

Non-detriment finding assessment for *Euphorbia colliculina*

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Summary of findings

Euphorbia colliculina is included in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). In terms of Article IV of the Convention, an export permit shall only be granted for an Appendix II species when a Scientific Authority of the State of export has advised that such an export will not be detrimental to the survival of that species in the wild. This document details the undertaking of a Non-Detriment Finding (NDF) assessment for *E. colliculina* and is based on the best available information, current as of December 2021.

Euphorbia colliculina is a perennial, spineless stem succulent with a medusoid growth form. The species is slow-growing and long-lived with populations characterised by adult plant persistence. Seedling recruitment is slow and episodic, with seed dispersal limited to short distances. Seed production and recruitment occurs primarily during the winter rainfall season and in early spring. A recent comprehensive study undertaken for *E. colliculina* revealed several extant populations that are dominated by small adult plants with a reduced number of plants in larger size classes. The majority of the populations surveyed showed no signs of recruitment with low rates of recent recruitment (1-4%) observed in just 36% of the subpopulations. Plants grow most commonly in close association with the surrounding vegetation and nurse objects are thought to be an important microhabitat requirement.

Euphorbia colliculina is endemic to the eastern Little Karoo in the Western Cape Province with populations generally distributed on gentle slopes at altitudes below 700 meters above sea level along waterways and drainage lines within the landscape, and plants almost always occur on alluvial soils that are abundant in nutrients (particularly calcium), loamy to clayey, and alkaline. The species is known to occur across 16 localities. Two of the subpopulations comprise an extremely reduced number of plants (<10 individuals) whilst the remaining 14 subpopulations vary in size between 54 and 4 748 individuals. The total population is projected to occupy an area of around 84 km² (EOO: ~1 814 km²), with just under 13 000 plants estimated to be remaining in the wild. Slightly negative size class distribution slopes suggest that the majority of the populations may be in a state of decline. *Euphorbia colliculina* has been assigned a national status of Endangered (B1ab(ii,iii,iv,v)+2ab(ii,iii,iv,v)) in line with the IUCN's (International Union for Conservation of Nature) Red List Categories and Criteria.

Although *E. colliculina* has been affected by habitat loss due to agricultural activities, the most significant and widespread threat to the species is habitat degradation, mainly as a result of overgrazing. Herbivory damage to *E. colliculina* plants from domestic livestock is also prevalent throughout the species' range, with individuals in all populations affected. This is suspected to have impacted negatively on reproductive potential and recruitment in populations, as well as to have caused mortality of mature individuals. Should

this situation persist, continuing decline in area of occupancy, quality of habitat, number of subpopulations and number of mature individuals can be expected. The western edge of the species distribution range has been severely impacted by ostrich farming, which has led to the extirpation of two previously known subpopulations. The national population is thus reduced and still decreasing.

There is limited evidence in the field of illegal wild collection of this species. The only South African nursery known to be trading in *E. colliculina* propagates plants from wild harvested seed that is reportedly collected (legally) on land belonging to the nursery owner. The depauperate state of the smallest adult size class in a population closest to the nursery may indicate that wild adult plants are also being harvested from this population to (illegally) supplement the shortfall in nursery production of seedlings, or perhaps to meet a demand for mature/larger plants that are not available in cultivation.

Data for exports of *E. colliculina* from South Africa are monitored on a regular basis, although the quality of the data is not as good as it should be owing to errors in reporting. South Africa is the primary exporter of *E. colliculina* plants accounting for more than 83% of all global exports. Close to 1 760 live plants have been exported from the country since 1994, and although 96% of plants exported over this period have been declared as artificially propagated, the sustainability of this trade cannot be guaranteed as the sole supplier does not have parental stock and is only able to produce plants from wild harvested seed. The production capacity of the country is essentially equal to zero at present. There has been a general (insignificant) decline in the export of the species with no plants having been legally exported since 2015. Nevertheless, should demand for the species continue or increase without a reliable supply of artificially propagated stocks, added pressure on the wild populations is anticipated. There is currently no field monitoring programme for the species.

A significant proportion of just one population of *E. colliculina* falls within a well-protected private nature reserve contracted to CapeNature, the provincial nature conservation body within the Western Cape. This population is fortunately the second largest in size with the highest plant density, and active conservation of the species is part of the reserve management plan, otherwise there is no management plan for the species. *Euphorbia colliculina* is listed as a protected plant in the Western Cape's Nature and Environmental Conservation Ordinance No. 19 of 1974. In terms of this legislation, the collection of protected plants requires a permit (though the landowner, his relative or fulltime employee are exempted from this legal requirement). Seed collection for the purpose of propagation is also allowed on private land where written landowner permission is given. Several populations of the species occur on privately owned land but the percentage of legal harvest occurring in these areas is at this stage uncertain. Cape Nature have not issued any permits for the wild collection of *E. colliculina* plants from anywhere in the province but due to limited staff capacity as well as a lack of specific skills and appropriate mechanisms, it remains challenging to effectively implement harvest controls and to monitor the status of wild populations or any legal or illegal activities involving the species. The probable laundering of wild plants into the legal trade has for example, gone undetected due to the lack of compliance monitoring of nurseries. There is no quota system for harvesting *E. colliculina* plants and any offtake at present is unmanaged with no oversight. Opportunistic illegal harvesting of plants could be ongoing. No incentives for species or habitat conservation are associated with harvest of *E. colliculina* seeds or plants.

The trade in *E. colliculina* is currently detrimental (Fig. 1 & 2). The species' biology, which is characterized by a poor dispersal ability and slow growing long-lived adults that regenerate predominantly from seed, renders *E. colliculina* particularly vulnerable to overutilization. Demand for the species over the past decade has been met by plants grown from wild seed, possibly also supplemented by wild adult specimens. While some seed harvesting is unlikely to impact significantly on the population persistence in this long-lived species, it is uncertain whether previous levels of offtake have been sustainable. If any trade is to be considered in future, it should be restricted to artificially propagated specimens in accordance with CITES Resolution Conf. 11.11 (Rev. CoP18). In addition, any legal trade in artificially propagated plants grown from wild harvested seed will require a monitoring plan. A small number of mother plants could be initially harvested in a sustainable manner from the three most robust populations in line with recommendations put forward by Jabar (2019), and with the necessary permits under the strict supervision of CapeNature officials. A sustainable and legal seed harvest for the purposes of propagation could also be considered provided that the source population(s) is monitored and protected from negative impacts such as livestock herbivory.

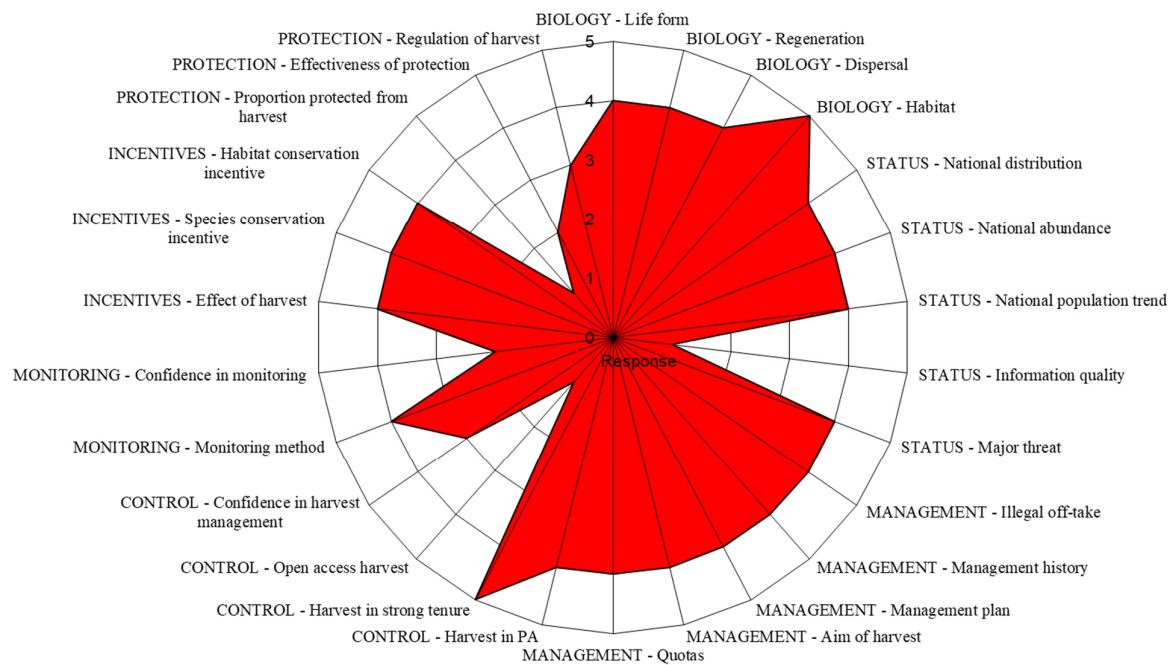


Figure 1: Radar chart summarizing the non-detriment finding assessment undertaken for *Euphorbia colliculina* in accordance with the CITES NDF checklist. Explanations of scores given are detailed in Table 1. Higher scores are indicative of higher risks to the species. The shaded area in the radar chart demonstrates a high risk to the species.

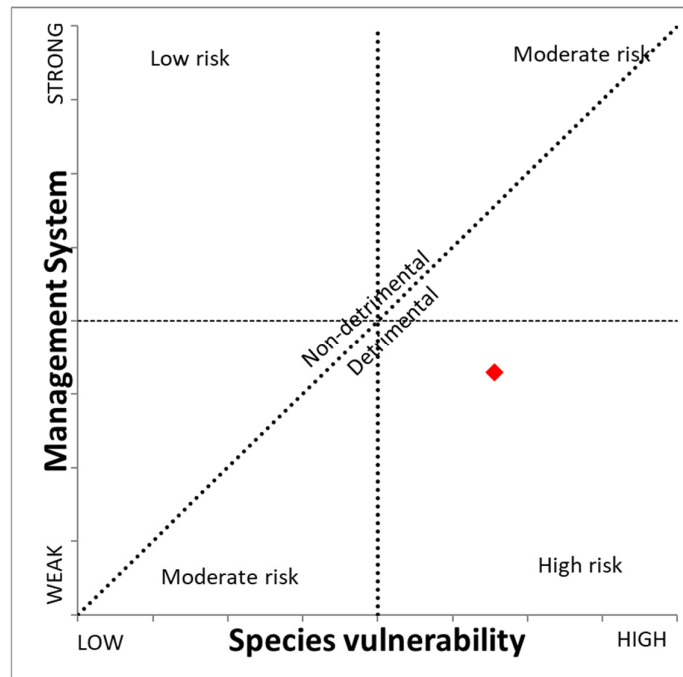


Figure 2: The risk of trading in *Euphorbia colliculina* as represented by the relationship between species vulnerability (biology and status) and the strength of the management system to which the species is subjected (management, control, monitoring, incentives and protection). The figure shows that the species is at a high risk and trade is detrimental.

Table 1: Detailed NDF assessment for *Euphorbia colliculina* undertaken in accordance with the CITES NDF checklist. Scores assigned to each question are indicated (bold text and shaded blocks) along with detailed explanations/justifications where relevant. Higher scores are indicative of higher risks to the species.

Biological characteristics		
1. Life form: What is the life form of the species?	Annual	1
	Biennial	2
	Perennials (herbs)	3
	Shrub and small trees (max. 12m.)	4
	Trees	5
<i>Euphorbia colliculina</i> is a perennial succulent plant with a spineless stem and medusoid growth form (Fig. 3). The tuberous root is continuous with the main stem forming a single body, or caudex, which is buried in the ground almost to the top (White <i>et al.</i>, 1941). Numerous cylindrical branches are produced in a rosette from a slightly depressed, tuberculate central area at the top of the caudex. Tubercles on the stems are slightly prominent, oblong to hexagonal with a small white leaf scar, and are arranged on the stems in a regular pattern of oblique rows. Tiny rudimentary leaves are produced during the growing season, but these are soon deciduous (White <i>et al.</i>, 1941). Clusters of solitary, bisexual cyathia (flowering structures) are produced at the stem tips in late winter and spring. The species inhabits an arid ecosystem and is slow-growing and long-lived.		
		
Figure 3: <i>Euphorbia colliculina</i> plant pictured in habitat. Photo by Laaiqah Jabar		
2. Regeneration potential: What is the regenerative potential of the species concerned?	Fast vegetatively	1
	Slow vegetatively	2
	Fast from seeds	3
	Slow or irregular from seeds or spores	4
	Uncertain	5
<i>Euphorbia colliculina</i> is a monoecious species that regenerates sexually from seed. The flowering bodies or cyathia are produced by reproductive individuals between June and September and pollination is facilitated by several species of ants, beetles and flies (Jabar, 2019). Seed capsules of <i>Euphorbia</i> species are trilocular, carrying up to three seeds each. The seeds are forcefully ejected by explosive dehiscence of the capsules		

and recruitment is episodic (Jabar, 2019). In arid regions, recruitment and seedling establishment is generally related to rainfall timing and quantity with populations requiring sustained high rainfall episodes in successive years to regenerate. Pulses of population renewal may occur at intervals of years, decades or even centuries (Milton *et al.*, 1999). No succulent *Euphorbia* species are known to maintain persistent seed banks (Milton *et al.*, 1999).

Populations of the species are generally dominated by adult plants with between 11 and 60 stems each and juveniles are scarce (1-4% of individuals per population), indicating that regeneration by seedling recruitment is slow (Jabar, 2019). Reproductive output is proportional to plant size (Jabar, 2019). Large percentages of *E. colliculina* individuals have been observed in close association with surrounding vegetation- and rock cover, indicating the importance of nurse objects for recruitment and regeneration in the species (Jabar, 2019).

3. Dispersal efficiency: How efficient is the species' dispersal mechanism?	Very good	1
	Good	2
	Medium	3
	Poor	4
	Uncertain	5

Euphorbia colliculina exhibits a ballistic dispersal mechanism, and myrmecochory (i.e. secondary dispersal by ants) has been discounted since no elaiosome (i.e. nutrient rich seed coat) is present on the seeds (Jabar, 2019). Ballistic dispersal alone typically scatters seeds to within a mere 0.6-2.5 m from the parent plant (Stamp and Lucas, 1990; Narbona *et al.*, 2005). Many plants in arid environments have evolved toward proxichory (short dispersal distance) (Pueyo *et al.*, 2008) and it has been suggested that this strategy has a selective advantage over long distance dispersal in xeric habitats because seedlings have a higher probability of survival close to where the parent plant has survived to a reproductive age (Esler, 1999). Incidences of pre-dispersal seed predation for this species were observed but not quantified (Jabar, 2019).

4. Habitat: What is the habitat preference of the species?	Disturbed open	1
	Undisturbed open	2
	Pioneer	3
	Disturbed forest	4
	Climax	5

Euphorbia colliculina occurs in the Rainshadow Valley Karoo Bioregion (Rutherford *et al.*, 2006) of the Succulent Karoo Biome. Plants can be found at altitudes of 284 – 683 meters above sea level and mostly grow on gentle to moderate slopes (1.1 – 8.5 degrees). Populations are generally distributed along waterways and drainage lines in the landscape, usually occurring on alluvial soils (Jabar, 2019). The species is most frequently found in Apronveld-, River and Floodplain-, and Gannaveld habitat types (Vlok *et al.*, 2005). Gravel Apronveld is always situated at the base of hills and ridges while Gannaveld usually occurs in valley bottoms, forming large open plains above the River and Floodplain habitat types (Vlok *et al.*, 2005). Rainfall across the region varies between 240 mm and 550 mm per year on average. Almost all populations occur on soils that are abundant in nutrients (particularly calcium), loamy to clayey, and alkaline. The plants grow mainly in association with nurse objects such as shrubs or rocks which afford them cover by modifying microclimatic conditions, thus ameliorating abiotic stress and facilitating not only germination and establishment of seedlings under them, but also promoting seedling survivorship (López *et al.*, 2007; Munguía- Rosas and Sosa, 2008; Vlok and Schutte-Vlok, 2015). Only a small proportion of individuals may be found growing in the open (Jabar, 2019). The species is thus sensitive to disturbance of the surrounding vegetation, and degradation of its habitat, particularly the removal of nurse plants by livestock grazing and trampling, presents a real threat to the regeneration and survival of its populations (A. Schutte-Vlok- Regional Ecologist, CapeNature, pers. comm.). Passive recovery of perennial vegetation following cultivation and

other forms of land degradation in the Succulent Karoo may take upward of 300 years (Milton and Dean, 2015).

National status

5. National distribution: How is the species distributed nationally?	Widespread, contiguous in country	1
	Widespread, fragmented in country	2
	Restricted and fragmented	3
	Localized	4
	Uncertain	5

The species is endemic to the eastern Little Karoo in the Western Cape Province of South Africa (Vlok & Schutte-Vlok, 2015). It has a restricted distribution range (EOO 1 814 km² and AOO 84 km²) (Fig. 4; Jabar, 2019). It does not occur continuously within its distribution range but is found in relatively isolated subpopulations. The two closest populations are separated by a distance of 2 km, whilst the populations furthest from one another are 114 km apart (Jabar, 2019). The distribution of the species appears to be influenced by precipitation and temperature parameters with minimum rainfall being the most limiting factor, followed by temperature during the winter rainfall growth season. Altitude is also a noteworthy predictor for the occurrence of the species (Jabar, 2019).

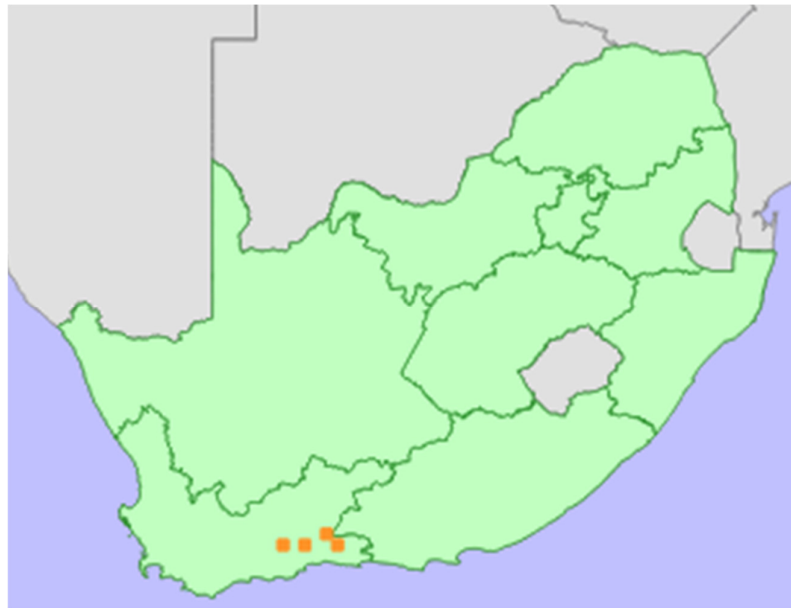


Figure 4: Distribution of *Euphorbia colliculina* within the eastern Little Karoo of the Western Cape Province, South Africa

6. National abundance: What is the abundance nationally?	Very abundant	1
	Common	2
	Uncommon	3
	Rare	4
	Uncertain	5

The 16 known *E. colliculina* subpopulations vary in size between three and 4 748 individuals, with a total of approximately 12 983 plants estimated to be remaining in the wild (Jabar, 2019). The density of subpopulations ranges from 73 plants/ha to 1 324 plants/ha with the two largest and most densely populated populations situated on the western edge of the distribution range. Two of the subpopulations comprise less than 10 individuals each (Jabar, 2019).

7. National population trend: What is the recent national population trend?	Increasing	1
	Stable	2
	Reduced, but stable	3
	Reduced and still decreasing	4
	Uncertain	5
The western edge of the species distribution range has been severely transformed by ostrich farming, which has led to the extirpation of two subpopulations. At another two localities, the number of plants has been so severely reduced by habitat degradation that extinction of these subpopulations is anticipated. Signs of recent recruitment were entirely absent in nine of 14 <i>E. colliculina</i> subpopulations, and in those where recruitment had occurred, juvenile plants constituted <5% of the subpopulation. Inconstant quotients between successive size classes observed for all subpopulations may be indicative of episodic recruitment or unstable populations (Venter and Witkowski, 2010; Shackleton <i>et al.</i>, 2015), and mildly negative size class distribution slopes obtained for the majority of subpopulations suggest that they may be shrinking (Niklas <i>et al.</i>, 2003; Jabar, 2019). Furthermore, given that population survival in this species is reliant on adult persistence, it is of concern that between one and three of the larger adult size classes were absent from all but two of the <i>E. colliculina</i> subpopulations. Both the widespread absence of juveniles and lack of large individuals may be attributed to exceedingly high levels of herbivory across the species range. The species conservation status is currently assessed as Endangered (B1ab(ii,iii,iv,v)+2ab(ii,iii,iv,v)). Should the problems of herbivory and overgrazing persist, continuing decline in area of occupancy, quality of habitat, number of subpopulations and number of mature individuals can be expected (Jabar, 2019).		
8. Quality of information: What type of information is available to describe abundance and trend in the national population?	Quantitative data, recent	1
	Good local knowledge	2
	Quantitative data, outdated	3
	Anecdotal information	4
	None	5
A detailed study on the population biology and ecology of the species was undertaken, and provides recent, quantitative data on the national status and abundance of <i>E. colliculina</i> (Jabar, 2019).		
9. Major threats: What major threat is the species facing (underline following: overuse/ <u>habitat loss and alteration</u> / invasive species/ <u>other</u>) and how severe is it?	None	1
	Limited/Reversible	2
	Substantial	3
	Severe/Irreversible	4
	Uncertain	5
Herbivory and overgrazing present the major threats to the <i>E. colliculina</i> population. Both the absence of juveniles and lack of large individuals may be attributable to the exceedingly high levels of herbivory observed in surveyed subpopulations (caused by domestic livestock), with the concomitant loss of reproductive capacity and habitat degradation associated with overgrazing (Jabar, 2019). All extant subpopulations were affected by some form of herbivory by either livestock or wild animals and in some areas, up to 67% of plants had been affected (Jabar, 2019). The terminal portions of stems are typically consumed to varying degrees resulting in reduction of the canopy area of individuals and loss of reproductive structures situated at the stem tips. Furthermore, the damage to stems is such that they would not be able to bear any reproductive structures in subsequent seasons. At various localities, porcupines had dug open and consumed parts of the caudices of <i>E. colliculina</i> plants resulting in the death of those individuals (Jabar, 2019). A decline in both the abundance and health of an <i>E. colliculina</i> population (situated within a protected area) observed during monitoring surveys conducted between 2018 and 2020 (Fourie and de Villiers, 2019; 2020) was attributed to increases in foraging activity by wild animals such as porcupines and tortoises, which was postulated to have intensified with prolonged periods of drought across the region. The impact of		

overgrazing extends to the surrounding vegetation and has the potential to cause declines in suitable nurse plants, thereby altering the microclimate that is critical for the persistence of viable *E. colliculina* populations. Removal of nurse plants also eliminates the degree of protection afforded to *E. colliculina* individuals thereby exposing plants to even higher levels of herbivory and other disturbances.

Habitat loss and degradation caused by anthropogenic factors has historically also had an effect on the status of *E. colliculina*. Its habitat has been severely degraded by ostrich farming, with two of the locations previously noted to be impacted by Vlok *et al.* (2008) now extinct (Jabar, 2019). The alluvial plains of the river system along which the species populations are distributed have been extensively and irreversibly altered by agriculture, and thus certain areas of potentially suitable habitat for this species have been lost (Jabar, 2019). Urban development poses a threat to several populations which occur within close distances to expanding human settlements (Jabar, 2019). Other local threats observed were collection of wild plants (across one population), soil erosion, quarrying, road construction and brick making (Jabar, 2019).

Harvest management

10. Illegal off-take or trade: How significant is the national problem of illegal or unmanaged off-take or trade?	None	1
	Small	2
	Medium	3
	Large	4
	Uncertain	5

The single South African nursery cultivating the species grows plants from wild harvested seed, and it is suspected that harvest of adult plants also takes place (Jabar, 2019). According to Section 63 of the Western Cape's Nature and Environmental Conservation Ordinance no. 19 of 1974, no person may pick (i.e. uproot) a protected plant without a permit (except in the case where a person is the owner of such land or a relative of such owner and any fulltime employee of such owner acting on the instructions or with the consent of the owner). A permit is also not required to pick seed if a person is authorised in writing to do so by the owner of the land. CapeNature have a management guideline to exercise precaution in the assessment of granting permits for wild collection (C. Birss- Executive Director: Biodiversity capabilities, Cape Nature, pers. comm.) and they have not issued permits for wild collection linked to trade of this species. The owner of the nursery is a titleholder of several properties in the little Karoo and has reportedly collected seeds on his own land. *Euphorbia colliculina* plants grown from legally sourced from wild seed can be considered artificially propagated but there is concern that illegally collected wild adult plants have been used to supplement the plants propagated for the international trade (Jabar, 2019). It is unfortunately challenging to keep track of any harvest occurring across private lands. Records of international trade indicate that from 2010 to 2014 the average number of live plants exported per year was around 149 ± 72 , which is more than double what was available on the domestic market in 2016 ($n = 62$; Jabar, 2019). It appears likely that the plants exported over this five-year period ($n = 744$) were illegally harvested and/or grown from wild harvested seed. Past and ongoing collection of seed (as well as some large plants) from the wild is thought to have impacted the recruitment and stability of populations in certain areas, for example, the majority of the *E. colliculina* populations are dominated by the first adult size class (11-60 stems), but at the locality closest to the nursery, this size class was found to be under-represented in the population (Jabar, 2019). These observations are consistent with the suspected ongoing harvest of wild adult plants to supplement the shortfall in nursery production of seedlings, or perhaps because mature/sizeable plants were in demand but not available in cultivation. In addition, several in-habitat pictures of the species are used to advertise the plants on the nursery's online website (Jabar, 2019). The nursery does have a permit to sell protected flora, including *E. colliculina*, and the owners have recently applied for a renewal of this permit. One other nursery has a permit to grow and sell *E. colliculina*, but it is uncertain whether or not the facility is actively propagating/trading in artificially propagated specimens produced from legally acquired parental stock.

The species has been the subject of several seizure incidents that have been reported to CapeNature (including one in March 2021), for plants being exported from the province without relevant or up to date permits (C. Birss, pers. comm.). Investigations into these incidents have been and continue to be carried out by CapeNature officials although the organization is under-staffed within the biodiversity enforcement department.

A snapshot internet survey to assess the general availability of the species in the online market place (conducted over two days in December 2015 and July 2016), yielded six adverts for live *E. colliculina* plants selling at an average price of R 145 ± 56 - although one advert (from Spain advertised on eBay) was excluded from the average price calculation as the amount requested was very high (R 3 228). It is suspected that the high sales price was due largely to the fact that the plant being offered for sale was large and most likely wild collected (with about 31 stems and a sizeable caudex that could not have grown to those dimensions in the pot pictured, with pathogens visible on the stems) (Jabar, 2019). The prevalence of online sale adverts for the study species, with many of the traders openly stating that they lack the required documentation, indicates how the internet facilitates illegal plant trade and demonstrates the ease with which CITES listed plants can be bought and sold over the internet in circumvention of the applicable regulations.

11. Management history: What is the history of harvest?	Managed harvest: ongoing with adaptive framework	1
	Managed harvest: ongoing but informal	2
	Managed harvest: new	3
	Unmanaged harvest: ongoing or new	4
	Uncertain	5

There has been no formal management of wild-harvesting of *E. colliculina* to date even though a large share of the plants leaving the country was apparently grown from wild seed. The species is listed as a protected plant in the Western Cape's Nature and Environmental Conservation Ordinance no. 19 of 1974. In line with the terms set out in the ordinance, no person may pick (i.e. uproot) a protected plant without a permit (except in the case where a person is the owner of such land or a relative of such owner and any fulltime employee of such owner acting on the instructions or with the consent of the owner). A permit is also not applicable to any person authorised in writing by the owner of any land to pick any protected flora on such land for the purpose of gathering and propagating the seed of such flora (i.e. for seed collection). The one registered nursery cultivating and trading in the species, grows plants from wild harvested seed reportedly collected on private land belonging to the nursery owner. To date, CapeNature have not issued any permits for the wild collection of *E. colliculina* from anywhere in the province (C. Arendorf – Law Admin Officer, CapeNature, pers. comm.) and they have a management guideline to exercise precaution in the assessment of granting permits for wild collection (C. Birss, pers. comm.). Any offtake at present is unmanaged with no oversight and the harvest is most likely unsustainable.

12. Management plan or equivalent: Is there a management plan related to the harvest of the species?	Approved and co-ordinated local and national management plans	1
	Approved national/state/provincial management plan(s)	2
	Approved local management plan	3
	No approved plan: informal unplanned management	4
	Uncertain	5

There is no management plan for the species and no strategy to manage any harvest. One of the largest subpopulations is however located in a private reserve and is actively monitored and protected in line with the objectives set out in an approved reserve management plan.

13. Aim of harvest regime in management planning: What is harvest aiming to achieve?	Generate conservation benefit	1
	Population management/control	2
	Maximize economic yield	3
	Opportunistic, unselective harvest, or none	4
	Uncertain	5
Wild-collecting is opportunistic and for the personal benefit (financial gain) of the harvester.		
14. Quotas: Is the harvest based on a system of quotas?	Ongoing national quota: based on biologically derived local quotas	1
	Ongoing quotas: "cautious" national or local	2
	Untried quota: recent and based on biologically derived local quotas	3
	Market-driven quota(s), arbitrary quota(s), or no quotas	4
	Uncertain	5
There is currently no quota system for harvesting <i>E. colliculina</i> from the wild.		
Control of harvest		
15. Harvesting in Protected Areas: What percentage of the legal national harvest occurs in State-controlled Protected Areas?	High	1
	Medium	2
	Low	3
	None	4
	Uncertain	5
There is no legal harvest of <i>E. colliculina</i> in protected areas of South Africa. The species is listed as a protected plant in the Western Cape's Nature and Environmental Conservation Ordinance no. 19 of 1974. CapeNature have not issued any permits for the wild collection of <i>E. colliculina</i> from anywhere in the province (C. Arendorf, pers. comm.) and it is unlikely that they would allow harvest within any of their protected areas. A single population of the species occurs partially within a CapeNature contracted private nature reserve and is therefore assigned the same status of a State protected area.		
16. Harvesting in areas with strong resource tenure or ownership: What percentage of the legal national harvest occurs outside Protected Areas, in areas with strong local control over resource use?	High	1
	Medium	2
	Low	3
	None	4
	Uncertain	5
Several of the <i>E. colliculina</i> populations occur on privately owned lands. The species is listed as a protected plant in the Western Cape's Nature and Environmental Conservation Ordinance no. 19 of 1974. No person may pick (i.e. uproot) a protected plant without a permit (except in the case where a person is the owner of such land or a relative of such owner and any fulltime employee of such owner acting on the instructions or with the consent of the owner). A permit is also not applicable to any person authorised in writing by the owner of any land to pick any protected flora on such land for the purpose of gathering and propagating the seed of such flora (i.e. for seed collection). CapeNature have a management guideline to exercise precaution in the assessment of granting permits for wild collection (C. Birss, pers. comm.) and they have not issued any permits for the wild collection of <i>E. colliculina</i> from anywhere in the province (C. Arendorf, pers. comm.). The one nursery known to have been trading in the species cultivates plants solely from wild harvested seed reportedly collected on land belonging to the nursery owner. Owing to resource constraints within CapeNature, it is unfortunately challenging to keep track of any harvest occurring across private land.		

17. Harvesting in areas with open access: What percentage of the legal national harvest occurs in areas where there is no strong local control, giving <i>de facto</i> or actual open access?	None	1
	Low	2
	Medium	3
	High	4
	Uncertain	5
The species is listed as a protected plant in the Western Cape's Nature and Environmental Conservation Ordinance no. 19 of 1974. No person may pick any protected plant without a permit and CapeNature have not issued any permits for the wild collection of <i>E. colliculina</i> from anywhere in the province (C. Arendorf, pers. comm.).		
18. Confidence in harvest management: Do budgetary and other factors allow effective implementation of management plan(s) and harvest controls?	High confidence	1
	Medium confidence	2
	Low confidence	3
	No confidence	4
	Uncertain	5
Capacity within the conservation sector across the country is an ongoing challenge. Apart from the limited number of staff (and budget) available to manage and monitor species, scientists and practitioners are presently ill-equipped to deal with the evolving pressures put on the country's biodiversity - for example, it is increasingly difficult to detect instances of poaching, smuggling, and laundering of succulent plants (that is facilitated largely by the internet and rapidly developing social media platforms) with existing mechanisms. The implementation of current management and harvest controls (particularly outside of protected areas) is therefore limited at present although ad hoc compliance inspections are starting to be implemented in the Western Cape. It has also been acknowledged that new skillsets and mechanisms are needed in-order to effectively detect illegal activities involving endemic species, as well as to improve the management of a legal and sustainable trade in these plants that satisfy both national and international conservation obligations.		
Monitoring of harvest		
19. Methods used to monitor the harvest: What is the principal method used to monitor the effects of the harvest?	Direct population estimates	1
	Quantitative indices	2
	Qualitative indices	3
	National monitoring of exports	4
	No monitoring or uncertain	5
Exports of <i>E. colliculina</i> from South Africa (extracted from the CITES Trade Database, UNEP World Conservation Monitoring Centre, Cambridge, UK) are monitored by the South African National Biodiversity Institute (SANBI) on behalf of South Africa's Scientific Authority. The species is not widely cultivated or traded globally, with South Africa being the largest exporter of <i>E. colliculina</i> plants (accounting for more than 84% of all global exports to date (~2 100 live plants)). Germany and the United States of America are the major importing Parties of the species, with both countries also previously involved in the export <i>E. colliculina</i> plants. Close to 1 760 live plants have been exported from South Africa since 1994, though exports have ceased since 2015 (Fig. 5). Ninety-six percent of plants exported over this period have been artificially propagated from wild collected seeds as the single nursery known to be trading the species is devoid of parental stock with a production capacity of zero. It is also suspected that exports from this nursery have been opportunistically supplemented by illegally harvested wild adult plants. Erratic patterns in the number of plants exported over the years supports this notion, as it is likely influenced by market driven demand.		
There is currently no field monitoring programme for the species.		

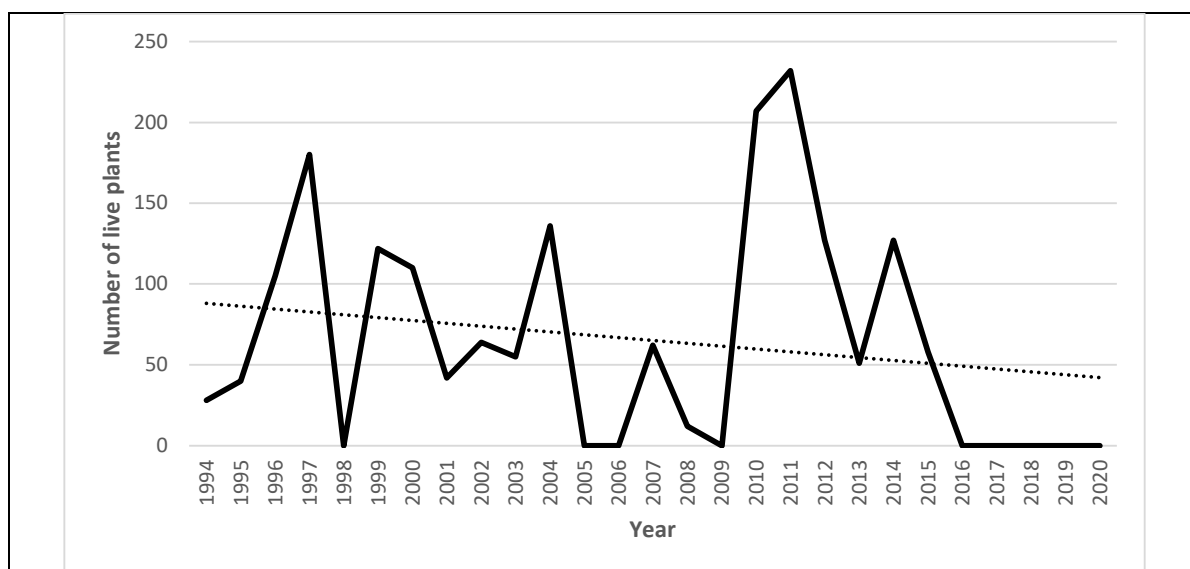


Figure 5: Gross exports of live *Euphorbia colliculina* plants from South Africa (with trend in trade over time indicated by the dashed line). An average of 61 plants ($\pm$ SD 70.70) have been exported annually since the year 2000 (up to 2020).

20. Confidence in harvest monitoring:

Do budgetary and other factors allow effective harvest monitoring?

High confidence	1
Medium confidence	2
Low confidence	3
No confidence	4
Uncertain	5

Trade data are regularly extracted from the CITES Trade Database (UNEP World Conservation Monitoring Centre, Cambridge, UK) and analysed. The quality of the trade data is not as good as it should be due to errors and inconsistencies in reporting. Lack of monitoring across local nursery facilities also undermines the accuracy of the trade data as some nurseries have been known to take advantage of poor oversight loopholes by mis-declaring wild plants of many species as artificially propagated. With an increase in the illegal collection and laundering of wild succulents noted across the country in recent years, provincial conservation authorities are now more aware of the issue and understand the need to commit more resources towards increased and improved monitoring efforts of local exporting nurseries. CapeNature is specifically looking into improvements in compliance monitoring and are undertaking ad hoc inspections of growing and exporting facilities.

Incentives and benefits from harvesting

21. Utilization compared to other

threats: What is the effect of the harvest when taken together with the major threat that has been identified for this species?

Beneficial	1
Neutral	2
Harmful	3
Highly negative	4
Uncertain	5

Given that the production capacity for this species domestically is effectively zero, added pressure on the wild populations for seed and adult plants is anticipated. Studies have shown that population persistence in long lived and slow reproducing species is not usually impacted upon heavily by seed harvest since this is the cohort with the highest natural mortality rate (Godínez-Álvarez *et al.*, 2003; Raimondo and Donaldson, 2003; Pfab and Scholes, 2004). In the case of *E. colliculina* however, when taken in conjunction with the concurrent impact of overgrazing on the reproductive outputs of individuals, any levels of sustained seed harvesting from the wild would have a detrimental effect on the populations. In addition, long-lived species are highly sensitive to extractive use of adult plants and unregulated removals of large plants would also be

detrimental to the persistence of populations (Godínez-Álvarez <i>et al.</i> , 2003; Raimondo and Donaldson, 2003; Pfab and Scholes, 2004; Mandujano <i>et al.</i> , 2007; Martorell <i>et al.</i> , 2015). It is suspected that wild plants may have previously been collected and laundered into trade as evidenced by field surveys, nursery audits, and snapshot analyses of the online trade (Jabar, 2019). Any ongoing, localized and, opportunistic removals of large plants from accessible areas by nurseries, hobbyist collectors and succulent traders will exacerbate the impact of habitat loss and herbivory on the species.		
22. Incentives for species conservation: At the national level, how much conservation benefit to this species accrues from harvesting?	High	1
	Medium	2
	Low	3
	None	4
	Uncertain	5
The one nursery known to be trading in the species admits to cultivating plants from wild harvested that is reportedly collected on land belonging to the owner of the nursery, however no conservation benefit to the species are derived from this harvest.		
23. Incentives for habitat conservation: At the national level, how much habitat conservation benefit is derived from harvesting?	High	1
	Medium	2
	Low	3
	None	4
	Uncertain	5
The one nursery known to be trading in the species admits to cultivating plants from wild harvested that is reportedly collected on land belonging to the owner of the nursery, however habitat conservation benefits are not derived from this harvest.		
Protection from harvest		
24. Proportion strictly protected: What percentage of the species' natural range or population is legally excluded from harvest?	>15%	1
	5-15%	2
	<5%	3
	None	4
	Uncertain	5
One locality falls partly within a CapeNature contracted nature reserve accounting for 22% of the national population which is effectively excluded from harvest (Jabar, 2019).		
25. Effectiveness of strict protection measures: Do budgetary and other factors give confidence in the effectiveness of measures taken to afford strict protection?	High confidence	1
	Medium confidence	2
	Low confidence	3
	No confidence	4
	Uncertain	5
The single largest <i>E. colliculina</i> population that occurs within a private nature reserve is well protected (and strictly excluded from harvest). There are worker's cottages near to where the species grows, and any unauthorized access into the property would probably be noticed and reported to the farm manager (M. de Villiers- Conservation Services Officer, CapeNature, pers. comm.). Although the provincial legislation makes provisions for the management and protection of the species, enforcement of and compliance with the regulations is challenging to guarantee.		
26. Regulation of harvest effort: How effective are any restrictions on harvesting	Very effective	1
	Effective	2

(such as age or size, season or equipment) for preventing overuse?	Ineffective	3
	None	4
	Uncertain	5
In spite of adequate provincial legislation that prohibits, in the absences of a permit, the harvesting of protected plants across the province (excepting for seed on private lands), limitations with respect to the adequacy of relevant skills and mechanisms within CapeNature, renders existing harvest controls ineffective. These limitations hinder effective field monitoring of the species populations and hinders the monitoring of nurseries trading in the species thus impeding the ability to detect laundering of wild plants into the trade. Whilst CapeNature have not issued any permits for the wild collection of <i>E. colliculina</i> from anywhere in the province (C. Arendorf, pers. comm.), access to many of the populations is fairly unrestricted given the inadequate fencing within some areas as well as the proximity of several populations to public roads. It is furthermore challenging to ensure oversight of acceptable legal collection occurring on privately owned lands where only landowner permission is required (in relation to the gathering of seed).		

List of participants

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