Assessment Instructions, IUCN Green Status of Species

Version 2, March 2022

Introduction

This document outlines the steps for making a Green Status of Species assessment of species recovery and conservation impact. The steps described here are meant to be used in conjunction with a software tool for entering the information. Currently, this is a Google Sheets/Excel workbook, which is available online.

The Green Status assessment can be thought of as having two main parts: (I) defining the "fully recovered" state, and (II) assessing species' condition relative to the "fully recovered" state in order to evaluate conservation impact. Conservation impact is evaluated based on estimation of species condition under various scenarios (past, current, and future, with or without conservation; Fig. 1 next page).

A species is considered "fully recovered" if it is viable, and ecologically functional, in each part of its range. The underlined terms are:

- defined in the ***Green Status of Species Standard*** (downloads available in English, French, and Spanish at link),
- discussed in depth in the ***Background and Guidelines for the IUCN Green Status of Species*** (available in English, French, and Spanish), and
- summarized in the relevant steps below.

The *Background and Guidelines* includes a detailed discussion of the different measures of species recovery and conservation success, and guidelines for each of the steps, and should be referred to when applying the steps outlined below.

Below, we outline the steps of a Green Status of Species assessment. The step numbers correspond with the sections of the assessment workbook and should be considered together. Note that steps 5-8 can be completed in any order.

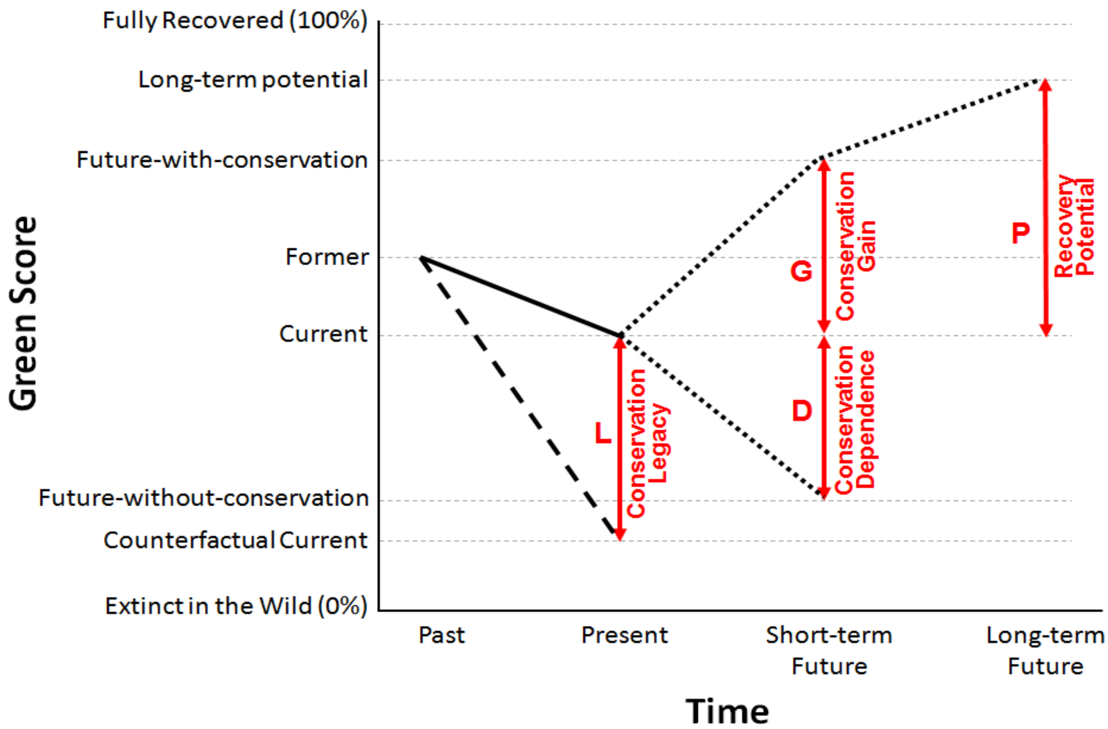


Figure 1. Green Status of Species assessments consider the past and potential future impacts of conservation actions on species condition relative to the Fully Recovered State. This condition is represented by a Green Score (Eq. 1). Vertical arrows represent the conservation impact metrics: Conservation Legacy (benefits of current and past conservation); Conservation Dependence (expected change in the short-term future in the absence of ongoing conservation); Conservation Gain (expected improvement in the short-term future with ongoing and planned conservation); Recovery Potential (possible improvement with long-term conservation and innovation).

Part I: Defining the Fully Recovered State

Step 1. Determine range

For the purposes of a Green Status of Species assessment, the range of the species is the total area of the **indigenous range** and the **expected additional range**.

Indigenous range is the known or inferred distribution of the species' occurrence prior to major human impacts (Fig. 2A). If no information about the timing of human impacts on the species is known, the recommended benchmark or reference date to delineate indigenous range is 1750 CE. If information about the timing of impacts exists, assessor may choose another date, but this date must fall between 1500 and 1950 CE.

Expected additional range consists of areas that are expected to become suitable *and occupied* by the species because of climate change, or conservation translocations (Fig. 2B). The time horizon for considering expected additional range is 100 years, or as close as possible based on the limits of most recent climate models.

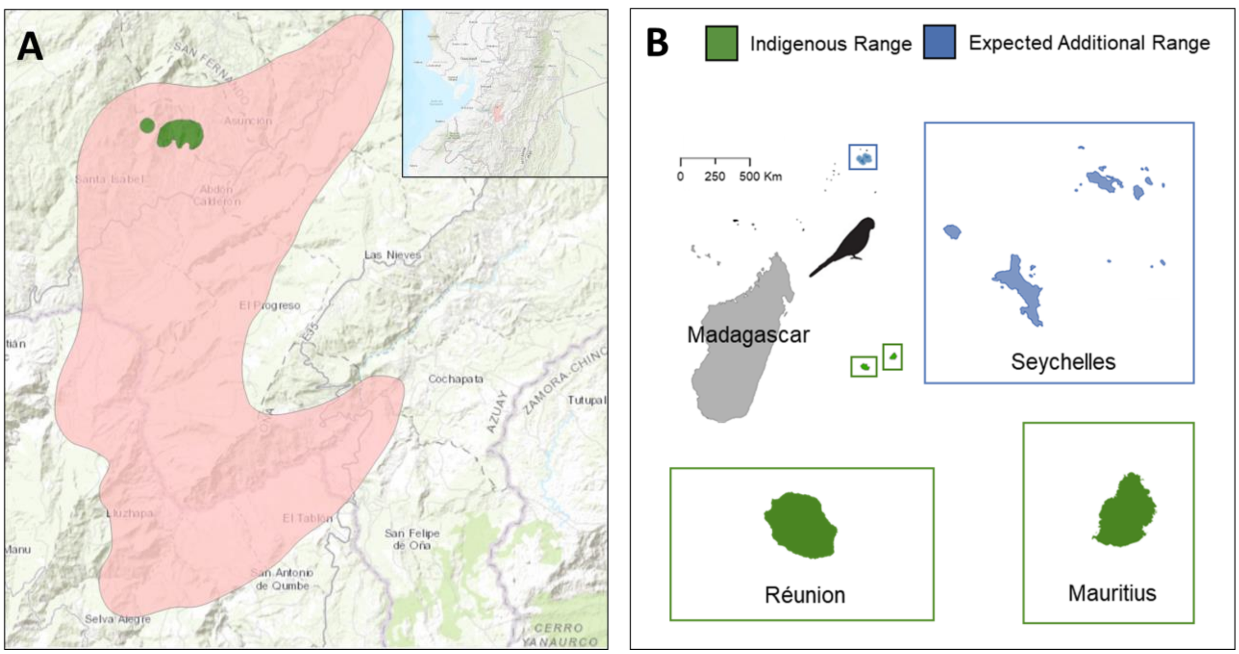


Figure 2. Examples of indigenous and expected additional range. (Note that colour scheme is not consistent across A and B, as they are from separate sources)
A) The indigenous range (pink area) of the Pale-headed Brush-finch (*Atlapetes pallidiceps*), contrasted with the range occupied by the species in 2021 (green area); inset shows the location of the indigenous range in Ecuador. Maps modified from the species' Green Status assessment (Hermes 2021).
B) The indigenous range of the Echo Parakeet (*Alexandrinus eques*) in green, and the expected additional range, where there may potentially be conservation translocations, in blue (modified from Grace et al. 2021). The species is indigenous to the islands of Reunion and Mauritius off the coast of Madagascar, but there are tentative plans for translocation to the Seychelles to fill the niche of an extinct parakeet.

Step 2. Delineate spatial units

This step divides the species range (indigenous and expected additional range) into spatial subdivisions that will be used in the Green Status of Species assessment (Fig. 3), and constitute the "parts" of the species range mentioned in the definition of a fully recovered species. These parts of the range are called **spatial units**.

There are several ways spatial units may be defined:

- **Specific-specific biological subdivisions,** including subpopulations (as defined in the Red List Guidelines), as well as subspecies, stocks, genetic units, flyways, evolutionarily significant units, and discrete population segments.
- **Ecological features**, such as ecoregions, habitat types, or ecosystems. Similar ecoregions/habitat types/ecosystems may be combined to reduce the number of spatial units.
- **Geological features**, such as watersheds, mountain ranges, and other geological features, used as proxies for subpopulations.
- **Locations**, which are areas of similar threatening processes (as defined in the Red List Guidelines).
- **Grid cells** for widespread and uniformly distributed, or for species whose spatial structure is not well known.
- **Combination**: The methods of subdivision can be applied hierarchically in order to create meaningful spatial units. For example, assessors could first subdivide using subpopulations, and within subpopulations, by ecoregion.

Number of units: For very restricted species, a single spatial unit may be used. However, in most cases, the range should be divided into multiple spatial units. It is recommended that the number of spatial units does not exceed 20, but a larger number of spatial units can be used if practical.

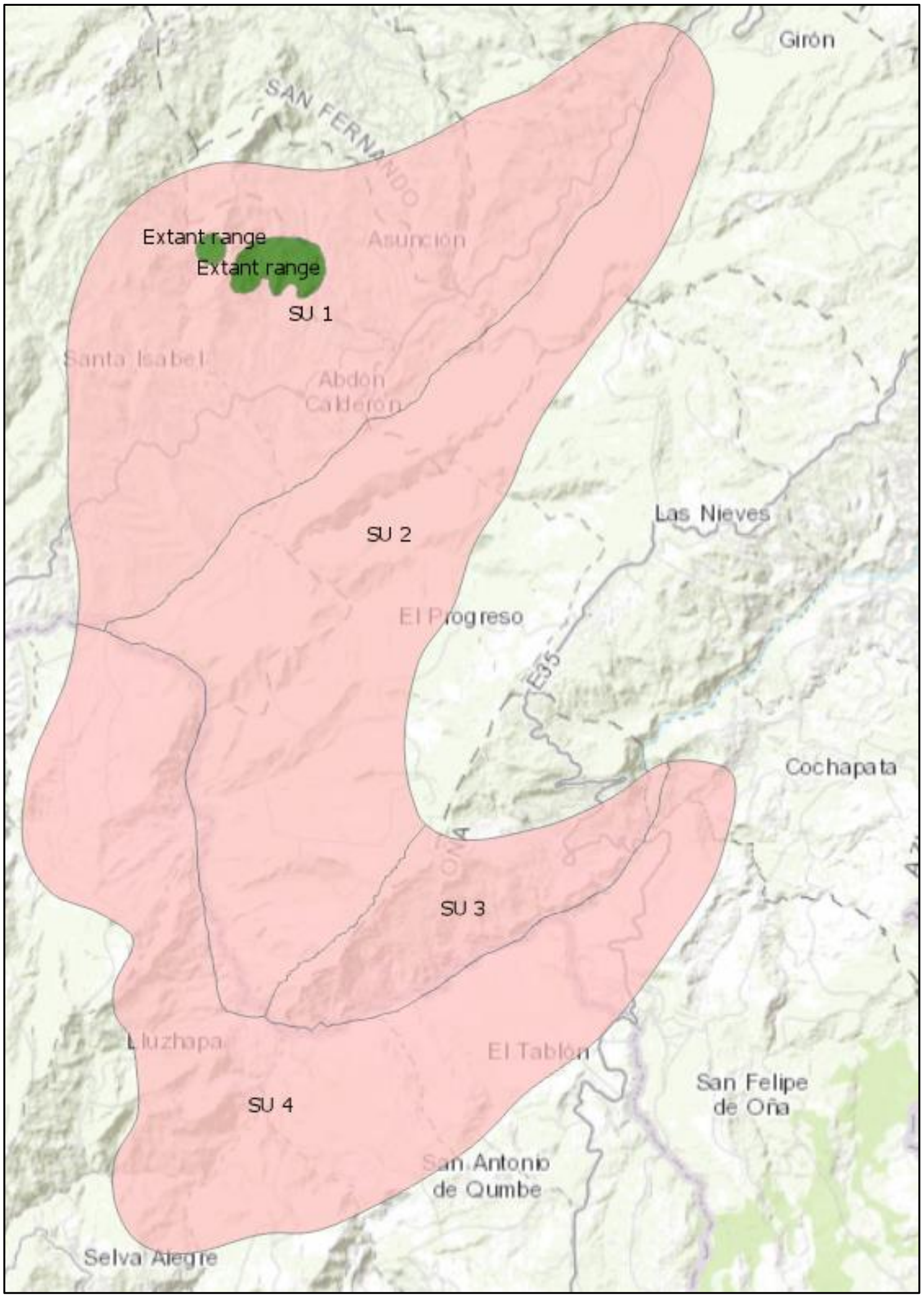


Figure 3. The indigenous range of the Pale-headed Brush-finch (pink; first shown in Fig. 2) divided into four spatial units (SUs). Note that the species is currently only present in one spatial unit (SU 1; green area). The spatial units were delineated along geological divisions, specifically mountain ridges and valley bottoms. The species has limited dispersal abilities and requires stretches of shrubby habitat for dispersal, e.g. along water courses and channels. It cannot easily spread across barren ridges or the densely populated (and converted) valley bottoms, so these features form barriers between population segments. Map and rationale from Hermes (2021).

Step 3. Define and quantify functionality

An ecologically functional population has the abundance or density, and the appropriate population structure, that allows its ecological interactions, roles, and functions to take place. A population within a spatial unit should be considered functional if it is at the largest density or abundance as needed for the identified functions, with the appropriate population structure. Examples of ecological functions include:

- **Trophic functions:** Population density, size and structure that allow the species to fulfill its role in the ecological community, such as source of prey/resource for its predators/consumers, or a significant disperser of seeds or pollen.
- **Trophic cascades:** Population density, size and structure that prevent a population of another native species from being extirpated as a direct or indirect result of the ecological interactions of the focal species.
- **Ecosystem functions:** Population density, size and structure that allow a significant ecosystem function, such as primary production, decomposition, nutrient cycling or redistribution, or modification of fire or hydrological regimes.
- **Structural functions**: Population density, size and structure that allow structural (ecosystem or landscape) functions, such as creation of habitat for other species, ecosystem engineering, and facilitation of landscape connectivity or heterogeneity.
- **Within-species functions:** Population density, size and structure needed in order for the species to display the notable social or behavioral phenomena that are characteristic of the species, such as migration, colony formation and other aggregations of individuals.

Assessing Functionality:

If the function(s) of a species can be identified, describe how a functional density for the species would be demonstrated in practice. If a species performs multiple functions, think in terms of the function that would require the highest number of individuals. For more information, see section 4.5 of the *Background and Guidelines* and Akçakaya et al. (2020).

Proxies:

When a function cannot be identified for a species, or it would be difficult to determine whether the species was fulfilling its function(s) in a given spatial unit, a number of proxies can be used to determine if the subpopulations are functional.

- **Pre-impact:** The natural or pre-disturbance population size or carrying capacity of a species.
- **Non-impact:** Population size, density or carrying capacity in areas that are apparently not significantly impacted by human activities.
- **Similar species:** Information from similar species on the principal ecological functions of the species, and densities that allow these functions; or the non-impact densities that can be used as proxy for functional density.

Selected examples from published species are shown in Table 1.

Table 1. Published examples of species functionality.

Species	Functionality definition (full)	Definition basis	Reference
Pale-headed Brush-finch (*Atlapetes pallidiceps*)	The carrying capacity is around 200 mature individuals on roughly 5 km^2. However, the high density observed in the only remaining population is likely to be a consequence of limited habitat availability. Genetic studies showed that the original population (prior to the bottleneck) numbered c. 4,200 mature individuals (Hartmann et al. 2014). Under the assumption that the 4,200 mature individuals were evenly distributed across the presumed indigenous range, the spatial units 1, 2 and 4 could each hold roughly 1,300 mature individuals, while the smaller Northern Oña Valley could hold c. 300 mature individuals.	Carrying capacity and pre-impact population estimates	Hermes, C. (2021). *Atlapetes pallidiceps* (Green Status assessment). *The IUCN Red List of Threatened Species* 2021: e.T22721487A2272148720213
White Shark (*Carcharodon carcharias*)	A spatial unit is Functional if there is no evidence of ecologically-damaging overabundance of its key prey species (large fishes, elasmobranchs, and marine mammals). In one spatial unit, the species is naturally rare due to climatic changes that occurred prior to the benchmark year; in that spatial unit, in the absence of threats or declines, the species is considered Functional (see Spatial Units section).	Considered functional unless dysfunction observed	Spaet, J.L.Y. 2021. *Carcharodon carcharias* (Green Status assessment). *The IUCN Red List of Threatened Species* 2021: e.T3855A385520213.
Greater Prairie-chicken (*Tympanuchus cupido*)	An estimated functional density for Greater Prairie-chickens is one bird per km2, based on previous research that indicated a similar density (30 birds per lek complex, or 30 km lek route) resulted in stable populations (Roy and Gregory 2019).	Observed density in a pre-/non-impacted area	Berger, D. 2021. *Tympanuchus cupido* (Green Status assessment). *The IUCN Red List of Threatened Species* 2021: e.T22679514A2267951420213.
Vicuña (*Vicugna vicugna*)	It is expected that functionality would look similar for this species as for the Guanaco. Following Marino et al. (2015), territorial defense by Guanaco males acts as a regulating agent of population density, buffering crowding effects, and preventing vegetation depletion. This mechanism allows Guanacos to self-adjust population density to resource availability before a detrimental grazing impact is inflicted. Therefore, if these behaviors are observed, we can estimate that the species is near carrying capacity in the spatial unit.	Carrying capacity as evidenced by behavioural regulation	Acebes, P. & Gonzalez, B. 2021. *Vicugna vicugna* (Green Status assessment). *The IUCN Red List of Threatened Species* 2021: e.T22956A2295620213.
Saiga (*Saiga tatarica*)	One key element of functionality for Saiga Antelopes is that its migratory behaviour is retained. The nominate subspecies (*Saiga tatarica tatarica*) currently migrates long distances in two of its populations (Betpak-dala, Ustiurt), and shifts seasonally in all of them; some of this loss of migration is due to constraints imposed by anthropogenic habitat modification (Russia, Ural). This subspecies naturally occurs in high numbers, and at high density at certain times of year, particularly during the birth aggregation period (aggregations of 10s to 100s of 1,000s), and this life history would also be required to be retained for functionality.	The functional behaviour itself can be observed	Milner-Gulland, E.J. 2021. *Saiga tatarica* (Green Status assessment). *The IUCN Red List of Threatened Species* 2021: e.T19832A1983220213.
Encino Arroyero (*Quercus brandegeei*)	… The second component of functionality within spatial units is population structure, described by size classes of individual trees. A Functional population of Encino Arroyero would include seedlings, saplings, young adults, and mature reproducing trees…	Pre-impact population structure	Alvarez-Clare, S.A.C., Carrero, C. & Perez Morales, D.W. 2021. *Quercus brandegeei* (Green Status assessment). *The IUCN Red List of Threatened Species* 2021: e.T30726A3072620213.

Part II: Assess species' condition relative to the Fully Recovered state

Step 4. Assess current state

The current state of the species should be assessed separately for each spatial unit. The state levels comprise Absent, Present, Viable, and Functional.

- ***Absent***: The species does not exist in the wild in the spatial unit.
- ***Present:*** The species occurs in the spatial unit, but does not have a Viable population.
- ***Viable:*** A regional Red List assessment of the species in the spatial unit as 'Least Concern (LC)' OR 'Near Threatened (NT) and not declining' in the spatial unit.
- ***Functional:*** The majority of the subpopulations in that spatial unit are functional (as defined above), in addition to being Viable.

To aid in selection of the appropriate state within the spatial unit, we have developed an online tool that guides the assessors through the regional Red Listing criteria and generates the correct state based in the information entered.

Only "wild" populations of the species should be considered in determining the state in each spatial unit.

The states in each spatial unit at the time of assessment are used to calculate the **Species Recovery Score** (see Scoring and Categorization, below). The Species Recovery Score is the most basic output of a Green Status of Species assessment and is the minimum requirement for completion of the assessment.

Incorporating uncertainty

It is important to record the uncertainty in the status in each spatial unit. For example, a species may be considered Viable in a given spatial unit, but with Present and Functional as plausible categories too. In extreme circumstances, a species may be data deficient in a given unit, if its status for that spatial unit ranges from Absent to Functional. Thus, data deficient is not an explicit state separate from the others, but is implied by the lower and upper values specified for a given spatial unit.

Uncertainty about the status in each spatial unit should be explicitly stated by providing a lower bound (minimum), an upper bound (maximum), and a most likely (best) estimate. See section 9 of the *Background and Guidelines* for further information on this procedure.

Step 5. Conservation Legacy

Conservation Legacy measures the impact of past conservation efforts on the status of the species. It is quantified as the difference between the current status and the "Counterfactual current status", which assumes no past conservation efforts (Fig. 1). For the purposes of these counter-factual scenarios, conservation actions to consider are those that were in effect at the year 1950 CE (even if they were implemented earlier, e.g. legislation, protected areas) and any conservation actions that came after 1950 CE.

Conservation Legacy is estimated by providing the expected state in each spatial unit at the time of assessment assuming that there were no conservation actions in the past. The status levels (Absent, Present, Viable, Functional) are defined above.

If you wish, you can also estimate the condition of the species at 1950 ("Former", Fig. 1) to capture the change in condition over time.

Step 6. Conservation Dependence

Conservation Dependence measures the expected change (usually deterioration) in the status of the species in an alternative future scenario in which all conservation actions (current or planned) are terminated. Conservation Dependence is quantified as the difference between the current status and the "Future without conservation" status (Fig. 1). It is estimated by providing the expected state in each spatial unit in the next 10 years, assuming that there are no conservation actions during this period, including any current actions. The status levels (Absent, Present, Viable, Functional) are defined above.

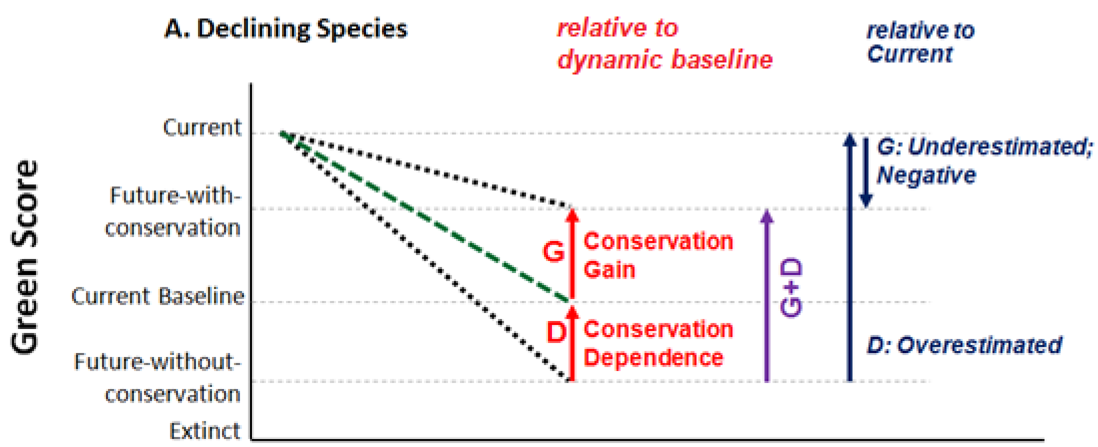
Step 7. Conservation Gain

Conservation Gain measures the expected change (usually improvement) in the status of the species under current and planned conservation actions. Conservation Gain is quantified as the difference between the current status and the "Future with conservation" status (Fig. 1). It is estimated by providing the expected state in each spatial unit in the next 10 years, considering the likely benefits of conservation actions that are currently planned and in place, or are very likely to be in place in the near future (within 5 years of the assessment). The status levels (Absent, Present, Viable, Functional) are defined above.

To determine the future status under conservation, the assessors should only consider conservation actions that are in place or are planned. For planned actions, assessors need to make realistic assumptions about (i) the probability that the action will be implemented, and (ii) the probability that the conservation actions will result in the species' recovery in a given spatial unit. For actions in place, the assessors should consider (ii).

Special case: Use of a *dynamic baseline* for Conservation Dependence and Conservation Gain

Typically, Conservation Dependence and Conservation Gain are calculated as the difference between the species' condition in future scenarios with (Gain) or without (Dependence) conservation, and the species' condition at the time of assessment ("Current"). Using the "Current" condition as a baseline assumes that if conservation continues, the species' condition will improve or stay the same, and if conservation stops, the species condition will decline or stay the same. However, in some cases, species status is expected to decline or improve over the next 10 years regardless of conservation actions. In these cases, using the "Current" condition as a baseline (***static baseline***) could lead to under- or over-estimation of conservation impact (see figure).



It may be more appropriate to compare future condition to a ***dynamic baseline*** to calculate Dependence and Gain. This dynamic baseline represents the condition of the species in 10 years considering all conservation actions that are in place and highly expected to be in place within 1 year of the assessment. When using a dynamic baseline, Gain is measured as the impact of additional actions within the 10-year time window. If you think a dynamic baseline is needed for your assessment, consult section 7.1 of the *Background and Guidelines* and contact the assessment coordinator; this feature is not yet built into the assessment workbook, but the coordinator will work with you to make the correct calculations.

Step 8. Recovery Potential

Recovery potential measures how much the status of the species could potentially be improved with sustained conservation efforts and conservation innovation, over the long-term of 100 years. To estimate Recovery Potential, provide the state that could be achieved in each spatial unit in the next 100 years, given sustained conservation action and innovation. The status levels (Absent, Present, Viable, Functional) are defined above.

Recovery potential should ideally be based on the long-term vision of a conservation action plan developed with stakeholder engagement. In the absence of such a vision, assessors need to make assumptions that are both optimistic and realistic, considering conservation actions that are planned, as well as those that are plausible, even if they have not been considered or tried for the conservation of the assessed species. They should consider the main threats, current and potentially emerging within the next 100 years, and all the conservation actions that have been tried to counteract them in other contexts, and assess whether their application for the assessed species is plausible.

Part III: Scoring and Categorization

The states chosen for each spatial unit are used to calculate Green Scores for each scenario; this happens automatically in the workbook. Green Scores are obtained through the formula:

$$G = \frac{\sum_S W_S}{W_F \times N} \times 100 \qquad \text{(Eq. 1)}$$

where s is each spatial unit, W_S the weight of the state in the spatial unit (Table 2), W_F is the weight of the "Functional" category (Table 2), and N is the number of spatial units.

Table 2. Default and (optional) fine-resolution weights for each state in a spatial unit. The default weights are appropriate for most assessments. However, if your assessment only has 1 or few spatial units, you may wish to use the fine-resolution weights that can show more subtle changes in condition (e.g., using the default weights, a species with 1 spatial unit has the same Green Score when the Red List category is Critically Endangered AND when the Red List category is Near Threatened and declining). For more information, see section 4.3 of the *Background and Guidelines*. There are two versions of the assessment workbook: one which uses the default weights in its calculations ("Green Status of Species assessment workbook_v1.0_default weights.xlsx") and one that uses the fine-resolution weights ("Green Status of Species assessment workbook_v1.0_fine-resolution weights.xlsx"); use the one that is most appropriate for your species.

State *(default)*	**Default weight**	**Fine-resolution State (*optional, e.g., if one or few spatial units*)**	**Fine-resolution weight *(optional)***
Absent	0	Absent	0
Present	3	Present-CR	1.5
		Present-EN	2.5
		Present-VU	3.5
		Present-NT with cont. decline	4.5
Viable	6	Viable-NT without cont. decline	5.5
		Viable-LC	6.5
Functional	9	Functional in <40% of SU	8
		Functional in 40-70% of SU	9
		Functional in >70% of SU	10

The Green Scores determine various Green Status of Species Categories. The Green Score at the time of assessment is called the Species Recovery Score and it is the only *required* output for a Green Status of Species assessment. The Species Recovery Score is assigned to a category based on the following criteria:

Table 3. Criteria for placement in Species Recovery Categories. SRS= Species Recovery Score.

Indeterminate	If $(SRS_{max} - SRS_{min}) > 40\%$
Non-Depleted	If $(SRS_{best} = 100\%)$ and $(L_{best} = 0\%)$
Fully Recovered	If $SRS_{best} = 100\%$
Slightly Depleted	If $SRS_{best} > 80\%$
Moderately Depleted	If $SRS_{best} > 50\%$
Largely Depleted	If $SRS_{best} > 20\%$
Critically Depleted	If $SRS_{best} > 0\%$
Extinct in the Wild	If $SRS_{best} = 0\%$

The conservation impact metrics (Conservation Legacy, Conservation Dependence, Conservation Gain, Recovery Potential) are also assigned to categories: High, Medium, Low, Zero, Negative, Indeterminate. See section IV.3 of the *Green Status of Species Standard* to view the criteria for these categories.

References

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