

Thick-billed parrot (*Rhynchopsitta pachyrhyncha*)

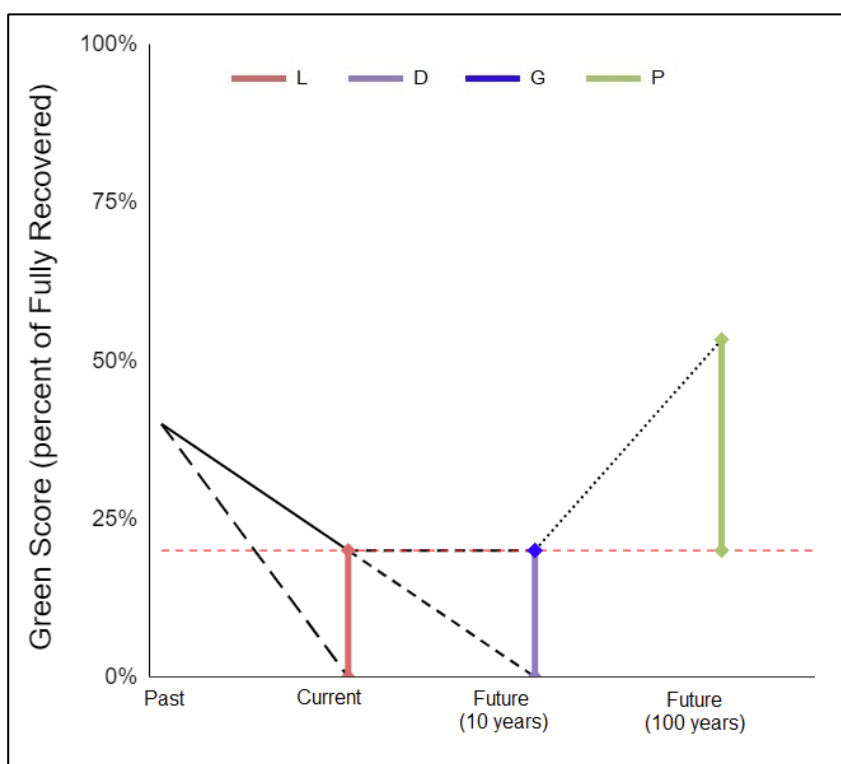


Figure S1. Graphical representation of the conservation metrics based on the Green Scores. Key: Vertical arrows represent the four conservation metrics: L – Conservation Legacy (may not appear if current and counterfactual states are the same); D – Conservation Dependence (may not appear if current and future-without-conservation states are the same); G – Conservation Gain (may not appear if current and future-with-conservation states are the same); P – Recovery Potential (may not appear if current and potential states are the same). The horizontal red dashed line represents the Current Green Score. Solid black line: observed change in the Green Score of the species (ignore it if "Former" state is not specified). Long-dashed black line: (counterfactual) past change expected in the absence of past conservation efforts. Dashed black lines: future scenarios of change expected with and without current and future conservation efforts. Dotted black line: long-term potential change expected with future conservation innovation and efforts.

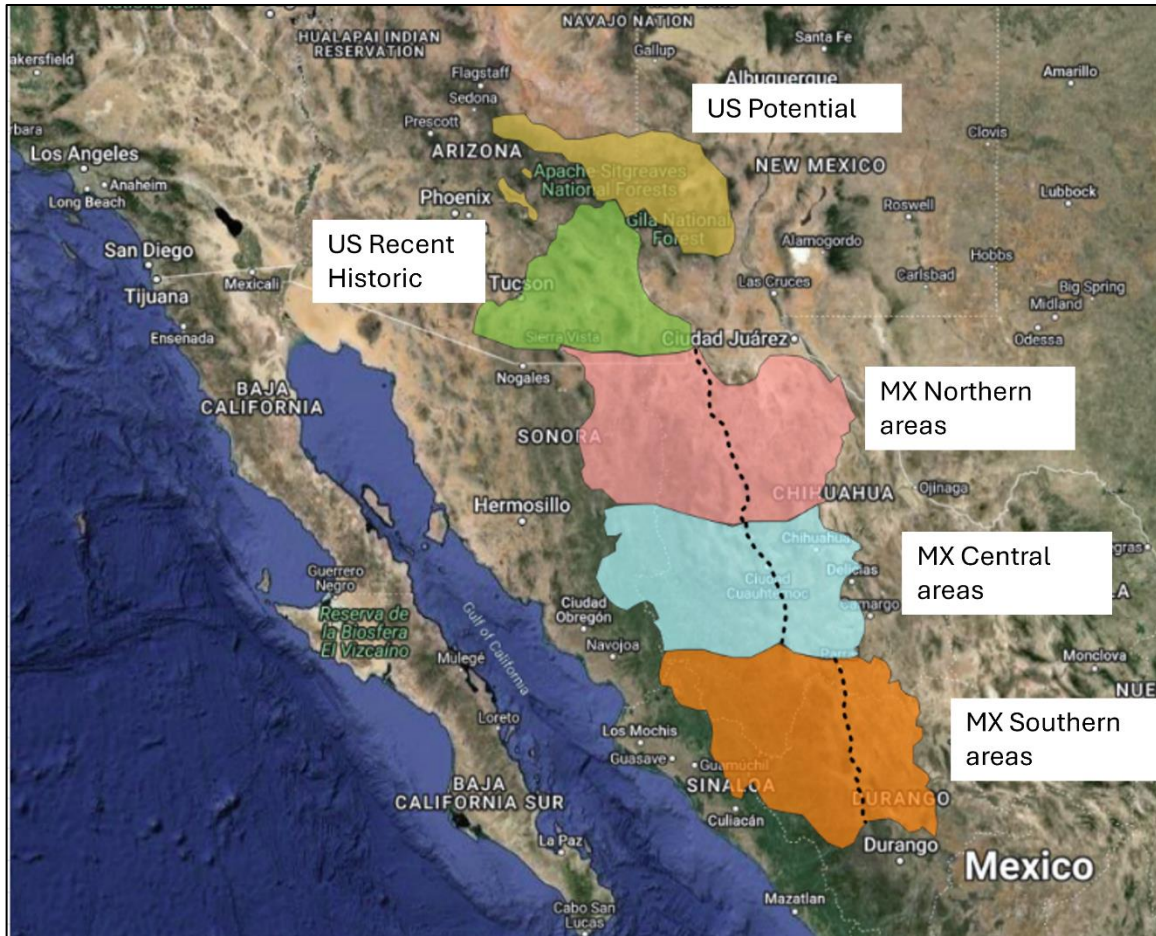


Figure S2. Thick-billed Parrot indigenous range based on a combination of habitat suitability and historical data, compiled by Ovis and divided into spatial units. The dotted line divides each spatial units into eastern and western parts. There is evidence of this species breeding on the western side of this spatial unit. It is unclear how far the range of this species expands to the east, as there have been some reports and sightings further east, but no verified nesting populations. These 'potential' sites further east have been included in this spatial unit, as it cannot be ruled out that this species is nesting here.

Table S1. Conservation Actions ([list of action codes](#)).

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
1.1.	1.1. Land/water protection: Site/area protection	x		X	
1.2.	1.2. Land/water protection: Resource & habitat protection				
2.1.	2.1. Land/water management: Site/area management		Ongoing in Mexico since mid-1990s. The most important nesting zone was afforded sanctuary in 2023	x	x
2.2.	2.2. Land/water management: Invasive/problematic species control		Control of ectoparasites, bobcats moving into the range - aluminum around trees to prevent them climbing and reaching nesting birds	x	x
2.3.	2.3. Land/water management: Habitat & natural process restoration		Restoration of forests and disturbance regimes ongoing in forestry practices by communal land owners and cooperatives.		
3.1.1.	3.1.1. Harvest management				

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
3.1.2.	3.1.2. Trade management	In the 1980's and 1990's there was a significant demand for birds as pets and for collectors such trade is no longer in existence.	Trade is minimal and not considered a significant threat. Mexican and international legislation prohibits trade.	Maintain restrictions on trade domestically and internationally.	Trade is expected to mostly disappear in the long term because of changing societal choices and demographics.
3.1.3.	3.1.3. Limiting population growth				
3.2	3.2 Species recovery		Recent and ongoing efforts to increase recruitment by intensive clutch management, including food supplementation, parasite control and direct protection of nests are underway (in 2024) and nest boxes have proved to be a valuable tool to increase recruitment.		
3.3.1.	3.3.1. Species re-introduction: Reintroduction	Availability of confiscated birds in the late 1980s and 1990s led to	Reintroduction into some of the former range especially recently	X	Potential to boost the population in the long-term

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
		some reintroduction efforts.	extirpated is being planned within Mexico.		
3.3.2.	3.3.2. Species re- introduction: Benign introduction				
3.4.1.	3.4.1. Ex-situ conservation: Captive breeding/artificial propagation			X	Potential to boost the population in the long-term
3.4.2.	3.4.2. Ex-situ conservation: Genome resource bank		Looking at bringing in post-doc for genetic study, bio samples have been banked for years	Yes	
4.1.	4.1. Education and Awareness: Formal education		Formal, informal and non- formal has been a part of the 28-year program started by Monterrey Tech and Pronatura to varying degrees. For example, the president of one ejido was a child involved in awareness activities in the early conservation efforts. She is currently a champion for Thick-billed Parrot. Ongoing as part of	Expected to continue and expand.	

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
			OVIS program with Thick-billed Parrot. Local, State and Federal authorities have Thick-billed Parrot as a priority species in their education and awareness programs.		
4.2.	4.2. Education and Awareness: Training				
4.3.	4.3. Education and Awareness: Awareness & communications		Flagship species, lots of awareness raining through zoo and locally in villages raising awareness about ecological function and risks. starting to engage local forestry groups to improve sustainability of legal forest harvest	X (Flagship species)	X (Flagship species)
5.1.1.	5.1.1. Legislation, International level		Under CITES management	X (CITES)	X (CITES)
5.1.2.	5.1.2. Legislation, National level		Listed as endangered. No parrot trade in Mexico allowed for over a decade now.	Maintained restriction of trade	Maintained restriction of trade
5.1.3.	5.1.3. Legislation, Sub-national level				

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
5.1.4.	5.1.4. Legislation, scale unspecified				
5.2.	5.2. Policies and regulations		CITES	X (CITES)	X (CITES)
5.3.	5.3. Private sector standards & codes		Working with forestry		
5.4.1.	5.4.1. Compliance and enforcement- International level		Very remote and difficult to access areas with a lot of corruption making enforcement difficult. Improving monitoring with the use of new technologies		
5.4.2.	5.4.2. Compliance and enforcement- National level				
5.4.3.	5.4.3. Compliance and enforcement- Sub- national level				
5.4.4.	5.4.4. Compliance and enforcement- Scale unspecified				
6.1.	6.1. Livelihood, economic & other incentives: Linked enterprises & livelihood alternatives		Lots of very disadvantaged communities so livelihood opportunity expansion is important in keeping	Incentives and payments to ejidos/communities have been in place since 1997 and continue to date and the near future. They have	

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
			<p>communities engaged. Will not exclude people from habitats. vital that local communities stay engaged and buy in. E.g. improved and sustainable logging practices. Ecotourism not an option currently</p>	<p>included a varying amount of land. Key sites have incorporated protection as part of their forest management and it is required that they do so. In practice the "incentive" is that they receive their forest management plan if they include consideration of Thick-billed Parrot conservation. New incentives for improved forest management and certification of "sustainable" forest products incentives better forest management that benefit Thick-billed Parrot.</p>	
6.2.	6.2. Livelihood, economic & other incentives: Substitution				
6.3.	6.3. Livelihood, economic & other incentives: Market forces				

Classification	Full Description	Past actions (no longer occurring)	Current actions	Actions planned within 10 years	Actions that could be implemented in the long-term aspiration scenario
6.4.	6.4. Livelihood, economic & other incentives: Conservation payments				
6.5.	6.5. Livelihood, economic & other incentives: Non-monetary values		Over three decades of education and awareness initiatives in the region have generated a sense of pride. Local festivals and school activities particularly in Madera, core area for Thick-billed Parrot, the parrots are part of an emerging culture of pride and belonging. Some of the current staff of the conservation projects became biologists because of the educational programs related to Thick-billed Parrot conservation and sustainable forest management.		

Table S2. Threats ([list of threat codes](#)).

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
1.1	1.1 Residential & commercial development: Housing & urban areas				
1.2	1.2 Residential & commercial development: Commercial & industrial areas				
1.3	1.3 Residential & commercial development: Tourism & recreation areas				
2.1.1	2.1.1 Agriculture & aquaculture: Annual & perennial non-timber crops: Shifting agriculture				
2.1.2	2.1.2 Agriculture & aquaculture: Annual & perennial non-timber crops: Small-holder farming				
2.1.3	2.1.3 Agriculture & aquaculture: Annual & perennial non-timber crops: Agro-industry farming				
2.1.4	2.1.4 Agriculture & aquaculture: Annual & perennial non-timber				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
	crops: Scale Unknown/Unrecorded				
2.2.1	2.2.1 Agriculture & aquaculture: Wood & pulp plantations: Small-holder plantations		x	x	x
2.2.2	2.2.2 Agriculture & aquaculture: Wood & pulp plantations: Agro-industry plantations		x	x	x
2.2.3	2.2.3 Agriculture & aquaculture: Wood & pulp plantations: Scale Unknown/Unrecorded				
2.3.1	2.3.1 Agriculture & aquaculture: Livestock farming & ranching: Nomadic grazing				
2.3.2	2.3.2 Agriculture & aquaculture: Livestock farming & ranching: Small-holder grazing, ranching or farming		x	x	x
2.3.3	2.3.3 Agriculture & aquaculture: Livestock farming & ranching: Agro-industry grazing, ranching or farming				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
2.3.4	2.3.4 Agriculture & aquaculture: Livestock farming & ranching: Scale Unknown/Unrecorded				
2.4.1	2.4.1 Agriculture & aquaculture: Marine & freshwater aquaculture: Subsistence/artisanal aquaculture				
2.4.2	2.4.2 Agriculture & aquaculture: Marine & freshwater aquaculture: Industrial aquaculture				
2.4.3	2.4.3 Agriculture & aquaculture: Scale Unknown/Unrecorded				
3.1	3.1 Energy production & mining: Oil & gas drilling				
3.2	3.2 Energy production & mining: Mining & quarrying				
3.3	3.3 Energy production & mining: Renewable energy				
4.1	4.1 Transportation & service corridors: Roads & railroads				
4.2	4.2 Transportation & service corridors: Utility & service lines				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
4.3	4.3 Transportation & service corridors: Shipping lanes				
4.4	4.4 Transportation & service corridors: Flight paths				
5.1.1	5.1.1 Biological resource use: Hunting & collecting terrestrial animals: Intentional use (species being assessed is the target)		x	x	
5.1.2	5.1.2 Biological resource use: Hunting & collecting terrestrial animals: Unintentional effects (species being assessed is not the target)				
5.1.3	5.1.3 Biological resource use: Hunting & collecting terrestrial animals: Persecution/control	x			
5.1.4	5.1.4 Biological resource use: Hunting & collecting terrestrial animals: Motivation Unknown/Unrecorded				
5.2.1	5.2.1 Biological resource use: Gathering terrestrial				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
	plants: Intentional use (species being assessed is the target)				
5.2.2	5.2.2 Biological resource use: Gathering terrestrial plants: Unintentional effects (species being assessed is not the target)				
5.2.3	5.2.3 Biological resource use: Gathering terrestrial plants: Persecution/control				
5.2.4	5.2.4 Biological resource use: Gathering terrestrial plants: Motivation Unknown/Unrecorded				
5.3.1	5.3.1 Biological resource use: Logging & wood harvesting: Intentional use: subsistence/small scale (species being assessed is the target [harvest])				
5.3.2	5.3.2 Biological resource use: Logging & wood harvesting: Intentional use: large scale (species being assessed is the target)[harvest]				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
5.3.3	5.3.3 Biological resource use: Logging & wood harvesting: Unintentional effects: subsistence/small scale (species being assessed is not the target)[harvest]	x	x	x	x
5.3.4	5.3.4 Biological resource use: Logging & wood harvesting: Unintentional effects: large scale (species being assessed is not the target)[harvest]	x	x	x	x
5.3.5	5.3.5 Biological resource use: Logging & wood harvesting: Motivation Unknown/Unrecorded				
5.4.1	5.4.1 Biological resource use: Fishing & harvesting aquatic resources: Intentional use: subsistence/small scale (species being assessed is the target)[harvest]				
5.4.2	5.4.2 Biological resource use: Fishing & harvesting aquatic resources: Intentional use: large scale (species being				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
	assessed is the target)[harvest]				
5.4.3	5.4.3 Biological resource use: Fishing & harvesting aquatic resources: Unintentional effects: subsistence/small scale (species being assessed is not the target)[harvest]				
5.4.4	5.4.4 Biological resource use: Fishing & harvesting aquatic resources: Unintentional effects: large scale (species being assessed is not the target)[harvest]				
5.4.5	5.4.5 Biological resource use: Fishing & harvesting aquatic resources: Persecution/control				
5.4.6	5.4.6 Biological resource use: Fishing & harvesting aquatic resources: Motivation Unknown/Unrecorded				
6.1	6.1 Human intrusions & disturbance: Recreational activities		x Use of ATV's and increased visitation and	x	

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
			disturbance during nesting		
6.2	6.2 Human intrusions & disturbance: War, civil unrest & military exercises		x Violence and cannabis plantations pose a threat that is likely at least continued.	x	
6.3	6.3 Human intrusions & disturbance: Work & other activities				
7.1.1	7.1.1 Natural system modifications: Fire & fire suppression: Increase in fire frequency/intensity				
7.1.2	7.1.2 Natural system modifications: Fire & fire suppression: Suppression in fire frequency/intensity				
7.1.3	7.1.3 Natural system modifications: Fire & fire suppression: Trend Unknown/Unrecorded	x	x	x	x
7.2.1	7.2.1 Natural system modifications: Dams & water management/use: Abstraction of surface water (domestic use)				
7.2.2	7.2.2 Natural system modifications: Dams &				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
	water management/use: Abstraction of surface water (commercial use)				
7.2.3	7.2.3 Natural system modifications: Dams & water management/use: Abstraction of surface water (agricultural use)				
7.2.4	7.2.4 Natural system modifications: Dams & water management/use: Abstraction of surface water (unknown use)				
7.2.5	7.2.5 Natural system modifications: Dams & water management/use: Abstraction of ground water (domestic use)				
7.2.6	7.2.6 Natural system modifications: Dams & water management/use: Abstraction of ground water (commercial use)				
7.2.7	7.2.7 Natural system modifications: Dams & water management/use: Abstraction of ground water (agricultural use)				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
7.2.8	7.2.8 Natural system modifications: Dams & water management/use: Abstraction of ground water (unknown use)				
7.2.9	7.2.9 Natural system modifications: Dams & water management/use: Small dams				
7.2.10	7.2.10 Natural system modifications: Dams & water management/use: Large dams				
7.2.11	7.2.11 Natural system modifications: Dams & water management/use: Dams (size unknown)				
7.3	7.3 Natural system modifications: Other ecosystem modifications				
8.1.1	8.1.1 Invasive & other problematic species, genes & diseases: Invasive non-native/alien species/diseases: Unspecified species				
8.1.2	8.1.2 Invasive & other problematic species, genes & diseases:				x While current parasites and diseases are native/endemic it is

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
	Invasive non-native/alien species/diseases: Named species				highly likely that alien species will appear in the mid to long term
8.2.1	8.2.1 Invasive & other problematic species, genes & diseases: Problematic native species/diseases: Unspecified species		x Ectoparasites are native and can kill nesting chicks	x	x
8.2.2	8.2.2 Invasive & other problematic species, genes & diseases: Problematic native species/diseases: Named species		x Not traditionally hunted by bobcats, but they are increasingly coming into the species range	x	x
8.3	8.3 Invasive & other problematic species, genes & diseases: Introduced genetic material				
8.4.1	8.4.1 Invasive & other problematic species, genes & diseases: Problematic species/diseases of unknown origin: Unspecified species				
8.4.2	8.4.2 Invasive & other problematic species,				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
	genes & diseases: Problematic species/diseases of unknown origin: Named species				
8.5.1	8.5.1 Invasive & other problematic species, genes & diseases: Viral/prion-induced diseases: Unspecified "species" (disease)				
8.5.2	8.5.2 Invasive & other problematic species, genes & diseases: Viral/prion-induced diseases: Named "species" (disease)				
8.6	8.6 Invasive & other problematic species, genes & diseases: Diseases of unknown cause				
9.1.1	9.1.1 Pollution: Domestic & urban waste water: Sewage				
9.1.2	9.1.2 Pollution: Domestic & urban waste water: Run-off				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
9.1.3	9.1.3 Pollution: Domestic & urban waste water: Type Unknown/Unrecorded				
9.2.1	9.2.1 Pollution: Industrial & military effluents: Oil spills				
9.2.2	9.2.2 Pollution: Industrial & military effluents: Seepage from mining				
9.2.3	9.2.3 Pollution: Industrial & military effluents: Type Unknown/Unrecorded				
9.3.1	9.3.1 Pollution: Agricultural & forestry effluents: Nutrient loads				
9.3.2	9.3.2 Pollution: Agricultural & forestry effluents: Soil erosion, sedimentation				
9.3.3	9.3.3 Pollution: Agricultural & forestry effluents: Herbicides & pesticides				
9.3.4	9.3.4 Pollution: Agricultural & forestry effluents: Type Unknown/Unrecorded				

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
9.4	9.4 Pollution: Garbage & solid waste				
9.5.1	9.5.1 Pollution: Air-borne pollutants: Acid rain				
9.5.2	9.5.2 Pollution: Air-borne pollutants: Smog				
9.5.3	9.5.3 Pollution: Air-borne pollutants: Ozone				
9.5.4	9.5.4 Pollution: Air-borne pollutants: Type Unknown/Unrecorded				
9.6.1	9.6.1 Pollution: Excess energy: Light pollution				
9.6.2	9.6.2 Pollution: Excess energy: Thermal pollution				
9.6.3	9.6.3 Pollution: Excess energy: Noise pollution				
9.6.4	9.6.4 Pollution: Excess energy: Type Unknown/Unrecorded				
10.1	10.1 Geological events: Volcanoes				
10.2	10.2 Geological events: Earthquakes/tsunamis				
10.3	10.3 Geological events: Avalanches/landslides				
11.1	11.1 Climate change & severe weather: Habitat shifting & alteration		x	x	x

Classification	Full Description	Past threats (no longer occurring)	Current threats	Threats expected to emerge or continue over next 10 years	Threats that would be relevant in the long-term aspiration scenario
11.2	11.2 Climate change & severe weather: Droughts		x Reduces food supply and makes trees more vulnerable to attack by pine bark beetles	x	x
11.3	11.3 Climate change & severe weather: Temperature extremes		x Many species are being affected by extreme heat waves in otherwise temperate regions	x	x
11.4	11.4 Climate change & severe weather: Storms & flooding				
11.5	11.5 Climate change & severe weather: Other impacts				
12.1	12.1 Other threat				

Appendix 1. Assessor Self-Review

- 1. Disclose any potential conflicts of interest which could bias the assessment.**
None (other than long-standing professional relationship with the in-country team who has worked with the parrots for over 20 years).

- 2. Is there any discrepancy between this assessment and the Red List assessment for the species? If so, comment on the likely reason for this discrepancy.**
The count data on the Red List is very outdated. It says that it was assessed in August 2020 but in reality it is based on data more than 10 years old. However, the temporal nature of population sizes given does not impact the results of this assessment, or lead to any direct contradictions with the Red List. The first ever comprehensive population estimate with multiple simultaneous observers and assisted by satellite radio points will be conducted in November 2024.

- 3. Review the impact that you assigned to the various threats and conservation actions. Would the trajectory of the species be very different if other choices were made? If so, review your justification for these choices. If appropriate, widen the bounds on tabs 4 and 5-8 (change the lower and upper plausible values) to reflect the uncertainty introduced by the possibility of these other choices. How, if at all, did this review question cause this assessment to change? If no changes were needed, please write "no changes".**
No changes.