Pest risk assessment

Blackberry (*Rubus* species)

DELIVERING FOR QUEENSLAND

Queensland Government

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

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Contents

Summary

This study assessed the weed risk of the *Rubus* genus, which includes a number of species known as 'blackberry'.

Rubus contains about 863 species that are native to Europe, North America, Asia and Australia. The taxonomy of the genus is notoriously complex (with multiple revisions and changes over the years) and remains unclear.

Species native to Australia are not included in this assessment.

A group of species collectively referred to as 'blackberry' are the most problematic taxa, and blackberry is listed as a Weed of National Significance (WoNS) in Australia. Blackberry is one of southern Australia's worst weeds, where it infests at least 8.8 million hectares, costing landholders an estimated $103 million in lost production per annum and causing broadscale damage to national parks and bushland in general.

Overseas, various *Rubus* species (primarily blackberry species) are major weeds of pastures and native vegetation, in Hawaii, New Zealand, the United States, Canada, South America (Chile and Argentina), India and Sri Lanka. One species is listed on the world's top 100 worst invasive pests.

The exact number of species effectively captured by the common name 'blackberry' is unclear, due to taxonomic confusion and the likelihood that naturalised species are genetically unstable and dynamic. Never the less, a range of species and forms collectively referred to as 'blackberry', involving at least 13 species, are significant invasive plants in southern Australia, extending into cooler, upland parts of southern Queensland. According to the Queensland Herbarium, there are five naturalised species of *Rubus* in Queensland: *R. alceifolius*, *R. anglocandicans*, *R. ellipticus*, *R. laudatus* and *R. niveus*. *R. anglocandicans* is generally considered to be the most widespread species in Queensland. One species, *R. laudatus*, has emerged as a potentially significant problem in considerably warmer, coastal, south-east Queensland (Sunshine Coast hinterland).

Under favourable conditions, 'blackberry' can grow into impenetrable thickets, replacing pastures and native vegetation and harbouring rabbits. For these reasons it has been listed as a 'declared pest/noxious weed' and, more recently, as 'restricted biosecurity matter' in Queensland since around 1954.

Certain species of 'blackberry' have existed in Queensland and Australia for over 150 years and *R. anglocandicans,* in particular, has had sufficient time to more or less fill its entire potential bioclimatic range. However, other species appear to be in earlier stages of spread and could become more significant problems in the future. Moreover, there is a risk that additional species could be introduced from overseas or interstate.

A number of commercial cultivars of blackberry have been developed and sold in Australia (mainly for their fruit) and the exact identity of these forms is unclear.

While further investigation is required, this study draws four main conclusions:

- a number of Rubus species, loosely described as blackberries, are major weeds in Australia and many more species have the potential to become major weeds. Due to taxonomic uncertainty and hybridisation it is not possible to accurately define which species pose the greatest risk.
- all non-native Rubus species appear to pose some weed risk, some more so than others
- claims that certain cultivars are non-invasive are questionable. Based on the literature, it appears conceivable that cultivars can hybridise with various other species in an unpredictable manner, with a risk of producing vigorously growing hybrids. This study accepts that, due to taxonomic uncertainty, hybridisation and the nature of biological invasions in general, it is not possible to make predictions of weed impacts with full certainty. For this reason, the precautionary principle should prevail when making decisions based on weed-risk

- the introduction and cultivation of additional species and cultivars are highly likely to expand and modify existing genetic diversity within invasive blackberry populations within Australia, thereby reducing the effectiveness and value of existing biocontrol agents

*Important note: This assessment is based on the best available literature at the time of writing. It is acknowledged that new information may come to hand over time and please send any additional information, or advice on errors, to the author.

Identity and taxonomy

Species: *Rubus* (all species, except for taxa native to Australia)

Common names: numerous common names apply to various species. The genus as a whole is referred to as 'brambles' (only certain species within the genus are called 'blackberry'). Some species are 'raspberries' and 'dewberries'. Certain hybrids are referred to as 'logan berry', 'boysenberry' and 'marionberry' to name a few. Numerous commercial cultivars and hybrids exist, using a diverse range of trade-names)

Family: Rosaceae

There are about 863 species of *Rubus* according to a recent global review by Huang *et al*. (2023). Global revisions of the genus were completed from 1910-1914 (Focke 1910, 1911, 1914) and then in 2023 (Huang *et al.* 2023).

Species native to Australia are not included in this study.

Globally, the *Rubus* genus is "one of the most complicated angiosperm genera" and "is notorious for its taxonomic difficulty" (Huang *et al*. 2023). Not only are there hundreds of forms and species, but many of these forms and species readily cross-breed to produce new forms (interspecific hybridisation), most of which have inherent phenotypic plasticity (variable morphology). Species differ from each other in such features as stem shape, density and shape of prickles, presence or absence of stalked glands, hairiness of stems and leaves, shape of leaflets and shape of the flowering stems, morphological attributes that are often variable within a species.

In the case of *Rubus* species referred to as 'blackberry', most species are polyploid, facultatively apomictic and pseudogamous. While various blackberry taxa have been assigned species status, by multiple authors over the years, it is important to realise that such assignments have been based on highly variable morphological traits. Whether such species assignments meet the widely accepted biological definition of a species is debateable (i.e. species that can successfully interbreed to produce sexually viable offspring have very similar DNA and are fundamentally the same species). This point is rarely discussed by taxonomists, perhaps due to the impracticality of conducting controlled experiments to test the ability of hundreds of different parent species to fertilise each other (a factorial experiment that would involve thousands of crosses). However, Evans *et al.* (2007) did point out that, in the case of 'blackberry' species, "the biological species concept is difficult to apply" and "assigning apomictic lineages to discrete taxa may be difficult." The majority of taxonomists have used the conventional species rank for apomictic taxa of *Rubus*, with the exception of Love and Love (1974), who made combinations such as *R. fruticosus* L. agamospecies *discolor*. "Their treatment has the advantage of alerting the user to the reproductive mode of the taxon, but it has not been adopted by more conventional taxonomists" (from Evans *et al*. 2007). The latter authors commented that "a taxonomy based solely on morphological characters has resulted in the description of numerous taxa, which differ from one another to varying degrees. If all morphological variants were characterised, then the number of potential taxa could be in excess of 15,000" (Richards *et al*. 1996, in Evans *et al*. 2007). More recent DNA analysis of the entire *Rubus* genus has "re-grouped" genetically similar species, however, it did not test whether such forms can successfully interbreed or produce new forms over time. It is relevant to note that in the western United States, Clark and Jasieniuk (2012) found "a limited amount" of hybridisation between the native *R. ursinus* and the introduced *R. armeniacus* and *R. pensilvanicus*, as well as cultivated varieties. *R. ursinus X R. armeniacus* and *R. ursinus X R. pensilvanicus* produced "a mix of apomictic and sexual seeds, with sexual seeds being more viable." This evidence of hybridisation between a native and introduced *Rubus* (and cultivars) suggests that hybridisation

could be widespread within the genus. Hence, it seems likely that taxonomic analysis will never fully define every species of *Rubus* with biological certainty.

Defining which species of blackberry exist in Australia, and which are the most invasive, appears equally challenging, with perhaps no definitive position (for the same reasons as outlined above). The fact of the matter is that we have a dynamic mix of highly variable species and hybrids in Australia. Some of these are clearly major weeds, whereas others are probably still in the process of becoming either major or minor weeds.

For many years in Australia, invasive types of blackberry were loosely labelled as *Rubus fruticosus* "aggregate" (the term aggregate being used as a brief and convenient way of capturing all invasive and problematic forms/species within Australia). A prevailing view, held for many years, was that the 'aggregate' only included forms of blackberry that originated from Europe and there is evidence that our most invasive forms did in fact originate from Britain (Evans *et al*. 2007). While European genetic material almost certainly dominates wild populations in Australia, it appears highly likely that existing forms of problematic blackberry in Australia now include varying degrees of genetic material with origins from around the world, including North America and Asia.

The exact number of naturalised blackberry species in Australia is unclear. Marshall (2015) suggested there are about 15 species formerly referred to as the *R. fruticosus* aggregate. Evans *et al.* (2007) reviewed the DNA of more than 13 species within the 'aggregate' (Table 1).

Taxon or putative taxon		
R. anglocandicans	*R. leightonii*	*R. rubritinctus*
R. cissburiensis	*R. leucostachys*	*R. ulmifolius*
R. echinatus	*R. phaeocarpus*	*R. vestitus*
R. erythrops	*R. polyanthemus*	*R. species* (multiple un-defined taxa)
R. laciniatus	*R. riddelsdellii*	

Table 1 Taxon or putative taxon of *Rubus fruticosus* 'aggregate' subject to sampling of DNA phenotypes by Evans *et al*. (2007).

The term 'aggregate' is no longer valid as a description of invasive blackberry in Australia and has largely been resolved. However, it is important to accept the taxa's phenotypic plasticity, capacity for interspecific breeding and the resultant high level of uncertainty and taxonomic imprecision that exists.

Clark *et al.* (2013) pointed out that "cryptic genetic diversity" can exist within asexual populations that are historically assumed to be genetically homogeneous (based on visually similar morphological traits). Using molecular analysis, they found three separate invasive clones in the Western United States, where the invasion had previously been thought to consist of a single asexual lineage, one from Germany (*R. armeniacus*), another identical to material from Australia (*R. anglocandicans*) and a third distinct clone from Chile.

Numerous cultivars of 'blackberry', derived from multiple parent species, have been developed for commercial sale (to produce fruit for human consumption). In the United States, the native *R. ursinus*, which is a sexually reproducing species, has been hybridised with other species to produce several popular cultivated varieties (McGregor 1998). *R. ursinus* is generally diecious (separate male and female plants) and has hexaploidy, octoploid, dodecaploid forms (Brown 1943).

The exact identity of some, if not all, cultivars appears impossible to determine, beyond reasonable doubt, again due to: (a) the inherent taxonomic uncertainty across the genus, (b) a long history of cultivation and breeding, (c) a propensity to hybridise with unknown material and (d) the fact that multiple species have been crossed artificially to produce novel material. Such confusion and uncertainty appears reflected by labels attached to material being offered for sale in Australia and

overseas, which use a variety of binomial identifiers and trade-names, some of which contradict each other. For example, material offered for sale in Queensland sometimes makes reference to *Rubus fruticosus* as well as a cultivar known as 'Chester thornless'.

Image 1. Material labelled as 'Rubus fruticosus Chester' and 'blackberry thornless Chester' at a retail nursery in Toowoomba, February 2024

According to McGregor (1998) 'Chester thornless' was not derived from *R. fruticosus*.

Similarly, some online sellers claim that 'Chester' is a form of *Rubus ursinus* (eg. Image 2). Others use the binomial *Rubus ulmifolius* (eg. Image 3). Others use the binomial *Rubus fruticosus* (Image 4). Hence, the use of binomial identifiers on material offered for sale appears somewhat arbitrary and should not be assumed to be correct.

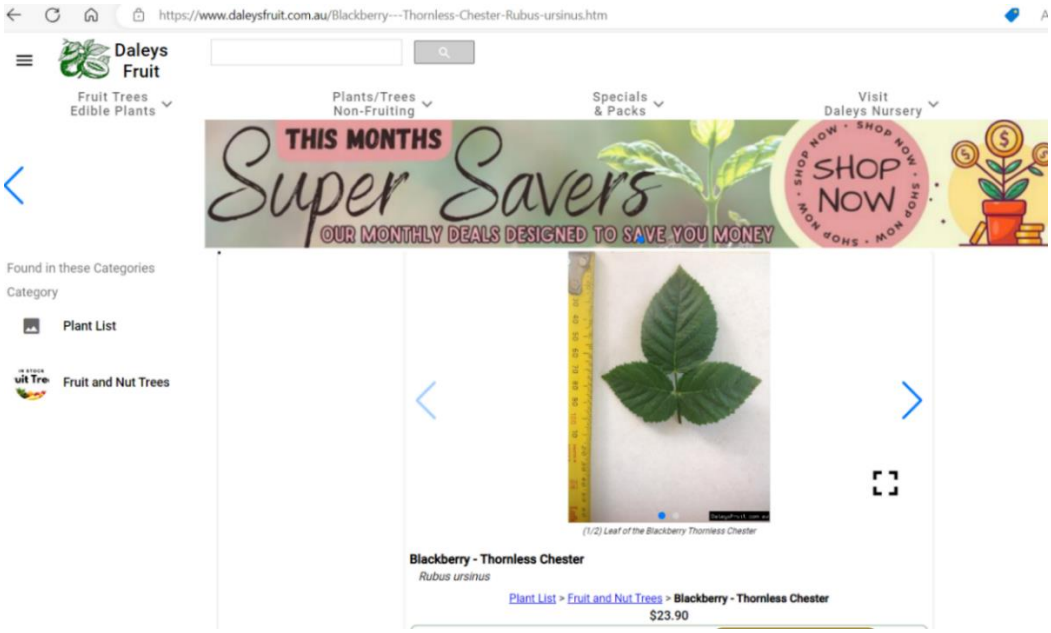

Image 2. Material offered for sale online labelled as 'Blackberry – thornless Chester - Rubus ursinus (Daley's fruit.com.au) downloaded 12 March 2024

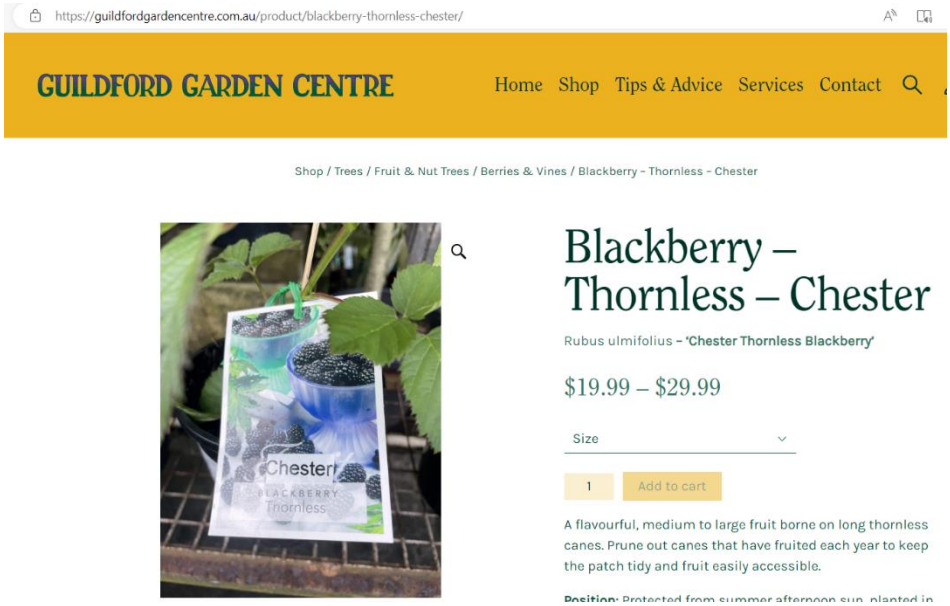

Image 3. Material offered for sale online labelled as 'Blackberry – thornless - Chester - Rubus ulmifolius (Guildford Garden Centre.com.au) - downloaded 12 March 2024

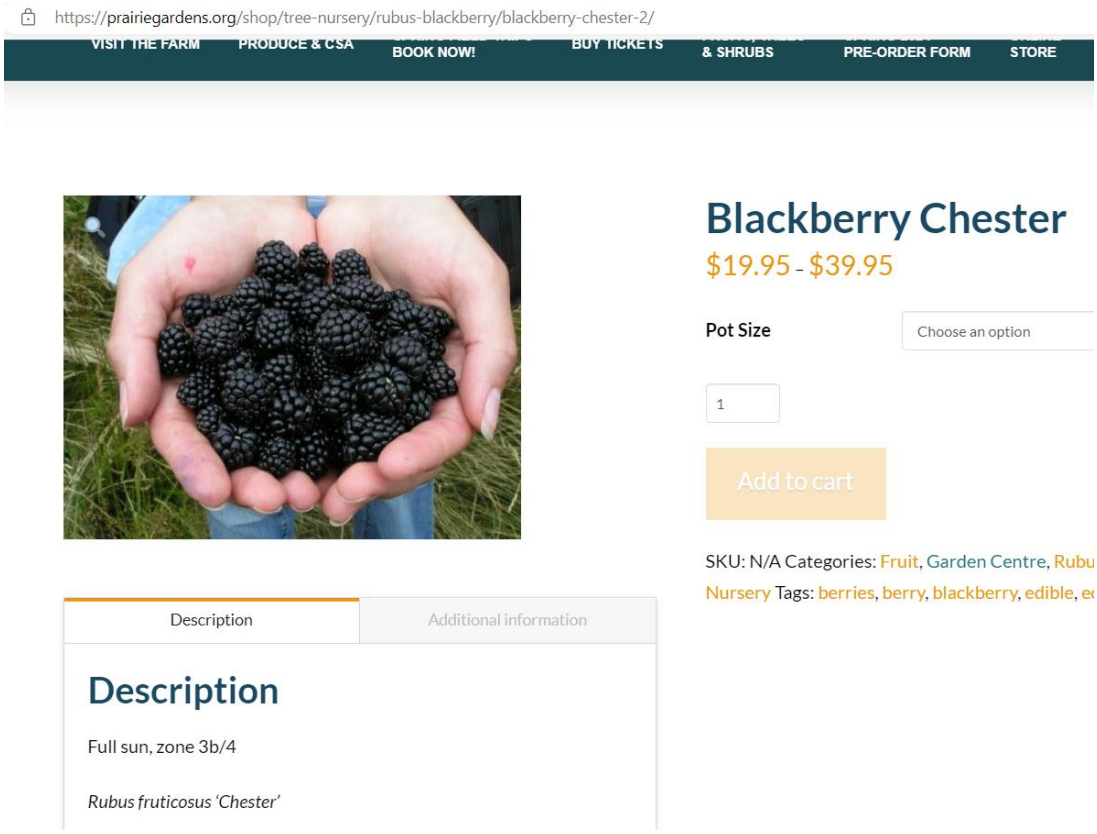

Image 4. Material offered for sale online labelled as 'Blackberry – Chester - Rubus fruticosus (Prairie Gardens.org) - downloaded 12 March 2024

Poor labelling probably reflects a lack of technical knowledge, and perhaps some guesswork, rather than "label swapping" to avoid regulation.

In the case of *Rubus* species that are not captured by the common name 'blackberry', the taxonomy is equally confused. In the most recent global review of *Rubus*, Huang *et al*. (2023) proposed 10 sub-genera based on DNA analysis. While comprehensive, and an improvement on previous reviews, the authors noted that the results of their work "are not without problems" and that their work "provide(s) a baseline for further studies on the numerous remaining questions." In the absence of full taxonomic certainty, it seems appropriate to adopt a precautionary approach when addressing the weed risk of this genus.

Description

Rubus species are a diverse range of flowering shrubs. Most species typically have woody stems and thorns. The fruit is an aggregate of drupelets. Most grow to a few metres tall and most have arching stems that produce roots when they touch the ground. Plants are perennial. 60-70 percent of species are polyploid. Leaves vary from simple to compound. Blackberry leaves are compound. Blackberry can be described as a dense, thorny, semi-deciduous, sprawling shrub, 0.3 – 7 m tall. For more detail on description and biology refer to Parsons and Cuthbertson (1992).

Reproduction and dispersal

Reproduction can occur from seeds or vegetatively when canes touch the ground. Clumps of certain species such as the blackberries can spread very quickly due to vegetative spread alone.

In the case of blackberries, most species utilise facultative apomixis, a process where pollen stimulates fruit/seed production but without sexual fertilisation. Resultant offspring from such seeds are genetic clones of the female parent. It is important to note, however, that blackberries can also reproduce sexually, albeit sparingly in most species. *R. ulmifolius* is one species that utilises sexual reproduction more so than apomixis. Fruit (and seeds) are dispersed by a variety of frugivores. As noted earlier, hybridisation between species and between species and cultivars can occur.

The ability to reproduce sexually and via facultative apomixis is considered to be an advantage for invasion success, since sexual reproduction allows adaption to new environments whereas asexual reproduction maintains genetic fitness within an area that has been successfully invaded (Clark and Jasieniuk 2012).

Seed production can be prolific. *Rubus procerus* can produce 7000 – 13 000 seeds per square metre (Bruzzese 1998). About one percent of seeds germinate in their first year and 10% in the first three years (Bruzzese 1998). Seed longevity is unknown. Ingestion by frugivores can increase germination by 30% (Bruzzese 1998).

Preferred habitat and climate

Most *Rubus* prefer temperate climates with some species extending into sub-tropical and tropical climates. In Australia, widely naturalised blackberries are traditionally restricted to cooler (temperate) climates across southern Australia (where rainfall exceeds 700 mm per annum) and, in Queensland, most are restricted to upland areas of south-east Queensland (mainly around Stanthorpe). However, more recently introduced species such as *R. laudatus* appear well-suited to coastal, sub-tropical areas. Blackberry can thrive in a range of habitats, including open grazing land, forests and riparian areas.

Marshall (2015) noted that "surprisingly, little is known about the biological and ecological attributes of individual species within the aggregate."

Native range and global distribution

Rubus is a cosmopolitan genus native to Europe, Asia, North America and Australia (certain species). While most problematic species of blackberry that are widespread and abundant in Australia appear to have originated in Britain (Evans *et al*. 2007), there is no doubt that other invasive and potentially invasive species originate from elsewhere. An emphasis on British species of blackberry is simply an artefact of the long history of propagule pressure from that particular area.

Distribution and impact in Australia

Rubus species knows as 'blackberry' are listed as a Weed of National Significance (WoNS) in Australia and have invaded an estimated 8.8 million hectares of southern Australia (south-west parts of Western Australia, parts of South Australia, Victoria, the ACT, New South Wales and parts of southern Queensland) (Parsons and Cuthbertson 1992). It ranks as one of the most significant invasive plants in temperate Australia as it invades both pastures and bushland, forming extensive, impenetrable thickets. Costs have been estimated at $103M per annum (Weeds Australia 2021).

Non-native *Rubus* were first recorded in Australia in 1842, although earlier import probably occurred (Parsons and Cuthbertson 1992, Evans *et al.* 2007). At least one species was naturalised in Tasmania by 1878. The most common and widespread species is *R. anglocandicans* (Evans and Weber 2003) (Figure 1). This is not to say this will always be the case – but rather, its dominance is most likely an artefact of duration of existence in Australia combined with propagule pressure (multiple imports). Given sufficient time and opportunity, other congeners could replicate its impact.

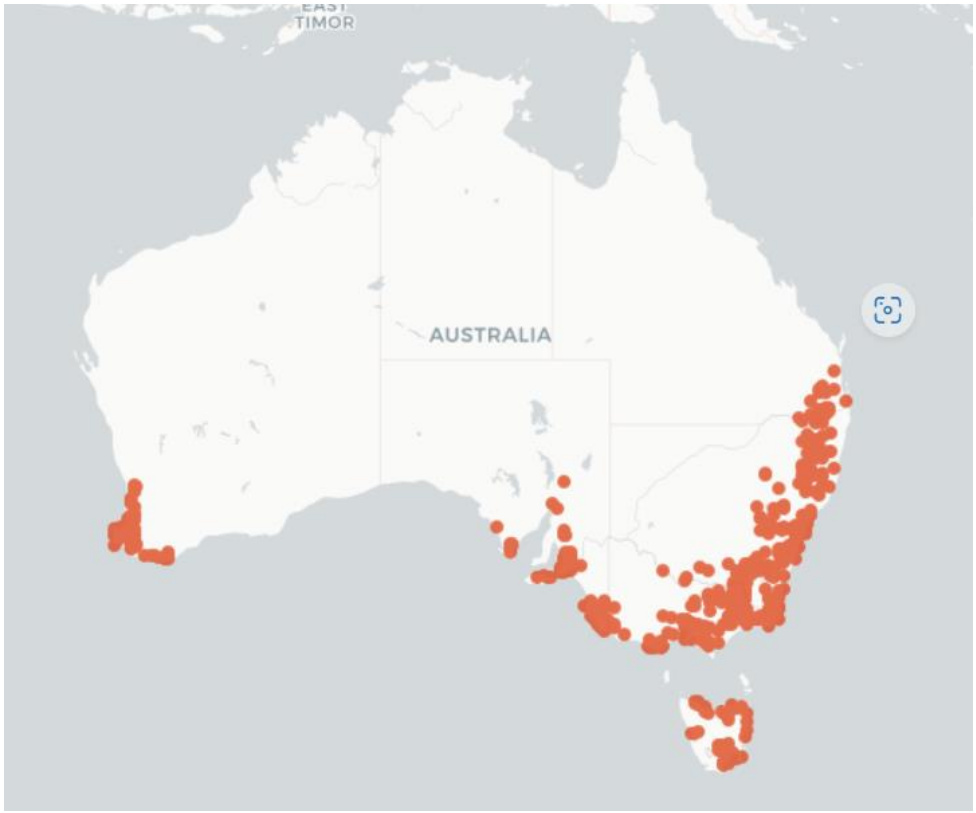

Figure 1. Distribution of Rubus anglocandicans (data from Australia's Virtual Herbarium 2024).

In Queensland, invasive (non-native) *Rubus* are generally most problematic in cooler (temperate), upland parts of southern Queensland around Stanthorpe (extending to Warwick and Toowoomba), where their populations have been stable for many decades. Blackberry has been listed as a "noxious" pest under some form of legislation in Queensland since about 1954.

According to the Queensland Herbarium (2022), there are five naturalised species of *Rubus* in Queensland:

- *R. alceifolius*
- *R. anglocandicans*
- *R. ellipticus*
- *R. laudatus*
- *R. niveus*

R. anglocandicans is generally considered to be the most widespread species in Queensland.

R. laudatus (known as 'Bundy blackberry') has more recently become a problem in the Sunshine Coast hinterland, an area with a much warmer climate, perhaps providing an insight into the broader weed risk of additional species within the genus (Figure 2).

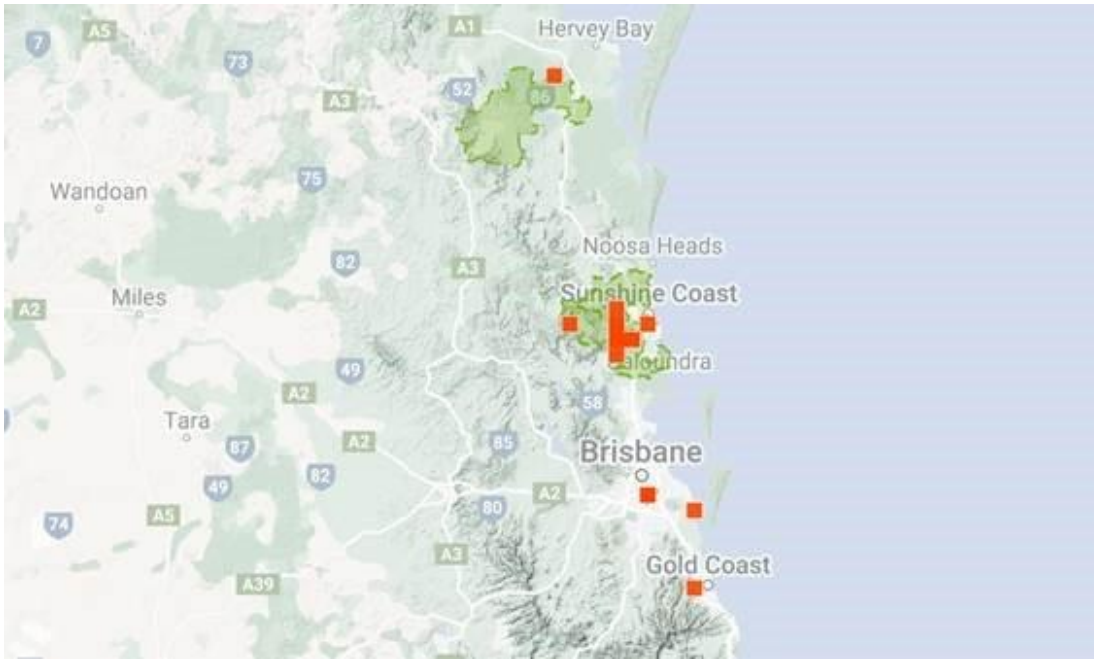

Figure 2. Records of Rubus laudatus in coastal south-east Queensland (image produced from iNaturalist data).

A blackberry rust, *Phragmidium violaceum*, was released in southern Australia and can cause some defoliation in summer. It does not affect all species or cultivars and there is a risk that resistant species and forms of blackberry may replace more vulnerable forms.

History as weeds overseas

A number of blackberry species are significant invasive pests of agriculture (generally pastures), forestry and conservation reserves in New Zealand, the east and west coast of the United States, South Africa, South America (Chile and Argentina), India and Sri Lanka.

The Himalayan yellow raspberry (*Rubus ellipticus*), also known as yellow raspberry or cheeseberry, is one of the world's 100 worst invasive alien species (Global Invasive Species Database 2006). It is invasive in Hawai'I, Australia, tropical Africa, tropical South America, the West Indies, and England (Evans *et al*. 2007, U.S. Forest Service 2010). The plant was introduced to Hawai'i in 1961 and subsequently replaced native plant species on a significant scale (Wu *et al.* 2013).

In Canada, material referred to as 'Himalayan blackberry', is particularly problematic in southwestern British Columbia (Gaire *et al*. 2015). Himalayan blackberry is listed among 40 of the most invasive woody angiosperms worldwide and is considered one of the worst weeds in western Oregon, where it forms dense populations that exclude other vegetation (Rejmanek and Richardson 1996).

An estimated 6 million hectares are infested by blackberry in Chile (Parsons and Cuthbertson 1992). In New Zealand, blackberry was recognised as the country's worst weed by 1925 (Parsons and Cuthbertson 1992). On Robinson Crusoe Island, Chile, *R. ulmifolius* has caused major damage to the forest ecosystem (Vargas-Gaete *et al*. 2019, Smith-Ramirez *et al.* 2017 and Vargas *et al*. 2013).

Use

A number of *Rubus* species and cultivars are sold commercially for fruit production. This assessment has not tried to list all cultivars as their taxonomy and identity are questionable.

Weed risk and potential impact in Queensland

The most widespread species of blackberry in Australia, *R. anglocandicans*, has probably filled its entire bioclimatic range over the past 180+ years. However, Marshall (2015) pointed out that the four most widespread species of blackberry in Australia demonstrate significant variability with respect to their potential invasive ranges. In contrast to *R. anglocandicans*, *R. erythrops*, for example, has a limited

distribution in Victoria, South Australia and Tasmania, but with "capacity to expand its range into new areas in Western Australia and New South Wales" (Marshall 2015). Other species that are currently less common display similar potential.

Considering the history of importation and the number of naturalised *Rubus* species in Australia and globally, it appears that most, if not all, non-native *Rubus* species have the potential to naturalise, given sufficient time and opportunity. Hence, all species and forms pose some level of biosecurity risk and this level is likely to vary. To date, many species have not yet been introduced and while the significance of their long-term impacts is difficult to predict, the fact that so many species within the genus have naturalised, combined with the fact that many can cross-breed with existing forms, or simply spread vegetatively, means a precautionary approach to assessing risk is appropriate and justified.

While some varieties and forms might be less invasive than others (or their invasiveness is less obvious), there is evidence that such forms can still out-cross to wild species and varieties, albeit slowly or rarely. This should be accepted as a significant biosecurity risk as out-crossing will further confound taxonomic uncertainty and, more importantly, confound existing and potential biocontrol efforts. With reference to the risk of cross-breeding, Alice *et al*. (2001) pointed out that "successful and complex hybridisation between phylogenetically distant taxa, *R. caesius* L. (subgenus Rubus, European dewberry) and *R. idaeus* (subgenus Idaeobatus, raspberry) has been demonstrated, thus providing evidence that contributes further to the taxonomic complexity in *Rubus* (in Evans *et al*. 2007). The latter authors acknowledged the possibility of hybridisation between non-native *Rubus* from different continents and possibly between native and non-native congeners but did not explore the matter. The risk was subsequently confirmed by Clark and Jasieniuk (2012) who reported hybridisation between *Rubus* species native to the United States and introduced (invasive) species. Moreover, the latter authors commented that while F1 hybrids are not currently widespread or recognised as invasive, they "could represent an early stage in the evolution of new invasive *Rubus* taxa" and that such hybrids "grew very vigorously in the greenhouse and appear to outcompete *R. ursinus* at field sites."

Historical claims that certain forms of 'blackberry' are non-invasive can be readily challenged and are not sufficiently robust to draw any reliable conclusions on risk. On the specific issue of material labelled as 'Merton thornless', McGregor (1998) states that this cultivar was developed from two parents, *R. ulmifolius* and *R. thyrsiger*. *R. ulmifolius* is a vigorous, highly invasive species, and is major weed in parts of Chile, declared in Western Australia and a weed in Victoria (Bruzzese 1998, Davies 1998, Vargas-Gaete *et al*. 2019, Smith-Ramirez *et al*. 2017, Vargas *et al*. 2013, Mazzolari *et al*. 2011). *R. ulmifolius* is often stated to be the only non-native blackberry to produce seeds sexually (other species produce most seeds via apomixis, otherwise known as pseudogamy). McGregor admitted that commercial cultivars "rarely" cross with wild blackberries and that the rate of honey bee mediated genetic drift "will be slow". Hence, while the risk may be reduced, such cultivars are clearly capable of out-crossing and therefore pose a biosecurity risk. With respect to existing restrictions under the Queensland *Biosecurity Act* 2014 (which currently places all species within the former *Rubus fruticosus* 'aggregate' into the 'restricted biosecurity matter' schedule), it should be noted that *R. ulmifolius* is part of the former aggregate.

Similarly, the cultivar sold as 'Chester thornless' is believed to have been developed by crossing *R. armeniacus* and *R. ulmifolius* (again, the latter being part of the former aggregate) (Johnson and Lisle date). Presumably, the parent *R. ulmifolius* was selected for its vigour.

On the specific issue of apomixis and claims that certain blackberry cultivars reproduce using obligate apomixis and, as a result, pose no weed risk, it needs to be noted that it appears likely that all apomixis in plants is facultative (not obligate). Apomixis, or asexual reproduction through seeds, is a process where plants produce progeny that are maternal clones. Thus, an apomictic plant can be a weed as it can still set seeds. Claims of obligate apomixis appear to often be an artefact of insufficient observation, where uncommon sexual reproduction is simply not noticed due to its rarity (and difficulty to observe). In other words, it appears that most blackberry species are capable of sexual reproduction, albeit rarely, and, as a result, can potentially cross with closely related species and forms to produce novel biotypes, with variable and unknown weed risk.

Out of around 750 species recognized in Europe, sexuals consist of four diploid and two tetraploid (*R. caesius*, *R. ser. glandulosi*) taxa, while all others are polyploids (Kurtto *et al*. 2010).

All species and forms of blackberry appear capable of reproducing vegetatively or asexually (via apomixis), with obvious biosecurity risk in terms of proliferation. Asexual reproduction can be equally effective, in terms of dispersal and impact as a pest, and blackberry is notorious for its ability to spread vegetatively/asexually. Again, McGregor (1998) claimed that field trials found no evidence of spread for commercial cultivars. However, these field trails were short-term "one offs" and did not consider multiple habitat types or the well-known lag effect evident across biological invasions generally. Moreover, Johnson and Lisle (undated) pointed out that three forms that died out in McGregor's field trials have in fact naturalised in Australia, evidence that "cast(s) some doubt on this assessment". Claims that so-called "thornless" varieties are non-weedy were challenged by Johnson and Lisle (undated) who pointed out that "a thornless cultivar is naturalised in South Australia". "Some researchers suggest there is potential for all cultivars to naturalise and become weedy" (E. Bruzzese, in Johnson and Lysle undated). This statement seems valid, considering the history of repeated and numerous naturalisation events recorded for *Rubus* species across the world, combined with their propensity to cross-pollinate and hybridise.

Other states have made legal exemptions for specific cultivars of *Rubus*. However, since "many blackberry (*Rubus*) cultivars used in commercial production have naturalised" (Johnson and Lisle undated), recommendations were made to develop industry codes of practice, to address the risk.

There is a strong likelihood that relatively "new" species and forms will compound historical problems, particularly if species that are better adapted to slightly warmer climates, such as *R. laudatus* (Bundy blackberry) and others, are introduced and sold.

Climate-matching software called 'CLIMATCH' (BRS 2009) was applied to predict areas of Queensland where climate is similar to that experienced where *R. laudatus* is native (Figure 3).

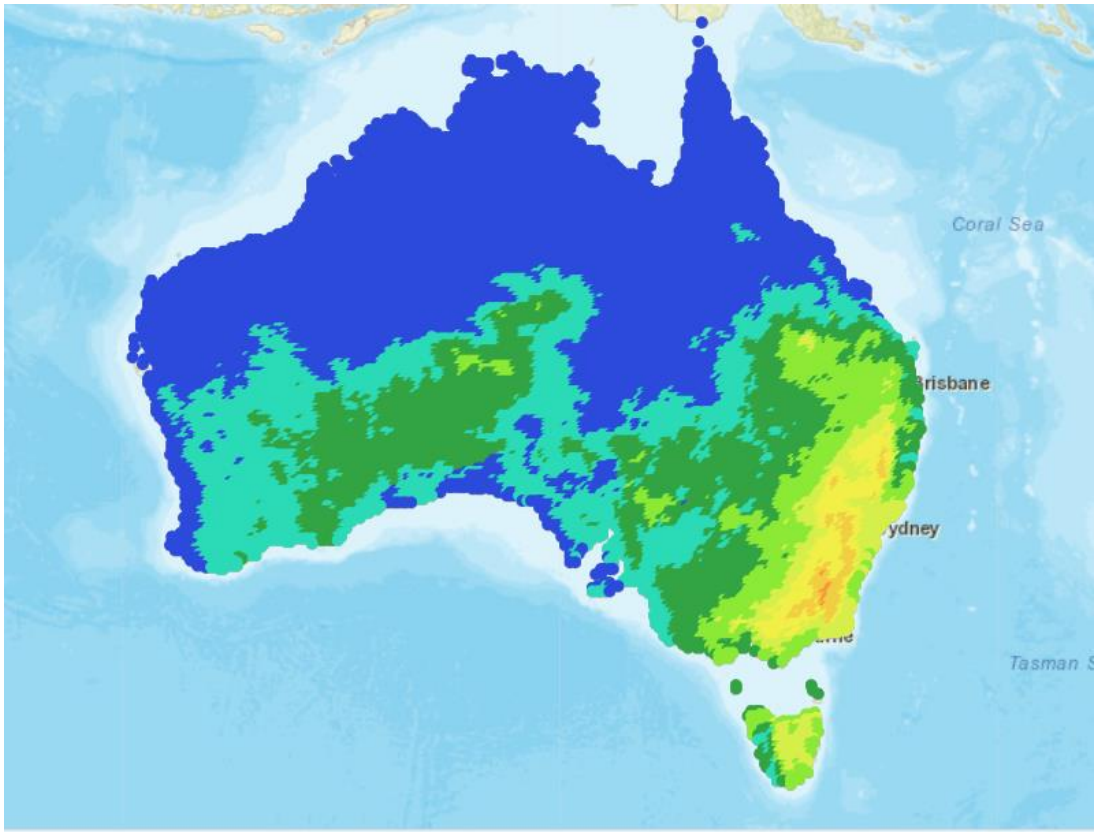

Figure 3. Area of Australia where climate appears suitable for survival of Rubus laudatus

The red, orange and yellow indicate areas where climate is highly suitable, green indicates moderate suitability and blue unsuitable.

On the matter of risk to the existing effectiveness of biocontrol agents, namely the rust fungus *Phragmidium violaceum*, it appears that, unlike European species of blackberry, American blackberry

species (such as *R. laudatus* and *R. ulmifolius*) are not susceptible to the rust. Hence, even if biocontrol is successful on certain invasive species of blackberry in Australia, these species could be readily replaced by equally invasive congeners that can grow free from biocontrol. Biocontrol effectiveness could conceivably be further compromised by the ongoing development of hybrids.

Feasibility of eradication in Queensland

Complete statewide eradication of naturalised species of *Rubus* in Queensland is not feasible. Eradication can generally only be achieved if target populations are detected early in the invasion process when populations occupy only a small area.

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