

**STATUS OF THE SPECIES** – Fragrant prickly-apple (*Cereus eriophorus* var. *fragrans* = *Harissia fragrans*)

**Legal Status** – *endangered*

The U.S. Fish and Wildlife Service (Service) listed the fragrant prickly-apple as endangered under the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*) on November 1, 1985 (50 FR 45621). The reason for listing was substantial losses of suitable habitat. *Cereus eriophorus* var. *fragrans* has been placed within the genus *Harrisia*. However, the former classification *C. e.* var. *fragrans*, and its common name, fragrant prickly-apple, were used in the federal regulations to list the species (50 CFR 17.12) and the recent taxonomic change has not yet been adopted in the list of endangered and threatened wildlife and plants (December 1998). To maintain consistency with the Service's recovery plan for this species and 50 CFR 17.11 and 17.12, we will use *C. e.* var. *fragrans* until the name is officially changed in the Federal regulations. A complete fragrant prickly-apple life history discussion may be found in the MSRP. In addition, a 5-year review was completed in 2010 resulting in no change to the listing status of the species (Service 2010).

**Species Description**

Fragrant prickly-apple is a slender, solitary tree cactus that may have from one to eight, spiny, cane-like, stout, and succulent stems. The columnar stems are 2.5 to 5.0 centimeters (cm) in diameter, and have 10 or 12 ridges alternated with deep, sharp grooves (Benson 1982). Stems may be erect, or for longer stems, the plant may recline over neighboring vegetation. The branching can be extensive, and the roots of this cactus are coarse, fibrous, and shallow (Small 1920). The spine-bearing regions (areoles) are aligned along its ridges about 2 cm apart. Each areole bears 9 to 13 spines, which are mostly grayish and yellowish at the tip, with one spine longer (2 to 4 cm) than the rest.

Fragrant prickly-apple has initial flower buds that are 1 cm long, white, and exceedingly hairy. Buds often appear on the plant one to two months prior to flower growth. About 9 days after initiation of flower growth, the flower opens (Rae 1995). The flowers are fragrant, showy, solitary, and open only at night. The buds are 12 to 20 cm long when about to open and 7.5 to 10 cm in diameter when open. The ovary bears many lanceolate scales while the flower tube has only a few scattered scales. A tuft of long white hairs [10 to 15 millimeters (mm) long] protrudes from the axil beneath each scale. The sepals are narrowly linear, with green outer sepals and nearly white inner ones. There are numerous spatulate petals, white or pinkish, with unevenly toothed margins. The stamens are numerous and are composed of white filaments and yellow anthers. The style is elongate with 9 to 12 stigmas (Service 1988). The fruits are attached at the narrower end; they average 4 to 6 cm in diameter and are a dull red. The fruit does not split and has long tufts of white hairs that remain persistent with the scale bases (Leon and Alain 1953). The fruits are swollen at the base and finely pitted; each contains approximately 1,500 black seeds that are about 3 mm long (Rae 1995).

## Life History

Fragrant prickly-apple reproduces sexually and by regeneration by vegetative reproduction. Plants flower from April to October with two distinct peaks. The first peak is in the spring with flowering starting in April and reaching a peak in May. Some sporadic flowering occurs in the summer. In September and October, another minor peak in flowering occurs. Flowering is uncommon in the late fall, and no flowering occurs from January through March. Fruit set follows flowering with a major peak in May and a minor peak in September. A large standing crop of fruit remains on plants for approximately 8 months of the year.

According to Rae (1995), mature plants are greater than 41 cm in length. The smallest plant to flower was 14.5 cm in stem length and the smallest plant to set fruit was 41 cm in length. In his study, 63 percent of the mature plants flowered. At two sites in the Savannas Preserve State Park (SPSP), in St. Lucie County, 38 and 60 percent of flowers successfully produced fruits and 44 and 61 percent of mature plants successfully set fruit. A positive relationship was observed between total length of the stems and branches of a plant and the total annual production of fruit.

The means for seed dispersal are uncertain, but there is evidence that birds consume the fruit of fragrant prickly-apple. Additionally, most individuals of this species are found within the drip line of other plants, suggesting avian seed dispersal. Rodents or gopher tortoises (*Gopherus polyphemus*) may also distribute the seeds. In addition to sexual reproduction, long stems will occasionally snap off of existing plants. After falling to the ground, stems may re-root at several places creating a small group of genetically identical plants (Rae 1994a).

Vegetative growth of this perennial species is slowest from November to March. Growth accelerates in April and May, with the fastest growth occurring from July through September. The growth rate drops off rapidly after September (Rae 1994a, 1995). These cacti are often found to occur in distinct clusters (Bradley *et al.* 2002a; Woodmansee *et al.* 2007).

The fragrant prickly-apple is characterized as a long-lived species with late maturity, low fecundity, and low adult mortality (Rae and Ebert 2002). Larger plants tend to have higher fecundity and lower mortality rates (Rae and Ebert 2002); therefore, the larger individuals in the population are extremely important to overall population health (Rae and Ebert 2002). Bradley and Hines (2007) noted that fragrant prickly-apple can survive for at least 19 years, based on the identification of individuals in 2007 that were tagged as adults in 1988.

Mortality of the fragrant prickly-apple can result from a variety of causes. Bradley and Hines (2007) identified mortality of adult plants resulted from the following: all-terrain vehicle or other vehicle damage, vandalism (chopped by machete), herbicide damage, burial by drifting sand, over-shading by love-vine (*Cassytha filiformis*), damage due to feral hogs (*Sus scrofa*), blown down by hurricane winds, and crushed by falling trees. The majority of the dead plants observed were killed by hurricane winds and treefall. Desiccation is also a source of mortality for very young seedlings (Moore 2009). If rains do not occur during these important weeks of development, the cacti tend to dry out because they do not have enough water stored to survive

(Moore 2009). Rae and Ebert (2002) noted that the two primary causes of mortality in the sites they studied were over-shading and over-exposure to sunlight resulting in desiccation.

## Habitat

The fragrant prickly-apple occurs in early-successional sand pine scrub and coastal hammock habitats (Rae 1994b). Habitat requirements include well-drained sandy soils with ground water normally deeper than 9 feet (3 meters) (Watts and Stankey 1980), and partial shade provided by surrounding plants during a portion of the day (Rae 1994b). The known sites are limited to St. Lucie sand. The most common plant species in this community include sandhill jointweed (*Polygonella fimbriata*), hairy jointweed (*P. ciliata*), tall jointweed (*P. gracilis*), sand live oak (*Quercus geminata*), myrtle oak (*Q. myrtifolia*), cabbage palm (*Sabal palmetto*), and pricklypear (*Opuntia humifusa*). Much of the Atlantic Coastal Ridge was cleared in the 1880s for pineapple plantations, but commercial pineapple cultivation was abandoned by 1920. The vegetative community has yet to regain its previous level of diversity or productivity. The vegetative succession has been arrested and the plant community has not succeeded to the climax sand pine habitat type (Rae 1994a, 1995).

This cactus prefers partial shade, which is often provided by surrounding plants that shelter it from sun for a portion of the day (Rae 1994b). Surrounding vegetation is often used for support by fragrant prickly-apple for its long stems. Other plants may serve as nurse plants for the seedlings, protecting them from direct sun, but this has not been studied. Overgrowth and shading by sand live oaks (*Quercus geminata*) and other species may cause reproductive failure and premature death. Growth and productivity seems to be greater for plants in areas that are partially shaded.

## Distribution

At the time of listing fragrant prickly-apple was only known to occur in St. Lucie County (Service 1985). Historically, fragrant prickly-apple occurred in coastal hammock habitats on the east coast of Florida in St. Lucie, Indian River, Brevard, and Volusia Counties, although some accounts in other areas were erroneously reported due to misidentification with Simpson's prickly-apple (*Cereus gracilis* var. *simpsonii*) (Service 1985; Service 1999; Woodmansee *et al.* 2007). Fragrant prickly-apple was reportedly collected in Everglades National Park (ENP), but this is not confirmed (NPS 2007; Sadle 2009). Because Simpson's prickly-apple commonly occurs in ENP, there is much confusion over identification of these two species, there is no voucher specimen available in herbarium collections for confirmation, the fragrant prickly-apple is limited in distribution, and ENP lacks the habitats believed to support fragrant prickly-apple, it is thought that the species was misidentified (NPS 2007; Sadle 2009).

Rae and Ebert (2002) observed population declines of fragrant prickly-apple on two sites in St. Lucie County, Florida from 1988 through 1993, and numbers of this cactus declined by 27.2 percent and 32.6 percent, respectively. The reduction was attributed primarily to low recruitment rates and high mortality. From 1993 through 1996, plants on these sites declined by approximately another 40 percent (Rae and Ebert 2002). Due to the decline in cactus numbers, a

preliminary program was initiated in 1998 by the Institute for Regional Conservation (IRC) and the Florida Department of Environmental Protection to monitor the entire population. The population estimate for the species was determined to be 879 in 1999; 1,206 in 2000; and 1,744 in 2001 (Bradley *et al.* 2002a), and overall the population was reported to be stable (Bradley *et al.* 2002a). Bradley *et al.* (2002b) reported approximately 2,150 plants occurred within nine subpopulations at or near the SPSP in 2002 (approximately 63 percent of these plants were actually on protected lands rather than on inholdings or the railroad right-of-way). Bradley *et al.* (2002b) estimated that the total population may number up to 3,000. A more recent monitoring study of three fragrant prickly-apple subpopulations in the SPSP found that the population declined from 1,094 plants in the winter of 2003 to 739 plants in the winter of 2007 (Bradley and Hines 2007). The authors suggested that the decline in numbers of plants may have been due to impacts from the hurricanes that occurred in 2004 (Bradley and Hines 2007).

The fragrant prickly-apple was re-discovered in Volusia County at Canaveral National Seashore in 2006 (Woodmansee *et al.* 2007). Approximately 96 cacti were located during visits to the Volusia County site, and the plants appeared to be healthy (Woodmansee *et al.* 2007). A total of 62 plants were confirmed on 14 private sites that were surveyed around SPSP in 2006 and 2007 (Woodmansee *et al.* 2007).

The current range of this plant species is greatly reduced (Service 2010). Although the species currently occurs in disjunct locations within its historic range, most of the suitable habitat has been destroyed or converted for residential housing and commercial activities (Service 1999). The Florida Natural Areas Inventory (FNAI) reported that as of 2009, fragrant prickly-apple occurs on 10 confirmed sites and 1 unconfirmed site. Nine of the 10 confirmed sites are located in and around the SPSP in St. Lucie County (FNAI 2009) and 1 is located in Volusia County (Woodmansee 2006; FNAI 2009). Six of the 10 confirmed sites are protected, 2 are on privately owned properties, and 3 are partially protected (FNAI 2009). The unconfirmed site is in Indian River County (Woodmansee *et al.* 2007; FNAI 2009); it remains unconfirmed because only a single sterile plant was observed on a coastal berm when surveys were conducted in 2006 (Woodmansee *et al.* 2007; FNAI 2009). It is possible that the current range of the species also includes Brevard and Indian River Counties, as these counties occur between confirmed locations and appropriate habitat is available (Woodmansee *et al.* 2007).

## **Threats**

Threats to the fragrant prickly-apple still persist. A large portion of the current occupied range of the species (*i.e.*, approximately 63 percent of known occupied sites in and around the SPSP) has been protected for conservation purposes. However, remaining occupied habitat within private lands is threatened to be lost due to development for commercial or residential purposes. The pressure to convert these lands will increase if Florida's human population continues to grow as predicted. The fragrant prickly-apple is also vulnerable to the encroachment of exotic plants and overgrowth of other vegetation due to suppression of natural fires or the lack of other forms of vegetation management (*i.e.*, exotic vegetation treatment and removal, prescribed burns, mechanical vegetation treatment). Excessive vegetation growth increases canopy cover that limits the amount of sunlight needed for survival of the fragrant prickly-apple, and increases the

likelihood that the species is crushed by falling branches (Bradley *et al.* 2002b). Consequently, the application of vegetation management is essential to maintain optimal habitat for the fragrant prickly-apple. Although the lack of vegetation management was largely considered a problem restricted to private lands in the past, management of fragrant prickly-apple habitat on public conservation lands may currently also be at risk due to the uncertainties of land management agencies receiving adequate funding to conduct such tasks in the current climate of shrinking government budgets. The species' restriction to specialized habitat, its limited distribution, and its limited reproductive capacity also renders it vulnerable to random natural events, such as freezes and hurricanes. Given the sensitivity of the species to storm events and drought, climate change is also considered a threat to fragrant prickly-apple.

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