James Watson

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Astronium urundeuva (Myracrodruon urundeuva)

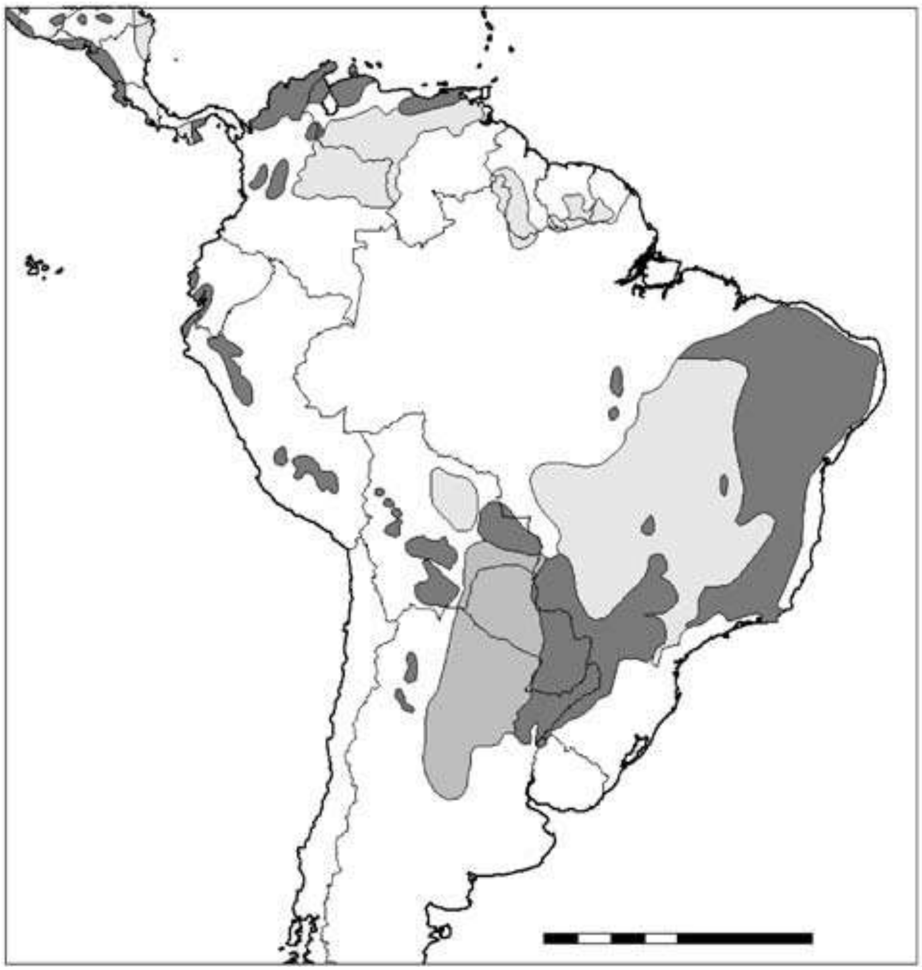
Introduction

Astronium urundeuva (also referred to as *Myracrodruon urundeuva*) is a little understood, though extensively exploited, tree species found in South America (Monteiro, et al, 2012). Currently, it is listed as Data Deficient and in need of updating by the IUCN Red List of Threatened Species (IUCN, 2014). It is colloquially referred to as urundeuva, urindeuva, urunday, aroiera, pandeiro e aroeria preta, urundel, and urundei-me e urunde'i throughout its range (Monteiro, 2006). While *A. urundeuva* and *M. urundeuva* are synonymous, *A. urundeuva* appears to be the more widely accepted name for the species.

Description

A. urundeuva is a broadleaf deciduous tree to 20 meters (about 65 feet) in height, with a straight, cylindrical trunk (Monteiro, et al, 2012). The species is confined to Seasonally Dry Tropical Forests (SDTF) in South America. Like many other woody species in the SDTF, *A. urundeuva* is slow growing (Monteiro, et al, 2006). As a deciduous tree in the SDTF, *A. urundeuva* drops its' leaves at the beginning of the drought season, and develops leaves once again during the wet season. It can form dense stands of many individuals in humid areas, while in drier climates, there are fewer individuals that are spread farther apart. *A. urundeuva* can survive at up to 1800 meters elevation in its range across the Andes Mountains. The tree is mostly dioecious, with some monoecious individuals among the populations. The tree produces small seeds through insect pollination, which disperse through the wind. It is an old species, most likely predating the Pleistocene, and contributing to its scattered range of distribution (Caetano, et al, 2008).

Figure 1- Areas of SDTF in South America darkest grey, Cerrado mid shade, Chaco lightest shade (Caetano, et al, 2008)



Like many SDTF woody species, access to light is critically important to the tree, as its seedlings and sprouts have high mortality under canopies. Light is the greatest limiting factor to the recruitment of *A. urundeuva.* With sufficient levels of light, it is one of the first trees to sprout after disturbance, provided lianas or other vegetation does not cover seedlings (Fredericksen and Mostacedo, 1999). The tree possesses the ability to quickly and densely regenerate following logging. It is a pioneer species of forest clearings, openings, and edges. It has a high rate of germination, and reestablishes quickly (Fredericksen and Mostacedo, 1999).

Seeds are dropped from the end of the dry season to the beginning of the wet season (Vieira, et al, 2006).

Distribution

The tree has a distribution across many parts of South America, as SDTF occur in several locations surrounding the continent. It is considered to be a characteristic tree core to the definition of SDTF in South America (Apgaua, et al, 2014). Seasonally dry tropical forests occur in areas with less than 1600 mm annual rainfall, and with five to six months of the year receiving less than 100 mm of rainfall. Continuous, or mostly continuous, canopies of trees ranging from 10 to 40 meters in height, and understory communities with a low composition of grasses, are characteristic vegetative features of SDTF in South America. SDTF can occupy a variety of soils and terrains. Because of the diversity and isolation of SDTF, they contain high rates of endemism. High β-diversity, as well as high rates of species turnover, is characteristic of SDTF in South America (Apgaua, et al, 2014).

The largest geographical distributions of *A. urundeuva* are in the Caatinga region of Brazil, the Cerrado of Brazil, and the Chaco in Paraguay, Argentina, and Bolivia. It occurs in other areas scattered throughout the Andes of Western South America, and north to the northern boundary of the continent (Caetano, et al, 2008). It occurs in scattered locations across the Atlantic Coast of South America, wherever rainfall stays at sufficient levels. There are competing hypotheses regarding the historical distribution of *A. urundeuva,* with the notion of a "Pleistocenic Arc" creating the currently scattered and isolated distribution throughout South America (Caetano, et al, 2008). During glacial periods, STDF could have spread as far as the Amazon Basin, as well as into other parts of the continent (Caetano, et al, 2008). As South

America has become wetter post-glaciation, the zones of SDTF have begun to shrink. The tree is showing signs of recent invasion into the Cerrado domain, a savanna biome in Central Brazil (Caetano, et al, 2008).

Population Trends

A baseline historical population figure for *A. urundeuva* is not known. However, populations are decreasing in many localities throughout South America. Seasonally dry tropical forests cover only about 5% of their historic range in Central Brazil, and only about 5% of their historic range overall on flat terrain in South America (Vieira, et al, 2006). The implications of such drastic loss in obligate habitat for the species are extreme in the reduction of population across its range. In the transitional region between Amazon Forests and Caatinga in particular, populations are decreasing rapidly (Monteiro, et al, 2012).

According to Monteiro, et al, in their 2006 report, the species could be facing local extinction. The largest populations of the species occur in the Caatinga region, as well as Cerrado and Chaco domains. Chaco is a region within Paraguay, Argentina, and Bolivia, composed of xeromorphic forests and woodlands on less than well drained soils. *A. urundeuva* would historically appear to be increasing its population in the Cerrado domain in particular (Caetano, et al, 2008). This one example of range expansion for the species, when compared to the overall removal of suitable habitat, showcases the trend of disappearance this species is facing across its range.

Threats

There is a lack of detail to the history of *A.urundeuva*, and further research needs to be conducted to determine specific information on various aspects of the species and its role and presence in its native range. Threats to the persistence of *A. urundeuva* are well documented, however, in many parts of its range. Seasonally dry tropical forests are considered one of the most threatened ecosystems on the planet, and the most threatened in the tropics, because of the rate at which humans are developing them (Vieira, et al, 2006). SDTF is highly sought after for its agricultural potential and ease of development. The tree is highly valued as a timber resource, as fuel wood, and for medicine (Monteiro, et al, 2012). The combination of threats against the species has led to dangerously low populations in several parts of the region.

In the Caatinga region of Brazil, SDTF are being converted to agricultural lands, primarily for grazing cattle (Vieria, et al, 2006). After the areas have been cleared, the continued presence of cattle suppresses the regrowth of forest. Farmers maintain an practice suppression through bulldozing of regrowth of woody species, plowing the fields, then replanting grasses. (Fredericksen and Mostacedo, 2000). The opportunity for regrowth of *A. urundeuva* is eliminated, disrupting the ability of SDTF to regenerate. Clearing and harvesting *A. urundeuva* for timber as well as fuel is hastening the decrease in populations throughout its range.

Uses

The extensive medicinal uses of the plant have resulted in extremely low local populations, some at risk for local extinction. The bark of the tree is collected intensively, and used by indigenous people, sold to local markets, or sold to pharmaceutical companies (Monteiro, et al, 2006). It has a relatively high value for its medicinal uses, and is particularly valued in Caatinga by the indigenous population. The tree is known for its anti-diarrheal, anti-inflammatory, as a mouthwash and general healing properties, throughout its range. There are many other reported medicinal uses of the species, and in laboratory studies, have been shown to have anti-inflammatory and analgesic effects (Monteiro, et al, 2006).

Conservation and Management

Conservation of this species is becoming critical for its persistence in several localities. It has been placed on a list of endangered species by the Instituto Brasileiro do Meio Ambiente e Recursos Naturais Renováveis, and has been identified in previous studies as a species of critical conservation importance (Monteiro, et al, 2012). As mentioned above, there are populations of *A. urundeuva* in Caatinga facing extirpation due to local medicinal uses. The conservation of the species hinges on the local populations' ability to effectively practice sustainable management of the species (Monteiro, et al, 2005).

The species has demonstrated an ability to regenerate, and has persisted for a long time in its current habitat, lending a notion it has a natural resilience and productivity. The ability for the plant to recolonize logged areas in Bolivia, as noted by Vieira and others in 2006, is evidence to its ability to naturally sustain after intense human disruption. The ability for sprouts and seedlings to persist in nature is evidence this plant needs little help in getting a start.

Tests have shown conclusively that *A. urundeuva* benefits from inoculation of the mycorrhizal fungus *Acaulispora longula.* The tree has shown increased vigor through production of fresh and dry mass, height, and number of leaves in seedlings inoculated with *A. longula* (Oliveira, et al, 2013). Seedlings of the species are able to grow quicker, allowing for better competition against encroaching lianas or other vegetation that could ultimately shade out the shrub. Added resilience and productivity in the initial growth stages of the plant should help in establishment of restoration sites, or reestablishment of forests. This could potentially be an effective approach to increasing the population of the species across its range through increased resistance to environmental variables.

Another effect of the symbiosis is an enhancement to the medicinal value of the tree. *A. urundeuva* has been shown to contain naturally high levels of tannins and phenols, compounds that are used for various medicinal treatments. The trees inoculated with *A. longula* showed an increase of soluble carbohydrate by 112.7%, protein content by 32.9%, total phenols by 81.03%, and flavonoids by 57.5% over an uninoculated control group (Oliveira, et al, 2013). The combination of increased plant vigor and increased value per plant could be incentive to manage *A. urundeuva* in a sustainable way. The promise of mycorrhizal technology to enhance both a local economy and ecology presents itself with the symbiosis between these species. Increased economic incentive to inoculate *A. urundeuva* with *A. longula* could directly lead to the restoration of the species in many localities where it has been driven to near extinction, such as Caatinga.

A critically important role in the management of *A. urundeuva* is its' ability to naturally recruit and regenerate in logging disturbances. Managers can utilize ongoing forestry practices to mitigate the impacts of deforestation of the species across other parts of its range. Monteiro and others in 2012, however, describe the ability of *A. urundeuva* to regrow from cuttings as insufficient to be of practical value for large-scale restoration or reforestation. The tree is most successful in forest openings and other microsites created through logging (Fredericksen and Mostacedo, 1999).

With what little research has been made into the ability for the plant to regenerate and persist after disturbance, and others in several reports, it could be that the plant is very workable for restoration goals. An in situ conservation approach to the management of the species will probably present itself as a more effective solution to the decreasing populations and range of the species. Cost effectiveness is going to be paramount in the areas where the tree has been facing its greatest threats, as much of the extraction is being done by indigenous people who probably wouldn't have the means to develop intensive methods of conservation management or environmental restoration.

The greatest hope for the survival of the species rests with the local people who have been exploiting it. Monteiro and others found in their 2012 report that 98.5% of people surveyed in the Riach˜ao de Malhada de Pedras and Alto das Ameixas communities in the Pernambuco State of Brazil are in favor of conserving *A. urundeuva.* Both communities had large percentages of people who understood the uses of the tree. While facing historically low populations and ranges, in many cases the very people responsible for its destruction have become increasingly aware if its peril. Significant contributions to the future success of conservation occur with such valuation of the tree, combined with an increase in knowledge with propagation and value in mycorrhizal technology.

Conclusion

More research and data are needed to effectively implement restoration plans for the species, though in situ approaches to its conservation seem to be favored (Fredericksen and Mostacedo, 1999). At the same time the species is losing ground to human development, the knowledge and awareness of the plant is becoming greater in indigenous communities. Some methods for optimizing growth and establishment have been developed, but more there is a vast gulf of information missing for the ecological interaction with the species.

While awareness of and support for the species is documented to be increasing, efforts to generate awareness and support of *A. urundeuva* need to be undertaken in areas of larger population to ensure its protection. Better regulation and oversight of the tree, and SDTF overall, will be key to the survival of the tree across its range. Perhaps with a greater understanding of its ecological role, conservationists, restorationists, and foresters will be able to implement more effective plans at increasing the species presence and persistence into the future.

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