Inclusion of *Yucca queretaroensis* in Appendix II

Proponent: Mexico

Summary: *Yucca queretaroensis* is a cold-hardy succulent plant endemic to Mexico where it occurs in the Sierra Madre Oriental in the states of Guanajuato, Querétaro and Hidalgo, specifically in the region known as the "Queretano-Hidalguense Semi-desert", occupying an estimated area of 600 km^2. It has a fragmented distribution, with subpopulations consisting of up to 20 individuals, separated by natural geological barriers such as canyons and steep hillsides. Some populations are relatively inaccessible and part of the habitat of the species is included in protected areas although it is not clear how effective protection is. Other populations are relatively accessible. The overall population is estimated at around 60 000 individuals and regeneration is reportedly limited, being mostly through offsets. Seed is apparently not set every year. The species has not been assessed against the Global IUCN Red List categories and criteria. A recent assessment in Mexico suggests that it could be classified as "at risk of extinction".

Yucca queretaroensis is considered a particularly attractive species of *Yucca* and is harvested principally as an ornamental plant for both local and international markets. Its relative cold-hardiness is likely to make it of particular interest to collectors in Europe and parts of North America. It is traded mainly as a living plant although trade in seeds also occurs. Locally, its flowers are also used in traditional festivals and the species was historically used in roof-making. *Y. queretaroensis* is in international trade, both as large, wild-collected plants and as artificially propagated specimens. Currently at least 300-500 wild-collected plants are believed to be imported into Europe each year, with larger numbers imported in the past. Artificially propagated plants have recently become available in Europe in some quantity. Mature plants command relatively high prices. The species resembles other *Yucca* species in trade, including *Yucca rostrata* and *Y. linearifolia*, neither of which is included in the Appendices, nor proposed for inclusion.

The species is listed under the category "subject to special protection" on the Mexican national red list (Sujeta a protección especial, Pr, Norma Oficial Mexicana NOM-059-SEMARNAT-2010). A more recent assessment suggests the species could be classified in the higher category of "at risk of extinction".

Analysis: *Yucca queretaroensis* has a relatively restricted distribution in Mexico. Its wild population is thought to number in the tens of thousands, although it apparently shows limited regeneration in the wild. It is sought-after as a horticultural plant and mature, wild-collected specimens enter international trade in some number, with at least 300-500 reported to be imported annually into Europe. If the estimate of the wild population is reliable and given its relatively limited regeneration capacity, the species may meet the criteria for inclusion in Appendix II in that regulation of trade may be required to ensure that the harvest of specimens from the wild is not reducing the wild population to a level at which its survival might be threatened by continued harvesting or other influences (Paragraph B of Annex 2 a to *Resolution Conf. 9.25 (Rev. CoP15)*). The species resembles other *Yucca* species in trade so that identification of specimens in trade might be problematic.

Supporting Statement (SS)	Additional information
Range	
Mexico	
IUCN Global Category	
	Not currently listed

Supporting Statement (SS)	Additional information

Biological and trade criteria for inclusion in Appendix II (Res. Conf. 9.24 (Rev. CoP15) Annex 2 a)

A) Trade regulation needed to prevent future inclusion in Appendix I

The Norma Oficial Mexicana NOM-059-SEMARNAT-2010 (the Mexican National Red List) classifies the species as being “Subject to special protection” (Pr), but the most recent evaluation of its conservation status indicates it could be classified in a higher category of ‘at risk of extinction’

The wild population of *Yucca queretaroensis* is small (approximately 60 300 individuals in total) and populations are fragmented. It has high habitat specificity and is considered to be biologically rare.

The species is endemic to central Mexico, distributed in the Sierra Madre Oriental in the states of Guanajuato, Querétaro and Hidalgo, specifically in the region known as the ‘Queretano-hidalguense Semi-desert’, occupying an estimated area of 607.64 km^2. *Y. queretaroensis* has a fragmented distribution, with subpopulations consisting of up to 20 individuals, separated by natural geological barriers such as canyons and steep hillsides.

There are two principal areas, one in the municipality of Xichú (in Guanajuato) and the other, where the largest number of subpopulations occurs, in the municipalities of Pinal de amoles, San Joaquin and Cadereyta de Montes (in Querétaro) and Pecula and Zimapàn (in Hidalgo).

Population analyses using two parameters, plant height and number of leaves per rosette, were conducted of two populations, in Xichu, Guanajuato and Rancho Quemado, Queretaro. Low numbers of tall plants were found at Rancho Quemado, with no individuals recorded over 270 cm. The tallest individuals with most leaves were found at Xichu.

Wild populations of *Y. queretaroensis* present high vulnerability to extrinsic and intrinsic factors. Extrinsic factors relate predominantly to the extraction of mature individuals for international trade, reducing sexual recruitment of wild populations. In terms of intrinsic factors, the species has low sexual reproductive success rate, a low regeneration rate, long generation length, specialised habitat and specialised pollination.

Reproduction is principally asexual, through the production of ramets at the base of the parent plant. It also reproduces sexually, but unlike other species of the genus *Yucca*, this does not occur annually. Few observations of fruiting plants have been made in the wild. Its fertility rate is less than 10% of its reproductive capacity potential per individual.

Garcia-Mendoza (2003) reports fragmentation and destruction of the habitat of Y. queretaroensis*.*

Piña (1990) notes that the tropical deciduous forest between las Adjuntas and las Moras in the municipality of Zimapan, Hidalgo, where the species grows, is very degraded.

Magallán-Hernández et al. *(2011) document in detail the localities of* Y. queretaroensis *subpopulations. Although many subpopulations are found on steep slopes, other subpopulations are noted to be situated in areas of moderate gradients, near to roads or inhabited areas, in areas reported as collection sites for medicinal plants and/or easily accessible areas.*

Supporting Statement (SS)	Additional information
The habitat of *Y. queretaroensis* is in a good conservation condition as human population densities are low, and there is no tendency towards urbanisation or drastic transformation of the landscape in the region. However, steep gradients limit the formation of deep soils and potential erosion levels range from high (50 to 200 tonnes/ha/yr) to severe (200 to 500 tonnes/ha/yr).	
B) Regulation of trade required to ensure that harvest from the wild is not reducing population to level where survival might be threatened by continued harvest or other influences	
Y. queretaroensis is harvested principally as an ornamental plant and is available in both local and international markets. It is traded mainly as a living plant, but trade of seeds also occurs. Locally, its flowers are also used in traditional festivals and it was historically used in roof-making.	
Use and export are regulated by the Environment and Natural Resources Secretary (SEMARNAT), but there are records of exports permitted by the Secretary of Agriculture, Farming, Rural Development, Fishing and Food (SAGARPA). .	*The proposal states that there are records of exports permitted by SAGARPA. It has since been verified that phytosanitary certificates were issued by SAGARPA for* Y. queretaroensis *but these do not validate export (CONABIO* in litt., *2012).*
At the 18th meeting of the Plants Committee in 2009, a presentation on "Trade in Agavaceae" was given documenting the growing interest in the cultivation of these species internationally (principally in Europe) and the possible unsustainable trade in species as a result, with large wild specimens of *Y. queretaroensis*, available in international markets since 2006.	*The demand in Europe for* Y. queretaroensis *has risen rapidly in recent years and continues to rise. This is due to the ornamental value of the plant, its rarity and low horticultural requirements.* Y. queretaroensis *is also cold tolerant and has high humidity tolerance, making it suitable for European climates, although in colder areas of central Europe (such as Austria, the Netherlands and Germany) a winter shelter is necessary (Weissbeck* in litt., *2012). Boeuf (2007) noted that, even though the species can tolerate cold and ice, it is better to maintain it in an artificial climate.*
In response to the "Trade in Agavaceae" study, the Scientific Authority of Mexico (CONABIO) undertook official consultation in August 2012 (OF. DEAI-239/2012) with CITES Authorities in North America and Europe, requesting information on the trade of *Y. queretaroensis* in their countries. 47 countries in Europe were contacted, as well as Canada and the United States. 12 countries in Europe replied - eight reported no known trade, and four recorded trade in *Y. queretaroensis* (Germany, Italy, the Netherlands and the UK). Canada reported no known trade and the United States recorded the presence of trade. From this information it was concluded that the principal specimens in trade are seeds, medium-sized plants (approximately 70 cm tall, with stem) and large plants (greater than 70 cm tall, with stem), and the majority of these were of wild and unknown origin. The level of international trade could not be clearly quantified.	*In accordance with the demand of the market, more wild collected plants from Mexico are being imported. Plants are imported bare-rooted in sea containers. They have high regeneration abilities and losses are rare. It is estimated that around 300-500 plants per year are imported into Europe by the main importer, although larger numbers have apparently been imported in the past (Weissbeck* in litt., *2012)* *Seeds of* Y. queretaroensis *were first offered following a collection in 2009 from a small group of plants located at the gorges near Zimapan, Hidalgo. The majority of seedlings and small plants (with rosettes of a few leaves) offered in Europe are from that collection. (A few years before, seeds were also available in Europe, but it was later revealed that these were seeds of* Y. filifera*). The appearance of seeds on the market is observed to have only slightly weakened the demand for wild collected plants (Weissbeck* in litt., *2012).*
By means of online surveys and consultations, 19 companies trading internationally in *Yucca queretaroensis* were identified. These companies appear to be involved in two different types of international trade of this species, namely 1) seeds and small seedlings (rosettes of few leaves) without stems that seem to be germinated from	*Magallán-Hernández* et al. *(2011) note that trade in the species appears to be unsupervised and the effects of harvest are not documented. They note that the species is available for sale as seed and living plant in Europe, although it is not easily found, and large plants are sold for very high prices in comparison with other*

Supporting Statement (SS)	Additional information
seeds (13 companies based in Germany, US, Japan, Netherlands and the UK) and 2) large-size adult plants (80-160 cm in height) with developed stems (6 companies in Germany, France, Belgium, the Netherlands and Portugal). The latter range in price from USD500 to over USD2000 per plant. In many cases the origin of the seeds/plants is unknown, in other cases it is specified that they were artificially propagated.	*Yucca species.* *A further web search confirmed the availability of* Y. queretaroensis *from online stores in Europe – with advert descriptions highlighting the extreme rarity of the species and the fact that it has only been available in Europe since 2006. Sales of seeds, small plants and large plants were observed.* *The main European consumer markets for* Y. queretaroensis *are the Netherlands, Germany, Spain, Portugal, Italy and the UK. It is thought that only the high unit price (per cm) limits an even higher volume of imports to Europe. However, each private collection usually has only one to two, or occasionally three to five plants (Weissbeck* in litt., *2012).* *Magallan-Hernandez* et al. *(2012a) report consultation with the US Fish and Wildlife Service who note that few established nurseries in the US advertise sale of* Y. queretaroensis *on the internet and trade is limited to small private collectors and enthusiasts.* *Magallan-Hernandez* et al. *(2012a) document attempts to contact sellers of* Y. queretaroensis*. A response was not received from companies based in Europe that were identified as selling large specimens of* Y. queretaroensis *online. Magallan-Hernandez* et al. *(2012a) note that the large-size of the plants offered by these nurseries does not align well with the slow growth rate of the species and highlighted the need for further investigation to determine the origin of these specimens. They also highlight the need to quantify the volume of trade through regulation of international trade.* *Magallan-Hernandez* et al. *(2012a) undertook surveys with people from Rancho Quemado and Xichu, two locations where* Y. queretaroensis *grows locally. 38% of the survey participants in Rancho Quemado and 51% in Xichu reported knowing a use(s) of* Y. queretaroensis*. 7% of the participants in Rancho Quemado reported experience of commercialisation of the plant, through the sale of leaves (for themselves or their parents) and the extraction of fibres from the stem. All indicated this was over 20 years ago. No survey participants in Xichu reported experience of commercialisation of the plant.* *The same survey participants were asked if they have knowledge of* Y. queretaroensis *being extracted from the wild recently. Three survey participants out of a total of 104 said yes they had heard of extraction taking place, one of which reported the collector was from Pheonix, Arizona (Magallan-Hernandez* et al., *2012a and summarised in Magallan-Hernandez* et al., *2012b). These findings do not align with the observed presence of suspected wild collected individuals on the market. However, this could be linked to a decline in the local cultural importance of* Yucca queretaroensis*, previously used as roofing material, due to the availability of new*

Supporting Statement (SS)	Additional information
	building materials, as reported by Magallan-Hernandez et al. *(2012a).*
Inclusion in Appendix II to improve control of other listed species	
A) Specimens in trade resemble those of species listed in Appendix II under Res. Conf. 9.24 (Rev. CoP15) Annex 2 a or listed in Appendix I	
Y. queretaroensis can be confused with other species of the same genus and other morphologically similar species of different genera, such as *Yucca linearifolia, Y. rostrata, Y. thompsoniana, Dasylirion quadrangulatum, Agave striata* and *Agave aff. striata.* These species can, however, be differentiated from *Y. queretaroensis* with training and the proposal includes an identification guide to facilitate enforcement if/when the species is listed in Appendix II.	*There are currently three species of Agavaceae listed in the CITES Appendices:* Agave parviflora *(Appendix I),* Agave victoriae-reginae *and* Nolina interrata *(Appendix II)*. Y. queretaroensis *can also be confused with* Dasylirion longissimum var. treleasei*, and* Yucca whipplei *(Weissbeck* in litt., *2012)*
Other information	
Threats	
Steep gradients limit the formation of deep soils and potential erosion levels range from high (50 to 200 tonnes/ha/yr) to severe (200 to 500 tonnes/ha/yr). Habitat loss also occurs from grazing. There is no monitoring programme in place to monitor the wild populations of *Y. queretaroensis* or the viability or consequences of wild extraction.	*Garcia-Mendoza (2003) reports fragmentation and destruction of the habitat of* Y. queretaroensis *and Piña (1990) notes that the tropical deciduous forest between las Adjuntas and las Moras in the municipality of Zimapan, Hidalgo, where the species grows, is very degraded.* *Magallan-Hernandez* et al. *(2011) note that the potential construction of mines could negatively impact the population found at Camino Azogues-San Francisco Gatos.* *Magallan-Hernandez* et al. *(2012a) report evidence of human disturbance, collection of parts of the plants, animal trampling and forest fires affecting some populations of* Y. queretaroensis*, along with soil erosion.*
Conservation, management and legislation	
Y. queretaroensis is listed under NOM-059-SEMARNAT-2010 as Subject to special protection (Pr). Its use is therefore controlled under the General Wildlife Law (Ley General de Vida Silvestre) (LGVS, 2000, Art. 1). Part of the habitat of *Y. queretaroensis* is found within two protected areas, delineated by the National Commission of Protected Natural Areas (CONANP); the Biosphere Reserve of la Sierra Gorda de Guanajuato (covering a total of ~2369 km^2) and the Biosphere Reserve of la Sierra Gorda de Querétaro (~3836 km^2). *Y. queretaroensis* is included in the management plan of the Regional Botanic Garden of Cadereyta (Querétaro) and this garden holds nine mature individuals within its collection. It is also represented in the living collections of "El Charco del Ingenio" Botanic Garden (San Miguel de Allende, Guanajuato) and the Botanic	*BGCI's online database of ex situ plant collections records two additional gardens as holding* Y. queretaroensis *in their collection (PlantSearch, 2012). Both are in Europe and are likely for display purposes only and their value for conservation, for example through involvement in reintroduction programmes, would likely be limited due to their distance from the natural habitat of the species.* *Magallan-Hernandez* et al*. (2012a) note that local governance of the species would be beneficial to its conservation, but that the decline in the local cultural importance of* Y. queretaroensis*, means that education about the ecosystem importance of* Y. queretaroensis *and the risks facing the species, such as low growth rate, low reproduction rate from seed and its national and international ornamental value, are needed for local governance to be successful.*

Supporting Statement (SS)	Additional information
Garden of the National Autonomous University of Mexico (UNAM, Mexico City), each with three mature individuals. There are some nurseries in the United States and the Netherlands which have begun reproducing the species from seed and by micropropagation in recent years.	*Magallan-Hernandez* et al. *(2012a) note that monitoring to avoid the extraction of seeds is also necessary as well as extraction of whole plants, due to the low reproductive rate from seed noted for this species in the wild.*
Captive Breeding/Artificial Propagation	
There are no controlled artificial propagation programmes for this species, but it is held in the collections of three botanic gardens affiliated with the Mexican Association of Botanic Gardens (AMJB).	*Magallan-Hernandez* et al. *(2011) note that there is not much information available about the propagation of* Y. queretaroensis*, but it is known that in Europe it is commonly sought after as an ornamental plant and efforts to propagate the species have been made in recent years.* *Weissbeck (2008) provides documentation of propagation trials of* Y. queretaroensis *undertaken in Europe. He noted that* Y. queretaroensis *acclimatised well to the humidity and frosts of central Europe, as was the case for* Y. linearifolia*, which had previously been imported to Europe and has many similarities with* Y. queretaroensis*. Weissbeck documents the first propagation attempts made in Holland in 2006 with promising results and the first individuals planted survived 3 years without damage from humid winters and temperatures below zero. Weissbeck (2008) also documented fast growth of roots, reproduction of new individuals from broken roots and the ability for regeneration following the loss of the full head of leaves.* *Propagation of* Y. queretaroensis *using in-vitro methods is theoretically possible, however, to date no in-vitro plants have been offered on the European market so it is assumed that in-vitro propagation is occurring (Weissbeck* in litt., *2012).* *Propagation through rhizome division is possible and has delivered good results in experiments, but this type of propagation is not profitable for trade because it yields too few plants at a high cost and there are high loss rates (Weissbeck* in litt., *2012).* *Since 2009/2010 seeds of* Y. queretaroensis *have been available in some southern European countries. This kind of propagation is currently the most cost-effective and profitable and is therefore the most common. As seeds have only been available in Europe since 2009, it is not possible to provide detailed information on growth rates from seed, but initial results indicate that two to three year old plants reach a height of 15-25 cm in height with 20-50 leaves and will not yet have a developed stem. Imported plants on the market with a minimum stem height of approximately 40-60 cm show a growth rate of approximately 1-3 cm per year when in good horticultural conditions. Between 1000 and 2500 plants are reported to have been raised for sale on the European market to date (Weissbeck* in litt., *2012). This indicates that the demand for larger specimens cannot yet be satisfied from artificially propagated individuals as propagation has only commenced recently.* *Magallan-Hernandez* et al. *(2012a) recommended that nurseries need to be set up in*

Supporting Statement (SS)	Additional information
	Mexico to propagate the species as a control measure.

Other comments

In 2011, the Scientific Authority of Mexico (CONABIO), in collaboration with the Regional Botanic Garden of Cadereyta, undertook the project 'Evaluation of the state of conservation, use of and threats to *Yucca queretaroensis* Piña (Agavaceae) and its inclusion in the Appendices of CITES', which concluded that it was necessary to include the species in Appendix II. *Y. queretaroensis* plays an important ecological function, contributing to the formation and retention of soil thanks to a system of deep fibrous roots. It is a host species and provides habitat for birds and insects at different life cycle stages.	Y. queretaroensis *is not the only species of the Yucca extracted from its habitat for use as an ornamental plant,* Y. thompsoniana *and* Y. elata *are also subject to this (Garcia-Mendoza* in litt., *2012). The species resembles* Yucca linearifolia, *which is sometimes apparently supplied instead. The two can apparently be distinguished by the cross-section of the leaf: in* Y. queretaroensis *this is square, in* Y. linearifolia *it is flat, so that the latter can be bent without forming cracks, unlike the former (www.tropicalcentre.com). It also resembles* Y. rostrata (*www.yuccado.com*).

Reviewers: A. Garcia-Mendoza, W. Hodgson, A. Reuter, S. Weissbeck.

References:

Boeuf, T. (2007). Yucca & Co – Winterharte Wüstengärten in Mitteleuropa anlegen und pflegen. – Medemia Verlag. Deutschland. 192 p.

CONABIO. (2012). In litt. to the IUCN/TRAFFIC Analyses Team, Cambridge, UK.

Garcia Mendoza, A.J. (2003). *Yucca queretaroensis.* Revision de las Agavaceae (sensu stricto), Crassulaceae y Liliaceae incluidas en el PROY-NOM-059-ECOL-2000. Jardin Botanico, Instituto de Biologia, Universidad Nacional Autonoma de Mexico. Bases de datos SNIB-CONABIO. Proyecto W020. Mexico. D.F.

Garcia Mendoza, AJ. (2012). In litt. to the IUCN/TRAFFIC Analyses Team, Cambridge, UK.

Magallán-Hernández, F., Maruri-Aguilar, B., Sánchez-Martínez, E., Hernández-Sandoval, L., Robledo-Mejía, M. and Hernández-Martínez, M. (2011). Evaluación del estado de conservación, uso y amenazas de Yucca queretaroensis Piña (Agavaceae) y la pertinencia de incluirla en los Apéndices de la CITES. Jardín Botánico Regional de Cadereyta. CONCYTEQ. Informe parcial CONABIO proyecto JE005. Cadereyta, Querétaro.

Magallán-Hernández, F., Maruri-Aguilar, B., Sánchez-Martínez, E., Hernández-Sandoval, L., Robledo-Mejía, M. and Hernández-Martínez, M. (2012a). Evaluación del estado de conservación, uso y amenazas de Yucca queretaroensis Piña (Agavaceae) y la pertinencia de incluirla en los Apéndices de la CITES. Jardín Botánico Regional de Cadereyta. CONCYTEQ. Segundo informe parcial CONABIO proyecto JE005. Cadereyta, Querétaro.

Magallán-Hernández, F., Maruri-Aguilar, B., Sánchez-Martínez, E., Hernández-Sandoval, L., Robledo-Mejía, M. and Hernández-Martínez, M. (2012b). Evaluación del estado de conservación, uso y amenazas de Yucca queretaroensis Piña (Agavaceae) y la pertinencia de incluirla en los Apéndices de la CITES. Jardín Botánico Regional de Cadereyta. CONCYTEQ. Informe final de la 1ª etapa, CONABIO proyecto JE005. Cadereyta, Querétaro.

Piña, I. (1990). Nuevas aportaciones a *Yucca queretaroensis* Piña sp nov. Cactaceaes y Suculentas Mexicanas. 35 (3): 61-62.

PlantSearch (2012). http://www.bgci.org/plant_search.php Viewed on 24 October 2012.

Weissbeck, S. (2008). Aktuelle erkenntnisse und kulturerfahrungen sowie methoden zur identifizierrung *Yucca queretaroensis*. Deutschland.

Weissbeck, S. (2012). In litt. to the IUCN/TRAFFIC Analyses Team, Cambridge, UK.