Towards Red Lists of organisms and of ecosystems in Occupied Palestine

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An annex to "An updated protected area network for Palestine: challenges and opportunities" Report by the Palestine Institute for Biodiversity and Sustainability, Bethlehem University Team Led by Prof. Mazin Qumsiyeh and involve Prof. Zuhair Amr, Mohammed Abusarhan, Duaa Husein, Mohammad Najajreh, Johanna Gideon, Elias Handal, with support from Staff of the Environment Quality Authority Dr. Issa Musa Albaradeiya, Mohammed Mahasneh, and Khaled Salem

Introduction

IUCN Red Listing is important for national planning processes such as area conservation for informing biodiversity-inclusive spatial options (e.g. identifying important plant or bird areas) and informing temporal options for example relating to previous destruction or threat analysis so as to construct restoration plans (Hoffman et al. 2008). Red listing ecosystems is critical for protected area designation and management (Keith et al. 2015) and for providing data for natural capital accounting.

A preliminary meta- analysis by AlSheikh and Qumsiyeh (2021a) identified 600 species that are of concern in the Israeli occupied West Bank of which 187 are endangered, 171 very rare species, 238 rare (R, found in 11-30 sites), and four already extinct in this area. This provides raw material for proper plant Red List analysis based on IUCN criteria. However, new rare plants are being reported from our area regularly (AlSheikh and Qumsiyeh 2021b; AlSheikh and Qumsiyeh 2022). As we noted (AlSheikh and Qumsiyeh 2021a), plants "provide the loudest alarm bell for a deteriorating environment in need of protection. We argue that protection is feasible: 1) in situ in the declared protected areas which are just beginning to be studied and managed properly, 2) in situ in special areas of rich biodiversity that would be informally protected, 3) ex situ in botanic gardens such as that at the Palestine Institute for Biodiversity and Sustainability." Red listing to start with plants and then to animals and ecosystems in Occupied Palestine would help conservation efforts (EQA, National Biodiversity Strategy and Action Plan 2022). This will help us join the global efforts to "reverse the red" (Reversethered.org).

In designing red list for our areas, we believe the work should complement the Israeli one and the Jordanian Red list work (see http://royalbotanicgarden.org/sites/default/files/files/Jordan%20Plant%20Red%20List%20(email)%20-%20Vol%201.pdf)

Methods

In developing countries and those with limited resources scientists can focus on threatened and rare species while in advanced countries with more resources, they can develop data for all species within the taxonomic group. National red listing will support the implementation of the majority of the post-2020 targets. Despite that half of the countries have a national red listing process under way but only six have actually finished!
Benefits of conducting an appropriate Red list in Occupied Palestine:

1) Involve stakeholders in the process which results in increased knowledge/awareness and better mechanisms for protection. The process ensures that species specific experts are organized to contribute to assessments and policy development and implementation.
2) Allows for the identification of species specific actions to help threatened species recovery.
3) Monitor effective conservation measures.
4) Provide data for spatial planning.
5) Identifies important areas to protect threatened and restricted range species (e.g Mozambique identified 29 KBAs based on redlisting data).

There are several methods that we can follow such as the "Rules of Procedure for IUCN Red List Assessments 2017– 2020" as approved by the IUCN SSC Steering Committee in September 2016 https://cmsdocs.s3.amazonaws.com/keydocuments/Rules_of_Procedure_for_IUCN_Red_List_Assessments_2017-2020.pdf . The Red List Category and Criteria, and a range of relevant supporting information (documentation) are provided to support and justify adequately each Red List assessment. Besides, it allows basic analysis of the Red List status across species, including calculating the Red List Index so as the Red List website (www.iucnredlist.org) shall function properly. As well as following the January 2022 guidelines https://nc.iucnredlist.org/redlist/content/attachment_files/RedListGuidelines.pdf These guidelines clarifies how the criteria is applicable to each Red List assessment to determine whether a taxon belongs in a category of threat. Moreover, these guidelines ought to be in conjunction with the official IUCN Red List Categories and Criteria booklet (IUCN 2001, 2012b).

Each target taxon shall be assessed on the basis of **taxonomy, distribution, population size and trends, habitats and ecology and threats** according to IUCN Red list Categories and Criteria, Version 3.1. The set of five criteria, and nested subcriteria, associated with quantitative thresholds used to assign Red List categories relate to

A: population size reduction in the past (A1 and A2), future (A3), or both (A4).

B: small geographic range size, either in the form of Extent of Occurrence (B1) or Area of Occupancy (B2), combined with severe fragmentation, and/or continuing decline in population, distribution, or habitat quality, and/or extreme fluctuations;

C: small population size and fragmentation, decline or fluctuation.

D: very small or very restricted population's distribution.

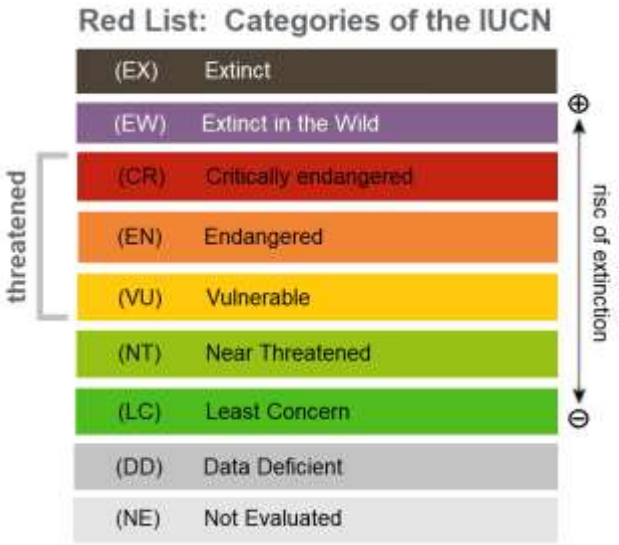
E: quantitative analysis of extinction risk (population viability analysis).

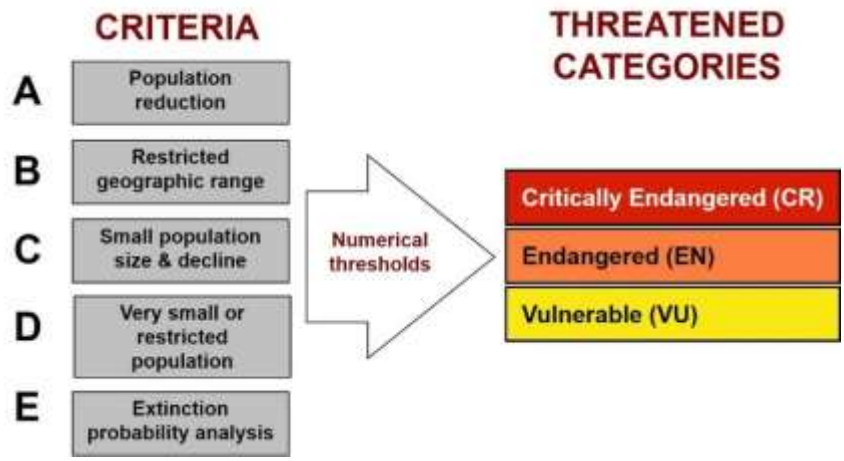
All the rules and definitions in the IUCN Red List Categories and Criteria: Version 3.1 (IUCN 2001, 2012) apply at regional levels which we shall follow. Provided that the regional population to be assessed

is isolated from conspecific populations outside the region, the IUCN Red List Categories and Criteria (IUCN 2001, 2012) can be used without modification within any geographically defined area. The extinction risk of such an isolated population is identical to that of an endemic taxon. However, we shall pay attention that when the criteria are applied to part of a population defined by a geopolitical border, the threshold values listed under each criterion may be inappropriate, because the unit being assessed is not the same as the whole population or subpopulation. As a result, the estimate of extinction risk may be inaccurate. Thus, by following the Guidelines methods for adjusting the initial category obtained by evaluating a taxon using the IUCN Red List Criteria to obtain a final Red List Category, we shall adequately get a taxon's risk of extinction within the region by taking into consideration the nature of the region, and especially the barriers to dispersal that exist.

Several issues are considered when determining which taxa to be included or excluded from a regional assessment, for instance is the taxon native to the region, do the breeding and non-breeding populations coexist within the region, furthermore whether the taxon occurs only marginally within the region. The categorization method ought to be applied only to wild populations inside their native natural range, also applied to populations introduced by benign intentions. Moreover, any taxon that has recently expanded its distribution outside the region and seems to be in a colonization phase ought to not be considered for regional assessment until the taxon in question has reproduced within the region for several years (at least 10 consecutive years). Another issue that should be taken into consideration is that taxa formerly considered regionally extinct (RE) that had naturally recolonized the region could be reevaluated after the first year of reproduction. Also, reintroduced formerly RE may be reevaluated as soon as at least a part of the introduced population has successfully reproduced without direct human interventions and the produced offspring is observed to be viable. All taxa which are eligible for assessment at the regional level ought to be classified into the category Not Applicable (NA)

The following are the categories of the IUCN for assessed taxa to be included in the Red List:





The IUCN Red List Criteria shall be applied in Occupied Palestine concerning the regional populations of the taxa, resulting in preliminary categorization. All data used in this initial assessment- such as number of mature individuals and parameters relation to area, reduction, decline, fluctuations, subpopulations, locations and fragmentation- are from the regional population not the global populations.

For threats, we will follow the classification scheme https://www.iucnredlist.org/resources/threat-classification-scheme By following these hierarchical threat drivers of specific species declines, it is attainable to indicate the threats affecting the assessed taxon. Thus, for each threat, it is recommended to take into consideration the timing of the threat (i.e. past, ongoing or future), its scope (i.e. the proportion of the total population affected) and severity (i.e the overall declines caused by the threat) to calculate an impact score.

Furthermore, our attendance at the CBD Conference 1 June 2022 on the IUCN red listing of species in context of the post-2020 biodiversity framework (2030 milestones, 2050 goals) shall help us to construct an impeccable Red list criteria for Occupied Palestine. Furthermore, we have attended a workshop by Bertrand de Montmollin, who is Chair of the Mediterranean Plants Specialist Group (IUCN / SSC). He is involved in many Mediterranean flora conservation projects, especially the IPAMed project (Conserving wild plants and habitats for people in the South and East Mediterranean) and CAREMEDIFLORA (Conservation Actions for Rare and Endangered Island Mediterranean Flora). Besides, he is a member of the Mediterranean Hotspot Advisory Committee for the CEPF (Critical Ecosystem Partnership Fund). Moreover, we have also attended a workshop by Doctor Mazin Qumseiyeh and Banan Al- Sheikh on rare plants in the West Bank.

The following are the required information guidance notes for any Red List assessment:

1. Scientific name and higher taxonomy details (Kingdom, Phylum, Class, Order, Family) to identify which taxon is being assessed.

2. Taxonomic authorities for all specific and infra-specific names used, following the appropriate nomenclature rules.

3. IUCN Red List Category and Criteria (including sub criteria) met at the highest category of threat.

4. A rationale for the Red List assessment to justify the Red List Category and Criteria selected.

5. Data for parameters triggering the Red List Criteria met at the highest Category level to underpin and justify the Red List Category and Criteria used.

6. Countries of occurrence (for native and reintroduced taxa), including Presence and Origin coding.

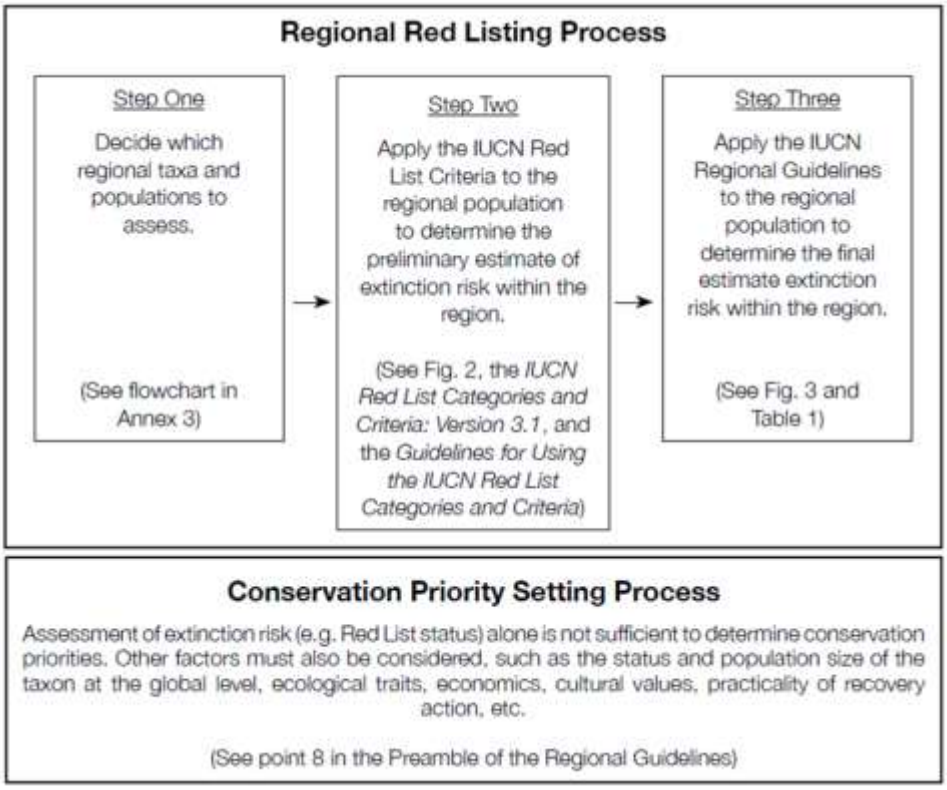
7. Geo-referenced distribution data for all taxa with a known distribution.

8. Direction of current population trend (stable, increasing, decreasing, unknown).

9. Coding for occurrence in freshwater (= inland waters), terrestrial, and marine ecosystems (i.e., "System" in SIS).

10. Suitable habitats utilized (coded to lowest level in Habitats Classification Scheme).

11. Bibliography (cited in full; including unpublished data sources but not personal communications).



The above Figure illustrates how the process of assessing the extinction risk of taxa at the regional level is performed. It is important to follow each step in order, and to refer to all listed documents, to obtain an appropriate regional assessment of extinction risk (IUCN 2012)

The following table deomnstrates the Sources of information about plants for conservation purposes (Heywood et al. 2015).

Source	Description	Useful links
Species description	Species descriptions often include details of growth habit and habitat preferences.	Try searching for the species name in Jstor Plants plants.jstor.org/ or GBIF www.data.gbif.org or Plants of the World Online www.plantsoftheworldonline.org. More detailed information is often available in national Floras and any relevant monographs or revisions.
Red list/ conservation assessment	If a conservation assessment has been carried out it will contain information on distribution, population status and threats affecting your species of interest that will need to be removed or mitigated to ensure the success of the species recovery programme. Conservation assessments may also provide information on habitat type.	Try searching for the species name in BGCI's ThreatSearch database, which compiles conservation assessments from multiple sources, including the IUCN Red List of Threatened Species, national red lists and published Red Data Books: www.bgci.org/threat_search.php
Statement of conservation needs/ conservation statement	Many examples can be found in national or regional red lists (see above) which often give a summary of what conservation management actions have been taken to date and/or an outline of what actions are recommended.	Other examples are the 'fiches' in the *Inventaire des Plantes Protegées en France*[3], the species accounts in the Flora Amenazada y Endémica de Sierra Nevada[4] and the Plant Profiles in *The Conservation Requirements of New Zealand's Nationally Threatened Vascular Plants*[5].
Herbarium records	Herbarium vouchers often contain notes on locality, associated species, habit and habitat type. Most herbaria allow people to visit for research purposes. Many herbaria are also in the process of digitising their records and making them available online.	Search on independent herbaria websites, and look for digitized vouchers on Jstor Plants plants.jstor.org/ or GBIF www.data.gbif.org or Tropicos www.tropicos.org

Published journal articles	More in-depth information is often published in scientific journal articles.	Search in an appropriate web browser (such as Google Scholar) for the target species. Some papers will not be public access, but most provide contact details for the lead author.
Websites or books containing information on cultivation requirements	If a species is widely cultivated there will likely be published material available in books or online on horticultural requirements and preferences.	Search for the species in BGCI's PlantSearch database and send a request for horticultural information to botanic gardens holding the species of interest: www.bgci.org/plant_search.php
Websites or books containing seed information	Published information may be available about the seed storage and germination requirements of the species of interest. If not, search for information for species of the same genus or family as many seed traits are shared within family groups.	Search for the target species in the Kew Seed Information Database: data.kew.org/sid/ Look for examples of published literature such as the Pilbarra Seed Atlas, published by Kings Park and Botanic Gardens and the University of Western Australia[6].
Existing conservation efforts for the target species	A web and literature search will help to identify whether conservation actions have been undertaken previously for the target species.	See Chapter 2 of this manual for an overview of who is doing what and where. You can also try contacting conservation agencies that are local to where your species of interest is found.
Historic photographs of habitat	Access to historic photographs will enable a comparison of previous population distribution, size and structure and compare this to the current status.	Use a web search engine to search for images. Visit a national archive or local museum to see if historic images are available.
Point/location data	GPS point data can be used to make a map of the distribution of the target species to obtain an idea of current and past distribution. Some point data is available on GBIF, but it is good practice to also access point data from herbarium vouchers.	A distribution map for the target species can be quickly and easily plotted using Kew's GeoCat tool, which imports available point data from GBIF, Flickr, iNaturalist and other websites (be careful to check the accuracy of imported data), and additional point data can also be added to the map as well: geocat.kew.org/
Habitat or vegetation or land cover maps	Comparing point data to habitat or vegetation maps, will enable identification of appropriate vegetation type for the target species.	Look for national or regional vegetation maps, which are often available in printed format or online. It is also possible to download GIS base layer maps, e.g. from ArcGIS: www.arcgis.com and ESRI www.esri.com. Google Earth will help to determine whether the native habitat of the target species is still remaining before you go into the field https://earth.google.com/web/

Table 2.1. Summary of the five criteria (A-E) used to evaluate if a taxon belongs in a threatened categor (Critically Endangered, Endangered or Vulnerable).

A. Population size reduction. Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4

	Critically Endangered	Endangered	Vulnerable
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3 & A4	≥ 80%	≥ 50%	≥ 30%

A1 Population reduction observed, estimated, inferred, or suspected in the past where the causes of the reduction are clearly reversible AND understood AND have ceased.

A2 Population reduction observed, estimated, inferred, or suspected in the past where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction projected, inferred or suspected to be met in the future (up to a maximum of 100 years) *[(a) cannot be used for A3]*.

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

based on any of the following:

(a) direct observation *[except A3]*
(b) an index of abundance appropriate to the taxon
(c) a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality
(d) actual or potential levels of exploitation
(e) effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)

	Critically Endangered	Endangered	Vulnerable
B1. Extent of occurrence (EOO)	< 100 km²	< 5,000 km²	< 20,000 km²
B2. Area of occupancy (AOO)	< 10 km²	< 500 km²	< 2,000 km²
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented **OR** Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: **(i)** extent of occurrence; **(ii)** area of occupancy; **(iii)** area, extent and/or quality of habitat; **(iv)** number of locations or subpopulations; **(v)** number of mature individuals			
(c) Extreme fluctuations in any of: **(i)** extent of occurrence; **(ii)** area of occupancy; **(iii)** number of locations or subpopulations; **(iv)** number of mature individuals			

C. Small population size and decline

	Critically Endangered	Endangered	Vulnerable
Number of mature individuals	< 250	< 2,500	< 10,000
AND at least one of C1 or C2			
C1. An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future):	25% in 3 years or 1 generation (whichever is longer)	20% in 5 years or 2 generations (whichever is longer)	10% in 10 years or 3 generations (whichever is longer)
C2. An observed, estimated, projected or inferred continuing decline AND at least 1 of the following 3 conditions:			
(a) (i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
(ii) % of mature individuals in one subpopulation =	90–100%	95–100%	100%
(b) Extreme fluctuations in the number of mature individuals			

D. Very small or restricted population

	Critically Endangered	Endangered	Vulnerable
D. Number of mature individuals	< 50	< 250	**D1.** < 1,000
D2. *Only applies to the VU category* Restricted area of occupancy or number of locations with a plausible future threat that could drive the taxon to CR or EX in a very short time.	-	-	**D2.** typically: AOO < 20 km² or number of locations ≤ 5

E. Quantitative Analysis

	Critically Endangered	Endangered	Vulnerable
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

1 Use of this summary sheet requires full understanding of the *IUCN Red List Categories and Criteria* and *Guidelines for Using the IUCN Red List Categories and Criteria*. Please refer to both documents for explanations of terms and concepts used here.

Furthermore, we shall take into consideration the Jordanian Red list book so as to build our own Red List criteria:
http://royalbotanicgarden.org/sites/default/files/files/Jordan%20Plant%20Red%20List%20(email)%20-%20Vol%201.pdf

Besides, the Israeli model for the IUCN Red list https://redlist.parks.org.il/plants/introduction/#rtp-54 will aid us to define several more criteria to build the Palestinian Red List. Where they use the IUCN Red Species Categories and Criteria Version 3.1, however they have built an array of 14 criteria according to which the suspected species were classified as rare or endangered they used the following criteria: the number of colonies in which the species grows in, the extent of geographical fragmentation of the species' distribution, the degree of affinity to the habitat, the assessment of the total number of individuals, life form, accessibility, sensitivity to development, and distribution model of the species, however, it was tubersome to apply some of its criteria upon each species thus they came up with the Israeli model which aids the ranking of plants according to the extent of their danger of extinction, according to six criteria summarized into one quantitative index: "The Red Number". The red number of each plant renders it easy to compare the degree of risk of the plant compared to other plants and objectively rate the priority for conservation or protection.
The six criteria of the red number are: 1) Rarity which is the number of sites where the species is found. "Site" is defined as an area unit of 1 X 1 square kilometer1 according to Israel's coordinate network (Cohen and Shimida, 1992), 2) Vulnerability (the rate of extinction and disappearance of the habitat) which is assessed by comparing the number of sites before the establishment of the Nature Conservation Law in 1964 to their number today. Therefore, even if there is no information on a change in the number of populations, the danger of extinction can be estimated based on the disappearance of the habitat and the degree of damage to it in recent years, 3) Attractiveness which includes all circumstances where a person has a motive to exploit the plant or damage it, 5) Endemics species of which Israel is the exclusive area of distribution are of great importance on a global scale, 5) Peripherals which are plants whose populations in Israel are at the edge of their global distribution- Northern and southern peripheral species, 6)Disjunctivness which is an index that expresses the extent to which the sites are adjacent to each other. This index is an inverse value for the degree of fragmentation of the sites.

Criteria for defining "red" species according to the Israeli model:

A. IUCN Red Species Categories(9) and Criteria(5): by using the IUCN 5 criteria (A-E) based on quantitative data for categorizing the different plants (IUCN, 2001) besides using their own developed model of criteria which they based the list through it.
B. Criteria for endangered plant species - the Israeli model (Yuval Sapir):
   For creating the red list 2 requirements should be fulfilled: 1. To set an objective threshold which any species above it will be included in the list (is not done worldwide) 2. Define a specific criteria for scaling a species to be included in the list.

The Israeli model for the red list:

Six criteria were developed to categorize species to be included to the red lits (Rarity , Vulnerability, Attractiveness,Endemics,Peripherality, Coherence) each criteria has its own scale, the scale is defined through a range of values according to its contribution to endangered species (explained in the table)

Criteria	Criteria values

Rarity	1	The number of sites where the plant is located is 31-100
	2	The number of sites where the plant is located is 11-30
	3	The number of sites where the plant is located is 5-10
	4	The number of sites where the plant is located is 3-4
	5	The number of sites where the plant is located is 2
	6	The number of sites where the plant is located is 1
Vulnerability	1	Slight vulnerability, extinction rate of 1-30% of all sites since 1964
	2	Moderate vulnerability, extinction rate of 31-50% of all sites since 1964
	3	High vulnerability, extinction rate of 51-80% of all sites since 1964.
	4	Extremely vulnerable, extinction rate over 81% of all sites since 1964.
Attractiveness	1	Little attractiveness: a colorful flower that is 1-2 cm in size.
	2	Medium attractiveness: a colorful flower measuring 2-3 cm in size.
	3	Very attractive: a colorful flower that grows over 3 cm, or an inflorescence with many flowers and stands out in its colorfulness.
	4	Utilization: The plant is collected for use and commercial purposes - for spice medicine and eating.
Endemics	1	The plant is endemic to the Levant or part of it (Israel, Syria, Lebanon, Jordan, Sinai)

	2	The plant is sub-endemic: it grows only in Israel and deviates from it only slightly (usually endemic to the coastal plain up to Beirut or al-Arish or endemic to the Negev and Sinai or to Israel and Jordan)
	3	The plant is in the status of an endemic subspecies (whose taxonomic status is clear and its separation from the non-endemic subspecies is clear. For example: Zehavit Sharonit)
	4	The plant is endemic: the plant is restricted in its global distribution only to the territories of Israel
Peripherality	1	The plant populations in Israel are at the edge of their geographical distribution. (Usually distributed north or south of Israel)
Coherence	1	When the plant populations in Israel are in one geographical section

For Palestine we believe a hybrid system of local red listing is possible that uses the continuously evolving global criteria (Cazalis et al. 2022) ahead with the experiences of neighboring countries to create a list of at least the most important more visible species: plants and vertebrates. For plants we can define the preliminary work of Al-Sheikh and Qumsiyeh (2021) as deficient and needing actual research and designations not merely based on occurrences in the grids. Other papers on plants are many (Shmida 2002; Shmida and Pollak 2007; Ali-Shtayeh 2017, 2018, Dafni 1976; Sapir 2003; Fragman-Sapir 2017; Ighbareyeh 2017). For vertebrates see Dolev & Perevolotsky (2004). GBIF and https://biogis.huji.ac.il/ databases should also be consulted.

The following is a summarized list of species from various publications (Sapir 2003 etc…)
https://docs.google.com/spreadsheets/d/1Vqjt8Wk1Knt4SI9ZwCm-91VKTr37bxWe39UcNQu1dvw/edit#gid=1517634756

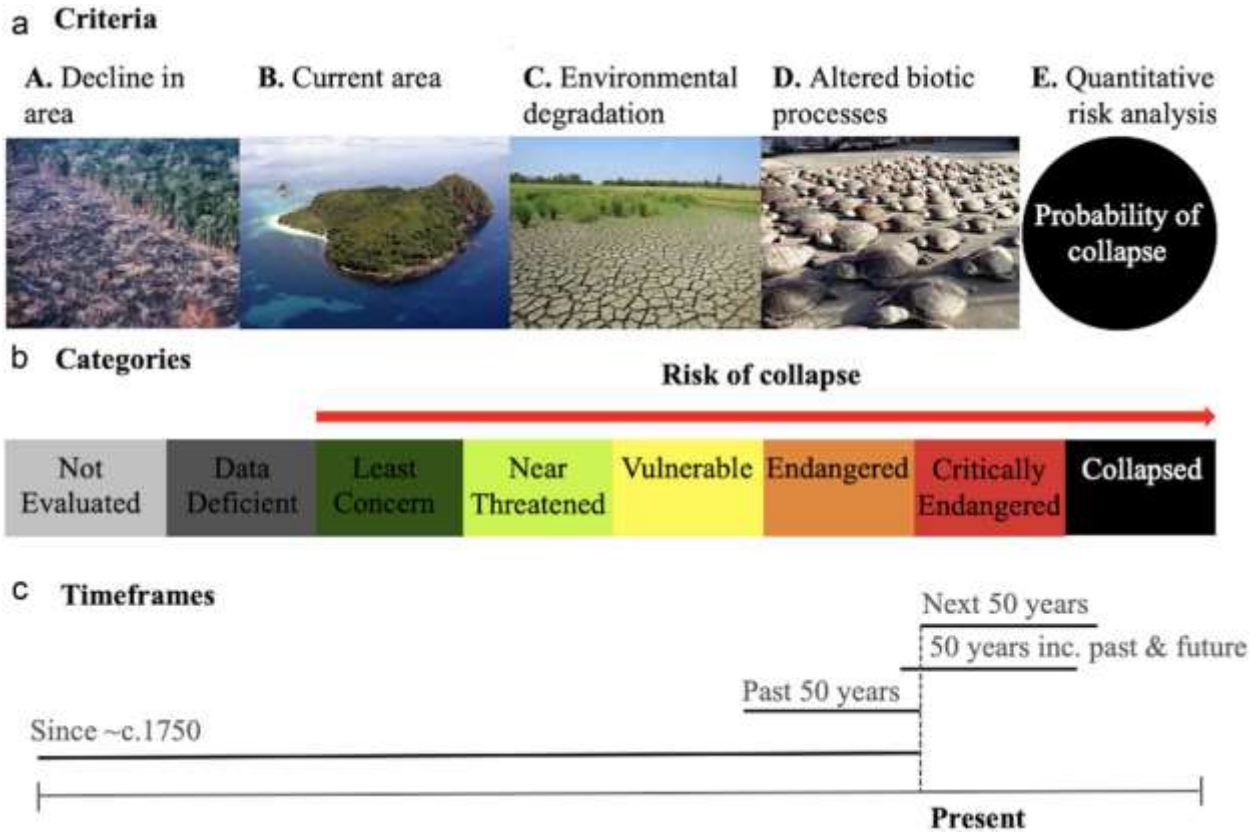
List of species in Palestinian territories according to GBIF
https://docs.google.com/spreadsheets/d/1luOdJmd0BEaXfKagW2QnMuUGzisCMbO2Eaaw4kd_e7s/edit

Data from redlist.park.il - based on "The Red Data Book: Endangered Plants of Israel" by Prof. Avi Shmida, Dr. Gadi Pollak and Dr. Ori Fragman-Sapir (2007)

GIS work is integral to the red list work and IUCN is even willing to give access to ArcGIS for one year to do work related to redlisting (email redlist@iucn.org)
More resources for this
Introduction to PostGIS
GRASS GIS tutorials (osgeo.org)
Documentation for QGIS 3.22 — QGIS Documentation documentation
IUCN Red List of Threatened Species resources and tools

Ecosystem Redlists

The Red List of Ecosystems (RLE) was adopted by IUCN in 2014 as the global standard for ecosystem risk assessment for terrestrial, freshwater and marine ecosystems. Ecosystems are defined based upon geographic distribution, native biotic assemblage or ecological community, the environmental conditions that support them, and the processes and interactions among components. Thus, environmental degradation leads to habitat quality reduction, disruption of suitability for native biota and disturbance of biotic processes. Disruptions lead to the reduction of ecosystem resilience and its ability to maintain its ecological community. Any change in geographic distribution, native biotic assemblage or ecological community is vital to be calculated because they provide a measure of how close an ecosystem is to collapse. Moreover, an ecosystem's area is strongly related to the capacity of an ecosystem to support biodiversity, ecological processes and thus the provision of ecosystem services. Area losses can reduce the diversity of niches species occupy, alter resource availability within the ecosystem, and reduce the ecosystems carrying capacity for species. Thus Ecosystem collapse ought to be prevented as it defined as the endpoint of ecosystem decline, when an ecosystem loses its significantly defining features (i.e., species, combinations, structure, and functions) and is replaced by a different, often depauperate (lacking variety in flora and fauna), ecosystem type. RLF has been designed to measure both an ecosystems' area and integrity. The Red List of Ecosystems complements the IUCN Red List of Threatened Species by focusing on a different level of biodiversity, deepening understanding of biodiversity loss and priorities for action to reverse it. RLF has five criteria (Decline in area, Current area, Environmental degradation, Altered biotic processes, Quantitative risk analysis) and these criteria demonstrate whether an assessed ecosystem is in familiar Red List categories (Not evaluated, Data deficient, Least concern, Near Threatened, Vulnerable, Endangered, Critically endangered and Collapsed) by reflecting upon its status throughout a timeframe (Its first reported existence in history, its existence within the last 50 years, its presence and its projected future (50 years forward)). For Occupied Palestine we can simply follow international standards to assess ecosystems (Rowland et al. 2020).
The following is the RLF's Criteria, Categories and Timeframes adopted by IUCN in 2014:

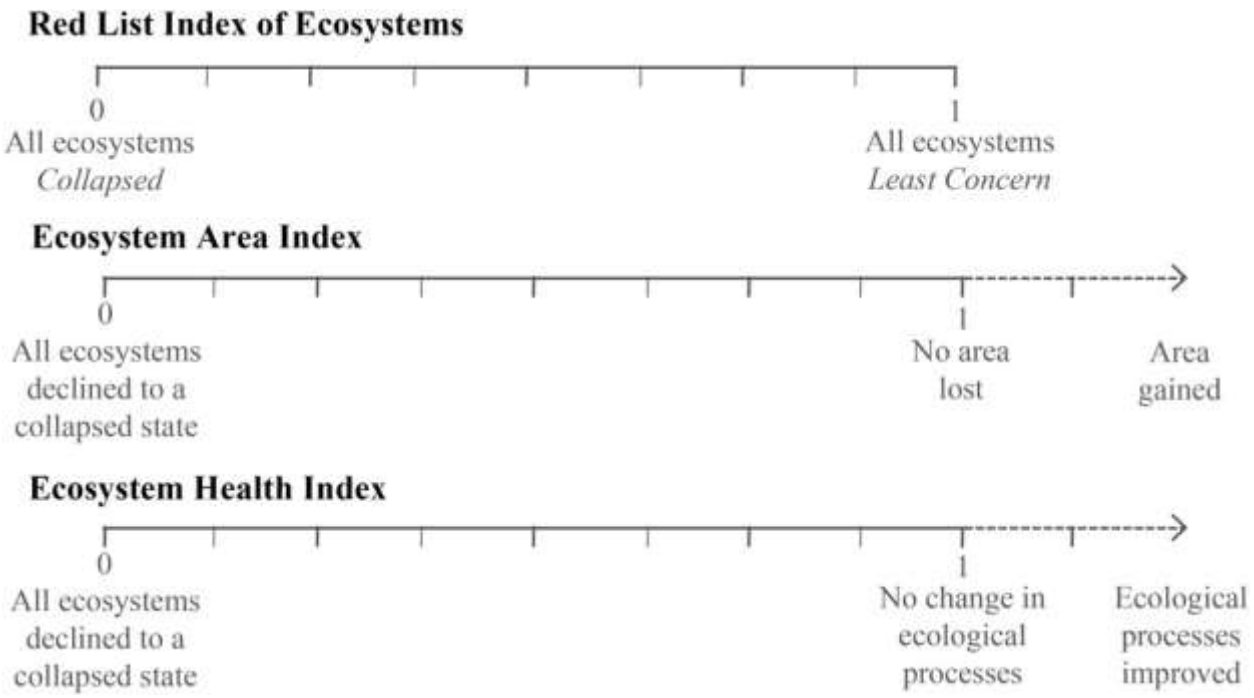


Red listing ecosystems goes via the following three indicators:
1. Red List Index of Ecosystems (RLIE) – summarizes the status and trends in the risk of terrestrial, marine and freshwater ecosystems collapse, incorporating information of an ecosystem's area and integrity, thus supplementing the used Red List Index of species. RLE is rich in data including ecosystem maps and classifications, and quantitative, spatial evaluations of change in ecosystem area and integrity. Hence, it is highly sensitive as it could differentiate between low and high threat levels, as well as it could respond rapidly to changes in threat levels within five years. Besides, it could detect changes in integrity and area of an ecosystem.

2. Ecosystem Area Index (EAI) – measures change in ecosystem extent. This index quantifies the average loss of ecosystem extent using data from Red List of Ecosystem risk assessments, or other relevant sources. It displays the mean proportion of ecosystem area remaining over a given timeframe, compared to the initial area at the beginning of a defined timeframe and an ecosystem-specific collapse threshold. This index was devised to reveal trends in ecosystem area towards or away from ecosystem collapse, where a value of 1 indicates no loss of area, and a value of 0 indicates complete loss of area. Ecosystem area's changes are critical since area is strongly related to the capacity of an ecosystem to secure biodiversity, ecological processes hence, the provision of ecosystem services.

3. Ecosystem Health Index (EHI) – measures ecosystem degradation from changes in integrity of the biological and physical parts of ecosystems. It quantifies average change in ecological integrity (biotic or environmental degradation), using data from Red List of Ecosystems risk assessments, or other relevant sources. It merges measures of the extent and severity of change in ecosystem-specific ecological

variables. The index displays the mean proportional change in integrity over a given timeframe, relative to the initial state and an ecosystem-specific collapse threshold.



The Biodiversity indicators partnership (BIP) to CBD https://www.bipindicators.net/ developed indicators for each of the post-2020 framework. Under Objective C (includes Aichi 11) "To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity" suggested these global indicators related to Objective C:

Wildlife Picture Index
Protected Area Coverage of Key Biodiversity Areas
Protected Areas Management Effectiveness
Protected Area Coverage of Ecoregions
Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type
Protected Area Representativeness Index (PARC-Representativeness)
Protected Area Connectedness Index (PARC-Connectedness)
Wildlife Picture Index in tropical forest protected areas
Protected Connected (ProtConn)
Large Reef Fish
Coverage by protected areas of important sites for mountain biodiversity
Species Protection Index
Protected area coverage
Growth in Species Occurrence Records Accessible Through GBIF
Red List Index
Trends in invasive alien species vertebrate eradications

The global system of ecosystem typology is now well developed (https://global-ecosystems.org/) and of those different typologies we have in Occupied Palestine are the following:

Terrestrial

T2 Temperate boreal forests and woodlands

T3 Shrublands

T5 Deserts and semi-deserts

T7 Intensive land use biome

Marine

M4 Anthropogenic Marine Biome

Freshwater

F1 River and stream biome

Subterranean

S1 Subterranean lithic biome

Marin-Terrestrial (transitional)

MT4 Anthropogenic shoreline

Terrestrial-Freshwater (transitional)

TF1 Palustrine wetlands biome

Our network of protected areas cover most of these ecosystems. Shoreline and coastal areas of Gaza need to be protected and more studies and protection of some caves need to be undertaken to include S1. Finally the river Jordan needs to be protected even though it is used as a political border between Jordan and Palestine (see comments on transnational issues).

No ecosystems in our region (Israel, Palestine, Jordan) have been redlisted https://assessments.iucnrle.org/search but this is likely due to lack of assessments; not the absence of danger. In our opinion a thorough study could red list ecosystems like the Dead Sea Basin (lowest point on earth) as a unique ecosystem by itself.

Conclusion

In our NBSAP we proposed regional and local redlisting and update of protected area network taking into account key species and habitats. Surveys and studies in our area are limited (e.g. only 5 Protected areas have been studied in a way to lead to management plans) but we believe targeted studies are important for effective conservation strategies. We can focus on species of special interest while we engage in more lengthy field surveys.

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