

American corn snake

Elaphe guttata



Steve Csurhes and Paul Fisher

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Summary

Elaphe guttata (American corn snake) is a small to medium-sized slender snake up to 180 cm long, native to the south-eastern United States. Colour is highly variable.

E. guttata is a generalist predator of a wide range of insects, amphibians, lizards, small mammals and birds. It can occupy a diverse range of habitats including open grassland, forest, agricultural land and semi-urban areas.

This study was unable to find evidence that *E. guttata* was a major pest anywhere. However, it is in the early stages of naturalisation and population development on several Caribbean islands, after being transported with cargo from the United States.

E. guttata is the most popular pet snake in the world, as it is easy to keep, comes in vivid colours and is easy to breed. Large numbers are kept both legally and illegally around the world.

E. guttata has several attributes that suggest it has the potential to become a widespread and abundant invasive pest in Queensland:

1. It is climatically pre-adapted to large areas of Queensland.
2. It is a generalist predator and would have little difficulty finding sufficient food items if naturalised in Queensland.
3. It tolerates a diversity of habitats that exist in Queensland.
4. It breeds freely and prolifically.
5. It has successfully naturalised elsewhere.

The brown tree snake, which ranks as one of the most destructive invasive animals in the world due to its irreversible impacts on native bird species in Micronesia, has comparable biological attributes.

E. guttata poses little risk to human safety, since it is non-venomous and reluctant to bite. Similarly, there is no evidence to suggest it poses a threat to agriculture.

In the event that *E. guttata* successfully naturalised in Queensland, detection and eradication would be unlikely. Closely related species have home ranges of 18–93 ha and can travel 8 km in search of a mate. When combined with an ability to hide under any object and to climb trees, detection is very difficult. As such, preventative legislation that avoids introduction, possession and sale is perhaps our only defence.

Introduction

Identity and taxonomy

Species identity: *Elaphe guttata* (Linnaeus 1766)

Common names: Corn snake, red rat snake, great plains rat snake, Emory's rat snake

Taxonomy

Elaphe guttata is in the Colubridae family of snakes, a family that contains two-thirds of all snake species. The genus contains 11 species, typically referred to as 'rat snakes'. *E. guttata* has at least two subspecies: the common corn snake (*Elaphe guttata guttata*) and the great plains or Emory's rat snake (*Elaphe guttata emoryi*). In this document the term 'corn snake' therefore includes both species, unless otherwise stated.

Synonyms of *Elaphe guttata guttata* include:

- *Pantherophis guttatus*
- *Pantherophis guttatus guttatus*.

Synonyms of *Elaphe guttata emoryi* include:

- *Pantherophis emoryi*
- *Pantherophis guttata emoryi*.

Description and biology

E. guttata guttata can be difficult to identify due to its highly variable colours and patterns (both in the wild and due to captive breeding). Perhaps the most common form is orange or brownish-yellow, with large black-edged red blotches down the middle of its back. It typically has alternate black marks on its underside, giving a checker-board appearance. *Elaphe guttata emoryi* generally has similar coloration being grey or tan with dark-grey, brown or green-grey blotching down its back.

Both subspecies are relatively slender snakes and grow to 60–180 cm. Specimens can live for up to 25 years.

In colder parts of its native range, *E. guttata* hibernates during winter. However, in the warmer climates along the south-eastern coast of the United States they shelter in rock crevices and logs during cold weather and come out on warm days to soak up the heat of the sun—a process known as brumation. During cold weather, snakes are less active and therefore hunt less (NatureServe 2009).



Figure 1. (A) Typical corn snake (*Elaphe guttata guttata*)—taken by Vassil
(B) Great plains rat snake (*Elaphe guttata emoryi*)—taken by LA Dawson

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Colour morphs

Highly variable colour morphs are generated via alteration to skin pigmentation, including loss of one or more pigments. Within the species' native range, specific colour morphs tend to be associated with certain regions. Many of these colour morphs are rare in the wild. However, after extensive captive breeding, many are common in the pet trade. New colour morphs can be developed via crossbreeding. Descriptions of the main morphs are presented in Table 1. Figure 2 shows a wild colour type and an amelanistic morph for comparison.



Table 1. Wild type and selectively bred colour morphs of *Elaphe guttata*

(This table uses information from Wikipedia contributors, ‘Corn Snake’, *Wikipedia, The Free Encyclopedia*, 26 August 2009, 14:25 UTC, <http://en.wikipedia.org/w/index.php?title=Corn_Snake&oldid=310169262> accessed 8 September 2009.)

Name of colour morph	Common name of morph	Description
Wild type	Normal	Orange with black lines around red-coloured saddle markings going down the back, with black and white checkered bellies
Wild type (regional)	Miami/Florida	Often smaller snake with some specimens having high contrasting light-silver to grey ground colour, with orange saddle markings surrounded by black
Wild type (regional)	Carolina/okeetee	Deep-red dorsal saddle marks surrounded by very black borders; the ground colour varies, with bright orange being popular among breeders
Amelanistic <i>Selectively bred</i>	Candy cane	Red saddle marks on a white background, often the background is orange/yellow
Amelanistic (okeetee) <i>Selectively bred</i>	Reverse okeetee	An amelanistic okeetee snake that has the normal black rings around the saddle marks replaced with wide white rings
Anerythristic	Black albino	Lacking erythrin (red, yellow and orange) pigments; produces a snake that is mostly black, grey and brown.
Hybrid (<i>Elaphe guttata</i> x <i>Lampropeltis getula californiae</i>)	Jungle	These show extreme pattern variations, taking markings from both parents



Figure 2. Wild-type and amelanistic corn snakes—image by Piatkowskk (2006)
(Reproduced from Wikimedia Commons under the terms of a GNU Free Documentation License)

Diet

Adults typically feed on rodents and other small animals including bats and birds. They hunt on the ground and in trees (arboreal). Juveniles feed on smaller prey such as insects, frogs and lizards. Prey is killed by constriction since the species is not venomous.

Reproduction

Mating occurs shortly after winter with eggs laid about one month after mating. Clutch size varies from 10–12 eggs, but can be up to 24. The eggs are usually laid in warm areas with high humidity (e.g. near rotting logs, decaying vegetation). Once laid, the adult snake abandons the eggs and does not return to them. The eggs hatch in approximately 65 days. Newly hatched snakes are about 25 cm long. Sexual maturity occurs after 600 days. Longevity can exceed 20 years in the wild (de Magalhaes & Costa 2009).

E. guttata can hybridise with related species, including the Californian king snake (*Lampropeltis getula californiae*). Despite belonging to different genera, offspring are sexually viable.

Predators and diseases

E. guttata are often taken by large birds and other reptiles (including snakes).

E. guttata represents a potential host for foreign pests and diseases, which could threaten native Australian and domestic animals. For example, some reptiles can potentially carry ticks that spread the bacterium *Cowdria ruminantium* that, although not lethal to reptiles, can kill grazing animals. *E. guttata* is a vector of cryptosporosis (Xioa et al. 2004).



Origin and distribution

E. guttata is native to the eastern and southern United States including the states of Arkansas, Mississippi, Alabama, South Carolina, North Carolina, Kentucky, Virginia, Maryland, Delaware, New Jersey, Florida, Texas, Louisiana and Georgia (Reptile Database, J Craig Venter Institute <<http://www.jcvi.org/reptiles/search.php>>). Some sources suggest that its range in the United States is more extensive and includes central states and Mexico (Lever 2003). Whether this is a result of natural range extension or human-assisted translocation is unknown.

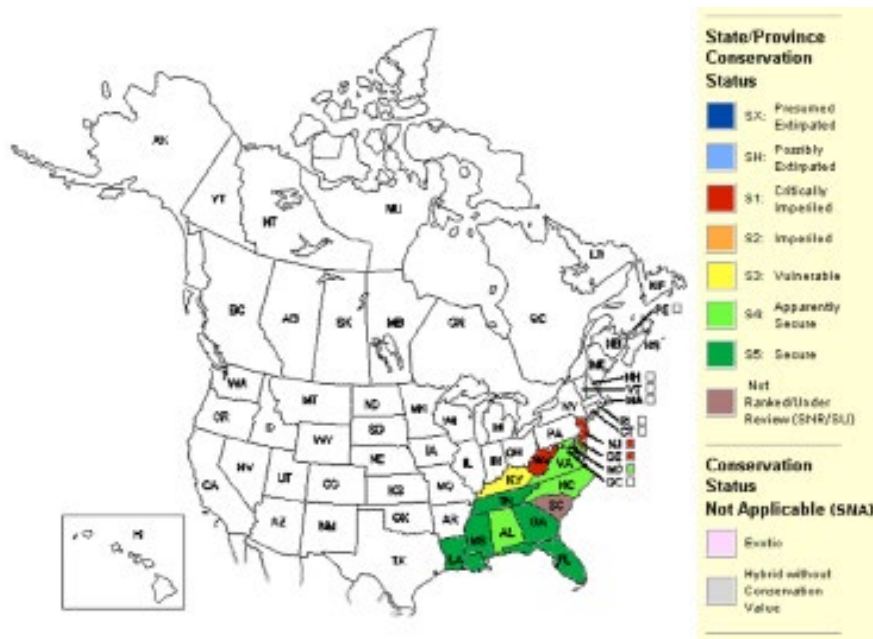


Figure 3. Native distribution of *Elaphe guttata* (NatureServe 2009)

E. guttata has naturalised on a number of Caribbean islands, including the Cayman Islands, United States Virgin Islands, Anguilla, Antigua and St Bartélmy (Powell & Henderson 2003, Perry et al. 2003). Their introduction to the Cayman Islands is thought to have originated from a single newly hatched clutch of eggs transported within an ornamental plant destined for a golf course on the island (Lever 2003).

Accidental transportation of live specimens probably happens regularly, since the species is frequently found within cargo (mainly from Florida and south-eastern United States). For example, small numbers have been sighted in South America (Lever 2003), Sao Paulo City, Brazil (Eterovic & Duarte 2002) and Taiwan (Shiau et al. 2006), as well as the Caribbean generally. However, in many cases it is too early to tell if self-sustaining wild populations have established.

Status in Australia and Queensland

E. guttata has not yet naturalised in Australia or Queensland. However, since it is kept illegally as a pet, there are occasional sightings of escaped or dumped animals. For example, single specimens were detected in the Hawkesbury area, New South Wales, (New South Wales Department of Environment and Climate Change 2008) and more recently in Cairns, Queensland (2009).

It is an offence to keep *E. guttata* as a pet in Australia and only a small number are kept under permits in zoos and reptile parks.

E. guttata is the most commonly kept pet snake in the world. This is not surprising since it is easy to keep, comes in a variety of colours and can be easily bred. Accordingly, demand is high. Illegal wild-type specimens can sell for \$500 and \$1000 in Australia, with selectively bred colour morphs fetching much higher prices (Keith Larner 2009, pers. comm.). As such, there is a commercial incentive for people to keep and breed this species, and perhaps smuggle it into the country.

Illegally kept specimens are regularly seized within Australia by state and federal government officers. Table 2 details the number of illegally seized specimens and eggs in Victoria over the last 10 years.

Table 2. Number of adult *Elaphe guttata* and eggs seized in Victoria since 1999 (data provided by Keith Larner, Department of Sustainability and Environment, Victoria)

Year seized	Corn snake	Corn snake eggs
1999–2000	0	0
2000–2001	0	0
2001–2002	0	0
2002–2003	39	18
2003–2004	14	0
2004–2005	10	0
2005–2006	1	0
2006–2007	14	0
2007–2008	1	0
2008–2009	2	0

Preferred habitat

E. guttata can survive in a range of habitats, including open forests/forest openings, pine woodland, grassland (and overgrown fields), shrub lands, rock hillsides, cultivated or agricultural land, urban areas, mangrove thickets, barnyards, abandoned buildings, areas near springs and old rubbish dumps (Ernst & Ernst 2003).

History as a pest elsewhere

While *E. guttata* has naturalised on a number of Caribbean islands—including the Cayman Islands, United States Virgin Islands, Anguilla, Antigua and St Bartélmey (Powell & Henderson 2003, Perry et al. 2003)—its impact on the local environment is poorly documented. This is probably due to the snake's recent arrival and, therefore, small population size (Platenberg & Boulon 2006). Nonetheless, they are considered to pose a significant long-term threat (Platenberg & Boulon 2006). As has occurred in places such as Micronesia, invasive snakes can have devastating impacts on local wildlife. On the island of Guam, introduced brown tree snakes (*Boiga irregularis*) have significantly reduced populations of several locally native bird species (Rodda et al. 1999). Hence, it seems reasonable to be concerned at the potential impact of other generalist predators such as *E. guttata*. Of particular concern, is a study by Hayes et al. (2004) that listed *E. guttata* as a significant threat to the endangered brown-headed nuthatch on Grand Bahama.

Pest potential in Queensland

E. guttata has several attributes that suggest it has the potential to become a significant invasive pest in Queensland:

- 1 It is climatically pre-adapted to humid subtropical areas of south-east Queensland, possibly extending into drier areas further west and north-west.
- 2 It is a generalist predator and would have little difficulty finding sufficient food items if naturalised in Queensland.
- 3 It tolerates a diversity of habitats that exist in Queensland.
- 4 It breeds freely and prolifically.
- 5 It has successfully naturalised elsewhere.

The brown tree snake, which ranks as one of the most destructive invasive animals in the world due to its irreversible impacts on native bird species in Micronesia, has comparable biological attributes.

The risk to human safety is considered small, since this species is non-venomous and generally reluctant to bite. Similarly, there is no evidence to suggest this species poses a threat to agriculture.

Climate match

Using the Climatch software, version 1.0 (Bureau of Rural Sciences), the area of Australia where the climate appears suitable for survival of *E. guttata* was predicted (Figure 4). Substantial areas of Queensland and Australia, highlighted in red and orange, appear to have climate types that are similar to climates experienced within the species' native range. Tropical savannas and the coastal wet tropics of north Queensland appear less suitable. Tasmania appears least suitable.

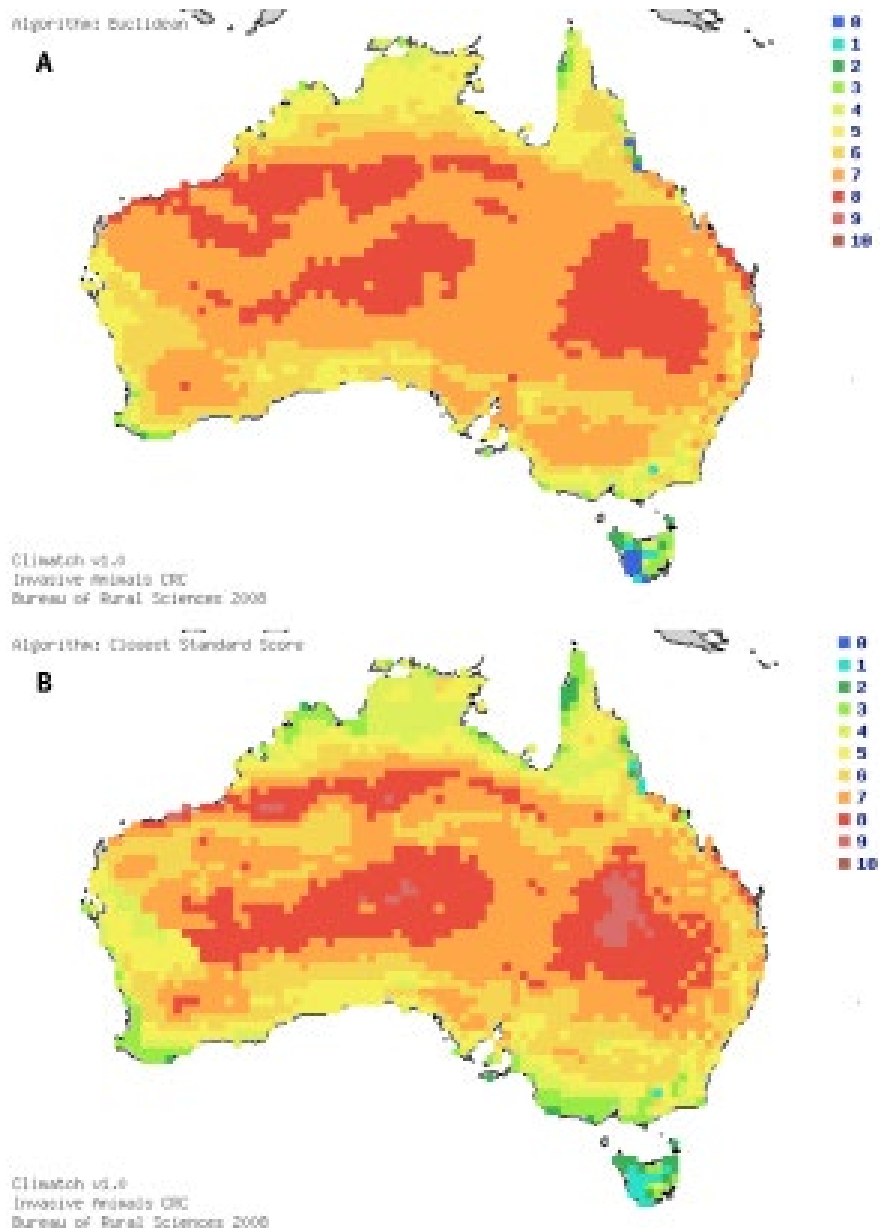


Figure 4. Climatch results for *Elaphe guttata* in Australia, using two distinct algorithms: (A) euclidean and (B) closest standard score (the scale indicates the degree of climate-match, with 10 being the highest or most suitable climate)

Habitat match

E. guttata is an ecological generalist that can survive in a diverse range of habitats from grassland, forest and agricultural land to semi-urban areas. Consequently, it is likely to find favourable habitat types in Queensland.

Generalist diet

E. guttata has a varied and opportunistic diet, including amphibians, lizards, small mammals and birds. Suitable prey items exist in Queensland and the species is predicted to have little difficulty finding sufficient food for survival and reproduction in the wild. No doubt, *E. guttata* would compete for food with a range of other generalist (native) reptilian predators.

High fecundity

E. guttata can lay up to 24 eggs per clutch (usually 10–12) and is likely to reproduce freely and quickly if naturalised in suitable habitat types in Queensland. A wild population could develop from the escape or release of a small number of individuals, as is believed to have occurred on the Cayman Islands where a wild population appears to have developed from a single clutch of eggs.

Risk of introduction and release

The species' most likely invasion pathway is via the illegal pet trade. Experienced reptile keepers admit that *E. guttata* can readily escape from enclosures, due to its small size and general agility. In addition, there is a risk that people will dump unwanted breeding stock into the wild in the belief that they are providing a 'good home' for the animals, a problem common to all domestic pets.

A less likely avenue of introduction is via live specimens (or eggs) hitching a ride within cargo from the south-eastern United States. For example, corn snakes on St Thomas (in the United States Virgin Islands) entered on uninspected construction cargo from the south-eastern United States.

Numerical risk analysis

Two separate numerical models developed by Bomford (2008) were applied to further assess the pest and establishment risk of *E. guttata* in Australia. Both models generated 'serious risk' scores (see the Appendix).

Appendix

Risk assessment using the Australian reptile and amphibian model

Using the Australian reptile and amphibian model (Bomford 2008), *E. guttata* was scored as a serious establishment risk.

Species	<i>Elaphe guttata</i> (corn snake)	
Date of assessment	10 September 2008	
Literature search type and date	See references	
A. Climate match	67	High climate match in Australia = 63 (Bureau of Rural Sciences 2006) (Figure 4)
B. Exotic population established overseas (0–4)	30	Species has been introduced into another country (United States Virgin Islands)
C. Taxonomic family risk score	10	Colubridae = 10

Risk assessment using the bird and mammal model (adapted for reptiles)

Using the bird and mammal model, adapted for reptiles (Bomford 2008), *E. guttata* was ranked as having a serious establishment risk.

Species	<i>Elaphe guttata</i> (corn snake)	
Date of assessment	10 September 2008	
Literature search type and date	See references	
A. Climate match	5	Very high climate match in Australia = 2083 (Bureau of Rural Sciences 2006) (Figure 4)
B. Exotic population established overseas (0–4)	2	Species has been introduced into mostly small islands = 2 (United States Virgin Islands)
C. Taxonomic family risk score	1	Global range—200 000–2 500 000 km ² (NatureServe 2009) = 1

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