SOUTHERN ROCKIES
Landscape Conservation Cooperative

HABITAT EXCHANGE
A Market-based Conservation Program for Greater Sage-grouse

TED TOOMBS
Environmental Defense Fund

Habitat Exchange:
Habitat Quantification Tool Overview

Scientists

- **Matt Holloran** - Ph.D., Chief Scientist, Wildlife Management Research Support and Principal and Senior Ecologist, Wyoming Wildlife Consultants
- **Jeff Beck** – Ph. D., Associate Professor, Wildlife Habitat Restoration Ecology, University of Wyoming
- **Amy Pocewicz** - Ph.D., Landscape Ecologist, The Nature Conservancy, Wyoming Chapter
- **Tony Apa** - Ph.D., Avian Research Biologist, Colorado Parks & Wildlife
- **Danielle Bilyeu** - Ph.D., Habitat Researcher, Colorado Parks & Wildlife
- **Dave Anderson** - Director and Chief Scientist, Colorado Natural Heritage Program

* Industry advisor – Hayden-Wing Associates

Process

- Independent Science Team
- Vetted with Stakeholder input
- EDF coordinated process
- Peer and Performance Review
- Adaptive Management

Outline

- Purpose of the Habitat Quantification Tool
- Description of habitat exchanges
- How it works
  - Components
  - Functional acre approach
  - Equation
  - Modifiers
  - Definitions

Need

- Improved quantification
- Consistent, standardized approach
- Science-based accounting

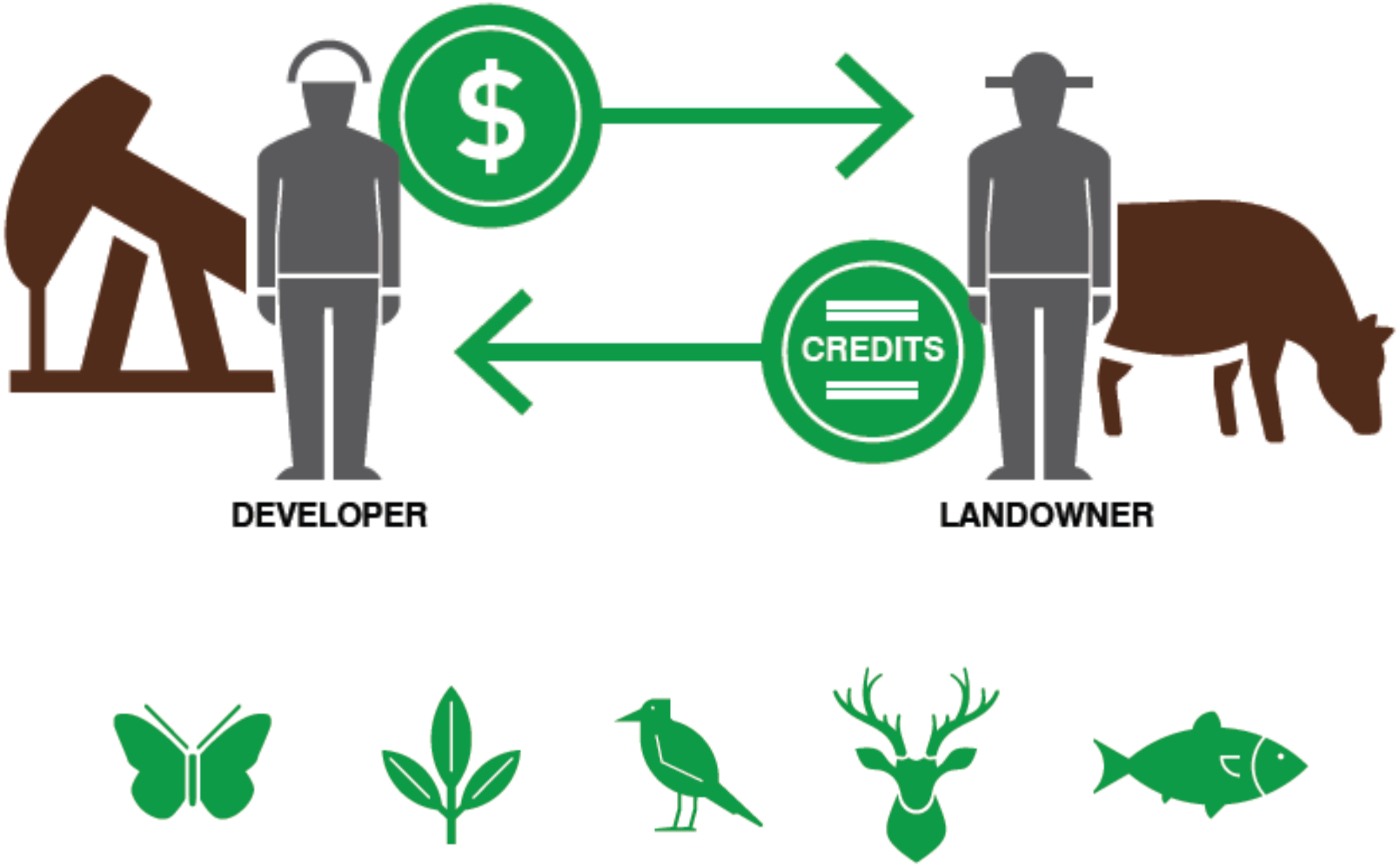
Role of HQT

- measures quantity and quality of habitat
- establishes a common “currency”
- accounts for direct and indirect impacts/benefits
- measures and verifies outcomes, not practices
- incorporates adaptive management

Purpose of the HQT

- To quantify the value of sage-grouse habitat in any particular location
- To quantify the change in habitat condition resulting from management activities
- To enable apples to apples comparisons of impacts to offsets
- To provide the basis for calculating credits and debits

Habitat Exchanges



Core Principles of Habitat Exchange

- Net Benefit
- Consistent, standardized approach
- Rewards quantifiable outcomes
- Involves Stakeholders
- Adaptively Managed

Exchange is One Part of the Mitigation Hierarchy

The mitigation hierarchy:

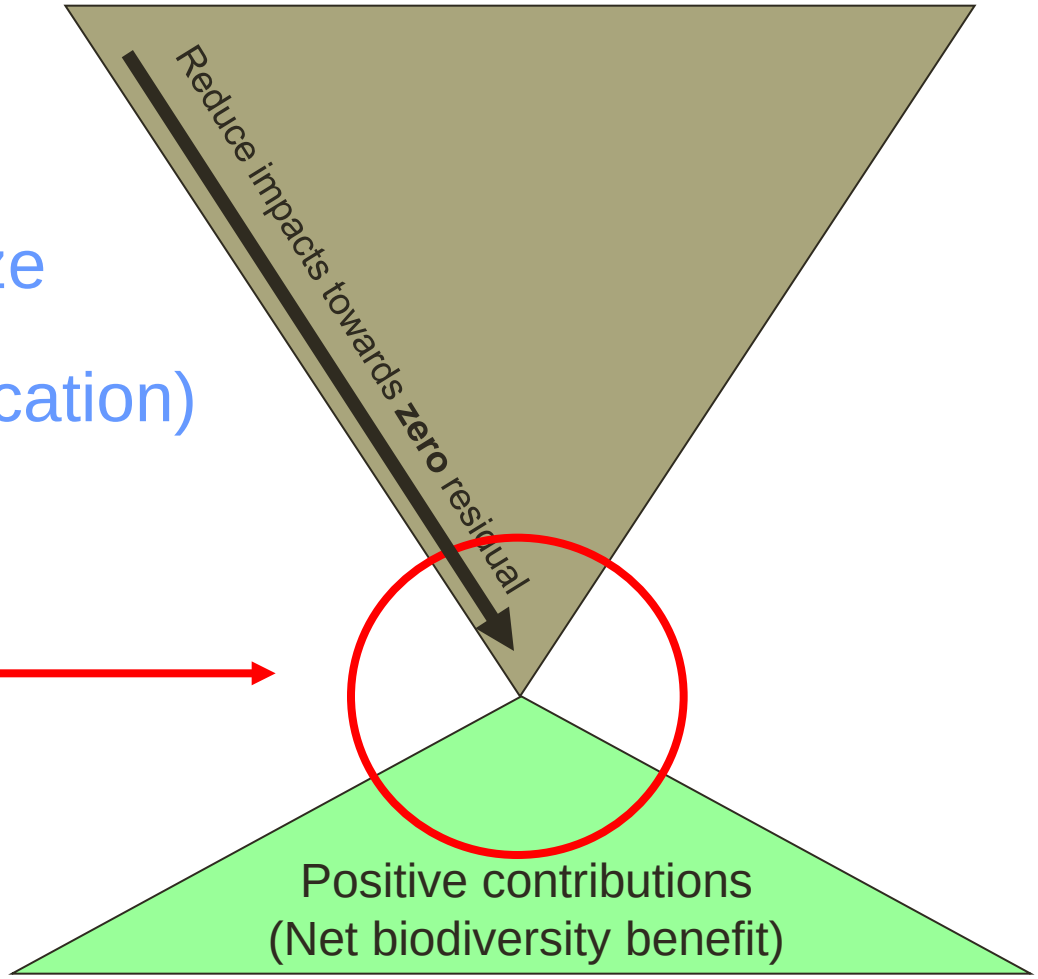
Avoid

Reduce, moderate, minimize

Rescue (relocation, translocation)

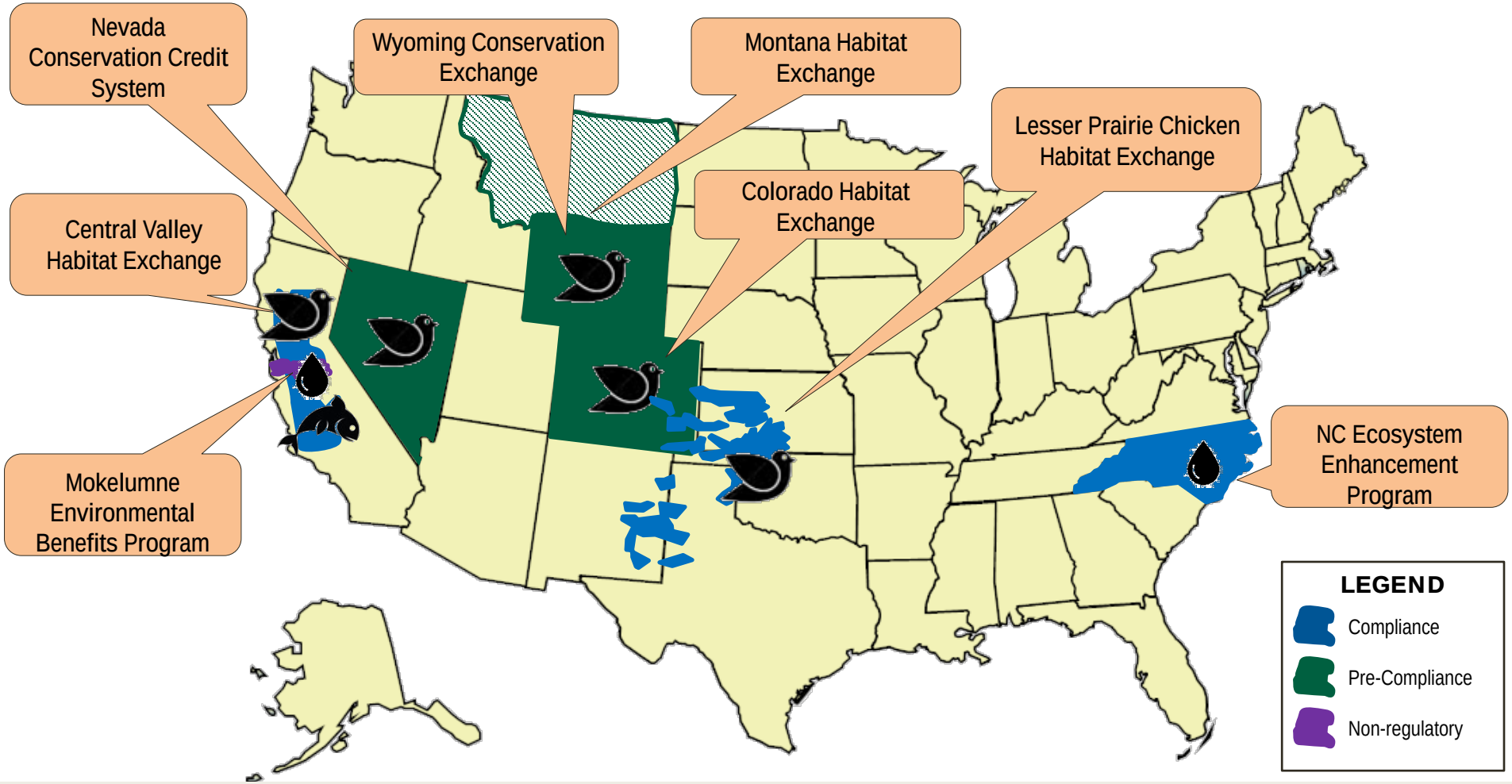
Repair, reinstate, restore

Compensate/offset



Thanks to Martin Hollands and Josh Bishop for slide

Exchanges in Development



Birds (Greater sage-grouse, Lesser prairie chicken, Swainson's Hawk, Riparian songbirds)

Water (water quality, increased flood capacity, stream mitigation)

Fish (salmon, steelhead)

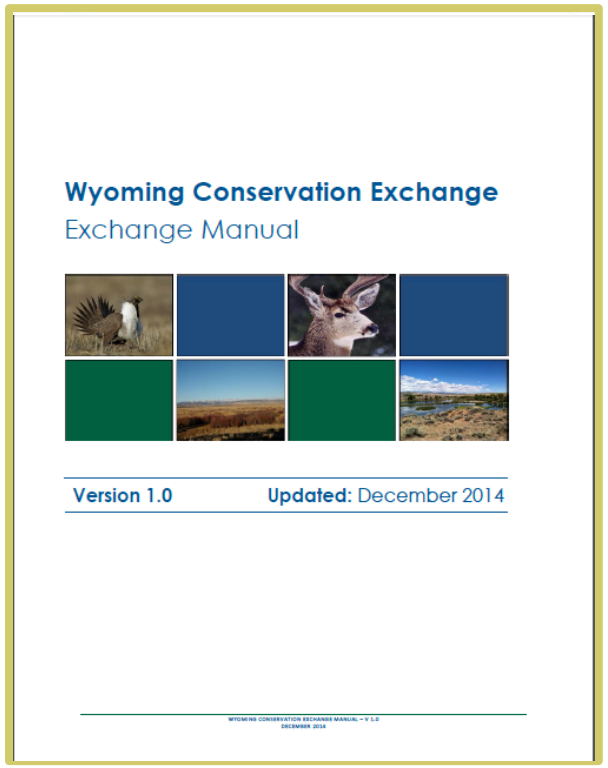
Partners of Greater Sage-Grouse Exchanges

Colorado Habitat Exchange

Wyoming Conservation Exchange

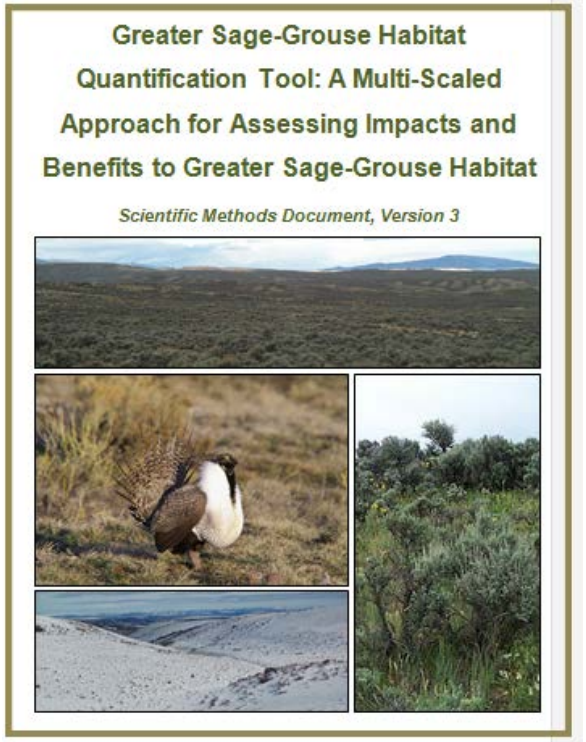
Exchange Documents

Exchange Manual



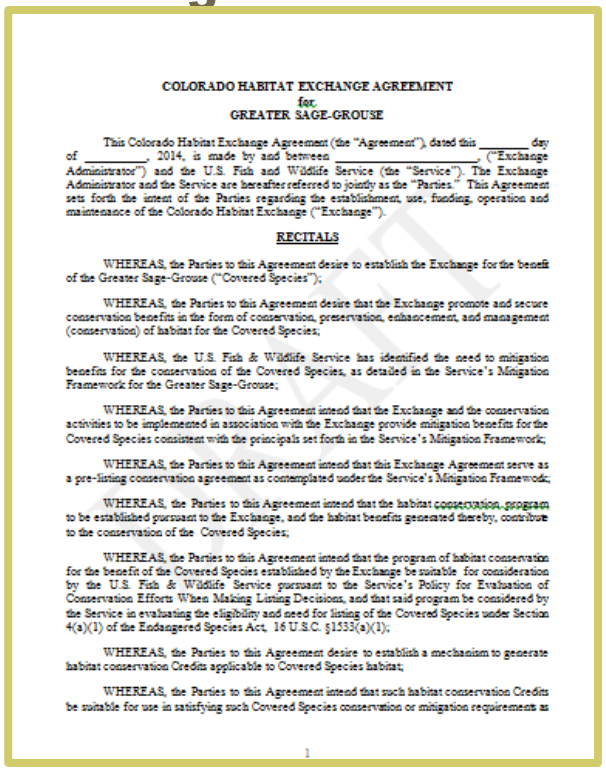
Policy Document

Habitat Quantification Tool



Science Document

Exchange Agreement



COLORADO HABITAT EXCHANGE AGREEMENT
for
GREATER SAGE-GROUSE

This Colorado Habitat Exchange Agreement (the "Agreement"), dated this _____ day of _____, 2014, is made by and between _____, ("Exchange Administrator") and the U.S. Fish and Wildlife Service (the "Service"). The Exchange Administrator and the Service are hereafter referred to jointly as the "Parties." This Agreement sets forth the intent of the Parties regarding the establishment, use, funding, operation and maintenance of the Colorado Habitat Exchange ("Exchange").

RECITALS

WHEREAS, the Parties to this Agreement desire to establish the Exchange for the benefit of the Greater Sage-Grouse ("Covered Species");

WHEREAS, the Parties to this Agreement desire that the Exchange promote and secure conservation benefits in the form of conservation, preservation, enhancement, and management (conservation) of habitat for the Covered Species;

WHEREAS, the U.S. Fish & Wildlife Service has identified the need to mitigation benefits for the conservation of the Covered Species, as detailed in the Service's Mitigation Framework for the Greater Sage-Grouse;

WHEREAS, the Parties to this Agreement intend that the Exchange and the conservation activities to be implemented in association with the Exchange provide mitigation benefits for the Covered Species consistent with the principals set forth in the Service's Mitigation Framework;

WHEREAS, the Parties to this Agreement intend that this Exchange Agreement serve as a pre-listing conservation agreement as contemplated under the Service's Mitigation Framework;

WHEREAS, the Parties to this Agreement intend that the habitat conservation program to be established pursuant to the Exchange, and the habitat benefits generated thereby, contribute to the conservation of the Covered Species;

WHEREAS, the Parties to this Agreement intend that the program of habitat conservation for the benefit of the Covered Species established by the Exchange be suitable for consideration by the U.S. Fish & Wildlife Service pursuant to the Service's Policy for Evaluation of Conservation Efforts When Making Listing Decisions, and that said program be considered by the Service in evaluating the eligibility and need for listing of the Covered Species under Section 4(a)(1) of the Endangered Species Act, 16 U.S.C. §1533(a)(1);

WHEREAS, the Parties to this Agreement desire to establish a mechanism to generate habitat conservation Credits applicable to Covered Species habitat;

WHEREAS, the Parties to this Agreement intend that such habitat conservation Credits be suitable for use in satisfying such Covered Species conservation or mitigation requirements as

1

Legal Document

Colorado Governor's Executive Order

Executive Order: D- 2015- 004

Directive D:

- Exchange Operational by end of 2015
- "this voluntary, market-driven program shall be made available to mitigate residual impacts of development on greater sage-grouse habitat after avoidance and minimization has occurred."

How it works

Components of HQT

- Method's Document
  - Explanation and justification of metrics used
- User's Guide
  - GIS instructions
- Calculator
  - Spreadsheet where data is entered that calculates credits and debits
  - Incorporates GIS data and site vegetation data
- Field Guide (to be completed at later date)
  - Instructions for field data collection

The Functional Acre Approach

- A measure of Quantity AND Quality
- Functional Acres = Acres x Functionality
- Function represents quality relative to optimal conditions on a scale of 0-1
- Example:

  100 acres x 20% function = 20 functional acres

Calculating Functional Acres

Functional Acres = Acres x Function

Functional Acres = Acres x Site Score x Modifiers

Functional Acres = Acres x Site Score x Site Modifiers x Local Modifiers x Landscape Modifiers

Site Score	Site Modifiers	Local Modifiers	Landscape Modifiers
Site Score Vegetation Condition	4th Order Modifiers Cheatgrass Conifer Cover Anthro. Dist.	3rd Order Modifiers Distance to Lek Presence of Sagebrush	2nd Order Landscape Disturbance Index

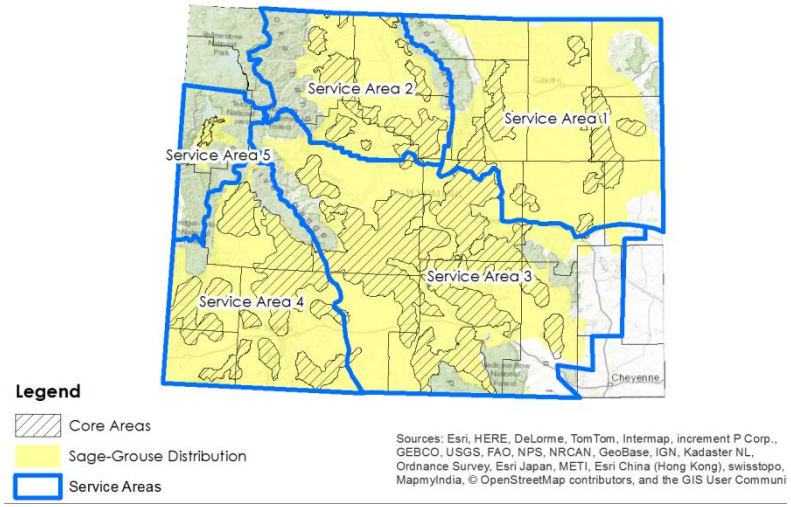
Multiple Scales Meaningful to Grouse

1st Order

Occupied range for the species in WY

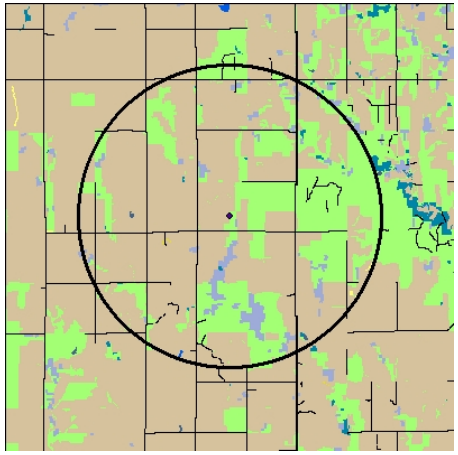
2nd Order

Habitats required by subpopulations



3rd Order

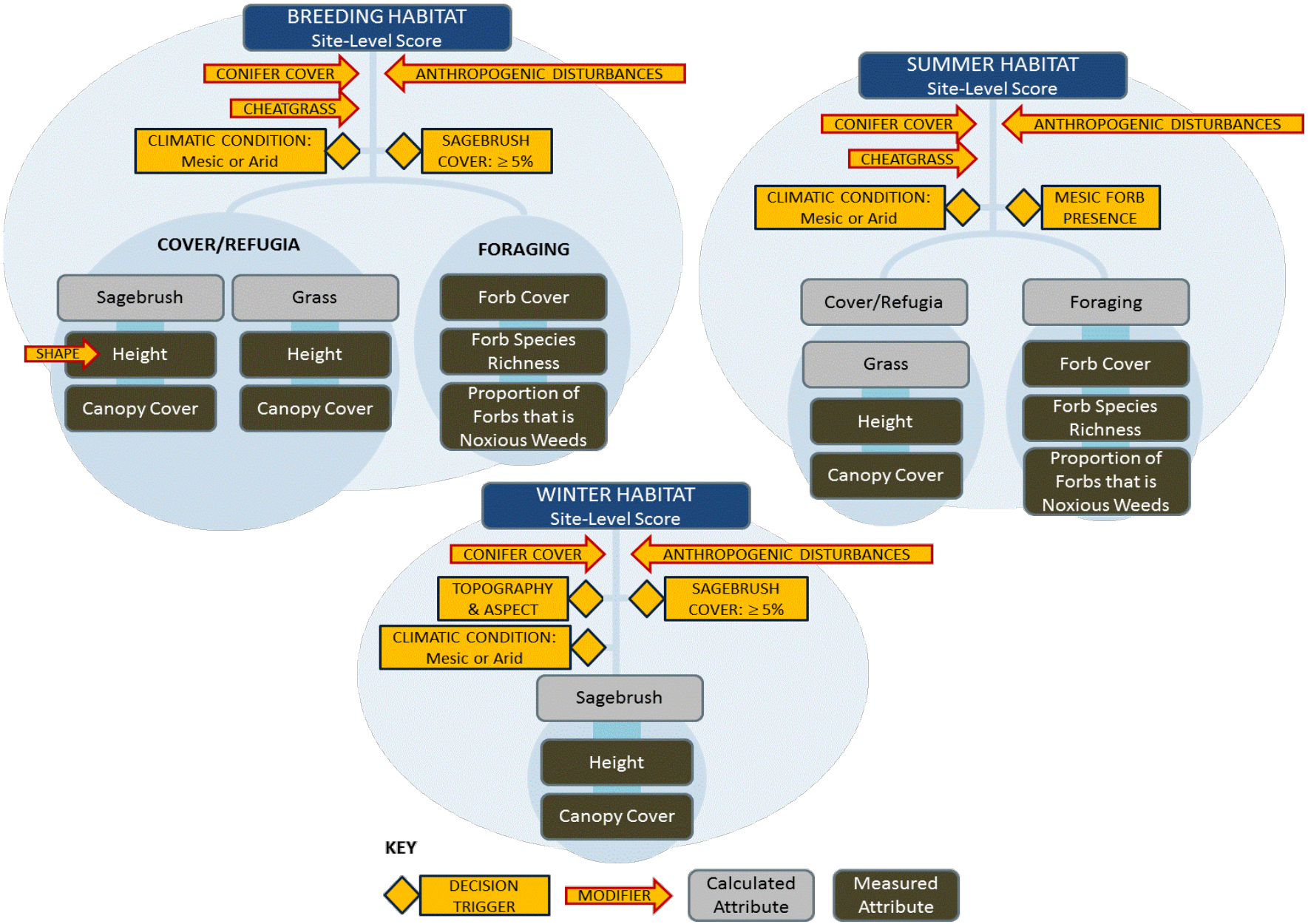
Habitats used by individuals in the subpopulation



4th Order

Habitat conditions at the site of proposed activities

Seasonal Habitat Concept Models



Vegetation Attribute Weighting

BREEDING						
Cover / Refugia (50%)				Forage (50%)[A]		
Sagebrush Height 10%	Sagebrush Canopy Cover 15%	Grass Canopy Cover 12.5%	Grass Height 12.5%	Forb Cover 16.7%	Forb Species Richness 16.7%	Presence of Specific Forbs 16.7%[B]

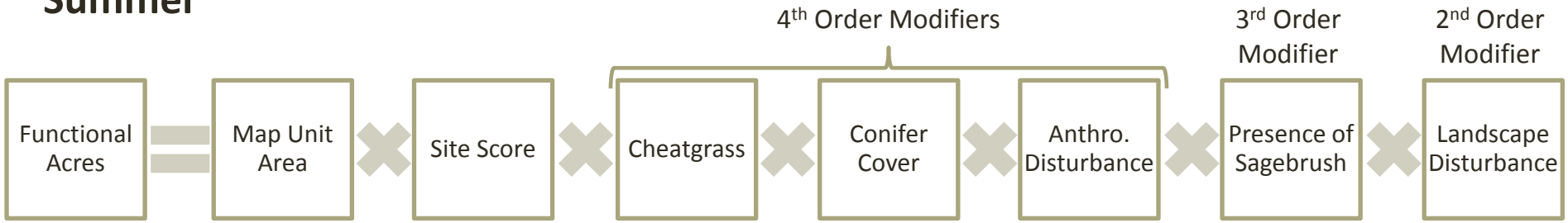
SUMMER [C]				
Cover / Refugia (30%)		Forage (70%)		
Grass Canopy Cover 15%	Grass Height 15%	Forb Cover 23.3%	Forb Species Richness 23.3%	Presence of Specific Forbs 23.3% [B]

WINTER	
Sagebrush Height 50%	Sagebrush Canopy Cover 50%

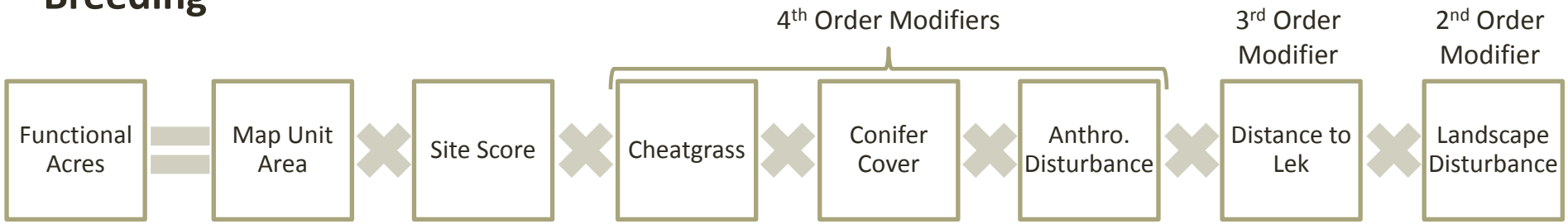
Calculating Functional Acres

Seasonal Functional Acre Accounting

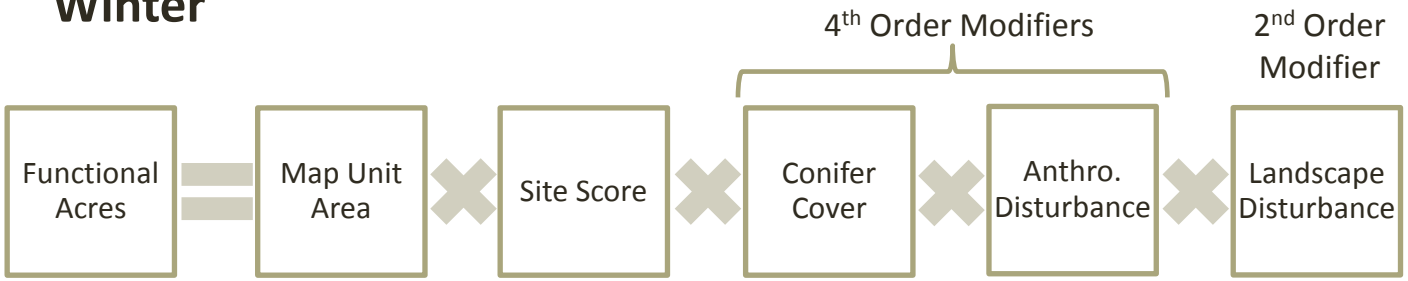
Summer



Breeding



Winter



Example: Seasonal Functional Acre Accounting (Summer)

Summer

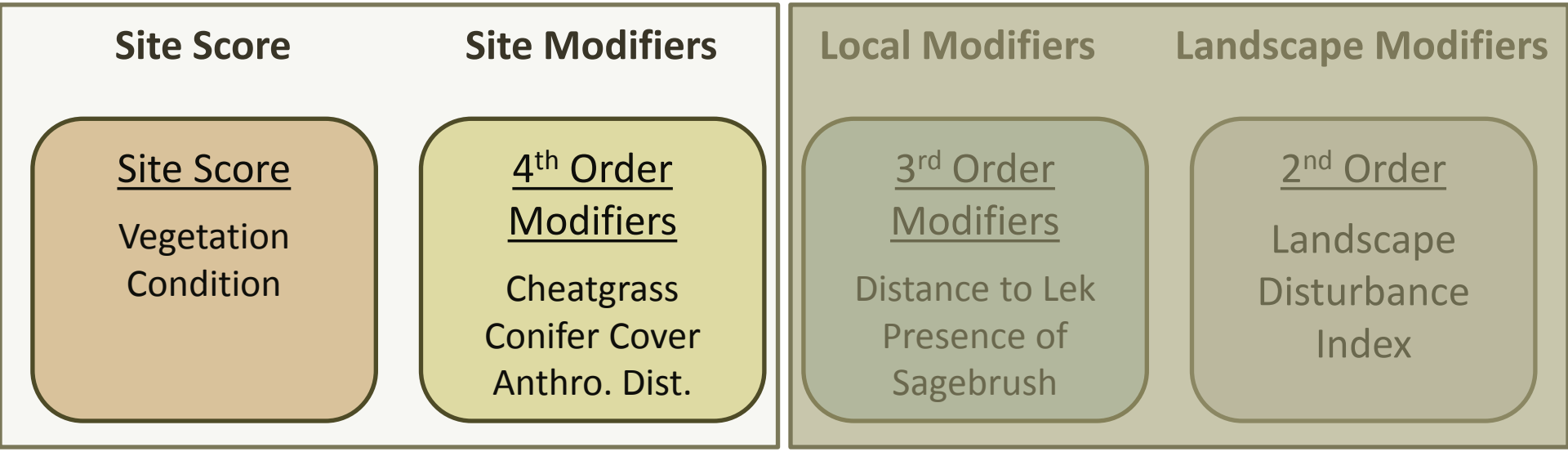
Functional Acres	=	Map Unit Area	×	Site Score	×	Cheatgrass	×	Conifer Cover	×	Anthro. Disturbance	×	Presence of Sagebrush	×	Landscape Disturbance
Functional Acres	=	100	×	.9	×	.6	×	.8	×	.6	×	.8	×	.8

Functional Acres	=	16.6

Calculating Change in Functional Acres

Change in Functional Acres (Pre- vs. Post-Project)

The 2nd and 3rd order modifiers do not change from pre-project to post-project condition.



Only site score and site modifiers adjust with changes in habitat quality, such as impacts or improvements.

Changes in Habitat Quality (Site Scale Only)

Impacts/Anthropgnc Dist.

- Oil & gas wells
- Towers (cell / met / etc.)
- Transmission lines
- Mines
- Agriculture
- Development
- Roads
- Reservoirs

Improvements

- Removing cheatgass
- Removing conifer
- Adding forbs cover
- Adding vegetation (sagebrush)
- Converting roads to vegetation

Calculating Change in Functional Acres

Change in Functional Acres =

Post-project functional acres – Pre-project functional acres

Change in Functional Acres			
Seasonal Habitat	**Post-Project**	**Pre-Project**	**Functional Acre Change**
Breeding	575.54 functional acres	755.11 functional acres	- 179.58 functional acres
Summer	830.65 functional acres	1042.66 functional acres	- 212.02 functional acres
Winter	537.68 functional acres	673.4 functional acres	- 135.73 functional acres

Scoring Curves and Decision Triggers

Decision Triggers

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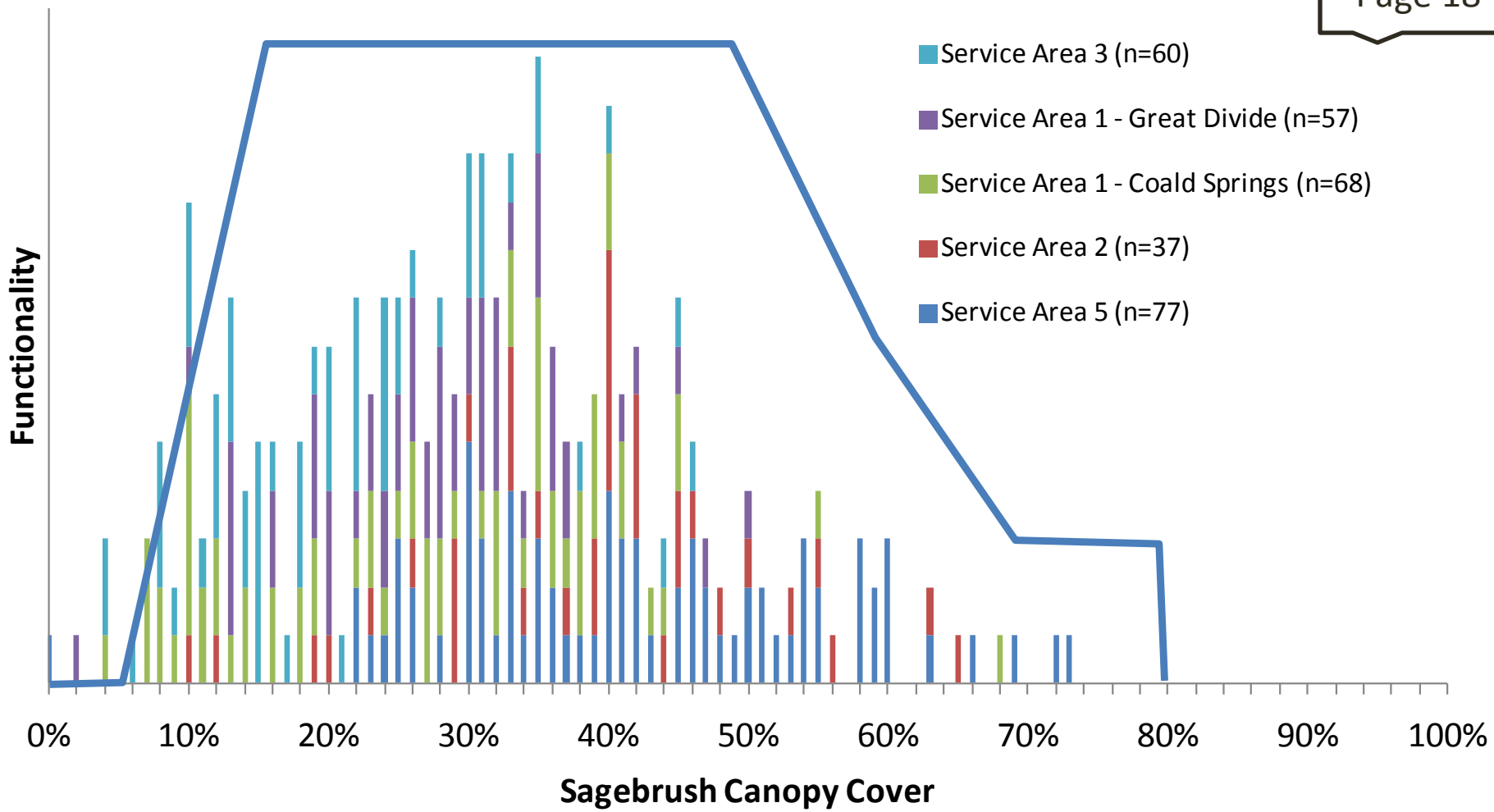
Local Climatic Conditions	Determine whether site is either mesic conditions or arid/xeric conditions for breeding, summer, and winter habitats
Topography and Aspect	Determine the topography and aspect curves (slope <5% or >5%) for winter habitat
Sagebrush Canopy Cover	≥5% required for breeding and winter habitat
Facultative Forb Presence	Presence of facultative forb species required for summer habitat, see Appendix D for species list

Example Scoring Curve: Sagebrush Canopy Cover (Breeding)



<5	5-14	15-19	20-29	30-39	40-49	50-59	60-69	70-79	>80
0	0.5	1	1	1	1	0.5	0.25	0.25	0

Example: Sagebrush Height, Cover (Breeding)

Breeding Habitat

Sagebrush Height, Arid condition in the Upper Green River Basin

Height (cm)	<10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	65-70	>70
% perf	0	0.2	0.7	1.0	1.0	1.0	0.8	0.4	0.2	0.15	0.15	0.1	0

Reference: Wuenschel, Amarina. 2014. *Ecological and Fine-Scale Spatial variation in Vegetation at Sage-grouse Nests in western Wyoming*. Thesis, Department of Ecosystem Science and Management, University of Wyoming, Laramie, USA.

Field data		HQT Calculator
Sagebrush height = 25cm	→	1.0

Sagebrush Cover, Arid condition in the Upper Green River Basin

Height (cm)	<5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	>65
% perf	0	0.2	0.5	0.8	1.0	0.9	0.7	0.5	0.3	0.2	0.15	0.1	0.1	0

Reference: Wuenschel, Amarina. 2014. *Ecological and Fine-Scale Spatial variation in Vegetation at Sage-grouse Nests in western Wyoming*. Thesis, Department of Ecosystem Science and Management, University of Wyoming, Laramie, USA.

Field data		HQT Calculator
Sagebrush cover = 20%	→	1.0

Site Scale Modifiers

Site Scale Modifiers by Season

Site modifiers:

4th Order Modifiers

Cheatgrass
Conifer Cover
Anthro. Dist.

Summer

Cheatgrass
Conifer Cover
Anthro. Dist.

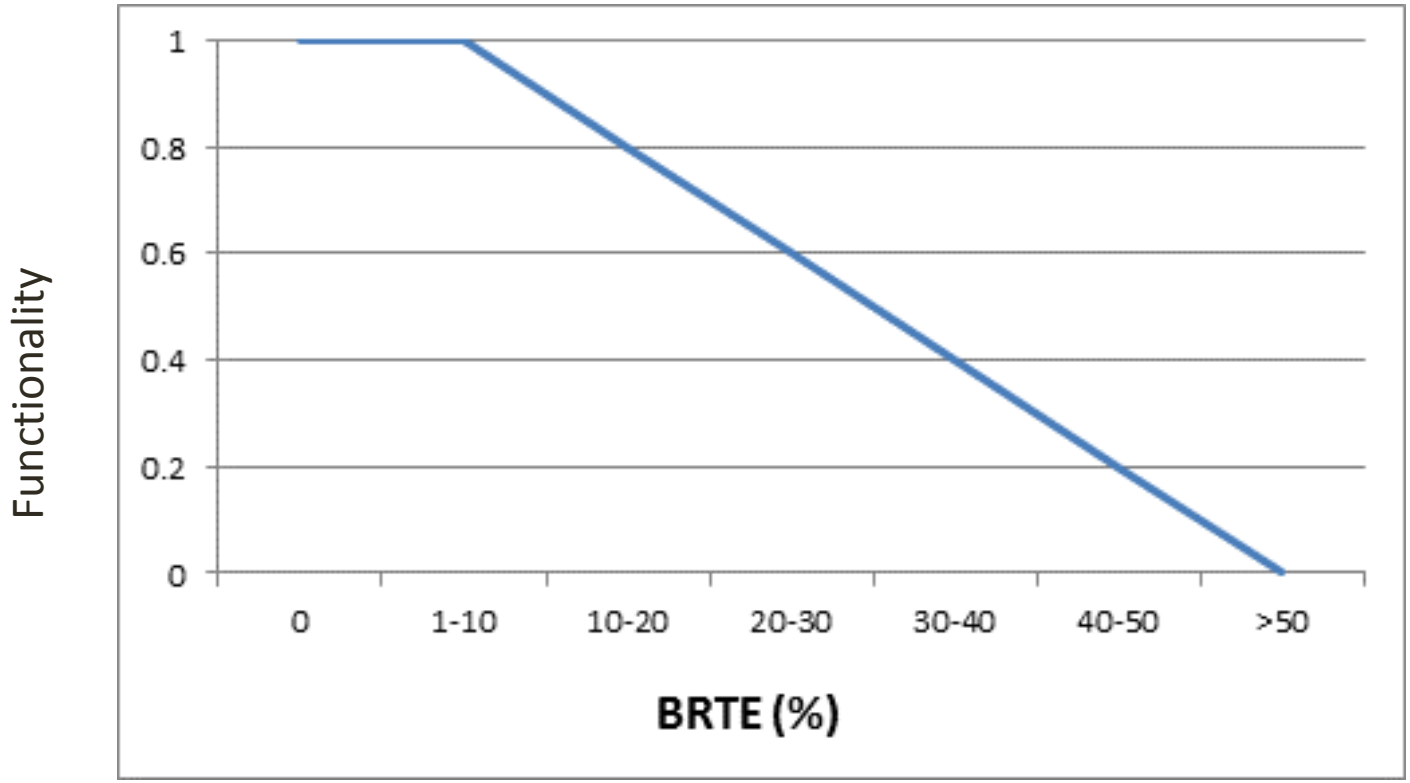
Breeding

Cheatgrass
Conifer Cover
Anthro. Dist.

Winter

Conifer Cover
Anthro. Dist.

Cheatgrass Modifier



% BRTE	0	1-10	10-20	20-30	30-40	40-50	>50
Functionality	1	1	0.8	0.6	0.4	0.2	0

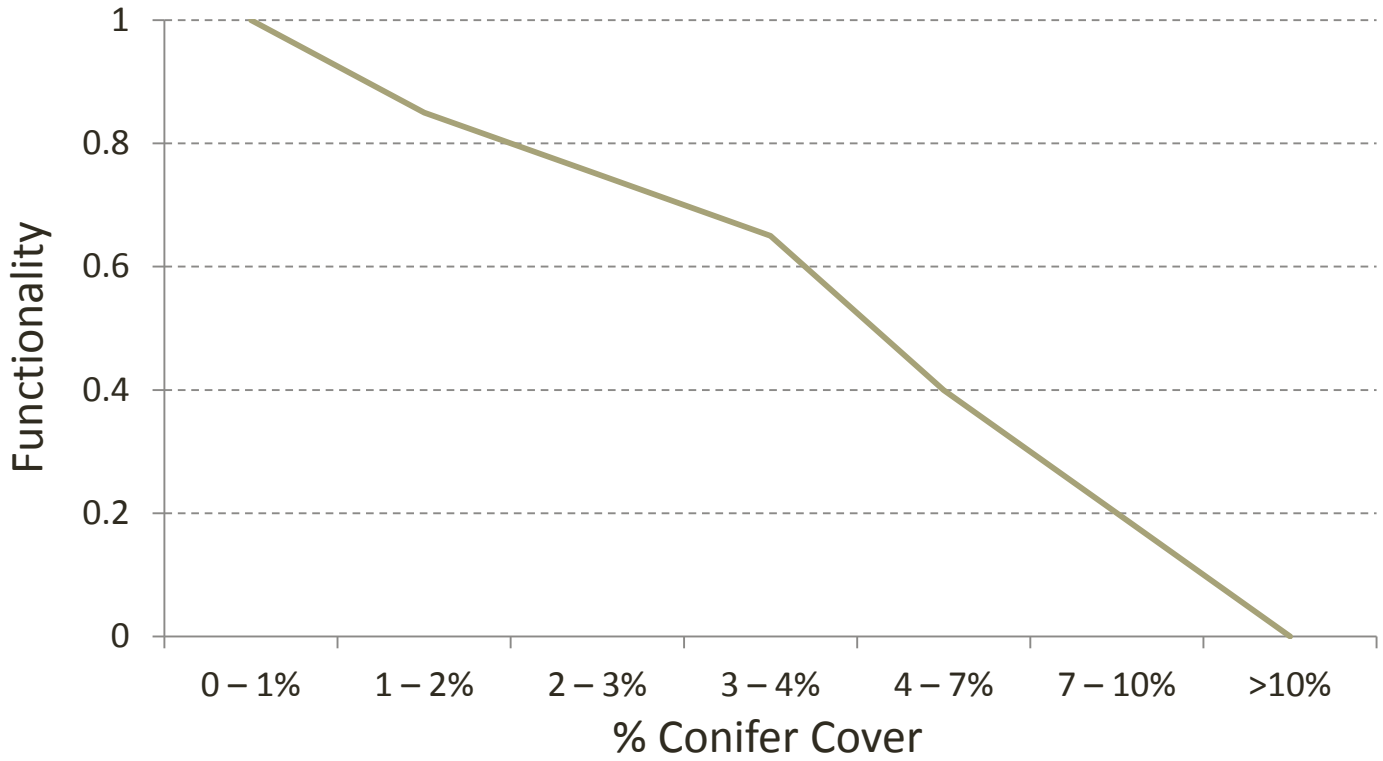
Functional Acres = Map Unit Area × Site Score × Cheatgrass × Conifer Cover × Anthro. Disturbance × Presence of Sagebrush × Landscape Disturbance

Conifer Cover Modifier

Encroachment of conifers into upland sagebrush habitats has the potential to transform sagebrush communities once suitable for GRSG into a less suitable state

Conifer Cover within 1km Radius of Map Unit	Percent Value
0 – 1%	100%[A]
>1 – 2%	85%
>2 – 3%	75%
>3 – 4%	65%
>4 – 7%	40%
>7 – 10%	20%
>10%	0%

Conifer Cover Modifier

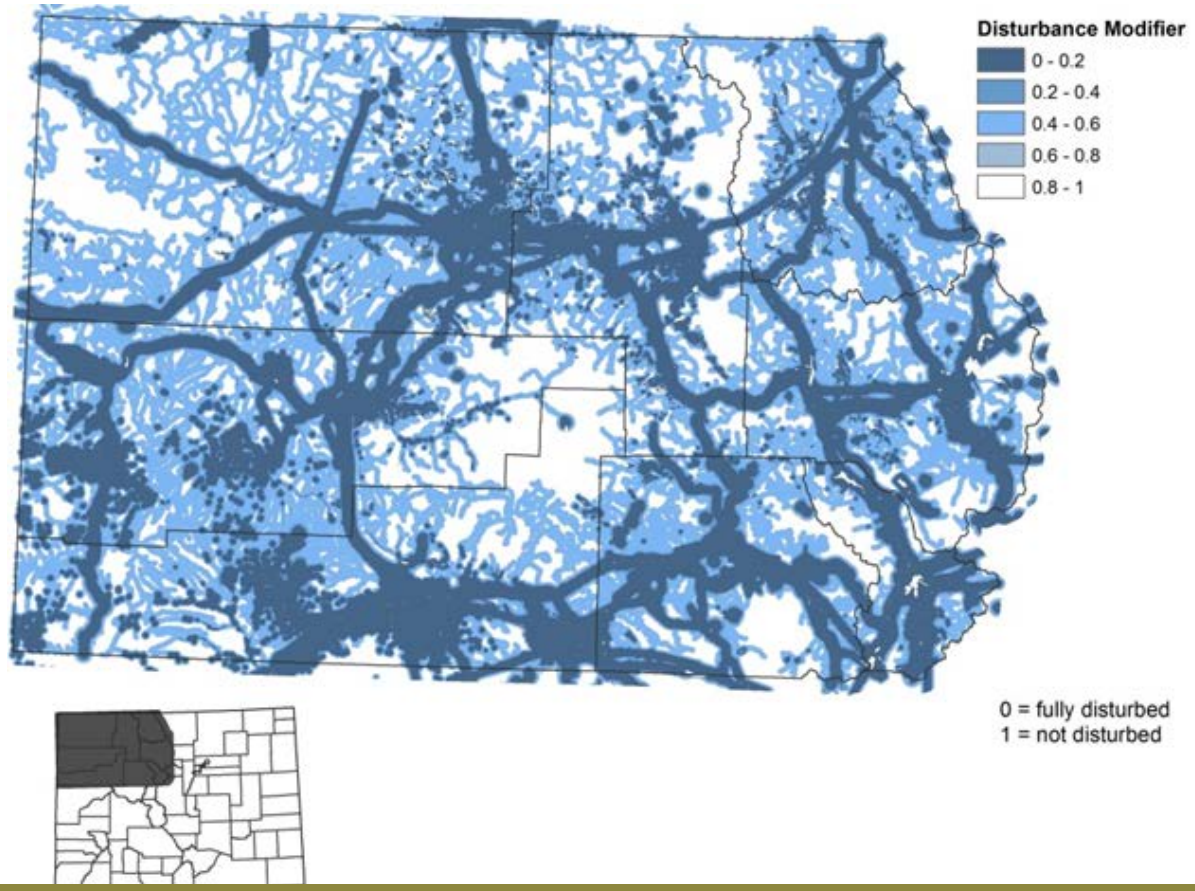


% cover	0-1%	1-2%	2-3%	3-4%	4-7%	7-10%	>10%
Functionality	**1.0**	**0.85**	**0.75**	**0.65**	**0.4**	**0.2**	**0**

Functional Acres = Map Unit Area × Site Score × Cheatgrass × Conifer Cover × Anthro. Disturbance × Presence of Sagebrush × Landscape Disturbance

Anthropogenic Disturbance Modifier

Anthropogenic features are defined as human-built features on the landscape that have influence on grouse.



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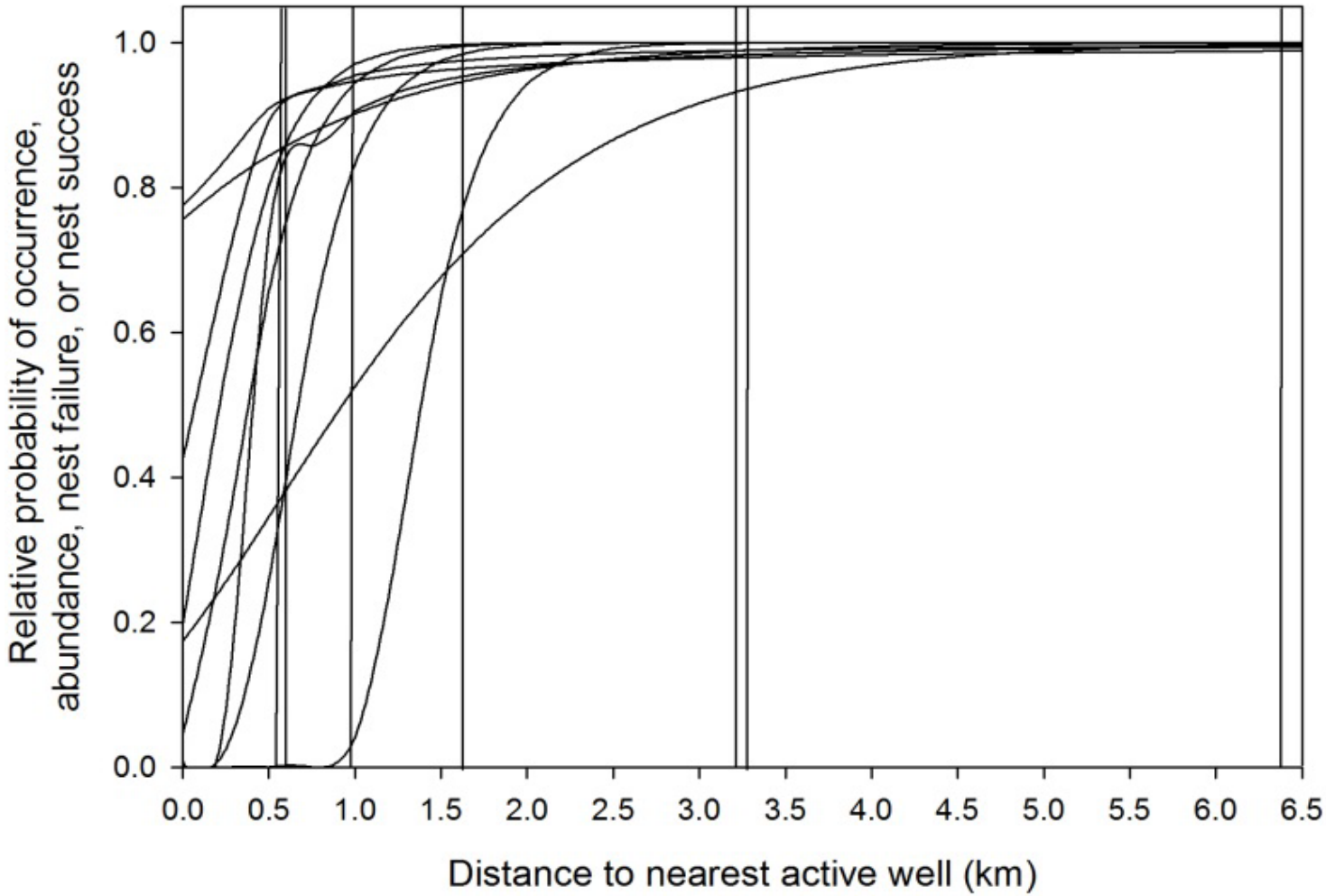
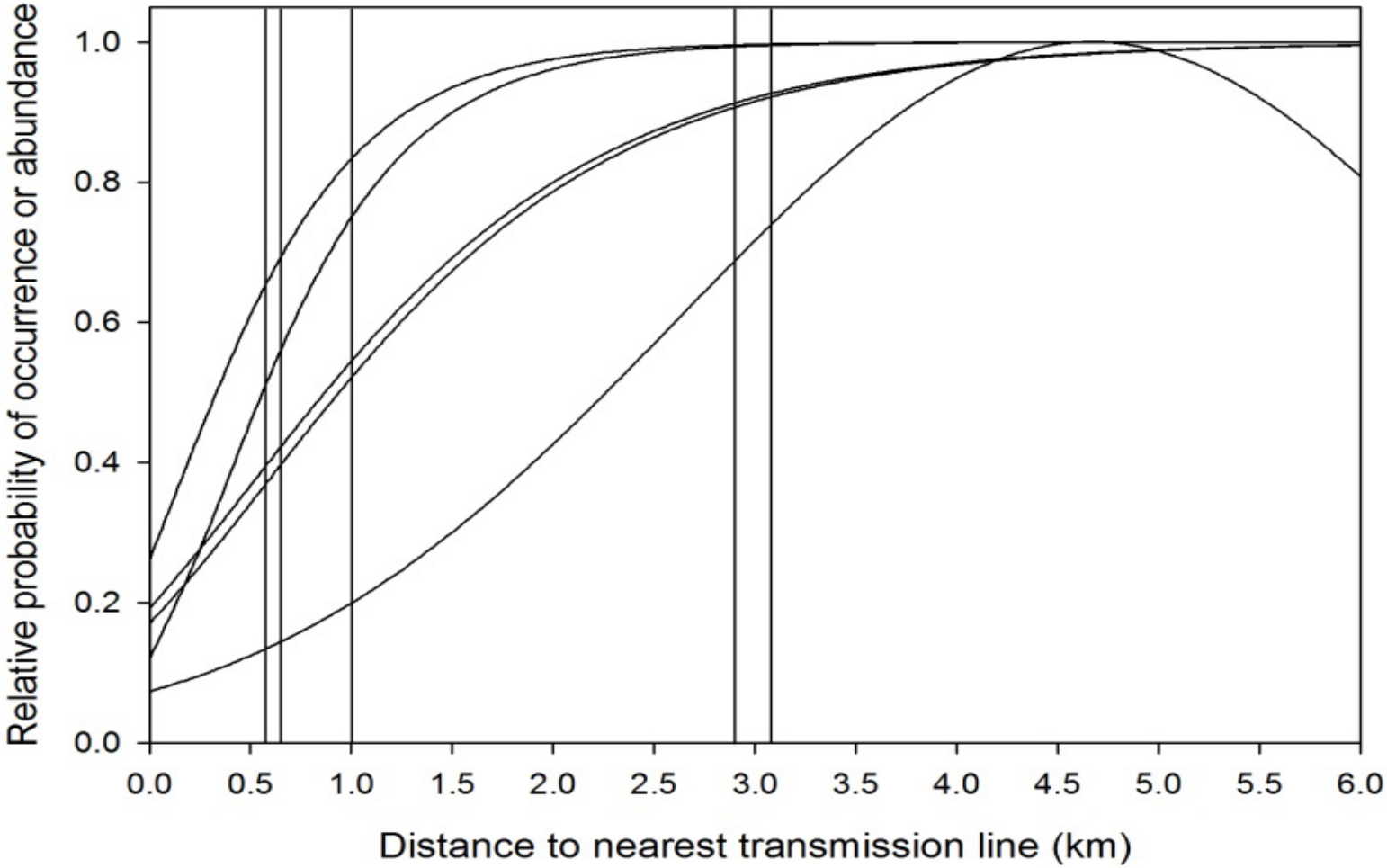
Anthropogenic Disturbance Modifier

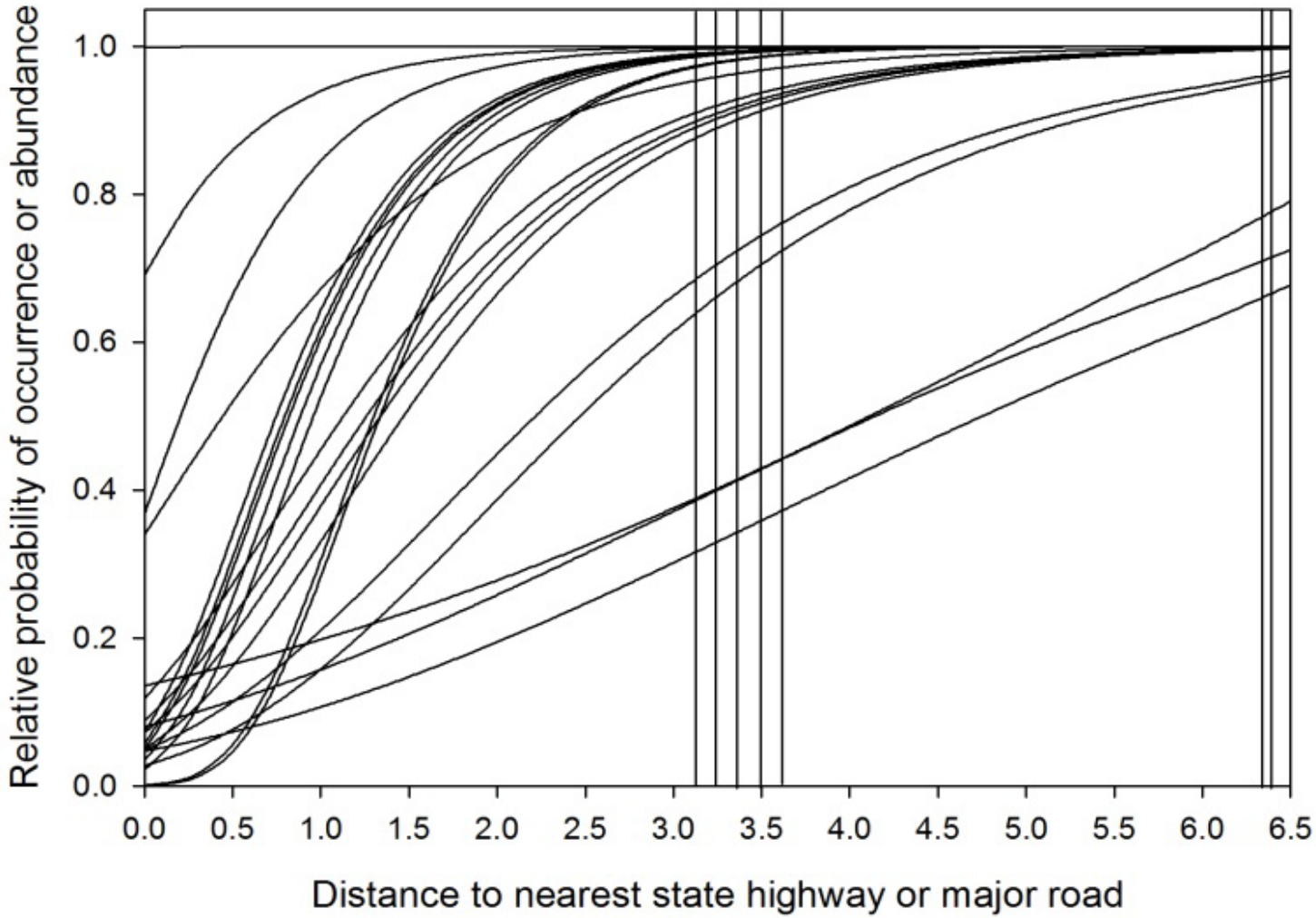


Functional Acres = Map Unit Area × Site Score × Cheatgrass × Conifer Cover × Anthro. Disturbance × Presence of Sagebrush × Landscape Disturbance

Anthropogenic Disturbance Modifier



Anthropogenic Disturbance Modifier



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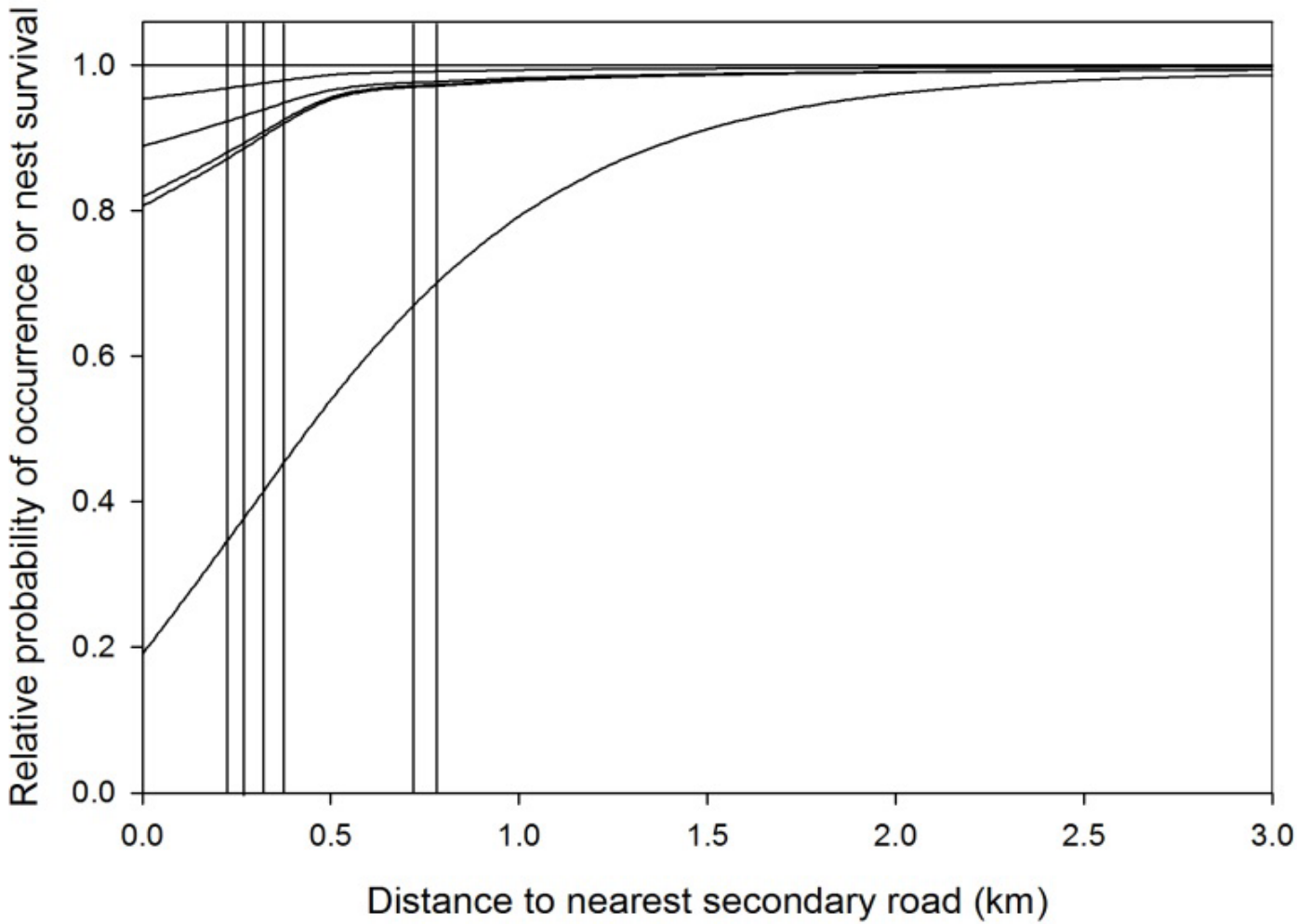
Anthropogenic Disturbance Modifier



Functional Acres = Map Unit Area × Site Score × Cheatgrass × Conifer Cover × Anthro. Disturbance × Presence of Sagebrush × Landscape Disturbance

Distance Effects/Weights of Structures of Anthropgnc Dist

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Disturbance	Subtype	Weight	Distance (km)
Oil & gas wells	Active	100	2.1
	Inactive	10	0
Towers (Met.)		50	0
Towers (Com.)		50	0
Transmission lines		100	3
Wind Turbines		100	3
Mines	Active – large	100	2.1
	Active – med or small	100	0
	Inactive – large	50	0
	Inactive – med or small	10	0
Agriculture	Tilled	100	0
	Untilled	85*	0
Development	Med – High	100	4.2
	Low	75	1.5
Roads	Major	100	4.2
	Secondary	50	1.5

Local Context Modifiers

Local Context Modifiers by Season

Local modifiers:

3rd Order Modifiers

Distance to Lek
Presence of Sagebrush

Summer

Presence of Sagebrush

Breeding

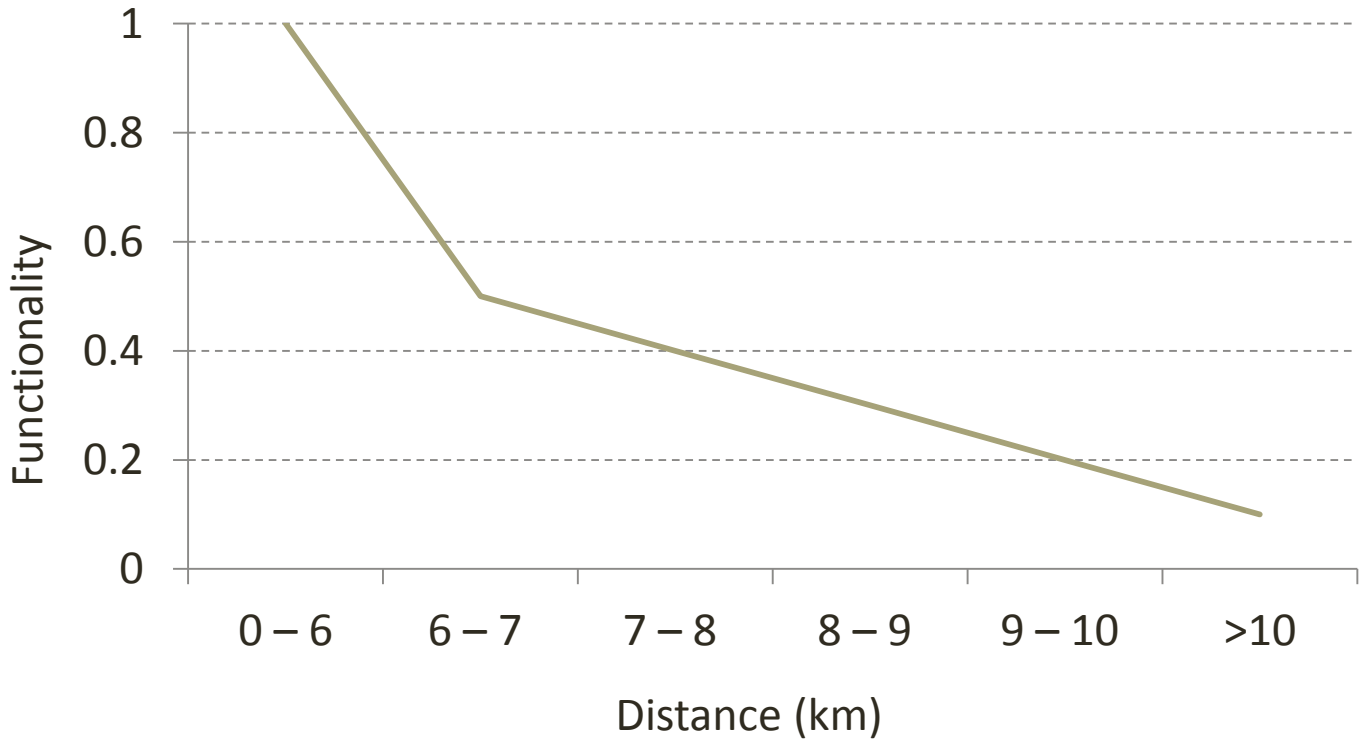
Distance to Lek

Distance to Known Lek (Breeding Season)

Distance to known lek applies only to breeding habitat. GRSG breeding habitat is spatially tied to lek locations; the majority of females breeding on a given lek nest within 6-km of that lek.

Distance to Known Lek (km)	Percent Value
0 – 6	100%[A]
>6 – 7	50%
>7 – 8	40%
>8 – 9	30%
>9 – 10	20%
>10	10%

Distance to Lek Modifier (Breeding Season)



Distance (km)	0-6	6-7	7-8	8-9	9-10	>10
Functionality	**1.0**	**0.5**	**0.4**	**0.3**	**0.2**	**0.1**

Functional Acres = Map Unit Area × Site Score × Cheatgrass × Conifer Cover × Anthro. Disturbance × Distance to Lek × Landscape Disturbance

Presence of Sagebrush (Summer Season)

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Presence of sagebrush cover applies only to summer habitat.

During this season, GRSG use habitat that does not have sagebrush directly present, but it is in close proximity.

As long as at least 15% sagebrush canopy cover, 20cm sagebrush height is located with 300-m of each sample point, the map unit is considered summer habitat.

Presence of Sagebrush Cover (m)	Percent Value
0 – 300	100%[A]
>300	0

Landscape Modifiers

Landscape Modifiers by Season

Landscape modifiers:

2nd Order

Landscape Disturbance Index

Summer

Landscape Disturbance Index

Breeding

Landscape Disturbance Index

Winter

Landscape Disturbance Index

Landscape Disturbance Index

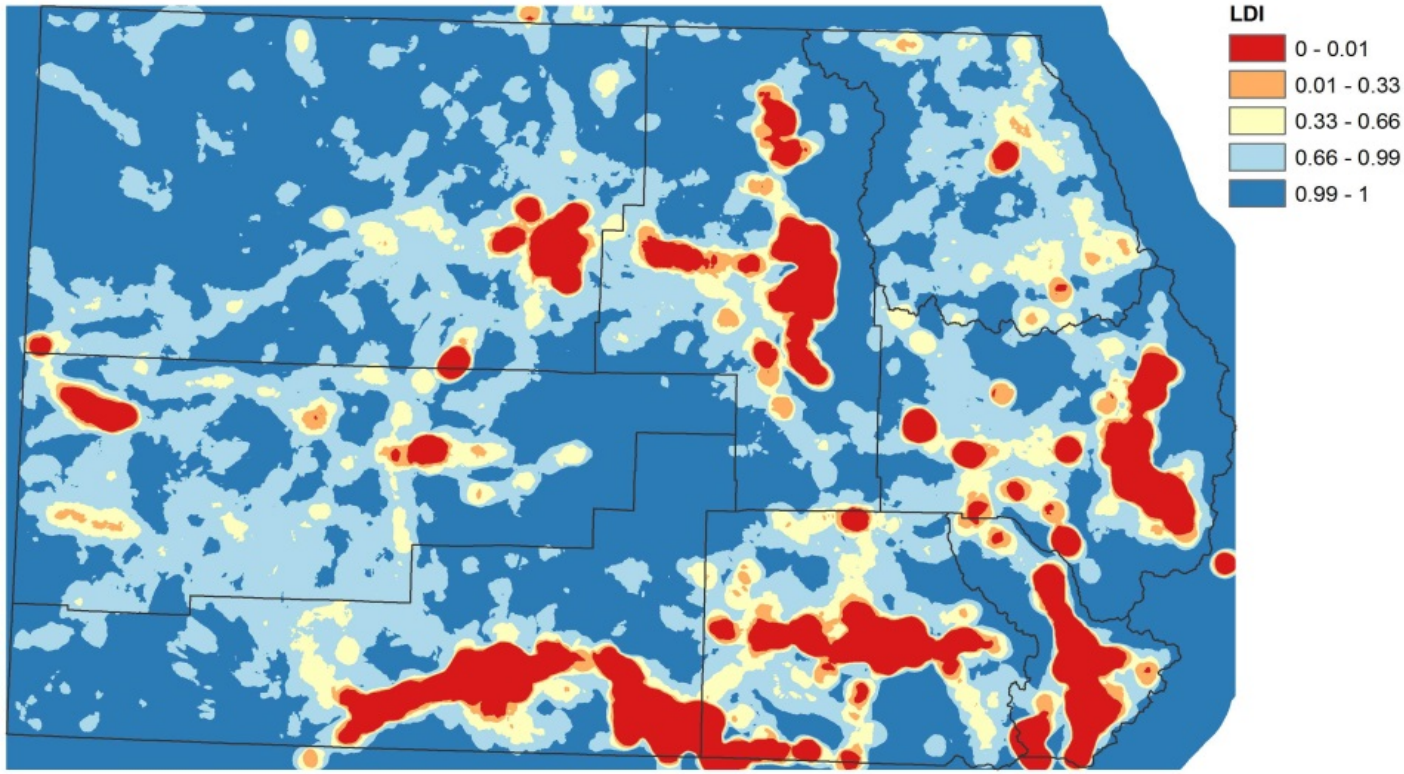
The Landscape Disturbance Index represents the density of anthropogenic disturbance at a landscape scale. It is calculated by:

- Mapping the cumulative distance footprint associated with anthropogenic features
- Calculating the disturbance density from the cumulative disturbance footprint for a 3.2-km radius surrounding each raster cell

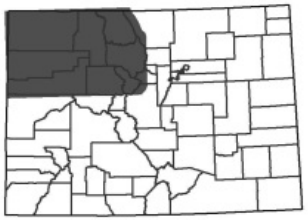
Landscape Disturbance Index

	Lower density threshold	Upper density threshold
Median well density [A]	0.39 wells/km^2 (1.01 wells/mi^2)	2.54 wells/km^2 (6.58 wells/mi^2)
Median road density [B]	0.94 km road/km^2	3.73 km road/km^2
Combined road and well density	0.03 km^2/ km^2	0.10 km^2/km^2
Density threshold applied to 3.2 km radius	0.82 km^2/ 32.2 km^2 (203 acres/12.4 mi^2)	3.07 km^2/ 32.2 km^2 (759 acres/12.4 mi^2)
Area associated with density threshold at 3.2-km radius	203 acres; equivalent to 2.5% disturbance	759 acres; equivalent to 9.5% disturbance

Landscape Disturbance Index



0 = fully disturbed
1 = not disturbed



Functional Acres = Map Unit Area × Site Score × Cheatgrass × Conifer Cover × Anthro. Disturbance × Presence of Sagebrush × Landscape Disturbance

Next Steps for HQT

- Complete External Peer Review by end 2016
- Develop Monitoring and Adaptive Management Plan by end of 2016
- Draft Field Guide by end of 2016
- Adapt model to other States

Questions?