Hinckley Oak
(Quercus hinckleyi)

5-Year Review:
Summary and Evaluation

Photo of Hinckley Oak by Mark W. Lockwood, Texas Parks and Wildlife, taken at the Solitario, Big Bend Ranch State Park, Presidio County, Texas

U.S. Fish and Wildlife Service
Trans-Pecos Sub-Office
Alpine, Texas

5-YEAR REVIEW

Species reviewed: Hinckley oak (*Quercus hinckleyi*)

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office: U.S. Fish and Wildlife Service - Southwest (Region 2)
Susan Jacobsen, Chief, Threatened and Endangered Species
505-248-6641

Wendy Brown, Recovery Coordinator, 505-248-6664;
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Lead Field Office: Trans-Pecos Ecological Services Sub-Office, Alpine, Texas
Aimee Roberson, Biologist, 432-837-0747.

1.2 Methodology used to complete the review:

The public notice for this review was published in the Federal Register on March 20, 2008 (73 FR 14995). This review considers both new and previously existing information from Federal and State agencies, non-governmental organizations, academia, and the general public. Information used in the preparation of the review includes the recovery plan, the Texas Parks and Wildlife Department (TPWD) Natural Diversity Database; a section 6-funded project on propagation, genetic constitution, and reintroduction of the species; unpublished documents; and communications from botanists familiar with the species. The 5-year review document was prepared by staff in the Trans-Pecos Sub-Office of the Austin Ecological Services Field Office without peer review.

1.3 Background:

Hinckley oak is an endemic evergreen shrub found on arid limestone slopes in the Chihuahuan desert of the Trans-Pecos region in Presidio County, Texas. The oak is believed to be a relict species, formerly associated with pinyon-juniper woodland, but now driven to exist in isolated, widespread groups by the development of more and climates over the past 15,000 years. Its small, gray-green leaves are holly-like and the plant occurs as single stems but more commonly as dense thickets of clonal patches standing about 1.2 meters (~4 feet) high. Reproduction is primarily vegetative, with separate female and male flowers, although acorns are annually produced. Currently, the plant has been reported to occur at 12 localities, with 10 of these verified. These groups generally consist of less than 100 individuals (ranging from 4 to 500 individuals) and cover less than 5 acres in area (U.S. Fish and Wildlife Service (USFWS) 1992).

The shrub was listed due to threats from low population numbers, possible hybridization with other *Quercus* species, road construction and maintenance activities, collecting by horticulturalists, herbivory of leaves and acorns by livestock and wildlife, and insect predation. Current threats appear to be similar but data is limited. Very few recovery actions from the 1992 recovery plan have been implemented, but 7 of the 12 occurrences have been acquired by the State of Texas from private holdings which has ensured their long-term protection. The populations acquired by the State of Texas are located in Big Bend Ranch State Park in an area known as the Solitario. The Solitario is a unique geologic feature that consists of a collapsed and eroded structural dome that is nearly 10 miles across. In addition, a few studies of this species have been completed or initiated and results are summarized in this review.

1.3.1 FR Notice citation announcing initiation of this review:

73 FR 14995; March 20, 2008

1.3.2 Listing history:

Original Listing
FR notice: 53 FR 32824
Date listed: August 26, 1988
Entity: Hinckley oak (*Quercus hinckleyi*)
Classification: Threatened, without critical habitat

1.3.3 Associated rulemakings: None

1.3.4 Review History:

No previous 5-year review has been conducted for this species. Other review documents include:

Miller, D.J. and A.M. Powell. 1982. Status report on *Quercus hinckleyi* (Hinckley Oak). USFWS, Albuquerque, New Mexico. July 15, 1982.

- Recommended Federal Status: Threatened.

U.S. Fish and Wildlife Service. 1988. Endangered and threatened wildlife and plants; determination of threatened status for *Quercus hinckleyi* (Hinckley Oak). 53 FR 188: 32824.

- Listed as threatened.

U.S. Fish and Wildlife Service. 1992. Hinckley oak (*Quercus hinckleyi*) recovery plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

1.3.5 Species' Recovery Priority Number at start of 5-year review: 8

1.3.6 Recovery Plan or Outline

Name of plan or outline: Hinckley Oak (*Quercus hinckleyi*) Recovery Plan
Date issued: September 30, 1992

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate?

_____ ***Yes***
__**x**__ ***No.*** The DPS policy applies only to vertebrate animals, and is therefore not relevant to Hinckley oak.

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan?

_x__ ***Yes***
____ ***No***

2.2.1.1 Does the recovery plan contain objective, measurable criteria

_x__ ***Yes***
____ ***No***

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

_x__ ***Yes***
____ ***No***

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?

____ ***Yes***
_x__ ***No***

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:

Recovery Criterion (1 of 1): "Attain at least 20 viable self-sustaining populations in at least 4 geographically distinct population centers and attain a total of at least 10,000 individual plants. Demonstrate population viability at recovery levels for 10 consecutive years."

Presently, there is not enough data to determine whether the status of Hinckley oak meets the recovery criteria. However, given that a maximum of 12 occurrences have been recorded and the definition of a viable, geographically distinct population center needs to be clarified, it is unlikely that this goal has been met. Defining a population for this species remains unclear because the degree of sexual reproduction, stand regeneration, and possible metapopulation structure is unknown.

The Hinckley Oak Recovery Plan (U.S. Fish and Wildlife Service 1992) did not relate the five listing factors to the recovery criterion (see Section 2.3.2). Of the five factors used to determine whether a species is endangered or threatened as outlined in section 4 (a)(1)(b) of the Endangered Species Act, the factors relevant to the Hinckley oak are:
(*A) present or threatened destruction, modification or curtailment of its habitat or range* - relevant to threats from livestock or wildlife grazing, habitat loss, and degradation from road construction;
(B) overutilization for commercial, recreational, scientific, or educational purposes – relevant to illegal collection by horticulturalists;
(C) disease or predation – relevant to leaf consumption by livestock, wildlife, and insects, as well as a possible fungus, and acorn consumption by wildlife;
(D) inadequacy of existing regulatory mechanisms – relevant to the lack of a management plan for the 7 occurrences on state lands and reliance on voluntary protection for the 3 occurrences on private lands.

2.3 Updated Information and Current Species Status

There has been very little new information collected or reported about Hinckley oak since the publication of the Hinckley Oak Recovery Plan in 1992. However, one study on the species has been completed (Weyerts 1992) and a few studies on the species have been initiated (Klein 2009). A recovery team for Hinckley oak has yet to be formed.

2.3.1 Biology and Habitat

2.3.1.1 New information on the species' biology and life history:

A study funded under Section 6 Cooperative Endangered Species Act Cooperative Conservation Fund (Weyerts 1992) proposed to look at the propagation, genetic constitution, and reintroduction of the Hinckley oak. However, the study was

unable to resolve questions about genetic viability and pollination sufficiency (Kennedy 1993) due to technical difficulties and other logistical issues encountered during the study. Greenhouse experiments resulted in a germination rate of 88%. Micropropagation experiments were unsuccessful and were terminated early in the project (Weyerts 1992).

Cathryn Hoyt, Director of the Chihuahuan Desert Research Institute, sent an electronic mail correspondence (email) on June 11, 2009, indicating that they have three cultivated Hinckley oaks in their living plant collection that are setting acorns this year. She also noted that they are surrounded by gray and emory oaks and thus the acorns may produce hybrids.

Two projects are currently gathering spatial information and genetic material from populations of Hinckley oak. Molly T. Klein, a graduate student at Sul Ross State University under the direction of Dr. Martin Terry, is collecting spatial data from known locations of the species, using a Trimble sub-meter GPS in order to more accurately locate individuals and populations. Ms. Klein is also sending leaf tissue samples for DNA analysis to another student, Janet Backs, with whom the Sul Ross group is collaborating. Janet is working on a microsatellite-based population genetic study on *Q. hinckleyi* for her thesis at the University of Chicago. Permits for field research on the Hinckley oak in the Big Bend Ranch State Park have been provided by David Riskind of the State Park Natural Resources Program, Texas Parks and Wildlife Department.

2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

Molly Klein (2009), a graduate student at Sul Ross State University, submitted the following anecdotal observations, made in the process of collecting spatial data over the past two years, for the purposes of this 5-year review in an email on June 21, 2009:

"On average, specimens of *Q. hinckleyi* growing in the vicinity of the town of Shafter, Texas, seem to be larger plants than those in the Solitario, a geologic feature in Big Bend Ranch State Park, which is south and east of Shafter. Taller and less densely branched than the Solitario plants, the Shafter plants do not appear to be as prolific as those in the Solitario. In some areas the Shafter trees appear to be growing in a ring formation. These clumps of trees resemble the rings of *Agave lechuguilla*, with old growth dead or dying in the center of the ring of living plants. No young trees are noticeable in the populations observed in Shafter. During one trip to Shafter some kind of microorganism—perhaps a fungus—seemed to be attacking some of the trees.

The Hinckley oak seems far more prolific, with a better chance of survival, in the Solitario. The remoteness of the region seems an obvious factor in the apparent

fitness of the plants. One can walk for a day in the "right area" looking for these plants, yet not find one plant; or, one may find a gorge with seemingly endless *Q. hinckleyi* trees up every tributary, suggesting that there are far more of these trees than have been previously documented. In these areas the Hinckley oaks cover the steepest slopes, growing in crevices of solid limestone, yet they seem fitter than those trees that are found at Shafter. Perhaps this is due to the somewhat higher elevations and greater precipitation in the Solitario. Plants in the Solitario seem to be more densely branched, more compact, and smaller in size as elevation increases. More data collection and analysis are needed to arrive at any useful conclusions about the species, and to assess possible hybridization or disease in the populations."

2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

The species is vulnerable because few populations are known, and each has a small number of individuals. The population centers are relatively widespread, limiting potential gene flow. These conditions make the species vulnerable to catastrophic destruction and loss of genetic viability.

All observers report a very low level of regeneration in the stands of *Quercus hincklevi*, with no juveniles reported, though in some years there have been heavy acorn yields (Bacon 1989, 1990). All reproduction appears to be vegetative. Populations may already have become so isolated, and the numbers of individuals fallen so low, that low genetic diversity has developed in the populations, reducing both fertility and the genetic ability to adapt evolutionarily to the changing environment (Hilsenbeck 1989).

Oak species are known to hybridize freely, and hybridization with *Quercus puncrens var. vasevana* (Vasey oak) has been reported at one population of *Quercus hincklevi* (U.S. Fish and Wildlife Service 1988). Genetic swamping by nearby native or introduced oak species is a potential problem, both for populations in the wild and any plants maintained under cultivation (Poole 1988).

There is no new information available since the publication of the recovery plan in 1992 regarding the genetics and genetic variation of the species. However, Janet Backs, a graduate student at the University of Chicago, is currently working on a microsatellite-based population genetic study on *Quercus hinckleyi* for her thesis project (Klein 2009).

2.3.1.4 Taxonomic classification or changes in nomenclature:

Quercus hincklevi is a narrowly endemic species of oak (family Fagaceae). The first known collection was made in 1950 from the Solitario (Presidio County, Texas), and is attributed to Dr. L.C. Hinckley. Dr. C.H. Muller, a noted systematist working on oaks, collected specimens from the same location a month later, and eventually described it as a new species, named in honor of Dr.

Hinckley (Muller 1951). He placed the species within his series Glaucoideae. The type specimen is located in Dr. Muller's herbarium at Santa Barbara, California. There has been no change in taxonomic classification or nomenclature since the publication of the recovery plan in 1992.

2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):

Muller (1951) noted in his original species description that *Ouercus hincklevi* was a relict species, "likely not abundant anywhere". Later analysis of ancient pack rat middens (Van Devender et al. 1978; Van Devender 1986) have shown that as much as 15,000 years ago the species was much more widespread over the area and comprised an element of pinyon-juniper woodland. The development of more arid climates is postulated to have resulted in restriction of the species to a few sites within its old range of distribution, resulting in a patchy distribution of a few populations with relatively few individuals.

The Hinckley Oak Recovery Plan was developed and issued in 1992 when only 10 populations were known to occur. Nine occurred at the Big Bend Ranch State Natural Area in Presidio and Brewster Counties, and one occurred near Shafter, Texas, on private land in Presidio County. Estimates of numbers of individuals in the populations are difficult because the species often produces numerous vegetative root sprouts. Estimates of population size have been made for four of the populations and are 4, 37, 145, and around 500 plants (Poole 1984, 1986, 1988a, 1988b, 1989). Land area covered by each of the populations is less than 5 acres (Service 1992).

According to the Texas Natural Diversity Database (NDD), 12 occurrences have been recorded, 7 of which are located in the Solitario (Big Bend Ranch State Park); 3 are located in or near Shafter, Texas; one is located in the Dead Horse Mountains in Big Bend National Park; and one occurrence is described only as "Big Bend area" (TPWD 2007). The occurrence record from the Dead Horse Mountains in southern Brewster County is an unconfirmed report. In floral surveys of the Dead Horse Mountains from 2003-2006, no Hinckley oak were found (Fenstermacher et al. 2008). Other than this survey of the Dead Horse Mountains and the information mentioned above about four of the populations in the Solitario, no attempts have been made to survey or in any way quantify known populations of the species or to record the possible presence of other populations in suitable habitat. Thus, additional information is needed to better understand the species' spatial distribution.

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

Quercus hincklevi occurs in an arid subtropical climate. Climatologists place it in the Trans-Pecos climatic area of Texas, which is extremely variable because of topographic differences. The area generally has great daily temperature fluctuations and an arid profile where evaporation exceeds precipitation. The average temperature is approximately 30.40°C (86.80°F), with an average precipitation of 23.4 cm (9.2 inches) (Poole 1988a, University of Texas Natural Fibers Information Center 1987).

Quercus hincklevi grows on dry limestone slopes between 1066.8 m arid 1372 m (3,500 - 4,500 feet) elevation. Slopes where the species occurs are mostly north and west-facing. Geologic formations in its area of occurrence are all Cretaceous, including the Shafter Formation, Santa Elena Limestone, Sue Peaks Formation, Del Carmen Limestone, Telephone Canyon Formation, and Glen Rose Formation. The plants are found growing in cracks of solid rocks or extremely rocky soils (Poole 1988a). No detailed soil survey is available for Presidio County. Detailed characterization of the soils where populations of *Quercus hincklevi* grow is needed.

Quercus hincklevi populations occur in Chihuahuan Desert Vegetation, classified in Texas as a part of the Trans-Pecos shrub savannah of Kuchler (1964), and in the Creosote-Lechuguilla Shrub vegetation type of McMahon, Frye, and Brown (1984). The community is likely best placed in the Lechuguilla-sotol series, characteristic of Chihuahuan desert slopes below 1372 m (4500 feet) (Diamond, Texas Parks and Wildlife Department, Austin, Texas, pers. comm. in Service 1992) and grading into the Creosote bush-mariola series at lower elevations and flatter areas (Diamond et al. 1987).

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

When *Quercus hinckleyi* was listed in 1988, threats to the species included potential expansion of Texas highway 67 in the Shafter, Texas, area and potential changes in grazing practices that could lead to increased herbivory in the Solitario (which was privately owned at the time). To our knowledge, no Hinckley oak have been destroyed due to highway expansion since the species was listed; however, this remains a potential future threat to species in the Shafter, Texas, area.

The Texas Parks and Wildlife Department has acquired the Solitario and now 7 of 12 documented Hinckley oak occurrences are located in Big Bend Ranch State

Park. Although a management plan specifically designed for the species has not yet been created by Texas Parks and Wildlife, adverse effects to these Hinckley oak populations are minimized due to their location on publicly-managed lands that prohibit grazing by livestock and the removal or destruction of the species.

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:

The attractive Hinckley oak has potential as a cultivar. Propagation research was conducted several years ago (B.J. Simpson, Texas A&M Research and Extension Center, Dallas, Texas, pers. comm., 1987), but the work was discontinued when the seedlings being grown were determined to be hybrids.

Although plants are grown easily from acorns, some people wanting plants to sell or to continue propagation research may want to take whole plants. Only one population (in the Shafter, Texas, area) is easily accessible and this population likely would receive the most collecting pressure. This population is already small and any loss of plants would be detrimental. There have been several reported instances of acorns being illegally taken from this population, but the actual impact of acorn collecting is unknown.

Since the Solitario was acquired by Texas Parks and Wildlife, the enforcement power against collecting is stronger than it was when privately owned and access for (and control of) research activities is improved.

2.3.2.3 Disease or predation:

Native deer, small mammals, and birds all eat the acorns of Hinckley oak. In a desert environment where food sources are often scarce, most of the annual acorn crop likely is consumed by predators. Neither the potential value of predators as agents of seed dispersal nor the potential damage caused by herbivory has been assessed (U.S. Fish and Wildlife Service 1992).

There is evidence of disease or insect predation at the type locality site. The leaf epidermis of green leaves disintegrates and webs are found on the leaves and branches. The frequency and severity of this infestation was unknown when the Recovery Plan was issued (U.S. Fish and Wildlife Service 1992) and remains unknown.

Molly Klein (2009), a graduate student at Sul Ross State University, submitted the following anecdotal information for the purposes of this 5-year review in an email on June 21, 2009: "During one trip to Shafter some kind of organism -- perhaps a fungus -- seemed to be attacking some of the trees. No material was collected."

More information is needed to assess the potential threats to the species caused by disease or predation.

2.3.2.4 Inadequacy of existing regulatory mechanisms:

Prior to its listing as a threatened species in 1988, this species was not protected by state or Federal law. Currently, the plant is protected as a threatened species by both State and Federal law. Texas state law requires permits to "take" listed plants on State lands; however, there is no protection for plants on private lands, except in the case of take for commercial sale, which requires permits and landowner permission (Poole et al. 2007).

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Genetic swamping of small Hinckley oak populations is possible whenever Hinckley oaks grow near more abundant oak species with which they can hybridize. Simpson (pers. comm., 1987 in U.S. Fish and Wildlife Service 1992) reports that *Quercus pungens* var.*vaseyona* (Vasey oak) is a contaminating pollinator that regularly causes hybrid seed production at one Hinckley oak locality. No new information has become available on this subject since the Recovery Plan was issued in 1992. More information is needed to understand the level of threat posed by potential genetic swamping.

According to the Intergovernmental Panel on Climate Change (IPCC) (2007) "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level." Average Northern Hemisphere temperatures during the second half of the 20th century were very likely higher than during any other 50-year period in the last 500 years and likely the highest in at least the past 1300 years (IPCC 2007). It is very likely that over the past 50 years cold days, cold nights and frosts have become less frequent over most land areas, and hot days and hot nights have become more frequent (IPCC 2007). It is likely that heat waves have become more frequent over most land areas, and the frequency of heavy precipitation events has increased over most areas (IPCC 2007).

The IPCC (2007) predicts that changes in the global climate system during the 21st century are very likely to be larger than those observed during the 20th century. For the next two decades a warming of about 0.2°C (0.4°F) per decade is projected (IPCC 2007). Afterwards, temperature projections increasingly depend on specific emission scenarios (IPCC 2007). Various emissions scenarios suggest that by the end of the 21st century, average global temperatures are expected to increase 0.6°C to 4.0°C (1.1°F to 7.2°F) with the greatest warming expected over land (IPCC 2007). Localized projections suggest the southwest may experience the greatest temperature increase of any area in the lower 48 States (IPCC 2007). The IPCC says it is very likely hot extremes, heat waves, and heavy precipitation will increase in frequency (IPCC 2007). There is also high confidence that many semi-arid areas like the western United States will suffer a decrease in water

resources due to climate change (IPCC 2007). Milly et al. (2005) project a 10–30 percent decrease in precipitation in mid-latitude western North America by the year 2050 based on an ensemble of 12 climate models.

The primary reason for the rarity of Hinckley oak is due to the effects of climate changes resulting in habitat loss and fragmentation over thousands of years (Miller and Powell 1982). Muller (1951) noted in his original species description that *Quercus hinckleyi* was a relict species with low abundance. Comparisons from pack rat midden data revealing the oak's more widespread distribution in the past (Van Devender et al. 1978; Van Devender 1986) to its current restricted and fragmented range, suggest that *Quercus hinckleyi* has been affected by climate change for a long time. The development of more arid climates is postulated to have restricted the species to a few sites within its old range of distribution, resulting in a patchy distribution of a few populations with relatively few individuals (U.S. Fish and Wildlife Service 1992). While it appears reasonable to assume that Hinckley oak has been and may continue to be affected, we lack sufficient certainty to know how climate change will affect the species.

2.4 Synthesis

Very little new information on the Hinckley oak has been collected since the publication of the recovery plan in 1992. The lack of available data highlights the need to focus on Hinckley oak recovery. The single recovery criterion to delist the species, to establish 20 viable populations totaling 10,000 individuals in 4 locales for 10 years, has yet to be met and may not be realistic for this species. However some threats to the species have been reduced since the species was listed due to land acquisition by the State of Texas. In 1988, Texas Parks and Wildlife Department acquired formerly private land occupied by the majority of the known populations (7 of 12 reported occurrences) located in the Solitario region of Big Bend Ranch State Park. At present, these public lands are managed for conservation of natural resources where removal or destruction of wildlife is prohibited. Within Big Bend Ranch State Park, livestock grazing in Hinckley oak habitat is not permitted. The State of Texas also manages permits for research and collection of plant materials on State lands, reducing the threat of over-utilization for the localities within the Solitario.

Changes in climate over thousands of years is believed to have affected the species by contracting its range due to warmer and drier conditions, but we lack sufficient information to know how climate change will affect the species in the future. In addition, genetic flow and swamping have been identified as potential threats to the species, but more information is needed to assess the magnitude of these threats.

To progress in recovering Hinckley oak, more information is needed about the species' ecology, management, propagation, and genetics. It would also be beneficial to contact the private landowner(s) in the Shafter, Texas, area where the species occurs to encourage continued conservation of this species.

Although some threats to the species have been reduced since it was listed and no new threats have been identified, others remain or are as yet poorly understood. Thus, we recommend that the status of this species remain as threatened.

3.0 RESULTS

3.1 Recommended Classification:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (*Indicate reasons for delisting per 50 CFR 424.11):*
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*
_X_ No change is needed

3.2 New Recovery Priority Number: No change

Brief Rationale: There is very little new information available since the publication of the recovery plan in 1992. None of the information available suggests that the status of the species or threats to it have changed significantly.

3.3 Listing and Reclassification Priority Number: N/A

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

The Hinckley Oak Recovery Plan should be revised to include criteria that incorporate the five-factor analysis (2.3.2). The revised plan should identify and seek to remedy gaps in knowledge necessary for effective management and recovery. The criteria must also be achievable and quantifiable. Criteria for uplisting from threatened to endangered status are not given in the plan and should be considered.

Only one Recovery Criterion was identified in the Recovery Plan (U. S. Fish and Wildlife 1992). It calls for establishment or maintenance of at least 20 viable self-sustaining populations in at least 4 geographically distinct population centers with a total of at least 10,000 individual plants. This criterion should be refined to further describe what constitutes a viable population and the geographic distribution necessary for recovery.

The most important recovery actions during the next five years include, but are not limited to, the following:

- Determine exact habitat requirements (Recovery Plan Action 31).

- Develop a model, based on soil types and other appropriate habitat attributes for Hinckley oak, to predict areas of potentially suitable habitat and then survey those areas for the species (related to Recovery Plan Action 4).

- Establish a reserve germ bank/cultivated population with a responsible agency/institution (Recovery Plan Action 2).

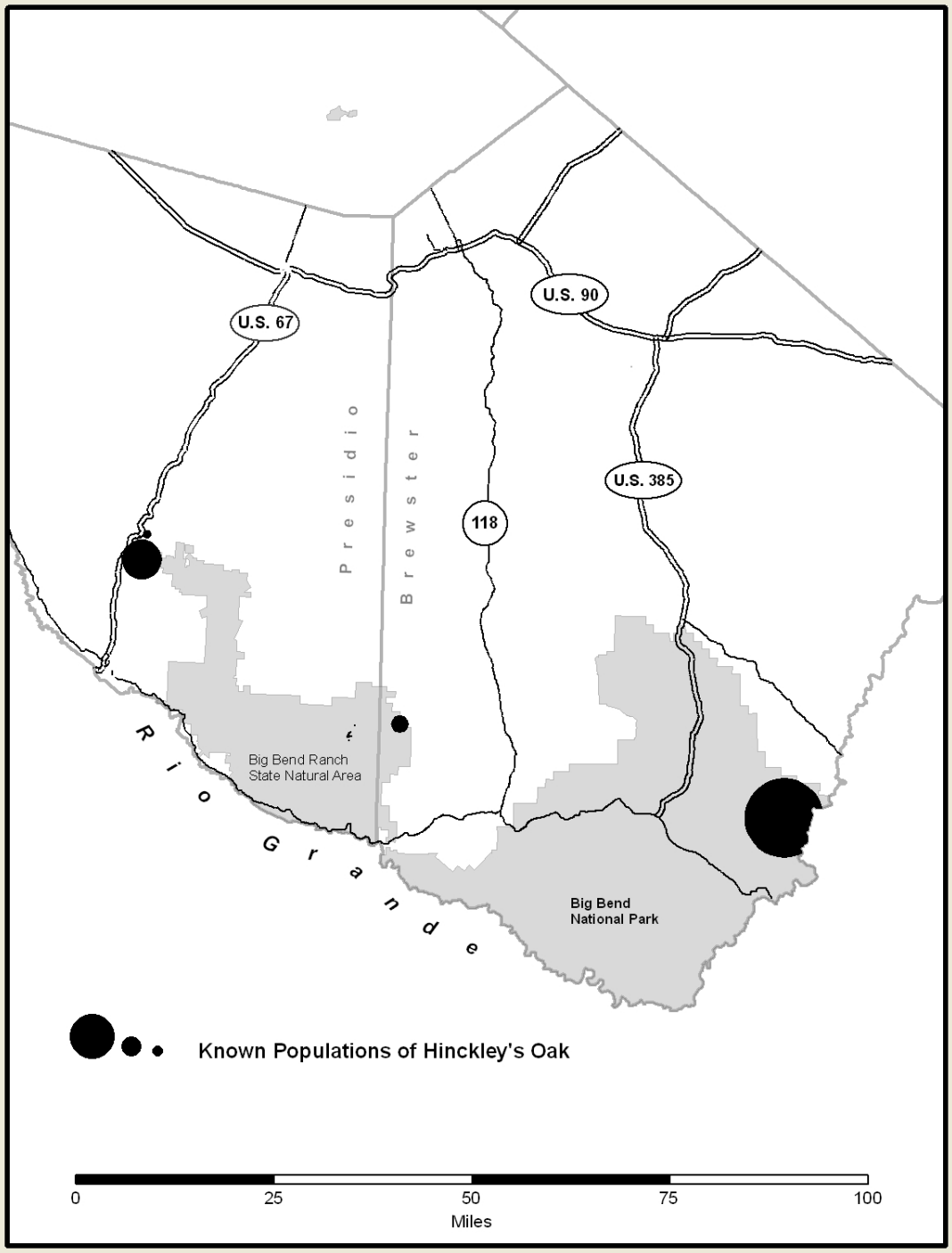
- Evaluate present conditions and determine stability requirements for populations (Recovery Plan Action 321).

- Assess incidence of (and potential threat from) hybridization with nearby oak (*Quercus*) species and develop management strategies to address any threats associated with hybridization (Recovery Plan Action 3213).

- Assess potential threats to the species associated with climate change and develop management strategies to address these threats.

A recovery team has not been formally established for Hinckley oak. The Service should consider the formation of an official recovery team to focus on all listed plant species in Trans Pecos Texas, including Hinckley oak.

Map 1. Reported locations of Hinckley oak from TPWD's Natural Diversity Database. Note: that the sizes of the circles do not correspond with the size of populations, but rather with the area of reported occurrence. Also, the reported occurrence in the Dead Horse Mountains of Big Bend National Park has never been verified and the species was not found in an extensive survey of vascular flora in the Dead Horse Mountains (Fenstermacher 2008).



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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Hinckley Oak*

Current Classification: Threatened

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__x__ No change needed

Appropriate Listing/Reclassification Priority Number, if applicable:

Review Conducted By: Aimee Roberson

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service, Austin Ecological Services Field Office

Approve Alisa Shull Date 6-30-09

REGIONAL OFFICE APPROVAL:

Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service, Region 2

Approve Nancy J Gloman Date 9-2-09