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Survival and Performance of Cultivated Woody Legume Species in Yuma, Arizona

Matthew B. Johnson

Haematoxylum brasiletto

Desert Plants

A journal devoted to broadening knowledge of plants indigenous or adapted to arid and sub-arid regions and to encouraging the appreciation of these plants.

Kim Stone, editor
DesertPlants@cals.arizona.edu

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37615 E US Highway 60
Superior, AZ 85173

From the editor

This issue of Desert Plants marks the end of nearly a quarter century of woody plant evaluation in Yuma, Arizona. It's a melancholy end, to be sure, but for financial, logistical, and practical reasons, it was time. The planting site, a three and half hour drive from Tucson, was chosen for its winter warmth, not for its convenient location. The distance made work trips to prune, weed, control pathogens and herbivores, and perform other routine maintenance a well-planned, multi-day affair, and limited DELEP staff (all two of them) and volunteers to only one or two visits per year.

In addition to this, the continued evaluation of these plants after so many years was met with diminishing returns. Most of the plants were now mature. Many seeds had been collected over the years, and assessments of growth, freeze damage, and general phenology had been diligently recorded. Slides, and then digital photographs, captured the visual characteristics of each plant. Even so, with so many years of documentation, it came as a surprise when the University of Arizona decided that they wanted to use this land for other agricultural purposes—with a looming deadline—which required a quick shift in thinking in order to formally bring this 22-year evaluation to a close.

Mark Siegwarth, Director of the Arboretum and DELEP, didn't want to simply walk away without trying to find homes for some of the plants before the land was cleared and the trees were gone forever. After all, he thought, they must have some value to someone. He approached several botanical gardens in Arizona and California, but none were willing to make the substantial commitment that would be required to salvage any of the plants. Mark also felt that the wood, itself, might be useful for milling, but because it had no track record for commercial workability, he was unable to generate any takers from this angle, either. Not one to be easily thwarted, he decided that we would try to salvage some of the plants ourselves for the Arboretum's collection.

After two decades spent evaluating these trees, Matt Johnson knew them better than anyone, so it was up to him to choose the trees that had the best chance of surviving the substantially colder winters at the Arboretum. He knew that a handful of the trees that were growing in Yuma had also survived winters in DELEP's Tucson fields. Because Tucson and Boyce Thompson Arboretum are at nearly the same elevation, Matt felt that there were some strong candidates that stood a good chance of surviving our winter cold—but they also had to be small enough to transport on a flatbed trailer. In late December 2013, Arboretum and DELEP staff, volunteers, and Yuma Mesa staff met at the Yuma Mesa Ag Center to dig and load these selected trees for the trip to the Arboretum. At the same time, herbarium voucher specimens and seeds were collected, photographs were taken, and measurements were taken for the very last time.

Though the Yuma Mesa Agricultural Station field has been officially decommissioned, the Desert Legume Program continues to grow legumes at two fields at the Campus Agricultural Center,

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and another field at the West Campus Agricultural Station, both in Tucson. Nearly 150 leguminous trees, shrubs, and perennials, and some annuals continue to be evaluated. Documentation of the survival and performance of these Tucson-based plants can be view on the DELEP website (cals.arizona.edu/desertlegumeprogram), as well as Desert Plants Vol. 27, No. 2, and several back issues of Aridus on the DELEP website.

Of the trees that were transplanted from the Yuma fields, only *Pterogyne nitens* survived. Matt feels that the failed transplants might be worth trying again under more ideal conditions, i.e., planted from nursery grown plants in containers. Several other taxa, too, show promise to survive the Arboretum's winter low temperatures. Here is a complete list:

Adenanthera colubrina
Bauhinia carronii
Bolusanthus speciosus
Havardia sonorae
Mariosousa coulteri
Peltophorum africanum
Peltophorum dubium
Schotia brachypetala
Senegalia cinereaVachellia luederitzii var. luederitzii

As I was wrapping up this issue of *Desert Plants*, Matt commented to me that hardly anyone puts a bunch of seeds in the ground anymore with the intent to evaluate the plants long term, at least not as far as trees are concerned. DELEP had the foresight to do this in Yuma in 1991, and within the pages of this issue, we all reap the benefits.

All figures by Ken Coppola unless noted

Survival and Performance of Cultivated Woody Legume Species in Yuma, Arizona

Matthew B. Johnson
Program Manager and Curator
Desert Legume Program
The University of Arizona/Boyce Thompson Arboretum
mjohnson@ag.arizona.edu

In March 1991, the Desert Legume Program (DELEP) began trial plantings of legume trees and shrubs at the University of Arizona Yuma Mesa Agricultural Center, in Yuma, Arizona. This location afforded a nearly freeze-free site to evaluate various taxa of cold-sensitive Fabaceae. An additional goal was seed-increase to augment DELEP's seed bank. As the field trials continued, the plants also served as a source of plant material for several research projects, primarily involving screening for bioactive compounds with pharmaceutical applications. Those plants that performed well and had an attractive growth form, foliage, or flowers were also evaluated for their potential as landscape plants. Initial plantings were made in Block 24. In March 1992 plantings began in Block 30. Together, these two fields totaled approximately 1.8 hectares (4.5 acres). Plantings in the fields continued through 2010.

The Yuma Mesa Agricultural Center is located south of the city of Yuma on what is called the Yuma Mesa – an area of semi-stable sand dunes adjacent to the flood plain of the Colorado River. The fields were located at N 32°36' x W 114°38'. Elevation at the site is 58 m (190 ft.). The area is characterized by long, hot summers and warm winters (BWh – Köppen climate classification). The mean annual temperature is 23.97° C (75.15° F). Summers can be brutally hot. The record high temperature at Yuma is 51° C (124° F). Minimum temperatures remain above freezing in most winters. This region is hyper arid with average annual precipitation at Yuma of 85.3 mm (3.36 in). The wettest months are August and December. Decaying tropical storms or hurricanes from the tropical western Pacific Ocean can infrequently bring substantial rain in the late summer and autumn. High winds occur and can generate sand storms. The soil at the site is fine-grained sand. Much of the surrounding area on the Yuma Mesa is devoted to citrus production.

With a few exceptions, the plants used in these field trials were propagated at DELEP's Campus Agricultural Center facilities in Tucson. In most cases, the plants were planted out from 2-gallon or 5-gallon containers. Depending on eventual mature size, between 2 and 6 plants of each accession were planted. Most planting took place during the spring months to optimize establishment and growth prior to winter. Newly planted plants were protected with poultry netting to exclude rabbits. This was removed after the plants had achieved sufficient size. The fields were flood irrigated. Irrigation frequency was approximately once every 3 weeks from March through October and once every 6 weeks from November through March, following an initial establishment period for the early plantings there. Manual and chemical weed control was performed as needed. The infrequent work trips to the Yuma site due to distance from DELEP's Tucson headquarters meant that weed control was an ongoing issue. Yuma Mesa Agricultural Center staff mowed the fields at least once per year in later years. During the late 1990's and early 2000's much of the field area was subjected to one or more carefully controlled burns to remove the accumulated weeds. Tree species were pruned when young to encourage development of an arborescent form and to keep them off the ground to facilitate weed control beneath the canopies.

A few general observations may be drawn from the information collected during this study. Some species did exceptionally well while others languished and eventually died. It appears that sandy soil may not be suitable for some species. It was not determined whether this was due to soil structure, soil pH, or to other factors. A few species performed poorly with little growth for several years and then began to grow and flower. Gophers accounted for significant mortality of young plants during the late 1990's and early 2000's. Larger established plants seem not to have been adversely affected by gophers in most cases, however, gophers may have caused or contributed

to the loss of a couple of larger trees. Other rodents and/or rabbits also caused some losses to small transplants. Damage by chewing or sucking insects caused little apparent damage. A severe freeze in January 2007 with a minimum low of -5 ° C (23° F) at the Yuma Mesa Agricultural Center caused significant damage to some plants. Sensitivity to freezing temperatures sometimes varies between plants from different accessions of the same species and even between individual plants within a single accession. This was apparent following the 2007 freeze. Most damaged plants had recovered within one or two growing seasons. A number of plants died for reasons that were not determined. Some newly planted plants simply disappeared without a trace. A few small plants were accidentally destroyed during weed removal. Others may have been killed by pathogens or herbivores. Had there been shorter intervals between field evaluations, it might have been possible to determine the cause of death of some of these plants.

Several species performed exceptionally well and had attractive features. These would make excellent landscape trees for hot, nearly frost-free desert regions such as western Arizona and southern California. They would also likely do well in other warm-winter climates including the Pacific slope of southern California, southern Texas and southern Florida. The most outstanding in terms of performance and appearance include *Albizia amara* subsp. *sericocephala*, *Ateleia gummifera*, *Bauhinia carronii*, *Bolusanthus speciosus*, *Colophospermum mopane*, *Haematoxylum brasiletto*, *Lysiloma candidum*, *Mariosousa willardiana*, *Philenoptera violacea*, and *Schotia brachypetala*. For larger spaces, large trees such as *Faidherbia albida*, *Vachellia sieberiana*, and *Vachellia xanthopholoea* are worthy of consideration.

DELEP is keenly aware of its responsibility to avoid introducing plants that could become ecosystem weeds. During the course of this study, 12 taxa of legumes were observed to reproduce from seeds in the Yuma field plots. It must be kept in mind that these fields are artificial environments that provide ideal conditions for germination and growth. The soil is regularly disturbed during weed control operations and ample moisture is present at intervals during the growing season. Arid environments present difficult challenges for the establishment of woody plants outside of riparian habitats as evidenced by the lack of infestations of exotic woody species in upland areas of the Sonoran Desert surrounding cities and towns with their abundance of non-native trees and shrubs.

Vigilance is essential, however, particularly with plants that are not native to southwestern North America. Of the 12 taxa of legumes observed to reproduce from seeds in the Yuma field site, 1 is native to the immediate vicinity and 6 others are native to the Sonoran Desert Region in Mexico. Only 4 taxa that reproduced in the Yuma field site are native to areas outside of North America. The species that was the most prone to reseed is *Leucaena leucocephala*, which is widely cultivated and naturalized in tropical and subtropical regions worldwide. This plant, thought to have originated in southern Mexico, is capable of rapid growth and produces a profusion of seeds. Thousands of seedlings were removed during the course of this study. It is cultivated in Yuma and other Arizona cites where it sometimes grows spontaneously. *Pithcellobium dulce* was also a problem with several hundred seedlings removed. Several individuals of a local native taxon, *Prosopis glandulosa* var. *torreyana*, volunteered in the field from seeds that were presumably introduced by wildlife.

Legume Taxa Observed to Reproduce from Seeds in DELEP Yuma Field Evaluation Site

Occurrence: F – Frequent, more than 20 plants
O – Occasional, 5-20 plants
R – Rare, less than 5 plants

Taxonomic name	Occurrence
Brongniartia alamosana	O
Coulteria platyloba	O
Haematoxylum brasiletto	O
Leucaena leucocephala	F
Lysiloma candidum	O
Mimosa palmeri	R
Philenoptera violacea	R
Pithecellobium dulce	F
Prosopis glandulosa var. torreyana	O
Senegalia modesta	O
Vachellia nilotica	R
Vachellia xanthopholoea	R

The field plantings were evaluated through 2009 with the final evaluation performed in 2013. Information recorded for plant specimens growing in the field plots includes survival, freeze damage and other problems, height or size, general health and appearance, and flowering/fruiting. Plants of most accessions were photographed one or more times during the course of the study. Herbarium voucher specimens of all accessions with surviving plants as of 2011 were deposited at the University of Arizona herbarium (ARIZ) with duplicates of many of these provided to the Arizona State University herbarium (ASU) and Desert Botanical Garden herbarium (DES).

Yuma field site evaluation dates

1991: evaluation completed in July 1991 for initial planting in spring 1991 and December 1991.
1992: evaluation completed in October 1992 for the remainder of 1991 and 1992 growing seasons.
1993: evaluation completed in January 1994 for the 1993 growing season.
1994: evaluation completed in January 1995 for the 1994 growing season.
1995: evaluation completed in December 1995 for the 1995 growing season.
1996: evaluation completed in February 1997 for the 1996 growing season.

1997: evaluation completed in March 1998 for the 1997 growing season.
1999: evaluation completed in November 1999 for the 1998 and 1999 growing seasons.
2000: evaluation completed in December 2000 for the 2000 growing season.
2001: evaluation completed in December 2001 for the 2001 growing season.
2002: evaluation completed in December 2002 for the 2002 growing season.
2004: evaluation completed in December 2004 for the 2003 and 2004 growing seasons.
2005: evaluation completed in December 2005 for the 2005 growing season.
2006: evaluation completed in December 2006 for the 2006 growing season.
2007: evaluation completed in December 2007 for the 2007 growing season.
2008: evaluation completed in December 2008 for the 2008 growing season.
2009: evaluation completed in December 2009 for the 2009 growing season.
2013: final evaluation completed in December 2013 for 2010 through 2013 growing seasons.

I extend my sincere appreciation to DELEP horticulturist Ken Coppola, all of the staff at Boyce Thompson Arboretum, and the many volunteers who have helped to propagate, plant, and care for the plant specimens in this field study. I am grateful also to the personnel of the University of Arizona Yuma Mesa Agricultural Center for preparing the fields, and for performing vital maintenance including irrigation, disking and mowing, removal of pruned material and gopher control.

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Figure 1. Block 24. View to southeast.

Plant Performance Summaries

Abrus precatorius Linnaeus – lucky bean, jequity bean, crab's eye

DELEP # 90-0491; planted March 1992 (6 plants)

Unarmed, woody semi-shrubs or vines with twining or trailing stems to 5 m long; odd once-pinnate leaves and racemes of small purplish flowers. The plants produce distinctive, small, red and black seeds that contain Abrin, an extremely potent toxin (Allen & Allen, 1981). The seeds have been used in jewelry and as weights (Allen & Allen, 1981), and other parts of the plant have been used medicinally (Lewis et al, 2005). This species is native to southern Asia, and is widely naturalized in tropical and subtropical regions around the world. Seeds for this accession originated from plants growing near the Munyati Power Station, Zimbabwe.

These plants flowered and fruited in containers prior to planting but do not appear to have done so following planting in the field. All of these plants died during the first two seasons. The cause was not determined.

1992 1 plant died during 1992; the cause was not determined. 5 plants with stems to 2' long; fair condition with some browsing damage.

1993 All 5 surviving plants died during 1993. The cause was not determined.

Abrus schimperi Hochstetter ex Baker subsp. ***africanus*** (Vatke) Verdcourt

DELEP # 95-0011; planted February 1996 (4 plants)

Unarmed, woody shrubs to 3.5 m tall with odd once-pinnate leaves and racemes of small, yellow or cream colored flowers. This variety is native to parts of eastern Africa. The seeds were collected from plants growing near the Munyati Power Station, Zimbabwe.

These plants died during their first season from undetermined causes.

1997 All 4 plants died during 1996. The cause was not determined.

Adenanthera pavonina Linnaeus – red sandalwood

DELEP # 91-0233; planted March 1993 (2 plants)

Unarmed trees to 14 m tall with fern-like, even twice-pinnate leaves and white flowers in cylindrical racemes. The wood of *A. pavonina* is valued for timber and fuel, plants are grown as ornamentals and for the decorative red seeds, and the species is used in folk medicine and as a source of dyes and oil (Allen & Allen, 1981; Lewis et al, 2005). The seeds are toxic when raw but may be eaten following cooking (Lewis et al, 2005). This species is native to a wide area extending from southern Asia to northern Australia and has been extensively introduced into tropical regions beyond its natural range. Seeds of this accession originated from cultivated plants in Hawaii.

Both plants died during their first year. The reason was not determined but soil factors could have contributed to their demise.

1993 Both plants died during 1993 from undetermined causes.

Albizia amara (Roxburgh) Boivin subsp. ***sericocephala*** (Bentham) Brenan – bitter albizia

DELEP # 90-0428; planted March 1993 (1 plant) and January 1994 (1 plant)

Unarmed trees to 12 m tall with soft, feathery, even twice-pinnate leaves and white flowers in dome-shaped heads. This species is used in folk medicine and the roots contain saponins that have been used as a substitute for soap (Palgrave, 1983). *Albizia amara* is found in eastern Africa and India. Subspecies *sericocephala* is widely distributed in eastern and southern Africa. Seeds for this accession originated between Harare and Bulawayo, Zimbabwe.

Though slow growing, these plants developed into beautiful trees with feathery leaves.

1993 Plant is 6" tall; poor condition due to browsing.

1994 Plants are both 3' tall; healthy with moderate growth.

1995 Plants are 4'/4.5' tall; healthy with slow growth.

1996 Plants are 4'/5.5' tall; healthy with slow growth.

1997 Plants are 6'/6.5' tall; healthy with slow growth.

1999 Plants are 6.5'/8' tall; healthy with slow growth.

2000 Plants are 6.5'/8' tall; healthy with little change in size.

2001 Plants are 10'/11' tall; healthy with moderate growth. No evidence of flowering.

2002 Plants are 10'/11' tall; healthy with little change in size.

2004 Plants are 12'/13' tall; healthy with slow growth. No flowering has been observed on these trees.

2005 Plants are 14'/17' tall; healthy with increased growth in the past year.

2006 Plants are 11'/14' tall; healthy with little apparent growth.

2007 Plants are 11'/13' tall; some stems froze back to 3' from the tips, healthy with slow regrowth.

2008 Plants are 15'/18' tall; healthy with rapid growth. These plants are completely recovered from the freeze which may have stimulated growth.

2009 Plants are 18'/22' tall; healthy with moderate growth. No evidence of flowering.

2013 Plants are 25'/27' tall; healthy with slow growth. These plants flowered and fruited in 2012 and 2013.

Albizia anthelmintica (A. Richard) Brongniart – worm-cure albizia

DELEP # 91-0130; planted March 1992 (4 plants)

Unarmed, spreading, thicket-like shrubs or trees to 10 m tall with small, even twice-pinnate leaves with rounded leaflets, and white flowers in dome-shaped heads. As the common name suggests, this species is used to treat parasitic worms (Palgrave, 1983). It is widely distributed in eastern and southern Africa. Seeds of this accession were collected along the road to Gaborone, Botswana.

This species had variable performance with 2 trees initially doing well and then dying more than a decade after planting. The 2 remaining trees continued to do well with no problems. While numerous flowers were produced, these yielded only a few viable seeds. These plants had a distinctly spreading growth habit and were broader than tall.

1992 Plants are 1'-2' tall; healthy with slow growth. The plants have had minor to moderate browsing.

1993 Plants are 1'-2.5' tall; fair to good condition with slow growth.
1994 Plants are 2'-5' tall; healthy with slow to moderate growth. These are doing much better.
1995 Plants are 2.5'-7' tall; healthy with slow growth.
1996 Plants are 3'-10' tall; healthy with slow to moderate growth. These plants are low-branched and spread horizontally.
1997 Plants are 4'-11' tall; healthy with slow growth.
1999 Plants are 8'-14' tall; healthy with slow to moderate growth. 1 plant flowered in 1999.
2000 Plants are 9'-14' tall; healthy with slow, mostly spreading growth. No evidence of flowering.
2001 Plants are 11'-14' tall; 1 is in poor condition and 3 are healthy with slow growth.
2002 1 plant is 9' tall; fair condition and recovering from major die-back. The other 3 plants are 10'-14' tall; fair to good condition with slow growth.
2004 1 plant died in 2003 – the cause was undetermined. The 3 surviving plants are 10'-17' tall; healthy with slow growth. There has been no evidence of flowering since 1 plant flowered in 1999.
2005 Plants are 14'/20'/22' tall; healthy with faster growth over the past year.
2006 Plants are 13'/18'/20' tall; healthy with little change in size. 2 plants produced flowers and fruit in 2006.
2007 1 plant died in 2007 – the cause was not determined but does not appear to be related to freezing as it was alive in March 2007. 1 surviving plant is 16' tall; stems froze back to 6' from the tips to stems 2" thick. The other surviving plant is 20' tall; it froze back to 2' from the tips of the stems. Both have healthy regrowth.
2008 Plants are 14'/22' tall; healthy and recovered from the 2007 freeze. 1 plant flowered and fruited.
2009 Plants are 12'/25' tall; healthy with slow to moderate growth. 1 plant flowered and fruited.
2013 Plants are 12'/23' tall; healthy with little growth. 1 plant flowered in 2013.

Albizia brevifolia Schinz – mountain albizia
DELEP # 91-0046; planted March 1993 (6 plants)

Unarmed shrubs or trees to 10 m tall with an open canopy, feathery, even twice-pinnate leaves, and white flowers in dome-shaped heads. *Albizia brevifolia* is native to parts of Botswana, Mozambique, Namibia, South Africa, Zambia and Zimbabwe. These plants were grown from seeds that originated in Hwange, Zimbabwe.

This species performed well with no significant problems except for damage from the 2007 freeze. Seed production was slow to develop with only two plants fruiting by the time that the study ended.

1993 Plants are 3'-6' tall; healthy with moderate growth. Minor browsing on 1 plant only.
1994 Plants are 3.5'-8' tall; healthy with slow to moderate growth.
1995 Plants are 4.5'-10' tall; healthy with slow growth.
1996 Plants are 5.5'-13' tall; healthy with slow to moderate growth. These have a generally upright growth habit.
1997 Plants are 6.5'-13' tall; healthy with slow growth.
1999 Plants are 7.5'-16' tall; healthy with slow to moderate growth.
2000 Plants are 7.5'-20' tall; healthy with slow to moderate growth. No evidence of flowering.
2001 Plants are 8'-20' tall; healthy with slow growth.
2002 Plants are 8'-20' tall; healthy with little change in size.
2004 Plants are 9'-26' tall; healthy with slow to moderate growth. No evidence of flowering has been observed.
2005 Plants are 10'-25' tall; healthy with little change in size.
2006 Plants are 10'/10'/14'/20'/20'/25' tall; healthy with littler apparent growth. 1 plant is flowering and fruiting.
2007 Plants exhibited highly variable responses to the 2007 freeze. 1 plant is 10' tall with stems frozen back to 8' from the tips, with stems to 1" thick killed. 1 plant is 10' tall with stems frozen back to 3' from the tips, with stems to 1" thick killed. 1 plant is 12' tall with stems frozen back to near the base of the plant, with stems to 4" thick killed. 1 plant is 15' tall with stems frozen back to 12' from the tips, with stems to 3" thick killed. 1 plant is 25' tall with no apparent freeze damage. 1 plant is 27' tall with stems frozen back to 3' from the tips. All plants survived and those that sustained freeze damage are exhibiting vigorous regrowth. No evidence of flowering in 2007.
2008 Plants are 10'/12'/16'/22'/24'/28' tall; heathy with variable growth. All have recovered from the 2007 freeze. The 2 largest trees are flowering and fruiting.
2009 Plants are 13'/16'/17'/24'/26'/27' tall; healthy with little change in size. No evidence of flowering in 2009.
2013 Plants are 14'/16'/22'/30'/36'/37' tall; healthy with slow to moderate growth. 2 plants are flowering and fruiting.

Albizia forbesii Bentham – broad-pod albizia
DELEP # 90-0464; planted March 1993 (2 plants)

Unarmed trees potentially growing to 20 m tall with even twice-pinnate leaves and white flowers in dome-shaped heads. This species is native to parts of Mozambique, Tanzania, South Africa, and Zimbabwe. Seeds for this accession were collected in Natal, South Africa.

These plants performed poorly and eventually died. The most likely cause is that they were root-bound when planted, based on an examination of the roots after the plants had died.

1993 Both plants are 5' tall; healthy with moderate growth
1994 Plants are 4'/5' tall; healthy but with no apparent growth.
1995 Plants are 4.5'/6' tall; fair condition with slow growth and low vigor.
1996 Plants are 4.5'/5' tall poor to fair condition with no growth.
1997 1 plant is 4.5' tall; fair condition with no growth. 1 plant is 5' tall; poor condition with no growth.
1999 Both plants are 4.5' tall; poor to fair condition with little or no growth.
2000 1 plant is 2.5' tall; poor condition with die-back. 1 plant is 4.5' tall; fair condition with no growth.
2001 Plants are 2.5'/4' tall; poor condition with no growth and continuing problems with die-back.
2002 1 plant died in 2002 – cause undetermined but the root problems may have been a factor. 1 plant is 5' tall; much improved in appearance but no growth.
2004 The surviving plant is 6.5' tall; healthy with slow growth. These plants may have been root-bound when planted.
2005 Plant is 6.5' tall; apparently healthy but no growth.
2006 Plant is 6.5' tall; apparently healthy but no growth.
2007 The plant appears to have been killed by the freeze, but had not grown for years, likely due to root problems.

Albizia harveyi E. Fournier – sickle-leaved albizia
DELEP # 90-0492; planted March 1992 (4 plants)

Unarmed, upright trees to 10 m tall with even twice-pinnate leaves and white flowers in relatively large, dome-shaped heads.

Albizia harveyi is rather widespread across southern and eastern Africa. These plants were grown from seeds that originated near Kwekwe, Zimbabwe.

This species proved durable after the plants became established. One plant died four years after planting, apparently from repeated browsing. One surviving plant suffered some stem damage from freezing in 2007, but the others lost only their foliage. No evidence of flowering was observed.

1992 1 plant is 4" tall; poor condition due to severe browsing. 3 plants are 1.5' tall; healthy with slow growth and minor browsing.
1993 1 plant is 2" tall; poor condition due to severe browsing. 3 plants are 2.5'-6' tall; healthy with slow to rapid growth.
1994 1 plant is 9" tall; healthy with slow growth, recovering from browsing. 3 plants are 3'-7' tall; healthy with slow growth.
1995 1 plant is 8" tall; healthy but with no growth. 3 plants are 7'-8' tall; healthy with slow to moderate growth.
1996 1 plant declined and died in 1996 – the cause was not determined but could be related to repeated browsing. 3 plants are 7'-10' tall; healthy with slow growth.
1997 The 3 surviving plants are 8'-11' tall; healthy with slow growth. These have an upright growth habit.
1999 Plants are 10'-14' tall; healthy with slow growth.
2000 Plants are 12'-15' tall; healthy with slow growth. No evidence of flowering has been observed.
2001 Plants are 14'-15' tall; healthy with slow growth.
2002 Plants are 14'-18' tall; healthy with slow to moderate growth.
2004 Plants are 20'-22' tall; healthy with moderate growth. No flowering has been observed on these plants.
2005 Plants are 22'/23'/25' tall; healthy with moderate growth.
2006 Plants are 17'/18'/20' tall; healthy but little apparent growth.
2007 1 plant is 17' tall with stems frozen back to 3' from the tips. 2 plants are 18'/20' tall no stem damage and only the foliage frozen. All 3 plants are healthy.
2008 Plants are 23'/25'/25' tall; healthy with rapid growth in the past year. No flowering observed.
2009 Plants are 23'/25'/25' tall; healthy but with little change in size. No evidence of flowering.
2013 Plants are all ca. 30' tall; healthy with slow growth. No evidence of flowering has been observed on these plants.

Albizia lebbeck (Linnaeus) Bentham – sersis tree
DELEP # 92-0140; planted March 1994 (2 plants)

Unarmed trees potentially reaching 30 m tall, upright or with a spreading canopy, large, even twice-pinnate leaves, and white flowers in dome-shaped heads. This species is grown for shade, as a cover crop and for wood for carpentry and fuelwood (NAS, 1979). *Albizia lebbeck* is distributed from southern Asia to northern Australia and has been widely planted and naturalized in tropical regions around the world. Seeds of this accession originated at Chottabelum, Burdwan, West Bengal, India.

These plants performed exceptionally well and exhibited no problems.

1994 Plants are 5'/6.5' tall; healthy with moderate growth.
1995 Plants are 7'/10' tall; healthy with slow to moderate growth.
1996 Plants are 9'/12' tall; healthy with slow growth. These have robust trunks and high canopies.
1997 Both plants are 15' tall; healthy with moderate to fast growth.
1999 Plants are 13'/16' tall; healthy with little increase in size.
2000 Plants are 14'/16' tall; healthy with little change in size. No evidence of flowering.
2001 Plants are14'/16' tall; healthy with little change in size.
2002 Plants are 16'/18' tall; healthy with slow growth.
2004 Plants are 18'/20' tall; healthy with slow growth. No evidence of flowering.
2005 Plants are 18'/20' tall; healthy with little growth during the past year. Both are flowering and fruiting in 2005.
2006 Plants are 18'/20' tall; healthy with little apparent growth. Both ae flowering and fruiting.
2007 Plants are 18'/20' tall; no apparent freeze damage; healthy with no change in size. Both are flowering and fruiting.
2008 Plants are 22'/25' tall; healthy with substantial growth in the past year. Both are flowering and fruiting.
2009 Plants are 28'/35' tall; healthy with continued rapid growth during the past year. Both are flowering and fruiting.
2013 Plants are 25'/34' tall; healthy with little increase in size. Both are flowering and fruiting.

Albizia sinaloënsis Britton & Rose – palo joso
DELEP # 90-0015; planted March 1992 (4 plants)

Unarmed trees to 20 m tall with a high, spreading crown, smooth, yellowish white bark, even twice-pinnate leaves, and white flowers in globose heads. The bark has been used in tanning (Felger et al, 2001). This species is native to parts of Sonora and Sinaloa, Mexico. These plants were propagated from seeds that originated at Alamos, Sonora, Mexico.

Initial growth of these trees was rapid and the plants seemed to thrive. By 1999 they began to decline for undetermined reasons. All four trees continued to decline until most of the aerial portions were dead, but continued to put out new growth and occasional flowers and fruit up to the time that this project ended.

1992 1 plant is 6" tall; alive but severely browsed. 3 plants are 2.5'-4.5' tall; healthy with moderate growth.
1993 Plants are 7'-9' tall; all are healthy with rapid growth during the past year.
1994 Plants are 12'-13' tall; healthy with continued rapid growth.
1995 Plants are 12'-15' tall; healthy but with slow growth over the past year.
1996 Plants are 13'-18' tall; healthy with slow to moderate growth.
1997 Plants are 15'-19' tall; healthy with slow growth and a lush appearance.
1999 Plants are 12'-18' tall. 2 plants are in poor condition and declining with some die-back – the cause was not determined. 2 plants appear healthy but with little or no growth.
2000 Plants are 12'-16' tall. All are in poor to fair condition with substantial branch death and areas of dead bark on the trunks. The cause for this has not been determined.
2001 Plants are 14'-18' tall; all are in poor condition with continued branch die-back but some live stems remain.
2002 Plants are 10'-15' tall; all are in poor condition with considerable dead wood.
2004 Plants are 10'-15' tall; all are in poor condition, mostly dead but with some live stems.
2005 Plants are 10'/12'/14'/15' tall; 3 are in fair condition with some recovery. 1 is in poor condition but still alive.
2006 Plants are 14'/16'/16'/16' tall; all are in poor condition but with some live stems.

2007 1 plant is 18' tall, poor condition, mostly dead. 1 plant is 18' tall; no apparent freeze damage, fair condition. 1 plant is 16' tall; stems froze back to 1' from tips, fair condition. 1 plant is 18' tall; no freeze damage, apparently healthy.
2008 Plants are 13'/16'/18'/18' tall; all are in fair condition with healthy new growth but continue to suffer die-back.
2009 Plants are 18'/18'/19'/20' tall; fair condition, all are growing but not really regaining vigor.
2013 Plants are 20'/25'/25'25' tall; all are in fair condition with some new growth but have never recovered from their decline. 3 plants are flowering and fruiting sparingly in 2013.

Albizia versicolor Welwitsch ex Oliver – poison-pod albizia, large-leaved false-thorn

DELEP # 95-0017; planted February 2001 (2 plants)

Unarmed trees to 18 m tall with a rounded canopy, even twice-pinnate leaves with large, oval leaflets, and white flowers in dome-shaped heads. The common name *poison-pod albizia* stems from the seeds and fruits, which can cause livestock poisoning (Palgrave, 1983). Palgrave (1983) indicates that the roots and bark have been used as a substitute for soap, and the wood is used to make furniture and other items. *Albizia versicolor* is widely distributed across southern and eastern Africa. These plants were grown from seeds that were collected near Bindura, Zimbabwe.

Though slow growing, this species appeared to do well at this site. It recovered from severe damage following the 2007 freeze, but had not reached flowering size by the time that this study ended.

2001 Plants are 4'/4.5' tall; healthy with slow growth.
2002 Plants are 4.5'/5.5' tall; healthy with slow growth.
2004 Plants are 6'/7' tall; healthy with slow growth.
2005 Plants are 6.5'/7.5' tall; healthy with slow growth.
2006 Plants are 6.5'/8' tall; healthy with little growth during the past year.
2007 Plants are both 4.5' tall; these froze to the base to stems 2" thick; healthy with rapid regrowth.
2008 Plants are 6'/6.5' tall; healthy with slow growth. Both have recovered from the 2007 freeze.
2009 Plants are 6'/7.5' tall; healthy with slow growth.
2013 1 plant is 3.5' tall; the main stem died but a healthy stem emerged from the base. 1 plant is 6.5' tall; healthy but with little apparent growth.

Amblygonocarpus andongensis (Welwitsch ex Oliver) Exell & Torre – Scotsman's rattle

DELEP # 91-0060; planted March 1993 (2 plants)

Unarmed trees to 20 m with even twice pinnate leaves with large oblong or ovate leaflets, and cream colored flowers in spikes that resemble those of some acacias. The wood is used for lumber and the fruits are used in folk medicine for treating ulcers (Allen & Allen, 1981). This species is widely distributed in sub-Saharan Africa. This accession originated from trees growing at the Victoria Falls Railway Station, Zimbabwe.

This species performed poorly and both plants were dead by the end of 1996. The cause for the plants' demise was not determined. It is known to occur in sandy soils but pH may have been a factor.

1993 Plants are 6"/8" tall; fair condition with no apparent growth.
1994 Plans are both 6" tall; poor condition with no growth.
1995 1 plant died in 1995 – the cause was not determined. 1 plant is 5" tall; poor condition with no growth.
1996 The remaining plant died in 1996 – the cause was not determined. These do not appear to be adapted to this site.

Anadenanthera colubrina (Vellozo) Brenan – cebil moro

DELEP # 91-0478; planted March 1994 (2 plants)

Unarmed trees to 20 m tall with an upright growth habit, ferny, even twice-pinnate leaves, and white flowers in spherical heads. *Anadenanthera colubrina* is a source of tannins and produces a gum that can be used in foods (Allen & Allen, 1981). The seeds are used as a hallucinogen in ceremonial rites (Allen & Allen, 1981). The trees are exploited commercially for timber and fuelwood (Allen & Allen, 1981; Lewis et al, 2005). This species is widespread in tropical and subtropical regions of South America. Seeds for this accession originated from a cultivated tree in the city of Catamarca, Argentina.

This species performed well. Though slow growing and somewhat crowded by a large, adjacent tree, the plants had no problems. It would make an attractive landscape tree for large spaces.

1994 Plants are 1'/4' tall; healthy with slow to moderate growth.
1995 Plants are 2'/3.5' tall; healthy with slow growth.
1996 Plants are 2.5'/5' tall; fair to good condition with slow growth.
1997 Plants are 5'/6' tall; healthy with slow to moderate growth.
1999 Plants are 5'/8' tall; healthy with slow growth. 1 plant flowered and fruited in 1999.
2000 Plants are 5'/9' tall; healthy with slow growth. 1 plant flowered and fruited.
2001 Plants are 8'/12' tall; healthy with moderate growth. 1 plant flowered and fruited.
2002 Plants are 8'/12' tall; healthy but little change in size. Both plants are flowering and fruiting.
2004 Plants are 12'/14' tall; healthy with slow growth. Both plants are flowering and fruiting.
2005 Plants are 15'/18' tall; healthy with moderate growth. Both plants are flowering and fruiting.
2006 Plants are 13'/14' tall; healthy with little growth. Both plants are flowering and fruiting.
2007 Plants are 12'/15' tall; no freeze damage, healthy with little change in size. Both plants are flowering and fruiting.
2008 Plants are 15'/16' tall; healthy with slow growth. Both plants are flowering and fruiting.
2009 Plants are 16'/20' tall; healthy with slow to moderate growth. Both plants are flowering and fruiting.
2013 Plants are 20'/25' tall; healthy with slow growth. Both plants are flowering and fruiting.

Ateleia gummifera (Bertero ex de Candolle) D. Dietrich – stinking-pea root

DELEP # 93-0033; planted February 1995 (6 plants)

Unarmed trees to 8 m tall with odd once-pinnate leaves and small white flowers in racemes. This species is found from the Bahamas and Cuba to southern Mexico and Central America. These plants were grown from seeds provided by the Jardín

Botánico Nacional, Havana, Cuba.

After the initial establishment period, this species performed well and developed into attractive trees with excellent landscape potential for mild-winter areas. The plants suffered significant stem damage from the 2007 freeze, but recovered rapidly. The roots were not examined for the aromatic properties suggested by the common name.

1995 2 plants died in 1995 from an undetermined cause. The 4 surviving plants are 2.5-4' tall; healthy with slow growth.
1996 Plants are 3'-4.5' tall; healthy with slow growth.
1997 Plants are 3'-6.5' tall; healthy with slow growth. These plants have attractive foliage.
1999 Plants are 3.5'-8' tall; healthy with slow growth. 3 plants flowered in 1999.
2000 Plants are 3.5'-10' tall; healthy with slow growth. 3 plants are flowering.
2001 Plants are 4'-15' tall; healthy with slow to rapid growth. 3 plants flowered and fruited 1n 2001.
2002 Plants are 5'-15' tall; healthy with slow growth. 3 plants are flowering and fruiting.
2004 Plants are 7.5'-20' tall; heathy with slow to moderate growth. All are flowering and 3 are producing fruits.
2005 Plants are 9'/15'/20'/20' tall; healthy with slow growth. All are flowering and fruiting.
2006 Plants are 10'/15'/18'/19' tall; healthy with slow growth. All are flowering and fruiting.
2007 Plants are 7'/10'/18'/18' tall; most stems froze back 1-'5' from the tips to stems 1" thick, healthy with vigorous regrowth. No flowering.
2008 Plants are 10'/13'/20'/22' tall; healthy with moderate growth, all have recovered from the 2007 freeze. 2 plants are flowering and fruiting.
2009 Plants are 9'/15'/20'/22' tall; healthy but little change in size. No flowering observed in 2009.
2013 Plants are 10'/12'/20'/23' tall; healthy but little growth over the past 5 years. Only 1 plant is flowering and fruiting this year, perhaps due to shading from adjacent trees.

Baphia massaiensis Taubert subsp. ***obovata*** (Schinz) Brummitt – jasmine pea, sand camwood

DELEP # 91-0059; planted March 1994 (6 plants)

Unarmed shrubs or rarely trees to 6 m tall with simple, obovate leaves and showy, fragrant, white, pea-like flowers. The species is rather widespread in southern Africa. Subspecies *obovata* is found in parts of Angola, Botswana, Namibia, South Africa, Zambia, and Zimbabwe. Seeds for this accession were collected between Bulawayo and Victoria Falls, Zimbabwe.

This taxon performed poorly and does not appear to be adapted to this site, though it occurs in sand in its native habitat.

1994 Plants are 1'-1.5' tall; fair condition with slow growth.
1995 Plants are 2"-6" tall; poor condition and declining, with no growth.
1996 All 6 plants died in 1996 – the cause was not determined but these plants steadily declined following planting.

Bauhinia carronii F. Mueller – Queensland ebony

DELEP # 94-0032; planted December 1995 (2 plants)

Unarmed trees to 10 m tall with simple, 2-lobed leaves and small red flowers. Native to northeastern Australia. Seeds for this accession originated northeast of Emerald, Queensland, Australia.

In spite of the loss of one of the plants, this species performed exceptionally well after establishment. Though slow growing, it eventually developed into an attractive plant and would make an excellent shade tree. The species tolerates temperatures to at least -7° C (19° F), based on observations of cultivated plants in Tucson. When young, the plants have small leaves. As the plant reaches reproductive age, these are replaced with substantially larger leaves.

1996 1 plant is 2" tall; poor condition with considerable die-back. 1 plant is 1.5' tall, healthy with slow growth.
1997 1 plant is 6" tall; fair condition with some growth. 1 plant is 2.5" tall; healthy with slow growth.
1999 1 plant died in 1998 – the cause was not determined. The surviving plant is 4' tall; healthy with slow growth.
2000 The plant is 4' tall; healthy but with little change in size.
2001 Plant is 6' tall; healthy with slow growth.
2002 Plant is 7' tall; healthy with slow growth
2004 Plant is 8' tall; healthy with slow growth.
2005 Plant is 12' tall; healthy with moderate growth over the past year.
2006 Plant is 12' tall; healthy with little apparent growth.
2007 Plant is 16' tall; no freeze damage, healthy with moderate growth. The plant flowered and fruited in 2007.
2008 Plant is 18' tall; healthy with slow growth. The plant flowered and fruited.
2009 Plant is 20' tall; healthy with slow growth. The plant flowered and fruited.
2013 Plant is 30' tall; healthy with moderate growth. Flowering and fruiting has continued each year.

Bauhinia carronii F. Mueller – Queensland ebony

DELEP #94-0033; planted December 1995 (3 plants)

Unarmed trees to 10 m tall with simple, 2-lobed leaves and small red flowers. Native to northeastern Australia. Seeds for this accession originated northeast of Emerald, Queensland, Australia.

All three of these plants died from undetermined causes. They were quite small when planted, and this likely contributed to their failure to establish. In spite of this, the surviving tree of this species from 94-0032 performed exceptionally well following establishment.

1996 Plants are 8"-10" tall; fair to good condition but with little growth.
1997 2 plants died in1997 - the cause was not determined. The surviving plant is 1' tall; healthy with slow growth.
1999 The last plant died in 1999 for undetermined reasons.

Bauhinia fassoglensis Kotschy ex Schweinfurth – creeping bauhinia

[*Tylosema fassoglense* (Kotschy ex Schweinfurth) Torre & Hillcoat

DELEP # 90-0472; planted March 1992 (2 plants)

Unarmed, trailing or climbing lianas to 6 m growing from a woody caudex, with large, 2-lobed leaves and racemes of pale yellow or pink flowers. The plants produce edible seeds and the

tuber-like caudex is also eaten (Allen and Allen, 1981; Brink, 2006). Additional uses are in traditional medicine, as a source of fiber, dye, a source of insecticide and fish poison, and the plants are occasionally grown as ornamentals (Brink, 2006). This species is native to a wide area of southern and eastern Africa. Seeds for this accession were collected along the Munyati River, Zimbabwe.

Information on the performance of these plants is missing. They survived into their third season, but then died. They may have been killed by gophers.

1992 Information missing.
1993 Information missing.
1994 Both plants died in 1994. These may have been killed by gophers.

Bauhinia petersiana Bolle subsp. ***macrantha*** (Oliver) Brummitt & J.H. Ross – white bauhinia

[*Bauhinia petersiana* Bolle subsp. *serpae* (Ficalho & Hiern) Brummitt & J.H. Ross]

DELEP # 91-0068; planted March 1992 (5 plants), February 1995 (2 plants)

Unarmed, often sprawling shrubs, or trees to 7 m tall, or sometimes climbing upon other trees, with simple, 2-lobed leaves and showy flowers with long, crinkled, white petals. The leaves of this species are used for treating colds and the seeds have been used as a substitute for coffee (Palgrave, 1983). The species is rather widely distributed in southern and eastern Africa. Subspecies *macrantha* is confined to southern Africa. Seeds for this accession originated between Dete and Bulawayo, Zimbabwe.

These plants performed poorly and none survived more than three years. The cause for their demise was not determined. They occur in sandy soil in habitat so soil is unlikely to be a factor unless soil pH is an issue.

1992 2 plants died in 1992 – the cause was not determined. The 3 surviving plants are 6"-1' tall; poor condition with little growth.
1993 2 plants died in 1993 from undetermined causes. The 1 surviving plant is 1' tall; poor condition with no growth.
1994 The last plant died in 1994 from undetermined causes. These plants do not appear to be adapted to this site.
1995 The 2 new plants are both 1' tall; healthy with slow growth.
1996 The 2 plants are 6"/9" tall; fair condition but declining with no growth and low vigor.
1997 Both plants died in 1997 from undetermined causes.

Bauhinia reticulata de Candolle

[*Piliostigma reticulatum* (de Candolle) Hochstetter]

DELEP # 91-0459, planted March 1994 (3 plants)

Unarmed shrubs or trees with dense, spreading canopies, large, simple, 2-lobed leaves and white flowers with pink stripes. The species is used in folk medicine, the leaves are used to flavor beverages, and rope is made from the bark (Baumer, 1983). *Bauhinia reticulata* is widely distributed across the Sahel region of Africa. Seeds for this accession originated from a cultivated tree in Wack N'Gouna, Department of Nioro du Rip, Senegal.

This species performed well and had no problems except for extensive damage from the 2007 freeze. Flowering was first observed in the spring of 2014. These plants closely resemble *Bauhinia thonningii*.

1994 Plants are 1'-3' tall; healthy with slow growth.
1995 Plants are 2.5'-3.5' tall; healthy with slow growth.
1996 Plants are 3'-6' tall; healthy with slow to moderate growth.
1997 Plants are 6'-7' tall; healthy with slow to moderate growth and a spreading habit.
1999 Plants are 7'-8.5' tall; healthy with slow growth.
2000 Plants are 7'-12' tall; healthy with slow growth. No evidence of flowering.
2001 Plants are 8'-12' tall; healthy with slow growth.
2002 Plants are 8'-14' tall; healthy with slow growth.
2004 Plants are 11'-14' tall; healthy with slow growth. No evidence of flowering.
2005 Plants are 11'/12'/15' tall; healthy but with little change in size.
2006 Plants are 9'/10'/16' tall; healthy with little change in size.
2007 Plants are 8'/10'/10' tall; extensive freeze damage with stems to 4" thick killed, healthy, vigorous regrowth.
2008 Plants are 12'14'/15' tall; healthy moderate to rapid growth. Fully recovered from the 2007 freeze.
2009 Plants are 12'/14'/14' tall; healthy with little change in size. No flowering evident.
2013 Plants are 14'/14'/17' tall; healthy with slow growth. 2 plants flowered in 2013 but did not produce fruits.

Bauhinia thonningii Schumacher – monkeybread

[*Piliostigma thonningii* (Schumacher) Milne-Redhead]

DELEP # 91-0071; planted March 1993 (4 plants) and January 1994 (2 plants)

Unarmed shrubs or trees to 5 m or sometimes 10 m tall with simple, 2-lobed leaves and small white flowers. The bark has been used for fiber to make rope and as a source of tannins for tanning leather (Orwa et al, 2009). The plant is also a source of dyes and a gum that has been used for caulking (Orwa et al, 2009). The plants are used in folk medicine to treat a wide variety of ailments (Palgrave, 1983). This species is extensively distributed in Africa south of the Sahara Desert. Seeds of this accession originated between Masvingo and Beitbridge, Zimbabwe.

Overall, this species performed well. Two plants were lost, apparently to root damage from gophers. The surviving plants suffered extensive freeze damage in 2007 but made a rapid recovery. Flowering was observed in only two years and no fruits were produced.

1993 Plants are 1.5'-5' tall; healthy with slow to moderate growth.
1994 Plants are 2'-6' tall; healthy with slow growth.
1995 Plants are 2.5'-6' tall; healthy with slow growth.
1996 Plants are 4'-7' tall; healthy with slow growth.
1997 Plants are 4.5'-8.5' tall; healthy with slow growth.
1999 1 plant died during the summer of 1999 – the cause was not determined but gophers could have caused this. The 5 surviving plants are 6'-9' tall; healthy with slow growth.
2000 Plants are 6.5'-9' tall; healthy with slow growth. Some lower limbs have died. No evidence of flowering on any of these plants.
2001 Plants are 7.5'-12' tall; healthy with slow to moderate growth.
2002 Plants are 5.5-12' tall; healthy with slow growth. There is

considerable gopher activity around these plants.
2004 1 plant died in 2003 due to gophers. The 4 surviving plants are 9'-15' tall; healthy with slow growth. The inner limbs die over time. No evidence of flowering.
2005 Plants are 7.5'/12'/13'/16' tall; healthy with slow growth. All plants flowered for the first time but no fruits were set.
2006 Plants are 8'/10'/13'/16' tall; healthy but with little growth. No flowering was observed this year.
2007 1 plant is 7' tall; froze to main trunk with stems to 6" thick killed. 3 plants are 7.5'/10'/14' tall with stems to 3" thick killed by the January freeze. All are healthy and exhibiting vigorous regrowth.
2008 Plants are 7.5'/8'/12'/20' tall; healthy and all have recovered from the freeze.
2009 Plants are 8'/8'/9'/17' tall; healthy with little or no growth. No flowering.
2013 Plants are 9'/10'/11'/18' tall; healthy with slow growth. These plants have not shown further evidence of flowering except during 2012. No fruits were observed to form.

Bauhinia tomentosa Linnaeus – yellow tree bauhinia
DELEP # 91-0061; planted March 1992 (4 plants)

Unarmed shrubs or trees to 4 m tall, small, simple, 2-lobed leaves, and large, showy yellow flowers with a dark maroon center. The species is reported to be used in folk medicine, for fiber, dyeing, light construction and is cultivated for its beautiful flowers (Orwa et al, 2009). Native to a rather wide area in eastern Africa as well as parts of India and Sri Lanka. Seeds for this accession were collected between Bulawayo and Victoria Falls, Zimbabwe.

These plants fared poorly and gradually died out. The cause was not determined but they do not appear to be adapted to this site.

1992 1 plant died in 1992 – the cause was not determined. The 3 surviving plants are 6"-1.5' tall; poor condition due to severe browsing.
1993 1 plant died in 1993 – the cause was not determined but severe browsing could have been a contributing factor. The 2 surviving plants are both 1' tall; fair to poor condition with little growth.
1994 1 plant died in 1994 – the cause was not determined. The 1 surviving plant is 1'tall; poor condition with no growth.
1995 The last plant died in 1995. These had done poorly and do not appear to be adapted to this site.

Bolusanthus speciosus (Bolus) Harms – tree wisteria
DELEP # 90-0496; planted March 1992 (6 plants)

Unarmed, usually multiple-trunked trees to at least 8 m tall with an upright growth habit, once-pinnate leaves with glossy, lance-shaped leaflets, and showy, pendulous racemes of lavender, pea-like flowers. The wood of *B. speciosus* is valued for woodworking and for durable fence posts, and the plant is utilized in folk medicine and as a flowering landscape tree (Lewis et al, 2005). This species is found in parts of southern and eastern Africa. Seeds for this accession were collected between Harare and Gweru, Zimbabwe.

This species performed exceptionally well and were perhaps the most beautiful trees that were grown at the Yuma field site. The growth form, bark, foliage, and flowers all lend to their attractive appearance and the plants exhibited no problems or undesirable tendencies. This species is sufficiently hardy to grow in warm or protected locations in Phoenix and Tucson. Plants growing at DELEP's Tucson fields have survived for many years, though the stems freeze back to ground level in most winters. A dry winter dormancy period appears to promote flowering.

1992 Plants are 1.5'-3' tall; healthy with slow growth.
1993 Plants are 3'-7.5' tall; healthy with slow to moderate growth.
1994 Plants are 5'-12' tall; healthy with slow to rapid growth.
1995 Plants are 7'-14' tall; healthy with slow growth.
1996 Plants are 8'-16' tall; healthy with slow growth.
1997 Plants are 10'-18' tall; healthy with slow growth. These trees have an upright form and beautiful, weeping, glossy foliage, and deeply furrowed, cinnamon colored bark.
1999 Plants are 11'-17' tall; healthy with slow growth. No evidence of flowering though these plants should be large enough.
2000 Plants are 12'-18' tall; healthy with slow growth.
2001 Plants are 12'-19' tall; healthy with slow growth. No evidence of flowering.
2002 Plants are 12'-19' tall; healthy with little change in size.
2004 Plants are 13'-22' tall; healthy with slow growth. No evidence of flowering.
2005 Plants are 12'-22' tall; healthy but with little change in size. 1 plant flowered and fruited on a single limb on the southeast side.
2006 Plants are 13'/14'/16'/19'/20'/20' tall; healthy but with little growth. 2 plants flowered and produced some fruits.
2007 Plants are 15'/16'/21'/23'/23'/24' tall; the foliage froze but no stem damage was noted, healthy with slow to moderate growth following the freeze. No evidence of flowering was noted in 2007.
2008 Plants are 16'/17'/20'/20'/24'/26' tall; healthy with slow growth. 2 plants flowered and fruited.
2009 Plants are 16'/18'/23'/26'/26'/28' tall; healthy with slow to rapid growth. 1 plant flowered and fruited in 2009. These are beautiful trees.
2013 Plants are 18'/18'/24'/27'/28'/28' tall; healthy with slow growth. No evidence of flowering and fruiting was observed since 2009.

Brongniartia alamosana Rydberg – Alamos pea tree, palo piojo
DELEP # 89-0398; planted March 1991 (4 plants)

Unarmed shrubs or trees to 6 (8) m tall, with odd once-pinnate leaves with large, oval leaflets and pea-like maroon flowers with a bright yellow-green spot on the banner. *Brongniartia alamosana* is native to western Mexico from Sonora to Guerrero. Seeds of this accession were collected near Alamos, Sonora, Mexico.

This species performed quite well. The trees suffered variable amounts of damage from the 2007 freeze but made a rapid recovery. One tree suffered a structural failure due to high winds with half of the tree splitting and falling. This tree subsequently died. Several plants of *B. alamosana* volunteered from seeds in areas adjacent to the parent trees. These trees are attractive and would make desirable landscape trees for hot climate locations with mild winters.

1991 Plants are 3'-5' tall; healthy with moderate to rapid growth.
1992 Plants are 3'-9' tall; healthy with slow to rapid growth.
1993 Plants are 4'-13' tall; healthy, 1 plant has grown slowly, 3 plants have had moderate growth.
1994 Plants are 6'-17' tall; healthy with slow to moderate growth.

1995 Plants are 5'-15' tall; healthy but little increase in height.
1996 Plants are 5'-19' tall; healthy, 1 plant had little growth, 3 plants had moderate growth. 2 plants flowered and fruited in 1996.
1997 Plants are 8'-18' tall; healthy with slow to moderate growth. 2 plants flowered and fruited.
1999 Plants are 8'-20' tall; healthy with slow to moderate growth. 2 plants flowered and fruited.
2000 Plants are 10'-23' tall; healthy with slow growth. 2 plants flowered and fruited.
2001 Plants are 12'-23' tall; healthy with slow growth. 2 plants flowered and produced a few fruits.
2002 Plants are 12'-23' tall; healthy but little change in size. 3 plants flowered and fruited.
2004 Plants are 16'-25' tall; healthy with slow growth. 2 plans flowered and fruited.
2005 Plants are 18'/24'/24'/26' tall; healthy with slow growth. 3 plants flowered and fruited.
2006 Plants are 13'/18'/25'/28' tall; healthy with little growth. No evidence of flowering this year.
2007 1 plant is 12' tall with stems frozen back to 8' from the tips and to 2" thick. 1 plant is 17' tall with exposed stems on the west side frozen back to 8' from the tips and to 1.5 thick. The other stems were undamaged. 2 plants 25'/27' tall had some stems freeze back 1'-3' from the tips. All 4 plants are healthy and exhibited vigorous regrowth.
2008 Plants are 16'/20'/25'/30' tall; healthy with rapid growth, all plants have recovered from the 2007 freeze. No flowering or fruiting this year.
2009 Plants are 20'/24'/28'/30' tall; healthy with slow to moderate growth. Half of the largest tree split out and fell due to high winds. This tree subsequently died in 2011. No evidence of flowering n 2009.
2013 The 3 surviving plants are 22'/24'/28' tall; healthy with little increase in size. 1 plant flowered and fruited sparingly in 2013.

Butea monosperma (Lamarck) Taubert – flame-of-the-forest
DELEP # 93-0084; planted March 1995 (2 plants)

Unarmed trees to 15 m tall with large, trifoliate leaves, and spectacular masses of large and showy orange-red flowers. The plants are grown for their beautiful flowers and have also been used in folk medicine, and for timber, charcoal, dyes, gum, and fodder (Lewis et al, 2005). It also figures prominently in certain religious beliefs (Lewis et al, 2005). *Butia monosperma* is native to southern Asia. Seeds of this accession originated from cultivated trees in Tamil Nadu, India.

This species appeared to perform well initially, but at least one and probably both plants were killed by gophers.

1995 Plants are 2'/2.5' tall; fair to good condition with slow growth.
1996 Plants are 1'/2' tall; fair to good condition but no apparent growth.
1997 1 plant is 6" tall and appears to be dying. The cause for this was not determined. The other plant is 4' tall; healthy with slow growth.
1999 1 plant died in 1998/1999 – the cause was not determined but gophers could have been responsible. The surviving plant is 4' tall; healthy but with little growth.
2000 The plant is 3' tall; healthy, slightly smaller but it has new stems and leaves.
2001 The plant was killed by gophers n 2001.

Caesalpinia bonduc (Linnaeus) Roxburgh – bonduc, gray nicker
DELEP # 92-0246; planted March 1994 (2 plants)

Shrubs or vine-like climbers to 6 m tall with prickles on the stems, even twice-pinnate leaves and yellow flowers in racemes. The seeds have been strung to make necklaces and the plants are widely used in traditional medicine to treat a variety of ailments. *Caesalpinia bonduc* is widely distributed and naturalized in tropical regions of the New and Old Worlds. Seeds of this accession were obtained from cultivated plants in Tamil Nadu, India.

This species did well initially and flowered but did not produce fruits. At least one of the plants appears to have been killed by gophers.

1994 Plants are 1'/1.5' tall; healthy with slow growth.
1995 Plants are both 2' tall; healthy with slow growth.
1996 1 plant died in 1996 – the cause was not determined. The surviving plant is 4.5' tall; healthy with moderate growth. It flowered in 1996 but no fruits were produced.
1997 The plant is 6' tall; healthy with slow growth. No evidence of flowering was observed.
1999 The plant is 7' tall; healthy with slow growth. The plant flowered but no fruits were observed.
2000 The plant is 7' tall; healthy and in fair condition with some die-back. The plant flowered but did not produce fruits.
2001 The plant died rapidly in 2001 with dried leaves remaining on the stems. It appears to have been killed by gophers.

Caesalpinia cacalaco Humboldt & Bonpland – cascalote
DELEP # 90-0480; planted March 1992 (4 plants)

Shrubs or trees to 4 (10) m tall with stout, paired prickles on the stems, even twice-pinnate leaves, and showy yellow flowers in racemes. This species is cultivated for its showy flowers. Native to western Mexico from Sinaloa to Guerrero. Seeds for this accession were collected from a cultivated plant growing in Phoenix, Arizona.

These plants performed well, though grew substantially slower than cultivated plants in Tucson. They also remained as multiple-stemmed shrubs (though no pruning was done to encourage an arborescent form).

1992 Plants are 1'-2' tall; healthy with slow growth.
1993 Plants are 2.5'-3' tall; healthy with slow growth.
1994 Plants are 3'-4' tall; healthy with slow growth.
1995 Plants are 3.5'-4' tall; healthy with little increase in height.
1996 Plants are 4'-6' tall; healthy with slow growth.
1997 Plants are 4'-7' tall; healthy with slow growth. All 4 plants flowered in 1996 but did not produce fruits.
1999 Plants are 5.5-8' tall; healthy with slow growth. All flowered but no fruits were produced.
2000 Plants are 6-'8' tall; healthy with slow growth. All flowered bud did not produce fruits.
2001 1 plant died in 2001 – the cause was not determined. The 3 surviving plants are 6.5'-9' tall; healthy with slow growth. These flowered and fruited in 2001.
2002 Plants are 7'-10' tall; healthy with slow growth. All are flowering and fruiting.
2004 Plants are 9'/10' tall; healthy with slow growth. All are flowering and fruiting.
2005 Plants are 10'/10'/10' tall; healthy but with little change in size. All flowered and fruited.
2006 Plants are 12'/12'/13' tall; health with slow growth. All are

flowering and fruiting.
2007 Plants are 12'/12'/13' tall; outer stems froze back to 1' from the tips. The plants are healthy and recovered from the freeze damage. All flowered and fruited in 2007.
2008 Plants are 10'/11'/12' tall; healthy but little change in size. All are flowering and fruiting.
2009 Plants are 11'/12'/14' tall; healthy with slow growth. All are flowering and fruiting.
2013 Plants are 12'/12'/14' tall; healthy with little increase in height. All are flowering and fruiting.

Caesalpinia nipensis Urban
DELEP # 93-0014; planted February 1995 (4 plants)

Shrubs or small trees to at least 5 m tall with even twice-pinnate leaves and small pale green flowers in racemes. The species is native to Cuba. Seeds for this accession were provided by the Jardín Botánico Nacional, Havana, Cuba.

This species struggled initially and two of the four plants died from undetermined causes. Fruit production was light and erratic, perhaps due to environmental conditions. The green flowers of these plants are unusual.

1995 Plants are 6" -1.5' tall; healthy with slow growth.
1996 Plants are 6"-3' tall; fair to good condition with slow growth.
1997 1 plant died in 1996 – the cause was not determined. The 3 surviving plants are 1.5'-3.5' tall; fair to good condition with slow growth.
1999 Plants are 2'-5' tall; fair to good condition with slow growth. 1 plant flowered in 1999.
2000 Plants are 2.5-5' tall; fair to good condition with slow growth. 1 plant produced flowers.
2001 Plants are 2'-6' tall; healthy but with slow growth. 1 plant flowered only.
2002 Plants are 2'-6' tall; healthy with little change in size. No evidence of flowering was observed this year.
2004 Plants are 3-7.5' tall; healthy with slow growth. 1 plant flowered in 2004.
2005 Plants are 4'/4'/9' tall; healthy with slow growth. 2 plants flowered and one of these produced fruits.
2006 Plants are 4'/5'/10' tall; healthy with slow growth. 3 plants flowered and 1 produced fruits.
2007 Plants are 1'/2'/6' tall; all 3 plants froze to the base with stems to 1" thick killed. All are recovering vigorously. The largest plant produced flowers.
2008 Plants are 2'/6'/8' tall; healthy with slow to moderate growth. 1 plant flowered n 2008.
2009 Plants 2.5'/7'/9' tall fair to good condition with slow growth. 1 plant flowered in 2009. The largest plant has been overgrown by a volunteer *Lysiloma candidum*.
2013 1 plant died in 2011 – cause undetermined but it never fully recovered from the 2007 freeze. The 2 surviving plants are 7'/9' tall; healthy with no apparent increase in height. 1 plant flowered in 2013.

Caesalpinia palmeri S. Watson – piojito, palo piojo
No accession number assigned; planted March 1994 (2 plants)

Unarmed shrubs or trees to 8 m tall with odd twice-pinnate leaves and yellow flowers in racemes. Native to northwestern Mexico in Sonora and Sinaloa. These plants were received from Desierto Verde Nursery as small plants.

This species initially performed satisfactorily, but one plant declined over several years and ultimately died. The cause was not determined. The other plant reached a point where it did not grow appreciably and flowering mostly stopped, though it appeared to be healthy. This species has performed very well in Tucson and it has exhibited considerable cold tolerance. The plants have grown much more rapidly and reseeded in a field that was flood irrigated. The reason these plants performed poorly in Yuma was not determined.

1994 Plants are 3'/3.5' tall; healthy with slow growth.
1995 Plants are 3'/5' tall; healthy with slow growth.
1996 Plants are 4'/6' tall; healthy with slow growth.1 plant flowered and fruited.
1997 Plants are 3.5'/6.5' tall; healthy with little change in size. Both plants flowered and fruited.
1999 1 plant is 3.5' tall; fair condition with little growth. 1 plant is 7' tall; healthy but with little growth.
2000 Plants are 3'/7' tall; fair to good condition, little change in size. Both plants are flowering and fruiting.
2001 1 plant is 3' tall; poor condition with no growth. 1 plant is 7' tall; healthy but with little change in size. It is flowering and fruiting.
2002 1 plant is 3' tall; poor condition with no growth. 1 plant is 7' tall; healthy but with little growth. It is flowering and fruiting.
2004 1 plant died in 2004 – the cause was not determined but it had been declining for several years. The surviving plant is 7' tall; fair condition with no growth. It is producing some flowers and fruit.
2005 Plant is 7' tall; fair condition with no growth. Only a few flowers and fruit were produced in 2005.
2006 Plant is 7' tall; apparently healthy but no new growth or flowering.
2007 Plant is 7' tall; no freeze damage, apparently healthy but no growth or flowering.
2008 Plant is 7' tall; healthy but no change in size or flowering.
2009 Plant is 7' tall; healthy with no change in size or flowering.
2013 Plant is still 7' tall; apparently healthy but little new growth. A few flowers were observed in 2013.

Caesalpinia paraguariensis (D. Parodi) Burkart – guayacán
DELEP # 90-0359; planted March 1991 (2 plants) and March 1992 (1 plant)

Unarmed trees to 20 m tall with distinctive, smooth, mottled, flaking bark, odd twice-pinnate leaves and small yellow flowers in racemes. The tree is valued for its durable timber, for fuelwood and charcoal production, for tannins from the fruits, and it is employed in traditional medicine (Aronson and Saravia Toledo, 1992). *Caesalpinia paraguariensis* is native to the Gran Chaco region of Argentina, Bolivia, Brazil, and Paraguay. Seeds for this accession were collected southeast of Filidelfia, Department of Presidente Hayes, Paraguay.

Overall performance of this species at the Yuma field site was disappointing. These plants are reported to do poorly in very sandy soils, so this may have been the primary factor. In contrast, this species has done very well in Tucson, Phoenix and at the Boyce Thompson Arboretum. Cultivated plants in Arizona have been undamaged with lows to -7° C. With its mottled, multi-hued bark, interesting form, and delicate foliage that is rust colored as it emerges, this is a beautiful landscape plant. In 2013, this accession flowered and fruited heavily for the first time.

1991 Both plants are 2' tall x 4' wide; healthy with slow to moderate growth.
1992 All 3 plants are 2' tall x 4' wide; apparently healthy but no increase in size.
1993 Plants are 2'-3' tall; fair condition with little additional growth.
1994 Plants are 2.5'-3' tall; fair condition with slow growth.
1995 Plants are 2'-3' tall; healthy but low vigor with little growth.
1996 Plants are 2.5'-3' tall; healthy but little or no growth.
1997 Plants are 2'-3' tall; fair condition with little growth.
1999 Plants are 2'-3' tall; poor to fair condition with little or no growth.
2000 1 plant died in 2000 – the cause was not determined but this species has not done well here. The 2 surviving plants are 2.5'/3' tall; fair condition with little or no growth.
2001 1 plant died in 2001 – this had been declining for several years and gophers may have finished it off. The surviving plant is 3' tall x 4' across; fair condition with little growth.
2002 Plant is 3' tall; fair condition with little change in size.
2004 Plant is 3' tall x 7' across; healthy with slow growth. This species is reported to dislike sandy soils.
2005 Plant is 6.5' tall x 10' across; much healthier with moderate growth.
2006 Plant is 6.5' tall x 10' across; healthy but with little growth this year.
2007 Plant is 6.5' tall; no freeze damage, healthy but no change in size.
2008 Plant is 8' tall x 10' across; healthy with slow growth.
2009 Plant is 9' tall; healthy and slowly developing into a tree. No flowering has been observed.
2013 Plant is 9' tall; healthy with slow growth and is beginning to develop an arborescent form. This plant flowered and fruited heavily in 2013.

Caesalpinia paraguariensis (D. Paroidi) Burkart – guayacán
No accession number assigned; planted March 1992 (3 plants)

Unarmed trees to 20 m tall with distinctive, smooth, mottled, flaking bark, odd twice-pinnate leaves and small yellow flowers in racemes. The tree is valued for its durable timber, for fuelwood and charcoal production, for tannins from the fruits, and it is employed in traditional medicine (Aronson and Saravia Toledo, 1992). *Caesalpinia paraguariensis* is native to the Gran Chaco region of Argentina, Bolivia, Brazil, and Paraguay. Seeds for this accession were collected adjacent to the Jojoba Reta plantation in western Paraguay.

Performance for these trees was similar to that of DELEP # 90-0359. They struggled for many years before starting to develop an arborescent form. Both surviving plants fruited for the first time in 2013, producing a heavy crop.

1992 All 3 plants are 2' tall x 4' across; healthy with more growth than 90-0359 this year.
1993 Plants are 1'-2.5' tall; fair condition with some die-back but also new growth.
1994 Plants are 7"-3' tall; fair condition with slow growth.
1995 Plants are 2'-3' tall; healthy but low vigor with little growth.
1996 Plants are 1'-2' tall; fair condition with no apparent growth.
1997 Plants are 1'-2.5' tall; fair condition with little growth.
1999 2 plants are 2'/2.5' tall; poor to fair condition with slow growth. 1 plant is 4' tall; healthy with slow growth.
2000 Plants are 2'-4' tall; poor to good condition with little or no growth.
2001 Plants are 1.5'-2.5' tall; fair to good condition with little or no growth.
2002 1 plant died in 2002 – the cause was undetermined but it had done poorly for several years. The 2 surviving plants are 2'/3' tall; healthy but little or no growth.
2004 Plants are 3'/5' tall; healthy but growing slowly. These are reported to do poorly in sand.
2005 Plants are 4'/6' tall; healthy with slow growth. These look better than they have in many years.
2006 Plants are 4'/6' tall; fair to good condition with little increase in height but with many low, spreading stems.
2007 Plants are 4'/6' tall; no freeze damage, healthy but little or no growth.
2008 Plants are 4'/6' tall; healthy but little apparent growth.
2009 Plants are 5'/8' tall; healthy and slowly growing taller.
2013 Both plants are 8' tall; healthy with slow growth and a shrubby habit. Both plants flowered and fruited heavily in 2013.

Caesalpinia platyloba S. Watson – palo colorado
DELEP # 89-0008; planted March 1991 (1 plant)

Unarmed upright trees to at least 10 m tall with even twice-pinnate leaves and yellow flowers in racemes. The trees provide durable wood for construction and posts (Felger et al, 2001). It is native to Mexico from Sonora to Oaxaca, Tamaulipas and Yucatán. Seeds for this accession originated from near Aduana, in southeastern Sonora, Mexico.

This species grew very well at the Yuma field site. Several plants volunteers from seeds in the vicinity of the parent plants. The plants suffered considerable freeze damage in 2007, but recovery was rapid the following year. This attractive plant is suitable as a landscape or patio tree for mild-winter regions. It can be planted in small spaces due to its upright growth habit.

1991 Plant is 1.5' tall; healthy with slow growth.
1992 Plant is 4' tall; healthy with moderate growth.
1993 Plant is 5' tall; healthy with slow growth. Flowers and fruits were produced in 1993.
1994 Plant is 9' tall; healthy with rapid growth. No evidence of flowering during 1994.
1995 Plant is 10' tall; healthy with slow growth. The plant flowered and fruited.
1996 Plant is 10' tall; healthy but with little increase in height. The plant flowered and fruited.
1997 Plant is 10' tall; healthy but little or no growth. The plant flowered and fruited.
1999 Plant is 10' tall; healthy with minimal growth. The plant regularly produces flowers and fruits.
2000 Plant is 11' tall; healthy with slow growth. It is flowering and fruiting.
2001 Plant is 10' tall; healthy with little change in height. The plant flowered and fruited.
2002 Plant is 10' tall; healthy but little or no growth. It has flowered and fruited regularly.
2004 Plant is 22' tall; healthy with rapid growth over the past 2 years. Flowering and fruiting.
2005 Plant is 18' tall; healthy with little growth. The plant is flowering and fruiting.
2006 Plant is 18' tall; healthy with little apparent growth. Abundant flowering and fruiting.

Figure 2. *Bolusanthus speciosus*

Figure 3. Block 30 South

2007 Plant is17' tall; stems froze back to 8' from the tips with stems to 3" thick killed, healthy with vigorous regrowth. No flowering was observed this year due to freeze damage.
2008 Plant is 22' tall, healthy and mostly recovered from the 2007 freeze. No flowering was noted in 2008.
2009 Plant is 20' tall; healthy with slow growth. Flowers and fruits were produced in 2009.
2013 Plant is 23' tall; healthy with slow growth. It has continued to flower and fruit each year since 2009.

Caesalpinia platyloba S. Watson – palo colorado
DELEP # 89-0411; planted March 1992 (3 plants)

Unarmed upright trees to at least 10 m tall with even twice-pinnate leaves and yellow flowers in racemes. The trees provide durable wood for construction and posts (Felger et al, 2001). It is native to Mexico from Sonora to Oaxaca, Tamaulipas and Yucatán. Seeds for this accession were collected near Alamos, Sonora, Mexico.

Plants of this accession, like 89-0008, performed very well. Aside from extensive damage from the 2007 freeze, they exhibited no problems.

1992 Plants are 1.5'-3' tall; healthy with slow to moderate growth.
1993 Plants are 4'-4.5' tall; healthy with slow to moderate growth. 1 plant flowered and fruited in 1993.
1994 Plants are 6'-7.5' tall; healthy with moderate growth. No flowering observed.
1995 Plants are 7'-9' tall; healthy with slow growth. 2 plants flowered and fruited.
1996 Plants are 7.5'-10' tall; healthy with slow growth. All 3 plants flowered and fruited.
1997 Plants are 9'-10' tall; healthy with slow growth. All flowered and fruited.
1999 Plants are 8'-12' tall; healthy with slow growth. All flowered and fruited.
2000 Plants are 9'-13' tall; healthy with slow growth. All flowered and fruited.
2001 Plants are 8'-12' tall; healthy with little change in size. All flowered and fruited.
2002 Plants are 8'-12' tall; healthy with little or no growth. All flowered and fruited.
2004 Plants are 15'-23' tall; healthy with moderate to rapid growth in the past 2 years. All flowered and fruited.
2005 Plants are 15'/18'/20' tall; healthy with little growth in the past year. All flowered and fruited.
2006 Plants are 14'/19'/20' tall; healthy with little apparent growth. All flowered and fruited.
2007 Plants are 11'/18'/22' tall; stems froze back to 8' from the tips with stems to 3" thick killed, healthy with vigorous recovery. No flowering in 2007.
2008 Plants are 13'/14'/18' tall; healthy and mostly recovered from 2007 freeze. No flowering in 2008.
2009 All 3 plants are ca. 20' tall; healthy with slow to rapid growth. All flowered and fruited.
2013 Plants are 14'/24'/27' tall; healthy with slow but steady growth. All 3 plants have flowered and fruited each year since 2009.

Caesalpinia pumila (Britton & Hooker) F.J. Hermann – piojo, piojito
DELEP # 89-0408; planted March 1992 (5 plants)

Unarmed shrubs to 3 m tall with numerous slender stems, even twice-pinnate leaves, and yellow flowers in small racemes. Native to Sonora and northernmost Sinaloa, Mexico. Seeds for this accession were collected near La Colorada, southeast of Hermosillo, Sonora, Mexico.

Overall, this species performed well. Two plants were lost during the first two years. The surviving plants developed into healthy, productive shrubs. The stems were frozen back to the base of the plants in 2007, but all three plants made a vigorous recovery. Following the freeze, the largest plant failed to flower and fruit while the other 2 plants flowered and fruited abundantly each year. The reason for this is unknown.

1992 1 plant died in 1992 – the cause was not determined. The 4 surviving plants are 8"-2' tall; fair condition with slow growth.
1993 1 plant died in 1993 – the cause was not determined. The 3 surviving plants are 3'-4' tall; healthy with slow to moderate growth.
1994 Plants are 4'-6.5' tall; healthy with slow to moderate growth. 2 of the plants flowered and fruited in 1994.
1995 Plants are 3.5'-7' tall; healthy with slow growth. All 3 plants flowered and fruited.
1996 Plants are 4'-7.5' tall; healthy with slow growth. All flowered and fruited.
1997 Plants are 5'-7.5' tall; healthy with slow growth. All flowered and fruited.
1999 Plants are 5'-6.5' tall; fair condition with little or no growth in the past 2 years. 1 plant flowered and fruited in 1999.
2000 Plants are 5'-7' tall; fair to good condition with little change in size. 2 plants flowered and fruited.
2001 Plants are 4'-7' tall; fair to good condition with little increase in height. All 3 plants flowered and fruited.
2002 Plants are 4'-7' tall; fair to good condition with no increase in height but with new stems emerging from the base of the plants. All flowered and fruited.
2004 Plants are 6'-10' tall; healthy with slow growth. All flowered and fruited.
2005 Plants are 6'/7'/10' tall; healthy but with little apparent growth. All flowered and fruited.
2006 Plants are 6'/7'/10' tall; healthy with no change in size. 2 of the plants flowered and fruited.
2007 Plants are 6'/6'/8' tall; all stems froze to the base of the plant with stems to 1" thick killed, healthy with vigorous regrowth. 1 plant flowered and fruited this year.
2008 Plants are 5'/10'/10' tall; healthy with rapid growth. All have recovered from the 2007 freeze. 2 of the plants flowered and fruited.
2009 Plants are 6'/10'/12' tall; healthy with slow growth. The 2 smaller plants flowered and fruited.
2013 Plants are 8'/10'/12' tall; health with little or no increase in height. The 2 smaller plants have flowered and fruited each year since 2009 while the largest plant has not.

Caesalpinia spinosa (Molina) Kuntze – tara
DELEP # 89-0117; planted March 1992 (5 plants)

Shrubs or trees to 5 m tall with prickles on the stems, even twice-pinnate leaves, and racemes of showy yellow and orange flowers. The fruits are a source of tannins for leather processing (Aronson, 1990, Orwa et al, 2009) and the plants produce a gum that has potential as a food additive (Orwa et al, 2009). This species is also used in folk medicine, as a dye plant, for

fuelwood, and is cultivated for its showy flowers (Aronson, 1990). Native to Peru and widely introduced into other regions around the world where it has sometimes become naturalized. Seeds for this accession originated near Pachica, Chile.

All five plants died within two years of planting. The cause was not determined, but these plants do not appear to be adapted to this site. Given the extent to which this species has been introduced beyond its native range and its apparent adaptability, this is surprising.

1992 3 plants died in 1992 – the cause was not determined. The 2 surviving plants are 1' tall; poor condition with dieback.
1993 The remaining 2 plants died in 1993 – the cause was not determined.

Caesalpinia violacea (Miller) Standley – brasiletto
DELEP # 93-0015; planted February 1995 (4 plants)

Unarmed trees to 18 m tall with even twice-pinnate leaves and racemes with flowers that are yellow or reportedly rose-purple or lilac colored. Wood of this species is used for construction, carpentry and for posts, and a red dye is obtained from the plants (Fern, 2014). *Caesalpinia violacea* is native to southern Mexico, Belize, Guatemala, Cuba and Jamaica. These plants were grown from seeds provided by the Jardín Botánico Nacional, Havana, Cuba.

In spite of the loss of two of these plants several years after planting, overall performance was satisfactory. This species resembles *Caesalpinia platyloba* in appearance.

1995 Plants are 1.5'-2.5' tall; healthy with slow growth.
1996 Plants are 1.5'-2.5' tall; healthy but with little apparent growth.
1997 Plants are 3'-6' tall; healthy with slow to rapid growth.
1999 1 plant died in 1999 – the cause was not determined. The 3 surviving plants are 3.5'-7' tall; healthy with slow growth.
2000 Plants are 3.5'-7' tall; healthy but with little increase in height. 1 plant flowered and fruited in 2000.
2001 Plants are 3.5'-7' tall; healthy with no increase in height. 1 plant flowered and fruited.
2002 2 plants are 1'/4' tall; fair condition with little or no growth. 1 plant is 7.5' tall; healthy but with little change in size. It has been flowering and fruiting each year since 2000.
2004 The smallest plant died in 2004 – the cause was not determined. The 2 surviving plants are 6'/10' tall; healthy with slow growth. Both flowered and fruited.
2005 Plants are 6.5'/11' tall; healthy with slow growth. Both flowered and fruited.
2006 Plants are 7'/11' tall; healthy with slow growth. Only the larger plant flowered and fruited this year.
2007 Plants are 3'/6' tall; stems froze back to 8' from the tips with stems to 2" thick killed, healthy and exhibiting a vigorous recovery.
2008 Plants are 7.5'/11' tall; these have recovered from the 2007 freeze and are healthy with rapid growth in the past year. No evidence of flowering was observed this year.
2009 Plants are 8'/14' tall; healthy with slow growth. No flowering on either plant this year.
2013 Plants are 16'/18' tall; healthy with slow growth. Both plants have flowered and fruited each year since 2010.

Calliandra haematocephala Hasskarl – red powderpuff
DELEP # 91-0491; planted March 1994 (5 plants)

Unarmed shrubs or small trees to 5 m tall, with even twice-pinnate leaves and showy, red, feather duster-like flower heads. *Calliandra haematocephala* is a popular ornamental flowering plant in tropical climates. It is native to Bolivia in the foothills of the Andes Mountains.

These plants thrived in containers prior to planting, and even produced seeds. Initially, their performance seemed satisfactory, but they gradually lost vigor and declined. One plant died following the 2007 freeze. The others recovered but subsequently went into decline. The plants flowered intermittently in most years. It is likely that environmental stress was responsible for their poor performance. This accession originated from cultivated plants in southern California.

1994 Plants are 4.5'-6' tall; healthy but growing slowly with some environmental stress.
1995 Plants are 4'-6' tall; healthy but slow growth. Flowers and developing fruits.
1996 Plants are 4'-5' tall; fair condition with some flowers but no fruits. The plants appear stressed.
1997 Plants are 3'-4' tall; fair to good condition. Flowers but no fruits.
1999 Plans are 3'-5.5' tall; healthy overall, though they appear a bit stressed. Flowering but no fruits.
2000 Plants 2'-6' tall; healthy but slow growth with dense, somewhat chlorotic foliate. Flowers only.
2001 Plants 3'-6' tall; healthy with little increase in size. Flowers only.
2002 Plants 2.5'-6' tall; healthy but little change in size. Flowers only.
2004 1 plant is 3' tall; poor condition. 4 plants are 4'-7' tall; fair to good condition with slow growth. Some flowering but no fruit production.
2005 1 plant is 2.5' tall; fair condition. The other plants are 5'/6'/7'/8' tall; healthy. Flowers only.
2006 1 plant is 3' tall; poor condition The other plants are 6'/6'/6.5'/7' tall; healthy. Flowers only.
2007 1 plant is dead – killed by freeze. The remaining plants froze to ground level but are alive with new growth. No flowering.
2008 Plants are 3'/3.5'/6'/6' tall; healthy. These have recovered from the 2007 freeze. No flowering.
2009 Plants are 2'/3'/4'/6' tall; poor to fair condition, struggling. No flowering.
2013 Plants are 2.5'/2.5'/2.5'/5' tall; poor condition with little or no growth. No flowering.

Cassia abbreviata Oliver – long-tailed cassia
DELEP # 95-0018; planted February 1997 (3 plants), March 1998 (1 plant), December 2004 (1 **plant)**

Unarmed shrubs or trees to 10 m tall with even once-pinnate leaves and racemes of showy pale yellow flowers. This species is widely used in traditional medicine (Palgrave, 1983; Orwa et al, 2009) and is worthy of further investigated for potential pharmaceutical properties. It has also been used in tanning leather and the wood is used for construction and fuel (Orwa et al, 2009). *Cassia abbreviata*, with three varieties, is widely distributed across southern and eastern Africa. Seeds for this accession originated south of Gwanda, Zimbabwe.

This species was disappointing. While losses following planting are not unexpected, the surviving trees exhibited little or no growth over a fifteen year period. The reason for this was not determined, but a number of other plants did not do well in

the sandy soil at this location.

1997 2 plants died in 1997 from undetermined causes. The surviving plant is 2' tall; poor condition with little growth.

1999 Plants are 1'/2' tall; healthy but little apparent growth.

2000 The last plant from the 1997 planting died from undetermined causes. The plant from the 1998 planting is 2' tall; fair condition but no apparent growth.

2001 Plant is 1.5' tall; fair condition with no growth.

2002 Plant is 1.5' tall; fair condition with no apparent growth.

2004 Plant is 1.5' tall; fair condition, no change in size. This plant has not grown since it was planted but remains alive. No cause has been determined for its lack of growth.

2005 Plants are 1.5'/2.5' tall; healthy with little growth.

2006 Plants are 1.5'/2.5' tall; healthy with no apparent growth in the past year.

2007 1 plant is 1' tall; no freeze damage, healthy but no growth. 1 plant is 2' tall; froze to the base with healthy regrowth.

2008 Plants are 1.5'/3.5' tall; healthy with slow growth.

2009 1 plant is 1.5' tall; fair condition with no growth. 1 plant is 3.5' tall; healthy with no growth.

2013 1 plant is 1.5' tall; fair condition but no apparent growth in the past years. 1 plant is 6' tall; healthy with slow growth.

Chloroleucon mangense (Jacquin) Britton & Rose var. ***leucospermum*** (Brandegee) Barneby & Grimes – palo pinto

[*Pithecellobium undulatum* (Britton & Rose) Gentry]

DELEP # 89-0064; planted March 1991 (4 plants)

Trees to 8 m tall with thorns on twigs, distinctive mottled bark, even twice-pinnate leaves and creamy white flowers in hemispherical heads. The wood is used locally in Mexico. The plants would make attractive landscape specimens with their beautiful trunks, but are sensitive to freezing. This taxon is distributed in western Mexico from Sonora to Oaxaca. Seed for this accession were collected near Alamos, Sonora.

These plants fared poorly following planting. They declined and died from undetermined reasons. They do not appear to be adapted to this site.

1991 Plants are 6"-10" tall; poor condition with no apparent growth. New leaves are emerging.

1992 1 plant died in 1992 from undetermined causes. The 3 surviving plants are ca. 6" tall; poor condition with no growth.

1993 The 3 remaining plants died in 1993. The cause was undetermined but they do not appear to be adapted to this site.

Colophospermum mopane (J. Kirk ex Bentham) J. Léonard – mopane

DELEP # 91-0016; planted March 1992 (4 plants)

Unarmed plants that grow as shrubs or small to larger trees, occasionally to 20 m tall, depending on environmental conditions. The leaves consist of paired leaflets that taper to a point, Flower are pale green and inconspicuous. This species often forms nearly pure stands over extensive areas that are termed mopane woodlands (Palgrave, 1983). The trees are valued for forage for livestock and wildlife, and for timber and fuelwood (Palgrave, 1983; Bainbridge, 2012). Mopane trees are host to mopane worms that serve as an important protein source for local people (Palgrave, 1983). The species is also used in traditional medicine (Allen and Allen, 1981; Bainbridge, 2012) and figures prominently in religious beliefs of some traditional societies (Bainbridge, 2012). Mopane is widespread in semiarid regions of southern Africa. Seeds for this accession were collected near Hwange, Zimbabwe.

Except for the loss of one plant in 2005 due to gophers, this species thrived. The largest plant in particular, developed into a beautiful, upright tree with a compact crown. The bark and foliage of this species is particularly attractive, and it is recommended as a landscape tree in areas to which it is adapted.

1992 Plants are 1'-2' tall; healthy with slow growth.

1993 Plants are 1'-4' tall and spreading to 6' across; healthy with slow growth.

1994 Plants are 2.5'-4' tall; healthy with slow growth.

1995 1 plant is 1.5' tall; fair condition but no apparent growth. 1 plant is 6' tall; healthy with slow growth.

1996 Plants are 5'-7.5' tall; healthy with slow growth. All 4 plants produced flowers and fruit in 1996.

1997 Plants are 6'-10' tall; healthy with slow to moderate growth. All flowered and fruited.

1999 Plants are 6.5'-13' tall; healthy with slow to moderate growth. All flowered and fruited.

2000 Plants are 7'-15' tall; healthy with slow growth. All flowered and fruited.

2001 Plants are 8'-17' tall; healthy with slow growth. All flowered and fruited.

2002 Plants are 8'-17' tall; healthy with little change in size. All flowered and fruited.

2004 Plants are 8'-20' tall; healthy (1 plant tipped over due to gophers feeding on its roots) with slow growth. All flowered and fruited. This species has an attractive growth form with beautiful dark green butterfly-like leaves and horizontal branches.

2005 1 plant died in 2005 from gopher damage to the roots. The surviving plants are 10'/14'/20' tall; healthy with slow growth. All flowered and fruited.

2006 Plants are 11'/12'/18' tall; healthy with little change in size during the past year. All flowered and fruited.

2007 Plants are 10'/12'/20' tall; the 2 smaller plants froze back 2'-3' from the stem tips while the larger plant exhibited no apparent freeze damage. All are healthy and produced flowers and fruit in 2007.

2008 Plants are 12'/14'/25' tall; healthy with slow to fast growth. All flowered and fruited. The largest plant has developed into a beautiful tree.

2009 Plants are 12'/17'/22' tall; healthy with slow growth. Flowers and fruit on the largest plant only in 2009.

2013 Plants are 14'/22'/26' tall; healthy with slow growth. The largest and smallest trees produced flowers and fruits.

Conzattia multiflora B.L. Robinson – palo joso

DELEP # 90-0352; planted March 1993 (2 plants), March 1994 (1 plant)

Unarmed trees to 25 m tall with a straight trunk, smooth white bark and a high canopy. Leaves are large, even, twice-pinnate. Small but showy yellow flowers are produced in racemes. The wood is soft and weak (Felger et al, 2001). This species is found in dry tropical forests of western Mexico from Sonora and Chihuahua to Oaxaca. Seeds for this accession originated near Alamos, Sonora, Mexico.

This species did poorly and the plants gradually died out.

It may be that a combination of the soil and climate were not suitable for these plants.

1993 Plants are 8"/10" tall; fair condition with little growth.

1994 1 plant died in 1994 from undetermined causes. Plants are 1'/1.5' tall; fair condition with low vigor.

1995 1 plant died in 1995 from undetermined causes. The surviving plant is 1.5' tall; poor condition with no growth.

1996 Plant is 1.5' tall; fair condition with no growth.

1997 The last plant died in 1997 from undetermined causes. This species does not appear to be adapted to this site.

Cordeauxia edulis Hemsley – yeheb nut

DELEP #90-0040; planted March 1991 (38 plants)

Unarmed shrubs to 3 m with odd once-pinnate leaves and yellow flowers in corymbs. The foliage is browsed by livestock and the seeds are eaten by people (Allen and Allen, 1981). It is a species of conservation concern due to overutilization (Allen and Allen, 1981). *Cordeauxia edulis* is native to a small area of Ethiopia and Somalia. Seeds for this accession were obtained from cultivated plants growing at Kibwezi, Kenya.

This species grew well in sandy soil in deep containers prior to planting, but does not appear to be adapted to the field site here. It is native to hot, sandy habitats, so the loss of all 38 plants during their first year was surprising. The cause for the demise of these plants was never determined.

1991 As of 01 June, plants were mostly stressed and yellowed. 1 plant was green and at least 2 plants were putting out new growth. All 38 plants died later in 1991. The cause was not determined, but they did not appear to be adapted to this site.

Crotalaria capensis Jacquin – Cape rattle pod

No accession number assigned; planted March 1993 (4 plants)

Unarmed shrubs or trees to 6 m tall with 3-foliate leaves and showy racemes of yellow pea-like flowers. The species is grown as a hedge and is browsed by livestock (Palgrave, 1983). *Crotalaria capensis* is native to parts of Malawi, Mozambique, South Africa, Swaziland and Zimbabwe. These plants were obtained from the Boyce Thompson Arboretum.

This species performed poorly with all of the plants dying within two years of planting. The cause was not determined, but these do not appear to be adapted to this site.

1993 1 plant died in 1993 from undetermined causes. The 3 surviving plants are 1.5' tall; healthy with slow growth.

1994 All 3 plants died in 1994. The cause was not determined but they do not appear to be adapted to this site.

Dalbergia martinii F. White – Zambezi dalbergia

DELEP # 91-0066; planted March 1992 (2 plants)

Unarmed shrubs, lianas, or rarely shrubby trees to 4 m tall with odd once-pinnate leaves and panicles of white, pea-like flowers. The species is found in parts of Namibia, Zambia and Zimbabwe. Seeds for this accession were collected between Bulawayo and Victoria Falls, Zimbabwe.

This species does not appear to be adapted to this site. The plants declined and died within a year and a half of planting.

1992 1 plant died in 1992 from undetermined causes. The surviving plant is 6" tall; poor condition.

1993 The last plant died in 1993 from undetermined causes. These never did well here.

Dalbergia melanoxylon Guillemin & Perrottet – African blackwood

DELEP # 90-0260; planted March 1993 (1 plant)

Unarmed shrubs or trees to 10 m tall with odd once-pinnate leaves and yellowish white flowers in small racemes. The wood of *D. melanoxylon* is prized for woodworking and the trees are used in traditional medicine (Orwa et al, 2009). The species has an extensive distribution in sub-Saharan Africa and extends into southern Asia. This accession originated near Kibweze, Kenya.

This plant exhibited superior performance for many years, though it was slow to develop. Following the 2007 freeze, the plant's vigor increased considerably. During 2013, it declined precipitously. The reason for this was not determined, but gophers could have been a factor.

1993 Plant is 1.5' tall; healthy with slow growth.

1994 Plant is 3' tall; healthy with slow growth.

1995 Plant is 5' tall; healthy with slow growth.

1996 Plant is 7.5' tall; healthy with moderate growth.

1997 Plant is 10' tall; healthy with moderate growth. This plant has an upright growth habit and dense foliage.

1999 Plant is 10' tall; healthy but little increase in height. Flowers and a few fruits in 1999.

2000 Plant is 11' tall; health with slow growth. No evidence of flowering this year.

2001 Plant is 16' tall; healthy with rapid growth in the past year. No flowering observed.

2002 Plant is 18' tall; healthy with slow growth.

2004 Plant is 16' tall; healthy with little change in size. This plant has a beautiful form and foliage. No evidence of flowering has been noted since 1999.

2005 Plant is 16' tall; healthy with no apparent change in size. Some flowering but no fruits in 2005.

2006 Plant is 16' tall; healthy with no growth. No evidence of flowering.

2007 Plant is 15' tall; stems froze back to 6' from the tips to stems 1" thick, healthy with vigorous new growth.

2008 Plant is 20' tall; healthy with rapid growth. The plant fully recovered from the 2007 freeze.

2009 Plant is 25' tall; healthy with rapid growth. No evidence of flowering.

2013 Plant is 25' tall; poor condition with many stems dead and few leaves on live stems. The plant declined rapidly in 2013. The reason was not determined, but gophers could have damaged the root system.

Dalbergia purpurascens Baillon

DELEP # 99-0032; planted December 2002 (2 plants)

Unarmed trees to 25 m tall with odd once-pinnate leaves and white, pea-like flowers in panicles. This species is endemic to Madagascar where it is threatened by overharvesting for its attractive wood and by habitat loss (de Puy, 1998). Seeds for this accession were obtained from a commercial seed vendor.

These plants died during their first season. The cause was not determined, but they are likely not adapted to this site.

2004 Both plants died during 2003 from undetermined causes.

Dalea tomentosa (Cavanilles) Willdenow var. ***mota*** Barneby - mota

DELEP # 89-0022; planted February 1995 (2 plants)

Unarmed, aromatic subshrubs to 1 m tall with odd once-pinnate leaves and purple flowers in dense spikes. The species is widespread in Mexico and Central America, while var. *mota* is restricted to parts of Chihuahua, Sinaloa and Sonora, Mexico. Seeds for this accession originated from near San Bernardo, Sonora.

These plants died during their first season. This species is likely not adapted to this field site.

1995 Both plants died in 1995. The cause was not determined but it is likely that the plants are not adapted to this site.

Dialium guineense Willdenow – Sierra Leone tamarind, velvet tamarind

DELEP # 91-0468; planted March 1994 (2 plants)

Unarmed trees to 30 m tall with odd once-pinnate leaves and panicles of small white flowers. Fruit pulp of this species is edible and the plant is used in traditional medicine (Orwa et al, 2009). The wood provides timber and fuelwood (Orwa et al, 2009). *Dialium guineense* is native to tropical West Africa. Seeds for this accession were obtained from a street vendor in Dakar, Senegal.

Both plants died during their first season. They are likely not adapted to this site.

1994 Both plants died in 1994. The cause was not determined, but this species is likely not adapted to this site.

Entada abyssinica Steudel ex A. Richard – tree entada

DELEP # 90-0261; planted March 1992 (2 plants), March 1995 (1 plant)

Unarmed trees to 15 m tall with even twice-pinnate leaves and pale yellow flowers in spike-like racemes. This species develops a flat-topped, spreading canopy and resembles some acacias. The foliage is used for fodder and the soft wood is sometimes utilized (Orwa et al, 2009). The species has a number of uses in traditional medicine (Orwa et al, 2009). It is also planted for shade and as a street tree (Orwa et al, 2009). *Entada abyssinica* is widely distributed in sub-Saharan Africa. Seeds for this accession were collected near Turbo, Eldoret, Kenya.

This species and other species of *Entada* performed poorly at this site. The plants grew little and slowly declined. The last surviving plant of *E. abyssincia* appears to have been killed by gophers.

1992 Plants are 1.5'/2' tall; fair condition with slow growth.

1993 1 plant is 3" tall; poor condition, declining. 1 plant is 2.5' tall; fair condition with no growth.

1994 1 plant died in 1994 from undetermined causes. The surviving plant is 2.5' tall fair condition with no growth.

1995 Plants are 1'/2' tall; fair condition with no growth.

1996 1 plant is 1' tall; heathy but with no growth. 1 plant is 3' tall, healthy with slow growth.

1997 1 plant died in 1997 from undetermined causes. The surviving plant is 3.5' tall; healthy with slow growth.

1999 Plant is 3.5' tall; fair condition with no additional growth.

2000 The last plant died in 2000. It appears to have been killed by gophers.

Entada africana Guillemin & Perrottet

DELEP # 90-0349; planted March 1992 (2 plants), March 1993 (3 plants)

Unarmed trees to 10 m tall with even twice-pinnate leaves and cylindrical spike-like racemes of cream colored to reddish yellow flowers. The plant has a variety of uses in traditional medicine and has rotenone-like toxic effects (Orwa et al, 2009). The wood is utilized in carpentry and the bark is a source of tannins and also fiber that is used for cordage (Orwa et al, 2009). *Entada africana* has a wide distribution in central and western Africa. Seeds of this accession originated in Senegal without specific locality.

These plants performed poorly. None were observed to grow and all died within a year to three years of planting. The reason for their demise was not determined. This genus does not do well at this site. The species grows naturally in moist situations, so irrigation may have been insufficient. Soil could also have been a factor.

1992 Both plants died in 1992 from undetermined causes.

1993 1 of the new plants died in 1993 from undetermined causes. The 2 surviving plants are 1'/1' tall; poor condition with no growth.

1994 1 plant died in 1994 from undetermined causes. The surviving plant is 1' tall; poor condition with no growth.

1995 The last plant died in 1995. The specific cause was not determined but this species is not adapted to this site.

Entada chrysostachys (Bentham) Drake

DELEP # 91-0015; planted March 1992 (3 plants), March 1996 (1 plant).

Unarmed shrubs or lianas to 12 m with even twice-pinnate leaves and cream-colored flowers in spike-like racemes. *Entada chrysostachys* is native to parts of Malawi, Mozambique, Tanzania, Zambia and Zimbabwe. This accession originated near Hwange, Zimbabwe.

As with the other species of *Entada*, this species performed poorly and the plants gradually declined and died. Plants of this genus do not appear to be adapted to this site.

1992 Plants are 2'-3' tall; fair condition with slow growth and minor to moderate browning of foliage.

1993 1 plant died in 1993 from undetermined causes. The 2 surviving plants are 1'/2.5' tall; poor condition with little or no growth.

1994 Plants are 10"/3' tall; poor condition with slow growth.

1995 Plants are 1.5'/3.5' tall; poor condition but some growth is evident.

1996 1 plant died in 1996 from undetermined causes. The remaining plants are 1'/3.5' tall; poor condition with no apparent

growth.

1997 Both plants died in 1997. No cause was determined. This species does not appear to be adapted to this site.

Enterolobium cyclocarpum Grisebach – ape's ear; guanacaste

DELEP # 89-0412; planted March 1992 (2 plants)

Unarmed trees potentially growing to 30 m tall with even twice-pinnae leaves and white flowers in hemispherical heads. This species produces distinctive, ear-like fruits. The plants are used for timber and woodworking, and it is planted as a shade tree (Allen & Allen, 1981). It can develop into a majestic tree. *Enterolobium cyclocarpum* occurs from southern Mexico through Central America to northern South America. Seeds for this accession originated from cultivated or naturalized trees in Mexico without specific locality.

These plants grew vigorously in the nursery but did poorly in the field with considerable die-back of stems each year. The plants do not appear to be adapted to this site.

1992 Plants 6'/6' tall; fair condition with slow growth.

1993 1 plant died in 1993 from undetermined causes. The surviving plant is 6' tall; fair condition with considerable die-back.

1994 Plant is 7' tall; fair condition with little growth.

1995 Plant is 6.5' tall; fair condition with considerable die-back each year. The plant continues to put out new growth.

1996 Plant is 6.5' tall; fair condition. It is trying to grow.

1997 Plant is 7' tall; poor condition and mostly dead.

1999 Plant died in 1998. The cause was not determined.

Erythrina crista-galli Linnaeus – cockspur coral tree, cock's comb

DELEP # 89-0317; planted March 1992 (1 plant)

Stocky trees to 6+ m tall with trifoliolate leaves that have small prickles, and racemes of large, showy red flowers. The species is cultivated for its showy flowers and is the national tree of Argentina. *Erythrina crista-galli* is native to parts of Argentina, Brazil, Paraguay and Uruguay. Seeds for this accession were donated to DELEP without locality information.

This plant survived its first year but grew little, and died during its second season from undetermined causes. No species of *Erythrina* were found to do well at the Yuma field site. Soil is suspected of being a factor.

1992 Plant is 1' tall; fair condition but little growth.

1993 Plant died in 1993 from undetermined causes.

Erythrina crista-galli Linnaeus – cock's comb

DELEP # 90-0636; planted March 1992 (1 plant)

Stocky trees to 6+ m tall with trifoliolate leaves that have small prickles, and racemes of large, showy red flowers. The species is cultivated for its showy flowers and is the national tree of Argentina. *Erythrina crista-galli* is native to parts of Argentina, Brazil, Paraguay and Uruguay. This accession originated from cultivated plants growing in Los Angeles, California.

As with the other accession of *E. crista-galli*, this plant performed poorly and died during its second season. The species is not adapted to this site.

1992 Plant is 1' tall; fair condition with no growth.

1993 Plant died in 1993 from undetermined causes.

Erythrina lysistemon Hutchinson – lucky bean tree

DELEP # 89-0318; planted March 1992 (2 plants)

Trees to 10 m tall with stems often armed with small prickles. The leaves have 3 distinctly-lobed leaflets. Showy red flowers are produced in racemes at the ends of the twigs. *Erythrina lysistemon* has many uses in traditional medicine and is planted for its showy flowers (Palgrave, 1983). The species is native to parts of Botswana, Democratic Republic of the Congo, Malawi, Mozambique, Swaziland, Tanzania and Zimbabwe. Seeds for this accession were donated to DELEP without locality information.

Both of these plants died during their first season. Plants grown from another accession (91-0011) of this species and planted in 1992 survived for over a decade.

1992 Both plants died in 1992 from undetermined causes.

Erythrina lysistemon Hutchinson – lucky bean tree

DELEP # 91-0011; planted March 1992 (2 plants)

Trees to 10 m tall with stems often armed with small prickles. The leaves have 3 distinctly-lobed leaflets. Showy red flowers are produced in racemes at the ends of the twigs. *Erythrina lysistemon* has many uses in traditional medicine and is planted for its showy flowers (Palgrave, 1983). The species is native to parts of Botswana, Democratic Republic of the Congo, Malawi, Mozambique, Swaziland, Tanzania and Zimbabwe. Seeds for this accession originated from near Masvingo, Zimbabwe.

Among all of the plants of *Erythrina* that were planted at the Yuma field site, these two plants were the only ones that survived beyond their second year. During the 14 years that they survived, they exhibited regular and sometimes severe die-back, followed by healthy new growth. The reason for this was not determined, but it appears that *Erythrina* species do poorly in sandy soil.

1992 Plants are 3'/4' tall; healthy with moderate growth.

1993 Plants are 4'/6' tall; healthy with slow growth.

1994 Plants are 3.5'/7' tall; fair condition with slow growth.

1995 Plants are 5'/7.5' tall; healthy with slow growth but some twig die-back.

1996 Plants are 4.5'/8' tall; fair to good condition with slow growth and some die-back evident.

1997 1 plant is 4' tall; poor condition with some die-back. 1 plant is 8' tall; healthy but with little change in size.

1999 Plants are 4/'8' tall; fair condition with some die-back. New growth is replacing dead stems.

2000 Plants are 4'/8' tall; fair condition with continued die-back and new growth.

2001 Plants are 5'/7' tall; poor condition with ongoing die-back.

2002 Plants are 2'/3' tall; poor condition with considerable die-back.

2004 Plants are 3'/4.5' tall; poor condition with continuing die-back. All species of *Erythrina* planted at this site have performed poorly. The cause has not been determined.

2005 Plants are 2'/3' tall; poor condition with continuing die-back and

subsequent regrowth.

2006 Both plants died in 2006. The cause was not determined. These plants always struggled here with regular die-back.

Erythrina vespertillio Bentham – bat-wing coral tree

DELEP # 89-0316; planted March 1992 (2 plants)

Stout, irregular trees to 6 m tall with prickles on the stems. The leaves have 3, unique, two-lobed leaflets that somewhat resemble the shape of a bat with its wings spread. Showy red flowers are produced in racemes. This species is sometimes grown for it flowers and foliage. *Erythrina vespertillio* has a rather wide distribution in northern and northeastern Australia. Seeds for this accession were donated to DELEP without locality information.

As with other *Erythrina* species, these plants fared poorly and died during their second season. They had thrived in containers but are not adapted to this site.

1992 Plants are 1'/1' tall; fair condition with little growth.

1993 Both plants died during 1993. The cause was not determined but all plants of this genus have done poorly at this site. They may not be adapted to sandy soil.

Erythrina sp.

DELEP # 88-0064; planted March 1992 (1 plant)

Shrubs or trees with trifoliolate leaves. This species was not identified. The seeds originated in Oaxaca, Mexico.

As with other species of *Erythrina*, this plant declined and died. All species of this genus evaluated at this field site exhibited poor performance following planting though they did well in the nursery.

1992 Plant is 1' tall; poor condition with no growth.

1993 Plant died during 1993 from undetermined causes. All plants of this genus have performed poorly here.

Erythrophleum africanum (Welwitsch ex Bentham) Harms – ordeal tree

DELEP # 91-0062; planted March 1994 (3 plants)

Unarmed trees to 12 m tall with odd or even twice-pinnate leaves and racemes of small, cream colored flowers in spike-like racemes. A poison is extracted from this species and the trees produce a gum (Palgrave, 1983). The wood is used in carpentry and to make charcoal (Palgrave, 1983). This species is widespread in central and southern Africa. Seeds for this accession were collected near Hwange National Park, Zimbabwe.

These plants performed poorly, declining and dying during their first or second season. They do not appear to be adapted to the conditions at this site, though they grow in sandy soil in habitat.

1994 2 plants died in 1994 from undetermined causes. The surviving plant is 6" tall; poor condition with no growth.

1995 The last plant died in 1995 from undetermined causes. This species does not appear to be adapted to this site.

Faidherbia albida (Delile) A. Chevalier – apple-ring thorn tree

DELEP # 91-0047; planted March 1992 (2 plants)

Trees to 30 m tall with stout, paired spines at the nodes, even twice-pinnate leaves, and white flowers in hemispherical heads. This species is highly esteemed in some regions of Africa, as crops grow especially well beneath its canopy. The trees have the unusual habit of dropping their leaves during the rainy season, which helps to improve soil fertility beneath the canopy. The fruits are eaten by livestock (NAS, 1979). In some sub-Saharan countries, it was a capital offence to cut down a *Faidherbia* tree (Giffard, 1974). Formerly classified as an *Acacia*, *Faidherbia albida* is the only species in its genus. The species is widely distributed across the Sahel and in eastern Africa as far south as South Africa. Seeds for this accession were collected between Bulawayo and Victoria Falls, Zimbabwe.

These plants exhibited outstanding performance throughout the evaluation. When planted in 1992, they were approximately 45 cm (18") tall, and rapidly became the largest trees in the fields with an upright growth habit and relatively narrow canopy. Root suckers were a maintenance issue, but these may have resulted from shallow roots that were damaged during disking of the field for weed control. The plants may have flowered for one or more years prior to producing fruits, as flowering was during months that the fields were not visited. This species would make an excellent tree for large spaces.

1992 Plants are 6.5'/9' tall; healthy with rapid growth. The plants have minor browsing damage.

1993 Plants are 12'/14' tall, healthy with rapid growth.

1994 Plants are 25'/25' tall; heathy with extremely rapid growth.

1995 Plants are 30'/35' tall, each with a 10" diameter trunk .The plants are healthy and continue to grow rapidly.

1996 Plants are ca. 40'/40' tall; healthy and growing rapidly. These are impressive trees with a beautiful upright growth habit.

1997 Plants are ca. 41'/41' tall; healthy with slow height increase though plants remain vigorous.

1999 Plants are ca. 43'/43' tall; healthy with slow growth.

2000 Plants are 45'/45' tall; healthy with slow height increase. Root suckers grew up to 10' this past year.

2001 Plants are ca. 50'//50' tall with trunks 2' in diameter; healthy with moderate growth. Root suckers are growing each year from damaged roots.

2002 Plants are ca. 50'/50' tall; healthy with little change in height. Root suckers grow to 10' tall in one season.

2004 Plants are ca. 50'/50' tall; healthy with little increase in height. No flowering has been observed on these trees.

2005 Plants are ca. 55'/55' tall; healthy with moderate growth. Root suckers are cut to ground level each year.

2006 Plants are ca. 55'/55' tall; healthy with little increase in height. Both plants flowered and fruited in 2006.

2007 Plants are ca. 55'/55' tall; no apparent freeze damage, healthy but little increase in height. Both plants flowered and fruited.

2008 Plants are ca. 55'/55' tall; healthy with slow growth. Both plant flowered and fruited. Root suckers grow back each year following cutting.

2009 Plants are ca. 60'/60' tall; healthy with moderate to rapid growth. Both plants flowered and fruited.

2013 The western plant is 71' tall with a trunk diameter of 42" and the eastern plant is 67' tall with a trunk diameter of 47". Both trees are in excellent health and produced flowers and fruits each year since 2009.

Guibourtia coleosperma (Bentham) J. Léonard – large false-mopane

DELEP # 91-0017; planted March 1994 (4 plants)

Unarmed trees to 20 m tall with a rounded crown. Leaves have 1 pair of broad, crescent-shaped leaflets. Small white flowers are produced in panicles. The seeds and arils are eaten by people, and the tree produces a valuable timber that is used in carpentry (Palgrave, 1983; Mojeremane and Kopong, 2011). The bark, roots and leaves are used in traditional medicine (Mojeremane and Kopong, 2011). The species is native to parts of Angola, Botswana, Democratic Republic of the Congo, Namibia, Zambia and Zimbabwe. Seeds for this accession were collected near the Victoria Falls Railway Station, Zimbabwe.

These plants fared poorly and all died in their first or second season. They put out little or no growth and do not appear to be adapted to this site. The species grows naturally on deep, sandy soil in a hot climate, so this was surprising.

1994 2 plants died in 1994 from undetermined causes. The 2 surviving plants are 2"/6" tall; poor condition with little growth.

1995 The last 2 plants died in 1995 from undetermined causes. These do not appear to be adapted to this site.

Guibourtia conjugata (Bolle) J. Léonard – small false-mopane

DELEP # 91-0065; planted March 1993 (4 plants)

Unarmed trees to 9 m tall with leaves with 1 pair of leaflets and small, pale yellow flowers in panicles. The wood is hard and heavy, and is used for fence posts and small wooden articles (Palgrave, 1983). *Guibourtia conjugata* is distributed in parts of Mozambique, South Africa, Zambia and Zimbabwe. Seeds for this accession were collected near Hwange, Zimbabwe.

This species performed poorly. The plants struggled for several years with little or no growth and were eventually killed by gophers. They do not appear to be adapted to this site though they occur in deep sandy soil in habitat.

1993 Plants are 6"-2' tall; fair to poor condition with slow growth.

1994 Plants are 1'-1.5' tall; fair condition but little or no new growth.

1995 Plants are 6"-1.5' tall; poor to fair condition with little or no growth.

1996 Plants are 6"-1.5' tall; poor to good condition but no apparent growth.

1997 Plants are 6"-2' tall; poor to fair condition with little growth.

1999 1 plant died in 1998 – killed by gophers. 2 plants are 2" tall; poor condition with gopher burrowing activity. 1 plant is 1'tall; fair condition but with some die-back.

2000 Plants are 2"-1' tall; poor to fair condition with little change in size. Some gopher activity is evident.

2001 1 plant died in 2001 – apparently killed by gophers. The 2 surviving plants are2"/5" tall; poor condition with no growth.

2002 1 plant may still be alive but the other appears dead – apparently killed by gophers.

2004 The last plant died in 2003, perhaps finished off by gophers.

Haematoxylum brasiletto Karsten – brazilwood

DELEP # 89-0029; planted March 1991 (3 plants)

Shrubs or trees to 10 m tall with thorny stems, even once-pinnate leaves with heart-shaped leaflets, and yellow flowers in small racemes. The trunks and larger limbs are exceptionally attractive with deep, fluted, anastomosing ridges. *Haematoxylum brasiletto* has been used since pre-Columbian times as a source of a red dye from the heartwood (Allen and Allen, 1981). It is also used as a histological stain and the wood has antibacterial properties (Allen and Allen, 1981). The wood is extensively cut for fuelwood and burns with a greenish flame. The plants coppice readily following cutting. This species is distributed from northwestern Mexico to Colombia and Venezuela. Seeds for this accession were collected from a cultivated plant growing in Tucson, Arizona.

In spite of the loss of 2 of plants of this accession, this species performed exceptionally well. It suffered only minor damage from the 2007 freeze and recovered the following season. This species has excellent potential as a shrub or small, upright tree in warm-winter areas. The plants produced an abundance of seeds each year from a young age and several plants of this species volunteered adjacent to the parent plants, one of which attained a height of 15' by the time that the study ended..

1991 All 3 plants are 2' tall; healthy with slow growth.

1992 Plants are 1.5'-4.5' tall; healthy with slow to moderate growth. 1 plant flowered and fruited in 1992.

1993 1 plant died in 1993 from undetermined causes. 1 plant is 2' tall; fair condition with little growth. 1 plant is 5' tall; healthy with slow growth. It flowered and fruited 1in 1993.

1994 1 plant is 2' tall; poor condition with low vigor. 1 plant is 7' tall; healthy with slow growth. Flowering and fruiting.

1995 1 plant is 2' tall; healthy but stunted with no growth. 1 plant is 7.5' tall; healthy with slow growth. Flowering and fruiting.

1996 1 plant is 2' tall; fair condition with no growth. 1 plant is 9' tall; healthy with slow growth. Flowering and fruiting.

1997 1 plant is 1' tall; poor condition – declining for unknown reasons. 1 plant is 10' tall; healthy with slow growth. Flowering and fruiting.

1999 1 plant died in 1998 – reason undetermined. This plant was always stunted and may have had root problems. The surviving plant is 10' tall; healthy with little increase in height but canopy is spreading. Flowering and fruiting.

2000 Plant is 11' tall; healthy with slow growth. Flowering and fruiting.

2001 Plant is 13' tall; healthy with slow growth. Flowering and fruiting.

2002 Plant is 13' tall; healthy with little change in size. Flowering and fruiting. Partially shaded by plants to south.

2004 Plant is 14' tall; healthy with slow growth. Flowering and fruiting.

2005 Plant is 15' tall; healthy with slow growth. Flowering and fruiting.

2006 Plant is 14' tall; healthy with no apparent growth. Flowering and fruiting.

2007 Plant is 14' tall; stems froze back 1'-5' from tips to stems 0.5" thick. The plant is healthy with vigorous regrowth. Flowering and fruiting.

2008 Plant is 16' tall; healthy with slow growth and fully recovered from 2007 freeze. Flowering and fruiting.

2009 Plant is 16' tall; healthy with little size increase. Flowering and fruiting.

2013 Plant is 17' tall; healthy with slow growth. It has flowered and fruited each year since 2009.

Haematoxylum brasiletto Karsten – brazilwood

DELEP # 89-0061; planted March 1992 (3 plants)

Shrubs or trees to 10 m tall with thorny stems, even

once-pinnate leaves with heart-shaped leaflets, and yellow flowers in small racemes. The trunks and larger limbs are exceptionally attractive with deep, fluted, anastomosing ridges. *Haematoxylum brasiletto* has been used since pre-Columbian times as a source of a red dye from the heartwood (Allen and Allen, 1981). It is also used as a histological stain and the wood has antibacterial properties (Allen and Allen, 1981). The wood is extensively cut for fuelwood and burns with a greenish flame. The plants coppice readily following cutting. This species is distributed from northwestern Mexico to Colombia and Venezuela. Seeds for this accession originated near Urique, Chihuahua, Mexico.

This accession performed exceptionally well with only minor damage from the 2007 freeze. *Haematoxlyum brasiletto* has excellent potential as a shrub or small, upright tree in warm-winter areas.

1992 Plants are 1.5'-3' tall; healthy with slow to moderate growth.
1993 Plants are 4'-7' tall; healthy with moderate to fast growth. All flowered and fruited in 1993.
1994 Plants are 6.5'-9' tall; healthy with slow to moderate growth. All flowered and fruited.
1995 Plants are all ca. 10' tall; healthy with slow to moderate growth. All flowered and fruited.
1996 Plants are 10'-13' tall; healthy with slow to moderate growth. All flowered and fruited.
1997 Plants are 12'-14' tall; healthy with slow growth. All flowered and fruited. These plants are have an attractive upright form and sculptural trunks and limbs.
1999 Plants are 11'-14' tall; healthy with little change in size over the past year. All flowered and fruited.
2000 Plants are 14'-18' tall; healthy with moderate growth. All flowered and fruited.
2001 Plants are 14'-19' tall; healthy with slow growth. All flowered and fruited.
2002 Plants are 14'-22' tall; healthy with slow to moderate growth. All flowered and fruited.
2004 1 plant is 25' tall; poor condition, most trunks appear to be dead . The cause has not been determined. No evidence of gophers was noted. 2 plants are16'/18' tall; healthy with slow growth. Flowering and fruiting on the 2 healthy plants only.
2005 1 plant is 25' tall; fair condition. 2 plants are15'/18' tall; healthy with slow growth. All 3 plants flowered and fruited.
2006 Plants are 13'/15'/19' tall; all appear healthy now but little apparent growth. All flowered and fruited.
2007 Plants are 13'/15'/19' tall; stems froze back 1'-2' from stem tips; healthy with rapid recovery. All flowered and fruited.
2008 Plants are 16'/16'/22' tall; healthy with slow growth and a full recovery from the 2007 freeze. All flowered and fruited.
2009 Plants are 17'/18'/23' tall; healthy with slow growth. All flowered and fruited.
2013 Plants are 18'/21'/25' tall; healthy with slow growth. All flowered and fruited each year since 2009.

Haematoxylum *species nova* – brasil chino

DELEP # 96-0094; planted February 1996 (2 plants)

Shrubs to at least 5 m tall with thorny stems, even once pinnate leaves with tiny leaflets, and small yellow flowers that are solitary or in compact racemes. The trunk and limbs of this species develop low ridges but do not become deeply fluted as in *H. brasiletto*. As of this writing, this species has not been formally named. It is apparently endemic to southeastern Sonora, Mexico in the vicinity of Alamos, where seeds of this accession originated.

These plants performed quite well after they became established. During their first several years they grew very little. They were undamaged by the 2007 freeze. The plants are attractive and would make interesting landscape subjects.

1997 Plants are 3'/3.5' tall; healthy with slow growth.
1999 Plants are 3'/3.5' tall; healthy but with little apparent growth.
2000 Plants are 3'/3.5' tall; healthy but no increase in size.
2001 Plants are 3.5'/5' tall; healthy with slow growth. The larger plant flowered and fruited in 2001.
2002 Plants are 3.5'/5' tall; healthy with little change in size. The larger plant flowered and fruited.
2004 Plants are 6.5'/8' tall; healthy with slow growth. Both flowered and fruited.
2005 Plants are 8.5'/10' tall; healthy with slow growth. Both flowered and fruited.
2006 Plants are 7'/9' tall; healthy but with no apparent growth. Both flowered and fruited.
2007 Plants are 8'/10' tall; healthy with slow growth, no apparent freeze damage. Both flowered and fruited.
2008 Plants are 9'/10' tall; healthy with slow growth. Both flowered and fruited.
2009 Plants are 10'/13' tall; healthy with slow to moderate growth. Both flowered and fruited.
2013 Plants are 11'/14' tall; healthy with slow growth. Both plants flowered and fruited each year since 2009.

Harpalyce arborescens A. Gray

DELEP # 93-0130; planted February 1996 (2 plants)

Unarmed shrubs or trees to 5 m tall with odd once-pinnate leaves and pink flowers in racemes. This species is native to parts of central and southeastern Mexico. Seeds for this accession were collected from a cultivated tree growing as Weslaco, Texas.

Both plants died during their first season, though they appeared healthy when planted. These may not be adapted to sandy soil.

1997 Both plants died during 1996 from undetermined causes.

Havardia sonorae (S. Watson) Britton & Rose – Sonoran ebony

[*Pithecellobium sonorae* S. Watson]

DELEP # 89-0066; planted March 1992 (4 plants)

Shrubs or trees to 7 (12) m tall with painfully sharp, paired spines on stems, even twice-pinnate leaves, and white flowers in hemispherical heads. With its thicket-forming habit and unpleasant spines, this species would make an effective barrier plant. *Havardia sonorae* occurs in thornscrub habitats in Sonora and Sinaloa, Mexico. Seeds for this accession were collected south of Navojoa, Sonora.

In spite of the loss of one plant during its second year, this species performed well. A second plant remained a low, sprawl-

ing shrub but two plants developed into attractive trees after the lower stems were pruned away. This species appears to be hardy to at least the mid-upper teens F.

1992 Plants are 1'-3.5' tall; healthy with slow to moderate growth.
1993 1 plant died in 1993 from undetermined causes. The 3 surviving plants are 4'-7' tall; healthy with moderate growth. 1 plant flowered and fruited in 1993.
1994 Plants are 3'-9' tall; healthy with slow growth. All flowered and fruited.
1995 Plants are 7.5'-10' tall; healthy with slow to moderate growth. All flowered and fruited.
1996 1 plant is 7' tall; healthy but it has remained a ground-hugging thicket. 2 plants are 11'/12' tall; healthy with slow growth and developing a tree form. All flowered and fruited.
1997 Plants are 10'-14' tall; healthy with slow to moderate growth. The two larger plants flowered and fruited.
1999 Plants are 8'-15' tall; healthy with slow growth. All flowered and fruited.
2000 1 plant is 6' tall; healthy, a mass of intertwined stems. The plant was heavily pruned. 2 plants are 14'/15' tall healthy with little increase in height. Pruned to reveal attractive bark. All flowered and fruited.
2001 1 plant is 6' tall; healthy but still a twisted mass of slender stems. 2 plants are 17'/22' tall healthy with moderate to rapid growth. All flowered and fruited.
2002 Plants are 8'/18'/23' tall; healthy with slow growth. All flowered and fruited.
2004 1 plant is 7' tall; healthy but with little growth . This plant appears to be permanently dwarfed. 2 plants are 19'/22' tall; healthy with slow growth. All flowered and fruited.
2005 Plants are 6.5'/19'/23' tall; healthy with slow growth. All flowered and fruited.
2006 Plants are 8'/20'/22' tall; healthy but with little apparent growth. 2 larger plants only flowered and fruited.
2007 Plants are 7'/20'/22' tall; no freeze damaged, healthy with little change in size. 2 larger plants flowered and fruited.
2008 Plants are 8'/23'/25' tall; healthy with slow to moderate growth. 2 larger plants flowered and fruited.
2009 Plants are 9'/24'/25' tall; healthy with slow growth. 2 larger plants flowered and fruited.
2013 Plants are 9'/25'/28' tall; healthy with slow growth. Smallest plant is still a thicket. Flowering and fruiting on 2 larger plants only.

Inga feuillei de Candolle – pacay

No DELEP accession number; planted March 1994 (2 plants)

Unarmed trees to 18+ m all with odd once-pinnate leaves and umbels of flowers with long white stamens. The species is cultivated for the edible pulp of its fruits and the trees are grown for shade. The species ranges from Central America to northwestern South America as least as far south as Peru. These were received as a donation of live plants to DELEP.

This species declined and died following planting and does not appear to be adapted to this site. It is reported to grow in Phoenix, Arizona with sufficient irrigation and protection.

1994 1 plant died in 1994 from undetermined causes. The surviving plant is 1.5' tall; poor condition with no growth.
1995 The second plant died in 1995. The cause was not determined but this species does not appear to be adapted to this site.

Leucaena lanceolata S. Watson var. ***lancecolata***

DELEP # 89-0032; planted March 1991 (1 plant), March 1992 (1 plant)

Unarmed trees to 13 m tall with even twice-pinnate leaves and white or pale yellow flowers in spherical heads. This variety is distributed along the Pacific slope of Mexico from Sonora to Chiapas, and is also found in Baja California Sur and Vera Cruz. This accession originated near Alamos, Sonora.

Initially, these plants exhibited excellent performance. The only significant problem noted were limbs that broke under high winds. Wood of this species is weak and brittle. One plant died in 2004 from undetermined causes. The surviving plant was severely damaged during the 2007 freeze, but exhibited vigorous recovery before dying in 2008 from undetermined causes.

1991 Plant is 6' tall; healthy with rapid growth. The plant flowered and fruited in the autumn of 1991.
1992 Plants are 5'/8' tall; healthy with rapid growth. Both plants flowered and fruited.
1993 Plants are 10'/14' tall; healthy with rapid growth. Both flowered and fruited.
1994 Plants are 15'/20' tall; healthy with rapid growth. Both flowered and fruited.
1995 Plants are 15'/18' tall; healthy with vigorous growth but little increase in height Both flowered and fruited.
1996 Plants are 18'/21' tall; healthy with moderate growth. Both flowered and fruited.
1997 Plants are 20'/25' tall; healthy with slow ot moderate growth. Both flowered and fruited.
1999 Plants are 20'/25' tall; heathy but little height increase. Both flowered and fruited.
2000 Plants are 20'/25' tall with little change in size. This species has brittle stems that are prone to break in winds. Both flowered and fruited.
2001 Plants are 27'/30' tall; healthy with moderate to rapid growth. Both flowered and fruited.
2002 Plants are 27'/30' tall; healthy with little change in size. Both flowered and fruited.
2004 The smaller plant died in 2004 for undetermined reasons. The larger plant is 30' tall; healthy with slow growth. It flowered and fruited.
2005 Plant is 27' tall; healthy with little increase in size. Flowering and fruiting.
2006 Plant is 27' tall; healthy but with little growth. Flowering and fruiting.
2007 Plant is 27' tall; it suffered major freeze damage with stems freezing back to 20' from the tips, to limbs 5" thick. It subsequently produced healthy, rapid growth. No flowering in 2007.
2008 The plant died in 2008 from undetermined causes. It has been recovering well from the 2007 freeze.

Leucaena leucocephala (Lamarck) de Wit – white lead tree; guaje

DELEP # 89-0031; planted March 1991 (2 plants)

Unarmed trees to 20 m tall, with feathery, even twice-pinnate leaves and white flowers in spherical heads. White lead tree is widely introduced and naturalized in tropical and subtropical regions around the world where it sometimes becomes an invasive weed. It is extensively planted for wood, reforestation, erosion control and also for livestock fodder (NAS, 1977; Allen

and Allen, 1981). The species is thought to have originated in southern Mexico. Seeds of this accession originated near Todos Santos, Baja California Sur, Mexico.

This species performed very well. The only significant problem encountered was the heavy seed production that resulted in thousands of volunteer seedlings in the field. This species became a serious weed that required considerable effort to control. With its rapid growth, plants could quickly become sizeable plants.

1991 Plants are 10'/10' tall; healthy with rapid growth. Both plants flowered and fruited in the autumn of 1991.
1992 Plants are 15'/15' tall; healthy with rapid growth. Both flowered and fruited.
1993 Plants are 20'/20' tall; healthy with rapid growth. Both flowered and fruited.
1994 Plants are ca. 30'/30' tall; healthy with very rapid growth. Both flowered and fruited.
1995 Plants are ca. 30'/30' tall; healthy with little increase in height. Both flowered and fruited.
1996 Plants are ca. 30'/30' tall; healthy with little height increase. Both flowered and fruited.
1997 Plants are ca. 32'/35' tall; healthy with some size increase. Both flowered and fruited. Seedlings volunteering in the field are a problem.
1999 Plants are ca. 30'/30' tall; healthy but little height increase. Both flowered and fruited.
2000 Plants are ca. 30'/30' tall; healthy with little change in size. Both flowered and fruited.
2001 Plants are ca. 35'/35' tall; healthy with rapid growth during the past year. Both flowered and fruited. Numerous volunteer seedlings are a major problem.
2002 Plants are ca. 40'/40' tall; healthy with rapid growth. Both flowered and fruited.
2004 Plants are ca. 40'/40' tall; healthy with little change in height. Both flowered and fruited.
2005 Plants are ca. 40'/40' tall; healthy with little change in size. Both flowered and fruited.
2006 Plants are ca. 40'/40' tall; healthy but little height increase. Both flowered and fruited.
2007 Plants are ca. 40'/40' tall; no apparent freeze damage, heathy but little growth. Both flowered and fruited.
2008 Plants are ca. 40'/40' tall; healthy with little apparent change in size. Both flowered and fruited.
2009 Plants are ca. 45'/45' tall; healthy with rapid growth in the past year. Both flowered and fruited.
2013 West tree is 54' tall with a trunk diameter of 23.5"/east tree is 51' tall with a trunk diameter of 33.5". Both plants are healthy and continued to flower and fruit each year since 2009. Volunteer seedlings are still a problem.

Leucaena pulverulenta (Schlechtendal) Bentham – great lead tree

DELEP # 90-0382; planted March 1992 (2 plants)

Unarmed trees to 15 m tall with feathery, even twice-pinnate leaves and flowers in spherical heads. It is occasionally planted as a shade tree in areas where it is native, and has been used for fence posts (Vines, 1960). It has been used in folk medicine (Alcorn, 1984). *Leucaena pulverulenta* is native to extreme southern Texas and parts of eastern Mexico. Seeds for this accession were collected near Brownsville, Texas.

This species performed well throughout the trial period, but was never observed to flower or fruit. The reason for this was not determined.

1992 1 plant is 1' tall; fair condition due to severe browsing. 1 plant is 4' tall; healthy with moderate growth. It had minor browsing.
1993 Plants are 4'/6' tall; healthy with moderate growth. Some browsing.
1994 Plants are 7.5'/9.5' tall; healthy with moderate growth.
1995 Plants are 9'/10' tall; healthy with slow height increase though they remain vigorous.
1996 Plants are 12'/13' tall; healthy with moderate growth.
1997 Plants are 14'/15' tall; healthy with slow growth. No evidence of flowering.
1999 Plants are 15'/15' tall; healthy with slow growth.
2000 Plants are 18'/18' tall; healthy with moderate growth.
2001 Plants are 20'/20' tall; healthy with slow growth. No evidence of flowering.
2002 Plants are 20'/20' tall; healthy but with little change in size.
2004 Plants are 25'/25' tall; healthy with moderate growth. No flowering has been observed on these plants.
2005 Plants are 25'/25' tall; healthy with little change in size. No evidence of flowering.
2006 Plants are 22'/25' tall; healthy with little apparent growth. No flowering.
2007 Plants are 22'/25' tall; no freeze damage, healthy but little change in size.
2008 Plants are ca. 30'/30' tall; healthy with substantial growth in the past year.
2009 Plants are ca.30'/35' tall; healthy with size increasing. No evidence of flowering.
2013 West tree is 37' tall/east tree is 26' tall; both are healthy but have never been observed to flower at this site.

Lonchocarpus hermannii M. Sousa - nesco

DELEP # 90-0023; planted March 1992 (3 plants), January 1994 (3 plants)

Unarmed trees to 15 m tall with odd once-pinnate leaves and racemes of showy pale purple flowers. The wood is used in construction. The roots have been used as a fish poison and to treat parasites in livestock (Felger et al, 2001). Honey from the nectar of this species is reportedly poisonous (Felger et al, 2001). Native to the Pacific slope of western Mexico from Chihuahua and Sonora to Jalisco. Seeds of this accession were collected near Alamos, Sonora.

Though initially slow growing, this species performed well and sustained minimal damage during the 2007 freeze. It produces masses of flowers in the late spring and would make an attractive addition to the landscape palette for warm-winter locations.

1992 Plants are 6"-1.5' tall; healthy with slow growth.
1993 Plants are 3'/3'/3' tall; healthy with slow growth.
1994 Plants range from 1'-7' tall; healthy with slow to moderate growth.
1995 Plants are 1'-9' tall; healthy with slow growth.
1996 Plants are 1'-10' tall; healthy with slow growth.
1997 Plants are 1'-14' tall; fair to good health with slow to moderate growth. 2 plants flowered in 1996.
1999 Plants are 2'-15' tall; fair to good health with slow growth. 3 plants

flowered and fruited.
2000 Plants are 2'-18' tall; fair to good health with slow to moderate growth. 4 plants flowered and fruited.
2001 Plants are 2'-20' tall; healthy with slow growth. 3 plants flowered and fruited.
2002 Plants are 2'-20' tall; healthy with little change in size. 3 plants flowered and fruited.
2004 Plants are 3'-26' tall; healthy with slow to moderate growth. 3 plants flowered and fruited.
2005 Plants are 3'/10'/14'/15'/17'/20' tall; healthy with little change in size. 4 plants flowered and fruited.
2006 Plants are 3'/12'/15'/17'/19'/22' tall; healthy with slow growth. 5 plants flowered and fruited.
2007 Plants are 1.5'/12'/15'/17'/19/22' tall; some stems froze back to 1' from tips and only minor damage to foliage. The plants are healthy. 4 plants flowered and fruited.
2008 Plants are 2'/12'/15'/18'/18'/30' tall; healthy with substantial growth on the largest tree. 4 plants flowered and fruited.
2009 Plants are 6'/14'/15'/25'/25'/35' tall; healthy with moderate to rapid growth in the past year. 4 plants flowered and fruited.
2013 Plants are 15'/16'/20'/20'/25'/35' tall; healthy with most plant growing slowly. 5 plants flowered and fruited.

Lysiloma candidum Brandegee – palo blanco
DELEP # 91-0249; planted March 1993 (6 plants)

Unarmed trees to 10+ m tall with even twice-pinnate leaves and white flowers in spherical heads. The distinctive bark of this species is smooth and dull white, providing an attractive contrast with the blue green foliage. *Lysiloma candidum* is native to the southern half of the Baja California peninsula and a small area on the coast of Sonora, Mexico. This accession originated west of Santa Rosalia, Baja California Sur.

Following establishment, this species performed exceptionally well for many years At least 2 plants appear to have been killed by scorching during a fire set to control weeds. Another plant appears to have been killed by the 2007 freeze. Several seedlings of *L. candidum* volunteered in the fields and persisted through the end of the field trails. Information on flowering and fruiting is underreported here as the plants flower in the summer and fruits are shed prior to the usual winter work trips to the field site. This species is a beautiful tree with potential for wider planting in near frost-free regions.

1993 Plants are 2'-7' tall; healthy with moderate to rapid growth.
1994 1 plant died from undetermined causes in 1994. The 5 surviving plants are 4'-10' tall; healthy with moderate growth.
1995 Plants are 5'-13' tall; healthy with slow to moderate growth.
1996 Plants are 6'/17' tall; healthy with slow to moderate growth.
1997 Plants are 7.5'-15' tall; healthy with slow growth. No evidence of flowering.
1999 Plants are 8'/20'/20'/20'/20' tall; healthy with slow to rapid growth.
2000 Plants are 8.5'/24'/24'/24'/24' tall; healthy with slow to moderate growth. The small plant may have root problems.
2001 Plants are 10'/ca. 25'/25'/25'/25' tall; healthy with slow growth. Several of the larger plants flowered and fruited.
2002 1 plant is 10' tall; healthy with little increase in size. 4 plants are ca. 30' tall; healthy with moderate growth. Perhaps some flowering and fruiting during the summer.
2004 1 plant appears to have died in 2004 following fire scorching. 1 plant is 30' tall; poor condition with top mostly dead and stems sprouting from base – possibly damaged by fire.1 plant is 10' tall; fair condition with little growth – possibly J-rooted when panted. 2 plants are ca. 30'/30' tall; healthy but with little change in size (no fire damage). These 2 plants flowered and fruited.
2005 1 plant died in 2005, possibly from fire damage. The 4 surviving plants are 10'/12'/35'/35' tall; healthy with slow growth.
2006 1 plant is ca. 30' tall; fair condition with little growth. 3 plans are 11'/12'/30' tall; healthy but with little apparent growth. No evidence of flowering this year.
2007 These plants exhibited highly variable responses to the freeze. 2 plants 10'/30' tall were killed. 1 plant 12' tall froze to the base with stems to 4" thick killed. It has vigorous regrowth. 1 plant 30' tall is healthy with no apparent freeze damage.
2008 The 30' tall plant died from undetermined causes. This does not appear to be related to the 2007 freeze or fire. The surviving plant is 15' tall; healthy with rapid growth following the 2007 freeze.
2009 Plant is 12' tall; apparently healthy but little growth.
2013 Plant is 14' tall; fair condition with slow growth.

Lysiloma divaricatum (Jacquin) J.F. MacBride – mauto
DELEP # 89-0067; planted March 1991 (4 plants)

Unarmed trees to 20 m tall with even twice-pinnate leaves and white flowers in spherical heads. The wood is valued for construction, grape stakes, fuelwood, and is used in tanning (Felger et al, 2001). This species is widespread from northwestern Mexico to Costa Rica and in parts of eastern Mexico. Seeds of this accession were collected near Guaymas, Sonora.

Plants of this accession performed well though grew slowly. The species has potential for landscaping and shade. The plants are attractive with their feathery foliage.

1991 Plants are 2//2'/2'/2' tall; healthy with slow growth.
1992 Plants are 1.5'-2.5' tall; little or slow growth.
1993 Plants are 1-'3' tall; fair to good condition with slow growth. Some browsing is evident.
1994 Plants are 1.5'-5' tall; healthy with slow to moderate growth.
1995 Plants are 2'-6' tall; healthy with slow growth. 1 plant flowered and fruited in 1995.
1996 Plants are 2'-7.5' tall; healthy with slow growth. 2 plants flowered and fruited.
1997 Plants are 2'-8' tall; fair to good condition with slow growth. 2 plants flowered and fruited.
1999 Plants are 4'-11' tall; fair to good condition with slow growth.3 plants flowered and fruited in 1999.
2000 Plants are 6.5'-13' tall; fair to good condition with slow to moderate growth. 3 plants flowered and fruited.
2001 Plants are 7'-12' tall; healthy with slow growth. 3 plants flowered and fruited.
2002 Plants are 8'-12' tall; healthy with slow growth. 3 plants flowered and fruited.
2004 Plants are 11'-15' tall; healthy with slow growth. All 4 plants flowered and fruited
2005 Plants are 11'/12'/13'/15' tall; healthy with little change in size. All flowered and fruited.
2006 Plants are 12'/14'/16'/16' tall; healthy with slow growth. All flowered and fruited.
2007 Plants are 10'/12'/17'/20' tall; stems from back to 1' from tips, healthy with slow to moderate growth. All flowered and fruited.

2008 Plants are 13'/15'/15'/15' tall; healthy with slow growth. Recovered from 2007 freeze. All flowered and fruited.
2009 Plants are 15'/18'/20'/20' tall; healthy with moderate to rapid growth. All flowered and fruited.
2013 Plants are 18'/20'/22'/22' tall; healthy with slow growth. All flowered and fruited each year since 2009.

Mariosousa coulteri (Bentham) Seigler & Ebinger – Coulter's acacia

[*Acacia coulteri* Bentham]

DELEP # 94-0141; planted December 1995 (2 plants)

Unarmed trees to at least 10 m tall with ferny, twice-pinnate leaves and white flowers in rounded heads. Native to northeastern Mexico. Seeds for this accession originated between Linares and Iturbide, Nuevo León, Mexico.

This species performed quite well but grew slowly. Fruit production was sparse. It has potential as a landscape tree and is likely sufficiently cold-tolerant to survive in many areas of Phoenix and Tucson.

1996 Plants are 4.5'/5' tall; healthy with moderate growth.
1997 Plants are 5'/6' tall; healthy with slow growth.
1999 Plants are 5'/6' tall; healthy but with little apparent growth in the past 2 years.
2000 Plants are 5'/6' tall; healthy but there has been little or no growth.
2001 Plants are 6'/6.5' tall; healthy with slow growth.
2002 Plants are 6'/6.5' tall; healthy but with little growth
2004 Plants are 6'/7.5' tall; healthy with slow growth.
2005 Plants are 6'/7.5' tall; healthy but with no apparent growth in the past year.
2006 Plants are 7'/7.5' tall; healthy with slow growth.
2007 Plants are 7'/7.5' tall; healthy with no freeze damage but with little change in size.
2008 Plants are 7.5'/8' tall; healthy with slow growth. Larger plant flowered and produced fruit.
2009 Plants are 8'/8.5' tall; healthy with slow growth. Both are flowering and fruiting.
2013 Plants are 10'/12' tall; healthy with slow growth. Both are flowering and fruiting.

Mariosousa willardiana (Rose) Seigler & Ebinger – palo blanco

[*Acacia willardiana* Rose]

DELEP # 89-0143; planted March 1992 (6 plants), planted January 1994 (1 plant).

Slender unarmed trees to 10 m tall with an open canopy, distinctive, white, papery bark peeling in sheets, long phyllode-like petioles with one or two pairs of pinnae, and white flowers in cylindrical racemes. Native to western Sonora and extreme northwestern Sinaloa, Mexico. Seeds for this accession were collected from cultivated trees on the University of Arizona campus in Tucson.

With the exception of 2 plants that died as young transplants, this species performed exceptionally well. These are striking, uniquely distinctive small trees for limited spaces. They are sufficiently hardy to survive in warmer areas of Phoenix and Tucson.

1992 1 plant died during 1992 – the cause was undetermined. 1 plant is 8" tall; poor condition due to severe browsing. 4 plants are 6'-9' tall; healthy with rapid growth.
1993 The plant that suffered severe browsing the previous year died during 1993. The 4 surviving plants are 8-10' tall; healthy with slow to moderate growth.
1994 The replacement plant is 5' tall; healthy with rapid growth. 4 original plants are 8'-13' tall; healthy with slow to moderate growth.
1995 5 plants are 8'-17' tall; healthy with moderate to rapid growth. 1 plant flowered in 1995.
1996 5 plants are 10'-18' tall; healthy with slow growth. Plants are flowering and perhaps fruiting, but no fruits were found as these are quickly deciduous.
1997 5 plants are 13'-18' tall; healthy with slow growth. Flowering but no evidence of fruit production.
1999 5 plants are 12'-20' tall; healthy with slow growth. Apparently flowering but no fruits found.
2000 5 plants are 13'-20' tall; healthy with little or no height increase. The plants may be flowering and fruiting.
2001 Plants are 16'-22' tall; healthy with slow to moderate growth. At least some plants are flowering and fruiting.
2002 Plants are 16'-25' tall; healthy with slow to moderate growth. Some plants are flowering and fruiting.
2004 1 plant appears to have been killed top killed by fire and has new stems to 3' tall emerging from the base. 4 plants are 18'-25' tall; healthy with slow growth. Some plants are flowering and fruiting.
2005 Plants are 7'/16'/20'/25'/25' tall; healthy with moderate growth on the fire-damaged plant and little growth on the others. Some plants are flowering and fruiting.
2006 Plants are 8'/17'/20'/20'/22' tall; healthy with little change in size. Some flowering and fruiting.
2007 Plants are 9'/16'/20'/20'/22' tall; no freeze damage, healthy with little apparent growth. No evidence of flowering or fruiting this year.
2008 Plants are 11'/20'/25'/25'/25' tall; healthy with significant growth in the past year.
2009 Plants are 13'/25'/25'/25'/25' tall; healthy with little growth on all but 1 plant. 1 plant is flowering and fruiting.
2013 Plants are18'/23'/30'/30'/33' tall; healthy with slow growth. No flowering evident.

Mimosa palmeri Rose - chopo

DELEP # 90-0022; planted March 1992 (3 plants)

Briar-like shrubs or small trees to 7 m tall, armed with recurved prickles along stems. Leaves are even twice-pinnate. Pink flowers in cylindrical spikes that are produced in panicle-like branches at the ends of the stems. The wood of *M. palmeri* is valued for tool handles and fence posts, and for making charcoal (Felger et al, 2001). The bark is chewed for hardening the gums and a medicinal tea is made from the bark (Felger et al, 2001). The species is distributed from central Sonora to central Sinaloa, Mexico. This accession originated near Alamos, Sonora.

These plants performed well and only one of the plants sustained any damage from the 2007 freeze. The masses of flowers are attractive.

1992 Plants are all 6.5' tall; healthy with moderate to rapid growth.
1993 Plants are 7'-9' tall; healthy with slow to moderate growth. All flowered and fruited in 1993.
1994 Plants are 7.5'-11' tall; healthy with slow growth. All flowered and fruited.

1995 Plants are 10’-13’ tall; healthy with slow to moderate growth. All flowered and fruited.
1996 Plants are 11’-15’ tall; healthy with slow growth. All flowered and fruited.
1997 Plants are 12’-15’ tall; healthy with slow growth. All flowered and fruited.
1999 Plants are 14’-17’ tall; healthy with slow growth. All flowered and fruited.
2000 Plants are 14’-17’ tall; healthy with little increase in size. All flowered and fruited.
2001 Plants are 15’-18’ tall; healthy with slow growth. All flowered and fruited abundantly in 2001.
2002 Plants are 15’-20’ tall; healthy with slow growth. All flowered and fruited.
2004 Plants are 15’-20’ tall; healthy with little change in size. All flowered and fruited.
2005 Plants are 15’/18’/20’ tall; healthy with little increase in size. All flowered and fruited.
2006 Plants are 15’/15’/15’ tall; healthy but no apparent growth. All flowered and fruited.
2007 2 plants are 15’/16’ tall; no apparent freeze damage, healthy. 1 plant is 18’ tall; stems froze back to 4’ from tips, healthy and recovering. All flowered and fruited.
2008 Plants are 16’/17’/20’ tall; recovered from 2007 freeze, healthy with slow growth. All flowered and fruited.
2009 Plants are 16’/17’/20’ tall; healthy with little change in size. All flowered and fruited.
2013 Plants are 18’/18’/20’ tall; healthy with slow growth. All flowered and fruited each year since 2009.

Mimosa xanti A. Gray – Xantus’ mimosa

DELEP # 89-0038; planted March 1991 (2 plants)

Sprawling, briar-like shrubs or rarely small trees to 5 m tall. The stems are armed with recurved prickles and have even twice-pinnate leaves. Pink flowers are produced in spherical heads. Apparently endemic to the Cape Region of Baja California Sur, Mexico. This accession originated north of Cabo San Lucas, Baja California Sur.

Overall, this species performed well. Both plants were killed to the base during the 2007 freeze but recovered well. Flowering was sporadic. This species would make an effective barrier plant.

1991 Plants are 1.5’/2’ tall; healthy with slow growth and a spreading growth habit.
1992 Plants are 2.5’/6’ tall; healthy with slow to moderate growth.
1993 Plants are 5’/8’ tall; healthy with slow to moderate growth.
1994 Plants are 6.5’/9’ tall; healthy with slow growth.
1995 Plants are 8’/8’ tall; healthy with slow to moderate growth. These plants have formed sprawling thickets. Both flowered and fruited in 1995.
1996 Plants are 10’/12’ tall; healthy with slow to moderate growth. Both plants flowered and fruited.
1997 Plants are 9’/11’ tall; healthy with slow growth. Both flowered and fruited .
1999 Plants are 10’/11’ tall; healthy with little height increase. Both flowered and fruited.
2000 Plants are 10’/12’ tall; healthy with little change in size. Both flowered and fruited.
2001 Plants are 6’/9’ tall; fair to good condition. Both plants are smaller due to heavy pruning to remove *Baccharis* shrubs that were growing within these plants. Bot flowered and fruited.
2002 Plants are 6’/9’ tall; healthy but little apparent growth. 1 plant flowered and fruited.
2004 Plants are 8’/9’ tall; healthy with slow growth. 1 plant flowered and fruited.
2005 Plants are 8’/9’ tall; healthy with little change in size. 1 plant flowered and fruited.
2006 Plants are 7’/8’ tall; healthy with no apparent growth. Both flowered and fruited.
2007 Plants are 5’/7’ tall; stems killed to base of plant with stems to 2” thick killed. Healthy regrowth during the year. No flowering in 2007.
2008 Plants are 6’-9’ tall; healthy with slow to moderate growth. Recovered from the 2007 freeze. No flowering.
2009 Plants are 7’/8’ tall; healthy with little change in size. No flowering.
2013 Plants are 8’/8’ tall; healthy but with little additional growth. 1 plant flowered and fruited in 2013.

Mimosa sp.

No accession number assigned; planted March 1994 (2 plants)

Open, rangy shrubs to at least 4 m tall with recurved prickles along stems, even twice-pinnate leaves and pale pink flowers in cylindrical spikes. The origin of these plants is not recorded.

Overall, these plants performed well. They suffered some stem damage from high winds and eventually reached a stable size. They were undamaged by the 2007 freeze.

1994 Plants are 6’/6’ tall; healthy with moderate growth.
1995 Plants are 8’/8’ tall; healthy with moderate growth. Both plants flowered and fruited n 1995.
1996 Plants are 9/10’ tall; healthy with slow growth. Both flowered and fruited.
1997 Plants are 10’/10’ tall; healthy with slow growth. Both flowered and fruited.
1999 Plants are 10’/11’ tall; healthy with slow growth. Both flowered and fruited.
2000 Plants are 10’/12’ tall; healthy with slow growth. Both flowered and fruited. Several volunteer seedlings nearby.
2001 Plants are 8’/11’ tall; healthy but somewhat smaller due to broken stems. Both flowered and fruited.
2002 Plants are 8’/11’ tall; healthy with little or no growth. Both flowered and fruited.
2004 Plants are 8’/11’ tall; healthy with no apparent change in size. Both flowered and fruited.
2005 Plants are 8’/11’ tall; healthy but with no change in size. Both flowered and fruited.
2006 Plants are 12’/14’ tall; healthy with moderate growth. Both flowered and fruited.
2007 Plants are 10’/11’ tall; no freeze damage, healthy but with no apparent growth. Bot flowered and fruited.
2008 Plants are 11’/12’ tall; healthy with slow growth. Both flowered and fruited.
2009 Plants are 12’/13’ tall; fair condition with slow growth. Both plants appear stressed. No flowering observed.
2013 Plants are 11’/13’ tall; healthy with little change in size. These still appear stressed and have flowered erratically since 2009.

Mundulea sericea (Willdenow) A. Chevalier – cork bush

DELEP # 91-0072; planted March 1992 (4 plants)

Unarmed, multiple-stemmed shrubs to 3 m or rarely small trees to 5 m tall with glossy, odd once-pinnate leaves and

purple pea-like flowers in racemes. *Mundulea sericea* is used for insecticide and as a fish poison (Allen & Allen, 1981). The foliage is grazed by livestock (Palgrave, 1983). The plant has a variety of uses in traditional medicine (Palgrave, 1983). This species has an extensive distribution through much of sub-Saharan Africa. Seeds for this accession were collected near Hwange, Zimbabwe.

This species performed well until killed by gophers. Cork bush would make an attractive addition to the landscape palette for nearly freeze-free areas. Cold tolerance has not been adequately evaluated, but plants from this accession were killed by winter freezing in DELEP's Tucson field site.

1992 Plants are 2'-3' tall; healthy with slow to moderate growth.
1993 Plants are 2.5'-5'5' tall; healthy with slow to moderate growth. All 4 plants flowered in 1993 and 1 plant produced fruits.
1994 Plans are 3'-5' tall; healthy with slow growth. All flowered and fruited.
1995 Plants are 3.5'-7' tall; healthy with slow growth. All flowered and fruited.
1996 2 plants were killed by gophers in 1996. The 2 surviving plants are 4'/8' tall; healthy with slow growth. These have developed into attractive, multiple-stemmed shrubs. Both flowered and fruited.
1997 Plants are 5'/9' tall; healthy with slow growth. 1 plant flowered and fruited.
1999 The last 2 plants were killed by gophers in 1998-1999.

Parkia biglobosa (Jacquin) R. Brown ex G. Don – African locust bean

DELEP # 91-0446; planted March 1993 (2 plants)

Unarmed trees to 20 m or rarely 30 m tall with even twice-pinnate leaves and red flowers in distinctive spherical heads. The fruit pulp and seeds are an important food resource and the tree is used in traditional medicine to treat a wide range of ailments (Lewis et al, 2005; Orwa et al, 2009). *Parkia biglobosa* is widely distributed across central Africa south of the Sahara Desert. These seeds originated near Koutango, Department of Nioro du Rip, Senegal.

These plants performed poorly and eventually died. They may not be adapted to the ambient conditions of the site, though root problems may have been a factor in their poor performance.

1993 Plants are 1'/1' tall; fair condition with no growth.
1994 Plants are 6"/1' tall; poor condition with no growth.
1995 Plants are 1'/1' tall; poor condition with little or no growth.
1996 Plants are 1'/1' tall; poor to fair condition with no growth.
1997 1 plant died I n 1997 from undetermined causes. The surviving plant is 1'tall; it appears healthy but has not grown.
1999 Plant is 6" tall; poor condition and declining.
2000 Plant is 6" tall; poor condition but still struggling to live.
2001 The last plant died in 2001 after a heroic struggle. These may have had root problems when they were planted.

Peltophorum africanum Sonder – African wattle

DELEP # 90-0494; planted March 1992 (4 plants)

Unarmed, shrubby trees to 10 m tall with even, twice-pinnate leaves and small yellow flowers in racemes at the ends of the stems. The plants have a number of uses in traditional medicine and the wood is used for carving (Palgrave, 1983). The species is rather widely distributed in southern and eastern Africa. Seeds for this accession were collected along the Munyati River, Zimbabwe.

These plants had superior performance with no significant problems. They would make effective screening plants and can be trimmed up to make attractive trees. Established plants appear to be hardy to ca. -7° C and should do well in most areas of Tucson and Phoenix, and other locations with similar minimum winter temperatures.

1992 Plants are 2'-3' tall; healthy with slow growth. 1 plant has minor damage from browsing.
1993 Plants are 2.5'-6.5' tall; healthy with slow to moderate growth.
1994 Plants are 7'-9' tall; healthy with moderate to rapid growth.
1995 Plants are 6'-9' tall; healthy with slow growth. All 4 plants flowered and fruited in 1995.
1996 Plants are 9'-12' tall; healthy with moderate growth. All flowered and fruited.
1997 Plants are 9'-12' tall; heathy but with little increase in height. All flowered and fruited.
1999 Plants are 10'-12' tall; healthy with slow increase in height. These plants have dense foliage and many stems from the base. All flowered and fruited.
2000 Plants are 10'-12' tall; healthy but with little change in size. All flowered and fruited.
2001 Plants are 12'-15' tall; healthy with slow to moderate growth. Only 2 plants flowered and fruited in 2001.
2002 Plants are 12'-15' tall; healthy but no apparent change in size. 3 plants flowered and fruited.
2004 Plants are 16'-19' tall; healthy with slow growth. All flowered with heave fruit set this year.
2005 Plants are 14'/16'/17'/18' tall; healthy with little change in size. 3 plants flowered and fruited.
2006 Plants are 14'/16'/17'/18' tall; healthy with little or no growth. All 4 plants flowered and fruited.
2007 Plants are 14'/16'/18'/20' tall; no apparent freeze damage, healthy with slow growth. All flowered and fruited.
2008 Plants are 20'/25'/25'/25' tall; healthy with substantial growth in the past year. All flowered and fruited.
2009 Plants are 20'/22'/22'/25' tall; healthy with little change in size. All flowered and fruited.
2013 Plants are 25'/27'/27'/35' tall; healthy with slow growth. All flowered and fruited each year since 2009.

Peltophorum dubium (Sprengel) Taubert – yellow poinciana, ibira pita

DELEP # 91-0154; planted March 1992 (4 plants)

Distinctive, unarmed trees to 25 m tall with long, slender trunks and limbs bearing clusters of large, even, twice-pinnate leaves near the tips, and showy masses of yellow flowers in terminal racemes. This species is sometimes planted as a flowering tree. It is native to parts of Argentina, Brazil, Paraguay and Uruguay. This accession originated between Ibotirama and Barreirias, Bahia, Brazil.

These plants performed well. Limbs occasionally broke

in high winds. No damage was observed following the 2007 freeze and the plants would likely tolerate winter temperatures in many locations in Phoenix and Tucson. Flowering at the Yuma site was erratic and sparse.

1992 Plants are 2.5'-7' tall; healthy with moderate growth.
1993 1 plant is 4' tall; fair condition with slow growth. 3 plants are 13'-14' tall; healthy with rapid growth.
1994 1 plant died in 1994 from undetermined causes. The 3 surviving plants are 12'-20' tall; healthy with slow to rapid growth.
1995 Plants are 11'-17' tall; healthy with little or no increase in height.
1996 Plants are 15'-20' tall; healthy with moderate growth. These are unusual trees with large leaves at the ends of sparse branches.
1997 Plants are 18'-22' tall; fair to good condition with moderate growth. No evidence of flowering.
1999 Plants are 15'-17' tall; fair to good condition (1 plant partially blew over) with little growth.
2000 Plants are 15'-20' tall; fair to good condition with moderate growth.
2001 Plants are 15'-20' tall; fair to good condition (1 plant has sunburn on trunk) with little change in size.
2002 Plants are 18'-25' tall; healthy with slow to rapid growth.
2004 Plants are 20'-25' tall; healthy with slow growth. No evidence of flowering.
2005 Plants are 22"24'28' tall; healthy with slow to moderate growth. 1 plant flowered in 2005.
2006 Plants are ca. 25'25'25' tall; healthy with little height increase. 1 plant flowered.
2007 Plants are ca. 25'/25'25' tall; no freeze damage apparent, healthy with little growth. No flowering this year.
2008 Plants are ca. 25'/25'/30' tall; healthy with slow to rapid growth. 1 plant flowered and fruited in 2008.
2009 Plants are ca. 35'/35'/40' tall; healthy with very rapid growth. No flowering was observed in 2009.
2013 Plants are 40'/41'/44' tall; healthy with slow to moderate growth. 1 plant flowered in 2013.

Philenoptera laxiflora (Guillemin & Perrotte) Roberty – Senegal lilac

[*Lonchocarpus laxiflorus* Guillemin & Perrottet]

DELEP # 91-0456; planted March 1993 (3 plants)

Unarmed trees to 8 m tall with odd once-pinnate leaves with 3 or 5 leaflets and panicles of showy, pink, pea-like flowers. *Philenoptera laxiflora* is used extensively in traditional medicine (FAO, n.d.). The plants are browsed by wildlife and livestock and a dye is extracted from the leaves (FAO, n.d.). The species is widespread across central Africa to the south of the Sahara Desert. Seeds for this accession were collected from a tree in a field north of Keur Samba Ka, Department of Nioro du Rip, Senegal.

These plants died during their first season. The cause of death was not determined. They do not appear to be adapted to this site.

1993 All 3 plants died during 1993 from undetermined causes.

Philenoptera violacea (Klotzsch) Schrire – apple-leaf rain tree

[*Lonchocarpus capassa* Rolfe]

DELEP # 90-0493; planted March 1992 (6 plants)

Unarmed trees to 10 m tall with odd once-pinnate leaves with 3 or 5 large, leathery, oval leaflets and showy racemes of small, pink, pea-like flowers. *Philenoptera violacea* is used in traditional medicine, and as a source of fish poison (Palgrave, 1983). The wood is used to some extent, and the foliage is browsed by wildlife and livestock (Palgrave, 1983). The species is widespread in seasonally dry areas of southern Africa. This accession originated from near Kwekwe, Zimbabwe.

When planted out, these plants appeared weak and had noticeable chlorosis. They had lacked vigor in containers. In addition, their large leaflets did not appear well-suited to the ambient climate at Yuma. Appearances can be deceiving. After planting, these plants began to grow well and the chlorosis disappeared. The large, leathery leaflets held up well to the high winds and extreme conditions of the site. These plants developed into beautiful trees with smooth, pale gray bark, and showy flowers. It would make an excellent shade tree and flowering specimen for nearly frost-free climates.

1992 Plants are 2'-5' tall; healthy with slow to moderate growth. The plants were chlorotic when planted, but this has disappeared.
1993 Plants are 3'-7' tall; healthy with slow to moderate growth.
1994 Plants are 5'-11' tall; healthy with moderate growth.
1995 1 plant is 5' tall; fair condition, chlorotic with little growth. 5 plants are 8'-13' tall; healthy with slow to moderate growth.
1996 Plants are 4'-14' tall; healthy with moderate growth except for the smallest plant that has not grown.
1997 1 plant is 5' tall; healthy but growing slowly. 5 plants are 14'-'18' tall; healthy with moderate to rapid growth. These plants flowered and fruited 1n 1996..
1999 1 plant is 7.5' tall; healthy but growing slowly. 5 plants are 15'-23' tall; healthy with slow to rapid growth. These flowered and fruited.
2000 Plants are 8'-23' tall; healthy but little increase in size during the past year. Most are flowering and fruiting.
2001 Plants are 9'-25' tall; healthy with slow growth. 3 plants flowered and fruited n 2001.
2002 Plants are 9'-25' tall; healthy with little or no increase in size. 3 plants flowered and fruited.
2004 1 plant is 12' tall; healthy with slow growth. This plant appears stunted – possible root problems. 5 plants are 25'-30' tall; healthy with moderate to rapid growth. 3 plants flowered and fruited. Despite their large leaves, these plants have done exceptionally well here and make excellent, attractive shade trees.
2005 Plants are 13'/17'/20'/25'/25'/30' tall; healthy with slow growth. 4 largest plants flowered and fruited.
2006 Plants are 14'/18'/25'/25'/25'/30' tall; healthy with mostly slow growth. The 3 southern plants flowered and fruited.
2007 Plants are 14'/18'/25'/25'/25'/30' tall; some twigs froze back to 3' from the tips and foliage was killed. The plants are making a vigorous recovery. The 3 southern plants flowered and fruited.
2008 Plants are 16'/20'/22'/28'28'/30' tall; recovered from 2007 freeze, healthy with slow to moderate growth. 3 plants flowered and fruited.
2009 Plants are ca. 16'/28'/28'/30'/35'/35' tall; healthy with slow to rapid growth. 3 plants flowered and fruited.
2013 1 plant 30' tall died to base in 2013 and has a 2.5' tall shoot emerging from the base. The cause was not determined. 5 plants are 16'/25'/33'/36'/37' tall; healthy with slow growth. The 3 southern plants flowered and fruited.

Figure 4. (Above) *Faidherbia albida*

Figure 5. (Below) Block 30 South with *Vachellia galpinii* and *Faidherbia albida*

Philenoptera wankieensis (Mendonca & E.C. Sousa) Lock – broad lance-pod

[*Lonchocarpus eriocalyx* Harms subsp. *wankieensis* Mendonca & E.P. Sousa]

DELEP # 91-0057; planted March 1994 (2 plants), February 1995 (1 plant)

Unarmed shrubs or trees to 10 m tall with odd, once-pinnate leaves and panicles of lilac to reddish purple pea-like flowers. *Philenoptera wankieensis* is restricted to the Zambezi River region in Zambia and Zimbabwe. Seeds for this accession were collected at Hwange, Zimbabwe.

After the loss of the first two plants during their first season, a third plant that was planted the next year appeared to do well initially. It also declined and died during its third season. No cause was determined for the demise of these plants.

1994 Both plants died in 1994 from undetermined causes.
1995 The new plant is 1.5' tall; healthy with slow growth.
1996 Plant is 1.5' tall; appears healthy but no apparent growth.
1997 Plant is 2' tall; fair condition with some new growth. The plant died later in 1997 from undetermined causes.

Piscidia mollis Rose – fish-poison tree

DELEP # 89-0063; planted March 1991 (1 plant); March 1992 (3 plants)

Unarmed trees to 12 m tall with a rounded canopy, odd once-pinnate leaves and small, pink and white pea-like flowers in panicles or racemes. The leaves have been used to stupefy fish (Gentry, 1942). The species is native to parts of Sinaloa and Sonora, Mexico. Seeds for this accession were collected east of Navojoa, Sonora.

The performance of this species at the Yuma site was disappointing. These plants may not be adapted to sandy soil. The species survives at DELEP's Tucson field site where it sustains freeze damage in colder winters, and at Boyce Thompson Arboretum. I warmer areas of Tucson and Phoenix it can develop into a small tree. The plants have attractive, blue gray foliage and showy flowers. It is worthy of planting as a landscape tree in areas to which it is adapted.

1991 The plant is 10" tall; poor condition with no growth.
1992 3 plants died in 1992 from undetermined causes. The surviving plant is 6" tall; poor condition with no growth.
1993 The last plant died in 1993 from undetermined causes. The species does not appear to be adapted to this site.

Piscidia piscipula (Linnaeus) Sargent – Jamaican dogwood, fish-fuddle tree

DELEP 93-0018; planted February 1995 (1 plant)

Unarmed trees to 15 m tall with odd, once-pinnate leaves and small, pea-like, white and pink flowers in racemes or panicles. The bark, roots and leaves have compounds that are used to stupefy fish (Allen and Allen, 1981). The tree has also been used to make arrow poison and is used in herbal medicine (Cheney, 1931). The wood is used in construction, for railway ties, and for fuel (Record and Hess, 1943). This species is native to the Caribbean Region, extending into southern Florida, eastern Mexico and northern South America. This plant was grown from seeds provided by the Jardín Botánico Nacional, Havana, Cuba.

This plant sat for several years before beginning to grow. After promising performance it declined and died for undetermined reasons.

1995 Plant is 2.5' tall; healthy with slow growth.
1996 Plant is 2.5' tall; healthy but little change in size.
1997 Plant is 2' tall; fair condition with little new growth.
1999 Plant is 4' tall; healthy with slow growth.
2000 Plant is 4' tall; healthy but no apparent growth.
2001 Plant is 3' tall; fair condition with some die-back. The cause for this has not been determined.
2002 The plant died in 2002 from undetermined causes.

Pithecellobium dulce (Roxburgh) Bentham – Manila tamarind, guamúchil

DELEP # 89-0046; planted March 1991 (2 plants)

Trees to 20+ m tall with paired spines along stems. Leaves with one pair of pinnae, each with two ovate to elliptic leaflets. Spherical heads of white flowers are, produced in racemes. This species is valued for the edible, white pulp of the fruits (Felger et al, 2001). *Pithecellobium dulce* is widely distributed in Mexico, Central America and South America, and has been extensively introduced and naturalized in many tropical regions around the world. Seeds for this accession originated at Alamos, Sonora.

In spite of the loss of one of the trees in 1993, this species performed well but had significant maintenance issues. A major limb split and leaned onto the ground, and the tree required regular pruning to keep it lifted. It produced abundant crops of seeds and became a problem with hundreds of volunteer seedlings in the fields. This tree sustained some damage in the 2007 freeze, but recovered vigorously. The plants are attractive and are suitable as shade trees for large spaces in near frost-free regions.

1991 Plants are 7'/7' tall; healthy with rapid growth.
1992 Plants are 11'/12' tall; healthy with rapid growth.
1993 1 plant died in the autumn of 1993. The cause was not determined but the soil here had remained saturated for an extended period due to leaks in the irrigation canal. The surviving tree is 16' tall; healthy with rapid growth.
1994 Plant is 15' tall; healthy and growing rapidly. A major trunk split out an d is leaning far to one side.
1995 Plant is 20' tall; healthy with rapid growth. Flowering and fruiting in 1995.
1996 Plant is 22' tall; healthy with rapid growth. Outer branches are arching and pendulous. The plant flowered and fruited.
1997 Plant is 28' tall; healthy with rapid growth. Flowering and fruiting.
1999 Plant is 25' tall; healthy with rapid growth though it appears shorter than in 1997. Flowering and fruiting. Numerous seedlings are volunteering in the field. Birds eat the fruit pulp and disperse the seeds.
2000 Plant is 25' tall; healthy with rapid growth. The low hanging branches are a maintenance issue. Flowering and fruiting.
2001 Plant is 25' tall; healthy with little increase in size. Flowering and

fruiting.
2002 Plant is ca. 30' tall; healthy with rapid growth. Flowering and fruiting.
2004 Plant is ca. 30' tall; healthy with little increase in height. Flowering and fruiting.
2005 Plant is ca. 30' tall; healthy with little change in size. Flowering and fruiting. Numerous seedlings beneath canopy.
2006 Plant is ca. 30' tall; healthy with little apparent change in size but the tree is vigorous. Flowering and fruiting.
2007 Plant is ca. 30' tall; many stems froze back to 3' fro tips to stems 1" thick, healthy with rapid growth. No flowering.
2008 Plant is ca. 40' tall; healthy with substantial growth in the past year and fully recovered from 2007 freeze. Flowering and fruiting.
2009 Plant is ca. 35' tall; healthy with little change in size. Flowering and fruiting.
2013 Plant is 45' tall; healthy with moderate growth. The plant flowered and fruited each year since 2009.

****Pithecellobium unguis-cati*** (Linnaeus) Bentham

[*This plant does not match the description for *P. unguis-cati*. It may be a species of *Chorloleucon*]

DELEP # 93-0012; planted March 1994 (1 plant)

Unarmed, thicket-like shrub to at least 6 m tall with even twice-pinnate leaves and greenish white flowers in hemispherical heads. This plant was grown from seeds of unknown origin that were labeled "*Pithcellobium unguis-cati*".

Though slow growing, this plant performed well and exhibited no problems. It was undamaged by the 2007 freeze and should receive further evaluation in a colder location. The plant produced many, low, spreading and arching stems with somewhat sparse foliage.

1994 Plant is 4' tall, healthy with moderate growth.
1995 Plant is 3.5' tall; slow growth with stems spreading outward.
1996 Plant is 6' tall; healthy with moderate growth.
1997 Plant is 7' tall; healthy with slow growth. Many stems are growing downward and forming a thicket.
1999 Plant is 7' tall; healthy with slow growth. The plant flowered and fruited in 1999.
2000 Plant is 7' tall; healthy with little change in size. The plant flowered and fruited.
2001 Plant is 9' tall; healthy with slow growth. The plant flowered and fruited.
2002 Plant is 9' tall; healthy with little change in size. The plant flowered and fruited.
2004 Plant is 11' tall; healthy with slow growth. No evidence of flowering this year.
2005 Plant is 9' tall; healthy with little apparent growth. The plant flowered and fruited.
2006 Plant is 12' tall; healthy with moderate growth. It has mounded form with arching stems. The plant flowered and fruited.
2007 Plant is 13' tall; no freeze damage apparent, healthy with slow growth. The plant flowered and fruited.
2008 Plant is 15' tall; healthy with slow growth. The plant flowered and fruited.
2009 Plant is 18' tall; healthy with moderate growth. The plant flowered and fruited.
2013 Plant is 14' tall; healthy with little growth. Many stems are arched out and down. The plant flowered and fruited.

Prosopis affinis Sprengel - Ñandubay

DELEP # 93-0068; planted February 1995 (2 plants)

Trees to 8 m tall with thorny, irregular stems, even twice-pinnate leaves, and greenish yellow flowers in spike-like racemes. The wood of *P. affinis* is valued for fuelwood and durable fence posts (Burkart, 1976). Livestock eat the fruits, and honey produced from the plants is of high quality (Burkart, 1976). The species is native to parts of Argentina, Brazil, Paraguay and Uruguay. Seeds for this accession originated in the Department of Paraná, Entre Ríos Province, Argentina, without specific locality.

This species initially performed well, but then began to decline. Flowering was sporadic and absent in later years. No reason for the poor performance was determined. It is possible that the plants had poor root systems which compromised there development as they grew larger. This species is native to savannah habitats and has strong horizontal growth when young, necessitating considerable effort to keep them off the ground to facilitate weed control.

1995 Plants are 1'/3' tall; healthy with slow growth.
1996 Plants are 3'/5' tall with a 10' horizontal spread; healthy with slow vertical growth and moderate lateral growth.
1997 Plants are 5'/7' tall; healthy with slow upward growth but spreading laterally.
1999 Plants are 8.5'/9.5' tall; healthy with moderate growth.
2000 Plants are 8.5'/11' tall; healthy with slow growth. 1 plant flowered and fruited in 2000.
2001 1 plant is 5' tall following heavy pruning; fair condition with slow growth. 1 plant is 13' tall; healthy with slow growth but it is developing into a tree. No evidence of flowering was observed this year.
2002 1 plant is 5' tall; poor condition with little growth. 1 plant is 14' tall; healthy with slow growth. No flowering evident.
2004 1 plant is 4' tall; fair condition but no apparent growth. 1 plant is 16' tall; healthy with slow growth. This plant flowered and fruited in 2004.
2005 1 plant is 4' tall; fair condition with no change in size. 1 plant is 14' tall; healthy with little change in size. No flowering observed.
2006 1 plant is 4' tall; poor condition, declining. 1 plant is 13' tall; healthy with little apparent growth. No flowering.
2007 Plants are 3'/12' tall; minor freeze damage to twig tips, fair condition with little apparent growth and no flowering.
2008 Plants are 6'/13' tall; fair condition with some growth. No evidence of flowering observed.
2009 Plants are 5'/11' tall; fair condition with no apparent growth. No flowering noted.
2013 Plants are 7'/12' tall; fair to good condition with slow growth. No flowering has been observed over the past 4 years.

Psorothamnus schottii (Torrey) Barneby – Schott's dalea

DELEP # 89-0336; planted March 1991 (4 plants)

Shrubs to 2.5 m tall with spinescent twigs, small leaves with 1 or 3 leaflets, and racemes of dark blue pea-like flowers. This species is native to arid habitats in the Sonoran Desert in Arizona and California, and in northern Baja California, Mexico. Seeds for this accession were received from the Mildred E. Mathias Botanical Garden, California.

Initially, these plants performed well, but one-by-one, they declined and died for reasons which were not determined.

These plants are native to the Yuma area and occur in sandy soils. Perhaps the irrigation was too much for them.

1991 1 plant died in 1991 from undetermined causes. The 3 surviving plants are 3'-4' tall; healthy with slow to moderate growth. These flowered and fruited in the spring of 1991.

1992 2 plants died in 1992 from undetermined causes. They had appeared healthy. The surviving plant is 4' tall; apparently healthy but little growth. No flowering observed.

1993 The last plant died in 1993 from undetermined causes.

Psorothamnus schottii (Torrey) Barneby – Schott's dalea

DELEP # 91-0162; planted March 1994 (1 plant)

Shrubs to 2.5 m tall with spinescent twigs, small leaves with 1 or 3 leaflets, and racemes of dark blue pea-like flowers. This species is native to arid habitats in the Sonoran Desert in Arizona and California, and in northern Baja California, Mexico. This accession was collected in eastern San Diego County, California.

As with the previous accession, this plant initially showed excellent performance, but then died during its second season.

1994 Plant is 4' tall; healthy with moderate growth. It flowered and fruited in 1994.

1995 The plant died in 1995 from undetermined causes.

Psorothamnus spinosus (A. Gray) Barneby – desert smoke tree

DELEP # 90-0684; planted March 1991 (4 plants)

Shrubs or shrubby trees to 8 m tall with spine-tipped twigs, leafless or with small, unifoliolate leaves, and small, indigo blue, pea-like flowers. The young stems of this tree are bluish gray and covered with small, resin glands that are highly aromatic when crushed. This species is occasionally used in landscaping. Desert smoke tree is native to arid regions of western Arizona, southern California and adjacent Sonora and Baja California, Mexico. No information on the collection locality of these seeds was provided to DELEP.

Initially, these plants thrived with vigorous growth and regular, heavy flowering. After a decade, the plants began to decline and 3 subsequently died for undetermined reasons. Cultivated plants of *P. spinosus* in Tucson have been observed to undergo periodic die-back followed by healthy recovery.

1991 Plants are 4'/4'/4'/4' tall; healthy with moderate growth.

1992 Plants are 6'-7' tall; healthy with slow to moderate growth.

1993 Plants are 7.5'-10' tall; healthy with slow to moderate growth. All 4 plants flowered and fruited in 1993.

1994 Plants are 10'-15' tall; healthy with moderate to rapid growth. All plants flowered and fruited.

1995 Plants are 12'-17' tall; healthy with slow increase in height. All flowered and fruited.

1996 Plants are 12'-18' tall; healthy with slow growth. All flowered and fruited.

1997 Plants are 14'-19' tall; healthy with slow growth. All flowered and fruited.

1999 Plants are 12'-19' tall; heathy with little height increase. All flowered and fruited.

2000 Plants are 12'-19' tall; fair to good condition with considerable die-back of small branches. All flowered and fruited.

2001 1 plant died in 2001 from undetermined causes. The 3 surviving plants are 8'-20' tall; poor to good condition with little growth and significant die-back. No evidence of lowering.

2002 1 plant is 4' tall; poor condition, mostly dead. 2 plants are 18'/20' tall; fair to good condition but little growth. No sign of flowering.

2004 1 plant died in 2003 from undetermined causes. 1 plant died in 2004 from undetermined causes. 1 plant is 20' tall; poor condition, declining with much die-back but some live stems with new growth. No flowering.

2005 The surviving plant is 8' tall; fair condition with some rapid growth. No evidence of flowering.

2006 Plant is 12' tall; healthy with moderate growth. It has regenerated well after severe die-back. No evidence of flowering

2007 Plant is 8' tall; no freeze damage, healthy with little new growth. No evidence of flowering

2008 Plant is 11' tall; healthy with moderate growth though it has never recovered to its previous size. No evidence of flowering.

2009 Plant is 11' tall; fair condition with some dead limbs and twigs. No evidence of flowering.

2013 Plant is 8' tall; fair condition with additional die-back. Flowering not noted since 2009.

Pterocarpus lucens Guillemin & Perottet subsp. ***antunesii*** (Taubert) Rojo – small-leaved blackwood

[*Pterocarpus antunesii* (Taubert) Harms]

DELEP # 91-0014; planted March 1992 (1 plant)

Unarmed shrubs or trees to 10 m tall with odd, once-pinnate leave and pea-like, pale yellow flowers. The wood is used to make tool handles and other small wooden articles (Palgrave, 1983). *Pterocarpus lucens* has a wide distribution in southern and eastern Africa while subspecies *antunesii* is confined to parts of Angola, Namibia and Zimbabwe. Seeds for this accession were collected near Hwange, Zimbabwe.

This species grew consistently and developed into a very attractive tree with a single trunk and a rounded canopy. No flowering was confirmed, however flower buds were observed in one year. Had the plant not been killed by gophers, it is likely that it would have continued to do well.

1992 Plant is 2.5' tall; healthy with slow growth.

1993 Plant is 4' tall; healthy with slow growth.

1994 Plant is 4.5' tall; healthy with slow growth.

1995 Plant is 6' tall; healthy with slow growth.

1996 Plant is 7' tall; healthy with slow growth.

1997 Plant is 9' tall; healthy with slow growth. Attractive upright growth habit with a rounded crown.

1999 Plant is 10' tall; healthy with slow growth. The plant appears to have flower buds but flowering not observed.

2000 Plant is 12' tall; healthy with slow growth. No further evidence of flowering.

2001 Plant is 12' tall; fair condition with no increase in size. Gophers are tunneling near this plant.

2002 Plant died in 2002 due to gopher damage to root system. This plant was not observed to flower. It is an attractive species worthy of further evaluation.

Pterogyne nitens Tulasne – tipa colorada, vivaró

DELEP # 90-0358; planted March 1993 (2 plants)

Unarmed trees to 25 m tall with even once-pinnate leaves bearing alternate leaflets: and with tiny, pale yellow flowers in racemes. The species is valued for high quality timber (Allen and Allen, 1981). It is threatened by overharvesting and habitat destruction (Prado, 1998). *Pterogyne nitens* is native to parts of Argentina, Bolivia, Brazil and Paraguay. This accession originated from cultivated street trees growing in Asunción, Paraguay.

These plants performed poorly at first, with one plant dying after two years and the second plant sitting with little change in size for a decade. These may have been root-bound. The surviving plant eventually began to grow slowly and flowered for the first time in 2013. It was subsequently transplanted to the Boyce Thompson Arboretum. A plant of this species survived and grew well in DELEP's much colder Tucson field site until killed by gophers. It is an attractive tree worthy of further evaluation.

1993 1 plant is 4" tall; poor condition with little growth. 1 plant is 1.5' tall; healthy with slow growth.
1994 1 plant is 4" tall; fair condition with no growth. 1 plant is 2' tall; healthy with slow growth.
1995 The smaller plant died in 1995 from undetermined causes. It had never done well and may have had poor roots. The surviving plant is 2' tall; fair condition with no growth.
1996 Plant is 2.5' tall; fair condition with slow growth.
1997 Plant is 2.5' tall; fair condition with little apparent growth.
1999 Plant is 2' tall; fair condition with no apparent growth.
2000 Plant is 2' tall; fair condition with no growth.
2001 Plant is 2' tall; healthy but with no new growth evident.
2002 Plant is 2' tall; healthy but with no growth.
2004 Plant is 3' tall; healthy with slow growth. These plants were likely pot-bound when planted.
2005 Plant is 3' tall; healthy, but no growth in the past year.
2006 Plant is 4' tall; healthy with slow growth.
2007 Plant is 4' tall; no freeze damage, healthy with no change is size.
2008 Plant is 6' tall; healthy with slow growth.
2009 Plant is 7.5' tall; healthy with slow growth.
2013 Plant is 13' tall; healthy with slow growth. It flowered for the first time in 2013. This plant was bare-rooted and transplanted to the Boyce Thompson Arboretum. The stems died back but the plant survived.

Schotia brachypetala Sonder – weeping Boer-bean

DELEP # 95-0022; planted December 1995 (4 plants)

Unarmed shrubs or trees to 16 m tall with even once-pinnate leaves and showy red flowers in panicles. *Schotia brachypetala* has edible seeds and is used in folk medicine, for tanning leather, and the wood is valued for carpentry (Palgrave, 1983). This species would be a useful shade tree and is especially showy when flowering. It is native to parts of Mozambique, South Africa, Swaziland and Zimbabwe. Seeds for this accession were collected at Gweru, Zimbabwe.

One plant died during its first season and the surviving plants sat for several years with little or no growth. The reason for this was not determined. They eventually began to grow and developed into attractive small trees. This species has survived with minimal freeze damage in one of DELEP's Tucson field sites.

1996 1 plant died in 1996. The cause was not determined. The 3 surviving plants are 1.5'-2' tall; fair to good condition with slow growth.
1997 Plants are 2'-2.5' tall; fair to good condition with slow growth.
1999 Plants are 2'-3' tall; fair to good condition with slow growth.
2000 Plants are 2'-3' tall; fair to good condition with little change in size.
2001 Plants are 2'-2.5' tall; fair to good condition with no apparent growth.
2002 Plants are 2'-3' tall; healthy with slow growth.
2004 Plants are 3.5'-7' tall; healthy with slow growth.
2005 Plants are 6'/7'/8' tall; healthy with slow to moderate growth.
2006 Plants are 6.5'/7'/8' tall; healthy with little change in size in the past year.
2007 1 plant is 6.5' tall; stems froze back to 1' from tips, healthy and recovering. 2 plants are 5'/9' tall; no freeze damage, heathy with little or slow growth.
2008 Data missing.
2009 Plants are 7'/9'/15' tall; healthy with slow to moderate growth. These are developing into attractive small trees.
2013 Plants are 10'/12'/20' tall; healthy with slow growth. These plants have not been observed to flower.

Senegalia ataxacantha (de Candolle) Kyalangililwa & Boatwright – flame thorn, flame acacia

[*Acacia ataxacantha* de Candolle]

DELEP # 91-0053; planted March 1992 (3 plants), March 1996 (1 plant)

Sprawling, multiple-stemmed shrubs or rarely small trees to 5 m tall with recurved prickles on the stems and also the leaf rachises, and feathery, even twice-pinnate leaves. The flowers are white or cream colored and are produced in cylindrical racemes. Wood of this species has minor uses and the roots are reported to be used in traditional medicine (Timberlake et al, 1999). With its prickly stems, it makes and effective barrier plant. The species is widely distributed in tropical and subtropical Africa. Seeds of this accession were collected between Bulawayo and Hwange, Zimbabwe.

Aside from damage from browsing during the first few years, there was no apparent reason for the poor performance of this species. Timberlake et al (1999) suggest that this species may have a preference for acidic sands, so soil pH may have been a factor in the poor performance observed.

1992 All 3 plants died back to the base and appeared dead.
1993 All 3 plants are alive. Heights range from 3" to 1.5'; fair to poor condition due to severe browsing.
1994 Heights range from 2" to 10"; poor condition - apparently browsing is continuing.
1995 Heights range from 4" to 3'; poor to fair condition with 2 plants growing slowly.
1996 1 plant died in 1996 for undetermined reasons. 2 remaining plants 1.5'/3' tall; fair condition with littler apparent growth. 1 plant was planted in 1996.
1997 The new transplant died from undetermined causes. 1 original plant died back to the crown but is apparently still alive. 1 plant is 1' tall; fair condition with some die-back.
1999 1 plant died in 1998 from undetermined causes. 1 plant is 1.5' tall; healthy with slow growth.
2000 Plant is 1.5' tall; healthy but no apparent growth.
2001 The last plant died in 2001. The cause was not determined.

Senegalia bonariensis (Gillies & Hooker ex Arnott) Seigler & Ebinger – uña de gato

[*Acacia bonariensis* Gillies & Hooker ex Arnott]

DELEP # 94-0143; planted February 1996 (2 plants)

Shrubs or small trees 3 to 7 m tall with recurved prickles on the stems and leaf rachises, feathery, even twice-pinnate leaves and white or cream colored flowers in short racemes. The species is rather widely distributed in subtropical South America. This accession originated in Catamarca Province, Argentina.

1997 Plants are 4//4.5' tall; poor condition with little or no growth.
1998 Both plants died in 1998. The cause was not determined.

Senegalia caffra (Thunberg) P.J.H. Hurter & Mabberley – common hook thorn

[*Acacia caffra* (Thunberg) Willdenow]

DELEP # 91-0049; planted March 1992 (2 plants)

Large shrubs or trees to 14 m tall with stems armed with recurved prickles; feathery, even twice-pinnate leaves, and white flowers in cylindrical racemes. The wood is used for fuel and posts, and the foliage is browsed by livestock (Timberlake et al, 1999). The plant is also used in traditional medicine (Palgrave, 1983). This species is native to parts of eastern South Africa, Mozambique, Botswana and Zimbabwe. The accession originated from Donkerkloof, near Lebowakgoma, South Africa.

This species performed reasonably well but flowering was not observed until 2013. One tree lost vigor and gradually declined over several years; finally dying in 2004. The cause was not determined but root problems (j-rooting and/or gopher damage) is suspected. *Acacia caffra* is quite cold tolerant and survives at Boyce Thompson Arboretum.

1992 Plants are 3'/5' tall; healthy with moderate to fast growth.
1993 Plants are both 8' tall; healthy with vigorous growth.
1994 Plants are 9'/10' tall; healthy with moderate growth.
1995 Plants are 10'/12' tall; healthy with moderate growth.
1996 Plants are 11'/16' tall; healthy, 1 exhibited slow growth and 1 exhibited fast growth.
1997 Plants are 12'/18' tall; healthy, 1 exhibited slow growth and 1 exhibited moderate growth.
1999 Both plants are 15' tall; healthy with slow growth. No evidence of flowering.
2000 1 plant is 10' tall; healthy overall but top is dead. 1 plant is 16' tall, healthy, slow growth.
2001 Plants are 10'/17' tall; healthy with slow growth. No evidence of flowering.
2002 1 plant is 10' tall; fair condition – declining, no growth. 1 plant is 20' tall; healthy with moderate growth.
2004 1 plant died in 2004. The cause was not determined but the plant had lacked vigor for several years. 1 plant is 25' tall; healthy with moderate growth. No evidence of flowering.
2005 Remaining plant is ca. 20' tall; healthy but little growth. The upper branches tend to bend down, affecting heights from year to year.
2006 Plant is 20' tall; healthy with little change in size. No flowering.
2007 Plant is 20' tall; no freeze damage, healthy but with little apparent growth.
2008 Plant is ca. 25' tall; healthy with significant growth in the past year.
2009 Plant is ca. 25' tall; healthy with little change in size. No evidence of flowering.
2013 Plant is 25' tall; healthy but little growth in the past 4 years. Sparse flowering was observed in the spring of 2013.

Senegalia catechu (Linnaeus) P.J.H. Hurter & Mabberley – black cutch, catechu

[*Acacia catechu* (Linnaeus) Willdenow]

DELEP # 92-0139; planted March 1994 (2 plants)

Sprawling shrubs or trees to 15 m tall with prickles along the stems, feathery, even twice-pinnate leaves, and white flowers in cylindrical racemes. The tree is widely used in traditional medicine, produces high quality gum and the wood is used in carpentry and as fuelwood (Orwa et al, 2009). The species is widely distributed across south Asia. These plants were grown from seeds received from the University of Burdwan, West Bengal, India.

This species did very well with one plant flowering and fruiting during its first year. The size of both plants eventually stabilized as the branches tended to droop and spread outward.

1994 Plants are 3'/6' tall; healthy with vigorous growth. The larger plant flowered and fruited during 1994.
1995 Plants are 7'/8' tall; healthy with moderate growth.
1996 Plants are 9'/10' tall; healthy with moderate growth. Both flowered and fruited heavily.
1997 Plants are 9'/10' tall; healthy but little growth in the past year. Both are flowering and fruiting.
1999 Plants are both 9' tall; healthy but little additional growth. Both are flowering and fruiting.
2000 Plants are both 9' tall; healthy but little increase in size. Both are flowering and fruiting heavily.
2001 Plants are 10'/11' tall; healthy with slow growth. Both are flowering and fruiting.
2002 Plants are 11'/13' tall; healthy with slow growth. Both are flowering and fruiting.
2004 Plants are both 15' tall; healthy with slow growth. Both are flowering and fruiting.
2005 Plants are both 16' tall; healthy with slow growth. Both are flowering and fruiting.
2006 Plants are 12'/20' tall; healthy with slow to moderate growth. Both are flowering and fruiting.
2007 Plants are 16'/18' tall; the outer stems froze back to 1' from the tips, healthy with vigorous growth. Larger plant flowered and fruited.
2008 Plants are 13'/15' tall; healthy with slow growth. Both are flowering and fruiting heavily.
2009 Plants are 17'/18' tall; healthy with moderate growth. Both are flowering and fruiting.
2013 Plants are 18'/20' tall; healthy with slow growth. Both are flowering and fruiting heavily.

Senegalia cinerea (Schinz) Kyalangalilwa & Boatwright – blade thorn

[*Acacia fleckii* Schinz]

DELEP # 91-0499; planted March 1992 (3 plants), February 1995 (1 plant)

Spreading, low-branched shrubs or trees to 10 m tall with painfully-sharp prickles at the nodes of the stems; small, feathery, even twice-pinnate leaves, and white flowers in rounded

heads. The species is widespread in southern Africa. These plants were grown from seeds that originated along the Munyati River near the Munyati Power Station, Zimbabwe.

Overall, this species did quite well, and eventually flowered and fruited heavily. The low-branched growth habit required considerable effort to prune into a low tree. This species would make an especially effective barrier plant. This species has survived in DELEP's Tucson fields with minor freeze damage in cold winters.

1992 Plants are 1' to 2' tall; healthy and growing slowly.
1993 1 plant dies in 2003 – cause undetermined. The other 2 plants are 4'/7' tall; healthy with moderate growth. The largest plant produced flowers and fruit in 1993.
1994 2 surviving plants are 8'/10' tall; healthy with moderate growth. 1 plant flowered and fruited.
1995 Both original plants are 10' tall and the new transplant is 2' tall; all are healthy with slow growth. The two larger plants are flowering and fruiting.
1996 Plants are 4'-12' tall; healthy with slow growth and a spreading habit. 2 larger plants are flowering and fruiting.
1997 Plants are 6'-16' tall; healthy with slow growth. 2 larger plants are flowering and fruiting.
1999 Plants are 9'-15' tall; healthy with slow to moderate growth. 2 larger plants are flowering and fruiting.
2000 Plants are 10'-15' tall; healthy with slow growth. 2 larger plants are flowering and fruiting.
2001 Plants are 11'-22' tall; healthy with slow to fast growth. All are flowering and fruiting.
2002 Plants are 11'-22' tall; healthy with slow growth. All are flowering and fruiting.
2004 Plants are 12'-25' tall; healthy with slow growth. All are flowering and fruiting.
2005 Plants are 13'/20'25' tall; healthy with slow growth. All are flowering and fruiting.
2006 Plants are 13'/17'/22' tall; healthy with little apparent growth. All are flowering and fruiting.
2007 Plants are 13'/18'/22' tall; no freeze damage, healthy but no change in size in past year. All are flowering and fruiting.
2008 Plants are 14'/20'/28' tall; all are healthy and the largest tree put on substantial growth in the past year. All are flowering and fruiting.
2009 Plants are 14'/22'/ca. 35' tall; healthy, the largest tree has substantially increased in height. All are flowering and fruiting.
2013 Plants are 12'/16'/30' tall; all are healthy. The middle tree developed a pronounced lean and the central trunk of the largest tree fell. All are flowering and fruiting.

Senegalia eriocarpa (Brenan) Kyalangalilwa & Boatwright - woolly-podded acacia

[*Acacia eriocarpa* Brenan]

DELEP # 91-0044; planted March 1992 (2 plants)

Straggling shrubs or treelets to 4 m tall with recurved prickles on the stems and leaf-stalks, ferny, even twice-pinnate leaves and white flowers in cylindrical racemes. It is native to the Zambezi River Valley in parts of Mozambique, Zambia and Zimbabwe. These plants were grown from seeds originating at Deka, between Bulawayo and Victoria Falls, Zimbabwe.

This species never did well at this site. Browsing may have contributed to the death of one of the plants. The other plant grew poorly and suffered from die-back. Soil pH may have been a factor as this is reported to grow in acidic soils in its native habitat.

1992 Both plants 10" tall; healthy but little growth since planting.
1993 Plants are 2"/3' tall; poor condition due to severe browsing.
1994 1 plant is 6" tall; poor condition. 1 plant is 2.5' tall; fair condition. Both are growing slowly.
1995 1 plant died during 1995. The cause for this was not determined but it declined following severe browsing. 1 plant is 3' tall; poor condition with slow growth.
1996 Remaining plant is 4' tall; fair condition with some growth.
1997 Plant is 3' tall; poor condition with some die-back.
1999 Plant died in 1998. Cause undetermined but this species never did well at this site.

Senegalia erubescens (Welwitsch ex Oliver) Kyalangalilwa & Boatwright – blue thorn

[*Acacia erubescens* Welwitsch ex Oliver]

DELEP # 91-0051; planted March 1993 (2 plants)

Shrubby trees to 10 m tall with hooked prickles along the stems, with flaking bark, small, even twice-pinnate leaves and white flowers in cylindrical racemes. It has a relatively wide distribution in eastern Africa. These plants were grown from seeds originating along the Masvingo to Beitbridge road, Zimbabwe.

One plant died the year after planting, however the other plant developed well and did not exhibit any problems. It flowered and fruited sparingly beginning in 2008. It is an attractive plant but the prickly stems would limit its landscape use.

1993 1 plant died in 1993 – cause undetermined. 1 plant is 2.5' tall; healthy.
1994 Remaining plant is 6' tall; healthy with moderate to fast growth.
1995 Plant is 7' tall; healthy with slow growth.
1996 Plant is 9' tall; healthy with slow growth.
1997 Plant is 10' tall; healthy with slow growth.
1999 Plant is 11' tall; healthy with slow growth. No evidence of flowering.
2000 Plant is 13' tall; healthy with slow growth.
2001 Plant is 15' tall; healthy with slow growth. No evidence of flowering.
2002 Plant is 15' tall; healthy with little apparent growth.
2004 Plant is20' tall; healthy with moderate growth. This plant has an attractive form and papery bark, but dangerous hooked prickles.
2005 Plant is 22' tall; healthy with slow growth. Attractive rounded canopy.
2006 Plant is 18' tall; healthy but with little apparent growth.
2007 Plant is 18' tall; no freeze damage; healthy but no apparent change in size in the past year.
2008 Plant is 25' tall; vigorous with substantial growth in the past year. Flowering and fruiting in 2008.
2009 Plant is 28' tall; healthy with moderate growth. Flowering and fruiting.
2013 Plant is 28' tall; healthy but no significant increase in height. Flowering and fruiting.

Senegalia galpinii (Burtt Davy) Seigler & Ebinger – monkey thorn

[*Acacia galpinii* Burtt Davy]

DELEP # 91-0106; planted March 1992 (2 plants)

Stately trees potentially growing to more than 30 m tall with stout, painfully sharp prickles on the stems; relatively small, even twice pinnate leaves, and cream colored flowers in slender cylindrical racemes. The trees are a source of timber and fence posts (Timberlake et al, 1999). This species is native to parts of southern Africa. Seeds for this accession originated 10 km south of Nata, Botswana.

This species did exceptionally well and the two trees in the field developed fine, upright trunks with a rounded canopy, ultimately becoming the second tallest species in the fields after *Faidherbia albida*. Flowering was not observed on these trees until 2013. They may have flowered in earlier years, but this was not observed as it occurred during the hot months when visits to Yuma were not usually made. No evidence of fruiting was found. These would make outstanding landscape trees for large spaces, however the viciously armed stems are a maintenance issue until the trees are tall enough to permit pruning branches to above head height.

1992 Plants are 5'/5' tall; healthy with moderate growth.
1993 Plants are 8'/8' tall; healthy with moderate growth.
1994 Plants are 17'/18' tall; healthy with exceptionally vigorous growth.
1995 Plants are 18'/20' tall; healthy but with slow growth in the past year.
1996 Plants are 24'/25' tall; healthy with slow growth.
1997 Plants are 25'/25' tall; no freeze damage, healthy with slow growth.
1999 Plants are both 25' tall; healthy but little apparent growth. These trees have stout trunks and dense foliage.
2000 Plants are both 30' tall; healthy with substantial growth in the past year. No evidence of flowering.
2001 Plants are both 35' tall; heathy with fast growth. Trunks are ca. 1.5' thick.
2002 Plants are both ca. 35' tall; healthy but little apparent change in height in the past year.
2004 Plants are both ca. 40' tall; healthy with moderate growth. No evidence of flowering.
2005 Plants are both ca. 40' tall; healthy but with little increase in size.
2006 Plants are both ca. 40' tall; healthy but little change in size. No evidence of flowering.
2007 Plants are both ca. 40' tall; no freeze damage to stems or foliage, healthy but little growth.
2008 Plants are both ca. 45' tall; healthy with noticeable increase in height. No flowering evident.
2009 Plants are both ca. 45' tall; healthy but little change in size. No evidence of flowering observed.
2013 Plants are 56'/60' tall; healthy with significant growth. Flowering observed in late spring of 2013 but no fruits were seen that autumn. The trees had trunk diameters of 23.5" and 29.5".

Senegalia goetzii (Harms) Kyalangililwa & Boatwright subsp. goetzii – purple-pod acacia

[Acacia goetzii Harms subsp. goetzii]

DELEP # 95-0014; planted March 1996 (4 plants)

A tree of variable stature, potentially growing to 15 m tall, but often much smaller, with paired, hooked prickles on the stems; small, even twice-pinnate leaves, and white flowers in cylindrical racemes. This species may be of hybrid origin (Timberlake et al, 1999). *Senegalia goetzii* is rather widely distributed across parts of southern and eastern Africa. Seeds of this accession were collected near Chegutu, Zimbabwe.

Initial results with this species were disappointing with 3 of the 4 plants dying in the first two years after planting. The surviving plant grew slowly and had no further problems except for damage from the freeze in 2007. It has an irregular, sprawling growth habit.

1996 1 plant died in 1996 – cause undetermined. 3 plants are 2" -1' tall; fair to good condition with little growth.
1997 2 plants died in 1997 – cause undetermined. Surviving plant is 2' tall; healthy with slow growth.
1999 Plant is 2' tall; healthy but little growth.
2000 Plant is 2' tall; healthy but no apparent growth.
2001 Plant is 5' tall; healthy with moderate growth during the past year.
2002 Plant is 5' tall; healthy but no increase in height.
2004 Plant is 6.5' tall; healthy with slow growth.
2005 Plant is 8' tall; healthy with slow growth.
2006 Plant is 9' tall; healthy with slow growth. This plant has an irregular, spreading growth habit.
2007 Plant is 8' tall; froze back to 3' from stem tips with stems up to 1" thick killed. Vigorous regrowth.
2008 Plant is 9' tall; healthy and has recovered from freeze damage.
2009 Plant is 9' tall; healthy but no height increase. No evidence of flowering.
2013 Plant is 12' tall; healthy with slow growth. No evidence that this has flowered.

Senegalia modesta (Wallich) P.J.H. Hurter

[*Acacia modesta* Wallich]

DELEP # 92-0085; planted March 1994 (4 plants)

Shrubs or small trees with recurved prickles on the stems, small, even twice-pinnate leaves and cream colored flowers in spherical heads. *Senegalia modesta* occurs in parts of Afghanistan, India, and Pakistan. Seeds for this accession were provided by the Pakistan Forestry Institute.

Overall, this species grew well and flowered and fruited heavily with flowering and fruiting on one tree beginning the same year it was planted and the others in their second year. One tree died in 2006 of undetermined causes. Several plants of this species volunteered from seeds in adjacent areas of the field.

1994 Plants are 4'-5' tall; healthy with moderate growth. 1 plant produced flowers and fruit.
1995 Plants are 6.5'-9' tall; healthy with moderate growth. All are flowering and fruiting.
1996 Plants are 8'-15' tall; healthy with moderate to fast growth. All are flowering and fruiting.
1997 Plants are 8'-14' tall; healthy, little vertical growth but considerable lateral growth with many low branches. All are flowering and fruiting.
1999 Plants are 9'-14' tall; healthy with little growth. All are flowering and fruiting.
2000 Plants are 10'-16' tall; healthy with slow growth. All are flowering and fruiting. This species has exceptionally heavy fruit production.
2001 Plants are 10'-15' tall; healthy but with little change in size. All are flowering and fruiting.
2002 Plants are 10'-15' tall; healthy with little change in size. All are

flowering and fruiting. Several volunteer seedlings have been observed in adjacent areas of the field.
2004 Plants are 11'-22' tall; healthy with slow to moderate growth. All are flowering and fruiting.
2005 Plants are 13'/17'/18'/22' tall; healthy with little change in size. All are flowering and fruiting.
2006 1 plant died in 2006 from undetermined causes. The 3 surviving plants are 14'/20'/20' tall; healthy with little growth. All are flowering and fruiting.
2007 Plants are 15'/22'/23' tall; healthy with slow growth. All are flowering and fruiting.
2008 Plants are 16'/22'/25' tall; healthy with slow growth. All are flowering and fruiting.
2009 Plants are 15'/25'/25' tall; healthy but with little change in size. All are flowering and fruiting.
2013 Plants are 19'/27'/33' tall; healthy with slow growth. All are flowering and fruiting heavily.

Senegalia nigrescens (Oliver) P.J.H. Hurter – knob thorn
[*Acacia nigrescens* Oliver]
DELEP # 91-0144; planted March 1992 (3 plants)

Upright trees to at least 15 m tall with paired recurved prickles at the stem nodes, even twice-pinnate leaves with 1 or 2 pairs of large, oval leaflets per pinna, and white flowers in cylindrical racemes. On older limbs and trunks the prickles are borne on distinctive raised knobs. The durable wood of this species is used for posts, timbers, carving and flooring, and the foliage is considered good browse for wildlife and livestock (Timberlake et al, 1999). *Senegalia nigrescens* has a wide distribution through eastern and southern Africa. These plants were grown from seeds that originated near Francistown, Botswana.

This species fared poorly and all plants died the year after planting, due at least in part to severe browsing.

1992 Plants are 6" to 1.5' tall; poor condition due to severe browsing.
1993 All 3 plants died during 1993 – cause undetermined but severe browsing was likely a contributing factor.

Senegalia polyacantha (Willdenow) Seigler & Ebinger subsp. ***campylacantha*** (Hochstetter ex A. Richard) Kyalangalilwa & Boatwright – white thorn
[*Acacia polyacantha* Willdenow subsp. *campylacantha* (Hochstetter ex A. Richard) Brenan]
DELEP # 90-0253; planted March 1992 (2 plants)

Trees potentially to 20 m tall with an open canopy, papery, grayish white bark, and paired, hooked, painfully sharp prickles at the nodes. The leaves are even twice-pinnate and feathery. Flowers are yellowish white and are produced in cylindrical racemes. The wood is valued for fuelwood and has limited use in carpentry, and the bark has been used in tanning leather (Timberlake et al, 1999). The plant is used in traditional medicine and produces an edible gum (Timberlake et al, 1999). *Senegalia polyacantha* var. *campylacantha* is widely distributed in Africa from south of the Sahara Desert to northern South Africa. Seeds for this accession originated at Mulango, Kitui, Kenya.

These plants initially performed well. One of the trees declined markedly in 2009 and subsequently died. The cause for this was not determined, but there was considerable gopher activity in the immediate vicinity. Both trees periodically had major limbs die as they grew larger.

1993 Information missing.
1994 1 plant is 10" tall; poor condition with little growth. 1 plant is 2' tall; good condition with slow growth.
1995 Plants are 3'/10' tall; healthy with moderate to rapid growth.
1996 Plants are 8.5'/16' tall; healthy with vigorous growth.
1997 Plants are 13'/20' tall; healthy with rapid growth.
1999 Plants are 20'/28' tall; healthy with rapid growth.
2000 Plants are 20'/28' tall; healthy but some limbs have died (self-pruning?), little or no height increase.
2001 Plants are 27'/30' tall; healthy, 1 plant grew rapidly and the other grew slowly. No evidence of flowering.
2002 Plants are 27'/30' tall; healthy with little change in size.
2004 Plants are 27'/35' tall; healthy with substantial growth on one of the trees. No evidence of flowering.
2005 Plants are 27'/35' tall; healthy overall but with several dead stems on the smaller tree.
2006 Plants are 27'/30' tall; healthy with little change in size. No evidence of flowering.
2007 Plants are 27'/30' tall; stems froze back to 3' from the tips, with stems to 1" thick killed. Healthy new growth but smaller tree has numerous dead stems along the trunk not related to freezing.
2008 Plants are 30'/35' tall; healthy with significant growth in the past year.
2009 1 plant is 30' tall; poor condition with considerable die-back. Considerable gopher activity has been observed near this tree. This tree subsequently died. 1 plant is 35' tall; healthy with little change in size.
2013 The surviving plant is 35' tall with a trunk diameter of 23"; healthy but with little growth. No evidence of flowering was observed on these plants.

Seneglia polyphylla (de Candolle) Britton & Rose – white tamarind
[*Acacia glomerosa* Bentham; *Acacia polyphylla* de Candolle; *Senegalia glomerosa* (Bentham) Britton & Rose]
DELEP # 91-0150; planted March 1993 (3 plants)

Trees to 20+ m tall, unarmed or with small prickles, with fern-like, even pinnate leaves and open racemes of white flowers in spherical heads. The species ranges widely in South America from Colombia to Argentina, Bolivia and Brazil. Seeds for this accession originated near Santa Rita de Cassia, Brazil.

These plants performed poorly and gradually died. The cause was not determined but this species does not appear to be adapted to the Yuma field site.

1993 Plants are 6"-1' tall; fair condition with little growth.
1994 All 3 plants are 1' tall; poor to fair condition with little growth
1995 1 died in 1995 – cause undetermined. 2 are 1'tall; fair condition with no growth.
1996 1 died in 1996 – cause undetermined. Surviving plant is 1' tall; poor condition and declining.
1997 The last plant died in 1997 for undetermined reasons. This species does not appear to be adapted to this site.

Senegalia schweinfurthii (Brenan & Exell) Seigler & Ebinger var. ***schweinfurthii*** – river climbing acacia

[*Acacia schweinfurthii* Brenan & Exell var. *schweinfurthii*]

DELEP # 95-0115; planted December 1995 (3 plants)

Scandant shrubs forming thickets or climbing to 20 m in height. Small prickles are scattered on the stems. Leaves are even twice-pinnate and feathery, and white flowers are produced in spherical heads. The species is widespread in eastern Africa from Sudan to South Africa. Seeds for this accession originated near Bulawayo, Zimbabwe.

These plants initially appeared not to have problems but all subsequently died.

1996 All 3 plants are 1' tall; fair condition with little or no growth.
1997 All died in 1997. The cause was not determined.

Senegalia senegal (Linnaeus) Britton & P. Wilson var. ***leiorachis*** (Brenan) Kyalangalilwa & Boatwright – three-thorn acacia

[*Acacia senegal* (Linnaeus) Willdenow var. *leiorachis* Brenan]

DELEP # 91-0048; planted March 1992 (2 plants)

Shrubs or trees to 8 m tall with 3 prickles at each node, and dull yellowish papery bark, small, even twice-pinnate leaves, and white flowers in cylindrical racemes. *Acacia senegal* var. *leiorachis* has a wide distribution in eastern Africa. Seeds of this accession originated between Hwange and Victoria Falls, Zimbabwe.

This variety exhibited excellent performance initially. The plants suffered extensive damage from the 2007 freeze. One plant was killed and the other exhibited weak recovery. By this time these plants were substantially shaded by adjacent trees in the field and also may have been adversely affected by excessively wet soil due to leaks from the adjacent irrigation canal. The surviving plant died in 2010.

1992 Plants are 2.5'/3' tall; healthy with slow growth.
1993 Plants are 4.5'/5' tall; healthy with slow to moderate growth.
1994 Plants are 6'/6.5' tall; healthy with slow growth.
1995 Plants are both 7' tall; healthy with slow growth.
1996 Plants are 7.5'/10' tall; healthy with slow to moderate growth.
1997 Plants are both 10' tall; healthy with slow to moderate growth.
1999 Plants are 11'/16' tall; healthy with slow to moderate growth. Both flowered and fruited in 1999.
2000 Plants are 13'/16' tall; healthy with slow growth. Both are flowering and fruiting.
2001 Plants are 15'/19' tall; healthy with slow to moderate growth. Both are flowering and fruiting.
2002 Plants are 15'/19' tall; healthy with little change in size. Both are flowering and fruiting.
2004 Plants are 16'/20' tall; healthy with slow growth. Both are flowering and fruiting.
2005 Plants are 15'/19' tall; healthy with little change in size. Both are flowering and fruiting.
2006 Plants are 16'/19' tall; healthy with little apparent growth. Both are flowering and fruiting.
2007 1 plant is 16' tall; killed by freezing with stems to 5" thick killed. 1 plant is 19' tall; stems were frozen back to 6' from tips with stems 2" thick killed; poor condition, low vigor with only scattered new growth.
2008 Surviving plant is 14' tall; poor condition with only a few live limbs, weak recovery from 2007 freeze. Only a few flowers and fruit.
2009 Plant is 12' tall; poor condition, still struggling to recover from the 2007 freeze. No flowering observed. This plant subsequently died in 2010. Shading from adjacent trees may have been a contributing factor.

Senegalia senegal (Linnaeus) Britton & P. Wilson var. ***rostrata*** (Brenan) Kyalangalilwa & Boatwright – three-thorn acacia

[*Acacia senegal* (Linnaeus) Willdenow var. *rostrata* Brenan]

DELEP # 91-0052; planted March 1992 (2 plants)

Rounded, spreading shrubs to 4 m tall with pale gray, papery bark, three prickles at stem nodes, small, even twice-pinnate leaves, and white flowers in cylindrical racemes. Variety *rostrata* is found in parts of eastern and southern Africa. Seeds of this accession originated from north of the Bubi River between Masvingo and Beitbridge, Zimbabwe.

These plants performed well, however, the painfully armed, low, spreading branches required considerable effort to prune up to facilitate weed control. This taxon would make an excellent barrier plant.

1992 Plants are 1.5'/3' tall; healthy and growing slowly.
1993 Plants are both 5' tall; healthy with moderate to fast growth.
1994 Plants are 6.5'/7' tall; healthy with slow to moderate growth.
1995 Plants are 7'/7.5' tall; healthy with a slow increase in height but are spreading laterally to form thickets.
1996 Plants are 9'/10' tall; healthy with slow to moderate growth. 1 plant flowered in 1996.
1997 Plants are both 11' tall; healthy with slow growth. These have formed dense, low-branched thickets. Both plants are flowering and fruiting.
1999 Plants are 9'/12' tall; healthy with slow growth. Both are flowering and fruiting.
2000 Plants are 10'/13' tall; healthy with slow growth. Both are flowering and fruiting.
2001 Plants are 12'/14' tall; healthy with slow growth. Both are flowering and fruiting.
2002 Plants are 12'/14' tall; healthy with little change in size. Both are flowering and fruiting.
2004 Plants are 14'/16' tall; healthy with slow growth. Both are flowering and fruiting.
2005 Plants are 14'/16' tall; healthy with little change in size. Both are flowering and fruiting.
2006 Plants are 14'/16' tall; healthy with little apparent growth. Both are flowering and fruiting.
2007 Plants are 14'/16' tall; some stem tips froze only, healthy with little growth. Both are flowering and fruiting.
2008 Plants are both 18' tall; healthy with significant growth in the past year. Both are flowering and fruiting.
2009 Plants are 18'/20' tall; healthy with slow growth. Both are flowering and fruiting.
2013 Plants are 18'/20' tall; healthy with little increase in size. Both are flowering and fruiting.

Senegalia sp.

[*Acacia* sp.]

DELEP # 90-0319; planted March 1992 (2 plants)

Rounded shrubs or small trees to 5 m tall with recurved prickles on stems and even twice-pinnate leaves. The identity of this accession has not been determined. The seeds were collected north of the Trans-Chaco Highway in the Department of Presidente Hayes, Paraguay.

These plants did poorly. Their demise may have been hastened by browsing.

1992 Both plants are 1' tall; poor condition due to severe browsing.
1993 Both plants died during 1993. The cause was undetermined but browsing was likely a contributing factor.

Senna artemisioides (de Candolle) Randell subsp. ***helmsii*** (Symon) Randell – blunt-leaf cassia

DELEP # 90-0157; planted February 1995 (2 plants)

Unarmed shrubs to 2 m tall with gray, even once-pinnate leaves and showy yellow flowers. This species has some potential as an ornamental, but has proven rather cold-sensitive in trail plantings in Tucson. Subspecies *helmsii* is widely distributed in arid regions of Australia. Seeds for this accession were obtained from a commercial seed vendor in Western Australia.

These plants appeared to do well initially. One plant died in 1997 but the other plant lived on and exhibited good performance until declining in 2003-2004. It subsequently recovered and then died in 2006. The reason for the demise of these plants was not determined.

1995 Plants are 2'/2' tall; healthy with slow growth. Both flowered and fruited in the autumn of 1995.
1996 Plants are 2'3' tall; fair to good condition with slow growth. No flowering noted in 1996.
1997 1 plant died in 1996 from undetermined causes. The surviving plant is 3' tall; healthy with slow growth. It flowered and fruited in 1997.
1999 Plant is 3' tall; healthy with little increase in size. The plant flowered and fruited.
2000 Plant is 3.5' tall; healthy with slow growth. Plant is flowering and fruiting.
2001 Plant is 4' tall; healthy with slow growth. The plant flowered and fruited.
2002 Plant is 4' tall; healthy but little change in size. The plant flowered and fruited.
2004 Plant is 1' tall; poor condition with most stems dead. The cause has not been determined. No flowering noted.
2005 Plant is 4' tall; healthy and apparently recovered. It flowered and fruited in 2005.
2006 The plant died during 2006 from undetermined causes.

Senna atomaria (Linnaeus) Irwin & Barneby – palo zorillo

DELEP # 89-0015; planted March 1991 (1 plant)

Unarmed trees to 10 m tall with even once-pinnate leaves with large oval leaflets and racemes of attractive yellow flowers. Fruits of this species are utilized for cattle fodder (Felger et al, 2001). *Senna atomaria* is widely distributed from northwestern Mexico to South America and the Caribbean region. This accession originated near Alamos, Sonora, Mexico.

Performance of this species was good. It suffered considerable damage from the 2007 freeze but recovered well. No other problems were noted.

1991 Plant is 1.5' tall; healthy with slow growth.
1992 Plant is 3' tall; healthy with slow growth.
1993 Plant is 4.5' tall; healthy with slow growth.
1994 Plant is 7.5' tall; healthy with moderate growth.
1995 Plant is 7' tall; healthy with little increase in height.
1996 Plant is 7' tall; healthy with little growth.
1997 Plant is 8' tall; healthy with slow growth.
1999 Plant is 9.5' tall; healthy with slow growth. The plant flowered and fruited in 1999.
2000 Plant is 11' tall; healthy with slow growth. The plant flowered and fruited.
2001 Plant is 11' tall; healthy with little apparent growth. The plant flowered and fruited.
2002 Plant is 11' tall; healthy with little change in size. The plant flowered and fruited.
2004 Plant is 17' tall; healthy with moderate growth. The plant flowered and fruited.
2005 Plant is 20' tall; healthy with moderate growth. The plant flowered and fruited.
2006 Plant is 17' tall; healthy but with little apparent growth. The plant flowered and fruited.
2007 Plant is 10' tall; stems froze back to 12' from the tips with stems to 3" thick killed. The plant is healthy with rapid regrowth. No evidence of flowering in 2007.
2008 Plant is 20' tall; healthy and mostly recovered from 2007 freeze with rapid growth. No flowering observed.
2009 Plant is 25' tall; healthy with rapid growth. No flowering.
2013 Plant is 22' tall; healthy with slow growth and no apparent increase in height since 2009. The plant has flowered and fruited most years since 2011.

Senna birostris Vogel var. ***arequipensis*** (Vogel) Irwin & Barneby

DELEP # 89-0118; planted February 1995 (2 plants)

Shrubs to 1.5 m tall with even once-pinnate leaves and racemes of yellow flowers. The species occurs along the Andes from Argentina and Chile to Ecuador. Variety *arequipensis* occurs in northern Chile and southern Peru. Seeds for this accession were collected at Chusniisa, near Iquique, Chile.

These plants died during their first season. The cause of death was not determined.

1995 Both plants died in 1995 from undetermined causes.

Senna pallida (Vahl) Irwin & Barneby – two-flowered senna

DELEP # 90-0351; planted March 1992 (2 plants), March 1993 (2 plants)

Unarmed shrubs to 3 m tall with even once-pinnate leaves and yellow flowers mostly in 2-flowered racemes. This variable species is widespread in Mexico, Central America, northern South America and the Caribbean region. Seeds for this accession were collected near Alamos, Sonora.

In spite of the loss of 2 plants to gophers, this species performed well. The plants seemed to reach a certain size and old stems would die back while new stems emerged. The plants flower over many months.

1992 Plants are 4'/5' tall; healthy with moderate growth. Both plants flowered in the autumn of 1992.
1993 Plants are 2.5'-5' tall; healthy with slow growth. The 2 larger plants flowered and fruited in 1993.
1994 Plants are 3.5'-6' tall; healthy with slow to moderate growth. All flowered and fruited.
1995 Plants are 4'-6' tall; healthy with slow growth. All flowered and fruited.
1996 Plants are 3'-6' tall; health with little increase in size. All flowered

and fruited.
1997 2 plants were killed by gophers in 1996. 1 surviving plant is 3' tall; fair condition with slow growth. No flowering. The other plant is 6' tall; healthy with slow growth. It flowered and fruited.
1999 Plants are 3'/4' tall; fair condition with little growth. Both flowered and fruited.
2000 Plants are 3'/4' tall; fair to good condition with little change in size. Both flowered and fruited.
2001 Plants are 2'/4' tall; healthy in spite of some die-back. Both flowered and fruited.
2002 Plants are 3'/4' tall; healthy with little change in size. Both flowered and fruited.
2004 Plants are 4'/5' tall; fair condition with some increase in size. Both flowered and fruited.
2005 Plants are 2'/4' tall; healthy but smaller this year. Both flowered and fruited.
2006 Plants are 4'/5' tall; healthy with some increase in size. Both flowered and fruited.
2007 Plants are 2'/3' tall; stems froze to ground level with healthy regrowth. Both flowered and fruited.
2008 1 plant died in 2008 from undetermined causes. The surviving plant is 4.5' tall; healthy with flowers and fruits.
2009 Plant is 5' tall; fair condition but with little growth. No flowering was observed this year.
2013 Plant is 5.5' tall; fair condition with new stems replacing older stems. The plant has flowered and fruited most years since 2009.

Senna purpusii (Brandegee) Irwin & Barneby
DELEP # 89-0331D; planted February 1995 (2 plants)

Unarmed shrubs to 1.5 m tall with even once-pinnate leaves with distinctive purple-tinged blue green leaflets and racemes of showy yellow flowers. The species makes an attractive xeric shrub for warm-winter locations. It is endemic to the Pacific slope of southern Baja California state, Mexico. DELEP obtained the seeds for this accession from the Mildred E. Mathias Botanical Garden, California.

After performing well during its first two seasons, this plant died from undetermined causes. Summers may have been excessively hot for this species, which is native to coastal regions.

1995 1 plant died in 1995 from undetermined causes. The surviving plant is 2.5' tall; healthy with slow growth. It flowered and fruited in 1995.
1996 Plant is 3' tall; healthy with slow growth. Flowering observed in 1996.
1997 The plant died in 1997 from undetermined causes.

Sophora tomentosa Linnaeus – yellow necklacepod
DELEP # 92-0033; planted March 1994 (1 plant)

Unarmed shrubs to 2 m tall with odd once-pinnate leaves and showy, yellow, pea-like flowers in racemes. This species is grown as a garden plant for its attractive flowers and is utilized as a nectar source by a variety of pollinators (NPIN: Native Plant Database, 2015.). *Sophora tomentosa* is widely distributed along tropical sea coasts in many regions of the world. Seeds for this accession were obtained from a commercial seed company.

This plant performed well for many years, developing into a spreading mound with attractive flowers. It was severely damaged by the 2007 freeze but made a rapid recovery before declining and dying from undetermined causes.

1994 Plant is 2' tall; healthy with flowering and fruiting in 1994.
1995 Plant is 2' tall; healthy with slow growth and a spreading habit. The plant flowered and fruited.
1996 Plant is 2.5' tall; healthy with slow growth. The plant flowered and fruited.
1997 Plant is 3.5' tall; healthy with slow growth and spreading stems. Flowering and fruiting.
1999 Plant is 4.5' tall; healthy with slow growth. The plant flowered and fruited.
2000 Plant is 4.5' tall; healthy with little change in size. Flowering and fruiting.
2001 Plant is 4.5' tall; healthy with little apparent increase in size. The plant is flowering and fruiting.
2002 Plant is 4.5' tall; healthy with little apparent growth. Flowering and fruiting.
2004 Plant is 6' tall; healthy with slow growth. The plant is flowering and fruiting.
2005 Plant is 5.5' tall; healthy with little change in size. Flowering and fruiting.
2006 Plant is 6' tall; healthy with little growth. The plant continues to flower and fruit heavily.
2007 Plant is 4.5' tall; all stems froze to the crown, with stems to 2" thick killed. The plant is healthy with vigorous regrowth. It flowered and fruited later in 2007.
2008 Plant is 4.5' tall; healthy and fully recovered from the 2007 freeze. Flowering and fruiting.
2009 Plant is 4' tall; poor condition with most stems dead. The cause was not determined. No flowering noted. The plant made a weak recovery in 2010, but died in 2011. The cause was not determined.

Tamarindus indica Linnaeus – tamarind
DELEP # 90-0361; planted March 1992 (2 plants)

Unarmed trees to 30 m tall with a spreading canopy, even once-pinnate leaves and small yellow flowers in racemes or panicles. The plants are grown for the sweet fruit pulp and seeds which are also edible. This species also has a variety of medicinal uses, the wood is used in carpentry and for fuel, and the trees are planted for shade (Allen and Allen, 1981). Tannin, ink and a yellow dye are also obtained from the trees (Allen and Allen, 1981). The species is native to tropical areas of Africa and the plants have been extensively introduced in other tropical regions of the world. Seeds of this accession were purchased at a grocery store in McAllen, Texas.

These plants declined and died during their second season. They do not appear to be adapted to this site.

1992 Plants are 14"/14" tall; healthy with little growth. 1 plant has minor damage from browsing.
1993 Both plants died in 1993 from undetermined causes.

Vachellia amythythophylla (Steudel ex A. Richard) Kyalangalilwa & Boatwright - large-leaved acacia
[*Acacia amythethophylla* Steudel ex A. Richard]
DELEP # 90-0500; planted March 1992 (2 plants), January 1994 (2 plants)

Shrubs or small trees growing to 7 m tall with small, stipular

spines; large, ferny, even twice-pinnate leaves and distinctive panicles of showy yellow flower heads during the winter months. The wood is used in turnery and the plant is used in traditional medicine (Timberlake et al, 1999). This species is widely distributed in Africa. These plants were grown from seeds originating between Gweru and Harare, Zimbabwe.

Overall performance of this species was good. The second pair of plants were killed to near ground level by fire in late 2003 but recovered rapidly. All of these plants suffered some damage from freezing in 2007, but recovered rapidly. Flowering began four years after planting and most plants flowered each year once they began flowering, however no fruits were observed to form.

1992 both plants are ca. 2.5' tall; healthy with slow growth.
1993 Plants are 3' and 3.5' tall; healthy with slow growth.
1994 Tallest of 4 plants is 6' tall; fair to good condition with slow to moderate growth.
1995 2 original plants are 8' tall; healthy with slow to moderate growth.
1996 Heights range from 2.5' to 10'; healthy with slow growth. Largest plant flowered in 1996.
1997 Heights range from 3' to 11'; healthy with slow growth. Both original plants flowering.
1999 Heights range from 5' to 13'; healthy with slow growth. 3 are flowering.
2000 Heights range from 6' to 15'; healthy with slow growth. All 4 are flowering but no fruit seen.
2001 Heights range from 6' to 17'; healthy with slow growth. 3 plants are flowering, no fruit.
2002 Heights range from 7' to 17'; healthy with slow growth. 3 plants are flowering, no fruit.
2004 2 original plants are 20' and 22' tall; healthy with moderate growth. Flowering; this species has flowered heavily for years but no evidence of fruiting has been found. Second pair are both 8' tall, tops killed by fire with healthy regrowth from base.
2005 Plants are 7'/11'/15'/17' tall; healthy with slow growth. 3 largest plants are flowering.
2006 Plants are 8'/11'/17'/20' tall; healthy with slow growth. 3 largest plants are flowering.
2007 Plants are 6'/10'/15'/20' tall; healthy, most stems were killed back to 5' from the tips by freezing; all plants exhibited rapid recovery. No flowering observed this year.
2008 Plants are 6'/12'/18'/20' tall; healthy and fully recovered from 2007 freeze. 2 largest plants are flowering.
2009 Plants are 6'/12'/20'/25' tall; healthy; 2 original plants have grown substantially and are flowering, the other two appear healthy but have grown little and are not flowering.
2013 Plants are 6'/15'/20'/26' tall; healthy. 3 largest plants are flowering.

Vachellia brandegeeana (I.M. Johnston) Seigler & Ebinger – Baja California acacia

[*Acacia brandegeeana* I.M. Johnston]

DELEP # 95-0007; planted December 1995 (2 plants)

Shrubs or small trees to 5 m tall with stipular spines; small, even twice-pinnate leaves and white or cream colored flowers in elongated heads. Native to the central and southern Baja California peninsula, Mexico. The seeds were received from the Desert Botanical Garden, Phoenix, Arizona. This species closely resembles *Vachellia rigidula* except for its much thicker fruits.

These plants did well with no apparent problems, but had not been observed to flower by the time that this field study ended.

1996 Plants are 1''/4'' tall; fair condition with little growth.
1997 Plants are 1'/1' tall; fair to good condition with slow growth.
1999 Plants are 2'/2' tall healthy with slow growth.
2000 Plants are 2'/2' tall; healthy but with little apparent growth.
2001 Plants are 2.5'/3.5' tall; healthy with slow growth.
2002 Plants are 2.5'/3.5' tall; healthy but with little apparent growth from previous year.
2004 Plants are 5'/6' tall; healthy with slow growth.
2005 Plants are 6.5'/6.5' tall; healthy with size slowly increasing.
2006 Both plants are 7' tall; healthy with slow growth.
2007 Plants are 7'/8' tall; healthy with little growth over the past year.
2008 Both plants are 7' tall; healthy with little growth since previous year.
2009 Both plants are 8' tall; healthy with slow growth.
2013 Both plants are 10' tall; healthy with numerous stems. This species has shown no evidence of flowering.

Vachellia cornigera (Linnaeus) Seigler & Ebinger – bullhorn acacia, swollen-thorn acacia

[*Acacia cornigera* (Linnaeus) Willdenow]

DELEP # 94-0139; planted December 1995 (2 plants)

Shrubs or trees to 10 m tall with greatly enlarged paired spines at nodes; feathery, even twice-pinnate leaves and yellow flowers in rounded heads. The spines of this species are hollow and provide shelter for ants that live on the plants and protect them from herbivores and encroaching vegetation in their native habitat (Janzen, 1967). This species is native to tropical regions of Mexico and Central America. Seeds for this accession were collected from a plant growing in a vacant field in Harlingen, Texas.

This species initially seemed to thrive, then underwent a major decline beginning in 2002 for reasons that were not determined. Both plants froze to the crown in 2007 and subsequently recovered but never thrived as they had done during their early years.

1996 Plants are 4.5'/6' tall; healthy with moderate to fast growth.
1997 Plants are 7'/7'5' tall; healthy with moderate growth.
1999 Plants are 7.5'/8' tall; healthy but slow growth. 1 plant has flowers and fruit; 1 plant has flowers only.
2000 Plants are 7.5'/8' tall; healthy but little growth. Both plants have flowers and fruit.
2001 Plants are 8'/9' tall; healthy with slow growth. Both plants with flowers only.
2002 Plants are 8'/9' tall; poor condition with many dead branches – cause undetermined. A few flowers only on both plants.
2004 1 plant is 4' tall; poor condition with a dead top and new sprouts from the base. 1 plant is 8' tall; poor condition, some growth but most stems are dead. The cause for the decline of these plants is undetermined. No flowering.
2005 1 plant is 6' tall; poor condition but it produced a few flowers and fruit. 1 plant is 8' tall; fair condition, flowering.
2006 Plants are 6'/8' tall; poor condition but still putting out growth. No flowering observed.

2007 Plants are 1.5'/4' tall; both froze to the crown with stems to 2" thick killed. Healthy regrowth.
2008 Plants are 2.5'/7' tall; these look better than they have in several years. No flowering evident.
2009 Plants are 7'/9' tall; healthy with slow to moderate growth and they continue to look better. 1 plant is flowering.
2013 Plants are 6'/7' tall; healthy overall but have grown little. No flowering evident.

Vachellia karroo (Hayne) Banfi & Galasso – sweet thorn
[*Acacia karroo* Hayne]
DELEP # 91-0054; planted March 1993 (1 plant)

Shrubs or trees to 15 m tall with paired, often large white spines at the nodes, small, even twice-pinnate leaves, and yellow flowers in rounded heads. This species is widely used for fuelwood and to make charcoal (Timberlake et al, 1999). It has also been used for fiber, as a dye source, livestock forage, and in traditional medicine (Timberlake et al, 1999). The species is widely distributed in southern Africa. Seeds of this accession were collected at the base of the Donkerkloof, near Lebowakgomo, South Africa.

The single plant of this species grew well and had no problems. It is unclear why it never flowered, though it is possible that flowering did occur during the summer months. No remnant fruits were found on the tree or beneath it. The blackish bark and imposing spines of this plant are distinctive. Many forms of *V. karroo* are quite cold-tolerant.

1993 Plant is 1.5' tall; healthy with slow growth.
1994 Plant is 3.5' tall; healthy with slow growth
1995 Plant is 8' tall; healthy with rapid growth during the past year.
1996 Plant is 13' tall; healthy with vigorous growth.
1997 Plant is 14' tall; healthy but with slow growth over the past year.
1999 Plant is 16' tall; healthy with slow growth.
2000 Plant is 20' tall; healthy with moderate growth. No evidence of flowering.
2001 Plant is 20' tall; healthy but little apparent change in size.
2002 Plant is 20' tall; healthy but little change in size.
2004 Plant is 25' tall; healthy with rapid growth. No flowering evident, though it may have done so during the summer.
2005 Plant is ca. 25' tall; healthy but no apparent change in size.
2006 Plant is ca. 25' tall; healthy with little apparent change in size.
2007 Plant is ca. 25' tall; no freeze damage, healthy but with little size increase.
2008 Plant is ca. 28' tall; healthy with moderate growth. No evidence of flowering.
2009 Plant is ca. 30' tall; healthy and slowly getting larger. No sign of flowering.
2013 Plant is 37' tall; healthy. No evidence of flowering has been noted on this tree.

Vachellia luederitzii (Engler) Kyalangalilwa & Boatwright var. ***luederitzii*** – Kalahari sand acacia
[*Acacia luederitzii* Engler var. *luederitzii*]
DELEP # 91-0143; planted March 1992 (2 plants)

Trees to 12 m tall with paired spines at stem nodes, small, even twice-pinnate leaves, and yellow flowers in rounded heads. The wood is used for fuelwood and the plants produce an edible gum (Timberlake et al, 1999). This variety is native to parts of Botswana, Namibia, South Africa, Zambia and Zimbabwe. Seeds for this accession originated near Nata, Botswana.

These plants grew well and presented no problems. They develop an attractive, upright growth habit and would make suitable trees for landscaping. Flowering and fruiting began 3 years after planting.

1992 1 plant is 1.5' tall; healthy but heavily browsed. 1 plant is 4' tall; healthy with moderate growth.
1993 1 plant appears to be dead due to browsing. 1 plant is 10' tall; healthy with vigorous growth.
1994 Browsed plant recovered and is 3' tall; healthy with slow growth. 1 plant is 14' tall; healthy with rapid growth.
1995 Plants are 6'/14' tall; healthy with slow to moderate growth. Larger plant flowered and fruited during 1995.
1996 Plants are 9'/16' tall; healthy with slow to moderate growth. Both plants are flowering and fruiting.
1997 Plants are 14'/22' tall; healthy with vigorous growth. Both plants are flowering and fruiting.
1999 Plants are 15'/18' tall; healthy with slow growth. Both are flowering and fruiting.
2000 Plants are 15'/18' tall; healthy but with little increase in height. Both are flowering and fruiting.
2001 Plants are 16'/22' tall; healthy with slow to moderate growth. Both are flowering and fruiting.
2002 Plants are 16'/18' tall; healthy with little apparent change in size. Both are flowering and fruiting.
2004 Plants are both ca. 25' tall; healthy with moderate growth and produce flowers and fruit each year. These are attractive but spiny trees with and upright growth form.
2005 Plants are both ca. 25' tall; healthy but with little change in size in the past year. Both are flowering and fruiting.
2006 Plants are both ca. 27' tall; healthy with slow growth. Both are flowering and fruiting.
2007 Plants are both ca. 27' tall; minor freeze damage to stem tips only, healthy but with little growth. Both are flowering and fruiting.
2008 Plants are both ca. 30' tall; healthy with moderate growth during the past year. Both are flowering and fruiting.
2009 Plants are both ca. 30' tall; healthy but with little change is size. Both continue to flower and fruit.
2013 Plants are 33'/40' tall; healthy and continuing to grow, flower and fruit.

Vachellia nebrownii (Burtt Davy) Seigler & Ebinger - water acacia
[*Acacia nebrownii* Burtt Davy]
DELEP # 91-0012; planted March 1992 (4 plants)

Shrubs or occasionally small trees to 4 m tall with paired, long, slender spines at the stem nodes and bark that peels in papery flakes from the smaller stems; small, even twice-pinnate leaves, and yellow flowers in rounded heads. *Vachellia nebrownii* is native to parts of Botswana, Namibia, South Africa and Zimbabwe. These plants were grown from seeds that were collected northeast of Burgersfort, Lebowa, South Africa.

In spite of the loss of 2 of the 4 plants, overall performance of this species was good. It is an attractive plant for smaller spaces and survives in cold areas of Tucson, though with considerable damage in cold winters.

1992 Plants are 3'-4' tall; healthy with moderate growth. 3 are flowering in the autumn of 1992.
1993 1 plant is 8' tall; poor condition but had grown considerably in the past year. 3 plants are 7'-8' tall; healthy with rapid growth. 3 healthy plants are flowering and fruiting.
1994 1 plant died in 1994 – possibly due to waterlogging from water seeping from adjacent irrigation canal. 3 remaining plants are 9'-10' tall; healthy with slow growth. They are flowering and fruiting.
1995 3 surviving plants are 11'-12' tall; healthy with slow growth. All are flowering and fruiting.
1996 Plants are 11'-12' tall; healthy with slow growth (1 has leaned over). All are flowering and fruiting.
1997 Plants are 10'-14' tall. 1 is in fair condition with little growth and no flowering. 2 are healthy with slow growth and flowers/fruits.
1999 1 plant is 8' tall; fair condition with no apparent growth and no flowers. 2 are 14'/14' tall; healthy with slow growth and flowers/fruits.
2000 1 plant died in 2000 – cause undetermined but possibly due to waterlogging along the irrigation canal. 2 remaining plants are 8'/14' tall; healthy with little growth. Only 1 is flowering and fruiting.
2001 Plants are 10'/17' tall; healthy with slow to moderate growth. Both are flowering and fruiting.
2002 Plants are 10'/17' tall; healthy with little change in size. Both are flowering and fruiting.
2004 Plants are 14'/16' tall; healthy with slow growth. Both are flowering and fruiting. These are attractive small trees with interesting bark.
2005 Plants are 14'/17' tall; healthy but with little change in size. Both are flowering and fruiting.
2006 Plants are 12'/15' tall; healthy with little growth. Both are flowering and fruiting.
2007 Plants are 14'/16' tall; stem tips and foliage killed by freezing, healthy with slow growth. Both are flowering and fruiting.
2008 Plants are 15'/18' tall; healthy with slow growth. Both are flowering and fruiting.
2009 Plants are 16'/20' tall; healthy with slow growth. Both are flowering and fruiting.
2013 Plants are 14'/24' tall; one is in fair condition (partially covered with milkweed) and one is healthy. Both are flowering and fruiting.

Vachellia nilotica (Linnaeus) P.J.H. Hurter & Mabberley subsp. ***subalata*** (Vatke) Kyalangalilwa & Boatwright – scented-pod acacia

[*Acacia nilotica* (Linnaeus) Willdenow ex Delile subsp. *subalata* (Vatke) Brenan]

DELEP # 90-0252; planted March 1992 (1 plant)

Trees to 14 m tall with a flattened or rounded crown and paired spines at the nodes; small, feathery, even twice-pinnate leaves, and yellow flowers in rounded heads. Wood of this species is widely used for fuelwood, posts, and timbers, and the bark has been used in tanning leather (Timberlake et al, 1999). The trees produce an edible gum and a variety of uses in traditional medicine are known (Timberlake et al, 1999). The species also serves as browse for livestock (Timberlake et al, 1999). *Vachellia nilotica* is widespread in Africa and in southwest Asia as far east as India. Subspecies *subalata* is found in parts of Ethiopia, Kenya, Sudan, Tanzania and Uganda. This accession originated near Wamba, Kenya.

This plant performed well until it died for undetermined reasons in 2007. The plant did not show damage from freezing but had developed a pronounced lean due to high winds several years previously.

1992 Plant is 6' tall; healthy with vigorous growth.
1993 Plant is 11' tall; healthy with rapid growth.
1994 Plant is 18' tall; healthy with rapid growth.
1995 Plant is 18' tall; healthy and vigorous, though no increase in height. Flowering and fruiting.
1996 Plant is 23' tall; healthy with rapid growth. No flowering noted this year.
1997 Plant is 25' tall; healthy with slow growth. Flowering and fruiting.
1999 Plant is 22' tall; healthy with little increase in size. Flowering and fruiting.
2000 Plant is 22' tall; healthy but no change in size. Flowering and fruiting.
2001 Plant is 25' tall; healthy with moderate growth. This tree has developed a pronounced lean to the west and pruning is an ongoing issue. Flowering and fruiting.
2002 Plant is 25' tall; healthy with slow growth. Flowering and fruiting.
2004 Plant is ca. 35' tall; healthy with rapid growth. Flowering and fruiting.
2005 Plant is 25' tall; healthy but leaning further. Flowering and fruiting.
2006 Plant is ca. 25' tall; healthy with little change in size. Flowering and fruiting.
2007 This plant died in 2007 – cause undetermined but not due to freezing. It was still alive and appeared reasonably healthy in March 2007.

Vachellia nilotica (Linnaeus) P.J.H. Hurter & Mabberley – scented-pod acacia

[*Acacia nilotica* (Linnaeus) Willdenow ex Delile]

DELEP # 90-0267; planted March 1991 (1 plant)

Trees to 14 m tall with a flattened or rounded crown and paired spines at the nodes; small, feathery, even twice-pinnate leaves, and yellow flowers in rounded heads. Wood of this species is widely used for fuelwood, posts, and timbers, and the bark has been used in tanning leather (Timberlake et al, 1999). The infraspecific taxon of this accession has not been determined. The seeds originated from cultivated trees in Manabí Province, Ecuador.

This tree did exceptionally well with no problems. It flowered and fruited prolifically, and is the likely parent tree of 2 volunteer seedlings in adjacent areas of the field. The tree had a spreading canopy and produced abundant shade.

1991 Plant is 3' tall x 6' across; healthy with rapid growth.
1992 Plant is 7' tall; healthy with moderate growth. Flowering in the autumn of 1992.
1993 Plant is 12' tall; healthy with rapid growth. Flowering and fruiting.
1994 Plant is 18' tall; healthy with rapid growth. Flowering and fruiting.
1995 Plant is 17' tall; healthy but no increase in height. Flowering and fruiting.
1996 Pant is 20' tall; healthy with moderate growth. Flowering and fruiting.
1997 Plant is 25' tall; healthy with rapid growth. Flowering and fruiting.

1999 Plant is 25' tall; healthy but little increase in height. Flowering and fruiting.
2000 Plant is ca. 25' tall; healthy but little change is size. Many low-hanging branches. Flowering and fruiting.
2001 Plant is 30' tall; healthy with rapid growth. Flowering and fruiting.
2002 Plant is 30' tall; healthy with slow growth. Flowering and fruiting.
2004 Plant is ca. 30' tall; healthy but little increase in height. Flowering and fruiting.
2005 Plant is ca. 30' tall; healthy but little change in size. Flowering and fruiting.
2006 Plant is ca. 35' tall; healthy with rapid growth. Flowering and fruiting.
2007 Plant is ca. 35' tall; no apparent freeze damage, healthy with little change in size. Flowering and fruiting.
2008 Plant is ca. 35' tall; healthy with little change in size. Flowering and fruiting.
2009 Plant is ca. 35' tall; healthy with little increase in size. Flowering and fruiting.
2013 Plant is 36' tall with a canopy spread of ca. 40' and a trunk diameter of 29.5"; healthy with slow growth. Flowering and fruiting.

Vachellia pennatula (Chamisso & Schlechtendal) Seigler & Ebinger subsp. ***pennatula*** – feather acacia

[*Acacia pennatula* (Chamisso & Schlechtendal) Bentham subsp. *pennatula*]

DELEP # 96-0001; planted February 1997 (1 plant)

Trees to 10 m tall with short, paired spines at the nodes, feathery, even twice-pinnate leaves with very numerous tiny leaflets, and yellow flowers in rounded heads. The fruits have been used for human food and the bark has been used to dye leather (Felger et al, 2001). This subspecies ranges from northwestern Mexico to northern South America. Seeds of this accession were collected from a cultivated plant in Tucson, Arizona.

This species performed well and exhibited no problems. It is suitable as a landscape tree for warm-winter areas.

1997 Information missing.
1999 Plant is 7' tall; healthy with moderate growth.
2000 Plant is 8.5' tall; healthy with slow growth.
2001 Plant is 14' tall; healthy with rapid growth.
2002 Plant is 15' tall; healthy with slow growth. Flowering and fruiting in 2002.
2004 Plant is 20' tall; healthy with rapid growth. Flowering and fruiting.
2005 Plant is 22' tall; healthy with slow growth. Flowering and fruiting.
2006 Plant is 20' tall; healthy with little change in size. Flowering and fruiting.
2007 Plant is 20' tall; no apparent freeze damage, healthy with little change in size. Flowering and fruiting.
2008 Plant is 24' tall; healthy with moderate growth. Flowering and fruiting.
2009 Plant is ca. 25' tall; healthy with little change in size. Flowering and fruiting.
2013 Plant is 29' tall; healthy with slow growth. Flowering and fruiting.

Vachellia pennatula (Chamisso & Schlechtendal) Seigler & Ebinger subsp. ***pennatula*** – feather acacia

[*Acacia pennatula* (Chamisso & Schlechtendal) Bentham subsp. *pennatula*]

DELEP # 96-0002; planted February 1997 (1 plant)

Trees to 10 m tall with short, paired spines at the nodes, feathery, even twice-pinnate leaves with very numerous tiny leaflets, and yellow flowers in rounded heads. The fruits have been used for human food and the bark has been used to dye leather (Felger et al, 2001). This subspecies ranges from northwestern Mexico to northern South America. Seeds of this accession were collected from a cultivated plant in Tucson, Arizona.

Like its companion accession, this species performed well and exhibited no problems.

1997 Information missing.
1999 Plant is 6' tall; healthy with moderate growth.
2000 Plant is 7.5' tall; healthy with slow growth.
2001 Plant is 9' tall; healthy with slow growth.
2002 Plant is 10' tall; healthy with slow growth.
2004 Plant is 14' tall; healthy with slow growth.
2005 Plant is 13' tall; healthy with little increase in size.
2006 Plant is 14' tall; healthy with little change in size. Flowering and fruiting in 2006.
2007 Plant is 14' tall; no apparent freeze damage, healthy with little growth. Flowering and fruiting.
2008 Plant is 19' tall; healthy with rapid growth. Flowering and fruiting.
2009 Plant is 18' tall; healthy with little change in size. Flowering and fruiting.
2013 Plant is 24' tall; healthy with slow growth. Flowering and fruiting.

Vachellia sieberiana (de Candolle) Kyalangalilwa & Boatwright – paperbark acacia

[*Acacia sieberiana* de Candolle]

DELEP # 91-0460; planted March 1994 (4 plants)

Trees to at least 15 m tall with high, with wide-spreading canopies, papery, pale gray bark and paired spines at the nodes. The even twice-pinnate leaves are feathery, and white flowers are produced in globular heads. This species is widespread in sub-Saharan Africa. These plants were grown from seeds that originated near Koutango, Department of Nioro du Rip, Senegal.

Aside from the loss of one plant the year following planting, this species thrived and the plants developed into impressive trees. This species would make outstanding shade trees for parks and other large spaces.

1994 1 plant died in 1994 – the cause was not determined. 3 plants are 3'-5' tall; healthy with moderate growth.
1995 3 remaining plants are 5'-6.5' tall; healthy with slow growth.
1996 Plants are 6'-14' tall; healthy with slow to rapid growth.
1997 Plants are 10'-20' tall; healthy with rapid, vigorous growth.
1999 Plants are 10'-22' tall; healthy with slow growth.
2000 Plants are 14'-28' tall; healthy with slow to moderate growth. The canopies are beginning to spread.
2001 Plants are 15'-30' tall; healthy with slow growth. No evidence of flowering.
2002 Plants are 15'to 30' tall; healthy with little increase in height but lateral growth is evident.
2004 Plants are 20' to ca. 40' tall; healthy with moderate to fast growth. No evidence of flowering.
2005 Plants are 20'/25'/ca. 40' tall; healthy with little height increase.

These are developing into beautiful shade trees.
2006 Plants are 18'/20'/ca. 40' tall; healthy with little change in size. No evidence of flowering.
2007 Plants are 15'/18'/ca. 35' tall; stems froze back to 5' from tips with stems to 1" thick killed, healthy with vigorous regrowth.
2008 Plants are 18'/21'/ca. 35' tall; healthy with moderate growth.
2009 Plants are 20'/28'/ca. 40' tall; healthy with moderate growth. No evidence of flowering.
2013 1 plant is 22' tall, 1 plant is 35' tall with a trunk diameter of 19.5', and 1 plant is 54' tall with a trunk diameter of 29.5". All are healthy with moderate growth. The largest tree began flowering and fruiting in 2012.

Vachellia tortilis (Forrskal) Galasso & Banfi subsp. ***spirocarpa*** (Hochstetter ex A. Richard) Kyalangalilwa & Boatwright – umbrella thorn

[*Acacia tortilis* (Forrskal) Hayne subsp. *spirocarpa* (Hochstetter ex A. Richard) Brenan]

DELEP # 90-0255; planted March 1991 (2 plants)

Shrubs or commonly trees potentially to 18 m tall with a flattened crown and both straight and curved spines in pairs at the nodes. The leaves are even twice-pinnate. Flowers are white or cream colored and are produced in rounded heads. Native to parts of eastern and southern Africa. Seed of this accession originated at Kibwezi, Kenya.

These plants initially thrived but then declined rapidly. One plant subsequently seemed to recover and grew vigorously, but then it too, rapidly declined and died. The cause was not determined.

1991 Plants are both 3' tall with a 6' spread; these thrived until December 1991 when they mostly died back. The cause for this was not determined.
1992 1 plant subsequently died. 1 plant is 8' tall x 10' across; apparently healthy with vigorous growth.
1993 The surviving plant rapidly declined and died in 1993 for undetermined reasons.

Vachellia xanthophloea (Bentham) P.J.H. Hurter – fever tree

[*Acacia xanthophloea* Bentham]

DELEP # 90-0259; planted March 1992 (4 plants)

Trees to 30 m tall with a spreading canopy, distinctive, smooth, yellowish or greenish bark with a powdery covering, pairs spines at the stem nodes, even twice-pinnate leaves, and yellow flowers in globose heads. The common name *fever tree* stems from the fact that the trees often grow in low areas near water where malarial mosquitoes are present (Timberlake et al, 1999). The species is widespread in eastern Africa. These plants originated as seeds collected near Nachu, Kikuyu, Kenya.

Overall, these plants did well. The largest individual was blown over by wind, but with substantial pruning, it developed strong vertical growth and was not adversely affected. The smallest plant began to decline in 2006 and subsequently died in 2008. The cause for this was not determined. These plants flowered and at least some fruits were produced, but no evidence of this was found except for a single volunteer seedling which came up in an adjacent area of the field. Flowering was observed on this plant in 2013. These are attractive trees with unique bark and would be suited to large spaces.

1992 Plants are 3'-7' tall; healthy with moderate to rapid growth.
1993 1 plant is 14' tall; blown over to 40°, healthy with rapid growth. 3 plants are 8'-12' tall; healthy with rapid growth.
1994 Plants are 13'-22' tall; healthy with rapid, vigorous growth.
1995 Plants are 15'-20' tall; healthy with slow growth.
1996 Plants are 18'-25' tall; healthy with moderate to rapid growth. These have spectacular yellow green bark.
1997 Plants are 17'-30' tall; healthy with slow to rapid growth. The largest plant is especially vigorous.
1999 Plants are 14'-24' tall; healthy with little growth.
2000 Plants are 14'-28' tall; healthy with slow growth. No evidence of flowering.
2001 Plants are 16'-28' tall; healthy but with little change in size.
2002 Plants are 16'-30' tall; healthy with slow growth.
2004 Plants are 15'-30' tall; healthy with little apparent growth. No evidence of flowering has been observed.
2005 Plants are 14'/20'/22'/35' tall; healthy with slow growth on all except the largest tree which exhibited rapid growth.
2006 1 plant is 12' tall; fair condition with substantial die-back. The other plants are 20'/22'/35' tall; healthy but with little change is size.
2007 1 plant is 12' tall; poor condition with major limbs dead to the trunk. This is not related to freezing. The other plants are 18'/20'/ca. 35' tall; some stems froze back to 3' from the tips, healthy with rapid regrowth.
2008 1 plant died in 2008 – cause undetermined. The surviving plants are 20'/25'/ca. 35' tall; healthy with slow to moderate growth.
2009 1 plant is 28' tall; fair condition with increase height but some dead limbs in the crown. The other 2 plants are 28'/ca. 40' tall; healthy with moderate growth. No evidence of flowering.
2013 1 plant is 20' tall; fair condition with substantial die-back but also healthy growth. The other 2 plants are 33'/40' tall; healthy with slow growth. No evidence of flowering.

Vachellia sp.

[*Acacia* sp.]

No accession number assigned; planted March 1992 (2 plants)

Trees to at least 15 m tall with spreading canopies and paired spines at the stem nodes, feathery, even twice-pinnate leaves and yellow flowers in globose heads. The identity of this accession has not been determined. The seeds originated in the Andes Mountains of Peru. An accession number was never assigned as the few seeds were all propagated.

These trees grew vigorously and had no problems, however the weeping outer branches required considerable pruning to keep them off of the ground. These trees flowered sparingly and no viable seeds were collected.

1992 Plants are 6'/7' tall; healthy with rapid growth.
1993 Plants are 14'/15' tall; healthy with rapid, vigorous growth.
1994 Plants are 21'/23' tall; healthy with rapid growth. Both are producing a few flowers.
1995 Plants are both 25' tall; healthy with rapid growth. Both are flowering but no fruits have been observed.
1996 Plants are both 25' tall; healthy with moderate growth. Little increase in height but branches are extending and drooping. Both plants are flowering.
1997 Plants are both ca. 30' tall; healthy with rapid growth. Both are flowering only.

1999 Plants are both ca. 25' tall; healthy with moderate growth but no increase in height. Flowering only.
2000 Plants are 25'30' tall; healthy with moderate growth. The drooping limbs are a maintenance issue. Flowering only.
2001 Plants are both ca. 30' tall; healthy and vigorous. Ongoing pruning is required to keep the outer limbs off of the ground. Flowering only.
2002 Plants are both ca. 30' tall; healthy and vigorous. Height seems to have stabilized. Flowering only.
2004 Plants are both ca. 35' tall; healthy with moderate growth. The low-hanging branches are a major maintenance issue. These trees have flowered for years but no fruits have been produced.
2005 Plants are both ca. 35' tall; healthy and vigorous. Both plants are flowering.
2006 Plants are both ca. 35' tall; healthy and vigorous. Both are flowering.
2007 Plants are both ca. 35' tall; some stems froze back to 4' from the tips, healthy regrowth. No flowering.
2008 Plants are both ca. 35' tall; healthy and recovered from 2007 freeze. Both are flowering.
2009 Plants are both ca. 35' tall; healthy with little change in size. Both are flowering.
2013 1 plant is 36' tall with a trunk diameter of 23.5" and 1 plant is 38' tall with a trunk diameter of 30.5"; both are healthy with slow growth. Both are flowering and have a few fruits, but these appear not to contain viable seeds.

Xanthocercis zambesiaca (Baker) Dumaz-le-Grand – nyala tree

DELEP # 91-0137; planted March 1993 (4 plants)

Unarmed trees to 30 m tall with a rounded canopy, odd once-pinnate leaves, and small, white, pea-like flowers produced in panicles. The berry-like fruits are eaten by wildlife and humans (Palgrave, 1983). The tree is also a source of timber (Palgrave, 1983). This species is found in parts of Democratic Republic of the Congo, Malawi, Mozambique, South Africa and Zimbabwe. Seeds for this accession originated near Nyanyadzi, Zimbabwe.

This species performed poorly at this site and the plants declined and died for reasons that were not determined. They do not appear to be adapted to the conditions at this site.

1993 Plants are 1.5'-4.5' tall; fair condition with little growth.
1994 Plants are 1'-3' tall; poor condition, declining with some die-back and little or no growth.
1995 2 plants died in 1995 from undetermined causes. The 2 surviving plants are 1.5'/4' tall; poor condition with little growth.
1996 The last 2 plants died in 1996 from undetermined causes. These did poorly at this site.

Xeroderris stuhlmannii (Taubert) Mendonca & E.C. Sousa – wing pod

DELEP # 90-0495; planted March 1992 (4 plants)

Unarmed trees to 10+ m tall with a spreading canopy, odd, once-pinnate leaves and small, white or greenish pea-like flowers in panicles. The wood is used in construction and tannins and a red dye are obtained from the plant (Palgrave, 1983). This species is used in traditional medicine and the seeds are ground into meal (Palgrave, 1983). Wildlife and livestock browse this species, though it may be toxic at some times of the year (Palgrave, 1983). *Xeroderris stuhlmannii* is widely distributed in sub-Saharan Africa. Seeds for this accession were collected near the Munyati Power Station, Zimbabwe.

These plants declined and died during their first season. The reason was not determined, but this species does not appear to be adapted to the Yuma field site.

1992 All 4 plants died in 1992 from undetermined causes. This species does not appear to be adapted to this site.

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Figure 1. *Albizia amara* ssp. *sericocephala*

Figure 2. Albizia amara ssp. sericocephala

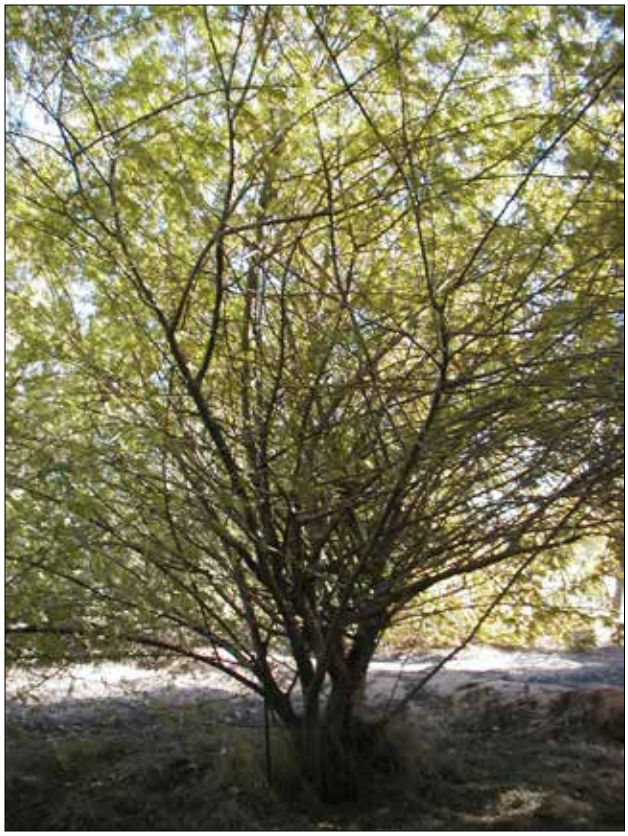

Figure 3. Albizia brevifolia

Figure 4. Albizia brevifolia

Figure 5. Albizia harveyi

Figure 6 Albizia harveyi

Figure 7. Albizia lebbeck

Figure 8. Albizia lebbeck

Figure 9. Albizia sinaloensis

Figure 10. Anadenanthera colubrina

Figure 11. Ateleia gummifera

Figure 12. Ateleia gummifera

Figure 13. Bauhinia carronii

Figure 14. Bauhinia carronii

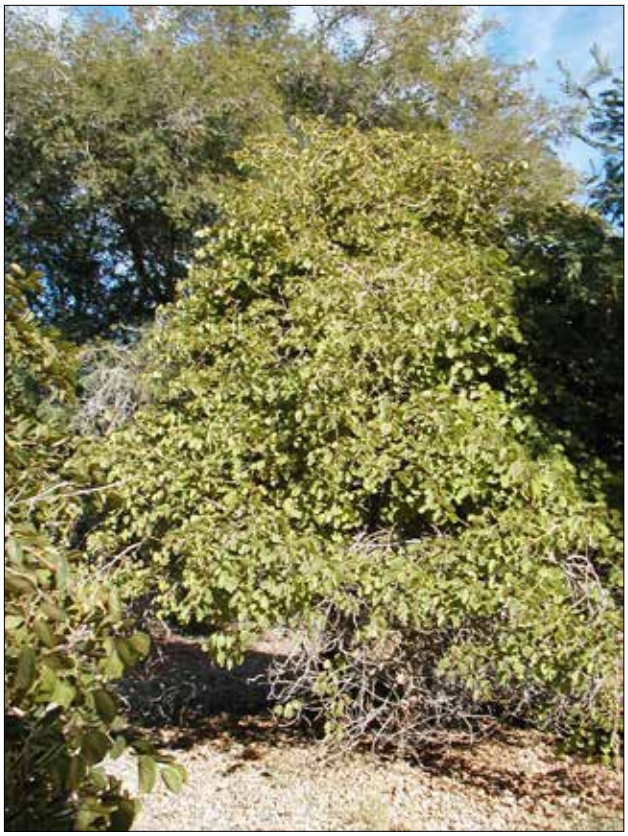

Figure 15. Bauhinia reticulata

Figure 16. Bauhinia reticulata

Figure 17. Bauhinia thonningii

Figure 18. Bolusanthus speciosus

Figure 19. Brongniartia alamosana

Figure 20. Caesalpinia cacalaco

Figure 21. Caesalpinia cacalaco

Figure 22. Caesalpinia platyloba

Figure 23. Caesalpinia violacea

Figure 24. Colophospermum mopane

Figure 25. Dalbergia melanoxylon

Figure 26. Faidherbia albida

Figure 27. Faidherbia albida

Figure 28. Haematoxylum brasiletto

Figure 29. Haematoxylum sp. nov.

Figure 30. Havardia sonorae

Figure 31. Havardia sonorae

Figure 32. Leucaena pulverulenta

Figure 33. Lonchcarpus hermannii

Figure 34. Lonchcarpus hermannii

Figure 35. Lysiloma candidum

Figure 36. Lysiloma divaricatum

Figure 37. Mariosousa coulteri

Figure 38. Mariosousa willardiana

Matt Johnson

Figure 39. Mariosousa willardiana with Ken Coppola

Figure 40. Peltophorum africanum

Figure 41. Peltophorum africanum

Figure 42. Peltophorum dubium

Figure 43. Philenoptera violacea

Figure 44. Pithecellobium dulce

Figure 45. Senegalia cinerea

Figure 46. Senegalia cinerea

Figure 47. Senegalia galpinii

Figure 48. Senegalia modesta

Figure 49. Senegalia modesta

Figure 50. Senegalia polycantha

Figure 51. Senegalia senegal var. rostrata

Figure 52. Vachellia amythethophylla

Figure 53. Vachellia luederitzii var. luederitzii

Figure 54. Vachellia luederitzii var. luederitzii

Figure 55. Vachellia pennatula subsp. pennatula

Figure 56. Vachellia sieberiana

Figure 57. Vachellia siberiana

Figure 58. Vachellia sp.

Figure 59. Vachellia sp.

Figure 60. Vachellia xanthophloea with Matt Johnson

Figure 61. Senegalia galpinii