Fassett's Locoweed
(Oxytropis campestris var. *chartacea)*

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Wisconsin Ecological Services Field Office
New Franken, Wisconsin

2009

5-YEAR REVIEW

Species reviewed: Fassett's locoweed (*Oxytropis campestris* var. *chartacea*)

TABLE OF CONTENTS

1.0 GENERAL INFORMATION 1
1.1 Reviewers 1
1.2 Methodology used to complete the review 1
1.3 Background 1
1.3.1 FR Notice citation announcing initiation of this review 1
1.3.2 Listing History 2
1.3.3 Associated rulemakings 2
1.3.4 Review history 2
1.3.5 Species' recovery priority number at start of review 2
1.3.6 Recovery plan 2
2.0 REVIEW ANALYSIS 2
2.1 Application of the 1996 Distinct Population Segment (DPS) policy 2
2.1.1 Is the species under review a vertebrate? 2
2.2 Recovery Criteria 2
2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria 2
2.2.2 Adequacy of recovery criteria 2
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? 2
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)? 3
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 3
2.3 Updated Information and Current Species Status 5
2.3.1 Biology and Habitat 5
2.3.1.1 New information on the species' biology and life history 5
2.3.1.2 Abundance, trends, and demographic features 6
2.3.1.3 Genetics and genetic variation 7
2.3.1.4 Taxonomic classification 7
2.3.1.5 Spatial distribution 7
2.3.1.6 Habitat or ecosystem conditions 8
2.3.1.7 Other 8
2.3.2 Five-factor analysis 9
2.3.2.1 Present or threatened destruction, modification, or curtailment of its habitat or range 9
2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes 9
2.3.2.3 Disease or predation 9
2.3.2.4 Inadequacy of existing regulatory mechanisms 10

2.3.2.5 Other natural or manmade factors affecting its continued existence 10
2.4 Synthesis 11
3.0 RESULTS 13
3.1 Recommended Classification 13
3.2 New Recovery Priority Number 13
3.3 Listing and Reclassification Priority Number 13
4.0 RECOMMENDATIONS FOR FUTURE ACTIONS 13
5.0 REFERENCES 14

APPENDICES

APPENDIX A. Summary Information on Fassett's Locoweed Sites in Wisconsin…… A-1

APPENDIX B. Summary of Peer Review for the 5-Year Review of Fassett's Locoweed *(Oxytropis campestris var. chartacea)* (2009) ……..……B-8

5-YEAR REVIEW
Fassett's Locoweed/*Oxytropis campestris* var. *chartacea*

1.0 GENERAL INFORMATION

1.1 Reviewers:

Lead Regional Office: Midwest Region
Contact: Carlita Payne, Endangered Species Division, 612-713-5339

Lead Field Office: Wisconsin Ecological Services Field Office
Contact: Cathy Carnes, Endangered Species Coordinator, 920-866-1732.

Cooperating Field Office(s): NA

Cooperating Regional Office(s): NA

1.2 Methodology used to complete the review:

The U.S. Fish and Wildlife Service (USFWS) conducts status reviews of species on the List of Endangered and Threatened Wildlife and Plants (50 CFR 17.12) as required by section 4(c)(2)(A) of the Endangered Species Act (ESA) (16 U.S.C. 1531 *et seq*.). The USFWS provided notice of this status review via the Federal Register (72 FR 144) on July 27, 2007, requesting new information on Fassett's locoweed (*Oxytropis campestris* var. *chartacea*) that may have a bearing on its classification as threatened. Craig Anderson, Botanist, with the Wisconsin DNR (WDNR) gathered relevant information and prepared a draft of the review with funding from an ESA section 6 grant. Cathy Carnes, Endangered Species Coordinator, and Janet King, Fish and Wildlife Biologist with the USFWS's Wisconsin Ecological Services (ES) Field Office completed the preliminary draft. This was peer reviewed for scientific accuracy by Dr. Emmett Judziewicz, Associate Professor of Biology and Forestry, UW-Stevens Point; Dr. Ted Cochrane, Senior Academic Curator, Wisconsin State Herbarium, UW-Madison; Dr. Robert Freckmann, Professor Emeritus, UW-Stevens Point; David Kopitzke, UW- Richland Center; and Darcy Kind, Bureau of Endangered Resources, WDNR. The final review and recommendations were prepared by Cathy Carnes of the USFWS's Wisconsin ES Field Office.

1.3 Background:

1.3.1 FR Notice citation announcing initiation of this review: 72 FR 144, Friday, July 27, 2007.

1.3.2 Listing history

Original Listing
FR notice: 53 FR 37970-37972
Date listed: Wednesday, September 28, 1988
Entity listed: Subspecies
Classification: Threatened

1.3.3 Associated rulemakings: None

1.3.4 Review History: Fassett's locoweed was included in a cursory 5-year review conducted for all species listed before 1991 (56 FR 56882). The 5-year review resulted in no change to the listing classification of threatened. There have been no biological opinions or other large scale analysis of this species.

1.3.5 Species' Recovery Priority Number at start of 5-year review: 9 (indicating a subspecies with a moderate degree of threat and high potential for recovery).

1.3.6 Recovery Plan

Name of plan: Fassett's Locoweed (*Oxytropis campestris* var. c*hartacea*) Recovery Plan
Date issued: March 29, 1991
Dates of previous revisions, if applicable: NA

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? *No*

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria? *Yes*

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? *Yes*

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*

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:

The Fassett's Locoweed Recovery Plan (USFWS 1991) (recovery plan) contains the following recovery criteria (refer to Executive Summary and Part II, Recovery, Objective):

- Protect lake shorelines with Fassett's locoweed at 6 of the currently known sites (the 6 sites known extant at the time the recovery plan was completed in 1991 were Plainfield Lake, Second Lake, Weymouth Lake, Lake Huron, Pickerel Lake, and Sherman Lake). Population protection should also be the goal at new locations yet to be found. Protection will best be accomplished through fee simple purchase. Where this is not possible, other methods should be pursued, including conservation easement and registry.
- Protected populations will be monitored and the site managed to maintain Fassett's locoweed for the following 7 years of the recovery period. Management needs may include removal of nonnative plant species and other measures necessary to sustain shoreline habitat.
- Removal of Fassett's locoweed from the list of U.S. Endangered and Threatened Species will be considered when 6 populations are permanently protected and managed, and monitoring indicates the populations to be self-sustaining (refer to Part II Recovery, Objective).

Criteria as they relate to the 5-listing factors:

- *Present or threatened destruction, modification or curtailment of its habitat or range*: All three recovery criteria are relevant to this listing factor.
- *Overutilization for commercial, recreational, scientific, or educational purposes*: Not relevant.
- *Disease or predation*: Relevant to second recovery criterion.
- *Inadequacy of existing regulatory mechanisms*: Not relevant.
- *Other natural or manmade factors affecting its continued existence*: Relevant to the second recovery criterion.

EXTENT RECOVERY CRITERIA HAVE BEEN MET

Protect lake shorelines with Fassett's locoweed at 6 of the currently known sites. Population protection should also be the goal at new locations yet to be found. Protection will best be accomplished through fee simple purchase. Where this is not possible, other methods should be pursued, including conservation easement and registry.

Six Fassett's locoweed sites have complete or partial long-term protection. While much protection has been achieved since listing of the species, because some sites are not yet totally protected, this criterion has not been met. Site protection efforts are discussed in more detail below.

There were six extant sites and three historic sites in 1991 when the recovery plan was completed. Currently there are 8 extant Fassett's locoweed sites known in Wisconsin (APPENDIX A). Six of the eight extant sites are in partial or entire public ownership. Those are Second, Sherman, Plainfield and Pickerel lakes, owned in part by the Wisconsin Department of Natural Resources (WDNR) State Natural Areas program (SNA), Mountain Lake owned entirely by the United States Forest Service (USFS), Chequamegon-Nicolet National Forest (CNNF), and Pigeon Lake owned in part by the UW-Wisconsin system. The remaining two sites (Lake Huron and Weymouth Lake) are owned by multiple private parties. The Mountain Lake site in northwest Wisconsin has been the only new site found since completion of the recovery plan (USFWS 1991). More seepage lakes should be surveyed for the presence of Fassett's locoweed and additional sites protected.

There are currently no conservation easements or other legal instruments (e.g., fee title purchases) in place on the two privately held sites. In addition no private landowners have registered their lands with WDNR. Registry of a site is not a legally binding agreement (Darcy Kind, in litt. 2008); it is an informal agreement with a private landowner for the protection of a rare species. While not legally binding, registry of lands can be a valuable tool, creating allies in the work of rare species protection (David Kopitzke, in litt. 2008). WDNR Bureau of Endangered Resources (BER) staff continues to communicate with private landowners to pursue the strongest conservation measure possible at both the previously mentioned sites and the remaining Fassett's locoweed sites. Refer to APPENDIX A for landownership information.

Protected populations will be monitored and the site managed to maintain Fassett's locoweed for the following 7 years of the recovery period. Management needs may include removal of nonnative plant species and other measures necessary to sustain shoreline habitat.

The monitoring and management criteria have been met, and are on-going. Semi-regular monitoring has occurred on accessible portions of all sites since the recovery plan was completed in 1991. Overall, population sizes (except for Weymouth Lake) have been stable or increasing since 2001 (APPENDIX A). A quantitative monitoring plan was implemented by the WDNR four out of five years between 1988 and 1992 at Plainfield Lake (Dobberpuhl, unpublished data; Thomas Meyer, WDNR, pers. comm. 2008). In 2006, another quantitative monitoring plan, funded by an ESA section 6 grant from the USFWS, was implemented at Plainfield and Pickerel lakes, which have the largest populations

of Fassett's locoweed (Almasi 2006). Almasi (2007) completed a second round of monitoring in 2007, and WDNR staff monitored these two sites in 2008. Nonnative invasive plant species, including spotted knapweed (*Centaurea stoebe),* yellow sweet clover (*Melilotus officinalis*), reed canary grass (*Phalaris arundinacea*), Canada thistle (*Cirsium arvense*), bull thistle (*C. vulgare*), and yellow hawkweed (*Hieracium kalmii*) have been monitored at several sites and some nonnative species have been hand-pulled on publicly-owned sites (WDNR 2008). Nonnative plant species on Plainfield and Pickerel lakes have been mapped (Almasi 2007). Private landowners have caged individual plants to prevent trampling or inadvertent mowing at the Lake Huron site (WDNR 2008). Fassett's locoweed habitat has been enclosed by fencing or roping at two other sites, one on the private portion of Pickerel Lake and one on the public portion of Pigeon Lake.

Removal of Fassett's locoweed from the list of U.S. Endangered and Threatened Species will be considered when 6 populations are permanently protected and managed, and monitoring indicates the populations to be self-sustaining.

These criteria have not been wholly met. Currently six populations on six sites are, in part or wholly permanently protected on publicly-owned land (Second, Sherman, Mountain, Plainfield, Pigeon, and Pickerel lakes). The SNA program continues to work toward expanding acquisition at the Plainfield Lake site. Additional permanent protection options are being pursued at other sites. Monitoring data demonstrates that populations fluctuate greatly in size depending on available suitable habitat and germinant survival (WDNR unpublished data, APPENDIX A) and that invasive plant species remain a significant threat.

2.3 Updated Information and Current Species Status

2.3.1 Biology and Habitat

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

In a pilot study on the population genetics and phylogeography of Fassett's locoweed, Chung et al. (2004) found that self-fertilization and apomixis (asexual reproduction) were absent or rare (<2% of flowers within bagged inflorescences set fruit). A healthy pollinator population is important for this species and appears to be a variety of bee species (Almasi 2006). Genetic research supports recognition of Fassett's locoweed as a distinct taxon. Also, genetic variation appears fairly high and there is no reason to suspect genetic factors as an overriding management concern (Chung 2001, Chung et al. 2004). Fassett's locoweed undergoes frequent population fluctuations, and therefore, it appears genetic diversity is preserved by the seed bank (Chung 2001). High within-population diversity and relatively low among-population differentiation are consistent with populations of Fassett's locoweed being relicts of a more continuous Pleistocene distribution (Chung et al. 2004).

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:

Most of the Fassett's locoweed populations in central and northwestern Wisconsin have been qualitatively monitored and surveyed on a semi-regular basis since the 1990s. The Fassett's locoweed population at Mountain Lake in northwestern Wisconsin has been observed annually from about 1990 to 2007 (Spickerman 2007; Spuhler 2006, 2007). Quantitative monitoring was conducted annually at Plainfield Lake between 1988 and 1992, with the exception of 1989. Due to very high lake levels and a lack of resources in 1993, monitoring was discontinued after 1992 (T. Meyer, pers. comm. 2008). A second quantitative monitoring protocol was developed and implemented at Plainfield and Pickerel lakes beginning in 2006 (Almasi 2006, 2007) and WDNR botanists continued implementation of that monitoring plan in 2008 (Craig Anderson, WDNR, pers. comm. 2008).

Populations of Fassett's locoweed have fluctuated considerably over time (APPENDIX A). Populations at several of the lakes in 1989 were moderate to high. In the early1990's, populations plummeted due to high water levels and reduced shoreline habitat. Since the late 1990's, populations have increased significantly and have generally remained stable due to low water levels in the lakes and expanded habitat. Populations have generally regained their high numbers of 1989 except for the Lake Huron population where the current population is less than one-fifth the size of largest recorded count, and the Pickerel Lake site where the population increased significantly from it's 1980's levels. Fassett's locoweed population data is housed in WDNR Natural Heritage Inventory program files.

Plainfield and Pickerel lakes contain the two largest populations of Fassett's locoweed. To count population numbers at these sites, Fassett's locoweed plants have been divided into reproductive, non-reproductive, and seedlings age structures (Almasi 2006, 2007). Comparing Almasi's results, in 2007 the estimated population of Fassett's locoweed fell about 40% at Plainfield Lake and 9% at Pickerel Lake from 2006 population levels (APPENDIX A). Numbers declined in all life stages at Plainfield Lake, but the number of seedlings actually rose at Pickerel Lake. Almasi (2007) notes that Plainfield Lake has been more or less dry since mid-2006, probably affecting plant survival. Pickerel Lake water levels dropped but the lake still had water in 2007. As the Pickerel Lake level dropped, more suitable habitat was exposed allowing for a large number of seeds to germinate in 2007. Fassett's locoweed locations have been mapped at these two sites (Almasi 2007).

Additional potential habitat has also been monitored. The Mountain Lake population, documented in 1992, is the only additional Fassett's locoweed site found after the completion of the recovery plan (USFWS 1991). Spickerman

(2007) surveyed 19 sites in northwestern Wisconsin, and Spuhler (2006) surveyed about an additional 39 sites in Bayfield County for Fassett's locoweed. Even though several of these lakes have suitable habitat, they remain unoccupied. Spickerman (2007) recommends that potential habitat in western Douglas County be surveyed. Dr. Emmet Judziewicz (in litt. 2008) recommends surveys in both eastern Douglas and western Bayfield counties. In the past, surveys in central Wisconsin were part of a now discontinued landowner contact program.

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

The Fassett's locoweed populations in northwest and central Wisconsin are separated by over 149 miles (240 km). In central Wisconsin, populations in Waushara County are separated from the Portage County population by about 15 miles (24 km) (USFWS 1991).

Chung et al. (2004) analyzed patterns of genetic variation within and among six populations (Second Lake, Lake Huron, Weymouth Lake, Plainfield Lake, Pickerel Lake, and Mountain Lake) of Fassett's locoweed and their relationship to other members of the *O. campestris* complex across northern North America. Fassett's locoweed within-population measures of genetic diversity were high compared with other herbaceous plants. Estimates of among-population differentiation were low, consistent with out-crossing. Morphologically speaking, the northwest and central Wisconsin populations are similar, indicating a lack of genetic drift or differentiation (Chung et al. 2004). Considering the high level of genetic diversity within populations, maintaining the ecological conditions that favor the life cycle of this plant may be a more pressing concern than the erosion of genetic variation (Chung et al. 2004).

2.3.1.4 Taxonomic classification or changes in nomenclature:

Chung et al. (2004) also examined the phylogeny of Fassett's locoweed (*Oxytropis campestris* var. *chartacea*) with respect to the *O. campestris* complex. Results support sister relationship between var. *chartacea* and var. *johannensis*, which was proposed by Barneby (1952) based on morphological and biogeographical grounds. Chung's et al. (2004) analysis, however, indicates that each variety is a distinct lineage.

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.):

The three historic sites (identified in the recovery plan), Pigeon, Shumway, and Mud lakes, have been surveyed several times since completion of the recovery plan in 1991. In 1993, Fassett's locoweed was rediscovered at the Pigeon Lake

historic site; no populations have been found at the Shumway and Mud lake sites. Surveys of potential sites in Wisconsin have resulted in the addition of one new Fassett's locoweed site, the Mountain Lake site in northwest Wisconsin, found in 1992. The Mountain Lake population is located less than 1 kilometer from the Pigeon Lake site and therefore does not reflect a significant change in the historic species range. However, the Mountain and Pigeon lake sites reflect an expansion of the extant range of Fassett's locoweed (since completion of the recovery plan in 1991) to northwest Wisconsin.

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

Fassett's locoweed is found on sandy-gravel lakeshores of seepage lakes, fed by groundwater, with fluctuating lake levels. Some shorelines have a high proportion of gravel. Fluctuating lake levels are critical in maintaining suitable habitat (low substrate fertility) and distributing seeds within the site. The amount of available habitat at each site depends on current and recent lake levels. Nearly all of the lakes are <15 ha in size and range in elevation from 350 to 370 meters (USFWS 1991). Lakes are shallow with the exception of Lake Huron. Beach slope varies from gentle to moderately steep. Fassett's locoweed is found along the lakes on open shorelines and, to a lesser extent, on higher ground under the partial shade of adjacent vegetation. Fassett's locoweed occurs in areas that are completely exposed to sunlight or receive only partial shade from other species. The soil surface is subjected to extreme temperature fluctuations, high solar radiation, strong winds, and soil moisture stress. It is in these areas, where competition from other plant species appears to be very low, that Fassett's locoweed occurs in the densest colonies (USFWS 1991).

Due to the very low water levels in 2007 at the central Wisconsin sites, suitable habitat may be at a peak. However, continued low water conditions may decrease habitat due to vegetation succession. Invasive plant species are a threat to Fassett's locoweed populations and it is important to control invasive species. It is also important to continue working with the private landowners to prevent unnecessary disturbances, such as from vehicular or pedestrian traffic, to the Fassett's locoweed populations.

2.3.1.7 Other:

General Fassett's locoweed information is available to the public on the WDNR Bureau of Endangered Resources (BER) website at: http://dnr.wi.gov/org/land/er/factsheets/plants/locowd.htm and at the USFWS Midwest Ecological Services, Endangered Species website at: http://www.fws.gov/midwest/endangered/plants/pdf/fassetts.pdf. A hard copy fact sheet was developed by BER for the general public in the 1990s.

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:

A primary threat to Fassett's locoweed identified in the recovery plan (USFWS 1991) is development. Fee simple title has been acquired for several properties at Fassett's locoweed sites in central Wisconsin by the WDNR State Natural Area (SNA) program. That program recently completed purchase of a large portion of Plainfield Lake and is continuing to negotiate protection of Weymouth Lake (Darcy Kind, in litt. 2008). Several of the properties with Fassett's locoweed are included in the Plainfield Tunnel Channel Lakes and Pickerel Lake SNAs. The USFS CNNF owns the lakeshore of Mountain Lake which was designated a SNA in 2007. WDNR staff continues to collaborate with interested landowners at the remaining sites to promote conservation of the species and sites. Protective signage is in place at several sites, although the presence of Fassett's locoweed is not advertised in order to protect the species from human disturbance (C. Anderson, pers. comm. 2008; Steven Spickerman, USFS, pers. comm. 2008). SNA signs occur at the lakes of the Plainfield Tunnel Channel Lakes SNA (Plainfield, Second, and Sherman lakes). There are SNA boundary signs on the northwest part of the Pickerel Lake SNA, and additional signs prohibiting campfires and littering will be installed at the public boat landing at the southeast corner of the lake. The USFS has a sign prohibiting ATV use at Mountain Lake (S. Spickerman, pers. comm. 2008). Maps and information on SNA can be found at the following WDNR website: http://dnr.wi.gov/org/land/er/sna; that website identifies allowable activities at SNAs.

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

There has been no past or current overutilization of Fassett's locoweed plants for commercial, recreational, scientific or educational purposes. Seeds from Fassett's locoweed were sent to the Holden Arboretum for curation and germination studies in 1986 (Parsons 1989). Chung (2001) collected leaves of Fassett's locoweed for genetic analysis.

2.3.2.3 Disease or predation:

No diseases are presently known to affect Fassett's locoweed population. However, one surveyor noted in 2006 and 2007 that flowers were eaten from a number of plants at one site, possibly by deer (WDNR, unpublished data). Monitoring should include assessment of this threat, especially herbivory on flowering and fruiting stems of the plant (Dr. Robert Freckmann, in litt. 2008). If herbivory is threatening the viability of a Fassett's locoweed population, measures (e.g., fencing) should be taken to reduce the threat.

2.3.2.4 Inadequacy of existing regulatory mechanisms:

The Wisconsin Endangered Species Act (State Statute 29.604) and Federal ESA protect Fassett's locoweed, which is listed as endangered by the state and federally-listed as threatened. All Federal and state landowners of occupied Fassett's locoweed sites (USFS and WDNR) are aware of the plant locations within their jurisdiction. The USFWS and the State of Wisconsin prohibit the unauthorized collection of this species. Fassett's locoweed populations that occur below the ordinary high water mark may be under state ownership and therefore, protected via the state Endangered Species statute (Darcy Kind, in litt. 2008, C. Anderson, pers. comm. 2008).

Federal agencies must consult with the USFWS on any actions that may affect Fassett's locoweed pursuant to section 7 of the ESA. The USFS CNNF has consulted with the USFWS on implementation of the Chequamegon-Nicolet Invasive Plant Control Program (USFS 2005), which includes controlling invasive species in and near Fassett's locoweed populations. To preclude adverse affects to locoweed, CNNF will not use herbicide control methods within 68 feet of known Fasssett's locoweed sites to control Canada thistle but rather use hand-pulling in this area by knowledgeable personnel skilled in the identification of locoweed and Canada thistle (USFWS, in litt. 7/13/2005). Existing regulatory mechanisms appear adequate at this time.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Water level fluctuations are important in maintaining suitable habitat (low substrate fertility) and dispersing seeds within a site. The recovery plan for Fassett's locoweed (USFWS 1991) notes that high capacity wells used for row crop irrigation may affect groundwater levels, and herbicide drift or run-off may pose threats to Fassett's locoweed. Weeks and Strangland (1971) note that streams and groundwater levels were affected to some extent by irrigation development and that irrigation began to be developed extensively in the Plainfield area in the late 1940s. An analysis assessing the factors affecting groundwater levels in central Wisconsin is currently being conducted by the WDNR, University of Wisconsin-Extension, and Wisconsin Association of Lakes. This study plans to examine long-term groundwater fluctuations to determine how these fluctuations relate to agriculture, other land uses, and precipitation (WDNR 2008). This study will be beneficial in helping to assess groundwater impacts to Fassett's locoweed sites in central Wisconsin that continue to have low water levels. Lake level monitoring at Lake Huron indicates that the lake is at the lowest level measured since monitoring began in 1973 (Roost and Cason 2007). If land use factors (e.g., high capacity wells, agricultural irrigation) and/or climate change, affect water levels, those threats should be evaluated and addressed. Climate change is a potential threat as

warming temperatures in central Wisconsin may affect the natural fluctuation of lake levels and potentially dry the seepage lakes that support Fassett's locoweed, resulting in greater threats from invasive nuisance plants and reductions in population numbers.

There have been no effects observed from herbicide use on Fassett's locoweed, although pesticides used in potato fields near occupied lakes may be a threat. Soils in central Wisconsin are sandy, allowing contaminants to enter the groundwater and nearby seepage lakes thereby creating the potential to expose Fassett's locoweed to these pesticides (David Kopitzke, in litt. 2008). Mechanical management and/or use of herbicides to control aquatic invasive plants including Eurasian water-milfoil *(Myriophyllum spicatum*), curly-leaf pond weed (*Potamogeton crispus*), and purple loosestrife *(Lythrum salicaria)* could potentially threaten Fassett's locoweed populations, especially on lakes with boat traffic (Darcy Kind, in litt. 2008). WDNR reviews and approves control methods for water-milfoil on Lake Huron, designing such projects to minimize harm to Fassett's locoweed (WDNR, in litt. 2003). These reviews should continue.

Invasive species may be a threat to Fassett's locoweed at several sites due to habitat degradation and low water levels. Some of the invasive plant species near or within Fassett's locoweed sites include: yellow sweet clover (*Melilotus officinalis*), spotted knapweed (*Centaurea stoebe)*, reed canary grass (*Phalaris arundinacea*), Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), butter-and-eggs (*Linaria vulgaris*), eastern cottonwood (*Populus deltoides*), and non-native yellow hawkweeds (*Hieracium* species). Monitoring should also include searches for potential new invasive species as yet unrecorded from occupied sites or nearby areas (Darcy Kind, in litt. 2008).

Invasive species growth is an increasing problem at some sites. Almasi (2006) recommends that invasive species be tightly monitored and controlled when possible at Pickerel and Plainfield lakes. Researchers should record location and density of invasive species that are being removed. Monitoring and controlling invasive plant species should continue. Invasive species control programs have the potential of adversely affecting Fassett's locoweed and should be designed to avoid impacts to the species (refer to 2.3.2.4 Inadequacy of existing regulatory mechanism above).

2.4 Synthesis

Fassett's locoweed is a rare endemic with eight populations currently occurring on two widely geographically separated clusters of seepage lakes in Wisconsin. Six of the populations occur in central Wisconsin and are separated from the two northern sites by 149 miles (240 km). In 2008, the populations at the six central Wisconsin sites ranged in size from 19 to over 48,000 individuals. Populations at the two sites in northwest Wisconsin range from 2 (2007) to over 1,000 plants (2008) (APPENDIX A). Two sites that were historically known to support Fassett's locoweed, Mud Lake and Shumway lakes, were repeatedly surveyed since the late 1980s, but no plants have been found at

either site. Repeated surveys of sites with potential habitat in central and northwestern Wisconsin have documented no new populations since 1992. Spickerman (2007) noted some potential habitats in western Douglas County should be surveyed and Dr. Emmet Judziewicz (in litt. 2008) recommends surveys in eastern Douglas and western Bayfield counties as well. Most of the populations have been qualitatively monitored on a semi-regular basis since the 1990s. Population levels can fluctuate greatly depending on lake levels and the availability of suitable habitat.

Fassett's locoweed habitat is found on lakeshores of seepage lakes with fluctuating lake levels. Dependent upon groundwater seepage, all of the lakes are subject to frequent, large fluctuations in lake level and the fluctuations are important for maintaining suitable habitat (low substrate fertility), and dispersing seeds within a site. Fassett's locoweed is found along the lakes on open shorelines and, to a lesser extent, on higher ground under the partial shade of adjacent vegetation. Fassett's locoweed occurs in areas where competition from other plant species appears to be very low; however, continued low water conditions may decrease habitat due to vegetation succession.

Propagation of Fassett's locoweed occurs sexually by dispersal of seeds, because self-fertilization is absent or rare. Pollinators appear to be a number of bee species. A healthy pollinator population is important for this species. Genetic research justifies recognition of Fassett's locoweed as a distinct taxon. Also, genetic variation appears to be fairly high, and there is no reason to suspect genetic factors as an overriding management concern. It appears genetic diversity is preserved by the seed bank.

Of the eight extant sites, only one Fassett's locoweed population (Mountain Lake) occurs entirely within Federal (USFS) jurisdiction. All or parts of the five additional populations occur on state-owned property. The remaining two sites are privately-owned. No over-utilization, disease, or predation threats (except for possible deer herbivory at one site) have been observed. WDNR staff continues to collaborate with public landowners to promote conservation of the species. Public agencies should continue to complete fee acquisition, conservation easements, or other forms of permanent conservation actions with willing landowners.

Invasive plant species are a threat to Fassett's locoweed populations, and control has been implemented on a majority of the sites. Also, the effects of high capacity wells on groundwater levels and flow may be a long-term threat in central Wisconsin, as may be climate change. An ongoing study looking at factors affecting groundwater levels in central Wisconsin is critical to our understanding of how groundwater levels may impact Fassett's locoweed populations. Results of this study will be important to assess.

None of the threats to the species have been removed since listing, however many have been reduced (i.e., site protection is in place in whole or part for six sites, and there are active monitoring and management programs in place to address threats from invasive species, ATV use, etc.). One new site in northern Wisconsin, Mountain Lake has been found since completion of the recovery plan.

No change in classification is warranted. Recovery efforts should continue with the goal of obtaining the highest level of protection for the remaining populations. This species may become endangered in the foreseeable future throughout all or a significant portion of its range, and therefore, continues to meet the definition of threatened.

3.0 RESULTS

3.1 Recommended Classification: Threatened, no change is needed

3.2 New Recovery Priority Number: NA (no change, remain 9)

3.3 Listing and Reclassification Priority Number: NA

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

Implementation of the recovery actions identified in the Fassett's Locoweed Recovery Plan (USFWS 1991) should continue, the highest priority action being to secure the strongest level of land protection at extant sites (Action No.1). Monitoring and management of Fassett's locoweed sites should continue annually (Action Nos. 2 and 3), giving special emphasis to the control of invasive species. Population augmentation should be considered at extant sites with very low population numbers to help secure those populations, such as at Pigeon Lake in northern Wisconsin.

Searches for new sites should continue (Action No. 4). If no new sites can be found, consideration should be given to the feasibility and appropriateness of reintroducing the species to historic sites or to introductions at suitable sites within the potential range of the species (Action No. 7). Protecting and managing new, reintroduced, or introduced populations would help buffer against large-scale stochastic variation, such as regional variation in weather, hydrology, or catastrophic disturbance. New sites in northern Wisconsin may help reduce the vulnerability of Fassett's locoweed populations to climate change. The USFWS's guidance on "Controlled Propagation of Species Listed under the ESA" (2000) should be followed (as appropriate) when developing reintroduction/introduction plans. When conducting reintroductions or introductions, only northern populations should be transplanted to northern sites and southern populations to southern sites (E. Judziewicz, in litt. 2008). As more information on seed germination and viability studies would be beneficial (R. Freckman, in litt. 2008) augmentation, reintroduction, and introduction programs should incorporate such research.

The potential threats to groundwater quantity and quality important to maintaining the lake level fluctuations on seepage lakes where Fassett's locoweed populations occur should be assessed (Action No. 65). The results of the on-going regional water study (refer to section 2.3.2.5) should be reviewed for information relative to this threat. If threats to the groundwater exist, measures should be identified to minimize this threat. In addition, a study should be conducted to identify the groundwater contribution areas important to maintaining Fassett's locoweed populations and the results used to help guide further protection efforts.

Fassett's locoweed seed should be collected for permanent storage at an approved seed storage facility. This will help protect against possible adverse effects to the species due to climate change or losses due to other causes.

More definitive work should be done to identify the pollinators of Fassett's locoweed (Action No. 62) and to investigate the effects of competition from nonnative as well as native plants on the species (Action No. 64). In addition, to help facilitate successful augmentation, reintroductions, and/or introductions, it should be determined whether *Rhizobium* bacteria and/or arbuscular mycorrhizal fungi are associated with Fassett's locoweed.

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Appendix A

Summary Information on Fassett's Locoweed (FL) Sites in Wisconsin										
Site	**Pigeon Lake [b]**	**Mountain Lake [d]**	**Pickerel Lake [a]**	**Plainfield Lake [a]**	**Second Lake [a]**	**Sherman (Marks) Lake [a,c]**	**Weymouth Lake [a]**	**Lake Huron [a]**	**Mud Lake [b]**	**Shumway Lake [b]**
County	Bayfield	Bayfield	Portage	Waushara	Waushara	Waushara	Waushara	Waushara	Waushara	Waushara
Land Ownership	University of Wisconsin System, private. Additional potential habitat owned by USFS & other private property	USFS - Chequamegon-Nicolet National Forest, private	WDNR (part of a State Natural Area), private	WDNR (part of a State Natural Area), private	WDNR (part of a State Natural Area), private	WDNR (part of a State Natural Area), private	Multiple Private	Multiple Private	Private	Private
Land Ownership Notes	Landowner contact should continue with adjacent private landowner.	All of population located on National Forest land. Contact should continue with adjacent private landowner.	Much of FL population is protected by SNA. A great number of plants remain in private property - a summer camp (Camp Helen Brachman) uses the beach where plants are located.		Part of Plainfield Lake Channel Lakes State Natural Area protected in 1990.	Part of Plainfield Lake Channel Lakes State Natural Area protected in 1990.	Permanent protection should be sought for this site. One landowner is very understanding and willing to protect the site (permanent protection is being sought). The adjoining landowner does not respond to correspondence.	Plants are monitored by the landowners around the lake. Plants are caged.		

Summary Information on Fassett's Locoweed (FL) Sites in Wisconsin										
Site	**Pigeon Lake [b]**	**Mountain Lake [d]**	**Pickerel Lake [a]**	**Plainfield Lake [a]**	**Second Lake [a]**	**Sherman (Marks) Lake [a,c]**	**Weymouth Lake [a]**	**Lake Huron [a]**	**Mud Lake [b]**	**Shumway Lake [b]**
County	Bayfield	Bayfield	Portage	Waushara	Waushara	Waushara	Waushara	Waushara	Waushara	Waushara
Comments	Water table down in 2007.	ATV trail through Nat. Forest property damaged a few plants. Illegal ATV trail found on N side of lake. Adjacent landowners contacted. Lake level down about 1ft from 2006.	Contact with private landowner should continue. Large portion of FL are roped off on the private beach. Threats include foot and vehicle traffic along with invasives.	Water levels very low in 2005 and two sandbar islands visible.	Water levels very low in 2005.	Located immediately S of Second Lake with a low ridge of trees between them. This lake was nearly dry in 2005.		Deepest of local channel lakes.		
2008	Not observed at UW-Field Station, private land not checked.	> 1,000 plants including seedlings. Few invasive species noted.	> 28,000 plants.	>60,000 plants, limited patches of reed canary grass.	2053-2353 plants, most in flower. Some encroachment by small pines, aspen, willow, and crab grasses (*Digitaria* sp.). Invasives in a few areas, e.g., knapweed, reed canary grass, and yellow hawkweed.	About 240 plants, most in flower. Some pockets of invasives e.g., knapweed, reed canary grass, and Canada thistle. Some encroachment by small pines, aspen, willow, and crab grasses (*Digitaria* sp.).	Not checked; little to no seedlings. Good shoreline plant diversity.	19 plants, all caged.		
2007	2 total, widely separated	>1,000 total, 30% in flower, 30% in fruit, 20% non-flowering adult, 20% seedlings	25,701 total, 14,527 flowering adults, 7,133 non-flowering adults, 4,041 seedling	125,808 total, 82,615 flowering adults, 14,912 non-flowering adults, 28,281 seedlings	1,000s total, most in flower	200-250 total, most in flower	250 flowering plants, 40 non-flowering plants, few to no seedlings.	30	No plants seen	
2006	2 total, widely separated	800	28,211 total, 16,487 flowering adults, 11,328 non-flowering adults, 396 seedlings	202,873 total, 116,196 flowering adults, 48,226 non-flowering adults, 38,451 seedlings	1,000s total, most in flower	500 total, most in flower	1,650	20		

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County	Bayfield	Bayfield	Portage	Waushara	Waushara	Waushara	Waushara	Waushara	Waushara	Waushara
2005		400 total, flowering adults, very few seedlings or juveniles	800 total, 75% flowering, great seedling/juvenile population	200,000 total, 100,000 juvenile/seedlings, 100,000 flowering adults	No plants found	No plants found, observed from road	One population at 650 total, 350 flowering adults and 300 juvenile/seedlings on W side of lake; second population at 800 total, 500 flowering adults and 300 juvenile/seedlings on N side of lake	17		
2004			500 total, 60% flowering, 40% non-flowering or seedlings, great reproduction	200,000 total, 100,000 juvenile/seedlings, 100,000 flowering adults	100 total, most in flower, few to none young or seedlings		One population at 350 flowering adults on W side of lake; second population at 1000 flowering adults with few to none juvenile/seedlings on N side of lake	10 flowering		
2003				No standard surveys, however, noted to be declining	No standard surveys, however, noted to be declining		No standard surveys, however, noted to be declining	No standard surveys, however, noted to be declining		
2002		1000 clumps total, 60% flowering, 40% juveniles or seedlings	75 total, on NE shore	Over 3,000 total, some new seedlings			Over 1,500 total, not many new seedlings	23 plants around lake, including one fertile clump in new spot on S shore		

Summary Information on Fassett's Locoweed (FL) Sites in Wisconsin										
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County	Bayfield	Bayfield	Portage	Waushara	Waushara	Waushara	Waushara	Waushara	Waushara	Waushara
2001	No plants found	1000 clumps total, 70% seedlings or juveniles, 25% fertile	1 total, on camp shore, other shores not checked	About 5,000-10,000 flowering stems in area ca. 100x10-15m on N side of lake	50		High number of seedlings	26	No plants found	No plants found, lake level low
2000			Many hundreds if not thousands of stems total, 25% seedlings, 75% fruiting, 482 plants, 427 seedlings, 55 sterile mature and past flower.	About 3,000-5,000 (25-40% in fruit) on N side of lake		10-15 clumps total, 20% fruiting, 80% sterile adults				
1999				Minimum of 5,000 rosettes total, 5% in flower/budding, 2% in fruit, 93% mature non-flowering plants						
1998			4 plants found w/ dried seed pods. Photo-documented	About 9,400 seedlings on NE stretch of beach			100 total, 4 flowering plant and 95 seedlings, 1 non-flowering adult			
1997				1 plant with 4 flowering stalks						
1996		12 total, observed					15 total, 70% sterile, 30% seedlings			

Summary Information on Fassett's Locoweed (FL) Sites in Wisconsin										
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County	Bayfield	Bayfield	Portage	Waushara	Waushara	Waushara	Waushara	Waushara	Waushara	Waushara
1995				Only 1 seedling seen on N shore of lake			20 plants observed on W shore ca 20ft above water, some seedlings, some still in flower, some pods are beginning to swell with seeds. Population on opposite shore not surveyed	Best colony on NW corner of lake, next to public access point, 11 plants counted		
1994				19 clumps observed at E side of lake total, 25% in flower/bud, 50% in fruit, 25% seedlings			21 clumps total, 25% in flower/bud, 50% in fruit, 25% seedlings	Subpopulations of 1 clump and 11 clumps on properties of two different owners total, 25% in flower/bud, 50% in fruit, 25% seedlings		
1993	1 plant observed									
1992		591 rosette clumps total, 90% in flower or fruit, 5% mature and non-flowering plants, 5% seedlings								
1990				Species observed						

Summary Information on Fassett's Locoweed (FL) Sites in Wisconsin										
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County	Bayfield	Bayfield	Portage	Waushara	Waushara	Waushara	Waushara	Waushara	Waushara	Waushara
1989			Several dozen small plants in 3-6ft wide band, several germinants near lake edge	Hundreds of thousands of germinants, seedlings, adult plants on NE and SW shores. Others scattered along N and NW shores. Germinants form continuous cover in places. Many fruiting plants present.	1000's total, germinants, seedlings, and 2-year plants in 2 bands paralleling E shore. No flowering/fruiting stems seen. Several dozen seedlings on NE shore		N shore total, 18 adult plants near tree line, 100's of small plants near shoreline. NE shore total, several dozen large plants, some in fruit, near tree line; 100's of small plants lakeward	75-100 germinants and seedlings on open shore in front of a cottage SW of boat landing. Ca 50 plants, up to 10 cm diameter, between cottage and tree line. <10 seedlings on shore between two cottages E of landing.		
1988	No plants found		Main population not seen, habitat submerged.							
1982	No plants found									
1980	No plants found		>750 plants in late flower/early seed. Population reproducing well with heavy seed production and young plants.		1000			110 plants observed		
1978				Specimen collected						
1966				Specimen collected						
1963			Specimen collected							
1962								Specimen collected		

Summary Information on Fassett's Locoweed (FL) Sites in Wisconsin										
Site	**Pigeon Lake [b]**	**Mountain Lake [d]**	**Pickerel Lake [a]**	**Plainfield Lake [a]**	**Second Lake [a]**	**Sherman (Marks) Lake [a,c]**	**Weymouth Lake [a]**	**Lake Huron [a]**	**Mud Lake [b]**	**Shumway Lake [b]**
County	Bayfield	Bayfield	Portage	Waushara	Waushara	Waushara	Waushara	Waushara	Waushara	Waushara
1939									Reported as rare	
1934	Specimen collected			Specimen collected				Specimen collected		
1928	Specimen collected									
[a] six extant Fassett's Locoweed sites identified in the Fassett's Locoweed Recovery Plan (1991)										
[b] three historic Fassett's Locoweed sites identified in the Fassett's Locoweed Recovery Plan (1991)										
[c] new site as reported in the Fassett's Locoweed Recovery Plan (1991)										
[d] new site found after Recovery Plan (1991) was complete										
Note: Early to mid-1990's were high water years (less suitable habitat available)										

APPENDIX B

Summary of Peer Review for the 5-Year Review of Fassett's Locoweed *(Oxytropis campestris var. chartacea)* (2009)

A. Peer Review Method:

On August 19, 2008, the U.S. Fish and Wildlife Service (Service) sent a letter to nine botanists or biologists knowledgeable about Fassett's locoweed in Wisconsin requesting their review of the Fassett's Locoweed 5-Year Review. The letter was sent via Email by Cathy Carnes of the Service's Wisconsin Ecological Services Field Office, New Franken, Wisconsin.

The request for peer review was sent to:

Dr. Kama Almasi, formerly of UW-Stevens Point
Dr. Ted Cochrane, Senior Academic Curator, Wisconsin State Herbarium, UW-Madison
Gary Fewless, UW-Green Bay, botanist, UW-Green Bay
Dr. Robert Freckmann, Professor Emeritus, UW-Stevens Point
Tom Givnish, botanist, UW-Madison
Dr. Emmett Judziewicz, Associate Professor of Biology and Forestry, UW-Stevens Point
Darcy Kind, Bureau of Endangered Resources, Wisconsin DNR
David Kopitzke, UW-Richland Center
Steve Spickerman, U.S.Forest Service, Wisconsin

B. Peer Review Charge:

The Service's August 19, 2008, letter requested the peer reviewers to provide comments on the following pertaining to the Fassett's Locoweed 5-Year Review:

"Specifically, we request your review of the following sections of the document:

2.3.1 Biology and Habitat
2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)
2.4 Synthesis
4.0 Recommendation for future actions

Please provide comments on:

- Adequacy of the data (e.g., are the data/information used sufficient to support the biological conclusions reached). If data are inadequate please identify additional data or studies that are needed to adequately justify biological conclusions.
- Oversights, omissions, and inconsistencies
- Reasonableness of judgments made from the scientific and biological evidence

- Reasonableness of the "Recommendations for future actions," and any recommended changes or additions to them.
- Any other comments you may have."

C. Summary of Peer Review Comments/Reports:

The following peer reviewers provided comments on the Fassett's Locoweed 5-Year Review:

Dr. Ted Cochrane, Senior Academic Curator, Wisconsin State Herbarium, UW-Madison

- Dr. Cochrane provided mostly editorial (grammatical) comments on the 5-Year review. Also inquired that with the delisting criterion of 6 populations permanently protected (small number of sites) shouldn't the taxon remain listed indefinitely. Also stated that the scientific name for spotted knapweed is now *Centaurea stoebe.* The majority of the suggested editorial changes were made to the document; the scientific name of spotted knapweed was changed to *Centaurea stoebe.* The 5-Year reviews include recommendations for searches for new sites, and management and protection of those sites. Therefore, more than 6 sites may be protected at the time of delisting.

Dr. Robert Freckmann, Professor Emeritus, UW-Stevens Point

- Dr. Freckmann stated that the 5-Year Review provides an "excellent overview of the status of Fassett's locoweed" and agreed with the recommendations for future actions. He noted that at present, considering the large number of plants present at six sites, that small population size in not a major problem. He recognized the importance of monitoring, invasive species control and groundwater studies. He suggested more study was needed on seed germination and viability and the extent of herbivory (probably deer) especially on the flowering/fruiting stems of plants. The recommendations for studies on herbivory and seed germination and viability were included in the 5-Year Review.

Dr. Emmett Judziewicz, Associate Professor of Biology and Forestry, UW-Stevens Point

- Dr. Judziewicz found the 5-Year review to be "adequate, and judgments and recommendation reasonable." He encouraged searches for new sites in eastern Douglas and western Bayfield Counties (Wisconsin), as well as research on the effect of lowered ground water levels (especially in Waushara and Portage Counties) on the locoweed population dynamics. He also recommended when considering reintroduction that only northern populations should be transplanted to northern sites and southern populations to southern sites. He advised contacting Josh Horky, a former student about a possible new site in Douglas County. The information provided was incorporated into the 5-Year review and Cathy Carnes followed up with Josh Horky on the potential Fassett's locoweed site in Douglas County.

Darcy Kind, Bureau of Endangered Resources, Wisconsin DNR

- Ms. Kind provided information on land protection measures, control and removal of invasive species (including aquatic invasives), state protection of species that occur below the ordinary high water mark of lakes, the recent purchase of a portion of Plainfield Lake by the Wisconsin State Natural Areas (SNA) program, and a website

where information on SNAs can be found. The information provided was incorporated into the 5-Year Review.

David Kopitzke, UW- Richland Center

- Mr. Kopitzke provided comments on land protection measures and the potential threat of contamination of groundwater from pesticides used on potato fields which were incorporated into the 5-Year Review. He also stated that he was impressed with the information provided, that the data was adequate and that no obvious oversights were noted.

D. Response to Peer Review:

All pertinent peer review comments were incorporated into the 5-Year Review as noted in "C. Summary of Peer Review Comments/Reports" above.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Oxytropis campestris* var. *chartacea*

Current Classification: Threatened

Recommendation resulting from the 5-Year Review:

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

Appropriate Recovery Priority Number: 9

Appropriate Listing/Reclassification Priority Number, if applicable: NA

Review Conducted By:
Janet King, Fish and Wildlife Biologist, Wisconsin ES Field Office
Cathy Carnes, Endangered Species Coordinator, Wisconsin ES Field Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve Louise Clemency Date 9/10/2009

REGIONAL OFFICE APPROVAL:

Lead Assistant Regional Director, Ecological Services, Fish and Wildlife Service, Midwest Region

Approve Lynn M. Lewis Date 9/28/09