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**Article** *in* Australian Journal of Zoology · January 2007

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# Geographic range, population structure and conservation status of the green python (*Morelia viridis*), a popular snake in the captive pet trade

*David Wilson*[A,B,C] *and Robert Heinsohn*[A]

[A]Fenner School of Environment and Society, Australian National University, Canberra, ACT 0200, Australia.
[B]Present address: School for Tropical and Marine Biology, James Cook University, Townsville 4811, Australia.
[C]Corresponding author. Email: david.wilson2@jcu.edu.au

**Abstract.** Accurate knowledge of distribution and population size is required for effective conservation and management of wild species. Here we report on the first estimates of the distribution and density of the green python (*Morelia viridis*), an iconic rainforest species widely kept in captivity. We used climatic modelling to predict its distribution in Papua New Guinea, and both climate and vegetation mapping to predict its Australian distribution. We used mark–recapture methods to estimate the density and population structure of green pythons at Iron Range, northern Australia. Bioclimatic analyses suggested that there is extensive climatically suitable habitat in Papua New Guinea (≥200 000 $km^2$), but very little in Australia (~300 $km^2$). However, use of vegetation maps increases the predicted suitable area of occupancy in Australia to 3127 $km^2$, including nine regional ecosystems. Density estimates at Iron Range were 4–5 $ha^{-1}$ in the complex vine forest regional ecosystem; however, only half of these were mature adults. The large predicted area of occurrence and the high density in the one intensively studied area suggest that the species is not vulnerable to extinction in the short term. However, more studies are needed in both New Guinea and Australia, especially to quantify the impact of harvesting green pythons for the pet trade.

## Introduction

The green python (*Morelia viridis* Schlegel, 1872) is a small (<1.5 m) python inhabiting a large part of New Guinea, including some satellite islands, and Cape York Peninsula, Australia (Barker and Barker 1994; O'Shea 1996). Although there are records from a large geographic area, the true distribution and estimates of population size of the green python are largely unknown. Globally, the species is listed on Appendix 2 of the *Convention on International Trade in Endangered Species* (Inskipp and Gillett 2003), while the Australian population is listed as 'Rare or Insufficiently Known' (Cogger *et al*. 1994). Such conservation assessments are hampered by an inadequate knowledge of the species' biology. It is an iconic rainforest species, and one of the most sought-after snake species in the captive pet industry. This interest from the captive trade stems from the snake's striking colours and remarkable colour change, with individuals hatching either bright yellow or brick red and changing to bright green (Wilson *et al*. 2006*b*; Wilson *et al*. 2007). Many are exported from Indonesia (West Papua) each year to satisfy the captive pet trade (UNEP-WCMC CITES trade database). Despite the high profile of green pythons and the potential pressures on wild populations, information for determining their conservation status is severely lacking.

Here we use data at multiple scales to address these knowledge gaps, including two complementary methods to predict their distribution, both globally, and specifically in Australia. Climatically suitable habitat was predicted for Australia and Papua New Guinea, whereas in the Australian region these results were combined with the distribution of regional ecosystem known to be used by green pythons. Density and population structure were then estimated using data from an intensively studied population in northern Australia. We combine all known data and discuss the likely conservation status of this species in the wild following IUCN criteria (IUCN 2001).

## Methods

### *Species localities for predictive distributions*

Localities in Papua New Guinea were primarily derived from museum specimens, the locality lists in O'Shea (1996), or our fieldwork in Papua New Guinea conducted in late 2005. In Australia localities were primarily based on our fieldwork, with additional localities from personal communications with local people (see Appendices 1 and 2 for site details). Museum specimens were used only if their locality could be accurately determined. Locations consisted of a latitude, longitude and elevation. Where elevations were not recorded as primary data they were derived from topographic maps.

### *Distribution prediction*

BIOCLIM is part of the ANUCLIM software package (Houlder *et al*. 1999) and is used to predict the bioclimatic space occupied by an organism and to make predictions on the geographic presence or absence of that organism in a defined area. The BIOCLIM analysis procedure and general limitations are

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explained in detail elsewhere (Nix 1986; Lindenmayer *et al.* 1991; Nix and Switzer 1991; Houlder *et al.* 1999).

We derived two predicted distributions from the locality data, the total range of the species based on minimum and maximum predicted bioclimatic values, and the 'core' distribution based on the 10–90 percentile levels of the multivariate bioclimatic profile (Lindenmayer *et al.* 1991; Sumner and Dickman 1998). Core areas represent those areas that have the greatest conservation value for a species, and may act as refugia under altered climatic conditions (Lindenmayer *et al.* 1991). Locality data from Australia and Papua New Guinea were used independently for their own region when running BIOCLIM.

### *Regional ecosystem use*

As no detailed land cover classifications are available for New Guinea this technique was used only in Australia. The vegetation in Queensland has been categorised into regional ecosystems comprising a vegetation community that is consistently associated with a particular combination of landform and soil (Sattler and Williams 1999). Locations were overlain onto the regional ecosystem map for Queensland in ArcView 3.1 (ESRI 1999). The area of each regional ecosystem where green pythons were recorded was taken from Neldner (1999) and ArcView map areas (see Table 1). Habitat preferences *per se* were not examined as this requires comparison on used and unused sites, and unused sites are difficult to comprehensively determine for this species.

### *Density and abundance*

The density and regional ecosystem use of green pythons was studied in the Iron Range area, in north-eastern Australia (12°45′S, 143°17′E). The climate there is strongly seasonal, with most rain falling in a distinct 'wet' season between December and May (for more details see Wilson *et al.* 2006*b*).

Spotlighting transects were established in the four most common regional ecosystems in the Iron Range area:

- Complex vine forest (regional ecosystem 3.3.1),
- Transitional rainforest (regional ecosystem 3.12.8),
- Dune rainforest (regional ecosystem 3.2.12), and
- Woodland (regional ecosystem 3.3.31).

For further details of these ecosystems see Neldner (1999).

Due to logistic constraints, transect lengths varied between regional ecosystems and were discontinuous. There were 17 km of transect in complex vine forest, 3 km in woodland, 2.3 km in transitional rainforest and 1 km in dune forest, with a transect width of 30 m (15 m either side of the transect path). This width was the furthest from the transect that an individual could be reliably detected, as determined during two weeks of survey work before the first field season. Transects were surveyed for green pythons each fortnight for two consecutive wet seasons (December 2002–April 2003 and December 2003–April 2004) for a maximum of 21 surveys. Surveys commenced after 2000 hours and all sightings were made by hand-held spotlight from a slow-moving (<10 km $h^{-1}$) car or by foot. Green pythons observed on transects were initially marked with a uniquely coded passive integrated transponder tag (Gibbons and Andrews 2004), which was recorded on all subsequent survey encounters to generate a recapture history for each individual. The location of all sightings was recorded using a GPS (Garmin 12).

The open-population Jolly–Seber method in the program MARK (White and Burnham 1999) was used to analyse the recapture histories for this population. This method estimates the population abundance at the start of the survey period for a known area. For this model we assumed that survival was time dependent, but the probability of recapture was constant throughout the study.

Population demographic data were also collected from individuals during spotlight surveys. Morphological measurements taken from recaptures of individuals were used to determine growth rates, while the initial capture record for each individual was used to determine the sex and age structure of the population. Ages were determined from snout–vent lengths using the regression equation of Wilson *et al.* (2006*b*). The movements, home range and habitat use of individuals and of different sex and age classes were determined using radio-tracking techniques on 27 individuals that were followed for up to 451 days over 18 months (see Wilson *et al.* 2006*a* for more details).

## Results

### *Distribution*

In Papua New Guinea BIOCLIM predicts 245 535 $km^2$ of climatically suitable habitat, with a 'core' area of 26 321 $km^2$

**Table 1. Regional ecosystems categories where green pythons were found in Australia, the dominant tree species and the extent of each ecosystem.**

| Regional ecosystem | Vegetation description | Total extent in protected areas (ha)[A] | Total extent on Cape York (ha)[A] |
|---|---|---|---|
| 3.2.7 | *Corymbia intermedia* or *C. clarksoniana* woodland in wet coastal areas | 2420 | 11 300 |
| 3.2.12 | Araucarian microphyll vine forest on coastal dunefields and beach ridges | 1170 | 12 000 |
| 3.3.1 | Closed semideciduous mesophyll vine forest | 12 930 | 48 850 |
| 3.3.31 | *Eucalyptus tetradonta* ± *Corymbia clarksoniana* ± *C. tessellaris* woodland on coastal plains | 9460 | 55 000 |
| 3.5.5 | *Corymbia novoguinensis* ± *C. tessellaris* woodland on northern Cape York Peninsula | none | 6250 |
| 3.5.13 | *Melaleuca viridifolia*, *Asteromyrtus brassii* woodland on flat plains | 770 | 8615 |
| 3.11.3 | Simple evergreen notophyll vine forest on exposed metamorphic and granitic slopes | 8300 | 79 000 |
| 3.12.3 | Notophyll vine forest | 3150 | 77 600 |
| 3.12.8 | *Corymbia clarksoniana* ± *C. tessellaris* open forest on coastal ranges and lowlands | 2170 | 33 400 |
| Total for all vegetation types | | 40 370 | 332 015 |

[A]Values taken from Neldner (1999). Protected areas are those listed under the *Nature Conservation Act 1992*, and include national parks, conservation parks and resource reserves (Neldner 1999).

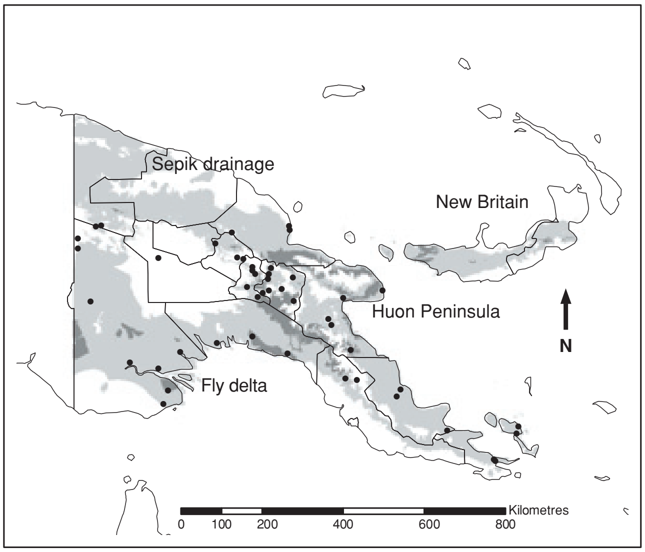


**Fig. 1.** BIOCLIM prediction of climatically suitable areas for the green python (*Morelia viridis*) in Papua New Guinea. Light grey represents total range, while dark grey represents the predicted core range. Dots are the sighting locations on which the prediction is based.

(Fig. 1). Large core areas are predicted on the lower slopes of the Huon Peninsula and southern portion of the central cordillera, plus parts of the trans-Fly region. Green pythons were predicted to be absent from the central highlands and swamp areas of the trans-Fly and Sepik drainages. BIOCLIM also predicts green pythons to be on New Britain, and many of the smaller satellite islands of New Guinea. In Australia BIOCLIM predicts there to be 292.82 $km^2$ of climatically suitable habitat, with a core area of 15.73 $km^2$ (Fig. 2*a*). This core area is contained within the Iron Range area, with smaller fragments of suitable habitat predicted further south in the McIllwraith Range and in isolated pockets (of single grid cells) further north along the coast. Interestingly, sites in Australia predicted no climatically suitable habitat in Papua New Guinea and *vice versa*.

### *Regional ecosystem preferences in Australia*

In Australia green pythons were recorded from nine regional ecosystems, totalling an area of 3127 $km^2$ (Fig. 2*b*, Table 1). Most of the suitable regional ecosystems were concentrated around the Iron and McIlwraith Ranges, with a smaller discrete area at the Lockerbie Scrub, and a few isolated patches between them (Fig. 2*b*). There were also suitable areas south of the Laura divide, notably in the Cape Melville area, but these were excluded from further analysis (see Discussion). Most records were from the Iron Range area, with two records each from the McIlwraith Range area and Lockerbie Scrub. Most records were from complex vine forest (regional ecosystem 3.3.1). There are 488.5 $km^2$ of this regional ecosystem on Cape York Peninsula, with 129.3 $km^2$ of this in protected areas (Neldner 1999).

### *Density, abundance and population structure*

In total, 101 individuals were captured 147 times in complex vine forest during the fortnightly surveys over the two wet seasons. The total number of green pythons in the surveyed area

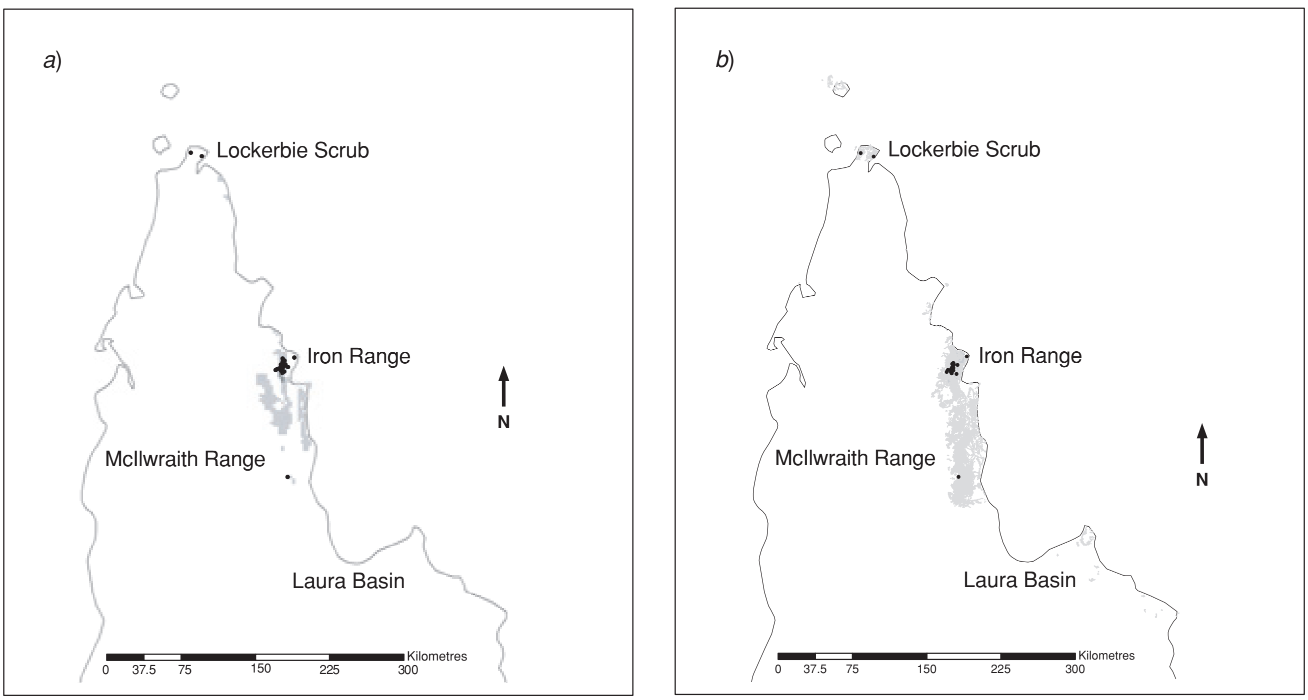


**Fig. 2.** Predicted distribution of the green python (*Morelia viridis*) in Australia. (*a*) BIOCLIM prediction of the total range. The core area is hidden under the clump of sightings at Iron Range. (*b*) Prediction based on regional ecosystem distributions matched with known sighting localities. In both cases dots are sighting localities on which the predictions are based.

of this regional ecosystem was estimated at 227 ± 85 (s.e.) using the Jolly–Seber model in MARK (White and Burnham 1999). Given a survey area of 50 ha (0.5 $km^2$, as defined in the Methods), this equates to ~4–5 $ha^{-1}$ in this regional ecosystem. Seven individuals were caught in transitional rainforest, but no recaptures were made, hence mark–recapture analysis techniques could not be used to estimate abundance in this regional ecosystem. Juveniles were found only in canopy gaps within complex vine forest and were never found in transitional rainforest. No green pythons were recorded from either the woodland or dune rainforests, and these transects were discontinued after 10 repeats.

On the basis of the known-age structure of this population (Wilson *et al*. 2006*b*) these 227 individuals comprise 49 adult females and 65 adult males, 75 immature females and 14 immature males, and 14 juvenile females and 10 juvenile males (Fig. 3*a*). The age structure of this population is positively skewed, with a mean age of 3.4 years and a maximum predicted age of at least 13 years (Fig. 3*b*).

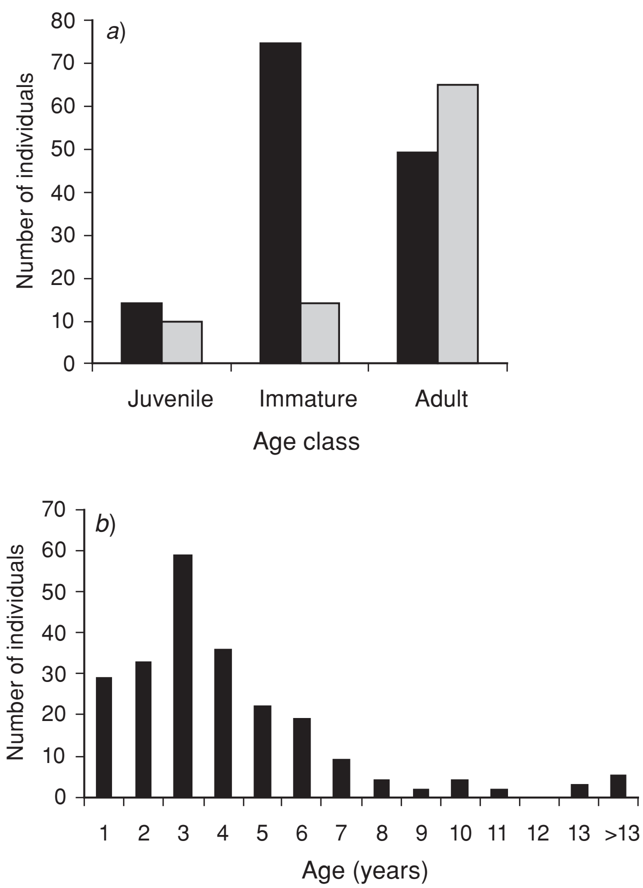


**Fig. 3.** Demographic composition of the green python (*Morelia viridis*) population in the survey area. Total numbers are based on the population estimate from a Jolly–Seber model in MARK, while the proportion in each category is based on the size distribution of all captures during fieldwork (Wilson *et al*. 2006*b*). Size class distributions (*a*) of females (black columns) and males (grey columns); age distributions of all individuals (*b*). Age categories listed are the upper bound of each range.

## Discussion

This study is the first to estimate the density and structure of a green python population and adds to our knowledge of this unusual and charismatic species in the wild. On the basis of bioclimatic data and the distribution of regional ecosystems used, green pythons appear to have a large potential distribution in Papua New Guinea, including inshore islands and much of the lowlands and foothills. In Australia green pythons are restricted to very small areas of suitable habitat on eastern Cape York Peninsula; however, the one intensively sampled regional ecosystem contained high densities of individuals.

### *Distribution*

Overall, the BIOCLIM analysis indicated that green pythons are potentially widely distributed in Papua New Guinea, but restricted to small areas of far northern Australia. BIOCLIM was chosen because of its simplicity of use and the requirement of presence-only data, rather than the presence or absence required by more detailed models (Elith *et al*. 2006). It is also a well established approach that has been used previously to predict the potential distributions for a variety of plant and animal species in Australia (Nix 1986; Lindenmayer *et al*. 1991, 1996; Olsen and Doran 2002). Climatic conditions in areas where green pythons were predicted to occur are characterised by hot and wet summers with cooler winters, typically corresponding to areas of rainforest.

In Papua New Guinea BIOCLIM predicts both a large core and total area of suitable habitat (Fig. 1). The distribution of green pythons could not be predicted in West Papua (Indonesia), as we could find no accurate climate models for this area, although we believe that this area would contain extensive suitable habitat due to the similar climate and landforms between Papua New Guinea and West Papua. Large areas of the central highlands were excluded, as were the higher altitudes on the Huon Peninsula and south along the central cordillera, presumably due to low minimum temperatures. Portions of the Fly delta (in the south-west), which are covered in low alluvial plains and flats, and the Sepik drainage (in the north), which is dominated by lowland freshwater swamps (Paijmans 1976), are also excluded from the predicted habitat. BIOCLIM predicts substantial climatically suitable habitat on New Britain, and on islands between New Britain and the mainland (Fig. 1), despite there being no records from any of these islands. These islands have never been connected to mainland New Guinea (Mayr and Diamond 2001), and green pythons have apparently not been able to colonise these islands. However, their presence on other oceanic islands such as Biak, off the north coast of Irian Jaya, shows that colonisation over water can occur. In contrast, the islands at the south-eastern tip of New Guinea were previously connected to the mainland (Mayr and Diamond 2001) and do contain green pythons (O'Shea 1996), as predicted by the BIOCLIM analyses.

The climatic analysis did not show a clear demarcation between the northern and southern watersheds in Papua New Guinea (Fig. 1). This is in contrast to the findings of Rawlings and Donnellan (2003), who found clear genetic differences between the northern and southern populations.

### Australian distribution

In Australia, both bioclimatic analysis and the distribution of regional ecosystems where green pythons were found were used to predict their potential distribution. Climatic modelling for the Cape York Peninsula area is poor due to the low number of data points (H. Nix, pers. comm. 2006), suggesting that, rather than using the regional ecosystems to further decrease the area predicted by climatic analysis (Meyer and Thuiller 2006), the two methods should be used in a complementary fashion. The area of regional ecosystems in Australia where green pythons have been found is considerably larger than the climatically suitable area as predicted by BIOCLIM (3127 $km^2$ compared with 293 $km^2$). Given this disparity, which one is closer to the true extent of occurrence of the green python? The distribution of location records in Australia may reflect the true distribution and density of green pythons, but may also represent the easiest access points into suitable habitat. Iron Range, where most records occur, is a popular area with both amateur naturalists and scientists due to the diversity of animal species that occur there (Kikkawa *et al*. 1981). In comparison, the McIlwraith Range is relatively remote and comparatively difficult to access. Areas of suitable regional ecosystems south of the Laura Basin were excluded from 'area of occurrence' estimates as no green pythons have been recorded from this area, and the Laura Basin is an effective barrier restricting the southward spread of rainforest species (Lavarack and Godwin 1987). Interestingly, BIOCLIM predicted no substantial areas of climatically suitable habitat in Australia where green pythons had not been previously recorded (Fig. 2*a*). Climatically suitable habitat exists in a few isolated locations between Iron Range and the northern tip of Cape York Peninsula; however, these do not appear to contain suitable vegetation (based on regional ecosystem mapping) and have never been surveyed for green pythons. Even the Lockerbie Scrub, where there were two green python records, has little climatically suitable habitat (Fig. 2*a*).

This study highlights the markedly different conclusions that may be drawn using different distribution prediction methods (Loiselle *et al*. 2003). There are biases in both methods and neither option should be viewed as more accurate. Both models should be used as indicators of predicted distribution, and be considered in conjunction with other traits that may limit distribution . Importantly, both methods predict the Iron Range area to be core habitat for green pythons in Australia, highlighting the conservation significance of this area (Mackay and Nix 2001). The Iron–McIlwraith Range area forms the largest remaining area of lowland tropical rainforest in Australia, and is distinct from more southerly rainforests in its flora and fauna. Both floristically and faunally, this area is more related to the Melanesian lowland rainforests of New Guinea, with which it shares a large number of genera and species (Kikkawa *et al*. 1981; Webb and Tracey 1981; Crisp *et al*. 2001).

### Density and abundance

Our estimate of 4–5 $ha^{-1}$ in complex vine forest is well within the range of densities reported, both for snake species worldwide and most other published studies on tropical snake species (Parker and Plummer 1987; Brown and Shine 2002). The density of green pythons was actually greater than expected. Individuals were rarely encountered during fieldwork, with new individuals encountered only every 2–3 h (authors' unpub. data). However, in support of our estimates, although we caught only 101 individuals during surveys, in total we caught 207 individuals in the study area during all research, similar to the 227 individuals predicted in the same area using the Jolly–Seber model. Radio-tracking shows that individuals do not always come to the ground at night to hunt (Wilson 2007), and this behaviour may give the impression of fewer individuals than suggested by the density estimates. The age structure of the Iron Range population appears to be healthy, with significant numbers of juveniles and a high proportion of recently mature adults.

There have been two other well studied Australian pythons, the carpet python (*M. spilota imbricata*), which had a density of ~0.5 $ha^{-1}$ in temperate south-western Australia (Pearson *et al*. 2005), and the water python (*Liasis fuscus*), which had encounter rates of ~0.5 $h^{-1}$ (Brown and Shine 2002), similar to the encounter rate for green pythons (authors' unpub. data). By comparison, Schulte (1988) estimated the density of the emerald tree boa (*C. caninus*) to be 0.004 $ha^{-1}$ in the Peruvian Amazon. This discrepancy is particularly noteworthy as green pythons and emerald tree boas show strikingly convergent evolution in many aspects of their ecology. Both species are tropical, arboreal specialists and show ontogenetic colour change from yellow or red juveniles to green adults at ~55 cm (Stafford and Henderson 1996; Wilson *et al*. 2006*b*).

Our density estimates suggest that there are substantial numbers of green pythons in complex vine forest at Iron Range, and this area represents the single largest known population in Australia. Adult green pythons were also observed in areas of transitional rainforest, but juveniles were never recorded in this regional ecosystem. This suggests that transitional rainforest can be recolonised, but may not be suitable for breeding in. Green pythons were opportunistically recorded in a further three regional ecosystems in the Iron Range area; however, density estimates are not available for these areas. These ecosystems lie primarily within the protected area of the Iron Range National Park.

Green pythons were twice recorded from the McIlwraith Range to the south of Iron Range (Christian 1997; K. McDonald, pers. comm. 2002) and these two areas may be connected by gallery rainforest (Legge *et al*. 2004). Although individual daily movements are small, the fact that they are constantly active and males have a roaming strategy (Wilson *et al*. 2006*a*) suggests that the Iron Range and McIlwraith populations would be connected wherever habitat corridors exist. There is a smaller area of suitable regional ecosystem further north at the Lockerbie Scrub where green pythons have twice been recorded (Waldren 1996; S. Templeton, pers. comm. 2004). At most, this area might contain a few hundred individuals and the Lockerbie Scrub may be too small to support a green python population that is viable in the long term.

Although the density of green pythons in the complex vine forest seems high, we hesitate to extrapolate our estimates to the entire possible range of green pythons. It would be problematic to extrapolate the density estimates from the one regional ecosystem at Iron Range to the McIlwraith Range for several reasons. First, there have been only two reports of green pythons from the McIlwraith Range in the last 150 years (authors'

**Table 2. Assessment of the world and Australian populations of the green python (*Morelia viridis*) against the summarised IUCN Vulnerable criteria (IUCN 2001)**

| IUCN Criteria | World | Australia |
|---|---|---|
| A. Has there been, or is there projected to be, a population decrease of more than 30% in 10 years? | Not known | Not known |
| B. Is the population extent of occurrence ≤20 000 km$^2$ or the area of occupancy ≤2000 km$^2$? | No | No |
| C. Is the population estimated at ≤10 000 mature individuals? | No | No |
| D. Is the population size ≤1000 individuals or with a very restricted area, such that it is quickly capable of becoming endangered? | No | No |
| E. Does quantitative analysis show the probability of extinction in the wild is at least 10% within 100 years? | Not undertaken | |
| Does the species qualify for Vulnerable status? | No | No |

unpub. data) and this makes any extrapolation tenuous. Second, although a density estimate is available for one of the regional ecosystems that occurs in the McIlwraith Range, actual densities may vary between the two areas, as has been shown in other snake species (Parker and Plummer 1987; Henderson 2002). Third, there are substantial areas of regional ecosystems where, although green pythons have been recorded, density estimates are not available. Ideally, surveys should be carried out in all regional ecosystems where green pythons are known to occur, both at Iron Range and in the McIlwraith Range region to estimate densities in these potentially important ecosystems.

### *Conservation status*

Our data suggest that green pythons do not satisfy the IUCN criteria (Table 2) for being listed as vulnerable, either globally or within Australia. We must stress that important information is still lacking, especially for the potentially larger New Guinea population and, as such, there is a large element of uncertainty in this conclusion. Although our bioclimatic analysis demonstrated large areas of suitable habitat in Papua New Guinea, and similarly large areas are probably also available in western New Guinea, there are currently no data available covering the extent to which local people hunt them for food. Further, although they are known to be taken for the international pet trade in West Papua, numbers taken and population densities for different regions are not currently available.

In Australia we have a more detailed knowledge of their distribution and population size. Green pythons do not appear to be vulnerable under any of the IUCN criteria (Table 2); however, further work needs to be undertaken to refine our assessment. Long-term information on population trends is lacking, as are density estimates from the other eight regional ecosystems where green pythons were recorded. The population structure at Iron Range also shows that mature individuals comprise less than 50% of the total population, reducing the effective population size. Surveys are needed in both the McIlwraith Range and at Lockerbie Scrub to determine the density and distribution of green pythons in these areas. Hence we conclude that there are insufficient grounds to list green pythons as threatened, either globally or in Australia, but reiterate the need for further study, especially in New Guinea.

## Acknowledgements

We thank all the people who helped search for specimens in the field, especially K. and A. Goetze, S. Legge, S. Murphy, B. Robinson, E. Sobey and K. Wilson. K. Nissen and J. Stein helped to generate maps. This research was funded by the Australian Geographic Society, National Geographic Society and the Hermon Slade Foundation. Appropriate permits were issued by the Queensland Environmental Protection Agency (WITK00337502) and the Australian National University (C.RE.24.02 and 27.02).

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Manuscript received 12 September 2006, accepted 15 May 2007

**Appendix 1. Details of locations in Papua New Guinea used in the BIOCLIM prediction of the distribution of the green python (*Morelia viridis*) in Papua New Guinea**

| Location | Latitude | Longitude | Elevation (m) |
|---|---|---|---|
| Abam | 8.95 | 143.183 | 50 |
| Aitape | 3.13333 | 142.333 | 0 |
| Aiyurafu | 6.56667 | 145.333 | 1968 |
| Aramia River | 7.93333 | 143.367 | 1 |
| Baiyer | 5.53333 | 144.15 | 1170 |
| Biniguni | 9.66667 | 149.283 | 198 |
| Bulolo | 7.2 | 146.65 | 794 |
| Chimbu River | 6.05 | 144.967 | 871 |
| Dede | 8.3 | 142.883 | 1 |
| Derongo | 5.41667 | 141.1 | 314 |
| Fergusson Island | 9.55 | 150.667 | 0 |
| Finschafen | 6.56667 | 147.85 | 0 |
| Garaina | 7.88333 | 147.15 | 699 |
| Goroka | 6.06667 | 145.383 | 1524 |
| Kainantu | 6.28333 | 145.867 | 1553 |
| Kapuma | 7.58333 | 144.967 | 1 |
| Karimui | 6.5 | 144.85 | 983 |
| Kebil | 6.2 | 145.033 | 1840 |
| Kerema | 7.96667 | 145.75 | 1 |
| Kunini | 9.08333 | 143 | 0 |
| Kwima | 6.13333 | 144.967 | 1541 |
| Lae | 6.73333 | 146.983 | 1 |
| Lake Murray | 6.81667 | 141.383 | 59 |
| Lufa | 6.31667 | 145.317 | 1621 |
| Mafulu | 8.51667 | 147.033 | 1500 |
| Maiwara | 10.35 | 150.35 | 0 |
| Mt Lamington | 8.91667 | 148.167 | 1679 |
| Nivi | 6.2 | 145.333 | 1646 |
| Nondugl | 5.86667 | 144.767 | 1702 |
| Normanby Island | 10 | 151.167 | 0 |
| Okapa | 6.53333 | 145.617 | 1814 |
| Omati | 7.73333 | 144.183 | 0 |
| Popondetta | 8.76667 | 148.25 | 156 |
| Simbai | 5.28333 | 144.517 | 2009 |
| Sinaeada | 10.3167 | 150.317 | 48 |
| Sturt Island | 8.16667 | 142.25 | 0 |
| Telefomin | 5.13333 | 141.617 | 1240 |
| Urapmin | 5.15 | 141.5 | 1808 |
| Waghi | 5.83333 | 144.633 | 0 |
| Wau | 7.33333 | 146.717 | 1200 |
| Woitape | 8.55 | 147.283 | 1850 |
| Wombon | 5.63333 | 141.1 | 191 |
| Wonenara | 6.8 | 145.883 | 1559 |
| Zim | 8.78333 | 143.1 | 91 |

**Appendix 2. Details of locations in Australia used in the BIOCLIM prediction of the distribution of the green python (*Morelia viridis*) in Australia**

| Location | Latitude | Longitude | Elevation (m) |
|---|---|---|---|
| Chili Beach 1 | 12.6299 | 143.422 | 5 |
| Chili Beach 2 | 12.629 | 143.425 | 5 |
| Chili Beach 3 | 12.6293 | 143.427 | 5 |
| Iron Range 1 | 12.741 | 143.285 | 20 |
| Iron Range 2 | 12.7437 | 143.283 | 50 |
| Iron Range 3 | 12.7104 | 143.293 | 80 |
| Iron Range 4 | 12.7541 | 143.288 | 50 |
| Iron Range 5 | 12.7143 | 143.319 | 70 |
| Iron Range 6 | 12.7096 | 143.297 | 80 |
| Iron Range 7 | 12.7644 | 143.287 | 92 |
| Iron Range 8 | 12.78 | 143.309 | 104 |
| Iron Range 9 | 12.7769 | 143.282 | 116 |
| Iron Range 10 | 12.7061 | 143.297 | 57 |
| Iron Range 11 | 12.6987 | 143.3 | 128 |
| Iron Range 12 | 12.6993 | 143.303 | 140 |
| Iron Range 13 | 12.7458 | 143.232 | 152 |
| Iron Range 14 | 12.7136 | 143.3 | 164 |
| Iron Range 15 | 12.7459 | 143.23 | 103 |
| Lockerbie 1 | 142.58 | 10.78 | 5 |
| Lockerbie 2 | 142.46 | 10.79 | 80 |
| Peach Creek 1 | 13.7367 | 143.339 | 530 |
| Peach Creek 2 | 13.7372 | 143.339 | 550 |



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