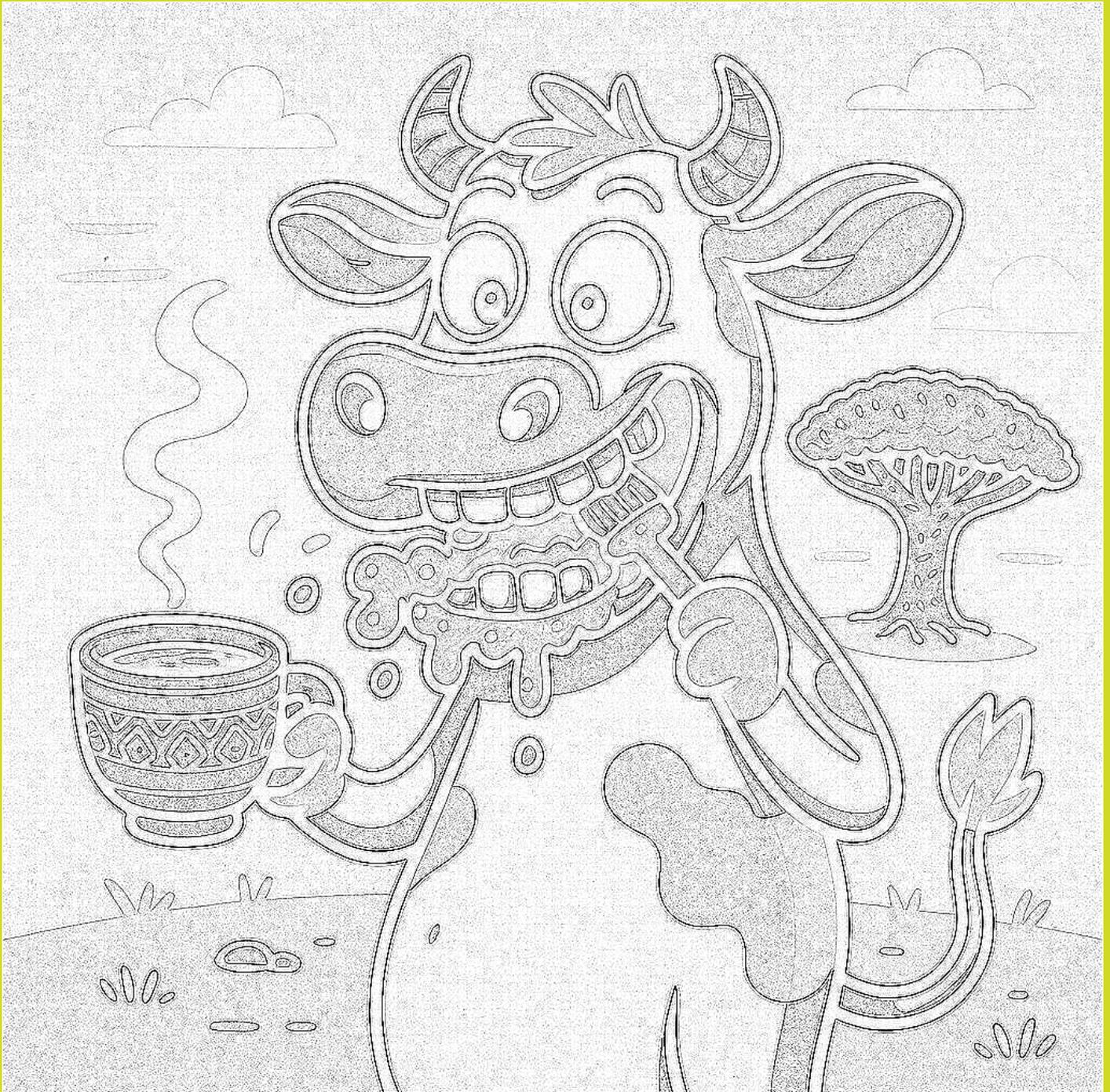
CHILDREN'S SECTION

Fill in the colours in any way you like!









Can *Dracaena* resin remove coffee stains from teeth? Researchers tested on cow teeth using Yemeni coffee and special toothpaste containing Socotran Dragon's Blood Tree resin. More details see page 26: Scientific papers about Socotra in 2023.



CADABA INSULARIS

By Lukáš Karas, photos Hana Habrová & Petr Madera

C*adaba insularis* is a rare shrub or small tree that grows only on the island of Socotra. It belongs to the caper family (Capparaceae) and is one of four species of *Cadaba* found on the island. While the other three species of this genus grow in dry regions of northeast Africa, southwest Arabia, Pakistan, and India, *Cadaba insularis* is found only on Socotra, making it truly



Cadaba insularis tree from one of the few known localities, Photo HH

unique to the island.

This species is critically endangered and known from just a few scattered locations. It is not a showy plant—its trunk is often twisted or bent, growing along rocky slopes. Unlike some of its relatives, which have large and colourful flowers, *Cadaba insularis* has very small blossoms. However, its flowers still share the typical structure of the family, with four petals and long, noticeable stamens. The petals are especially



The trunk of *Cadaba*, photo HH

interesting, as they are twisted up and narrow at the base.

Because it is so rare, *Cadaba insularis* is not widely used by local communities. However, it is threatened by overexploitation, especially for firewood. People say that when the bark is burned, it gives off a pleasant fragrance.

This plant is a close relative of the well-known *Capparis spinosa*, the Mediterranean caper bush. Its edible flower buds, called capers, are often used as a garnish in cooking. Even the young fruits, known as caper berries, can be eaten. While *Cadaba insularis* itself is



Details of *Cadaba* flowers, Photo PM

not used in this way, it is still an important part of Socotra's unique plant life and deserves protection.



Capers (*Capparis spinosa*), source: <https://images.immediate.co.uk/production/volatile/sites/30/2020/02/capers-c9a3002-scaled.jpg>



FRANKINCENSE

AND THE ISLAND THAT SMELLS LIKE HISTORY: HOW NATURE SHAPES A SACRED SCENT

By Jana Tulková

Imagine walking through a forest where the trees bleed a sweet, spicy-smelling sap that has been used for thousands of years in perfumes, medicine, and religious rituals. That magical substance is frankincense, and it comes from *Boswellia* trees.

But here's something you might not know: the scent and quality of frankincense can change depending on where and when it's collected. A recent study on Socotra Island, explored how climate and geography affect the chemistry of frankincense from a rare tree species *Boswellia elongata*.

WHY IS FRANKINCENSE SO SPECIAL?

Frankincense is a type of resin—a sticky substance that oozes from certain trees when their bark is cut. It hardens into golden drops and has a strong, pleasant smell when burned. People have used it for over 5,000 years in religious ceremonies, traditional medicine, and perfumes. Today, frankincense is still used in natural remedies and cosmetics. Scientists are also studying it for its potential to fight inflammation and bacteria. Most frankincense comes from a few well-known tree species, but *Boswellia elongata* is different. It grows only on Socotra, the perfect place to study how the environment affects the scent and chemistry of frankincense. The island has a unique climate. It's hot and dry for much of the year, but it also has two rainy seasons. The landscape includes rocky mountains, dry valleys, and coastal plains—all of which create different growing conditions for plants.

HOW IS THE SMELL OF A TREE STUDIED?

To find out what's inside frankincense, we collected resin from *B. elongata* trees in six different parts of Socotra, twice—once during the dry season and once during the rainy season. Then, we used a special machine that heats the resin and analyzes the tiny scent molecules it releases. This process is called gas



One of frankincense trees, *Boswellia elongata*, in Homhil. Photo Petr Maděra

chromatography-mass spectrometry (or GC-MS for short). It's like giving the resin a super-sensitive "sniff test" to see what it's made of.

WHAT DID WE FIND?

We discovered 92 different scent compounds in the resin. These included:

- ★ Monoterpenes – light, fast-evaporating molecules that give frankincense its fresh, piney smell.
- ★ Sesquiterpenes – heavier molecules with earthy, spicy aromas.
- ★ Diterpenes – larger molecules that don't smell as strong but may have health benefits.

Some of the most common compounds were alpha-pinene, gamma-terpinene, and o-cymene. But the exact mix of chemicals changed depending on the season and where the tree was growing.

HOW SEASONS CHANGE THE SCENT

In the dry spring, the resin had more of certain compounds like (Z)-sabinene hydrate and gamma-murolene. These might help the tree protect itself from heat and dryness.

In the wet autumn, other compounds like thujol and a mysterious unidentified compound ST3 were more common. These changes suggest that the tree adjusts its chemistry based on the weather—kind of like how we change our clothes with the seasons.

HOW LOCATION MAKES A DIFFERENCE

Even trees of the same species produced different resins depending on where they grew. For example:

- ★ Trees at higher elevations made more of some spicy-smelling compounds.
- ★ Trees closer to the sea had different chemical profiles than those inland.
- ★ One group of trees in a Ma'aleh was especially unique. Their resin was chemically different, and they even had red flowers instead of the usual yellow-green. This might mean they could be a new subspecies!

WHY DOES THIS MATTER?

This research helps us understand how plants interact with their environment. It also has practical uses:

- ★ For conservation: Socotra's plants are rare and vulnerable. Knowing how they respond to climate can help protect them.
- ★ For better quality: The quality of frankincense depends on when and where it's harvested. This info can help collectors make better products.
- ★ For science: The study adds to our knowledge of plant chemistry and how it evolves.

STILL SO MUCH TO LEARN

The study also raised new questions:

- ★ Many of the scent compounds were unknown. What are they? Could they have new uses in medicine or cosmetics?
- ★ Could the chemical "fingerprint" of frankincense help scientists identify different species of *Boswellia*?



Frankincense resin from *Boswellia* spp. Photo Lukáš Karas

- ★ How do soil, sunlight, and animal grazing affect the resin? More research is needed to find out.

THE BIG PICTURE

Frankincense isn't just a product—it's a story written in scent. It tells us about the tree that made it, the land it grew on, and the climate it endured. On Socotra, each drop of resin is a tiny chemical message from nature.

This study shows that even something as ancient and familiar as frankincense still has secrets to reveal. And sometimes, the best way to understand the past is to look closely at what's growing in the present.

FURTHER READING

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SCIENTIFIC PAPERS

ABOUT SOCOTRA IN 2023

By Kay Van Damme

We present a brief overview of highlighted scientific studies every year. In 2023, relatively few studies appeared in comparison to previous years (see previous issues of this newsletter), yet we can observe more papers appearing which include Socotri authors, which is very important.

ENDANGERED TREES

The **flora** of Socotra remains a major focus of scientific research. One study appeared (including several FoS Committee members as co-authors) on the current and potential future distribution of the endemic Socotran *Commiphora* or **Myrrh Tree** species (Burseraceae), taking into account different climate scenarios. This paper led by La Sapienza (Rome) researcher Dario La Montagna (Fig. 1) was published in *Frontiers in Forests and Global Change* (see La Montagna et al., 2023 and Tayf 20). The study, as part of the leading author's PhD within the Franklinia Foundation funded project on *Boswellia* and other endangered trees, indicates that for some of the endemic *Commiphora* species, the **future predicted distribution**, in a century from now, seems strongly reduced compared to now.

Dragon's Blood Trees remain an important organism for people to study every year. **How old** the endemic **Dragon's Blood Trees** (*Dracaena cinnabari*) of Socotra are, is a complex question. Like the date palms or other woody monocots, these trees have no rings that we can count. So, researchers have to use other methods, such as estimating the age of the division of branches. Or, they can measure the increase of the thickness of the stem (Fig. 2), called the "diameter at breast height" (DBH), over time. By measuring 1,077 trees (a lot!) and the difference in thickness of the main stem over 10 years (from 2011 to 2021), scientists from Mendel University (Bauerová et al., 2023) calculated that the fattest trees with a trunk diameter of about **90-95 cm** would be approximately **670 years** old. Thinner trees with about 10-15 cm trunk diameter were estimated at about 110 years old. The age estimation is becoming more reliable, but the exact

age remains a bit of a mystery. We can definitely conclude, as in previous studies, that these amazing Dragon's Blood Trees of Socotra are really old and that they grow very slowly.

On the same species, Vahalík et al. (2023) published the first detailed **drone** inventory of **Firmihin** forest (Fig. 3), analysing images of a resolution of 1 pixel/8 cm. The researchers counted that there are **35,542 adult trees** in this area, and they estimate that the average age is about 300 years, with some (few) trees over 500 years. In addition to the living trees, the scientists found 2,123 uprooted dead trees (so a total of ca. 18% of dead+alive). Most likely, besides overmaturity and other factors, intensified winds (e.g., cyclones) have affected the population in Firmihin strongly, considering the direction of the fallen trees.

FAUNA - INSECTS

A new genus and two new species of small **planthoppers** (Hemiptera: Caliscelidae) were described, one from Skand and one from Shuab, by Russian researchers (Gnezdilov & Malenovsky, 2023). The genus is called *Oceatra*, and the animals are tiny, not more than 3-4 mm long (Fig. 4). Irungbam et al. (2023) recorded the presence of a nice butterfly on Socotra, *Eurema brigitta*, in English called "the small grass yellow" of the family Pieridae, which is widespread in parts of Africa and Asia. They did DNA research on this species from all around the tropics, and found that the Socotran population derives from Africa.

MARINE ENVIRONMENT - FISH

Small-scale fisheries in Socotra were analysed between 1950 and 2019 by Derrick et al. (2023). The study unfortunately shows that there is a clear trend in this type of fishing (Fig. 5), increasing rapidly over time in the productive waters along Socotra's shores and adding to **overexploitation**. Small-scale catch (individual boats) increased from ca. 1,500 tonnes per year around 1950 to about 3,700 tonnes per year by 2019, which means an **increase** of about 2.5 times (Derrick et al., 2023).

One taxonomical paper by Zajonz et al. (2023a) on the number and distribution of parrotfish species in the Socotra Archipelago was published (Fig. 6). A checklist of coastal fish from Socotra by the same group of authors was uploaded (Zajonz et al., 2023b) on the Global Biodiversity Information Facility (GBIF) website as well.

TOURISM

Three studies were published in 2023 as part of the PhD degree of a Socotri researcher, Ahmed Abdullah Omer. In one study, he assessed **tourists' perception** visiting Socotra (Omer et al., 2023a), based on structured interviews with 410 international tourists asking about their understanding of Socotra's image. In particular, the study assessed expectations versus experience, by questioning what drove visitors to the island and how they felt before and after the visit (Omer et al., 2023a). The results indicate that there is really very little interest among tourists for Socotra's rich cultural heritage, yet a large interest in beach tourism, including diving or snorkelling, and seeing the Dragon's Blood Trees. These kinds of data are crucial to understand and hopefully **change tourist behaviour** to a more responsible, respectful and sustainable type of tourism on Socotra, as negative impacts of tourism on the environment are currently increasing. Some of the small protected areas are impacted by too many tourists (Fig. 7). The conclusion of a second study on products that are bought by tourists in Socotra is similar: little interest or awareness regarding cultural products, yet high interest in natural products (Omer et al., 2023b). A third study (Omer et al., 2023c) interviewed tourists (and FoS members) to understand challenges to tourism, which include solid waste management, low carrying capacity (many tourists arrive at the same time in very small places), and lack of education or training of ecotourism guides.

CULTURE AND HISTORY

One study focussed on the **Hawari Mountain** fortress between Hadiboh and Hawlaf, and more work is ongoing based on recent surveys in collaboration with Socotri GOAM represented by **Ahmed Al-Arqbi**, who is a co-author (Jansen van Rensburg et al., 2023). The ruins of this fortress (Fig. 8), generally called

by local people "the Portuguese fort" of Socotra, was actually not built by the Portuguese as it had been suggested by Doe, but relates to the Al-Mahrah stationed in Socotra. Naumkin (and Sedov) had already stated clearly in 1993 that these fortifications were not Portuguese, but earlier (and with additions during and after the brief Portuguese "occupation"). In the past, FoS took strong action to protect this important cultural heritage from destruction by development, sending letters to local authorities about its value, which eventually helped to save the ruins. However, still there is some development pressure along the slopes towards the fortress.

In addition, an opinion paper on **stories** was published (Belozerova et al., 2023), analysing a newly recorded Socotri story about a "wild" native man on the island who is compared to the wild hero of the Enkidu tale (part of the Akkadian tales in the Gilgamesh-epos). Both tales focus independently on the contact between the wild man and the wider human society, but the stories diverge. In the Gilgamesh story, the man loses his wild nature and survives by adapting to the world. However, in the Socotri story, the hero dies as he is unable to preserve his **wild nature** after the "civilised" world interfered with his life. It is a dark tale, but it is a true one, considering the declining number of people who speak the native Socotri language, and who know the very rich culture and traditions of the islands.

VARIOUS

Some research can be very unusual. A study in 2023, published in not a very high impact scientific journal, was carried out by people who love coffee and Socotra. They did a special experiment with red resin of the Socotran Dragon's Blood Tree based on the knowledge that local people in Socotra chew this against tooth decay (Elaiwa et al., 2023). The researchers, from Sana'a University, dipped cow teeth for one week in Yemeni coffee. Then, they made a special toothpaste, which included some (10%) Dragon's Blood Tree resin, and used this on the coffee-stained cow teeth for 6 hours every day for two weeks, comparing this with the effects of another toothpaste (with a bleaching compound). The conclusion: toothpaste with Socotran Dragon's Blood resin makes teeth a bit whiter after they had been dipped in coffee for a long time. We do wonder how these researchers managed to make the cows to stop drinking amazing Yemeni coffee after a week and then brush their teeth for 6 hours per day!



Figure 3. Using small drones, scientists counted about 35,542 mature Dragon's Blood Trees in Firmihin; photo Petr Vahalik

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Figure 1. Dario La Montagna studying Myrrh trees (*Commiphora*) in Socotra in October 2023. Several endemic tree species will be more restricted to the mountains in future climate scenarios. Photo KVD

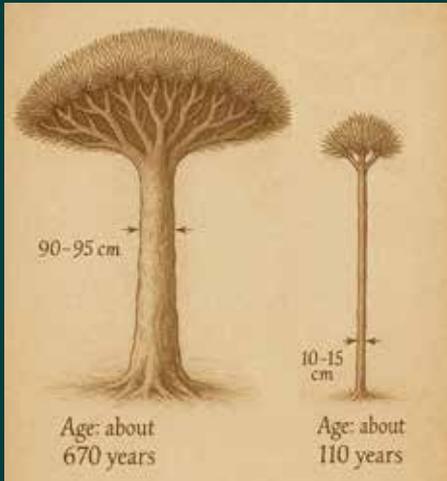


Figure 2. The age of *Dracaena cinnabari* was estimated using the increase of the thickness of the stem. Illustration/drawing generated with ChatGPT.



Figure 6. The Dhofar parrotfish was recorded from Socotra for the first time. Illustration/drawing generated with ChatGPT.

Figure 7. Tourism interests in Socotra are rarely about Socotra's unique history and culture, more about beach and the Dragon's Blood Trees. In addition, there is too much crowding in small areas. More responsible and sustainable tourism is needed, in particular to reduce impacts on environment. Tourist cars in Firmihin, March 2024. Photo KVD

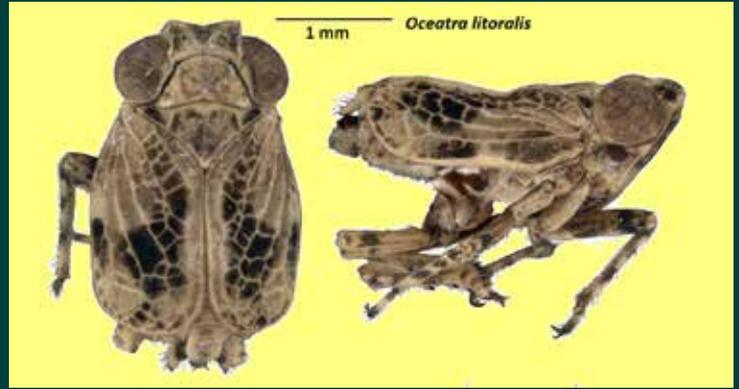


Figure 4. Two new species of tiny planthoppers were described from Shuab and Skant. Image after Gnezdilov & Malenovsky (2023).



Figure 5. Small scale fisheries have increased strongly in the last decades on Socotra. Qalansiyah, March 2024. Photo KVD



Figure 8. The Islamic fortifications on top of Hawari Mountain have been studied using new technologies. Photo Mohamed Amer





ROSH MARINE PROTECTED AREA IN HALAH AND THE LAST HURI IN THE SOCOTRAN SEAS

By Wagdi Omar Ali Ahmed (Association for the Conservation and Development of the Rosh Marine Nature Sanctuary, Halah, Socotra Island (whatsapp +976771355474))

Let me tell you about our home area. **Halah Area** is located along the coast in the northeastern part of Socotra Island. It is mainly inhabited by Socotri **fishermen**, who live in small villages here and who also own goats and produce date palms nearby. Within Halah, you can find the **Rosh Nature Sanctuary**, a protected area about 40 km east of Hadiboh along the road to Riy di Iriseyl, the eastern cape of the island.

ROSH MARINE NATURE SANCTUARY

The coastline is narrow here and mostly rocky, with some sandy areas inhabited by burrowing ghost crabs. Further to the east, there are large dunes at Arher. Rosh Nature Sanctuary is mainly characterised by **coral reefs** that harbour a rich underwater biodiversity. Many species live here that are part of these rich marine ecosystems. More than 40 reef-building coral species have been found here, which include various forms such as shelf corals, branching corals and brain corals. Algae and seaweed are not as common here, they are more typical along the southern coasts of Socotra Island. About **250 marine fish species** have been recorded in Rosh, which is 34% of the total estimated diversity of fish of the archipelago (733 records in 2019). Most of them are **coral reef fish**, including 11 species of the beautiful **butterfly fish**, which are indicators of good coral reef health, in addition to other key marine fauna like sharks, moray eels and sea turtles. Many of these species provide key sources of food and income for local people. Fishing activities in the area are well organised between the fishermen associations of Halah, Iriseyl, and the surrounding fishing zones. Times of fishing and types of catch (sizes, limitations) are very traditional in Halah, as we find these traditions important.

Rosh was declared a Nature Sanctuary, the highest protection level in the Socotra Conservation Zoning Plan, in 2000. Therefore,

all resource uses are done in the most sustainable way possible, to take care of this area in the best way. It is reached by a small trail to the village, on the only paved road in this direction branching off the northern road. The marine **nature sanctuary** is about 8.4 square kilometres in area. It is about 5.2 km long and 0.2 km wide. Two small springs provide water to this area, originating from the limestone escarpments to the south. In the fall, the water amount decreases and home gardens in the area have to be temporarily suspended until the next season.

The Rosh Nature Sanctuary is managed by a local Socotri NGO, the **Association for the Conservation and Development of the Rosh Marine Nature Sanctuary**, whose members live in Halah. The Association works with many international organisations to ensure the best **protection** and sustainable ecotourism providing local income for the area. Women in this association produce **handicrafts** that are sold in local shops.

HAMADEROH SLOPES AND HOQ CAVE

Just south of the coast, the limestone slopes and escarpments (called **Hamadero** area) are covered in dense vegetation, including many endemic and several endangered trees (*Boswellia dioscoridis*, *B. elongata*, *Adenium obesum* ssp. *socotranum*, *Sterculia africana*



Hawksbill turtle at Rosh Marine Nature Sanctuary. Photo by Martin Rejzek



Corals and Tawny Nurse Shark at Rosh Marine Nature Sanctuary. Photo by Martin Rejzek.



The huri before it was restored in the village. Photo by Wagdi Omar Ali Ahmed, February 2021.

var. *socotrana* etc.). It is, according to the Zoning Plan, a sensitive area of specific botanical interest. There are even several Socotran endemics that were described from here, which carry the name "hamaderoensis" (like *Euphorbia hamaderoensis* and *Cissus hamaderoensis*), but they are not restricted to these hills only.

Up the escarpment, at walking distance from Rosh, is **Hoq Cave**, with a rich history. Many archaeological remains have been found here, discovered by Belgian speleologists over 20 years ago, which have revealed ancient connections between Socotra and the rest of the world. There is also a small valley (escarpment) that leads to **Homhil Nature Sanctuary**, where on the plateau there are large (but declining) stands of frankincense trees (*Boswellia elongata*). Various small hiking trails are present from Rosh or from the sand dunes to Hoq, to Homhil and to other areas up on the Momi Plateau. Also the **Riqeleh Socotra Heritage Museum** is very near, which is very interesting if you wish to learn about Socotri culture (see previous Tayf).

The communities in Halah are working together with **conservation projects** for several years to protect endangered trees. In the area there are several fenced areas where plants are

protected from grazing, for example on the way to Hoq. These areas are important for the study of regeneration of endangered plants.

THE LAST HURI IN THE SEA

At Rosh, we have saved the last intact **huri** of the islands we use in the sea. The huri is the name of the **traditional ancient wooden Socotri canoe**. Most of these small wooden boats have been lost because they were replaced by more modern boats around the island, so they were decaying on the coast and gradually disappeared. We recovered an intact huri from a nearby local fisherman in 2021. With a personal donation by Dr Kay Van Damme and Miss Haifaa Abdulhalim, we bought that traditional boat and restored it completely in the traditional way (traditional oils), to be seaworthy and we equipped it with the traditional wooden ores. Now, it is the **only boat** of this type that is **actively being used**. It is truly amazing. Children use it for **recreation** and we also use it for **local fishing**, because the boat can lay quite deep and stable in the water. For a small fee, visitors can also have a **unique ride** in this traditional boat, feeling what it was like to be a Socotri fisherman in previous generations. The fees are used to maintain this boat and to support the villagers. Currently, the boat is in excellent shape and condition.

THE ROSH SHOP

Rosh community built a small **shop** along the tarmac road to Arher, to offer some local natural and cultural products from Socotra. This shop is open all year to visitors, and it is aimed to help the local people and provide an income from local products and handicrafts. The shop has been supported by the organisation HAD and the Franklinia Foundation project. The latter project helps to support the protection of frankincense trees and other endangered plant species of Halah and Hamaderoh.



The last actively used huri of Socotra is restored and saved in Halah. Children love it and visitors can use it for a small fee and try it out in the way Socotri did for generations. Photo by Wagdi Omar Ali Ahmed, March 2021.

Local traditional products include **pottery**, items made of **palm leaves**, **local honey** and sustainably harvested **frankincense resin** from the local area. It will not only help the communities in Halah but also all the communities from the areas close to it. All of the revenue goes back to **nature protection and sustainable development** of the people in Socotra, as it is entirely locally managed.



The shop with local handicraft and natural products along the Halah road near Rosh while it was still under construction, now established thanks to the support of the local community, HAD, the Frankinia Project, and other donors. Photo by Wagdi Omar Ali Ahmed, July 2024.



Preparation of the shop went very fast, in only a few months it transformed completely. Photo by Wagdi Omar Ali Ahmed.

Ensuring support for constructing the shop and realising the idea, has been a long process for the local community. Now it is a reality, and with certainty of income going back to local development and conservation efforts. As they say in Italian, a phrase I use often: “*piano, piano, si va lontano (e chi va piano, arriva a la montagna!*)” – slowly, slowly, one goes far (and he who goes slowly, reaches the mountain!).

VISITORS

Visitors are **welcome** to Halah and to Rosh, to dive and to see the fascinating coral reefs and colourful fishes, to hike up along the escarpment, and to take a short trip in the last traditional wooden canoe in the Socotri sea. But, we would like to ask all visitors to remain fully **respectful** to the Socotri culture and to the sensitive

natural beauties of Rosh, Hoq and Homhil, on the sea, coast and inland. Also be mindful and cautious of the heat, the sun and the rocky terrain with slopes – each year, some tourists have accidents because they underestimate the warmth or the rocky hikes in Socotra, it is still a strongly arid environment. We also request all visitors to use **local guides**. In these areas, we aim to keep everything **clean** (in particular, the beach) and healthy for the future. We ask visitors to be fully understanding and respectful for the local culture and nature. We ask all visitors to be **ecologically mindful**, not aiming for the sun and the beach only as the priority and not only wanting to eat (sometimes endangered) seafood, but to see the truly beautiful yet highly vulnerable nature and culture of Socotra. You can see birds, watch dolphins, and observe the amazing nature in all of its aspects, but please with the utmost respect for its fragility.

Any collection of **sea shells** and **plants** is forbidden (incense and resin are allowed to take), as well as discarding rubbish or destroying or disturbing any wildlife or even geological features (like stalactites and stalagmites). Aim for low impact tourism with no footprints and just take photos and some handicrafts and natural products that are allowed and sustainably made or collected. We ask all visitors to keep on the **paths** designated by the local guides (e.g. to and inside Hoq or along Hamadero), for your safety. The visit will be much richer with a true immersion and respect for Socotra’s fragile ecosystems which we, as Socotri, live in and depend on. Welcome!



Wagdi looking at the sea from the community house in Halah where meetings take place. Photo KVD, September 2024.

THANKS

On behalf of Rosh Community, we thank HAD, WFP (World Food Programme), the German Cooperation Deutsche Zusammenarbeit (BMZ/GIZ), FoS and the Frankinia Project Team for their continuous support for conservation of the biodiversity and nature awareness activities in Halah. Of course, also Tayf is available in the shop (for reading for free, not for sale!).



HOPE FOR SOCOTRA'S FRANKINCENSE TREES: UNVEILING THE SECRETS OF SEED GERMINATION FOR CONSERVATION

By Lukáš Karas

The Socotra Archipelago, a UNESCO World Heritage site, is often called the “Galapagos of the Indian Ocean” thanks to the unique and extraordinary biodiversity. Among many remarkable botanical treasures are the frankincense trees (genus *Boswellia*). Of the 24 species described so far, 11 are endemic to Socotra Archipelago. Unfortunately, these remarkable trees are facing increasing threats, from unsustainable frankincense collection to overgrazing by livestock and the undeniable impacts of climate change.

Recognizing the urgent need to protect these species, a recent study, done by the team composed of local and international researchers, studied the viability and germination ability of seeds from nine different *Boswellia* taxa collected across the island (Hamdiah et al., 2024). The germination trials were conducted directly on Socotra, making the findings highly relevant for conservation of the island's unique flora. This research offers a glimmer of hope, providing crucial insights that frankincense trees can still be saved.

Frankincense trees have been known since ancient times as a source of frankincense, oleogum or resin, that is oozing from a trunk. Resin serves as a protection from infection, herbivores or insect attack. But ancient humans found out that they can also use the resin themselves. The usage of frankincense is documented in many ancient texts, it was used as a medicine to treat wounds or to stop bleeding, cure various diseases or burned in frankincense burners in traditional rituals. It is still used as a tool to ward off evil spirits. Recent studies

have concentrated on the use of substances in frankincense to treat cancer or post-COVID symptoms. Another notable usage is of essential oils in perfumery or cosmetic products.

The most known species is definitely *Boswellia sacra* from south of Arabian peninsula and Horn of Africa. But there are also other species, such as *Boswellia serrata* from India, *B. frereana* from Somalia, and *B. papyrifera* from Eritrea, Ethiopia, and Sudan. On Socotra, the main resin-producing species is *Boswellia elongata*, but according to Socotri people, the best frankincense is collected from *B. socotrana*.

But why do we need to study the seeds, their viability and germination rate? Like many wild trees, Frankincense trees depend on natural regeneration. That means that the natural population is renewed by seeds naturally, without human interventions. In an ideal world, this process relies on older trees producing seeds, which then germinate and grow into young trees, eventually replacing the dying older trees. However, many factors disrupt this natural cycle, impacting it

negatively. Overgrazing, in particular, poses a significant threat: free-ranging livestock actively seek out and damage young frankincense seedlings, often beyond recovery. Without these vital young plants, the tree population lacks the crucial component for natural renewal. Some might say that herbivores are natural part of ecosystems, but with this intensity and in combination with other negative factors, populations of trees do not stand a chance.

When natural regeneration is hindered, we must turn to artificial regeneration. This involves cultivating young plants in nurseries and then transplanting them into the wild. However, even these planted seedlings require protection, such as individual fencing or larger fenced enclosures, to shield them from grazing animals. But before any of this can happen, we first need to confirm if the seeds themselves are “viable” — meaning capable of germinating and growing into a new plant.

Despite their importance, surprisingly little has been known about germination rates of Socotra’s endemic frankincense trees. This research was thus critical to determine if their seeds could germinate, what their germination rates were, and whether these rates varied among different species or locations.

were carefully extracted and stored in a seed bank. The subsequent testing of seed viability and germination took place on Socotra, under controlled experimental settings.

The viability (ability of seeds to grow) and germination capacity of seeds was examined via germination trials. This experiment was conducted in controlled conditions, and the seeds were germinated in Petri dishes on a filter paper. Each Petri dish contained exact number of seeds – 20 seeds per Petri dish in 5 replicates (repeated samples), in total 100 seeds per locality/species. Petri dishes were kept in controlled conditions with 8 hours of light and 16 hours of dark and each day, the seeds were observed to see, if any of the seeds already germinated. If the seed had already developed a root, it was carefully removed and planted in a soil, and marked as germinated. This was repeated for 21 days and at the end, the remaining ungerminated seeds were subjected to a cut test (a method to check if seeds are full or empty). That means that each seed was cut in half to see what is inside. Seed could be fresh (with solid, greenish inside, assuming that the seed would later germinate), empty (without embryo and incapable of germinating), dead (the inside was soft, brownish, incapable of germinating



Map of localities where seeds were collected

During 2020 and 2021, seeds of nine endemic Frankincense taxa were collected from 35 localities. We focused on these species: *Boswellia ameero*, *B. bullata*, *B. dioscoridis*, *B. elongata*, *B. nana*, *B. popoviana*, *B. scopulorum*, *B. socotrana* subsp. *socotrana*, and *B. socotrana* subsp. *aspleniifolia*. In each locality, we gathered ripe fruits directly from the trees and dried them naturally. After that, seeds

due to decay), and damaged by insect (the seed has visible insect exit hole or containing insect, incapable of germinating).

The study revealed some promising and encouraging results, indicating that the seeds of endemic Socotran species are capable of germinating. While germination rates varied significantly among different species and even among populations of the same species, and

between the two years of study, this variation itself offers valuable insights into the ecological factors at play. Notably, *Boswellia socotrana*, in both its subspecies (*B. socotrana* subsp. *socotrana* and *B. socotrana* subsp. *aspleniifolia*), showed the highest germination rates. In 2020, approximately 90% of germinated and fresh seeds were observed in *B. socotrana* across tested sites. Even in 2021, these subspecies, along with *B. dioscoridis*, achieved impressive germination rates of 70-80%. Interestingly, *B. socotrana* subsp. *aspleniifolia* seeds not only germinated at a high rate but also did so relatively quickly, with most full seeds sprouting within four days of the experiment's start. This "germination energy (how quickly seeds begin to grow)" is a positive indicator for rapid establishment in suitable conditions. Other species, such as *B. nana* and *B. elongata*, also demonstrated good germination energy (how quickly seeds begin to grow) in certain localities.

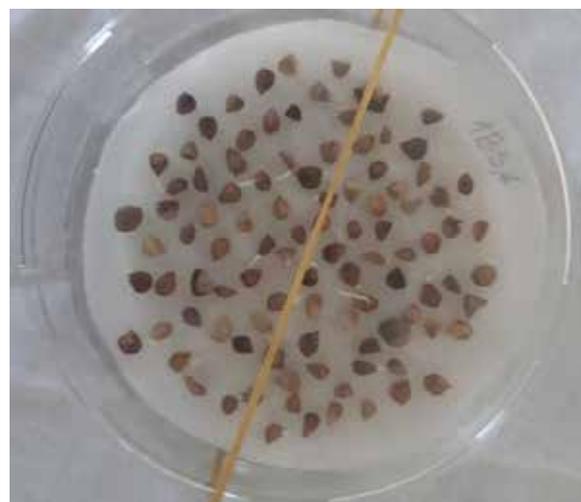
However, not all species performed equally well. Some, including *B. bullata*, *B. elongata*, and *B. popoviana*, showed much lower proportions of germinated seeds, with a significant number of seeds being empty. This issue of empty or non-viable seeds is not unique to Socotra and has been observed in other frankincense



Salem Hamdiah is preparing germination trials in project house on Socotra

tree species elsewhere. The presence of empty seeds could be influenced by various external factors, such as insufficient humidity during seed development. Additionally, some seeds were found to be dead or damaged by insects. A key takeaway is that the factors affecting seed viability (ability of seeds to grow) and germination are complex, involving both the inherent biology of the species (intrinsic factors) and external environmental pressures (extrinsic factors). While low germination rates have been reported for other frankincense species globally, our study shows promising potential, especially when considering the "full" or viable seeds.

TURNING KNOWLEDGE INTO



Petri dish with seeds of *Boswellia socotrana* subsp. *aspleniifolia*, with some already germinated seeds

ACTION

The findings of this study offer crucial direction for the conservation of Socotra's unique frankincense trees. The fact that seeds from most of the endemic frankincense trees on Socotra can germinate, and some with high success, indicates a strong potential for natural regeneration, provided the right conditions are met and threats are mitigated. Conducting the trials on Socotra ensured that the outcomes could be readily used for planning local reforestation and restoration programs "in situ", protecting the trees in their natural environment.

Despite promising seed germination in the lab, the lack of young *Boswellia* trees in the wild remains troubling. In places like Homhil and Dixam, mature trees dominate the landscape, but seedlings are scarce or absent.

BUT WHY?

- Goat Grazing: Perhaps the biggest threat to regeneration is grazing by free-ranging goats. Even when seeds sprout, the tender shoots are quickly eaten.
- Harsh Conditions: Young seedlings need water and shade. Without it, they may dry out and die



Example of seeds after cut test (seeds of *Boswellia sacra* from Oman), A: dead seed, B: empty seed, C and D: seed damaged by insect (photo by Lukáš Karas)

within days or weeks.

- Soil erosion: In some parts of Socotra, thin or degraded soils offer little support for young trees to establish roots.

NEXT STEPS FOR RESTORATION

The good news is that the seeds of most frankincense tree species on Socotra still have the ability to germinate. This means that, with the right support, natural regeneration is possible. Here's what could help:

- Protect Existing Populations: Efforts can focus on safeguarding mature trees that produce viable seeds, particularly those species showing higher germination rates.
- Manage Grazing: Reducing the impact of overgrazing, especially in areas where young seedlings would naturally establish, is paramount. Livestock can hinder the survival of delicate seedlings, even if seeds successfully germinate.
- Support Reforestation: The knowledge gained about germination rates and energy confirms that all endemic frankincense tree species produce

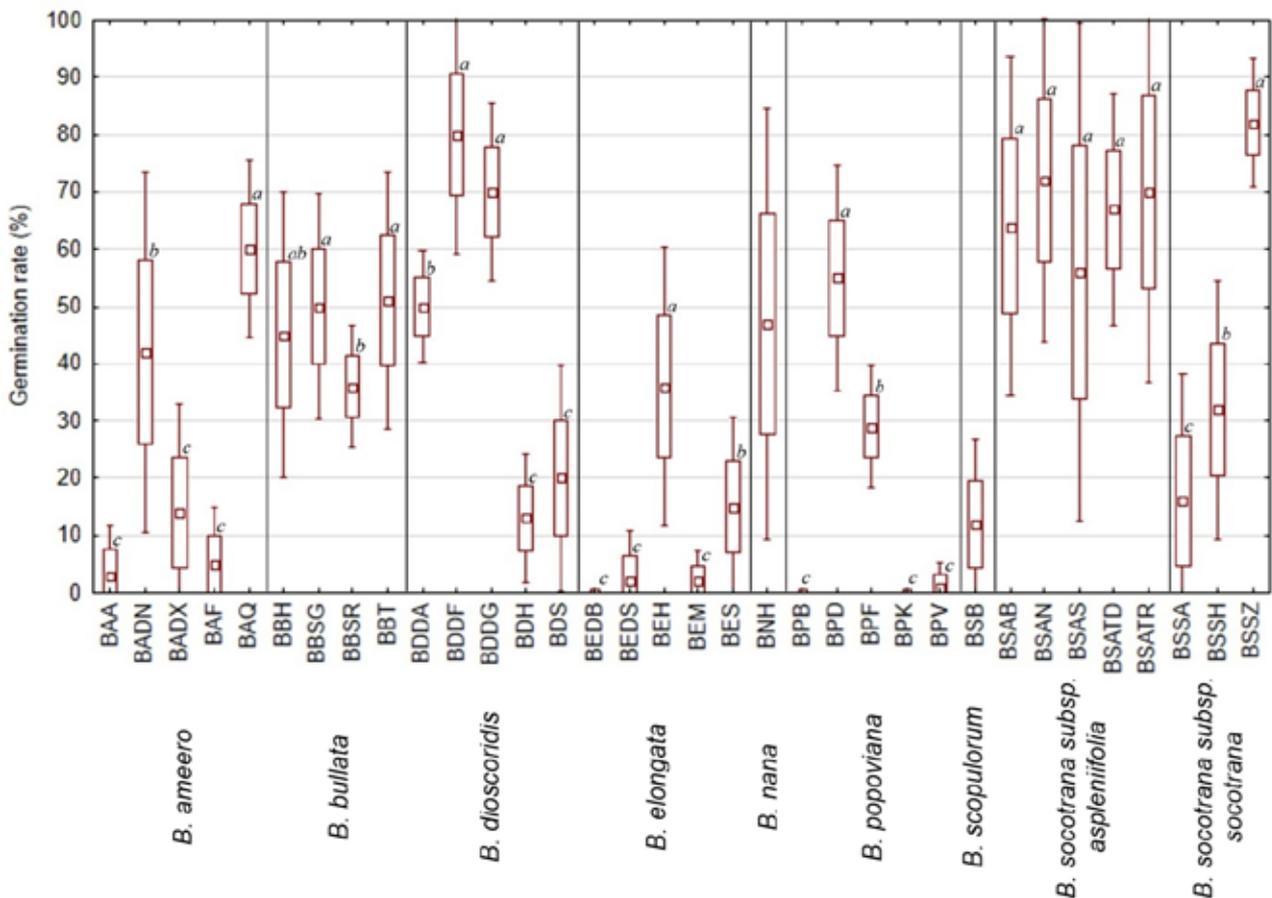
at least some viable and germinable seeds and those seeds can be used in nurseries to produce young seedlings that can be planted in the wild.

- Promote Sustainable Practices: Continuing the tradition of collecting naturally oozed resin or establishing a sustainable method of resin collection. Trees need time to regenerate after tapping and this sustainable method would achieve the balance between production and regeneration of trees.

SEEDS OF HOPE

Socotra's frankincense trees have adapted to grow in some of the harshest environments on Earth. Their twisted trunks and fragrant resin tell stories of resilience -and now, with care and cooperation, their seeds may tell stories of renewal.

If protected from grazing, supported by community replanting, and understood more deeply through ongoing research, these iconic trees can continue to thrive - for the benefit of people, wildlife, and future generations of Socotri people.



Seed germination rates of selected frankincense tree species (graph after Hamdiah et al. 2024)

Further Reading

Hamdiah, S., Karas, L., Houšková, K., Van Damme, K., Attorre, F., Vahalík, P., Habrová, H., Lvončík, S., Eler, K., & Maděra, P. (2022). Seed Viability and Potential Germination Rate of Nine Endemic *Boswellia* Taxa (*Burseraceae*) from Socotra Island (Yemen). *Plants*, 11(11), 1418. <https://doi.org/10.3390/plants11111418>



OVERTOURISM AND FIRE RISKS THREATEN FIRMIHIN DRAGON'S BLOOD TREE FOREST

By Kay Van Damme & Petr Madera

Roqeb di Firmihin (Firmihin Plateau) harbours the last piece of Dragon's Blood Tree forest ecosystem in the world. The vegetation has *Dracaena cinnabari* as a dominant tree species, in addition to several endemic frankincense trees and a rich understory including endemic *Croton*, *Cissus*, *Aloe* and other species. This habitat also harbours a wide range of endemic vertebrate and invertebrate species, and it is an important area for local tribes and for visitors. However, recently, more and more tourists are visiting Firmihin, and this development may pose new threats for this important Protected Area.

FIRE IN FIRMIHIN

We observed direct consequences of arson in Firmihin on February 28th, 2024. Direct charring of several mature individual *Dracaena cinnabari* trees was visible next to the road and we saw the **destruction by fire** in nearby areas among endemic plants in the understory. One tree on the road was completely destroyed and still smouldering, the others had clear damage by fire at the basis and parts of the stem. The damage was not accidental. We could see at least four separate individual heat sources within the same area and wood was still smoking. The damage was reported by our Socotri friend and colleague Mohamed Amer to local police and to EPA. Motivations for arson inside the vulnerable Dragon's Blood Tree forest ecosystem of Firmihin, are unknown; the people who did this were never identified. Some attributed the fires to a local tradition to deter feral cats, to protect young goats. However, this traditional approach has not been practiced in Firmihin for several decades, and was never of this type (it never directly damaged the trees or entire areas). Others said that the fire was

the direct result of people being unhappy with the increase of local tourism in the area, which indeed has been larger through the expansion and promotion of camp sites. The arson reached social and national media in March 2024. When we saw these effects, only local communities, tourist guides, western tourists, and scientists were present in Firmihin. Later evaluation of the damage in the same area (May to September 2024), indicated that the affected trees had died as a direct result of the fire. This is likely because of the heat damage to the (superficial) *Dracaena* root





systems. The understory had not recovered; considering the intensity of grazing and the difficulty of regeneration of vegetation in Socotra, it is **unlikely to recover**. In addition, the collection of firewood for tourists depletes nutrients, destroys microhabitats in the forest and creates a new form of competition for scarce firewood with local people. Wildfires can be devastating to the xeric vegetation. There is currently no **awareness** among tourists or tourism agencies regarding the potential impacts. Whichever the reason was, and whoever did it, fire is **highly dangerous** in Firmihin especially during the dry season. It could destroy the entire forest. Alarmingly, many tourists are proud to show campfires under Dragon's Blood Trees on their Instagram. This should be **strongly discouraged** by local authorities, and we expect responsible tourists and local guides – no fire should be near any of these trees, because they are very sensitive to the effect of fire when the heat destroys the water transport routes from roots to leaves in the crown.

OVERTOURISM

We observed during recent visits in Firmihin that there are more and more tourists, in particular going to the upper camp, where recently a (non-functional) toilet was built. As a result, several impacts on the area are visible. First of all, there is a lot of **rubbish**, which is also really upsetting local communities. Despite tourism being promoted inside the area and the potential benefits, many people from the area have expressed that they are strongly displeased with the intensive tourism traffic and the “rubbish left by tourists” who are “using Firmihin as an open-air toilet”. It is true, as in some areas even the smell is terrible and there is toilet paper everywhere. In February 2024, large groups of tourists were present, staying mainly at the upper camp in Firmihin.

As a result of the intense traffic (sometimes 50-100 cars per day!), and because it is very dry here, a lot of **dust** is settling on the trees along the road through the area. This dust is highly damaging, because the trees are not cleaned by rain so there can be less light on the leaves, which affects photosynthesis needed by the plant to survive. Dragon's Blood Trees are plants with an extremely high light-demand, therefore long-term exposure to dust covering the leaves, will severely affect their vitality.



SUGGESTIONS

- ★ There should be a much greater **awareness** towards the risks of fires in Firmihin. Any fires within 20 m of any tree or understory should be strongly forbidden.
- ★ As when tourism started in Socotra, in the early years of 2000, **tourist traffic should not be allowed inside Firmihin**. The entrance should be controlled by a gate. Tourists should camp outside and below the area, and visit by foot and back.
- ★ Tourists should be fully responsible for their own rubbish and make fire only in designated areas. Much greater respect to nature and the local culture and communities are required. Everything they bring, they should also take away.

Please take better care of this unique ecosystem!

CONTACT INFORMATION

Friends of Soqotra (FoS)

The Friends of Soqotra (UK Charity Number 1097546) was formed in 2001. Its distinctive rationale is to bring together people with backgrounds in scientific research and those with a more general interest and develops the synergies between them in order to:

- Promote the sustainable use and conservation of the natural environment of the Soqotra island group.
- Raise awareness of the archipelago's biodiversity and the unique culture and language of the islanders
- Help improve the quality of the islanders' communities and support their traditional land management practices



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FoS Website

The Friends of Soqotra website
is maintained by the website
subcommittee including Dana
Pietsch and Luca Malatesta. It
provides information on completed
and ongoing scientific research on
the Soqotra Archipelago including
data, bibliography and contacts of
institutions and research teams. The
structure and layout also includes
a page in Arabic, which gives some
general information about FoS. The
constitution is included in Arabic as
well. All financial reports and account
information are public on the website.

*If you would like to submit content for the
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