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REVIEW ARTICLE

IUCN RED LIST OF THREATENED SPECIES FOR BIODIVERSITY CONSERVATION: HISTORY AND IMPORTANCE

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ABSTRACT

Natural as well as anthropogenic catastrophes have led to the tremendous biodiversity crises all over the world. A growing concern regarding these catastrophes has led to the extensive compilation of threatened species lists, the aim of which is to identify the risk of extinction of taxa and to promote conservation actions that would help to halt the biodiversity crisis both globally as well as at the regional level. Awareness regarding the possible extinction of certain taxa is largely attributed to the development of the world conservation union's (IUCN) Red List and/ or Red Data Books (RDB). This information identify the threatened taxon which in turn is important to devise conservation strategies, research and monitoring of such taxa. The aim of present paper is to highlight the history, importance and role of IUCN in conservation of biodiversity.

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INTRODUCTION

Extinction proneness varies naturally according to natural phenomena which define ecological rarity and making populations more or less vulnerable to demographic, environmental or genetic stochasticity (Ricklefs & Bermingham 2002; Williamson 1989). For instance, the probability of having conservation problems is higher in species with low population sizes or local abundances (Mace& Kershaw 1997; O'Grady *et al*., 2004a; Pimm *et al*., 1993), small range sizes (Cardillo *et al*., 2008; Gage *et al*., 2004; Purvis *et al*., 2000) and those with specialized habitat preferences (Hawkins *et al*., 2000; Julliard *et al*., 2004; Gage *et al*., 2004). Therefore, species differ intrinsically in their vulnerability even before taking into account human-related factors that alter the natural scenario through habitat loss, over-exploitation and species introduction (Dulvy *et al*., 2003; Hawkins *et al*. 2000; Keane *et al*., 2005). Regardless of the specific underlying causes, the earth is currently experiencing a higher loss of biodiversity comparable to the great geological extinctions (Bini *et al*., 2005) due to over exploitation and habitat destruction (Samant *et al*., 1998). At present, the rapid loss of species is estimated to be between 100 and 1000 times higher than expected natural extinction rate and the major threats to biodiversity are habitat loss and fragmentation, over-exploitation, pollution, invasion of alien species and global climate change (IUCN, 2003). A large percentage of the world's 250,000–420,000 plant species (Stebbins 1974; Prance *et al*., 2000; Thorne 2002; Govaerts, 2001; Bramwell, 2002; Joppa *et al*., 2010; Moram *et al*., 2011) are threatened by habitat loss or degradation, overexploitation, biological invasions, industrialization, pollution and accelerated climate change, with perhaps as many as 94,000–194,000 species at risk of extinction in the near future (Pitman and Jorgensen 2002). A growing concern regarding these natural as well as anthropogenic catastrophes has led to the extensive compilation of threatened species lists, the aim of which is to identify the risk of extinction of taxa and to promote conservation actions that would help to halt the biodiversity crisis both globally as well as at the regional level (Miller *et al*., 2007). These lists are mostly based on the perceived pattern of rarity of the species (and subspecies), typically taking into account population sizes and trends, and the size of the range of distribution (Mace and Lande, 1991). Although there are a number of species assessment systems in place to check out the threat status of a species. Of these, the system proposed by IUCN is the most widely accepted. A leading organization in management of natural resources, IUCN is also a pioneer in developing an assessment system of global Red List of threatened species and has been continuing to do so over the last 47 years. Now, *The IUCN Red List of Threatened*

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Species™ is a brand. The global IUCN Red List is updated on a regular basis (Irfanullah, 2011). However, the information on the history of IUCN, its role in conservation of biodiversity and progress made in the past years is scattered and needs to be summed up. The aim of the present paper is to highlight the importance and role of IUCN in conservation.

Importance and role of IUCN

The first step to initiate conservation actions for endangered organisms is to identify the populations or species that are in decline or are faced with the risk of extinction because they are small (Caughley, 1994; Brooks *et al.*, 2006). Key to this process is the use of objective, quantifiable and consistent criteria to assess the status of a species. Included in this analysis is the identification of threats which are used to inform conservation actions if required (Rodrigues, *et al*., 2006). Growing awareness about the possible extinction of certain taxa is largely attributed to the development of the world conservation union's (IUCN) Red List and/ or Red Data Books (RDB) concept (Magin *et al.*, 1994). Red Data Lists and RDBs are in simple terms, methods for identifying declining taxa, which will allow conservation scientists to establish the nature and extent of such declines, introduce conservation actions, research and the monitoring of such taxa (Sutherland, 2001; Possingham *et al.*, 2002; Lamareux *et al.*, 2003). Red Lists and Red Data Books (RDBs) contribute to basic research and to the general knowledge of taxa by providing consolidated information, reflecting the probability of decline or loss of a taxon through extinction. The identification of taxa under threat of extinction has proven to be helpful by drawing public focus to these taxa, as well as their declining habitats (Ferrar, 1991; Possingham *et al.*, 2002). The compilation of Red Lists and RDBs are an essential component of modern conservation practice (Sutherland, 2001). The Red List, as an indicator of bio-diversity is important for biodiversity conservation and also provides clues regarding comparative framework for conservation planning (Given, 2003). The assessment of threatened status is considered to be one of the most important steps in biodiversity conservation (Cheng and Zang, 2004). The IUCN Red List is not limited to just providing a threat categorization. For an increasing number of species, be they threatened or not, it now provides extensive information covering taxonomy (classification of species), conservation status, geographic distribution, habitat requirements, biology, threats, population, utilization, and conservation actions (Vie *et al*., 2008). The threatened species list has been utilized to: (1) inform and influence conservation policies and legislation (National and International); (2) stimulate research and monitoring progress for species and /or habitats; (3) monitor the status of biodiversity and report on the state of environment; (4) regulate development and exploitation; (5) target geographical areas for conservation planning; (6) increase public awareness of human impact on biodiversity; and (7) set priorities for the allocation of limited conservation resources (Maes and Van Swaay 1997; Bennum *et al.*, 2000; Possingham *et al.*, 2002; Rodriquez *et al.*, 2004; Miller *et al.*, 2006).

History of IUCN Red Lists

IUCN began in 1948 when the first Director General of UNESCO, Sir Julian Huxley, sponsored a congress held at Fontainebleau, France to establish a new environmental institution to help and serve the conservation purpose. At that first congress, 18 governments, 7 international organizations, and 107 national nature conservation organizations all agreed to form the institution and signed a "constitutive act" creating an International Union for the Protection of Nature (Christoffersen, 1994). From its beginning, the overriding strategy and policy of the institution has been to explore and promote mutually beneficial conservation arrangements that suit those promoting development as well as assisting people and nations to better preserve their flora and fauna (Christoffersen, 1994). However, the foundation of IUCN Survival Service Commission (SSC) and its secretariat in London in the 1960s marked the institutionalization of work on establishing lists with species threatened by extinction (Scott *et al.,* 1987).

The concept of the Red Data Book, registers of wildlife, assigned categories of threat, is generally credited to Sir Peter Scott when he became Chair of the then IUCN Survival Service Commission in 1963, with the first two volumes (on mammals and birds) published in 1966. The work towards The Red Lists and RDBS of threatened plants began in the late 1960's, when Sir Peter Scott, the then chairman of the IUCN Special Survival Commission (SSC), invited Ronald Melville, a retired botanist at the Royal Botanical Garden Kew, to compile a Red Data book on Angiosperms to match the famous loose – leaf books on threatened animal groups. By 1971, R. Melville had been able to publish two sets of loose – leaf sheets covering 118 plants in all. But as a result of his work, he had come up with the prediction that about 20,000 flowering plant species were likely to be in need of some form of protection to ensure their well-being and survival. A large percentage of these are probably in imminent danger of total extinction (IUCN Red Data Book, 1997; Heslop-Harrison, 1974). To help counter this alarming situation, the Survival Service Commission of the International Union for Conservation of Nature and Natural resources (IUCN) in 1973 set up a Threatened Plants Committee (TPC) to advise the Union on the conservation of plants and to help stimulate action in the plant sphere (Lucas and Synge, 1977). In January 1975, the secretariat started work on compiling a full threatened list for the European continent. In 1977, the TPC published the list of some 2,000 threatened plant species of Europe (IUCN, 1997; Lucas and Synge, 1977). In 1978, IUCN Plant Red Data Book was published which provide details on the conservation status of 250 species of plants – 1% of the then estimated 25,000 threatened species (IUCN, 1997).

Since 1960s IUCN Red List has evolved from multiple lists and books dedicated to animal or plant groups into a unique comprehensive compendium of conservation-related information, the information gathered is now too large to publish as a book. However, it can be viewed in its entirety on a website managed and maintained by the IUCN Species Programme. It is updated once a year and is freely available to all users of the World Wide Web.

Changing the path from subjective to objective assessment

Before 1994, categories used by the IUCN were more subjective and had been in place, for almost 30 years (IUCN, 1994). These categories were largely qualitative and subjective, as a result dependent almost exclusively on expert opinion. These Red List assessments relied on the experience and common sense of experts, without following a protocol, as it was assumed that "any competent naturalist would have known the category to place a species in" (Burton, 2003). The Red Data categories used by IUCN to indicate the degree of threat to individual species were: extinct ***(EX)***, Endangered (***E***), vulnerable (***V***), rare (***R***), indeterminate (***I***), out of danger (***O***) and insufficiently known (***K***). Although the idea of having experts assessing the conservation status was revolutionary at that time, however, the subjectivity of these assessments was subsequently realized (Master, 1991; Mrosovsky, 1997; Possingham *et al.*, 2002; Mace and Lande, 1991). Consequently, categorization made by different authorities, from different areas and across RDBs, was inconsistent and did not accurately reflect the actual extinction risks (Mace and Lande, 1991; Master 1991; Todd and Burgman, 1998). In 1989, the IUCN Special Survival Commission Steering Committee started to develop a more objective and quantitative approach that provided the conservation community with a useful methodology for assessing the risk of extinction of species. In 1994, with the publication of IUCN Red List categories and criteria (version 2.3), there was a marked shift from qualitative to a more quantitative system (IUCN, 1994, 2001). With the implementation of these data driven and objective criteria, the nature of the assessments has changed dramatically (Mace and Lande, 1991; IUCN, 1994; IUCN, 2001). The listing criteria are clear and comprehensive but flexible enough to handle uncertainty (Akcakaya *et al.*, 2000). The assessments must be backed up by data, justifications, sources and estimates of uncertainty and data quality (IUCN, 2005). Between 1997 and 2000, the system was re-examined and changes in the criteria and categories were adopted (IUCN, 2001). The categories adopted were Extinct ***(EX)***, Critically Endangered (***CR***), Endangered ***(EN)***, Vulnerable ***(VU)***, Near Threatened (***NT***), Data Deficient (***DD***), Least Concern (***LC***) and Not Evaluated (***NE***) (Gardenfors, 2001).

The categories and criteria (IUCN, 1994; 2001) consider five different aspects of a taxon's life history traits, including information on population and distribution trends. A taxon, therefore qualifies any of the nine (9) IUCN Red List categories that is Extinct ***(EX)***, Extinct in Wild (***EW***),Critically Endangered (***CR***), Endangered ***(EN)***, Vulnerable ***(VU)***, Near Threatened (***NT***), Least Concern (***LC***) , Data Deficient (***DD***), Not Evaluated (***NE***) (IUCN, 2001 for definition) if it meets any one of the five specified threat criteria (A-E). These are then used to ascertain the possible threat extinction to that particular taxon (IUCN, 2001). These categories are assigned by one or more of the five criteria or decision rules, denoted as A-E. The criteria A-D draw on warning signals that indicate the population is at risk. Criteria 'A' builds on population reduction, 'B' on a small distribution area in combination with fragmentation, decline or extreme fluctuation of the population, 'C' on a small population number in combination with a population decline, and 'D' on an extremely small population. Criteria 'E' specifies explicit extinct risk levels within specified time frames. Species classified as ***CR***, ***EN*** or ***VU*** are referred to as threatened while as species classified a ***LC*** and ***NE*** categories are usually not published in Red lists and Red Data Books. The ***NT*** is used when the species is close to qualifying or is likely to qualify in the nearest future, for a threatened category (IUCN, 2001; Gardenfors, 2001). The Guidelines for Using the IUCN Red List Categories and Criteria have been developed and are updated on a regular basis; they provide detailed guidance on how to apply the categories and criteria and aim at providing solutions to specific technical issues to ensure that assessments are conducted in a standardized way across various plant and animal groups (IUCN, 2003). Today the IUCN Red List of threatened species is recognized as one of the most authoritative sources of information on the global conservation status of plants and animals (Lamareux *et al.*, 2003; de Grammot and Cuaron 2006, Rodrigues *et al.*, 2006).

The IUCN Red List Categories and Criteria

To list a particular taxon in any of the categories of threat, only one of the criteria, A, B, C, D, or E needs to be met. However, a taxon should be assessed against as many criteria as available data permit, and the listing should be annotated by as many criteria as are applicable for a specific category of threat (IUCN, 2003). The IUCN has developed 5 basic criteria A-E to evaluate the threat status of the species which include: Population size (A), Restricted geographical range (B), Small population size and decline (C), Very small or restricted population (D) and Quantitative analysis (E).

Nature of the categories

There are nine clearly defined categories into which every taxon in the world (excluding micro-organisms) can be classified. However, at the regional level two additional categories are used. These are: Extinct ***(EX)***, Extinct in Wild (***EW***), Regionally Extinct (***RE***), Critically Endangered (***CR***), Endangered ***(EN)***, Vulnerable ***(VU)***, Near Threatened (***NT***), Least Concern (***LC***), Data Deficient (***DD***), Not Evaluated (***NE***), and Not Applicable (***NA***)

IUCN Red Listing at Regional Level: need and importance

The 1994 and 2001 IUCN Red List categories and criteria were designed for the assessment of extinction risk of the species at the global level. However, need was felt to assess the population status at regional and local levels because it is the regional scale where the human actions and biodiversity collide (Pimm *et al.*, 2001); Moreover the National governments can also play an important role in conservation actions (Cuaron, 1993; Rodriguez *et al.*, 2000). The need of the IUCN Regional guidelines are because of the fact that national threatened species lists produced by different countries are difficult to interpret because they are often designed to serve different purposes in different countries and therefore encompass a wide range of methodologies (Burton, 2003). A threatened species list may reflect extinction risk, rarity, cultural importance, conservation value, population decline, conservation priorities, international responsibility for protection, or a combination of these factors. Further complicating matters are the definitions of categories which may also vary between the countries, so that terms such as threatened or vulnerable may have different meanings on different lists (Schnittler and Gunther, 1999; Grigera and Ubeda, 2002). Moreover, the criteria used are often neither explicit nor transparent (de Grammont and Cuaron, 2006). Although a given threatened species listing procedure may be effective within one country, but such variations in national listing makes direct international comparisons of population status difficult and can hamper the efforts to consolidate information from different countries. This can in turn impede species protection on a larger scale, rendering the national threatened species of limited use (Miller *et al.*, 2007). Applying the IUCN criteria (1994, 2001) to the portion of a population present within a particular region, that is, any sub-global geographical area, e.g., a continent, country, or province is also impractical and would artificially divides the biological population into a smaller, more restricted sub-population. As the small, isolated population face a higher threat of extinction than large, wide spread populations (Lande, 1993, 1998; O Grady *et al.*, 2004b), the artificially divided sub-populations may be assessed individually as having a higher risk of extinction than they actually face (Miller *et al.*, 2007). 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 (IUCN, 2001). In most cases, this will mean downgrading the category obtained in step one, because populations within the region may experience a "rescue effect" from populations outside the region (Brown and Kodric-Brown, 1977, Hanski and Gyllenberg, 1993). In other words, immigration from

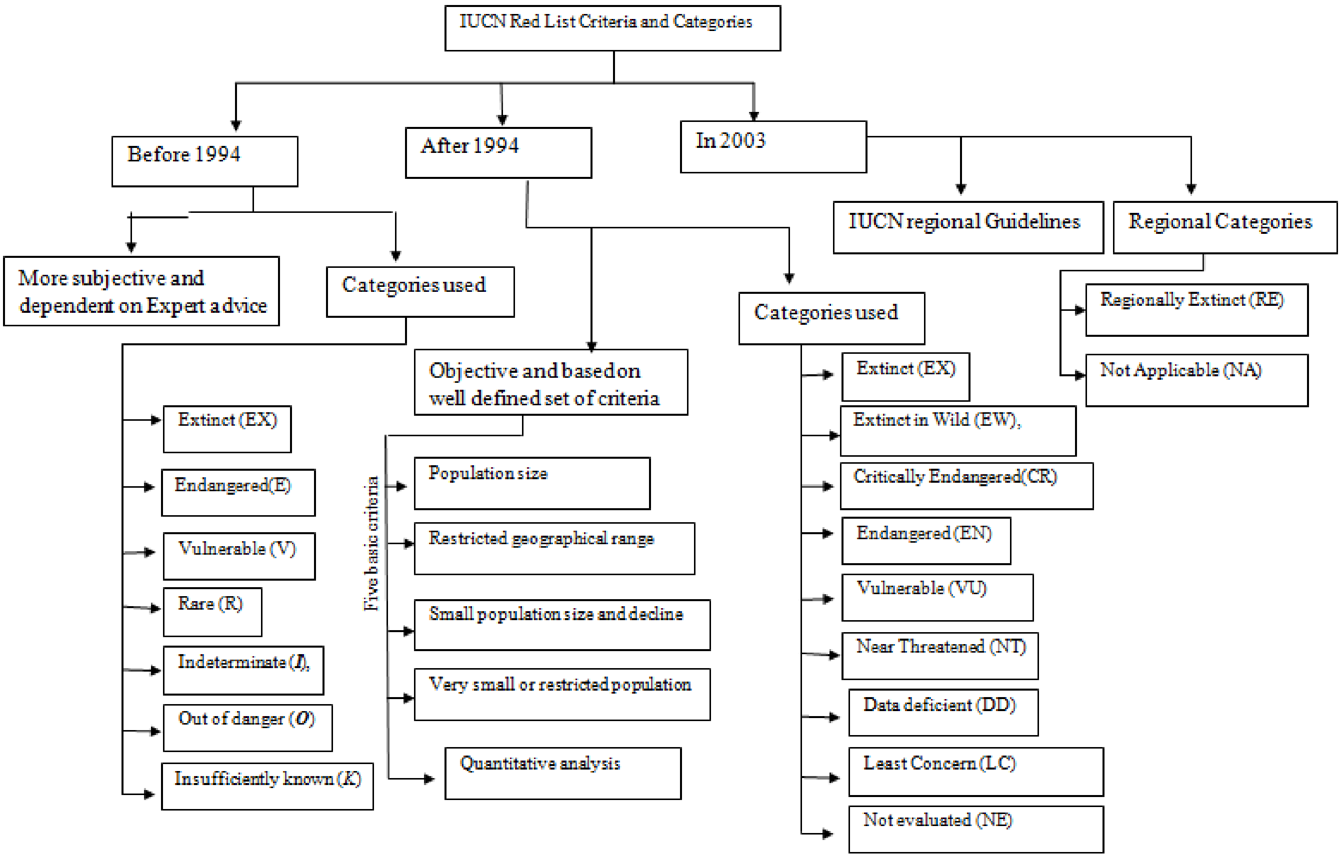

Fig. 1. Conceptual scheme of evolution of IUCN Red List Criteria and categories

To resolve the problem of incorrect regional assessment, the IUCN Special Survival Commission (SSC) appointed a regional application working group (RAWG) in 1998 following the adoption of a resolution on the matter at the first World Conservation Congress in Montreal (Resulation D.1.25) (Gardenfors, 2001). IUCN Regional guidelines (2003) were developed which adopt the criteria for use at the regional level by taking into account the effect of the sub-populations present outside a region on the likelihood of sub-populations extinction present within the region (Gardenfors *et al.,* 1999, Gardenfors, 2000; IUCN, 2003). These Guidelines proposed that the Regional assessments should be carried out in two-steps. In the first step, the IUCN Red List criteria (IUCN, 2001) proposed for the application at global scale should be applied to the regional population of the taxa. The data used (number of individuals and parameters relating to area, reduction, decline, fluctuations, subpopulations, locations, and fragmentation) should be from the regional population (IUCN, 2003). This first step results in a preliminary categorization of the taxa (IUCN, 2003). In step two, 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

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 changing 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. Likewise, if the region is very small and not isolated by barriers from surrounding regions, downgrading by two or more steps may be necessary. Conversely, if the population within the region is a demographic sink (Pulliam, 1988) that is unable to sustain itself without immigration from populations outside the region, and if the extra-regional source is expected to decrease, the extinction risk of the regional population may be underestimated by the criteria. In such exceptional cases, an upgrading of the category may be appropriate. If it is unknown whether or not extra-regional populations influence the extinction risk of the regional population, the category from step one should be kept unaltered. However, it should be noted that adjustments can be made to all the categories except for Extinct ***(EX)***, Extinct in the Wild (***EW***), Regionally Extinct (***RE***), Data Deficient (***DD***), Not Evaluated (***NE***), and Not Applicable (***NA***), which cannot logically be up- or downgraded (IUCN, 2003).

At regional level in addition to the 9 global categories, two more regional categories were proposed that is, at regional level 11 categories were adopted which are Extinct ***(EX)***, Extinct in Wild (***EW***), Regionally Extinct (***RE***), Critically Endangered (***CR***), Endangered ***(EN)***, Vulnerable ***(VU)***, Near Threatened (***NT***), Least Concern (***LC***) , Data Deficient (***DD***), Not Evaluated (***NE***), and Not Applicable (***NA***) (IUCN, 2003) (Fig.1). The national or regional threat lists play a valuable role in informing global conservation efforts, especially when the information that they contain is incorporated into the global IUCN Red List (Cuaron 1993; Rodriguez *et al.*, 2000). At the national level the threatened species obtain the strongest legal protection and also the national threat assessment can act as early warning signs of local decline and therefore, sufficient protection of a particular taxon at the national level by multiple countries could, theoretically, prevent or delay the species extinction globally (Miller *et al.*, 2007).

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REFERENCES

Akçakaya, H.R., S. Ferson, M.A. Burgman, D. A. Keith, G.M. Mace & C.R. Todd 2000. Making consistent IUCN classifications under uncertainty. *Conserv Biol.,* 14: 1001–1013

Bennum, L.A., P. Njoroge, D. Pomeroy 2000. Birds to watch, a red data list for East Africa. *Ostrich.,* 71,310–314

Bini, L.M., J. Alexandre, F. Diniz-Filho F, Carvalho P, Pinto MP, Rangel TFLVB 2005. Lomborgand the litany of biodiversity crisis, What the peer-reviewed literature says. *Conservation Biology,* 19, 1301–1305

Bramwell D. 2002. How many plant species are there? *Pl Talk 28*,32–34

Brooks TM, Mittermeier, RA, da Fonseca, GAB, Gerlach, J, Hoffmann, M Lamoreux, J F, Mittermeier, C G, Pilgrim, J D, Rodrigues A S L 2006. Global biodiversity conservation priorities. *Science*, 313,58–61

Brown J H, Kodric-Brown A 1977. Turnover rates in insular biogeography, effect of immigration on extinction. *Ecology, 58*, 445–449

Burton J A 2003. The context of red data books, with a complete bibliography of the IUCN publications 291–300 In, De Iongh, H H, B´anki, O S, Bergmans, W & van derWerfften Bosch, M J (eds) The harmonization of red lists for threatened species in Europe The Netherlands Commission for International Nature Protection, Leiden

Cardillo M, Mace G M, Gittleman J L, Jones K E, Bielby J, Purvis A 2008. The predictability of extinction, Biological & external correlates of decline in mammals. *Proceedings of the Royal Society B-Biological Sciences*, 275, 1441–1448.

Caughley G. 1994. Directions in conservation biology. *Journal of Animal Ecology*, 63, 215–244

Cheng KW. And Zang RG 2004. Advances in species endangerment assessment. *Biodiversity Science*, 12,534-540

Christoffersen Leif E 1994. *IUCN, A Bridge-Builder for Nature Conservation* Green Globe Year Book

Cuaron, A D. 1993. Extinction rate estimates. *Nature*, 366,118

De Grammont PC. and Cuaron, AD. 2006. An evaluation of threatened species categorization systems used on the American continent. *Conserv Biol*., 20,14–27

Dulvy N K, Sadovy Y, Reynolds J D 2003. Extinction vulnerability in marine populations. *Fish and Fisheries*, 4, 25–64

Ferrar AA 1991. The role of Red Data Books in conserving Biodiversity In, Huntley, BJ (Ed), Biotic diversity in South Africa, Concepts & conservation Oxford University press, Cape Town, pp 136-147

Gage G S, Brooke M D L, Symonds M R E, Wege D 2004. Ecological correlates of the threat of extinction in Neotropical bird species. *Animal Conservation*, 7, 161–168

Gärdenfors U 2000. *How to Red-List Species*Manual and Guidelines, Art Data banken, Swedish University of Agricultural Sciences

Gärdenfors U 2001. Classifying threatened species at a national versus global level. *Trends in Ecology & Evolution,* 16, 511–516

Gardenfors U, Rodrıguez J P, Hilton-Taylor C, Hyslop C, Mace G, Molur S, Poss S. 1999. Draft guidelines for the application of IUCN Red List criteria at national & regional levels Species 3.1., 58–70

Gary A. Krupnick, G.A., W. John Kress , W. L. Wagner, 2009. Achieving Target 2 of the Global Strategy for Plant Conservation: building a preliminary assessment of vascular plant species using data from herbarium specimens. *Biodivers Conserv*., 18:1459–1474.

Given D 2003. On Red Lists and IUCN Plant Talk*34*,6

Govaerts R 2001. How many species of seed plants are there? *Taxon*, 50,1085–1090

Grigera D. and Ubeda, C 2002. Unarevisi´on de los trabajossobre categorizaciones y prioridades de conservaci´on de los vertebrados de Argentina. *Ecolog´ıa Austral*., 12,163–174

Hanski I. and Gyllenberg M. 1993. Two general metapopulation models and the core-satellite species hypothesis. *The American Naturalist,* 142, 17–41

Hawkins J P, Roberts C M. and Clark V. 2000. The threatened status of restricted range coral reef fish species Animal Conservation, 3, 81–88

Heslop-Harrison J. 1974. Postscript, the threatened plants committee Succulents in Peril, Contributions on the theme of conservation presented during the XII Congress of the International Organisation for Succulent plant study In, DR Hunt IOS Bulletin (eds), pp 30-32

Irfanullah H M. 2011. Conserving threatened plants of Bangladesh, miles to go before we start? *Bangladesh J Plant Taxon.,* 18(1), 81-91

IUCN 1994. *IUCN Red List Categories IUCN Species Survival Commission* IUCN, Gland

IUCN 1997. *lUCN Red List of Threatened Plants* Gland, Switzerland, IUCN

IUCN 2001. *IUCN Red List Categories & Criteria, version 3.1* IUCN, Gland& Cambridge

IUCN 2003. *Guidelines for Application of IUCN Red List Criteria at Regional levels, Version 3.I UCN Species Survival Commission* IUCN, Gland, Switzerland and Cambridge, UK

IUCN 2005. *Guidelines for using the IUCN Red List Categories and Criteria Prepared by the Standards and Petitions Subcommittee of the IUCN SSC Red List Programme Committee* IUCN, Gland, Switzerland, and Cambridge, United Kingdom

IUCN 2009. *The IUCN Red List of threatened species 2009 update, plant facts* IUCN, Gland

IUCN 2010. *Guidelines for Using the IUCN Red List Categories & Criteria Version 8.1.* Prepared by the Standards and Petitions Subcommittee in March 2010

Joppa LN, Roberts DL, Pimm SL. 2011. How many species of flowering plants are there? Proceedings of the Royal Society B 278, 554-559

Julliard R, Jiguet F, Couvet D 2004. Common birds facing global changes, What makes a species at risk? *Global Change Biology,* 10, 148–154

Keane A, Brooke M D L, McGowan P J K (2005)Correlates of extinction risk & hunting pressure in gamebirds (Galliformes). *Biological Conservation*, 126, 216–233

Kricsfalusy, V.V. and N. Trevisan. 2014. Prioritizing regionally rare plant species for conservation using herbarium data Biodivers Conserv, 23:39–61.

Lamoreux J, Akçakaya HR, Bennun L, Collar NJ, Boitani L, Brackett D, Brautigam A, Brooks TM, Fonseca GAB, Mittermeier RA 2003. Value of the IUCN Red List. *Trends in Ecology and Evolution*, 18, 214-215

Lande R C. 1993. Risks of population extinction from demographic & environmental stochasticityand random catastrophes. *The American Naturalist*, 142,911–927

Lande RC 1988. Genetics and demography in biological conservation *Science*, 241,1455–1460

Lucas G L. and Synge A H M 1977. The IUCN Threatened Plants Committee and its Work Throughout the World Environmental Conservation, 4,179-187

Mace G M. and Kershaw M 1997. Extinction risk & rarity on an ecological timescale In, W E Kunin, & K J Gaston (eds), The biology of rarity (pp 130–149) London, Chapman & Hall

Mace GM. and Ladne R 1991. Assessing extinction threats—toward a reevaluation of IUCN threatened species categories. *Conserv Biol*., 5,148–157

Maes D. and van Swaay C A M 1997. A new methodology for compiling national red lists applied to butterflies (Lepidoptera, Rhopalocera) in Flanders (N-Belgium) & the Netherlands. *Journal of Insect Conservation*, 1,113–124

Magin CD, Johnson TH, Groombridge B, Jenkins M, Smith H 1994. Species extinction, endangerment & captive breeding In, Olney, PJS, Mace, GM, Feistner, ATC (eds), Creative conservation, Interactive management of wild & captive animals Chapman & Hall, London, pp 1-31

Master LL 1991. Assessing threats and setting priorities for conservation. *Conserv Biol.,* 5,559–563

Miller RM, Rodríguez J P, Aniskowicz-Fowler T, Bambaradeniya Ruben B C, Mark A E, Gärdenfors U, Keller V, Molur S, Walker S, Pollock C 2007. National threatened species listing based on IUCN Criteria & Regional Guidelines, current status & future perspectives. *Conserv Biol*., 21,684–696

Miller RM, Rodríguez JP, Aniskowicz-Fowler T, Bambaradeniya C, Boles R, Eaton MA, Gärdenfors U, Keller V, Molur S, Walker S, Pollock C 2006. Extinction risks and conservation priorities. *Science*, 313, 441

Miller, J. S., H. A. Porter-Morgan, H. Stevens, B. Boom, G. A. Krupnick, P. Acevedo-Rodrı´guez, J. Fleming, and Micah Gensler. 2012. Addressing target two of the Global Strategy for Plant Conservation by rapidly identifying plants at risk. DOI 10.1007/s10531-012-0285-3

Moram C, Tittensor DP, Adland S, Simpson AGB, Worm B 2011. How many species are there on earth and in the ocean? *PLoS Biol*., 9,1100-1127

Mrosovsky N 1997. IUCN's credibility critically endangered *Nature*, *389*,436

O'Grady J J, Burgman M A, Keith D A, Master L L, Andelman S J, Brook B W, Hammerson G A, Regan T, Frankham R 2004b. Correlations among extinction risks assessed by different systems of threatened species categorization. *Conservation Biology,* 18,1624–1635

O'Grady J J, Reed D H, Brook B W, Frankham, R 2004a. What are the best correlates of predicted extinction risk? *Biological Conservation*, 118, 513–520

Pimm S L, Ayres M, Balmford A, Branch G, Brandon K, Brooks T, Bustamante R, Costanza R, Cowling R, Lisa M C, Dobson A, Farber S, Fonseca G, Gascon C, Kitching R, McNeely J, Lovejoy T, Mittermeier R, Myers N, Patz J A, Raffle B, Rapport D, Raven P, Roberts C, Rodríguez J P, Rylands A B, Tucker C, Safina C, Samper C, Stiassny M L J, Supriatna J, Wall D H, Wilcove, D 2001. Can we defy nature's end? *Science*, 293,2207–2208

Pimm S L, Diamond J, Reed T M, Russell G J, Verner, J 1993. Times to extinction for small populations of large birds. Proceedings of the National Academy of Sciences of the United States of America, 90, 10871–10875

Pitman NCA. and Jorgensen, PM 2002. Estimating the size of the world's threatened flora. *Science*, 298,989

Possingham HP, Andelman SJ, Burgman MA, Medellin RA, Master LL, Keith DA. 2002. Limits to the use of threatened species lists, *Trends EcolEvol*., 17, 503–507

Prance GT, Beentje H, Dransfield J. and Johns, R 2000. The tropical flora remains under collected. *Ann Mo Bot Gard.,* 87,67–71

Pulliam H R 1988. Sources, sinks, & population regulation. *The American Naturalist*, 132,652-661

Purvis A, Gittleman J L, Cowlishaw G. and Mace G M 2000. Predicting extinction risk in declining species. Proceedings of the Royal Society of London Series B-Biological Sciences, 267, 1947–1952

Ricklefs R E. and Bermingham E. 2002. The concept of the taxon cycle in biogeography. *Global Ecology and Biogeography,* 11, 353–361

Rivers, M.C., L. Taylor, N. A. Brummitt, T. R. Meagher, D. L. Roberts, E. N. Lughadha. 2011. How many herbarium specimens are needed to detect threatened species? *Biological Conservation*, 144, 2541–2547.

Rodrigues ASL, Pilgrim JD, Lamoreux JF, Hoffmann M, Brooks, TM 2006. The value of the IUCN Red List for conservation. *Trends in Ecology and Evolution*, 21,71–76

Rodríguez J P , Ashenfelter G, Rojas-Suárez F, García Fernández J J, Suárez, L, Dobson, A P 2000. Local data are vital to world-wide conservation. *Nature*, 403,241

Rodrıguez J P, Rojas-Su´arez F, Sharpe, C J 2004. Setting priorities for the conservation of Venezuela's threatened birds. Oryx, 38,373–382

Samant SS, Dhar U. and Palni LMS 1998. *Medicinal Plants of Indian Himalaya, Diversity, Distribution Potential Values.* HIMAVIKAS Publ GyanPrakash,Nainital

Schnittler M. and Gunther K F 1999. Central European vascular plants requiring priority conservation measures—an analysis from national red lists & distribution maps. *Biodiversity and Conservation*, 8,891–925

Scott P, Burion J A, Fitter R 1987. Red Data Books, the historical background In, Richard Fitter & M Fitter (eds)The Road to Extinction, A Symposium Held by the Species Survival Commission (Madrid, 7 & 9 November, 1984), pp 1-5, IUCN

Stebbins GL 1974. *Flowering plants, evolution beyond the species level.* The Belnap Press of Harvard University, Cambridge

Sutherland WJ 2001. *The conservation Handbook, Research, management & policy.* Blackwell science, UK

Thorne R F 2002. How many species of seed plants are there? Taxon, *51*,511–522

Todd CD. and Burgman, MA 1998. Assessment of threat & conservation priorities under realistic levels of uncertainty & reliability. *Conservation Biology,* 12, 966-974

Vie JC, Hilton-Taylor C, Pollock C, Ragle J, Smart J, Stuart S, Tong, R. 2008. *The IUCN Red List, A key Conservation Tool.* IUCN, Gland, Switzerland

Williamson M H. 1989 Natural extinction on islands. Philosophical Transactions of the Royal Society B, *Biological Sciences*, 325, 457–468.

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