



AS WE SEE IT

Applications of the IUCN Red List: towards a global barometer for plant diversity

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ABSTRACT: The scale of the global biodiversity crisis means that international efforts to identify, conserve and monitor threatened species must be carried out at a greater speed than ever before. Recent developments in information technology present an opportunity to speed up the production of species conservation assessments, and methods and prospects for this are discussed in the context of the work being conducted on plant assessments for the International Union for Conservation of Nature (IUCN) Sampled Red List Index. The need for an internationally agreed upon, comparable, standardised system such as the Red List is emphasised here, but ultimately more efficient techniques must be developed to supplement the existing approach if this is to be able to meet the global demand.

KEY WORDS: IUCN · Red List · Plants · Sampled Red List Index · SRLI · Geographical Information System · GIS

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INTRODUCTION

It is widely agreed that we are now in the middle of the sixth great mass extinction of life on this planet. However, what is less commonly known by the general public but is more worrying is how little we, the scientific and conservation community, actually know about exactly what we are losing and how quickly. Which species are most at threat? Where are those threats greatest? What are those threats? Tremendous progress has been made recently in fields such as systematics, biogeography, population genetics, remote sensing and conservation biology itself. However, the same impediments that have existed since the adoption of the Convention on Biological Diversity (CBD) in 1992, the first truly global initiative to legislate for the need to conserve biological diversity, continue to hamper efforts to fully understand, monitor and conserve our planet's biological diversity: there is too little knowledge, there are too few scientists, there is not enough money, and we are running out of time.

At present we are only really guessing at the extent to which the world's flora is threatened and whether

this risk is increasing or not. Attempts have been made at an objective estimate to the first part of this question (Pitman & Jorgensen 2002), but without a comprehensive list of accepted species names and synonyms for the world's plants, estimates even just of total species of plants based on extrapolation from either partial checklists (Govaerts 2001, 2003) or on patterns of endemism (Bramwell 2002) are subject to a high degree of unquantifiable error (Ungricht 2004). However, many groups of plant species have been the focus of recent efforts to produce modern, authoritative taxonomic checklists, and international progress on this issue is encouraging, with the majority of species now thought to have been treated (Paton et al. 2008). The next step is to quantify the threat of extinction for species in these groups. Overall threat status has been inferred from global lists of threat such as the International Union for Conservation of Nature (IUCN) Red List (e.g. Walter & Gillett 1998), but this sample is biased and not representative. Consistent assessments at the species level also allow trends over time to be identified as species move between categories (Butchart et al. 2004, Baillie et al. 2008) and therefore

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will help to answer the second part of the question — How is the level of threat to the world's flora changing over time?

To date, there are 12 043 plant species assessed according to the IUCN Categories and Criteria as listed in the 2007 IUCN Red List of threatened species (www.iucnredlist.org, accessed on 3 January 2008). This is a mere 3.2% of the estimated number of currently known plant species (379 881; Paton et al. 2008), and is not a representative sample of species, most samples being those for which there happens to be an active Specialist Group (e.g. conifers, cycads), regional strength (e.g. South Africa), or a strong economic interest (e.g. trees; Oldfield et al. 1998). Most species have not been assessed as to their conservation status, and for the majority of known species there is currently insufficient baseline information with which to make that assessment. This is in stark contrast to knowledge of the world's bird species, for example. However, birds and other vertebrate groups must be seen as comparatively small, anomalously well-known taxa. There are more species of grasses than there are bird species worldwide, but far more ornithologists than there are agrostologists, or even botanists in general.

For the majority of plant species already described, especially for those in the biodiversity hotspots in the tropics, all that is known for each species is the original description and Latin diagnosis, plus at least 1 cited specimen (the holotype) and, if known, sometimes a brief summary of its broader distribution (Nic Lughadha et al. 2005). For many countries around the world, there is still no modern, complete Flora for all of the plant species found there, nor is there even an up-to-date and comprehensive checklist (Frodin 2001, Paton et al. 2008). Few species are really known in any detail — there is almost no existing information on numbers of individuals, numbers of separate populations, breeding success (or even breeding system), dispersal capability, or known or potential economic uses, let alone any population genetic studies or detailed understanding of gene flow patterns. For most plant species the most comprehensive, easily accessible information, and the most reliable data on which to base a species conservation assessment, is of the location and range of that species, the best source of which is the dried plant specimens held collectively in the world's herbaria.

PROBLEMS IN APPLYING THE IUCN CATEGORIES AND CRITERIA TO PLANTS

The IUCN system of classifying extinction risk to species (IUCN 2001) is now well established as the most comprehensive, quantitative and widely used method for determining threat of extinction to species

(Rodrigues et al. 2006). The product of the system, the Red List, is a list of species ranked according to their relative risk of extinction, and the associated species assessments compile the current knowledge of the conservation status of and threats to that species. The list is an extremely valuable tool for informing species and site level conservation efforts; it is recognised around the world by both specialists and non-specialists alike. So why have so few plants been assessed so far using the IUCN system? Several overlapping issues provide perhaps the major reason for the lack of plant species listed on the Red List. An unfortunate consequence of making the IUCN Categories and Criteria more quantitative and objective is that fewer plant species can be assessed; there simply are not enough experts and there is insufficient knowledge of most plant species to apply the criteria. Many groups of plants are thus not currently being actively studied and/or last received critical attention decades ago, so further information is unlikely to be forthcoming within a short period of time. A major, but perhaps not as obvious, reason for a poor showing of plants on the Red List is that this is not the only system for classifying species at risk of extinction. In the United States the NatureServe system (www.natureserve.org/explorer/ranking.htm) is primarily used, and over 62 000 plant taxa have already been assessed in that system. Variations on the Red List system also exist, for example in New Zealand (Hitchmough 2002), and other alternative systems are also available, such as the Genetic Heat Index (Hawthorne 2001). In other words, assessments are being made, but not necessarily within the IUCN system. Combine this with the taxonomic impediment already highlighted and a lack of recent Floras or checklists for most regions of the world, and it is no wonder that plants are poorly represented on the Red List.

Another reason for the apparent lack of plant assessments is the formulation of the IUCN Categories and Criteria themselves. The system has been modified over the years from the early subjective criteria (Fitter & Fitter 1987) to the thoroughly rigorous, quantitative and data-driven version that exists today (IUCN 2001). Sadly, plant assessments made with the old criteria (e.g. Walter & Gillett 1998) are now obsolete, and, in order to be listed again on the Red List, they must be re-assessed with the new version of the IUCN Categories and Criteria. Although a possible explanation, this may no longer be an excuse for a lack of plant assessments. The IUCN considers assessments that are 10 yr old to be out of date and due for re-assessment. Many plants assessed using older versions of the Categories and Criteria should now be close to or already due for a re-assessment. Although there are bound to be minor modifications, the present version of the Cat-

egories and Criteria (Version 3.1; IUCN 2001) is not expected to change in the near future (IUCN 2006). The IUCN specialist groups also have a significant influence on which and how many species are assessed. It is no surprise that active groups, such as the Conifers and Cycads Group, have completed assessments of their entire respective groups and, in some cases, have produced assessments on more than one occasion. Each specialist group acts as a focal point for a network of experts and can encourage knowledge and data transfer through websites and mailing lists to allow more assessments to be carried out. The work of the members of the specialist groups is, of course, voluntary, in addition to other commitments, and can take up a significant amount of time. At present a shortage of volunteers exists for these groups, which has resulted in a lack of coverage of many of the world's plants; there are currently 29 groups (www.iucn.org/themes/ssc/sgs/plants.htm), but major areas of plant diversity, including large taxonomic groups, such as the Asteraceae (the daisy family), estimated to include some 23 600 species (Stevens 2008), and geographical areas, most conspicuously among them, tropical forests, remain unrepresented.

However, there are several important points to note about the new Categories and Criteria that may allow more plant assessments to be made. The IUCN discourages the liberal use of the Data Deficient (DD) category, the rank used when there is inadequate information to make a direct, or indirect, assessment of extinction risk to a species, arguing that, in many cases, poorly known taxa can be assessed based on background information relating to threats, e.g. habitat loss or other causes (IUCN 2006). In essence, a threat or decline does not necessarily have to be observed in order for an assessment to be carried out; for some criteria it is enough to infer or suspect. In fact, a species can even be listed based on projected future threats. However, the extent to which inferences and projections can be used should be carefully considered (see the IUCN guidelines for discussions on data uncertainty; IUCN 2006). Another way in which data-poor species may be assessed is by using information from better known and closely related species. Some plants are well studied and their conservation status is well known for a variety of reasons: economic or livelihood value, most obviously crop wild relatives; rarities and oddities, such as carnivorous plants; or 'flagship' species such as the slipper orchids (subfamily Cypripedioideae). If information on population density and dispersal distance from these well studied taxa could be used for other species within a similar taxonomic or biological grouping, this would be one possible approach to obtaining the necessary information for carrying out a thorough conservation assessment.

GLOBAL INITIATIVES — GSPC TARGET 2

An ambitious attempt to accelerate the production of preliminary plant conservation assessments, and to galvanise the existing efforts of the world's botanists and plant conservationists into doing so, is the Global Strategy for Plant Conservation (GSPC) (UNEP 2002a) and the 16 quantitative targets set out within it. The targets of the GSPC were adopted at the 6th Conference of the Parties (COP) to the CBD in 2002 (COP Decision VI/9, www.cbd.int/decisions/cop6/?m=COP-06&id=7183&lg=0), and these targets were originally set to be achieved by 2010. It includes as its Target 2, for which the IUCN is the facilitating stakeholder, the production of 'a preliminary assessment of the conservation status of all known plant species' to highlight those of potential conservation concern (Target 1, on which many of the other targets rely, is the production of a global plant checklist; see Paton et al. 2008 for a review of progress towards Target 1). Target 2 is obviously an enormously challenging task, towards which disappointingly little progress has been made so far, and the prospects of much of this work being completed by 2010 seem remote. To date, much discussion has centred on just how these preliminary conservation assessments will be carried out, and it is proposed to use the Rapid List software (<http://iucn.org/RapidList/org.iucn.rapidlist.RapidList/RapidList.html>), which guides the user through a series of 7 questions to indicate whether or not a species is likely to fall into any of the 'Threatened' categories, but without capturing explicit quantitative data on either range size or population size. These assessments are thus deliberately preliminary, as a first step towards full assessments of the threatened species, and will not in themselves be sufficient for inclusion on the IUCN Red List. However, to date only a small proportion of species have received even a preliminary assessment.

PRELIMINARY CONSERVATION ASSESSMENTS

There is a clear need to drastically increase the rate at which we produce species conservation assessments. If GSPC Target 2 is to stand any chance of being met, a coherent approach to preliminary assessments is required. Callmender et al. (2005) argue that information derived from herbarium specimen labels is often sufficient for a preliminary assessment. For a 'first-cut' towards GSPC Target 2 there should be sufficient information to group plant species into 'threatened/potentially threatened' or 'not threatened' categories. Herbarium specimens provide verifiable records indicating the existence of taxa at a given time and place, assuming both are recorded, and, in com-

mon with the rise in museum- and herbarium-based informatics (Burgman et al. 1995, Ponder et al. 2001, Graham et al. 2004, Roberts et al. 2004), we have developed automated tools for carrying out conservation assessments (see also Willis et al. 2003). Certain parameters within the IUCN criteria lend themselves to calculation within a geographical information system (GIS); by simply collating known specimens for a species and plotting them on a map, it is possible to calculate values for area-based measures such as extent of occurrence (EOO), area of occupancy (AOO) and number of subpopulations (IUCN 2001; our Fig. 1).

By comparing these measures against the thresholds set in the IUCN criteria under Criterion B, a category of threat can be obtained. These GIS assessments should be described as preliminary, since they also need to satisfy at least 2 out of 3 subcriteria, but can already count towards the GSPC target. It is important to note that the 'first-cut' GSPC assessments will simply split species into 2 general groups: 'threatened/potentially threatened' and 'not threatened' so that attention can be focused on the first group. The preliminary GIS assessments go a step further by providing quantitative data that can actually be used for a full IUCN assess-

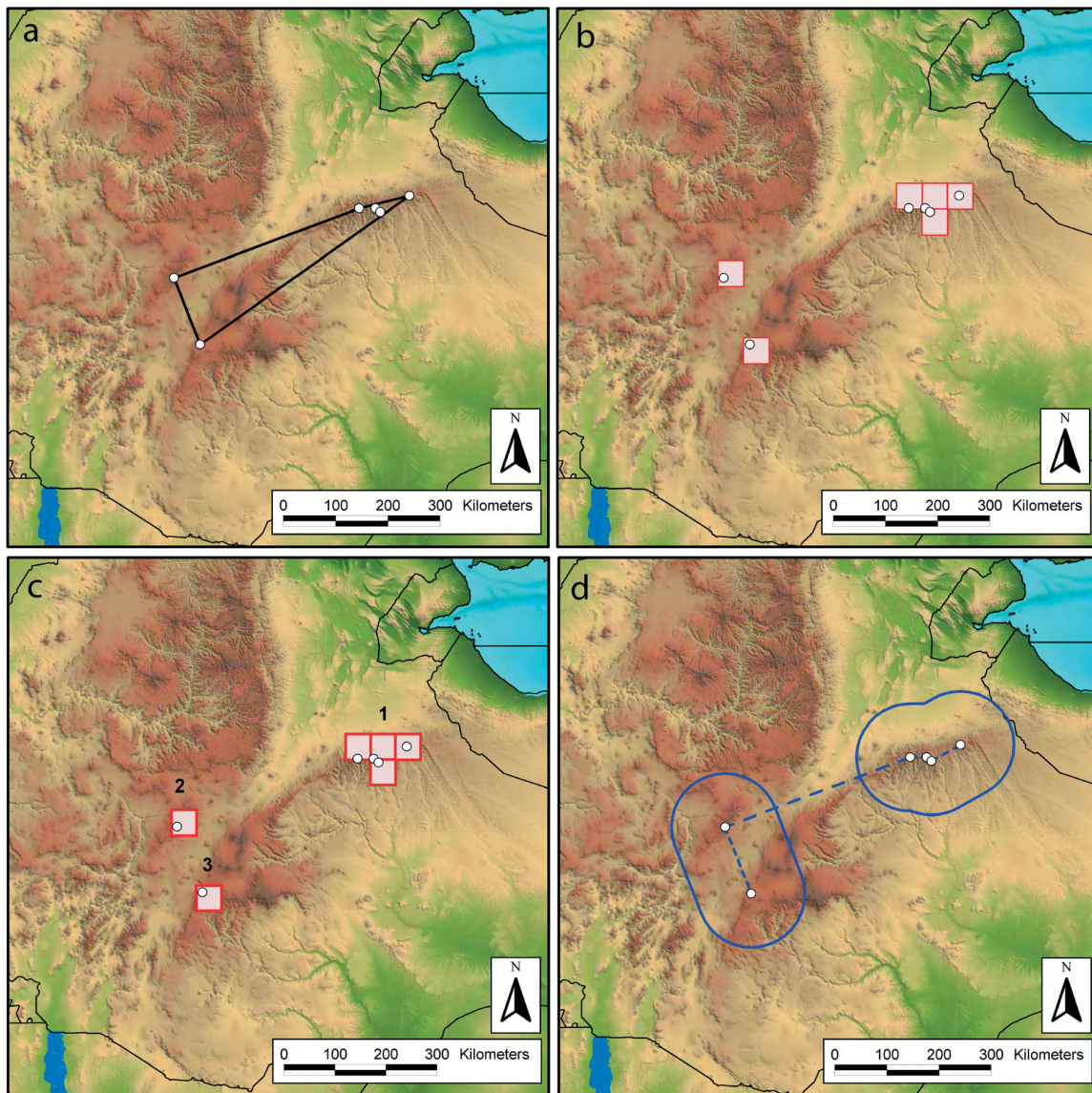


Fig. 1. Automated preliminary GIS analysis of *Aloe pubescens* Reynolds from the highlands of Ethiopia using georeferenced specimens from the herbarium at the Royal Botanic Gardens, Kew, showing (a) the extent of occurrence, measured as a convex hull; (b) the area of occupancy, measured with a cell width of 48 km; (c) the number of subpopulations using the cell-adjacency method of Schatz et al. (2000); and (d) the number of subpopulations using Rapoport's principle of mean propinquity (Rapoport 1982; see also Willis et al. 2003)

ment, although only when all subcriteria are satisfied and subsequently verified can the assessment be classified as 'full' and therefore included on the Red List. These tools can now be downloaded from the Royal Botanic Gardens (RBG), Kew, GIS Unit website as an ArcView extension (www.kew.org/gis/projects/cats).

To date, the preliminary GIS assessments have been successfully applied to a variety of taxa across systematic groups and over a broad geographic range. The tools are commonly utilised within RBG Kew (Utteridge et al. 2005, Davis et al. 2006, Rico Arce & Bachman 2006) and Missouri Botanical Garden (Callmender et al. 2007) and have been used elsewhere by counterparts from collaborating institutions. One of the major advantages of the technique is the fact that it is automated; at the click of a button a series of values including EOO and AOO, along with a preliminary rating, can be returned. Furthermore, a batch facility allows multiple species to be assessed in one run. If georeferenced specimen data existed for all plants it would be possible to calculate preliminary assessments in a matter of minutes and GSPC Target 2 would be accomplished. The only prerequisite is a database of error-checked, georeferenced specimens — a commodity that is becoming increasingly available as many herbaria are in the process of converting their collections to electronic format. As well as utilising historical collections, it is possible for contemporary and future collections to be used for the preliminary GIS technique. The majority of contemporary specimen collections are now accompanied by a global positioning system derived co-ordinate that should place the specimen collection to within metres of accuracy. At present, the Global Biodiversity Information Facility (GBIF; www.gbif.org/) is already serving up 136 million collections, 81 million of which are georeferenced; obviously not all are plants, but the automated preliminary assessment tool can be equally well applied to animal species.

Clearly one would like to assess the accuracy of preliminary conservation ratings produced in this way, but this has proved difficult to test, as it is not easy to find species that have been fully assessed (listed on the Red List) and also have complete, georeferenced specimen collections. However, one example for which both exist is in the cypress family (Cupressaceae; Farjon 2005) of conifers. The IUCN Conifer Specialist Group is one of the major, active plant groups and has been successful in assessing all conifers, excluding those with taxonomic uncertainties (Farjon et al. 2006). A database for Cupressaceae compiled as part of the efforts to produce a taxonomic monograph (Farjon 2005) contains a comprehensive collection of georeferenced specimens of the cypress family, which have a global distribution and a range from Critically Endangered (CR) to Least Concern (LC) status and so form an ideal dataset with

which to test the accuracy of the preliminary GIS assessments. Taxa were grouped into either 'Threatened' (CR, Endangered [EN], or Vulnerable [VU]) or 'not Threatened' (Near Threatened [NT] or LC) for both full and preliminary assessments. The extent to which the preliminary assessments were correct (accurately discriminated Threatened and non-Threatened taxa), overestimated threat status (not Threatened classed as Threatened), or underestimated threat status (Threatened classed as not Threatened) when compared with an expert assessment of that species is shown in Fig. 2. For nearly three-quarters of the species, the preliminary estimates correctly classified the full assessment.

The preliminary GIS approach can be criticised for only considering 1 aspect of an already contentious issue within the IUCN Categories and Criteria — range size. Considerable debate has taken place regarding the area measures used by the IUCN, particularly the imposition of a standard cell size for measuring AOO regardless of the size of EOO; a full 10 pages are dedicated to the explanation of EOO and AOO alone in the present guidelines to the Categories and Criteria document (IUCN 2006). An obvious omission from the preliminary analysis is the lack of population information. Geo-referenced specimens may represent a single individual or a population numbering 1000s of individuals. Only with adequate ground-truthing, surveying sizes and status of populations in the field can this information be obtained. The quality of georeferencing is a crucial consideration when dealing with area-based measures derived from specimen data; a species range could be miscalculated by 100s of km² if a specimen is inaccurately located (Miller et al. 2007). A 'clean' dataset is required, which means any outliers or georeferencing errors must be removed before carrying out the assessment; guidelines (Chapman & Wiczorek

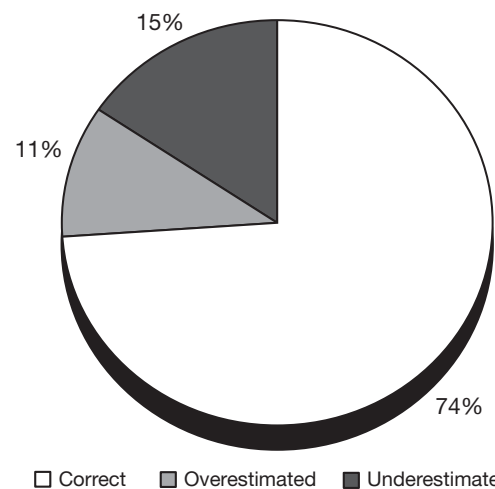


Fig. 2. Comparison of automated preliminary and full Red List assessments for Cupressaceae

2006) and resources (www.herpnet.org/Gazetteer/GeorefResources.htm) are already available to aid the georeferencing process, and many gazetteers now exist in electronic form to make georeferencing easier and quicker. There are even tools to automatically calculate the error associated with a georeference (Guralnick et al. 2006), an important measure that is often neglected, as imprecisely georeferenced specimens may need to be excluded from the analysis.

'DESKTOP' CONSERVATION ASSESSMENTS

The preliminary assessment can also be the basis for a full assessment, and, if checked for error, georeferenced herbarium specimen data can be provided; further GIS techniques then provide a means by which these assessments can be carried out. The preliminary techniques developed at RBG Kew (Willis et al. 2003) have now been extended into a more detailed methodology. This 'desktop' technique has developed in response to the need for assessments to be made on a variety of taxa from a wide variety of geographic areas. The 'desktop' assessor attempts to determine as much assessment-relevant information as possible about a species by trawling the literature, examining information from specimen labels, incorporating GIS techniques and (where data permits) statistical models, as well as contacting experts. To date, IUCN Red List assessments have mostly been carried out by the experts of a particular group, but we feel strongly that assessments can be compiled by non-experts, as long as they have a thorough understanding of the IUCN Categories and Criteria, a database of georeferenced specimen collections and some basic GIS knowledge. GIS techniques have already proven valuable for preliminary results, but more detailed analysis can still provide more useful information for assessments, filling the gaps when experts, specimen labels, or literature cannot provide enough information. Often this GIS analysis is enough to estimate fragmentation, number of locations and continuing decline or extreme fluctuations in range, habitat, or number of locations or subpopulations and so provide the data for a full assessment under Criterion B.

For example, a species may only be known from a single collection and by default will be treated as DD by the GIS algorithm, as neither EOO nor AOO can be automatically calculated, but it may still be possible to make an assessment by considering the area where the collection was made, the present threats in that area and how it may have changed over time. By simply querying various GIS layers at the known specimen localities, or within specified error buffers, it is possible to find out habitat preferences (GLC2000,

www.gvm.jrc.it/glc2000; Bartholomé & Belward 2005), elevation range (GTOPO 30, edcdaac.usgs.gov/gtopo30/gtopo30.htm, or SRTM, www2.jpl.nasa.gov/srtm/), human impact (Human Footprint, www.ciesin.columbia.edu/wild_areas/), level of protection (WDPA, www.unep-wcmc.org/wdpa/), type of Ecoregion (WWF Ecoregions, www.worldwildlife.org/science/ecoregions.cfm), fire activity (MODIS fire data, modis-fire.umd.edu/data.asp), as well as climate preferences (WORLDCLIM, www.worldclim.org/). GIS data derived from remote sensing imagery can also be useful for assessments; for example, changes in land cover can be used to infer or estimate reductions and declines of EOO, AOO, or habitat (Buchanan et al. 2008). GIS data and modelling techniques in the form of ecological niche models (ENM; Peterson et al. 2002) can also be used to provide a more refined estimate of range for both EOO (Sérgio et al. 2007) and AOO (IUCN 2006), as long as models are validated and represent occupied habitat. ENMs have also been used to project species distribution ranges into future climates to see how ranges might change and how this affects Red List status (Bomhard et al. 2005). These 'desktop' assessments are then sent to experts and specialists for their review and input, if necessary, before submission to the IUCN.

The 'desktop' technique can and should incorporate population level data when available. For some species, the information is presently being gathered by field botanists, but the process is deemed to be too time-consuming and resource-intensive to be a regular activity for botanical collecting expeditions. The lack of population data usually precludes the use of Criterion E, a quantitative analysis, for plant species. Although some statistical models based on the sighting rate of specimens have been developed (Roberts & Solow 2003, Solow 2005), these have not yet been generally accepted as the basis of a quantitative assessment. We believe that with only a small addition of time and effort it is possible to record data that are extremely relevant for conservation assessments, for example, local environmental conditions (climate, soil), status of local area (disturbed, pristine), quality of population (regenerating, few individuals) and estimates of population size. The development and deployment of electronic data-gathering devices and standardised forms of data input will undoubtedly aid this process. Since there are so few experts for most groups, particularly plants, and since these experts already face many demands on their time, it can be a much more effective and time-efficient approach to have assessments compiled by non-experts and then verified by experts—where these exist. We also argue that, if multiple assessments are compiled by the same individual, even a non-expert, there will be a greater

degree of standardisation and uniformity in the application of the IUCN Categories and Criteria than there will between numerous species 'experts' unused to the assessment methodology. In our experience, experts appreciate the contribution of GIS scientists and more often revise their conservation rating in line with the assessment data they are provided with than dispute the data and remain with their original rating.

THE SAMPLED RED LIST INDEX — MEASURING TRENDS IN THE STATUS OF BIODIVERSITY

A recent development of the IUCN Red List has been the formulation of a Red List Index (Butchart et al. 2004), a single value representing the conservation status of multiple species at a certain point in time, which may be used to track relative changes in conservation status by re-assessing these same species at regular intervals. Originally applied to birds (Butchart et al. 2004, 2005), it is now being expanded to cover all major groups of organisms for which sufficient species can be assessed (Baillie et al. 2008); this effort is being co-ordinated through the efforts of the Indicators and Assessments Unit at the Zoological Society of London (ZSL). For those speciose groups, including plants, which cannot be assessed in their entirety, a randomly selected sample of species is to be assessed; hence, the index will be known as the Sampled Red List Index (SRLI). The SRLI has already been adopted by the CBD, endorsed by COP VIII in 2006, as one of the measures of the World Summit on Sustainable Development (WSSD) 2010 Target:

Parties commit themselves to a more effective and coherent implementation of the three objectives of the Convention to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on earth. (Decision VI/26; UNEP 2002b, www.cbd.int/decisions/cop6/?m=COP-06&id=7200&lg=0).

After the 2010 Target had been set it was realised that there was not yet actually a measure of the current rate of loss of biodiversity, so it was not possible to know if this was being reduced. The SRLI was therefore adopted as a measure of this target, since it is species based and directly records threats to species conservation as a part of the assessment process. The Living Planet Index (LPI) (Loh et al. 2005), which measures trends in population size over time, was also adopted as a measure of the current rate of loss of biodiversity. For the plant component of the SRLI, being co-ordinated by us at RBG Kew, 5 major taxa have been selected: bryophytes, pteridophytes, gymnosperms, monocots and dicots. Selected at random from

complete species checklists for these taxa, 1500 species have been chosen for each major taxon, except in the case of gymnosperms of which <1500 species in total exist—in this case all gymnosperm species are being assessed. The decision to take 1500 species of each group was made following simulation modelling from the complete assessments of birds (almost 10 000 species) and amphibians (>5500 species); above 900 species there is a <5% chance that the value of the SRLI for a sample of 1500 species will be significantly different from that of a completely assessed taxon, regardless of the size of that taxon, and this sample is also robust with respect to distribution, higher taxon and ecology (Baillie et al. 2008). There is also a built-in redundancy to allow up to 40% of the species to be Data Deficient.

This gives a grand total of about 7000 plant species being assessed, which will be representative of plant diversity and distribution patterns as a whole. However, since plants are in general a diverse and not well-known group, most of which have never received a conservation assessment, this means that we are left with a sample of 7000 poorly known species, most of which have never received a conservation assessment. There simply are not enough taxonomic and regional experts familiar with each of the plant species in the SRLI sample to carry out expert-based conservation assessments on our behalf. So, in order to generate comparable assessments and provide the baseline data against which future changes in conservation status can be measured, the assessments of plant species for the SRLI are reliant on databases of georeferenced herbarium specimens. Moreover, the automated GIS methodology described here must be used to prioritise those species in need of full conservation assessments (threatened or near threatened), to de-prioritise those species for which a full assessment would not be time effective (LC), and to flag up those species for which there is currently insufficient knowledge (DD). Approximately 30% of species so far assessed have proven at first-pass to be DD, with another 38% falling into the category LC and 32% into either NT (12%) or one of the threatened categories (20%) (see Fig. 3).

Having compiled the specimen data and carried out the conservation assessment, these are then passed to relevant experts, if these exist, for their input and/or verification. This remains a time-consuming but essential stage in the assessment process. With expert opinion included, assessments can then be submitted to the IUCN as standard (new) Red List assessments. This brings into relief the obvious drawback to this approach: a lack of experts and of proper field data to fully ground-truth these assessments. What is ideally needed, and the goal that comprises our objective and principal focus beyond 2010, is an international net-

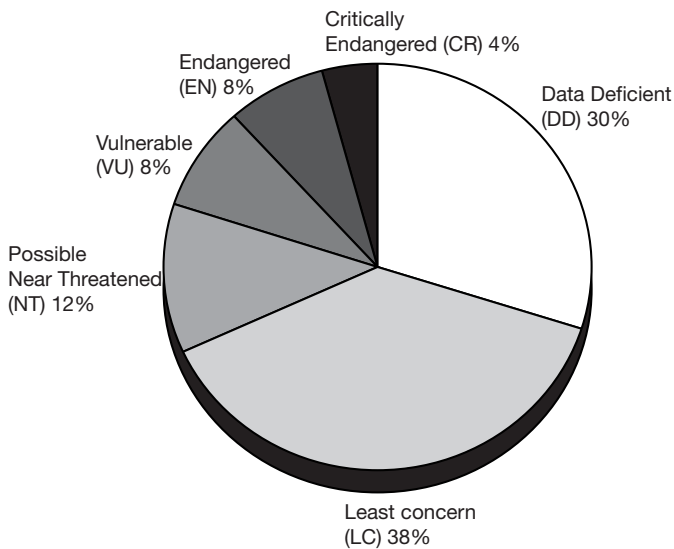


Fig. 3. Monocot threat status—results for preliminary assessments of ca. 600 species

work of field botanists actively going out and conducting field surveys of the species from the SRLI sample. In this way, as well as being able to apply Criteria B and D as we do now, we would also be able to test the conservation status of these species under Criteria A, C and possibly E. This will allow us to calculate a more balanced index. To this end we have developed a project website for the plant SRLI (<http://threatened-plants.myspecies.info/>), where the summary information for each species can be accessed as it is gathered and collaborators will be able to input population survey data. As the project continues to develop we hope to add species pages and identification tools to aid these field surveys.

It might be argued that the SRLI approach is too coarse to reflect small changes in the conservation status of biodiversity, since large changes are needed to cause a change in the IUCN rating for an individual species and hence changes in the value of the index (Butchart et al. 2004). While this is a valid criticism, the simultaneous adoption and development of the LPI should mean that small changes in population sizes will also be noticed here. Ultimately, if accurate population data can also be gathered for the species in the SRLI sample, we will be able to carry out more accurate conservation assessments as well as base a plant LPI on the same set of species, to produce an LPI more representative of global patterns of biodiversity than is currently the case (Loh et al. 2005). Another criticism of the SRLI is that it is open to manipulation through conservation measures aimed specifically at those species in the sample: if those appear to be stable or their status is improving then this is reflected in a stable or improving index, even if other species are generally in

decline. However, with an overall sample of many 1000s of species worldwide (Baillie et al. 2008) and detailed knowledge of the range and locations of each species, this knowledge base effectively spans most of the globe, and any conservation measures focused on the habitats or regions in which particular SRLI species are found will also have an additional benefit for those sympatric species not included in the index. Also, the sample size of 1500 was only recommended as a minimum requirement, so it is possible that in time more species would be included for each group in the SRLI.

As we continue to grind through our sample of almost 7000 species, for the first time there will be a representative sample of plants that have been fully assessed and documented in the Red List. This will be the baseline from which to compare post-2010 changes. This will tell us the percentage of plants we expect to be threatened, where the areas of greatest threat are, and what the threatening processes are. It will be the first scientifically defensible assessment of the current status of global plant diversity.

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