Prairie Beef & Biodiversity Program: Environmental Benefit Index (EBI) for Sagebrush/Greater Sage Grouse Habitat

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Ranchers Stewardship Alliance Inc.

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INTRODUCTION

An Environmental Benefit Index (EBI) is a compound index that considers multiple environmental factors when determining an ecosystem outcome. EBIs have been used to evaluate and rank lands for the conservation reserve program based on environmental benefits to soil resources, water quality and wildlife habitat (USDA 1999) and to determine priority sites for wetland restoration based on a predictive model for hatched nests (Hill *et al* 2011).

An EBI was identified in the design of the Prairie Beef & Biodiversity program as a method to target programming and prioritize participation (CEC 2013). The concept of an EBI was noted as an information deficiency and we have taken a step to address that deficiency by drafting a first approximation of an EBI associated with Greater Sage Grouse (GRSG) conservation. An EBI would be of considerable importance in determining priority sites to invest in for GRSG habitat, particularly when funds are limited.

The overall goal of the GRSG EBI is to ensure maximum environmental value for an investment in results-based conservation programming. The EBI has several potential uses including:

- To target geographically to the most important locations,
- To evaluate and rank candidate properties or projects for their environmental benefit,
- To rank the environmental benefit of candidate properties or projects by cost (or bid), and
- To evaluate projects over time to determine if environmental values are being improved or maintained, or to evaluate the efficiency of the investment over time.

CRITERIA AND SCORING

The EBI was developed by compiling comprehensive categories of criteria based on available knowledge such as GRSG population and habitat research as well as strategies compiled to recover the species.

The EBI begins with three screening criteria. These criteria are either met, in which case the user continues to the next criteria, or not met, in which case the property or potential project is eliminated from further consideration. The remaining criteria are grouped into either landscape level criteria (criteria 4.1, 4.2 and 4.3), or site level criteria (criteria 5 through 8).

A scoring system was devised for the EBI. Each criterion is weighted out of 300, 100, 50 or 30 based on relative importance to the species, or based on the importance of a threat as indicated by the federal recovery strategy for GRSG (Environment Canada 2013*b*).

The total scores are calculated based on the formula:

(1)(2)(3)((4.1.1+4.1.2+4.1.3)+(5.1+5.2+6+7+8.1+8.2+8.3))

which may then be divided by the costs of the project or the bid for the project to determine the

EBI.

The range of possible scores for candidates that pass the screening criteria is quite wide. The lowest possible total score is 20 and the highest possible score is 800. When evaluating candidate properties for a program, it may be possible to divide the scores into more general High, Moderate and Low priorities. There are many uses for a general ranking. For example it could be used to determine the total cost of implementing results-based programming on all High priority sites.

SCREENING CRITERIA

1. Area of consideration is located in South of Divide area. The South of the Divide action plan is focused on that area in southwest Saskatchewan which is also at the northern limits of the range of the Greater Sage Grouse (GRSG) (Environment Canada 2013*a*, Environment Canada 2013*b*). This is the only 2nd order of measuring habitat targets (Stiver *et al* 2010). However, there is anecdotal evidence that GRSG have been observed north of the range identified in the SOD area (K. Williamson, pers. Comm.).
   Yes=1, No=0.

2. Area of consideration contains sagebrush habitat or has the potential for sagebrush habitat. Sagebrush plant communities are associated with the Solonetzic overflow ecosites and are described by Thompson and Hansen (2001) plus a number of other authors. The solonetzic ecosite is described by Thorpe (2007). Sagebrush communities are essential to the recovery of the GRSG (Environment Canada 2013*b*). Any areas being considered as habitat or the potential for habitat should include the solonetzic ecosites. The exception to this would be upland sites in close proximity to the solonetzic overflow ecosites that have potential for nesting or brood rearing habitat. Range sites on area of consideration contain solontezic overflow range sites.
   Yes=1, No=0

3. Land managers should already be managing their grasslands to meet the basic needs of forage and livestock production. This level of condition of the producers natural resources would therefore constitute an 'industry standard'. The definition of an industry standard should be based on the condition of rangeland and riparian resources necessary to meet sustainable forage and livestock needs. The federal government suggested, with the aid of an expert panel, that more than 50% of native grasslands in the Prairies are in less than good condition. However, they also suggest that this level functions at a reduced level because of overgrazing and improper management (AAFC-PFRA, 2000). However, Thorpe (pers. comm) has unpublished data from 450 range sites that shows almost 90% of sites had range health scores that were rated either healthy or healthy with problems. In 2010, the State of the Watershed Report suggests that most southern watersheds are considered stressed, i.e. Native Prairie has a range health of 50-75% and Riparian Health of 60-79%. Riparian buffers are rated as healthy in the Milk and Cypress Watersheds but stressed in other agricultural watershed which reflects the higher levels of perennial vegetation found in the SW (Davies and Hanley, 2010). Unpublished data from a grasslands bird study lead by Steve Davis and Brenda Dale of Environment Canada and presented at the 54th Annual Meeting of the Society for Range

Management (2002) indicated that rangelands managed by a single land manager, either privately or publicly, were on average in low good range condition or approximately 60. Based on this information, it is suggested that we employ an average range condition score of > 60, an average range health score of > 60 and an average riparian health score of > 60 as industry standards.
If the land manager meets these requirements score is 1 and if not, the score will be 0.

LANDSCAPE LEVEL CRITERIA

4. Rating Criteria for the 3rd order of levels of habitat (Stiver *et al* 2010). Points 4.1-3 are landscape based attributes that are under the control of a single land manager:
    1. Size of the area of consideration: The size of the area of consideration is based on distance of nesting grounds from a lek. The maximum the GRSG nests from a lek in Sask. is 15km with the mean distance being 5kms. Maximum area associated with one lek would be PiR^2 or $3.14(15^2)$ = 70600 ha. In the past much attention was paid to the lek habitat but in order for the species to succeed, GRSG must have adequate nesting, brood rearing and wintering habitat. GRSG will nest as far as 10 to 15 kms away from the lek (Environment Canada 2013*b*, Aldridge and Boyce 2007). This implies that a fixed buffer of less than 15 kms from the lek may not suitably protect important nesting and brood rearing habitat. The smaller the area of consideration, the less chance there is for all life stages being protected or managed by a single land manager. Generally speaking any management agreements will be between a funding agency and a single land manager who is responsible for the day-to-day and long-term decision-making. Because of the vast area that would be involved in a 15km radius of any one lek, the door should remain open for a cooperative approach that may involve an agreement with a number of land managers. The rating of the area of consideration, which is managed by one land manager, would be based on the percentage of perennial grasslands managed by that particular land manger within the 15 km radius of the lek. (Max 100 points)

Area of consideration - Size (ha)

100	The land manager manages more than 50% of the perennial grasslands within the 15 km radius of any one lek.
90	More than 15% of the perennial grasslands within the 15 km radius of any one lek are managed by the land manager.
70	More than 10% of the perennial grasslands within the 15 km radius of any one lek are managed by the land manager.
50	More than 5% of the perennial grasslands within the 15 km radius of any one lek are managed by the land manager.
25	Less than 5% of the perennial grasslands within the 15 km radius of any one lek are managed by the land manager.

2. Contains habitat for life stages of GRSR (mating, nesting, brood rearing, wintering): Leks range in size from .04-16 ha and are usually in close proximity to feeding and nesting areas. Nesting areas include both sagebrush flats and adjacent uplands up to 15kms from the lek. Brood rearing areas are generally next to nesting habitat. The preferred wintering sites include areas of low elevation on south or southwest facing slopes with sagebrush large and robust enough so that GRSG can access them throughout the winter. (Max 100 points)

Area of consideration - Life stages habitat

100	Area of consideration contains habitat for all four life stages of GRSG including mating, nesting, brood rearing and wintering
75	Area of consideration contains habitat for three of four life stages of GRSG including mating, nesting, brood rearing and wintering
50	Area of consideration contains habitat for two of four life stages of GRSG including mating, nesting, brood rearing and wintering
25	Area of consideration contains habitat for one of four life stages of GRSG including mating, nesting, brood rearing and wintering

3. GRSG occupy the existing area of consideration: In order for the species to recover, it is important that GRSG not only occupies any given habitat but also succeeds in surviving there (Environment Canada 2013*b*, Aldridge and Boyce 2007). In the question of GRSG occupancy, the highest scores should be when there is documented evidence that the GRSG occupies the sites and that chicks and broods are surviving. Numerous researchers feel that there is the potential that GRSG may be attracted to ecological traps and may suffer poor survival. (Max 30 points)

Area of consideration – GRSG occupy the existing habitat

50	Area of consideration is currently occupied and there is documented evidence that there is chick and brood survival by GRSG in habitat for any of the four life stages of GRSG including mating, nesting, brood rearing and wintering
30	Area of consideration is currently occupied by GRSG in habitat for any of the four life stages of GRSG including mating, nesting, brood rearing and wintering
20	Records of occupancy within the area of consideration exist for GRSG in habitat for any of the four life stages of GRSG including mating, nesting, brood rearing and wintering
10	Area of consideration has no records of occupancy by GRSG in habitat for any of the four life stages of GRSG including mating, nesting, brood rearing and wintering. However, the potential for habitat exists in the area of consideration.
0	Area of consideration has no records of occupancy by GRSG in habitat for any of the four life stages of GRSG including mating, nesting, brood rearing and wintering and there is little potential for the existence of habitat

5. The area and the health of the sagebrush plant community: Points 5, 6 & 7 are reflective of the site specific habitat targets which align with the 4th order level of habitat objectives (Stiver et al 2010).
   1. Area of Sagebrush habitat or potential for habitat includes the lands dominated by solontezic overflow sites that have potential to produce the sagebrush flats. Many researchers including Aldridge and Boyce (2007) suggest that GRSG are attracted to relatively large areas of Sagebrush flats which are in the range of 1 km^2 or 100 ha (Environment Canada 2013*b*). However, Solonetzic overflow ecosites in the Frenchman River Watershed are closer to 10 ha is size (Anderson, pers. comm.) (Max 50 points)

Area of Sagebrush Habitat

50	Solonetzic overflow area dominated by Sagebrush and > 10 ha
25	Solonetzic overflow area dominated by Sagebrush but < 10 ha
10	Solonetzic overflow area sparsely populated by Sagebrush and > 10 ha
0	Solonetzic overflow area sparsely populated by Sagebrush but < 10 ha

   2. The robustness of the sagebrush plants are extremely important in the maintenance of the sagebrush plant community. The robustness of the sagebrush plants and plant community is important in providing habitat for the GRSG. A good indicator of ecological health is the presence and persistence of woody vegetation in the riparian areas (PCAP 2008). The desired sagebrush plants and plant community should contain a healthy balance of young plants for establishment and regeneration, and dead and decadent woody vegetation, which may be a signal of declining health. Also included in the assessment of sagebrush robustness is the level of utilization or impact by either domestic or wild animals. (Max 50 points)

Robustness of Sagebrush plants and plant community

50	More than 15% of the canopy cover of the sagebrush is comprised of seedlings or saplings and less than 5% is dead or decadent and less than 5% of the second year old or older leaders are browsed.
20	5 - 15% of the canopy cover of the sagebrush is comprised of seedlings or saplings and 5 - 25% is dead or decadent and less 5 - 25% of the second year old or older leaders are browsed.
0	Less than 5% of the canopy cover of the sagebrush is comprised of seedlings or saplings and more than 25% is dead or decadent and more than 25% of the second year old or older leaders are browsed.

6. The habitat quality of the Sagebrush community is measured by the structural and functional components, where all 4 layer exists including Sagebrush woody layer, grass layer measured by herb droop height, preferred forb layer and cover measured by robel pole, and levels of litter and bare soil in comparison to a reference plant community. Leks and wintering areas are generally found on solonetzic range sites and Brood rearing and nesting areas are generally found on upland range sites. Each area would support a different reference plant community. Habitat quality based on vegetation objectives for environmental benefits are analogous to fourth order or site scale habitat characteristics as described by Stiver *et al* (2010). More specifically, this project focuses on those components of site scale habitat characteristics that can be influenced by livestock grazing. (Max 300 points)

   The vegetation objectives for this EBI are:

   a. 10% or less exposed soil that is management-caused as determined by the Saskatchewan Native Grassland Range Health Assessment.

   b. A litter load that is 65-100% of expected amounts as determined by the Saskatchewan Native Grassland Range Health Assessment.

   c. Average herbaceous droop height of >18 cm on overflow sites as measured by Thorpe et al 2005.

   d. Forb canopy cover on overflow sites >7% and > 8% on upland sites as measured by Thorpe et al 2005.

   e. At sage brush dominated sites average robel pole measurements at sage brush plants will be coverage of four-5cm segments as measured by Thorpe *et al* 2005.

   Objectives a. and b. are included as base level goals for habitat to maintain healthy grassland. The rationale for including these components is that some basic components are necessary to maintain the site potential to produce the vertical habitat structure required.

   Objectives c and d are based on Connelly (2000) who identified detailed requirements for GRSG habitat. A large meta-analysis by Hagen *et al* (2007) confirmed that these are important habitat characteristics however questions remain whether the specific herbaceous height and forb covers identified are appropriate for the Saskatchewan ecosites.

Habitat Quality

300	All four layers exist, including sagebrush, grass, forb and ground cover. Grass droop height is > 18cm, preferred forb cover >7% and Robel pole cover at 4x5cm. A litter load that is 65-100% of expected amounts and 10% or less exposed soil that is management caused as determined by the Saskatchewan Native Grassland Range Health Assessment.
225	Three of four layers exist, or four layers exist at a slightly reduced level. One of the following parameters is reduced to the following levels. Grass droop height is 14-18cm, preferred forb cover 4-7% and Robel pole cover at 3x5cm. A litter load that is 65-100% of expected amounts and 10% or less exposed soil that is management caused as determined by the Saskatchewan Native Grassland Range Health Assessment.
150	Three of four layers exist at a moderately reduced level. Grass droop height is 14-18cm, preferred forb cover 4-7% and Robel pole cover at 3x5cm. A litter load that is 50-65% of expected amounts and 10-15% or less exposed soil that is management caused as determined by the Saskatchewan Native Grassland Range Health Assessment.
75	Three of four layers exist at a severely reduced level. Grass droop height is 9-14cm, preferred forb cover 4-7% and Robel pole cover at 2x5cm. A litter load that is 50-65% of expected amounts and 10-15% or less exposed soil that is management caused as determined by the Saskatchewan Native Grassland Range Health Assessment.
0	Only two of four layers exist. Grass droop height is <9cm, preferred forb cover <4% and Robel pole cover at 2x5cm. A litter load that is <50% of expected amounts and >15% or less exposed soil that is management caused as determined by the Saskatchewan Native Grassland Range Health Assessment.

7. Fences: fences or other vertical structures can negatively affect GRSG if they are within 600m of a lek or bisect sagebrush wintering grounds/riparian areas (Environment Canada 2013*b*). Markers or take down fences can reduce impacts. NRCS (2012) suggest that areas within a 1.8 km radius of a lek are a high risk area and fences within 400m of a lek should be marked. Stevens *et al* (2012) similarly agree that a radius of 2 km should be the focus area when marking fences to avoid collision. The emergency order (Environment Canada 2013*c*) indicators all fences within 1 km of leks identified should marked every 1.5 m. Additional requirements of fences in these areas include height restrictions (<1.2m) and wire restrictions (no more than 4 wires and the top 2 have to be barbless) (Max points 30)

Fencelines

30	None exist within 600m of a lek or on wintering grounds/riparian areas
20	A fence line exists within 600m of a lek or on wintering grounds/riparian areas but markers are used or fence can be dropped down during critical time periods.
10	A fence line exists within 600m of a lek or on wintering grounds/riparian areas.
0	Multiple fence lines exists within 600m of a lek or on wintering grounds/riparian areas.

8. Rating Criteria (Area of consideration NOT under the control of a land manager. Various risks and threats associated with GRSG recovery are outside the decision-making capability of a single land manager, but because of location and proximity to certain landscape features, environmental benefits can be impacted. However, points could be added for the demonstration of cooperative management between adjacent land managers):

    1. Adjacent habitat: the area outside that being considered can negatively impact GRSG if it is cropland with anthropogenic borders such as roads or infrastructure such as oil wells (Environment Canada 2013*b*, Aldridge and Boyce 2007). It is preferred that adjacent habitat is native grasslands or at least in perennial cover (Max points 30).

Adjacent Habitat

30	Native grasslands without anthropogenic borders or infrastructure.
10	Tame grasslands without anthropogenic borders or infrastructure.
5	Perennial grasslands, including native, with significant anthropogenic borders or infrastructure.
0	Cropland with or without anthropogenic borders or infrastructure.

    2. Noise: noise that is continuous or recurrent can negatively impact GRSG. Sources can be high levels of traffic, oil wells, windmills or other anthropogenic features on the landscape (Environment Canada 2013*b*, Aldridge and Boyce 2007, Connelly et al 2004). (Max points 30)

Noise

30	None to minimal occurrence.
20	Periodic or seasonal occurrence.
10	Continuous traffic, oil well head operation, seasonal occurrence during critical times in the life cycles of the GRSG or other anthropogenic impact.
0	Adjacent to industrial development.

3. Interaction with other Species at Risk: Other SAR exist in the area. The presence of optimal GRSG habitat may have a positive, negative or neutral effect on the other SAR found in the area of consideration (Environment Canada 2013*b*). (Max points 30)

Interaction with other Species at Risk

30	GRSG habitat contributes positively to other SAR.
0	GRSG habitat has no impact on other SAR.
-30	GRSG habitat has a negative impact on other SAR

9. Cost/Bid
The incremental cost to achieve the habitat requirements identified that are over and above the Range condition, Range health and Riparian health scores that are necessary to manage for forage and livestock production. These costs could be added management, added infrastructure or inputs or lost opportunities.

EBI= (1)(2)(3)((4.1.1+4.1.2+4.1.3)+(5.1+5.2+6+7+8.1+8.2+8.3))/9

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