State Rank Criteria for
Montana Animal Species of Concern

The ranking criteria described below have been used by the Montana Natural Heritage Program, Montana Department of Fish, Wildlife, and Parks, and other species experts to develop state ranks for animal species in Montana since 2004. Detailed definitions and guidance for use are provided for each criterion below and state ranks are calculated from these criterion using the process described in Appendix A.

This methodology has been adapted for Montana from a process developed and proposed by scientists at NatureServe (the international affiliate for natural heritage programs), as documented in:

Master, L. L., L. E. Morse, A. S. Weakley, G. A. Hammerson, and D. Faber-Langendoen. 2003. NatureServe Conservation Status Assessment Criteria. NatureServe, Arlington, Virginia, U.S.A.

CONSERVATION CRITERIA

Population Size
Enter the code for the estimated current naturally occurring wild total population of the species within Montana. Count or estimate the number of individuals of reproductive age or stage (at an appropriate time of the year), including mature but currently non-reproducing individuals.

Guidance, consider the following points (from IUCN 2000) when estimating population numbers:
* *Mature individuals that will never produce new recruits should not be counted (e.g., densities are too low for fertilization) [But see note below regarding long-persisting nonreproductive clones.]*
* *In the case of populations with biased adult or breeding sex ratios it is appropriate to use lower estimates for the number of mature individuals, which take this into account (e.g., the estimated effective population size).*
* *Where the population size fluctuates use a lower estimate. In most cases this will be much less than the mean.*
* *Reproducing units within a clone should be counted as individuals, except where such units are unable to survive alone (e.g., corals).*
* *In the case of taxa that naturally lose all or a subset of mature individuals at some point in their life cycle, the estimate should be made at the appropriate time, when mature individuals are available for breeding.*
* *Re-introduced individuals must have produced viable offspring before they are counted as mature individuals*
Also consider:
* For species that produce more than one generation per year, use the size of the smallest annual reproducing generation in estimations.
* For seed-banking plants or other intermittently obvious organisms, consider population size to be the number of mature individuals in a typical "good" year, but not a "poor" year or an extraordinarily productive year. Although data will rarely be available, population size for such species should be conceptually considered the median of the population over a 10-year or 3-generation (whichever is longer) time span.

- For clone-forming organisms that persist or spread locally but rarely if ever reproduce, consider the population size to be the number of distinct, self-maintaining clonal patches (approximating the number of genets), rather than the number of physiologically separate individuals (ramets).

Select from the following values:
    Z = Zero, no individuals known extant
    A = 1-50 individuals
    B = 50-250 individuals
    C = 250-1,000 individuals
    D = 1,000-2,500 individuals
    E = 2,500-10,000 individuals
    F = 10,000-100,000 individuals
    G = 100,000-1,000,000 individuals
    H = >1,000,000 individuals
    U = Unknown
    Null = Rank factor not assessed

Range Extent / Area of Occupancy
Range extent is described by IUCN (2001) for taxa:

Extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary that can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy. This measure may exclude discontinuities or disjunctions within the overall distribution of a taxon (e.g. large areas of obviously unsuitable habitat) (but see 'area of occupancy').

Area of occupancy is described by IUCN (2001) for taxa as:

Area of occupancy is defined as the area within its 'extent of occurrence' (see definition), which is occupied by a taxon, excluding cases of vagrancy. The measure reflects the fact that a taxon will not usually occur throughout the area of its extent of occurrence, which may contain unsuitable or unoccupied habitats. In some cases (e.g. colonial nesting sites, feeding sites for migratory taxa) the area of occupancy is the smallest area essential at any stage to the survival of existing populations of a taxon. The size of the area of occupancy will be a function of the scale at which it is measured, and should be at a scale appropriate to relevant biological aspects of the taxon, the nature of threats and the available data.

Figure 1 illustrates the differences between range extent and area of occupancy.
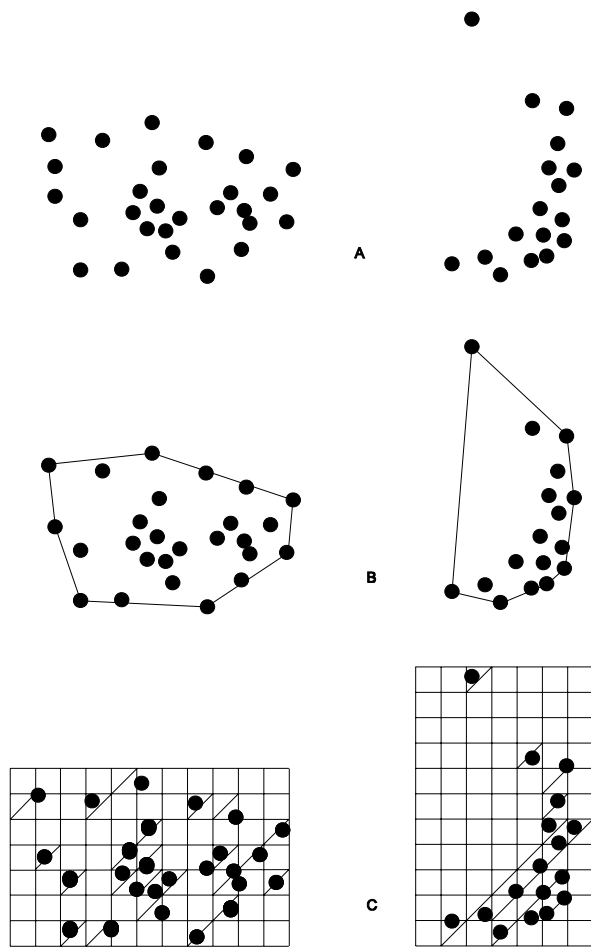

Figure 1. *Two examples of the distinction between range extent and area of occupancy. (A) Is the spatial distribution of known, inferred or projected sites of present occurrence. (B) Shows one possible boundary to the range extent, which is the measured area within this boundary using a minimum convex polygon.* [Note that Burgman and Fox (2001) strongly recommend the use of α-hulls rather than minimum convex polygons to estimate range extent as otherwise significant overestimates (e.g., right side of example B) may result.] *(C) Shows one measure of area of occupancy, which can be achieved by the sum of the occupied grid squares.*

(From IUCN 2001)

Range Extent
Enter the code that best describes the estimated current range of the species in Montana. See below for definitions of range extent (extent of occurrence) and for contrast of this with area of occupancy.

Select from the following values:
- Z = Zero (no occurrences believed extant)
- A = <100 km^2 (less than about 40 square miles)
- B = 100-250 km^2 (about 40-100 square miles)
- C = 250-1,000 km^2 (about 100-400 square miles)
- D = 1,000-5,000 km^2 (about 400-2,000 square miles)
- E = 5,000-20,000 km^2 (about 2,000-8,000 square miles)
- F = 20,000-200,000 km^2 (about 8,000-80,000 square miles)
- G = 200,000-2,500,000 km^2 (about 80,000-1,000,000 square miles)
- U = Unknown
- Null = Rank factor not assessed

Area of Occupancy
Determine the code for the estimated current area of occupancy of the species in Montana. See above for differences between area of occupancy and range extent.

For species in linear habitats (e.g., riverine shoreline, or cliff-edge species), enter the code for the total length of all currently occupied habitat segments. Where better information is lacking, area can be estimated from a linear dimension by assuming an appropriate average width *(e.g.,* 100 meters) for a linear habitat. If information on both occupied area and occupied length is available, use the one that results in the more restrictive value, but provide information on both in the comments field.

For migratory species, enter the code (area or length) that reflects the current area of occupancy (or length of occupied area) at the time of the year when occupancy is most restricted.

Select from the following values:
Area:

Z = Zero (no occurrences believed extant)
A = <0.4 km^2 (less than about 100 acres)
B = 0.4-4 km^2 (about 100-1,000 acres)
C = 4-20 km^2 (about 1,000-5,000 acres)
D = 20-100 km^2 (about 5,000-25,000 acres)
E = 100-500 km^2 (about 25,000-125,000 acres)
F = 500-2,000 km^2 (about 125,000-500,000 acres)
G = 2,000-20,000 km^2 (500,000-5,000,000 acres)
H = >20,000 km^2 (greater than 5,000,000 acres)
U = Unknown
Null = Rank factor not assessed

Length:

LZ = Zero (no occurrences believed extant)
LA = <4 km (less than about 2.5 miles)
LB = 4-40 km (about 2.5-25 miles)
LC = 40-200 km (about 25-125 miles)
LD = 200-1,000 km (about 125-620 miles)
LE = 1,000-5,000 km (about 620-3,000 miles)
LF = 5,000-20,000 km (about 3,000-12,500 miles)
LG = 20,000-200,000 km (about 12,500-125,000 miles)
LH = >200,000 km (greater than 125,000 miles)
LU = Unknown
Null = Rank factor not assessed

Long-term Trend
Enter the code that best describes the observed, estimated, inferred, or suspected degree of change in population size, extent of occurrence, area of occupancy, and/or number or condition of occurrences over the long term (ca. 200 years) in Montana. Specify in the comment field the time period for the change noted, as well as a longer-term view (e.g., back to European exploration) if information is available. If there are data on more than one aspect, specify which aspect is most influential.

Select from the following values:

      A = Very Large Decline (decline of >90%, with <10% of population size, range extent, area occupied, and/or number or condition of occurrences remaining)
      B = Large Decline (decline of 75-90%)
      C = Substantial Decline (decline of 50-75%)
      D = Moderate Decline (decline of 25-50%)
      E = Relatively Stable ($\pm$25% change)
      F = Increase (increase of >25%)
      U = Unknown. Long-term trend in population, range, area occupied, or number or condition of occurrences unknown
      Null = Rank factor not assessed

Short-term Trend
Enter the code that best describes the observed, estimated, inferred, suspected, or projected short-term trend in population size, extent of occurrence, area of occupancy, whichever most significantly affects the rank in Montana. Consider short-term historical trend within 10 years or 3 generations (for long-lived species), whichever is the longer (up to a maximum of 100 years.

The trend may be recent, current, or projected (based on recent past), and the trend may or may not be known to be continuing. Trends may be smooth, irregular or sporadic. Fluctuations will not normally count as trends, but an observed change should not be considered as merely a fluctuation rather than a trend unless there is evidence for this.

Specify what is known about various pertinent trends in the comment field, including trend information for particular factors, more precise information, regional trends, etc. Also comment, if known, on whether the causes of decline, if any, are understood, reversible, and/or ceased. If the trend is known not to be continuing, specify that in comments.

Select from the following values:

      A = Severely Declining. Decline of >70% in population, range, area occupied, and/or number or condition of occurrences
      B = Very Rapidly Declining. Decline of 50-70% in population, range, area occupied, and/or number or condition of occurrences
      C = Rapidly Declining. Decline of 30-50% in population, range, area occupied, and/or number or condition of occurrences
      D = Declining. Decline of 10-30% in population, range, area occupied, and/or number or condition of occurrences
      E = Stable.   Population, range, area occupied, and/or number or condition of occurrences unchanged or remaining within $\pm$10% fluctuation
      F = Increasing. Increase of >10% in population, range, area occupied, and/or number or condition of occurrences
      U = Unknown. Short-term trend in population, range, area occupied, and number and condition of occurrences unknown.
      Null = Rank factor not assessed

Threats (Severity, Scope, and Immediacy)
Indicate the degree to which the species is observed, inferred, or suspected to be directly or indirectly threatened in Montana (or throughout its range if it affects persistence in Montana) in the next 15 to 20 years. Use this field to evaluate the impact of extrinsic threats, which typically are anthropogenic but may be natural. The impact of human activity may be direct (e.g., destruction of habitat) or indirect (e.g., invasive species introduction). Effects of natural phenomena (e.g., fire, hurricane, flooding) may be especially important when the species is concentrated in few locations. Characteristics of the species that make it inherently susceptible to threats should be considered under the rank factor Intrinsic Vulnerability.

Threats considerations apply to the present and the future. Effects of past threats (whether or not continuing) should be addressed instead under the short-term trend and/or long-term trend factors. For species known only historically in the area of interest, but with significant likelihood of rediscovery in identifiable areas, current or foreseeable threats in those areas may be addressed here where appropriate if they would affect any extant (but unrecorded) occurrences of the species.

Threats may be observed, inferred, or projected to occur in the near term. They should be characterized in terms of severity (how badly and irreversibly the species population is affected), scope (what proportion of it is affected), and degree of imminence (how likely the threat is and how soon is it expected). "Magnitude" is sometimes used to refer to scope and severity collectively.

Consider threats collectively, and for the foreseeable threat with the greatest magnitude (severity and scope combined), rate the severity, scope, and immediacy each as High, Moderate, Low, Insignificant, or Unknown, as briefly defined below. Identify in the comment field the threat to which severity, scope, and immediacy pertains, and discuss additional threats identified, or interactions among threats, including any high-magnitude threats considered insignificant in immediacy.

Severity
High: Loss of species population (all individuals) or destruction of species habitat in area affected, with effects essentially irreversible or requiring long-term recovery (>100 years).
Moderate: Major reduction of species population or long-term degradation or reduction of habitat in Montana, requiring 50-100 years for recovery.
Low: Low but nontrivial reduction of species population or reversible degradation or reduction of habitat in area affected, with recovery expected in 10-50 years.
Insignificant: Essentially no reduction of population or degradation of habitat or ecological community due to threats, or populations, habitats, able to recover quickly (within 10 years) from minor temporary loss. Note that effects of locally sustainable levels of hunting, fishing, logging, collecting, or other harvest from wild populations are generally considered Insignificant as defined here.

Scope
High: > 60% of total population or area affected
Moderate: 20-60% of total population or area affected
Low: 5-20% of total population or area affected
Insignificant: < 5% of total population or area affected

Immediacy
High: Threat is operational (happening now) or imminent (within a year).
Moderate: Threat is likely to be operational within 2-5 years.
Low: Threat is likely to be operational within 5-20 years.
Insignificant: Threat not likely to be operational within 20 years.

The system will calculate a rank factor value of A, B, C, D, E, F, or G, as shown in Table 2 below. If two of the three parameters are known, the rank factor value will be calculated by treating the unknown (or not assessed [null]) parameter as "Low." If only one of the rank factors is rated (as High, Moderate, or Low), the resulting rank factor value will be "U" (unknown). If any of the three factors are considered "Insignificant," the resulting rank factor will be "H" (unthreatened)."

Threat values, calculated from scope, severity, and immediacy, or unknown, may be considered as follows.

A = Substantial, imminent threat. Threat is moderate to severe and imminent for most (> 60%) of the population or area.
B = Moderate and imminent threat. Threat is moderate to severe and imminent for a significant proportion (20-60%) of the population or area.
C = Substantial, non-imminent threat. Threat is moderate to severe but not imminent (> 10 years) for most of the population or area.
D = Moderate, non-imminent threat. Threat is moderate to severe but not imminent for a significant portion of the population or area.
E = Localized substantial threat. Threat is moderate to severe for a small but significant proportion of the population or area.
F = Widespread, low-severity threat. Threat is of low severity but affects (or would affect) most or a significant portion of the population or area.
G = Slightly threatened. Threats, while recognizable, are of low severity, or affecting only a small portion of the population or area.
H = Unthreatened. Threats if any, when considered in comparison with natural fluctuation and change, are minimal or very localized, not leading to significant loss or degradation of populations or area even over a few decades' time. (Severity, scope, and/or immediacy of threat considered Insignificant.)
U = Unknown. The available information is not sufficient to assign degree of threat as above. (Severity, scope, and immediacy are all unknown, or mostly [two of three] unknown or not assessed [null].)
Null = Rank factor not assessed, including instances in which the species is extinct (or extirpated from the area of interest).

Table 2. Calculation of Threats factor values from values for Severity, Scope, and Immediacy subfactors.

SEVERITY	SCOPE	IMMEDIACY	VALUE	DESCRIPTION
High	High	High	= A	Moderate to severe, imminent threat for most (>60%) of population, occurrences, or area
High	High	Moderate		
Moderate	High	High		
Moderate	High	Moderate		
High	Moderate	High	= B	Moderate to severe, imminent threat for a significant proportion (20-60%) of population, occurrences, or area
High	Moderate	Moderate		
Moderate	Moderate	High		
Moderate	Moderate	Moderate		
High	High	Low	= C	Moderate to severe, non-imminent threat for most of population, occurrences, or area
Moderate	High	Low		
High	Moderate	Low	= D	Moderate to severe, non-imminent threat for a significant proportion of population, occurrences, or area
Moderate	Moderate	Low		
High	Low	High	= E	Moderate to severe threat for small proportion of population, occurrences, or area
High	Low	Moderate		
High	Low	Low		
Moderate	Low	High		
Moderate	Low	Moderate		
Moderate	Low	Low		

Low	High	High		
Low	High	Moderate		
Low	High	Low	= F	Low severity threat for most or significant proportion of population, occurrences, or area
Low	Moderate	High		
Low	Moderate	Moderate		
Low	Moderate	Low		
Low	Low	High		
Low	Low	Moderate	= G	Low severity threat for a small proportion of population, occurrences, or area
Low	Low	Low		

Intrinsic Vulnerability

Enter the appropriate letter code for the observed, inferred, or suspected degree to which intrinsic or inherent factors of the species (such as life history or behavior characteristics of species) make it vulnerable or resilient to natural or anthropogenic stresses or catastrophes. Examples of such factors include reproductive rates and requirements, time to maturity, dormancy requirements, and dispersal patterns.

Since geographically or ecologically disjunct or peripheral populations may show additional vulnerabilities not generally characteristic of the species, these factors are to be assessed for the species throughout the area of interest, or at least for its better populations. Do not consider here such topics as population size, number of occurrences, area of occupancy, extent of occurrence, or environmental specificity; these are addressed as other ranking factors.

Note that the intrinsic vulnerability factors exist independent of human influence, but may make the species more susceptible to disturbance by human activities. The extent and effects of current or projected extrinsic influences themselves should be addressed in the Threat comments field.

Describe the reasons for your selection in the Intrinsic Vulnerability Comments field.

Select from the following values:

A = Highly Vulnerable. Species is slow to mature, reproduces infrequently, and/or has low fecundity such that populations are very slow (> 20 years or 5 generations) to recover from decreases in abundance; or species has low dispersal capability such that extirpated populations are unlikely to become reestablished through natural recolonization (unaided by humans).

B = Moderately Vulnerable. Species exhibits moderate age of maturity, frequency of reproduction, and/or fecundity such that populations generally tend to recover from decreases in abundance over a period of several years (on the order of 5-20 years or 2-5 generations); or species has moderate dispersal capability such that extirpated populations generally become reestablished through natural recolonization (unaided by humans).

C = Not Intrinsically Vulnerable. Species matures quickly, reproduces frequently, and/or has high fecundity such that populations recover quickly (< 5 years or 2 generations) from decreases in abundance; or species has high dispersal capability such that extirpated populations soon become reestablished through natural recolonization (unaided by humans).

U = Unknown

Null = Rank factor not assessed

Environmental Specificity

Enter the appropriate letter code for the observed, inferred, or suspected vulnerability or resilience of the species due to habitat preferences or restrictions or other environmental specificity or generality. Describe the reasons for your selection in the Environmental Specificity field. Indicate in the comment field why environmental specificity affects vulnerability. This factor is most important when the number of populations and the range extent or area of occupancy are largely unknown.

Select from the following values:

A = Very Narrow. Specialist. Specific habitat(s), substrate(s), food type(s), hosts, breeding/nonbreeding microhabitats, or other abiotic and/or biotic factor(s) are used or required by the Element in the area of interest, with these habitat(s) and/or other requirements furthermore being scarce within the generalized range of the species within the area of interest, and, the population (or the number of breeding attempts) expected to decline significantly if any of these key requirements become unavailable.

B = Narrow. Specialist. Specific habitat(s) or other abiotic and/or biotic factors (see above) are used or required by the Element, but these key requirements are common and within the generalized range of the species within the area of interest.

C = Moderate. Generalist. Broad-scale or diverse (general) habitat(s) or other abiotic and/or biotic factors are used or required by the species but some key requirements are scarce in the generalized range of the species within the area of interest.

D = Broad. Generalist. Broad-scale or diverse (general) habitat(s) or abiotic and/or biotic factors are used or required by the species, with all key requirements common in the generalized range of the species in the area of interest. If the preferred food(s) or breeding/nonbreeding microhabitat(s) become unavailable, the species switches to an alternative with no resulting decline in numbers of individuals or number of breeding attempts.

U = Unknown

Null = Rank factor not assessed

Other Considerations
Provide and comment on any other information that should be considered in the assignment of a conservation status rank, especially when the status rank resulting from the overall assessment is different from the rank that the values for the formal status factors, taken alone, would suggest. This (text only) field may also be used for other general notes pertinent to multiple factors.

The following are some examples of Other Considerations:

- Preliminary rank assessment does not necessarily reflect current status, since the rank was done by inspection from review of published distribution and habitat information, or museum collection information.

- A population viability analysis may indicate that the species has x percent probability of surviving for y years (or an equivalent number of generations) in the same area of interest (globe, nation, or subnation).

Appendix A.

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CONSERVATION STATUS FOR SPECIES:
A RULE- AND POINT-BASED PROCESS FOR RANK ASSIGNMENT

Adopted for Montana from a draft by– L. Master & T. Regan– 17 November 2001

A Quantitative approximation to assigning Heritage Ranks

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The method for determining an SRank is a hybrid of rule based approaches and point scoring techniques. The method incorporates unknown data. To determine an Srank, first determine what information is available for the species. Use the following rationale along with the Status Assessment Factors presented in this document and the method for point allocation for each of the factors presented below to determine the classification.

- *Population size.* If the number of mature individuals is small, it may be appropriate to raise the priority by one-half rank or more. If there are many mature individuals, the priority may be lowered. [A=-1, B=-0.75, C=-0.5, D-E=-0.25, F=0, G=+0.25, H=+0.5, U=0]

- *Geographic distribution.* If a species' area of occupancy or extent of occurrence (= range extent) is relatively small, it is more vulnerable to negative effects from localized events. It may be appropriate to raise priority by one-quarter rank or more for a species with a narrow distribution and lower it by one-quarter to one-half rank for a widespread species. [Area of occupancy: A=-1, B=-0.75, C=-0.5, D=-.25, E=0, F=0, G=0, H=+0.25, U=0; or (whichever is greatest) Extent of occurrence: A-B=-0.5, C-D=-0.25; E-F-G-H=0, U=0]

- *Environmental specificity.* If a species requires highly specific habitat(s) or other abiotic or biotic factor(s), and if the number of populations and distribution is unknown, the rank may be raised or lowered. [A=-0.5, B & C=0, D=+0.5, U=0].

- *Short-term trends in population size, area of occupancy, extent of occurrence, or number or condition of occurrences.* A significant short term and non-cyclic negative trend may be reason to raise priority by one-quarter rank or more, or a significant positive trend may indicate that priority should be lowered by one-half rank. [A=-1, B=-0.75, C=-0.5, D=-0.25, E=0, F=+0.25, U=0] In the absence of short-term trend data, the rank may be raised or lowered for *long-term trends*. [A=-0.5, B=-0.25, C & D & E=0, F=+0.25, U=0]

- *Threats.* Threats include habitat destruction or degradation, introduction of exotic species, overexploitation and direct human-caused mortality, and elimination of natural disturbance regimes, such as fire or flooding. Depending on the severity, scope, and immediacy of threats, the priority may be raised or lowered by one-half to one rank. [A=-1, B=-0.75, C=-0.5, D=-0.25, E & F=0, G=+0.75, H=+1.0, U=0]

- *Intrinsic vulnerability.* If a species is intrinsically vulnerable because it is slow to mature, reproduces infrequently, and/or has low fecundity such that populations are very slow to recover from decreases in abundance, or is a species has low dispersal capability such that extirpated populations are unlikely to become reestablished through natural colonization, it may be appropriate to raise its priority. [A=-0.5, B=-0.25, C & U=0]

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Step 1: Determine the available data for the species. The following subheadings are indicative of the types of data useful for classification (Refer to Heritage Conservation Status Assessment Factors for definitions of the following factors as noted in this document.

Population size
Geographic Distribution (Extent of Occurrence [EOO] or Area of Occupancy [AOO])
Environmental Specificity
Trends (short-term and long-term trends)
Threats (scope, severity, immediacy)
Management / Protection
Intrinsic Vulnerability

Step2: Determine which of the following combinations of the first five data requirements suits the available data (only choose one combination and the first to apply).

Pop size + Geographic Distribution (greatest value from EOO or AOO)
Pop size + Environmental Specificity
Population size
Geographic Distribution (EOO only; AOO unknown) and Environmental Specificity
Geographic Distribution (greatest value from EOO or AOO)
Environmental Specificity

Step 3: Start point allocation at 3.5. Using the point allocation document below, determine a value for the combination you choose and add or subtract if appropriate. If all six factors are unknown: points = 3.5

Step 4: Once a value has been determined for the first five data requirements, incorporate remaining data.

P = points (total from step 3) + trends (short term trend otherwise use Long term trend) + threats

OR if you have no information on threats, include intrinsic vulnerability as follows

P = points (total from step 3) + trends (short term trend if known, otherwise use Long term trend) + intrinsic vulnerability

The following Heritage Ranks correspond to the final point total.

Points (P)	SRANK
P < 1.5	S1
1.5 ≤ P < 2.5	S2
2.5 ≤ P < 3.5	S3
3.5 ≤ P < 4.5	S4
P ≥ 4.5	S5