

## Section 4

# Conservation Status of *Boswellia* species

It was the intention of this programme to facilitate Red List Assessments and Green Status Assessments globally for all species of *Boswellia*, and further to undertake National Red List Assessments for those species that occur in multiple States. This intention required acquiring as much distribution data as possible, and further to gather published and unpublished information about the status of these species across their ranges with regard to the IUCN Red List Criteria requiring assessment.

During the programme, several advances were made by other research groups. Firstly, a programme focused on the endemic *Boswellia* species of Soqatra was undertaken by a team from Mendel University in Brno, Czechia resulting in the publication of a range of details about those species and full Red List Assessments (see Madera *et al* 2024). The assessments cannot be re-examined as the data used to complete them is as yet not in the public domain. Secondly, advances have been made by the Global Tree Assessment, and this has resulted in an assessment being published for *B. dalzielii*.

Our approach to gathering information about the distribution, threats and declines of each species has been first to gather distribution information by (a) locating and geo-referencing as many herbarium specimens as possible as these are robust in terms of determination and in the face of future taxonomic change, and (b) by thoroughly searching the literature and online databases to add field and literature distribution records although this second category of records is not robust to taxonomic change and in some cases must be treated with caution in complementary analyses. Secondly, we made contact with range of actors in all range States to ascertain whether any additional knowledge exists about these species directly and whether there are any active research and conservation programmes ongoing. This also has the benefit of directly involving range State actors in conservation assessment and any subsequent decision making and action in those States as opposed to assessments conducted remotely and potentially published without the knowledge of those range States. This is especially pertinent to National Assessments, very few of which have been undertaken previously: while a number of range States have published National Red Lists these rarely contain information on taxa that are not endemic or are not assessed as threatened. It is especially pertinent that assessments involve range State actors and stakeholders because the requirements and actions under global conventions such as the Convention on Biological Diversity (CBD) and the Convention on International Trade in Endangered Species (CITES) are acted upon at the National level. Further, National Assessments are used by many States to prioritise conservation actions, especially where a species is threatened in a given territory even though it is not threatened globally.

Having gathered distribution data, literature and prior assessments were consulted along with field surveys undertaken as part of this programme to conduct draft assessments for all species. Assessments were undertaken in conjunction with Prof Mats Thulin, who published draft assessments previously (Thulin, 2020).

Species Distribution Models were consulted for widespread species to ascertain whether the AOO was representative or not.

## Section 4.1

### Global Assessments

Table 4.1 shows all previous, unpublished and current draft assessments. Differences are highlighted below and in more detail in Appendix 4.1.

All new assessments have been added to the IUCN Species Information Service database from which all assessments are submitted for review by the IUCN Red List Unit.

For those species not endemic to Soqotra, few of the assessments have changed. *B. dalzielii*, *B. rivaie* and *B. serrata* have been upgraded from Least Concern to Near Threatened based upon gathered evidence of various threats leading to a decline in some circumstances that could potentially lead to a threatened status if not monitored and managed. This is despite these species having large distribution ranges. Final assessments will depend upon more detailed information supplied by range State actors.

*B. ogadensis* has been downgraded from Critically Endangered to Endangered based upon published survey work that identified additional sub-populations and numbers of mature individuals.

Species endemic to Soqotra have been universally upgraded since their last formal assessment in 2004 based upon a large amount of data collection and subsequent analyses (Madera *et al*, 2024). However, it should be noted that not all assessments are directly comparable with previous assessments: most assessments have used contemporary data and not included previous distribution records for comparison, and several taxa have undergone taxonomic change. These include *B. bullata* which has been split into three taxa (*B. bullata*, *B. samhaensis* and *B. scopulorum*), *B. popoviana* which has been split into two taxa (*B. popoviana* and *B. hesperia*) and *B. socotrana* which has been split into two taxa (*B. asplenifolia* and *B. socotrana*).

Therefore, the most valuable assessments are those that (a) recognise significant threats in some localities even for widespread species warranting an assessment as Near Threatened, and (b) assessments for species never previously assessed including the widely traded *B. frereana* and *B. serrata*.

## Section 4.2

### National Assessments

Assessments at National Level for those species that occur in more than one State are given in Appendix 4.2.

Table 4.2 summarizes National Assessments by species and by country.

The majority of countries that have published Red Lists have undertaken assessments only for endemic species or those already considered to be rare or at risk. As such very few assessments have been previously attempted at the national level. Assessments summarized in Table 4.2 show that for the majority of species enough data is now available to make draft assessments, and these will be completed and published independently once all range State comments have been incorporated.

Species	Current RLA (date)	Draft RLA Thulin (2020)	Draft/New RLA 2024
<i>B. dalzielii</i>	LC Least Concern 2024	LC Least Concern	NT Near Threatened
<i>B. frereana</i>	Not Evaluated	VU C1	VU C1
<i>B. globosa</i>	Not Evaluated	VU D1	EN B1ab(iii)+2ab(iii)
<i>B. microphylla</i>	Not Evaluated	LC Least Concern	LC Least Concern
<i>B. neglecta</i>	Not Evaluated	LC Least Concern	LC Least Concern
<i>B. occulta</i>	Not Evaluated	EN B2a	EN B1ab(iii)+2ab(iii)
<i>B. ogadensis</i>	CR B1ab(iii) 2021	CR B1ab(iii)	EN B1ab(iii)+2ab(iii)
<i>B. ovalifoliolata</i>	VU A2cd; B1ab(I,ii,iii) 2015	VU A2cd; B1ab(I,ii,iii)	VU A2cd; B1ab(I,iii)+2ab(I,iii)
<i>B. papyrifera</i>	VU (not published)	VU A2cd+3cd	VU A2cd+3cd
<i>B. pirottae</i>	VU C1 2021	VU C1	VU C1
<i>B. rivaie</i>	LC Least Concern 2021	LC Least Concern	NT Near Threatened
<i>B. sacra</i>	NT Near Threatened 1998	VU A2cd	NT Near Threatened
<i>B. serrata</i>	LC Least Concern (not published)	LC Least Concern	NT Near Threatened
<i>B. ameero*</i>	VU B2ab(ii,iii) 2004	EN B2ab(v)	EN B1ab(iii,iv,v)+2ab(iii,iv,v)
<i>B. aspleniifolia*</i>	Not Evaluated	EN C1	EN B1ab(I,ii,iii,iv,v)+2ab(I,ii,iii,iv,v)
<i>B. bullata*</i>	VU D2 2004	EN D	EN B1ab(iii,v)+2ab(iii,v); C2a(ii)
<i>B. dioscoridis*</i>	VU D2 2004	EN C1	EN B1ab(I,ii,iii,iv,v)+2ab(I,ii,iii,iv,v)
<i>B. elongata*</i>	VU B2ab(iii) 2004	EN B2ab(v)	EN B1ab(I,ii,iii,iv,v)+2ab(I,ii,iii,iv,v)
<i>B. nana*</i>	VU D2 2004	CR D	CR B1ab(v)
<i>B. popoviana*</i>	VU D2 2004	EN D	EN B1ab(I,ii,iii,iv,v)+2ab(I,ii,iii,iv,v)
<i>B. samhaensis*</i>	Not Evaluated	CR C2a	CR B1ab(v)+2ab(v); C2a(ii)
<i>B. scopulorum*</i>	Not Evaluated	CR D	CR B1ab(iii,v); C2a(ii)
<i>B. socotrana*</i>	VU D2 2004 <i>sensu lato</i>	EN C1	EN B1ab(I,ii,iii,iv,v)+2ab(I,ii,iii,iv,v)
<i>B. "hesperia"*</i>	Not Evaluated	CR D	CR B1ab(iii)

Table 4.1. Comparison of current and new or draft IUCN Red List Assessments for all species of *Boswellia*. Assessments noted as “not published” means that a preliminary assessment has been conducted but has not been reviewed or published on the IUCN Red List by the IUCN Red List Unit. VU = Vulnerable. EN = Endangered. CR = Critically Endangered. \*Assessments undertaken by Madera *et al* (2024) for Soqotran endemics are indicated and are currently under review. The assessment for *B. socotrana* conducted in 2004 was prior to that species being split into two taxa, both of which were assessed independently as sub-species by Madera *et al* (2024) noted here as *B. aspleniifolia* and *B. socotrana*. Not Evaluated indicates that no assessment had ever been attempted previously at the date indicated.

Species & range State	Previous Assessment	Draft Assessment
<i>Boswellia dalzielii</i>		
Benin	NE Not Evaluated	NT Near Threatened
Burkina Faso	NE Not Evaluated	NT Near Threatened
Cameroon	NE Not Evaluated	LC Least Concern (pending)
Chad	NE Not Evaluated	NT Near Threatened (pending)
Ghana	NE Not Evaluated	EN Endangered
Mali	NE Not Evaluated	DD Data Deficient
Niger	NE Not Evaluated	NT Near Threatened
Nigeria	NE Not Evaluated	LC Least Concern
Senegal	NE Not Evaluated	DD Data Deficient
Togo	NE Not Evaluated	NT Near Threatened (pending)
<i>Boswellia microphylla</i>		
Ethiopia	NE Not Evaluated	LC Least Concern
Kenya	NE Not Evaluated	LC Least Concern
Somalia	NE Not Evaluated	LC Least Concern
<i>Boswellia neglecta</i>		
Ethiopia	NE Not Evaluated	LC Least Concern
Kenya	NE Not Evaluated	LC Least Concern
Somalia	NE Not Evaluated	LC Least Concern
Tanzania	NE Not Evaluated	NT Near Threatened (pending)
Uganda	NE Not Evaluated	DD Data Deficient (pending)
<i>Boswellia papyrifera</i>		
Cameroon	NE Not Evaluated	DD Data Deficient (pending)
Chad	NE Not Evaluated	LC Least Concern
Central African Republic	NE Not Evaluated	DD Data Deficient (pending)
Eritrea	NE Not Evaluated	VU Vulnerable
Ethiopia	NE Not Evaluated	EN (Criterion A)
Nigeria	NE Not Evaluated	DD Data Deficient
South Sudan	NE Not Evaluated	DD Data Deficient (pending)
Sudan	NE Not Evaluated	Threatened (pending)
Uganda	NE Not Evaluated	DD Data Deficient (pending)
<i>Boswellia rivae</i>		
Ethiopia	NE Not Evaluated	LC Least Concern
Kenya	NE Not Evaluated	NT Near Threatened (pending)
Somalia	NE Not Evaluated	LC Least Concern
<i>Boswellia sacra</i>		
Oman	NT Near Threatened	NT Near Threatened
Somalia	NE Not Evaluated	NT Near Threatened
Yemen	NE Not Evaluated	NT Near Threatened
<i>Boswellia serrata</i>		
India	Provincial Assessments*	NT Near Threatened
Pakistan	NE Not Evaluated	DD Data Deficient
Sri Lanka	CR/PE Possibly Extinct	CR (pending)

Table 4.2 Summary of National Assessments by species and range State. \*Some provinces in India have undertaken assessments at a local scale; these have been consulted when assessing *B. serrata* across India.

Draft Assessments at both global and national levels have been sent to range State actors and experts for consideration, including previous assessment authors. Following incorporation of responses, the draft assessments will be updated in SIS and submitted for review and publication by the IUCN Red List Unit.

Funding to facilitate a range State stakeholder meeting was sought and tentatively acquired, but this funding source is now no longer available. This meeting was designed to foster wide ranging discussions about *Boswellia* conservation and sustainable use as well as contributing to a face-to-face Red Listing workshop. The Kenya CITES Authority offered to host this meeting, but if this is to take place following recommendations from this report alternate funding sources will be required. Hosting such a meeting would have been beyond the financial scope of this programme. It would require funds for at least 1-2 (potentially more) attendees from each of 23 range States to travel to Kenya and accommodation and subsistence while there, as well as costs for hosting the meeting, preparation of materials and the provision of translation services. It would also have been beneficial for attendees out with Range States to attend including experts, commercial entities and potential importing nations.

### Section 4.3

## Green Status Assessments

Green Status Assessments are designed to incorporate Red List Assessments alongside subunits of information on conservation actions as a measure of future conservation gains that may be possible to ameliorate any noted declines. This requires more detailed information at a sub-regional level, and it was hoped this would also be possible at a range State stakeholders meeting. However, for all species other than those that are narrow endemics, Green Status Assessments require sub-regional threat and conservation information to facilitate scoring, and this has proved extremely difficult to acquire. Even using State boundaries as sub-units of widespread species – not a recommended way to produce such assessments – is difficult as in some states very few records of species are available and little knowledge about them is held locally. A decision as to whether Green Status Assessments can be completed with a reasonable degree of accuracy and subsequent utility will be taken once all range State responses have been received.

### Section 4.4

## References

Madera P, Vahalik P, Hamdiah S, Huskova K, Sekava J, Attorre F, La Montagna D, De Sanctis M, Netek R, Bongers F, Rivers M, Sebesta J, Amar M, Keybani S, Shanayeghen M, Van Damme K (2024) Distribution, ecology and threats assessment of 11 endemic frankincense tree taxa (*Boswellia*) in the Socotra Archipelago (Yemen). *Plants People Planet* 6: 1552-1571.

Thulin (2020) The genus *Boswellia* (Burseraceae): the frankincense trees. *Symbolae Botanicae Upsalienses* 39.