Evidence on Listing Eligibility and Conservation Actions 2021

Erythroxylum sp. Cholmondely Creek (J.R.Clarkson 9367) (NT Population)

Current EPBC Act status: Not listed
Current TPWC Act status: Endangered (D)

Proposed Action: Add to EPBC list
Nominated Status: Vulnerable (D)

Taxonomy

Scientific name:	*Erythroxylum* sp. Cholmondely Creek (J.R.Clarkson 9367)		
Common name:	N/A		
Family name:	ERYTHROXYLACEAE	Fauna ☐	Flora ☒

Species Information

Description

Erythroxylum sp. Cholmondely Creek is a small subshrub to 30 cm tall, usually with several sparingly branched reddish stems arising from just below ground level. The small leaves are obovate in shape (Figure 1) and several small heterostylous flowers can be borne in the uppermost leaf axils. The species appears as *Erythroxylum pusillum* Clarkson *ined.* in some published material (NT Herbarium)

Distribution

Erythroxylum sp. Cholmondely Creek is known in the Northern Territory (NT) from a single site on c. 680 m^2 of the Rio Tinto mine lease on the Gove peninsula in East Arnhem Land (METSERVE 2012). *Erythroxylum* sp. Cholmondely Creek is, however, locally common in woodland habitat on the western side of Cape York Peninsula (CYP) in Queensland. The extant NT population potentially originated from a single ancestral individual following the loss of geographic connectivity to the CYP region 12,000 to 7,000 years ago (van der Merwe et al. 2010). Molecular evidence (microsatellites) indicates that the NT population is genetically distinct from populations on the CYP, with no shared genotypes detected between NT and CYP (van der Mewe et al. 2010). Consequently, the NT population is considered to be isolated from conspecific populations outside the region and, thus, the IUCN Red List Categories and Criteria are applied to the NT population without modification.

Adequacy of Survey

Survey effort for this species is deemed adequate. The Gove Peninsula area which encompasses the NT location of Erythroxylum sp. Cholmondely Creek is the 8th most heavily surveyed of 129 one degree grid cells in NT, in terms of numbers of plant collections in NT Herbarium. This puts it in the top 10% in NT in terms of the specific and incidental flora survey effort it has received. There are 748 botanical survey and collecting points in a 30 by 30 minute cell (50% terrestrial habitat) in the vicinity of Gove Peninsula. As a perennial subshrub, Erythroxylum sp. Cholmondely Creek has a moderate to high level of detectability for methods used in well-timed general surveys and its detectability is considered to be high when appropriate methods for targeted survey are used.

Erythroxylum sp. Cholmondely Creek has been the subject of targeted species-specific searches in suitable habitat in the Gove area of NT, on and off the mine site, to facilitate conservation assessment of the NT subpopulation. Initial surveys for Erythroxylum sp. Cholmondely Creek were conducted in July 2007 within an area of 200 hectares on the mine site (Westaway 2007) (Appendix B). Additional targeted surveys were conducted in the Gove Peninsula area on and off the mine leases in Nov-Dec 2007, covering over c. 170 km of transects. For this latter survey, high quality satellite imagery, information on soil depth and a 1 m DEM (for part of the area) was used to locate land forms analogous to the known location, that is areas of apparently deeper loamy soils on internally drained parts of the Tertiary plateau surfaces. A grid-based survey methodology was employed to detect new subpopulations in areas regarded as high likelihood habitat and meander searches were utilised in areas regarded as likely to be less suitable habitat (e.g. areas of remnant plateau that were narrow and eroded along the margins, supporting only shallow soils with much exposed laterite or bauxite). An additional, third survey for rare plants on the remaining unsurveyed areas of the Gove mine leases was undertaken in June 2008 (Cowie & Stuckey 2008). These leases are concentrated almost entirely on the Tertiary plateau surfaces which are bauxite bearing, but also may support Erythroxylum sp. Cholmondely Creek. This survey utilised a combination of grid based and meander transect searches, as well as a quadrat-based sampling method appropriate for survey of rare plants on large areas. No additional subpopulations were located during any of these surveys.

Outside the Gove Peninsula in areas with similar or higher rainfall, analogous land forms and similar soils occur on Tertiary plateau on the west side of Arafura Swamp, on the Marrawal Plateau in the north of Nitmilik NP – southern Kakadu NP, and around Darwin. The latter two areas are the most heavily collected and best surveyed parts of NT. The Arafura Swamp area was the subject of an intensive flora survey from 1998-2001 utilising quadrat based full floristic assessments supported by vouchered herbarium specimens across a variety of habitats, as well as incidental collecting of specimens of unusual and significant species. No additional subpopulations have been located in these areas. The known distribution of E. sp. Cholmondely Creek is consistent with a number of other plant species occurring on Cape York Peninsula and in eastern NT, which also adds credibility to the evidence that the species does not occur further west.

The species has not been detected at any locations in the NT outside of its documented occurrence at a single location in Gove. These survey outcomes indicate that Erythroxylum sp. Cholmondely Creek (NT population) has a restricted range in the regional woodland flora of the NT. A population genetic survey of Erythroxylum sp. Cholmondely Creek (NT population) was conducted over an area of 5626 m^2 in 375 contiguous cells. The species was detected within an area of approximately 680 m^2 in 317 of the 375 1.5 m^2 cells. Twelve multi-locus genotypes (genets) were identified from 317 ramets sampled using six microsatellite loci (van der Merwe et al. 2010). Therefore, the NT population comprises 12 genotypic individuals from a minimum of 317 clonal plants (ramets). It is acknowledged that the last survey of the whole population was conducted more than ten years ago. The intensive survey effort and restricted area in which the

NT population occurs, however, support that the total number of clonal individuals (ramets) is less than 1,000.

Relevant Biology/Ecology

Molecular analysis of microsatellite markers provides strong evidence that the NT population of *Erythroxylum* sp. Cholmondely Creek is exclusively clonal (van der Merwe et al. 2010). Whereas sexual outcrossing is the dominant form of reproduction within Cape York populations, there is no evidence that recruitment from sexual reproduction occurs in the NT population. The growth habit of the NT population reflects the population's clonal nature, with vegetative reproduction by root suckering. The plants appear to be evergreen but above-ground parts are frequently lost to fires. Plants re-shoot from perennial rootstock at or slightly below ground level.

The NT population appears to have compensated for a lack of sexual recombination and gene flow by somatic mutation, thus managing to persist through historical environmental change via vegetative means while maintaining allelic diversity (van der Merwe et al 2010). The NT population therefore is a potential source population of genetic diversity for the species *Erythroxylum* sp. Cholmondely Creek.

The NT population of *Erythroxylum* sp. Cholmondely Creek is of taxonomic, phylogenetic, biogeographic and evolutionary importance because it is exclusively clonal, maintains allelic diversity and is genetically distinct from other populations of this species on the Cape York Peninsula in Queensland (see previous Ecology section). The NT population comprises 12 clonal genotypes that are not represented in other populations of this species. The NT population represents a remarkable expansion of the known species distribution (Rosetto 2008). In recognition of the isolated population status and current threatened species status of the NT population, a translocation program has been established for *Erythroxylum* sp. Cholmondely Creek (NT population) (see Management and Recovery section below).

Threats

Threat *(describe the threat and how it impacts on the species. Specify if the threat is past, current or potential)*	Extent *(give details of impact on whole species or specific subpopulations)*	Potential Impact *(what is the level of threat to the conservation of the species)*
Habitat destruction from mining. Current and Potential The site of the only known NT population of Erythroxylum sp. Cholmondely Creek has been explored for bauxite and was planned for clearing and mining. Strip mining for bauxite involves removal of the topsoil and as such would have caused loss or destruction of the population. Mine owners recognised the significance of this population and established a 500 m radius buffer (1972 – 2012) around the plants to protect them from mining activities. This buffer was reduced to 200 m in 2012, with approval from the Northern Territory Government. Further reduction to this buffer may potentially contribute to the decline of the entire population. The management plan for Erythroxylum sp. Cholmondely Creek states that the native population	100% of NT population	Low due to avoidance measures by mining company. High in the future.

(original) will not be directly affected by mining until 'introduced populations' are stable and expanding (see Management and Recovery). A translocation program, designed to safeguard the existing native population of *Erythroxylum sp. Cholmondely Creek* (NT population), was commenced in 2009. Ultimately, when the 'introduced populations' are established and the native population translocated to these sites (away from mining areas), the threat related to mining will increase. Further mining activities are anticipated in the next two years (METSERV 2012). As there appears to be no current evidence that the translocated plantings are stable, self-sustaining or increasing in abundance (see Management and Recovery Section and Appendix A), retention of the 200 m buffer is critical in the foreseeable future.		
Habitat damage through increased exposure to storms. **Current and Potential** The NT population occurs adjacent to an extensive area that has been cleared in preparation for mining. This clearing exposes the woodland containing the *Erythroxylum* sp. Cholmondely Creek NT population to considerable wind-throw and potential storm and or cyclone damage. The intensity of tropical cyclones is projected to increase under future climates (http://www.bom.gov.au/cyclone/climatology/trends.shtml).	100% of NT population	Medium
Declining habitat quality through changed hydrology. **Current and Potential** Habitat degradation is partly managed by retention of a 200 m buffer around the source population, but the efficacy of this buffer in the longer term is uncertain. As the surrounding landscape is progressively mined, the buffered *Erythroxylum* habitat patch may effectively become an elevated 'island' as removal of the bauxite layer lowers the surface of the ground by c. three metres. Such an 'island' would experience altered hydrology and drainage and this may have a negative impact on the ground flora including *Erythroxylum* sp. Cholmondely Creek (NT population). The response of the species to alterations in site hydrology and drainage patterns is unknown but could lead to a decline in health or resilience of the population.	100% of NT population	Uncertain level of current threat. Potentially medium-high in the future

Fire and altered fire regimes. **Current and Potential** Fire is well managed in the mine site. *Erythroxylum* sp. Cholmondely Creek is known to tolerate seasonal fire which is a regular part of the Top End landscape. If fuel loads were to change due to disturbance or introduced species, the fire risk could be altered.	100% of NT population	Low-medium
Weeds **Current and potential** Invasion by Gamba Grass and other introduced grasses (EPBC Act Key Threatening Process). Introduced grass species including Gamba Grass, *Cynodon radiatus* and *Urochloa humidicola* are present but are managed on the mine site and the surrounding area. Altered fire regimes driven by increased fuel loads is one major potential threat posed by the occurrence of these introduced species. The mine site contains the only natural subpopulation in the NT (within a 200 m buffer). Three translocation areas have been identified outside of the mine footprint, all of which are managed for fire and weeds. The current threat posed by altered fire regimes driven by introduced grasses is low due to management practices. Changes to the distributions of introduced grasses may alter the impacts on the NT subpopulation.	100% of NT population	Low - medium

Determination of IUCN parameters

Erythroxylum sp. Cholmondely Creek (NT population) comprises a single wild population. It is known from only one site in a patch of savanna woodland, c. 680 m^2 in size, within the Rio Tinto mine lease near Gove in the NT. The most serious plausible threat is habitat loss and modification due to mining activity. This single population is clonal and genetically distinct from other populations, comprising 12 multi-locus genotypes (genets) across 317 ramets (van der Merwe et al. 2010). A program was set up in 2010 to monitor the health and condition of 20 wild plants. As at 2018 there had been a 25% loss of these marked plants indicating changes in subpopulation size, although survival rates have not been tracked across the entire subpopulation. There is insufficient evidence to detect continuing decline or extreme fluctuations in the number of mature plants (ramets) or genotypes in the NT subpopulation. An ex situ conservation collection of *Erythroxylum* sp. Cholmondely Creek (NT population) located at the Greening Australia nursery in Darwin was established by MetServe Pty Ltd in 2009 to propagate the 12 wild clonal genotypes ex situ. The intent of the ex situ collection was to augment the wild population and reduce the extinction risk of the taxon through translocation of plants propagated ex situ to areas within the same ecoregion as the natural range of the population. Translocation of the propagated plants to three sites in Gove outside of the mine tenement was conducted during 2010 – 2012 and one translocation was initiated in February 2018 (MetServe 2012; Figure 3).

There is insufficient evidence that the translocated plantings are viable in the long term. Therefore, they are not included in population estimates or estimates of geographic range in this assessment. Subsequent references to ‘the population’ refer only to the single wild subpopulation.

On the basis of the above information, the Area of Occupancy (AOO) is calculated to be 4 km^2 (based on the 2 km x 2 km grid method) and the Extent of Occurrence is (EOO) is 4 km^2. The taxon is not severely fragmented and there is no evidence of extreme fluctuations in the size of the population.

Summary of IUCN attributes

EOO	4 km^2 (scaled up to match AOO)	AOO	4 km^2 (2 km x 2 km grid method).	Generation length	Unknown

No. locations	N/A	Severely fragmented?	Yes ☐ No ☒ Unknown ☐
No. subpopulations	1	No. mature individuals	317 clonal individuals (ramets); 12 genotypic individuals (genets).

Percentage global population within Australia	100%
Percentage population decline over 10 years or 3 generations	Unknown

Figure 1 a) *Erythroxylum* sp. Cholmondely Creek (NT population) leaf habit; b) habitat.

Figure 2. Occurrence of *Erythroxylum* sp. Cholmondely Creek (NT population) within Rio Tinto mine boundaries, near Gove, Northern Territory.

Assessment of available information in relation to the listing Criteria

Criterion A. Population size reduction (reduction in total numbers)
Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4

	Critically Endangered	Endangered	Vulnerable
A1	**≥ 90%**	**≥ 70%**	**≥ 50%**
A2, A3, A4	**≥ 80%**	**≥ 50%**	**≥ 30%**

A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.

A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(*a) cannot be used for A3*]

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

based on any of the followin

(a) direct observation [*except A3*]

(b) an index of abundance appropriate to the taxon

(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat

(d) actual or potential levels of exploitation

(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites

Evidence:
Erythroxylum sp. Cholmondely Creek is known in the NT from a single area within a mining tenement. Evidence from molecular analysis (microsatellites) of 317 ramets indicates that the maximum number of genetically distinct mature individuals that occur at the location is 12. Because the species is known to reproduce clonally, the generation length is unknown but is plausibly more than 3 years (NT Herbarium, pers comm, 2021).

Population reduction based on decline in the quality of habitat may result from the deleterious effects of altered site hydrology and increased exposure to storm events. There are no data available, however, to assess the scale of past or future population trends. The mine lease on which *Erythroxylum* sp. Cholmondely Creek (NT population) occurs has operated since 1972. As no survey of the species was undertaken until 2007, changes in population distribution prior to 2007 cannot be assessed. It is inferred that *Erythroxylum* sp. Cholmondely Creek was once more extensive in the Gove area, but that subpopulations may have been lost as a result of past mining activities. Protective measures, that is the 200 m buffer and fire and weed management on the mine site, appear to have successfully prevented decline in the native *Erythroxylum* sp. Cholmondely Creek (NT population) since 2007.

Translocation sites have been established with propagated plant material. There is inadequate data, however, to assess the long-term survival and success in maintaining genetic diversity in these translocation sites.

Based on the above evidence, there are insufficient data available to list *Erythroxylum* sp. Cholmondely Creek (NT population) against this criterion. Changes to threat mitigation practices, however, may escalate the threat of population decline such that population reduction may be suspected to be met in the future over ten years based on a decline in the area of occupancy, extent of occurrence and quality of habitat and uncertainty in translocation and propagation outcomes such that the criteria for A3 c) are likely to be met.

Criterion B.	**Geographic distribution as indicators for either extent of occurrence AND/OR area of occupancy**		
	Critically Endangered	**Endangered**	**Vulnerable**

B1. Extent of occurrence (EOO)	**< 100 km²**	**< 5,000 km²**	**< 20,000 km²**
B2. Area of occupancy (AOO)	**< 10 km²**	**< 500 km²**	**< 2,000 km²**
AND at least 2 of the following 3 conditions indicating distribution is precarious for survival:			
(a) Severely fragmented OR Number of locations	**= 1**	**≤ 5**	**≤ 10**
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations;(iv) number of mature individuals			

Evidence:
Erythroxylum sp. Cholmondely Creek is known in the NT from a single site within a mine lease. The EOO and AOO are both 4 km^2 (based on a 2 km x 2 km grid cell size). Species-specific targeted searches in appropriate habitat in the Gove area in 2007 (Westaway 2007) have established that it is unlikely there are other colonies of the species in the region, or in the NT. There are efforts to establish new subpopulations in nearby apparently suitable habitat outside the mined landscape but the long-term survival and success in maintaining genetic diversity in these translocation sites is uncertain.

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There are no data available to directly assess past or future population trends. Protective measures, including the 200 m buffer and fire and weed management on the mine site, may reduce the pace of continuing decline in the native *Erythroxylum* sp. Cholmondely Creek (NT population). The best-practice weed management for gamba grass (*Andropogon gayanus*), *Cynodon radiatus* and *Urochloa humidicola* is targeted control using herbicides with trained on-ground operators resulting in negligible off-target impacts. There is no intention or requirement to use techniques such as aerial control that would result in greater off-target impacts (NTG Weeds Management Branch, pers.comm. July 2021). Conversely, a failure to manage these invasive species would likely result in a greater threat to the native *Erythroxylum* sp. Cholmondely Creek (NT population) due to an increase in the intensity and frequency of fires and via direct competition. The intensity of tropical cyclones is projected to increase under future climates. A decline in the quality of the species' habitat (and thus in the number of individuals) may result from the impacts of altered site hydrology and drainage patterns or continued exposure to cyclones of the small 'island' habitat remnant within the mined landscape. The mine lease on which *Erythroxylum* sp. Cholmondely Creek (NT population) occurs has operated since 1972. As no survey of the species was undertaken until 2007, changes in population distribution prior to 2007 cannot be assessed. It is inferred that *Erythroxylum* sp. Cholmondely Creek was once more extensive in the Gove area, but that subpopulations may have been lost as a result of past mining activities.

Based on the above evidence, the EOO and the AOO meet the IUCN sub-criteria for Critically Endangered (B1+B2a). While there are plausible threats, these are under active management, and there is no available evidence of extreme fluctuations or to indicate continuing decline observed, estimated, inferred or projected. Continuing decline in the number of mature individuals is uncertain and is likely to depend in part on mining operations expected to occur in the next two years. Therefore, *Erythroxylum* sp. Cholmondely Creek (NT population) is not eligible for listing as threatened under this criterion, but would qualify for Near Threatened under the NT TWPC Act.

Criterion C. Population size and decline			
	Critically Endangered	**Endangered**	**Vulnerable**
Estimated number of mature individuals	**< 250**	**< 2,500**	**< 10,000**
AND either (C1) or (C2) is true			

C1	An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future)	**Very high rate 25% in 3 years or 1 generation (whichever is longer)**	**High rate 20% in 5 years or 2 generation (whichever is longer)**	**Substantial rate 10% in 10 years or 3 generations (whichever is longer)**
C2	An observed, estimated, projected or inferred continuing decline AND its geographic distribution is precarious for its survival based on at least 1 of the following 3 conditions:			
(a)	(i) Number of mature individuals in each subpopulation	**≤ 50**	**≤ 250**	**≤ 1,000**
	(ii) % of mature individuals in one subpopulation =	**90 – 100%**	**95 – 100%**	**100%**
(b)	Extreme fluctuations in the number of mature individuals			

Evidence:
Erythroxylum sp. Cholmondely Creek (NT population) is known to comprise 12 distinct genotypes and approximately 317 mature individuals (ramets) (Appendix A). Species-specific targeted searches in appropriate habitat in the Gove area in 2007 (Westaway 2007) have established that it is unlikely there are other colonies of the species in the region, or in the NT. The current number of mature individuals is uncertain because the most recent survey of the whole population was conducted more than ten years ago.

Protective measures including the 200 m buffer, and fire and weed management on the mine site, appear to have successfully prevented decline in the native *Erythroxylum* sp. Cholmondely Creek (NT population). A rapid decline in the quality of the species' habitat (and thus in the number of individuals) may result, however, from the deleterious effects of altered site hydrology and drainage patterns and the risk of exposure to cyclone events of the small 'island' of habitat remnant within the mined landscape.

Based on the above evidence, the number of individuals of this species meets the IUCN threshold for Critically Endangered (C). The geographic distribution is precarious to survival because there is only one population (a(ii)), but there is no available evidence of continuing decline. Therefore, *Erythroxylum* sp. Cholmondely Creek (NT population) is not eligible for listing as threatened under this criterion, but would qualify for Near Threatened under the NT TWPC Act.

Criterion D. Number of mature individuals			
	Critically Endangered	**Endangered**	**Vulnerable**
D. Number of mature individuals	**< 50**	**< 250**	**< 1,000**
D2. *Only applies to the VU category* Restricted area of occupancy or number of locations with a plausible future threat that could drive the taxon to CR or EX in a very short time.	**-**	**-**	**D2. Typically: AOO < 20 km^2 or number of locations ≤ 5**

Evidence:
Erythroxylum sp. Cholmondely Creek (NT population) is known to comprise 12 distinct genotypes and approximately 317 mature individuals (ramets) (van der Merwe et al. 2010). Species-specific targeted searches in appropriate habitat in the Gove area in 2007 (Westaway 2007) have established that it is unlikely there are other colonies of the species in the region, or in the NT. It is acknowledged that the current number of mature individuals (ramets) is uncertain because the most recent survey of the whole population was conducted more than ten years ago. The intensive past survey effort and restricted area in which the NT population occurs, however, provide strong support that the total number of clonal individuals (ramets) is less than 1,000.

Based on the above evidence, the number of mature individuals of this species is smaller than the IUCN threshold for Vulnerable (D). Consequently, *Erythroxylum* sp. Cholmondely Creek (NT population) is eligible for listing as **Vulnerable** (D, D2) under this criterion.

Criterion E. Quantitative Analysis			
	Critically Endangered	**Endangered**	**Vulnerable**
Indicating the probability of extinction in the wild to be:	**≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)**	**≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)**	**≥ 10% in 100 years**

Evidence:
Quantitative data are not available to assess the species under this criterion.

Summary

On the basis of numbers of individuals, small AOO and EOO and plausible future threats, the NT population of *Erythroxylum* sp. Cholmondely Creek is eligible for listing as Vulnerable (D, D2). The clonal nature of the Northern Territory population of *Erythroxylum* sp. Cholmondely Creek, representing only twelve genotypes and 317 ramets, distinguishes it from other populations on Cape York, Queensland. The NT population occurs at only a single site, in eucalypt savanna woodland on a lowland bauxite plateau within an active mining lease. Much of the surrounding area of woodland has been cleared for bauxite mining, although there is a 200 m buffer/protection zone (originally 500 m) around the single known site. Measures are in place to mitigate threats and reduce the likelihood of an inferred decline. There is an active translocation program but translocated individuals have not formed viable populations; the full complement of genetic diversity in the native population (12 distinct genotypes) is not represented in the translocated plantings; and more data are needed on the survival and demographic structure of the native population. Therefore, successful establishment of subpopulations and associated increase in the long-term viability of the species through the translocated plantings has not been demonstrated.

Management and Recovery

Is there a Recovery Plan (RP) or Conservation Management Plan operational for the species?	Yes ☒	No ☐
List all relevant recovery or management plans (including draft, in-preparation, out-of-date, national and State/Territory recovery plans, recovery plans for other species or ecological communities, or other management plans that may benefit or be relevant to the nominated species). • Mine Management Plan		
List current management or research actions, if any, that are being undertaken that benefit the conservation of the species. • Detailed spatial genetic mapping has been undertaken at the Gove site, identifying all the genetic individuals present within the wild population (van der Merwe et al 2010) • RioTinto (mine owners) have ceased mining activities near the site, and created a 200 m exclusion buffer around the native location. • A translocation program, to provide long-term protection for the single 'native' population commenced in 2009 (see notes below). • RioTinto (mine owners) sought and were approved a reduction of the exclusion buffer to 200 m in 2012, based on a proposal developed by consultants (METSERVE 2012). • Propagation of ramets, via cuttings, has been undertaken by Greening Australia Darwin and a management plan has been drafted for the taxon.		

- RioTinto (mine owners) have a program to establish additional sub-populations in suitable habitat (Appendix A)
- Monitoring of the size, health and recruitment of a subset of the native population (20 plants only) and the translocation populations has been underway since 2009 (Rio Tinto Alcan 2009).

List further recommended management or research actions, if any, that would benefit the conservation of the species.

- Fire should be prevented from burning the entire population at any one occasion to control the fire risk to the entire population.
- Incursion of introduced plants from adjacent cleared areas should continue to be controlled to manage direct weed impacts and prevent increases in fuel load.
- Increase the existing monitoring of the native population. Monitor and report on individual ramet survival rates and extent of fluctuations in the natural population, including the survival and re-growth of ramets from which cuttings are taken for translocation and the survival and growth rates of undisturbed ramets in the natural population.
- Monitor hydrology and drainage at the native population site and take actions if found to be deteriorating to manage and mitigate hydrological system modification
- Maintain the existing monitoring of the three translocation sites and review the health and rate of increase of these populations.
- Review the translocation program to optimise the genetic diversity of the plants grown in ex situ collections in Gove and established in the transocation sites.
- Assess options for genetic enhancement of the Gove population i.e. introduce non-native material, such as material from Weipa (Rossetto 2008).
- Removal of the 200 m buffer on the mine site should not proceed until self-sustaining populations are established in low threat, high suitability sites and are demonstrating an increase in population size, as demonstrated through both an increase in the number of ramets, and increased numbers of individual genotypes. As there appears to be no current evidence that the translocated plantings are stable, self-sustaining or increasing in abundance, retention of the 200 m buffer in the foreseeable future is critical and should be expected under the conditions of the Mine Management Plan.

Further comment.

Translocation program

A translocation program, designed to safeguard the existing native population of Erythroxylum sp. Cholmondely Creek (NT population), was commenced by RioTinto in 2009. The introduced plantings produced from the translocation program are intended to mitigate against current threats to the native population. The program is intended to maintain the genetic diversity of the clonal population that is associated with somatic mutation as a mechanism for allelic diversity.

In 2009 cuttings from all 12 distinct clonal genotypes present in the Gove population were used as propagation material in Darwin. In 2012, nine (9) clone genotypes had been successfully propagated in Darwin. Based on an analysis of site characteristics (slope, soil, vegetation structure and floristic community), to match those of the native population, 3 introduction/translocation sites were identified (Appendix A), and a total of 382 clones, representing 9 clonal genotypes, were transplanted between 2012 and 2013; the overall survival rate in the first 12 months was 63%. The translocation program introductions have been dominated by only two clone genotypes. In a clonal population it is expected population establishment and spread will be slow with any threats or disturbance e.g. fire, bandicoots (site EPP2) further slowing the establishment and growth. In February 2018, 105 clones were translocated to a fourth site and 14 clones were added to one of the previous sites (Appendix A).

Monitoring of a subset of the native and translocation populations will continue for 10 years after the planting of cuttings in the translocation program i.e. from 2010 until 2020/22. The power to detect differences in the data are limited however because only 20 plants in the native (undisturbed) population have been monitored. This is a limitation of the monitoring.

Proposed translocation of the native population will not occur until the translocated plantings are demonstrated to be stable, self-sustaining and increasing in abundance. As there appears to be no current evidence that the translocated plantings are stable, self-sustaining or increasing in abundance, retention of the 200 m buffer is critical in the foreseeable future.

An ex-situ colony in Gove (previously in Darwin) has been used to propagate the taxon. In 2010-12 there were translocations to three sites in the Gove region outside of the mine tenement and a fourth translocation was initiated in February 2018. Overall survival in the first 12 months was 63% and no subsequent spread in these areas has been detected (METSERVE 2012, 2018; see Appendix A). All three earlier translocationsdeclined in the first two years after establishment but mortality has been relatively low since 2016 and there were 64 plants alive in 2018. The survival of only 20 plants in the native population has been monitored. Of the 20 plants in the native population chosen for monitoring, 75% survival since 2010 was reported at February 2018 (METSERVE 2018), but more recent information is not available.

Therefore the survival, mortality and extent of fluctuations in the native population have not been monitored adequately to assess the impacts of the translocation protocol on the native population or to compare the performance of introduced translocated plantings and the native population.

Consistency with CAM MOU

Consistent with Schedule 1, item 2.7 (h) and 2.8 of the Common Assessment Method Memorandum of Understanding, it is confirmed that:	
• this assessment meets the standard of evidence required by the Common Assessment Method to document the eligibility of the species under the IUCN criteria;	Yes ☒ No ☐
Comments:	
• surveys of the species were adequate to inform the assessment;	Yes ☒ No ☐
Comments:	See section above under **Distribution**
• the conclusion of the assessment remains current and that any further information that may have become available since the assessment was completed supports or is consistent with the conclusion of the assessment.	Yes ☒ No ☐
Comments:	

Nomination prepared by:	Dr Caroline Chong Threatened Species Botanist, Flora and Fauna Division, Department of Environment, Parks and Water Security, Northern Territory Government
Contact details:	
Date submitted:	9 April 2021
If the nomination has been refereed or reviewed by experts, please provide their names and contact details:	

Professor Stephen Garnett, RIEL Charles Darwin University

Dr Chris Pavey, Senior Research Scientist, CSIRO Land and Water

Ian Cowie, Chief Botanist, NT Herbarium, Flora and Fauna Division, Department of Environment, Parks and Water Security, Northern Territory Government

Dr Catherine Nano, Director Ecosystem Management, Flora and Fauna Division, Department of Environment, Parks and Water Security, Northern Territory Government

Dr Tony Griffiths, Director Species Management, Flora and Fauna Division, Department of Environment, Parks and Water Security, Northern Territory Government

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NORTHERN TERRITORY GOVERNMENT

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Summary of subpopulation information						
Site, Location or subpopulation	Land tenure	Survey information: Date of survey and No. mature individuals	Area of subpopulations	Site / habitat Condition	Threats	Specific management actions
Gove	Mining lease	c. 250 stems counted, two specimens collected (Westaway 2007). Further cuttings taken in 2009 for ex situ propagation (METSERVE 2012) Of the 20 plants chosen for monitoring, at Feb 2018: 75% survival since 2010 (METSERVE 2018). 317 ramets reported and sampled for genetic analysis (van der Merwe et al. 2010).	0.068 ha	Natural woodland with 200m buffer to areas cleared for mining or mined. Low intensity burn in September 2017 (METSERVE 2018)	As outlined in Threats table	As outlined in Management and Recovery section
ex situ Initially at Greening Australia, Darwin; Now at Rio Tinto Nursery, Gove		Established 2009. propagation program as part of the translocation program. Nine clonal genotypes, propagated (from 12 genotypes collected)		Very good but artificial propagation habitat (nursery).		Propagate and supply representatives of 12 clonal genotypes for RioTinto translocation program.
Translocation sites x 4	Mining Lease	See Management and Recovery notes above.	<1 ha	Apparently suitable habitat.	As outlined in Threats table, except no threat from future mining.	

Established from Ex-situ population EPP7 EPP1 EPP2 EPO		March 2010; 76 plants introduced Feb 2011; 56 plants added Feb 2013; 25 plants added Feb 2018; 14 plants added Feb 2018 monitoring: 5.9% mortality since Feb 2017. Feb 2012; 79 plants introduced Feb 2013; 37 plants added Feb 2018 monitoring: 3 plants disappeared since Feb 2017 but 4 plants reappeared. Feb 2012; 73 plants introduced Feb 2013; 36 plants added Feb 2018 monitoring: 18.7% mortality since Feb 2017. Feb 2018; 105 plants introduced		None of the planted populations currently contain the full complement of wild genotypes (METSERVE 2018) Low intensity burn at all introduced sites in September 2017 (METSERVE 2018)		

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Erythroxylum sp. Cholmondely Creek Survey

Rio Tinto Alcan Gove

ALCAN

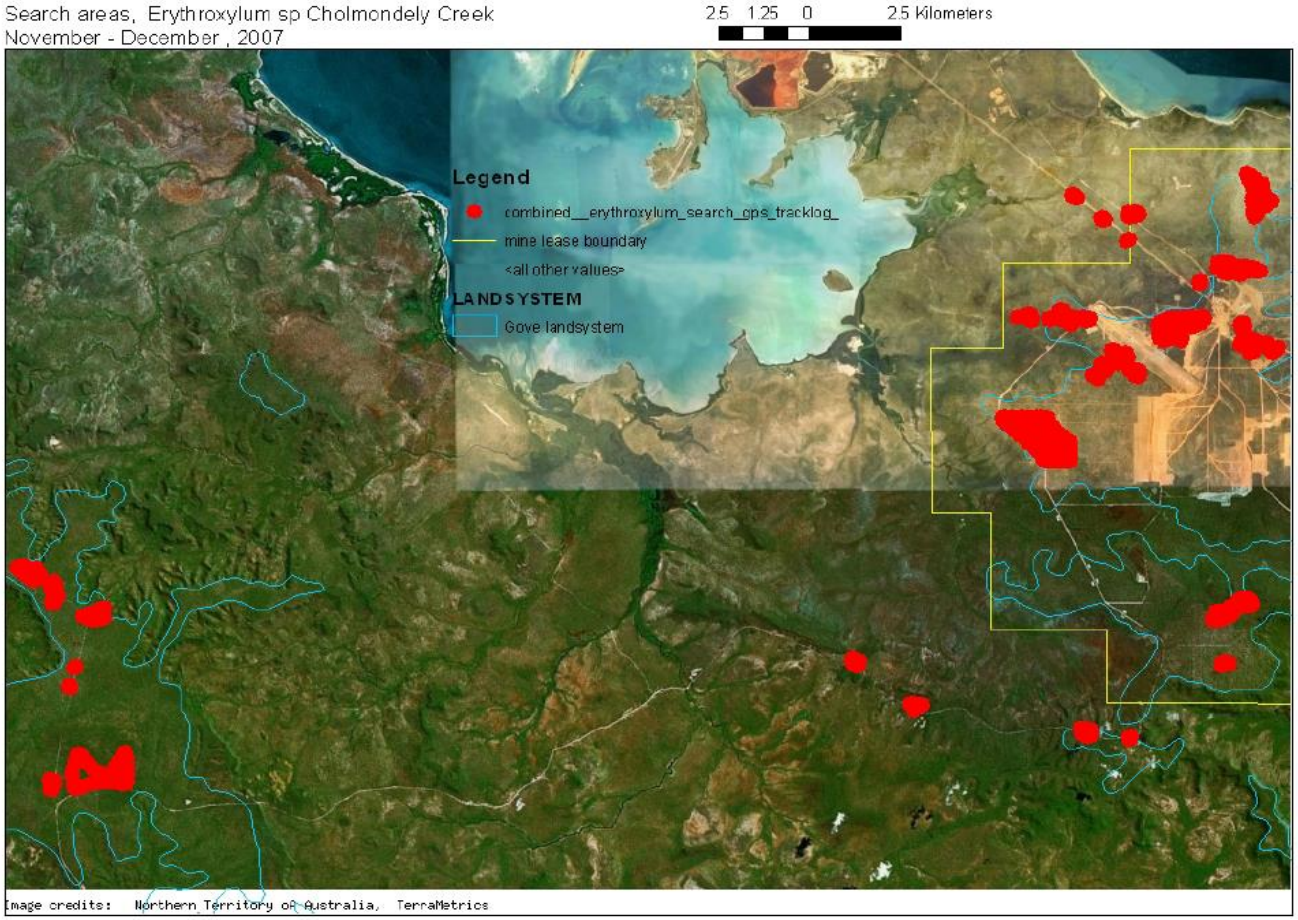

Figure 3. Search area for *Erythroxylum* sp. Cholmondely Creek in Gove.