Species Status Assessment Report

for

Golden Conure (*Guaruba guarouba*)

Prepared by:

U.S. Fish and Wildlife Service
Ecological Services Program
Division of Conservation and Classification
Branch of Delisting and Foreign Species

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This species status report provides information on the biology, status, and limiting factors of the golden conure (*Guaruba guarouba*).

Literature citation should read as follows:

U.S. Fish and Wildlife Service. 2018. Species status assessment report for Golden Conure (*Guaruba guarouba*), 63 pp.

Cover photo: ARKive 2017a, unpaginated.

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EXECUTIVE SUMMARY

This species status assessment reports the results of the comprehensive status review for the golden conure (*Guaruba guarouba*) (Gmelin, 1788) and provides an account of the species' overall viability and extinction risk. The golden conure is a psittacine bird (parrots, parakeets, macaws, cockatoos, and others) that is native to the Amazon in Brazil. The species primarily occurs in "terra firme" (unflooded) rainforest habitat.

The species status assessment (SSA) process has three successive stages: (1) document the species' life history and ecological relationships to provide the foundation for the assessment, (2) describe and hypothesize causes for the species' current condition, and (3) forecast the species' future condition (Smith *et al. in Press*, entire). We have used these stages as major headings in this report. To evaluate the current and future biological status of golden conure, we assessed a range of conditions that allow us to consider the species' resiliency, redundancy, and representation (together, the 3Rs).

The golden conure needs multiple resilient populations widely distributed across its range to maintain persistence into the future and to avoid extinction. A number of factors influence whether golden conure will maximize occupancy in suitable habitat, which increases the resiliency of the population to stochastic events. These factors include:

- large patches of intact rainforest with "terra firme" habitat that contain
  - quality habitat for breeding and roosting (i.e., old growth hardwood trees for cavity nesting and roosting);
  - quality habitat for foraging (i.e., fruiting vegetation within the forest matrix); and
  - connectivity between the large patches of rainforest with "terra firme" habitat

The golden conure historically ranged throughout the lower basin of the Brazilian Amazon. Its range roughly encompassed the area south of the Amazon River, east of the Rio Madeira River, and north of the Brazilian Shield and included five Brazilian states. The golden conure is now believed to be extirpated from the eastern portion of its former range (i.e., eastern portions of the states of Pará and Maranhão).

We have assessed the golden conure's current and future viability by gauging its resiliency, redundancy, and representation. Our analysis indicates that the golden conure faces the most risk from loss and degradation of its habitat from deforestation (i.e., originating from multiple anthropogenic activities). This risk will be intensified by synergistic effects associated with climate change (Staal *et al.* 2015, p. 2). Climate projections include increased temperatures, dryer conditions, and more extreme weather (including droughts) which have the potential to stress trees and cause tree mortality (Fearnside 2009, pp. 1003, 1005). These conditions also increase the unintentional spread of fires further contributing to deforestation (Fearnside 2009, p. 1005). The successful implementation of existing forest law and an extensive network of protected areas may help to mitigate some of these risks, but overall, long term declines are

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projected for the conure and its habitat. Nevertheless, it is important that protected areas are managed for the conure and are well maintained in perpetuity.

As noted above, the golden conure primarily faces risks from deforestation which are exacerbated by effects from climate change. The species' range partially overlaps the "Arc of Deforestation" — an area in the eastern and southern Amazon where rates of deforestation and forest fragmentation have been the highest (Prioste *et al.* 2012, p. 701; Laranjeiras 2011a, unpaginated; Laranjeiras and Cohn-Haft 2009, p. 8). Approximately 30-35 percent of the species habitat has already been lost to deforestation, primarily in the eastern portion of its former range (Laranjeiras 2011a, unpaginated; Laranjeiras and Cohn-Haft 2009, p. 8). An additional 23.3 to 30.9 percent of the species' suitable habitat is projected to be lost within three generations (22 years) (Bird *et al.* 2011 Appendix S1). We used the best available information to forecast future plausible conditions for the golden conure under three different scenarios (status quo, conservation, and considerable effects). The assumptions associated with each scenario are discussed below.

Scenario 1: Status quo

- Approximately 30.9 percent of suitable habitat is lost in 3 generations (22 years) (Bird *et al.* 2011 Appendix S1 "business as usual" scenario). This scenario assumes recent deforestation trends will continue, and:
  - as much as 40 percent of the forests inside of, and 85 percent outside of, protected areas will be subject to deforestation;
  - highways currently scheduled for paving will be paved;
  - compliance with legislation requiring forest reserves on private land will remain low; and
  - no new protected areas will be created.
- Additionally, the rate of emissions from greenhouse gasses will reach some level of stabilization at the end of the 21st century (Representative Concentration Pathways (RCPs) ranging from 4.5-6.0))
  - RCP 4.5 = global warming is *more likely than not* to be 2.0 °C (3.6 °F)
  - RCP 6.0 = global warming is *likely* to be 2.0 °C (3.6 °F)

Scenario 2: Conservation

- Approximately 23.3 percent of suitable habitat is lost in 3 generations (22 years) (Bird *et al.* 2011 Appendix S1 "governance" scenario). This scenario assumes environmental legislation is implemented across the Amazon basin and experiments in "frontier governance" are refined and applied, including:
  - enforcement of mandatory forest reserves on private properties through a satellite-based licensing system;

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Here we have not talked about the threat of illegal capture of nature's indivious. This is a very latent threat. I think it is important to simulate a scenario just by capturing individuals.

Capturing illegal trafficking is also a relevant threat. In eastern Pará, the species is often captured and individuals are raised as pets or sold for illegal trade (Kyle 2005, Silveira & Belmonte 2005). The same practice is observed in western Maranhão, where individuals were seen in popular homes in the city of Açailândia (D.M. Lima - com. pess.) The catch is relatively easy and can be enhanced in regions with fragmented landscape. Isolated trees are attractive to flocks of the species, due to the apparent protection against forest predators, but, however, these nests are easier to find by traffickers (Laranjeiras 2011). Ararajubas are still frequent in seizures by government agencies across the country, but, fortunately, there is no recent evidence of international trafficking (Silveira & Belmonte 2005). In western Pará, events and evidence of capture are increasing each day (Laranjeiras 2008). Locally, the species has suffered from hunting and hunting by indigenous peoples or farmers (Laranjeiras 2008a, BirdLife International 2012).
Deforestation of forest remnants followed by capture for trafficking may have devastating effects on local populations of ararajuba in the wild.

Laranjeiras, T.O. 2008a. **Distribuição geográfica histórica natural e conservação da ararajuba (*Guarouba guarouba* - Psittacidae)**. Dissertação (Mestrado em Biologia Tropical e Recursos Naturais). INPA/ UFAM. 114p.

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The habitat loss data estimated by Bird et. al. 2011 are not totally up to date. Then, I indicate habitat loss by consulting the analyzes of the following site; http://mapbiomas.org/map#coverage

There are already estimates of 2016 for habitat loss in the different regions of the Amazon. Since deforestation in the state of Rondonia, Mato Grosso, Pará and western Maranhão is totally different from what occurs in the state of Amazonas. In the indicated site one can make filters by states and type of vegetation to calculate loss of habitat.

- agro-ecological zoning of land use;
- successful expansion of the protected areas network; and
- 100 percent of the forests inside of and 50 percent outside of protected areas will be preserved.
- Additionally, the rate of emissions from greenhouse gasses will reach some level of stabilization at the end of the 21st century (corresponding to RCP 4.5; global warming is *more likely than not* to be 2.0 °C (3.6 °F).

Scenario 3 – Considerable effects

- More than 40 percent of suitable habitat is lost in 3 generations (22 years) (e.g., greater loss than projected in the Bird *et al.* 2011 Appendix S1 "business as usual" scenario). In this scenario we assume that:
  - Infrastructure projects currently considered within the conure's range will proceed and additional projects will be added and implemented
  - Protected areas will not well maintained or managed to include:
    - > 40 percent of the forests inside of and > 85 percent outside of protected areas will be subject to deforestation;
    - compliance with legislation requiring forest reserves on private land will be low; and
    - no new protected areas will be created.
  - Additionally, there will be continued high emissions from greenhouse gasses (corresponding to RCP 8.5; global warming at the end of the 21st century is *likely* to be 2.0 °C (3.6 °F)).

We then examined the resiliency, representation, and redundancy of golden conure under each scenario. Because the conure is forest-dependent, we assume that, over time, percent forest loss will correspond, almost one to one, with declines in the global population. (Table ES-1).

Scenario 1 - Status quo. Under this scenario, we expect the golden conure's future viability to be characterized by lower resiliency, redundancy, and representation than it exhibits under the current conditions. We expect declines in its habitat and the global population to reach approximately 30 percent in 22 years. Additional decreases in both of these rates are likely in the longer term under RCPs ranging from 4.5-6.0 due to synergistic effects associated with climate change. Under this scenario, some proportion of protected areas would remain (scored as medium). However, the decline in forest habitat will likely relate to declines in nesting tree abundance, extent of the range, and connectivity between remaining forested tracts. Therefore, we estimate the overall future condition to be low.

Scenario 2 – Conservation. Under this scenario, we expect the golden conure's future viability to be characterized by lower resiliency, redundancy, and representation than it exhibits under the current conditions. We expect declines in its habitat and the global population to reach

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approximately 23 percent in 22 years. Additional decreases in both of these rates are likely in the longer term under RCP 4.5 due to synergistic effects associated with climate change. We expect the species' abundance and population growth to decline, but at a slower rate than would be experienced under status quo. Efforts to increase the percentage and quality of protected areas would likely result in better conservation of nesting trees and connectivity between remaining forested tracts. Under this scenario, the largest proportion of protected areas would remain—which explains our high scores for connectivity and two of the habitat factors. However, because this level of deforestation would still likely result in declines in abundance and population growth, we estimate the overall future condition to be medium.

Scenario 3 – Considerable effects. Under this scenario, we expect the golden conure's future viability to be characterized by much lower resiliency, redundancy, and representation than it exhibits under the current conditions. We expect declines in its habitat and the global population to be greater than 40 percent in 22 years. Additional and significant decreases in both of these rates are likely in the longer term under RCP 8.5 due to synergistic effects associated with severe climate change. Projected decline in forest habitat (coupled with climate change effects) relate to declines in all demographic and habitat factors which explains our low estimates for these factors and for the overall future condition.

Table ES-1. Evaluation of three plausible future scenarios for the golden conure.

Scenario	IPCC	Deforestation	Demographic factors			Habitat factors			Overall future con-dition
	Global warming at the end of the Century	Projected % of habitat loss in 22 years	Abundance	Population growth	Connectivity	Nest tree abundance	Extent of range	Protected areas	
Status quo	*(RCP s 4.5 - 6.0) More likely than not* or *Likely* to be 2.0 °C	30.9%	Low (Decline)	Low	Low	Low	Low	Med	Low
Conservation	*(RCP 4.5) More likely than not* to be 2.0 °C	23.3%	Med (Decline but slower than for status quo)	Med	High	High	Med	High	Med
Considerable effects	*(RCP 8.5) Likely* to be 2.0 °C	>40%	Low (Decline But more rapid than status quo)	Low	Low	Low	Low	Low	Low

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INTRODUCTION

The golden conure (*Guaruba guarouba*) (Gmelin, 1788) is a psittacine bird (parrots, parakeets, macaws, cockatoos, and others) endemic to the Amazon Basin in Brazil. We (the U. S. Fish and Wildlife Service; Service) listed the species as endangered under the Endangered Species Act of 1973, as amended (Act) in 1976 (41 FR 21062). At that time, we used the name ‘‘golden parakeet’’ with the scientific name *Aratinga guarouba*. However, in this report, we refer to the species by the common name ‘‘golden conure’ ’and, based on the best available information on taxonomy, use the scientific name *Guaruba guarouba* (see TAXONOMY below).

This 2018 Species Status Assessment (SSA) Report for the golden conure is intended to provide the biological support for the decision on whether or not to delist or downlist the species from its current designation as endangered under the Act. Importantly, this SSA Report is not a decision by the Service on whether the golden conure should be proposed for delisting or downlisting under the Act. Instead, this SSA Report provides a review of the available information related to the biological status of the golden conure. The decision on whether to delist or downlist the species will be made by the Service after reviewing the best available scientific and commercial information, including this document along with its peer review, and all relevant laws, regulations, and policies. The results of a proposed decision will be announced in the Federal Register, with appropriate opportunities for public input.

For the purpose of this assessment, we generally define viability as the ability of a species, in this case the golden conure, to sustain populations in natural ecosystems and disturbed habitats over time. Using the SSA framework (Figure 1), we considered what the species needs to maintain viability by characterizing the status of the species in terms of the 3 Rs: Resiliency, Redundancy, and Representation (Wolf *et al.* 2015, entire).

- **Resiliency** describes the ability of populations to withstand stochastic events (arising from random factors). We can measure resiliency based on metrics of population health; for example, birth versus death rates and population size. Highly resilient populations are better able to withstand disturbances such as random fluctuations in reproductive rates (demographic stochasticity), variations in rainfall (environmental stochasticity), or the effects of anthropogenic activities.

- **Representation** describes the ability of a species to adapt to changing environmental conditions. Representation can be measured by the breadth of genetic or environmental diversity within and among populations and gauges the probability that a species is capable of adapting to environmental changes. The more representation, or diversity, a species has, the more capable it is to adapting to changes (natural or human caused) in its environment. In the absence of species-specific genetic and ecological diversity

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information, we evaluate representation based on the extent and variability of habitat characteristics across the species' geographical range.

- **Redundancy** describes the ability of a species to withstand catastrophic events. Measured by the number of populations, their resiliency, their distribution, and their connectivity, redundancy gauges the probability that the species has a margin of safety to withstand or the ability to bounce back from catastrophic events (such as a rare destructive natural event or episode involving many populations).

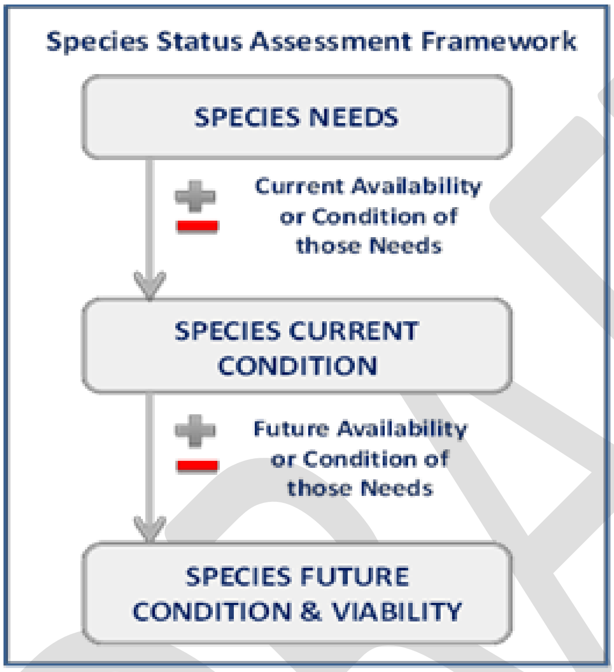

Figure 1. Species Status Assessment framework.

To evaluate the biological status of the golden conure both currently and into the future, we assessed a range of conditions to allow us to consider the 3Rs. This SSA Report provides a thorough assessment of the species' known biology and natural history and assesses demographic risks, threats, and limiting factors in the context of determining the viability and risks of extinction for the conure.

STAGE ONE (Life History and Ecological Relationships)

In stage one we document the species' life history and ecological relationships to provide the foundation for the SSA. In this stage, we provide basic biological information about the golden conure, including the species' (1) taxonomy, (2) description, (3) habitat, (4) known life history traits, and (5) current and historical range and distribution.

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Taxonomy

The golden conure (*Guaruba guarouba*) (Gmelin, 1788) is in the Psittacidae family which includes cockatoos, macaws, parrots, and others (ITIS 2017, unpaginated). The species was first documented in 1788 and was later noted in the manuscripts of European explorers to Brazil in the 18th and 19th centuries (Yamashita 2003, p. 38). It was originally placed in its own (monotypic) genus *Guaruba*, then some authors subsequently placed it in the genus *Aratinga* (Peters 1937, Pinto 1978, and Forshaw 1989 as cited in Tavares *et al.* 2004, p. 239), while others placed it in the genus *Conurus* (Salvadori 1891 and Miranda Ribeiro 1920 as cited in Tavares *et al.* 2004, p. 239).

Researchers have since noted that its behavior, including reproduction and vocalization, differ markedly from those of *Aratinga* species and have recommended that the golden conure's scientific name be returned to the monotypic genus *Guaruba* (Laranjeiras 2011a, unpaginated; Sick 1990, p. 112). Additionally, results from recent mitochondrial genetic analyses indicated that the golden conure is more closely related to the red-shouldered macaw (*Diopsittaca nobilis*), and the blue-crowned parakeet (*Thectocercus acuticaudatus*t) (Urantówka and Mackiewicz 2017, entire), than to the *Aratinga* parakeets (Tavares *et al.* 2004, pp. 230, 236-237, 239). The Integrated Taxonomic Information System (ITIS, 2017 unpaginated), the Brazilian Ornithological Records Committee (Piacentini *et al.* 2015, p. 163), and Birdlife International (BLI 2017, unpaginated) all recognize the golden conure as *Guaruba guarouba.* Based upon our review of the available information, we accept the golden conure as a valid full species in the monotypic genus *Guaruba.*

Species Description

The golden conure is described as a spectacular, large, macaw-like psittacid endemic to the Brazilian Amazon (Laranjeiras and Cohn-Haft 2009, p. 1; Figure 2). The species has striking yellow plumage with green flight feathers that easily distinguish it from any other psittacid within its range (Laranjeiras 2011a, unpaginated; Parr and Juniper 2010, p. 436). Other distinguishing features include (1) a large horn-colored (pinkish-gray) bill (BLI 2016, p. 1), (2) a white or pale-pink bare orbital (eye) ring, and (3) flesh-pink tarsi and toes (Forshaw 2017, p. 223; Laranjeiras 2011a, unpaginated). Adult body length is about 34 centimeters (cm) (13 inches (in)) (Forshaw 2017, p. 223; BLI 2016, p. 1; Laranjeiras 2011a, unpaginated) and adult weight is about 270 grams (9.5 ounces) (Forshaw 2017, p. 228). The sexes are similar in appearance (Parr and Juniper 2010, p. 436). Plumage of juveniles is similar to that of adults, but the yellow color is variably streaked with green—most often on the back of the head, nape and chest (Forshaw 2017, p. 223; Laranjeiras 2011a, unpaginated; Reynolds 2003, p. 10). Juveniles in the wild molt and develop adult plumage at about 1 year (Laranjeiras 2011a, unpaginated).

The golden conure is described as conspicuous and not easily missed in the field because of its unique coloration and voice. Vocalizations are described as a "greh" or "kray" calls that are softer than that of the *Aratinga* parakeets (BLI 2016, p. 1; Parr and Juniper 2010, p. 436). Most

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individuals in the flock emit intense vocalizations before leaving a perch, and, in flight, the flock can be heard from a long distance before crossing overhead (Laranjeiras 2011a, unpaginated). Additionally, first-year juveniles beg for food from adults by making a forceful ‘keh keeh keeh’ call (Laranjeiras 2011a, unpaginated). However, the species may be harder to find when it is quieter (e.g., while feeding in dense trees) (Forshaw 2017, p. 226; Laranjeiras 2011a, unpaginated).

Other names used for the golden conure include the “golden parakeet,” “Queen of Bavaria's conure” (Reynolds 2003, p. 10) and the local name of “Ararajuba” which is an indigenous word for "yellow macaw" (Kyle 2005, p. 3; Sick 1990, p. 112).

Figure 2. Adult golden conure (ARKive 2017b, unpaginated).

Habitat

The Amazon is the largest tract of rainforest in the world and supports the greatest level of biodiversity on Earth. The golden conure lives in in Brazil’s lower Amazon basin, in an area south of the Amazon River, east of the Rio Madeira River, and north of the Brazilian Shield (Laranjeiras and Cohn-Haft 2009, p. 9). Basically, a “shield” is a part of the continental crust where Precambrian basement rocks crop out extensively at the surface (Wikipedia 2018a, unpaginated).

Within this area, the golden conure occupies primary (old growth) terra firme (unflooded) rainforest on undulating landscapes in the lowlands at elevation at or under 300 meters (m) (984 feet (ft)) (Sick 1997 as cited by Laranjeiras 2011a, unpaginated). However, the species has also

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has been recorded in the regrowth of secondary forests and in igapó forests while feeding (Laranjeiras 2011a, unpaginated, citing several sources). Igapó forests are seasonally flooded with blackwater rivers (i.e., tanin- stained and slow moving) (Wikipedia 2018b & c, unpaginated).

The climate is described as hot and humid, with mean annual precipitation ranging from 1,800-2,300 millimeters (mm) (71-91 in) (Moraes *et al.* 2005 as cited in Laranjeiras 2011b, p. 304). Four seasons have been recognized (1) the "rainy season" from January to March, (2) "end of rainy season" from April to June, (3) "dry season" from July to September, and (4) the "beginning of the rainy season" from October to December (Laranjeiras 2011b, p. 304; Figure 3). Researchers who have modeled the species' distribution have noted that its range is generally less humid than the central Amazon region (to the north) and warmer than regions to the south (Laranjeiras 2011a, unpaginated).

Most known nest and roost sites have been found in disturbed (cleared) areas, with several dead trees adjacent to a large patch of continuous forest. For nesting and roosting, the conure seems to prefer isolated trees in these areas, probably because these trees offer better protection against terrestrial or arboreal predators like snakes or monkeys (Laranjeiras 2011a unpaginated; Kyle 2005, p. 3) that could use neighboring trees to gain access to the nesting tree.

The golden conure appears to be somewhat of a generalist in the tree species that it uses for nesting. At least six different species of nesting trees, and another four unidentified tree species, are noted in the literature (Laranjeiras 2011b, p. 308; Silveira and Belmonte *in Press*, unpaginated; Oren and Novaes 1986, p. 333; Table 1). Also, although the majority of nesting trees were described as dead or leafless, live trees have been used (Laranjeiras 2011b, p. 308, Silveira and Belmonte *in Press*, unpaginated; Yamashita 2003, p. 38). Similarly, the species uses many different fruiting tree species for food, including more than 28 species of food trees from at least 15 different families (see Appendix A).

Table 1. Scientific name, family, common name (when known) and literature source for known nesting tree species used by the golden conure.

Scientific name	Family	Common name	Source
Mezilaurus itatuba	Lauraceae	Itauba	Laranjeiras 2011b, p. 308
Aspidosperma vargasii	Apocynaceae	Amarelão	Laranjeiras 2011b, p. 308
Tabebuia roseoalba	Bignoniaceae	Ipê-Branco	Laranjeiras 2011b, p. 308
Astronium lecointei	Anacardiaceae	Muiricatiara	Laranjeiras 2011b, p. 308
Sclerobium sp.	Leguminosae	unknown	Oren and Novaes 1986, p. 333
Dinizia excelsa	Fabaceae/ Mimosoideae	Angelim vermelho	Silveira and Belmonte *in Press*, unpaginated

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Scientific name: *Hymenolobium* sp.
Family: Fabaceae
Common name: angelim-pedra
Source: Lima et al. 2014, p. 323

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Life History

The life history of the golden conure is mostly similar to that of other psittacids (Figure 3). However, their social structure and breeding behavior appears to be unique in that during the reproductive period, the species engages in communal breeding, where it remains in flocks made up of family groups or clans during the breeding season (Laranjeiras 2011a, unpaginated). Most other large psittacids are believed to incubate and rear young in pairs (Albertani *et al.* 1997, pp. 135-136). Preliminary results from genetic testing indicated that all the birds within a breeding group were closely related with the exception (in some cases) of a young, unrelated female (Reynolds 2003, p. 12).

The golden conure's communal breeding includes the use of one or two uncommon reproductive strategies where the flock is either made up of (1) multiple related nesting pairs with reproductive helpers (Oren and Novaes 1986, p.333), or (2) a single leading pair with juveniles from different generations acting as helpers (Reynolds 2003, p. 12; Oren and Novaes 1986, p.333). Extra-pair paternity (where the female is fertilized by more than one male) has been documented in captivity; a captive female was fertilized by two males and subsequently had a brood with four chicks fathered by one of the males and one chick fathered by the other (Albertani *et al.* 1997, entire). Extra-pair paternity has not been confirmed in the wild.

The size of the golden conure's family group or clan is one of the largest reported among the neotropical parrots—ranging from approximately 4 to 20 individuals, and averaging about 10 individuals (Laranjeiras 2011a, unpaginated). At feeding sites, these golden conures may group into larger flocks of up 50 individual (Laranjeiras 2011a, unpaginated).

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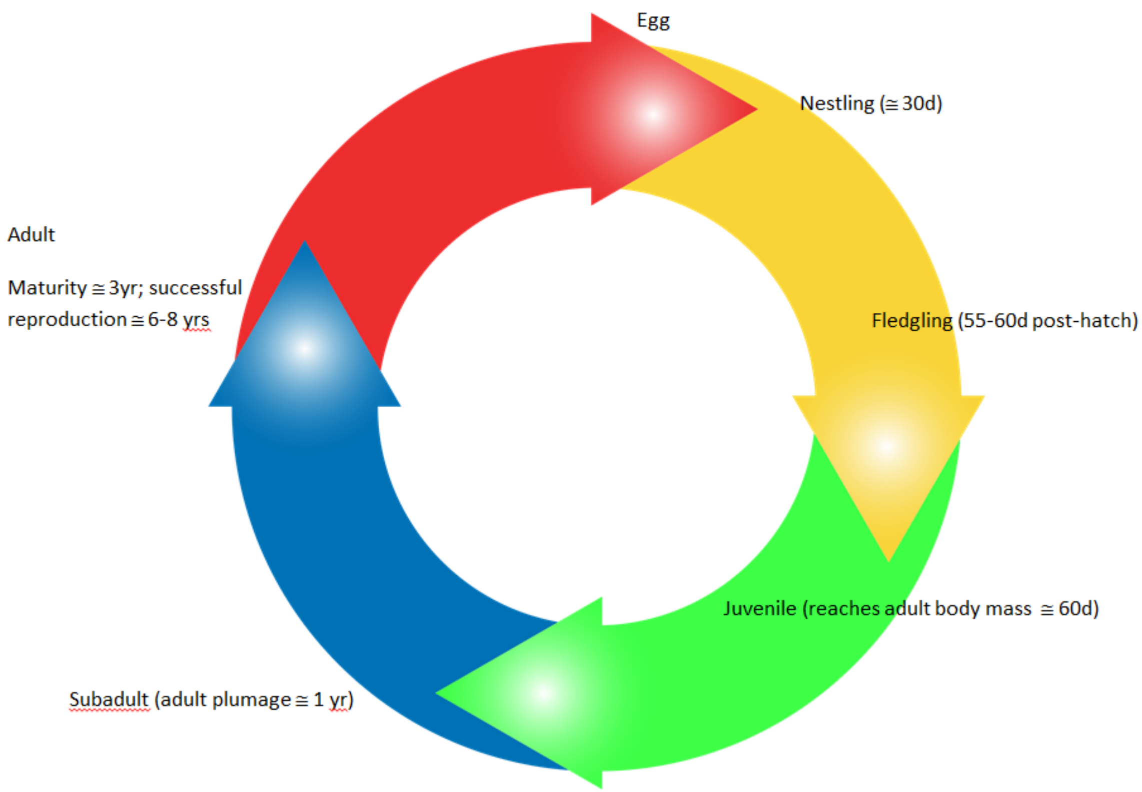
In the Gurupi Biological Reserve, Maranhão, a group of 34 individuals (Lima et al. 2014, p. 323).

Golden Conure Life Cycle



Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Breeding	Breeding	Breeding	Breeding PRP[1]	PRP[1]	PRP[1]	PRP[1]	PRP[1]			Breeding	Breeding
Rainy season[2] 600-1,000 mm/24-39 in			End of rainy season[2] 400-700 mm/16-28 in			Dry season[2] 150-350 mm/6-14 in			Beginning of rainy season[2] 400-600 mm/16-24 in		

PRP[1] = post-reproductive period (when first year juveniles can be seen in the flocks at feeding sites).
[2]Measurements in the "season" cells represent the range of precipitation in millimeters (mm) and inches for the months noted (Laranjeiras 2011b, p. 311).

Figure 3. Simple life cycle diagram for the golden conure. The annual breeding cycle and post reproductive period by month and season are also indicated.

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The golden conure is frugivorous and feeds on vegetation in both primary and secondary forests; the diet includes whole fruit, seeds, pulp, buds and flowers, nectar, and peels (Laranjeiras 2011b, pp. 308-309; Oren and Noveas 1986, p. 332; Laranjeiras 2008a as cited in Laranjeiras 2011a, unpaginated; See Appendix A). The golden conure is not a food specialist and its diet appears to vary throughout the year and also across its distribution (Laranjeiras 2011a, unpaginated). The species will also feed on cultivated plants such as corn (*Zea mays*) and mangoes (*Mangifera indica*) Laranjeiras 2011b , pp. 308-309; Oren and Noveas 1986, p. 332; Appendix A).

Breeding and nesting take place during the wet months, generally from November or December through April (Forshaw 2017, p. 227; Laranjeiras 2011a, unpaginated; Oren and Novaes 1986, p. 332). Incubating females may be assisted by other female, and possibly male, attendants. In captivity, three females shared incubation, but it was uncertain whether the males assisted (Oren and Novaes 1986, p. 333). Clutch size information is limited and variable (Laranjeiras 2011a, unpaginated). Hunters have reported two to nine eggs per nest cavity (Oren and Novaes 1986, p. 333). In captivity, the average clutch size is four eggs and the conure may lay as many as three successive clutches per season (Reynolds 2003, p. 12).

Eggs hatch within 28 to 30 days (Arndt 1996 as cited by Forshaw 2017, p. 227; Laranjeiras 2011a, unpaginated; Oren and Novaes 1986, p. 333). Chicks appear to be cared for by multiple attending adults (Forshaw 2017, p. 227; Collar 1992, p. 303; Oren and Novaes 1986, p. 333). In a captive group of three females and three males, all six cared for the 14 chicks that were produced (E. Beraut, *pers. comm.* as cited in Oren and Novaes 1986, p. 333). In the wild, two chicks appeared to be fed by 4 of 10 attending adults, although it was not possible to tell if the chicks had been fed by the same individuals (Forshaw 2017, p.227).

Nest protection seems to be an important part of the communal breeding strategy. Golden conure groups tend to inhabit isolated nesting trees in clearings with just a few other scattered trees, and in most cases, the same trees are used for both nesting and roosting (BLI 2016, p. 4 Laranjeiras 2011a, unpaginated). Most of the known nest and roost trees were found in disturbed areas, adjacent to patches of continuous forest (Laranjeiras 2011a, unpaginated). As noted earlier, the conure may favor isolated trees because they are more easily defended from predators such as snakes or monkeys (Laranjeiras 2011a, unpaginated).

A breeding group of conures will vigorously defend the nest in response to potential competitors or predators (Forshaw 2017, p. 228), including flocks of other golden conures, other parrot species (especially scarlet macaw (*Ara macao*)), and raptors (Laranjeiras 2008a as cited in Laranjeiras 2011a, unpaginated). In one study, defensive behavior consisted of the entire group flying directly at an intruder, then separating in flight into two smaller groups which simultaneously attacked from the sides and rear (Forshaw 2017, p. 228; Silveira and Belmonte *in Press*, unpaginated). In this same study, 22 defensive behaviors were noted, and in all instances,

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the intruders were quickly expelled, and were followed in the air for up to 20 m (66 ft) or more (Forshaw 2017, p. 228; Silveira and Belmonte *in Press*, unpaginated).

Field data on fledglings is limited. Captive nestlings reach adult body mass by about 60 days (Laranjeiras 2011a, unpaginated) and fledge at approximately 55-60 days post hatch (Arndt 1996 as cited by Forshaw 2017, p. 227). The post-reproductive period, when first year juveniles can be seen in the flocks at feeding sites, is from March/April to July or August (Laranjeiras 2011b, p. 304; Oren and Novaes 1986, p. 332).

First year juveniles always stay with the family group and can be easily identified by their green-streaked plumage (Yamashita 2003, p. 38). Juveniles attain adult plumage in a molt when they are about 1 year old (Laranjeiras 2011a, unpaginated). Recently fledged chicks and juveniles have been seen begging from foraging adults that regurgitate food to the beggars (Kyle 2005, p. 4) and different individual adults from the flock may feed the beggars (Laranjeiras 2011a, unpaginated). Annual survival information is limited, but first-year juveniles represent no more than 13 percent of the individuals in flocks (Laranjeiras 2008a as cited in Laranjeiras 2011a, unpaginated). In some areas (e.g., in eastern Pará, where trapping for illegal pet trade has occurred) the percentage of observed first year juveniles in the flocks was zero (Laranjeiras 2011a, unpaginated).

In captivity, adults reach sexual maturity at about 3 years of age (Oren and Novaes 1986, p. 333), with the average age for successful breeding occurring between 6 and 8 years (Reynolds, 2003, p. 12). Lifespan for the golden conure in the wild is not known, although the generation length was estimated as 7.4 years (BLI 2016, unpaginated). The maximum age recorded for the species in captivity was 60 years with a median age of 14 years (calculated using adults ≥ 4 years; n=190) (Young *et al*. 2011, p. 35).

There is mixed information on whether or not the golden conure makes seasonal migrations (Forshaw 2017, p. 226). While some researchers have reported nomadic behavior during the non-breeding season (BLI 2016, pp. 4-5, 10; Snyder *et al.* 2000, p. 132; Collar 1992, p. 303; Oren and Novaes 1986, p. 332), it appears that the majority of golden conure groups are resident, even in the post-reproductive period (Laranjeiras 2008 as cited in Forshaw 2017, p. 226; Laranjeiras 2011a, unpaginated; Yamashita 2003, p. 38). No evidence of seasonal movements or nomadism was reported in the better-forested western part of the range (Laranjeiras 2008 as cited in Forshaw 2017, p. 226; Laranjeiras 2011a, unpaginated). For example, in western Pará, golden conures stayed in the same area throughout the year (Laranjeiras 2011b, p. 311). Nomadic behavior appears to be more prevalent in the more fragmented forests in the eastern portion of the range, presumably because there are fewer food resources there (Laranjeiras 2011b, p. 311).

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Recent published article reports on migratory species in Brazil. It does not mention golden conure doing migratory movements. You can use it as a reference to consolidate understanding.

Somenzari, M.; Priscilla, P.A.; Víctor, R.C.; André, C.G.; Alex, E. J.; Diego, M.L.; Pedro, C.L.; Camile, L.; Caio, G.M.; Jaime, M.; João, L.X.N.; José, F.P.; Danielle, P.; Nêmora, P.P.; Patrícia, P.S.; Luís, F.S.; Antônio, E.B.A. S.; Nathália, A.S.; Manuella, A.S.; Wallace, R.Telino-Júnior & Bret, M.W. 2018. An overview of migratory birds in Brazil. **Pap. Avulsos Zool.**, 58: 1-66.

Individual Needs

In this section, we outline the resource needs of individual golden conures. These needs are best described when categorized by each life stage (Table 2).

Table 2. Golden conure individual resource needs by life stage. The third column categorizes the species' individual needs by whether they affect breeding (B), feeding (F), or sheltering (S).

Scale	Needs	B/F/S
Individuals		
Life Stage		
Adults	Food source (primarily fruiting trees) generally found in the forest matrix located not more than 200-300m from nest/roost tree	F
	Protected nesting cavity (primarily in an isolated, large, old growth, dead tree) in clearing located not more than 200-300m from continuous forest	B/S
	Protected roosting cavity (often the same as the nesting tree)	S
	Mate for reproduction	B
	Clan or family dynamics (social cohesion) for assistance with rearing of the young and protection at nesting/roosting and foraging trees	B/F/S
Eggs	Food source for egg formation	B
	Birth female with multiple attendants for incubation (female and possibly male incubators) (28-30 days to hatch)	B/S
	Protected nesting cavity (primarily in an isolated, large, old growth, dead tree) in clearing located not more than 200-300m from continuous forest	S
	Clan or family dynamics (social cohesion) for assistance with rearing of the young and protection at nesting tree	S
Nestlings	Food source from adults (primarily fruiting trees) generally found in the forest matrix located not more than 200-300m from nest/roost tree	F
	Adults to bring food to nestlings (both male and female)	F
	Protected nesting cavity (primarily in isolated, dead tree)	S
	Clan or family dynamics (social cohesion) for assistance with rearing of the young and protection at nesting tree	S
Fledglings	Food source (primarily fruiting trees) generally found in the forest matrix located not more than 200-300m from nest/roost tree	F
	Adults to bring them food /help them to locate food/ adults to beg for regurgitated food at the foraging tree	F
	Protected roosting cavity (primarily in isolated, large, old growth, dead tree)	S
	Clan or family dynamics (social cohesion) for assistance with their growing independence and protection at nesting/roosting and foraging trees	S
Juveniles	Food source (primarily fruiting trees) generally found in the forest matrix located not more than 200-300m from nest/roost tree	F
	Protected roosting cavity (primarily in isolated, large, old growth, dead tree)	S
	Clan or family dynamics (social cohesion) for assistance with their independence and protection at nesting/roosting and foraging trees	S

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Breeding adults seek out and excavate old, tall, isolated, hardwood trees (Yamashita 2003, p. 38), for cavity nesting (Oren and Novaes 1986, pp. 333-334). The species prefers dead trees over live trees, probably because dead trees are easier to excavate (Laranjeiras 2011a, unpaginated). Nest trees are generally located in clearings not more than 200-300 m (656-984 ft) from dense continuous forest (Laranjeiras 2011b, p. 308, Oren and Novaes 1986, pp. 332-333) but one account reports a greater distance of 3 kilometers (km) (1.9 miles (mi)) (Reynolds 2003, p. 11 noting work by Carlos Yamashita). Additionally, hunters report that the species also uses nest trees within the forest (Oren and Novaes 1986, p. 333), but this has not yet been confirmed by researchers (Laranjeiras 2011a, unpaginated).

The conure generally uses the same tree cavities for nesting and roosting (BLI 2016, p. 4; Laranjeiras 2011a, unpaginated; Yamashita 2003, p. 38) and will re-use nesting trees in subsequent years (Laranjeiras 2011a, unpaginated). The structure of nest trees varies, with the nest cavity located either on the main trunk or in branches, with multiple, elevated (above 15 m) entrances (Laranjeiras 2008a as cited by Laranjeiras 2011a, unpaginated). Thus, breeding adults need clearings with adjacent continuous forest. Within the clearing, they need tall, old hardwood trees that can be excavated (or already have been excavated) for nesting and roosting cavities. The adjacent forest (with associated food resources) should be no more than a couple hundred meters from the nesting tree. They also require the protection of the family group from predators.

Golden conure eggs are incubated by the birth female and other attending adults (other females and possibly males). Egg incubation in captivity is approximately 28-30 days (Arndt 1996 as cited by Forshaw 2017, p. 227; Laranjeiras 2011a, unpaginated; Oren and Novaes 1986, p. 333). Adults bring food to the nestlings (Lima *et al.* 2014, p 323; Silveira and Belmonte *in Press*, unpaginated) with one account noting eight feeding visits per day (Silveira and Belmonte *in Press*, unpaginated). The young are reared either by multiple pairs with reproductive helpers (Oren and Novaes 1986, p. 333) or a single leading pair with juveniles from different generations acting as helpers (Reynolds 2003, p. 12; Oren and Novaes 1986, p. 333). During the breeding season, all adults in the group help to defend the nest against other golden conure groups, other parrots, and potential predators (Forshaw 2017, p. 228; Laranjeiras 2011a, unpaginated; Silveira and Belmonte *in Press*, unpaginated). Thus eggs need a protected nesting cavity and incubation from the birth female and other attending adults. Eggs also require defense of the nesting cavity by the family group.

Nestlings reach adult body mass within the first 60 days (Laranjeiras 2011a, unpaginated) and captive birds fledge between 55 and 60 days after hatching (Arndt 1996 as cited by Forshaw 2017, p. 227). In one account of a fledging observed in the wild, a chick came to the entrance at about 17:00 hours, and, in response to much calling from the adults, flew off towards the forest, followed by the adults (Forshaw 2017, pp. 227-228; Silveira and Belmonte *in Press*,

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unpaginated). The fledgling returned to the canopy of the nesting tree after about 5 minutes, where it perched for about 20 minutes, and was fed and preened by four attending adults (Forshaw 2017, pp. 227-228; Silveira and Belmonte *in Press*, unpaginated). The fledgling returned to the nesting cavity at about 17:25 hours (Forshaw 2017, p. 228; Silveira and Belmonte *in Press*, unpaginated). Nestlings and fledglings need a protected nesting cavity and multiple attending adults to feed them. Nestlings require defense of the nesting cavity by the family group and also require protection from predators as they fledge.

First year juveniles always stay with the family group and can be easily identified by their green-streaked plumage (Yamashita 2003, p. 38). Juveniles attain adult plumage in a molt when they are about 1 year old (Laranjeiras 2011a, unpaginated). Begging behavior has been documented in recently fledged chicks and juveniles. Different individual adults from the flock may feed the beggars (Laranjeiras 2011a, unpaginated) by regurgitating their food to the young (Kyle 2005, p. 4). Fledglings and juveniles need a protected roosting cavity and may depend on multiple attending adults to feed them as they become more independent. They also require the protection of the family group from predators.

Population and Species Needs

In this section we consider the golden conure's historical distribution, its current distribution and what the species needs for viability.

Current and Historical Range and Distribution

The golden conure is endemic to the Brazilian Amazon. Its range roughly encompasses the area south of the Amazon River, east of the Rio Madeira River, and north of the Brazilian Shield (Laranjeiras and Cohn-Haft 2009, p. 9; Figures 4-6).

The species' current known range includes portions of the following four states (noted from east to west) (1) the western part of Maranhão, (2) the central region of Pará, (3) the extreme southeast of Amazonas, and (4) the northeastern portion of Rondonia (Laranjeiras 2011a, unpaginated). Additionally, the species was recorded in a fifth state, the northern portion of Mato Grosso in the 1990s (Lo 1995, entire) but there have been no recent records (BLI 2016, p. 2; Laranjeiras 2011a, unpaginated; Laranjeiras and Cohn-Haft 2009, p. 3; Albertani *et al.* 1997, p. 135).

The species' historical range once extended further eastward (to more eastern portions of the states of Pará and Maranhão) but the habitat there was mostly deforested in the 1970s and 1980s (Laranjeiras and Cohn-Haft 2009, p. 5) and the golden conure is believed to be extirpated from these regions (BLI 2017 unpaginated; BLI 2016, p. 3; Laranjeiras and Cohn-Haft 2009, p. 5; Figures 4, 6). Large tracts of intact rainforest with terra firme habitat appear to be needed for its long term survival. Although colonies may persist for a time in areas that have recently become deforested, the conure seems to require mostly intact forest and, over time, will disappear from

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the word is in Portuguese "Rio". Can be removed. Leave only "Madeira River"

places that are fully deforested (BLI 2007 and Laranjeiras 2008 as cited in Laranjeiras and Cohn-Haft 2009, p. 5). The species is limited to regions where extensive stands of tall Amazonian rain forest are still present (Oren and Novaes 1986, p. 331). Although the species can tolerate some disturbance in the forest, the golden conure is absent from landscapes with advanced deforestation; in fragmented forests, flocks disappear seasonally from the fragmented landscapes, indicating that they require intact forest (Laranjeiras 2011a, unpaginated).

Therefore, loss of the conure's range in the Arc of deforestation is expected to continue with projected continued deforestation there. The recent expansion of the range to the west (Rondônia) and south (Mato Grosso) is best explained by the theory that these populations have always existed, but had been overlooked because there were limited surveys in these areas prior to 1987 (Laranjeiras and Cohn-Haft 2009, p. 5).

The total current range of the golden conure is estimated to be no more than 340,000 square kilometers (km^2) (131,275 square miles (mi^2) (Laranjeiras and Cohn-Haft 2009, p. 3). The species' distribution within this range is not continuous and is described as patchy—possibly associated with the distribution of specific nesting or food resources (Laranjeiras 2008 as cited in Laranjeiras and Cohn-Haft 2009, p. 6). The estimated suitable habitat for the conure within this range based on habitat modeling is 174,000 km^2 (67,182 mi^2) (Laranjeiras 2011b, p. 311).

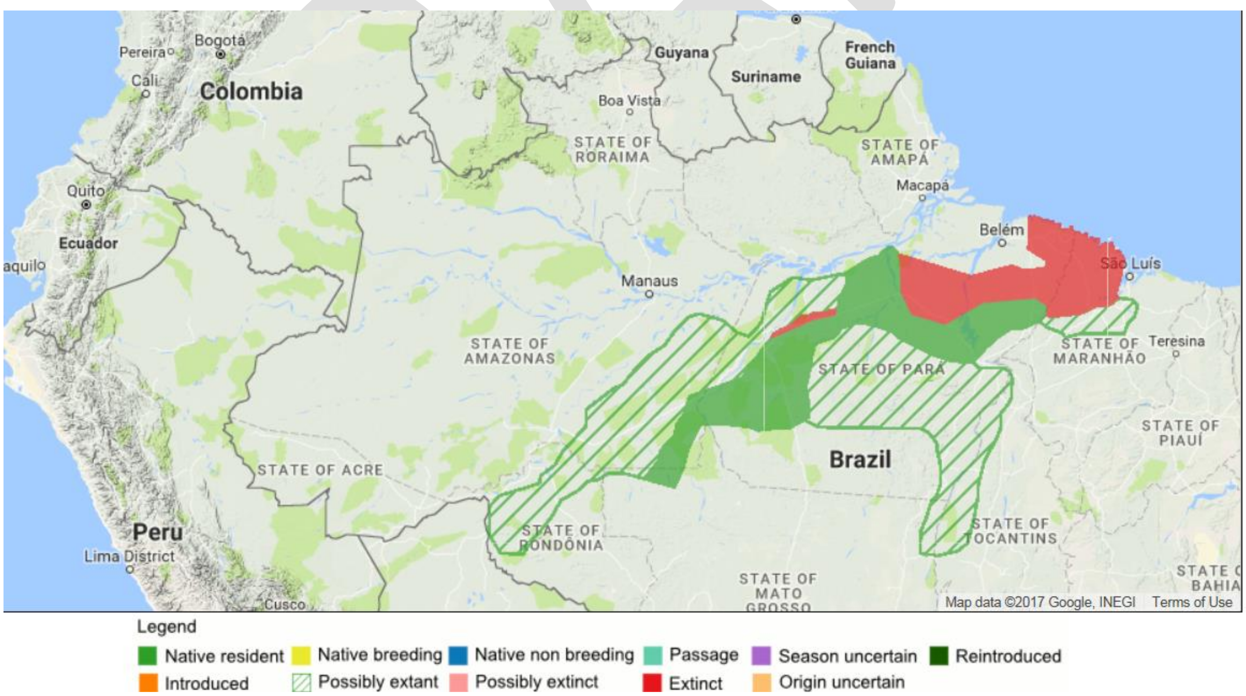

Figure 4. Map of the current and historical distribution of the golden conure (BLI 2017, unpaginated).

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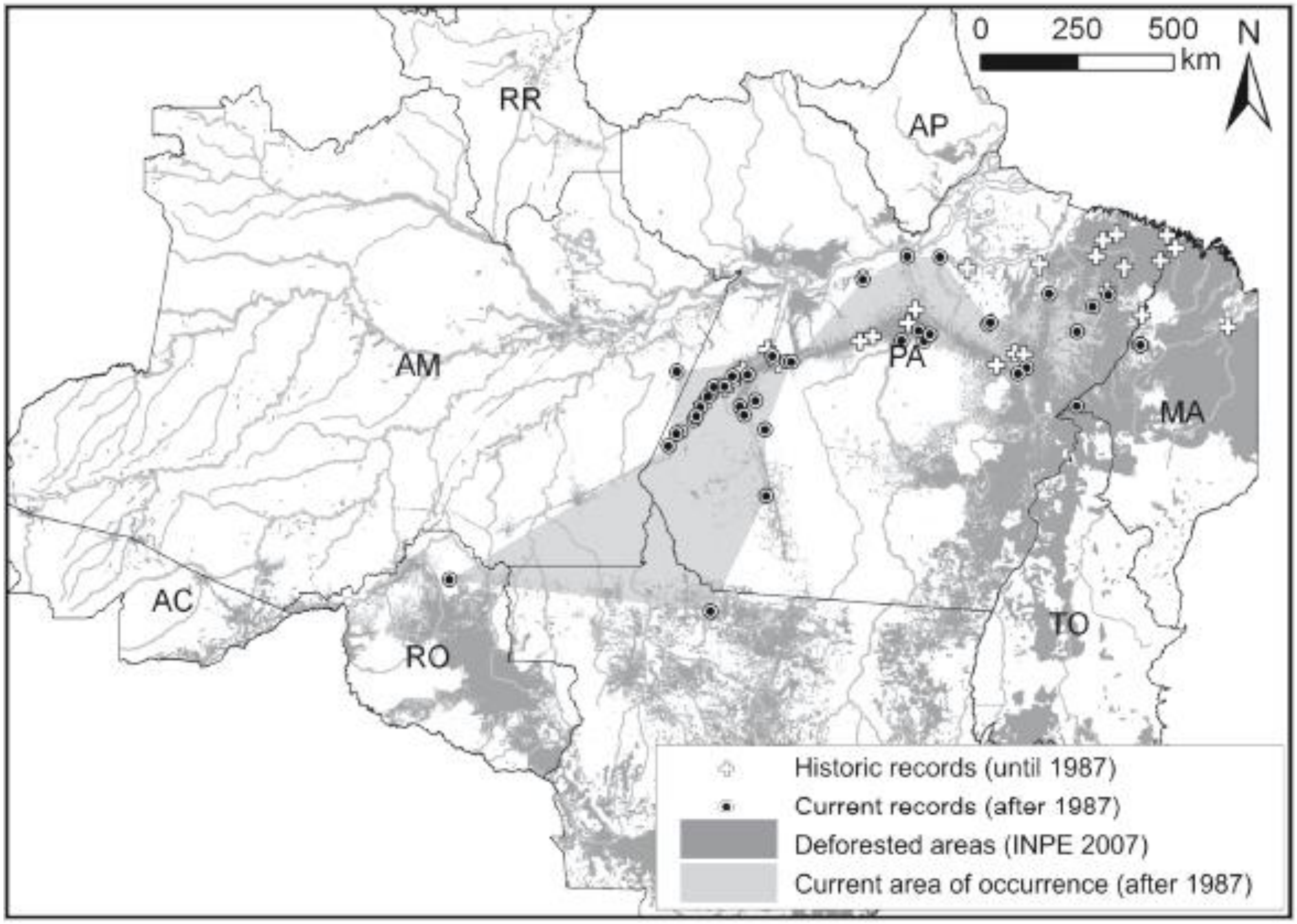

Figure 5. Map of the current and historical records of the golden conure depicting the current known area of occurrence in light gray and deforested areas in dark gray (map and analysis by Laranjeiras and Cohn-Haft 2009, entire).

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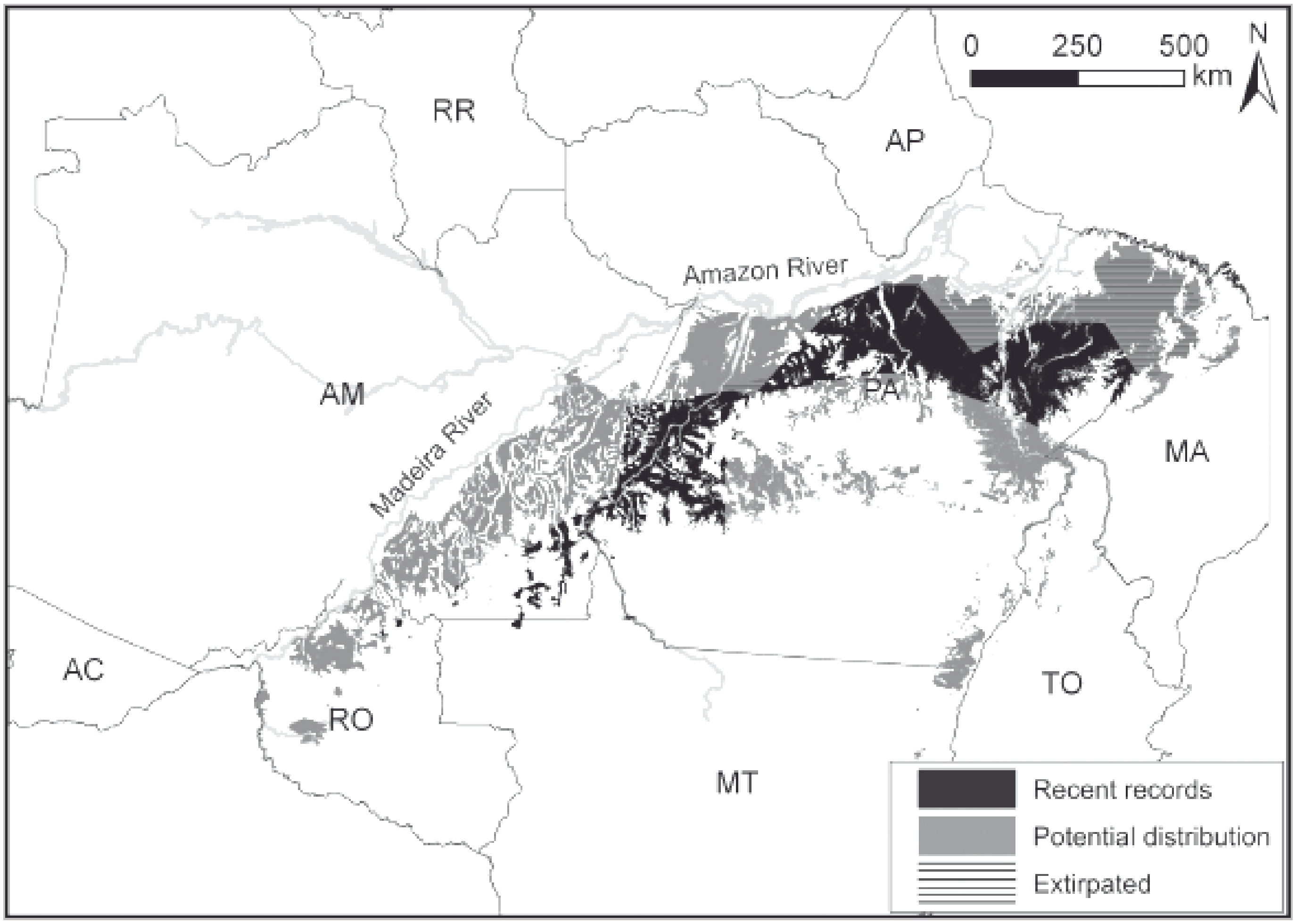

Figure 6. The best estimate of the geographic distribution of the Golden Parakeet based on recent records and modeling—cropped by the Amazon and Madeira rivers (Map and analysis by Laranjeiras and Cohn-Haft 2009, entire).

- Medium gray represents the overall potential distribution.
- Black represents where the potential distribution overlaps known records.
- The hatched area represents the potential distribution from which the species has not been reported since 1987
- Pale gray represents rivers.

(Map and analysis by Laranjeiras and Cohn-Haft 2009, entire).

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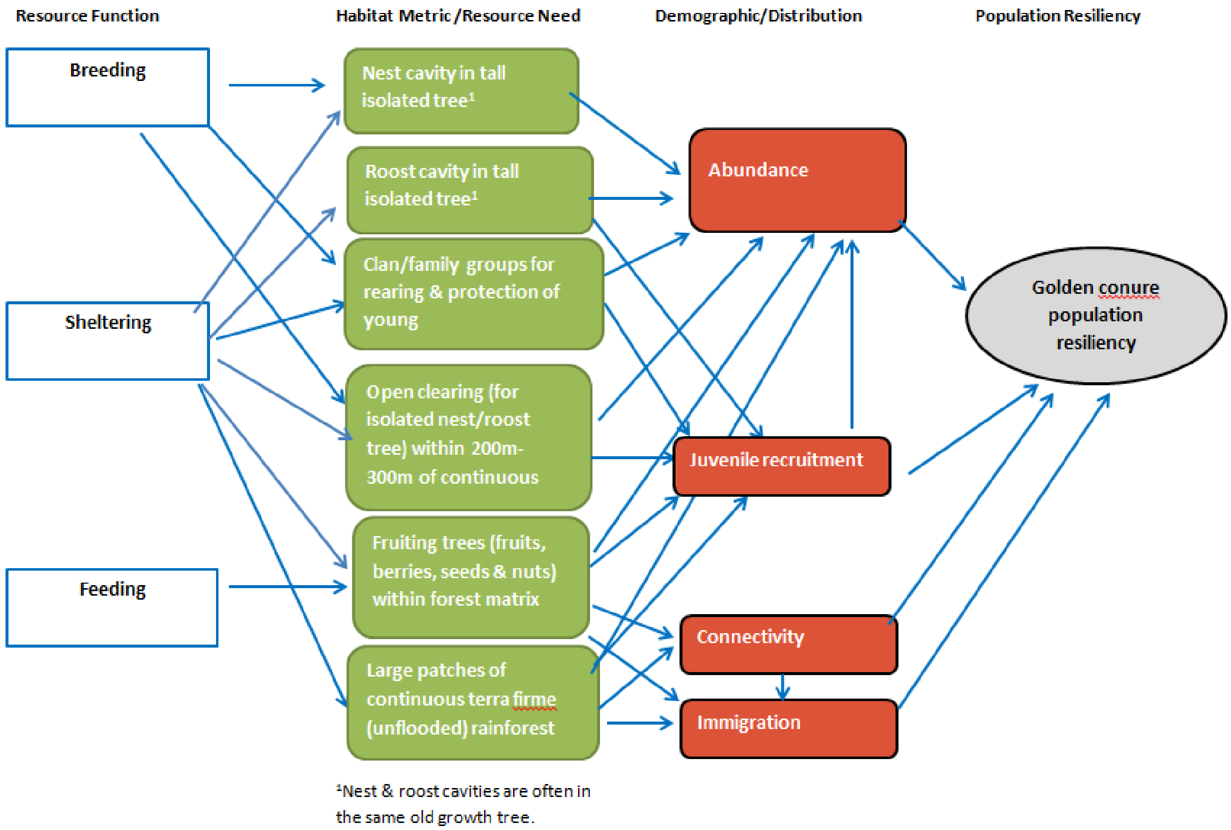

Figure 7. Basic conceptual diagram of the golden conure's population ecology

Population and Species Needs for Viability

Factors that contribute to the golden conure's population resiliency are represented in Figure 7 above.

SPECIES REPRESENTATION

Maintaining representation in the form of genetic or ecological diversity is important to maintain the conure's capacity to adapt to future environmental changes. However, we are unaware genetic or ecological diversity for the conure.

Population structure—to our knowledge, there has been no rigorous studies to determine the population (or subpopulation) structure of the golden conure. A preliminary (and unpublished) study of the genetic variability of golden conure groups that were separated by 300 km (186 mi) revealed no differentiation (Yamashita 2003, p. 40), presumably indicating gene flow between

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these populations. However, the current range of the conure includes sites that are separated by as much as 1,800 km (1,118mi) (distance was grossly estimated using linear measurement in Google Earth Pro), and more genetic work is needed to determine if there is population structure over larger distances.

Ecological diversity—we also examined available information on the conure's relationship to various environmental variables, its points of occurrence, and geographic distribution (Laranjeiras and Cohn-Haft 2009, entire) and found no geographical or ecological boundaries that would act as barriers to the bird's movement within its known and predicted distribution. Of note is that the species does not occur north of the Amazon River or west of the Madeira River despite the presence of seemingly good habitat there (Laranjeiras and Cohn-Haft 2009, p. 7). Researchers theorize that these very wide rivers with broad buffers of várzea habitat (seasonal floodplain forest, flooded by whitewater rivers), effectively act as a barrier for the conure (Laranjeiras and Cohn-Haft 2009, p. 7). These large rivers are well known distributional limits for hundreds of other Amazonian birds (Haffer 1978 as cited by Laranjeiras and Cohn-Haft 2009, p. 7).

In the absence of notable geographical or ecological boundaries to movement within the range of the conure, and no evidence of genetic variation, we treated the golden conure as one large population and did not divide it into smaller populations for our analysis of species viability.

Therefore, the species' needs are similar to those that we identified at the individual level (Table 2). These include:

- large patches of intact rainforest with "terra firme" habitat that contain
    - quality habitat for breeding and roosting (i.e., old growth hardwood trees for cavity nesting and roosting);
    - quality habitat for foraging (i.e., fruiting vegetation within the forest matrix); and
    - connectivity between the large patches of intact rainforest with "terra firme" habitat.

SPECIES REDUNDANCY

The golden conure needs multiple resilient populations distributed throughout its range to provide for redundancy. The more populations, and the wider the distribution of those populations, the more redundancy the species will exhibit. Redundancy reduces the risk that a large portion of the species' range will be negatively affected by a catastrophic natural or anthropogenic event at a given point in time. Species that are well-distributed across their historical range are considered less susceptible to extinction and more likely to be viable than species confined to a small portion of their historical range (Carroll *et al.* 2010, entire; Redford *et al.* 2011, entire).

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Historically, golden conure populations were likely connected throughout their range until the populations in the east were extirpated due to deforestation and development. We have no information on geographical or ecological boundaries to movement within the remaining range of the conure and presume that the species is relatively widespread (though patchily distributed) throughout the remaining range. Therefore, in the event of a catastrophic incident in one portion, it is possible (depending on the extent of the catastrophe) that repopulation or rescue could come from a portion that was not affected. Therefore we assume some redundancy of populations within the remaining range of the conure but we are unable to estimate numbers or strength of these populations and have limited knowledge of where they may occur across the remaining range.

STAGE TWO (Current Condition)

In this section, we describe the golden conure's current condition including its current range, distribution, and relative abundance, based on the best available scientific and commercial information. At this stage, we also hypothesize the *causes* for the conure's current condition which includes an analysis of historical and current stressors and threats, and any mitigating effects from legal protections, management, or conservation measures.

Current range and Distribution (see also C**urrent and Historical Range and Distribution** in **STAGE ONE** above)

The golden conure's current range likely does not exceed 340,000 km^2 (131,275 mi^2) (Laranjeiras 2011b, p. 311; Laranjeiras and Cohn-Haft 2009, p. 3). Within this range, the estimated suitable habitat for the conure is 174,000 km^2 (67,182 mi^2) (Laranjeiras 2011b, p. 311), which is comparable, in area, to Washington State. As noted above, approximately 30 to 35 percent of the golden conure's range was lost in recent decades, primarily in the states of Pará and Maranhão, (Laranjeiras 2011a, unpaginated; Laranjeiras and Cohn-Haft 2009, p. 8; Figures 4, 6).

Abundance

The current global wild population of the golden conure is estimated at around 10,875 individuals (Laranjeiras 2011b, p. 311). This estimate is based on (1) new occurrence data that increased the known range of the species, (2) the fact that the species' current area of occurrence includes sites that are fairly well preserved and/or are protected (e.g., western and central Pará and southwestern Amazonas), (3) indications that the species is resident (and not nomadic) in preserved landscapes, and (4) density estimates derived from the Transamazônica highway survey in western Pará (Laranjeiras 2011b, p. 311). The global estimate was obtained by extrapolating a density estimate of one individual per 16 km^2 (6.2 mi^2) to the suitable habitat within the current known range (174,000 km^2) (67,182 mi^2) (Laranjeiras 2011b, p. 311). The density value used in the extrapolation was thought to be conservative because it was the

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minimum number present in pristine habitat (Laranjeiras 2011b, p. 311). However, because the species has a patchy distribution within its range, extrapolation of densities to estimate the global population is problematic and population estimates throughout the range are needed (Laranjeiras 2011a, unpaginated).

The previous global population estimate for the golden conure was fewer than 2,500 individuals based on an assessment of known records, descriptions of abundance, and range size (BLI 2016, pp. 2, 4). Although this estimate was based on a higher density estimate of 0.9 to 2.5 individuals per 1 km^2 (0.4 mi^2), (BLI 2010, as cited by Laranjeiras 2011a, unpaginated), the estimated range of the conure at that time was smaller (i.e., the newer species records were not yet discovered).

Species experts believe the overall global population trend for the species is declining primarily based on threats from continuing deforestation (BLI 2016, p. 4; IBAMA 2003 & SEMA 2007 as cited by Laranjeiras 2011a, unpaginated; Collar 1992, p. 5).

Local abundance—only a few places within the golden conure's range have been studied well enough to produce an estimate of local abundance (Laranjeiras 2011a, unpaginated). All the studies to date have been conducted in the state of Pará and are summarized below.

1. Along the Transamazônica highway (BR-230) in western Pará, a minimum population size was estimated to be about 500 individuals (BLI 2016, p.4; Laranjeiras 2008a as cited in Laranjeiras 2011a, unpaginated), and the species was reported to be as common as other parrots in the area (Laranjeiras 2011a, unpaginated).

2. At the western border of Tapajós National Forest (on the Rio Cupari), groups of as many as 40 individuals were reported (Kyle 2005 as cited in Laranjeiras 2011a, unpaginated).

3. The conure was also recorded during a 1-year bird survey in the forest fragments near the Tucuruí Dam (Cestari and Dantas 2008, as cited in Laranjeiras 2011a, unpaginated).

4. The conure has been noted in bird inventories at the Caxiuanã National Forest (Valente 2006 as cited in Laranjeiras and Cohn-Haft 2009, p. 13).

5. More recently the conure was observed during bird surveys in Amana National Forest; several flocks of 18-22 individuals, flew daily over the camps at sites 3, 4, 5, 6, & 7 (Guilherme 2014, pp. 2-3, 5)

6. Additionally, the conure was observed on 57 occasions from 17 catchments totaling about 300 individuals in an area that included two important bird areas (IBAs) (containing portions of Gurupi Biological Reserve (Sites in Pará), Alto Rio Guamá Indigenous Reserve, and the Fazenda Rio Capim (Lees *et al.* 2012, pp. 99,110). Similarly 145 conures were observed on 19 occasions in Gurupi Biological Reserve (sites in Maranhão); the authors note that some of the sightings were likely duplicates (Lima *et al.* 2014, p. 323).

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This is not correct. The Gurupi Biological Reserve is in Maranhão, municipalities of Bom Jardim, Centro Novo do Maranhão and São João do Carú. There is not containing portions in Pará.

Please, see in Lima et al. 2014

We know of no additional information regarding local abundance of the golden conure from approximately 65 other known localities (Laranjeiras 2011a, unpaginated; Laranjeiras and Cohn-Haft 2009 Appendix A; see also Appendix B in this Report).

Cause and Effects – Assessing Reasons for Current Condition

Description of Stressors/Threats

The golden conure faces the most risk from loss and degradation of its habitat from deforestation (i.e., originating from multiple anthropogenic activities). This risk will be intensified by synergistic effects associated with climate change (Staal *et al.* 2015, p. 2). Climate projections include increased temperatures, dryer conditions, and more extreme weather (including droughts) which have the potential to stress trees and cause tree mortality (Fearnside 2009, pp. 1003, 1005). These conditions also increase the unintentional spread of fires further contributing to deforestation (Fearnside 2009, p. 1005).

Additionally, it appears that in some areas, the species may still be illegally collected and traded within Brazil for the live pet bird trade. The species is also likely still hunted at low levels as a food source, and for feathers, and birds that raid crops may be shot by farmers. Other potential stressors include predation and disease. These threats and stressors to the golden conure are discussed in more detail below.

Deforestation— large scale deforestation in the Amazon has occurred only since the 1970s and 1980s concurrent with the growth of Brazil's economy (GFA 2017, unpaginated). The Brazilian Amazon is approximately the size of Western Europe, and as of 2016, an area the size of France has been lost to deforestation (Fearnside 2017a, pp. 1, 3). The golden conure's range partially overlaps what is known as the "Arc of deforestation,"— an area in the southeastern Amazon where rates of deforestation and forest fragmentation have been the highest (Prioste *et al.* 2012, p. 701; Laranjeiras 2011a, unpaginated; Laranjeiras and Cohn-Haft 2009, p. 8). After a long period of deforestation in the Amazon, rates of deforestation dropped dramatically to levels not recorded in recent decades (Alves *et al.* 2017, p. 76). However, more recently, deforestation rates seem to be increasing again and southeastern portion of the basin and the "Arc of deforestation" could continue to be a hotspot in Brazil (Alves *et al.* 2017, p. 76; Prodes 2017, unpaginated). One recent study indicated that even with recent declines in the rates of forest clearing, deforested areas are projected to increase from about 18 percent today to as much as 40 percent by 2050 as the global demand for agricultural commodities continues to rise (Brando *et al.* 2016, abstract).

Approximately 30 to 35 percent of the golden conure's range has already been lost, primarily in the eastern states of Pará and Maranhão, (Laranjeiras 2011a, unpaginated; Laranjeiras and Cohn-Haft 2009, p. 8). Overall deforestation rates for the five states within the range of the golden conure from 2004-2017 ranged from 22 percent in Amazonas to 89 percent in Mato Grosso; the deforestation rate for Para (where we have the most information regarding occurrences of the

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The species is caught for illegal trade in the municipality of Tailândia, in the state of Pará (Silviera & Belmonte 2005, p. 93). Also, it is raised as a pet in the Centro Novo do Maranhão, in the state of Maranhão, in areas near the Gurupi Biological Reserve (com. pess.).

Laranjeiras, T.O. 2011. Biology and population size of the Golden Parakeet (*Guaruba guarouba*) in western Pará, Brazil, with recommendations for conservation. **Revista Brasileira de Ornitologia**, 19 (3): 303–314.

conure) was 73 percent (Prodes 2017, unpaginated; see Appendix C for more detailed information).

Habitat destruction and fragmentation generally begins with road construction and subsequent human settlement. Activities resulting from human settlement include (1) an increased network of unofficial roads, (2) logging, (3) farming and cattle ranching, (4) crop production, and (4) further infrastructure development—including more roads, dams and hydroelectric projects, and mining) (GFA 2018a, b, c, & d, unpaginated; GFA 2017, unpaginated; Sonter *et al.* 2017, entire; Barber *et al.* 2014, entire; BLI 2016, unpaginated; Yamashita 2003, p. 38).

<u>Roads</u> have a major effect on Amazon deforestation. A recent study reexamined the effects of transportation corridors on deforestation in the Brazilian Amazon and mitigating effects from protected areas (Barber *et al.* 2014, entire). Results indicated that deforestation was much higher near roads (including unofficial roads) and rivers; nearly 95 percent of all deforestation occurred within 5.5 km (3.4 mi) of roads or 1 km (0.6 mi) of rivers (Barber *et al.* 2014, pp. 203, 205, 208). This study also assessed effects from the network of illegal and unofficial roads that tier off of official roads and highways. Unofficial roads are rapidly expanding in the region and contribute to further degradation, including logging, new colonization, forest fragmentation, and increased fire risk (Barber *et al.* 2014, p. 203). The study confirmed the value of protected areas in preserving forest resources, even when these areas were highly accessible (Barber *et al.* 2014, p. 208). Less than 1.5 percent of all protected forest throughout the region had been cleared by 2006, and protected areas had four times less deforestation that unprotected areas (Barber *et al.* 2014, p. 208).

<u>Logging</u> in the Amazon was once restricted to areas bordering major rivers but the construction of highways and strategic access roads (see above), coupled with the depletion of hardwood stocks in the south of Brazil, made logging an important and growing industry (Veríssimo *et al.* 1992, p. 170). Only a few tree species are valuable for timber. Mahogany (*Sweitenia macrophylla*), is the most valuable and a single tree can sell for more than a $1,000 U.S. dollars (USD) in the US market (GFA 2018a, unpaginated).

In the Brazilian Amazon, logging operations often occur on private lands claimed by ranchers, land speculators, and squatters who sell extraction rights to loggers (GFA 2018a & b, unpaginated). The companies may also clear-cut and burn the land after logging, in preparation for crop planting (Reynolds 2003, p. 10). Burning makes land that is naturally nutrient-deficient temporarily nutrient rich for planting, but it will only yield crops for a few years, creating a cycle of more land clearing (Reynolds 2003, p. 10).   Revenues from timber sales are also used to finance conversion of the land to cattle ranching (GFA 2018a, unpaginated). Although the Brazilian forest code requires landowners in the Amazon to maintain 80 percent of their land as

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forest, the code has been poorly enforced (GFA 2018b, unpaginated) and full compliance has not been achieved (Azevedo *et al.* 2017, entire; see **Management Actions** below).

Logging on public lands, in Brazil's Amazon basin is allowed via a concessions system where logging companies are granted logging rights for a fee (GFA 2018a, unpaginated). This system often incorporates strategies such as rotation of harvest and minimum size limits (generally greater than 50 cm (20 in) tree diameter) to minimize effects to the forest (GFA 2018a, unpaginated). Recent reform to the concession system in 2000, included targets for long term sustainable yield (GFA 2018a, unpaginated). This reform was regarded by many as risky and unprofitable for logging companies, especially in light of continuing and widespread illegal harvest (GFA 2018a, unpaginated). Additionally, some claim that the reform mostly benefits larger companies at the expense of local landowners because permitting is expensive, lengthy, and requires paperwork in distant cities (GFA 2018a, unpaginated).

It appears that the concession system is not currently working as intended. Illegal logging in protected areas, particularly logging of mahogany, remains a serious threat (BLI 2016, p. 5). For example, Jamari National Forest is poorly protected and faces pressures from loggers, squatters and poachers (Forshaw 2017, p. 224, F. Olmos *in litt.* 1999 as cited in BLI 2016, p. 5). Also, as of 2010, Brazil had only leased a small amount of private concession forest, and instead, had announced plans to sell large forest tracts (GFA 2018a, unpaginated). Lastly, selective logging practices that are designed to reduce effects to the forest (e.g., the minimum size restriction noted above), may actually have a greater effect on the golden conure because the species uses larger, older trees for its nesting and roosting cavities (Yamashita 2003, p. 38).

<u>Farming and Ranching</u>. Expanding soy agriculture and cattle ranching are major drivers of deforestation in the Amazon basin. Soy only grew in temperate climates until agricultural research generated new varieties that will grow in the tropics. These innovations coupled with the application of fertilizer, allowed for the expansion of soy farming into the Amazon beginning in the 1970s (GFA 2018c, unpaginated). Soy beans are primarily used for cattle feed and in 1990s and early 2000s, high demand for beef created a "soy-cattle pasture deforestation dynamic," where soy production replaced existing cattle pasture, and forced new deforestation into the Amazon for pasture (GFA 2018c, unpaginated). Brazil is the largest beef exporter in the world, supplying about one quarter of the world market (GFA 2018d, unpaginated). Brazil's Amazon supports about 200 million head of cattle on approximately 450,000 km^2 (173,746 mi^2) of deforested land (GFA 2018d, unpaginated).

<u>Hydroelectric dams</u> are also a major contributor to deforestation in the Amazon. Areas affected by dams include both the area flooded by the dam and increased human settlement around the dam (GFA 2018e, unpaginated). Brazil is the second-largest producer of hydroelectricity in the world (after China) and hydropower supplies about 75 percent of Brazil's electricity (GFA 2018e, unpaginated; Fearnside 2017b, unpaginated). Numerous dams are under construction or planned in the Amazon basin; the most controversial has been the Belo Monte dam (GFA 2018e,

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unpaginated) on the Xingu River, a major tributary of the Amazon. The dam, which will have third-largest generating capacity in the world, became operational in 2015, but full construction will not be completed until 2019 (Sullivan 2018, unpaginated). Effects from this mega dam include: (1) blockage of the 1,609 km (1,000 mi) Xingu River, (2) displacement of more than 20,000 indigenous people and their livelihood on the river, (3) flooding of 673 km^2 (260 mi^2) of lowlands and forest, and (4) extensive damage to the river ecosystem, including endemic fish species (Fearnside 2017b, unpaginated). Once completed, 80 percent of the river's flow will be diverted (Fearnside 2017b, unpaginated), further affecting the river's ecology. The next mega dam was scheduled to be constructed on the Tapajós River but its licensing was recently cancelled and the Brazilian Government announced an end to the construction of mega dams in the Amazon (Branford 2018, unpaginated). The primary reasons given for this major shift in policy were intense resistance from indigenous groups and environmentalists, but experts also identified a decline in the political influence of construction companies after a major corruption investigation (Branford 2018, unpaginated). Although mega dam projects appear to no longer be a threat, smaller dams are still under construction and planned (GFA 2018e, unpaginated; Fearnside 2017b, unpaginated; Nobre *et al.* 2016, p. 10763) within the range of the golden conure.

<u>Mining</u> for minerals also contributes to deforestation of the Amazon. In Brazil, mining has grown from 1.6 percent of gross domestic product in 2000, to 4.1 percent in 2011; and is projected to increase by a factor of 3 to 5 by 2030 (Brasil Ministério de Minas e Energia 2010 as cited by Ferreira *et al.* 2014, p. 706). In Brazil's Amazon, mining leases, exploration permits, and concessions, collectively encompass 1.65 million km^2 (0.64 million mi^2) of land, with 60 percent located in the Amazon forest (Departamento Nacional de Produção Mineral 2012 as cited in Sonter *et al.* p. 1).

One recent study quantified mining-induced deforestation between 2005-2015 and estimated that it increased Amazon forest loss up to 70 km (43 mi) beyond the mining lease boundaries, and caused 11,670 km^2 (4,506 mi^2) of deforestation (Sonter *et al.* 2017, p. 1). The study concluded that, in total, mining-induced deforestation has been 12 times greater than that from the leases alone (Sonter *et al.* 2017, p. 2). Although mining appears to be an expanding industry in Brazil's Amazon region, to date environmental approval of new mines and expansion of existing projects do not consistently evaluate for off-lease, indirect, or cumulative impacts of deforestation (Sonter *et al.* 2017, p. 1).

In summary, the golden conure faces significant risk from loss and degradation of its habitat from deforestation. Drivers of deforestation include roads, human settlement, logging, and agricultural expansion for soy cultivation and cattle ranching. Additionally, infrastructure projects such as hydroelectric dams and mining operations are growing sources of deforestation that also contribute to loss of forest habitat in the range of the conure.

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Projected effects from climate change—changes in Brazil's climate and associated changes to the landscape are likely to result in additional habitat loss for the golden conure. Across Brazil, temperatures are projected to increase and precipitation to decrease (Barros and Albernaz 2014, p. 811; Carabine and Lemma 2014, p. 11). The 2013 Intergovernmental Panel on Climate Change (IPCC) predicted that by 2100, South America will experience temperature increases ranging from 1.7 to 6.7 °C (3.06 to 12.06 °F) under the medium and high emission scenarios and 1.0 to 1.5 °C (1.8 to 2.7 °F) under a low emissions scenario (Carabine and Lemma 2014, p. 10; Magrin *et al*. 2014, p. 1502). Projected changes in precipitation in South America vary by region—with rainfall reductions in the Amazon estimated with medium confidence (Carabine and Lemma 2014, p. 11; Magrin *et al*. 2014, p. 1502).

Downscaled models, based, in part, on the earlier (2007) IPCC data, predict temperature increases in Brazil with the greatest warming and drying occurring over the Amazon rainforest, particularly after 2040 (Marengo *et al*. 2011, pp. 8, 15, 27, 39, 48; Féres *et al*. 2009, p. 2). Estimates of temperature changes in the Amazon are 2.2 °C (4 °F) under a low greenhouse gas emission scenario and 4.5 °C (8 °F) under a high-emission scenario by the end of the 21st century (2090–2099) (Marengo *et al*. 2011, p. 27). Additionally, several models indicate the Amazon is at a high risk of forest loss and more frequent wildfires (Magrin *et al*. 2007, p. 596). Some leading global circulation models indicate that extreme weather events, such as droughts, will increase in frequency or severity due to global warming. As a result, droughts in Amazonian forests could become more frequent in the future (Marengo *et al*. 2011, p. 48). For example, the 2005 drought in Amazonia was a 1-in-20-year event; however, those conditions may become a 1-in-2-year event by 2025, and a 9-in-10-year event by 2060 (Marengo *et al*. 2011, p. 28). Effects of deforestation are greater under drought conditions because fires set for forest clearances may escape and burn larger areas (Marengo *et al*. 2011, p. 16).

A number of large-scale drivers of environmental change (i.e., land-use change from deforestation and climate changes due to global warming) are operating simultaneously and interacting nonlinearly in the Amazon (Nobre *et al.* 2016, p. 10759). Direct deforestation is an immediate threat to the Amazon and could alter regional climate conditions (Nobre et al. 2016, p. 10761). Modeling studies have indicated that the Amazon may have two "tipping points," (1) a temperature increase of 4.0 °C (7.2° F) or (2) deforestation exceeding 40 percent of the forest area (Nobre *et al.* 2016, p. 10759). Once exceeded, these tipping points could cause large-scale shifts in the vegetation to a savanna (i.e., "savannization") mostly in the southern and eastern Amazon (Nobre *et al.* 2016, p. 10759) within the golden conure's range.

When 40 percent of the original extent of the Amazon is lost, rainfall is expected to significantly decrease across Amazonia and the rainforests may not generate enough rainfall to sustain itself (Marengo *et al.* 2011, pp. 45, 48). This can be explained by an increase in carbon dioxide concentrations, increased temperatures, and decreased rainfall such that the dry season becomes longer. Previous work has indicated that, under increasing temperature and decreasing rainfall

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conditions, the rainforest of the Amazon could be replaced with different vegetation. Some models have predicted a change from forests to savanna-type vegetation over parts of, or perhaps the entire, Amazon in the next several decades (Magrin *et al*. 2014, p. 1523; Marengo *et al*. 2011, pp. 11, 18, 29, 43; Magrin *et al*. 2007, pp. 583, 596).

One recent study that considered only the effects from global warming (absent deforestation) predicted that by the end of this century, some areas of rainforest in the Brazilian Amazon will be replaced by deciduous forest and grassland in the RCP 4.5 scenario and by only grassland in RCP 8.5 scenario (Lyra *et al.* 2016, entire). For example, in the eastern Amazon (i.e., within the range of the conure), the model indicated a reduction of 9 percent of rainforest under RCP 4.5 and 50 percent under RCP 8.5 (Lyra *et al*. 2016, entire). Although there are uncertainties in all of these models, and the projected outcomes are not definitive, any terra firme forest habitat that shifts to savanna would no longer be available to the golden conure.

The influence of regional land cover change (e.g. deforestation) on the Amazon's climate has been widely reviewed in modeling and observational research since the 1980s (Alves *et al.* 2017, p. 77 citing several authors). Experts agree that in a vast Amazon deforestation scenario, the land cover change may cause a regional climate change, with reductions in rainfall and increases in temperature over the region (Alves *et al.* 2017, p. 77; Spraklen and Garcia-Carreras 2015, entire). However, projected results, including the strength, sign and distribution of projected precipitation change, differ depending on the models and methods used for representing land use and land cover change (Alves *et al.* 2017, p. 77).

Fire—Although fire use for land management is common in rural Amazonia (Malhi et al. 2008, p. 171) wildfires here were rare in the last millennia (Fearnside 2009, p. 1005). As a result, the trees did not develop adaptations for fire (Fearnside 2009, p. 1005). Amazonian trees have thin bark, and fire heats the cambium under the bark at the base of the trunk, causing the tree to die (Fearnside 2009, p. 1005).

In addition to the changing regional climate conditions noted above, logging and forest fragmentation have also increased the flammability of Amazonian forests by greatly increasing the amount of dry fire-prone forest edge (Vedovato *et al.* 2016, entire; Malhi *et al*. 2008, p. 171). Logging practices (1) open up the canopy, (2) generate combustible material, and (3) dry the understory and litter layer (Malhi *et al.* 2008, p. 171). Once grasses can establish in the forest understory, they may create a cycle where grasses provide a renewable source of fuel for repeated burns (Malhi *et al.* 2008, p. 171).

In summary, risks from deforestation will be intensified by synergistic effects associated with climate change (Staal *et al.* 2015, p. 2). Climate projections include increased temperatures, dryer conditions, and more extreme weather (including droughts) which have the potential to stress trees and cause tree mortality (Fearnside 2009, pp. 1003, 1005). These conditions also increase the unintentional spread of fires further contributing to deforestation (Fearnside 2009, p. 1005). Additionally, deforestation itself can cause regional shifts in the climate; in southeastern

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Amazonia, deforestation in the 2000s influenced the regional climate (i.e., increased temperature, decreased evapotranspiration).

Illegal collection and trade—the golden conure is highly prized as an aviary bird and has been extensively trapped for the domestic and international pet trade in the past (BLI 2016, p. 5; Alves *et al.* 2013, p. 60; Laranjeiras 2011a, unpaginated; Yamashita 2003, p. 38; Snyder *et al.* 2000, p. 132; Collar 1992, p. 304; Oren and Novaes 1986, pp. 329, 334-335). The value of some rare species such as the golden conure increases as their habitat is destroyed and they become rarer (Wright *et al.* 2001, p. 718). In the 1980s, despite prohibitions on export, golden conures were sold on the international market for as much as $10,000-15,000 USD (Ridgely 1981, p. 266). More recently, a golden conure sold in the Taiwanese market for $8,000 USD (Su *et al.* 2015, pp. 6-7, 9). Domestic trade of wild golden conures is also illegal and is believed to be much less controlled (Collar 1992, p. 304).

Historically, keeping birds was an important part of local indigenous tradition and culture (Carvalho 1951 and Cascudo 1973 as cited by Alves *et al.* 2013, p. 54). Indigenous groups took young conures to raise as pets and for feathers but now they will also sell young birds to traders (Oren and Novaes 1986, p. 335). Much of the area occupied by the conure is poor, and collection of birds for the pet trade provides an extra source of income (Yamashita 2003, p. 39).

A report from the 1980s described domestic trafficking of the conure as follows: (1) dealers would systematically visit towns along the main highways in March and April in search of young birds, (2) locals would sell the birds for $30 to $50 each, and (3) the birds were then sold in urban markets, such as Belem, for as much as $100 or $300 (Oren and Novaes 1986, p. 335).

Reported rates of poaching vary by area. Poaching appeared to be worse near the more developed areas (e.g., eastern Pará) with fewer reports from more pristine habitat. For example, there was no evidence of nest poaching in 2004 survey along the Cupari River in western Pará (Kyle 2005, p. 3). This was in strong contrast to a 2002 survey along the Capim River in the more developed region of eastern Pará, where on numerous occasions, chicks were offered for as little as $10 USD (Kyle 2005, p. 3). However, a report from 2008 indicated that incidents and evidence of trapping in more protected areas with intact forest were on the rise (i.e., in western Pará) (Laranjeiras 2008b, p. 12).

There are mixed reports regarding the degree to which illegal capture of the conure from the wild is still occurring. The Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) has licensed and regulated bird breeding in an effort to reduce harvest from wild populations (Alves *et al.* 2013, p. 61). As a result, several sources believe poaching is no longer a major concern because trade is thought to mostly be from the substantial captive population, and thus does not significantly affect the wild population (Silveira *in litt.* 2012, Lees *in litt*. 2013 in BLI 2016, p. 5). The captive population is Brazil is believed to be about 600 birds (Prioste *et*

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al. 2013, p. 146) and this number is substantiated by a bird breeder in Brazil who relayed that in 8 years she reared nearly 600 golden conures and has worked with approximately 160 pairs in different Brazilian aviaries (Weinzettl, *in litt.* 2015).

However, there are also reports that captive breeding of Brazilian birds may still be occurring because (1) the price of commercially-bred bird is approximately ten times higher than wild-caught individuals (Renctas 2001 as cited in Alves *et al.* 2013, p. 61; Machado 2002 as cited in Alves *et al.* 2010, p.155), and (2) many birds declared to be captive-bred were actually born in the wild and "legalized" through false records (Alves *et al.* 2013, p. 61). Thus, captive rearing may not be a practical alternative to illegal trade, particularly in low-income areas (Alves *et al.* 2013, p. 61).

Similarly, another study indicated that appropriate oversight of domestic wildlife breeding facilities is lacking. For instance, although each Brazilian state has a wildlife center that is responsible for the management, licensing and inspection of all categories of breeders, traders and zoos (Kuhnen & Kanaan 2014, p. 125), most centers lack resources and funding (Padrone, 2004 as cited in Kuhnen & Kanaan 2014, p. 125). Issues related to limited resources include (1) few employees, (2) lack of technical knowledge, and (3) limited cars and fuel for inspections (Padrone, 2004 as cited in Kuhnen & Kanaan 2014, p. 125). Given this lack of resources, it is believed that there are not enough inspections at market places and commercial breeding facilities to fight illegal domestic trade (Alves *et al.* 2010, pp. 154-155).

Legal trade—we also reviewed the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) trade data from the time the golden conure was listed in CITES Appendix I in 1975, through the last full year of data in 2016 (UNEP–WCMC 2018, unpaginated). There was no data prior to 1981, so our analysis was restricted to the years 1981 to 2016. We excluded three records from our analysis that appeared to be incorrectly reported (i.e., two were described as leather products and one was reported as a carving). Overall estimates of international trade in golden conure specimens for this timeframe (1981-2016) were approximately 1,707 exports and 1,095 imports. This constituted a total of 445 transactions, primarily from birds that were captive bred (Codes C, D, and F; Table 3). During this timeframe, approximately 43 birds were removed from the wild for export (Code W; Table 3) and 10 birds were confiscated upon import (Code I; Table 3). The majority of live birds were traded for commercial purpose (Table 4). Live birds were exported from a total of 32 countries and imported to a total of 58 countries (UNEP–WCMC 2018, unpaginated). During this time period the U.S imported 54 live birds and exported 26 (UNEP–WCMC 2018, unpaginated). The three countries with the greatest number of import transactions for live birds were (Germany-44; Taiwan-35; and Japan-34); the top three countries for export transactions were (Philippines-112; Switzerland-73 and South Africa-72).

Table 3. Reported source of all golden conure transactions and approximate total number of birds traded from each source (data from UNEP–WCMC 2018, unpaginated).

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Here you analyze the legal marketing of individuals. However, it would be more advantageous to carry out an analysis of individuals captured from nature (illegal). Conduct a formal consultation for State Surveillance Agencies, where the species occurs and for Federal Agency (Ibama). It is known that only in 2016, environmental inspection seized about 57 individuals illegally removed from nature. This scenario needs to be analyzed.

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Source	Number of Transactions	Approximate Number of Birds:	
		Exported	Imported
Code C; Animals bred in captivity in accordance with Resolution Conf. 10.16 (Rev.), as well as parts and derivatives thereof, exported under the provisions of Article VII, paragraph 5, of the Convention.	346	1,275	664
Code D; Appendix-I animals bred in captivity for commercial purposes in operations included in the Secretariat's Register, in accordance with Resolution Conf. 12.10 (Rev. CoP15).	72	332	200
Code F; Animals born in captivity (F1 or subsequent generations) that do not fulfil the definition of 'bred in captivity' in Resolution Conf. 10.16 (Rev.), as well as parts and derivatives thereof.	11	13	199
Code I; Confiscated or seized specimens	6	0	10
Code O; Pre-Convention specimens	2	1	1
Code U; Source unknown	2	3	0
Code W; Specimens taken from the wild	6	43	8
Total	445	1,667	1,079

Table 4. Record of live golden conure transactions by intended purpose and approximate total number of birds traded for each purpose (data from UNEP–WCMC 2018, unpaginated).

Purpose	Number of Transactions	Approximate Number of Birds:	
		Exported	Imported
Commercial	248	1,069	472
Breeding in captivity or artificial propagation	71	216	273
Personal	56	160	112
Zoo	20	14	33
Circus or traveling exhibit	1	0	2
Total	396	1,459	892

We found no additional information on illegal trade of this species in international markets. International trade of neotropical parrots was significantly reduced during the 1990s as a result of tighter enforcement of CITES regulations, stricter measures under European Union legislation, and adoption of the Wild Bird Conservation Act in the U.S., along with adoption of national legislation in various other countries (Snyder *et al*. 2000, p. 99).

In summary, captive breeding programs in Brazil have helped to limit poaching of wild golden conures (Silveira *in litt.* 2012, Lees *in litt*. 2013 in BLI 2016, p. 5) but poaching may still be

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occurring, particularly from poorer areas ((Alves *et al.* 2013, p. 61). Although an illegal international trade of the conure for the pet trade occurred in the past, there is little evidence that this practice is continuing (Laranjeiras 2011a, unpaginated; Silveira and Belmonte 2005 *in Press*, unpaginated). In contrast, there still appears to be a domestic illegal market for the species (Silveira and Belmonte *in Press*, unpaginated). However, we have no information to assess the degree to this is occurring and how it may be affecting golden conure populations.

Hunting—the golden conure was traditionally hunted in the past by indigenous people for meat and its tail feathers were used in head dresses (Snyder 2000, pp. 98, 132; Yamashita 2003, p. 38). One account relayed that peasant farmers would hunt the golden conure for food, particularly after larger game species had been hunted from an area but if other game is plentiful then they will leave the birds in peace (Oren and Novaes 1986, p. 335). Around 1980, the conure was shot for sport in Amazonia National Park by weekend and holiday hunters (Oren and Willis 1981, p. 396). It appears that the conure's social cohesion may be detrimental when they are hunted because flock members may remain near injured birds until they are also shot (Oren and Novaes 1986, p. 335).

Hunting of the golden conure is now prohibited by Brazilian law (see Management Actions) and we have no recent information on the rates of illegal hunting of the species for food or feathers.

Persecution— in some regions, the golden conure has been persecuted by farmers as a crop pest (Forshaw 2017, p. 223; Laranjeiras 2008a as cited in Laranjeiras 2011a, unpaginated). The diet of the conure in some areas includes food produced by farmers such as corn and mangoes (Forshaw 2017, p. 227; Parr and Juniper 2010, p. 436). Unfortunately the timing is such that the species will frequent corn fields (and be shot at) as the crop ripens and just before the young conures fledge (Oren and Novaes 1986, p. 335). We have no additional recent information on the rate of persecution of the conure as a crop pest, and, as, noted above, shooting the golden conure is prohibited by Brazilian law.

Predation—little is also known about the natural predators of, or predation rates on, golden conures. *Ramphastos* toucans are known natural predators of the golden conure eggs and nestlings (Oren and Novaes 1986, p. 334). Additional avian predators may include aracaris (medium-sized toucans from the genus Pteroglossus) (Forshaw 2017, p. 228) and several species of raptors, (Laranjeiras 2008a as cited in Laranjeiras 2011a, unpaginated; Silveira and Belmonte *in Press*, unpaginated). The raptors may prey on adult conures; for example, unsuccessful attacks by the bat falcon (*Falco rufigularis*) on adult conures were observed in 2007 (Laranjeiras 2011a, unpaginated). Additionally, monkeys, snakes, and the tayra (*Eira barbara*)—an omnivorous animal from the weasel family, may prey on the conure in the forest (Oren and Novaes 1986, p. 334).

One researcher theorized that predation may have been a principal factor in the development of key aspects of golden conure's life history, including the tendency to nest communally and to

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deepen nesting cavities (Oren and Novaes 1986, p. 334). Selection may have favored large reproductive groups that can more easily defend nests, and excavating behavior that promotes deep cavities to protect chicks or eggs from the toucans' probing bills (Oren and Novaes 1986, p. 334).

Disease—we have no information regarding diseases that may affect golden conures in the wild.

In summary, the golden conure has been hunted in the past for meat and feathers and we are unaware of the extent of this practice today. Likewise, persecution of the conure by farmers has also been noted in local areas where their range overlaps with corn and mango crops but we have no data on how this may be effecting wild populations of the species. We also have limited information on the natural predators of the golden conure and no information on diseases that may affect the species in the wild. It is possible that natural predation may be affecting populations in some areas where other stressors (e.g., fragmented landscapes) may have weakened family groups and their ability to defend nest cavities.

Management Actions

The golden conure is considered "Vulnerable" at the national level in Brazil (MMA 2014, p. 122), and, like other wildlife species, it is protected under Brazilian law. Because of its coloration (green and yellow like the Brazilian flag) it has also been proposed as the national bird of Brazil (BLI 2016, p. 5). In general, wildlife species and their nests, shelters, and breeding grounds are protected by Brazilian environmental laws (Clayton 2011, p. 4; Environmental Crimes law of Brazil (1999) as cited in MSU 2018, unpaginated; Official List of Brazilian Endangered Animal Species Order No. 1.522/1989 as cited in ECOLEX 2018; CFRB 2010, p.150; Law No. 5.197/1967 as cited in LatinLawyer 2018, unpaginated). Additionally, several Brazilian laws are designed to protect forests. Destruction and damage of forest reserves, cutting trees in forest reserves, and causing fire in forests, among other actions, without authorization are prohibited (Clayton 2011, p. 5; Law No. 9.605/1998 as cited in LatinLawyer 2018, unpaginated).

Protected areas— protected areas have traditionally formed the backbone of forest conservation in the Amazon Basin and they still remain a vital conservation strategy (GFA 2018h, unpaginated). Brazil has the largest protected area network in the world. The National Protected Areas System (Federal Act 9.985/2000 as cited in LatinLawyer 2018, unpaginated) was established in 2000 and covers nearly 2.2 million km^2 (0.8 million mi^2) or 12.4 percent of the global total (WDPA, 2012 as cited by Ferreira *et al.* 2014, p. 706). This extensive network of protected areas is intended to (2) preserve priority biodiversity conservation areas, (2) establish biodiversity corridors, and (3) protect portions of the 23 Amazonian ecoregions identified by World Wildlife Fund (Rylands and Brandon, 2005, p. 612, 615; Silva, 2005, entire). Strictly protected areas are designed to conserve biodiversity while federal and state sustainable use areas allow various levels of resource use and extraction (Barber *et al.* 2014, p. 204).

Various regulatory mechanisms (Law No. 11.516, Act No. 7.735 and Decree No. 78 as cited in ECOLEX 2018, unpaginated) and Act No. 6.938/1981(LatinLawyer 2018, unpaginated)) in

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Brazil direct federal and state agencies to promote the protection of lands and govern the formal establishment and management of protected areas to promote conservation of the country's natural resources. These mechanisms generally aim to protect endangered wildlife and plant species, genetic resources, overall biodiversity, and native ecosystems on federal, state, and privately owned lands (e.g., Law No. 9.985, Law No. 11.132, Resolution No. 4, and Decree No. 1.922 as cited in ECOLEX 2018, unpaginated).

By 2006, 1.8 million km^2 (0.7 million mi^2), or approximately 45 percent of Amazonian tropical forest, was under some level of protection as federal or state managed land, or designated as indigenous reserve (Barber *et al.* 2014, p. 204). Of this, 19.2 percent was strictly protected areas and 30.6 percent was comprised of federal and state sustainable use area with indigenous reserves making up the remainder (Barber *et al.* 2014, p. 204). Indigenous communities sustainably use their forest land through shifting cultivation, trade of non-timber forest products, and occasionally allow selective logging (GFA 2018f, unpaginated; Schwartzman and Zimmerman 2005, p. 721); large scale deforestation is prohibited (Barber *et al.* 2014, p. 204). The golden conure had been found in nine areas that were recently designated Important Bird Areas in Brazil (Appendix D) and its predicted range overlaps with numerous other protected areas (Appendix D; Laranjeiras and Cohn-Haft 2009, p.8; Figure 8). Several researchers have underscored the importance of protected areas as the conure's best hope for survival (e.g., in the Tapajos River region and the Gurupi Biological Preserve) (Laranjeiras and Cohn-Haft 2009, pp.1,8; Silveira and Belmonte *in Press*, unpaginated) in a region that continues to face strong pressures from deforestation.

Brazil's forest code—Brazilian forest code was created in 1965, and was subsequently changed in the 1990s via a series of presidential decrees (Soares-Filho *et al.* 2014, p. 363). As of 2001, the forest code required landowners in the Amazon to conserve native vegetation on their rural properties by setting aside what is called a "legal reserve" of the remaining 80 percent (Soares-Filho *et al.* 2014, p. 363). The forest code severely restricted deforestation on private properties but proved challenging to enforce (GFA 2018b, unpaginated; Azevedo *et al.* 2017, entire; Soares-Filho *et al.* 2014, p. 363). In late 2012, a new forest code was approved (backed primarily by the agribusiness lobby) that some believe is too lenient for landowners, while others believe that it is still a barrier to agricultural development (Soares-Filho *et al.* 2014, p. 363). Although key mechanisms of the revised forest code are still under negotiation, the biggest change is that the forest code provides amnesty for previous illegal deforestation by smaller property holders (Soares-Filho *et al.* 2014, p. 363). Under the older forest code, legal reserves that were illegally deforested were required to be restored at the landowner's expense. The new forest forgives the legal reserve debt of small properties (up to 440 hectares (1,087 acres) in the Amazon (Soares-Filho *et al.* 2014, p. 363).

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Although the 2012 forest code reduced the restoration requirements, it also introduced measures that strengthen conservation including addressing (1) fire management, (2) forest carbon, and (3) payments for ecosystem services (Soares-Filho *et al.* 2014, p. 363). Additionally, the new forest code created an Environmental Reserve Quota (CRA) where the CRA (surplus) on one property may be used to offset a legal reserve debt on another property within the same biome; this could create a market for forested lands, adding monetary value to native vegetation and potentially abating up to 56 percent of legal reserve debt (Soares-Filho *et al.* 2014, p. 363).

International Trade Regulations—the golden conure was listed on Appendix I of CITES on January 7, 1975 (CITES 2018, unpaginated). CITES is an international agreement between governments and ensures that the international trade of CITES-listed plants and animals does not threaten the survival of the species in the wild. Species included in CITES Appendix I are considered threatened with extinction, and international trade is permitted only under exceptional circumstances, which generally precludes commercial trade.

Efforts to reduce greenhouse gas emissions—"Reducing Emissions from Deforestation and Forest Degradation" (REDD) is a "payment for ecological services" type initiative that creates a financial value for the carbon stored in forests (GFA 2018g, unpaginated). The program offers incentives to developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development (GFA 2018g, unpaginated). REDD plus (REDD+) goes one step further by including objectives for (1) biodiversity conservation, (2) sustainable management of forests and (3) improvements to forest governance and local livelihoods (GFA 2018g, unpaginated).

Brazil is one of the most advanced countries in the world in REDD+ planning. In 2008, Brazil established the Amazon Fund –which receives compensation for reduction of deforestation. The Brazilian Development Bank manages the fund and implements national climate change and forest governance policies and mechanisms (GFA 2018g, unpaginated). To date, the Norwegian government is the major donor and lesser donors include the government of Germany and the Brazilian oil company "Petrobras" (GFA 2018g, unpaginated).

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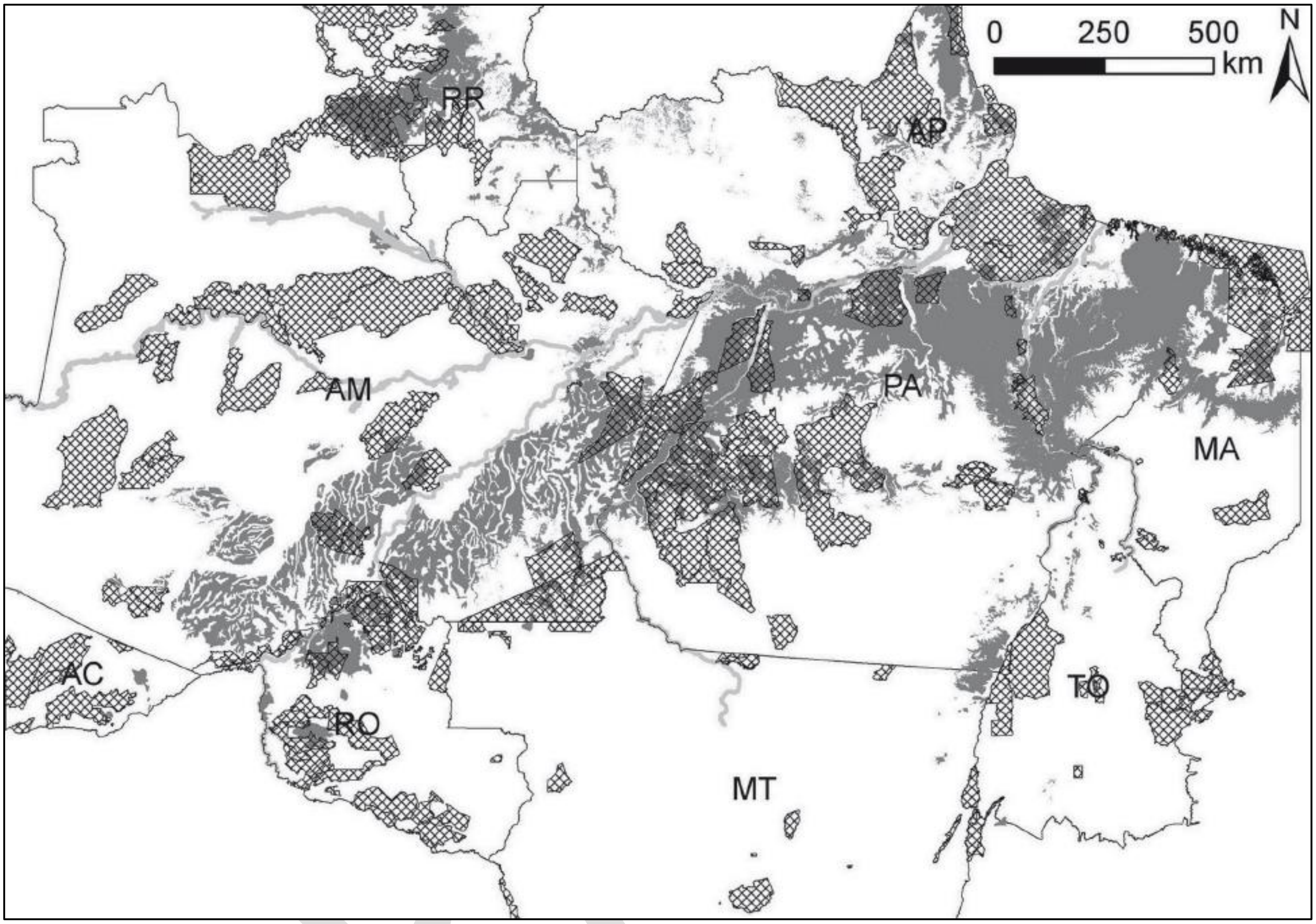

Figure 8. Coverage of the golden conure's potential distribution (shaded gray) by parks and reserves (hatched areas), including both sustainable development and integral protection categories at the federal and state levels (map and analysis by Laranjeiras and Cohn-Haft 2009, entire).

Summary of Overall Current Condition

The golden conure's global population is estimated at approximately 10,875 individuals within approximately 174,000 km^2 (67,182 mi^2) of suitable habitat (Laranjeiras 2011b, p. 311). The species is most vulnerable to effects from deforestation which is driven by a number of anthropogenic factors, particularly expanding agriculture for soy and beef. Risks from deforestation will be intensified by synergistic effects associated with climate change (Staal *et al.* 2015, p. 2). Although Brazil has an extensive network of protected areas and regulations regarding deforestation on public lands, deforestation is expected to continue as demand for agricultural commodities continues to rise (Brando *et al.* 2016, abstract). Additionally, the species was extensively trapped for the domestic and international pet trade in the past and illegal marketing of wild birds in the domestic pet trade may still be affecting the species. Hunting and persecution may also still be occurring at low levels. Experts believe that the

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overall trend for the species is declining, although its presence in protected areas may aid its longer-term survival.

Uncertainty

In general, the golden conure has been poorly studied and information is limited on local abundance and distribution of populations throughout the range. Information is lacking on home range, carrying capacity, birth rates, and nesting success. We can draw some conclusions regarding juvenile survival and recruitment from one study that observed 32 flocks and found that, on average, about 13 percent of the individuals in the flock are first-year juveniles (Laranjeiras 2011b, p. 307). Additionally, there is considerable uncertainty in the projections for deforestation and climate change.

STAGE THREE (Future Condition and Status)

In this section we forecast the species' potential future condition and viability.

Introduction and Summary

In Stage Two, we determined that the golden conure faces the most risk from loss and degradation of its habitat from deforestation (i.e., originating from multiple anthropogenic activities) and that this risk will likely be intensified by synergistic effects associated with climate change. Therefore, we used projections for both deforestation and climate change to construct three future scenarios for the golden conure.

Methods

We relied on existing projections of deforestation and climate change to construct our scenarios (status quo, conservation and considerable effects) for the future condition of the golden conure.

1. Deforestation projections

We used results from a study that assessed extinction risk for Amazonian birds using spatially explicit habitat projections (including deforestation projections) (i.e., Bird *et al.* 2011, entire) as the primary component for development of our scenarios. The study produced a projected estimate of forest loss under a pessimistic and optimistic scenario for golden conure habitat (Bird *et al.* 2011 Appendix S1). These two scenarios were termed "business as usual" (pessimistic) and "governance" (optimistic) and the set of conditions and assumptions for each are described (verbatim) below (Bird *et al.* 2011 citing Soares-Filho *et al.* 2006, p. 520; PA = protected areas).

> <u>Business as usual (BAU) (pessimistic)</u> assumes that: recent deforestation trends will continue; highways currently scheduled for paving will be paved; compliance with legislation requiring forest reserves on private land will remain low; and new PAs will not be created. The BAU scenario assumes that as much as 40% of the forests inside of

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PAs are subject to deforestation (B.S.S.-F., unpublished observation), climbing to 85% outside.

Governance (GOV) (optimistic) assumes that Brazilian environmental legislation is implemented across the Amazon basin through the refinement and multiplication of current experiments in frontier governance. These experiments include enforcement of mandatory forest reserves on private properties through a satellite-based licensing system, agro-ecological zoning of land use, and the expansion of the PA network (Amazon Region Protected Areas Program).

Within the governance scenario, the deforestation rate, although rising initially owing to road paving, declines over time, simulating the effects of growing market pressures in favour of sound land management, emerging markets for carbon retained in native forests and other incentives for landholders who conserve forest on their properties. The governance scenario assumes that the planned expansion of the PA network in the Brazilian Amazon, from 32% to 41% of the total forest area, succeeds and 100% of the forests in PAs are preserved intact, with only 50% of the forests outside of PAs subject to deforestation (compared with 20% currently permitted by Brazilian regulations).

Projections from this work for the golden conure indicated that within 3 generations (22 years) it would experience a loss of approximately 30.9 percent of forest habitat under the "business as usual" scenario, and a 23.3 percent loss under the "governance" scenario (Bird *et al.* 2011 Appendix S1). Because the conure appears to be mostly forest-dependent (Forshaw 2017, p. 224; Laranjeiras 2011a, unpaginated; Laranjeiras and Cohn-Haft 2009, p. 5; Oren and Novaes 1986, p. 331) we made the assumption that, over time, the projected percent of forest loss would correspond, almost one to one, with percent declines in the global population.

2. Climate change projections

We used information from IPCC's Fifth Assessment Report as the secondary component for our scenario development (Carabine and Lemma 2014, p. 8; IPPC 2013, entire). We used Representative Concentration Pathways (RCPs) projections that correspond to greenhouse gas concentrations to assess the likelihood that global temperatures would reach 2.0 °C (3.6 °F) by the end of the century (i.e., by 2100) (Carabine and Lemma 2014, p. 8).

We based the three scenarios for the golden conure on the following RCP projections: 4.5, 6.0 and 8.5. We also considered the low emissions scenario of RCP 2.6 , but then excluded it because achieving RCP 2.6 was thought to be unlikely. For example, estimates of temperature increases by the end of the 21st century in one downscaled model for the Amazon were 2.2 °C (4.0 °F) under a low greenhouse gas emission scenario (Marengo *et al*. 2011, p. 27).

We applied RCPs as follows:

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- RCPs of 4.5 and 6.0 (Status quo): Both these projections assume that the rate of emissions from greenhouse gasses will reach some level of stabilization at the end of the 21st century.
    - RCP 4.5 indicates that global warming is *more likely than not* to be 2.0 °C (3.6 °F) (i.e., more than 50 percent).
    - RCP6.0 indicates that global warming is *likely* to be 2.0 °C (3.6 °F) (i.e., 66 percent or more).

- RCPs of 4.5 (Conservation): This projection assumes that the rate of emissions from greenhouse gasses will reach some level of stabilization at the end of the 21st century.
    - RCP 4.5 indicates that global warming is *more likely than not* to be 2.0 °C (3.6 °F) (i.e., more than 50 percent).

- RCPs of 8.5 (Considerable effects): This projection assumes that there will be continued high emissions from greenhouse gasses and global warming at the end of the 21st century is *likely* to be 2.0 °C (3.6 °F) (i.e., 66 percent or more).

We then considered information from scaled-down climate models to the Amazon region (See "effects from climate change" in the Description of Stressors/Threats section above).

Scenario development—we combined the information from the deforestation and climate change projections (noted under numbers 1 and 2 above) to develop the three different scenarios (status quo, conservation, and considerable effects). The assumptions associated with each scenario are discussed below.

Scenario 1: Status quo

- Approximately 30.9 percent of suitable habitat is lost in 3 generations (22 years) (Bird *et al.* 2011 Appendix S1 "business as usual" scenario). This scenario assumes recent deforestation trends will continue, and:
    - as much as 40 percent of the forests inside of, and 85 percent outside of, protected areas will be subject to deforestation;
    - highways currently scheduled for paving will be paved;
    - compliance with legislation requiring forest reserves on private land will remain low; and
    - no new protected areas will be created.
- Additionally, the rate of emissions from greenhouse gasses will reach some level of stabilization at the end of the 21st century (Representative Concentration Pathways (RCPs) ranging from 4.5-6.0))
    - RCP 4.5 = global warming is *more likely than not* to be 2.0 °C (3.6 °F)
    - RCP 6.0 = global warming is *likely* to be 2.0 °C (3.6 °F)

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Its occurrence extent has been reduced by about 30% in the last 30 years and can be reduced by another 20-30% in the next 50 years. This represents declines in
equivalent to the size of the mature population (currently around 10,000 individuals), which together with the impacts of the withdrawal of individuals from nature to illegal trafficking generate estimates of about 30% of population decline over 22 years (three generations), involving past and future. It is also possible to conclude from this that there is a continued decline of at least 10% over three generations.

Scenario 2: Conservation

- Approximately 23.3 percent of suitable habitat is lost in 3 generations (22 years) (Bird *et al.* 2011 Appendix S1 “governance” scenario). This scenario assumes environmental legislation is implemented across the Amazon basin and experiments in “frontier governance” are refined and applied, including:
    - enforcement of mandatory forest reserves on private properties through a satellite-based licensing system;
    - agro-ecological zoning of land use;
    - successful expansion of the protected areas network; and
    - 100 percent of the forests inside of and 50 percent outside of protected areas will be preserved.
    - Additionally, the rate of emissions from greenhouse gasses will reach some level of stabilization at the end of the 21st century (corresponding to RCP 4.5; global warming is *more likely than not* to be 2.0 °C (3.6 °F).

Scenario 3 – Considerable effects

- More than 40 percent of suitable habitat is lost in 3 generations (22 years) (e.g., greater loss than projected in the Bird *et al.* 2011 Appendix S1 “business as usual” scenario). In this scenario we assume that:
    - Infrastructure projects currently considered within the conure’s range will proceed and additional projects will be added and implemented
    - Protected areas will not well maintained or managed to include:
        - > 40 percent of the forests inside of and > 85 percent outside of protected areas will be subject to deforestation;
        - compliance with legislation requiring forest reserves on private land will be low; and
        - no new protected areas will be created.
    - Additionally, there will be continued high emissions from greenhouse gasses (corresponding to RCP 8.5; global warming at the end of the 21st century is *likely* to be 2.0 °C (3.6 °F)).

To assess overall future condition, we considered the projected decline in forest habitat together with the projected effects from climate change to derive qualitative responses of demographic and habitat factors under each scenario (Table 5). We derived the overall future condition under each scenario using the mode of these qualitative responses. This resulted in a “tie” for the conservation scenario. However, because the level of deforestation in this scenario would still

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likely result in declines in abundance and population growth, we estimated the overall future condition to be medium.

Table 5. Evaluation of three plausible future scenarios for the golden conure.

Scenario	IPCC	Deforestation	Demographic factors			Habitat factors			Overall future con-dition
	Global warming at the end of the Century	Projected % of habitat loss in 22 years	Abundance	Population growth	Connectivity	Nest tree abundance	Extent of range	Protected areas	
Status quo	*(RCP s 4.5 - 6.0) More likely than not* or *Likely* to be 2.0 °C	30.9%	Low (Decline)	Low	Low	Low	Low	Med	Low
Conservation	*(RCP 4.5) More likely than not* to be 2.0 °C	23.3%	Med (Decline but slower than for status quo)	Med	High	High	Med	High	Med
Considerable effects	*(RCP 8.5) Likely* to be 2.0 °C	>40%	Low (Decline But more rapid than status quo)	Low	Low	Low	Low	Low	Low

Golden Conure Future Resiliency, Redundancy and Representation

We examined the resiliency, representation, and redundancy of golden conure under each scenario. Because the conure is forest-dependent, we assume that, over time, percent forest loss will correspond, almost one to one, with declines in the global population.

Scenario 1 - Status quo. Under this scenario, we expect the golden conure's future viability to be characterized by lower resiliency, redundancy, and representation than it exhibits under the current conditions. We expect declines in its habitat and the global population to reach approximately 30 percent in 22 years. Additional decreases in both of these rates are likely in the longer term under RCPs ranging from 4.5-6.0 due to synergistic effects associated with climate change. Under this scenario, some proportion of protected areas would remain (scored as

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medium). However, the decline in forest habitat will likely relate to declines in nesting tree abundance, extent of the range, and connectivity between remaining forested tracts. Therefore, we estimate the overall future condition to be low.

Scenario 2 – Conservation. Under this scenario, we expect the golden conure's future viability to be characterized by lower resiliency, redundancy, and representation than it exhibits under the current conditions. We expect declines in its habitat and the global population to reach approximately 23 percent in 22 years. Additional decreases in both of these rates are likely in the longer term under RCP 4.5 due to synergistic effects associated with climate change. We expect the species' abundance and population growth to decline, but at a slower rate than would be experienced under status quo. Efforts to increase the percentage and quality of protected areas would likely result in better conservation of nesting trees and connectivity between remaining forested tracts. Under this scenario, the largest proportion of protected areas would remain—which explains our high scores for connectivity and two of the habitat factors. However, because this level of deforestation would still likely result in declines in abundance and population growth, we estimate the overall future condition to be medium.

Scenario 3 – Considerable effects. Under this scenario, we expect the golden conure's future viability to be characterized by much lower resiliency, redundancy, and representation than it exhibits under the current conditions. We expect declines in its habitat and the global population to be greater than 40 percent in 22 years. Additional and significant decreases in both of these rates are likely in the longer term under RCP 8.5 due to synergistic effects associated with severe climate change. Projected decline in forest habitat (coupled with climate change effects) relate to declines in all demographic and habitat factors which explains our low estimates for these factors and for the overall future condition.

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Table 6. Summary of the expected future resiliency, representation, and redundancy of the golden conure.

Population Resiliency	**Representation**	**Redundancy**
Reduced resiliency is expected to occur across all three future scenarios. Reduction or loss of suitable habitat is the main reason for reduced population resiliency under future scenarios. Abundance is expected to decline.	Reduced representation is expected to occur across all three future scenarios. There is limited data on genetic diversity and currently no evidence of differentiation. There is not a large difference in habitat types or elevation across the known historical range. Low genetic differentiation (as currently understood) would likely not assist in sustainability. If a stressor (e.g., disease) affects one population, it will likely affect all. Stochastic events (mainly drought is anticipated) will cause additional loss of terra firme habitat needed by the conure. Drought could occur locally or be more widespread.	Reduced redundancy is expected to occur across all three future scenarios. We generally expect loss of conure habitat across its range. Some level of redundancy will be retained because of the existence of protected areas and indigenous lands across the range. Increases in extreme weather events (particularly drought) will decrease time for habitat and populations to recover/recolonize. We expect loss of populations from decreased connectivity.

CONCLUSION FOR SPECIES VIABILITY

The expected future viability of the golden conure (see Table 6 above) depends largely on future rates of deforestation in its rainforest habitat and future climate scenarios. Climate change effects will act synergistically with deforestation and will include increased temperatures, dryer conditions, and more extreme weather (including droughts). The risk to the rainforest from fire is also expected to increase. Projected future scenarios for the golden conure range from a low overall future condition (for status quo and considerable effects scenarios) to medium (for conservation scenario).

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LIST OF APPENDICES

Appendix A. Scientific name, family, common name (when known), and literature source for known forage species used by the golden conure (sorted by family).

Appendix B. Known localities of the golden conure by state, location, year, latitude/longitude, and notes.

Appendix C. Estimates of annual deforestation rates from 2004 to 2017 for the Brazilian states within the known range of the golden conure.

Appendix D. A summary of known protected areas where the golden conure has been documented.

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Appendix A. Scientific name, family, common name (when known), and literature source for known forage species used by the golden conure (sorted by family).

Species	Family	Common name/notes	Source
Anacardium occidentale	Anacardiaceae	Cajuí or cashew	Collar 1992, p. 303; Oren and Novaes 1986. p. 332
Anacardium spruceanum	Anacardiaceae	Cajuí or cashew	Collar 1992, p. 303; Oren and Novaes 1986. p. 332
Mangifera indica	Anacardiaceae	Mango	Laranjeiras 2011a, unpaginated; Gil Serique as cited in Reynolds 2003, p. 12; Collar 1992, p. 303; Oren and Novaes 1986. p. 332
Tapirira guianensis	Anacardiaceae	Unknown	Laranjeiras 2008a as cited in Laranjeiras 2011a, unpaginated; Laranjeiras 2011b, pp. 303 & 309
Euterpe species	Arecaceae	Includes: "Açai"; "Euterpe palm nuts"	Sick 1997 as cited in Laranjeiras 2011a, unpaginated; Gil Serique as cited in Reynolds 2003, p. 12; Sick 1985 as cited by Collar 1992, p. 303;
Oenocarpus bacaba	Arecaceae	Bacaba (palm)	Collar 1992, p. 303; Oren and Willis 1981, p. 395; Oren and Novaes 1986, p. 332
Protium species	Burseraceae	Breu (produces resin in response to wounding)	Collar 1992, p. 303; Oren and Novaes 1986. p. 332
Tetragastris species	Burseraceae	Breu (produces resin in response to wounding)	Collar 1992, p. 303; Oren and Novaes 1986. p. 332
Croton matourensis	Euphorbiaceae	Castor bean family; also called Croton matouensis (Yamashita 2003, p. 38)	Reynolds 2003, p. 12; Yamashita 2003, p. 38
Hymenaea species	Fabaceae	Legume, pea, or bean family	Laranjeiras 2011b, p. 309
Undentified species	Fabaceae	(includes 2 unidentified sp. from this family); Inga; Legume, pea, or bean family	Laranjeiras 2011b, p. 309
Unidentified Inga species	Fabaceae/ Leguminosae	Ingá (legume, pea, or bean family	Collar 1992, p. 303; Oren and Novaes 1986. p. 332

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Appendix A. Continued

Species	Family	Common name/notes	Source
Zea mays	Graminae/ Poaceae	Maize, corn	BLI 2016, p. 4; Descourtilz 1854-1856 as cited in Collar 1992, p. 303; Oren and Novaes 1986, p. 332
Symphonia globulifera	Guttiferae	In the igapó forest of Caxiaunã National Forest	Laranjeiras 2011a, unpaginated
Visnia gujanensis	Guttiferae	Lacre	Collar 1992, p. 303; Oren and Novaes 1986, p. 332
Symphonia species	Guttiferae/ Clusiaceae	Ananí	Laranjeiras 2011a, unpaginated; Collar 1992, p. 303; Oren and Novaes 1986. p. 332
unidentified Lauraceous tree	Lauraceae	Laurel family	Collar 1992, p. 303; Oren and Willis 1981, p. 395
Sapucaia Lecythis	Lecythidaceae	Sapucaia	Descourtilz 1854-1856 as cited in Collar 1992, p. 303
Byrsonima species	Malpighiacae	(includes 2 unidentified species from this family)	Laranjeiras 2011a, unpaginated; Laranjeiras 2011b, pp. 303 & 309; Laranjeiras 2008, p. 11
Byrsonima crassifolia	Malpighiaceae	Murucí (sometimes cultivated, used in desserts)	Kyle 2005, pp. 3-4; Collar 1992, p. 303; Oren and Novaes 1986, p. 332
Byrsonima crispa	Malpighiaceae	Murucí (also eaten by humans)	Gil Serique as cited in Reynolds 2003, p. 12; Yamashita 2003, p. 38
Miconia species	Melastomataceae	Unknown	Laranjeiras 2011a, unpaginated; Laranjeiras 2011b, p. 309
Carapa guianensis	Meliaceae	Andiroba, Mahogany family	Collar 1992, p. 303; Oren and Novaes 1986, p. 332
Cecropia species	Moraceae	Cecropia, nettle family	Collar 1992, p. 303; Oren and Novaes 1986, p. 332
Undentified Myrtaceae species	Myrtaceae	Myrtle family	Laranjeiras 2011b, p. 309
Pouteria species	Sapotaceae	Unknown	Laranjeiras 2011b, p. 309

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Appendix B. Known localities of the golden conure by state, location, year, latitude/longitude (Lat/Lon), and notes. The majority of these localities (numbers 1-69) are as summarized by Laranjeiras and Cohn-Haft 2009 (pp. 12-14). We compiled the additional records from the literature after the publication of Laranjeiras and Cohn-Haft 2009 (see second shaded heading below).

		69 localities of Golden Parakeet records (Laranjeiras and Cohn-Haft 2009, pp 12-14)				
#	*	State	Location	Year	Lat/Lon	Notes
1		Maranhão	Serra do Pirocaua	1909	1°31'S, 45°55'W	Three specimens MPEG (#06838, #06839, #06840). Collector: Lima,F.
2		Maranhão	Drainage of Pindaré River	1980	3°16'S, 44°41'W	Sight record (Silva 1993)
3		Maranhão	Gurupi area	1983	3°42'S, 46°45'W	Sight record (Silva 1993)
4		Maranhão	Primavera Farm of Celulose Maranhão Group	1999	4°66'S, 48°14'W	Sight records (Fabio Röhe pers. comm. 2008)
5	*	Maranhão	Reserva Biológica do Gurupi	2001	3°42'S, 46°44'W	Sight records (Carlos Yamashita *in litt.* 2008).
6	**	Pará	Maracanã River, Santo Antônio da Prata	1903	1°19'S, 47°36'W	Specimen MPEG (#02646). Collectors: Schönmann, J./Rodrigues, R. S.
7		Pará	Gurupi River	1906	3°00'S, 46°42'W	Sight record (Hidasi 1973).
8	**	Pará	Estação experimental do Peixe-Boi	1908	1°11'S, 47°17'W	Specimen MPEG (#05886). Collector: Martins, O.
9		Pará	Xingu River, Vitória	1909	2°52'S, 52°00'W	Collector: Snethlage, E.
10		Pará	Left bank of Tocantins River, Arumatheua	1912	3°53'S, 49°41'W	Two specimens Museu Nacional do Rio de Janeiro (#3443, #3444) and one specimen MPEG (#10273). Collector: Lima, F
11	**	Pará	Tocantins River	1920	1°53'S, 49°06'W	Two specimens MZUSP (#11057, #11058). Collector: Lima, F.
12	**	Pará	Vizeu	1932	1°13'S, 46°07'W	Collector: Lima, F.
13		Pará	Pracupi River, right bank of lower Amazonas River, Portel	1939	1°57'S, 50°47'W	Specimen MPEG (#28129). Collector: Lasso.
14		Pará	Córrego Murucutum, Gurupi River, Camiranga	1955	1°48'S, 46°16'W	Four specimens Museu Nacional do Rio de Janeiro (#1461, #1462, #1482, #1487). Collector: no data. Also in Aguierre and Aldrigui (1983).
15	**	Pará	Capim River near Belém-Brasília Highway (BR-163)	1959	1°41'S, 47°46'W	Eight specimens MZUSP (#43976, #43977, #43978, #43979, #43980, #43981, #43982, #43983). Collector: Dente.

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16		Pará	Km-92 of Belém-Brasilia Highway (BR-163)	1959	2°26'S, 47°31'W	Two specimens MPEG: one at 1959 (#15586) and other at 1962 (#28130). Collector: José Hidasi.
17		Pará	Fordlândia, right bank of Tapajós River	1962	3°48'S, 55°27'W	Three specimens MZUSP, collected at 1964 (#56313) and at 1971 (#64772, #64771). Collector: Olalla.
18		Pará	Km-186 of Transamazônica Highway (BR-230), to southwest of Itaituba	1974	5°05'S, 56°59'W	Sight record mentioned by Oren and Willis (1981). Also, personal observations (TOL) at 2007.
19		Pará	Transamazônica Highway (BR-230) between Itaituba and Altamira (east of Tapajos River)	1974	4°08'S, 55°12'W	Sight record mentioned by Oren and Willis (1981).
20		Pará	Transamazônica Highway (BR-230) at 85km to west of Altamira	1974	3°30'S, 53°00'W	Sight record (Oren and Willis 1981).
21		Pará	Transamazônica Highway (BR-230) at 120km to west of Altamira	1974	3°36'S, 53°18'W	Sight record (Oren and Willis 1981).
22		Pará	Transamazônica Highway (BR-230) between Altamira and Marabá (west of Tocantins River)	1974	4°10'S, 50°06'W	Sight record (Oren and Willis 1981).
23		Pará	Itaituba	1974	4°16'S, 56°02'W	Sight record (Silva 1993).
24		Pará	Altamira	1974	3°11'S, 52°10'W	Sight record (Silva 1993).
25		Pará	Sítio Fé em Deus, Igarapé Pedral, (a tributary of Guamá River), Ourém	1977	1°56'S, 47°07'W	Specimen MPEG (#32083). Collector: Moreira, M.
26		Pará	Km-95 of the Transamazônica Highway (BR-230) to southwest of Itaituba, Parque Nacional da Amazônia	1978	4°41'S, 56°27'W	Sight record (Oren and Willis 1981).
27		Pará	Km-60 of the Transamazônica Highway (BR-230) to southwest of Itaituba, Uruá. Parque Nacional da Amazônia.	1978	4°32'S, 56°18'W	Sight record (Oren and Willis 1981). Also, personal observations (TOL) at 2007.
28		Pará	Tucuruí, 18 km toward east of Tocantins River	1980	3°55'S, 48°28'W	Sight record (Oren and Willis 1981).
29		Pará	Porto do Buburé, Tapajós River, Parque Nacional da Amazônia	1985	4°36'S, 56°19'W	Sight record (Oren and Parker 1997).
30		Pará	Vilarinho do Monte	1992	1°43'S, 52°12'W	Sight record (Collar *et al.* 1992).
31		Pará	Fazenda Cauaxí, near 100km to southwest of Paragominas	1998	3°23'S, 48°14'W	Sight record (Alexandre Aleixo *in litt.* 2007).
32		Pará	Capim River	2002	2°49'S, 47°51'W	Sight record (Toa Kyle *in litt.* 2007).
33		Pará	Cuiabá-Santarém Highway (BR-163), 239 km to North of Novo Progresso, Trairão	2002	5°07'S, 56°06'W	Sight record (Pacheco and Olmos 2005)
34		Pará	Cupari River, Floresta Nacional do Tapajós.	2004	4°03'S, 55°19'W	Sight records (Kyle 2005).
35		Pará	Cachoeira do Grim-Rurópolis, Rurópolis	2004	4°05'S, 55°00'W	Sight records (André Ravetta *in litt.* 2008).

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36		Pará	Rurópolis	2004	4°54'S, 54°54'W	Sight records (André Ravetta *in litt.* 2008).
37		Pará	Reserva Florestal Cia Pará Pigmentos, Ipixuna	2005	2°33'S, 47°29'W	Sight record (Luís Fábio Silveira *in litt.* 2007).
38		Pará	Reserva Florestal Agropalma, Tailândia	2005	2°31'S, 48°52'W	Sight records (Silveira and Belmonte 2005).
39		Pará	20 km toward west of Novo Progresso	2005	7°11'S, 55°29'W	Sight record (Alexandre Aleixo *in litt.* 2007).
40		Pará	Km-145 of Transamazônica Highway (BR-230), to south of Itaituba, Parque Nacional da Amazônia	2005	4°49'S, 56°47'W	Sight records (Kyle 2005).
41		Pará	Km-160 of Transamazônica Highway (BR-230), to south of Itaituba, Parque Nacional da Amazônia	2005	4°53'S, 56°51'W	Sight records (Kyle 2005).
42		Pará	Km-250 of Transamazônica Highway (BR-230), to north of Jacareacanga	2005	5°25'S, 57°11'W	Sight records (Kyle 2005).
43		Pará	Km-305 of Transamazônica Highway (BR-230), to north of Jacareacanga	2005	5°42'S, 57°30'W	Sight records (Kyle 2005).
44		Pará	Vicinity of Cupari River	2005	3°57'S, 55°20'W	Sight record (André Ravetta and Toa Kyle *in litt.* 2008).
45		Pará	Monte Carmelo, Prainha	2006	2°11'S, 53°14'W	Sight record mentioned (Ivo Rohling *in litt.* 2006).
46		Pará	Floresta Nacional de Caxiuanã	2006	1°43'S, 51°26'W	Sight records (Renata de Melo Valente and Alexandre Aleixo *in litt.* 2007)
47		Pará	Km-350 of Transamazônica Highway (BR-230), to north of Jacareacanga	2006	6°02'S, 57°46'W	Personal observations (TOL).
48		Pará	Right bank of Tucuruí Dam	2006	4°13'S, 49°24'W	Sight records (Sidnei de Melo Dantas *in litt.* 2007).
49		Pará	Left bank of Tucuruí Dam	2006	4°22'S, 49°36'W	Sight records (Sidnei de Melo Dantas *in litt.* 2007).
50		Pará	Jamanxim River	2007	5°19'S, 56°00'W	Sight records mentioned by Wandler Camargo *(in litt.* 2007).
51		Pará	Km-330 of the Transamazônica Highway (BR-230), to north of Jacareacanga	2007	5°45'S, 57°36'W	Personal observations (TOL).
52		Pará	Right bank of the "Volta Grande" of the Xingu River, Belo Monte	2007	3°36'S, 51°47'W	Sight records (Sidnei de Melo Dantas *in litt.* 2008).
53		Pará	Vicinity of Pacajás River, Portel, near 100 km to north of Tucuruí	2007	3°14'S, 50°19'W	Sight records (Sidnei de Melo Dantas *in litt.* 2008).
54		Pará	Vicinity of Pacajás River, Portel, near 120 km to north of Tucuruí	2007	3°11'S, 50°15'W	Sight records (Sidnei de Melo Dantas *in litt.* 2008).
55		Pará	Km-48 of the Transamazônica Highway (BR-230), to south of Itaituba	2007	4°25'S, 56°17'W	Personal observations (TOL).

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56		Pará	Km-110 of the Transamazônica Highway (BR-230), to south of Itaituba, Parque Nacional da Amazônia	2007	4°38’S, 56°34’W	Personal observations (TOL).
57		Pará	Km-130 of the Transamazônica Highway (BR-230), to south of Itaituba, Parque Nacional da Amazônia	2007	4°40’S, 56°43’W	Personal observations (TOL).
58		Pará	Km-200 of the Transamazônica Highway (BR-230), to south of Itaituba	2007	5°08’S, 57°02’W	Personal observations (TOL).
59		Pará	Km-245 of the Transamazônica Highway (BR-230), to north of Jacareacaga	2007	5°20’S, 57°08’W	Personal observations (TOL).
60		Pará	Parque Nacional do Jamanxim	2007	5°39’S, 55°31’W	Sight record (Alexandre Aleixo *in litt.* 2008).
61		Pará	Parque Nacional da Amazônia. 5 km to west of the km-90 of the Transamazonica Highway (BR-230)	2007	4°39’S, 56°28’W	Sight record (André Ravetta *in litt.* 2008).
62		Pará	Left bank of the Xingu River (“Volta Grande”), Eletronorte Camping, Altamira	2008	3°22’S, 51°56’W	Personal observations (TOL).
63		Pará	Transamazônica Highway, at 12 km to east of Miritituba	2008	4°23’S, 55°55’W	Personal observations (MCH).
64		Pará	West boundary of the Floresta Nacional do Trairão	2008	4°59’S, 55°44’W	Sight record (André Ravetta *in litt.* 2008).
65		Pará	Right bank of Xingu River, Tapuama, 50 km to north of Altamira	2008	3°36’S, 52°20’W	Sight record (André Ravetta *in litt.* 2008).
66		Pará	Right bank of the “Volta Grande” of the Xingu River, Comunidade Caracol, Belo Monte	2008	3°27’S, 51°40’W	Sight record (André Ravetta *in litt. 2008*).
67		Mato Grosso	Alta Floresta	1991	9°51’S, 56°34’W	Sight record (Lo 1995). Also, in 1995, personal observation (MCH, B. M. Whitney).
68		Amazonas	Comunidade Laranjal, Maués/Amaná Rivers – Maués	2007	4°18’S, 57°35’W	Sight records (Luke Parry *in litt.* 2007).
69		Rondônia	Floresta Nacional do Jamari	1989	9°07’S, 62°54’W	Sight records (Yamashita and França 1991).
Additional golden conure records from the literature after the publication of Laranjeiras and Cohn-Haft 2009.						
		State	Location	Year	Lat/Lon	Notes (including reference cited)
		Pará	Amana National Forest, Site 3: JML Gold Mining	2008	05°06'35.7"S. 57°32'14.9"W	Guilherme 2014, pp. 2-3, 5 observed several flocks of 18-22 individuals, flying daily over the camps of sites 3, 4, 5, 6, & 7
		Pará	Amana National Forest, Site 4: JML Gold Mining	2008	05°06'28.3"S, 57°32'07.8"W	Guilherme 2014 (as above)
		Pará	Amana National Forest, Site 5: Maranhense	2008	05°21'10.7S, 57°28'32.0"W	Guilherme 2014 (as above)

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		Pará	Amana National Forest, Site 6: Maranhense	2008	05°21'04.7S, 57°28'27.0"W	Guilherme 2014 (as above)
		Pará	Amana National Forest, Site 7: São Pedro	2008	04°46'41.1"S, 57°28'24.7"W	Guilherme 2014 (as above)
		Pará	Paragominas - observed golden conures in 57 catchments - The study are Included 2 IBAs that contain areas known as Gurupi, Alto Rio Guamá Indigenous Reserve, and Fazenda Rio Capim (FSC certified forest land).	2010-2011	None given	Lees *et al.* 2012, pp. 99,110; Observed on 57 occasions from 17 catchments totaling ~300 individuals. More detailed locality data pending in a subsequent publication
		Maranhão	Gurupi Biological Reserve	2010-2011	12 sampling sites but specific areas were not given	Lima *et al.* 2014, p. 323; observed a total of approximately 145 conures were observed during 19 encounters; it's likely that some were seen more than once.

*Approximate date; ** Not used in Laranjeiras and Cohn-Haft's 2009 modeling

Additionally, in 2012, what appears to be a breeding group of golden conures was documented in the City of Joinville within the state of Santa Catarina in southeastern Brazil. This group is believed to have been formed from captive birds that escaped (COAMA 2012, unpaginated) and we could not find any updates on their status.

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03°54'21"S
46°45'16"W

Appendix C. Estimates of annual deforestation rates from 2004 to 2017 for the Brazilian states within the known range of the golden conure. Numbers represent forest loss in km^2 per year (PRODES 2017, unpaginated). The final two shaded rows represent the percent of forest lost during the years noted (i.e., the year between 2017 and 2016, and the years between 2017 and 2004) (PRODES 2017, unpaginated).

	State				
Year	Pará	Maranhão	Amazonas	Rondonia	Mato Grosso
2004	8,870	755	1,232	3,858	11,814
2005	5,899	922	775	3,244	7,145
2006	5,659	674	788	2,049	4,333
2007	5,526	631	610	1,611	2,678
2008	5,607	1,271	604	1,136	3,258
2009	4,281	828	405	482	1,049
2010	3,770	712	595	435	871
2011	3,008	396	502	865	1,120
2012	1,741	269	523	773	757
2013	2,346	403	583	932	1,139
2014	1,887	257	500	684	1,075
2015	2,153	209	712	1,030	1,601
2016	2,992	258	1,129	1,376	1,489
2017	2,413	237	965	1,252	1,341
Var. 2017-2016	**-19%**	**-8%**	**-15%**	**-9%**	**-10%**
Var. 2017-2004	**-73%**	**-69%**	**-22%**	**-68%**	**-89%**

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Appendix D. A summary of known protected areas where the golden conure has been documented. The information summarized includes name, type and size of the protected area, the level of protection, notes, and sources. Acronyms include: IBA= Important Bird Are; NF= National Forest; BR= Biological Reserve; IUCN = International Union for the Conservation of Nature; N/A=not applicable; and Unk=unknown.

#	Name	State(s)	Size (ha)	Year Assessed	IBA Threat Level	Type	IBA protection level: Total	Partial	None	IUCN Cate-gory	Notes	Sources/ Literature Cited
1	Baixo Rio Xingu IBA	Pará	622,266	2008	High	IBA			X		The southern boundary is the Koatinemo & Trincheira Bacajá Indigenous Lands which have well-preserved forest stands.	BLI 2018a, unpaginated; Devenish *et al.* 2009, pp. 104-106
2	Caxiuanã / Portel IBA	Pará	3,422,612	2008	High	IBA			X		This IBA occurs within the Arióca-Pruanã Extractive Reserve (83,445 ha) with 7,149 ha of overlap. It also borders, but does not overlap with, the 317,947 ha Caxiuanã Forest.	BLI 2018b, unpaginated; Devenish *et al.* 2009, pp. 104-106
3	Cristalino / Serra do Cachimbo IBA	Pará, Mato Grosso	1,123,562	2008	High	IBA		X			This IBA overlaps with the following protected areas: (1) Nascentes da Serra do Cachimbo Biological Reserve (comprises 342,192 ha with complete overlap of the IBA); (2) Lote Cristalino Natural Heritage Reserve (670 ha with complete overlap); (3) Cristalino II State Park (118,000 ha with complete overlap); (4) Cristalino I & III Natural Heritage Private Reserve (4,068 ha with unknown overlap); (5) Cristalino I State Park (66,900 ha with complete overlap).	BLI 2018c, unpaginated; Devenish *et al.* 2009, pp. 104-106
4	Gurupi IBA	Pará, Maranhão	1,392,974	2008	High	IBA		X			This IBA comprises the Alto Turiaçú, Alto Rio Guama, Awa and Caru Indigenous lands, as well as the Gurupi Biological Reserve (area of overlap not reported).	BLI 2018d, unpaginated; Devenish *et al.* 2009, pp. 104-106

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The REBIO Gurupi is an integral protection conservation unit, created by decree number 95,614 of January 12th, 1988, which delimits a total area of 341,650 hectares. Subsequently, however, measurements of the area using a Global Positioning System corrected the area to 271,000 ha, partially located within the municipalities of Bom Jardim, Centro Novo do Maranhão, and São João do Carú, all in the state of Maranhão (Lima et al. 2014, p. 318)

5	Jamanxim / Altamira IBA [includes all of Jamanxim National Park]	Pará	1,541,628	2008	High	IBA		X			This IBA overlaps with the Jamanxim National Park (852,616 ha with complete overlap) and the Altamira National Forest (724,966 ha with 689,012 ha overlap).	BLI 2018e, unpaginated; Laranjeiras 2011a, unpaginated; Devenish *et al.* 2009, pp. 104-106
6	Jamari IBA	Rondônia	792,165	2008	Low	IBA	X				This IBA overlaps with the following protected areas: (1) Serras das Araras Ecological Station (27,160 ha with unknown area of overlap); (2) Samuel Ecological Station (69,931 ha with unknown area of overlap); (3) Rio Preto-Jacundá Extractive Reserve (119,769 ha with complete overlap); (4) Jamari National Forest (222,116 ha with 215,000ha of overlap); (5) Gavião State Forest (440 ha with complete overlap); (6) Araras State Forest (965 ha with complete overlap).	BLI 2018f, unpaginated; Devenish *et al.* 2009, pp. 104-106
7	Ji-Paraná / Roosevelt IBA	Rondônia, Mato Grosso	1,112,493	2008	Low	IBA	X				This IBA overlaps with the following protected areas: (1) Tucumã State Park (66,475 ha); (2) Rio Roosevelt Ecological Station (80,915 ha); (3) Rio Madeirinha Ecological Station (13,683 ha); (4) Manicoré State Forest (83,381 ha); (5) Jaru Biological Reserve (346,861). All areas completely overlap with this IBA with the exception of Manicoré which overlaps the IBA with 57,528 ha.	BLI 2018g, unpaginated; Devenish *et al.* 2009, pp. 104-106
8	Parque Nacional da Amazônia IBA [includes all of Amazonia National Park]		1,161,379		Unk	IBA	X			II	Overlaps completely with Amazon National Park; IUCN category II is a park used for conservation purposes .	Laranjeiras 2011a, unpaginated; Devenish *et al.* 2009, pp. 104-106
9	Rio Capim IBA	Pará	2,141,584	2013	High	IBA			X		This IBA includes the entire Amanaye Indigenous Land, between the Surubiju and Ararandeua Rivers, whose confluence forms the Capim River.	BLI 2018h, unpaginated; Devenish *et al.* 2009, pp. 104-106

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10	Itaituba National Forest	Pará	220,639	N/A	N/A	NF	N/A	N/A	N/A	VI	Protected area with sustainable use of natural resources	ICMBio 2018a, unpaginated; Laranjeiras 2011a, unpaginated
13	Tapajós National Forest	Pará	549,067	N/A	N/A	NF	N/A	N/A	N/A	VI	Protected area with sustainable use of natural resources; managed as a timber reserve	GFA 2018h, unpaginated; ICMBio 2018b, unpaginated; Laranjeiras 2011a, unpaginated
14	Trairão National Forest	Pará	257,526	N/A	N/A	NF	N/A	N/A	N/A	VI	Protected area with sustainable use of natural resources	Wikipedia 2018d, unpaginated; Laranjeiras 2011a, unpaginated
15	Caixuanã National Forest	Pará	317,947	N/A	N/A	NF	N/A	N/A	N/A	VI	Protected area with sustainable use of natural resources	Laranjeiras 2011a, unpaginated
16	Gurupi Biological Reserve		271,000	N/A	N/A	BR	N/A	N/A	N/A	Ia	Strict Nature Reserve	Lima et al. 2014, pp. 318, 323; Laranjeiras 2011a, unpaginated
17	Amaná National Forest		540,417	N/A	N/A	NF	N/A	N/A	N/A	VI	Protected area with sustainable use of natural resources	Guilherme 2014, pp. 1-3, 5

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