FINAL

Mead's Milkweed
(*Asclepias meadii*)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Chicago Illinois Field Office
Barrington, Illinois

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1.0 GENERAL INFORMATION

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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 Plants (50 CFR 17.12) as required by section 4(c)(2)(A) of the Endangered Species Act (Act) (16 U.S.C. 1531 et seq.). The Service provided notice of this status review via the Federal Register (74 FR 11600) on March 18, 2009, requesting new information on the Mead's milkweed (Asclepias meadii) that may have a bearing on its classification as threatened. In addition, we applied information from a population viability assessment based on a compilation of data collected from across the species range (Dr. Timothy Bell, Chicago State University, unpub. data 2011). Cathy Pollack of the Chicago Illinois Field Office and Dr. Timothy Bell (Chicago State University) drafted the review. We received comments and edits from Cathy Carnes of the Green Bay, Wisconsin Field Office and Matthew Mangan of the Marion, Illinois sub-office. The preliminary draft was reviewed for scientific accuracy by Mr. Eric F. Ulaszek (U.S. Forest Service), Ms. Kayri Havens-Young (Chicago Botanic Garden), and Mr. James Anderson (Lake County Forest Preserve District).

1.3 Background

1.3.1 FR Notice citation announcing initiation of this review

74 FR 11600 (March 18, 2009) Endangered and Threatened Wildlife and Plants; 5-Year Reviews.

1.3.2 Listing history

Original Listing
FR notice: 53 FR 33992-33996
Date listed: September 1, 1988
Entity listed: Species
Classification: Threatened

1.3.3 Associated rulemakings

Not applicable

1.3.4 Review History

The Mead's milkweed 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 range-wide biological opinions or other large scale analyses of this species since its final rule listing.

1.3.5 Species' Recovery Priority Number at start of review

8C – A recovery priority of 8C denotes that the listed taxon is a species with a moderate degree of threat, high recovery potential, and it is in conflict with construction or other development project(s) or other forms of economic activity.

1.3.6 Recovery Plan

Name of plan: Mead's Milkweed (*Asclepias meadii*) Recovery Plan
Date issued: September 16, 2003
Dates of previous revisions: The recovery plan has not been revised.

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, and there is new information to consider regarding existing or new threats (see 2.3.2 for explanation).

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 Mead's Milkweed Recovery Plan (USFWS 2003) contains the following delisting criteria:

Criterion 1: Twenty-one populations are distributed across plant communities and physiographic regions within the historic range of the species.

Criterion 1 addresses issues associated with Factor A - present or threatened destruction, modification or curtailment of its habitat or range. Criterion 1 has not been met.

Currently 330 populations exist throughout the range of the species; however, the populations are not distributed as specified in the recovery plan (i.e., by state and physiographic region). The 21 populations must be highly viable and occur in 11 physiographic regions to achieve this criterion. Only three of the eleven physiographic regions contain a population considered highly viable, and that highly viable status is considered a "preliminary" status because it is based on only three to six of the seven possible variables (Table 1 and Appendix 1) necessary to generate the Population Viability Index (PVI) (Appendix 2). For many of the populations, information regarding reproduction, habitat size and/or management condition have not been compiled; therefore the Population Viability Index (PVI) (second to the last column in Appendix 2) was based on a smaller number of variables. Henceforth, in this document we use the term "preliminary" to indicate a PVI based on only a subset of the required variables. As indicated in Appendix 2, approximately 30% of Mead's milkweed populations have not been visited for a decade or more, so population size and habitat condition may have changed. Also, survey records for at least 43 populations indicate that the surveys either did not include all potential habitats or that Mead's milkweed was observed with no population census completed, so that the counts may not represent the total population census (Delisle 2010).

The recovery plan provides additional detail showing how the 21 populations should be distributed across states, physiographic regions, and plant communities (Table 2). In each state, the distribution of populations required for recovery varies from one to four, based on the extent of the physiographic region and former distribution of Mead's milkweed. Table 2 also displays the updated number of extant populations that occur in each state, physiographic region and community, based on the discovery of new populations in Kansas, Missouri and Iowa since the issuance of the 2003 Recovery Plan (Delisle 2010, Missouri Department of Conservation 2009, Pearson 2010).

Criterion 2: Each of these 21 populations is highly viable.

Criterion 2 addresses issues associated with the following listing factors: Factor A - present or threatened destruction, modification or curtailment of its habitat or range; Factor C - disease or predation; Factor D - inadequacy of existing regulatory mechanisms; and Factor E - other natural or manmade factors affecting its continued existence. Criterion 2 has not been met.

A highly viable population is defined as follows: more than 50 mature plants; seed production is occurring and the population is increasing in size and maturity; the population is genetically diverse with more than 50 genotypes; the available habitat is at least 125 acres (50 hectares) in size; the habitat is in a late-successional stage; the site is protected through long-term conservation easements, legal dedication as nature preserves, or other means; and the site is managed by fire in order to maintain a late successional graminoid vegetation structure that is free of woody vegetation (Bowles and Bell 1998). Currently, only three populations should be viewed as preliminarily highly viable. The calculation of the Population Viability Index (PVI) (second to last column in Appendix 2) for each Mead's milkweed population relied upon measurements of several variables (Table 1) to assess the viability of each population (i.e., population size, whether the population trend is increasing, effective population size, habitat size, habitat condition, protection status, whether the habitat has long-term protection, and the need for management). For each variable, a ranking from 0 to 3 was assigned and the sum of all variable rankings was then divided by the number of variables (e.g., seven variables would yield a maximum sum of 21) to produce an index ranging from 0 to 1. When information about a variable was not available for a site, that variable was not used in the calculation of the PVI for that site. An index greater than 0.75 indicates populations of high viability, an index from 0.50 to 0.75 indicates populations of moderate viability, and an index less than 0.50 indicates populations of low viability.

Despite the lack of variable information for some populations, a preliminary Population Viability Index (second to last column in Appendix 2) was determined for each Mead's milkweed population using the number of ramets and protection status' from the recovery plan's element occurrence ranking observed 1970 to 2001 (USFWS 2003). Reports and lists of element occurrences for the populations were also used in order to update counts and add information about reproduction, habitat quality, habitat size, and management condition (Delisle

2010, Missouri Department of Conservation 2009, Pearson 2010). The method by which the PVI ranks were assigned for each variable is described below.

Population size: Although the number of ramets was used as a proxy for population size, this will almost certainly be an overestimate of the population size since Mead's milkweed spreads clonally. A single individual or genotype may be represented by two or more shoots or ramets with uncertainty as to how many genotypes or genets are actually represented. This is particularly problematic in sites where mowing occurs, since mowing cuts off the flower heads, inhibiting sexual reproduction and encouraging clonal spread (Bowles *et al* 1998). The number of ramets listed in the recovery plan was updated using reports sent to the USFWS in response to requests for new information on Mead's milkweed for this 5-year review. An average ramet number from 2004 to 2010 was generally used if there were several counts over that period. For sites only visited sporadically, the most recent count was used. In a few cases where the most recent count was 0, but plants were observed at the site during 2004 to 2010, the highest count was used. Even though using the ramet number as a surrogate for the individual plant number, and using the highest plant count for the period 2004 to 2010, for populations where the most recent count is 0, might bias the preliminary Population Viability Index to be higher than it should, there are still only 3 populations that are highly viable. Populations with 0 to 9 ramets received a ranking of 0, 10 to 24 ramets received a ranking of 1, 25 to 49 ramets received a ranking of 2, and 50 or greater ramets received a ranking of 3 (See Appendix 2 Column: Population Size).

Population Trend: While it is recognized that the production of seed does not insure that plant establishment will outpace plant loss, populations with seed production occurring received a rank of 3; populations with flowering but no seed production received a rank of 2; populations containing only nonflowering plants, or for which flowering was not recorded, received a rank of 1; and populations with no plants received a rank of zero (See Appendix 2 Column: Population Trend).

Effective population size/# of genotypes: The information required to determine the variable ranking of effective population size/# of genotypes is not available for approximately 93% of the populations (Tecic *et al.* 1998; Hayworth *et al.* 2001; Comer 2009), hence this variable was not included in the PVI.

Habitat Size: The variable of habitat size was generally determined from the size reported for the prairie site, which would frequently overestimate the variable because the entire site would not necessarily be appropriate Mead's milkweed habitat. Large locations, defined as >50 ha (>125 ac) received a rank of 3; medium locations 25<50 ha (62.5<125 ac) received a rank of 2; small locations 1<25 ha (2.5<62.5 ac) received a rank of 1; and very small locations <1 ha (<2.5ac) received a rank of 0 (See Appendix 2 Column: Habitat Size).

Habitat Condition: Sites that were reported to have A-quality grade habitat, defined as having a high diversity of native species and located in undisturbed native areas received a habitat condition ranking of 3; populations reported to

have B-quality grade habitat defined as moderate quality habitat experiencing rotated haying with rest or burn received a ranking of 2; populations reported to have C-quality grade habitat defined as marginal habitat which might include annual haying/grazing or home to feral pigs received a ranking of 1; and populations in poor quality habitat reported to be degraded, developed, or if the habitat condition was unknown, received a ranking of 0 (See Appendix 2 Column: Habitat Condition).

Protection Status: In the Recovery Plan, protection status of each population was ranked from 0 to 9. For the PVI, a different ranking was used. Populations with legally binding protection (dedication, fee title held by conservation entity, conservation easement, federal protection of listed species on public land) are ranked as 3; formal but not legal protection (remainder interest) are ranked as 2; informal but not legal protection (voluntary agreement, right-of-first refusal, management agreement) are ranked as 1; and no protection or no information on protection status are ranked as 0 (See Appendix 2 Column: Protection Status).

Management Condition: Fire management appears to be critical for enhancing survivorship, growth, and flowering of Mead's milkweed (Bowles *et al*. 2001a, Alexander *et al*. 2009). Betz (1989) found 77.1% flowering stems in annually burned prairies with Bowles *et al*. (1998) finding an increase in milkweed juvenile growth and survivorship in burned tracts (Bowles *et al*. 1998), therefore, natural areas that are reported to be well managed or fire managed, and that support low populations of exotic or woody species are ranked as 3; natural areas that are burned, but with moderate sized populations of exotic or woody species, or hay meadows that are burned, are ranked as 2; sites which support high populations of exotic or woody species, unburned hay meadows or sites disturbed by growing season grazing (including patch/burn/graze), feral pigs, or oil fields are ranked as 1; and degraded or developed sites are ranked as 0 (See Appendix 2 Column: Management Condition). Although it was suggested that the ranking for habitat effects from feral pigs and oil fields be 0 instead of 1, the ranking will remain 1 because this number (1) indicates that habitat recovery may be possible with intense management (i.e., successful feral pig eradication) (Swanson 2011), whereas a ranking of 0 indicates an area of habitat that no longer exists or is so extremely degraded that even with intense management recovery would not be possible.

To obtain the PVI, ranks for all variables were summed and then divided by the maximum number of variables used for each population. Populations with an index greater than 0.75 are designated as having high viability, populations with an index from 0.51 – 0.75 have moderate viability, and populations with an index of 0.50 and less have low viability. Three populations are determined to be highly viable, one each in Glaciated (KS), Osage Plains (KS/MO), and Ozark-Springfield Plateau (MO) Physiographic Regions, and can be counted toward achieving Criterion 2.

Criterion 3: Monitoring data indicates that these populations have been stable or increasing for 15 years.

Criterion 3 addresses issues associated with the following listing factors: Factor A - present or threatened destruction, modification or curtailment of its habitat or range; Factor C - disease or predation; Factor D - inadequacy of existing regulatory mechanisms; and Factor E - other natural or manmade factors affecting its continued existence. Criterion 3 has not been met.

USFWS species status data from the year 2000 to the present indicated that the status of the species was stable in the years 2003, 2007, 2008, and 2009 (USFWS 2003, 2007, 2008, 2009). Additional information from 2003 indicated that many of the Mead's milkweed populations had not been surveyed for ten years or more (USFWS 2003). Additional information for 2007 and 2008 indicated that the species was declining in parts of its range, but stable or increasing in other parts of its range, resulting in the overall status of the species being described as stable (USFWS 2007, 2008). No additional information was given for the overall stable status of the species in the year 2009 (USFWS 2009). Current monitoring data is not sufficient to determine whether populations have been stable or increasing for 15 years; the vast majority of populations lack consistent monitoring for 15 years (Appendix 2, Fourth Column, "Date Last Observed").

Given the extremely long life of this species, and that it may take 25 to 30 years for this species to reach reproductive maturity, it has been suggested that a monitoring time frame of 15 years may not accurately capture population dynamics.

The population viability assessment (PVA) (Appendix 2) relied upon measurements of several variables to assess the viability of each population (i.e., population size, whether the population trend is increasing, effective population size, habitat size, habitat condition, protection status, whether the habitat has long-term protection, and the need for management) (Table 1). For each variable, a ranking from 0 to 3 was assigned and the sum of all variable rankings was then divided by the number of variables (e.g., seven variables would yield a maximum sum of 21) to produce a PVI ranging from 0 to 1 (See Appendix 2, second to last column). Variables were not included in the viability assessment when data was not available. A PVI greater than 0.75 indicates populations of high viability, an index from 0.50 to 0.75 indicates populations of moderate viability, and an index less than 0.50 indicates populations of low viability.

Table 1. Determination of the Population Viability Index (PVI). Values for each variable range from 0-3. PVI = [A+B+C+ D+E+F+G]/21. Low population viability < 0.50 PVI, moderate population viability = 0.50-0.75 PVI, and high population viability > 0.

Variable	Range of Values			
	0	**1**	**2**	**3**
1. Population size (adult plants)[1]	< 10	1 0-< 25	2 5-< 50	> 50
2. Population growth trend[2]	no measure or < survivorship and < growth	either + survivorship or + growth	flowering\no seeds + survivorship > growth	seeds produced + survivorship > growth
3. Effective population size/# of genotypes[3]	< 10 genotypes	10-< 25 genotypes	25-< 50 genotypes	> 50 genotypes
4. Habitat size[4]	< 1 hectare	1-<25 hectares	25-<50 hectares	>50 hectares
5. Habitat condition/ successional stage[5]	very heavily disturbed	heavily disturbed/early successional	moderately disturbed/mid-successional	lightly disturbed/late-successional
6. Protection status[6]	none	informal	formal	legal
7. Management condition[7]	severe	moderate	low	none

[1]Size based on total population census.
[2]Trend based on occurrence of flowering, seed production, stable (+) or declining (<) cohort survivorship, and increasing (>), stable (=) or declining (<) life stage transitions.
[3]Based on allozyme or molecular measures of the number of genotypes present
[4]Area of potential habitat.
[5]Based on natural quality grades. Lightly or undisturbed = grade A, moderately disturbed = grade B, heavily disturbed = grade C, very heavily disturbed = grade D.
[6]Function of ownership and deed restrictions. None = private ownership with no protection, informal = private ownership without legally binding protection, formal = private or public ownership with formal but not legal protection, legal = private or public ownership with legally binding protection.
[7]Degree of management needed due to habitat degradation from fire protection and woody plant succession, exotic species invasion, hydrology alteration, and other land use impacts.

Table 2. The number of Mead's milkweed populations needed to meet recovery criteria and the current number of extant populations in the United States by state, physiographic region, and plant community. Viability of extant populations is preliminary.

State	Physiographic Region	Community	Recovery Criteria	Number of Extant Populations	Current number of highly viable populations
Illinois/Indiana	Grand Prairie	Tallgrass Prairie	3 highly viable	0	0
Illinois	Shawnee Hills	Glades/Barrens	1 highly viable	4	0
Illinois/Iowa	Western Forest-prairie	Tallgrass Prairie	2 highly viable	0	0
Iowa	Southern Iowa Drift Plain	Tallgrass Prairie	2 highly viable	8	0
Kansas	Glaciated Region	Tallgrass Prairie	2 highly viable	18	1
Kansas/Missouri	Osage Plains	Tallgrass Prairie	4 highly viable	277	1
Missouri	Glaciated Plains	Tallgrass Prairie	2 highly viable	3	0
Missouri	Ozark Border	Tallgrass Prairie	1 highly viable	3	0
Missouri	Ozark-Springfield Plateau	Tallgrass Prairie	2 highly viable	9	1
Missouri	Ozark-St. Francois Mountains	Glades/Barrens	1 highly viable	8	0
Wisconsin	Driftless	Glades/Barrens	1 highly viable	0	0
TOTALS			**21 highly viable**	**330**	**3**

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:

There is no new information on the species' biology and life history.

2.3.1.2 Abundance, population trends, or demographic trends:

Field surveys for new population occurrences resulted in the discovery of 160 formerly unknown populations of Mead's milkweed in Kansas, Missouri and Iowa (Appendix 2) (Delisle 2010, Missouri Department of Conservation 2009, Pearson 2010). Since most of these new populations occur in hay meadows and are located in physiographic regions that already have Mead's milkweed populations, their contribution to Mead's milkweed recovery may be limited. Five high priority populations have been identified in Missouri (Niawathe, Regal Prairie, Wah'Kon-Tah Prairie, Paintbrush Prairie, and Profitt Mountain) and have received increased monitoring and management. These five populations were identified to receive increased monitoring and management based on being located within distinct physiographic regions, having existing long term monitoring data, having a historically large population size, and with the feasibility to conduct annual surveys (Missouri Department of Conservation 2009, p.33). However, determining range or species wide population trends, let alone demographic trends, remains hampered because the majority of Mead's milkweed populations do not receive regular monitoring and almost a third have not been revisited for a decade or more (Appendix 2, see column: Date last Observed).

Introductions of Mead's milkweed plants have occurred at 19 sites (Table 3). These introductions are not included in Table 2 for the following reasons. Introduction of Mead's milkweed began in Indiana and Illinois in 1994 with a combination of seeds and greenhouse grown 1-year-old juveniles (Bowles *et al.* 2001a). Two of these introductions occurred in physiographic regions (Northwestern Morainal and Northeastern Morainal) that were not included in the Recovery Plan (USFWS 2003) as it had not yet been written (Bell 2011 pers. comm.). Introductions began in 2001 in Wisconsin. The lack of availability of high quality prairies within the physiographic regions listed in the Recovery Plan (USFWS 2003) necessitated an attempt to expand the original scope of the range of physiographic regions within Wisconsin (Bell 2011 pers. comm.); hence the Wisconsin introductions were in the Till Plains physiographic region. No flowering has been observed at the Wisconsin introductions. Although flowering has occurred from transplanted juveniles at five of the introduced populations in Illinois and Indiana, no new plants have been recruited into the populations. Bell *et al*. (2003) originally projected that seedlings would require 12 or more years to reach reproductive maturity, but with nine additional years of demographic data that estimate has been revised to 25 to 30 years due to suppression of seedling growth by competition (Monks *et al*. 2011). Thus, none of the introductions are considered highly

viable. In addition, 16 of the 19 introductions are not distributed within the physiographic regions needed for recovery. Demographic monitoring indicates that initial survivorship tends to be below 50%. Once the introduced Mead's milkweed plants become established, they persist but grow slowly due to suppression from competition (Bowles *et al*. 2001a). None of the plants established from seed in the mid 1990s have flowered.

Current projections indicate that seedlings require 25 to 30 years to reach reproductive maturity (Monks *et al.* 2011). Thus, these introductions may require several decades or more to become highly viable. Because the recovery criteria require highly viable populations in states/physiographic regions currently lacking populations, introductions are critical to the recovery process. However, the process of establishing highly viable populations through introduction may be lengthy.

Table 3. The number of Mead's milkweed introductions by state and physiographic region.

State	Physiographic Region	Number of introductions	Number of highly viable population
Illinois	Grand Prairie	3	0
Illinois	Northeastern Morainal	3	0
Illinois	Western Forest-Prairie	1	0
Indiana	Northwestern Morainal	1	0
Wisconsin	Till Plains	11	0
Total		19	0

The lack of sexual reproduction in Mead's milkweed is a concern throughout the range (USFWS 2009) and may be due to various management techniques such as haying or grazing before seed capsules can mature, or the lack of fire (Bowles *et al.* 2001a; Grman and Alexander 2005). The lack of sexual reproduction may also be caused by insufficient genetic diversity to allow outcrossing in this self-incompatible species (USFWS 2009). The practice of haying during the growing season removes reproductive shoots before pods mature, and results in reduced genetic diversity. Over 50% of Mead's milkweed sites are mowed for hay, usually on an annual basis. Promotion of late-season haying may allow successful reproduction in Mead's milkweed haymeadows, but only if sufficient genetic diversity exists in these populations to overcome self-incompatibility (Bowles *et al* 1998). Deer and vole herbivory are other threats that limit fruit production (Grman and Alexander 2005; Missouri Department of Conservation 2009) and are associated with the lack of reproduction in Mead's milkweed. Grman and Alexander (2005) investigated these threats and concluded that managers could increase fruit production by protecting stems from mammal herbivory and by using prescribed fire. Additionally, the low number of individual

plants at any one site may not attract potential pollinators, and this may be another cause of low reproductive success (Eulinger and Skinner 2007). A tornado damaged Mead's milkweed plants at Wah' Kon-Tah Prairie in 2008 and prevented seed pod production (Missouri Department of Conservation 2008). Limited sexual reproduction may also result from asynchrony in the bloom period and pollinator activity (USFWS 2010), a phenomenon that has been linked to climate change in other species (USFWS 2010). Although pollen limitation was not correlated to fruit formation (Grman and Alexander 2005), funding to study pollinator limitation of Mead's milkweed in Missouri is proposed (Missouri Department of Conservation 2009).

Because Mead's milkweed plants are difficult to observe, especially when the habitat is not burned, mark-recapture methods for estimating population size have been used and indicated that an estimated population size was about 50% higher than observed through usual census methods (Alexander *et al*. 1997). This analysis, assuming there was no mortality and no recruitment based on four years of data, appeared reasonable because of high persistence and rare flowering of established plants (Alexander *et al*. 1997). However, subsequent analyses of the same Kansas population using 8 years of data (Slade *et al*. 2003) and then 15 years of data (Alexander *et al*. 2009), which allowed for mortality and recruitment, produced a higher estimated population size than initially indicated. The annual survival probability was estimated to be 95%, but annual recruitment (the proportion of new plants entering the population each year) was low (0.073) (Alexander *et al*. 2009). However, the estimated population growth rate of 1.023 (annual rate of population increase) indicates that this Kansas population is growing and is likely to persist (Alexander *et al*. 2009).

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

The lack of reproduction in natural prairie populations raises concern about the long-term viability of most populations. Although low genetic diversity is often cited as the reason for the lack of reproduction in populations of this self-incompatible species, a recent investigation of genetic diversity in five Missouri populations (Comer 2009) indicated that unlike previous genetic studies (Tecic *et al.* 1998, Hayworth *et al.* 2001), no clones were discovered. The previous genetic studies (Tecic *et al.* 1998, Hayworth *et al.* 2001) were conducted at sites that were hayed, whereas the site management had changed to burning by the time of Comer's study (2009). Because Mead's milkweed spreads clonally when mowed and the clones shrink when burned, it is more likely that when Comer later (2009) sampled, the clones were smaller and it was less likely that a particular ramet came from the same clone. Due to these sampling circumstances, the results of Comer's (2009) genetic study do not rule out self-incompatibility as a cause for lack of reproduction in light of the successful seed production in crossing experiments (Bowles *et al.* 1993; 1998). Mead's milkweed also showed lower genetic diversity compared to other *Asclepias* species and maintains 93% of its genetic variation within

populations (Comer 2009). These results suggest that destruction of any plants in these prairies will result in loss of genotypes.

These results also highlight the importance of augmentation of populations to increase genetic diversity, as done in Illinois (*Bowles et al.* 2001b), Missouri (Missouri Department of Conservation 2009), and at the Marais des Cygnes National Wildlife Refuge in Kansas (Kindscher *et al*. 2008). In May 2009, the Kansas Biological Survey, USDA Plant Materials Center (Manhattan, KS), and the U.S. Fish and Wildlife Service planted 86 Mead's milkweed plugs at Marais des Cygnes National Wildlife Refuge (Pleasanton, KS) (Menard 2012). These plants were dispersed among four sites consisting of native and reconstructed prairies (Menard 2012). The plants were permanently marked and are monitored annually. After three growing seasons, survival is 67% (Menard 2012).

2.3.1.4 Taxonomic classification or changes in nomenclature:

There has been no new information regarding taxonomic classification or nomenclature since the final listing rule and the issuance of the 2003 Recovery Plan.

2.3.1.5 Spatial distribution, trends in spatial distribution, or historic range:

After the recovery plan was written (2003), new populations of Mead's milkweed were discovered in several physiographic regions, thus increasing the number of Mead's milkweed populations. A population was discovered in Iowa's Southern Iowa Drift Plain and in Missouri's Ozark-St. Francois Mountains; 10 populations were discovered in Kansas' Glaciated; and 148 populations were discovered in Kansas/Missouri's Osage Plains [data compiled from Table ? (*sic*) in Missouri Department of Conservation (2009), Pearson (2010), and a data file from the Kansas Natural heritage Inventory (Delisle 2010)].

2.3.1.6 Habitat or ecosystem conditions:

Information indicates that feral hogs have contributed to habitat destruction in Missouri and that resulted in severe damage to Mead's milkweed plants at some sites (Mark Twain National Forest 2009). David Whittekiend (Forest Supervisor, Mark Twain National Forest) (pers. comm. 2009) indicated that feral hogs are reproducing at a rate greater than they can be trapped resulting in an increased population at the Bell Mountain Wilderness Area in Missouri. Recent efforts by the U.S. Department of Agriculture's Animal and Plant Health Inspection Service biologists and private landowners to trap and kill feral hogs have been successful in reducing feral hog numbers in Missouri (Swanson 2011). In addition, landowners of two sites which support Mead's milkweed populations are electric fencing these populations to prevent their destruction by feral hogs (Missouri Department of Conservation 2008).

2.3.1.7 Other:

In a study conducted at Paintbrush Prairie in Missouri during 2004 to 2007, fertilizer application tended to increase average and maximum height of Mead's milkweed (Missouri Department of Conservation 2009). However, statistical analysis was not performed to determine whether there was a significant difference in height between fertilized and unfertilized plants. Flowering frequency was too low to allow comparison between fertilizer treatments.

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:

Mead's milkweed habitat is threatened by urbanization, conversion to agricultural land, and habitat fragmentation (Eulinger and Skinner 2007). Many Mead's milkweed populations are also experiencing habitat loss due to the lack of appropriate prairie management such as prescribed fire. Fire suppression provides opportunities for subsequent woody vegetation encroachment, and invasion by exotic cool season grasses (Eulinger and Skinner 2007). Habitat destruction from feral hogs has also reduced Mead's milkweed habitat (Mark Twain National Forest 2009).

Over 50% of Mead's milkweed sites are usually mowed annually for hay (Appendix 2). Haying during the growing season prevents seed production of Mead's milkweed and results in reduced genetic diversity. Although haying and grazing occur on a large scale and may be a much more serious threat to the species, off-road vehicle use (Eulinger and Skinner 2007), in some cases associated with oil wells on a site, and trampling by researchers and school groups also adversely affects Mead's milkweed through excessive disturbance to its habitat (Delisle 2010). A proposed pipeline replacement project and highway construction project could potentially affect several Mead's milkweed populations in Kansas, however project sponsors are discussing alternatives with the USFWS Kansas Field Office (USFWS 2009).

Current threats include herbicide or pesticide application (Eulinger and Skinner 2007). In the Osage Plains physiographic region, reference to herbicide damaged Mead's milkweed plants was specifically made in occurrence records for three populations (Doering Place, Mount Hope Prairie, and Nodding Polytaenia Prairie) (Delisle 2010). Betz (1989) has reported constant herbicide application as a contributing factor in the decline of Mead's milkweed in railroad prairies.

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

No past or current demand exists for Mead's milkweed plants for commercial, recreational or educational purposes. Occasionally, permitted research activities collect Mead's milkweed.

2.3.2.3 Disease or predation:

According to Roels (2010), weevil activity on stems and developing fruits resulted in the lack of viable seeds on 25% of flowering Mead's milkweed ramets at Rockefeller and Anderson prairies (Roels 2010). In Kansas, weevils oviposit with their grubs feeding on seven *Asclepias* species, including *A. syriaca* (Common Milkweed) and *A. viridis* (Green Antelopehorn Milkweed), which are the most abundant milkweeds in the region, and may act as reservoirs for weevil populations, which then migrate to the rarer Mead's milkweed (Roels 2010). Early in the growing season, weevils damage and kill Mead's milkweed stems, while damage to developing fruits result in seed destruction and premature dehiscion of follicles.

Herbivory of Mead's milkweed from white-tailed deer has been observed at many sites across the species range and was documented at the Shawnee National Forest in 2007. Herbivory contributes to a lack of fruit production (Grman and Alexander 2005).

Grazing by cattle and to a lesser degree by bison can adversely affect Mead's milkweed populations, especially when grazing occurs during flowering and fruiting periods from April to September (Eulinger and Skinner 2007). The prairie management method of patch-burn and then grazing by cattle (PBG) has been introduced into a Mead's milkweed population at Niawathe Prairie Natural Area in Missouri. Kurz (2010) believes that current studies are inadequate to determine whether the PBG management technique is the best technique to maintain prairie diversity and quality (Kurz 2010). For this reason, Kurz (2010) suggests that implementing this management technique at Niawathe Prairie Natural Area, in Missouri, has the potential to greatly reduce the numbers of Mead's milkweed plants within this population (Kurz 2010).

In Missouri, some Mead's milkweed populations are also experiencing fungal attacks (Eulinger and Skinner 2007).

2.3.2.4 Inadequacy of existing regulatory mechanisms:

Mead's milkweed is a Federal listed species and is therefore afforded protection in all states under the Endangered Species Act (Act). At the State level, of the four states described as the current range of the species (Iowa, Illinois, Kansas, and Missouri), and of the two states where the species is considered extirpated and yet supporting introduced plants (Indiana and Wisconsin), the species is listed as state endangered in three states (Iowa,

Illinois and Missouri) thereby affording the species additional State level protections in those states.

Iowa code 481B states that a person shall not take, possess, transport, import, export, process, sell or offer for sale, buy or offer to buy, nor shall a common or contract carrier transport or receive for shipment, any species of fish, plants, or wildlife appearing on the state or federal "lists" (Iowa Code 2011).

The Illinois Endangered Species Protection Act requires State and municipal agencies taking actions that might affect State or federally listed species (including plants) to avoid, minimize, or mitigate impacts to the listed species (Illinois Department of Natural Resources 2011). Furthermore, it is unlawful in the State of Illinois for any person to take plants on the List of Endangered and Threatened Species in Illinois without the express written permission of the landowner, or to sell or offer for sale plants or plant products of endangered species.

The Wildlife Code of Missouri (Missouri Department of Conservation 2011) includes a provision for state endangered plants which states that the exportation, transportation or sale of any endangered species of plant or parts thereof, or the sale of or possession with intent to sell any product made in whole or in part from any parts of any endangered species of plant is prohibited.

In Kansas and Wisconsin, the species has no state designation as threatened or endangered. Kansas supports 258 of the 330 extant Mead's milkweed populations (Appendix 2). Indiana (reintroduced plants) considers the species extirpated with no state status.

The protection of federally threatened plants on privately-owned lands is extremely limited in all states throughout the Mead's milkweed range, leaving those populations vulnerable to habitat destruction and eventual extirpation. Currently, only about 11% of Mead's milkweed sites have legal protection (Appendix 2). Most Mead's milkweed populations occur on private land (Appendix 2), most of these are haymeadows (Appendix 2), and most are, therefore, not protected from habitat destruction, the primary threat to this species.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Climate change will be a particular challenge for endangered, threatened and other at-risk-species because the interaction of additional stresses associated with climate change and current stressors may push them beyond their ability to survive (Easterling *et al.* 2000). In addition, populations of some species that are near the southern end of the range may be at particular risk (IPCC 2007). There is uncertainty about the exact nature and severity of climate change related impacts that may be anticipated to occur within the Mead's milkweed's range. A number of scientific studies project that there will be

increased duration and intensity of heat waves in summer, higher levels of humidity and evaporation, changing patterns of precipitation with fewer rain events of greater intensity, increased frequency and more severe dry spells, and more flooding from heavy rains (Easterling *et al.* 2000; Ebi and Meehl 2007; NWF 2007; IPCC 2007). Research has suggested that climate change may also negatively impact pollinator species if plants and their pollinators respond differently to climate change (NRC 2007). These climatic changes may threaten the Mead's milkweed in a variety of direct and indirect ways including: changes in the timing of blooming, loss of suitable habitat, loss of inter-specific relationships with pollinators, and increased threats from invasive species.

2.4 Synthesis

An assessment of the viability of each population has been attempted based on the limited information available in Appendix 2 of the Recovery Plan (USFWS 2003), as well as reports updating plant numbers since completion of the Recovery Plan (USFWS 2003). This assessment is hindered by the lack of current information for several of the variables included in the index. Approximately 30% of the populations have not been visited since the 1990s. The number of extant populations has nearly doubled with the discovery of previously unknown Mead's milkweed populations. This results in an increase in the number of populations in Kansas, Missouri and Iowa; however, the majority of populations that have been discovered are in the Osage Plains physiographic region, where 4 highly viable populations are needed for recovery. This physiographic region currently has 277 extant Mead's milkweed populations with only one population ranked as highly viable, 69 populations ranked as moderately viable, and 207 populations ranked as having low viability. Therefore, the discovery of these new populations may have a limited contribution in the rangewide recovery criteria for the species.

At the time of the final listing rule, threats to Mead's milkweed were attributed to the destruction, modification, or curtailment of its habitat or range (i.e., urbanization, conversion to agricultural land, habitat fragmentation, invasive species expansion, lack of prescribed fire in occupied sites, annual hay mowing before completion of reproduction, and herbicide/pesticide application), predation, and inadequate regulatory mechanisms on non-Federal land. Today, these same threats continue to exist. Threats from urbanization, conversion of habitat to agricultural land, and habitat fragmentation continue. Threats from invasive species are also continuing and have expanded in many Mead's milkweed populations. Prescribed burning, associated with good prairie management, has been observed to increase flowering and fruiting in Mead's milkweed (Bowles *et al*. 1998; Grman and Alexander 2005). Management activities such as haying or grazing before seed capsules can mature, or the lack of prescribed fire (Bowles *et al.* 2001a; Grman and Alexander 2005; Alexander *et al*. 2009) with subsequent woody vegetation encroachment, and the invasion by exotic cool season grasses, continue to result in the loss of Mead's milkweed habitat (Eulinger and Skinner 2007). The lack of prescribed fire in natural prairie populations results in the lack of reproduction (flowering and fruiting) in Mead's milkweed (Bowles *et al*., 1998; Grman and Alexander 2005; Alexander *et al*. 2009) and raises concerns regarding the long-term viability of these populations. More recent habitat loss can be attributed to habitat damage caused by feral hogs. Introduced populations of Mead's milkweed in Illinois, Indiana and Wisconsin

have the potential to expand the range of Mead's milkweed into physiographic regions not required by the recovery criteria. Although these introductions are persisting, their distribution outside the required physiographic regions along with their lack of reproduction, may result in a limited contribution of these introductions to the rangewide recovery criteria for the species.

Although additional threats to Mead's milkweed populations have been identified since completion of the Recovery Plan (USFWS 2003), the current status across its range has not changed significantly. Deer and vole herbivory are additional threats that limit fruit production (Grman and Alexander 2005; Missouri Department of Conservation 2009) and can be associated with the lack of reproduction in Mead's milkweed. The low number of individual plants at any one site may not attract potential pollinators, which can also contribute to low reproductive success (Eulinger and Skinner 2007). At the time of the final listing rule, threats from climate change were not considered; however, limited sexual reproduction in Mead's milkweed may result from asynchrony in the bloom period and pollinator activity (USFWS 2010), a phenomenon that has been linked to climate change in other species (USFWS 2010).

Achievement of the delisting criteria is as follows:

> Criterion 1 - Only 3 of the required 21 highly viable populations are distributed across plant communities and physiographic regions (11) within the historic range of the species. Therefore, Criterion 1 has not been met.
>
> Criterion 2 - Only 3 of the required 21 populations are viewed as preliminarily highly viable. Criterion 2 has not been met.
>
> Criterion 3 - Current monitoring data is not sufficient to determine whether populations have been stable or increasing for 15 years; the vast majority of populations lack consistent monitoring for 15 years. Criterion 3 has not been met.

The five-factor analysis demonstrates that threats to Mead's milkweed are relevant from the destruction, modification or curtailment of its habitat (i.e., urbanization, conversion to agricultural land, habitat fragmentation, invasive species expansion, lack of prescribed fire in occupied sites, annual hay mowing before completion of reproduction, feral hog habitat destruction, and herbicide/pesticide application), predation (i.e. weevils, deer, voles, and cattle), inadequate regulatory mechanisms on non-Federal land, and natural or manmade factors (i.e., climate change effects). Based on the continuing threats, and the lack of recovery of viable 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 a threatened species.

3.0 RESULTS

3.1 Recommended Classification

No change is needed

3.2 New Recovery Priority Number

Not applicable

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

The highest priority recovery actions for the Mead's milkweed are assessing the viability of populations and protecting habitat. Assessing the viability of populations is recovery action 1 and identified as a priority 1 action (i.e., an action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future) (USFWS 2003). It is recommended that a plan be developed and implemented to collect information required to complete a thorough Population Viability Index for each population of Mead's milkweed. Data that is currently missing for most populations include population trend, number of genotypes, habitat size, and management condition. Although a new study investigated genetic diversity in five Missouri populations (Comer 2009), in general, no information is available to determine further estimates of the number of genets or genetic diversity, an important PVI variable, in every population. Regular population monitoring will be required in order to establish a population trend. Approximately one-third (111/330) of the populations have been surveyed since issuance of the 2003 Recovery Plan. Currently only about 11% of the populations have legal protection. Additional legal dedication has been obtained for only one population since the recovery plan was published (USFWS 2003). A prioritization of sites based on the population's potential to become highly viable and contribute to recovery should be considered, however, this prioritization cannot be completed without the data that is currently missing from most populations. At the time a prioritization of sites is possible, this information should be provided to all recovery partners (state, federal, and non-government organizations) to provide guidance on where recovery should best be targeted. Protection through conservation easement, acquisition and dedication, or other protection should be sought for Mead's milkweed populations within each physiographic region that have high viability or that have the potential to become highly viable (USFWS 2003). Land acquisition funding sources should be explored including the U.S. Fish and Wildlife Service's Non-Traditional Section 6 Recovery Land Acquisition Grant Program.

Recovery action 2 addresses managing habitat (USFWS 2003). Because sites supporting Mead's milkweed populations may require varying degrees of active management to maintain or enhance Mead's milkweed populations, habitat management was identified in the species recovery plan as a priority 1 action. The majority of populations are not receiving adequate management to maintain the populations. Only about 13% of sites are being managed with prescribed burning and some are managed for shrub and invasive plant removal. Thus, over 80% of Mead's milkweed populations are in danger of habitat loss and subsequent extinction. The number of populations managed with prescribed burns and removal of invasive species should be increased. Over 50% of sites continue to be mowed for hay. This activity prevents seed production and results in reduced genetic diversity. Although private landowners in Kansas and Missouri have been encouraged to delay hay mowing until after seed is collected (Eulinger and Skinner 2007;

USFWS 2009), continued outreach to landowners on the best practices for hay meadow management to benefit and increase Mead's milkweed reproduction is essential. Increasing the number of hay meadows that are managed to allow reproduction of Mead's milkweed through a reduction in haying and grazing, especially on public lands, would be beneficial to Mead's milkweed populations. The exploration of incentives offered by the U.S. Department of Agriculture, Natural Resource Conservation Service's (NRCS) Conservation Programs, whereby landowners are encouraged to manage their lands for the conservation of natural resources, may be beneficial in recovering Mead's milkweed. Some populations are also experiencing herbivory by deer or habitat destruction by feral hogs. Grazing, in general, adversely affects Mead's milkweed (Eulinger and Skinner 2007) and patch/burn/graze management appears to be reducing the quality of Mead's milkweed habitat (Kurz 2010). In addition, information on habitat size and management condition may already be available but needs to be compiled. Management condition can also be assessed during population monitoring.

Recovery action 3 addresses increasing the size and number of populations. Although management efforts to improve habitat and remove threats have occurred in some populations, actual increase in population size has been rare. Seven high priority recovery populations have been targeted in Missouri for intense recovery efforts. Introductions are underway in Illinois, Indiana and Wisconsin and planned in Missouri. Augmentation occurred in Illinois, Missouri, and Kansas (Kindscher *et al*. 2008; Menard 2012), in order to increase genetic diversity and promote successful reproduction. These introductions are not always located in the physiographic regions or community types indicated in the recovery criteria. For this reason, surveys are needed to locate suitable locations for the introduction and establishment of new populations in the physiographic regions and community types listed in the recovery criteria. Because Mead's milkweed grows slowly and rarely reproduces, it may be decades before the already introduced populations become viable.

There is a need for greater understanding of the species' life history requirements, specifically: phenology, pollination biology, and information on the species' reproduction in natural populations. Research indicates that introduction by transplanting juveniles reared in nurseries or greenhouses reduces time to reproduction and therefore should increase the potential viability of introductions (Bowles *et al*. 2003). Further research on restoration, management, introduction techniques, and the lack of reproduction in natural populations of Mead's milkweed will assist in the recovery of the Mead's milkweed. Establishing long-term seed collection of representative populations as well as establishing new, and maintaining current, propagation nurseries will also assist in the recovery of Mead's milkweed. Although a genetically diverse nursery population of Mead's milkweed is being maintained at the Morton Arboretum for introduction and augmentation purposes, a long-term seed collection protocol focused on representing populations throughout the range has not been established and would contribute to recovery of Mead's milkweed.

Statewide recovery groups have been developed in Missouri and Kansas. It is recommended that the states of Illinois, Iowa, and Wisconsin also develop recovery groups, which can be defined as either one recovery group for each state or one recovery group for all three states (WI, IA, and IL) that would include representatives from each state.

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Appendix 1: Variables Used in Mead's Milkweed Population Viability Index as Taken From the Mead's Milkweed Recovery Plan

Population Size: The size of a population strongly affects the potential for population persistence of Mead's milkweed. The larger the population the greater likelihood that there will be genetically different and sexually compatible individuals.

Population Growth Trend: This variable measures cohort survivorship and relative transitions from seedling to larger size classes, and occurrences of flowering and seed set.

Effective Population Size: This variable is based on the number of reproductively compatible Mead's milkweed in the population, determined by the seed source or assays of multi-allelic or molecular genotypes such as random amplified polymorphic DNA (RAPD). Populations with more than 50 genotypes have a higher capability to successfully cross-pollinate and are given the highest value. Populations with 25 to 50 genotypes are placed in the second category, 10 to 25 in the third, and less than 10 in the lowest category.

Habitat Size: This variable can influence a population's ability to survive by the amount of potential habitat available and indirectly by creating a buffer from negative influences outside the habitat. The capability of Mead's milkweed to persist is low in sites smaller than 1 hectare (2.5 acres), and 50 hectares (125 acres) is a threshold for maintenance of large numbers of plants, maximizing reproduction potential, and high levels of genetic diversity.

Habitat Condition and Successional Stage: This variable is a qualitative assessment of vegetation stability in relation to past or current disturbance regimes. Because Mead's milkweed are restricted to virgin prairies and glades/barrens, populations are considered more stable in late-successional vegetation in which the vegetational structure is that of stable bunch grasses.

Protection Status: Values for this variable represent the level of ownership and legal deed restrictions for the property in which the habitat occurs.

Management Condition: The degree of management needed as a result of habitat degradation from fire suppression, woody plant and non-native plant invasion, changes in hydrology, and other impacts to Mead's milkweed habitat. Values assigned are based on a determination of the need for, and frequency of, fire management to conserve a late-successional grammanoid vegetation structure.

Appendix 2: Population Viability Assessment

State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
IA	Southern Iowa Drift Plain	Woodside Prairie	2001	hay meadow; mowed in Sept.	0	2	1	2	1	2	0.444	low
IA	Southern Iowa Drift Plain	Adams County Pasture	2010	pasture	0	1		1	0	1	0.2	low
IA	Southern Iowa Drift Plain	Flaherty Prairie	1992	pasture; preserve? (Bowles *et al* . 1998)	0	2	1	1	0	1	0.278	low
IA	Southern Iowa Drift Plain	Garden Grove Prairie	1992	abandoned RR ROW	0	1	1	0	0	1	0.167	low
IA	Southern Iowa Drift Plain	Tingley Prairie	1993	natural area	0	1	1	3	0		0.333	low
IA	Southern Iowa Drift Plain	Powell Prairie	2002	natural area	2	1		3	0		0.5	low
IA	Southern Iowa Drift Plain	Great Western Trail, Churchville Prairie (Martensdale)	1988	abandoned RR ROW	0	2		0	3	1	0.4	low
IA	Southern Iowa Drift Plain	Great Western Trail, Cumming	1990	abandoned RR ROW	0	2		2	3	1	0.533	moderate

*An explanation of how each variable was ranked is described on pages 6-8.

State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
IL	Shawnee Hills	Saline #1 (Old Stone Face)	2008	national forest	0	2		2	0	1	0.333	low
IL	Shawnee Hills	Saline #2 (Cave Hill)	2008	national forest	0	2		2	0	1	0.333	low
IL	Shawnee Hills	Saline #3	2008	national forest	0	1		2	0	1	0.267	low
IL	Shawnee Hills	Saline #4 (Dennison)	2008	national forest	1	2		2	0		0.417	low
KS	Osage Plains	Allen #1	1986	hay meadow	1	3		1	0	1	0.4	low
KS	Osage Plains	Allen #2	1988	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Paint Brush Prairie	1989	hay meadow	2	2		2	0	2	0.53	moderate
KS	Osage Plains	Wolfpen Creek Prairie	1989	hay meadow/ oil field	1	2	1	0	0	1	0.278	low
KS	Osage Plains	Acorus Pond Prairie	2009	hay meadow	3	2		2	0	1	0.533	moderate
KS	Osage Plains	Anderson #1	2001	hay meadow	3	1	1	1	0	1	0.389	low
KS	Osage Plains	Anderson #2	1987	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Anderson #3	1987	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Anderson #4	1987	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Anderson #5	2009	hay meadow	3	2		2	0	1	0.533	moderate
KS	Osage Plains	Appetizer Prairie	2009	unglaciated tallgrass prairie	3	2		3	0	3	0.733	moderate

*An explanation of how each variable was ranked is described on pages 6-8

State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
KS	Osage Plains	Arrow Leaf Violet Prairie	2009	hay meadow	0	2	1	3	0	2	0.444	low
KS	Osage Plains	Both Sides of the Road Prairie	2008	hay meadow	0	2		2	0	1	0.333	low
KS	Osage Plains	Bridge Repair Site	2009	B-quality prairie/West edge is becoming wet prairie	0	3	1	2	0	2	0.444	low
KS	Osage Plains	Capillary Prairie	2009		1	2		2	0		0.417	low
KS	Osage Plains	Cole Place	2009	hay meadow	3	3		3	0	1	0.667	moderate
KS	Osage Plains	Colony Prairie	2009		3	1		3	0	3	0.667	moderate
KS	Osage Plains	Curry Prairie	1988	hay meadow	1	1		1	0	1	0.267	low
KS	Osage Plains	Deer Creek Prairie	2009	hay meadow	2	2		3	0	1	0.533	moderate
KS	Osage Plains	Doering Place	2009	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Down By Law Prairie	2009	hay meadow	3	2		3	0	1	0.6	moderate
KS	Osage Plains	Dumped-On Prairie	1990	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Garnet Prairie	1988	hay meadow; oil field	3	3	2	2	0	1	0.611	moderate
KS	Osage Plains	Garrison Prairie	2009	unglaciated tallgrass prairie	2	2		3	0	2	0.6	moderate

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
KS	Osage Plains	Goofy Brown Dog Prairie	2009	High B-quality unglaciated tallgrass prairie	1	2		2	0	2	0.467	low
KS	Osage Plains	Hay Bale Mile	2009	unglaciated tallgrass prairie	2	2		2	0		0.5	low
KS	Osage Plains	Hiccup Hay Meadow	2009	formerly grazed	3	2		2	0	2	0.6	moderate
KS	Osage Plains	Jack Holt Place	2009	former? Hay meadow	1	2		3	0	1	0.467	low
KS	Osage Plains	June Bodenhamer North Place	1987	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Lone Elm Prairie = Lone Elm Bend	2009	hay meadow	1	2		3	0	1	0.467	low
KS	Osage Plains	Lone Elm Prairie Southwest	1987	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Long Walk Prairie	2009	unglaciated tallgrass prairie	2	2		3	0	3	0.667	moderate
KS	Osage Plains	Maryland Road Prairie	2009	hay meadow	3	1		3	0	3	0.667	moderate
KS	Osage Plains	Meadowlark Tree Prairie	2009	Tallgrass prairie of overall B-quality	1	2		2	0	2	0.467	low
KS	Osage Plains	Mont Ida Cemetery Prairie	2009	hay meadow/ occasionally grazed	1	2	1	2	0	1	0.389	low

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
KS	Osage Plains	Mount Zion Cemetery North	1987	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Mount Zion Cemetery South	1987	hay meadow	0	2		1	0	1	0.267	low
KS	Osage Plains	Mud Cake Prairie	2009	hay meadow	1	2		2	0	1	0.4	low
KS	Osage Plains	New Fence Prairie	2008	past grazing (cow patties and a pond)	1	2		2	0	2	0.467	low
KS	Osage Plains	Nodding Polytaenia Prairie	2009	hay meadow	1	2		2	0	1	0.4	low
KS	Osage Plains	North Garnett Prairie	1958	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	North Rich Prairie	1987	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Northeast Garnett Prairie	1993	hay meadow	0	2	1	1	0	1	0.278	low
KS	Osage Plains	Pipeline Prairie	1990	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Pott Creek Prairie	1988	hay meadow; portion in good condition	1	3	1	2	0	1	0.444	low
KS	Osage Plains	Prairie swale	2009	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Railroad Triangle Prairie	2009	tallgrass prairie ranked A	3	2		3	0	3	0.733	moderate

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
KS	Osage Plains	Rainy Day Prairie	2009	unglaciated tallgrass prairie	0	2		2	0		0.333	low
KS	Osage Plains	Rocky Top Prairie	2009	hay meadow	3	2		3	0	1	0.6	moderate
KS	Osage Plains	Root Cellar Prairie	2009	unglaciated tallgrass prairie	2	2		2	0	2	0.533	moderate
KS	Osage Plains	Selma Prairie	1987	hay meadow / pasture	3	1	1	2	0	1	0.444	low
KS	Osage Plains	Singalong Prairie	2009		1	2		2	0		0.417	low
KS	Osage Plains	Sleeping Fawn Prairie	2009	unglaciated tallgrass prairie	0	1		3	0	2	0.4	low
KS	Osage Plains	Southfork Pott Creek Prairie	1989	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Spencer Lake Pairie	2009	B-quality unglaciated tallgrass prairie	0	2		2	0	3	0.467	low
KS	Osage Plains	Spray Paint Prairie	2009	hay meadow	2	2		3	0	1	0.533	moderate
KS	Osage Plains	Startled Sandpiper Prairie	2009	hay meadow	0	2		2	0	2	0.4	low
KS	Osage Plains	Strawberry Lunch Prairie	2009	grazed	0	2		2	0	1	0.333	low
KS	Osage Plains	Sunset Prairie	1988	hay meadow	3	1	2	2	0	1	0.5	low
KS	Osage Plains	Sunset Prairie	2009	hay meadow	3	2	2	3	0	2	0.667	moderate
KS	Osage Plains	Surprise Prairie	2009	hay meadow	1	2		2	0	1	0.4	low
KS	Osage Plains	Three Terrace Prairie	2009	unglaciated tallgrass prairie	0	1		2	0	1	0.267	low

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
KS	Osage Plains	Trail Prairie	2009	hay meadow	3	2		3	0	1	0.6	moderate
KS	Osage Plains	Two Highway Prairie	2009	hay meadow	0	2		1	0	1	0.267	low
KS	Osage Plains	Two Rocks Prairie	1988	hay meadow	2	3		1	0	1	0.467	low
KS	Osage Plains	Vulture Roost Prairie	2009	hay meadow	2	2		2	0	1	0.467	low
KS	Osage Plains	Welcome Prairie	2009	hay meadow	2	2		2	0	1	0.467	low
KS	Osage Plains	Welda Prairie	1990	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Welda Prairie North	2005	hay meadow	3	2		2	3	1	0.733	moderate
KS	Osage Plains	Westphalia Prairie	1989	hay meadow	3	2		2	0	1	0.533	moderate
KS	Osage Plains	Puppy Dog Prairie	1990	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Bronson Prairie	1986	hay meadow	0	1	1	1	0	1	0.222	low
KS	Osage Plains	Hinton Creek	1989	hay meadow	3	2	1	2	0	1	0.5	low
KS	Osage Plains	Little Pawnee Prairie	1990	hay meadow	0	2	1	1	0	1	0.278	low
KS	Osage Plains	Ronald Prairie North	1989	hay meadow	3	2		2	0	1	0.533	moderate
KS	Osage Plains	Ronald Prairie South	1989	hay meadow	1	2	3	1	0	1	0.444	low
KS	Osage Plains	Treaty Line Prairie	1989	hay meadow/ pasture	2	2	1	2	0	1	0.444	low
KS	Osage Plains	Uniontown Prairie	1987	hay meadow	3	3		2	0	1	0.6	moderate
KS	Osage Plains	Bourbon #1	1971	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Crooked Creek Prairie	1989	hay meadow	0	0		1	0	1	0.133	low

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
KS	Osage Plains	Farlington Prairie	1989	hay meadow	1	2	0	2	0	2	0.389	low
KS	Osage Plains	unnamed	1992	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Baldwin Creek Prairie	1988	not mowed or grazed	0	2		2	0	1	0.333	low
KS	Osage Plains	Blue Healer Prairie	2008	hay meadow	1	3	1	1	3	1	0.556	moderate
KS	Osage Plains	Coblenz Marsh Road Prairie	2005		0	1		3	2	3	0.6	moderate
KS	Osage Plains	Colyer Prairie	2005	hay meadow	3	2		1	0	1	0.467	low
KS	Osage Plains	Corner Prairie	1988	hay meadow	3	3	1	2	0	1	0.556	moderate
KS	Osage Plains	Double Prairie	2005	hay meadow/ burned	0	1		2	0	2	0.333	low
KS	Osage Plains	Dry Creek Prairie	1988	hay meadow	1	1	1	1	0	1	0.278	low
KS	Osage Plains	Elk Creek Prairie	2004	hay meadow?/ burned	0	2		2	2	2	0.53	moderate
KS	Glaciated Region	Fishermen's Prairie	2004	hay meadow	0	1	1	1	0	1	0.222	low
KS	Osage Plains	Gammagrass Prairie	1988	hay meadow / burned	3	3	1	2	0	2	0.611	moderate
KS	Osage Plains	Jack's Prairie	1988	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Jack's Prairie South	1989	hay meadow	3	2	1	2	0	1	0.5	low
KS	Osage Plains	Jagger Prairie	2005		0	1		2	0	2	0.333	low
KS	Osage Plains	Kanwaka Prairie South	1986		0	1	1	1	0		0.2	low
KS	Osage Plains	Kanwaka Prairie West	1986	partiall developed; ag field	1	3	1	0	0	0	0.278	low
KS	Osage Plains	Leary Prairie	2005	hay meadow	0	3	1	3	0	1	0.444	low

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
KS	Osage Plains	Lecompton Prairie	1995	small remnant in area of residential development	0	1	1	1	3		0.4	low
KS	Osage Plains	Lecompton Prairie	1987	hay meadow	2	3	1	1	0	1	0.444	low
KS	Osage Plains	Pioneer Cemetery Site	1988	cemetery; mowed annually; education & research	1	3	1	2	0	2	0.5	low
KS	Osage Plains	Rock Creek Prairie	2005	grazed, hay meadow	0	3		1	0	1	0.333	low
KS	Osage Plains	Rock Creek Prairie S	2005	hay meadow	0	1		3	0	2	0.4	low
KS	Glaciated Region	Row Prairie	2005	hay meadow	0	1	0	2	0	1	0.222	low
KS	Osage Plains	Semi-Circle Prairie	2005	hay meadow/ burned	0	1		3	0	2	0.4	low
KS	Osage Plains	Small Lakes Prairie	1988	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Spring Creek Prairie West	1994	hay meadow	0	2		1	3	1	0.467	low
KS	Glaciated Region	The Day After Prairie	2005	hay meadow	0	1		3	0	2	0.4	low
KS	Osage Plains	Triangle Prairie	1988	hay meadow	0	2	1	2	0	1	0.333	low
KS	Osage Plains	Turnpike Prairie	1986	hay meadow	3	2		1	0	1	0.467	low
KS	Osage Plains	Turnpike Prairie East	1988	former hay meadow, currently grazed	3	3	0	2	0	1	0.5	low

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
KS	Osage Plains	Twin Mounds Prairie NE	2005	hay meadow	2	2		3	0	1	0.533	moderate
KS	Osage Plains	Vinland Prairie NE	2005	burned in 2005	1	2		3	0	3	0.6	moderate
KS	Osage Plains	Vinland Prairie South	2005	hay meadow	0	2		2	0	1	0.333	low
KS	Osage Plains	Violet Hill	2008	prairie remnant	0	2	1	1	0	1	0.278	low
KS	Glaciated Region	Big Springs Prairie North	2005		0	1		3	0	1	0.333	low
KS	Osage Plains	Appanoose Church Prairie	1988	hay meadow	0	3	1	1	0	1	0.333	low
KS	Osage Plains	Bend-in-the-Road Prairie	1986	mowing; oil wells	1	2	1	1	0	1	0.333	low
KS	Osage Plains	Dead End Prairie	1986		0	1	1	1	0		0.2	low
KS	Osage Plains	Double Cross Prairie	1986		0	2	1	1	0		0.267	low
KS	Osage Plains	Elm Grove Prairie	1989		1	1		0	0		0.167	low
KS	Osage Plains	Fowler Hill Prairie	1992	hay meadow; mowed twice annually	0	3	1	2	0	1	0.389	low
KS	Osage Plains	Franklin 59 Prairie	2000	hay meadow	2	3		1	0	1	0.467	low
KS	Osage Plains	Homewood Prairie	1988	hay meadow	1	2	1	2	0	1	0.389	low
KS	Osage Plains	Middle Creek Prairie KS Franklin Co	1990	hay meadow	2	2		1	0	1	0.4	low
KS	Osage Plains	Mount Hope Prairie	1986	hay meadow	3	2		1	0	1	0.467	low
KS	Osage Plains	Ohio Prairie	1989	hay meadow	3	1		1	0	1	0.4	low

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
KS	Osage Plains	Pottawatomie Prairie	1986	mowed	1	2	1	2	0	2	0.444	low
KS	Osage Plains	Silo Prairie	1999	no evidence of disturbance	0	2	1	1	0	1	0.278	low
KS	Osage Plains	Lane Prairie	1986	partially hayed	0	0		2	0	1	0.2	low
KS	Glaciated Region	Dogleg Prairie	2008	degraded	0	0	1	0	3	0	0.222	low
KS	Glaciated Region	French Creek Prairie	1990	hay meadow	3	2		1	0	1	0.467	low
KS	Glaciated Region	Hershe Prairie	2005	hay meadow	0	1		1	0	1	0.2	low
KS	Glaciated Region	Kansas University Ecological Reserve-Rockefeller Native Prairie	2008	burned 2-3 years	3	3	1	2	3	3	0.833	high
KS	Glaciated Region	S & S Ranch Prairie	2005	hay meadow; grased occasionally	1	3	1	1	0	1	0.389	low
KS	Osage Plains	Wild Horse Prairie	1998	hay meadow	0	3	1	1	0	1	0.333	low
KS	Osage Plains	Camp Prairie	1983	hay meadow	1	1		1	0	1	0.267	low
KS	Osage Plains	De Soto Prairie	1993	hay meadow?	1	2	1	1	0	1	0.333	low
KS	Osage Plains	Kill Creek Prairie	2009	burn/mow/ rest rotation	2	2		3	0	2	0.6	moderate
KS	Osage Plains	Moonlight School Prairie	2009	hay meadow	3	2	1	1	0	1	0.444	low
KS	Osage Plains	Prairie Center Site	2009	prairie remnant	2	3		2	0	1	0.533	moderate
KS	Glaciated Region	Alexandria Northwest Prairie	1998	hay meadow	1	2		1	0	1	0.333	low

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
KS	Glaciated Region	Alexandria SW Prairie	2005	hay meadow	0	2		3	0	1	0.4	low
KS	Glaciated Region	Hawks Prairie	2004		0	1		1	0		0.167	low
KS	Glaciated Region	High Prairie	1992	hay meadow	0	1	2	1	0	1	0.278	low
KS	Glaciated Region	Hilltop Prairie	1986	hay meadow	0	1		1	0	1	0.2	low
KS	Glaciated Region	Lonesome Elm Prairie	1986	?	0	1	1	2	0	1	0.278	low
KS	Glaciated Region	Pond Prairie	2005	hay meadow and home site	0	1	1	2	0	0	0.222	low
KS	Glaciated Region	Reno Northwest Prairie	1998	hay meadow	0	1		1	0	1	0.2	low
KS	Glaciated Region	Turnpike Hilltop Prairie	1998	in fragmented landscape	0	1		1	0		0.167	low
KS	Osage Plains	Ancient Fence Prairie	2008	at least partially hayed	2	2		2	0	1	0.467	low
KS	Osage Plains	Bambi's Meadow	2008	B-quality, unglaciated tallgrass prairie	0	1		2	0	2	0.333	low
KS	Osage Plains	Big Blair Prairie	2008		0	1	3	3	0	3	0.556	moderate
KS	Osage Plains	Blue Mound City Lake	2000	hay meadow	0	2		1	0	1	0.267	low
KS	Osage Plains	Butterfly Hill Prairie	2008		0	2		3	0	3	0.533	moderate
KS	Osage Plains	Castle Prairie	2008		0	1		2	3	2	0.533	moderate
KS	Osage Plains	Centenarian Prairie	2008	hay meadow	1	2		2	0	1	0.4	low
KS	Osage Plains	Chatanooga Prairie	2008	hay meadow	2	2		2	0	1	0.467	low

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KS	Osage Plains	Coreopsis Prairie	2008		1	2		2	3	1	0.6	moderate
KS	Osage Plains	Curry Cemetery Prairie	1986	Upland tallgrass prairie ranked B	0	1		2	0		0.25	low
KS	Osage Plains	Deer Shelter Prairie	2008	hay meadow	0	1		2	0	1	0.267	low
KS	Osage Plains	Doggy Paddle Prairie	2008	burned in 2008	3	2		3	0	2	0.667	moderate
KS	Osage Plains	Double Luck Prairie	2008		0	1		2	0	1	0.267	low
KS	Osage Plains	Dry Pond Prairie	2008	burned some years	0	2		2	0	2	0.4	low
KS	Osage Plains	Eureka Prairie	2008	hay meadow	0	2	1	2	3	1	0.5	low
KS	Osage Plains	Everything but the Kitchen Sink Prairie	2009	unglaciated tallgrass prairie	1	2		3	0	3	0.6	moderate
KS	Osage Plains	Four Leaf Clover Prairie	2008	B-quality, unglaciated tallgrass prairie	3	2		2	0	3	0.667	moderate
KS	Osage Plains	Garlic Scape Prairie	2009	Low B quality, unglaciaged tallgrass prairie	0	2		2	0	2	0.4	low
KS	Osage Plains	Gentian Prairie	2008		0	2		3	0		0.417	low
KS	Osage Plains	Green Pond Prairie	2008	hay meadow	0	2		2	0	1	0.333	low
KS	Osage Plains	Iron Gate Prairie	2008	hay meadow	0	3		2	0	1	0.4	low
KS	Osage Plains	Jayhawk Prairie	2008		0	2		3	0	3	0.533	moderate
KS	Osage Plains	Lakeside Prairie	2008		1	2		3	0	3	0.6	moderate

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
KS	Osage Plains	Linn #1	1989	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Little Pond Prairie	1986	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Lost for Words Prairie	2008		3	2		3	0	3	0.733	moderate
KS	Osage Plains	Massasauga Prairie	2008	hay meadow	1	2		3	0	1	0.467	low
KS	Osage Plains	Morningside Prairie	2009	unglaciated tallgrass prairie	2	2		3	0	3	0.667	moderate
KS	Osage Plains	Muskrat Prairie	2008	unglaciated tallgrass prairie	0	2		3	0		0.417	low
KS	Osage Plains	Nice Guy Prairie	2008	hay meadow	1	2		3	0	1	0.467	low
KS	Osage Plains	Oil Well Prairie	2008	hay meadow	0	1		2	0	1	0.267	low
KS	Osage Plains	Paddleboat Prairie	2008		0	1		2	0	1	0.267	low
KS	Osage Plains	Penstemon Prairie	2008	hay meadow	1	2		2	0	1	0.4	low
KS	Osage Plains	Pig Head Prairie	2008		0	1		3	0		0.333	low
KS	Osage Plains	Pig Pen Prairie	2008		0	2		3	0	3	0.533	moderate
KS	Osage Plains	Pleasant Prairie	1989	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Pleasanton Prairie	2008	hay meadow	1	2		3	0	1	0.467	low
KS	Osage Plains	Powerline Prairie	2008	burned some years	3	2		3	0	3	o.733	moderate

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
KS	Osage Plains	Prescott Prairie	1998		1	1		2	0	3	0.467	low
KS	Osage Plains	Railroad Crossing Prairie	2008	hay meadow	1	2	2	3	0	1	0.5	low
KS	Osage Plains	Red, White, and Blue Prairie	2008	B quality, unglaciated tallgrass prairie	1	2		2	0	1	0.4	low
KS	Osage Plains	Regal Prairie	2008	hay meadow	0	1		3	0	2	0.4	low
KS	Osage Plains	Round Mound Prairie	2008	B quality, unglaciated tallgrass prairie	3	2		2	0	1	0.533	moderate
KS	Osage Plains	Second Try Prairie	2008	hay meadow	0	2		3	0	2	0.467	low
KS	Osage Plains	Sharon's First Prairie	2008		3	2		3	0	3	0.733	moderate
KS	Osage Plains	Shooting Range Prairie	2008	hay meadow	0	2		3	0	1	0.4	low
KS	Osage Plains	Snakeroot Sign Prairie	2008	hay meadow	0	1		3	0	1	0.333	low
KS	Osage Plains	Soaked Through Prairie	2008		0	2		2	0	2	0.4	low
KS	Osage Plains	Square Baler Prairie	2008	B quality, unglaciated tallgrass prairie	3	2		2	0	1	0.533	moderate
KS	Osage Plains	Standing Water Prairie	2008		0	2		3	0	2	0.467	low
KS	Osage Plains	Startled Fawn Prairie	2008		3	3		3	0		0.75	moderate

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
KS	Osage Plains	Stone Fence Prairie	2008	hay meadow	0	2		2	0	1	0.333	low
KS	Osage Plains	Sugar Creek Prairie	1989	hay meadow	3	3	1	1	0	1	0.5	low
KS	Osage Plains	Sugar Valley Prairie	2008	B quality, unglaciated tallgrass prairie	3	2		2	0	1	0.533	moderate
KS	Osage Plains	Three Wheeler Prairie	2008	hay meadow	3	2		2	0	1	0.533	moderate
KS	Osage Plains	Two Fence Prairie	2008	hay meadow	1	2		2	0	1	0.4	low
KS	Osage Plains	Two Meadows Prairie	2008	B quality, unglaciated tallgrass prairie	0	2		2	0	1	0.333	low
KS	Osage Plains	Viewed from roadside - no site name	2008	hay meadow	0	1		3	0	1	0.333	low
KS	Osage Plains	Walk in the Woods Prairie	2009	unglaciated tallgrass prairie	3	2		2	0	2	0.6	moderate
KS	Osage Plains	Wave Prairie	2008	hay meadow	0	2		3	0	1	0.4	low
KS	Osage Plains	Wild Onion Prairie	2008	B quality, unglaciated tallgrass prairie	0	2		2	0	2	0.4	low
KS	Osage Plains	Windsock Prairie	2008		3	2	2	2	0		0.6	moderate
KS	Osage Plains		2008	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Backyard Prairie	1995	hay meadow	0	1		2	0	1	0.267	low
KS	Osage Plains	Bell Branch Prairie	2004	hay meadow	3	2	1	3	0	1	0.556	moderate

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
KS	Osage Plains	Big Highland Prairie	2004	former haymeadow, converted to cool season	0	1		0	0	0	0.067	low
KS	Osage Plains	Centennial Prairie #1	1995	hay meadow, slightly grazed by horses	0	2	1	1	0	1	0.278	low
KS	Osage Plains	Centennial Prairie #2	2004	cool season grass/former hay	0	1		0	0	1	0.133	low
KS	Osage Plains	Coldwater Prairie	2004	hay meadow	0	1		2	0	1	0.267	low
KS	Osage Plains	Crappie Cove Prairie	2005	hay meadow	1	2		3	0	1	0.467	low
KS	Osage Plains	Debrick Prairie	2005	hay meadow	1	2		3	0	1	0.467	low
KS	Osage Plains	Fairview Prairie	1995		0	1		1	0		0.167	low
KS	Osage Plains	Flat Tire Prairie	2004	hay meadow	0	1	1	1	0	1	0.222	low
KS	Osage Plains	Green Valley Prairie	2005	hay meadow	0	2		2	0	1	0.333	low
KS	Osage Plains	Highland Prairie	1986	hay meadow	1	2	1	1	0	1	0.333	low
KS	Osage Plains	Jordan Branch Prairie	2005	hay meadow	0	2		3	0	1	0.4	low
KS	Osage Plains	Katy Prairie	2001	hay meadow	0	1		3	0	1	0.333	low
KS	Osage Plains	KU Endowment Prairie	2005	hay meadow	1	2		2	0	1	0.4	low
KS	Osage Plains	Maimi Prairie	2005		0	1		0	0		0.083	low

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
KS	Osage Plains	Metcalf Prairie	1989	hay meadow, mowed twice annually	3	2	1	1	0	1	0.444	low
KS	Osage Plains	Miami #1	1957	hay meadow	0	1		2	0	3	0.4	low
KS	Osage Plains	MIAMI PRAIRIE	2005		0	2		2	0	3	0.467	low
KS	Osage Plains	Middle Creek Prairie KS Miami CO	2005	burn/ mow/ brush removal	0	3		2	0	2	0.467	low
KS	Osage Plains	Mound Creek Prairie	2005	hay meadow	0	1		2	0	1	0.267	low
KS	Osage Plains	Mound Prairie	2004	hay meadow	2	1	1	1	0	1	0.333	low
KS	Osage Plains	North Mound Creek Prairie	2005	hay meadow	0	1		2	0	1	0.267	low
KS	Osage Plains	Outpost Prairie	2004	hay meadow	0	2		2	0	1	0.333	low
KS	Osage Plains	Pecan Prairie East	2004	hay meadow	0	1	1	1	0	1	0.222	low
KS	Osage Plains	Persistence Prairie	2005		0	2		2	0	3	0.467	low
KS	Osage Plains	Plum Creek Church Prairie	2005	hay meadow	0	2		2	0	1	0.333	low
KS	Osage Plains	Plum Creek Meadow	1993	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Plum Creek Prairie	2004	hay meadow	0	1		2	0	1	0.267	low
KS	Osage Plains	Quarry Prairie	2005		1	2		3	0	3	0.6	moderate
KS	Osage Plains	Round Bale Prairie	2004	hay meadow	1	2		3	0	1	0.467	low
KS	Osage Plains	Scott Branch Prairie	1995	hay meadow; slightly grazed by horses	0	1		1	0	1	0.2	low

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
KS	Osage Plains	Side Hill Prairie	1993	hay meadow	0	2	1	3	0	2	0.444	low
KS	Osage Plains	South Highway 169 Prairie	2005	hay meadow	0	1		2	0	1	0.267	low
KS	Osage Plains	South Wea Prairie	2000	hay meadow	1	2		2	3	1	0.6	moderate
KS	Osage Plains	Southwest Paola Prairie	2005	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Spring Valley Prairie	2005	hay meadow	0	1		2	0	1	0.267	low
KS	Osage Plains	Springview Prairie	1989	hay meadow	2	2	1	2	0	1	0.444	low
KS	Osage Plains	Sweetwater Creek Prairie	1993	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Union School Prairie	2005	hay meadow	0	1		2	0	1	0.267	low
KS	Osage Plains	Union Valley Prairie	2005	hay meadow	0	2		2	0	1	0.333	low
KS	Osage Plains	Wagstaff Prairie	2004	hay meadow	0	1		2	0	1	0.267	low
KS	Osage Plains	West Branch Bull Creek Prairie	1995	hay meadow	0	1		1	0	1	0.2	low
KS	Osage Plains	Whispering Oaks Prairie	2004	hay meadow	0	2		3	0	1	0.4	low
KS	Osage Plains	Flat Rock Prairie	1988	Native	3	2	3	2	0		0.67	moderate
MO	Glaciated Plains	Williams Prairie	2001	unknown	0	1		0	0		0.083	low

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
MO	Osage Plains	Buffalo Wallow Prairie Conservation Area (Catlin?)	2005	hay/rest/ burn rotation	0	1	3	2	3	1	0.556	moderate
MO	Ozark-Springfield Plateau	Cook (Shelton) Memorial Meadow	2008	hay/burn rotation	0	2	3	2	3	2	0.667	moderate
MO	Osage Plains	Haines Grove School Prairie	1993	hay meadow	0	1		1	0	1	0.2	low
MO	Osage Plains	Lone Star Prairie	2005	hay meadow	0	2	2	1	0	1	0.333	low
MO	Osage Plains	Regal Prairie Natural Area	2008	graze/burn rotation bison grazing	0	3	3	1	3	1	0.611	moderate
MO	Osage Plains	Tzi-Sho Prairie	2006	hay/rest/ burn rotation	0	2	3	2	3	2	0.667	moderate
MO	Osage Plains	Cole Camp vicinity North	2008	unknown	0	1		0	0	0	0.067	low
MO	Ozark-Springfield Plateau	Cole Prairie	2008	lake now present, development planned, former hay meadow/ pasture	0	1	1	0	0	0	0.111	low
MO	Osage Plains	Duran Branch Prairie	2005	degraded, hay meadow	0	1	1	0	0	0	0.111	low
MO	Ozark-Springfield Plateau	Hi Lonesome Prairie Conservation Area	2008	hay meadow/ pasture	0	0	3	1	3	1	0.444	low
MO	Osage Plains	Hobein Prairie	1988	hay meadow	1	2	1	1	0	1	0.333	low

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
MO	Ozark-Springfield Plateau	Lincoln Prairie	2005	hay meadow	0	2		1	0	0	0.2	low
MO	Osage Plains	Mora Prairie	1989	hay meadow	0	1	1	1	3	1	0.389	low
MO	Osage Plains	Mora vicinity Northeast	2008	hay meadow	0	2	1	1	0	0	0.222	low
MO	Ozark-Springfield Plateau	Mount Pleasant Prairie	2006	hay/winter pasture	0	0	1	1	0	1	0.167	low
MO	Ozark-Springfield Plateau	Poplar Prairie	1984	pasture burn rotation	0	1		1	0	1	0.2	low
MO	Osage Plains	Rock Hill Prairie	2009	hay/pasture/ burn, proposed hwy widening	3	2	2	1	3	1	0.667	moderate
MO	Osage Plains	Root Ranch (Morton Prairie)	2009	hay meadow	0	2		1	0	1	0.267	low
MO	Osage Plains	Windmill Prairie	1988	unknown	1	1		0	0		0.167	low
MO	Osage Plains	South Fork Prairie (Winn's Prairie)	2009	idle	2	3	1	1	1	2	0.556	moderate
MO	Osage Plains	West Dolan Prairie	2005	hay meadow	0	2		1	0	1	0.267	low
MO	Osage Plains	Mo-Ko Prairie	1989	hay/burn rotation	0	1	3	2	3	2	0.611	low
MO	Osage Plains	Thorsen Prairie	1989	grazed	1	2	3	0	0	1	0.389	low
MO	Ozark-Springfield Plateau	Niawathe Prairie	2009	patch/burn/ graze rotation S section, control N section	3	3	3	1	3	1	0.778	high

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
MO	Glaciated Plains	Helton Prairie Natural Area	2008	hay/burn/rest rotation	0	2	1	2	3	2	0.556	moderate
MO	Glaciated Plains	Old Catholic Church	2008	prescribed burn	0	2		2	1	2	0.467	low
MO	Osage Plains	Grand River Bottoms (Hilltop Prairie; Truman Reservoir)	2005	unknown	0	1		0	3	2	0.4	low
MO	Ozark-St. Francois Mountains	Bell Mountain - West	2008	natural area w/ feral hogs	0	2	0	2	3	1	0.444	low
MO	Ozark-St. Francois Mountains	St. Francois Mountains Natural Area	1905	natural area	0	1		3	3	2	0.6	moderate
MO	Ozark-St. Francois Mountains	Taum Sauk Mountain State Park #1	2004	natural area	2	1		3	3	2	0.733	moderate
MO	Ozark-St. Francois Mountains	Taum Sauk Mountain State Park #2	2004	natural area	1	1		3	3	2	0.667	moderate
MO	Ozark-St. Francois Mountains	Taum Sauk Mtn State Park - Weimer Hill	2008	natural area feral pigs	2	2	1	1	3	1	0.556	moderate
MO	Ozark-St. Francois Mountains	Taum Sauk Mtn State Park -Mina Sauk Falls	2008	natural area feral pigs	2	2	1	1	3	1	0.556	moderate
MO	Ozark Border	Bahner Branch Prairie	1989	hay meadow	0	1	1	2	0	1	0.278	low
MO	Ozark Border	Bahner vicinity	2005	winter grazing	0	1	1	0	0	1	0.167	low
MO	Osage Plains	Cordes Prairie	2008	hay meadow	0	0	1	1	0	1	0.167	low

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
MO	Osage Plains	Friendly Prairie	2008	hay/burn rotation	0	3	1	2	3	2	0.611	moderate
MO	Osage Plains	Grandfather Prairie Conservation Area	2008	hay/burn rotation	0	0	2	2	3	2	0.5	low
MO	Osage Plains	Highway W Prairie	2006	degraded, former hay meadow	0	2	1	0	0	0	0.167	low
MO	Osage Plains	Paint Brush Prairie Natural Area	2010	hay/burn rotation	3	2	3	2	3	2	0.833	high
MO	Osage Plains	Paint Brush Prairie Vicinity South	2008	hay/burn rotation	0	2		2	0	2	0.4	low
MO	Osage Plains	Shirley's Prairie	2005	hay meadow	0	1	1	3	0	1	0.333	low
MO	Ozark Border	St. Paul Prairie	1989	hay meadow	0	1	1	2	0	1	0.278	low
MO	Osage Plains	Vandyke Prairie	2005	unknown	0	1		0	0	0	0.067	low
MO	Osage Plains	Walnut Creek Prairie	2006	hay meadow	0	2	1	2	0	1	0.333	low
MO	Osage Plains	Windsor Junction vicinity East	2008	hay meadow	0	0	1	1	0	0	0.111	low
MO	Ozark-Springfield Plateau	Bushy Creek Upland Prairie	1989	grazed prairie	0	2	0	2	0	0	0.222	low
MO	Ozark-Springfield Plateau	South Fork Upland Prairie	1989	hay meadow	0	2	1	1	0	1	0.278	low

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State	Physiographic Region	Site Name	Date Last Observed	Current Land Use	Population Size *	Population Trend*	Habitat Size*	Habitat Condition *	Protection Status*	Management Condition*	PVI	Viability
MO	Ozark-St. Francois Mountains	Church Mountain	2008	natural area	0	1		3	3	2	0.6	moderate
MO	Ozark-St. Francois Mountains	Ketcherside Mountain Conservation Area (Proffit Mtn)	2009	natural area feral pigs	3	3	1	1	3	1	0.667	moderate
MO	Osage Plains	Taberville Prairie	2009	patch/burn/ graze	0	2	3	1	3	1	0.556	moderate
MO	Osage Plains	Wah-Kon-Tah Prairie	2009	patch/burn/ graze; haying; spring burn; rest	3	2	2	1	3	1	0.667	moderate
MO	Osage Plains	Bronaugh (Bushwacker Conservation Area)	2008	hay meadow	0	2	3	1	3	1	0.556	moderate
MO	Osage Plains	Gay Feather Prairie	2005	natural area burned, former hay meadow	0	2	2	2	3	2	0.611	moderate
MO	Osage Plains	KCSI Prairie	1994	unknown	1	1		0	3		0.417	low
MO	Osage Plains	Little Osage Prairie	2006	natural area/ former haymeadow	0	0	2	2	3	2	0.5	low
MO	Osage Plains	McGennis Prairie (Teel Prairie)	2009	annual haying, periodic burning	0	1		1	0	2	0.267	low
MO	Osage Plains	Osage Prairie Natural Area	2007	natural area, former hay meadow	0	0	3	2	3	2	0.556	moderate
MO	Osage Plains	West Twin Lakes Prairie	2005	unknown	0	0		0	0	0	0	low

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Asclepias meadii

Current Classification: Threatened

Recommendation resulting from the 5-Year Review

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
_X_ No change is needed

Appropriate Recovery Priority Number: 8C

Review Conducted By: Cathy Pollack, Chicago, Illinois Ecological Services Field Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve Louise Clemency Date 11/5/12
Louise Clemency

REGIONAL OFFICE APPROVAL:

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

Approve Lynn M Lewis Date 11/28/12

Cooperating Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service, Mountain Prairie Region

X Concur ____ Do Not Concur

Signature _____ Date 11/15/12