



Jackson Hole
Conservation Alliance

Partnering for a Wild & Beautiful Valley

Evaluation of the Natural Resource Overlay (NRO) in Teton County, Wyoming

April 2008

Summary for “ Evaluation of the Natural Resource Overlay (NRO) in Teton County, Wyoming.”
By the Jackson Hole Conservation Alliance and the Conservation Research Center of Teton Science Schools

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1.0 INTRODUCTION

1.1 Preface

Jackson Hole –Keeper of National Treasures

Jackson Hole is a high mountain valley that is home to Grand Teton National Park and our nation's most cherished wildlife, such as bears, wolves, elk, moose and deer. A gateway to Yellowstone National Park, Jackson Hole hosts millions of visitors and a growing number of residents.

As much as we like to think that Jackson Hole is special as compared to other mountain resort areas because of its amazing scenery, fabulous recreational opportunities and friendly people, what makes it truly unique is its wildlife. Remarkably, the valley is still home to the full complement of native species that have lived and migrated through the valley for thousands of years. It's a powerful place, where people share the rare experience of being able to see wild animals and dramatic scenery in the context of everyday life.

Accordingly, the people of Teton County, Wyoming, have a long history of being caring stewards to the lands and wildlife that Mother Nature has entrusted them with, and it's a role that has taken shape in hearts, minds and governmental policies. The community's 1994 Comprehensive Plan guiding principle No. 1 states: *"Teton County's wildlife and scenic resources are a local and national treasure, and, therefore, the community recognizes a stewardship responsibility for their protection. Future development in Teton County will take place in this context."*

But *has* development taken place in that context? How have our community's land development policies functioned in terms of protecting our local and national treasures? Going forward, what can our community do to preserve our wildlife and environment in the face of future growth?

These are questions the Jackson Hole Conservation Alliance believes are important to address, especially in 2008 as the community heads into the first major updates of the Comprehensive Plan since 1994. The Jackson/Teton County Comprehensive Plan, a.k.a. "Comp Plan," is the guiding government policy document to enable Jackson Hole to grow in a cohesive, broad context, as opposed to having planning decisions made in a piecemeal fashion. That's no easy task, with Teton County growing at a fast and furious pace of 63.3 percent and the Town of Jackson doubling in size between 1990 and 2000, according to census figures.

To help the valley assess how well it has done in protecting its national treasures, the Conservation Alliance began the **Natural Resource Overlay Mapping Project** about a year ago. Throughout the project, the Alliance has teamed with professional mapping technicians, planners, wildlife officials, state agencies and others to gather the most up-to-date and scientifically defensible information available.

We contracted with the Conservation Research Center of the Teton Science Schools, a new branch of the long-standing and well-respected conservation education center in Jackson Hole, to create maps with geographic information systems (GIS) technology. The Conservation Research Center conducted independent data compilation, data transfer, map production and data analysis. The collaboration drew on expertise from the Wyoming Game and Fish Department, Teton County, Wyoming Open Spaces Initiative, National Elk Refuge, Teton Science Schools, Wildlife Conservation Society, Grand Teton National Park, and the Jackson Hole Wildlife Foundation/Biota.

The Conservation Alliance is extremely grateful for the generous contributions of data by these agencies and independent researchers. Without their willingness to share findings, their time and expertise, our community would be left to make ill-informed, likely detrimental decisions.

And finally, this project couldn't have happened without funding from our generous sponsors: The Community Foundation of Jackson Hole, the Wyoming Community Foundation, and Conservation Alliance members who earmarked contributions specifically for this undertaking.

Planning for Wildlife, Open Space and a Clean Environment

As you will see in the document that follows, the Jackson Hole Conservation Alliance Natural Resource Overlay Mapping Project focuses on the "NRO," a zoning designation that is the single most important component in our local government regulations for protecting water quality, wildlife habitat and open space. Because wildlife, streams, wetlands and migration areas are often found in the same places people choose to build homes, the NRO, or Natural Resource Overlay, was created to identify and protect contiguous areas of private land so that species and overall water quality wouldn't be lost to piecemeal development. Developments occurring within the NRO are intended to have a higher level of environmental review than developments in other zones and may be asked to meet additional standards.

It's easy to think that because Jackson Hole still has a great mix of wildlife populations and a large amount of public lands, there's no need to worry about protecting habitat or conserving open spaces on private lands. The truth is, wildlife has been impacted by human activities in the valley, and those impacts add up over time. Private lands in Teton County, Wyoming, provide crucial habitat for many of the species visitors and residents are so lucky to see on a frequent basis in the valley.

According to a 1994 study funded by the Conservation Alliance, private lands are home to 41 percent of Jackson Hole's bald eagle nests, 43 percent of the crucial winter ranges for moose, 90 percent of the mule deer winter range, 22 percent of crucial winter ranges for elk, an estimated 80 percent of trumpeter swan crucial winter ranges, and 64 percent of the spawning grounds for the Snake River cutthroat trout. All of the species identified for protection in the community's Comprehensive Plan depend on private lands to survive. They need corridors for migration between summer and winter habitat, year-round access to forage and water, and large amounts of undisturbed habitat. It's clear that even though 97 percent of Teton County is protected by public land, wildlife do not understand the boundaries between public and private land.

Because of the acknowledged importance of private lands for wildlife and environmental health, the valley's Comprehensive Plan calls for continued monitoring of data and the boundary of the Natural Resource Overlay. However, a reassessment has never occurred. Consequently, this project brings critical and otherwise unavailable information to an important decision-making process that stands to have enormous repercussions for wildlife in and around Jackson Hole. It also brings current technology and new contributions of science together in a way that will allow the community to better protect areas most critical for wildlife habitat.

We believe one of the exciting things about this project is that it will show in images what our best science sees as the most critical natural resources for all wildlife and the Jackson Hole community.

What Have We Learned & Where Do We Go From Here?

We at the Jackson Hole Conservation Alliance took great measures to ensure that the maps generated and data compiled in this project are the most scientifically factual and unbiased as possible. As such, this report to date includes no policy analysis. In the future, as a separate portion of this program, we plan to hold meetings for project collaborators and policy experts to determine proposals for the community's Comprehensive Plan updates and Land Development Regulations.

In the meantime, there are a few basic facts that can be drawn from the project and its initial analysis by the Conservation Research Center. You will see those throughout this report. Here are a few highlights that we took notice of at the Conservation Alliance:

- 1) Since the Natural Resource Overlay was created, 684 buildings were constructed on private lands within its boundaries. That represents a 43 percent increase in that overlay zone from the amount of construction there in all years prior to 1994.
- 2) Most density between 1994-2006 in the NRO occurred in the following areas:
 - a. The Industrial area south of the Town of Jackson and east of Hwy. 89
 - b. North of Hwy. 22, west of the Snake River and east of Hwy. 390
 - c. South of Hwy. 22 around the Hwy. 390 intersection
 - d. East of the Snake River and west of the Jackson Hole Airport
- 3) With exceptions, the NRO appears to have encompassed many areas critical for the wildlife species that were included in 1994 as "species of concern." However, the "species of concern" listed in 1994 don't include some species that our reviewing biologists note are "of concern" in the valley today. Based on interviews and conversations with biologists, additional habitats and species should be considered for protection within Teton County, and include:
 - a. Parturition areas of major ungulates
 - b. Bear conflict areas
 - c. Sage grouse habitat
 - d. Big horn sheep winter range, big horn sheep parturition areas, big horn sheep migration routes
 - e. Peregrine falcon nesting habitat
 - f. Wetlands (additional)
- 4) Areas that are not currently included in the NRO but that include LDR-protected habitats for at least **three** species of concern include:
 - a. The Flat Creek corridor
 - b. Sections of Spring Creek
 - c. The upper reaches of the Gros Ventre River
 - d. The lower reaches of the Snake River Canyon
 - e. Fish Creek upstream and downstream of Wilson
 - f. The confluence of the Snake River and Gros Ventre River
 - g. The area west of Grand Targhee Resort / Alta
 - h. Togwotee Pass

- 5) The current NRO does not “weight” species of concern or their habitat in ecological terms (sensitivity or vulnerability), making it difficult to understand the true importance of specific areas. For example, the current NRO appears to greatly underestimate the importance of the Snake River corridor to numerous species.
- 6) Although the project encompasses the most current, verifiable information to date, the project illuminates notable gaps in current information. This gives us the opportunity to bring focus to areas of future research. This also gives us the challenge to err on the side of caution where data isn’t directly available. For instance, some well-known moose movement corridors, such as along the Snake River and Teton Village Road, have minimal data available from Wyoming Game and Fish Department (due to their inability to perform aerial data gathering over populated areas). However, in this same area, wildlife-vehicle collision data provided by the Jackson Hole Wildlife Foundation depicts a “hot spot” of use by wildlife.

We sincerely hope these maps will spur the right questions from the community about our land development policies and whether they are living up to our community’s vision as a world-class town amid world-class wildlife and scenery. What has worked? What hasn’t? What needs to be strengthened? What should be eliminated? How do we go about protecting the things we value about our community the most? How do we continue to enjoy the natural resources that brought us here and keep our economy thriving without destroying that which we love?

These maps appear to be a rich starting point for what promises to be a lively discussion about our community’s ability to maintain viable wildlife populations as few communities throughout the nation have been able to do. We look forward to participating in the discussion.



Jackson Hole Conservation Alliance
Partnering for a Wild & Beautiful Valley

Who We Are

Since 1979, the Jackson Hole Conservation Alliance has motivated friends and neighbors to sustain our unique community by standing up for our valley’s wildlife, open spaces, clean air and water. A nonprofit organization with approximately 2,000 members, we work together for:

- Valley character that is built on the common belief that our precious natural resources are of the highest importance to Jackson Hole.
- Valley cooperation that advocates for responsible development and land use.
- Valley solutions informed by science and research.
- Valley action that strengthens the town, region and ecosystem.

1.2 Significance of the Natural Resource Overlay

The Natural Resource Overlay (NRO) was approved as part of the Land Development Regulations associated with the 1994 Teton County Comprehensive Plan in an effort to protect critical wildlife areas:

The purpose of the NRO District is to protect (1) the migration routes and crucial winter ranges of elk, (2) the migration routes and crucial winter ranges of mule deer, (3) the crucial winter habitat of moose, (4) the nesting areas and winter habitat of trumpeter swans, (5) spawning areas of cutthroat trout, and (6) the nesting areas and crucial winter habitat of bald eagles. Development is to be designed to protect the areas wildlife need to survive; therefore, development is to be kept outside of the NRO, as much as possible (Article III Teton County Land Development Regulations 1994).

The NRO was initiated in 1994 as part of the Teton County Comprehensive Plan to protect critical wildlife habitat for mule deer, moose, elk, trumpeter swans, cutthroat trout, and bald eagles. The first portion of the project evaluated development patterns within the NRO, concentrating on the extent to which development has occurred within NRO since the 1994 adoption of the Comprehensive Plan. The second portion of the project evaluated whether the current NRO boundary encompassed the most critical wildlife habitat and corridors necessary to maintain ecological integrity within Teton County. The Conservation Research Center collected the most current data available on the Teton County's Comprehensive Plan's identified species of concern (elk, mule deer, moose, trumpeter swans, cutthroat trout, and bald eagles) to evaluate the NRO boundary. Likewise, the Conservation Research Center has gathered additional data on the identified species of concern as well as other significant species that will potentially be included in an updated version of the Comprehensive Plan.

2.0 LDR “SPECIES OF CONCERN” – MAPS AND DATA SOURCES

2.1 Elk

Data Sources:

Elk Migration Routes

Original data were compiled by the Wyoming Game and Fish Department and produced on mylar map overlays which corresponded to US BLM 1:100,000 scale quadrangle maps. Wyoming Open Spaces Initiative at the University of Wyoming digitized this hardcopy data to develop the original GIS layers in 2002. These have since been updated and continue to be maintained by the Wyoming Game and Fish Department. These data were last updated in 2006. The data are only as accurate as the source maps from which they were produced. The majority of these data are based on the expert opinion of Wyoming Game and Fish Department biologists; a smaller percentage is based on telemetry data collected from radio-collared animals.

Additional data was acquired from a migration study conducted by Doug Wachob (Teton Science Schools) and Bruce Smith (National Elk Refuge). Ground telemetry, snow tracking, and fixed wing aircraft were utilized to collect migration data from 1999 to 2001. Elk migration route data from GPS units and field maps were digitized into Arcview 3.3 over digital aerial photos. These datasets were clipped to Teton County and projected into UTM Zone 12N NAD83. Original line shapefiles were buffered to create 0.5 mile-wide migration route polygons. Migration route buffers of 0.5 miles were based upon personal communication with Wyoming Game and Fish Department Habitat Coordinator Steve Kilpatrick.

Elk Winter Range:

Data were derived from Wyoming Game and Fish Department 2006 Ungulate Seasonal Range Boundaries for Wyoming. Seasonal range delineations depict lands that are important in each season for certain biological processes within a herd unit. Seasonal range boundaries are based on long-term observation data, specific research projects, and professional judgment. Ranges are digitized at a scale of 1:100,000 using USGS 1:100,000 DRGs as a backdrop for heads up digitizing, and are revised as needed by the Wyoming Game and Fish Department. Current seasonal range definitions are based on a 1990 document drafted by the Wyoming Chapter of the Wildlife Society in cooperation with the Wyoming Game and Fish Department and federal land agencies. The Wyoming Game and Fish Department initially developed crucial winter ranges in the early 1960's. Herd unit boundaries and other seasonal ranges were first delineated in the early 1970's based on knowledge of local wildlife biologists and game wardens. Tagging and radio collar studies were used to refine boundaries. Data to revise seasonal ranges come from three sources: 1) The Wyoming Game and Fish Department's Wildlife Observation System. *This database contains millions of wildlife observation records including locations, dates, and other relevant information.* 2) Research data from animal movement studies performed by Wyoming Game and Fish, federal agencies, university researchers, and industry consultants. 3) Knowledge of local field personnel and land owners. *Game and Fish biologists are encouraged to update seasonal range boundaries at 5- year intervals or whenever new information indicates that revisions are warranted* (Wyoming Game and Fish Metadata 2006).

Individual ungulate winter range shapefiles were created by selecting and exporting all records from the Wyoming Game and Fish Department's 2006 Ungulate Seasonal Range Boundary shapefiles that had ranges of either Winter or Winter/Yearlong. A range is classified as winter when *a population or portion of a population of animals use the documented suitable habitat within this range annually, in substantial numbers only during the winter (variable, but commonly between 12/1 and 4/30)*. A range is classified as winter/yearlong when *a population or portion of a population of animals makes general use of the documented suitable habitat within this range on a year-round basis. But during the winter months (between 12/1 and 4/30), there is a significant influx of additional animals into the area from other seasonal ranges* (Wyoming Game and Fish Metadata 2006).

Based on personal communication with Tim Fuchs of the Wyoming Game and Fish, the ungulate data obtained from the Wyoming Game and Fish data management staff in Cheyenne was last updated as follows:

Jackson Elk Herd Unit: July 1987
Other Updates (Fall Creek Elk Herd Unit): 2006.

Map of Elk Habitat Overview:

<http://www.jhalliance.org/Images/Maps/NROMaps/1ElkA.pdf>

Map of Elk Habitat Closeup:

<http://www.jhalliance.org/Images/Maps/NROMaps/2ElkB.pdf>

2.2 Moose

Data Sources:

Moose Migration Routes:

Original data were compiled by the Wyoming Game and Fish Department and produced on mylar map overlays which corresponded to US BLM 1:100,000 scale quadrangle maps. Wyoming Open Spaces Initiative at the University of Wyoming digitized this hardcopy data to develop the original GIS layers in 2002. These have since been updated and continue to be maintained by the Wyoming Game and Fish Department. These data were last updated in 2006. The data are only as accurate as the source maps from which they were produced. The majority of these data are based on the expert opinion of Wyoming Game and Fish Department biologists; a smaller percentage is based on telemetry data collected from radio-collared animals.

In addition, moose migration routes were modified on 1/21/08 based on comments from Wyoming Game and Fish Department wildlife biologist Gary Fralick.

Moose Winter Range:

Data were derived from Wyoming Game and Fish Department 2006 Ungulate Seasonal Range Boundaries for Wyoming. Seasonal range delineations depict lands that are important in each season for certain biological processes within a herd unit. Seasonal range boundaries are based on long-term observation data, specific research projects, and professional judgment. Ranges are digitized at a scale of 1:100,000 using USGS 1:100,000 DRGs as a backdrop for heads up digitizing, and are revised as needed by the Wyoming Game and Fish Department. Current seasonal range definitions are based on a 1990 document drafted by the Wyoming Chapter of the Wildlife Society in cooperation with the Wyoming Game and Fish Department and federal land agencies. The Wyoming Game and Fish Department initially developed crucial winter ranges in the early 1960's. Herd unit boundaries and other seasonal ranges were first delineated in the early 1970's based on knowledge of local wildlife biologists and game wardens. Tagging and radio collar studies were used to refine boundaries. Data to revise seasonal ranges come from three sources: 1) The Wyoming Game and Fish Department's Wildlife Observation System. This database contains millions of wildlife observation records including locations, dates, and other relevant information. 2) Research data from animal movement studies performed by Wyoming Game and Fish, federal agencies, university researchers, and industry consultants. 3) Knowledge of local field personnel and land owners. Game and Fish biologists are encouraged to update seasonal range boundaries at 5- year intervals or whenever new information indicates that revisions are warranted (Wyoming Game and Fish Metadata 2006).

Individual ungulate winter range shapefiles were created by selecting and exporting all records from the Wyoming Game and Fish Department's 2006 Ungulate Seasonal Range Boundary shapefiles that had ranges of either Winter or Winter/Yearlong. A range is classified as winter when *a population or portion of a population of animals use the documented suitable habitat within this range annually, in substantial numbers only during the winter (variable, but commonly between 12/1 and 4/30)*. A range is classified as winter/yearlong when *a population or portion of a population of animals makes general use of the documented suitable habitat within this range on a year-round basis. But during the winter months (between 12/1 and 4/30), there is a significant influx of additional animals into the area from other seasonal ranges* (Wyoming Game and Fish Metadata 2006).

Based on personal communication with Tim Fuchs of the Wyoming Game and Fish, the ungulate data obtained from the Wyoming Game and Fish data management staff in Cheyenne was last updated as follows:

Jackson Moose Herd Unit: November 1994

Other Updates (Sublette Moose Herd Unit): December 2006.

Map of Moose Habitat Overview:

<http://www.jhalliance.org/Images/Maps/NROMaps/3MooseA.pdf>

Map of Moose Habitat Closeup:

<http://www.jhalliance.org/Images/Maps/NROMaps/4MooseB.pdf>

2.3 Mule Deer

Data Sources:

Deer Migration Routes:

Original data were compiled by the Wyoming Game and Fish Department and produced on mylar map overlays which corresponded to US BLM 1:100,000 scale quadrangle maps. Wyoming Open Spaces Initiative at the University of Wyoming digitized this hardcopy data to develop the original GIS layers in 2002. These have since been updated and continue to be maintained by the Wyoming Game and Fish Department. These data were last updated in 2006. The data are only as accurate as the source maps from which they were produced. The majority of these data are based on the expert opinion of Wyoming Game and Fish Department biologists; a smaller percentage is based on telemetry data collected from radio-collared animals.

Mule Deer Winter Range:

Data were derived from Wyoming Game and Fish Department 2006 Ungulate Seasonal Range Boundaries for Wyoming. Seasonal range delineations depict lands that are important in each season for certain biological processes within a herd unit. Seasonal range boundaries are based on long-term observation data, specific research projects, and professional judgment. Ranges are digitized at a scale of 1:100,000 using USGS 1:100,000 DRGs as a backdrop for heads up digitizing, and are revised as needed by the Wyoming Game and Fish Department. Current seasonal range definitions are based on a 1990 document drafted by the Wyoming Chapter of the Wildlife Society in cooperation with the Wyoming Game and Fish Department and federal land agencies. The Wyoming Game and Fish Department initially developed crucial winter ranges in the early 1960's. Herd unit boundaries and other seasonal ranges were first delineated in the early 1970's based on knowledge of local wildlife biologists and game wardens. Tagging and radio collar studies were used to refine boundaries. Data to revise seasonal ranges come from three sources: 1) The Wyoming Game and Fish Department's Wildlife Observation System. This database contains millions of wildlife observation records including locations, dates, and other relevant information. 2) Research data from animal movement studies performed by Wyoming Game and Fish, federal agencies, university researchers, and industry consultants. 3) Knowledge of local field personnel and land owners. Game and Fish biologists are encouraged to update seasonal range boundaries at 5- year intervals or whenever new information indicates that revisions are warranted (Wyoming Game and Fish Metadata 2006).

Individual ungulate winter range shapefiles were created by selecting and exporting all records from the Wyoming Game and Fish Department's 2006 Ungulate Seasonal Range Boundary shapefiles that had ranges of either Winter or Winter/Yearlong. A range is classified as winter when a population or portion of a population of animals use the documented suitable habitat within this range annually, in substantial numbers only during the winter (variable, but commonly between 12/1 and 4/30). A range is classified as winter/yearlong when a population or portion of a population of animals makes general use of the documented suitable habitat within this range on a year-round basis. But during the winter months (between 12/1 and 4/30), there is a significant influx of additional animals into the area from other seasonal ranges (Wyoming Game and Fish Metadata 2006).

For mule deer, additional data were acquired from winter observations collected by Teton Science Schools between 2002 and 2006. Point data were collected in winters of 2002 – 2003 and 2003 – 2004, while polygon data were collected in winters 2004 - 2005 and 2005 - 2006.

Teton Science Schools digitized points and polygons of mule deer winter range based upon direct field observation. To create a single shapefile, the mean area of Teton Science Schools mule deer winter range polygons was calculated. All Teton Science Schools polygons were then converted to points based on centroid location. 2004 – 2006 centroid points were merged with 2002 – 2004 points. This shapefile was buffered by the 2004 – 2006 polygon mean area of 21.6 feet. The final step was to merge this 2002 – 2006 Teton Science Schools mule deer winter range shapefile with the 2006 Wyoming Game and Fish Department mule deer winter range shapefile.

Based on personal communication with Tim Fuchs of the Wyoming Game and Fish, the ungulate data obtained from the Wyoming Game and Fish data management staff in Cheyenne was last updated as follows:

Sublette Deer Herd Unit: February 2005
Dubois Deer Herd Unit: July 1995.

Map of Mule Deer Habitat Overview:

<http://www.jhalliance.org/Images/Maps/NROMaps/5MuleDeerA.pdf>

Map of Mule Deer Habitat Closeup:

<http://www.jhalliance.org/Images/Maps/NROMaps/6MuleDeerB.pdf>

2.4 Trumpeter Swan

Data Sources:

Trumpeter Swan Winter Range:

Data were derived from a mid-winter survey flight conducted by Wyoming Game and Fish Department Nongame Biologist, Susan Patla. Swan observations were recorded with GPS on February 7, 2006. Coordinates were converted into shapefile format and projected into UTM Zone 12N NAD 1983. The swan observation point shapefile was then displayed on top of USGS National Hydrography Dataset (1:24,000). Stream reaches directly up and downstream of swan observation points were selected and exported to a separate shapefile. To create the swan winter range, the line shapefile was buffered by 300 ft. based on personal communication with Susan Patla.

Trumpeter Swan Historic Nesting Sites:

Data were obtained from Wyoming Game and Fish Department Nongame Biologist Susan Patla. Survey coordinates were converted into shapefile format and projected into UTM Zone 12N NAD 1983. The swan observation point shapefile was then buffered by 300 ft. based on Teton County Land Development Regulations Article III Section 3270.

Map of Trumpeter Swan Habitat Overview:

<http://www.jhalliance.org/Images/Maps/NROMaps/7SwanA.pdf>

Map of Trumpeter Swan Habitat Closeup:

<http://www.jhalliance.org/Images/Maps/NROMaps/8SwanB.pdf>

2.5 Cutthroat Trout

Data Sources:

Cutthroat Trout Spawning Areas:

Data were derived from the 2006 Range-Wide Status Assessment of Yellowstone Cutthroat Trout. This report was prepared for the Yellowstone Cutthroat Trout Interagency Coordination Group. Spatial data were created from the 1:24,000 National Hydrography Dataset (NHD). Individual shapefiles exist for Conservation Populations, Current Distribution, Historic Distribution, Current Lakes, and Historic Lakes. In addition to spatial data, the paper report included spawning data for individual conservation populations. Conservation population IDs were recorded for any populations that had Lake Out Spawning, Lake Tributary Spawning, Large River Spawning, or Local Dispersing Spawning. These conservation population IDs were selected and exported from the Conservation Population shapefile. This shapefile was then reviewed by Wyoming Game and Fish Department fisheries biologists Tracy Stephens and Rob Gibson. Based on their feedback, additional stream reaches along the Snake River were selected from the NHD and incorporated into the spawning shapefile. This line shapefile was then buffered by 150 ft. based on Teton County Land Development Regulation Article III Section 3270.

Map of Potential Cutthroat Trout Spawning Habitat Overview:

<http://www.jhalliance.org/Images/Maps/NROMaps/9CutthroatA.pdf>

Map of Potential Cutthroat Trout Spawning Habitat Closeup:

<http://www.jhalliance.org/Images/Maps/NROMaps/10CutthroatB.pdf>

2.6 Bald Eagle

Data Sources:

Nesting Habitat:

Data were derived from a survey flight conducted by Wyoming Game and Fish Department Nongame Biologist Susan Patla on October 19, 2007. Eagle nest observations were recorded with GPS. Coordinates were converted into shapefile format and projected into UTM Zone 12N NAD 1983. Nest points were then buffered by 660 ft. based on Teton County Land Development Regulation Article III Section 3270.

Bald Eagle Winter Habitat:

These data were created based on input from Wyoming Game and Fish Department Nongame Biologist Susan Patla. Reaches of the Snake River between Jackson Lake and Palisades Reservoir were selected and exported from the NHD. Stream reaches directly up and downstream of eagle nests were also selected and exported from the NHD. The above line shapefiles were merged, clipped to Teton County and buffered to a distance of 660 ft. based on Teton County Land Development Regulation Article III Section 3270

Map of Bald Eagle Habitat Overview:

<http://www.jhalliance.org/Images/Maps/NROMaps/11BaldEagleA.pdf>

Map of Bald Eagle Habitat Closeup:

<http://www.jhalliance.org/Images/Maps/NROMaps/12BaldEagleB.pdf>

2.7 **“Species of Concern” Habitat Data Union:**

Data Sources:

To identify areas of use by multiple wildlife species, the previous wildlife datasets were combined utilizing the Union tool in ESRI ArcToolbox. Once a master shapefile had been compiled, individual polygons were evaluated through a series of SQL queries to determine the number of wildlife uses occurring within each polygon. This number was entered into a new field to allow for the application of graduated symbology.

“Hotspots”, or sites used by multiple species, were identified by overlaying habitat areas for the species of concern identified in the Land Development Regulations. With the data currently available, each habitat was given equal weight and included mule deer and elk migration routes, mule deer, moose and elk winter range, bald eagle and trumpeter swan nest sites and winter use areas, as well as cutthroat trout spawning areas.

Map Showing Where “Species of Concern” Habitats Overlap (Overview):

<http://www.jhalliance.org/Images/Maps/NROMaps/13LayeredHabitatA.pdf>

Map Showing Where “Species of Concern” Habitats Overlap (Closeup):

<http://www.jhalliance.org/Images/Maps/NROMaps/14LayeredHabitatB.pdf>

3.0 OTHER SPECIES – MAPS AND DATA SOURCES

3.1 Sage Grouse

Data Sources:

Sage Grouse Leks

Original data were derived from Wyoming Game and Fish Department. Lek locations were last updated in 2007. A 5 km. buffer was applied to all lek locations based on Greater Sage-Grouse Seasonal Habitat Selection and Survival in Jackson Hole, Wyoming (Holloran and Anderson, 2004).

Works Cited:

Holloran, M.J. and S.H. Anderson. 2004 Greater Sage-grouse seasonal habitat selection and survival in Jackson Hole, Wyoming. Research Completion Report. University of Wyoming Cooperative Fish and Wildlife Research Unit, Laramie.

Map of Sage Grouse Lekking Habitat Overview:

<http://www.jhalliance.org/Images/Maps/NROMaps/15GrouseA.pdf>

Map of Sage Grouse Lekking Habitat Closeup:

<http://www.jhalliance.org/Images/Maps/NROMaps/16GrouseB.pdf>

3.2 **Bighorn Sheep**

Data Sources:

Bighorn Sheep Migration Routes:

Original data were compiled by the Wyoming Game and Fish Department and produced on mylar map overlays which corresponded to US BLM 1:100,000 scale quadrangle maps. Wyoming Open Spaces Initiative at the University of Wyoming digitized this hardcopy data to develop the original GIS layers in 2002. These have since been updated and continue to be maintained by the Wyoming Game and Fish Department. These data were last updated in 2006. The data are only as accurate as the source maps from which they were produced. The majority of these data are based on the expert opinion of Wyoming Game and Fish Department biologists; a smaller percentage is based on telemetry data collected from radio-collared animals.

Bighorn Sheep Winter Range:

Data were derived from Wyoming Game and Fish Department 2006 Ungulate Seasonal Range Boundaries for Wyoming. Seasonal range delineations depict lands that are important in each season for certain biological processes within a herd unit. Seasonal range boundaries are based on long-term observation data, specific research projects, and professional judgment. Ranges are digitized at a scale of 1:100,000 using USGS 1:100,000 DRGs as a backdrop for heads up digitizing, and are revised as needed by the Wyoming Game and Fish Department. Current seasonal range definitions are based on a 1990 document drafted by the Wyoming Chapter of the Wildlife Society in cooperation with the Wyoming Game and Fish Department and federal land agencies. The Wyoming Game and Fish Department initially developed crucial winter ranges in the early 1960's. Herd unit boundaries and other seasonal ranges were first delineated in the early 1970's based on knowledge of local wildlife biologists and game wardens. Tagging and radio collar studies were used to refine boundaries. Data to revise seasonal ranges come from three sources: 1) The Wyoming Game and Fish Department's Wildlife Observation System. This database contains millions of wildlife observation records including locations, dates, and other relevant information. 2) Research data from animal movement studies performed by Wyoming Game and Fish, federal agencies, university researchers, and industry consultants. 3) Knowledge of local field personnel and land owners. Game and Fish biologists are encouraged to update seasonal range boundaries at 5- year intervals or whenever new information indicates that revisions are warranted (Wyoming Game and Fish Metadata 2006).

Based on personal communication with Tim Fuchs of the Wyoming Game and Fish, the ungulate data obtained from the Wyoming Game and Fish data management staff in Cheyenne was last updated as follows: Jackson Bighorn Sheep: September 2002.

Map of Bighorn Sheep Habitat Overview:

<http://www.jhalliance.org/Images/Maps/NROMaps/17BighornA.pdf>

Map of Bighorn Sheep Habitat Closeup:

<http://www.jhalliance.org/Images/Maps/NROMaps/18BighornB.pdf>

3.3 **Mountain Goat**

Data Sources:

Mountain Goat Migration Routes:

Original data were compiled by the Wyoming Game and Fish Department and produced on mylar map overlays which corresponded to US BLM 1:100,000 scale quadrangle maps. Wyoming Open Spaces Initiative at the University of Wyoming digitized this hardcopy data to develop the original GIS layers in 2002. These have since been updated and continue to be maintained by the Wyoming Game and Fish Department. These data were last updated in 2006. The data are only as accurate as the source maps from which they were produced. The majority of these data are based on the expert opinion of Wyoming Game and Fish Department biologists; a smaller percentage is based on telemetry data collected from radio-collared animals.

Mountain Goat Winter Range:

Data were derived from Wyoming Game and Fish Department 2006 Ungulate Seasonal Range Boundaries for Wyoming. Seasonal range delineations depict lands that are important in each season for certain biological processes within a herd unit. Seasonal range boundaries are based on long-term observation data, specific research projects, and professional judgment. Ranges are digitized at a scale of 1:100,000 using USGS 1:100,000 DRGs as a backdrop for heads up digitizing, and are revised as needed by the Wyoming Game and Fish Department. Current seasonal range definitions are based on a 1990 document drafted by the Wyoming Chapter of the Wildlife Society in cooperation with the Wyoming Game and Fish Department and federal land agencies. The Wyoming Game and Fish Department initially developed crucial winter ranges in the early 1960's. Herd unit boundaries and other seasonal ranges were first delineated in the early 1970's based on knowledge of local wildlife biologists and game wardens. Tagging and radio collar studies were used to refine boundaries. Data to revise seasonal ranges come from three sources: 1) The Wyoming Game and Fish Department's Wildlife Observation System. This database contains millions of wildlife observation records including locations, dates, and other relevant information. 2) Research data from animal movement studies performed by Wyoming Game and Fish, federal agencies, university researchers, and industry consultants. 3) Knowledge of local field personnel and land owners. Game and Fish biologists are encouraged to update seasonal range boundaries at 5- year intervals or whenever new information indicates that revisions are warranted (Wyoming Game and Fish Metadata 2006).

Map of Rocky Mountain Goat Habitat Overview:

<http://www.jhalliance.org/Images/Maps/NROMaps/19MtnGoatA.pdf>

Map of Rocky Mountain Goat Habitat Closeup:

<http://www.jhalliance.org/Images/Maps/NROMaps/20MtnGoatB.pdf>

3.4 Pronghorn Antelope

Data Sources:

Pronghorn Antelope Migration Routes:

Original data were compiled by the Wyoming Game and Fish Department and produced on mylar map overlays which corresponded to US BLM 1:100,000 scale quadrangle maps. Wyoming Open Spaces Initiative at the University of Wyoming digitized this hardcopy data to develop the original GIS layers in 2002. These have since been updated and continue to be maintained by the Wyoming Game and Fish Department. These data were last updated in 2006. The data are only as accurate as the source maps from which they were produced. The majority of these data are based on the expert opinion of Wyoming Game and Fish Department biologists; a smaller percentage is based on telemetry data collected from radio-collared animals.

Pronghorn Antelope Winter Range:

Data were derived from Wyoming Game and Fish Department 2006 Ungulate Seasonal Range Boundaries for Wyoming. Seasonal range delineations depict lands that are important in each season for certain biological processes within a herd unit. Seasonal range boundaries are based on long-term observation data, specific research projects, and professional judgment. Ranges are digitized at a scale of 1:100,000 using USGS 1:100,000 DRGs as a backdrop for heads up digitizing, and are revised as needed by the Wyoming Game and Fish Department. Current seasonal range definitions are based on a 1990 document drafted by the Wyoming Chapter of the Wildlife Society in cooperation with the Wyoming Game and Fish Department and federal land agencies. The Wyoming Game and Fish Department initially developed crucial winter ranges in the early 1960's. Herd unit boundaries and other seasonal ranges were first delineated in the early 1970's based on knowledge of local wildlife biologists and game wardens. Tagging and radio collar studies were used to refine boundaries. Data to revise seasonal ranges come from three sources: 1) The Wyoming Game and Fish Department's Wildlife Observation System. This database contains millions of wildlife observation records including locations, dates, and other relevant information. 2) Research data from animal movement studies performed by Wyoming Game and Fish, federal agencies, university researchers, and industry consultants. 3) Knowledge of local field personnel and land owners. Game and Fish biologists are encouraged to update seasonal range boundaries at 5- year intervals or whenever new information indicates that revisions are warranted (Wyoming Game and Fish Metadata 2006). Pronghorn antelope migration corridor data were obtained as a shapefile from Grand Teton National Park. The shapefile is based on a study conducted by Wildlife Conservation Society from October 2003-August 2004 using GPS radio collars to track ten adult female pronghorn. The polygon depicting pronghorn antelope summer range was digitized using location data from the 2003-2004 Wildlife Conservation Society study.

Map of Pronghorn Antelope Habitat Overview:

<http://www.jhalliance.org/Images/Maps/NROMaps/21PronghornA.pdf>

Map of Pronghorn Antelope Habitat Closeup:

<http://www.jhalliance.org/Images/Maps/NROMaps/22PronghornB.pdf>

4.0 DEVELOPMENT, CONSERVATION AND THE NRO

4.1 NRO Boundary:

Of the 169,189 acres that compose the NRO, 34,702 acres are private land. The majority of private land falls west of the Town of Jackson to the Town of Wilson, from Game Creek in the south to the Jackson Hole Airport and Solitude Subdivision to the north (Table 1). Other concentrated areas of private land occur in near the Town of Alta, Hoback Junction, Buffalo Valley, Gros Ventre River, and Alta. The remaining 134,487 acres are comprised of town, county, state and federal lands managed by the Town of Jackson, Teton County, State of Wyoming, US Forest Service, National Park Service and US Fish and Wildlife Service. Of the 34,702 acres of private land in the NRO, 9,014 acres (26%) are under conservation easement held by one of the following entities: Jackson Hole Land Trust, Teton County Scenic Preserve Trust, The Nature Conservancy and U.S. Forest Service (Table 2).

Table 1. Acreage of public and private land in Natural Resource Overlay.

	Land Area
NRO	169,189
Public	134,487
Private	34,702

Map of Natural Resource Overlay Overview:

<http://www.jhalliance.org/Images/Maps/NROMaps/23NROa.pdf>

Map of Natural Resource Overlay Closeup:

<http://www.jhalliance.org/Images/Maps/NROMaps/24NROb.pdf>

4.2 NRO Boundary and Conservation Easements:

Table 2. Acreage of conservation easements in Teton County (as of 01/05/2007)

	Land Area
Easements in Teton County	20,413
Easements in NRO	9,877
Easements in NRO (Private)	9,014
Easements in NRO (Public)	864

Map of Conservation Easements Overview:

<http://www.jhalliance.org/Images/Maps/NROMaps/25ConsEasementsA.pdf>

Map of Conservation Easements Closeup:

<http://www.jhalliance.org/Images/Maps/NROMaps/26ConsEasementsB.pdf>

4.3 **Building and Parcel Density:**

Data Sources:

Development within the NRO was evaluated using three techniques:

- digitizing structures using 1994 and 2006 aerial imagery
- summarizing the Teton County building permit database,
- using parcel plat year designation provided by Teton County.

Findings:

Development has occurred in NRO since the adoption of the County Comprehensive Plan in 1994. Whether or not this development has been located in areas within specific parcels that contain the “least valuable resources” (Article III Teton County Land Development Regulations) is beyond the scope of this analysis. Comprehensive site-level data are not available. However, this analysis provides a useful tool to evaluate the extent of development that has occurred within the NRO at a broader, landscape level.

Approximately 1596 buildings were present in the NRO (private lands) during the summer of 1994 (Table 3). By 2006, an additional 684 buildings had been constructed within the NRO.

Table 3. Buildings on private land in and adjacent to the NRO.

Year	No. Buildings in NRO	No. Buildings in 3000' Buffer	Total No. Buildings in NRO and 3000' Buffer
1994	1596	5125	6721
2006	2280	6656	8936
Change	684	1531	2215

Evaluation of the Teton County building permit database revealed a total of 4,286 building permits in Teton County (excluding the Town of Jackson) between 1994 and 2006 (Table 4). The 4,286 building permits fell on 2,943 parcels, indicating that multiple permits occurred on a number of parcels. Of the 4,286 permits between 1994 and 2006, 32.5% (1,394 permits) occurred on properties in NRO designation. The 1,394 permits in the NRO fell on 820 parcels.

Table 4. Summary of Teton County Building Permit Database 1994-2006.

Teton County 1994-2006	No. Permits
Total Building Permits	4286
Parcels with Building Permits	2943
Building Permits within NRO	1394
Parcels with Building Permits NRO	820
Parcels with New Single Family Residences in NRO	219

Between 1994 and 2006 Teton County granted 2,785 changes of plat, which occurred on 2,643 parcels (Table 5). A total of 480 parcels that were completely within the NRO had a change of plat from 1994-2006. An additional 206 parcels which fell only partially in the NRO had a change in plat from 1994-2006.

Table 5. Summary of Teton County Plat Database 1994-2006.

Teton County 1994-2006	No.
Total Plat Changes	2785
Private Parcels with Plat Changes	2643
Private Parcels with Plat Changes within NRO	480
Parcels with Plat Changes in the NRO	686

Most of the building density added between 1994 and 2006 occurred (see Building Density 1994-2006 map):

- Industrial area south of the Town of Jackson and east of Highway 189
- North of Highway 22, west of the Snake River and east of Highway 390
- South of Highway 22 around the Highway 390 intersection
- East of the Snake River and west of the Jackson Hole Airport

Plat changes occurred in a number of locations in the county, but changes in plat for adjacent parcels occurred (see Parcels Platted 1994-2006 with some portion in NRO map):

- Near Astoria Hot Springs and the Snake River Sporting Club
- On Saddle Butte
- At the Bar B C Ranch near the north end of Spring Gulch
- At Teton Valley Ranch Camp near Kelly
- Between Snake River and the Jackson Hole Airport
- Buffalo Valley

Map of Building Density 1994 (Closeup):

<http://www.jhalliance.org/Images/Maps/NROMaps/28BldgDensity1994b.pdf>

Map of Building Density 2006 (Closeup):

<http://www.jhalliance.org/Images/Maps/NROMaps/30BldgDensity2006b.pdf>

Map of Parcels in the Natural Resource Overlay Platted 1994-2006 (Closeup):

<http://www.jhalliance.org/Images/Maps/NROMaps/34ParcelsIntersectNROb.pdf>

5.0 EVALUATION OF NRO BOUNDARY WITH WILDLIFE DATA

Limitations

The Conservation Research Center obtained the most current wildlife data from the Wyoming Game and Fish Department for species of special concern identified in the Jackson/Teton County Comprehensive Plan and several other species for which data is available. While these data are the most comprehensive available, it is critical to understand that the maps should not be interpreted to reflect a “complete” comprehensive wildlife assessment of Teton County, in terms of geographic areas and species. In short, the maps are only capable of depicting wildlife use in areas where research has been conducted. For example, the Wyoming Game and Fish Department does not conduct research in several developed areas including the incorporated areas of Wilson, Jackson, and Teton Village and the larger subdivisions around the Jackson Hole airport. In these areas it is particularly important to understand that a map depiction of an “absence of use” does not necessarily indicate the area lacks importance for wildlife. It may simply mean that no research is conducted in the area.

In addition, species differ in terms of the scale at which research findings should be used. In general, Wyoming Game and Fish data should not be used at scales less than 1:100,000. Conservation Research Center supplemented Wyoming Game and Fish data with fine scale data observations of mule deer winter range on buttes in the southern portion of the valley, as well as elk migration routes in the area north of the Gros Ventre River, south of Solitude Subdivision, east of the Snake River, and west of Black Tail Butte. While appropriate for large scale planning purposes, using Wyoming Game and Fish ungulate data for site-specific analyses is not appropriate. Caution is advised when interpreting these data, as there is a tendency to resolve them to much finer scales than the methods for collecting and compiling the data can support. That said, the data does represent the best science available.

Trumpeter swan and bald eagle nest sites are identified each year by Wyoming Game and Fish Department personnel through a systematic aerial survey. These data are appropriate for site-specific analyses. Trumpeter swan and bald eagle wintering habitats are more general summaries of suitable winter habitat areas. They were created by selecting stream reaches directly upstream and downstream of nest sites and include the entire Snake River corridor from Jackson Lake to Palisades Reservoir.

Cutthroat trout spawning areas were compiled through a regional collaborative project between Idaho, Wyoming and Montana and represent the most comprehensive data set available. Stream reaches were identified using the 1:24,000 national hydrography dataset. Spawning areas should not be used at scales greater than 1:24,000. When a specific stream reach is in question, fisheries biologists should be contacted.

Inclusion of Additional Species

Based on interviews and conversations with biologists, additional habitats and species should be considered for protection within Teton County. Parturition areas of major ungulates, bear conflict areas, sage grouse habitat, big horn sheep winter range, big horn sheep parturition areas, big horn sheep migration routes, peregrine falcon nesting habitat, and wetlands are of particular concern.

Wildlife-Important Areas Not Currently within the NRO

With few exceptions, the NRO does encompass areas critical for the multiple wildlife species currently identified in the Land Development Regulations. The areas that are not currently protected by the NRO that contain three or more habitat use areas include (see Land Development Regulations Wildlife Data Union map for specific locations):

- Flat Creek corridor
- sections of Spring Creek
- upper reaches of the Gros Ventre River
- the lower reaches of the Snake River Canyon to the Teton County line
- Fish Creek upstream and downstream of Wilson
- the confluence of the Snake River and Gros Ventre
- the area west of Grand Targhee Resort
- Togwotee Pass

The significance of these areas to wildlife is not fully known and likely requires further evaluation. Further, if additional species or habitats were adopted in revised Land Development Regulations, a similar analysis with the additional habitat areas would be extremely useful in identifying sections that would require protection under the NRO.

Map Showing Where Wildlife Habitat, the NRO and Development Overlap (Overview):

<http://www.jhalliance.org/Images/Maps/NROMaps/35LayeredHabitat&DevA.pdf>

Map Showing Where Wildlife Habitat, the NRO and Development Overlap (Closeup):

<http://www.jhalliance.org/Images/Maps/NROMaps/36LayeredHabitat&DevB.pdf>

6.0 NEEDS FOR ADDITIONAL DATA: A BRIEF SUMMARY

The Conservation Research Center identified a number of significant areas for improvement in the wildlife, natural resource, habitat, and development data currently available in Teton County. Most prominent is the lack of a habitat or vegetation map of private lands. Such a map would consist of vegetation polygons identifying key habitat types. A habitat map would aid in evaluating whether the most important areas are included in the NRO and would reveal changes in extent of habitat types over time. More data on ungulate movements and habitats is also critical to insure adequate habitat protections. Identifying how ungulates move through and utilize developed areas, including areas of different housing densities and their navigation of transportation corridors is essential to determine how wildlife and humans can coexist in this landscape.

In general, Teton County lacks a consistent, long-term ecological monitoring program on private lands. A better understanding of baseline conditions of diverse habitat ranges would increase the ability to assess changes in various habitats and wildlife populations through time.

Of great need is more information on the actual impacts to wildlife populations under various development scenarios. A development trajectory analysis modeling future development would identify possible building and road densities in the county and reveal the long-term threats to wildlife habitat. This analysis would also require a literature review on the effects of development on various species and conservation thresholds.

7.0 NEXT STEPS

Based on an analysis of compiled wildlife data in Teton County and a review of natural resource protection policies used throughout the country, the Conservation Alliance will assess the NRO as a planning tool and its ability to carry out its intent - to protect the irreplaceable wildlife and natural resources for which Jackson Hole is world-renowned.

The NRO, as a zoning tool in its current form, appears to fail to take into account ecological conditions at the landscape level. Its capacity, by direct assessments at the site-specific level only, is minimal in terms of assessing indirect and cumulative effects. Without a capacity to consider spatial and temporal effects beyond the boundary of any given development, the NRO standards need to be re-evaluated.