The Application of IUCN Red List Criteria at Regional Levels

Introduction

Red Lists and Red Data Books of the World Conservation Union (IUCN) are among the most widely used tools available to conservationists worldwide for focusing attention on species of conservation concern. Prior to 1994, the threatened categories used in Red Data Books and Red Lists had been in place, with some modification, for almost 30 years. In the late 1980s, the IUCN, under the auspices of the Species Survival Commission (SSC), initiated a process for revising the categories of the Red List. The aim of this revision was to improve the objectivity and repeatability of the assessment process and to develop quantitative criteria that assign species to categories on the basis of their relative extinction risk. In 1994 the IUCN Council adopted new categories and criteria for the Red List (IUCN 1994) that enabled assessment of extinction risk of species or lower taxa at the global scale. The most recent version of the criteria can be found in an IUCN (2001) paper or on the Internet (http://www.iucn.org/themes/ssc/redlists/rlcategories2000.html [accessed 8 August 2001]) and are briefly outlined in Fig.1.

The criteria of the IUCN Red List have inspired several national and regional authorities to develop similar systems. The IUCN is keen to support and encourage regional (here used to include any subglobal level) listings. Such lists are often linked to actions at the national level and also provide the global listing and action processes with valuable information. Our goal of mutually beneficial interaction between national/regional and global Red Lists will be more easily achieved with greater consistency in the application of the criteria (Hilton-Taylor et al. 2000; Rodríguez et al. 2000). Here, we present some guidelines for improving both the consistency and the validity of subglobal assessments.

Provided that the regional population to be assessed is isolated from conspecific populations outside the region, the (global) criteria of the IUCN Red List (IUCN 2001) can be used without modification. The extinction risk of such an isolated population is identical to that of an endemic taxon, and in these situations the criteria can be used with unaltered thresholds at any geographical scale. But when the criteria are applied to part of a population defined by a geopolitical border or to a regional population occasionally interchanging individuals with other populations beyond the border, the thresholds listed under each criterion will be incorrect because the unit being assessed is not the same as the actual population. As a result, the estimate of extinction risk will be inaccurate.

Within any region there will be taxa with different distribution histories, ranging from those that are indigenous (native to the area) since prehuman settlement to those recently introduced by people. There may also be breeding and nonbreeding taxa. The latter are those that do not reproduce in the region but still utilize and may be dependent upon its resources. There may also be formerly native taxa that are now extinct in the region but which are still extant in other parts in the world (Gärdenfors 1995, 1996). We present proposals for consistent listings of all these situations.

A first attempt to resolve these issues was made by the Regional Application Working Group (RAWG), formed under the SSC Red List Programme Subcommittee (Gärdenfors et al. 1999). Since then we have received many comments and suggestions and have also tested the principles in a number of real situations (Gärdenfors 2001). The draft that follows incorporates many amendments, and we are seeking further comments and suggestions. A final revision of the guidelines will be tested at regional workshops and will then be recommended for adoption by the IUCN Species Survival Commission in 2002.

Definitions

Benign introduction: an attempt to establish a taxon, for the purpose of
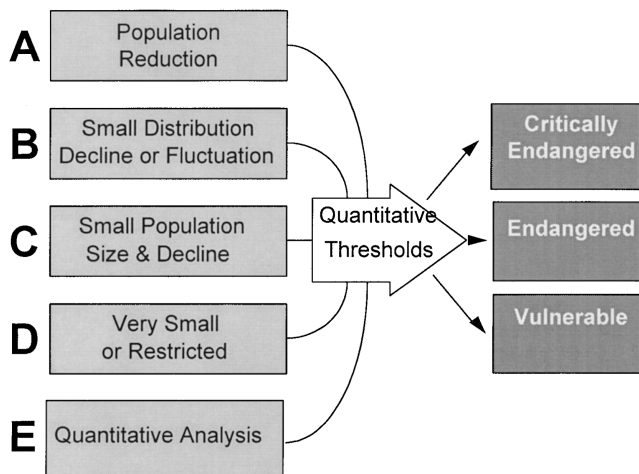
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Figure 1. Summary outline of the IUCN Red List criteria (A–E) for the categories critically endangered (CR), endangered (EN), and vulnerable (VU) according to IUCN (2001). At least one of these criteria should be met for a species to be assigned. The full system (see http://www.iucn.org/themes/ssc/redlists/ricategories2000.html [accessed 8 August 2001]) must be consulted for any application because it includes more complex subcriteria and numerical thresholds not included here.

conservation, outside its recorded distribution but within an appropriate habitat and ecogeographical area; a feasible conservation tool only when there is no remaining area left within a taxon's historic range (IUCN 1998).
Conspecific populations: populations of the same species, here applied to any taxonomic unit at or below the species level.
Current range: present geographical distribution of the taxon.
Downgrading and upgrading: process for adjusting the Red List category of a regional population according to a decreased or increased risk of extinction; downgrading refers to a reduced extinction risk and upgrading to an increased extinction risk.
Endemic taxon: a taxon naturally found in a specific area and nowhere else; a relative term in that a taxon can be endemic to a small island, to a country, or to a continent.
Global population: total number of individuals of a taxon. (See *population*).
Natural range: range of a taxon, excluding any portion that is the result of introduction to a region or neighboring region after the year 1800.

Taxa introduced before 1800 should also have developed local adaptations to be regarded as being within their natural range; natural range includes areas where the taxon does not breed but regularly utilizes resources, such as feeding grounds or watering sites during migration and other areas occupied during nonbreeding periods.
Population: term is used in a specific sense in the IUCN criteria (IUCN 2001) which is different from its common biological usage; thus, *population* is defined as the total number of individuals of the taxon. Within the context of a regional assessment, it may be advisable to use under the same definition the term *global population*. In regional guidelines we use the term *population*, for convenience, when general reference is made to a group of individuals of a given taxon that may or may not interchange propagules with other such entities. (See *regional population* and *subpopulation*).
Propagule: a live entity capable of dispersal and of producing a new mature individual (e.g., a spore, seed, fruit, egg, larva, or part of or an entire individual).

Region: a subglobal geographical area, such as continent, country, state, or province.
Regional assessment: process for determining the relative extinction risk of a regional population according to the guidelines given here.
Regionally extinct (RE): condition of a taxon when there is no reasonable doubt that the last individual potentially capable of reproduction within the region has died or disappeared from the region or when, if it is a former visiting taxon, the last individual has died or disappeared from the region.
Regional population: portion of the global population within the area being studied; may comprise one or more subpopulations.
Rescue effect: process by which immigrating propagules result in a lower extinction risk for the target population.
Subpopulations: geographically or otherwise distinct groups in the (global) population between which there is little demographic or genetic exchange (typically one successful migrant individual or gamete per year or less; IUCN 2001); a subpopulation may or may not be restricted to a region.
Taxon: a species or infraspecific taxon whose extinction risk is being assessed.
Vagrant: a taxon that is currently found only very occasionally within the boundaries of a region, a region that would therefore only have a very small share of the global population. (See *visitor*).
Visitor (also, *visiting taxon*): a taxon that does not reproduce within a region but regularly occurs within its boundaries either now or during some period of the last century. Visitors are distinguished from vagrants by a preset limit on the proportion (current or during any considerable period of the last century) of the global population involved. The limit is decided by those responsible for the regional Red List process.
Wild population: a population within its natural range in which the individ-

uals are the result of natural reproduction (i.e., not the result of human-mediated release or translocation); if a population is the result of a benign introduction that is now or has previously been successful (i.e., self-sustaining), the population is considered wild.

The Assessment

Taxa to Be Assessed

The categorization process should be applied only to wild populations inside their natural range and to populations resulting from benign introductions (IUCN 2001). Taxa only marginally within the region should also enter the assessment process. But a taxon that occasionally breeds under favorable circumstances in the region but regularly then becomes (regionally) extinct should not be considered because it is not within its natural range. Similarly, a taxon that is currently expanding its distributional range outside the region and appears to be in a colonization phase within the region should not be considered for regional assessment until the taxon has reproduced within the region for several years (typically for at least 10 consecutive years or three generations, whichever is longer).

Visiting taxa (i.e., taxa not reproducing within the region but regularly visiting the country as migrants or wintering/summering populations) may be assessed against the criteria, but vagrant taxa should not be assessed.

The Categories

The categories of the IUCN Red List (IUCN 2001) should be used unaltered at regional levels, with three exceptions or adjustments.

First, taxa extinct within the region but extant in other parts of the world should be classified as regionally extinct (RE). A taxon is RE when there is no reasonable doubt that the last individual potentially capable of reproduction within the region has died or dis-

appeared from the region or, in the case of a former visiting taxon, individuals no longer visit the region. Populations of long-lived individuals that have ceased to reproduce within the region (for example, as a result of a deteriorating environment) should be regarded as potentially capable of reproduction and consequently should not be classified as RE. The rationale behind this is that the environment may improve, allowing a resumption of reproduction by the remaining individuals. On the other hand, vagrant individuals of a formerly regionally breeding taxon that reach the region should not be regarded as potentially capable of reproduction. The classification of visiting taxa as RE will be determined by the assessors, using information from monitoring efforts devoted to the taxon within the region, the taxon's known status, and environmental conditions in its non-breeding and breeding areas.

Second, the category of extinct in the wild (EW) should be assigned only to taxa that are extinct in the wild over their entire natural range, including the region, but that are extant in cultivation, in captivity, or as a naturalized population (or populations) well outside the past range. If a taxon is (globally) EW but extant in a naturalized population within the region, the regional population should be viewed as result of a benign introduction and consequently should be assessed according to the Red List criteria.

Third, the category of not evaluated (NE) should be assigned to two kinds of taxa: (1) those not yet evaluated (due to lack of personnel or monetary resources, for example, which is the general definition of NE at the global level) and (2) those (mainly introduced taxa and vagrants) not eligible for assessment at a regional level which consequently have not been evaluated.

The Assessment Procedure

Regional assessment should be carried out in a two-step process (Table

1; Fig. 2). In the first step, the criteria of the global IUCN Red List are applied to the regional population of the taxon (as specified by IUCN 2001), resulting in a preliminary categorization. All data used in this initial assessment—such as number of individuals and variables relating to area, reduction, decline, fluctuations, subpopulations, locations, and fragmentation—should be from the regional population, not the global population. In the second step, the existence and status of any conspecific populations outside the region that may affect the risk of extinction within the region should be investigated. If the taxon is endemic to the region or the regional population is isolated, the Red List category defined by the criteria should be adopted unaltered. If, on the other hand, conspecific populations outside the region are judged to affect the regional extinction risk, the regional Red List category should be changed to a more appropriate level that reflects the extinction risk as defined by criterion E (Fig. 1). In most cases, this will mean downgrading the category met by the global criteria, because populations within the region may experience a "rescue effect" from populations outside the region (Brown & Kodric-Brown 1977; Hanski & Gyllenberg 1993). In other words, immigration from outside the region will tend to decrease extinction risk within the region. Normally, such a downgrading will involve a one-step change in category, such as moving the category from endangered (EN) to vulnerable (VU) or from VU to near threatened (NT). For expanding populations, whose global range barely touches the edge of the region, a downgrading of the category by two or even more steps may be appropriate. Conversely, if the population within the region is a demographic sink (Pulliam 1988) that is unable to sustain itself without migration from populations outside the region, and if the extraregional source is expected to decrease, the extinction risk of the regional population may be underestimated

Table 1.   Checklist for judging whether extraregional populations may affect the extinction risk of the regional population (compare Fig. 2).

Questions	*Comments*
2a. Is the taxon a nonbreeding visitor? Is the taxon reproducing within the region, or is it merely a visitor utilizing resources within the region?	If the answer to the headline question is both yes and no—there are two distinct subpopulations, with one being a nonreproducing migrant and the other being a reproducing subpopulation—then each subpopulation should be treated as different taxa and should be assessed separately.
2b. Likelihood of propagule migration Are there any conspecific populations outside the region within a distance from which propagules could reach the region? Is the regional population part of a larger metapopulation involving extraregional patches? Are there any effective barriers preventing dispersal to and from neighboring populations? Is the taxon capable of long-distance dispersal? Is it known to do so?	If there are no conspecific populations in neighboring regions or if propagules are not able to disperse to the region, the regional population behaves as an endemic and the category should be left unchanged.
2b. Evidence for the existence of local adaptations Are there any known differences reflecting local adaptations between regional and extraregional populations (i.e., is it probable that individuals from extraregional populations are adapted to survive within the region)?	If it is unlikely that individuals from extraregional populations would be able to survive within the region, the category should be left unchanged.
2b. Availability of suitable habitat Are current conditions of habitats and/or other environmental (including climatological) requirements of the taxon in the region such that immigrating propagules are able to successfully establish themselves (i.e., are there habitable patches?), or has the taxon disappeared from the region because conditions were not favorable?	If there is not enough suitable habitat and if current conservation measures are not leading to an improvement in the habitat within the foreseeable future, immigration from outside the region will not decrease extinction risk and the category should be left unchanged.
2c. Status of extraregional populations How abundant is the taxon in neighboring regions? Are the populations there stable, increasing, or decreasing? Are there any important threats to those populations? Is it probable that they produce an appreciable amount of emigrants and will continue to do so for the foreseeable future?	If the taxon is relatively common outside the region and there are no signs of population decline, and if the taxon is capable of dispersing to the region and there is (or soon will be) available habitat, downgrading the category is appropriate. If the taxon is currently decreasing in neighboring regions, the "rescue effect" is less likely to occur, so downgrading the category may not be appropriate.
2d. Degree of dependence on extraregional sources Are extant regional populations self-sustaining, showing a positive reproductive rate over the years, or are they dependent on immigration for long-term survival (i.e., are the regional populations sinks)?	If there is evidence that a substantial number of propagules regularly reach the region and the population still has a poor chance of survival, the regional population may be a sink. If so, and if there are indications that the immigration will soon cease, upgrading the category may be appropriate.

by the criteria. In such exceptional cases, an upgrading of the category may be appropriate. If it is unknown whether or not extraregional populations influence the extinction risk of the regional population, the global criteria should be kept unaltered.

Adjustments can be made to all the categories except for extinct (EX), extinct in the wild (EW), regionally extinct (RE), data deficient (DD), and not evaluated (NE), which cannot be up- or downgraded. Visiting taxa may be assessed against the IUCN Red List criteria. The distinction between a visitor and a vagrant should

be noted because the latter cannot be assessed. The lower limit in global population share for a species being defined as a visitor should be decided by the regional authority, but will normally be within the interval of 5–15%. All data used in the assessment, such as population size and the area of occupancy in the target region, should pertain to the visiting individuals only. But it may be essential to examine the conditions in the breeding area to be able to interpret the nature of changes in area used by visitors. For instance, a projected or suspected reduction in

population size (criterion A3 or A4) may be based not only on changing conditions in the area used by visitors but also on changes in the population's breeding area. It is also essential to distinguish true population changes and fluctuations from transient changes, which may be due to unsuitable weather or other factors and may result in visitors temporarily favoring other regions. The extent of occurrence and the area of occupancy may change considerably from year to year. It is then appropriate to use a lower estimate, which will in most cases be closer to the
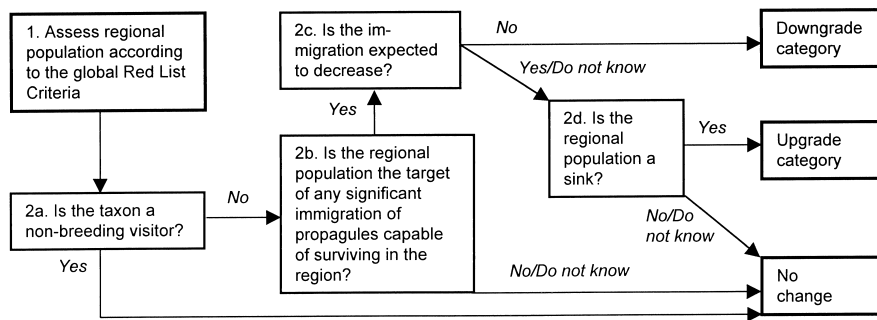
Figure 2. Conceptual scheme of the procedure for assigning an IUCN Red List category at a regional level. In step 1 all data used should be from the regional population, not the global population. The procedure for assigning the regionally extinct category is not included here. See Table 1 for further details on the procedure to be followed, especially in the second step.

mean than the lowest recorded estimate.

Priorities for Conservation

Assessment of extinction risk and setting conservation priorities are two related but different processes. Assessment of extinction risk, such as the assignment of IUCN Red List categories, generally precedes the setting of priorities. The purpose of the Red List categorization is to produce a relative estimate of the likelihood of extinction of the taxon. Setting conservation priorities, on the other hand, often includes consideration of extinction risk, but also takes into account many other factors, such as availability of funds or personnel to carry out conservation actions, legal frameworks for conservation of threatened taxa, or ecological, phylogenetic, historical, and cultural preferences for some taxa over others. In the context of regional risk assessments, a number of additional pieces of information are valuable for setting conservation priorities. For example, it is important to consider not only conditions within the region but also the status of the taxon from a global perspective. This is particularly important in small regions and midcontinental countries. Consequently, it is recommended that any publication that results from a

regional assessment should include at least three measures: (1) the regional Red List category, (2) the global Red List category, and (3) an estimate of the proportion (%) of the global population occurring within the region. If the proportion of the global population is unknown, this should be noted with a question mark. The taxonomic classification level of the taxon, whether an entire species or a single subspecies with a more restricted distribution is under consideration, will influence the proportion occurring within a region.

It is left to the regional authorities to judge how the three variables, as well as different taxonomic levels, should be used when conservation priorities are set. Likewise, the authorities may wish to consider other variables in setting priorities, which are to a large degree region-specific and therefore not covered by the guidelines.

Documentation and Publication

To facilitate the exchange of information between assessors in different regions and between regional and taxonomic Red List authorities, it is recommended that all regional (and global) assessment exercises should follow global documentation standards (IUCN 2001, annex 2-3).

(1) The introductory sections should include a list of the taxonomic groups

that have been evaluated against the criteria of the Red List.

(2) A printed regional Red List should present at least the scientific name and the authorship of the taxon, the regional Red List category (using the English abbreviated forms) and criteria, the global IUCN Red List category and criteria, and the proportion (%) of the global population occurring within the region. If possible, the vernacular name (in the national language) and a short summary of the documentation of the taxon should also be included. Visiting taxa that are in any of the categories NT, VU, EN, CR, RE, EW, EX, or DD should be listed in a separate section; if they are included in a list of breeding taxa, it should be clearly indicated that they are visitors.

(3) The global Red List Category should follow published IUCN Red Lists (Walter & Gillett 1998; Hilton-Taylor 2000). If a globally red-listed taxon is endemic to the region and the regional assessors have come to a different conclusion about the category than the global assessors (e.g., Hilton-Taylor et al. 2000; Rodríguez et al. 2000), then the appropriate authority on the Red List should be contacted and the status of the taxon reexamined (contact details are available from http://www.iucn.org/themes/ssc/sgs/sgs.htm [accessed 8 August 2001]). If agreement is reached to change the global assessment, the new global category may be given in the regional Red List even if it will be published before the next update of the global IUCN Red List (which will be updated annually from 2002). If no agreement is reached, the regional authority may submit an appeal based on the Red List criteria for judgment by the SSC Red List Programme Standards and Petitions Subcommittee. If no conclusion is reached before the finalization of the regional Red List, the category determined by the regional assessment may be used as the regional category, and the IUCN global Red List category should be used as the global category. In all three cases, the issues must be docu-

mented under the listing for the taxon concerned.

(4) The application of the global criteria, particularly criterion A, may under some circumstances result in a taxon qualifying for listing at the global but not at the regional level. This may be the case when the regional population is stable but constitutes only a small percentage of the global population, which is experiencing a net decline. Such taxa should be included (in the main list or in an annex) in the regional Red List, and their regional category should be denoted as LC.

(5) In addition to a printed Red List, which is normally written in the national language(s), publication on the Internet in English (and the national language) is recommended. The Web version could include the full documentation (according to IUCN 2001, annex 3), which could be difficult in the printed version unless it is published as a full Red Data Book. A Web version may also include the extensive listing and documentation of taxa assessed as LC. A publication on the Web may be a particularly important tool in the process of transferring information from the regional to the global scale (Rodríguez et al. 2000).

Discussion

New Criteria at a Regional Level

In discussions with those responsible for the preparation of national Red Lists, we have often heard that the criteria and the thresholds for the IUCN Red List categories should be changed for application at a national level. Two justifications are given for this opinion: (1) If we use the IUCN criteria, almost every species will enter the national Red List in a small country. (2) We do not have enough data from our country to apply the detailed criteria.

The first justification is based partly on confusion between the effect of geographical scale (extinction risk is correlated with the size of the popu-

lation, not with the size of the country) and issues arising from national borders that divide a population. National boundaries are often irrelevant to populations, so a taxon inhabiting a small country does not have a high extinction risk when the population as a whole is considered, rather than just the fragment of the population that occurs in the country in question. This view also results from confusing the assessment of extinction risk (the role of Red Lists) with the setting of conservation priorities (normally including consideration of additional variables that may include political or social factors).

A general change in thresholds for smaller regions (e.g., higher population numbers and smaller areas) and a decrease in population decline lead to an underestimation of extinction risk. Therefore, the appropriate approach is to make a taxon-by-taxon assessment based on the global IUCN Red List criteria and then consider whether the population is isolated (i.e., behaves as an endemic taxon) or is part of a larger population. The smaller the region, the more likely it will be that its populations are shared with neighboring countries; hence, designation of a Red List category will require consideration of the population as a whole. The problem may not be as serious as it first appears, however, because putative red-listed taxa, as a result of habitat destruction, often do have a fragmented distribution (reducing interaction between subpopulations). Hence, a well-defined subpopulation may often exist within a single country.

Problems will arise mostly with highly mobile organisms, such as birds, large mammals, some insects, marine organisms with pelagic stages, and certain lower plants with highly mobile spores. Despite this, one would still expect a higher percentage of the taxa occurring in smaller countries to be red-listed. This is because smaller countries have smaller populations on average (fewer locations), and the probability of local extinction is generally higher in smaller populations.

The second justification, that there are not enough data at the regional level, is generally not a significant issue. It is true that many countries do lack precise data on distribution, population numbers, and trends for their taxa, but the criteria do not require precise information. Generally, the assessor simply has to determine whether the value lies above or below some threshold. In fact, the IUCN Red List criteria have been applied successfully at the global level (the most data-poor of all scales) to over 15,000 taxa (Hilton-Taylor 2000). Most assessors also find that after they gain some experience in application, the criteria can be used readily with a limited amount of precise information.

Visiting Taxa

The quality of the habitat in areas occupied during nonbreeding periods may be essential for the survival of a species. Consequently, it is important to include assessments for visiting species in national and regional Red List assessments. This has rarely been attempted in the past, however, so there is little relevant experience. The IUCN Red List criteria were developed to produce a categorization correlated to risk of extinction. Whether the same criteria can be used for a nonreproducing phase of a population remains to be thoroughly tested and evaluated. This includes determining whether there are situations when it would be appropriate to apply the adjusting step to visiting population.

Objectivity and Conceptual Difficulties at the Regional Levels

The IUCN Red List categories and criteria (IUCN 1994, 2001) were developed to enhance the objectivity and comparability of Red Lists (Mace & Lande 1991; Mace & Collar 1995; Baillie & Groombridge 1996). Will these guidelines for regional application and the recommended two-step procedure still result in an objective categorization? We believe so. The assessment in both steps (using the

IUCN Red List criteria and the adjustment procedure) includes subjective evaluations of available data, but both steps have well-defined frames against which the assessment process is conducted.

The time frame considered in the risk assessment is most important at a regional level (Gärdenfors 1995, 1996). For instance, a regional extinction may be followed by a later recolonization. This effect will be even more pronounced for visiting taxa. Also, at a regional level, a taxon may be endangered according to criterion E on a 20-year time scale (IUCN 2001), whereas the long-term extinction risk may be less because of the rescue effects of neighboring populations. Although the time scale is conceptually important for particular definitions (e.g., criterion E and the category regionally extinct), we have largely ignored this issue in the proposed guidelines. Instead, we have tried to adopt a pragmatic approach and address, for example, the rescue effect by suggesting a downgrading of the category. We believe that any resulting difficulties are more conceptual than real. In most cases, regional populations disappear because of habitat destruction, and no immigrating propagules will rescue the population or lead to recolonization.

We propose the use of the term *regionally extinct*, rather than *extirpated* or *vanished*, as currently used in some countries. Extirpation literally means a successful eradication conducted on purpose, and that is hardly ever the cause of an extinction. Also, an abbreviation of extirpated could easily be confused with EX. Besides RE, some people want a category such as "regionally extinct in the wild." We believe this would not be an informative category because RE already implies that the taxon is extant somewhere in the world. The invention of yet another category could add more complexity to the system. Indeed, the comparative complexity that already encompasses the system makes it a big challenge to communicate and explain to those elaborating national and other regional Red Lists.

Acknowledgments

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