



# Pest risk assessment

Asian spined toad (*Duttaphrynus melanostictus*  
syn. *Bufo melanostictus*)

**DELIVERING**  
FOR QUEENSLAND



**Queensland**  
Government

This publication has been compiled by Steve Csurhes and Caitlin Davies of Biosecurity Queensland, The Department of Primary Industries.

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## Summary

The Asian spined toad (*Duttaphrynus melanostictus*) is closely related to one of Queensland's most infamous pests, the cane toad (*Rhinella marina*). While the cane toad is native to South America, the Asian spined toad is native to Asia.

Much like the cane toad, the Asian spined toad is highly fecund, producing up to 40,000 eggs per clutch. It is also poisonous, has a generalist diet and is well adapted for life in urban areas.

Asian spined toads are abundant in Bali and Papua New Guinea. Although not currently naturalised in Australia, they are regularly intercepted within baggage, shipping containers, vehicles and other imported goods.

Pest risk assessment suggests that Asian spined toads are highly likely to naturalise in Queensland. Moreover, the species has the potential to become a significant pest, with impact comparable to the cane toad. Habitats most at-risk include all tropical, coastal areas of northern Queensland, extending to coastal sub-tropical areas.

Preventative measures in the form of border quarantine exclusion, as well as post-border surveillance and early detection are vital to prevent naturalisation.

## Identity and taxonomy

**Species:** *Duttaphrynus melanostictus* (Schneider 1799)

**Synonyms:** *Ansonia kamblei*, *Bufo tienhoensis*, *Bufo melanostictus*

In 2006, a review of amphibian taxonomy placed *Bufo melanostictus* in a new genus, *Duttaphrynus* (Frost *et al.* 2006).

**Common names:** Asian spined toad, Southeast Asian toad, Asian common toad, spectacled toad, common Indian toad, black-spined toad, common Sunda toad, black-lipped toad, keeled-nosed toad, South Asian garden toad, black-spectacled toad, house toad, Asiatic toad, Asian eyebrow-ridge toad, Asian black-spotted toad, and Javanese toad.

**Family:** Bufonidae

*Bufo* is a genus of about 225 species of true toads. It is a cosmopolitan genus with species in all regions of the world except the Arctic, Antarctic, Australia, New Guinea and neighbouring islands. The genus *Bufo* has been subject to numerous taxonomic reviews. As a result, the genus has been split into numerous genera including *Duttaphrynus* (many Asian species) and *Rhinella* (including the cane toad) (Frost 2024). As such, the currently accepted name is *D. melanostictus*. The taxonomy of *D. melanostictus* is still subject to debate (Frost 2024).

*B. melanostictus* may be confused with *Rhinella marina* (cane toad), though the former is smaller with distinctive black warts (CaneToadsinOz.com 2009). Morphology is highly variable, especially the juveniles. As a result, it is often confused with co-existing species throughout its range (Daniels 2005). Similar species include Indian and other South and Southeast Asian toads such as *Bufo cyphosus*, *Bufo himalayanus*, *Bufo microtympanum*, *Bufo noellerti*, and *Bufo stuarti*. Juvenile *B. melanostictus* are sometimes confused with *Bufo microtympanum* (Daniels 2005).

## Description

*B. melanostictus* is a stocky, medium-sized to large toad with a relatively small head and short hind limbs. Snout-vent length of males is between 57–83 mm, and females between 65–85 mm, sometimes exceeding 150 mm. The head has elevated bony ridges, with long dark crests that border the eyelids and run down on either side of the eye. Another thicker crest runs from the eye to the parotoid gland. The parotoid glands are very prominent, oval-shaped and about as long as eye and snout combined.

Colour is highly variable, usually being greyish or reddish brown, but can range from plain brick-red to almost black. The most common colour pattern is pale yellow-brown marked boldly with dark or reddish-brown streaks and spots. In juveniles, the throat has a blackish band that runs between the chin and breast. The back is covered with round warts of varying sizes, often surrounded by darker pigment and capped with tiny dark spines. There are pimple-like warts on the sole and toes. The juveniles lack warts and often have a very inconspicuous eardrum. The underside is largely whitish with fine black spots. Males have a subgular vocal sac, and breeding males have a bright yellow orange throat region and develop cornified pads on the inner side of the first and second fingers. Tadpoles are black and small, up to 15 mm long (Daniels 2005; Forestry Department Sarawak 2008; Khan 2000; NationMaster.com 2005).



**Image 1.** Dorsal view of Asian black spined toad displaying the prominent black warts and reddish brown streaks (Source: L. Shyamal CC BY 2.5).

## Biology

### Life history

**Larvae metamorphosis:** 25–30 days

**Length of larval stage:** 34–90 days

**Number of eggs:** 40,000 per clutch

**Oviposition frequency:** can possibly breed twice per year, most likely once per year

**Sexual maturity:** can mature as small as 23 g body size

**Sexual activity:** unknown

**Life span:** 4-10+ years in captivity

(Bartlett & Griswold 2001; Daniels 2005; Jørgensen *et al.* 1986)

Breeding depends on rainfall and temperature. In areas with seasonal monsoon rains, breeding often peaks at the start of the wet season. Where climate is more stable, breeding can occur throughout the year (Jørgensen *et al.* 1986; Mathew 1999).

Ovulation follows a pattern related to the lunar cycle, with most females ovulating just before or after the full moon. The female ovaries can occupy 30% of the gross body weight, a trait that facilitates high fecundity (Whitten *et al.* 1997).

*B. melanostictus* breeds opportunistically in various bodies of freshwater including gutters, puddles and even cement cisterns in parks (Saidapur & Girish 2001). Males congregate at breeding sites where they call to females. The call is a 'creo-o-o'; cro-ro-ro-ro-ro-ro' that is repeated in choruses rather monotonously. The calling males may be heard throughout the night during rain and sometimes on overcast days (Daniels 2005).

There is intense competition between males for females. Often a number of males will cling to a female. The female lays a long string of black eggs which are fertilised externally by the male. The eggs are enclosed in a double gelatinous capsule and laid in a double jelly string around submerged vegetation (Khan 2000). The eggs develop into larvae in 24–48 hours, depending on water temperature.

The tadpoles are small, black and congregate into schools. Both kinship and density affect larval duration and size at metamorphosis. Tadpoles reared with siblings metamorphose more quickly than those reared with non-siblings, and tadpoles reared with siblings and in lower densities have a larger mean body mass (Saidapur & Girish 2001). Tadpoles are scavengers, feeding on almost anything. Time to metamorphosis varies between habitats and ranges from 34–90 days. Young toadlets actively feed during the night and day, often on soft-bodied ants (Daniels 2005).

## Diet

*B. melanostictus* has a broad, opportunistic diet. It hunts exclusively on the ground, often consuming a wide variety of invertebrates. Arthropods are often the dominant food type, especially ants and termites. Other prey include invertebrates in the orders Opisthoptera, Dermaptera, Orthoptera, Hemiptera, Lepidoptera, Coleoptera, Heteroptera, Hymenoptera, Dictyoptera, Diptera, Chilopoda, Diplopoda, Arachnida, and Mollusca. Even insects with noxious protective and offensive mechanisms such as scorpions, centipedes and millipedes are frequently taken. Most food items are between 5–20 mm in size (Berry & Bullock 1962; Mathew 1999). Tadpoles eat mainly phytoplankton (Sinha *et al.* 2001).

## Predators and diseases

Tadpoles are prey for water snakes and carnivorous tadpoles of species such as *Hoplobatrachus tigerinus* (Daniels 2005; Saidapur *et al.* 2009).

Adults are prey for checkered keelback snakes (*Xenochrophis piscator*) and crows (Kanade 2006). Larger toads probably poison a range of predators (Daniels 2005).

*B. melanostictus* can carry a number of parasites including microfilarial worms, nematodes (*Oxysomatium* sp. and *Rhabdias* sp.) and trematodes (*Mesocoelium burti*) (Rahman *et al.* 2008).

## Preferred habitat

*B. melanostictus* is a nocturnal terrestrial species found across temperate, subtropical and tropical habitats from sea level to 2000 m. The species can be described as a “habitat generalist” but tends to prefer disturbed lowland habitats such as disturbed forests, forest margins, riparian areas and human-dominated agricultural and urban areas. It is uncommon in closed forest.

Adults shelter during the day under rocks, leaf-litter, logs and man-made structures such as drains, rubbish piles and even houses. At night, they often gather to feed around street-lamps.

Breeding occurs in still and slow-flowing rivers as well as temporary and permanent ponds and pools. They can breed close to the sea with tadpoles tolerating brackish water up to 1% salinity (Daniels 2005; Forestry Department Sarawak 2008; Strahan 1957; van Dijk *et al.*

2004; Wildlife Singapore undated).

## Global distribution

*B. melanostictus* is abundant and widespread across Asia. Its native distribution extends from north Pakistan through Nepal, Bangladesh, India, Sri Lanka, southern China (including Taiwan, Hong Kong and Macau), Myanmar, Lao People's Democratic Republic, Vietnam, Thailand and Cambodia to Malaysia, Singapore, and Indonesia (Sumatra, Java, Borneo, Anambas Islands and Natuna Islands).

It has naturalised in parts of Indonesia (Bali, Sulawesi, Ambon, Manokwari, Maluku), New Guinea (West Papua and Papua New Guinea) and the Andaman and Nicobar Islands in the Indian Ocean (Lever 2003; van Dijk *et al.* 2004). *B. melanostictus* has recently been discovered in East Timor (CaneToadsinOz.com 2009).

## Distribution in Australia

*B. melanostictus* has not yet established in Australia. Individuals have been intercepted at Australian airports and sea-ports from flights and ships coming from Asia. They are usually found in international vessels, shipping containers, machinery and personal effects such as bags, shoes, boxes and cartons. When detected, they are destroyed by quarantine staff (AQIS 2008; AQIS 2009).

## Conservation status

*Bufo melanostictus* is listed on the IUCN Red List as 'Least Concern' due to its wide distribution, tolerance of a broad range of habitats, and large population. It is an abundant species throughout its range that is probably increasing in many areas (van Dijk *et al.* 2004).

*Bufo melanostictus* is not listed on a CITES appendix.

## Threat to human safety

*B. melanostictus* does not pose a direct threat to human safety but is toxic (much like *B. marina*). Adults secrete a milky toxin that has a pungent odour. The skin excretions contain several bioactive compounds with lethal, hypotensive, hypertensive, neurotoxic, cardiotoxic, haemolytic and sleep-inducing factors (Das *et al.* 2000). When handled by people, the toad can cause itching in the nostrils, eyes and exposed skin (Daniels 2005). In some Asian countries, toads are used as a food source, however the consumption of skin and eggs can cause serious illness or even death (Keomany *et al.* 2007).

## History as a pest overseas

*B. melanostictus* was first detected in Bali in 1958 and subsequently spread through Indonesia to Papua/New Guinea. Most recently it was discovered in East Timor where it was initially mistaken for *B. marina* (CaneToadsinOz.com 2009). In Papua, *B. melanostictus* was first noticed around 1980, and it is not known whether its introduction was accidental or deliberate. The toad is confined to the narrow coastal plain east of the Arfak Mountains. Here it is considered to be 'exceedingly abundant' and since introduction has achieved an explosive population increase, similar to establishment patterns exhibited by *B. marina* (Lever 2003). Their ecological impact in Papua is unknown. However, in other parts of Indonesia, they are displacing *Bufo biporcatus*— a smaller, less active species (Iskandar 2004).

In East Timor, they are suspected to cause serious ecological problems, comparable to the impact of *B. marina* in Australia. To date, no quantitative assessment has been carried out to

measure their impacts in East Timor (AQIS 2009; CaneToadsinOz.com, 2009). In Indonesia, some authors have commented that “nothing can hinder its expansion” (Church 1960; Whitten *et al.* 1997).

In Madagascar, *B. melanostictus* is considered a highly problematic invasive species. The species has a wide dispersal range (>500km) and has been deemed ineradicable (McClelland *et al.* 2015). The population is dispersing inland and causing considerable ecological impacts (Licata *et al.* 2023). The rate of spread is up to 3.3km/year in Madagascar (Licata *et al.* 2019). In Madagascar, *B. melanostictus* poses a threat to human health with documented cases of poisoning in humans and cardiac arrest in children who have consumed toad tissue (Keomany *et al.* 2007).

In Madagascar, the species poses a potential threat to native fauna. Notably, endemic groups that feed on frogs are likely to be vulnerable to poisoning and potentially death (McClelland *et al.* 2016). There are documented cases of poisoning in native predators, namely the Malagasy cat-eyed snake (*Madagascarophis colubrinus*) and Madagascan giant hognose snake (*Leioheterodon madagascariensis*) (McClelland *et al.* 2015; Licata *et al.* 2022).

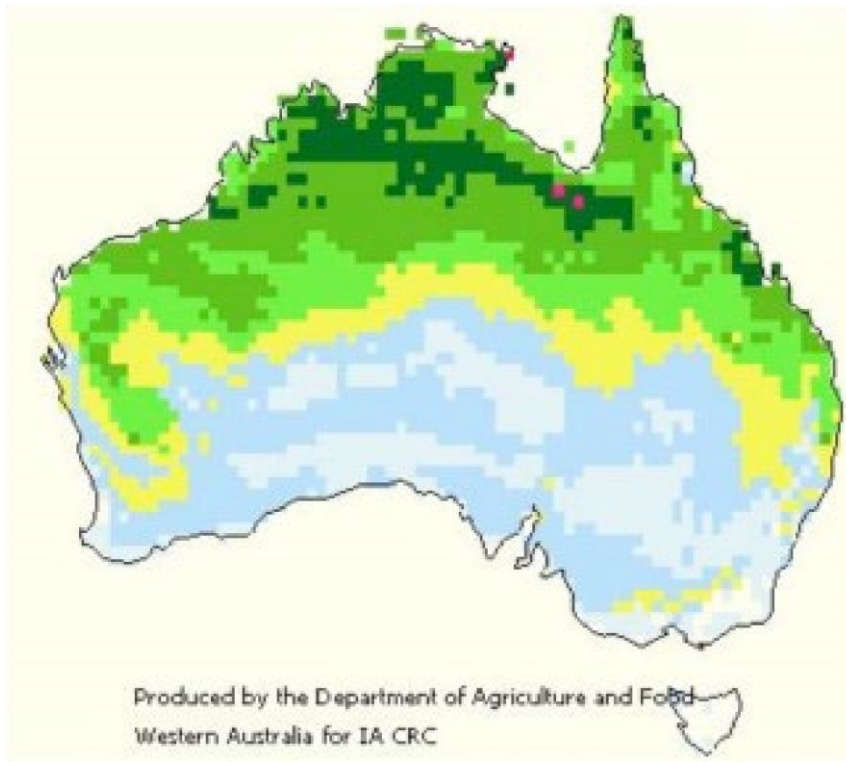
*B. melanostictus* is highly adaptable to a variety of habitats and climates. In Madagascar, the species inhabits regenerating rainforest, woody habitats (*Eucalyptus*, *Mimosa* and *Tamarix*), agricultural areas, rice paddies, industrial areas, urban areas, and disturbed areas (McClelland *et al.* 2015). While dry areas are typically considered to be less suitable, the species has successfully inhabited dry central northern regions of Sri Lanka (McClelland *et al.* 2015).

In Australia, cane toads are considered dead-end nutrients sinks which have altered the food chain substantially (McClelland *et al.* 2015). This is because predators will either die quickly after consumption or avoid consuming them. This leads to a lack of nutrients available to support native predators. *B. melanostictus* would have similar impacts.

## Potential distribution and impact in Queensland

*Bufo melanostictus* is not currently present in Australia.

Since climate is a primary factor that determines a species' distribution, climate-modelling software (PC CLIMATE) was used to predict the area of Australia where climate is suitable for *B. melanostictus* (Figure 1).



**Figure 1.** Potential distribution of *Bufo melanostictus* in Australia (pink and dark green areas indicate where climate is most suitable for the species; mid green, light green and yellow indicate areas where climate is moderately suitable; blue and light blue where climate has low suitability; and white where climate is unsuitable). Map courtesy of Department of Agriculture and Food, Western Australia.

Based purely on an assessment of climatic suitability, *B. melanostictus* is likely to survive over large areas of Queensland, with coastal and northern areas being most suitable. It is important to note, however, that other habitat attributes, such as the availability of food and predator abundance, will influence range and abundance.

The closely related species *Bufo marina* is a well-established significant pest across northern and eastern Queensland. *B. melanostictus* shares very similar attributes such as relatively large size, broad habitat tolerances, high fecundity and a generalist diet. Hence, it seems reasonable to predict that if *B. melanostictus* naturalised in Queensland, its ecological impact would be comparable to *B. marina*.

Kelly *et al.* (2023) suggested that Asian toads may have similar impacts to cane toads in Australia but a more limited distribution. Asian toads would likely interact with cane toads, especially in North Queensland, where detections of Asian toads at ports are most common (Kelly *et al.* 2023). The authors highlighted the lack of information on the life history of *B. melanostictus* especially when compared to cane toads. This creates uncertainty when using cane toads to predict the potential impacts of *B. melanostictus*.

Climate-match, a broad natural range and a history as a pest elsewhere are perhaps the most reliable predictors of invasion success (for a full review of attributes that confer invasion success see Hayes and Barry 2008). *B. melanostictus* has all three attributes and, as such, should be considered to pose a high risk.

Refer to '[Asian black spined toad national resource material](#)' for more information.

## The 'Bomford numerical risk assessment'

A numerical risk assessment system developed by Bomford (2008) is widely applied in Australia to assess the level of risk posed by vertebrates. This approach enables numerical ranking and prioritisation of large numbers of species. Firstly, a species' potential distribution is predicted using climate-modelling computer programs. The remaining steps involve allocation of scores for a number of attributes relevant to a species' pest status including biology, costs to the economy, the environment and society, and management efficacy.

Using the Bomford system, Asian spined toads were assessed as a 'serious' threat species (refer to attachment). Additional Bomford models confirm establishment risk as 'serious'.

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## Appendix

Using the Bomford (2008) system, Asian spined toads in Queensland were ranked as a 'serious' threat species.

Date of assessment: 16/07/2009 and 4/09/2009

Literature search type and date: see references

**Table 1.** Australian bird and mammal model for Asian spined toad.

Species		<i>Duttaphrynus melanostictus</i> (Asian black spined toad)
Factor	Score	Comment
A1. Risk to people from individual escapees (0–2)	2	Asian spined toads are capable of causing fatalities or serious injury to people.
A2. Risk to public safety from individual captive animals (0–2)	1	Moderate risk that toxins of captive animals pose a public safety risk.
<b>Stage A. Public Safety Risk Rank = Sum of A 1 to 2. (0–4)</b>	<b>3</b>	<b>Highly dangerous</b>
B1. Climate Match (1–6)	4	High climate match in Australia. CMS = 1183. From climate map produced by Department of Agriculture and Food,

		Western Australia, using PC Climate software.
B2. Exotic population Established Overseas (0–4)	4	Asian spined toads have established on larger islands: Bali, East Timor, and Papua.
B3. Overseas Range Size (0–2)	1	Overseas range size of 6.6 million square kilometres (Bomford et al. 2005).
B4. Taxonomic Class (0–1)	1	Amphibian
B5. Diet (0–1)	1	Generalist diet of invertebrates including arthropods, ants, termites, beetles, mollusc, spiders, scorpions, centipedes & millipedes.
B6. Habitat (0–1)	1	Asian spined toads are able to survive and breed in human-disturbed and manmade environments.
B7. Migratory (0-1)	1	Non-migratory.
<b>B. Probability escaped or released individuals will establish a free-living population = Sum of B 1 to 7. (1–16)</b>	<b>13</b>	<b>Serious Establishment Risk</b>
C1. Taxonomic group (0–4)	0	Other group
C2. Overseas range size including current and past 1000 years, natural and introduced range (0–2)	0	Approximately 6.6 million square kilometres (Bomford et al. 2005).
C3. Diet and feeding (0–3)	0	Not a mammal.
C4. Competition with native fauna for tree hollows (0–2)	0	Asian spined toads are not known to use tree hollows.
C5. Overseas environmental pest status (0–3)	2	Moderate environmental pest in Bali, East Timor and Papua.
C6. Climate match to areas with susceptible native species or communities (0–5)	5	The species has more than 20 grid squares within the highest two climate match classes, and has more than 100 grid squares within the four highest climate match classes that overlap the distribution of any susceptible native species or communities.

C7. Overseas primary production pest status (0-3)	1	Asian spined toads are known to predate on honey bee hives (Oldroyd & Wongsiri 2006; Pokhrel et al. 2006)
C8. Climate match to susceptible primary production (0-5)	1	Total commodity damage score = 5 (see Table 1).
C9. Spread disease (1-2)	1	Amphibian
C10. Harm to property (0-3)	0	\$0
C11. Harm to people (0-5)	4	Injuries or harm severe or fatal but few people at risk. People have died after consuming Asian spined toads or their eggs, and their poison can cause irritation.
<b>C. Probability an exotic species would become a pest (for birds, mammals, reptiles and amphibians) = Sum of C 1 to 11. (1-37)</b>	<b>14</b>	<b>Moderate Pest Risk</b>
<b>A. Risk to public safety posed by captive or released individuals</b>		
A = 0 = not dangerous; A = 1 = moderately dangerous; A ≥ 2 = highly dangerous	<b>3</b>	<b>Highly dangerous</b>
<b>B. Risk of establishing a wild population</b>		
<b>For birds and mammals:</b> B < 6 = low establishment risk; B = 7-11 = moderate establishment risk; B = 12-13 = serious establishment risk; B > 14 = extreme establishment risk	<b>13</b>	<b>Serious establishment risk</b>
<b>For reptiles and amphibians:</b> B < 3 = low establishment risk; B = 3-4 = moderate establishment risk; B = 5-6 = high establishment risk; B > 6 = extreme establishment risk		
<b>C. Risk of becoming a pest following establishment</b>		
C < 9 = low pest risk; C = 9-14 = moderate pest risk; C = 15-19 = serious pest risk; C > 19 = extreme pest risk	<b>14</b>	<b>Moderate pest risk</b>

<b>VPC Threat Category</b>		<b>Serious</b>
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**Table 2.** Establishment Risk Ranks Australian Reptile and Amphibian Model for Asian spined toad.

Species		<i>Duttaphrynus melanostictus</i> (Asian black spined toad)
Factor	Score	Comment
A. Climate Match Risk Score	27.2	CMRS = 100 (759/2785). From climate map produced by Department of Agriculture and Food, Western Australia, using PC Climate software.
B. Exotic Elsewhere Risk Score	30	Established breeding self-sustaining populations on Bali, East Timor and Papua.
C. Taxonomic Family Risk Score	20	Family: Bufonidae
$\leq 22$ = low establishment risk; 23-60 = moderate establishment risk; 61-115 = serious establishment risk; $\geq 116$ = extreme establishment risk		
<b>Establishment Risk Rank</b>	<b>77.2</b>	<b>Serious Establishment Risk</b>

**Table 3.** Bird and Mammal Model adapted for reptiles and amphibians for Asian spined toad.

Species		<i>Duttaphrynus melanostictus</i> (Asian black spined toad)
Factor	Score	Comment
A. Climate Match Score (1-6)	4	CMS = 1183. From climate map produced by Department of Agriculture and Food, Western Australia, using PC Climate software.
B. Exotic Population Established Overseas Score (0-4)	4	Asian spined toads have established on larger islands: Bali, East Timor, and Papua.
C. Overseas Range Size Score (0-2)	1	Approximately 6.6 million square kilometres (Bomford et al. 2005).
$\leq 4$ = low establishment risk; 5-7 = moderate establishment risk; 8-9 = serious establishment risk; 10-12 = extreme establishment risk		
<b>Establishment Risk Rank</b>	<b>9</b>	<b>Serious Establishment Risk</b>

**Table 4.** Calculating Total Commodity Damage Score.

Industry	Commodity Value Index <sup>1</sup> (CVI)	Potential Commodity Impact Score (PCIS, 0-3)	Climate Match to Commodity Score (CMCS, 0-5)	Commodity Damage Score (CDS, columns 2* 3*4)
Cattle (includes dairy and beef)	11	0	Not estimated	0
Timber (includes native and plantation forests)	10	0	Not estimated	0
Cereal grain (includes wheat, barley sorghum etc)	8	0	Not estimated	0
Sheep (includes wool and sheep meat)	5	0	Not estimated	0
Fruit (includes wine grapes)	4	0	Not estimated	0
Vegetables	3	0	Not estimated	0
Poultry and eggs	2	0	Not estimated	0
Aquaculture (includes coastal mariculture)	2	0	Not estimated	0
Oilseeds (includes canola, sunflower etc)	1	0	Not estimated	0
Grain legumes (includes soybeans)	1	0	Not estimated	0
Sugarcane	1	0	Not estimated	0
Cotton	1	0	Not estimated	0
Other crops and horticulture (includes nuts, tobacco and flowers)	1	0	Not estimated	0
Pigs	1	0	Not estimated	0
Other livestock (includes goats,	0.5	0	Not estimated	0

deer, camels, rabbits)				
Bees (includes honey, beeswax and pollination)	0.5	2	5	5
<b>Total Commodity Damage Score (TCDS)</b>	—	—	—	<b>5</b>