

## 1 Chapter 8

### 2 Iberian Lynx recovery potential: Results of the first Green Status of Species assessment

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#### 8 Abstract

9 The reduction in the extinction risk of the Iberian Lynx *Lynx pardinus* from Critically  
10 Endangered to Vulnerable is proof that conservation can work to bring species back from the  
11 brink. However, that does not mean that the work of conservation is over; preventing  
12 extinction is merely the first step on the road to recovery. In 2021, the International Union for  
13 Conservation of Nature (IUCN) expanded the Red List of Threatened Species assessment to  
14 include a standardised assessment of species recovery: The IUCN Green Status of Species.  
15 The Green Status of Species assessment assigns species to recovery categories,  
16 complementary to the classic extinction risk categories. In addition, the Green Status of  
17 Species provides a method to evaluate the impact of past conservation, and the potential for  
18 future conservation impact, on species' status. In 2023 the first-ever Green Status assessment  
19 for the Iberian Lynx was conducted. Though the species' status has improved greatly over the  
20 past decades, its Green Status has nonetheless been assessed as Largely Depleted, indicating  
21 that there is more work to do to restore the species to pre-impact levels. However, the  
22 assessment also indicates that without past conservation actions, the species would be  
23 Critically Depleted or possibly even Extinct in the Wild today. The assessment also indicates  
24 a high Recovery Potential, meaning that it would be possible to recover the species across  
25 much of its former range with concerted conservation effort.

26

#### 27 Introduction

28 The downlisting of the Iberian Lynx from Critically Endangered to Vulnerable (CrRef  
29 Chapter 1) is a conservation triumph. In the decades since 2002, when the Iberian Lynx was  
30 first assessed as Critically Endangered (Cat Specialist Group 2002), herculean efforts have  
31 been made to pull the species back from the brink (CrRef Chapters 4-6). While the change in  
32 Red List Category reflects those efforts, it does not tell the full story of the species'  
33 conservation. Firstly, it does not fully communicate the large reduction in range that has  
34 occurred within recent centuries (CrRef Chapters 2-3); although increasing lynx numbers are  
35 a sure sign of the species' diminishing extinction risk (as shown by its downlisting to  
36 Vulnerable), numbers are not yet increasing across all of the historical distribution. The  
37 change in Red List Category also does not fully capture the impact of conservation action for  
38 the Iberian Lynx; with conservation, the extinction risk has been reduced, but these actions  
39 also averted further declines.

40 Developed in response to a 2012 IUCN Members Resolution (IUCN 2012a), the Green Status  
41 of Species (previously known as the Green List of Species; Akçakaya et al. 2018), provides a

42 widely applicable, objective, and practical framework to assess species recovery. The Green  
43 Status of Species recovery definition considers the viability, ecological functionality, and  
44 representation of the species relative to a baseline representing these criteria prior to major  
45 human impacts on the species (IUCN 2021). This information about species condition  
46 relative to the “fully recovered” state complements the Red List Category (Grace et al.  
47 2021a) and can be used to inform and incentivise more ambitious conservation goals. The  
48 assessment also measures the impact of conservation actions on a species’ progress toward  
49 recovery, helping inform conservation planning (Grace et al. 2021b).

50 To fully understand the conservation story of the Iberian Lynx, the first IUCN Green Status of  
51 Species assessment for this species was completed at a workshop in Sevilla, Spain, in  
52 November 2023. Here, we present the assessment process and results of this Green Status of  
53 Species assessment for the Iberian Lynx.

54

## 55 **Methods**

### 56 *Green Status of Species assessment*

57 The methods for conducting an IUCN Green Status of Species assessment are documented  
58 thoroughly in a number of existing publications (i.e., IUCN 2021, IUCN SCSTF 2020). For  
59 full details, those publications should be consulted, but here we provide a brief summary of  
60 the assessment process:

61 The primary output of a Green Status assessment is a *Species Recovery Score (SRS)* and  
62 accompanying Species Recovery Category. The SRS reflects the species’ level of recovery on  
63 a scale from 0% (category: Extinct or Extinct in the Wild) to 100% (category: Fully  
64 Recovered or Non-Depleted). To calculate the SRS, assessors carry out the following steps:

- 65 1. Determine the species’ indigenous range (the range prior to major anthropogenic  
66 impacts on distribution or abundance).
- 67 2. Divide this range into a set of biologically relevant sections called spatial units. These  
68 spatial units are used to reflect any variations in status across the range and can be  
69 defined, for example, by biological or ecological divisions.
- 70 3. Assess the state of the species in each spatial unit. For each spatial unit, the state  
71 could be Absent (the species has been extirpated in the spatial unit), Present (the  
72 species occurs in the spatial unit, but is not Viable), Viable (the spatial unit meets the  
73 Regional Red List criteria (IUCN 2012b) for Least Concern or Near Threatened and  
74 not declining), or Functional (the species is Viable in the spatial unit and is also  
75 performing its ecological functions). Each of these states is assigned a weight  
76 (Functional = 9, Viable = 6, Present = 3, and Absent = 0, which are used to calculate  
77 the SRS:

78

79

$$SRS = \frac{\sum_s W_s}{W_F \times N}$$

80

81 Where  $s$  = each spatial unit,  $W_s$  = the weight of the state in the spatial unit,  $W_F$  = the  
82 weight of the Functional state, and  $N$  = the number of spatial units.  $W_F \times N$  represents the

83 maximum possible value (i.e., the species is functional in every spatial unit) and recovery  
84 is calculated as a percentage of this.

85 The Species Recovery Score and Species Recovery Category reflect the recovery condition of  
86 the species at the time of the assessment. However, the Green Status assessment also allows  
87 assessors to estimate scores under different scenarios to evaluate the impact of past  
88 conservation action, as well as the expected impact of future conservation. These scenarios  
89 are:

- 90 1. Counterfactual scenario: no past conservation actions
- 91 2. Future-without-conservation scenario: all conservation actions are halted
- 92 3. Future-with-conservation scenario: conservation actions continue as planned over the  
93 next 10 years
- 94 4. Long-term aspiration scenario: conservation actions are improved and sustained over  
95 the next 100 years

96 The scores estimated under these scenarios are used to calculate four conservation impact  
97 metrics (Fig. 1): Conservation Legacy (impact of past conservation); Conservation  
98 Dependence (expected impact of halting all conservation in the short term); Conservation  
99 Gain (expected impact of continuing conservation in the short term); and Recovery Potential  
100 (maximum possible recovery within 100 years).

101

### 102 *Iberian Lynx Green Status assessment process*

103 In November 2023, the IUCN SSC Cat Specialist Group in collaboration with the Life  
104 Project [LynxConnect](#) convened a workshop at the *Consejería de Sostenibilidad, Medio*  
105 *Ambiente y Economía Azul* (Ministry of Sustainability, Environment, and the Blue Economy)  
106 in Sevilla, Spain to discuss the Red List reassessment for the Iberian Lynx and to conduct the  
107 first-ever Green Status assessment for the species. Over the course of 2 days, the Green  
108 Status assessment of the Iberian Lynx was drafted. Subsequently, it was reviewed by species  
109 experts. The process was supported by the IUCN Green Status of Species-SSC Integration  
110 Task Force, with Elliot Carlton and Molly Grace facilitating. The full assessment with all  
111 documentation can be viewed at [either RL website if published in time, or assessment in  
112 Supplementary Information].

113

### 114 **Results: Iberian Lynx Green Status assessment**

#### 115 *Indigenous range and spatial units*

116 The indigenous range of the Iberian Lynx was determined to be much larger than the area it  
117 currently occupies. While the severe declines in the twentieth century are well-documented  
118 and have been accounted for when assessing the Red List category of the Iberian Lynx  
119 (CrRef Chapter 3), the Red List assessment does not consider earlier reductions in range (i.e.  
120 reductions occurring more than 3 generations ago; CrRef Chapter 2) when assessing  
121 extinction risk. These declines are, however, relevant to the Green Status recovery  
122 assessment.

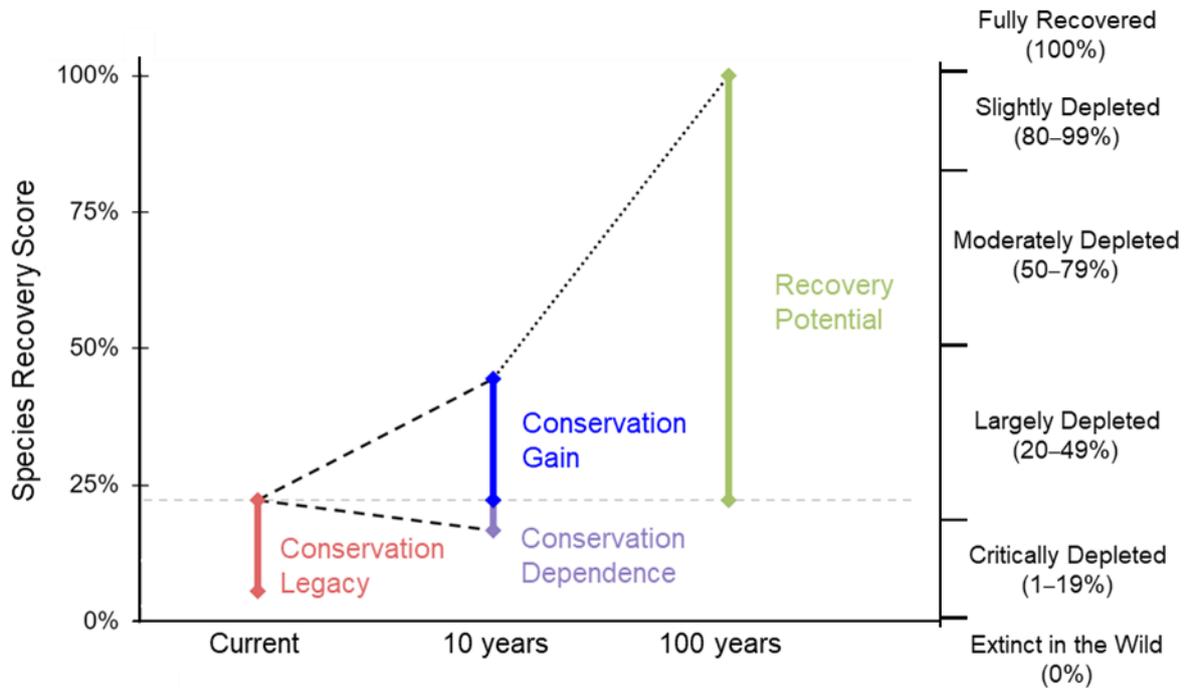
123 Evidence of a genetic bottleneck indicates that significant declines in abundance occurred  
124 between the 1400s and 1600s (Abascal et al. 2016). While some of these declines may be  
125 naturally attributed to climatic changes associated with the Little Ice Age, there was also a  
126 direct and extensive fur trade for Iberian Lynx in this period, as well as expansion of  
127 agricultural lands in the Iberian Peninsula (Villalpando-Moreno 2020). Prior to these  
128 declines, the Iberian Lynx was found throughout the Iberian Peninsula in non-forested areas;  
129 the species has long been associated with scrubland within the Mediterranean bioclimatic  
130 region of the peninsula. Thus, the indigenous range does not include the Atlantic and Alpine  
131 bioclimatic regions in the north and northwest.

132 Dividing this indigenous range into spatial units was less straightforward. There are currently  
133 many subpopulations/nuclei of Iberian Lynx existing in a metapopulation, and connectivity  
134 continues to increase. Prior to the aforementioned bottleneck, it is likely that connectivity  
135 between lynx nuclei was very high throughout the Iberian Peninsula. Therefore, spatial units  
136 were defined based on a mix of: major geographic barriers (e.g. rivers); strength of  
137 connectivity; and differences in climate/vegetation (which affect environmental favourability  
138 for rabbits, the lynx's primary prey item; Ferreras et al. 2010, Simón et al. 2012). This  
139 resulted in six spatial units: Southwestern Lowlands, Southern Plateau, Toledo Mountains,  
140 Northeast Spain, East Spain, and Northwest Iberia (see [either RL website if published in  
141 time, or assessment in Supplementary Information] for further description of the areas  
142 covered by these spatial units).

143

#### 144 *Recovery outlook*

145 The Iberian Lynx was assessed as being Largely Depleted, with a Species Recovery Score of  
146 22%, in 2023 (Fig. 1). This is because the species was Present in four of the six spatial units  
147 (but not Viable or Functional), and Absent in two spatial units (Northeast Spain and  
148 Northwest Iberia). This result indicates that even though the Red List category has improved,  
149 there is still work to do to restore viable (and functional) populations throughout the  
150 indigenous range.



151

152 **Figure 1.** Green Status results for the Iberian Lynx. The *Species Recovery Score* was estimated at the  
 153 time of assessment (Current) under two conditions: the score based on observed status (22%), and  
 154 based on expected status if no conservation had taken place to date (6%). The difference between  
 155 these two values gives the *Conservation Legacy* (pink). The expected score ten years in the future was  
 156 estimated under two conditions: a scenario of conservation continuing as planned (44%) and a  
 157 scenario where all conservation stopped (17%). The difference between these values and the current  
 158 observed score (represented by the horizontal grey dashed line) gives the **Conservation Gain** (blue)  
 159 and **Conservation Dependence** (purple), respectively. The maximum possible score that can be  
 160 achieved in the next 100 years was also estimated, giving the **Recovery Potential** (green). The  
 161 **Species Recovery Category** that corresponds to different ranges of the Species Recovery Score are  
 162 shown on the right; the Iberian Lynx is currently **Largely Depleted**.

163

164 Just as the change in Red List Category from Critically Endangered to Vulnerable over the  
 165 past decades demonstrates the positive impact of conservation, so too do the four  
 166 conservation impact metrics of the Green Status assessment (Fig. 1). The Iberian Lynx has a  
 167 High Conservation Legacy, because it is estimated that in the absence of any past  
 168 conservation efforts, the species' score would have been 17% lower in 2023 (range 11–22%),  
 169 bringing the counterfactual score to a mere 6% (Critically Depleted). The uncertainty around  
 170 this estimate acknowledges that, in the absence of past conservation action, it is possible that  
 171 the Iberian Lynx could have become Extinct in the Wild by 2023.

172 It is expected that, if conservation continues as planned (including reintroduction efforts),  
 173 within 10 years the Iberian Lynx will be Present in all six spatial units, and Functional in the  
 174 Southwestern Lowlands spatial unit (which is home to the largest current population, in  
 175 Doñana). This would bring the score to 44% (Largely Depleted), via a Medium Conservation  
 176 Gain of 22% (range: 0–33%; Fig. 1). However, if all conservation actions were halted in  
 177 2023, it is expected that no spatial units would improve, and indeed that the East Spain spatial

178 unit would likely be lost; this would result in an expected score of 17% and a Low  
179 Conservation Dependence of 6% (range: -11–6%).

180 Finally, the Recovery Potential reflects the biologically possible space for recovery within the  
181 next 100 years: if funds were not an issue, what could conservation achieve for the Iberian  
182 Lynx within that time period? Although large areas of native shrubland have been replaced by  
183 agricultural mosaics over the past two centuries, this change has increased rabbit abundance  
184 and therefore these areas are suitable for lynx occupancy (CrRef Chapter 2). Therefore, it  
185 would be possible to restore the species across much of its former range, and within 100  
186 years to achieve Functional lynx populations over at least 50% of each spatial unit. Under this  
187 scenario, the Iberian Lynx would be considered Fully Recovered (SRS = 100%; Fig. 1).

188 The full results of the Green Status assessment can be viewed at [either RL website if  
189 published in time, or assessment in Supplementary Information].

190

## 191 **Discussion**

192 The results of the first Green Status assessment for the Iberian Lynx demonstrate the  
193 tremendous impact of past conservation actions and help provide a glimpse of the possible  
194 future for the species. The result that, within 100 years, full recovery of the species is  
195 possible should galvanise the conservation community to sustain and augment their efforts  
196 for this iconic species. It is important to note that this assessment is not a conservation plan;  
197 nonetheless, the results can inform conservation planning. For example, the substantial  
198 Conservation Legacy indicates that past actions were effective, which can inform how similar  
199 actions are implemented across the range. The Conservation Gain, on the other hand, shows  
200 that the recovery score is expected to double within just 10 years if currently planned  
201 conservation actions are implemented. While this result is hopefully motivating in itself,  
202 conservation planners may also consider whether additional actions could be implemented in  
203 the same timeframe to have an even greater impact on recovery across the range.

204 The results can also help provide a horizon scan for threats that need to be addressed. In the  
205 Green Status assessment, assessors indicate uncertainty with lower bound, most likely, and  
206 upper bound estimates for states in each spatial unit. While the most likely estimate of  
207 Recovery Potential is that full recovery is achievable within 100 years, the lower bound  
208 estimate is more sobering. This is because rabbit disease outbreaks (rabbit haemorrhagic  
209 disease (RHD) and myxomatosis) remained a threat in 2023, with three disease outbreaks in  
210 the previous 75 years. These disease outbreaks in rabbits were accompanied by dramatic  
211 decreases in Iberian Lynx populations (Delibes-Mateos et al. 2014). Therefore, in the lower  
212 bound estimate of Recovery Potential, assessors assumed that there could be as many as four  
213 rabbit disease outbreaks in the next 100 years, which would keep lynx populations at low  
214 levels. In this pessimistic scenario, which assumes disease affects all spatial units, the lowest  
215 possible score in 100 years would be 33%; an improvement over the score in 2023, but  
216 nowhere near the inspiring heights of full recovery. This indicates that disease management  
217 and treatment should be a key priority as part of the species recovery plan moving forward.

218 While this uncertain future should be kept in mind, it is also important to see this as a major  
219 opportunity for conservation of the species; over the next century, new data about these

220 diseases and innovation in veterinary medicine can play a large role in helping the Iberian  
221 Lynx achieve full recovery.

## 222 **Conclusion**

223 The Green Status of Species assessment complements the Red List assessment of the Iberian  
224 Lynx to tell a powerful story of conservation success and hope for the future. Going forward,  
225 the two assessments will be re-evaluated in parallel at least every ten years, which will allow  
226 continued reflection on the recovery of the Iberian Lynx and the role of conservation actions  
227 in its recovery.

228

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