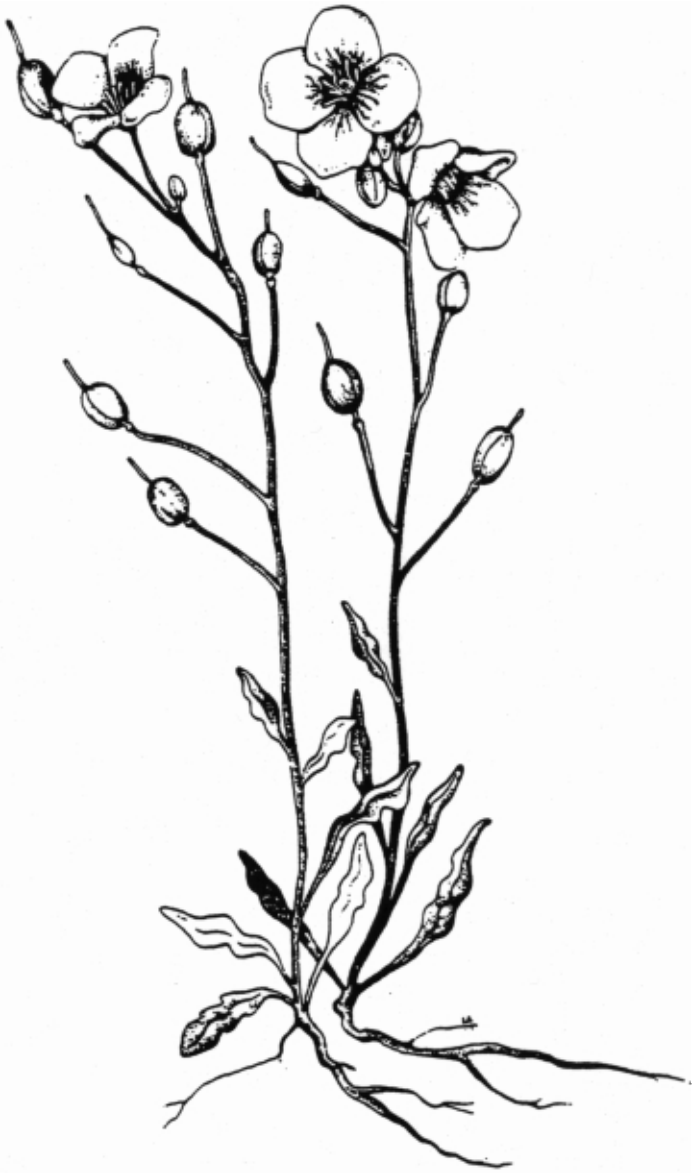
WHITE BLADDERPOD

(Lesquerella pallida)

RECOVERY PLAN



U.S. Fish and Wildlife Service
Albuquerque, New Mexico

1992

WHITE BLADDERPOD
(*Lesquerella pallida*)
RECOVERY PLAN

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For:

Region 2
U.S. Fish and Wildlife Service
Albuquerque, New Mexico

Approved: _____
Acting Regional Director, U.S. Fish and Wildlife Service

Date: OCT 16 1992

DISCLAIMER

Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect listed species. Plans are published by the U.S. Fish and Wildlife Service, sometimes prepared with the assistance of recovery teams, contractors, state agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service. They represent the official position of the U.S. Fish and Wildlife Service **only** after they have been signed by the Regional Director or Director as **approved**. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature citations should read as follows:

U.S. Fish and Wildlife Service. 1992. White Bladderpod (*Lesquerella pallida*) Recovery Plan. USDI Fish and Wildlife Service, Albuquerque, New Mexico. 22 pp.

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EXECUTIVE SUMMARY

Current Status: White bladderpod is listed as endangered. Six populations occupying less than 30 acres are known from private land and a county road right-of-way in San Augustine County, Texas.

Habitat Requirements and Limiting Factors: The white bladderpod is restricted to open areas where outcrops of the Eocene-age Weches Formation occur. This formation produces limited areas of alkaline soils in a region where most soils are acidic. Invasion of woody species into its limited habitat, competition with introduced plant species, and possible extirpation of its small populations from successive years of unfavorable growing conditions are believed to be important threats to white bladderpod.

Recovery Objective: Downlisting

Recovery Criteria: Maintain or establish 12 self-sustaining populations of white bladderpod and establish agreements for the protection and management of these populations.

Actions Needed:
1. Protect and manage white bladderpod populations and habitat.
2. Gather biological information necessary for management.
3. Establish a botanical garden population.
4. Search for new populations.
5. Establish new populations as necessary to meet downlisting criteria.

Costs ($000's):

Year	Need 1	Need 2	Need 3	Need 4	Need 5	Total
1993	49.0	50.0	10.0	5.0	8.5	122.5
1994	31.0	50.0	10.0	5.0	8.5	104.5
1995	31.0	50.0	0.0	5.0	8.5	94.5
1996	26.0	25.0	0.0	5.0	8.5	64.5
1997	26.0	25.0	0.0	5.0	8.5	64.5
1998	26.0	0.0	0.0	0.0	5.0	31.0
1999	26.0	0.0	0.0	0.0	5.0	31.0
2000	26.0	0.0	0.0	0.0	5.0	31.0
2001	26.0	0.0	0.0	0.0	5.0	31.0
2002	26.0	0.0	0.0	0.0	5.0	31.0
Recovery Cost	293.0	200.0	20.0	25.0	67.5	605.5

Date of Recovery: Downlisting should be considered in 2002, if recovery criteria are met.

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PART I - INTRODUCTION

Brief Overview

The white bladderpod [*Lesquerella pallida* (T. & G.) S. Watson] was listed on April 10, 1987, as an endangered species under the Endangered Species Act of 1973, as amended (U.S. Fish and Wildlife Service 1987). Critical habitat was not designated. In addition to being federally listed, the white bladderpod is listed as endangered by the State of Texas. The white bladderpod has a recovery priority of 8. Recovery priorities for listed species range from 1 to 18, with 1 being the highest recovery priority.

The white bladderpod is known from six sites on private land and a county road right-of-way in San Augustine County, Texas. It is restricted to open areas where outcrops of the Weches Formation occur. This Eocene-age formation produces alkaline soils in a region where most soils are acidic. The species is threatened by invasion of woody species into its limited habitat and competition with weedy plant species, which are both promoted by overgrazing, conversion of its habitat to improved pasture, quarrying of Weches outcrops for gravel, and the possible extirpation of its small populations from successive years of unfavorable growing conditions.

Taxonomy

The white bladderpod was initially collected by Dr. M.C. Leavenworth in the 1830's on small prairies near San Augustine, Texas. This was the only specimen available until the species was rediscovered by Dr. E.S. Nixon and John Ward in 1981. In 1838, Torrey and Gray described white bladderpod as a variety of *Vesicaria grandiflora* Hook., then elevated it to species rank in

1840 as Vesicaria pallida (T. & G.) T. & G. The genus Lesquerella was erected by Sereno Watson in 1888, and thus the taxon became Lesquerella pallida (T. & G.) S. Watson. The species was maintained by Payson in his 1922 monograph, although he thought it might be conspecific with L. recurvata (Rollins and Shaw 1973). Lesquerella pallida was also maintained as a distinct species in the Manual of the Vascular Plants of Texas (Correll and Johnston 1970). Because it had not been relocated and because of questionable flower color not adequately shown by the type specimen, Rollins and Shaw (1973) considered L. pallida to be a slightly anomalous specimen of L. gracilis (Hook.) Watson. When the species was rediscovered, a new description was prepared from live material (Nixon, et al. 1983). Based on the new description, Rollins, the current authority on the genus, has concluded Lesquerella pallida is a distinct species.

Morphology

The white bladderpod is an erect to spreading annual in the mustard family (Brassicaceae). Plants are 5 - 60 centimeters (2.0 - 23.6 inches) tall, usually branching at the base and/or in the upper parts. The root system has a small taproot with lateral branches. The stems are slender and decumbent to erect. The leaves are yellowish-green to grayish-green, linear to oblong to oblanceolate, entire to dentate, sometimes undulate, occasionally pinnately lobed in basal leaves; tips are acute to obtuse to rounded, bases are mostly attenuate; upper and lower surfaces have stellate pubescence. Basal leaves are up to 10 centimeters (3.9 inches) long and 2 centimeters (0.8 inches) wide with petioles to 4 centimeters (1.6 inches) long. Stem leaves gradually reduce in size upward, becoming sessile, extending into the inflorescence. The inflorescence is a raceme to 33 centimeters (13.0 inches) long, with (1-) 6 - 20 (-120) flowers. Flowers have 4 white petals to 12 millimeters (0.5 inches) long

and 8.5 millimeters (0.3 inches) wide with yellow bases and brownish to olive colored veins. Fruits are globose to ellipsoid and stipitate, up to 5.5 millimeters (0.2 inches) long and 6 millimeters (0.2 inches) wide. There are usually 8 - 12 seeds per fruit. The chromosome number is 2n = 12 (Nixon 1984).

Habitat

The white bladderpod occurs in the east Texas Pineywoods of the West Gulf Coastal Plain physiographic province. Annual precipitation in the region averages 45 inches with no pronounced summer drought. The average frost-free period is from early March through mid-December (Larkin and Bomar 1983). The elevation is about 330 feet with gently rolling topography.

The white bladderpod most frequently grows in full sun of open herbaceous dominated glauconitic outcrops of the Weches Formation. However, it can be locally abundant at the edge of shrubby thickets and occasionally on Weches outcrops in shaded thickets surrounding the open glades (Texas Natural Heritage Program 1988).

The geology and soils of white bladderpod sites are unique in East Texas. Outcrops of the Eocene-age Weches Formation create limited areas of relatively thin alkaline soils in a region of mostly sandy acid soils (Bureau of Economic Geology 1967). Soil series have not been mapped in San Augustine County, but general soils maps include the Weches Formation outcrops within the Nacogdoches-Trawick Association (Soil Conservation Service 1974). George (1987) found the soil profile of three Weches outcrops had a surface layer of sandy loam or sandy clay loam with impermeable glauconite clay occurring at a depth of about 50 centimeters (19.7 inches). The pH ranged from 7.6 to 8.1, while exchangeable cations were high. These soils create a

harsh and variable environment that is generally seepy and saturated during cool moist winter and spring months, and during rainy periods, but can become hard and dry during hot summer months.

Associated Species

The known populations of white bladderpod grow in habitat islands formed by the Weches Formation. However, soils and habitats within the Weches Formation are themselves variable, and support a variety of herbaceous, shrub, and tree-dominated communities. Some herbaceous species commonly associated with white bladderpod include corn salad (*Valerianella* spp.), Arkansas savory (*Satureja arkansana*), wild onion (*Allium drummondii*), anemone (*Anemone heterophylla*), sandwort (*Arenaria patula*), white-top (*Erigeron strigosus*), spurge (*Euphorbia dentata*), side-oats grama (*Bouteloua curtipendula*), Indian plantain (*Cacalia plantaginea*), yellow evening primrose (*Calylophus drummondianus*), *Dracopis amplexicaulis*, *Hedyotis nigricans*, standing cypress (*Ipomopsis rubra*), rattlesnake-master (*Polianthes virginica*), false-gromwell (*Onosmodium occidentale*), prairie clover (*Petalostemum pulcherrimum*), brown-eyed-susan (*Rudbeckia triloba*), little bluestem (*Schizachyrium scoparium*), greenthread (*Thelesperma filifolia*), and small hop clover (*Trifolium dubium*). Some woody species associated with white bladderpod include gum bumelia (*Bumelia lanuginosa*), eastern red cedar (*Juniperus virginiana*), rough-leaf dogwood (*Cornus drummondii*), *Forestiera ligustrina*, hawthorn (*Crataegus* spp.), Carolina buckthorn (*Rhamnus caroliniana*), Macartney rose (*Rosa bracteata*), red buckeye (*Aesculus pavia*), Japanese honeysuckle (*Lonicera japonica*), Mexican plum (*Prunus mexicana*), smooth sumac (*Rhus glabra*), and yucca (*Yucca arkansana*) (Texas Natural Heritage Program 1988; M. Warnock, Sam Houston State University, Huntsville, Texas, *in litt*. 1992). Many of these herbaceous and

woody species are more or less restricted in east Texas to places where there are alkaline soils (U.S. Fish and Wildlife Service 1988).

Distribution and Abundance

The white bladderpod was first collected in the 1830's from small prairies near San Augustine, Texas. No further collections were made until 1981, when it was rediscovered by Dr. E.S. Nixon and John Ward (Nixon, et al. 1983). Thus, nothing is known about the historic range and abundance of this species.

The white bladderpod is presently known from six sites, all in San Augustine County, Texas. Five of the sites are on private property and the sixth site is on private property and adjacent county road right-of-way. In total, the sites occupy less than 12 hectares (30 acres).

The 1981 rediscovery site is located approximately 8 miles west of San Augustine, Texas, on land used for pasture. The population covers about 2 hectares (5 acres) and numbered about 3,300 individuals when counted in 1982 (Nixon 1984). More than 5,000 plants were counted at this site in 1990 and fewer than 100 in 1992 (M. Warnock, in litt. 1992).

Two populations were discovered in 1985. One population is located about 10 miles west of San Augustine, Texas, in a small opening about 4 by 15 meters (13 by 49 feet) and contained about 50 plants in 1985. The site is being invaded by Macartney rose (Rosa bracteata) and other shrubs and trees (Mahler 1985). This site had more than 200 plants in 1990, but only 10 in 1992 (M. Warnock, in litt. 1992). The other population is located about 6 miles southeast of San Augustine, Texas, on county road right-of-way and adjacent pasture. The population occupies about 30 by 75

meters (98 by 246 feet) and contained about 160 plants in 1985. The right-of-way is quite brushy and the remaining open habitat is being invaded by shrubs and trees (Mahler 1985). This site had more than 500 plants in 1990 and 22 in 1992. No plants were seen in the adjacent pasture either year (M. Warnock, in litt. 1992).

Two populations were discovered in 1988, about 1.5 and 2 miles southeast of San Augustine, Texas. The larger population occupies about 8 hectares (20 acres) of lightly grazed pasture and contained more then 1,000 plants in 1988 (Texas Natural Heritage Program 1988). This population had more than 2,000 plants in 1990, more than 4,000 plants in 1991, and fewer than 200 plants in 1992 (M. Warnock, in litt. 1992). The smaller population occupies 5 by 8 meters (16 by 26 feet) in former pasture. It was densely populated with more than 1,000 plants in 1988 (Texas Natural Heritage Program 1988). However, this population had no plants in 1990, only 8 in 1991, and no plants in 1992 (M. Warnock, in litt. 1992). These two areas were once likely contiguous but are now isolated due to disturbance (Texas Natural Heritage Program 1988).

The final population, discovered in 1991, occurs in an improved pasture approximately 1 mile south-southeast of San Augustine, Texas. This small population had 3 plants in 1991, but none in 1992 (M. Warnock, in litt. 1992).

As can be seen from the reported population counts, population sizes of this annual plant vary drastically from year-to-year. These population fluctuations appear to be due to differences in winter or spring moisture and spring frost (M. Warnock, in litt. 1992).

Impacts and Threats

The invasion of woody and herbaceous plants into the limited habitat of white bladderpod is the principle threat to this species. Some of these invading species are native to the area and were probably controlled by occasional wildfire under natural conditions. The more serious invaders are introduced species. Plants such as small hop clover (*Trifolium dubium*) can cover Weches outcrops and eliminate most other vegetation. Introduced shrubs such as Macartney rose (*Rosa bracteata*) and Japanese honeysuckle (*Lonicera japonica*) will invade any open space including white bladderpod habitat.

Overgrazing is a threat to white bladderpod. While cattle typically do not eat white bladderpod, they can trample plants and cause soil compaction. More seriously, overgrazing promotes the invasion of woody species and competition with herbaceous weedy plants like plantain (*Plantago virginiana*), Japanese brome (*Bromus japonicus*), and spurge (*Euphorbia spathulata*).

Pasture improvement through the use of herbicides, plowing, and the introduction of non-native pasture grasses can destroy white bladderpod populations and habitat. Considerable habitat may have been lost already from this practice. Conversely, the use of fire or mechanical brush removal (brush hogging) without plowing and introduction of non-native grasses may improve habitat, but brush clearing should not be done during the months of November through June, nor when the ground is very wet.

Since all populations occur partly or wholly on private property, land conversion is a threat. Any of the populations could be eliminated by home or other building construction. The populations near the town of San Augustine are most likely to be impacted by this threat. The population occupying county road

right-of-way occurs on a wide portion of right-of-way where the road jogs to go up a small hill. If the road is ever widened or improved, the jog would likely be straightened, running the road directly through the population. This portion of right-of-way is also large enough to be used to stockpile roadbuilding materials or as a dumpsite for excess soil taken from elsewhere.

Rock quarrying poses a threat to the species. The Weches formation is one of the few sources of rock for crushed stone in this part of eastern Texas. Some of the formerly suitable habitat between the two populations southeast of San Augustine has been lost to quarrying.

The number of plants in white bladderpod populations naturally fluctuates from year to year. For instance, at the rediscovery site the population has fluctuated from 3,319 plants counted in 1982, to no plants found during two field trips in 1984 and 1987 (Nixon 1984, USFWS 1988, Texas Natural Heritage Program 1988). Small populations could be prone to extirpation if a series of unfavorable years greatly reduces seed production and depletes the soil seed bank. Recolonization after a population has been lost would require long distance seed dispersal, which appears to be poor in white bladderpod.

Conservation and Research Efforts

The initial research following the rediscovery of white bladderpod was done by Dr. E.S. Nixon and students at Stephen F. Austin State University. Nixon provided descriptions and made population counts at the rediscovery site (Nixon, et al. 1983; Nixon 1984). Two new sites for the species were discovered in 1984 (Mahler 1985). George (1987) conducted a study of the herbaceous flora of three Weches outcrops, including one that supports white bladderpod, as part of a Masters thesis at Stephen

F. Austin State University. Results of this study appear in George and Nixon (1990).

The Texas Natural Heritage Program conducted several surveys for the species from 1983 to 1988. Two new locations were discovered during the spring of 1988.

In 1990, Dr. Michael J. Warnock and students at Sam Houston State University began experiments to determine factors contributing to the rarity of white bladderpod. They have studied the effects of shading, competition, simulated grazing, and fire on plots containing the species. This work is continuing.

PART II - RECOVERY

Objective and Criteria

The primary objective of this recovery plan is to maintain adequate white bladderpod populations in natural habitat to insure that the species is safe from extinction. White bladderpod will be considered for reclassification from endangered to threatened when 12 distinct self-sustaining populations are being maintained. Due to the present restricted distribution of the species and the limited understanding of its life history and habitat requirements, it is impossible at this time to predict what measures will be sufficient to permit delisting the species. Tasks in this plan necessary to accomplish the downlisting objective should provide the information necessary to determine if delisting will be possible and what the delisting objectives and criteria should be. Once downlisting is accomplished, this plan will be revised to establish specific delisting criteria. The criteria to meet the downlisting objective are:

1. Establish or maintain 12 self-sustaining populations or metapopulations (i.e. small populations near enough together to function as a single population) of white bladderpod. For the purposes of this plan, a population will be considered self-sustaining if it reaches a population number of 1,000 plants and a density of 0.25 plants per square foot in at least one year of five continuous years. Because white bladderpod occurs in habitat islands or patches dispersed within a larger matrix of less suitable or non-habitat, some sites may be too small to support 1,000 plants and thus should not be considered among the 12 self-sustaining populations. However, they could be part of a

metapopulation. The numbers of plants in populations must be verified through monitoring.

2. Establish agreements for the protection and management of the 12 self-sustaining populations. Binding agreements are preferable because they will provide long-term management continuity, but non-binding agreements will be adequate to contribute to the objective of this plan.

If, following downlisting, either of these criteria are no longer being attained, the white bladderpod should be returned to the status of endangered.

Outline of Recovery Actions

1. Contact the landowners and land managers of all white bladderpod sites. All parties must be made aware of the species to prevent inadvertent destruction of any populations.

    11. Educate landowners about the significance of white bladderpod and its protection under the Endangered Species Act. All landowners were made aware of the presence of an endangered species on their property when the white bladderpod was listed. However, three sites were discovered after the listing and these landowners should also be informed about the species. All landowners should receive information about the significance of the plants on their property, an explanation of Endangered Species Act protection for plants, and an explanation of Federal and state policies concerning recovery of endangered plants species.

12. Inform state and county highway departments of the exact locality of plants on road right-of-way. The state highway department should be notified of plant locations so these can be considered when highway improvements are being planned. The county highway department must develop a system to make local road workers and mowing crews aware of the population on county road right-of-way. This system must take into account the possibility of frequent personnel changes. Although periodic mowing should not affect the population, some road maintenance or improvement, dumping, or herbicide use could damage or destroy it.

2. Work with landowners to develop and implement management for the species. Landowner cooperation and involvement will be critical to survival of the small isolated populations.

21. Determine landowner short-term and long-term land use goals and the effect on white bladderpod. Presently, cattle grazing is the predominate land use for white bladderpod sites and habitat. Pasture improvements through introduction of non-native aggressive species or brush clearing with herbicides could damage or destroy populations. Conversion of land to row crop agriculture, residential or business sites, or quarrying would permanently destroy plants and habitat.

22. Develop and implement management plans that are beneficial to the species and acceptable to landowners. Since the white bladderpod populations are small and habitat is very limited, it should be possible for landowners to avoid incompatible land uses in those areas. Work with landowners to develop long-term plans for management of white bladderpod populations. The plans should include prescriptions for grazing

management, management of woody species, provisions to avoid certain land use practices, monitoring, etc.

23. Develop simple but quantitative monitoring techniques to include in management plans. Try to use the same techniques in all plans so results will be comparable between populations. Seek landowner assistance in monitoring. Monitoring results will help evaluate management success.

24. Encourage the establishment of stewardship agreements. Landowners can enter into non-binding agreements with conservation organizations such as the Nature Conservancy or the Texas Land Steward Society. These agreements help recognize landowners who voluntarily protect sensitive species or ecosystems. Some landowners may find long-term binding agreements with conservation organizations or government agencies compatible with their land use goals. These could include management agreements where the landowner is paid to maintain certain management practices, easements that are purchased by the conservation organization or agency, or sale or donation of land parcels to a conservation organization or agency.

3. Manage plants on road right-of-way. The plants on county road right-of-way should be managed to maintain the habitat. This may involve brush removal or controlled burning. These plants should be monitored the same as other populations.

4. Enforce rules and regulations of the Endangered Species Act and the Texas Parks and Wildlife Code. Federal and state agents should exercise their full authorities to protect populations on private land. It is a violation of the Endangered Species Act for any person to maliciously damage

or destroy an endangered plant in the course of a violation of a state criminal trespass law. Since most plants are on private land, it is expected few permits will be required for research on this species. Investigators must, however, obtain permission from private landowners before doing research on private lands. Since white bladderpod is rare and not presently in commercial trade, it is expected few Federal or state trade permits will ever be requested for this species. Federal agencies must conduct informal and formal consultations required under Section 7 of the Endangered Species Act. These consultations are required with the Fish and Wildlife Service if an action authorized, funded, or carried out by a Federal agency may affect a threatened or endangered species.

5. Study the biology of white bladderpod. Very little is known about the life history, ecology, and population biology of this species. Studies done to better understand the species should concentrate on factors that relate directly to species and habitat management. As information is obtained, it should be incorporated into management practices.

   51. Determine the soil seed bank and seed viability. This information is needed to help understand how populations respond to repeated years of poor growing conditions or to certain management practices.

   52. Study germination and seedling establishment. The effect of variables such as moisture, light, and soil chemistry should be studied under both field and greenhouse conditions.

   53. Study fire, shading, competition, and grazing. These factors are believed to significantly effect

populations and all can be managed. Studies should be done to determine how these factors influence all aspects of plant life history.

6. Search for new populations. The Weches outcrops that support white bladderpod are often too small to appear on geology or soils maps. Ask landowners and other knowledgeable individuals such as Soil Conservation Service agents if they can identify any Weches outcrops. Request landowner permission to search these areas. Conduct searches only in years that the known populations have healthy numbers of plants.

7. Establish a botanical garden population and a seed bank. The Center for Plant Conservation or other appropriate organization should be contracted to establish and maintain plants in cultivation and in a seed bank. The plants would be available for research and as a source of stock for possible introduction projects. The botanical garden population and seed bank will provide assurance against extinction in the event of catastrophic loss of the natural populations.

8. After all potential habitat has been identified and surveyed, establish new populations in suitable sites if still needed to meet the downlisting criteria. Since suitable habitat for white bladderpod occurs in small isolated patches, many areas may be unoccupied due to chance or prior extirpation. A sufficient number of populations should be established in these areas to bring the total number of natural and introduced populations up to the number required to meet the downlisting criteria.

81. Search for potential introduction sites. This can be done simultaneously with searches for new populations.

82. Obtain permission from the landowner or land managing agency. Any introductions must be done with the full cooperation of landowners or land managers. Cooperation should be formalized with written agreements.

83. Design introduction projects so their success can be quantitatively measured. Such things as number of seeds sown, type of soil preparation, weather conditions, and exact locality of introduction plots should be recorded. Visit plots regularly during the period when seeds are germinating and seedlings developing. Make counts of plants at these early stages of development.

84. Monitor introduced populations. The same monitoring procedures should be used for both introduced and natural populations.

9. Develop and implement a public awareness program. Public education is a vital part of the recovery process and public cooperation is essential for the success of any recovery program. An informative program about the white bladderpod should be developed for presentation to private landowners and other interested groups. The program should explain the Endangered Species Act, limitations of the Act, and the white bladderpod recovery program. The program should describe tasks that the individuals or groups being addressed can accomplish to directly participate in white bladderpod recovery.

Literature Cited

Bureau of Economic Geology. 1967. Geologic Atlas of Texas - Palestine Sheet. The University of Texas, Austin.

Correll, D.S. and M.C. Johnston. 1970. Manual of the Vascular Plants of Texas. Texas Research Foundation, Renner.

George, R.J. 1987. The herbaceous flora of three Weches outcrops in eastern Texas. M.S. thesis, Stephen F. Austin State University, Nacogdoches, Texas.

George, R.J. and E.S. Nixon. 1990. The herbaceous flora of three Weches Formation outcrops in eastern Texas. Sida 14(1):117-127.

Larkin, T.J. and G.W. Bomar. 1983. Climatic Atlas of Texas. Texas Department of Water Resources, Austin.

Mahler, W.F. 1985. Status report update: Lesquerella pallida (T. & G.) Wats., Spring 1985. USDI Fish and Wildlife Service, Region 2, Albuquerque, New Mexico.

Nixon, E.S. 1984. Status report on Lesquerella pallida. USDI Fish and Wildlife Service, Region 2, Albuquerque, New Mexico.

Nixon, E.S., J.R. Ward, and B.L. Lipscomb. 1983. Rediscovery of Lesquerella pallida (Cruciferae). Sida 10:167-175.

Rollins, R.C. and E.A. Shaw. 1973. The genus Lesquerella (Cruciferae) in North America. Harvard University Press, Cambridge, Massachusetts.

Soil Conservation Service. 1974. General soil map of Sabine and San Augustine Counties, Texas. USDA Soil Conservation Service, Washington, D.C.

Texas Natural Heritage Program. 1988. Site survey summaries and element occurrence database. TNHP Files, Texas Parks and Wildlife Department, Austin.

U.S. Fish and Wildlife Service. 1987. Final rule to determine Lesquerella pallida to be an endangered species. Federal Register 52:7424-7426.

U.S. Fish and Wildlife Service. 1988. Endangered Species Information System, Lesquerella pallida. USDI Fish and Wildlife Service, Office of Endangered Species, Washington, D.C.

PART III - IMPLEMENTATION SCHEDULE

The following implementation schedule outlines actions and costs for the white bladderpod recovery program. It is a guide for meeting the objectives discussed in Part II of this Plan. The schedule indicates task priorities, task numbers, task descriptions, duration of tasks, responsible agencies, and estimated costs. These actions, when accomplished, should bring about the recovery of white bladderpod and protect its habitat. It should be noted that the estimated monetary needs for all parties involved in recovery are identified and, therefore, Part III reflects the total estimated financial requirements for the recovery of this species.

Task Priorities

Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality, or some other significant negative impact short of extinction.

Priority 3 - All other actions necessary to meet the recovery objectives.

Abbreviations Used

DOT - Texas State and County Highway Departments
FWS - USDI Fish and Wildlife Service
  ES - Ecological Services
  LE - Law Enforcement
PVT - Private Landowners
TPWD - Texas Parks and Wildlife Department

RECOVERY PLAN IMPLEMENTATION SCHEDULE

PRIOR-ITY #	TASK #	TASK DESCRIPTION	TASK DURA-TION (YRS)	RESPONSIBLE PARTY			COST ESTIMATES ($000)			COMMENTS
				FWS						
				Region	Program	Other	YEAR 1	YEAR 2	YEAR 3	
1	11	Inform and educate landowners	1	2	ES		5.0			
1	12	Inform and educate highway departments	1	2	ES	DOT	1.0 1.0			
1	22	Develop and implement management plans for private lands	ongoing	2	ES	PVT	20.0 -0-	10.0 -0-	10.0 -0-	
1	23	Monitor populations	ongoing	2	ES	PVT	10.0 -0-	10.0 -0-	10.0 -0-	
1	24	Establish private land stewardship agreements	3	2	ES	PVT	5.0 -0-	5.0 -0-	5.0 -0-	
1	3	Manage plants on road right-of-way	ongoing			DOT TPWD	.5 .5	.5 .5	.5 .5	
1	6	Search for new populations	5	2	ES		5.0	5.0	5.0	
2	21	Determine landowner land use goals	1	2	ES	PVT	1.0 -0-			
2	4	Enforce the ESA and state endangered plant law	ongoing	2	ES LE	TPWD	2.0 1.0 2.0	2.0 1.0 2.0	2.0 1.0 2.0	
2	51	Determine soil seed bank and seed viability	3	2	ES		10.0	10.0	10.0	
2	52	Study germination and seedling establishment	3	2	ES		15.0	15.0	15.0	
2	53	Study fire, shading, grazing, and competition	5	2	ES		25.0	25.0	25.0	

PRIOR-ITY #	TASK #	TASK DESCRIPTION	TASK DURA-TION (YRS)	RESPONSIBLE PARTY			COST ESTIMATES ($000)			COMMENTS
				FWS						
				Region	Program	Other	YEAR 1	YEAR 2	YEAR 3	
2	6	Establish a botanical garden population and seed bank	2	2	ES		10.0.	10.0		
2	81	Search for introduction sites	5	2	ES		1.0	1.0	1.0	
2	82	Obtain landowner permission for introductions	5	2	ES		.5	.5	.5	
2	83	Plan introduction projects so success can be measured	5	2	ES		2.0	2.0	2.0	
2	84	Monitor introduced populations	ongoing	2	ES		5.0	5.0	5.0	
						PVT	-0-	-0-	-0-	
2	9	Develop public awareness	ongoing	2	ES		4.0	2.0	2.0	
							1.0	1.0	1.0	
						TPWD	127.5	107.5	97.5	

APPENDIX

The availability of the draft White Bladderpod Recovery Plan for review and comment was announced in the Federal Register on August 14, 1992 (57 FR 36668). Copies of the draft plan were supplied to agencies, interested parties, and those requesting the plan in response to the Federal Register notice. No comments on the plan were received.