

those sites under poor range management.

D. The Inadequacy of Existing Regulatory Mechanisms

Endangered plants do not receive a high degree of protection on private property under the Act. If the landowner is not using Federal funding or does not require any type of Federal permit or authorization, listed plants may be removed at any time unless prohibited by State law. Under chapter 88 of the Texas Parks and Wildlife Code, any Texas plant that is placed on the Federal list as endangered is also required to be listed by the State as endangered. In addition to the State of Texas regulations pertaining to listing, other State laws may apply. The State prohibits taking and/or possession of listed plants for commercial sale, or sale of all or any part of an endangered, threatened, or protected plant from public land. Scientific permits are required for purposes of collection of endangered plants or plant parts from public lands for scientific or educational purposes. Commercial permits must be obtained from the Texas Parks and Wildlife Department to collect endangered plants from private land—only if the collector intends to sell the plants or plant material. The destruction or removal of any plant from a State park without a permit from the TPWD Director is unlawful. If this proposed delisting rule is finalized, we anticipate that Texas will also remove *Frankenia johnstonii* from its State list of endangered species.

Section 9(a)(2)(B) of the Act, as amended in 1982, prohibits removal and possession of endangered plants from areas under Federal jurisdiction. A portion of one population of *Frankenia johnstonii* is located in one of our National Wildlife Refuges. A small portion of another population is growing in a highway right-of-way where it is afforded some protection from TDOT mowing and Border Patrol maintenance activities. Portions of one, and possibly two, other Zapata County populations extend onto IBWC-controlled property. The remainder of the 4 aforementioned populations, as well as the other 54 populations found in the United States, are on privately owned land. The regulations described above, and the conservation activities agreed upon for 19 populations between the landowners and the TPWD, help to provide protection for a number of the U.S. populations.

We are not aware of any measures being taken by Mexico to protect *Frankenia johnstonii*. It appears that the populations known to us are all on

ranchland. We will be contacting the Mexican Government during the comment period for this proposed rule for any additional information that they may have on the status of the species in Mexico.

E. Other Natural or Manmade Factors Affecting Its Continued Existence

Certain inherent biological characteristics, including small numbers of individuals, restricted distribution, and low reproductive potential, were also thought to affect the continued existence of *Frankenia johnstonii* (USFWS 1988). Turner (1980) observed seed set at less than 50 percent in the natural habitat, and Poole noted that seedlings are rarely seen (USFWS 1988). The recovery plan for *Frankenia johnstonii* referred to the approximately 1,500 plants known at the time of listing, and their occurrence in small populations with none greater than a few hundred plants, as implying a small gene pool with limited variability and therefore a diminished capacity for tolerating stresses and threats. The recovery plan indicated that scattered populations and disjunct distributions are commonly seen in the genus *Frankenia*. Whalen's (1980) reproductive data in the systematic analysis of the genus *Frankenia* showed *Frankenia johnstonii* had little propensity to reproduce. Turner (1980) found low seed viability (<50%) and had problems germinating seeds.

Janssen collected data on reproductive characteristics from six large populations in Webb (2), Zapata (3), and Starr (1) Counties. All attempts at germination in a greenhouse ended in failure, which was attributed to insufficient light conditions within the greenhouse (Janssen and Williamson 1996, Janssen 1999). Results of field observations showed that this species flowers throughout the year, but less abundantly in winter, with the highest numbers of flowers and fruit in spring/early summer. The flowers show no apparent morphological barriers to self-pollination. For plants having a reproductive system where gametophytic (the sexual generation of a plant which produces gametes) incompatibility is the case, the incompatibility can show up as an inhibition of pollen tube growth, but differential pollen tube growth was not observed in *Frankenia johnstonii*. Analysis of pollen grain viability resulted in a variance from 94–100% with an average of 96%. A large variety of diurnal pollinators visited *Frankenia johnstonii* flowers including flies, bees, and butterflies, with bee flies and bees being the most common. Within the

fruit, only one of three ovules typically developed into a seed; the other two aborted (Janssen 1999). The percentage of seed set among populations that Janssen studied ranged from 15–30 percent. Using seed viability tests, 31 percent of the seeds were found to be viable. Results of soil seed bank analysis from three populations, over 1 year's time, yielded the germination of only four total seedlings. Seedling recruitment, as monitored within two populations, showed 82 and 85 percent recruitment.

The results of Janssen and Williamson's reproductive analysis of *Frankenia johnstonii* showed this species to be a generalist with respect to pollinators. Floral visitation rates were high, and the species appeared to successfully compete for pollinators. Although *Frankenia johnstonii* is readily cross-pollinated, this species also has a floral morphology that allows self-pollination, and self-compatibility is indicated (Janssen and Williamson 1996, Janssen 1999). Janssen (1999) concluded that "although self-pollination can result in less genetic variability, it may not be so detrimental for plants that occupy narrow ecological habitats."

Plant population growth and stability can be limited by the production of viable seeds, especially if there is not asexual reproduction. *Frankenia johnstonii* does not reproduce vegetatively, so seed production is critical. Seed production depends on plant size, fruit-to-flower ratio, and number of seed-producing ovules. With respect to the three aforementioned factors, *Frankenia johnstonii* has low fruit-to-flower ratio, low seed set, and low seed viability. Janssen (1999) acknowledged that her results regarding these factors may reflect decreased vigor in the limited number of populations on which she was able to conduct reproductive studies.

With respect to long-term survival of the seeds, the seed bank does not appear to be a persistent reservoir of buried viable seeds. The seeds are small in size, may remain for the most part in the above-ground litter, and probably could not emerge if buried deep. The seed's thin coat does not favor long-term survival in the soil, but is suited for taking in water fast and then subsequently germinating. This may be the reason that, despite low seed set and viability, those seeds that do germinate have a high rate of recruitment (82 percent and 85 percent in the two populations studied). The fruit does not appear to be specialized for dispersal, and the seedlings are always found in close proximity to the parent. Timing of