Does species prioritization list suffice for protecting endangered plants?

Merav Lebel Vine[1], Jonathan Belmaker[2], Yuval Sapir[1]

[1] Botanical Garden, School of Plant Sciences and Food Security, Faculty of Life Sciences, Tel Aviv Uni., Israel. [2] School of Zoology, Faculty of Life Sciences The Steinhart Museum of Natural History Tel Aviv Uni., Israel. ✉ meravlebel@gmail.com

Introduction

The **World Conservation Union red list** is the most comprehensive information source on the global extinction risk status of species, but only a tiny fraction (2.7%) of the approximately 1.9 million world species have been formally evaluated by the IUCN for extinction status. In Israel, >400 plant species are included in the **Israeli Red List** of endangered plants, a local evaluation of all rare plants of Israel, used by the INPA (Israeli Nature and Parks Authority) as the base for plant conservation actions (=prioritization list). Until now, most of the Israeli flora was not assessed by the IUCN criteria.

We ask to examine whether prioritization list (Israeli Red List) and extinction risk (IUCN) provide similar information for each species, and if so to what degree?

Comparing the Red number and the IUCN criteria

Parameters of the Israeli Red number:
1. Rarity
2. Vulnerability
3. Attractiveness
4. Endemism
5. Peripherality

IUCN Criteria:
A. Population size reduction (AOO)
B. Geographic range and decline (EOO)
C. Small populations and decline
D. Very small or restricted populations
E. Quantitative analysis

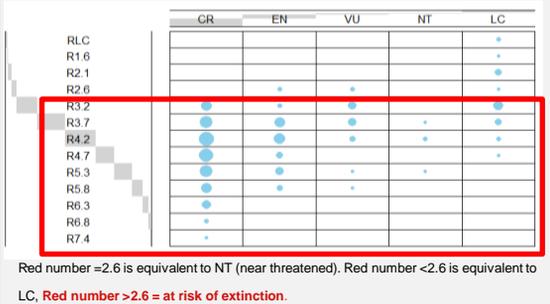| CR: CRITICALLY ENDANGERED | EN= ENDANGERED | VU= VULNERABLE | LC= LEAST CONCERNE |

Methods

157 plant species that were included in the Israeli red list were assessed using IUCN criteria. Plants assessed were statistically analyzed using χ^2 **test in R (R core Team 2013)** for comparison between their Israeli status (in the Israeli red list) and the IUCN evaluation. Principal component analysis **(PCA; prcomp function in R)** was made to find the most explanatory variables for each of the two assessment methods.
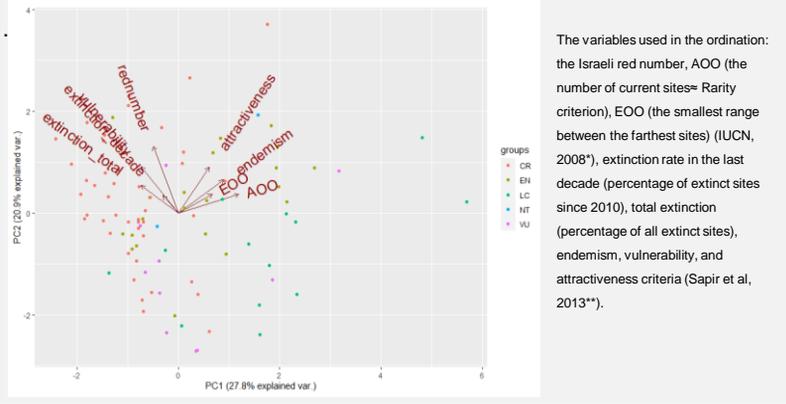

Results

Fig 1. 157 plant species assessed as LC (least concern) to CR (critically endangered) using the IUCN criteria, and their Israeli red number.

Red number =2.6 is equivalent to NT (near threatened). Red number <2.6 is equivalent to LC, **Red number >2.6 = at risk of extinction**.

Fig 2. Residual's contribution in the chi test for comparison between the Israeli red number and the IUCN assessment.

● positive contribution
● negative contribution
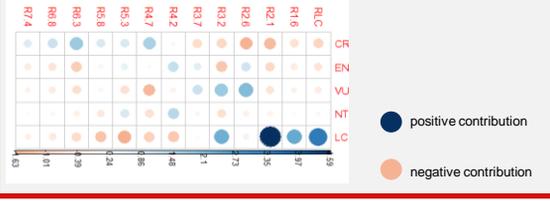
Fig 3. PCA analysis. The species are colored by their category of risk (IUCN assessment).

The variables used in the ordination: the Israeli red number, AOO (the number of current sites≈ Rarity criterion), EOO (the smallest range between the farthest sites) (IUCN, 2008*), extinction rate in the last decade (percentage of extinct sites since 2010), total extinction (percentage of all extinct sites), endemism, vulnerability, and attractiveness criteria (Sapir et al, 2013**).

The Israeli red number and the IUCN assessment were found to be significantly dependent by the chi test ($\chi^2_{48} = 89.834$, P<0.05). Species assessed as LC (least concern) contributed most for the resemblance and had very low red number (figure 2). Rarity and Endemism criteria contributed at the same direction and explain the group of species assessed as EN (endangered). Vulnerability correlated with total extinction and extinction rate in the last decade and are the best explanatory factors for species evaluated as CR (critically endangered) (figure 3).

Conclusion

All species assessed as CR (critically endangered) have high Israeli red numbers and most of the species assessed at risk (by IUCN) are currently in the Israeli red list (figure 1). PCA shows (figure 3), that **vulnerability (of the habitat) is a good estimation of population decline (=extinction rate) and can be used when change in population size is unknown** (and therefore IUCN evaluation can not be done).
In conclusion, local prioritization list can be a good estimation of local risk status (=endangered species) for species not evaluated by the IUCN.

*IUCN. 2008. GUIDELINES FOR APPLICATION OF IUCN RED LIST CRITERIA AT REGIONAL AND NATIONAL LEVELS The IUCN Red List of Threatened Species™.
**Sapir, Y., A. Shmida, and O. Fragman. 2003. Constructing Red Numbers for setting conservation priorities of endangered plant species: Israeli flora as a test case. J. Nat. Conserv. 11:91–107.