APPENDIX H

CLIMATE CHANGE VULNERABILITY INDEX DOCUMENTATION

THIS PAGE INTENTIONALLY LEFT BLANK

The NatureServe Climate Change Vulnerability Index

Release 2.1 *7 April 2011; Bruce Young, Elizabeth Byers, Kelly Gravuer, Kim Hall, Geoff Hammerson, Alan Redder*
With input from: *Jay Cordeiro, Kristin Szabo*

Funding for Release 2.0 generously provided by the Duke Energy Corporation.

NatureServe

* = Required field

Geographic Area Assessed:	Middle Rockies Ecoregion	*			
Assessor:	Sarah Bresnan				
Species Scientific Name:	Ursus arctos	*	English Name:	Grizzly Bear	
Major Taxonomic Group:	Mammal	*			
			G-Rank:	G4	
Relation of Species' Range to Assessment Area:	Southern edge of range	*	S-Rank:		

Check if species is an obligate of caves or groundwater aquatic systems: ⬜ *(Must be marked with an "X" for accurate scoring of these species.)*

Assessment Notes (to document special methods and data sources)

S-Rank - NatureServe Explorer U.S. & Canada State/Province Status: Montana (S2S3)

Section A: Exposure to Local Climate Change *(Calculate for species' range within assessment area)*

Temperature *

Severity	Scope (percent of range)
>5.5° F (3.1° C) warmer	18.002
5.1-5.5° F (2.8-3.1° C) warmer	69.4715
4.5-5.0° F (2.5-2.7° C) warmer	12.5265
3.9-4.4° F (2.2-2.4° C) warmer	0
< 3.9° F (2.2° C) warmer	0
Total:	100 *(Must sum to 100)*

Hamon AET:PET Moisture Metric *

Severity	Scope (percent of range)
< -0.119	8.2668
-0.097 - -0.119	61.8974
-0.074 - -0.096	27.5892
-0.051 - -0.073	2.2466
-0.028 - -0.050	0
>-0.028	0
Total:	100 *(Must sum to 100)*

Section B: Indirect Exposure to Climate Change *(Evaluate for specific geographical area under consideration)*

Mark an "X" in all boxes that apply.

Effect on Vulnerability

Greatly increase	Increase	Somewhat increase	Neutral	Somewhat decrease	Decrease	Unknown
			X			
			X			
			X			
						X

Factors that influence vulnerability *(* at least three required)*

1) Exposure to **sea level rise**
2) Distribution relative to **barriers**
 a) **Natural barriers**
 b) **Anthropogenic barriers**
3) Predicted **impact of land use changes resulting from human responses** to climate change

Section C: Sensitivity

Mark an "X" in all boxes that apply.

Effect on Vulnerability						
Greatly increase	Increase	Somewhat increase	Neutral	Somewhat decrease	Decrease	Unknown
			X	X		
				X		
		X	X			
				X		
		X	X			
			X			
		X				
				X		
		X				
		X				
						X
		X				
		X				
						X
		X				
			X			

Factors that influence vulnerability *(* at least 10 required)*

1) **Dispersal and movements**
2) Predicted **sensitivity to temperature** and **moisture changes**
   a) Predicted **sensitivity to changes in temperature**
      i) **historical thermal niche**
      ii) **physiological thermal niche**
   b) Predicted **sensitivity to changes in precipitation, hydrology, or moisture regime**
      i) **historical hydrological niche**
      ii) **physiological hydrological niche**
   c) Dependence on a **specific disturbance regime** likely to be impacted by climate change
   d) Dependence on **ice, ice-edge, or snow-cover habitats**
3) **Restriction to uncommon geological features or derivatives**
4) **Reliance on interspecific interactions**
   a) Dependence on **other species to generate habitat**
   b) **Dietary versatility** (animals only)
   c) **Pollinator versatility** (plants only)
   d) Dependence on **other species for propagule dispersal**
   e) Forms part of an **interspecific interaction** not covered by 4a-d
5) **Genetic factors**
   a) Measured **genetic variation**
   b) Occurrence of **bottlenecks** in recent evolutionary history *(use only if 5a is "unknown")*
6) **Phenological response to** changing seasonal temperature and precipitation dynamics

Section D: Documented or Modeled Response to Climate Change *(Optional; May apply across the range of a species)*

Mark an "X" in all boxes that apply.

Effect on Vulnerability						
Greatly increase	Increase	Somewhat increase	Neutral	Somewhat decrease	Decrease	Unknown
			X			
						X
						X
						X

(Optional)

1) **Documented response** to recent climate change
2) Modeled **future (2050) change in population** or **range size**
3) **Overlap** of modeled future (2050) range with current range
4) Occurrence of **protected areas in modeled future (2050) distribution**

Middle Rockies
Grizzly Bear NSCCVI

Climate Change Vulnerability Index

for Ursus arctos in Middle Rockies Ecoregion

Not Vulnerable/Presumed Stable

Notes: **Species range may shift and perhaps leave the assessment area.**

Confidence in Species
Information
High

* Histogram below

Definitions of Index Values

Extremely Vulnerable (EV): Abundance and/or range extent within geographical area assessed extremely likely to substantially decrease or disappear by 2050.
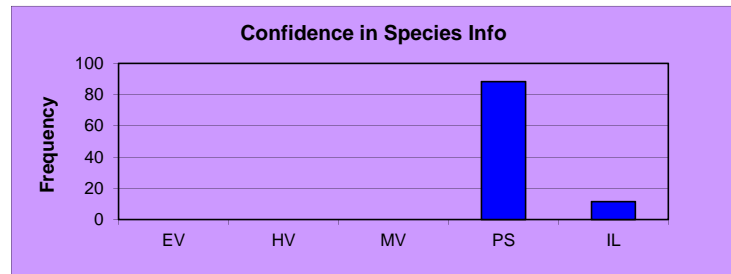
Highly Vulnerable (HV): Abundance and/or range extent within geographical area assessed likely to decrease significantly by 2050.

Moderately Vulnerable (MV): Abundance and/or range extent within geographical area assessed likely to decrease by 2050.

Not Vulnerable/Presumed Stable (PS): Available evidence does not suggest that abundance and/or range extent within the geographical area assessed will change (increase/decrease) substantially by 2050. Actual range boundaries may change.

Not Vulnerable/Increase Likely (IL): Available evidence suggests that abundance and/or range extent within geographical area assessed is likely to increase by 2050.

Insufficient Evidence (IE): Available information about a species' vulnerability is inadequate to calculate an Index score.

Confidence in Species Info

Results of a Monte Carlo simulation (1000 runs) of the data entered in the Index.

THIS PAGE INTENTIONALLY LEFT BLANK

The NatureServe Climate Change Vulnerability Index

Release 2.1 *7 April 2011; Bruce Young, Elizabeth Byers, Kelly Gravuer, Kim Hall, Geoff Hammerson, Alan Redder*

With input from: *Jay Cordeiro, Kristin Szabo*

Funding for Release 2.0 generously provided by the Duke Energy Corporation.

NatureServe

* = Required field

Geographic Area Assessed:	Middle Rockies Ecoregion	*
Assessor:	Sarah Bresnan	
Species Scientific Name:	Centrocercus urophasianus	*

English Name: Greater Sage-Grouse

Major Taxonomic Group:	Bird	*

G-Rank:	G3G4

Relation of Species' Range to Assessment Area:	East/west edge of range	*

S-Rank:	

Check if species is an obligate of caves or groundwater aquatic systems: *(Must be marked with an "X" for accurate scoring of these species.)*

Assessment Notes (to document special methods and data sources)

S-Rank - NatureServe Explorer U.S. & Canada State/Province Status: Montana (S3), Idaho (S2), Wyoming (S4), South Dakota (S2)

Section A: Exposure to Local Climate Change *(Calculate for species' range within assessment area)*

Temperature *

Severity	Scope (percent of range)
>5.5° F (3.1° C) warmer	24.7544
5.1-5.5° F (2.8-3.1° C) warmer	57.5526
4.5-5.0° F (2.5-2.7° C) warmer	17.693
3.9-4.4° F (2.2-2.4° C) warmer	0
< 3.9° F (2.2° C) warmer	0
Total:	100 *(Must sum to 100)*

Hamon AET:PET Moisture Metric *

Severity	Scope (percent of range)
< -0.119	13.919
-0.097 - -0.119	42.1471
-0.074 - -0.096	36.3474
-0.051 - -0.073	7.5723
-0.028 - -0.050	0.000143
>-0.028	0.014057
Total:	100 *(Must sum to 100)*

Section B: Indirect Exposure to Climate Change *(Evaluate for specific geographical area under consideration)*

Mark an "X" in all boxes that apply.

Effect on Vulnerability

Greatly increase	Increase	Somewhat increase	Neutral	Somewhat decrease	Decrease	Unknown
			X			
		X	X			
			X			
			X			

Factors that influence vulnerability *(* at least three required)*

1) Exposure to **sea level rise**
2) Distribution relative to **barriers**
   a) **Natural barriers**
   b) **Anthropogenic barriers**
3) Predicted **impact of land use changes resulting from human responses** to climate change

Section C: Sensitivity

Mark an "X" in all boxes that apply.

Effect on Vulnerability						
Greatly increase	Increase	Somewhat increase	Neutral	Somewhat decrease	Decrease	Unknown
			X			
				X		
			X			
				X		
			X			
		X				
			X			
				X		
	X	X				
			X			
						X
			X			
			X			
						X
		X				
	X	X				

Factors that influence vulnerability *(* at least 10 required)*

1) **Dispersal and movements**
2) Predicted **sensitivity to temperature** and **moisture changes**
  a) Predicted **sensitivity to changes in temperature**
      i) **historical thermal niche**
      ii) **physiological thermal niche**
  b) Predicted **sensitivity to changes in precipitation, hydrology, or moisture regime**
      i) **historical hydrological niche**
      ii) **physiological hydrological niche**
  c) Dependence on a **specific disturbance regime** likely to be impacted by climate change
  d) Dependence on **ice, ice-edge, or snow-cover habitats**
3) **Restriction to uncommon geological features or derivatives**
4) **Reliance on interspecific interactions**
  a) Dependence on **other species to generate habitat**
  b) **Dietary versatility** (animals only)
  c) **Pollinator versatility** (plants only)
  d) Dependence on **other species for propagule dispersal**
  e) Forms part of an **interspecific interaction** not covered by 4a-d
5) **Genetic factors**
  a) Measured **genetic variation**
  b) Occurrence of **bottlenecks** in recent evolutionary history *(use only if 5a is "unknown")*
6) **Phenological response to** changing seasonal temperature and precipitation dynamics

---

Section D: Documented or Modeled Response to Climate Change *(Optional; May apply across the range of a species)*

Mark an "X" in all boxes that apply.

Effect on Vulnerability						
Greatly increase	Increase	Somewhat increase	Neutral	Somewhat decrease	Decrease	Unknown
						X
						X
						X
						X

(Optional)

1) **Documented response** to recent climate change
2) Modeled **future (2050) change in population** or **range size**
3) **Overlap** of modeled future (2050) range with current range
4) Occurrence of **protected areas in modeled future (2050) distribution**

Climate Change Vulnerability Index

for Centrocercus urophasianus in Middle Rockies Ecoregion

Moderately Vulnerable

Confidence in Species Information
Low

* Histogram below

Notes:

Definitions of Index Values

Extremely Vulnerable (EV): Abundance and/or range extent within geographical area assessed extremely likely to substantially decrease or disappear by 2050.
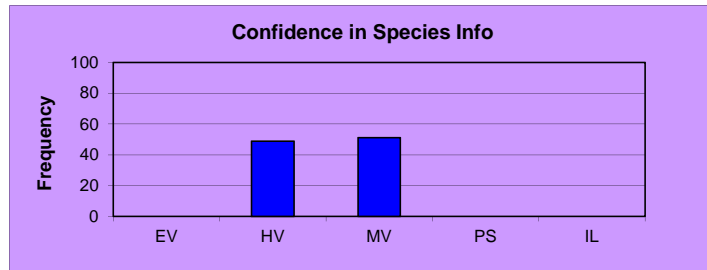
Highly Vulnerable (HV): Abundance and/or range extent within geographical area assessed likely to decrease significantly by 2050.

Moderately Vulnerable (MV): Abundance and/or range extent within geographical area assessed likely to decrease by 2050.

Not Vulnerable/Presumed Stable (PS): Available evidence does not suggest that abundance and/or range extent within the geographical area assessed will change (increase/decrease) substantially by 2050. Actual range boundaries may change.

Not Vulnerable/Increase Likely (IL): Available evidence suggests that abundance and/or range extent within geographical area assessed is likely to increase by 2050.

Insufficient Evidence (IE): Available information about a species' vulnerability is inadequate to calculate an Index score.

Results of a Monte Carlo simulation (1000 runs) of the data entered in the Index.

THIS PAGE INTENTIONALLY LEFT BLANK

The NatureServe Climate Change Vulnerability Index
Release 2.1 *7 April 2011; Bruce Young, Elizabeth Byers, Kelly Gravuer, Kim Hall, Geoff Hammerson, Alan Redder*
With input from: *Jay Cordeiro, Kristin Szabo*

Funding for Release 2.0 generously provided by the Duke Energy Corporation.

NatureServe

* = Required field

Geographic Area Assessed:	Middle Rockies Ecoregion	*
Assessor:	Sarah Bresnan	
Species Scientific Name:	Aquila chrysaetos	*
	English Name:	Golden Eagle
Major Taxonomic Group:	Bird	*
	G-Rank:	G5
Relation of Species' Range to Assessment Area:	Entire range	*
	S-Rank:	

Check if species is an obligate of caves or groundwater aquatic systems: *(Must be marked with an "X" for accurate scoring of these species.)*

Assessment Notes (to document special methods and data sources)

S-Rank - NatureServe Explorer U.S. & Canada State/Province Status: Montana (S4), Idaho (S4B, S4N), Wyoming (S3B, S3N), South Dakota (S3S4B,S3N)

Section A: Exposure to Local Climate Change *(Calculate for species' range within assessment area)*

Temperature *

Severity	Scope (percent of range)
>5.5° F (3.1° C) warmer	20.5
5.1-5.5° F (2.8-3.1° C) warmer	59.7
4.5-5.0° F (2.5-2.7° C) warmer	19.8
3.9-4.4° F (2.2-2.4° C) warmer	0
< 3.9° F (2.2° C) warmer	0
Total:	100 *(Must sum to 100)*

Hamon AET:PET Moisture Metric *

Severity	Scope (percent of range)
< -0.119	12.7224
-0.097 - -0.119	43.7861
-0.074 - -0.096	32.2697
-0.051 - -0.073	10.9624
-0.028 - -0.050	0.2594
>-0.028	0
Total:	100 *(Must sum to 100)*

Section B: Indirect Exposure to Climate Change *(Evaluate for specific geographical area under consideration)*

Mark an "X" in all boxes that apply.

Effect on Vulnerability						
Greatly increase	Increase	Somewhat increase	Neutral	Somewhat decrease	Decrease	Unknown
			X			
			X			
			X			
		X				

Factors that influence vulnerability *(* at least three required)*

1) Exposure to **sea level rise**
2) Distribution relative to **barriers**
  a) **Natural barriers**
  b) **Anthropogenic barriers**
3) Predicted **impact of land use changes resulting from human responses** to climate change

Section C: Sensitivity

Mark an "X" in all boxes that apply.

Effect on Vulnerability

Greatly increase	Increase	Somewhat increase	Neutral	Somewhat decrease	Decrease	Unknown
					X	
				X		
			X			
				X		
			X			
		X				
						X
				X		
			X			
			X			
						X
			X			
			X			
						X
			X			
			X			

Factors that influence vulnerability *(* at least 10 required)*

1) **Dispersal and movements**
2) Predicted **sensitivity to temperature** and **moisture changes**
   a) Predicted **sensitivity to changes in temperature**
      i) **historical thermal niche**
      ii) **physiological thermal niche**
   b) Predicted **sensitivity to changes in precipitation, hydrology, or moisture regime**
      i) **historical hydrological niche**
      ii) **physiological hydrological niche**
   c) Dependence on a **specific disturbance regime** likely to be impacted by climate change
   d) Dependence on **ice, ice-edge, or snow-cover habitats**
3) **Restriction to uncommon geological features or derivatives**
4) **Reliance on interspecific interactions**
   a) Dependence on **other species to generate habitat**
   b) **Dietary versatility** (animals only)
   c) **Pollinator versatility** (plants only)
   d) Dependence on **other species for propagule dispersal**
   e) Forms part of an **interspecific interaction** not covered by 4a-d
5) **Genetic factors**
   a) Measured **genetic variation**
   b) Occurrence of **bottlenecks** in recent evolutionary history *(use only if 5a is "unknown")*
6) **Phenological response to** changing seasonal temperature and precipitation dynamics

Section D: Documented or Modeled Response to Climate Change *(Optional; May apply across the range of a species)*

Mark an "X" in all boxes that apply.

Effect on Vulnerability

Greatly increase	Increase	Somewhat increase	Neutral	Somewhat decrease	Decrease	Unknown
						X
						X
						X
						X

(Optional)

1) **Documented response** to recent climate change
2) Modeled **future (2050) change in population** or **range size**
3) **Overlap** of modeled future (2050) range with current range
4) Occurrence of **protected areas in modeled future (2050) distribution**

Climate Change Vulnerability Index

for Aquila chrysaetos in Middle Rockies Ecoregion

Not Vulnerable/Increase Likely

Notes: Species range may shift and perhaps leave the assessment area.

**Confidence in Species
Information
Very High**

* Histogram below

Definitions of Index Values

Extremely Vulnerable (EV): Abundance and/or range extent within geographical area assessed extremely likely to substantially decrease or disappear by 2050.
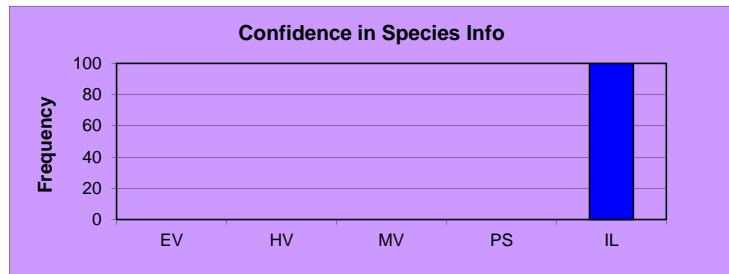
Highly Vulnerable (HV): Abundance and/or range extent within geographical area assessed likely to decrease significantly by 2050.

Moderately Vulnerable (MV): Abundance and/or range extent within geographical area assessed likely to decrease by 2050.

Not Vulnerable/Presumed Stable (PS): Available evidence does not suggest that abundance and/or range extent within the geographical area assessed will change (increase/decrease) substantially by 2050. Actual range boundaries may change.

Not Vulnerable/Increase Likely (IL): Available evidence suggests that abundance and/or range extent within geographical area assessed is likely to increase by 2050.

Insufficient Evidence (IE): Available information about a species' vulnerability is inadequate to calculate an Index score.

Results of a Monte Carlo simulation (1000 runs) of the data entered in the Index.

THIS PAGE INTENTIONALLY LEFT BLANK

The NatureServe Climate Change Vulnerability Index

Release 2.1 *7 April 2011; Bruce Young, Elizabeth Byers, Kelly Gravuer, Kim Hall, Geoff Hammerson, Alan Redder*

With input from: *Jay Cordeiro, Kristin Szabo*

Funding for Release 2.0 generously provided by the Duke Energy Corporation.

NatureServe

* = Required field

Geographic Area Assessed:	Middle Rockies Ecoregion	*
Assessor:	Sarah Bresnan	

Species Scientific Name:	Odocoileus hemionus	*	**English Name:**	Mule Deer

Major Taxonomic Group:	Mammal	*

G-Rank:	G5

Relation of Species' Range to Assessment Area:	Entire range	*	**S-Rank:**	S5

Check if species is an obligate of caves or groundwater aquatic systems: *(Must be marked with an "X" for accurate scoring of these species.)*

Assessment Notes (to document special methods and data sources)

S-Rank - NatureServe Explorer U.S. & Canada State/Province Status: Montana (S5), Idaho (S5), Wyoming (S5), South Dakota (S5)

Section A: Exposure to Local Climate Change *(Calculate for species' range within assessment area)*

Temperature *

Severity	Scope (percent of range)
>5.5° F (3.1° C) warmer	4.2661984
5.1-5.5° F (2.8-3.1° C) warmer	47.753053
4.5-5.0° F (2.5-2.7° C) warmer	47.980749
3.9-4.4° F (2.2-2.4° C) warmer	0
< 3.9° F (2.2° C) warmer	0
Total:	100 *(Must sum to 100)*

Hamon AET:PET Moisture Metric *

Severity	Scope (percent of range)
< -0.119	0.349484
-0.097 - -0.119	43.70727
-0.074 - -0.096	40.69229
-0.051 - -0.073	14.89858
-0.028 - -0.050	0.352378
>-0.028	0
Total:	100 *(Must sum to 100)*

Section B: Indirect Exposure to Climate Change *(Evaluate for specific geographical area under consideration)*

Mark an "X" in all boxes that apply.

Effect on Vulnerability						
Greatly increase	Increase	Somewhat increase	Neutral	Somewhat decrease	Decrease	Unknown
			X			
			X			
		X	X			
			X			

Factors that influence vulnerability *(* at least three required)*

1) Exposure to **sea level rise**
2) Distribution relative to **barriers**
   a) **Natural barriers**
   b) **Anthropogenic barriers**
3) Predicted **impact of land use changes resulting from human responses** to climate change

Section C: Sensitivity

Mark an "X" in all boxes that apply.

Effect on Vulnerability

Greatly increase	Increase	Somewhat increase	Neutral	Somewhat decrease	Decrease	Unknown
				X	X	
			X			
		X				
			X			
		X				
		X				
		X				
			X			
		X				
		X				
						X
		X				
		X				
						X
		X				
						X

Factors that influence vulnerability *(* at least 10 required)*

1) **Dispersal and movements**
2) Predicted **sensitivity to temperature** and **moisture changes**
   a) Predicted **sensitivity to changes in temperature**
        i) **historical thermal niche**
        ii) **physiological thermal niche**
   b) Predicted **sensitivity to changes in precipitation, hydrology, or moisture regime**
        i) **historical hydrological niche**
        ii) **physiological hydrological niche**
   c) Dependence on a **specific disturbance regime** likely to be impacted by climate change
   d) Dependence on **ice, ice-edge, or snow-cover habitats**
3) **Restriction to uncommon geological features or derivatives**
4) **Reliance on interspecific interactions**
   a) Dependence on **other species to generate habitat**
   b) **Dietary versatility** (animals only)
   c) **Pollinator versatility** (plants only)
   d) Dependence on **other species for propagule dispersal**
   e) Forms part of an **interspecific interaction** not covered by 4a-d
5) **Genetic factors**
   a) Measured **genetic variation**
   b) Occurrence of **bottlenecks** in recent evolutionary history *(use only if 5a is "unknown")*
6) **Phenological response to** changing seasonal temperature and precipitation dynamics

---

Section D: Documented or Modeled Response to Climate Change *(Optional; May apply across the range of a species)*

Mark an "X" in all boxes that apply.

Effect on Vulnerability

Greatly increase	Increase	Somewhat increase	Neutral	Somewhat decrease	Decrease	Unknown
						X
						X
						X
						X

(Optional)

1) **Documented response** to recent climate change
2) Modeled **future (2050) change in population** or **range size**
3) **Overlap** of modeled future (2050) range with current range
4) Occurrence of **protected areas in modeled future (2050) distribution**

Climate Change Vulnerability Index

for Odocoileus hemionus in Middle Rockies Ecoregion

Not Vulnerable/Increase Likely

Notes: **Species range may shift and perhaps leave the assessment area.**

Confidence in Species
Information
Very High

* Histogram below

Definitions of Index Values

Extremely Vulnerable (EV): Abundance and/or range extent within geographical area assessed extremely likely to substantially decrease or disappear by 2050.
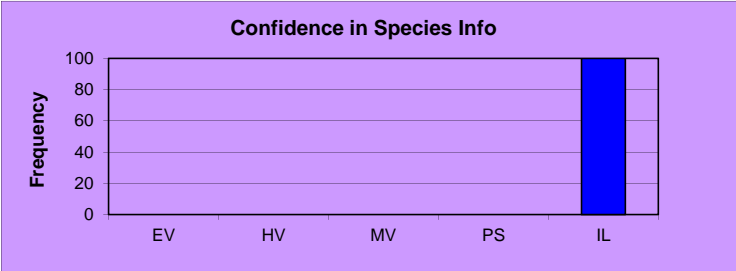
Highly Vulnerable (HV): Abundance and/or range extent within geographical area assessed likely to decrease significantly by 2050.

Moderately Vulnerable (MV): Abundance and/or range extent within geographical area assessed likely to decrease by 2050.

Not Vulnerable/Presumed Stable (PS): Available evidence does not suggest that abundance and/or range extent within the geographical area assessed will change (increase/decrease) substantially by 2050. Actual range boundaries may change.

Not Vulnerable/Increase Likely (IL): Available evidence suggests that abundance and/or range extent within geographical area assessed is likely to increase by 2050.

Insufficient Evidence (IE): Available information about a species' vulnerability is inadequate to calculate an Index score.

Confidence in Species Info

Results of a Monte Carlo simulation (1000 runs) of the data entered in the Index.

THIS PAGE INTENTIONALLY LEFT BLANK

The NatureServe Climate Change Vulnerability Index

Release 2.1 *7 April 2011; Bruce Young, Elizabeth Byers, Kelly Gravuer, Kim Hall, Geoff Hammerson, Alan Redder*

With input from: *Jay Cordeiro, Kristin Szabo*

Funding for Release 2.0 generously provided by the Duke Energy Corporation.

NatureServe

* = Required field

Geographic Area Assessed:	Middle Rockies Ecoregion	*
Assessor:	Sarah Bresnan	
Species Scientific Name:	Cervus canadensis	*
Major Taxonomic Group:	Mammal	*

English Name: Elk

G-Rank: G5
S-Rank: S5

Relation of Species' Range to Assessment Area:	Entire range	*

Check if species is an obligate of caves or groundwater aquatic systems: *(Must be marked with an "X" for accurate scoring of these species.)*

Assessment Notes (to document special methods and data sources)

S-Rank - NatureServe Explorer U.S. & Canada State/Province Status: Montana (S5), Idaho (S5), Wyoming (S5), South Dakota (S5)

Section A: Exposure to Local Climate Change *(Calculate for species' range within assessment area)*

Temperature *

Severity	Scope (percent of range)
>5.5° F (3.1° C) warmer	16.63
5.1-5.5° F (2.8-3.1° C) warmer	51.94
4.5-5.0° F (2.5-2.7° C) warmer	31.43
3.9-4.4° F (2.2-2.4° C) warmer	0
< 3.9° F (2.2° C) warmer	0
Total:	100 *(Must sum to 100)*

Hamon AET:PET Moisture Metric *

Severity	Scope (percent of range)
< -0.119	14.41
-0.097 - -0.119	56.46
-0.074 - -0.096	26.69
-0.051 - -0.073	2.44
-0.028 - -0.050	0
>-0.028	0
Total:	100 *(Must sum to 100)*

Section B: Indirect Exposure to Climate Change *(Evaluate for specific geographical area under consideration)*

Mark an "X" in all boxes that apply.

Effect on Vulnerability

Greatly increase	Increase	Somewhat increase	Neutral	Somewhat decrease	Decrease	Unknown
			X			
			X			
			X			
			X			

Factors that influence vulnerability *(* at least three required)*

1) Exposure to **sea level rise**
2) Distribution relative to **barriers**
   a) **Natural barriers**
   b) **Anthropogenic barriers**
3) Predicted **impact of land use changes resulting from human responses** to climate change

Section C: Sensitivity

Mark an "X" in all boxes that apply.

			Effect on Vulnerability			
Greatly increase	Increase	Somewhat increase	Neutral	Somewhat decrease	Decrease	Unknown
					X	
				X		
			X			
				X		
			X			
			X			
			X			
		X				
			X			
			X			
						X
			X			
			X			
						X
			X			
						X

Factors that influence vulnerability *(* at least 10 required)*

1) **Dispersal and movements**
2) Predicted **sensitivity to temperature** and **moisture changes**
   a) Predicted **sensitivity to changes in temperature**
       i) **historical thermal niche**
       ii) **physiological thermal niche**
   b) Predicted **sensitivity to changes in precipitation, hydrology, or moisture regime**
       i) **historical hydrological niche**
       ii) **physiological hydrological niche**
   c) Dependence on a **specific disturbance regime** likely to be impacted by climate change
   d) Dependence on **ice, ice-edge, or snow-cover habitats**
3) **Restriction to uncommon geological features or derivatives**
4) **Reliance on interspecific interactions**
   a) Dependence on **other species to generate habitat**
   b) **Dietary versatility** (animals only)
   c) **Pollinator versatility** (plants only)
   d) Dependence on **other species for propagule dispersal**
   e) Forms part of an **interspecific interaction** not covered by 4a-d
5) **Genetic factors**
   a) Measured **genetic variation**
   b) Occurrence of **bottlenecks** in recent evolutionary history *(use only if 5a is "unknown")*
6) **Phenological response to** changing seasonal temperature and precipitation dynamics

Section D: Documented or Modeled Response to Climate Change *(Optional; May apply across the range of a species)*

Mark an "X" in all boxes that apply.

Effect on Vulnerability						
Greatly increase	Increase	Somewhat increase	Neutral	Somewhat decrease	Decrease	Unknown
						X
						X
						X
						X

(Optional)

1) **Documented response** to recent climate change
2) Modeled **future (2050) change in population** or **range size**
3) **Overlap** of modeled future (2050) range with current range
4) Occurrence of **protected areas in modeled future (2050) distribution**

Climate Change Vulnerability Index

for Cervus canadensis in Middle Rockies Ecoregion

Not Vulnerable/Increase Likely

Confidence in Species Information
Very High
* Histogram below

Notes: **Species range may shift and perhaps leave the assessment area.**

Definitions of Index Values

Extremely Vulnerable (EV): Abundance and/or range extent within geographical area assessed extremely likely to substantially decrease or disappear by 2050.
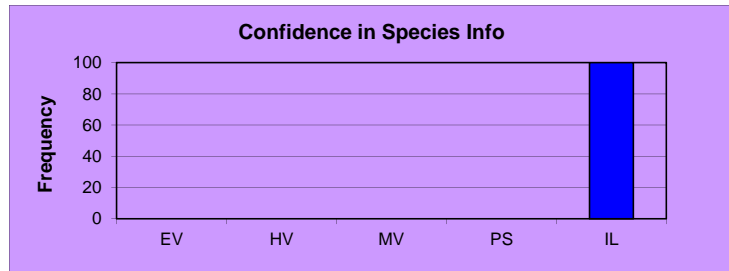
Highly Vulnerable (HV): Abundance and/or range extent within geographical area assessed likely to decrease significantly by 2050.

Moderately Vulnerable (MV): Abundance and/or range extent within geographical area assessed likely to decrease by 2050.

Not Vulnerable/Presumed Stable (PS): Available evidence does not suggest that abundance and/or range extent within the geographical area assessed will change (increase/decrease) substantially by 2050. Actual range boundaries may change.

Not Vulnerable/Increase Likely (IL): Available evidence suggests that abundance and/or range extent within geographical area assessed is likely to increase by 2050.

Insufficient Evidence (IE): Available information about a species' vulnerability is inadequate to calculate an Index score.

Confidence in Species Info

Results of a Monte Carlo simulation (1000 runs) of the data entered in the Index.

THIS PAGE INTENTIONALLY LEFT BLANK