CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

Eighteenth meeting of the Conference of the Parties
Colombo (Sri Lanka), 23 May – 3 June 2019

CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II

A. Proposal

To list the species Widdringtonia whytei in CITES Appendix II without annotation specifying the types of specimens to be included, in order to include all readily recognizable parts and derivatives in accordance with Resolution Conf. 11.21 (Rev. CoP17). On the basis of available trade data and information it is known that the regulation of trade in the species is absolutely necessary to avoid this critically endangered species, with major replantation efforts underway, becoming eligible for inclusion in Appendix I in the very near future.

B. Proponent

Malawi*:

C. Supporting statement

1. Taxonomy

1.1 Class: Pinopsida

1.2 Order: Pinales

1.3 Family: Cupressaceae

1.4 Genus, species or subspecies, including author and year: Widdringtonia whytei Rendle

1.5 Scientific synonyms: Widdringtonia nodiflora variety whytei (Rendle) Silba

1.6 Common names: Mulanje cedar, Mulanje cedarwood, Mulanje cypress, Mkunguza

1.7 Code numbers:

2. Overview

Widdringtonia whytei or Mulanje cedar, the national tree of Malawi, is a conifer in the cypress family endemic to the upper altitude reaches of the Mount Mulanje massif (1500-2200 a.s.l.). This highly valued, decay- and termite-resistant species is considered to be “critically endangered” by the International Union for Conservation of Nature (IUCN) Red List of Threatened Species after years of overexploitation from unsustainable and illegal logging combined with human-induced changes to the fire regime, invasive competing tree species, aphid infestation, and low rates of regeneration or recruitment. As of 2018, population surveys did not find a single standing, reproductively mature tree on the Mulanje Mountain. Small plantation areas have been established in other areas of Malawi and a major effort is underway to replant the cedar on Mount Mulanje, but until such efforts have resulted in the renewal and stabilization of the

* *The geographical designations employed in this document do not imply the expression of any opinion whatsoever on the part of the CITES Secretariat (or the United Nations Environment Programme) concerning the legal status of any country, territory, or area, or concerning the delimitation of its frontiers or boundaries. The responsibility for the contents of the document rests exclusively with its author.*

population, any trade, international or national, in its timber should be considered a threat to the survival of the species.

3. Species characteristics

3.1 Distribution

Widdringtonia whytei or Mulanje cedar is endemic to the Mount Mulanje massif in southeastern Malawi, whose total area covers approximately 650 km^2 (Chapman et al 1991). Much of this area is gazetted as the Mount Mulanje Forest Reserve (MMFR) and known locally as *chilumba mu mlengalenga*, "island in the sky". Mulanje cedar historically grew across upper reaches of the MMFR (1500-2200m a.s.l.).

Smith (2015) suggests the possibility that the Mulanje cedar's historic range – thousands of years ago if not longer – was greater, as evidenced by the success of plantations established on the nearby Zomba Plateau (1500m) and the Viphya Plateau (1600m), where trees exhibit higher growth rates than on the mountain itself.

3.2 Habitat

Mount Mulanje is the highest peak in southern tropical Africa, rising above 3000m a.s.l. and surrounded by several large plateaus. The formation is a granitic batholith formed approximately 130 million years ago that is eroding at a slower rate than surrounding material (Farjon 2013). Soils on Mulanje are rocky, acidic (pH 4.2 to 4.9) humic ferrisols (Chanyenga 2013). The Mount Mulanje Forest Reserve is today surrounded by a mosaic of habitats and agricultural land uses. Approximately four hundred thousand people live within a seven-kilometer buffer zone around the massif (Hecht 2008). Mount Mulanje is also designated as a Biosphere Reserve in part due to the presence of *Widdringtonia whytei* (United Nations Educational, Scientific and Cultural Organization – UNESCO 2018).

Mount Mulanje exhibits a decreasing precipitation gradient from Southeast to Nortwest due to prevailing southwestern coastal weather patterns, receiving between 2000 and 3000 mm of annual rainfall (Bayliss et al. 2007). The site is recognized for having high biodiversity and high endemism (approximately 70 endemic plant species [Strugnell 2002]). Three distinct forest types are found here along the elevational gradient; *Widdringtonia whytei* is today limited to the Afromontane forests between 1850-2300m a.s.l., although scattered remnant stumps can be observed in remaining mid-altitude forest areas. The afromontane ecosystems preferred by *W. whytei* are found in scattered patches within gullies, gorges and ravines protected from wind, fire and logging (Chanyenga 2013).

3.3 Biological characteristics

Widdringtonia whytei is one of four species in the genus Widdringtonia found in Malawi. *W. whytei* has a set of characteristics that have made it particularly sensitive to the human-induced changes in its habitat. It is an early successional pioneer species that will not regenerate under closed canopy, needing light gaps or edge habitat (Edwards 1982). Seeds typically germinate on exposed mineral soil at forest edges, after fire destroys stands of the other evergreen species with whom *W. whytei* grows in association (Chanyenga 2013). However, the cedar presents something of an ecological paradox: while successful population regeneration depends on periodic fires, individual trees are highly flammable with very thin outer bark, and particularly vulnerable in the seedling stage (Smith 2015; Chanyenga 2013). Nor does the species coppice from stumps when adult trees are destroyed by fire, unlike its congener *Widdringtonia nodiflora* (Pauw & Linder 1997). It therefore has been highly susceptible to changes in the fire regime on Mount Mulanje resulting from crop-burning, hunting and illegal logging.

Despite being a pioneer species, Mulanje cedar grows relatively slowly, particularly in comparison to the non-native conifer species with whom it now competes on the mountain (Chapman 1995). It takes 80-100 years to fully mature but will eventually become a dominant or co-dominant tree in its ecosystem if canopy out-competition, natural or human disturbances do not intervene (ibid.).

3.4 Morphological characteristics

Mulanje cedar is a coniferous tree in the cypress family that can reach 40 meters in height and over one meter in diameter (Chanyenga 2013). The tree is wide-crowned and often branchless up to about 21 meters (USDA 2007). Its bark is spongy and thickens with age, splitting along longitudinal cracks

(Pauw and Linder 1997). *W. whytei* wood is has copious amounts of aromatic resin whose resistance to fungal rot, decay and insects make its yellow-white timber highly valuable (Bayliss et al 2007; Chanyenga 2013). Its basic density is 385-430 kg/m^3 (Chapola 1989).

As with other members of the Cupressaceae family, juvenile and adult leaves are distinct. Juvenile leaves are cultrate or needle-like, spirally arranged and up to two cm long, while adult leaves are scale-like, close to the stem, decussate and only two mm long, appearing when *W. whytei* reaches 1.5 to two meters in height (Chanyenga 2013). Trees are bisexual (Chapman 1995). Male cones are terminal and yellow-brown while female cones are white-blue, globose, 1.5 to two cm in diameter and take two years to develop. Cones are semi-serotinous, appearing to depend on moderate to severe fires for heavy seedfall and wide dispersal. Seeds germinate between 15°C and 25°C, optimally around 20°C, in both light and dark conditions, suggesting that the species does not likely form a persistent soil seed bank such as is frequently found in fire-adapted species (Chanyenga et al. 2012).

3.5 Role of the species in its ecosystem

Widdringtonia whytei historically has been a co-dominant species in the Afromontane forests of Mount Mulanje, alongside *Podocarpus milanjianus*, *Cassipourea malosana*, *Ekebergia capensis*, *Olea capensis*, *Polyscias fulva*, *Rapanea melanophloeos* and *Xymalos monosporoa*, as well as at the forest's edge where the ecosystem transitions to ericaceous scrub and grasslands (Farjon 2013). Within the forest, cedar trees provide habitat and seed food source for birds, small mammals and insects. The Afromontane forests of which *W. whytei* is an integral part provide multiple ecosystem services such as food, fuel, medicines and water to the thousands of nearby residents (Hecht 2008). This forest cover plays a critical role in regulating water flows off Mount Mulanje: the massif is the origin of nine different watersheds, providing water to hundreds of thousands of people, and the severe loss of its forest area has been correlated with more damaging floods. In 2017 eighteen people were killed in flash floods on the Lichenya side of the mountain, and over 2000 smallholders were impacted on the Thuchila side (BGCI 2017).

4. Status and trends

4.1 Habitat trends

Habitat degradation and loss on Mont Mulanje's lower slopes occurs through a combination of logging, fuelwood collection, agricultural expansion, crop-burning fires and establishment of exotic tree plantations such as *Pinus patula* and *Cupressus macrocarpa*. This gradual loss puts additional pressure on the higher altitude forests where cedar grows (Farjon 2013). Hecht (2008) indicated that trends could lead to the lower slopes being completely deforested within a decade. This predicted trends has now come reality. A remote sensing analysis of land use change on Mount Mulanje found an annual decline of 0.5 percent in Afromontane and mid-altitude forest types between 1973 and 2002, from 9,292 ha to 7,928 ha (Bouvier 2006).

Widdringtonia whytei distribution is currently highly fragmented and patchy, largely reduced to fire-protected valleys inaccessible to logging in the upper reaches of the Forest Reserve. Its decline has been steep: in 1986, estimates of extant cedar habitat were approximately 1462 hectares (Sakai 1989). By 2007, analysis done by Bayliss et al found that cedar forest fragments had been reduced to a total of 845.3 ha. A decade later, almost none of these fragments were found to have any mature specimens of *W. whytei* (BCGI 2017), which indicate a 100 percent removal of mature trees live and dead.

4.2 Population size

The most recent ecological baseline survey, conducted in 2017, found that "Mulanje cedar is considered to be practically extinct on Mulanje mountain. It is very likely that the small number of sizeable standing individuals that remain will be gone before the end of 2017." This survey found only seven mature individual *Widdringtonia whytei* trees, clustered together in a single inaccessible gully. (For purposes of the survey, mature individuals were those capable of producing seed.) Out of 34 20-meter plots surveyed, 25 plots had fewer than 20 living individuals, most of which were young seedlings recently planted by a restoration project in the Forest Reserve. Eight of these plots had no living individuals (BGCI 2017). As of 2018, the seven reproductively mature standing individuals had been felled (Mount Mulanje Conservation Trust, *pers. obs*.).

Outside the known habitat on Mount Mulanje, small plantation areas of *W. whytei* have been successfully established, although it appears that *W. whytei* and *W. nodiflora* were sometimes mixed together in these plantations (Pauw and Linder 1997). There are 66.2 ha of plantation on Zomba Mountain and another 76 ha in the large timber plantations of the Viphya Plateau (Chanyenga 2018).

4.3 Population structure

Cedar stands exhibit distinctive size cohorts rather than a continuum, suggesting sporadic establishment events in response to a specific combination of conditions (Smith 2015).

Low natural regeneration and relatively high mortality rates have been observed by all recent studies conducted (Edwards 1982, Sakai 1989, Lawrence et al. 1994, Makungwa 2004). A regeneration assessment in 2014 found very low natural regeneration in remaining cedar clusters: a total of 285 natural seedlings were recorded on the entire mountain, averaging out to only one seedling per hectare of surveyed habitat. Of these, 152 seeedlings were ≤20 centimeter height, 106 seedlings were 21-150 centimeter height, and only 7 were over 150 centimeters (i.e. in the sapling category) (Chanyenga 2013). Bayliss et al. (2007) similarly found most individuals in the >55 centimeter size class.

Meanwhile, mortality rates due to the multiple threats described below are unsustainably high. In 2007, Bayliss et al found that 33 percent of standing trees were dead. Likewise, Chanyenga (2013) found that 32.6 percent of standing cedar trees were dead. In 2014, a population estimate by the Malawi Forestry Department indicated no less than 41.5 percent of standing trees were dead (Smith 2015).

4.4 Population trends

As the data above suggests, the population trend has been catastrophically downward in recent years. The IUCN Red List assessment stated that a population decline of over 80 percent was likely by 2030 and considers the species “critically endangered” (Farjon 2013). The actual decline has been even more drastic. In 2007, Bayliss et al. still found densities between 41 and 131 stems per hectare of trees above 5 centimeter diameter, and 78,159 cubic meter of standing live volume. In 2014, a Forest Department survey found 38,138 mature, living cedar trees (and another 25,609 dead trees) (Chanyenga 2018). But by 2017, field surveys found only seven mature living trees (BGCI 2017).

Regeneration and recruitment are troublingly low due to multiple factors. Chanyenga (2013) found that viable seed production from *W. whytei* cones was only 23 percent. In closed canopy forest areas, the cedar, a pioneer successional species, will not grow. In open areas, human activities are preventing regeneration. Loggers have typically burned areas after cutting cedar trees, in order to expose remaining planks, and these unnatural fires kill seedlings (BGCI 2017).

Since 2017, a major restoration project has planted approximately 325,000 seedlings throughout areas of known former cedar habitat, and has the goal of planting another 250,000 on the mountain and selling 250,000 seedlings commercially to remove pressure from the Mount Mulanje population (Shaw, *pers. comm.*). The success of this restoration effort will not however be known for years to come. Previous planting efforts have seen heavy seedling mortality for unclear reasons (Shaw and Smith 2017). Bayliss (pers obs) etsimates chances of survival from sapling to seed producing tree on Mulanje Mountain to be between 0.1 to 1 percent only.

4.5 Geographic trends

The Mulanje Cedar is endemic to sheltered habitat in the upper elevations of Mt. Mulanje Nature Reserve, Malawi. Without significant and ongoing human intervention, this species will disappear entirely from its known geographic range. Beginning as far back as 1907, *ex situ* plantations of *W. whytei* were being established on the adjacent Zomba Mountain plateau. These now cover 66.2 ha and have become the primary seed source to produce seedlings for a large-scale restoration effort in the native habitat of Mt Mulanje (Chanyenga 2018; Smith 2015).

5. Threats

The Mulanje cedar population is being decimated by a convergence of threats: illegal and unsustainable logging, fire damage, invasive tree species, conifer aphids, and the lack of natural regeneration described in 4.4 above (Bayliss et al. 2007).

Logging: Both legal and illegal logging have long occurred in the MMFR. The British colonial government gazette the Forest Reserve in large part to manage cedar populations for timber provision and attempted (with limited success) to establish plantations in other areas.

Although the Forest Department's recent policy was to issue licenses only for salvage logging of dead trees, illegal logging that targeted the remaining large, living trees escalated throughout the period 2007-2018, removing crucial potential seed trees and damaging the habitat. In the 2007 sawing season, for example, 31.8% of total trees removed were estimated to have been living (Makungwa and Chanyenga 2007).

In 2017, despite almost a complete absence of live mature trees, the ecological survey team observed ongoing removal of planks and remnant timber (BGCI 2017).

Changing fire regime: As described above, *W. whytei* regeneration is linked to periodic fire that kills off shade canopy and exposes new mineral soil. But these natural fires are usually caused by lightning during rainy season and are less damaging than the now-frequent fires caused by humans for various reasons. Many are set during the hot dry season to renew grasses for local livestock grazing. Hunting flush fires and crop waste fires are also common and can spread out of control, particularly on the drier northeastern slopes of the mountain adjacent to communities. Loggers set fires to expose remaining pieces of cedar in already-cut areas. Such fires damage or kill the adult trees and, critically, also have heavy impact on regenerating seedlings (Chanyenga 2013).

Invasive tree species: Mexican pine (*Pinus patula*), originally planted by the colonial administration as a nurse crop for Mulanje cedar, turns out to grow much faster and shade it out. *P. patula* is also a pioneer species coadapted with fire. It has taken over areas of the mountain to the exclusion of other species including *W. whytei* (Bayliss et al. 2007).

Conifer aphids: the Giant Cypress Aphid (*Cinara cuppresivora*), originally from Europe and North America was first recorded in Malawi in 1986 (Ciesla,1991; Chilima, 1995) This aphid attacked and killed many *W. whytei* trees in the 1980s and 1990s, before a parasitic wasp was released as biological control (Bayliss et al. 2007; Chilima, 1995). It has not been eradicated and remains a factor in the high mortality levels described in section 4.3 above.

Other threats: Deposits of around 30 million tons of bauxite have been found over about one third of the Mulanje plateau. While large-scale open cast mining has not yet occurred, the possibility remains and would completely destroy any cedar forest habitat in these areas (Bayliss et al. 2007, Farjon 2013). Most recently, rare earth minerals needed by computer and cell phone technologies have been found on the plateau (Bayliss *pers. comm.*).

6. Utilization and trade

6.1 National utilization

The Mulanje cedar was declared the national tree of Malawi in 1984 by the late President Dr. Hastings Banda. It has a powerful role in the national imagination and the extinction of this species would have symbolic implications far beyond its ecology.

Widdringtonia whytei timber is highly valued in Malawi, as its light-to-moderately-heavy yellow-brown wood is easy to work with and is decay- and insect-resistant (Farjon 2013; Bayliss et al. 2007). It is a highly desirable species for construction and boat building, and has been commercially harvested for over a century. The British colonial regime in fact established Mount Mulanje Forest Reserve in large measure to manage its extraction. As recently as 2007, the government of Malawi issued harvesting licenses for cedar to build 400 plank boats (Chanyenga 2013). The species is also preferred for furniture, roof shingles (weathering to a silver-grey), paneling, flooring and handicrafts such as walking sticks sold to tourists. An oil called "Mulanje tar" can be distilled and used as a preservative (ibid).

6.2 Legal trade

There is no legal export of Mulanje cedar (Farjon 2013).

6.3 Parts and derivatives in trade

Mulanje cedar has been traded as logs, sawnwood, or smaller dimensional pieces of timber salvaged from dead trees. Derivative products can also be made from its resin.

6.4 Illegal trade

Much of the *W. whytei* timber has been taken illegally from within the Mulanje Mountain Forest Reserve. Illegal harvest significantly increased over the last 10 years due to a variety of factors. In 2005, the Department of Forestry and the Mulanje Mountain Conservation Trust confiscated 28.5 m^3 of timber, equivalent to approximately 33 trees, the majority from living trees, despite only salvage licenses being granted in the Reserve (Bayliss et al. 2007). In 2007, a total of 1233 trees were harvested, of which 393 (31.8%) were living trees and therefore illegally cut. The last licenses for salvage logging were issued in 2007, which means that 100% of both dead and living tree volume harvested from 2008 onwards has been illegal. Given the volume estimates done by Bayliss et al. (2007), this means that almost 115,000 m^3 of cedar have been illegally harvested in the last ten years.

6.5 Actual or potential trade impacts

Given the current dire status of the endemic natural population of *W. whytei*, any domestic or international trade will have grave impacts on the viability and survival of the species.

7. Legal instruments

7.1 National

The Forest Law in Malawi allows for the Forestry Department to issue licenses for extraction of timber including *Widdringtonia whytei*.

Country	**Special measures for protection and management of the species**	**Export-related regulation**
Malawi	• W. whytei is on protected species list • Cedar Management Plan adopted by Forest Department in 2014	• Native hardwood log exports banned since 2008

Note that traditional chiefs have significant authority over harvest rights in their villages or territories. Their decisions may not always be in line with the national government's policies.

The Mulanje Cedar was listed as a Protected Species in a revision to the National Parks and Wildlife Protected Species Act which was revised and published in September 2017 (Malawi 2017). Under this Act one could receive a jail sentence of up to 30 years if found to be illegally posssing Mulanje Cedar.

7.2 International

There are no international controls specifically related to *Widdringtonia whytei* in place. Imports to the USA, European Union and Australia are subject to national legislation in those jurisdictions prohibiting the import and/or sale of wood which was illegally sourced in the country of origin (Hoare 2015).

Malawi is a member of the South African Development Community, which has had a Protocol on Forestry since 2002 that "aims to promote the development, conservation, sustainable management and utilisation of all types of forest and trees; trade in forest products and achieve effective protection of the environment, and safeguard the interests of both the present and future generations" (SADC 2018). In theory, members states are required to conduct and update national forest assessments, including data on uses of forest products, markets and commercial and industrial issues, to collaborate on a regional database and a market information system, and to exchange information concerning forest management and trade (Lukumbuzya and Sianga 2016).

8. Species management

8.1 Management measures

Malawi's Department of Forestry issued sawing licenses for living specimens of *Widdringtonia whytei* annually until 2004, when logging was put on hold for several years in order to allow export development of a more sustainable harvesting system (Chanyenga *pers. comm*.). In 2007, due in part to a commitment to supply cedar timber for 400 boats as part of the Lake Malawi Artisan Fisheries Development Project, another sawing season was opened, and 60 sawyers were registered to work on the mountain (Chanyenga 2013; Chanyenga pers. comm.). Harvest and salvage logging post-2007 have not been legal.

The Forestry Department developed and in recent years has been operating on the basis of a Cedar Management Plan (2014-2019), which recommends several key actions: cessation of any logging for five years; large-scale ecological restoration of the cedar across 1400 ha; protection of the growing trees from fires, insects, disease and illegal harvest; development of good working relationships with surrounding communities and other stakeholders, to promote protection and restoration; and development of appropriate ecological research on *W. whytei*.

Fire breaks have been established in strategic areas throughout the Forest Reserve, but resources to maintain and monitor them, or to fight fires when they occur, are limited. Schemes to reduce fuelwood demand have been initiated, and biological controls were introduced to combat the invasive aphids (Chanyenga 2013; Bayliss et al. 2007). There was also a major operation over the past decade to remove the invasive *Pinus patula*, which competes with the Mulanje cedar, although this removal reduced fuelwood and timber availability for local communities and may have been part of the dynamics leading to the heavy illegal cedar logging in recent years.

8.2 Population monitoring

Regular population surveys have been conducted by researchers and/or projects focused on *Widdringtonia whytei* at Mount Mulanje (see section 4 above). The Malawi Forest Department and the Mount Mulanje Conservation Trust closely monitor the remaining population of this critically endangered species.

8.3 Control measures

See section 7 above.

8.4 Captive breeding and artificial propagation

Plantation forestry has been attempted for over a century with Mulanje cedar, with limited success. The species' growth is far slower than exotic conifers like *Cupressus lusitanica* and *Pinus patula*. It also appears that in some cases *W. whytei* and *W. nodiflora* have been mixed together in these plantations (Pauw & Linder 1997).

Previous plantation or restoration attempts have been seriously hampered by a poor understanding of ecology, pathology and horticulture, although the tree has been successfully planted at small scale elsewhere in Malawi as well as in botanic gardens. The "Save our Species" project planted 220,000 seedlings between 2003 and 2010, but almost all were lost to wildfire (Shaw and Smith 2017). Low seedling survival has been a consistent problem in the nursery as plants attain 5-10 cm, and survival dropped off again once they were outplanted to the natural habitat. It remains urgent to identify whether this high mortality is being caused by a microbial pathogen or the absence of an ecto-mycorrhizal fungus (Smith 2015).

Currently an initiative funded by the Darwin Initiative and implemented by Botanic Gardens Conservation International, in partnership with the Mulanje Mountain Conservation Trust and the Forestry Research Institute of Malawi, is attempting a major *W. whytei* replanting project within appropriate habitat of Mount Mulanje Forest Reserve. Ten community nurseries were established around the base of the mountain and apparently traditional authorities were consulted and involved in project implementation (BGCI 2017). The project trained nursery supervisors and extension staff in horticultural protocols, refinement of which is ongoing. Trial plots were also set up across Malawi to "test growth limits and identify optimal growing conditions for Mulanje cedar" (Shaw and Smith 2017).

The project has planted 325,000 seedlings and its goal is to plant another 250,000 on the mountain by 2019 while selling 250,000 seedlings commercially to remove pressure from the Mount Mulanje population (Shaw *pers. comm.*).

8.5 Habitat conservation

The entire existing native habitat of *W. whytei* is within the Mount Mulanje Nature Reserve, which was gazetted in 1927 to regulate cedar exploitation and protect the numerous watersheds that originate on the slopes of the mountain. This protected area status allows for the possibility of logging and/or dead tree salvage as part of forest management.

8.6 Safeguards

No information available at this time.

9. Information on similar species

Widdringtonia whytei was long thought to be the same species as the more widespread *Widdringtonia nodiflora* (L.) Powrie, which has a more narrow and multi-stemmed growth form. However, genetic analysis at the Unversity of Cape Town has conclusively shown that they are distinct species. Both species grow on Mount Mulanje (Pauw and Linder 1997).

10. Consultations

Given that Malawi is the only range State for *Widdringtonia whytei*, no specific consultation was carried out.

11. Additional remarks

None.

12. References

Bayliss, J., Makungwa, S., Hecht, J., Nangoma, D. and Bruessow, C. 2007. Saving the Island in the Sky: the plight of the Mount Mulanje cedar *Widdringtonia whytei* in Malawi. *Oryx* 41(1): 64-69.

Botanical Gardens Conservation International (BCGI). 2017. Mulanje Mountain Ecological Baseline Survey. Available upon request.

Bouvier, I. 2006. Mount Mulanje Land Cover Time Series Analysis. STTA Draft Report. Community Partnerships for Sustainable Resource Management in Malawi, COMPASS, Blantyre, Malawi.

Chanyenga, T.F. 2018. Mulanje Cedar (*Widdringtonia whytei*) Malawi's national tree: Does it deserve this hostility? Powerpoint presentation to the British High Commission.

Chanyenga, T.F. 2013. Effect of population size on viable seed output, seed rain and natural regeneration pattern of a tropical conifer *Widdringtonia whytei* Rendle in Malawi. PhD Thesis, Stellenbosch University, Stellenbosch, South Africa.

Chanyenga, T.F., C.J. Geldenhuys and G.W.Sileshi. 2012. Germination response and viability of an endangered tropical conifer *Widdringtonia whytei* seeds to temperature and light. *South African Journal of Botany* 81:25-28. https://doi.org/10.1016/j.sajb.2012.04.002

Chapman, J. D. 1995. *The Mulanje Cedar, Malawi's National Tree*. The Society of Malawi, Blantyre.

Chapman, J.D., J.H. Seyani and A.C. Chikuni. 1991. The Mulanje Mountain in Malawi – a world heritage resource worth conserving. Paper presented at the XIIIth AETFAT Congress, Zomba, Malawi.

Chapola, G.B.J. 1989. Comparisons of some of the wood properties of wide and narrow crowned variants of *Widdringtonia nodiflora* – Powrie (Mulanje cedar). *FRIM Report* 89002. FRIM, Zomba, Malawi.

Chilima, C.Z. 1995. Cypress aphid control: first African release of Pauesia juniperorum . FRIM Newsletter No 74:2

Ciesla, W. 1999. Cypress aphid, *Cinara cupresi*, a new aphid pest of conifers in eastern and southern Africa.FAO Plant Protection Bulletin 39 (2-3) :82-93.

Edwards, I. 1982. A Report on Mulanje Cedar (*Widdringtonia nodiflora*) Resources on Mulanje Mountain. Report no. 82035, Forestry Research Institute of Malawi, Zomba, Malawi.

Farjon, A. 2013. *Widdringtonia whytei. The IUCN Red List of Threatened Species 2013*:

e.T33216A2835167. http://dx.doi.org/10.2305/IUCN.UK.2013-1.RLTS.T33216A2835167.en

Hecht, J. 2008. When will community management conserve biodiversity? Evidence from Malawi. *Field Actions Science Reports* 1: 9-17.

Hoare, A. 2015. Tackling illegal logging and the related trade: what progress and where next? Chatham House.

Lawrence M.J., A. Oshino, and C. Chinguwo. 1994. Mulanje cedar (*Widdringtonia cupressoides* Endlicher) inventory. Report No 94010, Forestry Research Institute of Malawi, Zomba, Malawi.

Lukumbuzya, K. and C. Sianga. 2017. *Overview of the Timber Trade in East and Southern Africa: National Perspectives and Regional Trade Linkages.* 53 pp. TRAFFIC and WWF.

Makungwa, S. 2004. Inventory results of Mulanje Cedar resources on Mulanje Mountain. A report submitted to Mulanje Mountain Conservation Trust.

Makungwa S. and T. Chanyenga. 2007. Evaluation of the 2007 Mulanje cedar (*Widdringtonia whytei*) sawing season on Mulanje Mountain. A report submitted to Mulanje Mountain Conservation Trust.

Malawi 2017. *National Parks and Wildlife Act (No. 11 of 1992). National Parks and Wildlife (Protected Species) Declaration Order*.

Pauw, C.A. and H.P. Linder. 1997. Tropical African cedars (*Widdringtonia*, Cupressaceae): systematics, ecology and conservation status. *Biological Journal of the Linnaean Society* 123: 297-319.

Sakai, I. 1989**.** A report on the Mulanje cedar resources and the present crisis. *Forestry Record* 65. FRIM, Malawi.

Shaw, K. and P. Smith. 2017. Darwin Initiative Main Project Annual Report: Domestication of the Mulanje cedar for Improved Rural Livelihoods (project reference 23-026).

Smith, P. 2015. Saving Malawi's national tree: Can a combination of in situ and ex situ conservation approaches bring this iconic species back from the brink? *Botanical Gardens Conservation International* 12:2, available at http://www.bgci.org/resources/article/0828/

South African Development Community. 2018. "Protocol on Forestry." Webpage. https://www.sadc.int/documents-publications/sadc-treaty/

Strugnell, A.M. 2002. Endemics of Mount Mulanje – the endemic spermatophytes of Mount Mulanje, Malawi. *Systematics and Geography of Plants* 72:11-26.

UNESCO. 2015. "Mount Mulanje." Available at http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/africa/malawi/mount-mulanje/, last accessed 2 December 2018.

USDA Forest Service. 2007. "*Widdringtonia whytei*." Wood technical factsheet. Available at http://www2.fpl.fs.fed.us/techsheets/Chudnoff/African/htmlDocs_africa/Widdringtoniawhytei.html , last accessed 2 December 2018.