

New Acacia species from Gindalbie Metals Pty Ltd iron ore leases on Karara Station and nearby areas, Western Australia



**A Report Produced For
Gindalbie Metals Pty Ltd
By Bruce R. Maslin**

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Department of
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Our environment, our future



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EXECUTIVE SUMMARY

This report summarizes the results of a taxonomic assessment of a number of *Acacia* species (Wattles) that occur on Gindalbie Metals Pty Ltd iron ore leases on Karara Station and nearby areas in the Mid West region of Western Australia, about 80 km to the east of Perenjori. Field work commenced in mid 2006 and most of the study was undertaken in 2007 at the Western Australian Herbarium, Department of Environment and Conservation, supported by funds provided by Gindalbie Metals Pty Ltd.

Eight new species contained in four scientific publications (published in the journal *Nuytsia*) were described namely, *Acacia diallaga*, *Acacia effusifolia*, *Acacia incognita* (False Sugar Brother), *Acacia karina* (Karina's Wattle), *Acacia latior* (Broad-leaf Sugar Brother), *Acacia sulcaticaulis*, *Acacia umbraculiformis* (Western Umbrella Wattle) and *Acacia woodmaniorum* (Woodman's Wattle). These species occur on Gindalbie lease areas, except for *A. sulcaticaulis* which is restricted to the nearby Mt Mulgine. Copies of the scientific papers have been presented to Gindalbie Metals Pty Ltd and pdf files of these same four papers accompany this report.

An assessment of the conservation status of the new species has shown that one is a Declared Rare Flora (*Acacia woodmaniorum*), one a Priority 1 species (*Acacia sulcaticaulis*) and two are Priority 2 species (*Acacia karina* and *Acacia diallaga*).

A revision of the taxonomically complex *Acacia coolgardiensis* group was necessary in order to properly assess the representatives of this group that occur on the Gindalbie leases. Three members of this group occur on the leases (*Acacia effusifolia*, *Acacia incognita* and *Acacia latior*) and the remaining two members (*Acacia coolgardiensis* and *Acacia sulcaticaulis*) occur nearby. The study has shown that the form of *Acacia latior* which is common on the Gindalbie leases is a narrow phyllode variant of that species; this variant occurs outside the lease area (as far north as Mullewa) and is not considered rare or endangered.

Simplified descriptions accompanied by photographs are presented here to aid in the identification of the new species.

The newly described species are as follows.

Acacia diallaga. Prickly low shrubs with short, sharp-pointed leaf-like structures called phyllodes that are bluish to blue-green but change to purple-red when plants are drought-stressed. It has a restricted distribution in the Blue Hills Range and Mt Mulgine areas.

Acacia effusifolia. Shrubs or trees with long, narrow, leaf-like structures called phyllodes that are ±straight and sub-rigid, flower-heads that are mostly paired within the axil of the phyllodes and often lack a basal stalk, and pods that are very narrow and round in cross-section. This wide-spread species is a member of the *Acacia coolgardiensis* group and is not common in the lease area.

Acacia incognita (False Sugar Brother). Umbrella-shaped shrubs or small trees with longitudinally fissured bark on their stems and branches, the leaf-like structures called phyllodes are long, slender and not especially rigid, the flower-heads are small and on short, slender stalks, and the pods are very narrow and round in cross-section. This reasonably wide-spread species is a member of the *Acacia coolgardiensis* group and is common in the Blue Hills Range, especially on the flats at the base of the Banded Ironstone Formation 'Karara Range'.

Acacia karina (Karina's Wattle). Openly branched shrubs with long, slender leaf-like structures called phyllodes that are round in cross-section and 8-nerved, the flowers are loosely arranged in long, cylindrical spikes and the pods are long and narrow. Although relatively common in the lease areas and adjacent regions this species appears to have a restricted distribution (as far east as Mt Gibson).

Acacia latior (Broad-leaf Sugar Brother). Low shrubs with a dense, compact crown, the new shoots are conspicuously hairy, the leaf-like structures called phyllodes are dull green to grey-green and have a distinctive silvery sheen, they are variable in width and a narrow-phyllode form occurs mainly in the Blue Hills Range area, the short pods are very narrow and round in cross-section. This species is a member of the *Acacia coolgardiensis* group and is reasonably wide-spread; the narrow-phyllode form that occurs on the Gindalbie leases is considered to be the end-point of a cline for phyllode width and has not been afforded formal taxonomic rank.

Acacia sulcatacaulis. Umbrella-shaped, multi-stemmed shrubs with stems bearing distinctive longitudinal flutings (with longitudinal furrows between the flutes), the leaf-like structures called phyllodes are relatively broad and dull green and the small pods are round in cross-section. This species is a member of the *Acacia coolgardiensis* group and is known only from Mt Mulgine area.

Acacia umbraculiformis (Western Umbrella Wattle). Shapely, umbrella-shaped trees with characteristically wide-spreading, curved, shiny, dark green leaf-like structures called phyllodes, the pods are wide and hard-textured and the seeds are large. A wide-spread species that is normally found on granite but in the Blue Hills Range area some plants also grow on Banded Ironstone Formation.

Acacia woodmaniorum (Woodman's Wattle). Bizarre-looking, prickly, low, sprawling shrubs with winged branchlets and leaf-like structures called phyllodes that are characterized by having 2 or 3 very prominent, rigid, sharp spines along their upper margin. A rare species known only from 'Mungada Ridge' (the main population) and two nearby, small Banded Ironstone Formation hills.

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INTRODUCTION

Preamble

In 2006 I commenced work on arid zone *Acacias* (Wattles) with particular emphasis on Mulga (*Acacia aneura* and its relatives) and species that occurred on Banded Ironstone Formation (BIF) ranges. My study of BIF areas formed part of the Department of Environment and Conservation's *Biodiversity Conservation Initiative* project into plant species of the Mid-West region's Banded Ironstone Formation ranges. BIF ranges are believed to have acted as refugia for species during arid phases of the Tertiary Period and many support a range of plant taxa and communities which appear restricted to these specialized habitats, and as such have high conservation value. Some BIF ranges contain significant deposits of hematite and magnetite and therefore may be of potential high economic value. Gindalbie Metals Pty Ltd is currently in the exploration phase of a mining operation in the Blue Hills Range area on Karara Station, about 80 km to the east of Perenjori. Because the flora of this area is poorly known and because there was potential for mining operations to be constrained by the presence of species with high conservation value, Gindalbie Metals Pty Ltd and Department of Environment and Conservation entered an agreement to enable the *Acacia* flora of the Blue Hills Range to be taxonomically scrutinized so that new species and those of conservation value to be identified. This would then enable both the Company and the Department to make informed decisions concerning future management of at least the *Acacia* taxa of conservation importance. The agreement, called the *Acacia Study Agreement*, forms the basis of the project that is the subject of this report (a copy of the Agreement is attached here as Appendix 1).

Scope of the Study

The primary purpose of this study was to assess the taxonomic status of six *Acacia* taxa (Wattles) that grow on Gindalbie Metals Pty Ltd iron ore leases on Karara Station. The project required that formal names and descriptions to be prepared for those taxa deemed as new to science, and simplified, 'user-friendly' versions of these treatments be presented to Gindalbie Metals. The conservation status of each taxon was to be assessed and relevant geographic, ecological and biological information concerning them to be made available so that informed judgments can be made regarding impact assessment processes.

The majority of the work was done during 2007, but the first field trip to the Gindalbie lease area on Karara Station was conducted in June 2006 and the final paper in which species from this region were described was published in August 2008.

Study Area

The primary focus of this study was the Gindalbie iron ore lease areas located on Karara Station in the Mid West region of Western Australia, about 80 km to the east of Perenjori. From a natural history perspective this is a particularly important region for a number of reasons: it is adjacent to the very species-rich South West Botanical Province, it incorporates a

number of Banded Ironstone Formation (BIF) ranges and because, until recently, it had been very poorly collected. The study area includes the Blue Hill Range which comprises a series of BIF ranges that extend from Mt Karara in the southwest to Windanning Hill in the east and encompasses the following geomorphological units: 'Karara Range' (an informal name used here for the discrete range that incorporates Mt. Karara), 'Mungada Ridge' (an informal name used here for the high crescent-shaped range with Windanning Hill at its southern extremity) and Jasper Hill which is located about 5 km to the north of 'Mungada Ridge'.

Because a number of the species on the lease areas were related to *Acacia coolgardiensis* it was necessary to study this species over much of its geographic range. Therefore, some work was conducted in areas to the north of Blue Hills Range, extending to the vicinity of Mullewa.

The Taxa

The taxa (species) of primary focus were those listed in the *Acacia Study Agreement* (see Appendix 1). However, during the course of the work an additional taxon of interest was discovered at Mt Mulgine, on land adjacent to the study area. Because this species was a member of the *Acacia coolgardiensis* group it was decided to include this species in the work. This taxon was subsequently described as *Acacia sulcatacaulis*.

The following were the primary target taxa of the project; they are listed by their now formally published names (with previous formal or informal names given in angle brackets).

1. *Acacia diallaga* [*Acacia* aff. *subsessilis*]
2. *Acacia effusifolia* [*Acacia coolgardiensis* subsp. *effusa*]
3. *Acacia incognita* [*Acacia* sp. nov. 3]
4. *Acacia karina* [*Acacia* sp. Karara (C. Godden 14)]
5. *Acacia latior* [*Acacia coolgardiensis* subsp. *latior*, *Acacia* aff. *coolgardiensis*]
6. *Acacia umbraculiformis* [*Acacia* sp. Murchison (B.R. Maslin 7331)]
7. *Acacia woodmaniorum* [*Acacia* sp. Blue Hills Range (R.J. Cranfield 8582)]
8. *Acacia sulcatacaulis* [no prior informal or phrase name]

As already noted it was also necessary to include *Acacia coolgardiensis* in the study because it is closely related to a number of those listed above, namely, *Acacia effusifolia*, *Acacia incognita*, *Acacia latior* and *Acacia sulcatacaulis*.

Methods

Conventional taxonomic methodology was used to assess the taxonomic status of the taxa included in this study. This necessitated a number of field trips to collect critical flowering and fruiting material, and to assess the range of variation of plants in the field. Supplementary study material was provided by staff of Woodman Environmental Consulting. The collected specimens were processed and deposited in the Western Australian Herbarium, and are thus available for future study should the need arise.

The following field trips were conducted in relation to this project:

Gindalbie leases and associated areas, Karara Station: 27 June 2006; 10 April 2006; 13

September 2006; 16–19 July 2007; 30–31 October 2007.

Mullewa – Karara Station area: 23–20 January 2008 (*Acacia coolgardiensis* extended study).

Critical examination of the collected material, together with other specimens collected prior to commencement of the project, was undertaken using light microscopy. Morphological details were documented and compared with those of related taxa at the W.A. Herbarium in order to assess the taxonomic status of each taxon. All known distribution records of the taxa were used to assess the conservation status of the taxa. In this work I was assisted by Ms Carrie Buscumb who was appointed to the project with funds provided by Gindalbie Metals.

RESULTS

All eight taxa referred to above were deemed to be new to science and a formal description of each has been published in four papers in the journal *Nuytsia*. Simplified, user-friendly descriptions based on the scientific descriptions were prepared and are presented in this report. Four of the species have been shown to have conservation value with the most important being *Acacia woodmaniorum* which is now classified as a Declared Rare Flora species pursuant to the Wildlife Conservation Act 1950.

Scientific papers published

During 2007 and 2008 four scientific papers were published in which new species from the study area and adjacent regions were described. Gindalbie Metals Pty Ltd was acknowledged in each of these papers for their generous support of the project. Copies of these papers have been presented to Gindalbie Metals and a pdf version of each is also included on the CD that accompanies this report. The papers are:

Maslin, B. R. and Buscumb, C. (2007). Two new *Acacia* species (Leguminosae: Mimosoideae) from banded ironstone ranges in the Midwest region of south-west Western Australia. *Nuytsia* 17: 263–272.

Maslin, B. R. and Buscumb, C. (2008). A review of *Acacia coolgardiensis* (Leguminosae: Mimosoideae) and closely related species in Western Australia. *Nuytsia* 18: 107–125.

Maslin, B. R. and Buscumb, C. (2008). *Acacia diallaga* (Leguminosae: Mimosoideae), a new geographically restricted species with diallagous phyllodes from the Midwest Region of southwest Western Australia. *Nuytsia* 18: 127–132.

Maslin, B. R. and Buscumb, C. (2008). *Acacia umbraculiformis* (Leguminosae: Mimosoideae), a new species related to *A. quadrimarginea* from the Midwest Region of south-west Western Australia. *Nuytsia* 18: 133–138.

It is worthy of note that paper #2 comprised a comprehensive revision of this the *Acacia coolgardiensis* group of species. It was necessary to undertake a review of this complex group of species in order to determine the taxonomic status of the three members of this group which occur on Gindalbie leases, namely, *Acacia incognita*, *Acacia effusifolia* and *Acacia latior* (Note: *Acacia sulcatacaulis* from Mt Mulgine is also a member of this group).

Species recognized

Contained in the above-mentioned publications are descriptions of eight new species, namely:

Acacia diallaga, *Acacia effusifolia*, *Acacia incognita*, *Acacia karina*, *Acacia latior*, *Acacia umbraculiformis*, *Acacia woodmaniorum* and *Acacia sulcatacaulis*. These species occur on Gindalbie lease areas, except for *A. sulcatacaulis* which is restricted to the nearby Mt Mulgine.

In addition a revised description of *Acacia coolgardiensis* (which does not occur on Gindalbie leases at Karara) was prepared.

The above-mentioned species are all good (i.e. taxonomically robust) taxa and as such are relatively invariable and clearly distinguishable from their closest relatives. However, as noted below the Blue Hills Range form of *A. latior* is a little different from most other members of this species.

Conservation status of the species

Four of the new species described have conservation value; none of the remaining species is considered rare or endangered.

Declared Rare Flora

Acacia woodmaniorum

Priority 1

Acacia sulcatacaulis

Priority 2

Acacia karina and *Acacia diallaga*

The definition of these conservation ratings which are determined by the Department of Environment and Conservation are as follow:

Declared Rare Flora: Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.

Priority 1: Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

Priority 2: Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

SPECIES DESCRIPTIONS

The descriptions provided below are simplified versions of the new species that appear in the four *Nuytsia* papers listed above. These descriptions, which are arranged alphabetically by species name, are accompanied by a range of colour photographs which will help identify them. It should be noted that no description of *Acacia coolgardiensis* is given below because this wide-spread species does not occur on the Gindalbie leases; however, a description of *Acacia sulcatacaulis* (related to *Acacia coolgardiensis*) is included, even though it does not occur on Gindalbie leases, because it has a high conservation value and occurs on the nearby Mt Mulgine.

The following descriptions are presented.

<i>Acacia diallaga</i>	6-7
<i>Acacia effusifolia</i>	8-9
<i>Acacia incognita</i>	10-11
<i>Acacia karina</i>	12-13
<i>Acacia latior</i>	14-15
<i>Acacia sulcatacaulis</i>	16-17
<i>Acacia umbraculiformis</i>	18-19
<i>Acacia woodmaniorum</i>	20-21

Acacia diallaga



Acacia diallaga

This species is listed in the *Acacia Study Agreement* as *Acacia* aff. *subsessilis*. It was formally described by Bruce Maslin and Carrie Buscumb in *Nuytsia* volume 18, pages 127–132 (2008).

Description. Dense, spreading, much-branched, prickly shrubs 0.5–1.5 (–3) m tall. Leaf-like structures called phyllodes are short (mostly 15–36 mm long and 5–6 mm wide) and wide-spreading, they have 3 longitudinal nerves on each face and narrow at the apex into a needle-like, sharp tip, the colour is bluish to blue-green (except on young growth which is green) but change to purple-red when plants are drought-stressed. The light golden flowers are aggregated into short, cylindrical structures called spikes and these are inserted on very short stalks 2–4 mm. The pods are 2.5–5.5 cm long and 4 mm wide, they are ±straight-edged, slightly rounded over the seeds, thin-textured and light brown in colour. The seeds are 3 mm long, 2 mm wide and black with a satin lustre.

Distribution and ecology. *Acacia diallaga* is known from a small area on Karara and Warriedar Stations where it occurs in the vicinity of Blue Hill Range and Mt Mulgine. It has a patchy distribution over about 30 km in an east-west direction; it is common in the places where it grows. It is possible that additional populations will be discovered with future study. It grows in skeletal, red, silty loam on the slopes, or occasionally crests, of low rocky (basalt) hills in open mixed *Allocasuarina* and *Acacia* thickets.

Flowering and fruiting. Because of the paucity of collections it is difficult to accurately determine the flowering and fruiting period for this species. However, the material collected in 2007 was in full flower in early September and had pods with mature seeds in early to mid-December. It is expected that flowering would probably commenced around the middle of August. Only few of the plants in the populations produced flowers or pods during the rather dry year of 2007.

Conservation status. *Acacia diallaga* is listed on the Department of Environment and Conservation's *Declared Rare Flora and Priority Flora List* as a Priority 2 taxon.

Affinities. *Acacia diallaga* is most closely related to *Acacia subsessilis* which grows on Warriedar Station, with only about 20 km separating the two. *Acacia subsessilis* is most readily recognized by its phyllodes which are narrower (about 1 mm wide) and dull green, and by its broader pods (5–7 mm wide) and slightly larger seeds (4–5 mm long and 3–3.5 mm wide).

Notes. This species, like *A. subsessilis*, is unusual in that its phyllodes change colour (from blue/blue-green to purple-red) when water becomes limiting during periods of drought. Unless the phyllodes die they revert to their normal blue/blue-green colour when conditions improve with the advent of rainfall. The species was discovered by David Coultas and Frank Obbens (Woodman Environmental Consulting) in August 2006 while undertaking botanical surveys for Gindalbie Metals Pty Ltd on Karara Station.

Origin of botanical name. The name is derived from diallagy (adj. diallagous) which describes the ability of some plants to change the colour of their foliage and then reverse it according to weather conditions.

Acacia effusifolia



Acacia effusifolia

This species was formerly called *Acacia coolgardiensis* subsp. *effusa*. It was formally described by Bruce Maslin and Carrie Buscumb in *Nuytsia* volume 18, pages 111–114 (2008).

Description. Shrubs or small trees 2–5 m tall, with smooth bark and presumably fluted stems. The branchlets have minute, flattened hairs between ribs which normally have an overburden of thick resin. The young new shoots are encrusted with resin. The leaf-like structures called phyllodes are flat, long and narrow (normally 6–10 cm long and 1.5–3 mm wide), they are straight to shallowly curved, sub-rigid and commonly grey-green to bluish green, they possess many, fine, longitudinal nerves that are close together and the hardened apex is not sharp-pointed. The golden flowers are arranged on short-oblong to cylindrical structures called spikes which are mostly paired within the axil of the phyllodes and which may or may not be inserted on a short stalk. The thin-textured, brown to reddish brown pods are mostly 3–7 cm long and 1–2 mm wide, they are round in cross-section, often very slightly constricted between the seeds and possess silvery flattened hairs between the ±obscure longitudinally nerves. The brown seeds are 3–4 mm long and about 1 mm wide.

Distribution and ecology. Widespread and common in places in rangeland country (marginally entering the north-central wheatbelt in places) from north of Geraldton to north of Kalgoorlie). It is not common on Karara Station. It grows in a variety of habitats but is commonly recorded from sand or sandy loam, or in heavier-textured red or brown loam or clay-loam soil in Eucalyptus woodland.

Flowering and fruiting. Flowers mostly between July and September, but occasionally in December or March (presumably in response to the intermittent summer rainfall). Pods with mature seeds have been collected between October and December.

Conservation status. *Not considered rare or endangered.*

Affinities. *Acacia effusifolia* is closely related to *Acacia coolgardiensis* which is not recorded from the Gindalbie Mining leases (although it grows nearby). *Acacia coolgardiensis* is most easily distinguished from *A. effusifolia* by its phyllodes which are round in cross-section and which do not exceed 1 mm in width (*Acacia effusifolia* phyllodes are clearly flattened and are normally 1.5–3 mm wide). There is a remarkable resemblance between *Acacia effusifolia* and *Acacia ramulosa* variety *ramulosa* (Bowgada), not only in phyllode shape and size but also in flower characters; the two taxa sometimes grow together or in close proximity on Karara Station. Fruiting specimens are easy to distinguish because the pods of Bowgada (which are round in cross-section) are much wider (5 mm or more) than those of *Acacia effusifolia* (1–2 mm) and have distinct longitudinal nerves. Non-fruiting specimens are more problematic but in Bowgada the phyllodes are more rigid and generally greener and straighter than those of *Acacia effusifolia* and the stalks of the flowering spikes and the new shoots lack the minute, red-brown resin hairlets that occur on these organs in *Acacia effusifolia* (observe with a hand lens).

Origin of botanical name. The botanical name refers to the flat phyllodes which distinguish the species from its closest relative, *Acacia coolgardiensis*.

***Acacia incognita* (False Sugar Brother)**



***Acacia incognita* (False Sugar Brother)**

This species is listed in the *Acacia Study Agreement* as *Acacia* sp. nov. 3. It was formally described by Bruce Maslin and Carrie Buscumb in *Nuytsia* volume 18, pages 114–118 (2008).

Description. Umbrella-shaped shrubs or small trees 3–5 m tall, the main stems slightly crooked and not fluted, the bark is longitudinally fissured on the stems and normally also the branches. The branchlet ribs do not have an overburden of resin. The leaf-like structures called phyllodes are long and slender (mostly 7–12 cm long, and about 1 mm wide), they are mostly sub-round or flat in cross-section, not especially rigid or resinous, ±hairless and green (sometimes tinged greyish), they possess many fine longitudinal nerves and the apex is not sharp-pointed. The golden flowers are arranged in small, round or short-oblong heads which normally occur singly within the axil of the phyllodes, the heads are on short, slender, ±hairless stalks 4–6 mm long. The thin-textured, dark red-brown pods are 3.5–10 cm long and 1–2 mm wide, they are round in cross-section, very slightly constricted between seeds and ±obscurely longitudinally nerved. The brown seeds are 3–5 mm long and about 1 mm wide.

Distribution and ecology. False Sugar Brother is found mainly from the vicinity of Mullewa and Yalgoo south to Karara Station. It is common in the Blue Hill Range where it occurs in a number of populations, especially on the flats at the base of the Banded Ironstone Formation 'Karara Range'. It grows on red to red-brown loam or loamy clay (often with a stony or sandy surface) in Open Woodland or Mallee Woodland dominated by species of *Eucalyptus* (*E. ewartiana*, *E. kochii* subsp. *amaryssia* and *E. loxophleba* subsp. *supralaevis*) or shrubland dominated by *Melaleuca leiocarpa*.

Flowering and fruiting. Flowers in January, February, April, September and October (presumably flowering quickly and opportunistically in response to rainfall) but not all plants in populations flower at any one time. Plants with mature seed have been collected mainly in late October and early December.

Conservation status. *Not considered rare or endangered.*

Affinities. False Sugar Brother is related to, and formerly confused with, *Acacia coolgardiensis* which is not recorded from the Gindalbie Mining leases (although it grows nearby). *Acacia coolgardiensis* differs in having predominantly smooth bark and few to numerous longitudinal flutings on its stems. Also, its flower heads are normally larger than those of *Acacia incognita* (5–9 x 5–6 mm when dry), are mostly paired within the axils of the phyllodes and importantly, either lack a basal stalk have a very short one (to about 2 mm long). In *A. incognita* the heads are usually 4–6 x 4–5 mm, occur singly within the axils of phyllodes and are on slender stalks normally 4–6 mm long.

Notes. In the field *A. incognita* can easily be over-looked because it does not possess any particularly distinctive features.

Origin of botanical name. The botanical name was selected because the identity of this species has gone unrecognized until recently on account of its superficial resemblance to *Acacia coolgardiensis*.

***Acacia karina* (Karina's Wattle)**



***Acacia karina* (Karina's Wattle)**

This species is listed in the *Acacia Study Agreement* as *Acacia* sp. Karara (C. Godden 14). It was formally described by Bruce Maslin and Carrie Buscumb in *Nuytsia* volume 17, pages 264–267 (2007).

Description. Openly branched shrubs 1–3 m tall, the crown not dense. Leaf-like structures called phyllodes are long and slender (mostly 10–28 cm long and about 1 mm wide), they are round in cross-section, not rigid, mostly sub-straight or curved and not spiny at their tips, they possess 8 fine longitudinal nerves each separated by a longitudinal groove. The light golden flowers are loosely arranged in long cylindrical structures called spikes (15–60 mm long). The pods are long and narrow (4–20 cm long, 4–5 mm wide) and shallowly to deeply constricted between the seeds, they are thin-textured and light brown in colour. The dark brown to black seeds are normally minutely pitted at their centre.

Distribution and ecology. Most collections of Karina's Wattle are from the Blue Hill Range (it is most common on 'Karara Range' where there exists many thousands of plants) and some low ranges located about 6 km to the east and south of Windanning Hill; there is also a single gathering from Mt Gibson. The Mt Gibson plant was collected in 1984 and has not been recollected since. In the Blue Hill Range Karina's Wattle is mainly associated with Banded Ironstone Formation in a variety of topographical situations on shallow, acidic, orange to red-brown soils. It grows in dense thickets and shrubland and is not especially easy to spot unless it is in flower.

Flowering and fruiting. Flowers from about early May to about late July. Pods with mature seeds occur mid-November and late March.

Conservation status. *Acacia karina* is listed on the Department of Environment and Conservation's *Declared Rare Flora and Priority Flora List* as a Priority 2 taxon.

Affinities. *Acacia karina* is most closely related to *Acacia stanleyi* which occurs on granite outcrops only about 50 km south of the southernmost occurrence of *Acacia karina*. However, *Acacia stanleyi* (Stanley's Wattle) is distinguished by having thicker, more rigid phyllodes which persist on the branchlets for a long period upon dying (in *Acacia karina* the dead phyllodes are readily dropped from the plants). Also, its upper branchlets are yellow whereas in *Acacia karina* they are reddish brown, and its denser flowering spikes have a shorter stalk (1–2 mm compared with 3.5–7.5 mm in *Acacia karina*). Both these species are closely related to *Acacia jibberdingensis* (Jibberding Wattle) which occurs on granite outcrops in the north-central wheatbelt and which differs most obviously in having (commonly flat) phyllodes with a distinct 'cushion' (called a pulvinus) at their base.

Notes. *Karina's Wattle* first discovered in June 1984 on Mt Gibson Station.

Origin of botanical and common name. This attractive species is named for the Western Australian Herbarium Collections Manager, Karina Knight, from which both the botanical and common names are derived.

***Acacia latior* (Broad-leaf Sugar Brother)**



***Acacia latior* (Broad-leaf Sugar Brother)**

This species was formerly called *Acacia coolgardiensis* subsp. *latior* and is listed in the *Acacia Study Agreement* as *Acacia* aff. *coolgardiensis*. It was formally described by Bruce Maslin and Carrie Buscumb in *Nuytsia* volume 18, pages 119–122 (2008).

Description. Rounded or umbrella-shaped, normally multi-stemmed shrubs 1–3 m tall with ± sparingly fluted stems and dense, compact crowns, the branchlet ribs are obscure and not resinous. The new shoots are densely clothed with conspicuous, silvery white flattened hairs. The leaf-like structures called phyllodes are normally 5–11 cm long and 5–8 mm wide, but on plants found mainly in the Blue Hills Range area the phyllodes are narrower than normal (2–4 mm wide), they are sub-rigid, erect, dull green to grey-green with a distinctive silvery sheen, there are numerous, fine longitudinal nerves which are very close together. The golden flowers are in sub-round heads or short, cylindrical structures called spikes and are inserted on hairy stalks 3–7 mm long. The ± thin-textured, reddish brown pods are 2–5 cm long and mostly 2–3 mm wide, round in cross-section and not or scarcely constricted between the seeds, they are appressed hairy and very obscurely longitudinally nerved. The brown seeds are mostly 2–2.5 mm long and 1.2–1.5 mm wide.

Distribution and ecology. Broad-leaf Sugar Brother occurs in the vicinity of Mullewa – Yalgoo area south to the Blue Hill Range and adjacent areas where it is very common. In the northern part of its range it is found most commonly in shrubland on yellow or pale brown, often gravelly, sand or sandy loam. However, in the Blue Hill Range area it occurs on heavier, red-brown, loam clay loam soils where it is common on mid to upper slopes of Banded Ironstone Formations in open woodland and shrubland.

Flowering and fruiting. Flowers from June to August or sometimes in September. Pods with mature seeds have been collected in November and December.

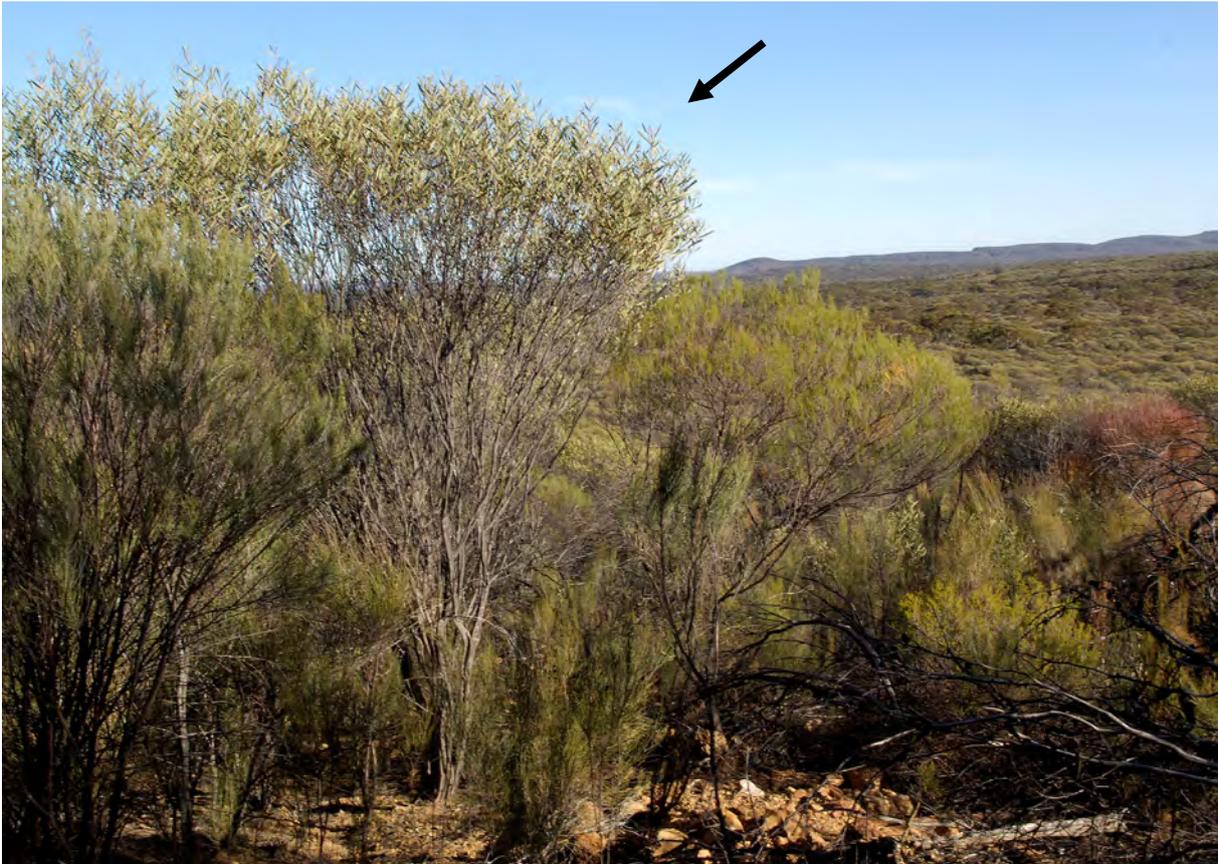
Conservation status. *Not considered rare or endangered.*

Special note. *As noted above the phyllodes on plants from the Blue Hills Range area are narrower than on most plants from elsewhere. These narrow-phyllode forms may ultimately prove to represent a discrete entity but currently they are judged being the end-point of clinal variation for phyllode width.*

Affinities. *Acacia latior* is a member of the *Acacia coolgardiensis* group and is generally recognized by its low stature, dense compact crowns, broad, flat phyllodes, conspicuously silvery hairy new shoots and non-resinous branchlet ribs. The narrow-phyllode form from Blue Hill Range sometimes grows with *Acacia effusifolia*. These two entities are superficially similar but *Acacia latior* is recognized most reliably by its conspicuous, densely hairy new shoots and its mature phyllodes having a distinctive silvery sheen. *Acacia ramulosa* variety *ramulosa* (Bowgada) often grows with *Acacia latior* and/or *Acacia effusifolia* and can be confused with these species. See under *Acacia effusifolia* for discussion of differences.

Origin of botanical name. The botanical name refers to the wide phyllodes. See the *Nuytsia* paper cited above for further discussion.

Acacia sulcata



Acacia sulcatacaulis

This species was formally described by Bruce Maslin and Carrie Buscumb in *Nuytsia* volume 18, pages 122–125 (2008).

Description. Multi-stemmed, umbrella-shaped *shrubs* normally 2–4 m tall, however, on favourable sites (around the base of Mt Mulgine) it may develop into a tree to 6 m tall whereas on very skeletal soils in open sites towards the summit of Mt Mulgine plant are often only 1–1.5 m tall, the stems are distinctively longitudinally fluted with longitudinal furrows between the flutes, the bark is smooth. The branchlets are flattened at their extremities. The leaf-like structure called *phyllodes* are mostly 5–10 cm long and 5–10 mm wide, they are dull green, generally hairless and marked with numerous, very fine, longitudinal nerves that are close to one another. The golden flowers are arranged in oblong heads about 1 cm long and which are on ±resinous stalks 3–7 mm long. The thin-textured, red-brown, ±straight pods are small (20–35 mm long and less than 2 mm wide), round in cross-section and are not or only very slightly constricted between the seeds. The small seeds are mid-brown in colour (sometimes dull yellowish near their centre) and have a dark-coloured nerve around their periphery.

Distribution and ecology. This species is known only from the vicinity of Mt Mulgine where it is locally abundant. It appears to be habitat-specific to areas having a quartz substrate. It typically grows in dense shrubland with *Acacia burkittii* and *Allocasuarina acutivalvis* on skeletal red silty loam, on steep slopes, ridges and along the rocky creek courses.

Flowering and fruiting. Because *Acacia sulcatacaulis* is poorly known it is difficult to accurately assess its flowering and fruiting periods. Nevertheless it is known to flower in September and produce pods with mature seeds in December. It may have a relatively short flowering period of perhaps only about one month. The onset of flowering is possibly dependent upon the timing and intensity of autumn/winter rainfall.

Conservation status. *Acacia sulcatacaulis* is listed on the Department of Environment and Conservation's *Declared Rare Flora and Priority Flora List* as a Priority 1 species.

Affinities. *Acacia sulcatacaulis* belongs to the *Acacia coolgardiensis* group and is most closely related to *Acacia latior* (which occurs on the Gindalbie leases). *Acacia latior* is most easily recognized by its silvery grey-green phyllodes that are covered by a layer of short, flat, glistening hairs when young (phyllodes bright green and ±hairless in *Acacia sulcatacaulis*), its slightly wider pods (2–3 mm) which are more obviously hairy, its upper branchlets which are not clearly flattened and its stems which are not as prominently fluted as in *Acacia sulcatacaulis*.

Notes. This species was discovered in April 2007 by David Coultas and Kylie Greenacre.

Origin of botanical name. The botanical name refers to the characteristic fluting that is found on stems and branches.

***Acacia umbraculiformis* (Western Umbrella Wattle)**



***Acacia umbraculiformis* (Western Umbrella Wattle)**

This species is listed in the *Acacia Study Agreement* as *Acacia* sp. Murchison (*B.R. Maslin* 7331). It was formally described by Bruce Maslin and Carrie Buscumb in *Nuytsia* volume 18, pages 133–138 (2008).

Description. Shapely, umbrella-shaped trees 3–6 m tall, with a spreading, flat-topped to sub-rounded crown. Leaf-like structures called phyllodes are wide-spreading, recurved and rather long and narrow (5–11 cm long and mostly 3–7.5 mm wide), they are dark green, shiny, hairless and marked with numerous, very fine, parallel longitudinal nerves that are close to one another (the central one is slightly more pronounced than the rest), the margins are normally red-brown and resinous, the apex is narrowed to a ±curved, non-spiny point. The golden coloured flowers are arranged in more or less round heads or short-cylindrical structures called spikes. The sub-straight to prominently curved pods are 5–16 cm long and 6–9 mm wide, they are hard-textured (often almost woody), dark brown, rounded over the seeds and vary from being straight-edged to moderately (rarely prominently) constricted between the seeds, the discrete marginal nerve is thickened and yellow or light brown. The seeds are large (5–10.5 mm long and 5–6.5 mm wide) and somewhat flattened.

Distribution and ecology. Western Umbrella Wattle occurs from near Cue and Mt Magnet south to near Koorda (this line forms the eastern boundary of its geographic range), then west to near Morawa and north of Mullewa to about 150 km inland from Kalbarri. It has a discontinuous distribution because it grows in rocky habitats. It is often abundant in the places where it occurs. Although Western Umbrella Wattle is normally found on granite, on Karara Station it grows on both granite and Banded Ironstone Formations.

Flowering and fruiting. Flowers in response to summer and early winter rainfall. Pods with mature seed have been collected between mid-September and mid-December.

Conservation status. *Not considered rare or endangered.*

Affinities. Until recently plants of *Acacia umbraculiformis* had been confused with its closest relative, *Acacia quadrimarginea*. Indeed, in the absence of pods it can be very difficult to distinguish the two species. However, *Acacia quadrimarginea* pods are distinctively quadrangular in cross section on account of possessing a vertical flange along each margin that is perpendicular to and, importantly, extending beyond the face of the pod (the pods of Western Umbrella Wattle lack this marginal flange). There are other minor differences between the species (see *Nuytsia* paper cited above) but distribution can help separate them with *Acacia quadrimarginea* being distributed to the east of where *Acacia umbraculiformis* occurs except that the two come together north of Cue.

Notes. Western Umbrella Wattle is not known in cultivation but this hardy, long-lived species with its attractive growth form could be useful in amenity plantings as a provider of shade. In nature it is probably slow-growing but with supplementary water under cultivation it may attain acceptable growth rates.

Origin of botanical name. The species name is derived from the Latin word for an umbrella and refers to both the growth form of the plants and to the shape of the phyllodes.

***Acacia woodmaniorum* (Woodman's Wattle)**



***Acacia woodmaniorum* (Woodman's Wattle)**

This species is listed in the *Acacia Study Agreement* as *Acacia* sp. Blue Hills Range (*R.J. Cranfield* 8582). It was formally described by Bruce Maslin and Carrie Buscumb in *Nuytsia* volume 17, pages 268–271 (2007).

Description. Sprawling, prickly shrubs mostly 1–2 m tall and up to 2 m across, the dead phyllodes persisting on lower branches below the living crown. New shoots red when first initiated. The broad, leaf-like structures called phyllodes run down the branchlets to form a wing on either side of them, the phyllodes are blue or blue-green in colour but turn green with age, they are leathery and possess along their upper margin 2 or 3 very prominent, rigid, sharp, brown spines. The light golden flowers are arranged in round heads which are on stalks about 1–2 cm long. The pods are 10–45 mm long, 5–7 mm wide and straight or variously curved (especially after opening), they are somewhat thin-textured and dark brown in colour. The seeds are somewhat irregularly shaped, they are 3–4 mm long, raised at centre and narrowed toward their edges.

Distribution and ecology. This is a rare species. The main population comprises several to many thousand individuals occurs on 'Mungada Ridge'; there are two smaller populations on nearby BIF hills. The total area covered by these populations is about 5.560 hectares with a north to south range of 8.8 km and an east to west range of 6.3 km (Greg Woodman, pers. comm.). All three populations occur in areas covered by mining exploration leases. These plants grow on ridges of hematite and magnetite and appears to be highly substrate-specific to this rock type. They typically occur high in the landscape (over 400 m), often growing in rock crevices on exposed, steep slopes. The soils are skeletal, acidic, red-brown loam, sandy loam or silt.

Flowering and fruiting. Flowers from late June to August with the main flush in July. Pods with mature seeds occur between late November and late March.

Conservation status. Woodman's Wattle has been gazetted as a Declared Rare Flora species.

Affinities. This very distinctive species is most closely related to *Acacia alata* variety *biglandulosa* which occurs in the general vicinity of Geraldton, about 200 km to the northeast of where Woodman's Wattle is found. Variety *biglandulosa* differs most obviously from Woodman's Wattle by its white-coloured flower heads bearing only 4–7 flowers (heads golden and 27–28-flowered in Woodman's Wattle), its phyllodes which bear only a single spinose point and 2 or 3 prominent, stalked glands (phyllodes have 2 or 3 spiny points and non-stalked, obscure glands in Woodman's Wattle) and densely hairy pods (pods hairless in Woodman's Wattle).

Notes. Recent observations of undisturbed sites within its native area show Woodman's Wattle as having good seedling recruitment (regeneration is from seed). Woodman's Wattle was first discovered in 1992.

Origin of botanical name. This bizarre-looking, spiny Wattle is named for the Woodman brothers, Simon, Richard and Greg. Greg's company, Woodman Environmental Consulting, has conducted extensive botanical surveys of Gindalbie Metals' leases on Karara Station.

Appendix 1: Acacia Study Agreement between Gindalbie Metals Pty Ltd and the Department of Environment and Conservation

ACACIA STUDY AGREEMENT

Date 2007

Parties

A. DEPARTMENT OF ENVIRONMENT AND CONSERVATION ABN 38052 249 024 of 17 Dick Perry Ave, Technology Park, Western Precinct, Kensington, Western Australia (“DEC”);

AND

B. GINDALBIE METALS LIMITED ACN 060 857 614 of Level 9, 216 St Georges Terrace, Perth, Western Australia (“Gindalbie”)

The parties agree:

Study Scope

1. The DEC will undertake a study to describe and name the six taxa of *Acacia* described in Schedule 1 (the “Species”) that are located on Gindalbie’s mining project area at Karara Station, together with any ecological and biological information concerning the Species (“Study”).
2. The Study will involve the collection of relevant flowering and fruiting material, and relevant ecological and biological information, of the Species, with reference to specimens already collected and housed at the Western Australian Herbarium.
3. The DEC will provide a scientific description of those Species which are new to science.
4. The Study is to be completed no later than 28 February 2008 (“Completion Date”).

Payment

5. (a) Gindalbie has agreed to contribute \$50,510 (plus GST) to the DEC towards completion of the Study. Payments will be made in 5 installments of \$10,102 over 12 months. DEC will issue valid tax invoices for these amounts which will be payable by Gindalbie within 30 days of receipt.

(b) In addition where the DEC requires access to the mining area for the purposes of the Study, Gindalbie will provide the DEC with free accommodation and food from the mine site camp if available.

Resources

6. The DEC will provide the services of Bruce Maslin and a field assistant to complete the Study and any other resources reasonably required to complete the Study by the Completion Date.

Study Report

7. The DEC will provide Gindalbie with a copy of the Study report which it may use for

its own purposes.

8. The DEC will ensure that Gindalbie has a reasonable opportunity to provide input and comment during the preparation of the Study report and in particular before any publication in respect of the Study Report.
9. The DEC may publish the outcomes of the Study report in a scientific journal.

Ongoing communication

10. The DEC will ensure that Bruce Maslin remains in contact with Peter Spalding of Gindalbie throughout the Study to ensure open communication.

Identification of Species

11. In addition to the Study, the DEC will provide Gindalbie with a user friendly means of identifying any Species considered of conservation value (ie those that are referable to DEC's Declared Rare Flora and Priority Species List.). This may include some form of key to the species or plain-language Fact Sheets, which ever is deemed appropriate at the time.

Safety

12. The DEC will need to access Gindalbie's mining project area from time to time in order to carry out the Study.
13. When accessing Gindalbie's mining project area the DEC will ensure that its representatives:
 - give Gindalbie at least 48 hours notice of its intention to access the area so that a site induction can be arranged;
 - comply in all respects with all applicable legislation relevant to environmental matters, heritage, and health and safety, and will provide a safe system of work for its personnel;
 - comply with all reasonable safety procedures and restrictions which Gindalbie imposes on people accessing the mining project area;
 - leave all gates open or closed as found; and
 - restrict vehicle access to existing tracks so far as is reasonably possible.

Relationship

14. Nothing contained in this agreement shall be construed to constitute any party a partner or agent of any other party.

Signed as an agreement

For Department of Environment and Conservation

Director, Science Division

Date

For Gindalbie Metals Ltd

Date

Schedule 1

THE SPECIES

1. *Acacia* sp. Blue Hills Range (*R.J. Cranfield* 8582).

2. *Acacia* sp. Karara (*C. Godden* 14): occurs on BIF but not known if confined to this rock type.

3. *Acacia* aff. *coolgardiensis*

4. *Acacia* aff. *subsessilis*

5. *Acacia* sp. nov. 3

6. *Acacia* sp. Murchison (*B.R. Maslin* 7331)