SUMMARY OF POPULATION VIABILITY ASSESSMENT AND ANALYSIS

1. Protocols

Protocols for evaluating selected species' future population abundance and distribution under alternative management plans for Midewin National Tallgrass Prairie

This document describes the protocols used during a meeting with a panel of scientists (hereafter Expert Panel) with expertise on Regional Forester's Sensitive Species (RFSS) that inhabit Midewin National Tallgrass Prairie (Midewin). The purpose of the document is twofold. First, it informed members of the Expert Panel how the meeting was to be conducted, what information would be collected, and how the information would be used. It also provides a written record of the protocols. These protocols were adapted from similar expert panel processes that have been used in population viability assessments, including those in the Forest Ecosystem Management Assessment (FEMAT), land management planning on the Tongass National Forest in Alaska (Shaw 1999), and in the Interior Columbia River Basin Ecosystem Management Project (ICBEMP). The process documented by the ICBEMP (Quigley et al. 1997) was used as a basis for this protocol; where procedures differ, it is because of the difference in size and other local conditions between the Midewin and the ICBEMP, or because of modifications suggested by a national team of Forest Service scientists who are coordinating population viability assessments (Richard Holthausen, personal communication).

2. Background

Continued existence - Because species and their environments are dynamic, and our knowledge of future events and impacts is limited, it is not possible to say with certainty that a species will persist indefinitely. Also, it is not possible to determine a single, fixed population size above which a species is viable and below which it will be extirpated from an area. Consequently, recent viability assessments have expressed estimates of future viability as a likelihood, with associated measures of uncertainty.

Well-distributed - The term "well-distributed" is applied differently, depending on the historic population structure of the species being considered. For some species, a well-distributed pattern is one in which the species is evenly distributed across the landscape, or distributed in a metapopulation pattern where dispersal of individuals or propagules occurs among local populations that are distributed throughout the landscape. For other species, such as local endemics or those tied to naturally scarce habitats, the concept of well-distributed must be based on the species natural history and historical distribution. For these species, it may not be possible or desirable to manage for broadly- or evenly-distributed habitat

2.1. Conservation assessments

To assist in fulfilling viability requirements, Midewin convened a previous Expert Panel to provide information used in conservation assessments for the Midewin RFSS. Conservation assessments (CAs) are documents that present biological characteristics, including status, range, life history and habitats, threats to the species from natural and human sources, management recommendations, monitoring, and research needs, of each RFSS. They are not quantitative projections of viability based on genetic or demographic models, but rather they are reasoned assessments of likely population abundance and distribution based on projected environmental conditions, with consideration of the ecological requirements of each species.

2.2. Land and Resource Management Planning

Viability assessment is a part of the formal land and resource management planning process under the NFMA. Planning also follows process requirements for disclosure and public involvement set forth by the National Environmental Policy Act (NEPA). The Midewin is currently in the process of developing its first Land and Resource Management Plan (henceforth known as the Prairie Plan).

Six possible management scenarios, called “Alternatives” were drafted; after public review and comment under NEPA, one Alternative will be selected to become the Plan and thus guide future management at Midewin. Information from the CA’s was used in developing the draft Alternatives. Alternatives include statements about goals and objectives, and standards and guidelines. Goals are concise statements that describe the desired conditions expected to be achieved some time in the future. They are generally timeless and difficult to measure. Goals describe the ends to be achieved, rather than the means of doing so. Objectives are concise, time specific statements of measurable planned steps taken to accomplish a goal. Objectives are generally achieved by implementing a project or activity.

Standards are practices that must be followed or are required limits to activities designed to achieve goals and objectives. Site-specific deviations from standards must be analyzed and documented in prairie plan amendments. Guidelines are advisable actions that should be followed to achieve prairie goals and objectives. Deviations from guidelines must be analyzed during project level analysis and documented in a project decision document, but do not require plan amendments.

These goals and objectives, together with the standards and guidelines, were evaluated for their likely future effects on populations of the Midewin RFSS relative to each draft Alternative under consideration for the Plan. To aid in this evaluation, a panel of experts was convened and their opinions solicited.

2.3. Meeting protocols – The Expert Panel met with staff (USDA Forest Service and Illinois DNR) of Midewin National Tallgrass Prairie. The meeting was led by a facilitator. Prior to the meeting, Midewin sent a package of documents to each member of the Expert Panel consisting of:

- the draft of each CA for each Midewin RFSS, including a map showing both regional distribution and local presence at Midewin for each RFSS;
- a preliminary draft of the Land and Resource Management Plan for Midewin, including Goals and Objectives, Standards and Guidelines descriptions of desired future conditions;
- maps and descriptions of the six draft Alternatives for management of Midewin;
- maps showing potential habitat for each species or group of species under each draft Alternative, for the desired future condition that is expected to be realized in 100 yrs.;
- tabular summaries of acres of potential habitat under each draft Alternative;
- description of threats or limiting factors, mapped if possible, showing differences among draft Alternatives (where differences exist);
- panel protocols.

2.4. Collection of Expert Assessments – Based on information about the RFSS and the draft management Alternatives, panelists identified likely future conditions for populations of RFSS. The likely future conditions was selected from a set of Outcomes that provide an index of population abundance and distribution (see following section for the list of Outcome statements). Outcome determinations were made for historic and current time frames, and for future conditions 100 years hence under each draft Alternative. For each time frame and Alternative, panelists were asked to make judgments based on two spatial scales and using two different assumptions about factors that influence species (see following table). The first rating, "*Outcomes based on Midewin environmental conditions*", was based only on environmental conditions that are under the control of management, for the Midewin area. The second rating, "*Outcomes based on cumulative effects in the Central Till Plains Section*", represented the sum of all effects on species populations in the Central Till Plains Section, including air pollution, genetic factors, land use changes, and any other factor likely to affect population abundance and distribution.

Judgments to be made by Panelists for each Midewin RFSS		
Time frame	*Outcomes based on Midewin environmental conditions*	*Outcomes based on cumulative effects in Central Plains Section*
Historic condition	X	X
Current condition	X	X
100 yrs in the future for Alternative 1	X	X
100 yrs in the future for Alternative 2	X	X
100 yrs in the future for Alternative 3	X	X
100 yrs in the future for Alternative 4	X	X
100 yrs in the future for Alternative 5	X	X
100 yrs in the future for Alternative 6	X	X

Expert judgments about which Outcome(s) best describe population abundance and distribution were collected using a structured process. For each judgment, an Expert distributed 100 likelihood points across the five possible Outcomes. The individual outcomes represent points along a gradient ranging from (A) a condition which has a high likelihood of favorable population abundance and distribution, to (E) which has extremely unfavorable conditions of abundance and distribution and a high likelihood of extirpation. Any distribution of the 100 points was considered legitimate provided that all 100 points are used. Placing 100 points on a single outcome indicated great certainty in that outcome. Spreading the points among several outcomes indicated less certainty in any one of those outcomes. Complete uncertainty was represented by equal scores among all outcomes (20 points each). In addition to assigning likelihood points, panelists were asked to write their comments and rationale about reasons for their judgments.

The expert panels were held as one large group; however, not all panelists rendered judgments on all RFSS; they will only evaluated the species for which they consider themselves an expert. Panelists made their judgments independently after reviewing the information supplied by Midewin. Because of time limitations during the meeting, it was desirable for panelists to review the materials and make preliminary judgments prior to the actual meeting. Following the independent evaluations, panelists were asked to present the basis for their decisions, including identifying specific factors that led to a low likelihood assessment and how those factors might be altered to increase the likelihood of persistence. Based on information that surfaced during this discussion, panelists changed some of their ratings. Both scores were recorded. Consensus was not be an objective of this process and was not sought.

2.5. Outcome scales – Two sets of outcomes were used to assign likelihood points for judgments about abundance and distribution of populations of RFSS. Outcomes were provided by Richard Holthausen (National Wildlife Ecologist, USDA Forest Service) as adapted from ICBEMP publication (Quigley et al. 1997).

3. OUTCOMES BASED ON MIDEWIN ENVIRONMENTAL CONDITIONS

The first set of outcomes is based solely on the environmental conditions that would occur in the future under each Alternative. These outcomes were designed to provide statements about the abundance and distribution of suitable environments for each species at Midewin and to allow panelists to make inferences about the potential effects of these conditions on population abundance and distribution. Environmental outcomes, however, do not account for all factors that ultimately determine a species' realized population characteristics. Thus, environmental outcomes should be thought of as an index of the capability of the environment to support population abundance and distribution, but not as an actual prediction of population occurrence, size, density, or other demographic characteristics. For example, environmental outcomes may not account for spatially uniform and pervasive effects of interspecific competition, disease, predation, taking, pesticide effects, air pollution effects, current population status, and other effects beyond the control of managers.

> *Outcome A*. Suitable environments are broadly distributed and of high abundance across the historical range of the species. The combination of distribution and abundance of environmental conditions provides opportunity for continuous or nearly continuous intraspecific interactions for the species.
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> *Outcome B*. Suitable environments are either broadly distributed or of high abundance across the historical range of the species, but there are gaps where suitable environments are absent or only present in low abundance. However, the disjunct areas of suitable environments are typically large enough and close enough to permit dispersal among subpopulations and potentially to allow the species to interact as a metapopulation across its historical range.
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> *Outcome C*. Suitable environments are distributed frequently as patches and/or exist at low abundance. Gaps where suitable environments are either absent, or present in low abundance, are large enough that some subpopulations are isolated, limiting opportunity for species interactions. There is opportunity for subpopulations in most of the species range to interact as a metapopulation, but some subpopulations are so disjunct or of such low density that they are essentially isolated from other populations. For species for which this is not the historical condition, reduction in overall species range from historical may have resulted from this isolation.
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> *Outcome D.* Suitable environments are frequently isolated and/or exist at very low abundance. While some of the subpopulations

associated with these environments may be self-sustaining, there is limited opportunity for population interactions among many of the suitable environmental patches. For species for which this is not the historical condition, reduction in overall species range from historical may have resulted from this isolation.

Outcome E. Suitable environments are highly isolated and exist at very low abundance, with little or no possibility of population interactions among suitable environmental patches, resulting in strong potential for extirpations within many of the patches, and little likelihood of re-colonization of such patches. There has likely been a reduction in overall species range from historical, except for some rare, local endemics that may have persisted in this condition since the historical period.

4. OUTCOMES BASED ON CUMULATIVE EFFECTS IN CENTRAL TILL PLAINS SECTION:

The second set of outcomes is based on the cumulative effects of all influences, both at Midewin and on all other lands in the Central Till Plains Section. It includes habitat and environmental conditions and all other factors that affect species. Examples of these other influences include spatially uniform, pervasive effects of interspecific interactions, disease, predation, illegal taking, pesticide effects, air pollution effects, and population factors. In particular, low population size, which may be brought about by Allee effects (from animal biology, the tendency of breeding individuals in small, isolated populations to have difficulty finding each other) or other factors that cause populations to be much smaller than the environment might otherwise support, may be an important factor in the projection of population outcomes.

Outcome A. The combination of environmental and population conditions provides opportunity for the species to be broadly distributed and of high abundance across its historical range. There is potential for continuous or nearly continuous intraspecific interactions at high population size.

Outcome B. The combination of environmental and population conditions provide opportunity for the species to be broadly distributed and/or of high abundance across its historical range, but there are gaps where populations are potentially absent or present only in low density as a result of environmental or population conditions. However, the disjunct areas of higher potential population density are typically large enough and close enough to other subpopulations to permit dispersal among subpopulations and potentially to allow the species to interact as a metapopulation across its historical range.

Outcome C. The combination of environmental and population conditions restrict the potential distribution of the species, which is characterized by patchiness and/or areas of low abundance. Gaps where the likelihood of population occurrence is low or zero, are large enough that some subpopulations are isolated, limiting opportunity for species interactions. There is opportunity for subpopulations in most of the species range to interact as a metapopulation, but some subpopulations are so disjunct or of such low density that they are essentially isolated from other populations. For species for which this is not the historical condition, reduction in overall species range from historical may have resulted from this isolation.

Outcome D. The combination of environmental and population conditions restrict the potential distribution of the species, which is characterized by areas with high potential for population isolation and/or very low potential abundance. While some of these subpopulations may be self-sustaining, gaps where the likelihood of population occurrence is low or zero are large enough that there is limited opportunity for interactions among them. For species for which this is not the historical condition, reduction in overall species range from historical has likely resulted from this isolation.

Outcome E. The combination of environmental and population conditions restricts the potential distribution of the species, which is characterized by high levels of isolation and very low potential abundance. Gaps where the likelihood of population occurrence is low or zero are large enough there is little or no possibility of interactions, strong potential for extirpations, and little likelihood of recolonization. There has likely been a reduction in overall species range from historical, except for some rare, local endemics that may have persisted in this condition since the historical period.

Panelists were advised that some outcomes may not be applicable to all taxa. For example, many amphibians occur naturally in a localized or patchy distribution, and thus, never would occur in the conditions described as Outcome A or Outcome B or Outcome C. This point was emphasized to avoid a potential tendency to consider the “best possible” outcome for each taxon to be Outcome A.

4.1. Factors considered in judgments - As noted earlier, panelists were asked to make a judgment based on environmental conditions at Midewin and a cumulative effects judgment for the Central Till Plains Section. The Midewin judgment, "*Outcomes based on Midewin environmental conditions*", was based on species' response to the following factors:

1) amount and distribution of environmental conditions controlled by management at Midewin, including habitat, human use levels, and infrastructure;
2) severe population decline associated with environmental conditions (see definition).

Panelists based the cumulative effects judgment, "*Outcomes based on cumulative effects in Central Till Plains Section*", on likely population response to all of the following factors:

1) current population status;
2) environmental conditions at Midewin and elsewhere in Central Till Plains Section;
3) severe population decline associated with habitat;
4) environmental stochasticity and natural catastrophes;
5) effects not controlled by management, such as global warming.

Panelists utilized the written Conservation Assessments and draft cumulative effects analysis for the Draft EIS, as well as relying on personal knowledge in making judgments.

4.2. Definitions - The following definitions were used to help assure consistent interpretations.

<u>Effects not controlled by management:</u> All influences on the species population that are not the direct result of resource management. Examples would include illegal taking, indirect pesticide effects, air and water pollution, and urbanization or other land use changes.

<u>Severe population decline associated with environmental conditions</u>**:** This factor is included to reflect any bottleneck events caused by habitat reduction that are likely to occur prior to the specified time of the judgment, and which would influence the likelihood that the species population would still respond (in a predictable way, and at the specified time of the judgment), to habitat availability.

<u>Environmental stochasticity and natural catastrophes:</u> This factor is included to reflect random environmental variation that would influence the likelihood of species attaining the specified outcomes. Such random variation could result from variations in climate and random effects of disturbance (such as, fire, insect activity, or wind).

Panelists' judgments considered the way that populations of a species may respond to these factors based on its life history characteristics. Life history characteristics include demographic characteristics, responses to varying qualities of habitat for specific life functions, types and ranges of seasonal and permanent movements, genetic characteristics, and biotic interactions (such as, competition, predation, and herbivory).

4.3. Analysis of the judgments - Two primary analyses were performed on the data derived from the expert panel. First, we calculated the mean likelihood scores for all expert judgments, by Outcome, for each RFSS. For example, if there were four expert judgments for a particular RFSS, and the likelihood assessments for Outcome B for that species are: 30, 30, 60, and 40, then the mean likelihood score would be 40. These mean likelihood scores were calculated for each species-Outcome judgment, and tables displaying these species-Outcome means were developed. This information is available in the Planning Record at the Midewin office.

We also calculated a weighted mean outcome, which was used to provide a single number for comparing likelihood among draft Alternatives and time frames. The weighted mean likelihood were calculated by:

- assigning a value to each of the outcome categories (Outcome A, value = 1; Outcome B, value = 2; etc.);
- multiplying the mean likelihood of that outcome by its assigned value;
- adding these products for all outcomes;
- dividing by 100.

For instance, consider the following example:

Outcomes	**Alternative 1**	**Alternative 2**
Outcome A	0	0
Outcome B	0	0
Outcome C	40	3
Outcome D	50	63
Outcome E	10	34
TOTAL	100	100

To determine the weighted mean for Alternative 1, calculate the following: [(0 × 1) + (0 × 2) + (40 × 3) + (50 × 4) + (10 × 5)]/100 = (370)/100 = 3.7. Implementing Alternative 1 would have a weighted mean outcome most close to Outcome D.

To determine the weighted mean for Alternative 2, calculate the following: [(0 × 1) + (0 × 2) + (3 × 3) + (63 × 4) + (34 × 5)]/100 = (431)/100 = 4.3. In this example, Alternative 2 would have a weighted mean outcome most close to Outcome D, but slightly more unfavorable than the weighted mean outcome for Alternative 1. These weighted means provide an index that allows Midewin to make comparisons among the Alternatives.

Weighted mean outcome classes were used. The five classes are:

1) Outcome A includes weighted means from 1.00 to < 1.50
2) Outcome B includes weighted means from 1.50 to < 2.50
3) Outcome C includes weighted means from 2.50 to < 3.50
4) Outcome D includes weighted means from 3.50 to < 4.50
5) Outcome E includes weighted means from 4.50 to 5.00.

We assessed uncertainty around the weighted mean outcome scores by calculating the standard deviation (S.D.) of the distribution of likelihood points among the outcome classes for each species and each draft Alternative:

$$\text{S. D.} = [\{\text{summation } f_i x_i^2 - [(\text{summation } f_i x_i)^2/n]\}/(n-1)]^{1/2}$$

where
f_i = likelihood in Outcome i;
i = 1, 2, 3, 4, or 5;
x_i = numerical outcome i;
n = 100 (likelihood points).

Uncertainty of the results included two components, (1) the variation of likelihood distributions among panelists and (2) the range of likelihood point outcome assessments by each panelist. Uncertainty was low if panelists provided similar ratings, and if likelihoods were assigned to one outcome. One standard deviation is considered an expected amount of uncertainty in outcome scores. The distribution of outcomes is on five discrete values, and therefore, is not continuous, and standard deviations were smaller when outcome likelihood is distributed at the extremes of the distribution (that is, Outcomes A or E).

4.4. Interpretation, Limitations, and Assumptions of the Analysis of the Panel Ratings

4.4.1. Interpretation of results - The analysis of the outcome assessments of the Expert Panel provided a simple determination of what does and does not constitute a "viable" population. There are not simple thresholds for viability, particularly when assessments are done on a broad array of taxa. Rather than providing a simple determination, the analysis described likely future conditions for populations of species and provided a comparison of those conditions to current and historic conditions.

Interpretation of the outcome assessments emphasizes a comparison of the projected future conditions under the draft Alternatives to the historic and current conditions. Projected future conditions that produce outcomes similar to historic conditions will generally be considered to be favorable. Similarly, projected future conditions that result in improvements from current conditions were considered favorable, especially where current conditions are below historic conditions. Projected future conditions that result in declines from current conditions were viewed as unfavorable, particularly if they indicate a significant increase in the likelihood that local populations will be isolated. Any projected change that resulted in a strong likelihood of species extirpation from a large portion of its range was viewed as a serious concern.

Interpretation of results included a consideration of uncertainty. One measure of uncertainty is the standard deviation of the frequency distribution of likelihood among the outcome classes for each species.

4.4.2. Limitations of the analysis - A variety of cautions must be applied to the interpretation of this analysis. These cautions fall into four areas: (1) broad geographic and time scale of the analysis; (2) lack of site specificity in Plan prescriptions and standards and guidelines; (3) limitations on ability to infer population results from habitat and other management effects; and (4) gaps in knowledge. These are briefly discussed below.

1) The scope of this analysis covers the entire Midewin. For some species, it is possible that conditions within some smaller areas could be much better than the composite, and in others they could be worse. This could have negative effects on a species' distribution that could not be predicted from the data reviewed here.

2) The scale of resolution of the planning guidance (that is, standards and guidelines, and prescriptions) given under each of the draft Alternatives limit the reliability of the analysis. Plans are programmatic, rather than site-specific, and do not contain detailed prescriptions for management actions, or detailed information on how management actions and habitats would be distributed geographically across the landscape. As a consequence, much of this analysis was based on the intent of the draft Alternatives, rather than on specific provisions. If one of the draft Alternatives is chosen as the Plan, additional analyses and guidance will be needed to design management actions that are consistent with the intent of the draft Alternative and that would achieve the outcomes projected here.

3) The third caution relates to our ability to infer population consequences from habitat assessments and assessments of other management effects (e.g. human presence). This caution is particularly strong for species whose populations are small and/or poorly distributed across the landscape. Conclusions on trends of habitats, particularly when extended to inferring potential effects on species, must be treated as tentative working hypotheses. The lack of specific data on population size, structure, and functional and numerical responses, requires that much inference be made from changes in habitat abundance and gross distribution patterns. Actual population response might differ.

4) The final caution relates to gaps in knowledge. Many of the species assessed here are poorly studied and not well understood. Their distribution, habitat associations, biotic interactions, and demographic statuses and characteristics are not well known. Likewise, successional dynamics and system interactions are incompletely understood for many vegetation types, and natural, large-scale disturbances cannot be accurately predicted. Projection reliability is reduced by these gaps in knowledge.

4.4.3. Assumptions used in analysis - As explained in the preceding "Limitations of analysis" section, some facets of the draft Alternatives were not clear, or were not spatially explicit at this level of planning. In some situations, the Midewin Planning Team had to make reasonable assumptions about the intent of the Alternatives and the judgments. The following major assumptions were for analysis of the outcome assessments of the Expert Panel:

1) Activities scheduled for the first 10 years of plan implementation will result in trends toward the desired future condition.

2) Consideration of plant and animal species will be a key component of the ecosystem analysis process used to implement the selected Alternative. Habitat needs of species will be used to help shape specific prescriptions and the scheduling and location of activities. Such considerations will be part of all prescriptions, including those designed to accomplish restoration objectives. A key consideration of ecosystem analysis will be projected changes in the availability of specific habitats through time, all of which should increase due to restoration activities.

3) Appropriate vegetation patterning will be a key objective of restoration activities. Historic patterns of vegetative dispersion and juxtaposition will be used to establish stand and landscape objectives for vegetative restoration. Such considerations are particularly important where historic prairie, savanna, and woodland conditions included a fine-scale mix of different prairie, savanna and woodland seral stages.

4) Restoration activities will be directed at all appropriate vegetation types, with priorities based on ecosystem analysis and as specified in the Midewin Land and Resource Management Plan.

5) Restoration activities that are well studied and well understood will be pursued according to similar time lines under all draft Alternatives except for Alternative 1, which calls for no actions.

6) Conservation strategies will be applied in any Alternative.
For their assessments, the experts had preliminary versions of Alternative 1-6. It is not likely that the small adjustments made in the alternatives presented here would have made any difference in panel ratings.

5. Overview--Analysis of all Alternatives and Sensitive Species.

5.1. Outcomes For Midewin National Tallgrass Prairie

Examining the outcomes of the alternatives on each species turned up three distinct groups of sensitive species: those species where the outcomes were basically the same across all action alternatives, those species where the alternatives 5 and 6 were the most favorable and those where alternatives 2 and 3 were the most favorable. Four species fell into the group where alternatives 2 and 3 were most favorable. Sixteen species fell into the group where alternatives 5 and 6 were most favorable. Eight species fell into the group where the alternatives were all essentially the same. See the table below.

Breakdown of Sensitive Species by Most Favorable Action Alternative

Group 1 Alternatives 2 & 3	**Group 2** Alternatives 5 & 6	**Group 3** Alternatives 2-6
Short-eared Owl Bobolink Loggerhead Shrike Upland Sandpiper	Henslow' Sparrow Northern Harrier Eryngium Root-borer Blazing Star Stem Borer Red-veined Leafhopper Hairy Valerian Earleaf Foxglove Hill's Thistle Eastern White-fringed Orchid Pitcher's Stitchwort Crawe's Sedge Glade Mallow Blanding's Turtle King Rail Least Bittern Plains Leopard Frog	Leafy Prairie Clover Butler's Quillwort False Mallow Sullivant's Coneflower Cerulean Warbler American Ginseng[1] Goldenseal[1] Ellipse

[1] These two species might also fit in Group 2 (alternative 6 tends to be a little more favorable, but the remaining are alternatives are very similar.

Habitat acreages for group 3 species are identical and managed similarly through the action alternatives, hence identical rankings for each species. This group doesn't need to be analyzed further; any of the action alternatives are optimal.

Group 2 species are all related to native vegetation habitat restoration either typic prairie, dolomite prairie or wetland. The larger the amount of appropriate habitat available the more optimal the alternative for each species. Alternative 6 has the greatest amount of restoration, with alternative 5 usually equal or a very close second for various reasons usually dependent upon visitor access. Some of these species, primarily the insects and plants aren't as dependant upon large areas of habitat as the others. Large viable populations (possibly in the thousands or larger) of these species can be more readily maintained on smaller areas. Henslow's sparrow and the northern harrier are area sensitive and need large areas (550 acres for Henslow's sparrow) to even maintain small viable populations. In the case of northern harrier, Midewin could probably only support 2-3 pairs. Henslow's sparrow population that could be supported on Midewin might number in the hundreds. The wetland species fall somewhere in between, they need a number of wetlands, typically a complex of wetland and uplands.

Group 1 species are all dependent upon the availability of grassland (non-native) habitat. Alternative 2 has the largest amount of grassland habitat. These species are area sensitive and need large areas to even maintain small viable populations similarly to the grassland birds in group 2. For example, upland sandpipers' habitat is best managed in blocks of 1,235 acres of unfragmented habitat.

Groups 1 and 2 present a problem, choosing an alternative that is most favorable for one group will likely be least favorable for the other group. Although there are fewer species affected by making an either or decision in group 1, the species in group 1 are probably most area sensitive. The only way around this dilemma is to find an alternative which will provide a compromise where both groups can be maintain viable populations although it won't be the most ideal alternative for any of the species in group 1 or group 2.

Alternative 4, based upon the expert panel ratings and opinions of the biologists at Midewin seems to be the best compromise to provide viable populations for all the sensitive species that would be capable of sustaining viability at Midewin. Some species like the Cerulean Warbler, will never have a viable population at Midewin, there just isn't enough habitat.

5.2. Outcomes For Central Till Plains Section

Examining the outcomes of the alternatives on each species again turned up three distinct groups of sensitive species: those species where the outcomes were basically the same across all action alternatives, those species where the alternatives 5 and 6 were the most favorable and those where alternatives 2 and 3 were the most favorable. Some of the species have changed category. See the table below.

Group 1 Alternatives 2 & 3	**Group 2** Alternatives 5 & 6	**Group 3** Alternatives 2-6
Loggerhead Shrike Upland Sandpiper Bobolink	Leafy Prairie Clover False Mallow Earleaf Foxglove Hill's Thistle Eastern Prairie White-fringed Orchid American Ginseng Goldenseal Blanding's Turtle King Rail Plains Leopard Frog Henslow's Sparrow Northern Harrier	Butler's Quillwort Pitcher's Stichwort Crawe's Sedge Sullivant's Coneflower Hairy Valerian Glade Mallow Cerulean Warbler Least Bittern Short-eared Owl Red-veined Leafhopper *Eryngium* Root-borer Blazing Star Stem-borer Ellipse

The panelists with only one slight exception felt Midewin would make little difference within the Central Till Plains Section. So for the most part there would be no difference between the alternatives. The panelists felt there might be some positive impact from Midewin with the loggerhead shrike. The biologists at Midewin take a little more optimistic view and think Midewin might make a difference because of the large size of the restoration work. Based on the groupings, alternative 4 continues to be a good compromise.