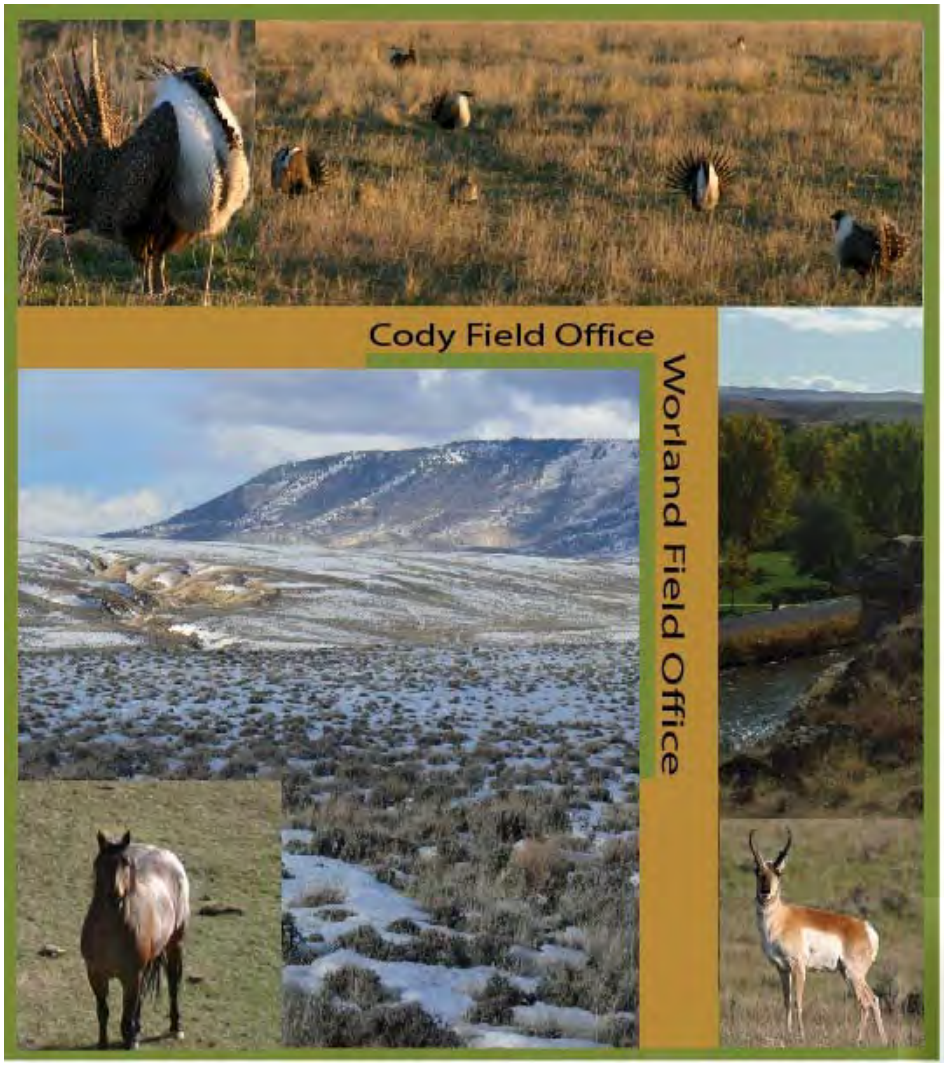
Bighorn Basin Resource Management Plan Revision Project

Proposed Resource Management Plan and Final Environmental Impact Statement



Volume 3 of 4
Chapters 5 - 7, Glossary, and Maps

BLM

Wyoming - Cody & Worland Field Offices

May 2015

The BLM's multiple-use mission is to sustain the health and productivity of public lands for the use and enjoyment of present and future generations.

The Bureau accomplishes this by managing such activities as outdoor recreation, livestock grazing, mineral development, and energy production, and by conserving natural, historical, cultural, and other resources on public lands.

BLM/WY/PL-15/013+1610
Volume 3 of 4

Bighorn Basin Resource Management Plan Revision Project

Proposed Resource Management Plan and Final Environmental Impact Statement

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U.S. Department of the Interior
Bureau of Land Management
Cody Field Office, Wyoming

and

U.S. Department of the Interior
Bureau of Land Management
Worland Field Office, Wyoming

May 2015

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TABLE OF CONTENTS

VOLUME 3 OF 4

LIST OF TABLES

LIST OF FIGURES

GLOSSARY

The glossary is included at the end of Volume 3.

ACRONYMS

Acronyms used in Volume 3 can be found in the Volume 1 Table of Contents.

MAPS

MAPS (CONTINUED)

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CHAPTER 5 – PUBLIC INVOLVEMENT AND LIST OF PREPARERS

Public involvement, consultation, and coordination initiated prior to and occurred throughout preparation of the Bighorn Basin Resource Management Plan (RMP) revision and associated Environmental Impact Statement (EIS). The Bureau of Land Management (BLM) incorporated public involvement, consultation, and coordination through public meetings, informal meetings, individual contacts, news releases, newsletters, workshops, a planning website, and the *Federal Register*. This chapter describes the public involvement process, as well as other key consultation and coordination activities undertaken to prepare the EIS in support of the RMP revision. It also contains the List of Preparers in Table 5-3.

The BLM decision-making process is conducted in accordance with the requirements of the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations implementing NEPA, and the United States Department of the Interior (DOI) and BLM policies and procedures implementing NEPA. NEPA and the associated regulatory and policy framework require that all federal agencies involve the interested public and potentially affected parties in their decision-making, consider reasonable alternatives to proposed actions, and prepare environmental documents that disclose the potential impacts of proposed actions and alternatives.

A Notice of Intent (NOI) published in the *Federal Register* on October 17, 2008, formally announced the BLM's intent to revise the existing plans and prepare the associated EIS. The NOI initiated the scoping process and invited participation of affected and interested agencies, organizations, and members of the public in determining the scope and issues to be addressed by alternatives and analyzed in the EIS. The BLM solicited additional public involvement, including cooperating agency meetings and workshops, to help identify issues to be addressed in developing a full range of land management alternatives. Subsequent to the release of the Draft RMP and Draft EIS on April 22, 2011, the BLM held six public meetings in June 2011 to discuss the commenting process, respond to questions, and solicit comments on the Draft RMP and Draft EIS. The BLM also held six public meetings in September of 2013 following the release of the Supplement to the Draft RMP and Draft EIS on July 12, 2013. Table 5-1 lists public involvement, coordination, and consultation events.

5.1 Public Involvement

In accordance with CEQ scoping guidance, the BLM provided opportunities for public involvement as an integral part of revising the RMP and preparing the EIS. CEQ scoping guidance defines scoping as the "process by which lead agencies solicit input from the public and interested agencies on the nature and extent of issues and impacts to be addressed and the methods by which they will be evaluated" (CEQ 1981). The scoping report, which summarizes public participation during scoping and issues identified during the scoping process, is available on the Bighorn Basin RMP website at: http://www.blm.gov/wy/st/en/programs/Planning/rmps/bighorn.html.

The intent of the scoping process is to provide an opportunity for the public, tribes, other government agencies, and interest groups to learn about the project and provide input on the planning issues, impacts, and potential alternatives that will be addressed in the EIS, and the extent to which those issues will be analyzed. In general, public involvement during scoping assists the agency through the following:

- Broadening the information base for decision-making
- Informing the public about the EIS and proposed RMP and the potential impacts associated with various management decisions

- Ensuring public needs and viewpoints are brought to the attention of the agency
- Determining the scope and the significant issues to be analyzed in depth in the EIS

Table 5-1. Public Involvement, Coordination, and Consultation Events

Date	Location	Event
November 5, 2008	Thermopolis, Wyoming	Public Scoping Meeting
November 6, 2008	Worland, Wyoming	Public Scoping Meeting
November 7, 2008	Greybull, Wyoming	Public Scoping Meeting
November 12, 2008	Cody, Wyoming	Public Scoping Meeting
November 13, 2008	Powell, Wyoming	Public Scoping Meeting
November 14, 2008	Lovell, Wyoming	Public Scoping Meeting
January 12, 2009	Greybull, Wyoming	Travel Management and Recreation Assessment Meeting
January 13, 2009	Lovell, Wyoming	Travel Management and Recreation Assessment Meeting
January 14, 2009	Cody, Wyoming	Travel Management and Recreation Assessment Meeting
January 15, 2009	Worland, Wyoming	Travel Management and Recreation Assessment Meeting
January 16, 2009	Thermopolis, Wyoming	Travel Management and Recreation Assessment Meeting
March 25 – 27, 2009	Cody, Wyoming	Cooperating Agency Workshop/Development of the Goals and Objectives
April 29 – May 1, 2009	Worland, Wyoming	Cooperating Agency Workshop/Development of the Range of Alternatives
May 27 – 29, 2009	Worland, Wyoming	Cooperating Agency Workshop/Development of the Range of Alternatives
June 24 – 26, 2009	Cody, Wyoming	Cooperating Agency Workshop/Development of the Range of Alternatives
July 29 – 31, 2009	Thermopolis, Wyoming	Cooperating Agency Workshop/Development of the Range of Alternatives
October 28, 2009	Cody, Wyoming	Open House
February 17 – 19, 2010	Cody, Wyoming	Cooperating Agency Workshop/Development of the Preferred Alternative
April 5, 2010	Worland, Wyoming	Open House
June 6, 2011	Thermopolis, Wyoming	Draft RMP Public Meeting
June 7, 2011	Worland, Wyoming	Draft RMP Public Meeting
June 8, 2011	Greybull, Wyoming	Draft RMP Public Meeting
June 13, 2011	Lovell, Wyoming	Draft RMP Public Meeting
June 14, 2011	Cody, Wyoming	Draft RMP Public Meeting
June 15, 2011	Powell, Wyoming	Draft RMP Public Meeting
January 31, 2013	Cody, Wyoming	Cooperating Agency Workshop/Supplement to the Bighorn Basin Draft RMP and Draft EIS
September 4, 2013	Powell, Wyoming	Supplemental EIS Public Meeting
September 5, 2013	Cody, Wyoming	Supplemental EIS Public Meeting
September 9, 2013	Lovell, Wyoming	Supplemental EIS Public Meeting
September 10, 2013	Greybull, Wyoming	Supplemental EIS Public Meeting
September 11, 2013	Thermopolis, Wyoming	Supplemental EIS Public Meeting
September 12, 2013	Worland, Wyoming	Supplemental EIS Public Meeting

EIS Environmental Impact Statement
RMP Resource Management Plan

5.1.1 Scoping Period

Publication of the NOI on October 17, 2008 announced the BLM's intention to revise existing plans and prepare an EIS. The scoping period provides an opportunity for the public to identify potential planning issues and concerns associated with the RMP and EIS. Information obtained by the BLM during scoping is combined with issues identified by the agencies to form the scope of the EIS.

5.1.2 Public Notification of Scoping

News Release

The BLM issued a news release to local media on October 14, 2008, describing the upcoming NOI and listing the time, date, and location of the public scoping meetings. Copies of the news release went out to numerous radio stations and newspapers within and outside the Planning Area. The news release was also posted on the Bighorn Basin RMP Revision Project website.

Postcard

Another means of outreach prior to the public scoping meetings included a postcard mailing announcing the scoping meetings. The BLM mailed the postcards to cooperating agencies, individuals and organizations on the project mailing list (see the following section, Scoping Meetings), as well as P.O. Box holders in the Planning Area. The BLM mailed 2,679 postcards on October 21, 2008, and more than 2,500 were successfully delivered.

Additional Sources of Public Information about the Scoping Process

In addition to news releases and other notifications from the BLM regarding the scoping process, some members of the public received notification from other sources. More than 15 articles and news bulletins regarding some aspect of the RMP process were published in newspapers, both within and outside the Planning Area. Many of the articles listed the dates for the scoping period and the dates, times, and locations of public scoping meetings. Most of the articles provided some background regarding the purpose of the RMP revision and information about the process. The County Commissioners for the counties within the Planning Area, all of whom are cooperating agencies, also contacted county residents and interest groups. The County Commissioners from Park County used an automated phone system, e-mails, and radio to contact thousands of county residents and invite them to attend the public meetings and participate in the scoping process. Big Horn, Washakie, and Hot Springs Counties performed similar outreach efforts including contacting county residents, posting flyers, and taking part in radio outreach.

Website

On October 17, 2008, the Bighorn Basin RMP Revision Project website came online. The website provides background information on the project, a description of the scoping process and meeting locations, instructions on how to submit comments, a map of the Planning Area, and copies of public information documents such as the NOI and the Preparation Plan. The website is one of the methods used to communicate project news and updates to the public. The website can be accessed at: http://www.blm.gov/wy/st/en/programs/Planning/rmps/bighorn.html.

5.1.3 Scoping Meetings

During the weeks of November 3, 2008 and November 10, 2008, the BLM hosted scoping meetings in six locations across the Planning Area. Table 5-1 lists the scoping meeting locations and dates. The six public scoping meetings provided the public with an opportunity to learn and ask questions about the project and the planning process and to submit their issues and concerns to the BLM. The BLM chose an open house format over a more formal public meeting format to encourage broader participation, to allow attendees to learn about the project at their own pace, and to enable attendees to ask questions of BLM representatives in an informal one-on-one setting.

In addition to members of the BLM Interdisciplinary Team, a total of 381 people attended the scoping meetings. The BLM provided four handouts and presented four display boards at each scoping meeting. BLM resource specialists also brought maps, photographs, pamphlets, and other visual aids to the meetings for use when speaking with the public.

The BLM encouraged meeting attendees to comment by submitting written comment forms (either at the meetings or via mail) or by sending an e-mail. Comment sheets were available to attendees at all meetings, as was a computer station where the public could type and submit their comments. Attendees to the November 14 public meeting received a notification of the extension of the scoping period until November 24, 2008. At the November 12 through November 14 meetings, attendees also received a survey from the County Commissioners.

5.1.4 Open Houses/Public Meetings

After the public scoping period closed, the BLM held two open house meetings in Cody and in Worland, Wyoming. Similar to the public scoping meetings, resource specialists and other representatives of the BLM were on hand to personally address questions and provide information to meeting participants. The BLM also hosted five public workshops to obtain information and input on travel management and recreational activities at locations throughout the Basin that were attended by 203 participants.

Mailing List

The BLM compiled a list of 158 individuals, agencies, and organizations that participated in past BLM projects or requested to be on the general mailing list. The BLM mailed the initial scoping postcard to each individual on this list. In addition to those on the general mailing list, the BLM purchased a mailing list covering the entire Bighorn Basin (over 16,000 addresses) and mailed postcards to P.O. Box addresses included in this basin-wide list (2,485 addresses). Visitors to the scoping meetings were asked to sign in and provide their mailing address so that they could also be added to the mailing list. Other additions to the mailing list include those individuals who have submitted requests to be added to the list. Duplicate entries, changes of address, and return-to-sender mailings were deleted from the official project mailing list as identified. Through this process, the general mailing list was revised to approximately 500 entries. Requests to be added to or to remain on the official mailing list will continue to be accepted throughout the planning process.

Newsletters

Periodic newsletters have been and are being developed and distributed to keep the public informed of the Bighorn Basin RMP Revision Project. The January 2009 newsletter summarized the public scoping period and invited the public to the recreation and travel management workshops. Eight newsletters have been mailed to individuals on the Bighorn Basin RMP mailing list.

Website

The Bighorn Basin RMP Revision Project website can be found at: http://www.blm.gov/wy/st/en/programs/Planning/rmps/bighorn.html. The site serves as a virtual repository for documents related to the development of the RMP, including announcements, newsletters, and documents. The documents are available in PDF format to ensure they are accessible to the widest range of interested parties. The website provides the public an opportunity to submit their comments for consideration as part of the planning process and to be added to the project mailing list.

Field Trips

Six field trips were held during the summer of 2010 to various locations within the Planning Area to provide on-site discussion of RMP topics and to describe opportunities for effective public comment in advance of the 90-day public comment period.

In addition, Field Managers and RMP project leader were available to discuss RMP issues at the invitation of external individuals and groups. Multiple outside groups requested information from BLM managers and staff during 2010.

5.1.5 Public Comment Period on the Draft RMP and Draft EIS

A notice of availability announcing the release of the Draft RMP and Draft EIS was published in the *Federal Register* on April 22, 2011 initiating a 90-day comment period. At the request of the public and cooperating agencies, the BLM extended the comment period by 45 days, for a total comment period of 135 days. The comment period ended on September 7, 2011. During the 135-day comment period, the BLM hosted six public meetings within the Planning Area to gather comments on the Draft RMP and Draft EIS and to answer questions from the public (see Table 5-1).

Notification

The BLM issued a news release April 22, 2011 announcing the release of the Draft RMP and Draft EIS, which provided the dates, times, and locations of the public meetings for the Draft RMP and Draft EIS. The BLM issued a subsequent news release on May 23, 2011 again providing the dates, times, and locations for the June public meetings. The news releases were also posted on the Bighorn Basin RMP Revision Project website.

Public Meetings

During the public comment period, the BLM held six public meetings in June of 2011 in towns and cities throughout the planning area (see Table 5-1). The meetings were held in an open-house format to encourage participation and allow for the public to have informal one-on-one discussions with BLM resource specialists. The public meetings provided additional opportunity for the public to ask questions and submit comments. BLM managers, resource specialists, and other representatives of the BLM were present during these meetings to discuss and answer questions.

Comment Analysis

Based on comments received during this period, the BLM revised the RMP where appropriate. Changes made to the Draft RMP and Draft EIS based on comments are reflected in the Proposed RMP and Final EIS. The Comment Analysis Report summarizes all substantive comments received during the 135-day public comment period and the BLM responses to those comments, including how the document was revised based on comments. The report is presented in Appendix A.

5.1.6 Public Comment Period on the Supplement to the Draft RMP and Draft EIS

A notice of availability announcing the release of the Supplement was published in the *Federal Register* on July 12, 2013 initiating a 90-day public comment period. The BLM initially scheduled 90 days for public comment, and the original date for the close of the comment period was October 12, 2013. However, due to the lapse in appropriations and the resulting federal government shutdown, the documents were not available on the BLM website from October 1 through October 16, 2013 and the comment period was extended 20 days, ending on November 1, 2013. During the 110-day comment period, the BLM hosted six public meetings within the Planning Area to gather comments on the Supplement and to answer questions from the public (see Table 5-1).

Notification

The BLM issued a new release to local media on July 12, 2013 announcing the release of the Supplement. The new release provided the dates, times, and locations of the six public meetings for the Supplement. The BLM issued a subsequent news release on August 21, 2013 again providing the dates, times, and locations for the September public meetings. The news releases were also posted on the Bighorn Basin RMP Revision Project website. On October 24, 2013, the BLM issued a third news release announcing the extension of the public comment period and new end date.

Public Meetings

During the comment period, the BLM held six public meetings in September of 2013 in towns and cities throughout the planning are (see Table 5-1). The meetings were held in an open-house format with presentations discussing the cause for the Supplement, outlining alternatives E and F, and providing guidance for making effective comments. Each presentation also included a question and answer session. The open house portions of the meetings were designed to allow attendees to learn about the project at their own pace and to enable them to ask BLM representatives questions in an informal one-on-one setting.

Comment Analysis

Based on comments received during the 110-day comment period, the BLM revised the RMP where appropriate. Changes made based on comments are reflected in the Proposed RMP and Final EIS, which integrates the content of the Draft RMP and Draft EIS and the Supplement. The Comment Analysis Report summarizes all substantive comments received during the 110-day comment period and the BLM responses to those comments. The report is presented in Appendix A.

5.1.7 Future Public Involvement

Public participation efforts will be ongoing throughout the remainder of the process of revising the RMP and developing the EIS. The Proposed RMP and Final EIS considered all substantive oral and written comments received during the comment periods for the Draft RMP and Draft EIS and the Supplement. Members of the public with standing will have the opportunity to protest the content of the Proposed RMP and Final EIS during the specified 30-day protest period. The Record of Decision will be issued by the BLM following the Governor's Consistency Review and protest resolution.

5.2 Consultation and Coordination

This section documents the consultation and coordination efforts undertaken by the BLM throughout the process of revising the RMP and developing the EIS. Title II, Section 202 of the Federal Land Policy and Management Act (FLPMA) directs the BLM to coordinate planning efforts with Native American Tribes, other federal departments, and agencies of the state and local governments as part of its land use planning process. The BLM is directed to integrate NEPA requirements with other environmental review and consultation requirements to reduce paperwork and delays (40 Code of Federal Regulations 1500.4-5). The BLM accomplished coordination with other agencies and consistency with other plans through ongoing communications, meetings, and collaborative efforts with the BLM Interdisciplinary Team, which includes BLM specialists, and federal, state, and local agencies.

The BLM is aware that there are specific state laws and local plans relevant to aspects of public land management that are discrete from, and independent of, federal law. However, BLM is bound by federal law. As a consequence, there may be inconsistencies that cannot be reconciled. The FLPMA and its implementing regulations require that BLM's land use plans be consistent with state and local plans only if those plans are consistent with the purposes, policies, and programs of federal laws and regulations applicable to public lands. Where state and local plans conflict with the purposes, policies, and programs of federal law there will be an inconsistency that cannot be resolved. While county and federal planning processes, under FLPMA, are required to as integrated and consistent as practical, the federal agency planning process is not bound by or subject to county plans, planning processes, or planning stipulations.

5.2.1 Cooperating Agencies

The BLM invited local, state, federal, and tribal representatives to participate as cooperating agencies on the Bighorn Basin RMP Revision Project and EIS. The BLM invited the following entities to participate because they have jurisdiction by law or because they could offer special expertise:

Counties

- Big Horn County Commission
- Hot Springs County Commission
- Park County Commission
- Washakie County Commission

Conservation Districts

- Cody Conservation District
- Hot Springs Conservation District
- Powell-Clarks Fork Conservation District
- Meeteetse Conservation District
- Shoshone Conservation District
- South Big Horn Conservation District
- Washakie County Conservation District

Wyoming State Agencies

- Office of the Governor
- Department of Agriculture
- Department of Environmental Quality
- Game and Fish Department
- Office of Lands and Investments
- Oil and Gas Conservation Commission
- State Engineer's Office
- State Geological Survey
- State Historic Preservation Office

Federal Agencies

- U.S. Environmental Protection Agency (EPA), Region 8
- U.S. Forest Service – Shoshone National Forest/Wapati Ranger District
- U.S. Forest Service – Bighorn Ranger District

Tribes

- Northern Cheyenne Tribe Tribal Historic Preservation Office
- Crow
- Rosebud Sioux

The BLM formally invited the cooperating agencies to participate in developing the alternatives and RMP and EIS, and to provide data and other information relative to their agency responsibilities, goals, mandates, and expertise. Cooperating agencies provided input during the initial scoping process. The BLM held general meetings with cooperators to discuss procedures and processes. The BLM hosted teleconferences to obtain cooperator input on the Analysis of the Management Situation in February 2009. The BLM and cooperating agencies held several workshops to develop goals and objectives, a range of alternatives, and the Agency Preferred Alternative between March 2009 and February 2010. Cooperating agencies met with the Field Managers to relay concerns and propose options for the Preferred Alternative between October 2009 and February 2010. The BLM and cooperating agencies have routinely met to be orientated to process and procedures and to resolve process related issues. Though not in effect during meetings and consultation with cooperating agencies and the general public leading up the Draft RMP and Draft EIS, the BLM applied the guidance provided in Instruction Memorandum No. WY 2010-033 (BLM 2010d) in future public involvement activities for this revision project, including those with cooperating agencies.

Cooperating agencies were provided an opportunity to submit position statements for publication in the Draft RMP and Draft EIS. The intent of these position statements was to allow the cooperating agencies to express their agreement or disagreement on substantive elements of the alternatives or impacts and whether or not these disagreements were adequately resolved in the Agency Preferred Alternative. No position statements were provided opposing the Agency Preferred Alternative, and only the Wyoming Department of Agriculture and the Washakie County Conservation District provided positions statements for publication in the Draft RMP and Draft EIS, which are also included in this Proposed RMP and Final EIS (Appendix E).

The BLM held an additional cooperating agency workshop on January 31, 2013 to update the cooperators on the status of the RMP revision process and the need to prepare a Supplement to the Draft RMP and Draft EIS to incorporate additional considerations for the protection of greater sage-grouse. The meeting also presented an opportunity for cooperators to discuss and provide input on how impact analyses should be conducted for the new alternatives.

5.2.2 Section 7 Consultation

The Worland and Cody Field Offices contacted the U.S. Fish and Wildlife Service (USFWS) regarding Section 7 of the Endangered Species Act and the Bighorn Basin RMP revision. The BLM sent a scoping letter to the USFWS requesting comments concerning Section 7 consultation and the Bighorn Basin RMP revision project. On November 13 of 2008 the USFWS provided comments on (1) threatened and endangered species, (2) migratory birds, and (3) wetlands and riparian areas. Within these comments was also provided a list of threatened and endangered species likely to occur on BLM-administered land in the Worland and Cody Field Offices, for evaluating BLM Section 7 responsibilities. The USFWS was also provided opportunities to comment on chapters 2 and 4 of the Draft RMP and Draft EIS, and in November and December of 2009 comments were received on both chapters. The Worland and Cody Field Offices continued consultation with the USFWS regarding the RMP revision through completion of

the Final Biological Assessment and Proposed RMP and Final EIS. Consultation letters concerning the Bighorn Basin RMP revision project are located in Appendix E.

5.2.3 Consultation with the Wyoming Historic Preservation Officer

The Worland and Cody Field Offices initiated consultation with the Wyoming State Historic Preservation Office (SHPO) regarding the Bighorn Basin Resource Management Plan revision pursuant to the National Historic Preservation Act and the Wyoming State Protocol Agreement between BLM and the Wyoming SHPO. The BLM formally invited the Wyoming SHPO to be a cooperating agency; to participate in developing the alternatives and RMP and EIS; and to provide data and other information relative to their agency responsibilities, goals, mandates, and expertise concerning. The Wyoming SHPO participated in the development of the Preferred Alternative between March 2009 and February 2010. The BLM also provided the Wyoming SHPO with opportunities to comment on Chapters 2 and 4 of the Draft RMP and Draft EIS. On September 1, 2011 the Wyoming SHPO provided comments on the Draft RMP and Draft EIS regarding prehistoric and historic cultural resources within the Planning Area. The Worland and Cody Field Office continued consultation with the Wyoming SHPO regarding the RMP revision through completion of the Proposed RMP and Final EIS.

5.2.4 Native American Interests

Consultation with Native American tribes is part of the NEPA process and a requirement of FLPMA. The BLM invited Native American tribes to be cooperating agencies as part of the RMP revision and three tribes attended cooperator meetings. On October 10, 2008, the BLM sent letters to the following 11 tribes inviting them to be part of the planning process through consultation and public scoping meetings:

- Blackfeet
- Cheyenne River Sioux
- Crow
- Eastern Shoshone
- Nez Perce
- Northern Arapaho
- Northern Cheyenne
- Oglala Sioux
- Rosebud Sioux
- Salish & Kootenai
- Shoshone Bannock

The consultation letters invited Native American tribes to comment on interests or concerns related to management in the Planning Area and asked tribes to identify any places of traditional religious or cultural importance within the Planning Area. The chairman and cultural contacts for the 11 tribes invited to participate in the planning process are shown in Table 5-2. An example consultation letter between the Native American tribes and the BLM is included in Appendix E.

Following the scoping process, the BLM sent a letter to each of the above tribes requesting specific information to help identify areas of special concern for the tribes and presenting the opportunity for meetings or field trips with tribal representatives. BLM representatives followed these letters with

telephone calls to each tribe. In letters and during the follow-up calls, the BLM stressed its desire for the tribes to review and comment on the Draft RMP and EIS. On December 17, 2008 the BLM met with tribal representatives in Rapid City, South Dakota to discuss the RMP revision. Additional inquiries were made of interested tribes who might desire face-to-face opportunities to discuss RMP issues. In January 2010, Field Managers and staff met with the Northern Cheyenne Tribal Historic Preservation Officer to discuss the Tribe's interest in RMP topics. Government-to-government consultation with the tribes continued throughout the RMP process. In 2013, the BLM sent additional consultation letters to the tribes listed in Table 5-2 informing them of the need to prepare a Supplement to the Draft RMP and EIS, and welcoming continued feedback.

Comments have not been received from any tribe during the scoping period, or the public comment periods on the Draft RMP and Draft EIS, or Supplement, however, consultation is an on-going process.

Table 5-2. Tribal Consultation

State	Tribe	Chairman	Cultural Contact
Idaho	Nez Perce	Silas C. Whitman, Chairman Nez Perce Tribal Executive Committee	Keith "Pat" Baird Tribal Historic Preservation Officer Nez Perce Tribe
Idaho	Shoshone-Bannock	Nathan Small, Chairman Shoshone-Bannock Tribes of the Fort Hall Reservation	Carolyn Boyer Smith Cultural Resource Coordinator HETO/Cultural Resources Shoshone-Bannock Tribes of the Fort Hall Reservation Cleve Davis, Environmental Program Manager Shoshone-Bannock Tribes of the Fort Hall Reservation
Montana	Blackfeet	Harry Barnes, Chairman Blackfeet Tribal Business Council	John Murray Tribal Historic Preservation Officer Blackfeet Tribe
Montana	Crow	Darrin Old Coyote, Chairman Crow Tribal Council	Emerson Bull Chief Tribal Historic Preservation Officer George Reed Director, Cultural Resources Department
Montana	Northern Cheyenne	Llevando "Cowboy" Fisher, President Northern Cheyenne Tribal Council	James Walksalong, Interim Tribal Historic Preservation Officer Northern Cheyenne Tribe
Montana	Confederated Salish and Kootenai	Mr. E.T. "Bud" Moran, Chairman Confederated Salish and Kootenai Tribes of the Flathead Indian Nation	Ms. Marcia Pablo Tribal Historic Preservation Officer Confederated Salish and Kootenai Tribes of the Flathead Indian Nation
South Dakota	Cheyenne River Sioux	Harold Frazier Cheyenne River Sioux Tribal Council	Steve Vance Tribal Historic Preservation Officer
South Dakota	Oglala Sioux	Bryan Brewer, President Oglala Sioux Tribal Council	Michael Catches Enemy Tribal Historic Preservation Officer
South Dakota	Rosebud Sioux	Cyril "Whitey" Scott, President Rosebud Sioux Tribe	Russell Eagle Bear Tribal Historic Preservation Officer Rosebud Sioux Tribe

Table 5-2. Tribal Consultation (Continued)

State	Tribe	Chairman	Cultural Contact
Wyoming	Eastern Shoshone	Darwin St. Clair, Jr., Chairman Eastern Shoshone Tribe of the Wind River Reservation	Wilfred Ferris Tribal Historic Preservation Officer Eastern Shoshone Tribe of the Wind River Reservation
Wyoming	Northern Arapaho	Darrell O' Neal, Sr., Chairman Northern Arapaho Tribe	Yufna Soldier Wolf Tribal Historic Preservation Officer

5.3 Distribution List

The BLM sent postcards announcing the availability of the Bighorn Basin Proposed RMP and Final EIS to all mailing list entries including the public; media; educational institutions; federal, state, and local agencies; clubs, alliances, and societies; and other associations and councils. In addition, the BLM distributed electronic copies of the Proposed RMP and Final EIS to the following entities for their review and comment. Hardcopy documents were distributed to select libraries noted below.

Tribal Governments

- Blackfeet
- Cheyenne River Sioux
- Crow
- Eastern Shoshone
- Nez Perce
- Northern Arapaho
- Northern Cheyenne
- Oglala Sioux
- Rosebud Sioux
- Salish & Kootenai
- Shoshone-Bannock

Local Governments (Counties, Cities, Towns)

Big Horn County, Wyoming

- Big Horn County Commission
- South Big Horn Conservation District

Park County, Wyoming

- Park County Commission
- Cody Conservation District
- Meeteetse Conservation District
- Powell-Clarks Fork Conservation District

Washakie County, Wyoming

- Washakie County Commission
- Washakie County Conservation District

Hot Springs County, Wyoming

- Hot Springs County Commission
- Hot Springs Conservation District

State of Wyoming

- Senator Henry H.R. 'Hank' Coe
- Senator Gerald Geis
- Senator R. Ray Peterson
- Representative Mike Greear
- Representative Elaine Harvey
- Representative Samuel Krone
- Representative Dan Laursen
- Representative David Northrup
- Representative Nathan Winters

Wyoming State Agencies

- Office of the Governor, Environmental Policy Division
- Business Council
- Department of Environmental Quality
  - Air Quality Division
  - Land Quality Division
  - Water Quality Division
- Department of Agriculture
- Department of State Parks and Cultural Resources
  - State Museum
- Department of Transportation
- State Planning Office
- Game and Fish Department
- State Geologic Survey
- Office of State Lands and Investments
- State Engineer's Office
- State Historic Preservation Office
- Department of Administration and Information
- Department of Employment, Research, and Planning Division

Wyoming State Boards/Commissions

- Air Quality Advisory Board
- Board of Wildlife Commissioners
- Agriculture Board
- Environmental Quality Council
- Farm Bureau Federation
- Land Quality Advisory Board
- Livestock Board
- Oil and Gas Conservation Commission
- State Grazing Board
- Trails Council

Congressional Delegation

- U.S. Senator Michael Enzi
- U.S. Senator John Barrasso
- U.S. Representative Cynthia Lummis

U.S. Department of the Interior

- Bureau of Indian Affairs
- U.S. Bureau of Reclamation
- National Park Service
    - Bighorn Canyon National Recreation Area
    - Yellowstone National Park
- U.S. Fish and Wildlife Service
- Bureau of Land Management
    - Washington, D.C.
    - Wyoming State Office, Cheyenne
    - Wyoming Field Offices: Worland and Cody

Other Federal Agencies

- U.S. Environmental Protection Agency
- U.S. Department of Agriculture Forest Service
    - Big Horn National Forest
    - Shoshone National Forest

Libraries

- Park County Library
- Big Horn County Public Library
- Washakie County Library
- Hot Springs County Library

Educational Institutions

- University of Wyoming

Media

Newspapers

- Northern Wyoming Daily News, Worland, Wyoming
- The Independent Record, Thermopolis, Wyoming
- Greybull Standard Tribune, Greybull, Wyoming
- Basin Republican Rustler, Basin, Wyoming
- The Cody Enterprise, Cody, Wyoming
- Powell Tribune, Powell, Wyoming
- Lovell Chronicle, Lovell, Wyoming
- Billings Gazette, Billings, Montana
- Wyoming Livestock Roundup, Casper, Wyoming
- Associated Press, Billings, Montana
- Casper Star Tribune, Casper, Wyoming
- Riverton Ranger, Riverton, Wyoming

Radio

- Big Horn Radio Network: KODI/KZMQ/KTAG/KKLX/KWOR, Cody AM and FM
- KPOW/KLZY, Powell AM and FM
- KTHE, Thermopolis AM
- KWOR/KKLX, Worland AM and FM
- KVOW/KTAK, Riverton AM and FM
- Wyoming Public Radio

5.4 List of Preparers

Table 5-3. List of Preparers

Name	Education (degree, year, school)	Title	Project Role	Years of Experience
Bureau of Land Management				
Holly Elliott	B.S. Environmental Science & Natural Resource Management with emphasis in Environmental Law/Policy, 2001, University of Nevada, Reno	Planning and Environmental Coordinator	Project Manager/Inspector and Team Leader	18
Caleb Hiner	B.S. Geosciences, 2001, Idaho State University	Senior Resource Advisor	Senior Resource Advisor	14
Delissa Minnick	J.D., 2006, University of Wyoming	Field Manager	Cody Field Office Manager	8
Rebecca Good	B.S. Geological Engineering, 1994, South Dakota School of Mines (SDSM&T) B.S. Geology, 1995, SDSM&T	Field Manager	Worland Field Office Manager	21
Jessica Montag	B.S. Recreation Resource Management, 1998, University of Minnesota M.S. Resource Management, 2000, University of Montana; Ph.D. Wildlife Biology, 2004, University of Montana	Economist	Social Conditions/ Economic Conditions	11
Sarah Beckwith	B.A. Environmental Studies and Geography, 1993, University of California, Santa Barbara	Public Affairs Specialist	Public Affairs	17
JoDee Cole	B.A. Anthropology, 1978, Southern Illinois University	Resource Information Specialist	GIS Data Management	37
Kierson Crume	B.A. Anthropology, 1995, University of New Mexico	Archaeologist	Cultural, including National Historic Trails	20
Jared Dalebout	B.A. Geology, 2003, Weber State University	Hydrologist	Water, Riparian/Wetlands, Aquatic Resources, Vegetation (Riparian/Wetland, Grasslands/Shrublands)	8
John Elliott	B.S. Range Management, 1993, University of Wyoming	Rangeland Management Specialist	Livestock Grazing	22
Jim Gates	B.S. Forest Resources, 1996, University of Idaho	Forester	Forestry	21
Monica Goepferd	B.S. Mining Engineering, 2002, Montana Tech	Supervisory Civil Engineer	Transportation, Facilities, Maintenance	11
Destin Harrell	B.A. Biology, 2000, Western State College	Wildlife Biologist	Wildlife, Special Status Species	14

Table 5-3. List of Preparers (Continued)

Name	Education (degree, year, school)	Title	Project Role	Years of Experience
Patricia (Tricia) Hatle	B.S. Range Science, 1991, University of Wyoming	Rangeland Management Specialist	Wild Horses	25
Cam Henrichsen	B.S. Range Science, 1990, South Dakota State University	Range Management Specialist	Wild Horses	24
Karen Hepp	B.S. Range/Wildlife, 1983, University of Nebraska	Rangeland Management Specialist	Rangeland Vegetation, Special Status Species	29
Charis A. Tuers	B.S. Environmental Engineering, 1997, Montana Tech	Air Quality Specialist	Air Quality	13
Gretchen Hurley	B.S. Natural Science & Mathematics, 1981, University of Wyoming	Geologist	Geology, Paleontology, Minerals	33
Rance Neighbors	B.S. Forestry, 2002, Auburn University	Natural Resource Specialist	Invasive Species	11
Paul Rau	B.S. Geography, 2000, University of Wyoming	Outdoor Recreation Planner	Visual Resource Management, OHV, Travel Management, Recreation, and Special Designations	13
David Seward	B.S. Range Management, 1995, University of Wyoming	Natural Resource Specialist	Surface Compliance	20
Carol Sheaff	BLM-Lands Academy, 2003, Northwest Community College, Various courses University of Nebraska, Kearney, Education	Realty Specialist	Lands & Realty, including Transportation/Access and ROWs, Renewable Energy Utility/ Communication Corridors	31 – Retired
Tim Stephens	B.A. Greenville College, 1983 M.S. Environmental Biology, 1985, Emporia State University Teachers Certificate, 1988, Lawrence University, Appleton Wisconsin	Biologist	Fish & Wildlife, Special Status Species	25
Eve Warren	B.S. Wildlife Management, 1991, Utah State University M.S. Conservation Biology, 1993, Utah State University Ph.D. Range Science, 2001, Texas Tech University	Natural Resource Specialist	Rangeland Vegetation	23
Criss Whalley	B.S. Range Management, 1984, Humboldt State University M.S. Plant Science, 1987, University of Nevada, Reno	Rangeland Management Specialist	Livestock Grazing	28
Jim Wolf	B.S. Range Ecology, 1983, Colorado State University	Fire Management Specialist	Fire Ecology, Soil, Vegetation (Grasslands, Shrublands, Special Status Plants)	30

Table 5-3. List of Preparers (Continued)

Name	Education (degree, year, school)	Title	Project Role	Years of Experience
Consultants				
Laura Ziemke	B.A. Anthropology, Boise State University, 1993	Vice President	Project Manager	24
Alex Bartlett	B.G.S. Environmental Studies, emphasis in Environmental Policy, University of Kansas, 2006	Technical Specialist	Deputy Project Manager	8
Nathan Wagoner	M.S. Human Dimensions of Ecosystem Science and Management, Utah State University, Logan, Utah, 2006 B.S. Natural Resources Integrated Policy and Planning, The Ohio State University, Columbus, Ohio, 2003	Senior Project Manager	Deputy Project Manager	12
Kim Stevens	B.S. Geography, University of Utah, 1982	NEPA Specialist	Project Coordinator	12
Dan Nally	M.A. Urban and Environmental Policy and Planning, Tufts University, 2011 B.S. Biology, The College of William and Mary, 2007	NEPA Specialist	Technical Support	4
Karen DiPietro	Communications, Lewes Technical College, England, 1987	Publication Specialist	Editor	24
Jay Haney	M.S. Meteorology, Saint Louis University, 1980 B.S. Meteorology, Saint Louis University, 1978	Air Quality Specialist	Air Quality	33
Rob Fetter	M.S. Resource Economics, University of Massachusetts, 2002 B.S. Resource Economics, University of Massachusetts, 1999	Socioeconomics Specialist	Social Conditions/ Economic Conditions/ Environmental Justice	12
Alex Uriarte	Ph.D. Development Studies, University of Wisconsin, 2000 M.S. Economics, University of Wisconsin-Madison, 1996 M.S. Business Economics, Getúlio Vargas Foundation, São Paulo, Brazil, 1994 B.A. Economics, University of São Paulo, Brazil, 1989	Socioeconomics Specialist	Social Conditions/ Economic Conditions/ Environmental Justice	15
Lissa Johnson	B.A. Anthropology, University of Idaho, 1995	GIS Specialist	GIS	12

Table 5-3. List of Preparers (Continued)

Name	Education (degree, year, school)	Title	Project Role	Years of Experience
Joe Walsh	B.A. Physical Geography, University of California, Santa Barbara, 1993	GIS Specialist	GIS	18
Lucas Bare	MESM, Conservation Planning Specialization, Donald Bren School of Environmental Science & Management, University of California, Santa Barbara, California, 2009 BA, Biology, Bowdoin College, Brunswick, Maine, 2006	Manager	Technical Specialist	13
Randall Coleman	MURP, Urban and Regional Planning, University of Colorado, 2013 B.A. (cum laude), History and Spanish, Trinity University, 2005	Manager	Technical Specialist	8
ICF International	Interdisciplinary Team			
SAIC – now Laidos	Cultural Resources – Interdisciplinary Team			
EMPSi	Prepared: Executive Summary and Greater Sage-grouse Cumulative Effects (Chapter 7)			

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CHAPTER 6 – REFERENCES

Advanced Resources International. 2006. Technical oil recovery potential from residual oil zones: Big Horn Basin: Prepared for U.S. Department of Energy, Office of Fossil Energy – Office of Oil and Natural Gas. 30 pages. Available online: http://www.adv-res.com/pdf/ROZ_Big_Horn_Document.pdf.

Anderson, E.W., and R.J. Scherzinger. 1975. Improving Quality of Winter Forage for Elk by Cattle Grazing. Journal of Range Management 28:120-125.

APHIS (Animal and Plant Health and Inspection Service) and BLM (Bureau of Land Management). 2003. Memorandum of Understanding Document #03-8100-0870-MU, February 27, 2003.

APLIC (Avian Power Lines Interaction Committee) and USFWS (U.S. Fish and Wildlife Service). 2005. Avian Protection Plan Guidelines. A Joint Document Prepared By The Edison Electric Institute's Avian Power Line Interaction Committee and U.S. Fish and Wildlife Service. April.

Archer, A.W., L.C. Furer, K. Keller, D.L. Mickelson, G.D. Johnson, and E.P. Kvale. 2001. Middle Jurassic (Bajocian and Bathonian) Dinosaur Megaracksites, Bighorn Basin, Wyoming, U.S.A. Palaios, Vol. 16. Pages 233-254.

Arneson, C.S., J.C. Case, K.D. Frederick, S.P. Gloss, J.D. Hamerlink, P.W. Huntoon, L.C. Munn, S. Needham, and M. Wireman. 1998. Wyoming Groundwater Vulnerability Assessment Handbook, Volume I: Background, Model Development, and Aquifer Sensitivity Analysis, University of Wyoming SDVC Report 98-01, 201 p.

Auerbach, N., M.D. Walker, and D.A. Walker. 1997. Effects of Roadside Disturbance on Substrate and Vegetation Properties in Arctic Tundra. Ecological Applications, Vol. 7:1; 218-235.

Bailey, W.B., R.G. Welling, and E.T. Miller. 2001. Cattle Use of Foothills Rangeland Near Dehydrated Molasses Supplement. Journal of Range Management 54:338-347.

Bartos, D.L. 2001. Landscape Dynamics of Aspen and Conifer Forests. USDA (U.S. Department of Agriculture) Forest Service Proceedings RMRS-P-18.

Bartos, D.L., and R.B. Campbell. 1998. Decline of Aspen in the Interior West – Examples from Utah. Rangelands 20(1):17-24.

Bartuszevige, A.M., and B.A. Endress. 2008. Do Ungulates Facilitate Native and Exotic Plant Spread? Seed Dispersal by Cattle, Elk, and Deer in Northeastern Oregon. Journal of Arid Environments 72:904-913.

Baruch-Mordo, S., J.S. Evans, J.P. Severson, D.E. Naugle, J.D. Maestas, J.M. Kiesecker, M.J. Falkowski, C.A. Hagen, and K.P. Reese. 2013. Saving sage-grouse from Trees.

BEA (Bureau of Economic Analysis). 2010a. Regional Economic Information System, 1969-2008. Available online: http://www.bea.gov/regional/. Accessed June 2010.

BEA. 2010b. Regional Economic Information System: Local Area Personal Income and Employment Methodology. Available online: http://www.bea.gov/regional/pdf/lapi2008/lapi2008.pdf. Accessed June 2010.

BEA. 2012. Regional Economic Information System, Local Area Personal Income and Employment. Available online: http://www.bea.gov/regional/index.htm. Accessed September 2013.

BEA. 2013. Local Area Unemployment Statistics. Available online: http://data.bls.gov. Accessed June 2010 and September 2013.

Beck, J.L., and D.L. Mitchell. 2000. Influences of Livestock Grazing on Sage Grouse Habitat. Wildl. Soc. Bull. 4: 993-1002. Available online: http://www.jstor.org/discover/10.2307/3783858?uid=2134&uid=2&uid=70&uid=4&sid=21103450199423.

Beck, J.L., J.K. Garrett; J. Wright, and K.P. Wolfley. 2011. Potential and Pitfalls of Prescribed Burning Big Sagebrush Habitat to Enhance Nesting and Early Brood-Rearing Habitats for Greater Sage-Grouse. Natural Resources and Environmental Issues: Vol. 16, Article 5. Available online: http://digitalcommons.usu.edu/nrei/vol16/iss1/5.

Beever, E.A. 2003. Management Implications of the Ecology of Free-Roaming Horses in Semi-Arid Ecosystems of the Western United States. Wildlife Society Bulletin 31(3):887-895.

Beever, E.A., and J.E. Herrick. 2006. Effects of Feral Horses in Great Basin Landscapes on Soils and Ants: Direct and Indirect Mechanisms. Journal of Arid Environments 66(1):96-112.

Belsky, A.J., A. Matzke, and S. Uselman. 1999. Survey of Livestock Influences on Stream and Riparian Ecosystems in the Western United States. Journal of Soil and Water Conservation 54:419-431.

BHBLWG (Big Horn Basin Sage-grouse Local Working Group). 2007. Sage-grouse Conservation Plan for the Big Horn Basin, Wyoming.

Big Horn County. 2005. Big Horn County Mountain Community Wildfire Protection Plan, March 31, 2005.

Big Horn County. 2009. 2009 Big Horn County Land Use Plan. Adopted January 6, 2010. Available online: http://www.bighorncountywy.gov/dep-land-planning-land-use-plan.htm.

Billings, W.D. 1973. Arctic and Alpine Vegetations: Similarities, Differences, and Susceptibility to Disturbance. BioScience, Vol. 23. Pages 697-704.

Birds of North America Online. 2008. Cornell Lab of Ornithology and the American Ornithologists' Union. Available online: http://bna.birds.cornell.edu/bna/. Accessed November 18, 2008.

BLM and DOE (Department of Energy). 2003. Assessing the Potential for Renewable Energy on Public Lands. February. U.S. Department of the Interior, Bureau of Land Management. U.S. Department of Energy, Energy Efficiency and Renewable Energy.

BLM and the National Biological Information Infrastructure Great Basin Information Project. No Date. Literature Synthesis of Livestock Grazing Management Literature Addressing Grazing Management for Greater Sage-Grouse Habitat in the Wyoming Basin – Southern Rocky Mountains Ecoregions. Available online: http://sagemap.wr.usgs.gov/SageGrouse.aspx.

BLM and USFS (U.S. Forest Service). 2008a. Final Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States. Available online: http://www.blm.gov/wo/st/en/prog/energy/geothermal/geothermal_nationwide.html.

BLM and USFS. 2008b. Record of Decision and Resource Management Plan Amendments for Geothermal Leasing in the Western United States. December.

BLM and USFS. 2013. Wyoming Greater Sage-Grouse, Draft Land Use Plan Amendment and Draft Environmental Impact Statement for the Casper, Kemmerer, Newcastle, Pinedale, Rawlins, and Rock Springs Field Offices and Bridger-Teton and Medicine Bow National Forests and Thunder Basin National Grassland. Available online: https://www.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=18704.

BLM and USFS. 2014. Forest Service and BLM Announce Grazing Fee. Available online: http://www.blm.gov/wo/st/en/info/newsroom/2014/january/NR_01_31_2014.html. January 31, 2014.

BLM and Wyoming SHPO. 2014. Programmatic Agreement Among the Bureau of Land Management, Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers Regarding the Manner in Which BLM Will Meet its Responsibilities Under the National Historic Preservation Act, State Protocol Between the Wyoming Bureau of Land Management and the Wyoming State Historic Preservation Officer. March 3.

BLM Land and Resources Project Office. 2013. Rangeland Administration System. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C. Available on internal intranet: http://web.ras.blm.gov/ras/ras.html.

BLM, ACHP (Advisory Council on Historic Preservation), and National Conference of SHPO (State Historic Preservation Officers). 2012. Programmatic Agreement Among the Bureau of Land Management, Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers Regarding the Manner in Which BLM Will Meet its Responsibilities Under the National Historic Preservation Act. Available online: http://www.blm.gov/wo/st/en/prog/more/CRM/blm_preservation_board/prog_agreement.html.

BLM, State of Montana DEQ (Department of Environmental Quality), and MBOGC (Montana Board of Oil and Gas Conservation). 2003. Montana Final Statewide Oil and Gas Environmental Impact Statement (EIS) and Proposed Amendment of the Powder River and Billings Resource Management Plans. Available online: http://www.blm.gov/mt/st/en/fo/miles_city_field_office/og_eis.html.

BLM. 1976. Environmental Analysis Record, Horse Roundup North Shoshone Area- Two Miles N.E. of Lovell, Wyoming. U.S. Department of the Interior, Bureau of Land Management, Wyoming.

BLM. 1978. The Influence of Livestock Grazing on Non-game Wildlife.

BLM. 1980. Memorandum regarding the North Shoshone Wild Horse Herd, from Range Conservationist Cody Resource Area. July 21, 1980. U.S. Department of the Interior, Bureau of Land Management, Cody Resource Area, Cody, Wyoming.

BLM. 1981. Environmental Analysis, Spring Creek Wild Horse Removal, Washakie Resource Area. WY-010-981. U.S. Department of the Interior, Bureau of Land Management, Wyoming.

BLM. 1983a. Grass Creek Resource Area Reservoir Habitat Management Plan. U.S. Department of the Interior, Bureau of Land Management, Wyoming.

BLM. 1983b. Grass Creek Grazing Environmental Impact Statement. U.S. Department of the Interior, Bureau of Land Management, Worland District Office, Worland, Wyoming.

BLM. 1984a. Grass Creek Resource Area Stream Habitat Management Plan. U.S. Department of the Interior, Bureau of Land Management, Wyoming.

BLM. 1984b. West Slope Habitat Management Plan. U.S. Department of the Interior, Bureau of Land Management. Worland District Office, Worland, Wyoming.

BLM. 1985. The McCullough Peaks Herd Area Management Plan. U.S. Department of the Interior, Bureau of Land Management.

BLM. 1986a. Absaroka Front Habitat Management Plan. W1-WHA-T10. U.S. Department of the Interior, Bureau of Land Management, Wyoming.

BLM. 1986b. Historic Trails Plans 1986. Oregon/Mormon Pioneer National Historic Trails Management Plan. U.S. Department of the Interior, Bureau of Land Management. Wyoming State Office, Cheyenne, Wyoming.

BLM. 1986c. Manual 8410-1, Visual Resource Inventory. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C. Available online: http://www.blm.gov/nstc/VRM/8410.html.

BLM. 1986d. Manual 8431-1, Visual Resource Contrast Rating. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C. Available online: http://www.blm.gov/nstc/VRM/8431.html.

BLM. 1987. Bighorn River Habitat and Recreation Management Plan. Prepared in cooperation with the Wyoming Game and Fish Department.

BLM. 1988a. Washakie Resource Management Plan. U.S. Department of the Interior, Bureau of Land Management, Worland District Office, Worland, Wyoming.

BLM. 1988b. BLM Manual 1613, Areas of Critical Environmental Concern. U.S. Department of the Interior, Bureau of Land Management. Available online: http://www.ntc.blm.gov/krc/uploads/360/5_1613_ACEC_Manual%201988.pdf.

BLM. 1990. Cody Resource Area – Resource Management Plan. U.S. Department of the Interior, Bureau of Land Management, Cody Resource Area, Cody, Wyoming.

BLM. 1992a. Upland Game Bird Habitat Management on the Rise. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 1992b. Raptor Habitat Management. Fish and Wildlife 2000. National Strategy Plan Series. U.S. Department of the Interior, Bureau of Land Management. August.

BLM. 1992c. Nongame Migratory Bird Habitat Conservation Plan. Fish and Wildlife 2000. National Strategy Plan Series. U.S. Department of the Interior, Bureau of Land Management.

BLM. 1993. Mineral Potential Report for the Grass Creek Resource Area Resource Management Plan/Environmental Impact Statement. U.S. Department of the Interior, Bureau of Land Management. Worland District Office, Worland, Wyoming.

BLM. 1994a. Red Gulch/Alkali National Backcountry Byway Interpretive Master Plan. U.S. Department of the Interior, Bureau of Land Management. Worland, Wyoming. June.

BLM. 1994b. Decision Record and Finding of No Significant Impact for the Washakie Resource Area Reservoir Habitat Management Plan, WY-010-WHA-T23. Environmental Assessment EA-WY-015-EA2-78.

BLM. 1994c. Brown/Howe Dinosaur Area in the Cody Resource Area Big Horn County, Wyoming, Environmental Assessment WY-017-EA3-056. U.S. Department of the Interior, Bureau of Land Management. Cody Resource Area, September 1994.

BLM. 1995. Instruction Memorandum 96-04, Use of Land Exchanges. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 1996. Partners Against Weeds: An Action Plan for Bureau of Land Management. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C. Available online: http://www.blm.gov/weeds/PAW/index.htm.

BLM. 1997. Decision Record and Finding of No Significant Impact for the Management of the Big Cedar Ridge Fossil Plant Area. U.S. Department of the Interior, Bureau of Land Management. Available online: http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1009&context=wyoming_recdecisions. January.

BLM. 1998a. Grass Creek Resource Management Plan. U.S. Department of the Interior, Bureau of Land Management, Worland District, Worland, Wyoming.

BLM. 1998b. Riparian Area Management, A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas. Technical Reference 1737-15. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C. Available online: http://www.blm.gov/nstc/library/techref.htm.

BLM. 1999. Riparian Area Management, A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lentic Areas. Technical Reference 1737-16. Revised 2003. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C. Available online: http://www.blm.gov/nstc/library/techref.htm.

BLM. 2000. Instruction Memorandum 2000-182, Mitigating and Remediating Physical Safety Hazards at Abandoned Mine Land Sites. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2001a. National Strategy for Motorized Off-Highway Vehicle Use on Public Lands. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C. Available online: http://www.blm.gov/ohv/OHV_FNL.pdf.

BLM. 2001b. BLM Manual 6840, Special Status Species Management. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2002a. Worland Field Office Review of Potential Wild and Scenic Rivers in the Washakie Resource Management Plan Planning Area. U.S. Department of the Interior, Bureau of Land Management, Worland, Wyoming.

BLM. 2002b. Instruction Memorandum WY-2002-164, Guidance to Address Environmental Justice in Land Use Plans and Related National Environmental Policy Act Documents. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2003a. Cody Field Office Review of Potential Wild and Scenic Rivers in the Cody RMP Planning. U.S. Department of the Interior, Bureau of Land Management, Cody, Wyoming.

BLM. 2003b. Statewide Programmatic Bald Eagle Biological Assessment. U.S. Department of the Interior, Bureau of Land Management, Wyoming State Field Office, Cheyenne, Wyoming.

BLM. 2004a. National Sage-grouse Habitat Conservation Strategy. 1.4.1 Guidance for the Management of Sagebrush Plant Communities for Sage-Grouse Conservation. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2004b. Fire Management Plan: Wyoming Northern Zone. U.S. Department of the Interior, Bureau of Land Management. Worland, Wyoming. Available online: http://www.blm.gov/wy/st/en/programs/Fire/planning.html.

BLM. 2004c. BLM Manual 8130, Planning for Uses of Cultural Resources. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2004d. BLM Manual 8110, Identifying Cultural Resources. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2004e. BLM Manual 8120, Tribal Consultation Under Cultural Resource Authorities. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2004f. Final Statewide Programmatic Gray Wolf Biological Assessment. Wyoming State Office, Cheyenne, Wyoming.

BLM. 2005a. Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM-Administered Lands in the Western States. June. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2005b. Land Use Planning Handbook H-1601-1. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2005c. Technical Reference 1734-6 Interpreting Indicators of Rangeland Health. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C. Available online: http://www.blm.gov/nstc/library/pdf/1734-6rev05.pdf.

BLM. 2005d. Statewide Programmatic Black-tailed Prairie Dog (*Cynomys ludovicianus*) Biological Evaluation. Submitted March 8, 2007. U.S. Department of the Interior, Bureau of Land Management. Wyoming State Office. Cheyenne, Wyoming.

BLM. 2005e. Record of Decision for Implementation of a Wind Energy Development Program and Associated Land Use Plan Amendments. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2005f. Final Statewide Programmatic Grizzly Bear (*Ursus arctos*) Biological Assessment. Updated June 29, 2006. U.S. Department of the Interior, Bureau of Land Management. Wyoming State Office. Cheyenne, Wyoming.

BLM. 2005g. Mountain Plover (*Charadrius montanus*) Biological Evaluation. Final Report. September. U.S. Department of the Interior, Bureau of Land Management. Wyoming State Office. Cheyenne, Wyoming.

BLM. 2005h. Final Statewide Programmatic Canada Lynx (*Lynx canadensis*) Biological Assessment. U.S. Department of the Interior, Bureau of Land Management. Wyoming State Office. Cheyenne, Wyoming.

BLM. 2006a. BLM Memorandum of Understanding WO-300-2006-07, Memorandum of Understanding between U.S. Department of the Interior Bureau of Land Management and U.S. Department of Agriculture Forest Service Concerning Oil and Gas Leasing and Operations. Forest Service Agreement No. 06-SU-11132428-052. U.S. Department of the Interior, Bureau of Land Management. Available online: http://www.blm.gov/pgdata/etc/medialib/blm/wo/MINERALS__REALTY__AND_RESOURCE_PROTECTION_/energy/epca_chart.Par.42324.File.dat/BLM_MOU_WO_300-2006-07.pdf.

BLM. 2006b. Instruction Memorandum 2006-216, Wind Energy Development Policy, August 24, 2006. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2006c. Instruction Memorandum 2006-073, Weed-Free Seed Use on Lands Administered by the Bureau of Land Management U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2007a. Burned Area Emergency Stabilization and Rehabilitation Handbook. H-1742-1. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C. Available online: http://www.blm.gov/pgdata/etc/medialib/blm/wo/Information_Resources_Management/policy/blm_handbook.Par.52739.File.dat/h1742-1.pdf.

BLM. 2007b. Final Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C. Available online: http://www.blm.gov/wo/st/en/prog/more/veg_eis.htm.

BLM. 2007c. Instruction Memorandum No. 2008-030, Instructions for Implementing the National Vegetation Treatments Final Programmatic Environmental Impact Statement. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C. Available online: http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/20080/im_2008-030.html.

BLM. 2007d. Instruction Memorandum No. 2007-097, Solar Energy Development Policy, April 4, 2007. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2007e. Instruction Memorandum No. 2007-043, A Unified Strategy to Implement BLM's Priorities for Recreation and Visitor Services Workplan. January 9. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2007f. Post-fire Recovery of Wyoming Big Sagebrush Shrub-steppe in Central and Southeast Montana. U.S. Department of the Interior, Bureau of Land Management. Montana State Office. Billings, Montana.

BLM. 2007g. Record of Decision and Approved Casper Resource Management Plan. Updated with Amendments and Maintenance Actions. Available online: http://www.blm.gov/pgdata/etc/medialib/blm/wy/programs/planning/rmps/casper/rod.Par.74551.File.dat/rod-armp-amend2012.pdf.

BLM. 2008a. Analysis of the Management Situation. Bighorn Basin Planning Area. Unpublished internal report. Cody Field Office, Worland Field Office. U.S. Department of the Interior, Bureau of Land Management. Worland, Wyoming.

BLM. 2008b. MS-8380 Cave and Karst Management. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2008c. Wyoming State Office Plan Summary – Mineral Material Disposals – Sales and Free Use Permits. Unpublished annual database and report to the Washington Office. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2008d. Draft 2008 Wyoming Northern Zone Fire Management Plan (Unpublished). U.S. Department of the Interior, Bureau of Land Management. Wyoming State Office. Cheyenne, Wyoming.

BLM. 2008e. BLM Manual 6840, Special Status Species Management. U.S. Department of the Interior, Bureau of Land Management. Available online: http://www.blm.gov/pgdata/etc/medialib/blm/wo/Information_Resources_Management/policy/blm_manual.Par.43545.File.dat/6840.pdf. December.

BLM. 2008f. Review of Unpublished and Proprietary Paleontological Resources Reports received by the Wyoming State Office, and Cody and Worland Field Offices. U.S. Department of the Interior, Bureau of Land Management. Wyoming State Office and Cody Field Office and Worland Field Office, Wyoming.

BLM. 2008g. Instruction Memorandum No. 2009-043, Wind Energy Development Policy, December 19, 2008. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2008h. Record of Decision and Approved Pinedale Resource Management Plan for Public Lands Administered by the Bureau of Land Management. Pinedale Field Office. Pinedale, WY. Available online: http://www.blm.gov/wy/st/en/programs/Planning/rmps/pinedale/rod_armp.html.

BLM. 2009a. Summary of the Analysis of the Management Situation for the Bighorn Basin Planning Area, U.S. Department of the Interior, Bureau of Land Management, Cody Field Office and Worland Field Office. Available online: http://www.blm.gov/wy/st/en/programs/Planning/rmps/bighorn/docs.html.

BLM. 2009b. Bighorn Basin Cultural Class I Regional Overview. Cody Field Office, Worland Field Office. U.S. Department of the Interior, Bureau of Land Management. Cody Field Office and Worland Field Office, Wyoming. September.

BLM. 2009c. Proposed Oil Shale and Tar Sands Resource Management Plan Amendments to Address Land Use Allocations in Colorado, Utah and Wyoming and Final Programmatic Environmental Impact Statement. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2009d. Solid Mineral Occurrence and Development Potential Report: Bighorn Basin Resource Management Plan Revision Project. U.S. Department of the Interior, Bureau of Land Management, Cody Field Office and Worland Field Office, Wyoming. Available online: http://www.blm.gov/wy/st/en/programs/Planning/rmps/bighorn/docs.html.

BLM. 2009e. Visual Resource Inventory for the Cody Field Office. U.S. Department of the Interior, Bureau of Land Management, Cody Field Office. Cody, Wyoming.

BLM. 2009f. Scoping Report Bighorn Basin Resource Management Plan Revision Project, March 20, 2009. U.S. Department of the Interior, Bureau of Land Management. Cody Field Office and Worland Field Office, Wyoming.

BLM. 2009g. Summary of the Analysis of the Management Situation for the Buffalo Field Office. U.S. Department of the Interior, Bureau of Land Management, Buffalo Field Office. Buffalo, Wyoming. Available online: http://www.blm.gov/wy/st/en/programs/Planning/rmps/buffalo/docs.html.

BLM. 2009h. Reasonable Foreseeable Development Scenario for Geothermal, Bighorn Basin Planning Area, Wyoming. Prepared by Wyoming Reservoir Management Group. March 13, 2009. U.S. Department of the Interior, Bureau of Land Management.

BLM. 2009i. Vegetation Treatment GIS Coverage; National Fire Plan Operations and Reporting System. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2009j. Riparian Aquatic Information Data System. U.S. Department of the Interior, Bureau of Land Management. Cody Field Office and Worland Field Office, Wyoming.

BLM. 2009k. Personal communication between T. Hatle (Range/Wild Horse Specialist) and A. Tkach regarding wild horses remaining in Herd Management Areas following fall 2009 roundup. U.S. Department of the Interior, Bureau of Land Management. Cody Field Office and Worland Field Office, Wyoming.

BLM. 2009l. Environmental Assessment WY-020-EA08-86, Finding of No Significant Impact and Decision Record. Location: McCullough Peaks Herd Management Area. October 26. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2009m. Instruction Memorandum No. 2009-138, Confidentiality of Paleontological Locality Information Under the Omnibus Public Lands Act of 2009 (123 Stat. 991), Title VI, Subtitle D, Paleontological Resources Preservation (OPLA-PRP). June 5, 2009. Available online: http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2009/IM_2009-138.html. Accessed July 20, 2009.

BLM. 2009n. Instruction Memorandum No. 2009-113, Casual Collecting of Common Invertebrate and Plant Paleontological Resources under the Paleontological Resources Preservation Act of 2009. April 24, 2009. Available online: http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2009/IM_2009-113.html. Accessed July 20, 2009.

BLM. 2009o. Recreation Planning. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C. Available online: http://www.blm.gov/wo/st/en/prog/Recreation/national_recreation/recreation_planning.print.html. Accessed August 2009.

BLM. 2009p. Draft Addendum to the Cody Field Office Review of Potential Wild And Scenic Rivers in the Cody RMP Planning Area. U.S. Department of the Interior, Bureau of Land Management. Cody Field Office, Wyoming.

BLM. 2009q. Reservoir Management Group, Bighorn Basin Well Count By Alternative. September 29. U.S. Department of the Interior, Bureau of Land Management. Cody Field Office and Worland Field Office, Wyoming.

BLM. 2010a. Wyoming's Oil and Gas Leasing Reform Implementation Plan for Wyoming. U.S. Department of the Interior, Bureau of Land Management. Available online: http://www.blm.gov/pgdata/etc/medialib/blm/wy/programs/energy/og/leasing/reform.Par.27217.File.dat/ImpPlan.pdf. August.

BLM. 2010b. BLM Wyoming Sensitive Species Policy and List. U.S. Department of the Interior, Bureau of Land Management. Wyoming State Office, Cheyenne, Wyoming. March 31, 2010. Available online: http://www.blm.gov/pgdata/etc/medialib/blm/wy/resources/efoia/IMs/2010.Par.41285.File.dat/wy2010-027atch2.pdf.

BLM. 2010c. Draft Areas of Critical Environmental Concern Evaluation Report. Bighorn Basin Resource Management Plan Revision Project. U.S. Department of the Interior, Bureau of Land Management.

BLM. 2010d. Instruction Memorandum No. WY 2010-033, BLM Wyoming Guidance on Public Information Process and National Environmental Policy Act (NEPA). U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2011a. Documentation Forms from BLM Cody and Worland Field Offices Wilderness Characteristics Inventory. U.S. Department of the Interior, Bureau of Land Management. Cody Field Office and Worland Field Office, Wyoming. Available online: http://www.blm.gov/wy/st/en/field_offices/Cody/wild-inv.html and http://www.blm.gov/wy/st/en/field_offices/Worland/wild-inv.html.

BLM. 2011b. Bureau of Land Management National Greater Sage-Grouse Planning Strategy, Charter. U.S. Department of the Interior, Bureau of Land Management. Available online: http://www.blm.gov/style/medialib/blm/wo/Communications_Directorate/public_affairs/sage-grouse_planning/documents.Par.2415.File.dat/Final%20Signed%20GSG%20Planning%20Strategy%20Charter.pdf. August 22.

BLM. 2011c. BLM Manual 1626, Travel and Transportation Management. U.S. Department of the Interior, Bureau of Land Management.

BLM. 2011d. Instruction Memorandum No. WY-2012-007, Management of Oil and Gas Exploration and Production Pits. U.S. Department of the Interior, Bureau of Land Management. Available online: http://www.blm.gov/pgdata/etc/medialib/blm/wy/resources/efoia/IMs/2012.Par.59729.File.dat/wy2012-007.pdf. November 15.

BLM. 2011e. BLM Handbook 9112, Bridges and Major Culverts. U.S. Department of the Interior, Bureau of Land Management.

BLM. 2011f. Instruction Memorandum No. 2011-154, Requirement to Conduct and Maintain Inventory Information for Wilderness Characteristics and to Consider Lands with Wilderness Characteristics in Land Use Plans. U.S. Department of the Interior, Bureau of Land Management. Available online: http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2011/IM_2011-154.html. July.

BLM. 2012a. BLM Manual 6330, Management of Wilderness Study Areas. U.S. Department of the Interior, Bureau of Land Management.

BLM. 2012b. Instruction Memorandum No. WY-2012-032, Wyoming Bureau of Land Management Reclamation Policy. Available online: http://www.blm.gov/pgdata/etc/medialib/blm/wy/programs/reclamation.Par.60413.File.dat/wy2012-032w-atch.pdf. March 27.

BLM. 2012c. BLM Manual 6250, National Scenic and Historic Trail Administration. Available online: http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/blm_manual.html.

BLM. 2012d. BLM Manual 6280, Management of National Scenic and Historic Trails and Trails Under Study or Recommended as Suitable for Congressional Designation. Available online: http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/blm_manual.html.

BLM. 2012e. BLM Manual 6400, Wild and Scenic Rivers – Policy and Program Direction for Identification, Evaluation, Planning, and Management. Available online: http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/blm_manual.html.

BLM. 2012f. WO IM 2012-019, Greater Sage-Grouse Habitat Management Policy on Wyoming BLM Administered public Lands Including the Federal Mineral Estate. U.S. Department of the Interior, Bureau of Land Management. Available online: http://www.blm.gov/pgdata/etc/medialib/blm/wy/resources/efoia/IMs/2012.Par.56874.File.dat/wy2012-019.pdf.

BLM. 2012g. IM 2012-043, Greater Sage-Grouse Interim Management Policies and Procedures. U.S. Department of the Interior, Bureau of Land Management.

BLM. 2013a. GIS data files. U.S. Department of the Interior, Bureau of Land Management.

BLM. 2013b. WO IM 2013-142, Interim Policy, Draft - Regional Mitigation Manual Section 1794. Available online: http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2013/IM_2013-142.html. June.

BLM. 2013c. North Dakota Greater Sage-Grouse Resource Plan Amendment and Environmental Impact Statement. U.S. Department of the Interior, Bureau of Land Management.

BLM. 2013d. Nine-Plan Greater Sage-Grouse Resource Plan Amendment and Environmental Impact Statement. U.S. Department of the Interior, Bureau of Land Management.

BLM. 2013e. Northwest Colorado Greater Sage-Grouse Resource Plan Amendment and Environmental Impact Statement. U.S. Department of the Interior, Bureau of Land Management.

BLM. 2013f. Idaho and Southwestern Montana Sub-Regional Greater Sage-Grouse Resource Plan Amendment and Environmental Impact Statement. U.S. Department of the Interior, Bureau of Land Management.

BLM. 2013g. Utah Sub-Regional Greater Sage-Grouse Resource Plan Amendment and Environmental Impact Statement. U.S. Department of the Interior, Bureau of Land Management.

BLM. 2013h. "Sage-Grouse and Sagebrush Conservation". Available online: http://www.blm.gov/wo/st/en/prog/more/sagegrouse.html. Updated April 4. Accessed June 18.

BLM. 2013i. Draft Resource Management Plan Revision and Environmental Impact Statement for the Buffalo Field Office Planning Area. U.S. Department of the Interior, Bureau of Land Management.

BLM. 2013j. Draft Resource Management Plan and Environmental Impact Statement for the Miles City Field Office Planning Area. U.S. Department of the Interior, Bureau of Land Management.

BLM. 2013k. HiLine Draft Resource Management Plan and Environmental Impact Statement. U.S. Department of the Interior, Bureau of Land Management.

BLM. 2013l. South Dakota Draft Resource Management Plan and Environmental Impact Statement. U.S. Department of the Interior, Bureau of Land Management.

BLM. 2013m. Billings and Pompeys Pillar National Monument Draft Resource Management Plan and Environmental Impact Statement. U.S. Department of the Interior, Bureau of Land Management.

BLM. 2013n. Proposed Resource Management Plan and Final Environmental Impact Statement for the Lander Field Office Planning Area. U.S. Department of the Interior, Bureau of Land Management.

BLM. 2014a. Reasonable Foreseeable Development Scenario for Oil and Gas, Bighorn Basin Planning Area, Wyoming. Prepared by Wyoming Reservoir Management Group. U.S. Department of the Interior, Bureau of Land Management.

BLM. 2014b. BLM Paleontological Resources Permit Database, Unpublished Proprietary Database, Bighorn Basin. U.S. Department of the Interior, Bureau of Land Management, Wyoming.

BLM. 2014c. Rangeland Administration System. U.S. Department of the Interior, Bureau of Land Management. Available online through the BLM's internal intranet: http://web.ras.blm.gov/ras/ras.html.

BLS (Bureau of Labor Statistics). 2010a. Local Area Unemployment Statistics and Historical Labor Force. Available online: http://data.bls.gov. Accessed June 2010.

BLS. 2010b. Labor Force Statistics from the Current Population Survey: Series ID LNU04000000, Unemployment Rate. (Not Seasonally Adjusted). Available online: http://data.bls.gov. Accessed June 2010.

BLS. 2013. Local Area Unemployment Statistics. Available online: http://data.bls.gov. Accessed June 2010 and September 2013.

Bock, C.E., V.A. Saab, T.D. Rich, and D.S. Dobkin. 1993. Effects of livestock grazing on Neotropical migratory landbirds in western North America. Pages 296-309 in Status and management of Neotropical migratory birds, D.M. Finch and P.W. Stangel (Eds). Gen. Tech. Rep. RM-229, Fort Collins, CO. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. 422 pp.

Braun, C.E. 2002. A Review of Sage-Grouse Habitat Needs and Sage-Grouse Management Issues for the Revision of the Bureau Of Land Management's Pinedale District Resource Management Plan. Prepared for The Wilderness Society, Wyoming Outdoor Council, and Greater Yellowstone Coalition by Grouse, Inc. Tucson, Arizona.

Breithaupt, B. 1996. The Discovery of a Nearly Complete Allosaurus from Jurassic Morrison Formation, Eastern Bighorn Basin, Wyoming, Wyoming Geological Association 47th Annual Field Conference Guidebook, Resources of the Bighorn Basin, Casper, WY.

Cagney J., E. Bainter, B. Budd, T. Christiansen, V. Herren, M. Holloran, B. Rashford, M. Smith and J. Williams. 2010. Grazing Influence, Objective Development, and Management in Wyoming's Greater Sage-grouse Habitat. University of Wyoming College of Agriculture Extension Bulletin B-1203. Laramie.

Call, M.W., and C. Maser. 1985. Wildlife Habitats in Managed Rangelands--The Great Basin of Southeastern Oregon. U.S. Department of Agriculture Forest Service Pacific Northwest Forest and Range Experiment Station. General Technical Report PNW-187. Portland, Oregon.

CEQ (Council on Environmental Quality). 1997a. Council on Environmental Quality Environmental Justice Guidance Under the National Environmental Policy Act. Executive Office of the President of the United States. Washington, D.C.

CEQ. 1997b. Considering Cumulative Effects Under the National Environmental Policy Act. January 1997. Executive Office of the President of the United States. Washington, D.C.

CertainTeed Gypsum. 2008. Annual Report – Gypsum Mining for 2007. Submitted to the Wyoming Department of Environmental Quality. Unpublished Annual Report.

Chambers, Jeanne C.; Pyke, David A.; Maestas, Jeremy D.; Pellant, Mike; Boyd, Chad S.; Campbell, Steven B.; Espinosa, Shawn; Havlina, Douglas W.; Mayer, Kenneth E.; Wuenschel, Amarina. 2014. Using resistance and resilience concepts to reduce impacts of invasive annual grasses and altered fire regimes on the sagebrush ecosystem and greater sage-grouse: A strategic multi-scale approach. Gen. Tech. Rep. RMRS-GTR-326. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 73 p.

Ciuti S., J.M. Northrup, T.B. Muhly, S. Simi, and M. Musiani. 2012. Effects of Humans on Behaviour of Wildlife Exceed Those of Natural Predators in a Landscape of Fear. PLoS ONE 7(11): e50611. doi:10.1371/journal.pone.0050611.

Cody Conservation District. 2007. Long Range Plan 2007-2012. Cody Conservation District.

Coe, P.K., B.K. Johnson, K.M. Steward, and J.G. Kie. 2004. Spatial and Temporal Interactions of Elk, Mule Deer, and Cattle. Transactions of the Sixty-ninth North American Wildlife and Natural Resources Conference, pp. 656-669.

Connelly, J.W., M.A. Schroeder, A.R. Sands, and C.E. Braun. 2000. Guidelines to Manage Sage-Grouse Populations and their Habitats. Wildlife Society Bulletin 28(4):967-985.

Connelly, J.W., S.T. Knick, M.A. Schroeder, and S.J. Stiver. 2004. Conservation Assessment of Greater Sage-Grouse and Sagebrush Habitats - Western Association of Fish and Wildlife Agencies.

Connelly, J.W., K.P. Reese, and M.A. Schroeder. 2003. Monitoring of Greater Sage-grouse Habitats and Populations. University of Idaho College of Natural Resources Experiment Station Bulletin 80. University of Idaho, Moscow, ID.

Cooper, S.V., Lesica, P., and G.M. Kudray. 2007. Post-fire Recovery of Wyoming Big Sagebrush Shrubb-steppe in Central and Southeast Montana. Prepared for the United States Department of the Interior Bureau of Land Management. Available online: http://mtnhp.org/reports/Sage_Succ_Veg.pdf.

Cooperative Riparian Restoration Montana. 2006. Proper Functioning Condition, Montana Training Sessions for 2006. Available online: http://water.montana.edu/pdfs/2006_pfc.pdf.

Crawford, J.A., R.A. Olson, N.E. West, J.C. Mosley, M.A. Schroeder, T.D. Whitson, R.F. Miller, M.A. Gregg, and C.S. Boyd. 2004. Ecology and Management of Sage-grouse and Sage-grouse Habitat. Range Management 57:2-19.

CREG (Consensus Revenue Estimating Group). 2013. Wyoming State Government Revenue Forecast, Fiscal Year 2013 – Fiscal Year 2018. Cheyenne, Wyoming. January. Available online: http://eadiv.state.wy.us/creg/creg.html. Accessed September 2013.

Davies, K.W., J.D. Bates, R.F. Miller. 2006. Vegetation characteristics across part of the Wyoming big sagebrush alliance. Rangeland Ecology & Management. 59, 567–575. November.

Davies, K.W., T.J. Svejcar, and J.D. Bates. 2009. Interaction of Historical and Nonhistorical Disturbances Maintains Native Plant Communities. Ecological Applications 19:1536-1545.

Davies, Kirk W., Bates, Jonathan D., Svejcar, Tony J., Boyd, Chad S. 2010. Effects of Long-term Livestock Grazing on Fuel Characteristics in Rangelands: An Example from the Sagebrush Steppe. Rangeland Ecology & Management. November.

Dean Runyan Associates. 2007. The Economic Impact of Travel on Wyoming: 1997-2006 Detailed State and County Estimates. Prepared for the State Office of Travel and Tourism, Wyoming Business Council. Portland, Oregon: Dean Runyan Associates. September.

Dean Runyan Associates. 2008. The Economic Impact of Travel on Wyoming: 1997-2007 Detailed State and County Estimates. Prepared for the State Office of Travel and Tourism, Wyoming Business Council. Portland, Oregon: Dean Runyan Associates. September.

Dean Runyan Associates. 2010. The Economic Impact of Travel on Wyoming: 1997-2009p (preliminary) Detailed State and County Estimates. Prepared for the State Office of Travel and Tourism, Wyoming Business Council. Portland, Oregon: Dean Runyan Associates. May. Available online: http://www.wyomingbusiness.org/pdf/tourism/18_may_10_WYSt09pRptFinal.pdf. Accessed June 14, 2010.

Dean Runyan Associates. 2012. The Economic Impact of Travel on Wyoming: 1998-2011p (preliminary) Detailed State and County Estimates. Prepared for the State Office of Travel and Tourism by Dean Runyan Associates. Portland, Oregon. May. Available online: http://www.wyomingofficeoftourism.gov/industry/pdf/2011EconomicImpactReport.pdf. Accessed September 2013.

Derner, J.D., W.K. Lauenroth, P. Stapp, and D.J. Augustine. 2009. Livestock as Ecosystem Engineers for Grassland Bird Habitat in the Western Great Plains of North America. Journal of Rangeland Ecology & Management 62:111-118.

Diamond, J.M., C.A. Call, and N. Devoe. 2009. Effects of Targeted Cattle Grazing on Fire Behavior of Cheatgrass-dominated Rangeland in the Northern Great Basin. International Journal of Wildland Fire 18:944-950.

DiTomaso, J.M. 2000. Invasive Weeds in Rangelands: Species, Impacts, and Management. Weed Science 48:255-265.

DOE (U.S. Department of Energy) and BLM. 2008a. Record of Decision for Programmatic Environmental Impact Statement, Designation of Energy Corridors on Federal Land in the 11 Western States (DOE/EIS-0386).

DOE and BLM. 2008b. Programmatic Environmental Impact Statement, Designation of Energy Corridors on Federal Land in the 11 Western States (DOE/EIS-0386).

DOE. 2008. 2009 Carbon Sequestration Atlas of the United States and Canada, second edition: 89 pages. Available online: http://www.netl.doe.gov/technologies/carbon_seq/refshelf/atlasII/index.html.

DOE. 2009. Press Release: President Obama Announces Over $467 Million in Recovery Act Funding for Geothermal and Solar Energy Projects. May 27. Available online: http://www.energy.gov/news2009/7427.htm.

Doherty. 2008. Sage-grouse and Energy Development: Integrating Science with Conservation Planning to Reduce Impacts.

Doherty, K.E., D.E. Naugle, J.D. Tack, B.L Walker, J.M. Graham and J.L. Beck. 2014. Linking Conservation Actions to Demography: Grass Height Explains Variation in Greater Sage-grouse Nest Survival. Wildlife Biology, 20(6): 320-325.

DOI (U.S. Department of the Interior). 1997. Notice to Lessees (NTL-3A), Reporting of Undesirable Events. Geological Survey Conservation Division. Available online: http://www.blm.gov/wy/st/en/programs/energy/Oil_and_Gas/docs/ntl_3a.html. March 1.

DOI and BLM. 2002. Management Considerations for Sagebrush (Artemisia) in the Western United States: A Selective Summary of Current Information About the Ecology and Biology of Woody North American Sagebrush Taxa. Washington, D.C. Available online: http://efotg.sc.egov.usda.gov/references/public/UT/BLM_Sage_management.pdf.

DOI and The Nature Conservancy. 2008. Interagency Fire Regime Condition Class Guidebook. BIA (Bureau of Indian Affairs), BLM, NPS (National Park Service), USFWS, and The Nature Conservancy. Available online: www.frcc.gov. Accessed August 5, 2010.

DOI. 2006. Scientific Inventory of Onshore Federal Lands Oil and Gas Resources and Reserves and the Extent and Nature of Restrictions or Impediments to their Development - Energy Policy and Conservation Act of 2000. U.S. Department of the Interior. Washington, D.C.

DOI. 2007. Departmental Manual 517, Integrated Pest Management. U.S. Department of the Interior. Washington, D.C. Available online: www.fws.gov/contaminants/Documents/DOIIPMpolicyFINAL.pdf.

DOI. 2009. Local Government's Comment Letter. U.S. Department of the Interior.

DOI. 2010. Climate Science Centers. U.S. Department of the Interior. Washington, D.C. Available online: http://www.doi.gov/whatwedo/climate/strategy/CSC-Map.cfm. Accessed July 27, 2010.

Downs, G.R. 1952. Summary of Mesozoic Stratigraphy, Bighorn Basin, Wyoming: Wyoming Geological Association Guidebook, 7th Annual Field Conference.

Druckenmiller, P.S. 2002. Osteology of a New Plesiosaur from the Lower Cretaceous (Albian) Thermopolis Shale of Montana, Journal of Vertebrate Paleontology 22(1):29–42, March 2002, Society of Vertebrate Paleontology, Museum of the Rockies, Montana State University, Bozeman, Montana 59717-2730.

Eagle Bear, R. 2009. Personal Communication between Russell Eagle Bear and Chris Willson (Science Applications International Corporation) regarding Sioux cultural resources. Rosebud Sioux Tribe, Rosebud, South Dakota.

Easterly, T. 2012. Narrative Report on Sage-grouse in the Cody Region.

EIA (Energy Information Administration). 2009. Annual Energy Outlook 2009 with Projections to 2030. Report No. DOE/EIA-0383(2009). Released March 2009. U.S. Department of Energy, Energy Information Administration. Available online: http://www.eia.doe.gov/oiaf/aeo/electricity.html.

Eicher, D.L. 1962. Biostratigraphy of the Thermopolis, Muddy and Shell Creek Formations, Symposium on Early Cretaceous Rocks of Wyoming and Adjacent Areas; 17th Annual Field Conference Guidebook, Wyoming Geological Association, Casper, WY.

Elliot, W.J., Hall, D.E., and Scheele, D.L. 2000. Disturbed WEPP (Draft 02/2000) WEPP Interface for Disturbed Forest and Range Runoff, Erosion and Sediment Delivery. Technical Documentation. United States Department of Agriculture Forest Service. Rocky Mountain Research Station and San Dimas Technology and Development Center. Available online: http://forest.moscowfsl.wsu.edu/fswepp/docs/distweppdoc.html#introduction.

EPA (U.S. Environmental Protection Agency). 1989. Region 8 Wyoming State Implementation Plans. U.S. Environmental Protection Agency.

EPA. 1993. Region 8 Wyoming State Implementation Plans. U.S. Environmental Protection Agency.

EPA. 1999. Region 8 Wyoming State Implementation Plans. U.S. Environmental Protection Agency.

EPA. 2003. MOBILE6 Vehicle Emission Modeling Software. U.S. Environmental Protection Agency. Available online: http://www.epa.gov/otaq/m6.htm.

EPA. 2007. Region 8 Wyoming State Implementation Plans. U.S. Environmental Protection Agency.

EPA. 2008. NONROAD2008a Model. U.S. Environmental Protection Agency. Available online: http://www.epa.gov/otaq/nonrdmdl.htm.

EPA. 2009. Nitrous Oxide Sources and Emissions. U.S. Environmental Protection Agency. Available online: http://www.epa.gov/nitrousoxide/sources.html.

EPA. 2010. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2008. Public Review Draft. U.S. Environmental Protection Agency.

EPA. 2013. AirData: Access to Air Pollution Data. Available online: http://www.epa.gov/air/data/index.html.

Erickson, W.P., G.D. Johnson, and D.P. Young Jr. 2005. A Summary and Comparison of Bird Mortality from Anthropogenic Causes with an Emphasis on Collisions. U.S. Forest Service General Technical Report PSW-GTR-191.

Eustes, A.W. 2003. Directional Drilling Seminar: Course Notes from Bureau of Land Management Directional Drilling Seminar held in Casper, Wyoming. March 18-19.

Faaborg, J., M. Brittingham, T. Donovan, and J. Blake. 1995. Habitat Fragmentation in the Temperate Zone. Pages 357-380. In: T.E. Martin and D. Finch, editors. Ecology and Management of Neotropical Migratory Birds: A Synthesis and Review of Critical Issues. Oxford University Press, New York, New York.

Fanshawe, John R. 1971. Structural Evolution of Big Horn Basin: Wyoming Geological Association Guidebook, 23rd Annual Field Conference.

Fenner, J.N., and M. Kornfeld. 2006. 2006 Rockshelter Testing in Lone Tree Canyon (PRCALD) and Spring Creek Canyon (BMAD). Technical Report No. 43. George C. Frison Institute of Archaeology and Anthropology. University of Wyoming.

Fertig, W. 2000a. *Astragalus gilviflorus* var. *purpureus* - Dubois Milkvetch. State Species Abstract. Wyoming Natural Diversity Database. Available online: http://www.uwyo.edu/wynddsupport/docs/Reports/SpeciesAbstracts/Astragalus_gilviflorus_purpureus.pdf. Accessed July 23, 2009.

Fertig, W. 2000b. *Cymopterus evertii* - Evert's Waterparsnip. State Species Abstract. Wyoming Natural Diversity Database. Available online: http://www.uwyo.edu/wynddsupport/docs/Reports/SpeciesAbstracts/Cymopterus_evertii.pdf. Accessed July 23, 2009.

Fertig, W. 2000c. *Cymopterus williamsii* - Williams' Spring Parsley. State Species Abstract. Wyoming Natural Diversity Database. Available online: http://www.uwyo.edu/wynddsupport/docs/Reports/SpeciesAbstracts/Cymopterus_williamsii.pdf. Accessed July 23, 2009.

Fertig, W. 2000d. *Descurainia Torulosa* - Wyoming Tansymustard. State Species Abstract. Wyoming Natural Diversity Database. Available online: http://www.uwyo.edu/wynddsupport/docs/Reports/SpeciesAbstracts/Descurainia_torulosa.pdf. Accessed May 11, 2010.

Fertig, W. 2001. *Astragalus jejunus* var. *articulatus* - Hyattville Milkvetch. State Species Abstract. Wyoming Natural Diversity Database. Available online: http://www.uwyo.edu/wynddsupport/docs/Reports/SpeciesAbstracts/Astragalus_jejunus_articulatus.pdf. Accessed July 23, 2009.

Fertig, W., and L. Welp. 2001. Status of Hyattville Milkvetch (*Astragalus jejunus* var. *articulatus*) in Wyoming. Wyoming Natural Diversity Database. Available online: http://www.uwyo.edu/wynddsupport/docs/Reports/WYNDDReports/U01FER05WYUS.pdf. Accessed October 21, 2009.

Fertig, W., and S. Mills. 2000. *Shoshonea pulvinata* - Shoshonea. State Species Abstract. Wyoming Natural Diversity Database. Available online: http://www.uwyo.edu/wynddsupport/docs/Reports/SpeciesAbstracts/ Shoshonea_pulvinata.pdf. Accessed July 23, 2009.

Fisher, C. 2009. Personal Communication between Conrad Fisher and Chris Willson (Science Applications International Corporation) regarding Northern Cheyenne cultural resources. Northern Cheyenne Tribe, Lame Deer, Montana.

Flora of North America. 1993a. *Pinus flexilis* - Limber Pine. Flora of North America. Available online: http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=233500936. Accessed May 11, 2010.

Flora of North America. 1993b. *Pinus albicaulis* - Whitebark Pine. Flora of North America Association. Available online: http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=233500921. Accessed May 11, 2010.

Francian, F. 1998. ICOMOS World Heritage Committee Mission to Katadu1999, "The Impacts of Dust in the Conservation and Management of Aboriginal Rock Paintings in Northern Australia". Alan Watchman, School of Anthropology, Archaeology and Sociology, James Cook University.

Freddy, D.J., W.M. Brenough, and M.C. Fowler. 1986. Responses of Mule Deer to Disturbances by Persons Afoot and Snowmobiles. Wildlife Society Bulletin 14:63-68.

Frisina, M.R. 1992. Elk Habitat Use within a Rest-rotation Grazing System. Rangelands 14:93-96.

Furniss, M.J., S. Flanagan, and B. McFadin. 2000. Hydrologically-Connected Roads: An Indicator of the Influence of Roads on Chronic Sedimentation, Surface Water Hydrology, and Exposure to Toxic Chemicals. In: Stream Notes. Stream Systems Technology Center, USDA Forest Service, Rocky Mountain Research Station. Fort Collins, Colorado. Available online: www.stream.fs.fed.us/news/streamnt/jul00/jul00_2.htm#anchortop.

Gee, C.K., S.V. Gleason, D.J. Mayhoffer, and K.J. Sutter. 1986a. Enterprise Budgets for Livestock Businesses That Use National Forest Grazing Land. ANRE Work. Pap. WP:85-9, Dept. Agr. and Resour. Econ., Colorado State University.

Gee, C.K., S.V. Gleason, D.J. Mayhoffer, and K.J. Sutter. 1986b. Enterprise Budgets for Livestock Businesses That Use Bureau of Land Management Grazing Land. ANRE Work. Pap. WP:86-1, Dept. Agr. and Resour. Econ., Colorado State University.

Georgia Pacific Gypsum, LLC. 2008. Annual Report – Gypsum Mining for 2007. Submitted to the Wyoming Department of Environmental Quality. Unpublished Annual Report.

Gill, R.B., editor. 1999. Declining mule deer populations in Colorado: Reasons and responses. Colorado Division of Wildlife, Department of Natural Resources Report to the Colorado Legislature, Nov. 1999.

Glass, G.B. 1981. Coal Deposits of Wyoming: Wyoming Geological Association Guidebook, 32nd Annual Field Conference.

Glass, G.B., K. Westervelt, and C.G. Oviatt. 1975. Coal Mining in the Bighorn Coal Basin of Wyoming: Wyoming Geological Association Guidebook, 27th Annual Field Conference.

Global Change Research Program. 2009. United States Global Change Research Program. Global Climate Change Impacts in the U.S. June 16. Available online: http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts/regional-climate-change-impacts/great-plains.

Gruver, J.C., and D.A. Keinath. 2006. Townsend's Big-eared Bat (*Corynorhinus townsendii*): A Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region. Available online: http://www.fs.fed.us/r2/projects/scp/assessments/townsendsbigearedbat.pdf.

Hagen, C.A., J.W. Connelly, and M.A. Schroeder. 2007. A Meta-Analysis for Greater Sage-Grouse Nesting and Brood Rearing Habitats. Wildlife Biology 13 (Supplement 1):42-50.

Hall, F.C., and L.D. Bryant. 1995. Herbaceous Stubble Height as a Warning of Impending Cattle Grazing Damage to Riparian Areas. USDA Forest Service, Pacific Northwest Research Station. General Technical Report PNW-GTR-362. September.

Handley, J., and B. Heidel. 2008. *Rorippa calycina*. State Species Abstract. Wyoming Natural Diversity Database. Available online: http://www.uwyo.edu/wynddsupport/docs/Reports/SpeciesAbstracts/Rorippa_calycina.pdf. Accessed July 23, 2009.

Hanser, S.E., M. Leu, S.T. Knick, and C.L. Aldridge (editors). 2011. Sagebrush Ecosystem Conservation and Management: Ecoregional Assessment Tools and Models for the Wyoming Basins. Lawrence, KS.

Harrell, D., and L. Marks. 2009. Habitat Selection and Changes in the White-tailed and Black-tailed Prairie Dog Population within the Northern Bighorn Basin, Wyoming. Technical Note 431. U.S. Department of the Interior, Bureau of Land Management. Cody Field Office, Wyoming. BLM/WY/ST-09/031+1110. 16 pp.

Harris, Larry D. 1984. The Fragmented Forest: Island Biogeography Theory and the Preservation of Biotic Diversity. Chicago, Illinois: University of Chicago Press.

Headwaters Economics. 2007a. A Socioeconomic Profile: Big Horn County, Wyoming. Produced by the Economic Profile System. Available online: http://www.headwaterseconomics.org/eps/.

Headwaters Economics. 2007b. A Socioeconomic Profile: Park County, Wyoming. Produced by the Economic Profile System. Available online: http://www.headwaterseconomics.org/eps/.

Headwaters Economics. 2007c. A Socioeconomic Profile: Hot Springs County, Wyoming. Produced by the Economic Profile System. Available online: http://www.headwaterseconomics.org/eps/.

Headwaters Economics. 2007d. A Socioeconomic Profile: Washakie County, Wyoming. Produced by the Economic Profile System. Available online: http://www.headwaterseconomics.org/eps/.

Heart Mountain Wyoming Foundation. 2009. Heart Mountain - A Story Worth Remembering. Available online: http://www.heartmountain.us/history.htm. Accessed August 5, 2009.

Heidel, B. 2007. *Spiranthes diluvialis* - Ute Ladies'-tresses. State Species Abstract. Wyoming Natural Diversity Database. Available online: http://www.uwyo.edu/wynddsupport/docs/Reports/SpeciesAbstracts/Spiranthes_diluvialis.pdf. Accessed July 23, 2009.

Holechek, J.L., T.T. Baker, J.C. Boren, and D. Galt. 2006. Grazing Impacts on Rangeland Vegetation: What We Have Learned: Livestock Grazing at Light-to-moderate Intensities Can Have Positive Impacts on Rangeland Vegetation in Arid-to-Semiarid Areas. Rangelands 28(1):7-13.

Holloran and Anderson. 2005. Spatial Distribution of Greater Sage-grouse Nests in Relatively Contiguous Sagebrush Habitats.

Holloran, M.J. 2005. Greater Sage-Grouse (*Centrocercus urophasianus*) Population Response to Natural Gas Field Development in Western Wyoming. Thesis. University of Wyoming Department of Zoology and Physiology.

Holloran, M.J., R.C. Kaiser, and W.A. Hubert. 2010. Yearling Greater Sage-Grouse Response to Energy Development in Wyoming. Journal of Wildlife Management 74(1):65-72.

Horn, B.E. 2005. WYO Range Facts. MP-111.05. Livestock Grazing Distribution. University of Wyoming Cooperative Extension Service. Big Horn Mountain Extension Area. Available online: http://www.wyomingextension.org/agpubs/pubs/MP111_05.pdf.

Hot Springs Conservation District. 2006. Hot Springs Conservation District Long Range Plan 2006-2010. Hot Springs Conservation District.

Hot Springs County. 2002. Land Use Plan. 11/18/2002 Revision, Combining the Hot Springs County Land Use Plan and Development Permit System. Available online: http://www.hscounty.com/Upload/File/20080811_538_land_use_plan_1.doc. Accessed August 2009.

Hot Springs County. 2005. Hot Springs County Natural Resources Plan for State and Federal Lands: An Addendum to the Revised Hot Springs County Land Use Plan of 2002. Available online: http://www.hscounty.com/Upload/File/20080811_780_Hot_Springs_county_LUP_1-5-05.doc. Accessed August 2009.

Hurley, K. 1996. Carter Mountain Elk Migration Study Final Report. Wyoming Game and Fish Department, Thermopolis. pp. 99.

IHS Energy Group. 2009. Rocky Mountain United States Well Data: Network License for PI/Dwights PLUS Version 1.7.

IMPROVE (Interagency Monitoring of Protected Visual Environments). 2013. Available online: http://vista.cira.colostate.edu/improve.

Interagency Wild & Scenic Rivers Coordinating Council. 2008. Agency-By-Agency Mileage/Management Chart. Available online: http://www.rivers.gov/publications.html.

IPCC (Intergovernmental Panel on Climate Change). 2007a. Climate Change 2007: The Physical Basis (Summary for Policymakers). Cambridge University Press. Cambridge, England and New York, New York. Available online: http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf.

IPCC. 2007b. Summary for Policymakers: Climate Change 2007: The Physical Basis (Summary for Policymakers). Cambridge University Press. Cambridge, England and New York, New York. Available online: http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf.

Johnson, M.D., and C.M. Horn. 2008. Effects of Rotational Grazing on Rodents and Raptors in Coastal Grassland. Western North American Naturalist 68(4):444-452.

Jones, A. 2000. Effects of Cattle Grazing on North American Arid Ecosystems: A Quantitative Review. Western North American Naturalist 60(2):155-164.

Kay, C.E. 1995. Browsing by Native Ungulates: Effects on Shrub and Seed Production in the Greater Yellowstone Ecosystem. In: Proceedings: Wildland Shrub and Arid Land Restoration Symposium; 1993 October 19-21; Las Vegas, Nevada. General Technical Report INT-GTR-315.

Keeley, J.E. 2006. Fire Management Impacts on Invasive Plants in the Western United States. Conservation Biology 20(2):375-384.

Keinath, D.A. 2004. Fringed Myotis (*Myotis thysanodes*): A Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region. Available online: http://www.fs.fed.us/r2/projects/scp/assessments/fringedmyotis.pdf.

Kennedy, G. 2008. Personal e-mail communication between G. Kennedy, Bureau of Economic Analysis, and R. Fetter, Science Applications International Corporation, regarding BEA data. October 24 and November 17.

Kerr, R. 1992. Earth Scientists Assemble Atop an Ancient Rift. Science. 258:5085, pages 1082-1084. Available online: http://www.sciencemag.org/content/258/5085/1082.full.pdf. November.

Keyser, J.D., and M.A. Klassen. 2001. Plains Indian Rock Art. University of Washington Press. Seattle.

Keystone Center. 1991. Final Consensus Report of the Keystone Policy Dialogue on Biological Diversity on Federal Lands. Colorado. April.

Knick, S.T., and J.W. Connelly (editors). 2011. Greater Sage-Grouse: Ecology and Conservation of a Landscape Species and its Habitats. Studies in Avian Biology. University of California Press, Berkeley, California.

Knick, S.T., D.S. Dobkin, J.T. Rotenberry, M.A. Schroeder, W.M. Vander Haegen, and C. Van Ripper III. 2003. Teetering on the Edge or Too Late? Conservation and Research Issues for Avifauna of Sagebrush Habitats. The Condor 105:611-634.

Langner, L.L., and C.H. Flather. 1994. Biological Diversity: Status and Trends in the United States. USFS-Rocky Mountain Forest and Range Experiment Station. Colorado. April.

Larson, T.A. 1978. History of Wyoming. University of Nebraska Press, Lincoln.

Laufen, J.M., W.J. Elliot, D.C. Flanagan, C.R. Meyer, and M.A. Nearing. 2000. WEPP-Predicting water erosion using a process-based model. Journal of Soil and Water Conservation 52(2):96-102. Available online: http://srv2.lemig.umontreal.ca/donnees/geo3162/References/Laflen%20et%20al._1997_WEPP-Predicting%20water%20erosion%20a%20process-based%20model.pdf.

Lawler, J.J., S.L. Shafer, D. White, P. Kareiva, E.P. Maurer, A.R. Blaustein, and P.J. Bartlein. 2009. Projected Climate-Induced Faunal Change in the Western Hemisphere. Ecology 903(3):588-597.

Leatherman, D.A., I. Aguayo, and T.M. Mehall. 2007. Fact Sheet No. 5.228: Mountain Pine Beetle. Colorado State University Extension. Available online: http://www.ext.colostate.edu/pubs/insect/05528.html. Accessed November 30, 2009.

Love, J.D., and A.C. Christiansen. 1985. Geologic Map of Wyoming, Scale: 1:500,000, U.S. Geological Survey, Denver, Colorado.

Luce, R.J., and D. Keinath. 2007. Spotted Bat (*Euderma maculatum*): A Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region. Available online: http://www.fs.fed.us/r2/projects/scp/assessments/spottedbat.pdf.

Lumley, J.P., B. Basse, and F. Manning. 2010. Letter to Karla Bird and Caleb Hiner. March 16. RE: Recommendation of the Grass Creek Fieldwide Unit in Hot Springs County as a "Special Management Area" for Energy Development.

Lynx Biology Team. 2000. Canada Lynx Conservation Assessment and Strategy. U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management; U.S. Fish and Wildlife Service. Available online: http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1196&context=usfwspubs. January.

Manier, D.J., and N.T. Hobbs. 2007. Large Herbivores in Sagebrush Steppe Ecosystems: Livestock and Wild Ungulates Influence Structure and Function. Oecologia 152:739-750.

Manier, D.J., Bowen, Z.H., Brooks, M.L., Casazza, M.L., Coates, P.S., Deibert, P.A., Hanser, S.E., and Johnson, D.H. 2014. Conservation buffer distance estimates for Greater Sage-Grouse—A review: U.S. Geological Survey Open-File Report 2014–1239, 14 p. Available online: http://dx.doi.org/10.3133/ofr20141239.

Manier, D.J., D.J.A. Wood, Z.H. Bowen, R.M. Donovan, M.J. Holloran, L.M. Juliusson, K.S. Mayne, S.J. Oyler-McCance, F.R. Quamen, D.J. Saher, and A.J. Titolo. 2013. Summary of Science, Activities, Programs and Policies that Influence the Rangewide Conservation of Greater Sage-Grouse (*Centrocerus urophasianus*). Department of Interior, U.S. Geological Survey. Denver, CO. Available online: http://pubs.usgs.gov/of/2013/1098/.

McCleary, T.P. 2008. Ghosts on the Land. Apsáalooke (Crow Indian) Interpretations of Rock Art. Dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Anthropology in the Graduate College of the University of Illinois at Urbana-Champaign. Urbana, Illinois.

Meeteetse Conservation District. 2011. Land Use Management and Resource Conservation Plan 2011, Meeteetse Conservation District. Available online: http://www.meeteetsecd-wy.gov.

Miller RF, Bates JD, Svejcar TJ, Pierson FB, Eddleman LE. 2005. Biology, Ecology and Management of Western Juniper. Technical Bulletin 152. OSU, Agricultural Experiment Station. Corvallis, OR. Available online: http://juniper.oregonstate.edu/bibliography/documents/phpQ65pOk_tb152.pdf.

Miller, S.G., R.L. Knight, and C.K. Miller. 1998. Influence of Recreational Trails on Breeding Bird Communities. Ecological Applications 8(1):162-169.

Mills, S., and W. Fertig. 2000a. *Penstemon absarokensis*. State Species Abstract. Wyoming Natural Diversity Database. Available online: http://www.uwyo.edu/wynddsupport/docs/Reports/SpeciesAbstracts/Penstemon_absarokensis.pdf. Accessed July 23, 2009.

Mills, S., and W. Fertig. 2000b. *Physaria saximontana* var. *saximontana*. State Species Abstract. Wyoming Natural Diversity Database. Available online: http://www.uwyo.edu/wynddsupport/docs/Reports/SpeciesAbstracts/Physaria_saximontana_saximontana.pdf. Accessed July 23, 2009.

Muscha, J.M., and A.L. Hild. 2006. Biological Soil Crusts in Grazed and Ungrazed Wyoming Sagebrush Steppe. Journal of Arid Environments 67:195-207.

NADP (National Atmospheric Deposition Program). 2013. NADP/NTN Monitoring. Available online: http://nadp.sws.uiuc.edu/nadpdata.

NASS (National Agricultural Statistics Service). 2013. Range Review, February 2013. Cheyenne, Wyoming. Issue 2013-02. U.S. Department of Agriculture, National Agricultural Statistics Service.

National Academy of Sciences. 2006. Understanding and Responding to Climate Change: Highlights of National Academies Reports. Division on Earth and Life Studies. National Academy of Sciences. Washington, D.C. Available online: http://dels.nas.edu/dels/rpt_briefs/climate-change-final.pdf.

Neighbors, R. 2010. Personal communication between R. Neighbors, Bureau of Land Management and A. Tkach, Bureau of Land Management, regarding vegetation and fire data. June 9.

NPS (National Park Service). 1993. Indian Lands Judicially Established 1978. Map updated 1993. U.S. Department of the Interior, National Park Service. Available online: http://www.nps.gov/history/nagpra/ONLINEDB/INDEX.HTM. Accessed April 2009.

NPS. 2004. Yellowstone National Park Fire Management Plan. U.S. Department of the Interior. Government Printing Office, Washington, D.C.

NPS. 2006. Mandatory Class I Areas. U.S. Department of the Interior, National Park Service. Available online: http://www2.nature.nps.gov/air/Maps/images/ClassIAreas.jpg.

NPS. 2008. National Park Service Stats. U.S. Department of the Interior. National Park Service. Available online: http://www.nature.nps.gov/stats/state.cfm?st=wy.

NPS. 2009. Heart Mountain Relocation Center. National Historic Landmark Program. U.S. Department of the Interior, National Park Service. Available online: http://tps.cr.nps.gov/nhl/detail.cfm?ResourceId=1164118837&ResourceType=District. Accessed August 5, 2009.

NRCS (Natural Resources Conservation Service). 1983. Washakie County Soil Survey. U.S. Department of Agriculture., Natural Resources Conservation Service. Available online: http://soils.usda.gov/survey/online_surveys/wyoming/.

NRCS. 2003. National Range and Pasture Handbook. Issued September 1997, Revised December 2003. Available online: http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/landuse/rangepasture/?cid=stelprdb1043084.

Nummedal, D., B. Towler, C. Mason, and M. Allen. 2003. Enhanced Oil Recovery in Wyoming: University of Wyoming, 26 pages. Available online: http://www.uwyo.edu/acadaffairs/_files/docs/eorfinal.pdf.

OMB (Office of Management and Budget). 1992. Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs. Office of Management and Budget. Circular A-94. Revised October 29, 1992. Available online: www.whitehouse.gov/omb/circulars/.

Outdoor Foundation. 2009. Outdoor Recreation Participation Report. The Outdoor Foundation. Boulder, Colorado. Available online: http://www.outdoorfoundation.org/pdf/ResearchParticipation2009.pdf.

Park County. 1998. Park County Land Use Plan. September 15. Park County, Wyoming. Available online: http://www.parkcounty.us/planningandzoning/documents/Land%20Use.pdf. Accessed August 2009.

Parker, P.L., and T.F. King. 1998. Guidelines for Evaluating and Documenting Traditional Cultural Properties. National Register Bulletin 38. U.S. Department of the Interior, National Park Service.

Paton, P.W. 1994. The Effect of Edge on Avian Nest Success: How Strong is the Evidence? Conservation Biology 8(1):17-26.

Pellant, M., P. Shaver, D.A. Pyke, and J.E. Herrick. 2005. Interpreting indicators of rangeland health, version 4. Technical Reference 1734-6. U.S. Department of the Interior, Bureau of Land Management, National Science and Technology Center, Denver, CO. BLM/WO/ST-00/001+1734/REV05. 122 pp.

Pergams, O.R.W., and P.A. Zaradic. 2006. Is Love of Nature in the U.S. Becoming Love of Electronic Media? 16-year Downtrend in National Park Visits Explained by Watching Movies, Playing Video Games, Internet Use, and Oil Prices. Journal of Environmental Management 80:387-393.

Peters E.F., and S.C. Bunting. 1994. Fire Conditions Pre- and Post- Occurrence of Annual Grasses on the Snake River Plain. P 31–36 In: S.B. Monsen and S.G. Kitchen (eds.) Proc. Ecology and Management of Annual Rangelands. U.S.D.A. For. Serv., Gen. Tech. Rept. INT-313. Available online: http://www.fs.fed.us/rm/pubs_int/int_gtr313/int_gtr313_031_036.pdf.

Phillips, G.E., and A.W. Alldredge. 2000. Reproductive Success of Elk Following Disturbance by Humans During Calving Season. Journal of Wildlife Management 64:521-530.

Pierce, W.G., and D.A. Andrews. 1941. Geology and Oil and Coal Resources of the Region South of Cody, Park County, Wyoming. U.S. Geological Survey Bulletin 921-B. U.S. Department of the Interior.

Pilliod, D.S., and E. Wind (editors). 2008. Habitat Management Guidelines for Amphibians and Reptiles of the Northwestern U.S. and Canada. PARC Technical Publication HMG-4. Birmingham, Alabama.

Plafcan, M., E.W. Cassidy, and M.L. Smalley. 1993. USGS Water-Resources Investigations Report 93-4021, Water Resources of Big Horn County, Wyoming.

Powell-Clarks Fork Conservation District. 2004. Bitter Creek Watershed Plan. Powell-Clarks Fork Conservation District.

Powell-Clarks Fork Conservation District. 2006. Long Range Plan 2006-2011. Powell-Clarks Fork Conservation District.

Priday, J., and B. Luce. 1995. Inventory of Bats and Bat Habitat Associated with Caves and Mines in Wyoming Completion Report. Wyoming Game and Fish Department, Bureau of Land Management, U.S. Forest Service-Shoshone National Forest, and U.S. Fish and Wildlife Service. April 14, 1994 - April 14, 1995.

Provencher, L., T.A. Forbis, L. Frid, and G. Medlyn. 2007. Comparing Alternative Management Strategies of Fire, Grazing, and Weed Control Using Spatial Modeling. Ecological Modeling 209:249-263.

Roberts, S.B., and G.S. Rossi. 1999. Chapter SB: A Summary of Coal in the Fort Union Formation (Tertiary), Bighorn Basin, Wyoming and Montana, in U.S. Geological Survey Professional Paper 1625-A. Available online: http://pubs.usgs.gov/pp/p1625a/Chapters/SB.pdf.

Rogers, P. 2001. Using Forest Health Monitoring to Assess Aspen Forest Cover Change in the Southern Rockies Ecoregion. Ogden, Utah: USDA Forest Service, Rocky Mountain Research Station, p.5.

Roggenbuck, J.W., and A.E. Watson. 1988. Wilderness Recreation Use: The Current Situation. Available online: http://www.fs.fed.us/rm/pubs_other/rmrs_1989_watson_a001.pdf.

Rosentreter, R., M. Bowker, and J. Belnap. 2007. A Field Guide to Biological Soil Crusts of Western U.S. Drylands: Common Lichens and Bryophytes.

Sage-Grouse NTT (National Technical Team). 2011. A Report on National Greater Sage-Grouse Conservation Measures. December.

Samson, F.B., F.L. Knopf, and W.E. Ostlie. 2004. Great Plains Ecosystems: Past, Present, and Future. Wildlife Society Bulletin 32:5-15.

Saunders, D.A., R.J. Hobbs, and C.R. Margules. 1991. Biological Consequences of Ecosystem Fragmentation: A Review. Conservation Biology 5:18-32.

Sawyer, H., and R. Nielson. 2005. Seasonal distribution and habitat use patterns of elk in the Jack Morrow Hills Planning Area; Western Ecosystems Technology, Inc. Cheyenne, Wyoming. Available online: http://www.west-inc.com/reports/big_game/Sawyer%20and%20Nielson%202005.pdf.

Sawyer, H., Nielson, R., Lindzey, F., and L. McDonald. 2006. Winter habitat selection of mule deer before and during development of a natural gas field; The Journal of Wildlife Management 70(2):396-403. Available online: http://migrationinitiative.org/sites/migration.wygisc.org/themes/responsive_blog/images/Sawyer-etal-2006.pdf.

Schaeffer, C.M. 2010. Personal communication with Claire M. Schaeffer, Program Analyst, Mineral Management Service, Denver, Colorado and Caleb Hiner, Bureau of Land Management. March 1.

Scolvin, J.M., P.J. Edgerton, and R.W. Harris. 1968. The Influence of Cattle Management on Deer and Elk. Transactions of the Thirty-third North American Wildlife Conference, pp. 169-180.

Severson, K.E., and P.J. Urness. 1994. Livestock grazing- a tool to improve wildlife habitat. In: M. Vavra, W.A. Laycock, and R.D. Pieper [eds.]. Ecological implications of livestock herbivory in the West. Denver, CO: Society for Range Management. Pgs. 232-249.

Shimkin, D.B. 1947. Wind River Shoshone Ethnography. University of California Press, Berkeley, California.

Shively, K.J., A.W. Alldredge, and G.E. Phillips. 2005. Elk Reproductive Response to Removal of Calving Season Disturbance by Humans. Journal of Wildlife Management 69:1073-1080.

Shoshone Conservation District. 2005. Shoshone Conservation District Long Range Plan 2006-2011. Shoshone Conservation District.

Shoshone River Watershed Plan Steering Committee. 2008. Draft Shoshone River Watersheds Plan.

Skold, M.D., and R.M. Davis. 1995. A Rangeland Grasshopper Insurance Program. Journal of Agricultural and Resource Economics, 20 (2):291-300.

South Big Horn Conservation District. 2006. South Big Horn County, Wyoming Watershed Plan 2006-2011. South Big Horn Conservation District.

South Big Horn Conservation District. 2012. Natural Resource and Land Use Plan, Long Range Plan 2012-2017. Available online: http://www.sbhcd.org/NRLUP.pdf.

State of Wyoming. 2004. Statute 9-4-601: Distribution and Use; Funds, Accounts, Cities and Towns Benefited; Exception for Bonus Payments.

Stewart, K.M., R.T. Bowyer, J.G. Kie, N.J. Cimon, and B.K. Johnson. 2002. Temporospatial Distributions of Elk, Mule Deer, and Cattle: Resource Partitioning and Competitive Displacement. Journal of Mammalogy 83(1):229-244.

Stiver, S.J., A.D. Apa, J.R. Bohne, S.D. Bunnell, P.A. Deibert, S.C. Gardner, M.A. Hilliard, C.W. McCarthy, and M.A. Schroeder. 2006. Greater Sage-Grouse Comprehensive Conservation Strategy. Western Association of Fish and Wildlife Agencies. Unpublished Report. Cheyenne, WY.

Stiver, SJ., E.T. Rinkes, D.E. Naugle, P.O. Makela, D.A. Nance, and J.W. Karl. In Press. Sage-Grouse Habitat Assessment Framework: Multi-scale Habitat Assessment Tool. Bureau of Land Management and Western Association of Fish and Wildlife Agencies Technical Reference XXXX-X. U.S. Bureau of Land Management, Denver, CO.

Stohlgren, T.J., I.D. Schell, and B.V. Huevel. 1999. How Grazing and Soil Quality Affect Native and Exotic Plant Diversity in Rocky Mountain Grasslands. Ecological Applications 9:45-64.

Strategic Marketing & Research, Inc. 2012. 2012 Year in Review. Wyoming Office of Tourism.

Taucher, Paul; Bartos, T.; Clarey, K.E.; Bartos, T.; Quillinan, L.; Hallberg, L.; Clark, M.; Thompson, M.; Gribb, N.; Worman, B.; Gracias, T. 2012. Wind/Bighorn River Basin Water Plan Update Groundwater Study Level I (2008-2011). Available groundwater determination, Technical Memorandum. Prepared for the Wyoming State Geological Survey (WSGS), United States Geological Survey (USGS), and Water Resources Data System (WRDS), in cooperation with the Wyoming State Engineer's Office (WSEO) and the Wyoming Oil and Gas Conservation Commission (WOGCC) for the Wyoming Water Development Commission. Available online: http://waterplan.state.wy.us/plan/bighorn/bighorn-plan.html.

Taylor, D.M. 1986. Effects of Cattle Grazing on Passerine Birds Nesting in Riparian Habitat. Journal of Range Management 39(3):254-258.

Taylor, D.T., R.H. Coupal, T. Foulke, and J.G. Thompson. 2004. The Economic Importance of Livestock Grazing on BLM Land in Fremont County Wyoming. University of Wyoming Department of Agricultural and Applied Economics. October.

Taylor, R.L., D.E. Naugle, and L.S. Mills. 2012. Viability Analyses for Conservation of Sage-Grouse Populations: Buffalo Field Office, Wyoming. U.S. Department of the Interior, Bureau of Land Management. 46 pages. Available online: http://www.blm.gov/wy/st/en/programs/Wildlife/sage-grouse.html.

Temple, S.A. 1985. Ecological Principles of Wildlife Management. Pages 11-21. In: Management of Nongame Wildlife in the Midwest: A Developing Art. Edited by J.B. Hale, L.B. Best, and R.L. Clawson. Proceedings of a Symposium held at the 47th Midwest Fish and Wildlife Conference. Grand Rapids, Michigan. December 17.

Thomas, L.E. 1965. Sedimentation and Structural Development of the Bighorn Basin. American Association of Petroleum Geologists Bulletin 49:1867-1877.

Thompson III, F.R., J.R. Probst, and M.G. Raphael. 1993. Silvicultural Options for Neotropical Migratory Birds. In: Status and Management of Neotropical Migratory Birds. Edited by D.M. Finch and P.W. Stangel. USDA Forest Service General Technical Report RM-229. pp. 353-362.

Torrel., M.D., J. Martinez-Padilla, R. Bonal, J. Vinuela, and J.A. Fargallo. 2007. Cattle Grazing, Raptor Abundance and Small Mammal Communities in Mediterranean Grasslands. Basic and Applied Ecology 8(6):565-575.

U.S. Census Bureau. 2000. 2000 Census of Population and Housing. U.S. Department of Commerce, U.S. Census Bureau. Washington, D.C.

U.S. Census Bureau. 2009a. County Characteristics: Selected Age Groups and Sex. U.S. Department of Commerce, U.S. Census Bureau, Population Division. Washington, D.C. Available online: http://www.census.gov/popest/counties/asrh/. Accessed June 2009.

U.S. Census Bureau. 2009b. Table 2: Annual Estimates of the Resident Population by Sex and Age for Wyoming: April 1, 2000 to July 1, 2008. U.S. Department of Commerce, U.S. Census Bureau. Washington, D.C. Available online: http://www.census.gov/popest/states/asrh/. Accessed June 2009.

U.S. Census Bureau. 2010a. Annual Estimates of the Resident Population by Sex and Five-Year Age Groups for the United States: April 1, 2000 to July 1, 2009. U.S. Department of Commerce, U.S. Census Bureau, Population Division. Washington, D.C. Available online: http://www.census.gov/popest/national/asrh/./NC-EST2009/NC-EST2009-01.xls. Accessed June 2010.

U.S. Census Bureau. 2010b. Annual Estimates of the Resident Population by Sex and Selected Age Groups for the United States: April 1, 2000 to July 1, 2009. U.S. Department of Commerce, U.S. Census Bureau, Population Division. Washington, D.C. Available online: http://www.census.gov/popest/national/asrh/./NC-EST2009/NC-EST2009-02.xls. Accessed June 2010.

U.S. Census Bureau. 2010c. Annual Estimates of the Population for Counties of Wyoming: April 1, 2000 to July 1, 2009. U.S. Department of Commerce, U.S. Census Bureau, Population Division. Washington, D.C. March 23. Available online: http://eadiv.state.wy.us/pop/CO-09EST.htm. Accessed June 2010.

U.S. Census Bureau. 2010d. Annual Estimates of Housing Units for Counties in Wyoming, April 1, 2000 to July 1, 2009. U.S. Census Bureau, Population Division. Washington, D.C. May. Available online: http://www.census.gov/popest/index.html. Accessed September 2013.

U.S. Census Bureau. 2010e. 2010 Census Summary File 1. Washington, D.C. Available online: http://factfinder2.census.gov. Accessed September 2013.

U.S. Census Bureau. 2010f. Annual Estimates of the Resident Population by Sex, Race, and Hispanic Origin for the United States: April 1, 2000 to July 1, 2009 (NC-EST2009-03). U.S. Department of Commerce, U.S. Census Bureau, Population Division. Washington, D.C. Available online: http://www.census.gov/popest/statespopest/national/asrh/SC-EST2008-03NC-EST2009-srh.html. Accessed June 2010.

U.S. Census Bureau. 2011a. 2007-2011 American Community Survey 5-Year Estimates. U.S. Department of Commerce, U.S. Census Bureau. Washington, D.C. Available online: http://factfinder2.census.gov. Accessed September 2013.

U.S. Census Bureau. 2011b. County Business Patterns (Big Horn, Hot Springs, Park, Washakie Counties). U.S. Department of Commerce, U.S. Census Bureau. Washington, D.C. Available online: http://www.census.gov/econ/cbp/index.html. Accessed September 2013.

U.S. Census Bureau. 2011c. Small Area Income and Poverty Estimates. U.S. Department of Commerce, U.S. Census Bureau, Small Area Estimates Branch. Available online: https://www.census.gov/did/www/saipe/index.html. Accessed September 2013.

U.S. Census Bureau. 2012. Annual Estimates of the Population for the United States, Regions and States: April 1, 2010 to July 1, 2012. U.S. Department of Commerce, U.S. Census Bureau, Population Division. Washington, D.C. December. Available online: http://eadiv.state.wy.us/pop/st-12est.htm. Accessed September 2013.

U.S. Census Bureau. 2013a. Wyoming Incorporated Place Population Estimates, April 1, 2010 to July 1, 2012. U.S. Department of Commerce, U.S. Census Bureau, Population Division. Washington, D.C. May. Available online: http://eadiv.state.wy.us/pop/SUB-12EST.htm. Accessed September 2013.

U.S. Census Bureau. 2013b. Intercensal Estimates of the Resident Population for Cities and Towns of Wyoming: April 1, 2000 to July 1, 2010. U.S. Department of Commerce, U.S. Census Bureau, Population Division. Washington, D.C. March 14. Available online: http://eadiv.state.wy.us/pop/sub-est01-09.htm. Accessed September 2013.

U.S. Census Bureau. 2013c. Annual Estimates of the Resident Population for Selected Age Groups by Sex: April 1, 2010 to July 1, 2012. U.S. Department of Commerce, U.S. Census Bureau. Washington, D.C. Available online: http://www.census.gov/popest/data/index.html. Accessed September 2013.

U.S. Census Bureau. 2013d. Annual Estimates of Housing Units for Counties in Wyoming, April 1, 2010 to July 1, 2012. U.S. Census Bureau, Population Division. Washington, D.C. May. Available online: http://www.census.gov/popest/index.html. Accessed September 2013.

University of Wyoming. 1994. Gap Analysis Program Data.

USACE (U.S. Army Corps of Engineers) and BOR (Bureau of Reclamation). 2009. Reclamation Managing Water in the West: Bighorn Lake Sediment Management Study. Final Draft Report, September.

USDA (U.S. Department of Agriculture). 1999. Census of Agriculture, 1997: Wyoming State and County Data. U.S. Department of Agriculture, National Agricultural Statistics Service. Vol. 1, Geographic Area Series, Part 50. Available online: http://usda.mannlib.cornell.edu/reports/census/ac97awy.pdf. Accessed July 2009.

USDA and DOI. 2000. National Fire Plan. U.S. Department of Agriculture and U.S. Department of the Interior.

USDA. 2004. Census of Agriculture, 2002: Wyoming State and County Data. U.S. Department of Agriculture, National Agricultural Statistics Service. Vol. 1, Geographic Area Series, Part 50. Available online: http://www.agcensus.usda.gov/Publications/2002/Vol._1,_Chapter_1_State_Level/Wyoming/WYVol.104. Accessed July 2009.

USDA. 2008. Major Land Resources Areas of MO-4. U.S. Department of Agriculture. Available online: http://www.mt.nrcs.usda.gov/soils/mlra/mlramap.html.

USDA. 2009. Census of Agriculture, 2007: Wyoming State and County Data. National Agricultural Statistics Service. Vol. 1, Geographic Area Series, Part 50. Available online: http://www.agcensus.usda.gov/Publications/2007/Full_Report/Vol._1,_Chapter_1_State_Level/Wyoming/wyv1.pdf. Accessed July 2009.

USFS (U.S. Forest Service). 1986. Final Environmental Impact Statement for the Shoshone National Forest Land and Resource Management Plan. Cody, Wyoming.

USFS, BLM, BIA, USFWS (U.S. Fish and Wildlife Service), and NPS. 2009. Guidance for Implementation of Federal Wildland Fire Management Policy.

USFS. 1990. Nez Perce National Historic Trail Comprehensive Management Plan. U.S. Department of Agriculture, Forest Service. Available online: http://www.fs.fed.us/npnht/.

USFS. 2005a. Bighorn National Forest Revised Land and Resource Management Plan. November. U.S. Department of Agriculture, Forest Service.

USFS. 2005b. Influence of Precommercial Thinning on Snowshoe Hares. Research Paper PNW-RP-562. U.S. Department of Agriculture, Forest Service.

USFS. 2007. Bark Beetle Incident Implementation Plan 2007 to 2011: Narrative. U.S. Department of Agriculture, Forest Service. Available online: http://www.fs.fed.us/r2/bark-beetle/BBIM_Implementation_Plan_Narrative.pdf. Accessed November 30, 2009.

USFS. 2012. National Insect and Disease Risk Maps. Available online: http://www.fs.fed.us/foresthealth/technology/nidrm.shtml.

USFS. 2014. Rocky Mountain Aerial Detection Survey Data. Available online: http://www.fs.usda.gov/detail/r2/forest-grasslandhealth/?cid=fsbdev3_041629.

USFWS. 2002. Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances. U.S. Fish and Wildlife Service. Utah Field Office, Salt Lake City, Utah.

USFWS. 2008. National Wetland Inventory Data. U.S. Fish and Wildlife Service.

USFWS. 2009. Conserving America's Fisheries, Mountain-Prairie Region Strategic Plan, Working with Partners in Montana, Wyoming, Utah, Colorado, North Dakota, South Dakota, Nebraska, and Kansas to Conserve Fish and Wildlife Resources, 2010-2014. U.S. Fish and Wildlife Service. Available online: http://www.fws.gov/mountain-prairie/fisheries/strategic-plan-draft-2014-v3.pdf.

USFWS. 2010. Federal Register - 12-Month Findings for Petitions to List the Greater Sage-Grouse (*Centrocercus urophasianus*) as Threatened or Endangered. March 4. U.S. Fish and Wildlife Service.

USFWS. 2013a. Greater Sage-Grouse (*Centrocercus urophasianus*) Conservation Objectives: Final Report. U.S. Fish and Wildlife Service. Denver, CO. February.

USFWS. 2013b. Environmental Conservation Online System. Available online: http://ecos.fws.gov/ecos/home.action.

USGS (U.S. Geological Survey). 2007. Environmental Effects of Off-Highway Vehicles on Bureau of Land Management Lands: A Literature Synthesis, Annotated Bibliographies, Extensive Bibliographies, and Internet Resources. U.S. Geological Survey.

USGS. 2008a. Assessment of Moderate- and High-Temperature Geothermal resources of the United States; Fact Sheet 2008-3082, 4 pp. U.S. Geological Survey.

USGS. 2008b. Assessment of Undiscovered Oil and Gas Resources of the Bighorn Basin Province, Wyoming and Montana, 2008. Fact Sheet 2008-3050, 2 pp. U.S. Geological Survey. Available online: http://pubs.usgs.gov/fs/2008/3050/. Accessed March 3, 2009.

USGS. 2008c. National Biological Infrastructure, Gap Analysis Program. Wyoming State Data. U.S. Geological Survey.

USGS. 2009. Madison Aquifer. U.S. Geological Survey. Available online: http://water.usgs.gov/ogw/karst/aquifers/madison/index.

USGS. 2010. Climate Change in Mountain Ecosystems. U.S. Geological Survey. Available online: www.nrmsc.usgs.gov/research/global.htm. Accessed July 27, 2010.

Vavra, M. 1992. Livestock and Big Game Forage Relationships. Rangelands 14(2):57-59.

Veil, John A., M.G. Puder, D. Elock, and R.J. Redweik, Jr. 2004. A White Paper Describing Produced Water from Production of Crude Oil, Natural Gas, and Coal Bed Methane. Prepared by Argonne National Laboratory for U.S. Department of Energy, National Energy Technology Laboratory.

VIEWS (Visibility Information Exchange Web Site). 2013. Visibility Information Exchange Web Site (VIEWS). Available online: http://views.cira.colostate.edu/web/.

WAFWA (Western Association of Fish and Wildlife Agencies). 2007. Wild Sheep Working Group Initial Subcommittee Recommendations for Domestic Sheep and Goat Management in Wild Sheep Habitat. June 12. Available online: http://www.mwvcrc.org/bighorn/wafwawild sheepreport.pdf.

Walker, B.L., D.E. Naugle, and K.E. Doherty. 2007. Greater Sage-Grouse Population Response to Energy Development and Habitat Sage-Grouse Loss. Journal of Wildlife Management 71:2644-2654.

Warmoloy, C., M. Bayer, and V. Geist. 1988. Behavior Responses and Reproduction of Mule Deer, Odocoileus hemionus, Does Following Experimental Harassment with an All-Terrain Vehicle. Canadian Field-Naturalist 102:425-429.

WARMS (Water and Atmospheric Resource Monitoring). 2013. Available online: http://12.183.80.118/station.php.

Washakie County Conservation District. 2006. Big Horn River Watershed Management Plan, Washakie County, Wyoming 2006-2011.

Washakie County Conservation District. 2009. History of the Washakie County Conservation District. Available online: http://www.conservewy.com/history.htm.

Washakie County Conservation District. 2010. Long Range Program Natural Resource Land Use Plan. Available online: http://www.washakiecd.com/uploads/4/6/2/9/46293003/long_range_plan.pdf.

Washakie County. 2012. Comprehensive Plan. Available online: http://www.washakiecounty.net/planner.

WDA (Wyoming Department of Agriculture). 2008. Wyoming Department of Agriculture Strategic Plan.

WEPP (Water Erosion Prediction Project). 2008. Available online: http://www.ars.usda.gov/Research/docs.htm?docid=10621.

West, N.E. 1999. Managing for Biodiversity of Rangelands. P101–126 In: W.W. Collins and C.O. Qualset (eds.) Biodiversity in Agrosystems. CRC Press, Boca Raton, Fla.

Westerling, A.L., H.G. Hidalgo, D.R. Cayan, and T.W. Swetam. 2006. Warming and Earlier Spring Increase Western U.S. Wildfire Activity. Science 313(5789):940-943.

Western Regional Climate Center. 2013. Climate Data Available for the West. Available online: http://www.wrcc.dri.edu.

WGFD (Wyoming Game and Fish Department). 2000. Sage-Grouse Annual Report and Summary Data of the Cody Region, 1956-1999. Wyoming Game and Fish Department, Cheyenne, Wyoming.

WGFD and BLM. 1990. Umbrella Memorandum of Understanding Between Wyoming Game and Fish Department and United States Department of the Interior Bureau of Land Management (Wyoming) for Management of Fish and Wildlife Resources on the Public Lands. March.

WGFD and BLM. 2007. Sage-Grouse Habitat Management Guidelines for Wyoming. Wyoming Game and Fish Department. U.S. Department of the Interior, Bureau of Land Management.

WGFD. 2004. Annual Sage-Grouse Report, 2000 to 2004. Wyoming Game and Fish Department, Cheyenne, Wyoming.

WGFD. 2005a. A Comprehensive Wildlife Conservation Strategy for Wyoming. Species of Greatest Conservation Need List. Wyoming Game and Fish Department, Cheyenne, Wyoming. Available online: http://gf.state.wy.us/wildlife/CompConvStrategy/.

WGFD. 2005b. Comprehensive Wildlife Conservation Strategy for Wyoming. Species of Concern. Wyoming Game and Fish Department, Cheyenne, Wyoming. Available online: http://www.wildlifeactionplans.org/pdfs/action_plans/wy_action_plan.pdf. Accessed October 9, 2009.

WGFD. 2008. Aquatic Resources Database. Wyoming Game and Fish Department, Cheyenne, Wyoming.

WGFD. 2009a. Wyoming Strategic Habitat Plan. Available online: https://wgfd.wyo.gov/web2011/Departments/Wildlife/pdfs/HABITAT_STRATEGICHABITATPLAN0000352.pdf.

WGFD. 2009b. Recommendations for Development of Oil and Gas Resources within Crucial and Important Wildlife Habitats. Wyoming Game and Fish Department, Cheyenne, Wyoming.

WGFD. 2010a. State Wildlife Action Plan. Wyoming Game and Fish Department. Cheyenne, WY. Available online: http://wgfd.wyo.gov/web2011/Departments/Wildlife/pdfs/SWAP_2012_FULL0001898.pdf.

WGFD. 2010b. Recommendations for Development of Oil and Gas Resources within Crucial and Important Wildlife Habitats. Wyoming Game and Fish Department, Cheyenne, Wyoming.

WGFD. 2010c. Wildlife Protection Recommendations for Wind Energy Development in Wyoming (Draft). March. 74 pp.

WGFD. 2011a. 2003-2011 Annual Reports. Wyoming Game and Fish Department, Cheyenne, Wyoming.

WGFD. 2011b. Wildlife Observation System Database, unpublished data. July. Wyoming Game and Fish Department, Cheyenne, Wyoming.

WGFD. 2014. Big Game Hunt Area Boundaries for Wyoming at 1:100,000. Wyoming Game and Fish Department, Cheyenne, Wyoming.

WHDP (Wyoming Housing Database Partnership). 2009a. A Profile of Wyoming - Demographics, Economics and Housing. Semiannual Report, Ending December 31, 2009. Sponsored by the Wyoming Community Development Authority. Prepared by Western Economic Services, LLC, Portland, Oregon.

WHDP. 2009b. The Wyoming Profile of Demographics, Economics and Housing. Semiannual Report, Ending June 30, 2008. Sponsored by the Wyoming Community Development Authority. Prepared by Western Economic Services, LLC, Portland, Oregon.

WHDP. 2013. The Wyoming Profile of Demographics, Economics and Housing. Semiannual Report, Ending June 30, 2013. Sponsored by the Wyoming Community Development Authority. Prepared by Western Economic Services, LLC, Portland, Oregon.

Williams, T. 2011. Letter to Caleb Hiner entitled Comments re; Big Horn Basin RMP Revision. Rocky Mountain Power. September.

WOGCC. 2008. Well Status Report. Wyoming Oil and Gas Conservation Commission. Casper, Wyoming.

WOGCC. 2009. Wyoming Well Data and Statistics: Wyoming Oil and Gas Conservation Commission Online database. Available online: http://wogcc.state.wy.us.

Woods, L.M. 1997. Wyoming's Big Horn Basin to 1901: A late Frontier. The Arthur H. Clark Foundation, Spokane, Washington.

Wyoming Department of Employment. 2008. Annual Report of the State Inspector of Mines of Wyoming, Year Ending December 31, 2008. Office of Mine Inspector. Available online: http://doe.wyo.gov/ProductionDocuments/Mines/2008%20Annual%20Report%20PDF_Report.pdf. Accessed August 16, 2010.

Wyoming Department of State Parks & Cultural Resources – Trails Program. 2004. Wyoming Statewide Trails Plan 2004.

Wyoming Department of State Parks and Cultural Resources. 2009. Wyoming Statewide Comprehensive Outdoor Recreation Plan 2009-2013. Available online: http://www.recpro.org/assets/Library/SCORPs/wy_scorp_2009.pdf.

Wyoming DEQ, Abandoned Mine Land Division. 2008. Personal communication between Bureau of Land Management and Wyoming DEQ regarding the location of AML sites within the Bighorn Basin Planning Area.

Wyoming DEQ, Abandoned Mine Land Division. 2009a. AML Dangers. Wyoming Department of Environmental Quality. Cheyenne, Wyoming. Available online: http://deq.state.wy.us/aml/Dangers.htm.

Wyoming DEQ, Abandoned Mine Land Division. 2009b. Personal communication between Marcia Murdock, Wyoming DEQ and Randall Coleman, ICF International.

Wyoming DEQ, Abandoned Mine Land Division. No Date. AML General Information. Wyoming Department of Environmental Quality. Cheyenne, Wyoming.

Wyoming DEQ. 2002. Wyoming Surface Water Quality Standards – Implementation Policies for Antidegradation, Mixing Zones, Turbidity, Use Attainability Analysis.

Wyoming DEQ. 2004. Water Quality Rules and Regulations, Chapter 2 – Permits Regulations for Discharges to Wyoming Surface Waters. Wyoming Department of Environmental Quality. Cheyenne, Wyoming. Available online: http://deq.state.wy.us/wqd/WQDrules/Chapter_02.pdf. Accessed August 27, 2009.

Wyoming DEQ. 2008. Wyoming's 2008 305(b) Integrated State Water Quality Assessment Report and 2008 303(d) List of Waters Requiring TMDLs. Available online: http://deq.state.wy.us/wqd/watershed/Downloads/305b/2008/2008%20Integrated%20Report.pdf.

Wyoming DEQ. 2010. Surface Monitoring Strategy 2010-2019. Available online: http://deq.state.wy.us/wqd/watershed/Downloads/Monitoring/WY_strategy2010_final.pdf.

Wyoming DEQ. 2012. Wyoming Water Quality Assessment and Impaired Waters List, 2012 Integrated (305(b) and 303(d) Report. Available online: http://deq.state.wy.us/wqd/watershed/Downloads/305b/2012/WY2012IR.pdf.

Wyoming DEQ. 2013a. E. Coli Total Maximum Daily Loads for the Big Horn River Watershed. Topical Report RSI-2289. Available online: http://deq.state.wy.us/wqd/watershed/TMDL/Front%20Page%20Misc/Big%20Horn%20TMDL%20Draft%207-5.pdf.

Wyoming DEQ. 2013b. Air Quality Division. Available online: http://deq.state.wy.us/aqd/.

Wyoming DEQ. 2013c. Wyoming Visibility Monitoring Network. Available online: http://www.wyvisnet.com/.

Wyoming DEQ. 2013d. Wyoming Water Quality Rules and Regulations, Chapter 1, Surface Water Quality Standards. Effective Sept. 24, 2013. Available online: http://soswy.state.wy.us/Rules/RULES/9176.pdf.

Wyoming DEQ. 2013e. Wyoming Surface Water Classification List. Water Quality Division Surface Water Standards. Available online: http://deq.state.wy.us/wqd/watershed/Program%20Documents/3.%20Surface%20Water%20Standards/Guidance%20Docs/2013-0726_wqd-wpp-surface-water-standards_Wyoming-Surface-Water-Classification-List.pdf.

Wyoming DOR (Department of Revenue). 1999. 1999 Annual Report. Wyoming Department of Revenue. Cheyenne, Wyoming. Available online: http://revenue.state.wy.us/PortalVBVS/DesktopDefault.aspx?tabindex=3&tabid=10. Accessed October 2009.

Wyoming DOR. 2000. 2000 Annual Report. Wyoming Department of Revenue. Cheyenne, Wyoming. Available online: http://revenue.state.wy.us/PortalVBVS/DesktopDefault.aspx?tabindex=3&tabid=10. Accessed October 2009.

Wyoming DOR. 2001. 2001 Annual Report. Wyoming Department of Revenue. Cheyenne, Wyoming. Available online: http://revenue.state.wy.us/PortalVBVS/DesktopDefault.aspx?tabindex=3&tabid=10. Accessed October 2009.

Wyoming DOR. 2002. 2002 Annual Report. Wyoming Department of Revenue. Cheyenne, Wyoming. Available online: http://revenue.state.wy.us/PortalVBVS/DesktopDefault.aspx?tabindex=3&tabid=10. Accessed October 2009.

Wyoming DOR. 2003. 2003 Annual Report. Wyoming Department of Revenue. Cheyenne, Wyoming. Available online: http://revenue.state.wy.us/PortalVBVS/DesktopDefault.aspx?tabindex=3&tabid=10. Accessed October 2009.

Wyoming DOR. 2004. 2004 Annual Report. Wyoming Department of Revenue. Cheyenne, Wyoming. Available online: http://revenue.state.wy.us/PortalVBVS/DesktopDefault.aspx?tabindex=3&tabid=10. Accessed October 2009.

Wyoming DOR. 2005. 2005 Annual Report. Wyoming Department of Revenue. Cheyenne, Wyoming. Available online: http://revenue.state.wy.us/PortalVBVS/DesktopDefault.aspx?tabindex=3&tabid=10. Accessed October 2009.

Wyoming DOR. 2006. 2006 Annual Report. Wyoming Department of Revenue. Cheyenne, Wyoming. Available online: http://revenue.state.wy.us/PortalVBVS/DesktopDefault.aspx?tabindex=3&tabid=10. Accessed October 2009.

Wyoming DOR. 2007. 2007 Annual Report. Wyoming Department of Revenue. Cheyenne, Wyoming. Available online: http://revenue.state.wy.us/PortalVBVS/DesktopDefault.aspx?tabindex=3&tabid=10. Accessed October 2009.

Wyoming DOR. 2008. 2008 Annual Report. Wyoming Department of Revenue. Cheyenne, Wyoming. Available online: http://revenue.state.wy.us/PortalVBVS/DesktopDefault.aspx?tabindex=3&tabid=10. Accessed October 2009.

Wyoming DOR. 2009. 2009 Annual Report. Wyoming Department of Revenue. Cheyenne, Wyoming. Available online: http://revenue.state.wy.us/PortalVBVS/DesktopDefault.aspx?tabindex=3&tabid=10. Accessed June 2009.

Wyoming DOR. 2010. 2010 Annual Report. Available online: http://revenue.state.wy.us/PortalVBVS/uploads/Department%20of%20Revenue%20%2010.29.2009.pdf. Accessed June 2010.

Wyoming DOR. 2011. 2011 Annual Report. Available online: https://sites.google.com/a/wyo.gov/wy-dor/dor-annual-reports. Accessed September 2013.

Wyoming DOR. 2012. 2012 Annual Report. Available online: https://sites.google.com/a/wyo.gov/wy-dor/dor-annual-reports. Accessed September 2013.

Wyoming Economic Analysis Division. 2011. Population for Wyoming, Counties, Cities, and Towns: 2010 to 2030. Cheyenne, Wyoming: State of Wyoming, Department of Administration and Information, Economic Analysis Division. Available online: http://eadiv.state.wy.us/pop/wyc&sc30.htm. Accessed September 2013.

Wyoming Economic Analysis Division. 2012a. Wyoming Cost of Living for the Fourth Quarter 2012. Cheyenne, Wyoming: State of Wyoming, Department of Administration and Information, Economic Analysis Division. April 1. Available online: http://eadiv.state.wy.us/wcli/NewsRelease-4Q12.pdf.

Wyoming Economic Analysis Division. 2012b. Wyoming Sales, Use, and Lodging Tax Revenue Report. Cheyenne, Wyoming: State of Wyoming, Department of Administration and Information, Economic Analysis Division.

Wyoming Game and Fish Commission. 2011. Wyoming Gray Wolf Management Plan. September 14, 2011. Available online: http://www.fws.gov/mountain-prairie/species/mammals/wolf/wyoming-102011/2011-09-14_FinalApprovedWolfMgmtPlan.pdf.

Wyoming Geographic Information Science Center. 1998. Wyoming Ground Water Vulnerability Assessment Handbook. Spatial Data and Visualization Report 98-01. Editors: J.D. Hamerlinck and C.S. Arneson. Available online: www.sdvc.uwyo.edu/groundwater/report.html.

Wyoming Interagency Vegetation Committee. 2002. Wyoming Guidelines for Managing Sagebrush Communities with Emphasis on Fire Management. Wyoming Game and Fish Department and Wyoming BLM. Cheyenne, Wyoming, 53 pp.

Wyoming Office of the Governor. 2008. State of Wyoming Executive Department Executive Order EO-2008-2 Greater Sage-grouse Core Area of Protection.

Wyoming Office of the Governor. 2010. Executive Order 2010-4, Greater Sage-grouse Core Area of Protection.

Wyoming Office of the Governor. 2011. Executive Order 2011-5, Greater Sage-Grouse Core Area Protection. Available online: http://governor.wy.gov/Documents/Sage%20Grouse%20Executive%20Order.pdf.

Wyoming Office of the Governor. 2013. Executive Order 2013-3, Greater Sage-Grouse Core Area - Grazing Adjustments. Available online: http://www-wsl.state.wy.us/sis/wydocs/execorders/EO2013-03.pdf.

Wyoming Office of Tourism. 2012. Wyoming Travel Impacts 1998 - 2012.

Wyoming Sage-grouse Working Group. 2003. Wyoming Greater Sage-grouse Conservation Plan. 97 pp. Cheyenne, Wyoming.

Wyoming SBLC (State Board of Land Commissioners). 2014. Grazing & Agricultural Leasing. Available online: https://lands.state.wy.us/index.php/trust-land-management/grazing-agricultural-leasing.

Wyoming SHPO. 2007. Wyoming's Comprehensive Statewide Historic Preservation Plan, 2007-2015.

Wyoming SHPO. 2009. Wyoming Cultural Resources Online (WYCRO). Database supplied by Wyoming State Historic Preservation Office. January.

Wyoming State Auditor. 2012. Comprehensive Annual Financial Report - Basic Financial Statements for the Fiscal Year Ended June 30, 2012. Available online: http://sao.state.wy.us/CAFR/2012_Report/2012_05_Financial_Basic.pdf. Accessed September 2013.

Wyoming State Division of Forestry. 2001. Wyoming Forest Health Report. Available online: http://slfweb.state.wy.us/forestry/adobe/wyfhm.pdf.

Wyoming State Engineer's Office. 2006. Underground Water Database.

Wyoming State Geological Survey. 2008. Oil and Gas Group. Available online: http://www.wsgs.uwyo.edu/WSGSgroups/OILGAS/Default.aspx.

Wyoming State Office of Travel and Tourism. 2007. Discover the Impact of Tourism in Wyoming – 2006 Impact Report. Wyoming Travel and Tourism. Available online: http://www.wyomingbusiness.org/pdf/tourism/2006_Impact_Report.pdf.

Wyoming State Treasurer's Office. 2010. FY 2009 Annual Report.

Wyoming State Treasurer's Office. 2011. FY 2010 Annual Report. Available online: http://treasurer.state.wy.us/publications.asp.

Wyoming State Treasurer's Office. 2012. FY 2011 Annual Report. Available online: http://treasurer.state.wy.us/publications.asp.

Wyoming State Treasurer's Office. 2013. FY 2012 Annual Report. Available online: http://treasurer.state.wy.us/publications.asp.

Wyoming State-wide Bighorn/Domestic Sheep Interaction Working Group. 2004. Final Report and Recommendations. Available online: http://gf.state.wy.us/wildlife/Sheep/index.asp.

Wyoming Tales and Trails. No Date. Coal Camps, Gebo. Available online: http://www.wyomingtalesandtrails.com/coalgebo.html.

Wyoming Water Development Commission. 2003. Wind/Bighorn River Basin Water Plan. Available online: http://waterplan.state.wy.us/plan/bighorn/bighorn-plan.html.

Wyoming Water Development Commission. 2010. Wind-Bighorn Basin Plan Update - 2010 Final Report. Available online: http://waterplan.state.wy.us/plan/bighorn/2010/finalrept/finalrept.html. May.

Wyoming Weed and Pest Council. 2012a. Wyoming Weed and Pest Control Act Designated List. Available online: http://www.wyoweed.org/statelist.html.

Wyoming Weed and Pest Council. 2012b. Declared Weed and Pest List. Available online: http://www.wyoweed.org/Documents/DocumentPage/2012%20Declared%20List.pdf.

Wyoming Wilderness Coalition. 2004. Wilderness at Risk: Citizens' Wilderness Proposal for Wyoming BLM Lands.

Wyoming Wilderness Coalition. 2011. Wilderness at Risk: Citizens' Wilderness Proposal for Wyoming BLM Lands.

Wyoming Wilderness Coalition. 2012. Wilderness at Risk: Citizens' Wilderness Proposal for Wyoming BLM Lands.

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CHAPTER 7 – CUMULATIVE IMPACTS (GREATER SAGE-GROUSE)

7.1 Greater Sage-Grouse Cumulative Effects Analysis: Bighorn Basin

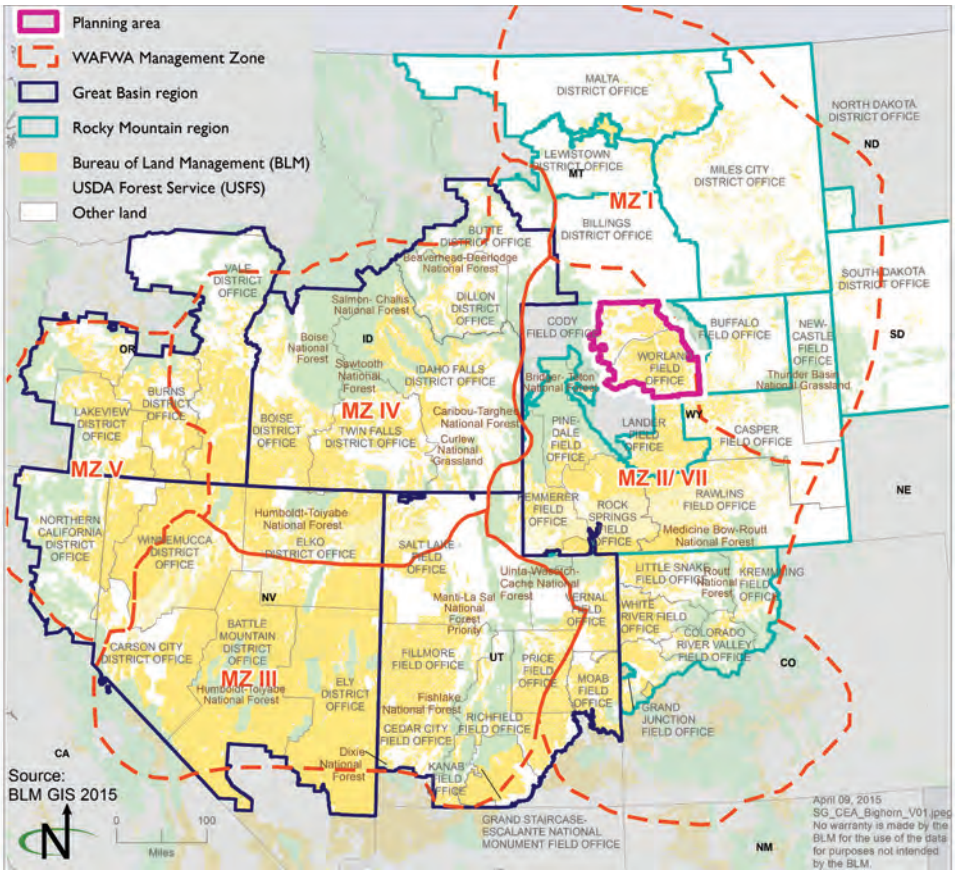
This cumulative effects analysis (CEA) discloses the long-term effects on Greater Sage-Grouse (GRSG) from implementing each RMP/EIS alternative in conjunction with other past, present, and reasonably foreseeable future actions. In accordance with Council on Environmental Quality guidance, cumulative effects need to be analyzed in terms of the specific resource and ecosystem being affected (Council on Environmental Quality 1997). As discussed in Chapter 1, the purpose for the proposed federal action is to identify and incorporate appropriate conservation measures to conserve, enhance, and restore GRSG habitat by reducing, eliminating, or minimizing threats to GRSG habitat. The Western Association of Fish and Wildlife Agencies (WAFWA) delineated seven sage-grouse management zones (MZ) based on populations within floristic provinces as depicted in Figure 7-1 (Stiver et al. 2006). The MZ is the appropriate geographic scope for this analysis because it encompasses areas with similar floristic conditions containing important GRSG habitat. Therefore, the cumulative effects analysis study area for the Greater Sage Grouse extends beyond the Bighorn Basin planning area boundary and incorporates WAFWA Management Zone (MZ) II/VII. MZ II and VII are combined for the purpose of characterizing GRSG habitat conditions and impacts, as was done in the Baseline Environmental Report (Manier et al. 2013). The planning area is almost entirely located within MZ II/VII, with the exception of a small portion on the eastern boundary located in MZ I. This portion of MZ I land contains 76,700 acres of GHMA and 0 acres of PHMA, which represents one tenth of one percent of all GHMA across MZ I; thus the relative influence of cumulative actions in the MZ I portion of the Bighorn Basin RMP planning area would be negligible.

The analysis of BLM actions in MZ II/VII is focused on the GRSG habitat within the MZs and is primarily based on MZ-wide datasets developed by the BLM National Operations Center (NOC). Where quantitative data are not available, analysis is qualitative. This analysis includes past, present and reasonably foreseeable future actions for all land ownerships in the MZ, and evaluates the impacts of the Bighorn Basin RMP, by alternative, when added to those actions. Non-federal actions considered in this analysis include, but are not limited to, the following:

- State plans
- Coordination with states and agencies during consistency reviews
- Additional data from non-BLM-administered lands

The following diagram shows the boundaries of the WAFWA MZs and BLM and Forest Service planning areas. The Bighorn Basin planning area has a relatively small influence in the context of MZ II/VII because it contains relatively few priority habitat management areas (PHMA) or general habitat management areas (GHMA): 1,786,200 acres of PHMA out of 14,105,000 total acres in MZ II/VII; and 3,780,500 acres of GHMA out of 17,771,500 total acres in MZ II/VII). As a result, actions in the Bighorn Basin RMP/EIS may have less cumulative impact on GRSG than those in larger planning areas in MZ II/VII.

Figure 7-1. Western Association of Fish and Wildlife Agencies Greater Sage-Grouse Management Zones



Section 7.1.1 describes the methods used in the analysis. Section 7.1.2 lists assumptions used in the analysis. Section 7.1.3 describes existing conditions in MZ II/VII and in the Bighorn Basin planning area. Section 7.1.4, Regional Efforts to Manage Threats to GRSG, provides a broad-scale description of past, present, and reasonably foreseeable future federal, state, local, and private actions influencing GRSG in MZ II/VII. Section 7.1.5 summarizes the relevant cumulative actions occurring in MZ II/VII. Section 7.1.6 analyzes threats to GRSG in MZ II/VII and discusses the potential cumulative effects resulting from each threat for each alternative. Section 7.1.7, Conclusions, determines the cumulative effects on GRSG as a result of implementing each alternative in the Bighorn Basin RMP, in combination with other private, local, regional, state, and federal past, present, and reasonably foreseeable future actions in MZ II/VII.

7.1.1 Methods

The CEA uses the following methodology:

- Data from the USGS publication "Summary of Science, Activities, Programs, and Policies That Influence the Rangewide Conservation of Greater Sage-Grouse" (Manier et al. 2013) establishes the baseline environmental condition against which the alternatives and other past, present, and reasonably foreseeable future actions are compared. Data from this publication are presented in terms of priority habitat and general habitat.
- The USFWS's 12-Month Findings for Petitions to List the Greater Sage-Grouse (*Centrocercus urophasianus*) as Threatened or Endangered (USFWS 2010) and the USFWS publication Conservation Objectives: Final Report (i.e., the COT report; USFWS 2013) were reviewed to identify the primary threats facing GRSG in each WAFWA MZ. Table 2 of the COT report lists threats to GRSG that are present and widespread in each population in the MZ.
- For MZ II/VII the list of threats that are directly or indirectly affected by BLM actions are energy development/mining, infrastructure, grazing/free roaming equids, conversion to agriculture/urbanization, fire, spread of weeds, recreation, and conifers (USFWS 2013). Two other threats listed in the COT report, sagebrush eradication and isolation/small population size, affect GRSG populations in MZ II/VII. While they are not addressed separately in this analysis, they are discussed as elements of other threats.
- Predation was not included as a threat in the final COT report and was not identified by USFWS as a significant threat to GRSG populations (USFWS 2010). Predation is a natural occurrence that may be enhanced by human habitat modifications such as construction of infrastructure that may increase opportunities for nesting and perching or increase exposure of GRSG nests. In such altered habitats, predators may exert an undue influence on GRSG populations. Predation is discussed in this CEA in the context of these other threats.
- Sagebrush eradication is a component of many threats. Isolation/small population size is not analyzed separately, because no management actions directly address this threat. These two threats are discussed as a component of other threats and in the conclusions. Not all the threats discussed in this section represent major threats to GRSG in each planning area in the MZ, but each poses a present and widespread threat to at least one population.
- Each threat is analyzed, and a brief conclusion for each threat is provided.
    - The BLM NOC compiled MZ-wide datasets for quantifiable actions in all proposed LUPs within MZ II/VII. These datasets provide a means by which to quantify cumulative impacts resulting from direct impacts of the threats identified in the COT report on BLM-administered lands.
    - The tables in this cumulative analysis display the number of acres across the entire MZ and the percentage of those acres that are located within the Bighorn Basin planning area. The total number of acres in the MZ includes the number of acres in the other BLM and Forest Service proposed plans plus the number of acres in the applicable Bighorn Basin RMP alternative. For example, the total number of acres for Alternative A includes all of the other proposed plans in MZ II/VII plus Bighorn Basin RMP Alternative A. Likewise, the Alternative B acreage includes all of the other proposed plans in MZ II/VII plus Bighorn Basin RMP Alternative B.
    - Data and information were gathered from other federal, state, and local agencies and tribal governments, where available, and were used to inform the analysis of cumulative impacts on GRSG from each of the threats in MZ II/VII.

- A discussion is provided for each alternative in Section 7.1.7. Each alternative considers the cumulative impacts on GRSG from each of the threats. It also considers whether those threats can be ameliorated via implementation of that particular alternative in conjunction with past, present, and reasonably foreseeable non-BLM/Forest Service and BLM actions in MZ II/VII.
- The list of reasonably foreseeable future actions was derived from each proposed BLM/Forest Service RMP in MZ II/VII to provide an MZ-wide overview of the ongoing and proposed land uses in both MZs.
- Baseline data that are consistent across planning areas and that analyze cumulative effects for each alternative, including the No Action Alternative and Proposed Plan, are used in this analysis.
- PHMA and GHMA were developed to protect the best habitat and highest population density of GRSG. Although PHMA and GHMA are not designated under Alternative A, spatial data was clipped to these boundaries by the BLM's NOC to provide a consistent lens for comparison across all alternatives.
- This analysis uses the most recent information available. For purposes of this analysis, the BLM has determined that the Proposed Plans for the other ongoing GRSG planning efforts in MZ II/VII are reasonable foreseeable future actions.

7.1.2 Assumptions

This cumulative analysis uses the same assumptions and indicators as those established for the analysis of direct and indirect effects on GRSG in Section 4.4.9. In addition, the following assumptions are have been made:

- The timeframe for this analysis is 20 years.
- The CEA area extends beyond the planning area and encompasses all of WAFWA MZ II/VII.
- The magnitude of each major threat would vary geographically and may have more or less impact on GRSG in some parts of the MZs, depending on factors such as climate, land use patterns and topography.
- A management action within an alternative would contribute a net conservation gain to GRSG if its effect is to reduce the level of a threat to GRSG from the level detailed in the 2010 USFWS listing decision for GRSG (USFWS 2010). A net conservation gain is equivalent to an actual benefit or gain above baseline conditions. Baseline conditions are defined as the pre-existing conditions of a defined area and/or resource that can be quantified by an appropriate metric(s).
- The CEA quantitatively analyzes GRSG and their habitat in the MZ. Impacts on habitat are likely to correspond to impacts on populations within MZ II/VII, since reductions or alterations in habitat could affect reproductive success through reductions in available forage or nest sites. Human activity could cause disturbance to the birds preventing them from mating or successfully rearing offspring. Human activities could also increase opportunities for predation, disease, or other stressors (Connelly et al. 2004; USFWS 2010; Manier et al 2013).
- In order to have consistency of analysis across the various planning areas within the MZ, the proposed Connectivity Areas have been classified as PHMA for cumulative analysis.

7.1.3 Existing Conditions in WAFWA MZ II/VII, and the Bighorn Basin Planning Area

This section summarizes existing conditions and past and present actions in the Bighorn Basin RMP planning area (provided in more detail in Chapter 3) and MZ II/VII as a whole. Reasonably foreseeable future actions are discussed in Section 7.1.5.

GRSG Habitat and Populations

MZ II/VII consists of nine populations: Eagle-South Routt, Middle Park, Laramie, Jackson Hole, Wyoming Basin, Rich-Morgan, Uintah, North Park, and Northwest Colorado. The bulk of the Bighorn Basin RMP planning area constitutes the Wyoming Basin population, which contains the largest regional extent and highest breeding density of GRSG in the western U.S. Leks in the northern portion of MZ II/VII are the most highly connected in the range (Knick and Hanser 2011), while populations in southern portions of MZ II/ VII (i.e., the Colorado Plateau) are less robust, with low lek connectivity and a 96 percent chance of populations declining below 200 males by 2037 (Garton et al. 2011; Knick and Hanser 2011).

In MZ II/VII, state and private lands account for approximately 43 percent of GRSG habitat, with BLM-administered and other federal land accounting for 57 percent (Manier et al. 2013, p. 118). The BLM also has some management authority over split-estate lands, with privately held surface land and federal subsurface mineral rights. The higher percentage of GRSG habitat on BLM-administered and other federal land means BLM management could play a key role in alleviating threats to GRSG across MZ II/VII; however, the Bighorn Basin planning area has a small footprint relative to other planning areas in MZ II/VII.

Table 7-1 provides a breakdown of landownership and acres of GRSG habitat in MZ II/VII. As the table shows, approximately 30 percent of priority habitats, and 30 percent of general habitats are on BLM-administered lands. In the Bighorn Basin planning area, there are approximately 5.6 million acres of GRSG habitat, including approximately 3.1 million acres (56 percent) on BLM-administered lands. The remaining 2.5 million acres (44 percent) of GRSG habitat comprise private, local state, and other federal and tribal lands.

Table 7-1. Management Jurisdiction in MZ II/VII by Acres of Priority and General Habitats

	Total Surface Area (Acres)	Priority (Acres)	General (Acres)	Non-habitat (Acres)
MZ II and VII	92,776,100 (100%)	17,476,000 (19%)	19,200,200 (21%)	56,099,900 (60%)
BLM	30,295,000 (33%)	9,021,200 (30%)	9,012,500 (30%)	12,261,300 (40%)
Forest Service	23,558,800 (25%)	162,000 (<1%)	452,500 (2%)	22,944,300 (97%)
Tribal and Other Federal	7,086,200 (8%)	784,000 (11.1%)	1,354,600 (19%)	4,947,600 (51%)
Private	27,405,400 (30%)	6,233,900 (22%)	7,394,800 (27%)	13,776,700 (50%)
State	4,053,900 (4%)	1,244,800 (31%)	979,800 (24%)	1,829,300 (45%)
Other	376,700 (<1%)	30,100 (8%)	6,000 (2%)	340,600 (90%)

Source: Manier et al. 2013, p. 118

BLM Bureau of Land Management
MZ Management Zone

Planning Area Habitat Conditions

Much of the Bighorn Basin RMP planning area is characterized by sagebrush shrub, foothill mountain sage and shrub, and desert salt shrub and greasewood. Livestock grazing, fire, fire suppression, and surface-disturbing activities have influenced many grassland/shrub vegetation types within the planning area. Leks within the planning area are generally located at mid-elevation sagebrush habitats. Nesting and brood-rearing habitat is sometimes associated with the lek and sometimes found at a distance from the lek in sagebrush habitat. No SFAs are located within the planning area.

Population Trends in Management Zone II/VII

The Wyoming Basin population within MZ II/VII is the largest population in the GRSG range with over 20,000 males attending leks annually. Although recent data suggests a population increase, long-term monitoring is trending downward and population modeling suggests this trend will continue (Garton et al. 2011).

Wyoming data suggest a cyclic pattern, with population lows in 1995, 2002 and 2013, and peaks in 2000 and 2006. Actual trends are difficult to discern due to the lower survey effort prior to 2007, meaning the number and proportion of active to inactive leks is unknown. Since 2007, the number of active leks in Wyoming has remained stable (approximately 1,100 active leks), but the number of males/active lek has declined by more than half (from 42 to 17 males/lek). (Christiansen 2013). Garton et al. (2015, p. 33) found that between 2007 and 2013, the Wyoming Basin population showed a 63 percent decline in the estimated minimum male population attending leks.

The isolation of many other populations on the fringes of MZ II/VII makes them particularly vulnerable to habitat loss and fragmentation. Subpopulation areas at greatest risk include the Laramie and Jackson Hole subpopulation areas, which are close to energy development and recreational areas and face fragmentation risk from infrastructure (USFWS 2013).

7.1.4 Regional Efforts to Manage Threats to GRSG

Across the Greater Sage-Grouse range, other BLM and Forest Service sub-regions are undergoing RMP revision or amendment processes similar to this one for the Bighorn Basin planning area. The Final EIS associated with each of these efforts has identified a Proposed Plan that meets the purpose and need of conserving, enhancing, and/or restoring GRSG habitat by reducing, eliminating, or minimizing threats. The management actions from the various Proposed Plans will cumulatively decrease the threat of GRSG habitat loss and will limit fragmentation throughout the range. Key actions present in many of the Proposed Plans include changes in land use allocations, mitigation framework, an adaptive management strategy, anthropogenic disturbance cap, and protective management actions in priority and general habitat areas.

The BLM has incorporated management of Sagebrush Focal Areas (SFAs) into its proposed plan management approach for GRSG. SFAs are a subset of PHMA and represent recognized “strongholds” for the species that have been noted and referenced by the conservation community as having the highest densities of the species and other criteria important for the persistence of the species. Portions of the SFAs that are located on BLM-administered and National Forest System lands would be petitioned for withdrawal from mineral entry, and are prioritized for management and conservation actions, including, but not limited to, review of livestock grazing permits/leases. Management of SFAs would enhance protection of GRSG in these areas, providing a net conservation gain to the species in light of other past, present, and reasonably foreseeable future actions considered in this CEA. Within MZ II/VII

there are two SFAs (Bear River Watershed Area, and Southwestern/South Central Wyoming), totaling approximately 3,895,500 acres.

The WAFWA Sage-Grouse Strategy (Stiver et al. 2006) outlines a plan for monitoring, research, outreach, and funding for conservation projects for GRSG. A basic premise of the WAFWA Sage-Grouse Strategy is that additional conservation capacity must be developed at all local, state, federal, and range-wide levels for both the short term (3 to 5 years) and for the long term (10 years or more) to ensure GRSG conservation.

Wyoming Statewide Efforts

Wyoming has established Core Population Areas to help delineate landscape planning units by distinguishing areas of high biological value. These areas are based on the locations of breeding areas and are intended to help balance GRSG habitat requirements with demand for energy development (Doherty et al. 2011).

In 2000, the Wyoming Sage-Grouse Working Group (WSGWG) was formed to develop a statewide strategy for GRSG conservation. This group prepared the Wyoming GRSG Conservation Plan (WSGWG 2003) to provide coordinated management and direction across the state. In 2004, local GRSG working groups were formed to develop and implement local conservation plans. Eight local working groups around Wyoming have completed conservation plans, many of which prioritize addressing past, present, and reasonably foreseeable threats at state and local levels, and prescribe management actions for private landowners to improve GRSG conservation at the local scale, consistent with the overall Wyoming Core Strategy. The Northeast Wyoming Sage-Grouse Conservation Plan was completed in 2006 and was updated in 2014 (Northeast Wyoming Sage-grouse Working Group 2014). The local and regional working group plans would assist in GRSG conservation through monitoring, public awareness, and voluntary conservation actions on private land.

Wyoming Executive Order

Wyoming Governor Matt Mead issued an executive order on June 2, 2011 that complemented and replaced several executive orders issued by his predecessor. The 2011 Wyoming executive order articulates the State's Core Population Area Strategy (Core Area Strategy) as an approach to balancing GRSG conservation and development. It also provides an approach to mitigating human disturbances to GRSG.

The Wyoming executive order applies to state trust lands starting in 2008. These trust lands cover almost 23 percent of GRSG habitat and benefit approximately 80 percent of the estimated breeding population in the state (USFWS 2010). All proposed activities are evaluated through a density/disturbance calculation tool to determine if the project would exceed recommended density/disturbance thresholds. Additionally, the order has stipulations to be included in such permits, with varying restrictions, depending on whether the proposed development activity occurs within or outside delineated Core Population Areas (Wyoming Executive Order, June 2, 2011).

In Core Areas, there is a 0.6-mile no surface occupancy (NSO) buffer around occupied leks and restrictions on activities in breeding and winter concentration habitat. Wyoming's Industrial Siting Council, which permits large development projects on all lands in the state, is subject to the terms of the executive order. This buffer provides protection for males during lekking season and acts in coordination with the density disturbance cap. The combination of protections could offer GRSG considerable regulatory protection when large wind energy and other development projects are being considered in Wyoming (USFWS 2010; Manier et al. 2013). Statewide modeling of trends under the

Core Area Strategy suggests that with effective enforcement statewide, the strategy could reduce population losses by 9 to 15 percent across Wyoming. Moreover, the number of Core Areas predicted to maintain 75 percent of their current populations could increase from 20 to 25 under long-term scenarios (Copeland et al. 2013). Combining the Core Area Strategy with $250 million in target conservation easements (provided willing landowners and funding are available) could reduce population declines by another 9 to 11 percent (Copeland et al. 2013).

Core Population Areas in Wyoming also incorporate connectivity corridors (Wyoming Executive Order 2011). These are areas GRSG use to maintain connectivity between habitat areas (Manier et al. 2013). Connectivity reduces isolation, thereby also reducing a population's vulnerability to disease, drought, or other events that may result in extirpation.

Umbrella Candidate Conservation Agreement with Assurances for Wyoming Ranch Management

Candidate Conservation Agreements with Assurances are voluntary conservation agreements between the USFWS and one or more federal or private partners (e.g., the ranchers). In return for managing lands to benefit GRSG, landowners receive assurances against additional regulatory requirements should GRSG be listed under the Endangered Species Act. Within Wyoming, the USFWS and Wyoming Governor's Office in conjunction with the BLM, Natural Resources Conservation Service, Forest Service, and other agencies, have developed an umbrella Candidate Conservation Agreement with Assurances for range management activities. Enrolled landowners are expected to comply with grazing specific conservation measures including but not limited to: avoid (or rotationally utilize) known nesting and brood-rearing habitat as a location for activities that concentrate livestock such as stock tank placement branding and roundup; place salt or mineral supplements in sites minimizing impacts to GRSG habitat; and within 24 months develop and implement a written grazing management plan to maintain or enhance the existing plant community as suitable GRSG habitat (USFWS et al. 2013).

Sweetwater River Conservancy Habitat Conservation Bank

The Sweetwater River Conservancy Habitat Conservation Bank is the first conservation bank established for GRSG. Located in central Wyoming, the bank manages habitat for GRSG allowing energy development and other activities to proceed on other lands within Wyoming. A conservation bank is a site or suite of sites established under an agreement with the USFWS, intended to protect, and improve habitat for species. Credits may be purchased which result in perpetual conservation easements and conservation projects on the land to offset impacts occurring elsewhere. The Sweetwater River Conservancy Habitat Conservation Bank launched with 55,000 deeded acres of GRSG habitat, and could expand up to 700,000 acres on other lands owned by the Sweetwater River Conservancy contingent upon demand (USFWS 2015).

Wyoming Landscape Conservation Initiative

The Wyoming Landscape Conservation Initiative is a long-term science based effort to assess and enhance aquatic and terrestrial habitats at a landscape scale in southwest Wyoming, while facilitating responsible development through local collaboration and partnership. Collaborative efforts address multiple concerns at a scale that considers all activities on the landscape, and can leverage resources that might not be available for single agency projects. GRSG initiatives from the Wyoming Landscape Conservation Initiative have included habitat enhancement efforts (e.g., invasive weed treatment, prescribed grazing strategies), and GRSG research studies (Wyoming Landscape Conservation Initiative 2013).

Montana Statewide Efforts

The Montana Department of Fish, Wildlife and Parks (MFWP) is tasked with implementing the range-wide WAFWA Sage-Grouse Strategy (Stiver et al. 2006) in Montana.

In addition, the MFWP's Montana Management Plan and Conservation Strategy for Sage-Grouse was initiated in 2005 to protect, maintain, and restore GRSG habitat. The plan ranks threats to the species across the state and provides an overall strategy for public and private cooperation in conservation actions. In 2013, the governor established the Greater Sage-Grouse Habitat Conservation Advisory Council to provide recommendations on policies and actions for GRSG conservation and provide regulatory authority for conservation actions. The council provided these recommendations in January 2014. The governor subsequently issued an executive order on September 9, 2014 (State of Montana 2014), based on the council recommendations that provided the direction for future GRSG conservation in Montana.

Montana Executive Order

The Montana governor issued an executive order on September 9, 2014 (State of Montana 2014), based on the council recommendations that provided the direction for GRSG conservation in Montana. Stipulations for development in the executive order and Montana Management Plan and Conservation Strategy for Sage-Grouse include but are not limited to:

- A 0.6-mile NSO buffer around the perimeter of active leks for new activities;
- Locating new overhead power lines and communication towers a minimum of 0.6 mile from the perimeter of active leks;
  A minimum 2.0-mile buffer from active lek perimeters for main roads and a minimum 0.6-mile buffer for facility site access roads;
- A 5 percent limit on anthropogenic surface disturbance within the Density and Disturbance Calculation Tool examination area (based upon suitable habitat); and
- As authorized by permitting agency or agencies, activities (production, maintenance and emergency activity exempted), will typically be prohibited from March 15 through July 15 outside of the NSO perimeter of an active lek and within 2 miles of that perimeter in Core Population Areas where breeding, nesting, and early brood-rearing habitat is present.

Specifically, the following measures which would be implemented under the Proposed Plan, or are considered reasonably foreseeable future actions, would help meet the COT report objectives:

- Managing ROW exclusion and avoidance areas would help meet the COT report objective for infrastructure by limiting ROW/SUA development within PHMA. These actions would also help to meet the COT objectives for non-native, invasive plant species by reducing disturbances that promote the spread of weeds.
- Designating major and moderate oil and gas stipulations would limit development in PHMA, except where pre-existing valid rights apply. In these areas Conditions of Approval would limit disturbance.
- Implementation of state conservation plans and/or state executive orders would help meet all COT report objectives, particularly on non-BLM and non-National Forest System lands. Applying a 5 percent disturbance limit (under the Wyoming and Montana GRSG plans/executive orders) would reduce impacts contributing to population declines and range erosion associated with multiple threats including energy, mining, and infrastructure.

- Prioritizing conifer treatments closest to occupied GRSG habitats and near occupied leks, and where juniper encroachment is phase I or 2, would reduce the rate of pinyon-juniper incursion and help to maintain healthy native sagebrush plant communities.
- Continued implementation of the Natural Resource Conservation Service Sage-Grouse Initiative would help meet the COT objective for the threat of agriculture conversion, by securing conservation easements on private lands. Fence marking, implementing prescribed grazing systems, and vegetation seeding would help meet the COT objectives for range management structures, grazing, and non-native, invasive plant species.

The approach of the Montana executive order/Montana Management Plan and Conservation Strategy for GRSG is similar to the Wyoming executive order. Montana's plan will apply a disturbance cap in core habitat and will limit well density and apply timing limitations. The 0.6-mile buffer would protect males in the vicinity of leks during the breeding season; the density limits and disturbance cap would protect GRSG during nesting, brood-rearing, and winter concentration activities. The timing restrictions would reduce the potential for displacement or disruption during the breeding season.

Colorado Statewide Efforts

In 2008, the Colorado Division of Wildlife (now Colorado Parks and Wildlife [CPW]) developed a state conservation plan, which prioritized threats and identified key issues facing conservation. The plan included issues, objectives, and strategies in detail. The strategies for conservation discussed responsible parties, lead agency, timeline, and cost associated with implementation of the strategy.

In 2012, a state conservation plan revision process began, and in consultation with stakeholders, a matrix summarizing implementation and effectiveness of the strategies was developed (Colorado Package), along with a subsequent Synthesis Report. The Colorado Package identified a number of conservation efforts within Colorado which have resulted in positive impacts to GRSG including acquisition of conservation easements and habitat improvement projects (Colorado Department of Natural Resources 2013). The Synthesis Report provided additional information on the effectiveness of conservation efforts such as county zoning ordinances which support protection of GRSG habitat, and measures from the Colorado State Board of Land Commissioners (SLB) which will support adaptive management techniques to improve GRSG habitat (Colorado Department of Natural Resources 2014).

Utah Statewide Efforts

The Conservation Plan for Greater Sage-grouse in Utah (Utah Division of Wildlife Resources 2013) was designed to protect, enhance, and restore GRSG habitat, in an effort to reduce the threats to the species. The plan identifies 11 sage grouse management areas throughout the state (including lands within MZ II/VII), which represent areas of high habitat value. The plan calls for state and local efforts to obtain incentive-based negotiated covenants, easements, leases or other legal tools in order to protect habitat. Additionally, the plan identifies a five percent disturbance limitation of habitat on state or federally managed lands, intended to limit the effects of large scale disturbances.

Idaho Statewide Efforts

In 2006, Idaho developed a statewide plan for the conservation of GRSG (Idaho Sage-grouse Advisory Committee 2006). The plan includes a toolbox of conservation measures to address threats to the species, as well as research, monitoring, and evaluation guidelines and recommendations. The plan was designed to provide guidance, tools, and resources to the local working groups in Idaho, and to facilitate

development of their plans. Rural Fire Protection Districts have been established within the state to help suppress fires in GRSG habitat.

Similar to efforts in nearby states, the governor of Idaho is expected to issue an executive order providing direction for GRSG conservation in Idaho on state lands. This executive order is expected to be largely consistent with BLM and Forest Service direction, though exact details are not known and are speculative as of the time this FEIS is published.

Natural Resource Conservation Service Sage Grouse Initiative

The Natural Resource Conservation Service's (NRCS) Sage Grouse Initiative (SGI) is working with private landowners in 11 western states to improve habitat for GRSG (Manier et al. 2013). With approximately 31 percent of all sagebrush habitats across the range in private ownership (Stiver 2011, p. 39), including 37 percent of priority and general habitat in MZ II/VII (Manier et al. 2013, p. 118), a unique opportunity exists for the NRCS to benefit GRSG and ensure the persistence of large and intact rangelands by implementing long term contracts and conservation easements.

Participation in the SGI program is voluntary, but willing participants enter into binding contracts to ensure that conservation practices that enhance GRSG habitat are implemented. Participating landowners are bound by a contract (usually 3 to 5 years) to implement, in consultation with NRCS staff, conservation practices if they wish to receive the financial incentives offered by the SGI. These financial incentives generally take the form of payments to offset costs of implementing conservation practices and easements or rental payments for long-term conservation.

While potentially effective at conserving GRSG populations and habitat on private lands, incentive-based conservation programs that fund the SGI generally require reauthorization from Congress under subsequent farm bills, meaning future funding is not guaranteed.

As of 2015, SGI has secured conservation easements on 243,400 acres within MZ II/VII (NRCS 2015). On these and additional lands in the MZ, SGI has completed specific GRSG conservation actions, including implementation of grazing systems, conifer removal, vegetation seeding, and fence marking. These conservation actions are targeted at the critical threats in the MZ. Additionally, SGI clusters implementation to achieve landscape benefits (NRCS 2015).

Other Regional Efforts

A programmatic EIS by the Western Area Power Administration (WAPA) and the USFWS for the entire upper Great Plains will focus future wind energy developments in specific corridors outside of GRSG core habitat (WAPA 2013). In accordance with Section 7 of the ESA, preparation of the programmatic EIS has involved consultation between cooperating entities and the USFWS and preparation of a programmatic Biological Assessment to ensure that the action will not jeopardize the continued existence of any federally-listed species, including the federal candidate GRSG. At the time of this RMPA specific conservation measures for protecting GRSG and its habitat under the programmatic EIS are not developed.

Tribes, counties, and local working groups are playing a critical role in promoting GRSG conservation at the local level. Individual conservation plans have been prepared by most local working groups to develop and implement strategies to improve or maintain GRSG habitat and reduce or mitigate threats. The proposed conservation actions and recommendations in these plans are voluntary actions. The conservation plans located in Wyoming are used as instruments to inform the Wyoming executive order.

Local working group projects include monitoring, research, and mapping habitat areas, as well as public outreach efforts, such as landowner education and collaboration with federal, state, and other local entities. These efforts provide a net conservation gain to GRSG through increased monitoring and public awareness.

Local working group GRSG conservation plans in MZ II/VII include the following:

- Northwest Colorado (Northwest Colorado Greater Sage-Grouse Conservation Plan; 2008)
- Piceance/Parachute Roan Creek (Parachute-Piceance-Roan Greater Sage-Grouse Conservation Plan; 2008)
- Northern Eagle/Southern Routt (Northern Eagle County and Southern Routt County Greater Sage-Grouse Conservation Plan; 2004)
- North Park (North Park Greater Sage-Grouse Conservation Plan; 2001)
- Middle Park (Middle Park Sage Grouse Conservation Plan; 2001)
- Rich County (Rich County Sage-grouse Conservation Plan; 2006)
- Morgan-Summit (Morgan-Summit Greater Sage-Grouse Local Conservation Plan; 2006)
- Uintah Basin (Uinta Basin Greater Sage-Grouse Local Conservation Plan; 2007)
- Upper Green River Basin (Upper Green River Basin Sage-Grouse Grouse Conservation Plan; 2007)
- Upper Snake River Basin (Upper Snake River Basin Sage-Grouse Conservation Plan; 2008)
- Wind River/Sweetwater River Basin (Wind River/Sweetwater River Local Sage-Grouse Conservation Plan; 2007)
- Southwest Wyoming (Southwest Wyoming Sage-grouse Conservation Assessment and Plan; 2007)
- South Central Wyoming (South Central Sage-Grouse Conservation Plan; 2007)
- Bates Hole/Shirley Basin (Bates Hole/Shirley Basin Sage-grouse Conservation Plan; 2007)
- Bighorn Basin, Wyoming (Sage grouse Conservation Plan for the Bighorn Basin; Bighorn Basin Sage-grouse Local Working Group; 2007)

7.1.5 Relevant Cumulative Actions

This cumulative effects analysis considers the incremental impact of the Bighorn Basin RMP and alternatives in combination with other past, present, and reasonably foreseeable future federal and non-federal action on all lands in MZ II/VII. Where these occur within GRSG habitat, they would cumulatively add to the impacts of BLM- and Forest Service-authorized activities set forth in the Bighorn Basin Proposed Plan. In addition to the conservation efforts described above, relevant reasonably foreseeable future cumulative actions occurring on federal, private, or mixed landownership in MZ II/VII are described in the Proposed RMPAs/LUPAs for Northwest Colorado. The following list includes large-scale past, present, and reasonably foreseeable future actions in MZ II/VII that when added to the Proposed Plan and alternatives for the Bighorn Basin RMP, could cumulatively affect GRSG (see Table 7-12 for more detail):

- Hiawatha Regional Energy Development EIS
- LaBarge Platform Exploration & Development Project
- Continental Divide-Creston Natural Gas Project

- Moneta Divide Natural Gas and Oil Development Project
- Pinedale Anticline Project
- Black Fork Project (Formerly Moxa Arch Area Infill)
- Oil Shale and Tar Sands Programmatic EIS
- Atlantic Rim Natural Gas Field Development Project
- Chokecherry Sierra Madre Wind Farm
- Gateway South Transmission Line Project
- TransWest Express Transmission Line Project
- Gateway West Transmission Line Project
- Riley Ridge o Natrona Pipeline Project
- Invasive Plant Management EIS for the Medicine Bow – Routt National Forests, and Thunder Basin National Grassland
- Normal-Pressured Lance Natural Gas EIS
- Bird Canyon Field Infill EIS

These projects are incorporated into the following analysis as the relevant past, present, and reasonably foreseeable future projects associated with each threat to GRSG in MZ II/VII.

7.1.6 Threats to GRSG in MZ II/VII

The COT Report identifies the present and widespread threats facing GRSG in MZ II/VII as identifies energy development; infrastructure; grazing, including free-roaming equids; conversion to agriculture and urbanization; fire; spread of weeds; and recreation (USFWS 2013). These threats impact GRSG mainly by fragmenting and degrading their habitat. For example, the loss of sagebrush steppe across the West approaches or exceeds 50 percent in some areas. Habitat fragmentation and degradation is a primary factor in long-term declines in GRSG abundance across its historical range (USFWS 2010).

Habitat fragmentation reduces connectivity of populations and increases the likelihood of extirpation from random events such as drought or outbreak of West Nile virus. Furthermore, climate change is likely to affect habitat availability to some degree by decreasing summer flows and limiting growth of grasses and forbs, thereby limiting water and food supply (BLM 2012). Sensitive species such as GRSG, which are already stressed by declining habitat, increased development, and other factors, could experience additional pressures as a result of climate change.

Each COT report threat considered "present and widespread" in at least one population in MZ II/VII is discussed below. For more detail on the nature and type of effects and the direct and indirect impacts on GRSG in the planning area, see Chapter 4 of the Bighorn Basin PRMP/FEIS.

7.1.6.1 Energy Development

The COT report states that energy development should be designed to ensure that it will not impinge on stable or increasing GRSG population trends. For mining, the COT objective is to maintain stable to increasing GRSG populations and no net loss of GRSG habitats in areas affected by mining (USFWS 2013).

There are approximately 1,144,800 acres of GRSG habitat in MZ II/VII where energy development, including oil and gas, coal leasing, mineral materials, and non-energy leasable minerals, is occurring. In

addition, there are over 30,000,000 acres indirectly influenced by energy development (Manier et al. 2013, pp. 55-71).

Oil and Gas

Nature and Type of Effects

As discussed in Chapter 4, oil and gas development impacts GRSG and sagebrush habitats through direct disturbance and habitat loss from well pads, construction activities, seismic surveys, roads, power lines, and pipeline corridors. Indirect disturbances result from noise, gaseous emissions, vehicle traffic, changes in water availability and quality, and human presence. These factors could cumulatively or individually lead to habitat fragmentation in the long term (Connelly et al. 2004; Holloran 2005).

Oil and gas development also directly impacts GRSG through the species' avoidance of infrastructure. This development can also impact GRSG survival or reproductive success. Indirect effects include habitat quality changes, predator communities, and disease dynamics (Naugle et al. 2011).

Several studies completed in the Great Plains and Wyoming Basin have shown that breeding GRSG populations are affected at oil and gas well densities commonly permitted in Montana and Wyoming (Naugle et al. 2011). Doherty et al. (2010) found that although impacts were indiscernible at densities of less than one well per square mile, lek losses were two to five times greater in areas with development above this threshold. They also found that the abundance (number) of males per lek at the remaining leks declined by approximately 30 to 80 percent. These and other studies demonstrate that both direct and indirect impacts result from the impacts of energy development and geophysical exploration in GRSG habitat.

Studies have researched the efficacy of NSO stipulations for leasing and development within certain distances of a lek (Holloran 2005; Walker et al. 2007). Walker et al. (2007) found that in the Powder River Basin, buffer sizes of 0.25, 0.5, 0.6, and 1.0 mile resulted in an estimated lek persistence (the ability of leks to remain on the landscape) of approximately 5, 10, 15, and 30 percent, respectively; conversely, lek persistence in areas without oil and gas development averaged approximately 85 percent. 0.25-mile NSO lease stipulations were found to be insufficient to conserve breeding GRSG populations in Wyoming and Montana, when nearly 100 percent of the area within approximately 2 miles of leks remained open to full-scale development (Walker et al. 2007).

Research has also studied the effects of energy development on GRSG at distances greater than one mile. Naugle et al. (2011) reported that impacts of energy development on leks had been documented at distances greater than 3.5 miles from the lek. Holloran (2005) found impacts on abundance at a distance between 3 and 4 miles in western Wyoming. However, Naugle et al. (2011) also stated that impacts on leks caused by energy development were most severe nearer the lek.

The impacts of well density have also been researched. Naugle et al. (2011) found that impacts from energy development often extirpate leks from gas fields. Doherty (2008) documented that lek losses increased and male abundance decreased as well density increased in the Powder River Basin. Lek extirpation in areas with 8 wells per section (40 to 100 wells total) within 2 miles of the lek was 5 times more likely to occur than in areas with no wells within 2 miles. Male attendance at the remaining leks in these areas declined approximately 20 to 60 percent (Doherty 2008).

The effects of noise on GRSG have been quantified in several studies. Lyon and Anderson (2003) reported that oil and gas development influenced the rate of nest initiation of GRSG in excess of approximately 2 miles of construction activities. GRSG numbers on leks within approximately 1 mile of natural gas compressor stations in Campbell County, Wyoming, were consistently lower than numbers

on leks unaffected by this noise disturbance (Braun et al. 2002). Holloran and Anderson (2005) reported that lek activity decreased downwind of drilling activities, suggesting that noise caused measurable impacts. In addition to activities directly associated with oil and gas development, road traffic also generates noise. Knick et al. (2003) indicated that there were no active GRSG leks within approximately 1 mile of Interstate 80 across southern Wyoming; only 9 leks were known to occur between approximately 1 and 2.5 miles of Interstate 80.

Conditions in MZ II/VII

The Greater Green River Basin, Uintah-Piceance Basin, and North Park Basin are all important oil and gas reserves in MZ II/VII.

Oil and natural gas development-related wells indirectly influence 78 to 84 percent of priority habitats and general habitats respectively across MZ II/VII. BLM-administered lands are host to 54 percent of wells in priority habitats and 50 percent in general habitats within MZ II/VII (Manier et al. 2013). Therefore, BLM actions are likely to have a greater potential to ameliorate the adverse impacts of oil and gas development on GRSG habitat than any other single land management entity.

Oil and gas conservation measures across MZ II/VII are more widespread than in the past. Much oil and gas development on private lands previously occurred with minimal mitigation efforts, but restrictions are now in place to protect GRSG habitat under the Wyoming and Montana executive orders. Additionally, in Colorado, operators may be subject to consultation requirements under the Colorado Oil and Gas Conservation Commission rules, to determine if conditions of approval are necessary to minimize adverse impacts from proposed oil and gas operations in sensitive wildlife habitat (such as GRSG PHMA).

Impact Analysis

Table 7-2, Acres Open and Closed to Fluid Mineral Leasing in GRSG Habitat in MZ II/VII, and Table 7-3, Acres with NSO and CSU/TL Stipulation in GRSG Habitat in MZ II/VII, provide a quantitative summary of present fluid mineral leasing conditions on BLM-administered lands across MZ II/VII. An analysis of this summary along with other past, present, and reasonably foreseeable actions in MZ II/VII (Table 7-12) follows.

As stated under Methods and Assumptions, acreages in these tables are limited to BLM-administered lands and always assume implementation of Proposed Plans in other RMP planning areas across MZ II/VII. Tables displaying fluid mineral acreage include the federal mineral estate.

Table 7-2. Acres Open* and Closed to Fluid Mineral Leasing in GRSG Habitat in MZ II/VII

	Priority Habitat Management Areas		General Habitat Management Areas	
	MZ II/VII	Percent Within Planning Area	MZ II/VII	Percent Within Planning Area
Open* to Fluid Mineral Leasing				
Alternative A	208,000	100%	2,522,000	43%
Alternative B	0	0%	1,875,000	20%
Alternative C	0	0%	3,949,000	62%
Alternative E	0	0%	1,854,000	19%
Alternative F	0	0%	2,370,000	37%
Proposed Plan	0	0%	2,378,000	37%
Closed to Fluid Mineral Leasing				
Alternative A	1,266,000	3%	1,142,000	18%
Alternative B	2,715,000	55%	1,825,000	49%
Alternative C	1,224,000	0%	1,083,000	13%
Alternative E	2,715,000	55%	1,825,000	49%
Alternative F	1,290,000	5%	1,133,000	17%
Proposed Plan	1,290,000	5%	1,165,000	19%

Source: BLM 2015

*Open with standard lease terms and conditions. This table displays the acres of PHMA and GHMA open and closed to fluid mineral leasing in MZ II/VII; it also displays the percentage of those acres that are found within the planning area.

GHMA General Habitat Management Areas
GRSG Greater sage-grouse
MZ Management Zone
PHMA Priority Habitat Management Areas

Table 7-3. Acres with NSO and CSU/TL Stipulations in GRSG Habitat in MZ II/VII

	Priority Habitat Management Areas		General Habitat Management Areas	
	MZ II/VII	Percent Within Planning Area	MZ II/VII	Percent Within Planning Area
NSO Stipulations				
Alternative A	4,102,000	14%	1,277,000	25%
Alternative B	3,546,000	0%	1,876,000	49%
Alternative C	3,546,000	0%	1,044,000	8%
Alternative E	3,546,000	0%	1,913,000	50%
Alternative F	4,442,000	20%	1,273,000	25%
Proposed Plan	4,442,000	20%	1,281,000	25%
CSU/TL Stipulations				
Alternative A	5,562,000	12%	6,679,000	14%
Alternative B	4,923,000	0%	6,074,000	5%
Alternative C	4,923,000	0%	7,058,000	19%
Alternative E	4,923,000	0%	6,059,000	5%
Alternative F	5,407,000	9%	6,913,000	17%
Proposed Plan	5,407,000	9%	6,957,000	17%

Source: BLM 2015

This table displays the acres of PHMA and GHMA with NSO Stipulations and CSU/TL Stipulations in MZ II/VII; it also displays the percentage of those acres that are found within the planning area.

CSU	Controlled surface use
GHMA	General Habitat Management Areas
GRSG	Greater sage-grouse
MZ	Management Zone
NSO	No surface occupancy
PHMA	Priority Habitat Management Areas
TL	Timing limitations

As shown in Table 7-2 and Table 7-3, fluid mineral closures and stipulations within the Bighorn Basin RMP planning area generally exert limited influence due to their small acreage compared to the broader MZ. However, actions such as closing PHMA and GHMA to leasing, establishing 0.6 mile-lek buffers in accordance with the Wyoming executive order, applying the disturbance cap, and implementing NSO and CSU/TL stipulations within the planning area would help to reduce the threat of oil and gas development within the MZ.

Under Alternative A, 208,000 acres of PHMA in MZ II/VII would be open to fluid mineral leasing under standard lease terms and conditions (all of which would be located in the Bighorn Basin planning area). Additionally, 2,522,000 acres of GHMA would be open to leasing in the MZ. The lack of protective restrictions in these areas would increase the potential for harm or disturbance associated with new leasing projects. GRSG would be most vulnerable to disturbances from oil and gas leasing and development in the Bighorn Basin planning area; implementing other BLM proposed plans throughout the remainder of the MZ would result in greater long-term protections on BLM-administered lands in those areas. Conservation actions at the state and local level (e.g., state GRSG plans, conservation easements, etc.) would complement other BLM proposed plans while oil and gas related past, present,

and reasonably foreseeable future actions that result in surface disturbance would result in a continued threat to GRSG specifically within the planning area.

Acres of PHMA and GHMA closed to fluid mineral leasing in MZ II/VII would be greatest under Alternative B and E. As such, there would not be oil and gas development in these areas, reducing the potential impact to GRSG populations. The risk of habitat fragmentation or disturbance due to new oil and gas development would be reduced. The incremental effect of implementing alternatives B or E in conjunction with BLM proposed plans elsewhere in the MZ and the past, present, and reasonably foreseeable future actions disclosed in Table 7-12 would result in a net conservation gain to GRSG in MZ II/VII because these two alternatives are the most restrictive for oil and gas development.

Alternative C provides the fewest restrictions on energy development in MZ II/VII. For example, approximately 3,949,000 acres of GHMA would be open to fluid mineral leasing under standard conditions. Reasonably foreseeable future leasing projects would be less restricted under this alternative, which could increase the risk of habitat fragmentation or disturbance, particularly within the Bighorn Basin planning area. Implementation of the BLM/Forest Service Proposed Plans in other planning areas would help ameliorate the threat of oil and gas development in those areas, but this alternative would result in a lower net conservation gain than alternatives B, E, or the Proposed Plan.

Under the Proposed Plan, no PHMA in MZ II/VII would be open to fluid mineral leasing with standard terms and conditions; approximately 2,378,000 acres of GHMA would be open with standard terms and conditions. Closing PHMA to fluid mineral leasing or applying major or moderate stipulations would benefit GRSG by limiting new development in PHMAs. While new oil and gas development is likely to occur on lands not administered by the BLM, such projects may be subject to the requirements of the Wyoming executive order and other state plans, which would limit disturbance. The incremental effect of implementing the Proposed Plan in conjunction with other GRSG conservation actions in MZ II/VII would be a net conservation gain for GRSG because of the additional restrictions in PHMAs.

Acres of GRSG habitat open, closed, or subject to NSO and CSU/TL stipulations under Alternative F are similar to those under the Proposed Plan, with slightly more acres of GHMA closed to fluid mineral leasing. Because the past, present, and reasonably foreseeable future actions would remain the same, the cumulative effects on GRSG in MZ II/VII would be similar to those discussed under the Proposed Plan.

All BLM/Forest Service Proposed Plans within MZ II/VII include BMPs and required design features to minimize impacts on GRSG from oil and gas development on federal lands. In areas where mineral estate is currently unleased, these tools can be applied to future leases; in areas which are already leased, BMPs can be applied as conditions of approval for development of existing leases. Examples include: locating new compressor stations outside of PHMA to reduce noise disturbance; clustering operations and facilities as closely as possible; placing infrastructure in already disturbed locations where the habitat has not been fully restored; and restoring disturbed areas at final reclamation to the pre-disturbance landforms and desired plant communities. State plans contain similar measures to reduce impacts. Together, these measures would help protect unfragmented habitats, minimize habitat loss and fragmentation, and maintain conditions that meet GRSG life history needs. Recent research indicates that restored habitats lack many of the features sought by GRSG in their habitat areas, and may not support GRSG for long periods following restoration activities. In order to conserve GRSG populations on the landscape, protection of existing habitat through minimizing development, would provide the best hope for GRSG persistence (Arkle et al. 2014).

The effect of the alternatives and other conservation actions in the MZ (most notably the Montana and Wyoming executive orders) could be synergistic, meaning that the effects of the actions together is

greater than the sum of their individual effects. For example, applying buffers in PHMA and on state and private land would effectively conserve larger blocks of land than if these actions occurred individually. This would provide a landscape-scale net conservation benefit, especially in areas where little development has occurred to date.

Implementation of the Proposed Plan within the Bighorn Basin planning area, in combination with other BLM planning efforts and other GRSG conservation plans within MZ II/VII could affect proposed oil and gas development projects. Large-scale oil and gas projects which could potentially occur on GRSG habitat within MZ II/VII (such as the Hiawatha Regional Energy Development EIS, LaBarge Platform Exploration & Development Project, and Continental Divide-Creston Natural Gas Project as discussed in Table 7-12) would be subject to disturbance cap limitation requirements of the Wyoming executive order and/or BLM/Forest Service Proposed Plans. NSO and CSU/TL stipulations would also apply in GRSG habitat on BLM-administered lands. These restrictions would contribute to the greatest net conservation gain of any alternative because they would limit development in key habitat areas. Because leasing restrictions (e.g., closures in PHMA and NSO stipulations) under the Proposed LUPs in MZ II/VII would not preclude existing leases in PHMA and GHMA from being developed, reasonably foreseeable future projects for oil and gas development are likely to affect GRSG and sagebrush habitats. However, mitigation requirements in BLM/Forest Service LUPAs and state and other GRSG conservation plans would offset disturbances from future projects and result in a net conservation gain for GRSG.

Coal

Nature and Type of Effects

Coal extraction is a major mining activity in GRSG habitat (Braun 1998), and environmental effects include soil erosion, dust, noise, water pollution, acid-mine drainage, and air emissions. These environmental effects can result in GRSG behavioral disruptions and habitat removal or degradation. Although land disturbed by coal mining can be restored to a point that supports a diversity of vegetation, including big sagebrush, reclamation projects require long durations, and GRSG habitat may fail to be restored (Arkle et al. 2014).

Conditions in MZ II/VII

Coal surface leases indirectly influence 8 to 10 percent of priority habitats and general habitats respectively across MZ II/VII. Approximately 50 percent of coal leases in priority habitats (and 57 percent in general habitats) occur on private lands within MZ II/VII (Manier et al. 2013). Therefore, private actions are likely to have a greater potential to ameliorate the effects of coal development on GRSG than any other single land management entity.

Impact Analysis

Coal leasing and development is less extensive in the Bighorn Basin planning area than in other areas of MZ II/VII. As such, management actions in the Bighorn Basin RMP/EIS would have less influence in ameliorating the threat than other regional efforts. Because the Bighorn Basin RMP/EIS would have such a small impact on the broader MZ, there would be little variation in the effects on GRSG within MZ II/VII across the RMP/EIS alternatives.

Under all alternatives and the Proposed Plan, new coal lease applications on federal mineral estate would be subject to suitability determinations governed by 43 CFR, Part 3461.5. Under unsuitability criterion 15, the BLM may determine that portions of the MZ contain essential GRSG habitat and are

unsuitable for all or certain stipulated methods of coal mining. If the BLM made this determination, it would apply stipulations to restrict coal mining and protect GRSG, including possibly prohibiting surface coal mining. As such, the regulations under Criterion 15 of 43 CFR, Part 3461.5(o)(1) would reduce the potential for long-term impacts associated with new coal leasing projects on GRSG habitats and populations.

New coal leasing and development may also occur on non-federal lands in MZ II/VII, subject to state regulations (including reclamation requirements). Additionally, new coal leasing in Wyoming and Montana would be subject to the Surface disturbance limit as required by the Wyoming and Montana executive orders. These measures would help protect GRSG habitat on lands where 43 CFR, Part 3461.5(o)(1) do not apply.

The requirements of 43 CFR, Part 3461.5, Criterion 15, in combination with BLM planning efforts and state plans, would help reduce the threat from coal extraction and would provide a net conservation gain to GRSG in MZ II/VII.

Mineral Materials

Nature and Type of Effects

Development of surface mines (e.g., for sand, gravel and other common mineral materials found in MZ II/VII) may negatively impact GRSG numbers and disrupt the habitat and life-cycle of the species, similar to other types of mining activities (Braun 1998; Manier et al. 2013).

Conditions in MZ II/VII

Mineral material disposal sites indirectly influence 17 percent of priority habitats and 11 percent of general habitats across MZ II/VII. Approximately 65 percent of mineral material disposal sites in priority habitats and 60 percent of sites in general habitats occur on BLM-administered lands within MZ II/VII (Manier et al. 2013). Therefore, BLM actions are likely to have a greater potential to ameliorate the effects of mineral material disposal on GRSG than any other single land management entity.

Impact Analysis

As shown in Table 7-4, Acres Open and Closed to Mineral Material Disposal in GRSG Habitat in MZ II/VII, acres of PHMA and GHMA closed to mineral material disposal within the planning area generally have a relatively smaller influence, when compared to the broader MZ.

Table 7-4. Acres Open and Closed to Mineral Material Disposal in GRSG Habitat in MZ II/VII

	Priority Habitat Management Areas		General Habitat Management Areas	
	MZ II/VII	Percent Within Planning Area	MZ II/VII	Percent Within Planning Area
Open to Mineral Material Disposal				
Alternative A	7,530,000	19%	10,417,000	23%
Alternative B	6,680,000	8%	8,971,000	11%
Alternative C	6,126,000	0%	11,705,000	32%
Alternative E	6,126,000	0%	8,971,000	11%
Alternative F	7,556,000	19%	10,436,000	24%
Proposed Plan	7,181,000	15%	9,762,000	18%
Closed to Mineral Material Disposal				
Alternative A	3,487,000	2%	1,285,000	13%
Alternative B	4,398,000	22%	2,675,000	58%
Alternative C	3,433,000	0%	1,454,000	23%
Alternative E	4,952,000	31%	2,675,000	58%
Alternative F	3,461,000	1%	1,265,000	12%
Proposed Plan	3,495,000	2%	1,390,000	20%

Source: BLM 2015

This table displays the acres of PHMA and GHMA open and closed to mineral material disposal in MZ II/VII; it also displays the percentage of those acres that are found within the planning area.

GHMA General Habitat Management Areas
GRSG Greater sage-grouse
MZ Management Zone
PHMA Priority Habitat Management Areas

Under Alternative A, 3,487,000 acres of PHMA are closed to mineral material disposal in MZ II/VII and 1,285,000 acres of GHMA are closed. 7,530,000 acres of PHMA would remain open, as would 10,417,000 acres of GHMA. Reasonably foreseeable future mineral material disposals in MZ II/VII could affect GRSG through habitat disturbance, fragmentation, or behavior disruptions, depending on the location and extent of the project; however, implementation of BLM/Forest Service Proposed Plans in other areas of MZ II/VII would restrict development, thereby reducing the risk of removing or fragmenting habitat elsewhere in MZ II/VII, particularly on federal lands. There would be a net conservation gain to GRSG in MZ II/VII, but it would be concentrated in areas outside the Bighorn Basin planning area and would have a less widespread beneficial impact on the Wyoming Basin population in the planning area.

Substantially more acres of PHMA and GHMA are closed under alternatives B and E. These closures would restrict the development of mineral materials on GRSG habitat on federal lands, thereby contributing to the protection of habitat. However, designating GRSG habitat as open or closed to mineral material disposal would not preclude existing facilities from continued operation. In areas where existing mineral material disposal sites affect GRSG (e.g., through noise disturbance or vehicle

collision risk), these impacts would likely continue. Impacts in other areas of MZ II/VII would be the same as under Alternative A.

Under Alternative C, 3,433,000 acres of PHMA would be closed to mineral material disposal in MZ II/VII and 1,454,000 acres of GHMA would be closed. While this Alternative closes the fewest acres of PHMA to mineral material disposal, implementation of state plans and BLM/Forest Service Proposed Plans in other areas of MZ II/VII are considered present and reasonably foreseeable future actions, respectively, which would contribute to the protection of habitat and a net conservation gain.

Under the Proposed Plan, 3,495,000 acres of PHMA would be closed to mineral material disposal in MZ II/VII; 1,390,000 acres would be closed in GHMA. On non-federal lands, the development limitations applied under the Wyoming executive order would reduce impacts to GRSG habitat across the state, and would encourage mineral material disposal in areas away from Core Areas. Together, the incremental effect would be a net conservation gain to GRSG.

Under Alternative F, slightly fewer acres of PHMA and GHMA in MZ II/VII would be closed to mineral material disposal in comparison to the Proposed Plan; the cumulative effects on GRSG are similar to those for the Proposed Plan, but less beneficial on BLM-administered lands within the planning area. This would impact the Wyoming Basin population's integrity more than populations elsewhere in the MZ.

Locatable Minerals

Nature and Type of Effects

Locatable minerals include gold, silver, uranium, and bentonite. Activities associated with locatable mineral development, such as stockpiling topsoil and extracting and transporting material, have direct impacts on GRSG through mortality and nest disruption. These actions also would reduce the functionality of the surrounding habitat via noise and light disturbance, resulting in lost and degraded PHMA and GHMA.

As with fluid mineral development, reclamation practices may help to reduce long-term impacts on GRSG and their habitat. Although disturbed areas have not been restored to near pre-disturbance conditions in the past, recent efforts have been directed toward restoring functional habitat. However, even with effective restoration, restored areas may not support GRSG populations at the same level as prior to disturbance.

Conditions in MZ II/VII

Within MZ II/VII, bentonite, gypsum, gold, and uranium are all commonly mined for commercial use.

Impact Analysis

As shown in Table 7-5, Acres Open and Recommended with Mineral Withdrawal, acres of GRSG habitat recommended for withdrawal generally represents a relatively small influence, when compared to the broader MZ.

Table 7-5. Acres Open and Recommended for Withdrawal from Mineral Entry in GRSG Habitat in MZ II/VII

	Priority Habitat Management Areas		General Habitat Management Areas	
	MZ II/VII	Percent Within Planning Area	MZ II/VII	Percent Within Planning Area
Open to Mineral Entry				
Alternative A	8,154,000	17%	8,910,000	27%
Alternative B	8,213,000	18%	8,830,000	27%
Alternative C	6,770,000	0%	10,413,000	38%
Alternative E	6,770,000	0%	8,825,000	27%
Alternative F	8,169,000	17%	8,993,000	28%
Proposed Plan	8,190,000	17%	8,940,000	28%
Recommended for Withdrawal from Locatable Mineral Entry				
Alternative A	890,000	0%	209,000	8%
Alternative B	941,000	6%	355,000	46%
Alternative C	887,729	0%	202,000	4%
Alternative E	2,383,000	63%	359,000	46%
Alternative F	894,000	1%	217,000	12%
Proposed Plan	893,000	1%	235,000	18%

Source: BLM 2015

This table displays the acres of PHMA and GHMA open to mineral entry and recommended for withdrawal from locatable mineral entry in MZ II/VII; it also displays the percentage of those acres that are found within the planning area.

GHMA General Habitat Management Areas
GRSG Greater sage-grouse
MZ Management Zone
PHMA Priority Habitat Management Areas

Under Alternative A, 890,000 acres of PHMA would be recommended for withdrawal from locatable mineral entry in MZ II/VII. Additional acres of PHMA would be recommended for withdrawal under alternatives B, E, F, and the Proposed Plan. Acres of PHMA and GHMA recommended with withdrawal in MZ II/VII would be greatest under Alternative E. Under all alternatives, withdrawing lands from locatable mineral development is unlikely to mitigate existing or approved projects in GRSG habitat. However, withdrawing GRSG habitat from mineral entry would reduce the risk of sagebrush habitat loss or fragmentation caused by new locatable mineral development projects.

Under all alternatives, required design features would help minimize the impacts on GRSG from locatable mineral development on federal land. All BLM/Forest Service Proposed Plans within MZ II/VII include required design features. Examples include: locating facilities outside of PHMA to reduce noise disturbance; clustering operations and facilities as closely as possible; placing infrastructure in already disturbed locations where the habitat has not been fully restored; and restoring disturbed areas at final reclamation to the pre-disturbance landforms and desired plant communities.

Under the Proposed Plan, portions of SFAs would be recommended for withdrawal. As such, if these areas are withdrawn the Proposed Plan would provide a greater net conservation gain to GRSG populations by reducing disturbance to birds from mining activities.

Nonenergy Leasable Minerals

Nature and Type of Effects

Nonenergy leasable minerals include materials such as sulfates, silicates, and trona (sodium carbonate). Impacts on GRSG are similar to those from other types of mining as described above.

Conditions in MZ II/VII

In MZ II/VII, existing federal mineral prospecting permits for nonenergy leasable resources have a direct footprint on 378,400 acres of priority habitats and 557,100 acres of general habitats (Manier et al. 2013, P. 79).

Impact Analysis

Table 7-6, Acres Open and Closed to Nonenergy Leasable Mineral Leasing in GRSG Habitat in MZ II/VII, shows acres of GRSG habitat open and closed to nonenergy leasing in the MZ.

Table 7-6. Acres Open and Closed to Nonenergy Leasable Mineral Leasing in GRSG Habitat in MZ II/VII

	PHMA		GHMA	
	MZ II/VII	Percent Within Planning Area	MZ II/VII	Percent Within Planning Area
Open to Nonenergy Leasing				
Alternative A	5,921,000	0%	7,939,000	0%
Alternative B	5,921,000	0%	7,939,000	0%
Alternative C	5,921,000	0%	7,939,000	0%
Alternative E	5,921,000	0%	7,939,000	0%
Alternative F	5,921,000	0%	7,939,000	0%
Proposed Plan	5,921,000	0%	7,939,000	0%
Closed to Nonenergy Leasing				
Alternative A	3,646,000	0%	1,114,000	0%
Alternative B	3,646,000	0%	1,114,000	0%
Alternative C	3,646,000	0%	1,114,000	0%
Alternative E	3,646,000	0%	1,114,000	0%
Alternative F	3,646,000	0%	1,114,000	0%
Proposed Plan	3,646,000	0%	1,114,000	0%

Source: BLM 2015

This table displays the acres of PHMA and GHMA open and closed to nonenergy leasing in MZ II/VII; it also displays the percentage of those acres that are found within the planning area.

GHMA General Habitat Management Areas
GRSG Greater sage-grouse
MZ Management Zone
PHMA Priority Habitat Management Areas

No federal lands within the Bighorn Basin planning area were designated as open or closed under the RMP; therefore, cumulative impacts to GRSG within MZ II/VII would vary little across all alternatives because past, present, and reasonably foreseeable future actions would not vary across alternatives. New nonenergy leasable projects occurring in GRSG habitat could impact GRSG and their habitat, depending on the location and extent of the development. Precluding nonenergy leasable development in PHMA and GHMA would reduce habitat disturbance and fragmentation as well as direct disturbance to GRSG, improving the likelihood of successful breeding and reproduction. Implementing a 3 percent disturbance cap under alternatives E, F, and 5 percent disturbance cap under Alternative B and the Proposed Plan would limit nonenergy mineral development over the long term and may reduce development more than alternatives A, or C. As a result, in combination with the disturbance cap applied under state plans, BLM actions in other planning areas in MZ II/VII, and other past, present, and reasonably foreseeable future actions, alternatives B, E, F, and the Proposed Plan would provide a net conservation gain to GRSG. This gain would be greatest under alternatives E and F, as these alternatives implement the most restrictive disturbance caps.

7.1.6.2 Infrastructure

Rights of Way/Special Use Authorizations

Nature and Type of Effects

As discussed in Chapter 4, power lines can directly affect GRSG by posing a collision and electrocution hazard, and can indirectly decrease lek attendance and recruitment by providing perches and nesting habitat for potential avian predators, such as golden eagles and ravens (Connelly et al. 2004). In addition, power lines are linear and often extend for many miles. Thus, ground disturbance associated with construction, as well as vehicle and human presence during maintenance activities, may introduce or spread invasive weeds over large areas, thereby degrading habitat. Impacts from roads may include direct habitat loss from road construction and direct mortality from collisions with vehicles. Roads may also facilitate predator movements, spread invasive plants, and increase human disturbance from noise and traffic (Forman and Alexander 1998).

Numerous studies have researched the impact of infrastructure on GRSG. For example, GRSG avoided nesting and summering near major roads (for example, paved secondary highways) in south-central Wyoming (LeBeau 2012), and traffic disturbance (1 to 12 vehicles per day) within 1.9 miles of leks during the breeding season reduced nest-initiation rates and increased distances moved from leks during nest site selection of female sage-grouse in southwestern Wyoming (Lyon and Anderson 2003). Nesting propensity (i.e., nest initiation rates) was 24 percent lower for females breeding on road-disturbed leks compared with undisturbed females, 56 percent of females breeding on disturbed leks initiated nests in consecutive years compared to 82 percent of females breeding on undisturbed leks, and females moved twice as far from leks to nest locations if breeding on disturbed leks (Lyon and Anderson 2003). Increased length of road (correlated with use), increased traffic levels on roads, and traffic activity during the early morning on roads within approximately 1.9 miles of leks negatively influence male lek attendance (Manier et al. 2013).

An examination of leks within 62 miles of Interstate 80 in Wyoming and Utah found no leks within 1.25 miles of the interstate, reduced numbers of leks within 4.7 miles of the interstate, and a positive distance-effect with higher rates of decline in lek counts between 1970 and 2003 on leks within 4.5 miles compared to leks 4.7 to 9.3 miles from the interstate (Connelly et al. 2004). Rates of decline in GRSG male lek attendance increased as traffic volumes on roads near leks increased, and vehicle activity on roads during the daily strutting period (i.e., early morning) had a greater influence on male lek attendance compared with roads with no vehicle activity during early morning in southwestern Wyoming (Holloran 2005). In central Wyoming, peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads decreased 73 percent relative to paired controls (Blickley 2012; Manier et al. 2013).

Transmission lines are especially prevalent in MZ II/VII (Manier et al. 2013) and their impact on GRSG in the MZ has been studied. Negative effects of power lines on lek persistence were documented in northeastern Wyoming; the probability of lek persistence decreased with proximity to power lines and with increasing proportion of power lines within a four-mile window around leks (Walker et al. 2007). Braun reported that use of areas near transmission lines by sage-grouse, as measured by pellet counts, increased as distance from transmission line increased up to 600 m (1968 feet) (Braun 1998). Sage-grouse avoided brood-rearing habitats within 2.9 miles of transmission lines in south-central Wyoming (LeBeau 2012; Manier et al. 2013).

Power lines may also cause changes in lek dynamics, with lower growth rates observed on leks within 0.25 miles of new power lines in the Powder River Basin of Wyoming as compared with those further from the lines. This was attributed to increased raptor predation (Braun et al. 2002). Raptors and corvids forage on average 3.1 to 4.3 miles from perching sites, potentially impacting 32 to 40 percent of the sage-grouse conservation area (Connelly et al. 2004). Removing or reducing the number of perching structures and landfills in key nesting, brood rearing, and lekking habitats may reduce predation pressure on sage-grouse (Bui 2009; Leu and Hanser 2011; Manier et al. 2013).

Conditions in MZ II/VII

Infrastructure, such as ROWs and associated facilities and urbanization, is prevalent throughout MZ II/VII.

Although not representative of all infrastructure ROW, transmission lines (greater than 115 kilovolt) indirectly influence 60 to 63 percent of priority habitats and general habitats respectively across MZ II/VII. Approximately 50 percent of transmission lines in priority habitats (and 45 percent in general habitats) are located on BLM-administered lands across GRSG habitats in MZ II/VII (Manier et al. 2013). Therefore, BLM actions are likely to have a greater potential to ameliorate the effects of transmission line ROW on GRSG than any other single land management entity.

Impact Analysis

Table 7-7, Acres of Rights-of-Way/Special Use Authorization Management within GRSG Habitat in MZ II/VII, lists the acres of ROW/SUA avoidance and exclusion within GRSG habitat by alternative.

Table 7-7. Acres of Rights-of-Way/Special Use Authorization Management within GRSG Habitat in MZ II/VII

	Priority Habitat Management Areas		General Habitat Management Areas	
	MZ II/VII	Percent Within Planning Area	MZ II/VII	Percent Within Planning Area
Open to Rights-of-Way/Special Use Authorization				
Alternative A	822,000	91%	6,624,000	21%
Alternative B	78,000	0%	5,455,000	4%
Alternative C	77,000	0%	7,166,000	27%
Alternative E	77,000	0%	5,455,000	4%
Alternative F	77,000	0%	5,961,000	13%
Proposed Plan	77,000	0%	5,954,000	12%
Right-of-Way/Special Use Authorization Exclusion				
Alternative A	583,000	4%	678,000	6%
Alternative B	694,000	19%	727,000	12%
Alternative C	562,000	0%	646,000	1%
Alternative E	1,793,000	69%	727,000	12%
Alternative F	562,000	0%	677,000	6%
Proposed Plan	564,000	0%	674,000	5%
Right-of-Way/Special Use Authorization Avoidance				
Alternative A	7,570,000	5%	2,409,000	23%
Alternative B	8,319,000	13%	3,426,000	46%
Alternative C	7,220,000	0%	3,020,000	39%
Alternative E	7,220,000	0%	3,426,000	46%
Alternative F	8,335,000	13%	3,080,000	40%
Proposed Plan	8,336,000	13%	3,134,000	41%

Source: BLM 2015

This table displays the acres of PHMA and GHMA within rights-of-way/special use authorization management areas in MZ II/VII; it also displays the percentage of those acres that are found within the planning area.

GHMA General Habitat Management Areas
GRSG Greater sage-grouse
MZ Management Zone
PHMA Priority Habitat Management Areas

Past, present, and reasonably foreseeable projects within MZ II/VII identified in Table 7-12 indicate ROW/SUA applications are anticipated to continue to increase within MZ II/VII/. Major interstate transmission lines are currently proposed in MZ II/VII, and may contribute to the cumulative impacts on GRSG and their habitat. However, by implementing avoidance and exclusion management areas on BLM-administered lands, proposed transmission lines would be restricted in GRSG habitat. Exclusion areas would strictly prohibit ROW/SUA development, while avoidance areas may allow ROW/SUA development subject to restrictions and mitigation.

Exclusion and avoidance area management areas are intended to minimize disturbance to GRSG populations by limiting the siting of roads and other ROWs/SUAs which can increase bird mortality, habitat avoidance, habitat fragmentation. Additionally, the location of tall structures can increase predation (Connelly et al. 2004). These adverse impacts would be most prevalent under Alternative A and C, as these alternatives have the fewest acres of ROW/SUA avoidance and exclusion management areas within MZ II/VII.

Reasonably foreseeable future actions (as discussed in Table 7-12) include multi-state transmission lines which cross multiple land jurisdictions, including private, state, and federally owned lands. ROW exclusion and avoidance management under the Proposed Plan or any of the alternatives would not apply to non-federal lands. Therefore, the disturbance cap limitation under the Wyoming executive order, and other state plan incentives would have a greater impact towards ameliorating the threat.

Alternative A has the most acres of PHMA open to ROW/SUA development in MZ II/VII (822,000 acres), the majority of which are located within the Bighorn Basin planning area. All other action alternatives and the Proposed Plan reduce the number of PHMA acres open to ROW/SUA in MZ II/VII by 91%. Under Alternative A, 6,624,000 acres of GHMA would be open to ROW/SUA development in the MZ; this number is reduced for all other action alternatives and the Proposed Plan, except of Alternative C (7,166,000 acres). This would result in the smallest net conservation gain for GRSG because gains would be concentrated in other portions of MZ II/VII and would also be less pronounced on BLM-administered lands in the Bighorn Basin planning area.

Acres of GRSG habitat managed as ROW/SUA exclusion in MZ II/VII are highest under Alternative B and E and, because relevant cumulative actions do not vary across alternatives, these alternatives would provide the greatest net conservation gain in terms of acres that are closed or restricted for development. The Proposed Plan relies more on ROW avoidance management to protect GRSG habitat rather than ROW exclusion. While ROW avoidance areas do not afford the same level of protection as ROW exclusion areas, ROW developments in avoidance areas would be subject to restrictions and mitigation, which would limit impacts on GRSG habitats and populations. As a result, the incremental effect of implementing the Proposed Plan in conjunction with past, present, and reasonably foreseeable future actions would be a reduction in disturbance of GRSG leks, nests, and brood-rearing and wintering areas compared to other alternatives. The anthropogenic disturbance cap would also have a similar effect.

The cumulative impact of installing multi-state transmission lines and other ROWs/SUA would include adverse effects to some populations of GRSG within MZ II/VII. These effects may include lek abandonment; removal, degradation, and fragmentation of habitat; direct mortality through collisions with vehicles; impeding migration; increased risk of predation; and spread of noxious or invasive weeds. Construction of access roads and ancillary facilities in GRSG habitat would contribute to these negative effects. BMPs, design features, state or BLM field office-specific stipulations, and Forest Standards and Guidelines are incorporated into the NEPA documents for many of these proposed transmission line in MZ II/VII. However, the extent to which these measures are to be implemented during construction is uncertain. GRSG would be particularly vulnerable to the effects of new transmission lines in Colorado, where reasonably foreseeable future transmission line project routes are proposed in both GHMA and PHMA.

The effect of the alternatives and other conservation actions in the MZ (most notably the Montana and Wyoming executive orders) could be synergistic. By implementing restrictions on infrastructure in PHMA and on state and private lands together, the cumulative beneficial effect on GRSG would be greater than the sum of their individual effects because protections would be applied more consistently across the landscape. This is especially important in areas of mixed land ownership patterns where

complementary protections can benefit leks, early brood rearing habitat, or other important areas that do not follow geopolitical boundaries.

Presidential Priority transmission projects which are proposed in MZ II/VII (i.e., TransWest Express and Gateway West), would not be subject to GRSG conservation requirements in BLM/Forest Service GRSG RMP Amendments, but would be subject to requirements in applicable state plans as well as other state and federal laws and regulations. They would also develop their own suite of protective measures analyzed in project-specific NEPA documents. Whether or not these project-specific measures would adequately protect GRSG is unknown at this point in time because the measures have not been finalized. Regardless, impacts would likely be greater in Colorado where the proposed route would impact approximately 26 miles in PACs (key habitats that are essential for GRSG conservation) and 57 miles in PHMA in the Little Snake and White River BLM Field Offices. This impact would be especially harmful to fringe GRSG populations in Colorado, as some are less robust than those in Wyoming and southern Montana. In Wyoming, the routes avoid Core Areas due to that state plan's requirements; this would reduce impacts in Wyoming.

Under all alternatives and the Proposed Plan, the cumulative effect of constructing multiple new transmission lines and other ROWs/SUAs is likely to result in negative effects to GRSG and their habitat. However, implementation of the BLM/Forest Service Proposed Plans in combination with other regional efforts would restrict the extent to which proposed ROWs/SUA could be located in or near GRSG habitat, providing more benefit to the species than current management.

Renewable Energy

Nature and Type of Effects

Impacts on GRSG from renewable energy development, such as that for wind and solar power, are similar to those from nonrenewable energy development. Additional concerns associated with wind energy developments are rotor blade noise, structure avoidance, and mortality caused by collisions with turbines (Connelly et al. 2004).

A study on specific effects of wind development on sage-grouse in south-central Wyoming showed that the relative probability of a GRSG nest failing (eggs not hatching) or brood failing (all chicks lost within 35 days post-hatch) increased with proximity to the nearest wind turbine. This study investigated short-term response of sage-grouse to a wind energy facility; additional impacts may be realized in the longer term following addition of wind turbines, due to the time lags associated with responses of breeding populations to infrastructure (Garton et al. 2011).

Conditions in MZ II/VII

While most federal lands are not currently leased or developed for wind or solar energy resources, areas of potential development coincide closely with GRSG habitats in MZ II (Manier et al. 2013). Within the Bighorn Basin planning area, renewable energy potential is present, but existing facilities are limited. Although not representative of all renewable energy development, wind turbines indirectly influence less than 1 to 2 percent of priority habitats and general habitats respectively across MZ II/VII. Private lands are host to 70 percent of wind turbines affecting GRSG in priority habitats (and 73 percent in general habitats) within MZ II/VII (Manier et al. 2013). If this trend continues into the future, conservation actions on private land are likely to have a greater potential to ameliorate the effects of wind energy development than any other single land management entity.

Impact Analysis

Table 7-8, Acres of Wind Energy Management Areas in GRSG Habitat in MZII/VII, lists acres of wind energy ROW/SUA by alternative.

Table 7-8. Acres of Wind Energy Management Areas in GRSG Habitat in MZ II/VII

	Priority Habitat Management Areas		General Habitat Management Areas	
	MZ II/VII	Percent Within Planning Area	MZ II/VII	Percent Within Planning Area
Open to Wind Rights-of-Way/Special Use Authorization				
Alternative A	0	0%	4,159,000	0%
Alternative B	0	0%	4,403,000	6%
Alternative C	0	0%	5,542,000	25%
Alternative E	0	0%	4,403,000	6%
Alternative F	0	0%	4,758,000	13%
Proposed Plan	0	0%	5,461,000	24%
Wind Right-of-Way/Special Use Authorization Exclusion				
Alternative A	3,684,000	0%	700,000	0%
Alternative B	4,214,000	13%	1,407,000	50%
Alternative C	3,684,000	0%	848,000	17%
Alternative E	4,915,000	25%	1,407,000	50%
Alternative F	3,761,000	2%	916,000	23%
Proposed Plan	3,796,000	3%	958,000	27%
Wind Right-of-Way/Special Use Authorization Avoidance				
Alternative A	4,179,000	0%	2,827,000	0%
Alternative B	4,880,000	14%	3,783,000	25%
Alternative C	4,179,000	0%	4,427,000	36%
Alternative E	4,179,000	0%	3,783,000	25%
Alternative F	5,217,000	20%	4,029,000	30%
Proposed Plan	5,184,000	19%	3,323,000	15%

Source: BLM 2015

This table displays the acres of PHMA and GHMA within wind energy management areas in MZ II/VII; it also displays the percentage of those acres that are found within the planning area.

GHMA General Habitat Management Areas
GRSG Greater sage-grouse
MZ Management Zone
PHMA Priority Habitat Management Areas

No PHMA would be managed as open to wind ROWs/SUAs in MZ II/VII under any of the alternatives or the Proposed Plan. All action alternatives and the Proposed Plan would manage GHMA as open to wind ROWs/SUAs in MZ II/VII to varying degrees with Alternative C (5,542,000 acres) and the Proposed Plan (5,461,000 acres) designating the most open acres within the MZ.

Alternative B and E would manage more acres of GRSG habitat in MZ II/VII as wind ROW/SUA exclusion compared to the other alternatives and the Proposed Plan. This would include 4,214,000 acres of PHMA and 1,407,000 acres of GHMA managed as ROW/SUA exclusion under Alternative B; 4,915,000 acres of PHMA and 1,407,000 acres of GHMA under Alternative E.

The Proposed Plan relies more on wind ROW avoidance management to protect GRSG habitat rather than wind ROW exclusion. Similar to other ROWs, this approach preserves management flexibility in situations where landownership is mixed. Without this flexibility, rerouting ROWs/SUAs across nonfederal land may result in a longer route, increasing disturbance of GRSG leks, nests, and brood-rearing and wintering areas more than direct routing across federal land.

Managing wind ROW/SUA avoidance and exclusion areas in GRSG habitat would reduce or minimize impacts from wind utility infrastructure on BLM-administered land by prohibiting or restricting new ROWs/SUAs. In addition, renewals or upgrades of existing facilities could incorporate additional conservation actions. Collocation or clustering of facilities would reduce impacts on GRSG habitat and would reduce disturbance in new areas.

Reasonably foreseeable future projects within MZ II/VII include renewable energy developments, such as the Chokecherry/Sierra Madre Wind Farm in southern Wyoming. Projects which require state agency review or approval would be subject to the Wyoming executive order permitting process for development in Core Areas, which would encourage ROW/SUA development outside of Core Areas and restrict surface occupancy within 0.6 miles of occupied leks.

Impacts would be minimized on BLM-administered land across all alternatives by adhering to the wildlife protection provisions of the Wind Energy Development Programmatic EIS (BLM 2005). Implementation of wind energy ROW/SUA avoidance in PHMA for all BLM/Forest Service Proposed Plans, in combination with the disturbance caps under the state plans, exclusion zones in other BLM planning areas and other past, present, and reasonably foreseeable future actions, would provide the greatest net conservation gain to GRSG in MZ II/VII.

7.1.6.3 Grazing/Free-Roaming Equids

Nature and Type of Effects

In general, livestock can influence habitat by modifying plant biomass, plant height and cover, and plant species composition. As a result, livestock grazing could cause changes in habitat that alter species abundances and composition in GRSG insect prey. Changes in plant composition could occur in varying degrees and could change vegetative structure, affecting cover for nesting birds. Grazing could also alter fire regimes (Davies et al. 2010).

If not managed properly, cattle and sheep grazing could compact soil, enrich soil with nutrients, trample vegetation and nests, directly disturb GRSG, and negatively affect GRSG recruitment. Cattle and sheep also can reduce invertebrate prey for GRSG or increase their exposure to predators (Beck and Mitchell 2000, Pp. 998-1,000; Knick 2011; Coates 2007, Pp. 28-33). Grazing in riparian areas can destabilize streams and riverbanks, cause the loss of riparian shade, and increase sediment and nutrient loads in the aquatic ecosystem (George et al. 2011). Stock watering tanks can contribute to stream and aquifer

dewatering and may concentrate livestock movement and congregation in sensitive areas (Vance and Stagliano 2007).

Grazing can be used to reduce fuel load and reduce the risk of wildfire (Connelly et al. 2004, Pp. 7, 28-30). Under certain conditions, grazing can reduce the spread of invasive grasses, if applied early in the season before the grasses have dried (Strand and Launchbaugh 2013). Light to moderate grazing does not appear to affect perennial grasses, which are important to nest cover (Strand and Launchbaugh 2013). However, excessive grazing can eliminate perennial grasses and lead to expansion of invasive species such as cheatgrass or Japanese brome (Reisner et al. 2013).

A well-developed understory of grass, forbs, and deciduous shrubs is critical for GRSG and other wildlife. Impacts on habitat vary with livestock densities and distribution; the more evenly livestock is distributed, the lower its impact on any given area (Gillen et al. 1984). However, cattle show a strong preference for certain areas, leading to high use in some areas and little to no use in others. Livestock grazing is generally limited by slopes of greater than 60 percent, dense forests and vegetation, poor or little upland forage, and lack of water (Holechek et al. 2010).

Although livestock grazing is the most widespread land use across the sagebrush biome, it exerts a more limited influence on soils and vegetation than land uses that remove or fragment habitat (e.g., mineral extraction or infrastructure development). GRSG are able to co-exist with grazing animals when properly managed. Thus, reducing AUMs or acres open to grazing would not necessarily restore high-quality GRSG habitat.

Reducing grass height caused by livestock grazing in GRSG nesting and brood-rearing areas has been shown to negatively impact nesting success. Livestock grazing could reduce the suitability of breeding and brood-rearing habitat, which would impact GRSG populations (USFWS 2010).

Since the passage of the 1934 Taylor Grazing Act, range conditions on BLM-administered lands have improved due to improved grazing management practices and decreased livestock numbers and annual duration of grazing. In addition, the BLM has applied Standards for Rangeland Health since 1997. The purpose of this practice is to enhance sustainable livestock grazing and wildlife habitat, while protecting watersheds and riparian ecosystems.

For BLM-administered lands, Standards for Rangeland Health require the BLM to ensure rangelands are capable of sustaining viable populations and a diversity of native plant and animal species appropriate to the habitat. Habitats that support or could support threatened species, endangered species, or species of special concern sensitive species will be maintained or enhanced. The BLM Washington Office Instruction Memorandum 2009-018 serves as an aid to BLM field offices in determining priorities for focusing resources when processing permits and leases. The IM is based upon rangeland health, and considers critical habitat conditions, conflicts with GRSG, and whether projects have been proposed for implementing the Healthy Lands initiative. The authorized officer shall take appropriate action upon determining that existing management needs to be modified to ensure that standards are met or are making significant progress towards meeting standards. Modifying management could involve a variety of actions including, but not limited to, changing animal kind, changing season of use, adjusting AUMs, adjusting livestock numbers, implementing a grazing prescription or implementing range improvement projects.

On National Forest Systems lands, livestock grazing is administered in accordance to the Multiple Use and Sustained Yield Act of 1960. As with BLM-administered lands, the Forest Service issues livestock grazing permits for a period of up to 10 years that are generally renewable if it is determined that the terms and conditions of the permit are being met and the ecological condition of the rangelands are meeting the fundamentals of rangeland health.

Range improvements could result in livestock overusing important GRSG areas. For example, developing springs would generally change vegetative composition from a high diversity of grasses and forbs, important to broods, to one dominated by grasses.

Concentrated livestock use can remove standing vegetation and subsequently reduce associated insects and forbs, both of which are important to GRSG broods. Allowing spring developments along ephemeral streams and wetlands and allowing livestock watering tanks would decrease GRSG habitat. Springs, seeps, and wetland areas are vitally important to GRSG broods; therefore, allowing spring developments could reduce resources for GRSG.

Other direct and indirect effects may occur from range improvements. Water developments may also contribute to the increased occurrence of West Nile virus (Walker and Naugle 2011). Barbed wire fences contribute to direct mortality through fence collisions (Stevens et al. 2011).

Conditions in MZ II/VII

In general, the risks to GRSG and their habitat associated with improper grazing practices are less in the northerly, wetter parts of GRSG range (i.e., MZ I and northern portions of MZ II/VII) than across the arid semi-deserts of the rest of MZ II/VII. Nonetheless, livestock grazing is widespread across MZ II/VII, and may, if improperly conducted, pose a substantial threat to GRSG habitat (Stiver et al. 2006).

A large portion of the central regions of MZ II/VII (approximately 5 million acres) is federally managed wild horse and burro range, suggesting potential effects to GRSG from livestock grazing and the compounding effects of free-roaming equids (Manier et al. 2013). Within MZ II/VII, 19.9 percent of priority habitats are negatively influenced by free-roaming equids (Manier et al. 2013). Two designated herd management areas (HMAs) occur on BLM-administered lands in the planning area, both which contain GHMA and PHMA.

Impact Analysis

Table 7-9, Acres Available and Unavailable to Livestock Grazing in GRSG Habitat in MZ II/VII, lists the acres of PHMA and GHMA available and unavailable for grazing, by alternative.

Table 7-9. Acres Available and Unavailable to Livestock Grazing in GRSG Habitat in MZ II/VII

	Priority Habitat Management Areas		General Habitat Management Areas	
	MZ II/VII	Percent Within Planning Area	MZ II/VII	Percent Within Planning Area
Available to Livestock Grazing				
Alternative A	8,901,000	13%	9,667,000	21%
Alternative B	7,786,000	0	8,829,000	13%
Alternative C	7,786,000	0%	10,782,000	29%
Alternative E	7,786,000	0	1,194,000	98%
Alternative F	8,901,000	13%	9,667,000	21%
Proposed Plan	8,901,000	13%	9,705,000	21%
Unavailable to Livestock Grazing				
Alternative A	28,000	0%	16,000	31%
Alternative B	1,231,000	100%	7,460,000	98%
Alternative C	28,000	0%	16,000	31%
Alternative E	1,259,000	98%	746,000	98%
Alternative F	28,000	0%	16,000	31%
Proposed Plan	28,000	0%	16,000	31%

Source: BLM 2015

This table displays the acres of PHMA and GHMA available and unavailable to livestock grazing in MZ II/VII; it also displays the percentage of those acres that are found within the planning area.

GHMA General Habitat Management Areas
GRSG Greater sage-grouse
MZ Management Zone
PHMA Priority Habitat Management Areas

Under Alternative A, 8,901,000 acres of PHMA would be available to livestock grazing in MZ II/VII; 9,667,000 acres of GHMA acres would be available. Under Alternative F and the Proposed Plan, a similar amount of GRSG habitat acres are available for livestock grazing on federal lands. Alternatives B and E place more restrictions on grazing by designating more acres of PHMA and GHMA within the MZ as unavailable to livestock grazing. These restrictions would help to protect GRSG habitat from the potential effects of improper livestock grazing on BLM-administered lands and National Forest System lands.

As literature suggests that moderate grazing is compatible with GRSG habitat (Strand and Launchbaugh 2013), closing acres to grazing may not itself benefit or harm GRSG. As described above under Nature and Type of Impacts, possibly equally or more beneficial is restricting range improvements in GRSG habitat, limiting fencing, and effectively implementing range health standards on grazing allotments in GRSG habitat.

The COT report objectives for livestock grazing are to manage grazing in a manner consistent with local ecological conditions. This type of management would maintain or restore healthy sagebrush shrub and native perennial grass and forb communities and conserve essential habitat components for GRSG. The

COT report also states that land managers should avoid or reduce the impact of range management structures on GRSG habitat.

Under the Proposed Plan, management actions specifically related to GRSG would help reduce the threat of grazing throughout the MZ to meet the COT report objectives. For example, allotments within PHMAs, (focusing on those containing riparian areas, including wet meadows), will be prioritized for field checks to help ensure compliance with the terms and conditions of the grazing permits. Field checks could include monitoring for actual use, utilization, and use supervision. Other alternatives do not include a similar action, therefore the Proposed Plan would afford greater protection to GRSG from improper grazing practices on BLM-administered lands by increased monitoring of PHMAs.

In addition, all BLM/Forest Service Proposed LUPs in MZ II/VII would prioritize SFAs for grazing permit renewals, to determine if modification is necessary prior to renewal. This would provide an opportunity to adjust forage levels to meet rangeland health standards, thereby reducing the risk of non-functioning rangelands impacting GRSG habitats. The BLM establishes an appropriate management level for each HMA, which represents the population objective for free-roaming equids. Under all alternatives and the Proposed Action, the BLM has the ability to adjust appropriate management levels of wild horses if resource damage occurs. Additionally, under all action alternatives and the Proposed Plan, HMA plans will be updated to include GRSG objectives. This will result in a net conservation gain for GRSG. Under alternatives B, E, F, and the Proposed Plan, the BLM would apply season restrictions from February 1 to July 31 within the two HMAs in the Bighorn Basin planning area. Therefore, the cumulative net conservation gain in MZ II/VII would be slightly greater compared to alternatives A and C, as seasonal surface disturbance restrictions for wild horse management would also benefit GRSG during nesting and early brood-rearing season.

BLM/Forest Service grazing and free-roaming equid management actions in MZ II/VII would not apply on non-federal lands. Conservation initiatives conducted through the NRCS's SGI would have a greater direct impact towards ameliorating the threat on these lands. Since 2010, SGI has enhanced rangeland health through rotational grazing systems, re-vegetating former rangeland with sagebrush and perennial grasses and control of invasive weeds. On privately-owned lands, SGI has developed a prescribed grazing approach that balances forage availability with livestock demand. This system allows for adjustments to timing, frequency, and duration of grazing, ensuring rangelands are managed sustainably to provide continued ecological function of sagebrush-steppe. A primary focus of the prescribed grazing approach is maintenance of key plant species, such as deep-rooted perennial grasses that have been shown to be essential for ecological resistance to invasive annual grasses (Reisner et al. 2013, pp. 1047-1048). These actions help to alleviate the adverse impacts associated with improper grazing practices outlined above under Nature and Type of Effects. Within MZ II/VII, SGI has implemented 552,600 acres of prescribed grazing systems. This program is likely the largest and most impactful program on private lands within MZ II/VII. Because of its focus on priority areas for conservation, which often overlap PHMA, the SGI's past, present, and reasonably foreseeable work has had and likely will continue to have a cumulative beneficial impact on GRSG when considered alongside protective BLM management actions in PHMA.

Candidate Conservation Agreements with Assurances are another tool being implemented to protect private lands from the threat of improper grazing. Candidate Conservation Agreements with Assurances are voluntary conservation agreements between the USFWS and one or more federal or private partners (e.g., the BLM). In return for managing lands to benefit GRSG, landowners receive assurances against additional regulatory requirements should GRSG be listed under the Endangered Species Act. Within Wyoming, the USFWS and Wyoming Governor's Office in conjunction with the BLM, Natural Resources Conservation Service, Forest Service, and other agencies, have developed an umbrella Candidate

Conservation Agreement with Assurances for range management activities. Enrolled landowners are expected to comply with grazing specific conservation measures including but not limited to: avoid (or rotationally utilize) known nesting and brood-rearing habitat as a location for activities that concentrate livestock such as stock tank placement branding and roundup; place salt or mineral supplements in sites minimizing impacts to GRSG habitat; and within 24 months develop and implement a written grazing management plan to maintain or enhance the existing plant community as suitable GRSG habitat (USFWS et al. 2013). The incremental effects of the Natural Resources Conservation Service actions under the SGI, (including fence marking and conservation easements), Candidate Conservation Agreements with Assurances, and state efforts to maintain ranchland, BLM management actions (related to grazing and free-roaming equids) would provide a net conservation gain to GRSG in MZ II/VII.

7.1.6.4 Spread of Weeds

Nature and Type of Effects

As discussed in Chapter 4, invasive weeds alter plant community structure and composition, productivity, nutrient cycling, and hydrology. Invasive weeds also may cause declines in native plant populations, including sagebrush habitat, through such factors as competitive exclusion and niche displacement. Invasive plants reduce and may eliminate vegetation that GRSG use for food and cover. Invasive weeds fragment existing GRSG habitat and reduce habitat quality by competitively excluding vegetation essential to GRSG. Invasive weeds can also create long-term changes in ecosystem processes, such as fire cycles and other disturbance regimes that persist even after an invasive plant is removed (Connelly et al. 2004).

Roads and recreation can promote the spread of invasive weeds through vehicular traffic. Weed infestations can further exacerbate the fragmentation effects of roadways. Irrigation water has also supported the conversion of native plant communities to hayfields, pasture, and cropland, thus fragmenting sagebrush habitats. Excessive grazing in these habitats can lead to the demise of the most common perennial grasses in this system and an abundance of invasive species such as cheatgrass or Japanese brome (Reisner et al. 2013).

Conditions in MZ II/VII

By means of seeds carried by wind, humans, machinery, and animals, invasive and noxious weeds have invaded and will continue to invade many locations in MZ II/VII, including the planning area. Cheatgrass (one of the primary invasive species threatening GRSG habitat) is found throughout MZ II/VII, and is generally more abundant in comparison to MZ I due to more favorable climate conditions.

The BLM currently manages weed infestations through integrated weed management, including biological, chemical, mechanical, manual, and educational methods. It is guided by the 1991 and 2007 Records of Decisions (RODs) for Vegetation Treatment on BLM Lands in Thirteen Western States (BLM 1991) and by the 2007 Programmatic Environmental Report (BLM 2007). Weeds are managed in cooperation with county governments and represent a landscape-level approach across management jurisdictions.

Impact Analysis

Increased surface disturbance, motorized transportation, and animal and human activity would increase the chance for invasive plants to establish and spread.

The BLM and National Forest System manage weed infestations through integrated weed management practices, which include biological, chemical, mechanical, manual, and educational methods. This

general approach for combating infestations will continue under all alternatives and the Proposed Plan. Increased activity (e.g., surface disturbance, motorized transportation, and animal or human activity) would increase the likelihood for the spread and establishment of invasive plants, regardless or surface land ownership. Alternatives A and C would place the fewest constraints on resource uses, and would allow for the most acres of surface disturbing activities within GRSG habitat in MZ II/VII. Therefore, the potential for invasive weed spread and establishment would be greatest under this alternative, and effects to GRSG (e.g., reduction in quality of habitat) would be more pronounced. Reasonably foreseeable future projects which result in surface disturbance within or near GRSG habitat could increase the likelihood of invasive weed spread under these alternatives.

Relevant cumulative actions that result in surface-disturbing activities would increase the potential for the spread of invasive weeds on federal and non-federal lands. Projects subject to the general stipulations outlined in the Wyoming and Montana executive orders are required to control noxious and invasive weed species and to use native seed mixes during reclamation processes. These stipulations would benefit GRSG Core Areas by limiting the spread or establishment of invasive species, particularly on lands that lack BLM protective regulatory mechanisms. Additionally, the Colorado Package has identified GRSG conservation strategies related to invasive weeds, such as interagency cooperation, mapping, monitoring, and integrated weed management treatments. However, complete weed eradication within MZ II/VII is not anticipated under any alternative or the Proposed Plan because of the scale and scope of efforts needed for complete eradication.

Alternatives B and E, would place the most restrictions on resource uses within GRSG habitat on BLM-administered land. Therefore, less disturbance associated with resource uses is likely to occur under these alternatives, which would reduce the potential for invasive weed spread and establishment on BLM-administered lands. Protective stipulations, in combination with state and county noxious weed regulations, continued integrated weed management practices, and other past, present and reasonably foreseeable future actions would provide a net conservation gain to GRSG habitats and populations in MZ II/VII under the Proposed Plan and the other RMP alternatives by restoring degraded sagebrush habitat and increasing native forbs, thus improving nest cover and food supply.

7.1.6.5 Conversion to Agriculture/Urbanization

Nature and Type of Effects

Converting sagebrush habitat to agricultural use, causes direct loss of habitat available for GRSG. Habitat loss also decreases the connectivity between seasonal habitats, increasing population isolation and fragmentation. Fragmentation then increases the probability for decline of the population, reduced genetic diversity, and extirpation from stochastic events (Knick and Hanser 2011).

In addition to reducing the land area available to support GRSG, habitat loss and fragmentation also results in other disturbances, such as human traffic, that increase the potential for wildfire and invasive plant spread.

Converting cropland has eliminated or fragmented sagebrush on private lands in areas with deep fertile soils or irrigation potential. Sagebrush remaining in these areas has been limited to the agricultural edge or to relatively unproductive environments that are ill-suited to sustaining leks, although these area may be beneficial for brood-rearing GRSG depending upon the particular crop.

Biofuel production and small grain prices have increased the conversion to cropland of native grasslands or lands formerly enrolled in the US Department of Agriculture's Conservation Reserve Program. This conversion of private lands further emphasizes the cumulative importance of BLM-administered lands

and associated private grazing lands in maintaining large blocks of native grassland and shrubland habitats suitable for GRSG.

Conditions in MZ II/VII

Less than 1 percent of priority habitats and 2 percent of general habitats in MZ II/VII are directly influenced by agricultural development (Manier at al 2013). Approximately 4 percent of habitat has been converted for agricultural use in the Wyoming Basin compared to 19 percent in the Great Plains (i.e., MZ I), (Knick et al. 2011).

Urban development also results in permanent loss of GRSG habitat. Human population centers continue to grow and expand across the range. The direct footprint of urban development is higher in priority habitats in MZ II/VII compared to other parts of the GRSG range, though it is still low (approximately 1 percent) compared to other threats (Manier et al. 2013). However, percentages and associated disturbance are higher in some areas. In some Colorado counties, fifty percent of sage-grouse habitat has been subdivided, while an estimated 3 to 5 percent of all historical habitat in Colorado has been converted into urban areas (Braun 1998; USFWS 2010).

Impact Analysis

The BLM does not convert public lands to agriculture. As such, the only direct authority it has over conversion to agriculture is by retaining or disposing of lands in the realty program. Disposing of lands could increase the likelihood they will be converted to agriculture, depending on their location and the policies of the new management authority. Lands retained under BLM management will not be converted to agriculture under any alternative.

As shown below in Table 7-10, Acres Identified for Retention and Disposal in GRSG Habitat in MZ II/VII, these acreages vary relatively little between alternatives.

Table 7-10. Acres Identified for Retention and Disposal in GRSG Habitat in MZ II/VII

	Priority Habitat Management Areas		General Habitat Management Areas	
	MZ II/VII	Percent Within Planning Area	MZ II/VII	Percent Within Planning Area
Acres Identified for Retention				
Alternative A	7,278,000	15%	8,855,000	22%
Alternative B	7,414,000	17%	8,808,000	21%
Alternative C	6,185,000	0%	9,946,000	30%
Alternative E	7,414,000	17%	8,808,000	21%
Alternative F	7,290,000	15%	8,890,000	22%
Proposed Plan	7,301,000	15%	8,928,000	22%
Acres Identified for Disposal				
Alternative A	46,000	48%	189,000	44%
Alternative B	26,000	8%	127,000	17%
Alternative C	24,000	0%	213,000	51%
Alternative E	26,000	8%	127,000	17%
Alternative F	36,000	33%	156,000	32%
Proposed Plan	24,000	0%	156,000	33%

Source: BLM 2015

This table displays the acres of PHMA and GHMA identified for retention and disposal in MZ II/VII; it also displays the percentage of those acres that are found within the planning area.

GHMA General Habitat Management Areas
GRSG Greater sage-grouse
MZ Management Zone
PHMA Priority Habitat Management Areas

BLM land tenure adjustments require site-specific NEPA analysis, and land sales must meet specific disposal criteria. Lands identified for disposal in MZ II/VII are typically small isolated parcels that are difficult to manage and do not have high resource value. BLM land tenure adjustments are not anticipated to be a significant contributing element to the threat of agricultural conversion because of the small number of acres involved and the criteria in place that would reduce the likelihood of disposing of parcels containing significant wildlife value, (such as those lands containing leks, early brood rearing habitat, or winter habitat). As a result, cumulative impacts would vary relatively little across alternatives and BLM/Forest Service management would have little impact on alleviating this threat.

Studies of agricultural conversion risk on grasslands have shown a high probability of grassland plots being converted to cropland under current economic and climatic conditions (Rashford et al. 2013). The recent federal Farm Bill tried to discourage converting prairie to cropland by denying crop insurance for such conversions. Nevertheless, if corn and other crop prices remain high, the economic incentive to convert parcels to cropland in GRSG habitat areas will continue and will potentially increase.

The COT Report objectives for converting land to agriculture are to avoid further loss of sagebrush habitat for agricultural activities (both plant and animal production) and to prioritize restoration. In areas where taking agricultural lands out of production has benefited GRSG, the programs supporting

these actions should be targeted and continued (USFWS 2013). In accordance with this objective, the NRCS's SGI program focuses on maintaining ranchland that provides habitat for GRSG.

This voluntary program provides private landowners with monetary incentives to protect GRSG habitat, often through conservation easements. As a result, private land containing GRSG habitat is protected from conversion to agriculture or other development for the life of the conservation agreement. The conservation easements and other conservation incentives, such as restoration of water features and fence marking, can enhance the ability of private ranchlands to support GRSG. As of 2015, SGI has secured conservation easements on 243,400 acres within MZ II/VII, and marked or removed 23 miles of fence (NRCS 2015). This has preserved habitat and reduced the risk of direct mortality on these lands.

These efforts, in conjunction with BLM management, would provide a net conservation gain to GRSG in MZ II/VII, but its impact would be localized and not likely to ameliorate the threat because of limited management authority.

7.1.6.6 Fire

Nature and Type of Effects

Sagebrush killed by wildfire often requires many years to recover, especially after large fires. Contiguous old-growth sagebrush sites are at high fire risk, as are large blocks of contiguous dead sagebrush and sagebrush sites with a substantial cheatgrass understory. Before recovering, these sites are of limited use to GRSG, except along the edges and in unburned islands.

Because of its widespread impact on habitat, fire has been identified as a primary factor associated with GRSG population declines. Depending on the species of sagebrush and the size of a burn, a return to a full pre-burn community cover can take from 25 to 120 years (Baker 2011). In addition, fires can reduce invertebrate food sources and may facilitate the spread of invasive weeds.

While most sagebrush subspecies are killed by fire and slow to reestablish, cheatgrass recovers within one to two years of a fire from seed in the soil. This annual recovery leads to a reoccurring fire cycle that prevents sagebrush reestablishment (USFWS 2010, P. 13932).

BLM management to prevent or control wildfires can also affect GRSG and habitat. Increased human activity and noise associated with fire suppression, fuels treatments, and prescribed fire in areas occupied by GRSG could affect nesting, breeding, and foraging behavior. Important habitats could be altered because of the use of heavy equipment, hand tools, and noise.

In addition, suppression may initially result in higher rates of conifer encroachment in some areas. In the initial stages of encroachment, fuel loadings remain consistent with the sagebrush understory. As conifer encroachment advances, fire return intervals are altered by decreasing understory abundance. The depleted understory causes the stands to become resistant to low intensity wildfires; over years, the accumulating conifer loads contribute to larger-scale wildfires and confound control efforts due to extreme fire behavior.

Conditions in MZ II/VII

Fuels models predict fire risk as generally low across MZ II/VII with 10 percent of priority habitats and general habitats at high risk for fire (Manier et al. 2013). Within the Bighorn Basin planning area, wildfires and prescribed burns are more prevalent at lower elevations, except near river bottoms where vegetation density is higher. Upslope of the basin bottom, wildfires and prescribed burns are more common.

Impact Analysis

BLM/Forest Service management actions in MZ II/VII that emphasize wildfire suppression in GRSG habitat would benefit the species by limiting habitat loss in the event of a wildfire. BLM/Forest Service Proposed Plans would prioritize suppression immediately after life and property to conserve GRSG habitat. In GHMA, suppression would be prioritized where wildfires threaten priority sage-grouse habitat.

The Wyoming and Montana executive orders emphasize fire suppression in Core Population Areas, while recognizing other suppression priorities may take precedent. This would benefit GRSG habitat during wildfire planning and response, particularly on lands not administered by the BLM or Forest Service.

WAFWA's guidance on fire and fuels management for GRSG conservation (WAFWA 2014) promotes coordination among local fire response agencies similar to a "natural disaster" response; it emphasizes the importance of fuel breaks and the need to incorporate GRSG habitat objectives in fire management, as well as the use of grazing as a fuel reduction tool.

On the local level, the Bighorn Basin Sage-grouse Conservation Plan (Bighorn Basin Sage-grouse Local Working Group 2007) includes recommended management practices related to fire and fuels management such as evaluate all wildfires greater than 40 acres in occupied GRSG habitat to determine if rehabilitation of the burned area is needed; and protect and maintain areas of unburned sagebrush within perimeter of treated areas to allow for use in the untreated portion of a pasture or allotment.

Recognition of the importance of sagebrush habitat during interagency wildfire response would benefit the GRSG in the event of an unplanned fire. The Interagency Standards for Fire and Fire Aviation Operations "Red Book" includes a BMP for GRSG habitat conservation for wildlife and fuels management (BLM 2013). This document serves as supplemental policy or guidance for the BLM, Forest Service, and USFWS. This BMP would benefit the GRSG (particularly during interagency wildland fire operations) by utilizing spatial habitat data and using predictive services to prioritize and preposition firefighting resources in critical habitat areas. The coordination of federal, state, and local fire prevention actions, changes in fire management, and other past, present, and reasonably foreseeable future actions would provide a net conservation gain to GRSG in MZ II/VII. The gain would be greatest under the Proposed Plan because of increased fire and fuels management flexibility (e.g., by designing fuels treatments in protect and improve GRSG habitat), interagency coordination, and emphasis on preserving and restoring GRSG habitat.

7.1.6.7 Recreation

Nature and Type of Effects

Recreation such as camping, bicycling, wildlife viewing, horseback riding, fishing, and hunting can be dispersed, concentrated (e.g., OHV use and developed campsites), or permitted (e.g., BLM Special Recreation Permit). The BLM also manages Special Recreation Management Areas (SRMAs), where recreation is a primary resource management consideration.

Recreation on federally administered lands that use the extensive network of double-track and single-track routes have an impact on sagebrush and GRSG. Ecological impacts of roads and motorized trails include mortality due to collisions; behavior modifications due to noise, activity, and habitat loss; alteration of physical environment; nutrient leaching; erosion; invasive plants spread; increased use; and alteration by humans due to accessibility (Knick et al. 2011). Recreation activities can degrade GRSG habitat through direct impacts on vegetation and soils, introduction or spread of invasive species, and

habitat fragmentation. This occurs in areas of concentrated use, trailheads, staging areas, and routes and trails.

Motorized activities, including OHV use, are expected to have a larger footprint on the landscape. They are anticipated to have the greatest level of impact due to noise levels, compared to nonmotorized uses such as hiking or equestrian use. Cross-country motorized travel, which is permitted in designated areas on BLM-administered lands but not on National Forest System lands, would increase the potential for soil compaction, loss of perennial grasses and forbs, and reduced sagebrush canopy cover. Losses in sagebrush canopy could be the result of repeated, high-frequency, cross-country OHV use over long periods. In addition, the chances of wildfire are increased during the summer, when fire dangers are high and recreation is at its highest.

Dispersed uses expand the human footprint. Closing areas to recreation and reclaiming unused, minimally used, or redundant roads in and around sagebrush habitats during seasonal use by GRSG may reduce the footprint and presumably impacts on wildlife. Restricting access to important habitat areas during seasonal use (lekking, nesting, brood-rearing, and wintering) may decrease the impacts associated with humans. However, access restriction will not eliminate other impacts, such as invasive plant spread, predator movements, cover loss, and erosion (Manier et al. 2013).

Conditions in MZ II/VII

BLM, Forest Service, and other agencies provide a variety of dispersed recreation opportunities within MZ II/VII governed by laws, policy, and guidance. Recreation also occurs on private land with fewer restrictions. Within the planning area, year-round dispersed recreational opportunities are available. Increased visitation to small towns and destination resorts contribute to the increased use of public lands within the planning area. The central and eastern portions of the planning area, as well as the western slopes of the Big Horn Mountains provide more accessible public access to BLM-administered lands, and therefore increased levels of recreation compared to the Absaroka Foothills region where public access is more limited.

Impact Analysis

Table 7-11, Acres of Travel Management Designations in GRSG Habitat in MZ II/VII, shows acres of GRSG habitat open, limited, or closed to travel in MZ II/VII.

Table 7-11. Acres of Travel Management Designations in GRSG Habitat in MZ II/VII

	Priority Habitat Management Areas		General Habitat Management Areas	
	MZ II/VII	Percent Within Planning Area	MZ II/VII	Percent Within Planning Area
Open				
Alternative A	5,000	0%	53,000	5%
Alternative B	5,000	0%	55,000	5%
Alternative C	5,000	0%	67,000	22%
Alternative E	5,000	0%	55,000	5%
Alternative F	5,000	0%	58,000	10%
Proposed Plan	5,000	0%	58,000	10%
Limited				
Alternative A	8,859,000	13%	9,293,000	21%
Alternative B	8,931,000	13%	9,125,000	20%
Alternative C	7,747,000	0%	10,449,000	30%
Alternative E	8,931,000	13%	9,125,000	20%
Alternative F	8,861,000	13%	9,294,000	21%
Proposed Plan	8,861,000	13%	9,331,000	21%
Closed				
Alternative A	113,000	4%	371,000	18%
Alternative B	158,000	31%	429,000	29%
Alternative C	109,000	0%	317,000	3%
Alternative E	158,000	31%	429,000	29%
Alternative F	112,000	3%	366,000	16%
Proposed Plan	112,000	3%	366,000	16%

Source: BLM 2015

This table displays the acres of PHMA and GHMA within travel management designations of open, limited and closed in MZ II/VII; it also displays the percentage of those acres that are found within the planning area.

GHMA General Habitat Management Areas
GRSG Greater sage-grouse
MZ Management Zone
PHMA Priority Habitat Management Areas

The COT Report objectives for recreation are to maintain healthy native sagebrush communities, based on local ecological conditions, and to manage direct and indirect human disturbance (including noise) to avoid interruption of normal GRSG behavior (USFWS 2013). Limits on road use under the action alternatives and the Proposed Plan, and limits on OHVs would help meet these objectives.

As shown in Table 7-11, acres of GRSG habitat closed to motorized vehicles would be greatest under Alternative B and E; and less under all other alternatives and the Proposed Plan. However, the vast majority of GRSG habitat on BLM/Forest Service lands in MZ II/VII would be designated as limited to existing routes. As such, OHVs would be prohibited from traveling off existing routes, which would

reduce the risk of direct and indirect effects from recreational motorized vehicles. Approximately 5,000 acres of PHMA in MZ II/VII would be open to OHV use under all alternatives and the Proposed Plan; between 53,000 and 67,000 acres of GHMA would be open under all alternatives and the Proposed Plan. In these areas, habitat degradation, behavior disruptions, and the potential for other direct and indirect effects caused by recreational use would be higher. However, these lands constitute a relatively small percentage of all PHMA and GHMA in MZ II/VII, therefore, the effects would be localized and no notable differences are anticipated in cumulative impacts across the alternatives.

On the local level, the Bighorn Basin Sage-grouse Conservation Plan (Bighorn Basin Sage-grouse Local Working Group 2007) includes recommended management practices related to recreation management such as includes recreation recommended management practices such as restricting organized recreational activities between March 15 and July 15 within two miles of a lek site, and discourage dispersed camping within important riparian habitats occupied by GRSG during late summer. Other local working groups within MZ II/VII include similar recommendations.

Implementation of the action alternatives and Proposed Plan described above, in concert with travel management planning on BLM-administered lands within MZ II/VII, the disturbance caps applied under the state plans, and other past, present, and reasonably foreseeable future actions would help reduce the threat of recreation and travel on GRSG populations and habitats and would provide a net conservation benefit to GRSG in MZ II/VI.

7.1.6.8 Conifers

Nature and Type of Effects

Conifer woodlands, especially juniper (*Juniperus* spp.) and in some regions pinyon pine (*Pinus edulis*), may expand into sagebrush habitat and reduce availability of habitat for GRSG. Conifer expansion may be encouraged by human activities, including fire suppression and grazing (Miller et al. 2011). If woodland development is sufficient to restrict shrub and herbaceous understory growth, habitat quality for GRSG will be reduced (Connelly et al. 2004). Mature trees offer perch sites for raptors; thus, woodland expansion may also increase the threat of predation, as with powerlines (Manier et al. 2013). Locations within approximately 1000 yards of current pinyon-juniper woodlands are at highest risk of expansion (Bradley 2010). The greatest risks from conifer encroachment are thought to be in the Great Basin, with smaller risks (6 to 7 percent of PH and GH) in the Wyoming Basin (Connelly et al. 2004; Manier et al. 2013). Studies have shown that GRSG incur population-level impacts at very low levels of conifer encroachment (Baruch-Mordo et al. 2013).

Conditions in MZ II/VII

Approximately 46 percent of conifer encroachment risk in priority habitats (and 43 percent in general habitats) occur on BLM-administered lands within MZ II/VII (Manier et al. 2013). Therefore, BLM actions are likely to have a greater potential to ameliorate the effects of conifer encroachment on GRSG than any other single land management entity.

Impact Analysis

Specific required design features common to all BLM/Forest Service plans in MZ II/VII include removal of standing and encroaching trees within 100 meters of occupied leks and other habitats (e.g., nesting, wintering, and brood rearing). Additionally, reintroduction of appropriate fire regimes would limit conifer encroachment into the sagebrush plant communities. These actions would benefit GRSG by improving the quality of habitat throughout the MZ.

Additionally, under all action alternatives and the Proposed Plan, conifer removal treatments would be prioritized closest to occupied GRSG habitats and near occupied leks, and where juniper encroachment is phase 1 or phase 2. This action would benefit GRSG by improving the quality of habitat and functionality. Alternative A, does not prioritize conifer removal treatments in areas closest to occupied GRSG habitats, therefore the risk of conifer encroachment would be greater under this alternative.

Recommendations within the Wyoming GRSG Conservation Plan (WSGWG 2003) call for removal of juniper and other conifers where they have invaded sagebrush sites important to GRSG, which could help ameliorate the threat on non-BLM lands. In Colorado, the Colorado Parks and Wildlife has conducted conifer treatments totaling 2,600 acres (Colorado Department of Natural Resources 2013).

SGI has helped reduce the threat of early succession conifer encroachment through mechanical removal on 10,500 acres of private lands within MZ II/VII. The majority of these efforts were located inside PACs (NRCS 2015), helping to preserve historic fire return intervals and important GRSG habitat. While the threat of conifer encroachment is likely to continue under all alternatives and the Proposed Plan, implementing mechanical treatments, reintroduction of appropriate fire regimes, and implementing BLM/Forest Service required design features and BMPs (e.g., removing standing and encroaching trees within 100 meters of occupied leks and other GRSG habitats) under all action alternatives and the Proposed Plan, would result in a net conservation gain for GRSG.

7.1.7 Conclusions

In addition to BLM management in RMP planning areas throughout MZ II/VII, GRSG will also be impacted by management and conservation at state, regional, and local levels. This analysis takes into account each alternative in the Bighorn Basin RMP in conjunction with state and private initiatives, and past, present, and reasonably foreseeable future actions. For purposes of this analysis, the BLM has determined that the Proposed Plans for the other ongoing GRSG and RMP planning efforts in MZ II/VII are reasonable foreseeable future actions.

Some of the most important past, present, and reasonably foreseeable future actions benefitting GRSG populations on private land in MZ II/VII are the conservation easements coordinated by the Natural Resources Conservation Service SGI, State of Wyoming, State of Colorado, BLM, Forest Service, and other agencies and organizations. As of 2015, SGI has secured conservation easements on 243,400 acres within MZ II/VII. Additionally, SGI has worked with landowners to increase fence marking, seeding of native vegetation, remove conifers, and implement prescribed grazing systems to help alleviate the adverse impacts associated with historic improper grazing practices. Future coordination of private landowners within SGI is expected to provide further benefits to GRSG habitat.

This coordination with private landowners enhances conservation in addition to what BLM management can accomplish on federal lands. Ranchers in MZ II/VII are also using Candidate Conservation Agreement with Assurances with the USFWS. Under these instruments, the ranchers voluntarily agree to manage lands to reduce threats to GRSG in exchange for a guarantee that they will not be subject to additional regulations should the species become listed. While ranchers have used these agreements across GRSG range, thus far the agreements have been applied to only a small number of ranches in Wyoming and Montana.

As discussed in Section 7.1.4, Wyoming, Montana, Utah, Colorado, and Idaho have adopted statewide plans to promote GRSG conservation throughout MZ II/VII. Wyoming's plan implements a Core Population Area Strategy with well density limitations, timing restrictions, and a uniform 5 percent disturbance cap across all landownership types. These measures would improve GRSG population levels

if effectively enforced (Copeland et al. 2013). Other state plans include similar, if sometimes less aggressive, measures to reduce impacts on state lands. In Montana, a 5 percent limit on anthropogenic disturbance is applied within the Density and Disturbance Calculation Tool examination area (based upon occupied leks within any given Core population area). Similarly in Utah, the Conservation Plan for Greater Sage-grouse in Utah (Utah Division of Wildlife Resources 2013), includes under certain circumstances, a general limit on new permanent disturbance of 5 percent of habitat on state or federally managed lands within any particular Sage-grouse Management Area.

Alternative A: Current Management

Under Alternative A, current management would continue on BLM-administered lands within the Bighorn Basin planning area. The Bighorn Basin plan would not designate PHMA, GHMA, or SFAs, and would not manage any additional ROW avoidance or exclusion areas. Appropriate and allowable uses and restrictions with regard to such activities as mineral leasing and development, recreation, utility corridors, and livestock grazing would also remain unchanged.

Management prescriptions to protect GRSG currently in place include restricting surface disturbance and occupancy within a 0.25-mile radius of occupied GRSG leks and within 2 miles of occupied leks in GRSG nesting and early brood-rearing habitats. Additionally, the BLM prohibits surface-disturbing activities in GRSG winter concentration areas from November 15 to March 14. These management actions would continue to be implemented under Alternative A.

In the rest of MZ II/VII, other BLM/Forest Service LUP planning efforts would implement their Proposed Plans to improve protection of GRSG and their habitat. In addition, other regional GRSG conservation strategies as discussed in Section 7.1.4, would be implemented on non-federal lands. As a result, the lack of protections under the Alternative A would be offset to an extent by more protective management elsewhere MZ II/VII. However, in the Bighorn Basin planning area, current management would do little to reduce the threats from energy development, mining, and infrastructure on GRSG wintering and breeding grounds. Although current management actions, including the temporary BLM GRSG IMs, provide a limited array of conservation measures that are intended to avoid continued degradation of GRSG habitat in MZ II/VII, they would not be subject to the same development restrictions in GRSG habitat under Alternative A as they would under the action alternatives or the Proposed Plan. Thus, Alternative A would not meet the goals and objectives in this plan to identify and incorporate conservation measures for GRSG and may meet the COT report objectives for present and widespread threats to GRSG, but only in localized areas and not on BLM-administered lands within the Bighorn Basin planning area.

Alternative B

Alternative B emphasizes conservation of biological resources, including habitat for fish and wildlife, maintenance of contiguous blocks of native plant communities, ecosystem management, protection of natural functions in riparian areas, and control of invasive species. Alternative B extends the protective buffers around GRSG habitat, prohibiting surface-disturbing activities within 0.6 mile of occupied GRSG leks and seasonally mitigating surface disturbing activities in GRSG nesting and early brood-rearing habitat. GRSG Key Habitat Areas are closed to mineral leasing and area closed to motorized vehicle use from March 15 to June 30. Alternative B would meet the objectives presented in the COT report for fire, invasive plants, range management, recreation, infrastructure, energy, and mining by implementing management actions which specifically address these threats.

Implementing these protective measures on BLM-administered lands within the Bighorn Basin RMP planning area would help preserve GRSG habitat by limiting resource use activities in PHMA and GHMA. In the rest of MZ II/VII, other BLM/Forest Service LUP planning efforts would implement their Proposed Plans to improve protection of GRSG and their habitat. In addition, other regional GRSG conservation strategies as discussed in Section 7.1.4, would be implemented on non-federal lands. The incremental effects of Alternative B combined with implementation of other regional efforts would result in a net conservation gain for GRSG in MZ II/VII.

Alternative C

Alternative C emphasizes resource uses with reduced constraints. Compared to the other alternatives, Alternative C conserves the least land for physical, biological, and heritage resources; and is the least restricted to motorized vehicle use and energy and mineral development. Under this alternative, the BLM would not manage to maintain contiguous blocks of native plant communities or minimize fragmentation.

In the rest of MZ II/VII, other BLM/Forest Service LUP planning efforts would implement their Proposed Plans to improve protection of GRSG and their habitat. In addition, other regional GRSG conservation strategies as discussed in Section 7.1.4, would be implemented on non-federal lands. COT objectives for fire, invasive plants, range management, recreation, infrastructure, energy, and mining would likely be met in these areas. However, within the Bighorn Basin planning area, the limited protective measures would not meet the goals and objectives to identify and incorporate conservation measures for GRSG and would not meet the COT report objectives.

Alternative E

Impacts under Alternative E are the same as Alternative B outside of GRSG Key Habitat Areas. Within GRSG Key Habitat Areas, Alternative E includes additional management actions and an ACEC designation. Alternative E emphasizes conservation of biological resources with more constraints on resource uses than any other alternative. Alternative E would meet the objectives presented in the COT report for fire, invasive plants, range management, recreation, infrastructure, energy, and mining by implementing management actions which specifically address these threats.

Implementing these protective measures on BLM-administered lands within the Bighorn Basin RMP planning area would help preserve GRSG habitat by limiting resource use activities in PHMA and GHMA. In the rest of MZ II/VII, other BLM/Forest Service LUP planning efforts would implement their Proposed Plans to improve protection of GRSG and their habitat. The Proposed Plans include better management flexibility to reduce the potential for development spilling over onto adjacent lands in an unrestricted manner; however, this is less of an issue within the Bighorn Basin planning area, due to the fewer non-BLM administered lands. In addition, other regional GRSG conservation strategies as discussed in Section 7.1.4, would be implemented on non-federal lands. The incremental effects of other regional efforts combined with implementation of Alternative E would result in a net conservation gain for GRSG in MZ II/VII, but the strict protective measures on BLM-administered land in the Bighorn Basin planning area may have an unintended effect of reducing gains for GRSG in the planning area via the effects described above.

Alternative F

Impacts under Alternative F are the same as the Proposed Plan outside of GRSG PHMA. Within GRSG PHMA, Alternative F includes additional management actions and an ACEC designation. Alternative F generally emphasizes conservation of biological resources, while placing moderate constraints on resource uses and reclamation and mitigation requirements to reduce impacts to resource values. Alternative F would meet the objectives presented in the COT report for fire, invasive plants, range management, recreation, infrastructure, energy, and mining by implementing management actions which specifically address these threats.

In the rest of MZ II/VII, other BLM/Forest Service LUP planning efforts would implement their Proposed Plans to improve protection of GRSG and their habitat. In addition, other regional GRSG conservation strategies as discussed in Section 7.1.4, would be implemented on non-federal lands. The incremental effects of other regional efforts combined with implementation of the Alternative F would result in a net conservation gain for GRSG in MZ II/VII.

Proposed RMP (Alternative D)

The Proposed Plan generally increases conservation of biological resources compared to current management. The Proposed Plan also emphasizes moderate constraints on resource uses and reclamation and mitigation requirements. This would reduce the potential for development occurring solely on private land where less protections are afforded to GRSG. The Proposed Plan would meet the objectives presented in the COT report for fire, invasive plants, range management, recreation, infrastructure, energy, and mining by targeting these threats in the RMP/EIS and implementing management actions which specifically address these threats.

In the rest of MZ II/VII, other BLM/Forest Service LUP planning efforts would implement their Proposed Plans to improve protection of GRSG and their habitat. In addition, other regional GRSG conservation strategies as discussed in Section 7.1.4, would be implemented on non-federal lands. Reasonably foreseeable future actions in MZ II/VII such as proposed oil and gas developments, interstate transmission lines, and other land disturbance projects would be subject to the requirements set forth in the BLM/Forest Service Proposed Plans which encompass MZ II/VII, where those projects occur on federal decision area lands. For non-federal lands, reasonably foreseeable future projects may be subject to disturbance caps, buffer restrictions, and other requirements of GRSG state plans, as well as site specific mitigation measures.

Regional efforts combined with the incremental effect of implementing the Proposed Plan would result in a net conservation gain for GRSG in MZ II/VII.

Summary

The primary threats affecting GRSG populations throughout MZ II/VII are energy development, infrastructure, grazing/free-roaming equids, spread of weeds, conversion to agriculture, fire, recreation, and spread of conifers (USFWS 2013).

Infrastructure and energy development are of particular concern in MZ II/VII because they affect the greatest amount of land. Numerous multi-state transmission lines are proposed through GRSG habitat, as are large-scale oil and gas field developments in excess of 100,000 acres. Implementation of the BLM/Forest Service Proposed Plans in MZ II/VII is unlikely to preclude such projects from proceeding, especially Presidential Priority transmission line projects that are not subject to GRSG protective measures in the BLM/Forest Service planning efforts; however, GRSG protective measures are being

considered in the project specific analysis. The cumulative effect of the conservation measures in the Proposed Plan will result in protection of GRSG populations. In some localized areas, small populations may be at continued risk due to the cumulative effect of reasonably foreseeable future infrastructure and energy development projects over the next 20 years, when combined with unplanned events such as wildfires, drought, or West Nile virus outbreaks. However, the restrictions on land use, in combination with project-specific BMPs and RDFs and other regional efforts would achieve an overall net conservation gain for the regional population and would help mitigate the effects on small, at risk populations.

Implementation of alternatives B, E, F, and the Proposed Plan are anticipated to result in a net conservation gain for GRSG in MZ II/VII when compared to current management (Alternative A). Alternatives B and E emphasize conservation of biological resources, and contain more restrictions on resource uses than the other alternatives. While not as extensive as alternatives B or E, Alternative F and the Proposed Plan include GRSG conservation measures and resource use allocations which would improve baseline conditions.

Although small fringe populations may be at continued risk of decline in the next 20 years, implementing alternatives B, E, F, or the Proposed Plan in combination with other regional efforts (such as the Proposed Plans for other BLM planning areas; conservation strategies in the Montana, Wyoming, Idaho, Utah, and Colorado state plans; increased land protections via NRCS SGI, and local habitat restoration efforts) would effectively conserve the region-wide population of GRSG in MZ II/VII.

7.1.8 MZ-Wide Reasonably Foreseeable Future Actions Summary Table

Table 7-12 includes a selection of some of the larger projects from the reasonably foreseeable future actions tables in the RMPAs/LUPAs for MZ II/VII. The full tables can be found in each EIS within the MZ.

Table 7-12. Reasonably Foreseeable Future Actions in Management Zone II/VII Likely to Impact GRSG Habitat

MZ	Planning Area	GRSG Population(s) Affected	Project Name	Project Location	Project Description, Estimated Footprint	Project Status
Energy and Mining						
II/ VII	Northwest Colorado, 9-Plan	Wyoming Basin, Northwest Colorado	Hiawatha Regional Energy Development EIS	Sweetwater County, Wyoming; Moffat County, Colorado	Proposed development of up to 4,208 new natural gas wells on approximately 157,361 acres of mixed federal, state, and private lands. The project area overlaps with lands identified as GRSG Core Areas. 91% of the project area is managed by the BLM.	Proposed
II/ VII	9-Plan	Wyoming Basin	LaBarge Platform Exploration & Development Project	Lincoln and Sublette County, Wyoming	Proposed development of up to 838 new oil and gas wells on 218,000 acres of private, state, and federal lands. Approximately 154,000 acres of surface lands are administered by the BLM.	Proposed

Table 7-12. Reasonably Foreseeable Future Actions in Management Zone II/VII Likely to Impact GRSG Habitat (Continued)

MZ	Planning Area	GRSG Population(s) Affected	Project Name	Project Location	Project Description, Estimated Footprint	Project Status
II/ VII	9-Plan	Wyoming Basin	Continental Divide-Creston Natural Gas Project	Carbon and Sweetwater Counties, Wyoming	Proposed development of up to 8,950 additional natural gas wells on 1.1 million acres of land, including GRSG Core Areas. The proposed facilities would add to the existing network of wells, pipelines, access routes and electrical distribution systems. Approximately 59 percent of the project area is on federally-owned lands.	Proposed
II/ VII	Lander, 9-Plan	Wyoming Basin	Moneta Divide Natural Gas and Oil Development Project	Fremont and Natrona Counties, Wyoming	Proposed development of approximately 4,250 natural gas and oil wells on 265,000 acres of land (including approximately 169,500 acres of land administered by the BLM). The project area includes GRSG Core Areas.	Proposed
II/ VII	9-Plan	Wyoming Basin	Pinedale Anticline Project	Sublette County, Wyoming	Proposed development of natural gas resources within nearly 200,000 acres of land, of which approximately 80 percent is federal surface ownership. The project area occurs within GRSG Core Areas.	Ongoing
II/ VII	9-Plan	Wyoming Basin	Blacks Fork Project (Formerly Moxa Arch Area Infill)	Sweetwater, Uinta, and Lincoln Counties, Wyoming	Proposed infill drilling project, on approximately 7,500 hydrocarbon wells within 633,532 acres of mixed federal, state, and private lands.	Proposed
II/ VII	9-Plan, Northwest Colorado, Utah	Wyoming Basin, Northwest Colorado	Oil Shale and Tar Sands Programmatic EIS	Colorado, Utah, and Wyoming	Amendment of 10 BLM RMPs to designate certain public lands as available for application for leasing and future exploration and development of oil shale and tar sands resources. A ROD was signed in 2013 which made approximately 678,000 acres available for potential development of soil shale, and approximately 132,000 acres available for development of tar sands.	Ongoing
II/ VII	9-Plan	Wyoming Basin	Atlantic Rim Natural Gas Field Development Project	Carbon County, Wyoming	Ongoing development of oil gas resources on 270,080 acres of land, of which 173,672 are federal surface estate. A ROD was signed in 2007. The project area includes GRSG Core Areas.	Ongoing
II/ VII	9-Plan	Wyoming Basin	Chokecherry/ Sierra Madre Wind Farm	Carbon County, Wyoming	Proposed development of approximately 1,000 wind turbines and associated ancillary facilities on 220,000 acres of land. The project area includes private, state, and federally managed lands, and overlaps with GRSG Core Areas.	Proposed

Table 7-12. Reasonably Foreseeable Future Actions in Management Zone II/VII Likely to Impact GRSG Habitat (Continued)

MZ	Planning Area	GRSG Population(s) Affected	Project Name	Project Location	Project Description, Estimated Footprint	Project Status
II/ VII	9-Plan	Wyoming Basin	Normally-Pressured Lance Natural Gas EIS	Sublette County, Wyoming	Proposed development of approximately 3,500 natural gas wells within 141,000 acres of state, private, and BLM-administered lands.	Proposed
II/ VII	9-Plan	Wyoming Basin	Bird Canyon Field Infill Project	Sublette and Lincoln Counties, Wyoming	Proposed drilling and production of 348 new natural gas wells within 17,612 acres of BLM-administered land.	Proposed
Rights-of-way						
II/ VII	9-Plan, Northwest Colorado, Utah	Wyoming Basin, Rich-Summit-Morgan, Uintah, North Park, NWCO, Strawberry Valley, Carbon	Gateway South Transmission Line Project	17 Counties in Wyoming, Colorado, and Utah	Proposed 500 kV transmission line which would begin near Medicine Bow, Wyoming, and would extend south and west to a proposed substation near Mona, Utah. The proposed transmission line would span over 400 miles, with a 250-foot right-of-way, and would cross multiple land jurisdictions including lands administered by the BLM.	Proposed
II/ VII	9-Plan, Northwest Colorado, Utah	Wyoming Basin, Northwest Colorado, Sheeprock, Strawberry Valley, Carbon, Bald Hills	TransWest Express Transmission Line Project	Wyoming, Colorado, Utah, and Nevada	Proposed 600 kV transmission line extending from south-central Wyoming to southern Nevada. The transmission line corridor would span over 700 miles and would cross private, state, and federally owned lands. The proposed route and alternative routes under consideration would cross priority and general habitats.	Proposed
II/ VII	9-Plan, Idaho and Southwest Montana	Wyoming Basin, East Central, Northern Great Basin, Box Elder	Gateway West Transmission Line Project	Wyoming and Idaho	Proposed 230 kV and 500 kV transmission line project between Glenrock, Wyoming, and Melba, Idaho. Approximately 1,000 miles of new high-voltage transmission lines would be constructed. The project would cross multiple land jurisdictions, including sage grouse Core Areas in Wyoming.	Proposed
II/ VII	9-Plan	Wyoming Basin	Riley Ridge to Natrona Pipeline Project	Sublette, Sweetwater, Fremont, and Natrona Counties, Wyoming	Proposed 243-mile pipeline from Riley Ridge to Big Piney, Wyoming. The pipeline would consist of a 50-foot right-of-way, and would cross GRSG Core Areas.	Proposed
II/ VII	9-Plan	Wyoming Basin	Zephyr Power Line Transmission Project	Wyoming, Colorado, Utah, and Nevada	Proposed 500 kV transmission line spanning between Chugwater, Wyoming to just south of Las Vegas, Nevada.	Proposed

Table 7-12. Reasonably Foreseeable Future Actions in Management Zone II/VII Likely to Impact GRSG Habitat (Continued)

MZ	Planning Area	GRSG Population(s) Affected	Project Name	Project Location	Project Description, Estimated Footprint	Project Status
Weeds						
II/ VII	9-Plan, Northwest Colorado	Wyoming Basin, Northwest Colorado, Powder River Basin, North Park	Invasive Plant Management EIS for the Medicine Bow - Routt National Forests, and Thunder Basin National Grassland	Wyoming and Colorado	Proposed treatment of invasive plant species using adaptive and integrated invasive plant treatment methods. These include manual, mechanical, biological, aerial, and ground herbicide applications. Potential treatment areas include GRSG Core Areas.	Proposed

Notes:

1. Hiawatha Regional Energy Development Project Update: http://www.blm.gov/pgdata/etc/medialib/blm/wy/information/NEPA/rsfodocs/hiawatha/newsltrs.Par.79506.File.dat/Hiawatha03-2013.pdf
2. LaBarge Platform Exploration & Development Project: http://www.blm.gov/wy/st/en/info/NEPA/documents/pfo/labarge_platform.html
3. Continental Divide-Creston Natural Gas Project: http://www.blm.gov/wy/st/en/info/NEPA/documents/rfo/cd_creston.html
4. Moneta Divide Natural Gas and Oil Development Project: http://www.blm.gov/wy/st/en/info/NEPA/documents/lfo/moneta-divide.html
5. Pinedale Anticline Project: http://www.blm.gov/wy/st/en/info/NEPA/documents/pfo/anticline/seis.html
6. Black Forks Project (Formally Moxa Arch Area Infill Project): http://www.blm.gov/wy/st/en/info/NEPA/documents/kfo/moxa_arch.html
7. Oil Shale and Tar Sands Programmatic EIS: http://ostseis.anl.gov/
8. Atlantic Rim Natural Gas Field Development Project: http://www.blm.gov/wy/st/en/info/NEPA/documents/rfo/atlantic_rim.html
9. Chokecherry/Sierra Madre Wind Farm: http://www.blm.gov/wy/st/en/info/NEPA/documents/rfo/Chokecherry.html
10. Gateway South Transmission Line Project: http://www.blm.gov/wy/st/en/info/NEPA/documents/hdd/gateway_south.html
11. TransWest Express Transmission Line Project: http://www.blm.gov/wy/st/en/info/NEPA/documents/hdd/transwest.html
12. Gateway West Transmission Line Project: http://www.gatewaywestproject.com/
13. Riley Ridge to Natrona Pipeline Project: http://www.blm.gov/wy/st/en/info/NEPA/documents/rsfo/RRNP.html
14. Normally Pressured Lance Natural Gas Development Project: http://www.blm.gov/wy/st/en/info/NEPA/documents/pfo/npl.html
15. Bird Canyon Natural Gas Infill Project: http://www.blm.gov/wy/st/en/info/NEPA/documents/rsfo/birdcanyon.html
16. Invasive Plant Management EIS for the Medicine Bow – Routt National Forests and Thunder Basin National Grasslands: http://www.fs.usda.gov/wps/portal/fsinternet/!ut/p/c4/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gDfxMDT8MwRydLA1cj72BTMwMTAwjQL8h2VAQArb-_RA!!/?ss=110206&navtype=BROWSEBYSUBJECT&navid=130110000000000&pnavid=130000000000000&accessDB=true&position=Project*&groupid=19692&ttype=projectdetail&pname=Medicine%20Bow-Routt%20National%20Forests%20&%20Thunder%20Basin%20National%20Grassland-%20Projects

BLM	Bureau of Land Management
EIS	Environmental Impact Statement
GRSG	Greater sage-grouse
kV	Kilovolt
MZ	Management Zone
RMP	Resource Management Plan
ROD	Record of Decision

7.1.9 References

Arkle R.S., D.S. Pilliod, S.E. Hanser, M.L. Brooks, J.C. Chambers, J.B. Grace, K.C. Knutson, D.A. Pyke, J.L. Welty, T.A. Wirth. 2014. Quantifying restoration effectiveness using multi-scale habitat models: implications for sage-grouse in the Great Basin. Ecosphere 5 (3): p.1-32.

Baker, W.L., 2011, Pre- Euro-American and recent fire in sagebrush ecosystems, in Knick, S.T., and Connelly, J.W., eds., Greater sage-grouse: ecology and conservation of a landscape species: Berkeley, Calif., University of California Press, p. 185–202.

Baruch-Mordo, S., J.S. Evans, J.P. Severson, D.E. Naugle, J.D. Maestas, J.M. Kiesaecker, M.J. Falkowski, C.A. Hagan, and K.P. Reese. 2013. Saving sage-grouse from the trees: a proactive solution to reducing a key threat to a candidate species. Biological Conservation 167:233-241.

Bates Hole/Shirley Basin Sage-grouse Working Group. 2007. Bates Hole/Shirley Basin Sage-grouse Conservation Plan. Available online: https://wgfd.wyo.gov/web2011/Departments/Wildlife/pdfs/SG_BATESSHIRLEYBASIN_CONSVPLAN0000679.pdf. Accessed July 2, 2014.

Beck, J.L., and D.L. Mitchell. 2000. Influences of livestock grazing on sage grouse habitat. Wildlife Society Bulletin 28:993-1002.

Bighorn Basin Sage-Grouse Local Working Group. 2007. Sage-grouse Conservation Plan.

Blickley, J.L., D. Blackwood, and G.L. Patricelli. 2012. Experimental evidence for the effects of chronic anthropogenic noise on abundance of Greater Sage-Grouse at leks: Conservation Biology 26:461-471.

BLM (US Department of the Interior, Bureau of Land Management). 1991. Record of Decision Environmental Impact Statement for Vegetation Treatment on BLM Lands in Thirteen Western States. BLM, Wyoming State Office. Cheyenne.

BLM. 2005. Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM-Administered Lands in the Western United States. FES 05-11. Washington, DC. June 2005.

BLM. 2007. Final Vegetation Treatments on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Report. June 2007, FES 07-21. BLM. Reno, NV and Washington, D.C. Available online: http://www.blm.gov/wo/st/en/prog/more/veg_eis.html. Accessed July 2, 2014.

BLM. 2012. Northwestern Plains Rapid Ecological Assessment. Final Memorandum. Available online: www.blm.gov/wo/st/en/prog/more/Landscape_Approach/reas/nwplains.html. Accessed July 2, 2014.

BLM. 2012. Q & A for the Buffalo Field Office Viability Analysis for Conservation of Sage-Grouse Populations. Available online: www.blm.gov/wy/st/en/programs/Wildlife/sage-grouse.html. Accessed on September 14, 2014.

BLM. 2013. Interagency Standards for Fire and Fire Aviation Operations. U.S. Department of the Interior, Bureau of Land Management. Washington, D.C.

BLM. 2015. Geographic Information Systems Data. National Operations Center, Denver, Colorado.

Bradley, B.A. 2010. Assessing ecosystem threats from global and regional change: hierarchical modeling of risk to sagebrush ecosystems from climate change, land use and invasive species in Nevada, U.S.A. Ecography, v. 33, Pp. 198-208.

Braun, C.E., O.O. Oedekoven, and C.L. Aldridge. 2002. Oil and gas developments in western North America: effects on sagebrush steppe avifauna with particular emphasis on sage-grouse. Transactions of the North American Wildlife and Natural Resources Conference, 67: 337.

Braun, C.E. 1998. Sage Grouse declines in western North America: what are the problems? Proceedings of the Western Association of State Fish and Wildlife Agencies 78: 139-156.

Bui, T.D. 2009. The effects of nest and brood predation by common ravens (Corvus coraz) on Greater Sage-Grouse (Centrocercus urophasianus) in relation to land use in western Wyoming: University of Washington.

Christiansen, T. 2013. Wyoming Sage-Grouse Population Trend Data – 1995-2013. Unpublished data, Wyoming Game and Fish. August 24, 2013.

Coates, P.S. 2007. Greater sage-grouse (Centrocercus urophasianus) nest predation and incubation behavior. Ph.D. dissertation, Idaho State University, Pocatello, ID.

Colorado Department of Natural Resources. 2013. Colorado Greater Sage-Grouse Conservation Plan: The Colorado Package. Available online: http://cpw.state.co.us/learn/Pages/GreaterSagegrouseConservationPlan2.aspx. Accessed on July 2, 2014.

Colorado Department of Natural Resources. 2014. Greater Sage Grouse: Colorado Synthesis Report. Available online: http://cpw.state.co.us/Documents/WildlifeSpecies/SpeciesOfConcern/GreaterSageGrouse/ColoradoSynthesisReportFINAL.pdf. Accessed on July 1, 2014.

Connelly, J.W., S.T. Knick, M.A. Schroeder, and S.J. Stiver. 2004. Conservation assessment of greater sage-grouse and sagebrush habitats. Western Association of Fish and Wildlife Agencies (WAFWA).

Copeland H.E., A. Pocewicz, D.E. Naugle, T. Griffiths, D. Keinath, J. Evans, J. Platt. 2013. Measuring the Effectiveness of Conservation: A Novel Framework to Quantify the Benefits of Sage-Grouse Conservation Policy and Easements in Wyoming. PLoS ONE 8(6): e67261. Doi:10.1371/journal.pone.0067261.

Council on Environmental Quality. 1997. Considering Cumulative Impacts under the National Environmental Policy Act. January 1997.

Davies K.W., C.S. Boyd, J.L. Beck, J.D. Bates, T.J. Svejcar, M.A. Gregg. 2010. Saving the sagebrush sea: An ecosystem conservation plan for big sagebrush plant communities Biological Conservation 144, pp. 2573–2584.

Doherty, K.E., D.E. Naugle, B.L. Walker, and J.M. Graham. 2008. Greater Sage-Grouse Winter Habitat Selection and Energy Development. University of Montana.

Doherty, K.E., Tack, J.S. Evans, and D.E. Naugle. Mapping breeding densities of greater sage-grouse: A tool for range-wide conservation planning. Prepared for the Bureau of Land Management, CLM Completion Report: Interagency Agreement #L10PG00911. September 24, 2010.

Doherty, K.E., J.L. Beck, and D.E. Naugle. 2011. Comparing Ecological Site Descriptions to Habitat Characteristics Influencing Greater Sage-Grouse Nest Site Occurrence and Success. Rangeland Ecology & Management 64:344-351.

Forman, R.T.T., and L.E. Alexander. 1998. Roads and their major ecological effects. Annual Review of Ecology and Systematics. 1998. 29:207–31.

Garton, E.O., J.W. Connelly, J.S. Horne, C.A. Hagen, A. Moser, and M. Schroeder. 2011. Greater sage-grouse population dynamics and probability of persistence. Pages 293-381 in S.T. Knick and J.W. Connelly, editors. Greater Sage-Grouse: ecology of a landscape species and its habitats. Cooper Ornithological Union, University of California Press, Berkeley, California.

Garton, E.O., A.G. Wells, J.A. Baumgardt and J.W. Connelly. 2015. Greater Sage-Grouse Population Dynamics and Probability of Persistence. Final Report to Pew Charitable Trusts. 18 March.

George, M.R., R.D. Jackson, C.S. Boyd, K.W. Tate. 2011. A scientific assessment of the effectiveness of riparian management practices. In: D.D. Briske [ed.]. Conservation Benefits of Rangeland Practices: assessment, recommendations, and knowledge gaps. Washington, DC, USA: USDA-NRCS. P. 213-252.

Gillen, R.L., W.C. Krueger, and R.F. Miller. 1984. Cattle distribution on mountain rangeland in northeastern Oregon. Journal of Range Management 37:549-553.

Holechek, J.L., R.D. Pieper, and C.H. Herbel. 2010. Range Management Principles and Practices. Sixth Edition. Prentice-Hall Inc. Upper Saddle River, NJ.

Holloran, M.J., and S.H. Anderson. 2005. Greater sage-grouse populations response to natural gas development in western Wyoming: Are regional populations affected by relatively localized disturbances? In wildlife Management Institute (Ed.), Transactions from the 70th North American Wildlife and Natural Resources Conference (March 16-19, 2005, Arlington, VA). Wildlife Management Institute.

Holloran, M.J. 2005. Greater Sage-Grouse (Centrocercus urophasianus) Population Response to Natural Gas Field Development in Western Wyoming. Thesis. University of Wyoming Department of Zoology and Physiology, Laramie, WY.

Idaho Sage-grouse Advisory Committee. 2006. Conservation Plan for the Greater Sage-grouse in Idaho.

Knick, S.T. 2011. Historical development, principal federal legislation and current management of sagebrush habitats: implications for conservation. Pages 13-32 in S.T. Knick and C.J.W., editors. Greater Sage-Grouse: ecology of a landscape species and its habitats. Cooper Ornithological Union, University of California Press, Berkeley, California.

Knick, S.T., and S.E. Hanser. 2011. Connecting pattern and process in greater sage- grouse populations and sagebrush landscapes. Pages 383-406 in S.T. Knick and C.J.W., editors. Greater Sage-Grouse: ecology of a landscape species and its habitats. Cooper Ornithological Union, University of California Press, Berkeley, California.

Knick, S.T., D.S. Dobkin, J.T. Rotenberry, M.A. Schroeder, W.M. Vander Haegen, and C. van Riper. 2003. Teetering on the Edge or Too Late? Conservation Issues for Avifauna of Sagebrush Habitats. The Condor 105(4):611-634.

Knick, S.T., S.E. Hanser, R.F. Miller, D.A. Pyke, M.J. Wisdom, S.P. Finn, E.T. Rinkes, and C.J. Henny. 2011. Ecological Influence and Pathways of Land Use in Sagebrush, in S.T. Knick and J.W. Connelly (editors), Greater Sage-Grouse: Ecology and Conservation of a Landscape Species and its Habitats. Studies in Avian Biology. Vol. 38:203-251. University of California Press, Berkeley, California.

LeBeau, C.W., 2012. Evaluation of Greater Sage-Grouse reproductive habitat and response to wind energy development in south-central Wyoming: Laramie, University of Wyoming, M.S. thesis.

Leu, M., and S.E. Hanser. 2011. Influences of the human footprint on sagebrush landscape patterns. Pages 253-271 in S.T. Knick and C.J.W., editors. Greater Sage-Grouse: ecology of a landscape species and its habitats. Cooper Ornithological Union, University of California Press, Berkeley, California.

Lyon, A.G., and S.H. Anderson. 2003. Potential gas development impacts on sage grouse nest initiation and movement. Wildlife Society Bulletin 31:486-491.

Manier, D.J., D.J.A. Wood, Z.H. Bowen, R.M. Donovan, M.J. Holloran, L.M. Juliusson, K.S. Mayne, S.J. Oyler-McCance, F.R. Quamen, D.J. Saher, and A.J. Titolo. 2013. Summary of Science, Activities, Programs and Policies that Influence the Rangewide Conservation of Greater Sage-Grouse (Centrocercus urophasianus). U.S. Geological Survey Open-File Report 2013-1098, Fort Collins, Colorado.

Middle Park Sage-Grouse Working Group. 2001. Middle Park Sage Grouse Conservation Plan. Colorado Division of Wildlife, Denver, Colorado.

Miller, R.G., Knick, S.T., Pyke, D.A., Meinke, C.W., Hanser, S.E., Wisdom, M.J., and Hild, A.L. 2011. Characteristics of sagebrush habitats and limitations to long-term conservation, in Knick, S.T., and Connelly, J.W., eds., Greater Sage-Grouse: ecology of a landscape species and its habitats: Berkeley, Calif., University of California Press, Cooper Ornithological Union, Pp. 145-184.

Morgan-Summit Adaptive Resource Management Local Working Group. 2006. Morgan-Summit Greater Sage-grouse (Centrocercus urophasianus) Local Conservation Plan. Utah State University Extension and Jack H. Berryman Institute and Utah Division of Wildlife Resources Unpublished Report. Salt Lake City, Utah. Unpublished Report.

Naugle, D.E., K.E. Doherty, B.L. Walker, M.J. Holloran, and H.E. Copeland. 2011. Energy development and greater sage-grouse. Pages 489-504 in S.T. Knick and C.J.W., editors. Greater Sage-Grouse: ecology of a landscape species and its habitats. Cooper Ornithological Union, University of California Press, Berkeley, CA.

North Park Sage Grouse Working Group. 2001. North Park Greater Sage-Grouse Conservation Plan. Colorado Division of Wildlife, Denver, Colorado.

Northeast Wyoming Sage-Grouse Working Group. 2014. Northeast Wyoming Sage-Grouse Conservation Plan Addendum. February 25, 2014.

Northern Eagle/Southern Routt Greater Sage-Grouse Work Group. 2004. Northern Eagle Southern Routt Greater Sage-Grouse Conservation Plan. Colorado Division of Wildlife, Denver, Colorado.

Northwest Colorado Greater Sage-Grouse Working Group. 2008. Northwest Colorado Greater Sage-Grouse Conservation Plan. Available online: http://cpw.state.co.us/learn/Pages/SagegrouseLocalGroupPlans.aspx. Accessed July 2, 2014.

NRCS. 2015. Greater Sage-Grouse Habitat Conservation Strategy. USDA. February.

Parachute-Piceance-Roan (PPR) Greater Sage-Grouse Work Group. 2008. Parachute-Piceance-Roan (PPR) Greater Sage-Grouse Conservation Plan. Colorado Division of Wildlife, Denver, Colorado.

Rashford, B.S., A.M. Schrag, J. Walker. 2013. Targeting Grassland Conservation: An Estimate of Land-Use Conversion Risk in the Northern Great Plains. Available online: www.plainsandprairiepotholeslcc.org/wp-content/uploads/2013/12/FinalGrantTechnicalReport_small.pdf. Accessed on July 2, 2014.

Reisner, M.D., J.B. Grace, D.A. Pyke, P.S. Doescher. 2013. Conditions favouring Bromus tectorum dominance of endangered sagebrush steppe ecosystems. Journal of Applied Ecology 50, pp. 1039-1049.

Rich County Coordinated Resource Management Sage-grouse Subcommittee. 2006. Rich County Greater Sage-grouse (Centrocercus Urophasianus) Local Conservation Plan. Utah State University Extension and Jack H. Berryman Institute and Utah Division of Wildlife Resources unpublished Report. Salt Lake City, Utah. Unpublished Report.

South Central Sage-grouse Working Group. 2007. South Central Sage-Grouse Conservation Plan.

Southwest Wyoming Local Sage-grouse Working Group. 2007. Southwest Wyoming Sage-grouse Conservation Assessment and Plan.

State of Montana. 2014. Executive Order No 10-2014. Executive Order Creating the Montana Sage Grouse Oversight Team and the Montana Sage Grouse Habitat Conservation Program. Available online: https://governor.mt.gov/Portals/16/docs/2014EOs/EO_10_2014_SageGrouse.pdf. Accessed on December 11, 2014.

Stevens, B.S., K.P. Reese, and J.W. Connelly. 2011. Survival and Detectability Bias of Avian Fence Collision Surveys in Sagebrush Steppe. Journal of Wildlife Management 75(2):437-449.

Stiver, S.J. 2011. The legal status of greater sage-grouse: Organizational structure of planning efforts. Pp. 33-49. In: S.T. Knick and J.W. Connelly (eds.) Greater Sage-Grouse: Ecology of a Landscape Species and Its Habitats. Cooper Ornithological Union, University of California Press, Berkeley.

Stiver, S.J., A.D. Apa, J.R. Bohne, S.D. Bunnell, P.A. Diebert, S.C. Gardner, M.A. Hilliard, C.W. McCarthy, and M.A. Schroeder. 2006. Greater sage-grouse comprehensive conservation strategy. Western Association of Fish and Wildlife Agencies. Cheyenne, WY.

Strand E.K., and K.L. Launchbaugh. 2013. Livestock Grazing Effects on Fuel Loads for Wildland Fire in Sagebrush Dominated Ecosystems. Great Basin Fire Science Delivery Report, April 2013.

Uinta Basin Adaptive Resource Management Local Working Group. 2006. Uinta Basin Greater Sage-grouse (Centrocercus urophasianus) Local Conservation Plan. Utah State University Extension and Jack H. Berryman Institute and Utah Division of Wildlife Resources Unpublished Report. Salt Lake City, Utah. Unpublished Report.

Upper Green River Basin Sage-Grouse Working Group. 2007. Upper Green River Basin Sage-Grouse Conservation Plan.

Upper Snake River Basin Sage-Grouse Working Group. 2008. Upper Snake River Basin Sage-Grouse Conservation Plan. Jackson, Wyoming.

USFWS (United States Fish and Wildlife Service). 2010. Endangered and Threatened Wildlife and Plants; 12-Month Findings for Petitions to List the Greater Sage-Grouse (Centrocercus urophasianus) as Threatened or Endangered. Page 107pp. in F. a. W.S., editor. FWS R6-ES-2010-0018. Federal Register, Washington, D.C.USFWS 2013.

USFWS. 2013. Greater Sage-grouse (Centrocercus urophasianus) Conservation Objectives: Final Report. U.S. Fish and Wildlife Service, Denver, CO. February 2013.

U.S. Fish and Wildlife Service, Wyoming Bureau of Land Management, Natural Resources Conservation Service, Wyoming Game and Fish Department, Wyoming Department of Agriculture, Wyoming Associated of Conservation Districts, U.S. Forest Service. 2013. Greater Sage-Grouse Umbrella CCAA for Wyoming Ranch Management A Candidate Conservation Agreement with Assurances for Greater Sage-Grouse (Centrocercus urophasianus)

U.S. Fish and Wildlife Service. 2015. State of Wyoming, Sweetwater River Conservancy Launch Nation's First Greater Sage-Grouse Conservation Bank. March 18, 2015. Available online: http://www.fws.gov/news/ShowNews.cfm?ID=2EA1ED88-F89B-76F0-9D79A5EB32AB6E61. Accessed on April 2, 2015.

Utah Division of Wildlife Resources. 2013. Conservation Plan for Greater Sage-grouse in Utah. February 14, 2013. Available online: http://wildlife.utah.gov/uplandgame/sage-grouse/pdf/greater_sage_grouse_plan.pdf. Accessed July 2, 2014.

Vance, L.K., and D. Stagliano. 2007. Watershed assessment of portions of the Lower Musselshell and Fort Peck Reservoir Subbasins. Report to the Bureau of Land Management, Billings, MT. Montana Natural Heritage Program, Helena, MT.

WAFWA (Western Association of Fish and Wildlife Agencies). 2014. Fire and Fuels Management Contributions to Sage-Grouse Conservation: A Status Report.

WAPA (Western Area Power Administration). 2013. Upper Great Plains Wind Energy programmatic Environmental impact Statement (Draft). DOE/EIS-0408. March 2013.

Walker, B.L., and D.E. Naugle. 2011. West Nile Virus Ecology in Sagebrush Habitat and Impacts on Greater Sage-Grouse Populations, in S.T. Knick and J.W. Connelly (editors) Greater Sage-Grouse: Ecology and Conservation of a Landscape Species and its Habitats. Studies in Avian Biology. Vol. 38:127–144. University of California Press, Berkeley, California.

Walker, B.L., D.E. Naugle, and K.E. Doherty. 2007. Greater sage-grouse population response to energy development and habitat loss. Journal of Wildlife Management 71:2644-2654.

WSGWG (Wyoming Sage-Grouse Working Group). 2003. Wyoming Greater Sage-grouse Conservation Plan. Cheyenne, Wyoming.

Wyoming Executive Order No. 2011-5, June 2, 2011, Greater Sage-Grouse core area protection: Casper, Wyo., Governor's Office, State of Wyoming.

Wyoming Landscape Conservation Initiative. 2013. Annual Report. Available online: https://www.wlci.gov/sites/default/files/misc-files/2013AnnualReport_0.pdf. Accessed on April 2, 2015.

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Proposed Resource Management Plan and
Final Environmental Impact Statement

Bighorn Basin Resource Management Plan Revision Project

Glossary

GLOSSARY

Abandoned Mine: An abandoned hardrock mine on or affecting public lands administered by the Bureau of Land Management (BLM), at which exploration, development, mining, reclamation, maintenance, and inspection of facilities and equipment, and other operations ceased as of January 1, 1981 (the effective date of BLM's Surface Management regulations codified at 43 Code of Federal Regulations (CFR) Subpart 3809) with no evidence demonstrating that the miner intends to resume mining. For many abandoned mines, no current claimant of record or viable potentially responsible party exists. Abandoned mines generally include a range of mining impacts, or features that may pose a threat to water quality, public safety, and/or the environment (BLM no date).

Abandoned Mine Land (AML) Program: BLM program that focuses on reclaiming hardrock abandoned mine lands on or affecting public lands administered by BLM. The primary goal of the program is to remediate and reduce actual or potential threats that pose physical safety risks and environmental degradation. BLM applies risk-based criteria and uses the watershed approach to establish project priorities. The program also works to return mine-impacted lands to productive use(s) (BLM No Date).

Active Preference: see *Active Use.*

Active Use: The current authorized livestock grazing use. Active use may constitute a portion, or all, or permitted use. Active use does not include a temporary non-use or suspended use of forage within all or a portion of an allotment.

Additionality: The conservation benefits of compensatory mitigation are demonstrably new and would not have resulted without the compensatory mitigation project. (BLM Manual Section 1794).

Aeolian: Pertaining to the wind, especially said of such deposits as loess and dune sand, of sedimentary structures such as wind-formed ripple marks, or of erosion and deposition accomplished by the wind; also the erosive action of the wind and deposits that are transported by the wind (American Geological Institute 2005).

Alfisols: Moderately leached soils with a subsurface zone of clay accumulation and a low base status.

Allotment: An area of land where one or more livestock operators graze their livestock. Allotments are BLM lands, but may also include other federally managed, state-owned, and private lands. An allotment may include one or more separate pastures. Livestock numbers and periods of use are specified for each allotment.

Allotment Categorization: Grazing allotments and rangeland areas used for livestock grazing are assigned to an allotment category during resource management planning. Allotment categorization is used to establish priorities for distributing available funds and personnel during plan implementation to achieve cost-effective improvement of rangeland resources. Categorization is also used to organize allotments into similar groups for purposes of developing multiple use prescriptions, analyzing site-specific and cumulative impacts, and determining trade-offs.

> **Category "I" (Improvement):** The category for allotments where (1) present range condition is unsatisfactory and where range condition is expected to decline further; (2) present grazing management is not adequate; (3) the allotment has potential for medium to high vegetative production but production is low to moderate; (4) resource conflicts/controversy with livestock grazing are evident; (5) there is potential for positive economic return on public investment (BLM 1990). Additionally, allotments are categorized as Improvement where current livestock grazing management or level of use on public land is, or is expected to be, a significant causal factor in the

non-achievement of land health standards, or where a change in mandatory terms and conditions in the grazing authorization is or may be necessary. When identifying Category I allotments, review condition of critical habitat, conflicts with sage-grouse, and whether projects have been proposed specifically for implementing the Healthy Lands Initiative (BLM 2008a).

Category "M" (Maintain): The category for allotments where (1) the present range condition an management are satisfactory with good to excellent condition and will be maintained under present management, or fair condition and improving with improvement expected to continue under present management or opportunities for BLM management are limited because percentage of public land is low or acreage of public lands is small; (2) the allotment has a potential for moderate or high vegetative production is producing at or near this potential; (3) there are no significant land-use resource conflicts with livestock grazing; (4) land ownership status may or may not limit management opportunities; (5) opportunities for positive economic return from public investment may exist (BLM 1990). Additionally, allotments are categorized as Maintain where land health standards are met or where livestock grazing on public land is not a significant causal factor for not meeting the standards and current livestock management is in conformance with guidelines developed by the State Directors in consultation with Resource Advisory Councils. Allotments where an evaluation of land health standards has not been completed, but existing monitoring data indicates that resource conditions are satisfactory (BLM 2008a).

Category "C" (Custodial): The category for allotments where (1) present range condition is not in a downward trend; (2) the allotment has a low vegetative production potential and is producing near this level; (3) there may or may not be limited conflicts between livestock grazing and other resources; (4) present management is satisfactory or is the only logical management under existing conditions; and (5) opportunities for a positive economic return on public investments do not exist (BLM 1990). Additionally, allotments are categorized as Custodial where public lands produce less than 10 percent of the forage in the allotment or are less than 10 percent of the land area. An allotment should generally not be designated Category C if the public land in the allotment contains: (1) critical habitat for a threatened or endangered species, (2) wetlands negatively affected by livestock grazing (BLM 2008a).

Allotment Management Plan: A written program of livestock grazing management, including supportive measures if required, designed to attain specific management goals in a grazing allotment.

Alluvial: Composed of alluvium or deposited by a stream or running water.

Alluvium: A general term for all deposits resulting from the operations of modern rivers and creeks, including the sediments laid down in riverbeds, floodplains, and fans at the foot of mountain slopes.

Analysis Area: Any lands, regardless of jurisdiction, for which the BLM synthesizes, analyzes, and interprets data for information that relates to planning for BLM-administered lands.

Animal Unit Month (AUM): A standardized measurement of the amount of forage necessary for the sustenance of one cow unit or its equivalent for 1 month (approximately 800 pounds of forage).

Animal-unit: Considered to be one mature cow of approximately 1,000 pounds, either dry or with calf up to 6 months of age, or their equivalent, based on a standard amount of forage consumed.

Anticline or Anticlinal: A fold, generally convex upward, whose core contains the stratigraphically older rocks; also configuration of folded, stratified rocks in which the rocks dip or incline in two directions away from the crest, like the two halves of a pitched roof (BLM 2006; American Geological Institute 2005).

Appropriate Management Level: The number of adult horses or burros (expressed as a range with an upper and lower limit) to be managed within an HMA. The appropriate management level range is the number of adult wild horses and burros within which herd size will be allowed to fluctuate. The upper limit of the range is the maximum number of wild horses and burros that results in a thriving natural ecological balance and avoids a deterioration of the range; the lower limit of the range is the number that allows the population to grow to the appropriate management level upper limit over 4 to 5 years, without the need for gathers to remove excess wild horse and burros in the interim.

Archaeology: A method of the discovery, study and reconstruction of past human cultures from material remains such as artifacts and sites.

Archaeological Site: A place which holds evidence of past human activity.

Archeological Landscape District: A significant concentration, linkage, or continuity of cultural resource sites important in history or prehistory (BLM 2002b).

Archaic: Ancient, old, or surviving from an earlier people. Archaic can also mean relating to an earlier time.

Area of Critical Environmental Concern (ACEC): An area within the public lands designated for special management attention to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards. According to 43 CFR 1601.0-5a, "The identification of...[an] ACEC shall not, of itself, change or prevent change of the management or use of public lands."

Areas Administratively Unavailable to Leasing: BLM H-1601-1 – Land Use Planning, Appendix C.4 uses the term “areas closed to oil and gas leasing.” Areas administratively unavailable or closed to oil and gas leasing are areas where it has been determined that other land uses or resource values cannot be adequately protected with even the most restrictive oil and gas leasing stipulations; appropriate protection can be ensured only by making the areas administratively unavailable to oil and gas leasing for the life of the plan. Lands currently under lease would remain leased for the life of the leases. After expiration of these leases, no lands would be available for lease.

Aridisols: Soils developed in arid environments with subsurface development that contains calcium carbonate ($CaCO_3$).

Arroyo: A deep gully from the Spanish word riachuelo meaning stream, brook, small river or the dry bed of a waterway in the southwestern part of the United States.

Arroyo Traps: A dead end arroyo that was deep and broad enough to trap bison. Hunters drove a group of bison into one. When the stampeding bison reached the dead end, hunters armed with spears slaughtered the struggling animals.

Artifact: Any object made, modified, or used by humans usually, but not necessarily portable.

Assessment Unit: A mapable volume of rock within a total petroleum system that encompasses accumulations (discovered and undiscovered) that share similar geologic traits and socio-economic factors. Accumulations within an assessment unit should constitute a sufficiently homogeneous population such that the chosen methodology of resource assessment is applicable. A total petroleum system might equate to a single assessment unit. If necessary, a total petroleum system can be subdivided into two or more assessment units in order that each unit is sufficiently homogeneous to assess individually. An assessment unit may be identified as conventional, if it contains conventional accumulations, or as continuous, if it contains continuous accumulations.

Associated Settings: The geographic extent of the resources, qualities, and values or landscape elements within the surrounding environment that influence the trail experience and contribute to resource protection. Settings associated with a National Scenic or Historic Trail include scenic, historic, cultural, recreation, natural (including biological, geological, and scientific), and other landscape elements (see resources, qualities, and values).

Atlatl: A spear thrower that extended the range of a thrown spear. Using it caused the spear to go faster and farther than when it was thrown without an atlatl.

Avoid: A term used to address mitigation of some activity (i.e., resource use). Paraphrasing the Council on Environmental Quality Regulations (40 CFR 1508.20), avoidance means to circumvent, or bypass, an impact altogether by not taking a certain action, or parts of an action. Therefore, the term "avoid" does not necessarily prohibit a proposed activity, but it may require the relocation of an action, or the total redesign of an action to eliminate any potential impacts resulting from it.

Avoidance Areas: Areas where negative routing factors exist. ROWs either will not be granted in these areas, or—if granted—will be subject to stringent terms and conditions. In other words, ROWs would be *restricted* (but not necessarily prohibited) in these avoidance areas.

Avoidance Mitigation: Avoiding the impact altogether by not taking a certain action or parts of an action. (40 CFR 1508.20(a)) (e.g., may also include avoiding the impact by moving the proposed action to a different time or location).

Back Country Byway:

> **Back Country Byway Type I:** Byways that are either paved or have an all-weather surface. Normal passenger cars can easily negotiate the roads. They are usually narrow, slow-speed, secondary roads. None of the byways follow the main highways.
>
> **Back Country Byway Type II:** Roads that require high-clearance trucks or four-wheel-drive vehicles, although passenger cars may be able to negotiate them under good conditions. These roads are not paved but often have an improved gravel surface. They often cross dry, rocky arroyos, have rough rutted sections, and have occasional steep grades and sharp curves.
>
> **Back Country Byway Type III:** Byways requiring four-wheel-drive vehicles and others such as dirt bikes and all-terrain vehicles (ATVs). These roads are often unimproved dirt tracks. Expect steep grades, rocky and muddy sections, and possible route-finding. Do not attempt these byways in a two-wheel-drive vehicle, the consequences could be serious for operator/passenger and car.
>
> **Back Country Byway Type IV:** Trails that are managed for snowmobile, dirt bike, mountain bike, or ATV use.

Basal Area: An area of land that is occupied by the cross-section of tree trunks and stems at their base.

Baseline: The pre-existing condition of a defined area and/or resource that can be quantified by an appropriate metric. During environmental reviews, the baseline is considered the affected environment that exists at the time of the review's initiation, and is used to compare predictions of the effects of the proposed action or a reasonable range of alternatives.

Basement Rock: A complex of undifferentiated rocks that underlies the oldest sedimentary rocks (SOP and WLA no date).

Basin: An extent of land where water from rain or snow melt drains downhill into a body of water, such as a river, lake, reservoir, estuary, wetland, sea or ocean. The basin includes both the streams and rivers that

convey the water as well as the land surfaces from which water drains into those channels, and is separated from adjacent basins by a drainage divide.

Best Management Practices (BMP): A suite of techniques that guide, or may be applied to, management actions to aid in achieving desired outcomes. Best management practices are often developed in conjunction with land use plans, but they are not considered a land use plan decision unless the land use plan specifies that they are mandatory. They may be updated or modified without a plan amendment if they are not mandatory.

Benefits-Based Management: Method for prescribing wildland recreation management from analysis in identifying and applying psychological motivators of participants in leisure activities. Benefits-based management is used in prescribing management, administration, monitoring, and marketing actions based on identified on-site desired experiences and lasting desired beneficial outcomes from activities influenced from the local recreational setting character conditions.

Big Game Crucial Winter Range: Winter habitat on which a wildlife species depends for survival. Because of severe weather conditions or other limiting factors, no alternative habitat would be available.

Biodiversity: The range of biological resources present in a particular region. It can be measured by the numbers and types of different ecosystems, species, or the genetic variation within species.

Biologically Significant Unit: In Wyoming, the Biologically Significant Unit for greater sage-grouse is Priority Habitat Management Areas (PHMAs), regardless of whether PHMAs cross multiple planning boundaries.

Borrow Material: A term used in conjunction with construction. The term refers to unprocessed material excavated from a borrow pit for use as fill at another location.

Bow and Arrow: A bow is a weapon for shooting arrows. It is made of a flexible material, often wood, that is bent by a string that is fastened to each end. An arrow is a straight slender stick that has a projectile point at one end and feathers on the other.

C Category (Custodial): see *Allotment Categorization*.

Carbon Dioxide Flood: A carbon dioxide flood (CO_2) is an enhanced oil recovery technique that injects fluid into the reservoir. When carbon dioxide is injected, it mixes with the oil and the two compounds dissolve into one another. The injected CO_2 acts as a solvent to overcome forces that trap oil in tiny rock pores and helps sweep the immobile oil left behind after the effectiveness of water injection decreases, resulting in increased oil production (EnCana 2005).

Carbon Isotope Excursion: A marked deviation in the atmospheric C^{13}/C^{12} ratio due to a change in the global primary productivity level.

Carrying Capacity: The maximum stocking rate possible which is consistent with maintaining or improving vegetation or related resources. It may vary from year to year on the same area due to fluctuating forage production.

Casual Collecting: The collecting of a reasonable amount of common invertebrate and plant paleontological resources for non-commercial personal use, either by surface collection or the use of non-powered hand tools resulting in only negligible disturbance to the Earth's surface and other resources.

Category (see *Allotment Categorization*): The criteria used for the placement of the allotments into categories based on resource potential, resource use conflicts or controversy, opportunity of positive economic return on public investments, and the present management situation (BLM 1990).

Cattleguard: A device or structure, at points where roads or railroads cross a fence line, that is so designed that vehicular travel is uninterrupted, but crossing by all kinds of livestock is restricted.

Causal: Relating to a cause or causes; relating to a cause of effect.

Cheatgrass: Cheatgrass (*Bromus tectorum*) is an annual grass that forms tufts up to 2 feet tall. The leaves and sheaths are covered in short, soft hairs. The flowers occur as drooping, open, terminal clusters that can have a greenish, red, or purple hue. Flowering occurs in the early summer. These annual plants will germinate in fall or spring (fall is more common), and senescence usually occurs in summer. Cheatgrass invades rangelands, pastures, prairies, and other open areas. Cheatgrass has the potential to completely alter the ecosystems it invades. It can completely replace native vegetation and change fire regimes and is most problematic in areas of the western United States with lower precipitation levels.

Class I Wells: Injection wells that are:

(1) Used by generators of hazardous waste or owners or operators of hazardous waste management facilities to inject hazardous waste beneath the lowermost formation containing, within ¼ mile of the well bore, an underground source of drinking water.

(2) Other industrial and municipal disposal wells that inject fluid beneath the lowermost formation containing, within ¼ mile of the well bore, an underground source of drinking water.

(3) Radioactive waste disposal wells that inject fluid below the lowermost formation containing an underground source of drinking water within ¼ mile of the well bore.

Class II Wells: Injection wells that are:

(1) Brought to the surface in connection with natural gas storage operations, or conventional oil or natural gas production, and may be commingled with wastewaters from gas plants, which are an integral part of production operations, unless those waters are classified as a hazardous waste at the time of injection.

(2) For enhanced recovery of oil or natural gas.

(3) For storage of hydrocarbons that are liquid at standard temperature and pressure.

Closed: Generally denotes that an area is not available for a particular use or uses; refer to specific definitions found in law, regulations, or policy guidance for application to individual programs.

Clovis Point: Spear point made by early Paleo-Indians; characterized by a short, shallow channel on one or both faces; larger than a Folsom point.

Colluvium: Rock fragments, sand, or soil material that accumulates at the base of slopes; slope wash (BLM 2008b).

Commercial Forestland: Capable of producing 20 cubic feet of wood fiber from commercial species per acre per year and has not been withdrawn from forest product harvest by law or statute.

Commodity: An economic good, such as a product of agriculture or mining.

Communal Hunt: A hunt in which all the group's able people joined. It may involve a number of groups and employ a technique that could kill many animals, such as bison (or buffalo) jump.

Communication Site Management Plan: A plan that provides for effective administration of a communications site. The site plan defines the principles and technical standards adopted in the site designation. The site plan provides direction for the day-to-day operations of the site in connection with

the lease. The site plan shall delineate the types of uses that are appropriate at this site and the technical and administrative requirements for management of the site. The site plan should reflect the complexity of the current situation and the anticipated demand for the site.

Community: (1) An assemblage of populations of plants and/or animals in a common spatial arrangement. (2) As assemblage of plants occurring together at any point in time, while denoting no particular ecological status. (3) A unit of vegetation.

Community Phase: A unique assemblage of plants and associated dynamic soil property levels that can occur within a state (Caudle et al. 2013).

Community Recreation-tourism Market: A community or communities dependent on public lands recreation or related tourism use, growth, or development. Major investments in facilities and visitor assistance are authorized within SRMAs where the BLM's strategy is to target demonstrated community recreation-tourism market demand. Here, recreation management actions are geared toward meeting primary recreation-tourism market demand for specific activity, experience, and benefit opportunities. These opportunities are produced through maintenance of prescribed natural resource or community setting character and by structuring and implementing management, marketing, monitoring, and administrative actions accordingly.

Compensatory Mitigation: Compensating for the (residual) impact by replacing or providing substitute resources or environments. (40 CFR 1508.20)

Compensatory Mitigation Projects: Specific, on-the-ground actions to improve and/or protect habitats (e.g., chemical vegetation treatments, land acquisitions, conservation easements).

Compensatory Mitigation Sites: The durable areas where compensatory mitigation projects will occur.

Comprehensive Weed Management Plan: A plan for controlling invasive plant species that incorporates integrated weed management techniques and accounts for pertinent considerations, such as management actions and allocations affecting weeds.

Context and Intensity (NEPA): Determining the significance of an impact under NEPA requires consideration of the context and intensity. Context is the significance of an action that must be analyzed in its current and proposed short- and long-term effects on the whole of a given resource (e.g., the affected region). Intensity refers to the severity of the effect, expressed qualitatively (relative comparable terms) or quantitatively (empirically measurable units).

Continuous Grazing: The grazing of a specific unit by livestock throughout a year or that part of the year during which grazing is feasible. The term is not necessarily synonymous with yearlong grazing, since seasonal grazing may be involved.

Cool-Season Plant: A plant which generally makes the major portion of its growth during the late fall, winter, and early spring. Cool-season species generally exhibit the C3 photosynthetic pathway.

Nonconsumptive Use: This is a use that does not reduce supply. For example, wildlife viewing does not reduce the supply of wildlife as opposed to big game hunting, which reduces the supply of big game.

Contrast: Opposition or unlikeness of different forms, lines, colors, or texture in a landscape.

Controlled Surface Use (CSU): Surface occupancy or use will be restricted or prohibited unless the operator and surface managing agency arrive at an acceptable plan for mitigation of anticipated impacts. Identified resource values require special operational constraints that may modify the lease rights. CSU is used for operating guidance, not as a substitute for the no surface occupancy (NSO) or timing limitations.

Cordage: Plant fibers twisted into cord, rope, or yarn.

Core Areas: An area of habitat of an appropriate size, configuration, and plant community type as to be capable of supplying all elements for the long-term security of a population of a given species (County of Riverside No Date).

Cover: (1) The plants or plant parts living or dead, on the surface of the ground. Vegetative cover or herbage cover is composed of living plants and litter cover of dead parts of plants. (2) The area of ground cover by plants of one or more species.

Critical Growing Season (Growth Period): A specified period of time in which plants need to develop sufficient carbohydrate reservoir and produce seed. This period of time varies by growth form. For example: Cool season bunchgrasses: May 1 – July 15; Warm season perennial grasses: June 1 – July 30; Riparian vegetation: July 1 through August 30.

Cryic Soils: Soil temperature regime that has mean annual soil temperatures between 0°C and 8°C (32°F and 47°F) (University of Wyoming 1999).

Cultural Resource Inventory Levels: A three-tiered process for discovering, recording, and evaluating cultural resources.

> **Class I** - A review of existing literature and oral informant data combined with an analysis of a specific geographic region (e.g., an area of potential effect, drainage basin, resource area, etc.).
>
> **Class II -** A sampling survey usually aimed at developing and testing a predictive model of cultural resource distribution.
>
> **Class III -** An on-the-ground survey to discover, record, and evaluate cultural resources within a specific geographic area (e.g., usually an area of potential effect for a proposed undertaking).

Cultural Resources Setting Consideration Zones (SCZ): Zones of view shed management of "X" distance or the visual horizon, whichever is closer, from the external site boundaries, created to reduce visual and acoustic impacts to cultural resources for which the elements of setting and association are important. Where the vegetation, rock formations, open space, and bodies of water that made up the environmental setting during the periods of prehistoric or historic occupation or use are intact, management actions will be modified to maintain the long term integrity of those features. The current integrity of environmental features or factors related to the location, use, formation, or preservation of the site will be the important factors for determining appropriate management actions.

Culture: The customs, beliefs, and ways of life of a group of people.

Cultivate: To raise crops; to water, loosen the soil, and weed around growing plants.

Cultivation: The process of preparing the land and caring for growing crops.

Dark Zone Cave: An environmental zone found in deep and extensive caves. This cave zone is typified by complete darkness, almost constant temperature and humidity, and a unique array of cave-adapted organisms.

dB (decibel): A unit of measurement of the loudness or strength of a signal. One decibel is considered the smallest difference in sound level that the human ear can discern. Decibels are a relative measurement derived from two signal levels: a reference input level and an observed output level. A decibel is the logarithm of the ratio of the two levels. One Bel is when the output signal is 10 times that of the input and one decibel is 1/10 of a Bel.

Declared Pest: Any animal or insect which the board and the Wyoming weed and pest council have found, either by virtue of its direct effect, or as a carrier of disease or parasites, to be detrimental to the general welfare of persons residing within a district.

Declared Weed: Any plant which the board and the Wyoming weed and pest council have found, either by virtue of its direct effect, or as a carrier of disease or parasites, to be detrimental to the general welfare of persons residing within a district (State of Wyoming 1973).

Deferment: Delay of livestock grazing on an area for an adequate period of time to provide for plant reproduction, establishment of new plants, or restoration of vigor of existing plants. Rest is not defined as deferment in the Cody Field Office.

Deferred Grazing: The use of deferment in grazing management of a management unit, but not in a systematic rotation including other units. In the Cody Field Office, this is usually used to identify grazing use after the growing season, generally after August 15.

Deferred-rotation: Any grazing system which provides for a systematic rotation of the deferment among pastures.

Dendrochronology: The study of tree-ring dating. The science of dating events and weather patterns in former times by studying growth rings in trees. One can determine the age of a tree by counting its rings.

Designated Noxious Weeds: Weeds, seeds, or other plant parts that are considered detrimental, destructive, injurious, or poisonous, either by virtue of their direct effect or as carriers of diseases or parasites that exist within this state, and are on the designated list.

Designated Pests: Animals or insects which are on the designated list considered detrimental to the general welfare of the state (State of Wyoming 1973).

Designated Roads and Trails: A network of roads and trails specifically identified as the official travel and transportation network for a given area on which some type of motorized vehicle use is allowed either seasonally or year-long. Designated roads and trails are identified on maps, identified by signs in the field, and may be assigned road numbers for inventory and identification purposes. This may include routes on the official BLM transportation plan that are routinely maintained as well as routes that were user-created and which receive no regular maintenance. Vehicle travel is permitted only on roads and vehicle routes designated by the BLM. In areas where no formal travel management plan has been implemented, motorized use is limited to existing roads and trails on an interim basis.

Desired Future Condition (DFC): A portrayal of the land or resource conditions which are expected to result if goals and objectives are fully achieved (BLM and USFS 2001).

Desired Future Condition (DFC) for Riparian and Wetlands (after 20-40 years of management):

- Proper functioning conditions on all riparian and wetland habitats.
- Riparian and wetland vegetation supports proper functioning condition of biologic, hydrologic, and physical components of streams and wetlands.
- Systems are vertically stable (no downcutting).
- Floodplain connectivity.
- Herbaceous plant communities are composed of functional and structural plant groups that are dominated by deep-rooted native species that support streambank and shoreline stability, floodplain development, water quality, and nutrient cycling. Also includes woody species and cottonwoods within the site's potential.
- Management of invasive, noxious, and undesirable species.
- Provide 'Yellow, Red and Blue Ribbon' streams on those systems with fish habitat potential.

Desired Plant Community (DPC): Of the several plant communities that may occupy a site, the DPC is the community that has been identified through a management plan to best meet the plan's objectives for the site. At a minimum, it must protect the site.

Destination Recreation-Tourism Market: National or regional recreation-tourism visitors and other constituents who value public lands as recreation-tourism destinations. Major investments in facilities and visitor assistance are authorized within special recreation management areas (SRMAs) where the BLM's strategy is to target demonstrated destination recreation-tourism market demand. Here, recreation management actions are geared toward meeting primary recreation-tourism market demand for specific activity, experience, and benefit opportunities. These opportunities are produced through maintenance of prescribed natural resource setting character and by structuring and implementing management, marketing, monitoring, and administrative actions accordingly.

Determination (Standards and Guidelines [S&G]): Document recording the authorized officer's finding that existing grazing management practices or levels of grazing use on public lands grazing either are or are not significant factors in failing to achieve the standards and conform with the guidelines within a specified geographic area (preferably watershed or a group of contiguous watersheds) (BLM 2001).

Diet: What people and living organisms eat is their diet. A diet is a combination of foods and liquids that provide the necessary nutrients for the body.

Digging Stick: A pointed, wooden stick used to dig and pry edible roots from the ground.

Disruptive Activity: Those activities that disrupt or alter wildlife actions at key times, during important activities, or in important areas (feeding, breeding, nesting, herd movement, winter habitat). Disruptive activities are those which can result in reductions of energy reserves, health, reproductive success, or population. Some examples of disruptive activities include geophysical (seismic), well plugging or work-over operations that last 24 to 48 hours or longer, road reclamation, and wild horse grazing and management. Emergency activities, rangeland monitoring, recreational activities, livestock grazing and management, and other field activities are not considered disruptive activities (BLM 2008f).

Domestication: The process of taming or making usable for humans.

Drive Line: Alignments of stone, brush, logs or other materials designed to control the movement of animals during hunts.

Driveway: A strip of land specifically designated for the controlled movement of livestock.

Drought: (1) A prolonged chronic shortage of water, as compared to the norm, often associated with high temperatures and winds during spring, summer, and fall. (2) A period without precipitation during which the soil water content is reduced to such an extent that plants suffer from lack of water.

Dung: Animal manure. Solid waste material passed from the bowels of animals. Scientists study dung to learn what animals and humans ate in the past.

Durability (protective and ecological): The maintenance of the effectiveness of a mitigation project for the duration of the associated impacts, which includes resource, administrative/legal, and financial considerations (adopted and modified from BLM Manual Section 1794).

Ecological Site: A distinctive kind of land with specific soil and other physical characteristics that differs from other kinds of land in its ability to produce distinctive kinds and amounts of vegetation and in its ability to respond to management actions and natural disturbances.

Ecological Site Description (ESD): The official documentation of an ecological site describing the distinctive properties and characteristics, the abiotic and biotic relationships, and the ecological dynamics

of the site. In addition an ESD also provides interpretations about land uses and ecosystem services that a particular ecological site can support and management alternatives for achieving land management objectives.

Ecological Status: Ecological status is the present state of vegetation of a range site in relation to the potential natural community for that site. It is an expression of the relative degree to which the kinds, proportions and amounts of plants in a plant community resemble that of the potential natural plant community for the site. Four classes are used to express the degree to which the production or composition of the present plant community reflects that of the potential natural community (climax).

Ecosystem: A complete, interacting system of living organisms and the land and water that make up their environment; the home places of all living things, including humans.

Eligible River: An eligible river segment found through administrative study to meet the criteria for designation as a component of the National System, as specified in Section 4(a) of the Wild and Scenic Rivers Act.

Endangered Species: A plant or animal species whose prospects for survival and reproduction are in immediate jeopardy, as designated by the Secretary of the Interior, and as is further defined by the Endangered Species Act.

Enhanced Recovery: The use of artificial means to increase the amount of hydrocarbons that can be recovered from a reservoir. A reservoir depleted by normal extraction usually can be restored by secondary or tertiary methods of enhanced recovery.

Enhancement: A management action designed to improve visual quality.

Entisols: Soils with little or no development.

Environment: The conditions around an area that affect it. These include geography, soil, climate, plants, and animals.

Ephemeral Stream: A stream that flows only in direct response to precipitation, and whose channel is at all times above the water table. Confusion over the distinction between intermittent and ephemeral streams may be minimized by applying Meinzer's suggestion that the term "ephemeral" be arbitrarily restricted to streams that do not flow continuously for at least 30 days (Prichard et al. 1998). Ephemeral streams support riparian areas when streamside vegetation reflects the presence of permanent subsurface water.

Epicontinental Seaway: Shallow sea extending far into a continent.

Epidemic: An outbreak of a pest or disease in a high proportion of the individuals of a population in a geographic area. For example, outbreaks of bark beetles causing mortality in a large portion of pine trees in a forest.

Evaluation (S&G): An evaluation is conducted to arrive at 2 outcomes. Firstly, an evaluation conducts an analysis and interpretation of the findings resulting from the assessment, relative to land health standards, to evaluate the degree of achievement of land health standards. Secondly, an evaluation conducts an analysis and interpretation of information--be it observations or data from inventories and monitoring--on the causal factors for not achieving a land health standard. An evaluation of the causal factors provides the foundation for a determination (see *Determination*) (BLM 2001).

Evidence: Data which are used to prove a point, or which clearly indicate a situation.

Excavation (Archaeological): Carefully removing layers of dirt or sediment to find objects or features made by people from long ago.

Exceedance: An event in which measurements of ambient air quality are above the national ambient air quality standard (NAAQS) or Wyoming Department of Environmental Quality (DEQ) standard set for a particular pollutant. For example, an annual average nitrogen dioxide value of 110 µg/m^3 is an exceedance of both the NAAQS and Wyoming DEQ annual average standard for nitrogen dioxide of 100 µg/m^3.

Exclusion Areas: Areas with sensitive resource values where rights-of-way (ROWs) and 302 permits, leases, and easements would not be authorized.

Existing Roads and Trails (interim existing roads and trails): Defined as routes existing prior to the date the OHV designation is announced in the *Federal Register*. These routes may have been constructed and maintained or may be two-track routes created and maintained by the passage of motor vehicles and which receive regular use. Roads and trails may be added, modified, or deleted by the Bureau from the inventory through authorizations as needs arise. Recent CTTM guidance (BLM Handbook 8342-1) directed the BLM to manage all BLM-administered public lands under "Designated Roads and Trails". Existing roads and trails is to be used on an interim basis until a Travel Management Plan designates each individual route as open or closed for motorized use. The term "interim existing roads and trails", or "existing roads and trails" are used to identify areas of low priority for travel management planning.

Extensive Recreation Management Areas (ERMA): *See Recreation Management Areas*.

Extinct: No longer existing or active; died out.

Extinction: Bring to an end, wiping out, or destruction.

Fault: A fracture in bedrock along which there has been vertical and/or horizontal movement caused by differential forces in the earth's crust (BLM 2008f).

Fire Management Plan: Identifies appropriate strategies to achieve resource objectives. Identifies fire policy, objectives, and prescribed actions; may include maps, charts, tables, and statistical data.

Fire Regime Condition Class: A classification of the amount of departure from the natural fire regime. The departure results in changes to one or more of the following ecological components: vegetation characteristics (e.g., species composition, structural stages, stand age, canopy closure, and mosaic pattern), fuel composition, fire frequency, severity, and pattern, and other associated disturbance (e.g., insect and disease mortality, grazing, and drought). The three condition classes are listed below:

Condition Class 1:

- The historic disturbance regime is largely intact and functioning (e.g., has not missed a fire return interval)
- Potential intensity and severity of fire within historic range
- Effects of disease and insects within historic range
- Hydrologic functions within normal historic range
- Vegetation composition and structure resilient to disturbances
- Nonnative species currently not present or to a limited extent
- Low risk of loss for key ecosystem components.

Condition Class 2:

- Moderate alterations to historic disturbance regime evident (e.g., missed one or more fire return intervals)
- Effects of disease and insects pose an increased risk of loss of key community components

- Riparian areas and associated hydrologic function show measurable signs of adverse departure from historic conditions
- Vegetation composition and structure shifted toward conditions less resilient to disturbances
- Populations of nonnative species may have increased, increasing the risk of further increases following disturbance.

Condition Class 3:

- Historic disturbance regime significantly altered; historic disturbance processes and impacts may be precluded (e.g., missed several fire return intervals)
- Effects of disturbance (fire, insects, and disease) may cause significant or complete loss of key community components
- Hydrologic functions may be adversely altered; high potential for increased sedimentation and reduced streamflows
- Invasive, nonnative species may be common and in some cases the dominant species on the landscape; disturbance will likely increase both the dominance and geographic extent of these invasive species
- Highly altered vegetation composition and structure predisposes community to disturbance events outside the range of historic availability; disturbance may have effects not observed or measured before.

Fire Return Interval: The number of years between two successive fire events at a specific site or area.

Flaring/Venting: The controlled burning (flare) or release (vent) of natural gas that cannot be processed for sale or use because of technical or economic reasons.

Floodplain Connectivity: Maintenance of lateral, longitudinal, and vertical pathways for biological and hydrological processes in the floodplain. Examples of failures to maintain connectivity could include culverts or levees that restrict flow in the floodplain and that focus overbank flow into the channel.

Floristic Province: Areas of ecological and biological issues similarity (Stiver et al. 2006).

Flushing Livestock: Flushing livestock is the holding of livestock in an invasive, nonnative plant species (INPS) seed-free area where they are fed an INPS seed-free ration for 72 hours, thus flushing INPS seed from the animals' digestive systems.

Fluvial: Pertaining to rivers, streams, and floodplains (BLM 2006).

Folsom Point: A spear or atlatl dart point made by later Paleo-Indians. Characterized by a long, shallow channel on one or both faces; smaller than a Clovis point.

Foothill: A low hill near the base of a mountain or range of mountains.

Forage: Browse and herbage that are available and may provide food for grazing animals or be harvested for feeding. To search for or consume forage.

Forage Production: The weight of forage that is produced within a designated period of time on a given area (e.g., pounds per acre). The weight may be expressed as either green, air-dry, or oven-dry. The term may also be modified as to time of production such as annual, current years, or seasonal forage production.

Foreground-Middle Ground Zone: An area that can be seen from a travel route for a distance of 3 miles (foreground) to 5 miles (middle ground) where management activities might be viewed. A distance from 5 to 15 miles is called the *Background Zone* and the area beyond 15 miles is called the *Seldom-Seen Zone.*

Foreland Basin: A linear sedimentary basin in a foreland which subsides in response to flexural loading of the lithosphere by adjacent thrust sheets; also a depression that develops adjacent and parallel to a mountain belt (American Geological Institute 2005).

Forestland: Capable of producing 20 cubic feet of wood fiber from commercial species per acre per year.

Fossil: Fossils are any naturally occurring evidence of life older than 10,000 years.

Frigid (soils): The frigid soil temperature regime has mean annual soil temperatures below 8°C (47°F) but above 0°C (32°C). Frigid soils are described as cool (University of Wyoming 1999).

Functional/Structural Groups: A suite of species that are grouped together, on an ecological site basis, because of similar shoot (height or column) or root (fibrous vs. tap) structure, photosynthetic pathways, nitrogen fixing ability, or life cycle (University of Wyoming 1999).

Fundamentals of Rangeland Health: Overarching principles of rangeland health, listed at 43 CFR § 4180.1, which establish BLM policy of managing for healthy rangelands (60 Federal Register (FR) at 9954). State or regional standards and guidelines must provide for conformance with the Fundamentals of Rangeland Health (43 CFR § 4180.2(b)) (BLM 2001).

Geographic Information System (GIS): A computer system capable of storing, analyzing, and displaying data and describing places on the earth's surface.

Geologic Province: A spatial entity with common geologic or geomorphic attributes. A province may include a single dominant structural element such as a basin or a fold belt, or a number of contiguous related elements.

Geologic Resources: Resources associated with the scientific study of the Earth, including its composition, structure, physical properties, and history. Geologic resources commonly include the study of minerals (mineralogy) and rocks (petrology); the structure of the Earth (structural geology) and volcanic phenomena (volcanology); and landforms and the processes that produce them (geomorphology and glaciology).

Glacier: A large mass of ice that moves slowly down a slope or valley.

Goal: A broad statement of a desired outcome. Goals are usually not quantifiable and may not have established timeframes for achievement.

Goal Interference: Recreationist pursuing desired beneficial outcomes is not able to realize the positive aspects of a visit because of the behavior of someone else.

Granitic: General term for all light-colored, granite-like igneous rocks (BOR no date).

Graze: (1) The consumption of standing forage by livestock or wildlife. (2) To put livestock to feed on standing forage.

Grazing: To graze.

Grazing License or Permit: Official written permission to graze a specific number, kind, and class of livestock for a specified period on a defined allotment or management area.

Grazing Management: The manipulation of grazing and browsing animals to accomplish a desired result.

Grazing Management Plan: A program of action designed to secure the best practicable use of the forage resource with grazing or browsing animals.

Grazing Period: The length of time that animals are allowed to graze on a specific area.

Grazing Permit: A document that authorizes grazing use of the public lands under Section 3 of the Taylor Grazing Act. A grazing permit specifies terms and conditions under which permittees make grazing use during the term of the permit. Terms and conditions include the area authorized for grazing use, the number of livestock, period of use, and amount of use in AUMs and others.

Grazing Preference: (1) Selection of plants, or plant parts, over others by grazing animals. (2) Grazing preference means a superior or priority position against others for the purpose of receiving a grazing permit or lease. This priority is attached to base property owned or controlled by the permittee or lessee. (Title 43 CFR 4100.0-5).

Grazing Season: (1) On public lands, and established period for which grazing permits are issued. May be established on private land in a grazing management plan. (2) The time interval when animals are allowed to utilize a certain area.

Grazing System: A specialization of grazing management which defines the periods of grazing and non-grazing.

Great Basin: is a large, arid region of the western United States, commonly defined as the contiguous watershed region, roughly between the Rocky Mountains and the Sierra Nevada, that has no natural outlet to the sea (WordIQ no date).

Greenhouse Gas (GHG): Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. This property causes the greenhouse effect. Water vapor (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), and ozone (O_3) are the primary greenhouse gases in the Earth's atmosphere.

Growing Season: In temperate climates, that portion of the year when temperature and moisture permit plant growth.

Guidelines: Actions or management practices that may be used to achieve desired outcomes, sometimes expressed as best management practices. Guidelines may be identified during the land use planning process, but they are not considered a land use plan decision unless the plan specifies that they are mandatory.

Guzzler: A water development for wildlife.

Habitat: The natural abode of a plant or animal, including all biotic, climatic, and edaphic factors affecting life.

Habitat Fragmentation: The destruction or splitting up of continuous habitat by a physical barrier (e.g., fence) or a land use that results in surface disturbance (e.g., road construction, development, or agriculture).

Habitat Guild: A group of species that tend to occur in similar types of habitats.

Habitat Management Area (HMA): An area containing a specific habitat type(s) that is managed for the maintenance or recovery of a particular species.

Habitat Management Plan (HMP): A written and approved activity plan for a geographical area of public lands which identifies wildlife habitat management actions to be implemented in achieving specific objectives related to RMP planning document decisions (BLM 1987).

HABS/HAER: The Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) is an integral component of the federal government's commitment to historic preservation. The program documents important architectural, engineering and industrial sites throughout the United States and its territories. A complete set of HABS/HAER documentation, consisting of measured drawings, large-format photographs, and written history plays a key role in accomplishing the mission of creating an archive of American architecture and engineering and in better understanding what historic resources tell us about America's diverse ethnic and cultural heritage. To insure that such evidence is not lost to future generations, the HABS/HAER Collections are archived at the Library of Congress, where they are made available to the public.

Hazard Fuels: A fuel complex defined by kind, arrangement, volume, condition, and location that presents a threat of ignition and resistance to control.

Hazardous Material: A substance or combination of substances that, because of quantity, concentration, or physical, chemical, or infectious characteristics, may either: (1) cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating, illness; or (2) pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

Heavy Equipment Use: This phrase is used in fire management and is relative to limiting fire suppression tactics. In this context it refers to not using dozers, skidders, or graders in areas where important resource values are in need of protection. Fire engines and water tenders used during suppression activities would be allowed.

Held by Production: Leases that become productive and do not terminate until all wells on the lease have ceased production.

High Potential Historic Site: Historic sites related to the route or sites in close proximity thereto which provide opportunity to interpret the historic significance of the trail during the period of its major use. The criteria for consideration of sites as high potential historic sites include historic significance, presence of visible historic remnants, scenic quality, and relative freedom from intrusion. High potential historic sites are assumed to contain remnants, artifacts, and other properties eligible for the National Register of Historic Places, pending evaluation. Under the National Trails System Act, high potential historic sites located on federally owned land are referred to as Federal Protection Components.

High Potential Route Segment: Segments of a trail which would afford a high-quality recreation experience in a portion of the route having greater than average scenic values or affording an opportunity to vicariously share the experience of the original users of a historic route. National Historic Trail high potential route segments are assumed to contain remnants, artifacts, and other properties eligible for the National Register of Historic Places, pending evaluation. Under the National Trails System Act, high potential route segments located on federally owned land are referred to as Federal Protection Components.

Historic: Referring to the time after written records or after the Europeans first came and wrote about the people and events in America.

Historic Trails: Generally those routes utilized during the initial exploration and settlement of an area. These routes are known from maps and other documents and may also retain physical integrity on the ground (see also *National Historic Trails).*

History: The study of past events and times through use of written and recorded sources. In some cases, oral sources may also be available.

House Pit: A dwelling that had an excavated floor and a roof of poles covered with branches or hides. An earth sheltered home that was probably used on a seasonal basis.

Hunter-gatherers: People who depend on seasonally available wild animals and plants for food to survive.

Hydrologic Units: The United States is divided and sub-divided into successively smaller hydrologic units which are classified into four levels: regions, sub-regions, accounting units, and cataloging units. The hydrologic units are arranged within each other, from the smallest (cataloging units) to the largest (regions).

I Category (Improve): See *Allotment Categorization*.

Impact Analysis for Planning (IMPLAN 2000) Model: IMPLAN is a regional economic model that provides a mathematical accounting of the flow of money, goods, and services through a region's economy. The model provides estimates of how a specific economic activity translates into jobs and income for the region. It includes the "ripple effect" (also called the "multiplier effect") of changes in economic sectors that may not be directly impacted by management actions, but are linked to industries that are directly impacted. In IMPLAN, these ripple effects are termed indirect impacts (for changes in industries that sell inputs to the industries that are directly affected) and induced impacts (for changes in household spending as household income increases or decreases due to the changes in production).

Important Cultural Resources: All historic properties allocated to Conservation for Future, Scientific, and Traditional use categories. Additionally on a case by case basis some historic properties assigned to Experimental, and Public use categories may be determined to be included in this class of resource.

Important Cultural Sites: See *Important Cultural Resources*.

Inceptisol: A soil order in the United States Department of Agriculture (USDA) soil taxonomy characterized by young soils just starting to show horizon development.

Increaser: Plant species of the original vegetation that increase in relative amount, at least for a time, under continued disturbance to the norm.

Indicator: An indicator is a component of a system whose characteristics (for example, presence, absence, quantity, and distribution) can be observed, measured, or monitored based on sound scientific principles. An indicator can be evaluated at a site- or species-specific level. Monitoring of an indicator must be able to show change within timeframes acceptable to management and be capable of showing how the health of the ecosystem is changing in response to specific management actions. Selection of the appropriate indicators to be observed, measured, or monitored in a particular allotment is a critical aspect of early communication among the interests involved on-the-ground. The most useful indicators are those for which change or trend can be easily quantified and for which agreement as to the significance of the indicator is broad based.

Indigenous: Born, growing, or produced naturally (native) in an area, region or county.

Infestation: The inhabitation of a host by large numbers of pests, such as bark beetles on pine trees. Invasion by large numbers of parasites or pests.

Infiltration: The downward entry of water into the soil or other material.

Integrated Weed Management: The use of all appropriate weed control measures, including fire, as well as mechanical, chemical, biological, and cultural techniques, in an organized and coordinated manner on a site-specific basis.

Interested Public: Interested public means an individual, group, or organization that has: (1)(i) Submitted a written request to BLM to be provided an opportunity to be involved in the decision making process as

to a specific allotment, and (ii) Followed up that request by submitting written comment as to management of a specific allotment, or otherwise participating in the decision making process as to a specific allotment, if BLM has provided them an opportunity for comment or other participation; or (2) Submitted written comments to the authorized officer regarding the management of livestock grazing on a specific allotment (CFR 4100.0-5).

Interim Management Policy (IMP): The policy and guidelines under which the BLM manages lands under wilderness review (known as Wilderness Study Areas). This policy is referred to as the "interim" management policy because it applies to specific areas of the public lands for a limited amount of time, depending upon various stages and schedules of the review process (BLM Manual 8550).

Intermittent Stream: A stream that flows only at certain times of the year when it receives water from springs or from some surface source such as melting snow in mountainous areas. Confusion over the distinction between intermittent and ephemeral streams may be minimized by applying Meinzer's suggestion that the term "intermittent" be arbitrarily restricted to streams that flow continuously for periods of at least 30 days (Prichard et al. 1998).

Invasive Species: According to Executive Order 13112, an invasive species is an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health. The executive summary of the National Invasive Species Management Plan further clarifies and defines an invasive species as a species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Inventory: Gathering of baseline information (including quantitative data, cultural knowledge, and qualitative observations) about condition of resources. Examples of inventory are Ecological Site Inventory, and Population Counts of Threatened or Endangered Species (BLM 2001).

Karst Region: Karst topography is a landscape shaped by the dissolution of a layer or layers of soluble bedrock, usually carbonate rock such as limestone or dolomite. Due to subterranean drainage, there may be very limited surface water, even to the absence of all rivers and lakes. Many karst regions display distinctive surface features, with sinkholes or dolines being the most common. However, distinctive karst surface features may be completely absent where the soluble rock is mantled, such as by glacial debris, or confined by a superimposed non-soluble rock strata. Some karst regions include thousands of caves, even though evidence of caves that are big enough for human exploration is not a required characteristic of karst.

Key Area (grazing): A relatively small portion of a rangeland selected because of its location, use, or grazing value as an area on which to monitor the effects of grazing use. It is assumed that key areas, if selected properly, will reflect the effects of current grazing management over all or a part of a pasture, allotment or other grazing unit.

Key Area (greater sage-grouse): Sagebrush habitat where there are known leks, brood-rearing or winter sage-grouse habitat (BLM 2004).

Key Species: Those species which must, because of their importance, be considered in a management program, or forage species whose use serves as an indicator of the degree of use of associated species.

Kinds of Livestock (animal): An animal species or species group such as sheep, cattle, goats, deer, horses, elk, antelope, etc.

Lacustrine: Pertaining to, produced by, or formed in a lake or lakes (BLM 2006).

Land: The total natural and cultural environment within which production takes place; a broader term than soil. In addition to soil, its attributes include other physical conditions, such as mineral deposits,

climate, and water supply; location in relation to centers of commerce, populations, and other land; the size of the individual tracts or holdings; and existing plant cover, works of improvement, and the like.

Land Health: Degree to which the integrity of the soil and the ecological processes of ecosystems are sustained (BLM 2001).

Land Tenure: To improve the manageability of BLM lands and improve their usefulness to the public, the BLM has numerous authorities for "repositioning" lands into a more consolidated pattern, disposing of lands, and entering into cooperative management agreements. These land-pattern improvements are completed primarily through the use of land exchanges, but also through land sales, jurisdictional transfers to other agencies, and through the use of cooperative management agreements and leases. These ownership or jurisdictional changes are referred as "Land Tenure Adjustments."

Lands with Wilderness Characteristics: Lands that have been inventoried and found to contain wilderness characteristics as defined in Section 2(c) of the Wilderness Act of 1964.

Landscape Character: The arrangement of a particular landscape as formed by the variety and intensity of the landscape features and the four basic elements of form, line, color, and texture. These factors give the area a distinctive quality which distinguishes it from its immediate surroundings.

Leasable Minerals: Those minerals or materials subject to lease by the federal government under the Mineral Leasing Act of 1920. They include coal, phosphate, asphalt, sulphur, potassium, and sodium minerals; oil and gas, as well as geothermal resources.

Lease: (1) A legal document that conveys to an operator the right to drill for oil and gas; (2) the tract of land, on which a lease has been obtained, where producing wells and production equipment are located. Contractual instruments granting rights to use specific managed public lands, with certain conditions, for specific purposes such as livestock grazing, timber harvesting, and energy or mineral development.

Lease Notice or Information Notice: Provides more detailed information concerning limitations that already exist in law, lease terms, regulations, or operational orders. A Lease Notice also addresses special items the lessee should consider when planning operations, but does not impose new or additional restrictions (Uniform Format for Oil and Gas Lease Stipulations, March 1989. Rocky Mountain Regional Coordinating Committee). An information notice has no legal consequences, except to give notice of existing requirements, and may be attached to a lease by the authorized officer at the time of lease issuance to convey certain operational, procedural or administrative requirements relative to lease management within the terms and conditions of the standard lease form. Information notices shall not be a basis for denial of lease operations (43 CFR 3101.1-3).

Lease Stipulation: A provision that modifies standard lease rights and is attached to and made a part of the lease (Uniform Format for Oil and Gas Lease Stipulations, March 1989. Rocky Mountain Regional Coordinating Committee). The authorized officer may require stipulations as conditions of lease issuance. "Stipulations shall become part of the lease and shall supersede inconsistent provisions of the standard lease form. Any party submitting a bid… shall be deemed to have agreed to stipulations applicable to the specific parcel…" (43 CFR 3101.1-3).

Lek: A traditional courtship display area attended by male sage-grouse in or adjacent to sagebrush dominated habitat. A lek is designated based on observations of two or more male sage-grouse engaged in courtship displays. Before adding the suspected lek to the database, it must be confirmed by an additional observation made during the appropriate time of day, during the strutting season. Sign of strutting activity (tracks, droppings, feathers) can also be used to confirm a suspected lek. Sub-dominant males may display on itinerant (temporary) strutting areas during population peaks. Such areas usually fail

to become established leks. Therefore, a site where small numbers of males (<5) are observed strutting should be confirmed active for two years before adding the site to the lek database.

Lentic: Standing water riparian/wetland areas such as lakes, ponds, seeps, bogs, and meadows (University of Arizona No Date).

Limited Area: Means an area restricted, at certain times, in certain areas, and/or to certain vehicle use. These restrictions may be of any type, but can generally be accommodated within the following type of categories: Number of vehicles; type of vehicles; time of season of vehicle use; permitted or licensed use only; use on existing roads and trails; use on designated roads and trails; and other restrictions.

Livestock: Domestic animals.

Livestock Carrying Capacity: The maximum stocking rate possible without inducing damage to vegetation or related resources. It may vary from year to year on the same area due to fluctuating forage production.

Livestock Management: Application of technical principles and business methods to livestock production.

Livestock Operation: The management of a ranch or farm so that a significant portion of the income is derived from the production of livestock.

Livestock Production: (1) The weight, number of animals, etc., that a particular range, seeded pasture, or management system produces. (2) The business of producing livestock.

Locatable Minerals: Minerals subject to exploration, development, and disposal by staking mining claims as authorized by the Mining Law of 1872, as amended. This includes deposits of metallic minerals such as gold, silver, and other uncommon materials not subject to lease or sale.

Lotic: Running water riparian/wetland areas such as rivers, streams, and springs (University of Arizona No Date).

M Category (Maintain): See *Allotment Categorization*.

Major Constraints (Oil and Gas): Any stipulations or conditions of approval which may restrict the timing or placement of oil and gas developments and may result in an operator dropping the development proposal. Major constraints include NSOs, areas of overlapping TLS that last more than 6 months, areas closed to surface-disturbing activity, areas where surface-disturbing activity is prohibited, and VRM Class I areas. Leaseholders have the right to explore, develop, and produce mineral resources from any valid, existing lease, even if the area containing the lease were proposed to be closed to future leasing.

Major Land Resource Areas (MLRA): Broad geographic areas that are characterized by a particular pattern of soils, climate, water resources, vegetation, and land use.

Management Plan: A program of action designed to reach a given set of objectives.

Management Zone (greater sage-grouse): Biologically based management areas determined using sage-grouse populations and sub-populations identified within distinct floristic provinces. Management Zones reflect ecological and biological issues and similarities, not political boundaries. In addition, the vegetation communities found in the floristic provinces, as well as the management challenges within a given Management Zone, are similar and sage-grouse and their habitats are likely responding similarly to environmental factors and management actions (Stiver et al. 2006).

Mass Wasting: Down slope movement of soil or rock as a result of gravity.

Measureable Targeted Outcomes: A quantitative scale used to measure explicitly stated targeted experience and benefit outcomes as prescribed in each Recreation Management Area (SRMA, RMZ, Separate ERMA) though monitoring methods such as on site surveys, focus groups, or other means

appropriate and as funding allows to sample and collect data. Measurable targeted outcomes is ranged on a probability scale where 1=not at all, 2=somewhat, 3=neutral, 4=moderate, 5=total realization.

Mechanized Use: Use of public lands by human-powered vehicles (such as mountain bicycles).

Medicine Wheel: A stone structure or alignment which may include a ring, spokes, cairns, or other features. Many are rings with radial spokes and cairns in the center and along the ring. Others are simple radial spokes or combinations of both (Brumley 1988). These features are believed to have functions in ceremonial practices including astronomically based calendars. They are commonly found in association with other stone features (Brumley 1988).

Megafauna: Large animals especially in the last Ice Age or Pleistocene. These animals are now extinct and include mammoths, mastodons, American lions, American camels, and saber-toothed cats.

Mesic: Related to conditions of moderate moisture or water supply. Used to describe organisms occupying moist habitats.

Metamorphic Rock: Rocks that have undergone a fundamental change as the result of heat, pressure, and the chemical action of pore fluids and gases.

Middle Rocky Mountain Foreland: A sub-province within the Rocky Mountain System geologic province (see *Geologic Province*) that includes complex mountains with many intermontane foreland basins (see *Foreland Basin*) and plains.

Mineral Materials (Salables): Materials such as common varieties of sand, stone, gravel, pumice, pumicite, and clay that are not obtainable under the mining or leasing laws, but can be acquired under the Mineral Materials Act of 1947, as amended.

Mineral Withdrawal: A formal order that withholds federal lands and minerals from entry under the Mining Law of 1872, as amended, and closes the area to mineral location (i.e., staking mining claims) and development.

Minimization Mitigation: Minimizing impacts by limiting the degree or magnitude of the action and its implementation (40 CFR 1508.20 [b]).

Minimum Impact Suppression Techniques: The application of strategy and tactics that effectively meet suppression and resource objectives with the least environmental, cultural and social impacts.

Mitigation:

- Avoiding the impact altogether by not taking a certain action or parts of an action.
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
- Compensating for the impact by replacing or providing substitute resources or environments.

Mitigation Measures: Methods or procedures designed to reduce or lessen the adverse impacts caused by management activities.

Moderate (recreation outcomes): See *Measurable Targeted Outcomes*.

Moderate Constraints (Oil and Gas): Any stipulations or conditions of approval which may restrict the timing or placement of oil and gas development, but would not otherwise restrict the overall

development. Moderate constraints include all timing restrictions (TLS), CSUs, areas where surface-disturbing activity is avoided, and VRM Class II areas.

Mollisol: Dark colored grassland type soils with high base status.

Monitoring: The orderly collection, analysis, and interpretation of resource data to evaluate progress toward meeting management objectives.

Multiple Use Reservoir: A human-created lake or pond with a combination of balanced uses, including, but not limited to, recreation, livestock watering, watershed health, and wildlife and fish.

National Historic Trails: A protected area designation containing historic trails and surrounding areas authorized under the National Trails System Act of 1968. National Historic Trails may only be designated by an act of Congress.

National Register of Historic Places: The official list of the Nation's historic places worthy of preservation. Properties listed or eligible for listing are associated: with events, activities, or developments that were important in the past; with the lives of people who were important in the past; with significant architectural history, landscape history, or engineering achievements; or have already, or have the potential, to yield important information through investigation about our past. These may include districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association as appropriate.

National Trail Management Corridor: Allocation established through the land use planning process, pursuant to Section 202 of Federal Land Policy and Management Act and Section 7(a)(2) of the National Trails System Act ("rights-of-way") for a public land area of sufficient width within which to encompass National Trail resources, qualities, values, and associated settings and the primary use or uses that are present or to be restored.

National Wild and Scenic Rivers System: A system of nationally designated rivers and their immediate environments that have outstanding scenic, recreational, geologic, fish and wildlife, historic, cultural, and other similar values and are preserved in a free-flowing condition. The system consists of three types of streams:

(1) Recreation – rivers or sections of rivers that are readily accessible by road or railroad and that may have some development along their shorelines and may have undergone some impoundments or diversion in the past;

(2) Scenic – rivers or sections of rivers free of impoundments with shorelines or watersheds still largely undeveloped but accessible in places by roads; and

(3) Wild – rivers or sections of rivers free of impoundments and generally inaccessible except by trails, with watersheds or shorelines essentially primitive and waters unpolluted.

Native American: The people living in North and South America prior to European exploration. Many groups of people today are Native Americans and have ancestors who lived on these continents for thousands of years before Columbus came. They are also called American Indian, First American, Alaska Native and Native People.

Native Species: A species that is a part of the original fauna or flora of a given area in question.

Native Species Status: Native Species Status (NSS) refers to the population status of species native to the area in which their habitats occur. The NSSs are divided into the following categories:

NSS1 **Native Species Status 1**

Populations are greatly restricted or declining, extirpation appears possible; or ongoing significant loss of habitat.

NSS2 **Native Species Status 2**

Populations are declining, extirpation appears possible; habitat is restricted or vulnerable, but no recent or ongoing significant loss; species may be sensitive to human disturbance; or

Populations are declining or restricted in numbers and (or) distribution, extirpation is not imminent; ongoing significant loss of habitat.

NSS3 **Native Species Status 3**

Populations are greatly restricted or declining, extirpation appears possible; habitat is not restricted, vulnerable, but no loss; species is not sensitive to human disturbance; or

Populations are declining or restricted in numbers and (or) distribution, extirpation is not imminent; habitat is restricted or vulnerable, but no recent or ongoing significant loss species may be sensitive to human disturbance; or

Species is widely distributed; population status or trends are unknown, but are suspected to be stable; ongoing significant loss of habitat.

NSS4 **Native Species Status 4**

Populations are greatly restricted or declining, extirpation appears possible; habitat is stable and not restricted; or

Populations are declining or restricted in numbers and (or) distribution, extirpation is not imminent; habitat is not restricted, vulnerable, but no loss; species is not sensitive to human disturbance; or

Species is widely distributed, population status or trends are unknown, but are suspected to be stable; habitat is restricted or vulnerable, but no recent or ongoing significant loss; species may be sensitive to human disturbance; or

Populations that are stable or increasing and not restricted in numbers and (or) distribution; ongoing significant loss of habitat.

Natrargid: Aridisols with an accumulation of clay and sodium.

Natural Fire Regime: The general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning (Agee 1993, Brown 1995).

Nature and Purposes: The term used to describe the character, characteristics, and congressional intent for a designated National Trail, including the resources, qualities, values, and associated settings of the areas through which such trails may pass; the primary use or uses of a National Trail; and activities promoting the preservation of, public access to, travel within, and enjoyment and appreciation of National Trails.

Necessary Tasks (Clause): Work requiring the use of motor vehicles. Examples include using motor vehicles to repair range improvements, manage livestock, perform geophysical exploration activities and other types of leasable mineral exploration activity (other than casual use), and performing mining claim functions resulting in less than 5 acres of surface disturbance as described in 43 CFR 3809.

Net Conservation Gain: The actual benefit or gain above baseline conditions.

No Surface Occupancy (NSO): Used to prohibit the physical presence of oil and gas operations and associated facilities on the surface of Public Lands in a specified area to protect sensitive surface resource values. The NSO provision is reserved for use in fluid mineral land use planning and allocation decisions and lease stipulations. Other terms, such as restricted area, avoidance area, exclusion area, etc., are used with non-fluid mineral functions.

Nomad: A person who belongs to a group of people who have no permanent home, but wander from place to place searching for water, food, or grazing land.

Nonconsumptive Use: A use that does not reduce supply. For example, wildlife viewing does not.

Nonmarket Values: These values are not revealed through market transactions that establish market prices. For example, clean air, open space, preservation of critical wildlife habitat, etc., are not traded in the market place and therefore there is no market price for them. Nonetheless, there is a value for these resources that can be measured based on how much people would be willing to pay for them.

Objective: A description of a desired condition for a resource. Objectives can be quantified and measured and, where possible, have established timeframes for achievement.

Occupied Lek: A lek that has been active during at least one strutting season within the last 10 years.

Off-Highway Vehicle (OHV): Any motorized vehicle capable of, or designed for, travel on or immediately over land, water, or other natural terrain, excluding (1) any nonamphibious registered motorboat; (2) any military, fire, emergency, or law enforcement vehicle being used for emergency purposes; (3) any vehicle whose use is expressly authorized by the authorized officer, or otherwise officially approved; (4) vehicles in official use; and (5) any combat or combat support vehicle when used in times of national defense emergencies.

Off-Highway Vehicle (OHV) Management Designations: All public lands are required to have off-highway vehicle area designations. Areas must be classified as open, limited, or closed to motorized travel activities. Travel by over-snow vehicles is subject to the same requirements and limitations as all other vehicles unless specifically addressed otherwise in activity plans.

> **Closed:** Vehicle travel is prohibited in the area. Access by means other than motorized vehicle is usually permitted. This designation is used if closure to all vehicular use is necessary to protect resources, to ensure visitor safety, or to reduce conflicts. Use of vehicles in closed areas may be allowed for certain reasons; however, such use shall be made only with the approval of the authorized officer.
>
> **Open:** Vehicle travel is permitted in the area (both on and off roads) if the vehicle is operated responsibly in a manner not causing, or unlikely to cause, significant undue damage to or disturbance of the soil, wildlife, wildlife habitats, improvements, cultural or vegetative resources, or other authorized uses of the public lands. These areas are used for intensive OHV use where there are no compelling resource needs, user conflicts, or public safety issues to warrant limiting cross-country travel.

Limited: (a) Vehicle travel is permitted only on roads and vehicle routes which were in existence prior to the date of publication in the Federal Register. Vehicle travel off of existing vehicle routes is permitted only to accomplish necessary tasks and only if such travel does not result in resource damage. Random travel from existing vehicle routes is not allowed. Creation of new routes or extensions and (or) widening of existing routes are not allowed without prior written agency approval.

(b) Vehicle travel is permitted only on roads and vehicle routes designated by the BLM. Vehicle travel off of designated vehicle routes is permitted only to accomplish necessary tasks and only if such travel does not result in resource damage. Random travel from designated vehicle routes is not allowed. In areas where final designation has not been completed, vehicle travel is limited to existing roads and vehicle routes as described above. Designations may include, but are not limited to, the following:

(1) Vehicle route is open to vehicular travel.

(2) Vehicle route is closed to vehicular travel.

(3) Vehicle travel is limited by number or type of vehicle such as:

- Vehicle route limited to four-wheel drive vehicles only.
- Vehicle route limited to motorbikes only.

(4) Vehicle route limited to ATVs only.

(5) Area is closed to over-snow vehicles.

(6) Vehicle travel is limited to licensed or permitted use.

(7) Vehicle travel is limited to time or season of use.

Where specialized restrictions are necessary to meet resource management objectives, other limitations also may be developed. The BLM may place other limitations, as necessary, to protect other resources, particularly in areas that motorized OHV enthusiasts use intensely or where they participate in competitive or group events.

Oil and Gas Management Area: Intensively developed existing fields to be managed primarily for oil and gas exploration and development.

Old-Growth Forest: Ecosystem distinguished by old trees and related structural features. Old growth encompasses the later stages of stand development that typically differs from earlier stages in several ways, including tree size, accumulation of large dead woody material, number of canopy layers, species composition, and ecosystem function. Old-growth forest is typically distinguished by the following:

- Large-sized trees of specific species
- Wide variation in age classes and stocking levels
- Accumulations of large-sized dead standing and fallen trees
- Decadence in the form of broken or deformed tops and boles
- Multiple canopy layers
- Canopy interspaces and understory patchiness (BLM 2008c).

Open: Generally denotes that an area is available for a particular use or uses. Refer to specific program definitions found in law, regulations, or policy guidance for application to individual programs.

Open Area (Vehicle Use): All types of vehicle use is permitted at all times anywhere in the area. However, motor vehicles may not be operated in a manner causing or likely to cause significant, undue damage to or disturbance of the soil, wildlife, wildlife habitat, improvements, cultural or vegetative resources or other authorized uses of the public lands (see 43 CFR 8340.0-5) (Manual 1626 Travel and Transportation Management). Accordingly, in "Open" areas, driving off-road to perform necessary tasks, for recreational activities, or any other purpose, is allowed. The experience in the western United States suggests that "Open" designations encourage route proliferation and unlimited cross-country driving and is causing degradation of the lands and resources. It is the policy of the BLM in Wyoming to limit the use of "Open" designations to areas suitable for unlimited off-road driving such as sand dune areas that are essentially devoid of vegetation.

Operator: Any person who has taken formal responsibility for the operations conducted on the leased lands.

Outbreak: The infestation of a relatively small and contained grouping of trees by bark beetles.

Outstandingly Remarkable Values: Values among those listed in Section 1(b) of the Wild and Scenic Rivers Act: "scenic, recreational, geological, fish and wildlife, historical, cultural, or other similar values." Other values that may be considered include, but are not limited to, ecological, biological or botanical, paleontological, hydrological, traditional cultural uses, water quality, and scientific values. The Wild and Scenic Rivers Act does not further define outstandingly remarkable values. Agency resource professionals develop and interpret criteria in evaluating river values (unique, rare, or exemplary) based on professional judgment on a regional, physiographic, or geographic comparative basis.

Over-the-snow Vehicle: A motor vehicle that is designed for use over snow and that runs on a track or tracks and/or a ski or skis, while in use over snow.

Overgrazing: Continued heavy grazing that exceeds the recovery capacity of the forage plants and creates deterioration of the grazing lands (Valentine 1990).

Paleo-Indian: The name given to the oldest known cultural group in North America.

Paleocene Eocene Thermal Maximum (PETM): The Paleocene-Eocene Thermal Maximum (PETM) is one of the most intense and abrupt intervals of global warming in the geological record. It occurred around 56 million years ago, at the boundary between the Paleocene and Eocene epochs and lasted about 200,000 years. This warming has been linked to a similarly rapid increase in the concentration of greenhouse gases in Earth's atmosphere, which acted to trap heat and drive up global temperatures by more than 5 degrees Celsius in just a few thousand years. The fossil record gives us the means of understanding how life was affected by the PETM, and so provides an excellent opportunity to study the relationships between evolution, extinction, migration and climate change. See http://www.palaeontologyonline.com/articles/2011/the-paleocene-eocene-thermal-maximum/.

Paleoclimate Change: Changing climatic conditions during past geologic ages.

Paleoecological: Relating to the study of ancient or prehistoric ecosystems (National Park Service no date).

Paleontological Locality: A geographic point or area where a fossil or associated fossils are found in a related geological context. A paleontological locality is confined to a discrete stratigraphic layer, structural feature, or physiographic area.

Paleontological Resource Monitoring: The systematic examination for and often collection of paleontological resources associated with surface disturbance.

Paleontological Resources: Paleontological resources are any fossilized remains, traces, or imprints of organisms, preserved in or on the Earth's crust, that are of paleontological interest and that provide information about the history of life on Earth.

Paleontological Resources Protection Stipulations:

Collecting: The project proponent/Operator is responsible for informing all persons associated with this project including employees, contractors and subcontractors under their direction that they shall be subject to prosecution for damaging, altering, excavating or removing any vertebrate fossils or other scientifically significant paleontological resources from the project area. Collection of vertebrate fossils (bones, teeth, turtle shells) or other scientifically significant paleontological resources is prohibited without a permit. Unlawful removal, damage, or vandalism of paleontological resources will be prosecuted by federal law enforcement personnel.

Discovery: If vertebrate or scientifically significant paleontological resources are discovered on BLM-administered land during operations, the Operator shall suspend operations that could disturb the materials, and immediately contact the BLM Cody or Worland Field Manager. The BLM will arrange for evaluation of the find by an appropriate BLM paleontologist, Paleontological Coordinator, or Paleontological Use Permittee within an agreed timeframe. The BLM will determine the need for any mitigation actions that may be necessary. Any mitigation would be developed in consultation with the Operator, who would be responsible for the cost of site evaluation and mitigation of project effects to the paleontological resources. Depending on site evaluation, operations within 100 feet of a paleontological discovery will not be resumed in written authorization to proceed is issued by the Field Office Manager.

Avoidance: All vertebrate or scientifically significant paleontological resources found as a result of the project/action will be avoided during operations. Avoidance in this case means "no action or disturbance within a distance of at least 100 feet of the outer edge of the paleontological locality".

Paleontology: The study of ancient life, particularly the fossil record (BLM 2008d).

Parturition Areas: Documented birthing areas commonly used by females. They include calving areas, fawning areas, and lambing grounds. These areas may be used as nurseries by some big game species.

Pasture: (1) A grazing area enclosed and separated from other areas by fencing or other barriers; the management unit for grazing land. (2) Forage plants used as food for grazing animals. (3) Any area devoted to the production of forage, native or introduced, and harvested by grazing. (4) A group of subunits grazed within a rotational grazing system.

Pemmican: A mixture of dried meat mixed with crushed berries and fat. It was used as food on hunting trips and other journeys because it kept well without spoiling.

Perennial Stream: A stream that flows continuously. Perennial streams generally are associated with a water table in the localities through which they flow (Prichard et al. 1998).

Permit: Contractual instruments granting rights to use specific managed public lands, with certain conditions, for specific purposes such as livestock grazing, timber harvesting, paleontology, and energy or mineral development.

Permitted Use: (1) The forage allocated by, or under the guidance of, an applicable land use plan for livestock grazing in an allotment under a permit or lease and is expressed in AUMs. (2) A paleontologist must have a valid paleontological resource use permit before collecting or disturbing fossil resources on BLM-administered lands. Permitted uses for paleontology include activities related to paleontological surveys, excavation and consulting.

Permittee: One who holds a permit to graze livestock on state, federal, or certain privately-owned lands.

Period of Use: The time of livestock grazing on a range area based on type of vegetation or stage of vegetative growth.

Pest: With the exception of vascular plants classified as invasive nonnative plant species, a pest can be any biological life form that poses a threat to human or ecological health and welfare. For the purposes of this planning effort, an "animal pest" is any vertebrate or invertebrate animal subject to control by Animal and Plant Health Inspection Service (APHIS). APHIS is currently BLM's authorized agent for controlling "animal pests." For this reason, "animal pests" will be considered a subset of Pest. An annoying or troublesome animal or thing; nuisance.

Pestle: A tool used to mash or grind substances.

Petroglyph: Pictures created on rock faces by removing a portion of the rock by pecking, abrading, incising, or scratching.

Pictograph: Picture created on a rock face by applying pigment or charcoal.

Planning Area: A geographic area for which land use and resource management plans are developed and maintained.

Play Area (OHV): An area where on- or off-route OHV use is nearly unrestricted. Often attracting many riders, such areas may be on dunes, in sand and gravel pits, and in other areas that present challenges to OHV users. Structured recreation management is applied to these areas so as to appropriately manage for health and safety, resource protection, and use and user conflicts. Play areas are designated on OHV "Open" Areas. See *Open Area* (BLM 2007a).

Pleistocene: The epoch of geologic time, about 1.6 million to 10,000 years ago, characterized by the appearance and disappearance of continental ice sheets.

Potential Fossil Yield Classification (PFYC): Occurrences of paleontological resources are closely tied to the geologic units that contain them. The probability for finding paleontological resources can be broadly predicted from the geologic units present at or near the surface. Using the PFYC system, geologic units are classified based on the relative abundance of vertebrate fossils or scientifically significant invertebrate or plant fossils, with a higher class number indicating a higher potential. The classification uses a ranking of 1 through 5, with Class 5 assigned to units with a very high potential for paleontological resources. The classifications are described below.

> **Class 1 – Very Low.** Igneous or metamorphic geologic units, or other units not likely to contain recognizable fossil remains. Management concern is very low or negligible, Assessment or mitigation is usually unnecessary except in very rare or isolated occurrence.
>
> **Class 2 – Low.** Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant invertebrate and pant fossils. Management concern for paleontological resources is generally low. Assessment or mitigation is usually unnecessary except in rare or isolated occurrences.
>
> **Class 3 – Moderate or Unknown.** Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance and predictable occurrence; or sedimentary units of unknown fossil potential. Management concern may extend across the entire range of management. PFYC 3 (Moderate) Units may require field surveys for determination of appropriate course of actions. Mitigation may be necessary before and/or during these actions. Avoidance or non-site monitoring may be necessary during project activities. Justification required for survey decisions

on PFYC 3 (Moderate) formations (i.e., whether a survey is required or not). PFYC 3 (Unknown) Units will require pre-disturbance field surveys prior to surface disturbing activities or land tenure adjustments. Mitigation may be necessary before and/or during these actions. Avoidance or non-site monitoring may be necessary during project activities.

Class 4 – High. Geologic units containing a high occurrence of vertebrate fossils or scientifically significant invertebrate or plant fossils, but may vary in occurrences and predictability. Surface disturbing activities may adversely affect paleontological resources in many cases, management concern for paleontological resources is high, depending on the proposed action. Pre-disturbance field surveys are usually necessary prior to surface disturbing activities or land tenure adjustments. Mitigation will often be necessary before and/or during these actions. Avoidance or non-site monitoring may often be necessary during project activities.

Class 5 – Very High. Highly fossiliferous geologic units that consistently and predictably produce vertebrate fossils or scientifically significant invertebrate or plant fossils. Paleontological resources are highly susceptible to adverse impacts from surface disturbing activities. Management concern for paleontological resources is very high. Pre-disturbance field surveys are usually necessary prior to surface disturbing activities or land tenure adjustments. Mitigation will often be necessary before and/or during these actions. Avoidance or non-site monitoring may often be necessary during project activities. Special management designations may be appropriate for protection or interpretation. These units are often the focus of illegal collecting activities.

Potential Natural Community (PNC): The biotic community that would become established if all successional sequences were completed without interference by humans under the present environmental conditions. Natural disturbances are inherent in development. PNCs can include naturalized nonnative species.

Pottery: Earthenware or clayware pots, dishes, or vases. These cups, bowls, and other dishes or objects were made from clay and hardened by heat.

Prairie Dog "Complex": Defined as a cluster of two or more prairie dog towns within 3 kilometers of each other (Clark and Stromberg 1987; Luce 2003), and bounded by either natural or artificial barriers (Whicker and Detling 1998) which effectively isolate one cluster of colonies from interacting/interchanging with another. Prairie dogs may commonly move among colonies of a cluster, and thereby foster reproductive/genetic viability, but exhibit little emigration/immigration between clusters. A cluster may include some currently unoccupied, through physically suitable (i.e., vegetation, soils, topography, etc.), land immediately adjacent to occupied colonies that support other prairie dog-associated (ecosystem function), obligate or facultative species (e.g., swift fox, mountain plover, burrowing owl, etc.).

Preference: (1) Selection of plants, or plant parts, over others by grazing animals. (2) In the administration of public lands, "Grazing preference" or "preference" means a superior or priority position against others for the purpose of receiving a grazing permit or lease. This priority is attached to base property owned or controlled by a permittee or lessee (43 CFR Part 4100).

Prehistory/Prehistoric: Information about past events prior to the recording of events in writing. The period of prehistory differs around the world depending upon when written records became common in a region.

Prescribed Burning: Controlled application of fire to wildland fuels in either their natural or modified state under specified environmental conditions that allow the fire to be confined to a predetermined area and at the same time to produce the fire intensity and rate of spread required to attain planned resource management objectives.

Prescribed Fire: The introduction of fire to an area under regulated conditions for specific management purposes.

Priority Fish Species: Priority fish species are species considered to be sport fish and native species.

Priority Habitat Area (greater sage-grouse): Habitat designated to maintain sage-grouse distribution and population sustainability. In this document, management for priority habitat is based on areas encompassed by either Priority Habitat Management Areas or Key Habitat Areas.

Produced Water: Groundwater removed to facilitate the extraction of minerals, such as coal, oil, or gas.

Projectile Point: A point or tip attached to a projectile to increase its ability to penetrate a target. These points are frequently made from stone, bone, ivory, antler, wood, or metal. The method, shape and material used to manufacture these points are frequently used to identify the groups making and using them.

Proper Functioning Condition: Riparian-wetland areas are functioning properly when adequate vegetation, landform, or large woody debris is present to:

(1) dissipate stream energy associated with high waterflows, thereby reducing erosion and improving water quality;

(2) filter sediment, capture bedload, and aid floodplain development;

(3) improve flood-water retention and ground-water recharge;

(4) develop root masses that stabilize streambanks against cutting action;

(5) develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and

(6) support greater biodiversity.

Proper Grazing: Proper grazing is the practice of managing forage use by grazing animals at a sustainable level that maintains rangeland health. Proper grazing will maintain or increase plant cover, including residue, which acts to slow down or reduce runoff, increase water infiltration, and keep erosion and sedimentation at or above acceptable levels within the potential of ecological sites within a given geographic area (e.g., watershed, grazing allotment, etc.).

Protohistoric: Immediately before written history. The period when artifacts imported from other continents are found but for which no historic records exist.

Public Land: Land or interest in land owned by the United States and administered by the Secretary of the Interior through the BLM, except lands located on the Outer Continental Shelf, and land held for the benefit of Indians, Aleuts, and Eskimos.

Range: Any land supporting vegetation suitable for grazing including rangeland, grazable woodland and shrubland. Modifies resources, products, activities, practices and phenomena pertaining to rangeland.

Range Condition: (A) A generic term relating to present status of a unit of range in terms of specific values or potentials. Specific values or potentials must be stated. (B) Some agencies define range condition as follows: The present state of vegetation of a range site in relation to the climax (natural potential) plant community for that site. It is an expression of the relative degree to which the kinds, proportions, and amounts of plants in a plant community resemble that of the climax plant community for the site.

Range Improvement Project: A structural improvement requiring placement or construction to facilitate management or control distribution and movement of grazing or browsing animals. Such improvements may include, but are not limited to, fences, wells, troughs, reservoirs, water catchments, pipelines, and cattleguards. The project also may include a practice or treatment which improves rangeland condition and or resource production for multiple use. Nonstructural types of projects may include, but are not limited to, seeding and plant control through chemical, mechanical, and biological means or prescribed burning.

Range Management: A distinct discipline founded on ecological principles and dealing with the use of rangelands and range resources for a variety of purposes. These purposes include use as watersheds, wildlife habitat, grazing by livestock, recreation and aesthetics, as well as other associated uses.

Range Site: Synonymous with ecological site when referring to rangeland. An area of rangeland which has the potential to produce and sustain distinctive kinds and amounts of vegetation to result in a characteristic plant community under its particular combination of environmental factors, particularly climate, soils, and associated native biota. Some agencies use range site based on the climax concept, not potential natural community.

Rangeland: Land on which the native vegetation is predominantly grasses, grass-like plants, forbs, or shrubs suitable for grazing or browsing. This includes lands re-vegetated naturally or artificially when routine management of that vegetation is accomplished mainly through manipulation of grazing. Rangelands include natural grasslands, savannas, shrublands, most deserts, tundra, alpine communities, coastal marshes, and wet meadows.

Rangeland Health: The degree to which the integrity of the soil and ecological processes of rangeland ecosystems are sustained.

Raptor: Bird of prey with sharp talons and a strongly curved beak, such as hawks, falcons, owls, vultures, and eagles.

Reasonable Access: For lands not involving Wilderness Study Areas (WSAs), reasonable access means access determined on a case by case basis using site specific NEPA analysis. Access to private land across public land in a WSA is addressed in the Wilderness Interim Management Policy for lands under Wilderness Review (IMP).

Recreation and Public Purposes Act (R&PP): The Recreation and Public Purposes Act (43 USC 869 et. seq.) authorizes the sale or lease of public lands for recreational or public purposes to state and local governments and to qualified nonprofit organizations. Examples of typical uses under the act are historic monument sites, campgrounds, schools, fire houses, law enforcement facilities, municipal facilities, landfills, hospitals, parks, and fairgrounds.

Recreation Area Management Plan (RAMP): An officially approved document for a specific area of public land that identifies the management actions to be implemented to achieve recreation related decisions made in a management framework of a resource management plan. The Recreation Area Management Plan is the link between the allocation of land for recreation uses in the multiple-use planning process and the actions necessary to implement such allocations (BLM 2005).

Recreation Experiences: Psychological outcomes realized either by recreation-tourism participants as a direct result of their on-site leisure engagements and recreation-tourism activity participation or by nonparticipating community residents as a result of their interaction with visitors and guests within their community or interaction with the BLM and other public and private recreation-tourism providers and their actions.

Recreation Management Areas: Recreation management areas are units within a planning area guiding recreation management on public lands having similar recreation related issues and concerns. There are two types of recreation management areas, extensive and special (ERMAs and SRMAs):

> **Extensive Recreation Management Areas (ERMA):** The ERMAs are identified areas where recreation is planned for and actively managed on an interdisciplinary-basis in concert with other resources/resource programs. ERMAs offer recreation opportunities that facilitate visitors' freedom to pursue a variety of outdoor recreation activities and attain a variety of outcomes. They include all lands that are not designated as an SRMA or closed to public use. Recreation management actions within an ERMA are limited to only those of a custodial nature and address visitor health and safety, resource protection and use and user conflicts.
>
> **Special Recreation Management Areas (SRMA):** SRMAs are designated administrative units where a commitment has been made to emphasize recreation by managing for specific recreation opportunities and settings on a sustained or enhanced, long-term basis. SRMAs are designated through the land use plan process. Plans establish SRMA management objectives and identify supporting management actions and allowable uses.
>
> **Recreation Management Zones:** Subunits within a SRMA managed for distinctly different recreation products. Recreation products are composed of recreation opportunities, the natural resource and community settings within which they occur, and the administrative and service environment created by all affecting recreation-tourism providers, within which recreation participation occurs.

Recreation Niche: The place or position within the strategically targeted recreation-tourism market for each SRMA that is most suitable (i.e., capable of producing certain specific kinds of recreation opportunities) and appropriate (i.e., most responsive to identified visitor or resident customers), given available supply and current demand, for the production of specific recreation opportunities and the sustainable maintenance of accompanying natural resource or community setting character.

Recreation Opportunities: Favorable circumstances enabling visitors' engagement in a leisure activity to realize immediate psychological experiences and attain more lasting, value-added beneficial outcomes from the combination of recreation settings, activities, and experiences provided by the area.

Recreation Opportunity Spectrum: A means of classifying and managing recreational opportunities based on physical, social, and managerial settings. Each of the following six ROS classes is defined in terms of its combination of activity, setting, and experience: Primitive, Semi-Primitive Non-Motorized, Semi-Primitive Motorized, Road Natural, Rural, and Urban.

Recreation Setting Characteristics (RSC): RSCs are derived from the Recreation Opportunity Spectrum. It is a continuum divided into a spectrum of classes from primitive to urban recreation settings. The continuum of classes is characterized by three components; physical, social and operational.

Recreation Settings: The collective distinguishing attributes of landscapes that influence and sometimes actually determine what kinds of recreation opportunities are produced.

Recreation-Tourism Market: Recreation and tourism visitors and local residents who affect local governments and private sector businesses and the communities or other places where these customers originate (local, regional, national, or international). Based on analysis of supply and demand, land use plans strategically identify primary recreation-tourism markets for each special recreation management area—destination, community, or undeveloped.

Reference State: A reference state is recognized in each state-and-transition model that describes the ecological potential and natural or historical range of variability of the ecological site (Caudle et al. 2013).

Renewable Energy: Energy generated from renewable resources such as sunlight, wind, and biomass.

Required Design Features (RDFs): Required Design Features (RDFs) are required for certain activities in all priority greater sage-grouse habitat. RDFs establish the minimum specifications for certain activities to help mitigate adverse impacts. However, the applicability and overall effectiveness of each RDF cannot be fully assessed until the project level when the project location and design are known. Because of site-specific circumstances, some RDFs may not apply to some projects (e.g., a resource is not present on a given site) and/or may require slight variations (e.g., a larger or smaller protective area). All variations in RDFs would require that at least one of the following be demonstrated in the NEPA analysis associated with the project/activity:

- A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g., due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable;
- An alternative RDF is determined to provide equal or better protection for greater sage-grouse or its habitat;
- A specific RDF will provide no additional protection to greater sage-grouse or its habitat.

Reserve Common Allotment – A reserve common allotment is an area which is designated in the land use plan as available for livestock grazing but reserved as an area available for use as an alternative to grazing in another allotment in order to facilitate rangeland restoration treatments and recovery from natural disturbances such as drought or wildfire. The reserve common allotment would provide needed flexibility that would help the agency apply temporary rest from grazing where vegetation treatments and/or management would be most effective.

Residual Impacts: Impacts from an authorized land use that remain after applying avoidance and minimization mitigation; also referred to as unavoidable impacts.

Resource Management Plan: A land use plan as prescribed by the Federal Land Policy and Management Act which establishes, for a given area of land, land-use allocations, coordination guidelines for multiple-use, objectives and actions to be achieved.

Resource Uses: Activities that utilize resources, such as minerals development, livestock grazing, forestry, OHV use, and recreation.

Resources, Qualities, and Values: The significant scenic, historic, cultural, recreation, natural (including biological, geological, and scientific), and other landscape areas through which such trails may pass as identified in the National Trails System Act (see associated settings).

Rest: Leaving an area ungrazed, thereby foregoing grazing of one forage crop. Normally rest implies absence of grazing for a full growing season or during a critical portion of plant development; i.e., seed production. In the Cody Field Office, rest is defined as foregoing grazing for a full grazing year defined as starting on March 1 and ending on February 28.

Rest-Rotation: A grazing-management scheme in which rest periods, usually for a full growing season, for individual grazing units are incorporated into a grazing rotation.

Restricted Disposal: Parcels identified for restricted disposal may be disposed of under the Recreation and Public Purposes Act, by exchange, may limit the disposal to a particular type of entity capable of preserving

the resource values, or may include the use of covenants in the deed or land sale patent to ensure the resource values are protected.

Right-of-Way (ROW) Corridor: Public land where rights-of-way are concentrated and where the placement of future rights-of-way would be favored over lands that are currently unaffected by these disturbances. The designation of right-of-way corridors would be used to facilitate the regional development of major rights-of-way, by linking right-of-way concentration areas between planning areas. Major rights-of-ways are defined as ROW authorizations for pipelines 24-inches in diameter or greater or high voltage transmission lines greater than 115 kilovolts.

Rights-of-Way (ROW): A ROW grant is an authorization to use a specific piece of public land for a specific project, such as roads, pipelines, transmission lines, and communication sites. The grant authorizes rights and privileges for a specific use of the land for a specific period of time.

Riparian: A form of wetland transition between permanently saturated wetlands and upland areas. These areas exhibit vegetation or physical characteristics reflective of permanent surface or subsurface water influence. Lands along, adjacent to, or contiguous with perennially and intermittently flowing rivers and streams, glacial potholes, and the shores of lakes and reservoirs with stable water levels are typical riparian areas (See BLM Manual 1737). Included are ephemeral streams that have vegetation dependent upon free water in the soil. All other ephemeral streams are excluded.

Riparian/Wetland Functionality Classification:

Functional-At-Risk: Riparian/wetland areas that are in functional condition, but an existing soil, water, or vegetation attribute makes them susceptible to degradation.

Proper Functioning Condition (PFC): A riparian or wetland area is considered to be in proper functioning condition when adequate vegetation, landform, or large woody debris is present to do the following:

- Dissipate stream energy associated with high water flows, thereby reducing erosion and improving water quality
- Filter sediment, capture bedload, and aid floodplain development
- Improve floodwater retention and groundwater recharge
- Develop root masses that stabilize streambanks against cutting action
- Develop diverse ponding and channel characteristics to provide the habitats and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses
- Support greater biodiversity.

Non-functional: Riparian or wetland areas that clearly are not providing adequate vegetation, landform, or large woody debris to dissipate stream energy associated with high flows and thus are not reducing erosion, improving water quality, and so on, as listed above. The absence of certain physical attributes, such as a floodplain where one should be, are indicators of nonfunctioning conditions.

Unknown: Riparian or wetland areas that the BLM lacks sufficient information on to make any form of determination.

Roasting Pit: A pit dug into the ground that was used for cooking. The pit contained fire-cracked rocks, charcoal, ash, and sometimes the remains of whatever was cooked.

Rotation (forest): The period of years between when a forest stand (i.e., primarily even-aged) is established (i.e., regeneration) and when it receives its final harvest. This time period is an administrative decision based on economics, site condition, growth rates, and other factors (BLM 2007b).

Rotation Grazing: A grazing scheme where animals are moved from one grazing unit in the same group of grazing units to another without regard to specific graze: rest periods or levels of plant defoliation.

Salable Minerals: Common variety of minerals on public lands, such as sand and gravel, used mainly for construction. Salable minerals are disposed of by sales to the public or free-use permits to government agencies or nonprofit organizations.

Scenic Area: An area whose landscape character exhibits a high degree of variety and harmony among the basic elements which results in a pleasant landscape to view.

Scenic Quality: The relative worth of a landscape from a visual perception point of view. Scenic quality is rated as Class A (high), Class B (medium), or Class C (low).

Season-long Use: Grazing throughout the growing period, with little or no effort to control the amount of distribution of livestock use in area/pasture/allotments. Generally defined in the Cody Field Office as starting on April 1 and ending September 30.

Seasonal Grazing: Grazing use throughout a specific season.

Seasonal Ranges: The Wyoming Game and Fish Department has identified various ranges for big game species. These ranges are defined as follows:

> **Summer or Spring-Summer-Fall:** A population or portion of a population of animals uses the documented habitats within this range annually from the end of previous winter to the onset of persistent winter conditions.
>
> **Severe Winter Relief:** A documented survival range, which may or may not be considered a crucial range area as defined above. It is used to a great extent, but only in extremely severe winters. It may lack habitat characteristics that would make it attractive or capable of supporting major portions of the population during normal years, but is used by and allows at least a significant portion of the population to survive the occasional extremely severe winter.
>
> **Winter:** A population or portion of a population of animals annually uses the documented suitable habitat sites within this range in substantial numbers during the winter period only.
>
> **Winter/Year-long:** A population or a portion of a population of animals makes general use of the documented suitable habitat sites within this range on a year-round basis. During the winter months there is a significant influx of additional animals into the area from other seasonal ranges.
>
> **Year-long:** A population or substantial portion of a population of animals makes general use of the suitable documented habitat sites within the range on a year-round basis. On occasion, animals may leave the area under severe conditions.

Section 106 of the National Historic Preservation Act: "The head of any Federal agency having direct or indirect jurisdiction over a proposed federal or federally assisted undertaking in any state and the head of any federal department or independent agency having authority to license any undertaking shall, prior to the approval of the expenditure of any federal funds on the undertaking or prior to the issuance of any license, as the case may be, take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The head of any such federal agency shall afford the Advisory Council on Historic Preservation established under Title II of this Act a reasonable opportunity to comment with regard to such undertaking" (16 U.S.C. 47 df).

Sedimentary Rock: Rock that has formed through the deposition and lithification of sediment, especially sediment transported by water (rivers, lakes, and oceans), ice (glaciers), and wind; or rocks that are chemically precipitated (BLM 2008c).

Sensitive Sites or Resources: Sensitive sites or resources refer to significant cultural resources that are or may be eligible for nomination to the National Register of Historic Places. This category also refers to cultural resources that require management under the American Indian Religious Freedom Act, the Native American Grave Repatriation Act or Executive Orders independent of the National Register of Historic Places.

Sensitive Species: Species designated as sensitive by the BLM State Director include species that are under status review, have small or declining populations, live in unique habitats, or require special management. BLM Manual 6840 provides policy and guidance for special status species management. The BLM Wyoming Sensitive Species Policy and List are provided in a memorandum updated annually. Primary goals of the BLM Wyoming policy include maintaining vulnerable species and habitat components in functional BLM ecosystems and preventing a need for species listing under the Endangered Species Act.

Seral Stage: One of a series of plant communities that follows another in time on a specific ecological site.

Setting: Setting is the physical environment of a historic property and how the property evokes a sense of feeling and association with past events. Accordingly, setting referees to the character of the place in which the property played its historic role. It involves how, not just where, the property is situated and its relationship to surrounding features and open space. These features and their relationships should be considered not only within the exact boundaries of the property, but also between the property and its surroundings.

Shaman: A medicine man or religious leader; a person who calls upon the spirits to cure the sick and to control events (weather or hunting).

Significant Factor (S&G): Principal causal factor in the failure to achieve the land health standard(s) and conform with the guidelines. A significant factor would typically be a use that, if modified, would enable an area to achieve or make significant progress toward achieving the land health standard(s). To be a significant factor, a use may be one of several causal factors contributing to less-than-healthy conditions; it need not be the sole causal factor inhibiting progress towards the standards.

Significant Paleontological Resource: Any paleontological resource that is considered to be of scientific interest, including most vertebrate fossil remains and traces, and certain rare or unusual invertebrate and plant fossils.

Site: A location, place. Is a term used by archaeologists for places that prehistoric and historic people lived in or used. Sites are places where humans left things behind.

Slope: A slant or incline of the land surface, measured in degrees from the horizontal, or in the percent (defined as the number of feet or meters change in elevation per 100 of the same units of horizontal distance); may be further characterized by direction (exposure).

Soil Moisture Regimes: The categorization of the presence or absence of water in soils.

> **Aridic:** Soils dry more than half of the time when they are warm enough for plant growth. These soils are too dry for annual cropping and many require irrigation for crop production.
>
> **Udic:** The udic moisture regime implies that, in 6 or more out of 10 years, the soil moisture control section is not dry in any part for as long as 90 cumulative days per year.

Ustic: The ustic moisture regime implies that moisture is limited but is present at a time when conditions are suitable for plant growth.

Xeric: The xeric moisture regime implies that, in 6 or more out of 10 years, the soil moisture control section is dry in all parts for 45 or more consecutive days in the four months following the winter solstice.

Soil Write-up Area (SWA): The smallest geographical unit delineation to be used as a base for collecting vegetation data and resource information. It is the smallest mapped soil – vegetation unit. For management purposes, SWA boundaries can be set on administrative boundaries such as allotments, pasture, wildlife habitat areas or watersheds.

Special Recreation Management Areas (SRMA): A public lands unit identified in land use plans to direct recreation funding and personnel to fulfill commitments made to provide specific, structured recreation opportunities (i.e., activity, experience, and benefit opportunities). Both land use plan decisions and subsequent implementing actions for recreation in each SRMA are geared to a strategically identified primary recreation-tourism market – destination, community, or undeveloped, as well as a corresponding and distinguishing recreation management strategy. Recreation setting conditions are prescribed as part of the land-use allocation decision. Subsequent implementing actions, as identified in the activity planning framework, are proactive and address management, marketing and visitor information, and monitoring and administration.

Special Status Species: Special status species are species proposed for listing, officially listed as threatened or endangered, or are candidates for listing as threatened or endangered under the provisions of the endangered species act; those listed by a state in a category such as threatened or endangered implying potential endangerment or extinction; and those designated by the State Director as sensitive (BLM 6840 Manual 2001). Special Status Species may include wildlife (including fish and invertebrate) or plant species.

Species: A taxon or rank species; in the hierarchy or biological classification, the category below genus.

Species Diversity: The number, different kinds of, and relative abundances of species present in a given area.

Split-Estate: Surface land and mineral estate of a given area under different ownerships. Frequently, the surface will be privately owned and the minerals federally owned.

Spring: Flowing water originating from an underground source.

SRMA: See *Recreation Management Areas*.

Stakeholder: Federal, state, or local governments and agencies, or other entities where a Memorandum of Understanding, Cooperative Agreement, Interagency Agreement, or other such agreement has been executed with the BLM, or an applicant for a BLM authorization or permit.

Stand Basal Area: The sum of the cross-sectional area of all living trees in a stand, measured at "breast height" or 4.5 feet high on the uphill side of the trees.

Stand Productivity: Measured by comparison to site index. If the site index is 75 feet at 100 years, but the stand averages 65 feet at 100 years, then a factor such as high basal area or mistletoe might be decreasing stand productivity.

Stand Vigor: General term that refers to the current growth and health of the stand. Live crown ratio is a measure of stand vigor. For example, most stands with an average live crown ratio of 50% or more have vigorous growth. Most stands with an average of less than 20% live crown ratio have poor vigor.

Standard: A description of the physical and biological conditions or degree of function required for healthy, sustainable lands (e.g., land health standards).

State-Listed Species: Species proposed for listing or listed by a state in a category implying, but not limited to, potential endangerment or extinction. Listing is either by legislation or regulation.

Stipulations: Requirements that are part of the terms of a mineral lease. Some stipulations are standard on all Federal leases. Other stipulations may be applied to the lease at the discretion of the surface management agency to protect valuable surface resources and uses.

Stock Trail: A trail constructed across a natural barrier to permit movement of livestock to otherwise inaccessible areas.

Stocking Rate: The number of specific kinds and classes of animals grazing a unit of land for a specified time period. May be expressed as AUMs or animal unit days per acre, hectare, or section, or the reciprocal (area of land/AUM or day).

Stratigraphy: The science of studying layers of materials, as in rock layers in the Earth or deposits in archaeological sites. Cultural remains and dirt become buried over time and, usually, the layer on the bottom is the oldest, the layer on the top is the youngest. Dirt of different layers is often colored differently.

Suitable River: An eligible river segment found through administrative study to meet the criteria for designation as a component of the National System, as specified in Section 4(a) of the Wild and Scenic Rivers Act.

Surface Water Classes and Uses: The following water classes are a hierarchical categorization of waters according to existing and designated uses. Except for Class 1 waters, each classification is protected for its specified uses plus all the uses contained in each lower classification. Class 1 designations are based on value determinations rather than use support and are protected for all uses in existence at the time of or after designation. There are four major classes of surface water in Wyoming with various subcategories within each class (see "Wyoming Surface Water Classification List" for current listing).

> **Class 1 – Outstanding Waters:** Class 1 waters are those surface waters in which no further water quality degradation by point source discharges other than from dams will be allowed. Nonpoint sources of pollution shall be controlled through implementation of appropriate best management practices. Pursuant to Section 7 of these regulations, the water quality and physical and biological integrity that existed on the water at the time of designation will be maintained and protected. In designating Class 1 waters, the Environmental Quality Council shall consider water quality, aesthetic, scenic, recreational, ecological, agricultural, botanical, zoological, municipal, industrial, historical, geological, cultural, archeological, fish and wildlife, the presence of substantial quantities of developable water, and other values of present and future benefit to the people.
>
> **Class 2 – Fisheries and Drinking Water:** Class 2 waters are waters, other than those designated as Class 1 that are known to support fish or drinking water supplies or where those uses are attainable. Class 2 waters may be perennial, intermittent, or ephemeral and are protected for the uses indicated in each subcategory listed below. Five subcategories of Class 2 waters exist.
>
> **Class 3 – Aquatic Life Other than Fish:** Class 3 waters are waters other than those designated as Class 1 that are intermittent, ephemeral, or isolated waters, and because of natural habitat conditions, do not support nor have the potential to support fish populations or spawning or certain perennial waters that lack the natural water quality to support fish (e.g., geothermal areas). Class 3 waters provide support for invertebrates, amphibians, or other flora and fauna that

inhabit waters of the state at some stage of their life-cycles. Uses designated on Class 3 waters include aquatic life other than fish, recreation, wildlife, industry, agriculture, and scenic value. Generally, waters suitable for this classification have wetland characteristics; and such characteristics will be a primary indicator used in identifying Class 3 waters. There are four subcategories of Class 3 waters.

Class 4 – Agriculture, Industry, Recreation, and Wildlife: Class 4 waters are waters other than those designated as Class 1 where it has been determined that aquatic life uses are not attainable pursuant to the provisions of Section 33 of these regulations. Uses designated on Class 4 waters include recreation, wildlife, industry, agriculture and scenic value (Wyoming DEQ, Wyoming Surface Water Quality Standards).

Surface-Disturbing Activities: An action that alters the vegetation, surface/near surface soil resources, and/or surface geologic features, beyond natural site conditions and on a scale that affects other Public Land values. Examples of surface disturbing activities may include: operation of heavy equipment to construct well pads, roads, pits and reservoirs; installation of pipelines and power lines; and the conduct of several types of vegetation treatments (e.g., prescribed fire, etc.). Surface disturbing activities may be either authorized or prohibited. (Information Bulletin WY-2007-029).

Suspension: The temporary withholding from active use, through a decision issued by the authorized officer or by agreement, of part or all of the permitted use in a grazing permit or lease (43 CFR Part 4100). These AUMs could potentially be re-authorized for use if range conditions improve.

Sustainability: The ability of an ecosystem to maintain ecological processes and functions, biological diversity, and productivity over time.

Syncline or Synclinal: A fold in rocks in which the rock layers dip inward from both sides toward the axis, like a hot dog bun (BLM 2002a).

Tank: A reservoir of any construction for water storage.

Tanning: The process which turns animal hides into leather.

Technical/Economically Feasible: Actions that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant. It is the BLM's sole responsibility to determine what actions are technically and economically feasible. The BLM will consider whether implementation of the proposed action is likely given past and current practice and technology; this consideration does not necessarily require a cost-benefit analysis or speculation about an applicant's costs and profit. (Modified from the Council on Environmental Quality's 40 Most Asked Questions and BLM NEPA Handbook, Section 6.6.3)

Tentative Classification: The process where rivers are segmented according to the criteria and classes established in Section 2(b) of the Wild and Scenic Rivers Act. These classifications are based on an analysis of the present level of development within the stream corridor at the time the inventory was completed. These classifications also control the level of development that may occur within a stream corridor, once a stream is determined eligible or suitable and a classification is assigned. The classifications are:

(1) recreational: rivers or sections of rivers that are readily accessible by road or railroad and that may have some development along their shorelines and may have undergone some impoundments or diversion in the past.

(2) scenic: rivers or sections of rivers free of impoundments, with shorelines or watersheds still largely undeveloped but accessible in places by roads.

(3) wild: rivers or sections of rivers free of impoundments and generally inaccessible except by trails, with watersheds or shorelines essentially primitive and waters unpolluted.

Threatened Species: Any plant or animal species defined under the Endangered Species Act as likely to become endangered within the foreseeable future throughout all or a significant portion of its range; listings are published in the *Federal Register*.

Timeliness: The lack of a time lag between impacts and the achievement of compensatory mitigation goals and objectives (BLM Manual Section 1794).

Timing Limitations (TLS): Prohibits surface use during specified time periods to protect identified resource values (BLM 2009).

Tipi: A cone-shaped tent used especially by Plains Indians usually made of skins or bark spread over a frame of poles. Also spelled tepee or teepee.

Torrifluvents: Entisols formed in stream deposited materials under limited moisture conditions.

Torriorthents: Entisols formed under very limited moisture conditions.

Traditional Cultural Property: A cultural property eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (A) are rooted in that community's history, and (B) are important in maintaining the continuing cultural identity of the community. "Traditional" in this context refers to those beliefs, customs, and practices of a living community of people that have been passed down through the generations, usually orally or through practice. The traditional cultural significance of a historic property is derived from the role the property plays in a community's historically rooted beliefs, customs, and practices.

Trail: A linear route managed for human-powered, stock, or off-highway vehicle forms of transportation or for historical or heritage values. Trails are not generally managed for use by four-wheel drive or high clearance vehicles.

Travois: A device used by Plains Indians to move things. It consisted of two long poles with a platform or netting to carry objects. Originally pulled by dogs, horses were later used to pull it.

Trend: The direction of change in ecological status or resource value rating observed over time. Trend in ecological status should be described or toward, or away from the potential natural community, or as not apparent. Trend in resource value rating for a specific use should be described as up, down or not apparent. Trends in resource value rating for several uses on the same site at a given time may be in different directions, and there is no necessary correlation between trends in resource value rating and trend in ecological status.

Two-track Vehicle Trails: A two-track is where perennial vegetation is devoid or scarce, or where wheel tracks are continuous depressions in the soil yet evident to the casual observer and are vegetated.

Undeveloped Recreation-tourism Market: National, regional, or local recreation-tourism visitors, communities, or other constituents who value public lands for the distinctive kinds of dispersed recreation produced by the vast size and largely open, undeveloped character of their recreation settings. Major investments in facilities are excluded within special recreation management areas where the BLM's strategy is to target demonstrated undeveloped recreation-tourism market demand. Here, recreation management actions are geared toward meeting primary recreation-tourism market demand to sustain distinctive recreation setting characteristics; however, major investments in visitor services are authorized both to sustain those distinctive setting characteristics and to maintain visitor freedom to choose where to go and what to do—all in response to demonstrated demand for undeveloped recreation.

Unoccupied Lek: There are two types of unoccupied leks, "destroyed" and "abandoned." Unoccupied leks are not protected during surface disturbing activities.

Uplands: Lands at higher elevations than alluvial plains or low stream terraces; all lands outside the riparian-wetland and aquatic zones.

Use: (1) The proportion of current years forage production that is consumed or destroyed by grazing animals. May refer either to a single species or to the vegetation as a whole. (2) Utilization of range for a purpose such as grazing, bedding, shelter, trailing, watering, watershed, recreation, forestry, etc.

Ustorthents: Entisols formed under limited moisture conditions.

Utilization: The proportion or degree of current year's forage production that is consumed or destroyed by animals (including insects). It may refer either to a single plant species, a group of species, or to the vegetation as a whole, generally expressed as a percentage.

Vegetation: Plants in general, or the sum total of the plant live above and below ground in an area.

Vegetation Treatments:

> **Mechanical Treatment:** Use of vehicles such as wheeled tractors, crawler type tractors, or specially designed vehicles with attached implements designed to cut, uproot or chop existing vegetation. Includes manual treatments involving hand tools, and hand operated power tools to cut, clear or prune herbaceous and woody species.
>
> **Biological Treatments:** Intentional use of domestic animals, insects, nematodes, mites, or pathogens that weaken or destroy vegetation.
>
> **Chemical Treatments:** Use of chemicals (herbicides), to kill or injure plants.

Vegetative Diversity: The variety of vegetative types in an area, including species, the genetic differences among species and populations, the communities and ecosystems in which vegetation types occur, and the structure and seral stage of these communities. Vegetative diversity includes rare as well as common vegetative types, and typically supports a diverse array of animal species and communities.

Viewshed: Term used in Visual Resource Management (VRM) to describe "…landscape that can be seen under favorable atmospheric conditions from a viewpoint (key observation point) or along a transportation corridor" (BLM 1984).

Vision Quest: A method used by American Indians, and others to seek spiritual power and knowledge through a vision of a guardian spirit or other entity. The process normally involves fasting and praying for extended periods of time.

Visual Resource Management (VRM) Classes:

> **Class I:** The objective of this class is to maintain a landscape setting that appears unaltered by humans. It is applied to wilderness areas, some natural areas, wild portions of wild and scenic rivers, and other similar situations in which management activities are to be restricted.
>
> **Class II:** The objective of this class is to design proposed alterations so as to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
>
> **Class III:** The objective of this class is to design proposed alterations so as to partially retain the existing character of the landscape. Contrasts to the basic elements (form, line, color, and texture)

caused by a management activity may be evident and begin to attract attention in the characteristic landscape; however, the changes should remain subordinate to the existing characteristic landscape.

Class IV: The objective of this class is to provide for management activities that require major modification of the existing character of the landscape. Contrasts may attract attention and be a dominant feature of the landscape in terms of scale; however, changes should repeat the basic elements (form, line, color, and texture) inherent in the characteristic landscape.

Rehabilitation Area: Change is needed or change may add acceptable visual variety to an area. This class applies to areas where the naturalistic character has been disturbed to a point at which rehabilitation is needed to bring it back into character with the surrounding landscape. This class would apply to areas identified in the scenic evaluation where the quality class has been reduced because of unacceptable cultural modification. The contrast is inharmonious with the characteristic landscape. It may also be applied to areas that have the potential for enhancement; i.e., add acceptable visual variety to an area or site. It should be considered an interim or short-term classification until one of the other VRM class objectives can be reached through rehabilitation or enhancement. The desired VRM class should be identified.

Visual Resources: The visible physical features of a landscape (topography, water, vegetation, animals, structures, and other features) that constitute the scenery of an area.

Voluntary Non-Use: When a grazing permittee voluntarily agrees to not use a portion of the allotted AUMs in an allotment.

Watershed: See *Basin*.

Weed: Any undesirable or troublesome plant, especially one that grows profusely where it is not wanted. Weeds can be native or non-native, invasive or noninvasive, and noxious or not noxious.

Wetlands: Areas that are inundated or saturated by surface or groundwater often and long enough to support and under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions.

Wilderness: A congressionally designated area of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, that is protected and managed to preserve its natural conditions and that (1) generally appears to have been affected mainly by the forces of nature, with human imprints substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least 5,000 acres or is large enough to make practical its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historic value. The definition contained in Section 2(c) of the Wilderness Act of 1964 (78 Stat. 891) (from H-6310-1, Wilderness Inventory and Study Procedures).

Wilderness Characteristics: Wilderness characteristics include size, the appearance of naturalness, outstanding opportunities for solitude, or a primitive and unconfined type of recreation. They may also include ecological, geological, or other features of scientific, educational, scenic, or historical value. However Section 2(c) of the Wilderness Act of 1964 has been updated by IM-2003-195, dated June 20, 2003. Indicators of an area's naturalness include the extent of landscape modifications, the presence of native vegetation communities, and the connectivity of habitats. Outstanding opportunities for solitude or primitive and unconfined types of recreation may be experienced when the sights, sounds, and evidence of other people are rare or infrequent, in locations where visitors can be isolated, alone or secluded from

others, where the use of the area is through non-motorized, non-mechanical means, and where no or minimal developed recreation facilities are encountered.

Wilderness Study Area: A roadless area or island that has been inventoried and found to have wilderness characteristics as described in Section 603 of FLPMA and Section 2 (c) of the Wilderness Act of 1964 (78 Stat. 891).

Wildland Fire: A general term describing any non-structure fire that occurs in the vegetation and/or natural fuels.

> **Wildfire:** Unplanned ignition caused by lightning, volcanoes, unauthorized and accidental human-caused fires and escaped prescribed fires.
>
> **Prescribed Fire:** Any fire intentionally ignited by managed under an approved plan to meet specific objectives.

Wildland Industrial Interface: The area where industrial development meets or intermingles with undeveloped wildland.

Wildland Urban Interface (WUI): Healthy Forest Recreation Act 2003: defines wildland urban interface (WUI) (section 101) as an area within or adjacent to an at risk community that has been identified by a community in its wildfire protection plan or, for areas that do not have such a plan, an area extending; (1) ½ mile from the boundary of an at risk community, or (2) 1½ miles when other criteria are met. (e.g., a sustained steep slope or a geographic feature aiding in creating an effective fire break or is condition class III land, or (3) is adjacent to an evacuation route.

Wildlife Habitat Management Area (WHMA): Special management areas that are designed to protect or preserve certain qualities or uses for wildlife and plant species. The environment in these areas is unique in some respects, and it is therefore desirable to apply different management prescriptions to these areas from those of the surrounding public lands. The integration of different land management goals, objectives, and actions will be implemented to ensure that the integrity of these areas will be maintained. They will be directed toward habitat management rather than species management and encompass featured species and species diversity to ensure compliance with existing laws; prevent species from becoming threatened or endangered; and provide values and uses for the public. The BLM will implement site-specific management actions in coordination with other agencies to maintain and/or improve these unique wildlife habitat management areas (BLM 2008e).

Wildlife Security Area: A geographic location or area that typically provides for some, if not all, of the wildlife species cover and forage needs and where wildlife are free from human caused disturbance and/or disruption.

Wildlife-Disturbing Activity: BLM-authorized activities other than routine maintenance that may cause displacement of or excessive stress to wildlife during critical life stages. Wildlife-disturbing activities include human presence, noise, and activities using motorized vehicles or equipment.

Withdrawal: Removal or withholding of public lands, by statute or Secretarial order, from operation of some or all of the public land laws. A mineral withdrawal includes public lands potentially valuable for leasable minerals, precluding the disposal of the lands except with a mineral reservation clause, unless the lands are found not to contain a valuable deposit of minerals. A mineral withdrawal is the closing of an area to mineral location and development activities.

Woodlands: Not capable of producing 20 cubic feet of wood fiber from commercial species per acre per year.

Yearlong Grazing: Continuous grazing for a calendar year. In the Cody Field Office, the year is defined at starting on March 1 and ending on February 28.

Yellowcake: Yellowcake is the product of the uranium extraction (milling) process. Early production methods resulted in a bright yellow compound, hence the name yellowcake. The material is a mixture of uranium oxides that can vary in proportion and color from yellow to orange to dark green (blackish), depending at which temperature the material was dried (level of hydration and impurities). Higher drying temperatures produce a darker, less soluble material. Yellowcake is commonly referred to as U_3O_8 and is assayed as pounds U3O8 equivalent. This fine powder is packaged in drums and sent to a conversion plant that produces uranium hexafluoride as the next step in the manufacture of nuclear fuel.

REFERENCES

Agee, J.K. 1993. Fire ecology of Pacific Northwest Forests. Island Press, Wash. DC.

American Geological Institute. 2005. The Glossary of Geology, 5th Edition, 2005, American Geological Institute, Alexandria, Virginia.

Bestelmeyer, Brandon T., K. Moseley, P.L. Shaver, H. Sanchez, D.D. Briske, and M.E. Fernandez-Gimenez. 2010. Practical Guidance for Developing State-and-Transition Models. Rangelands: December 2010, Vol. 32, No. 6, pp. 23-30.

BLM. No Date. Glossary of AML Terms. Available online: http://www.blm.gov/wo/st/en/prog/more/Abandoned_Mine_Lands/About_AML/aml_glossaryand_acronyms.html. Accessed June 4, 2010.

BLM. 1984. Visual Resource Management. BLM Manual 8400.

BLM. 1987. Cascade Proposed Resource Management Plan and Final Environmental Impact Statement, Glossary. Available online: http://www.blm.gov/pgdata/etc/medialib/blm/id/plans/cascade_rmp.Par.58190.File.dat/part5_11.pdf. Accessed June 4, 2010.

BLM. 1990. Allotment Categorization.

BLM. 1998. Standards for Rangeland Health and Guidelines for Livestock Grazing Management on BLM-Administered Lands in California and Northwestern Nevada Final Environmental Impact Statement, Glossary. Available online: http://www.blm.gov/pgdata/etc/medialib//blm/ca/pdf/pa/rangeland_management/final_rangeland_health.Par.1ac0ddab.File.pdf/GLOSSARY_EIS.pdf. Accessed June 4, 2010.

BLM. 2001. BLM Handbook H-4180-1, Rangeland Health Standards. U.S. Department of the Interior, Bureau of Land Management. Available online: http://www.blm.gov/pgdata/etc/medialib/blm/wo/Information_Resources_Management/policy/blm_handbook.Par.61484.File.dat/h4180-1.pdf.

BLM. 2002a. Mineral Potential Report for the Vernal Planning Area, Glossary. Available online: http://www.blm.gov/pgdata/etc/medialib/blm/ut/vernal_fo/planning/mineral_potential.Par.51777.File.dat/MPR%20100702.pdf. Accessed June 4, 2010.

BLM. 2002b. Trans-Alaska Pipeline System Glossary. Archeological District. Available online: http://tapseis.anl.gov/glossacro/index.cfm?init=A. Accessed June 4, 2010.

BLM. 2004. National Sage-grouse Habitat Conservation Strategy. 1.4.1 Guidance for the Management of Sagebrush Plant Communities for Sage-Grouse Conservation.

BLM. 2005. Draft Recreation Management Plan for the Upper Lake Creek Special Recreation Management Area Environmental Assessment, Glossary. Available online: https://scholarsbank.uoregon.edu/xmlui/bitstream/handle/1794/7338/Upper_Lake_Creek_Special_Recreation_Management_Area_Plan.pdf?sequence=1. Accessed June 4, 2010.

BLM. 2006. Final Environmental Impact Statement, Jonah Infill Drilling Projects, Chapter 8 – Glossary. Available online: http://www.blm.gov/pgdata/etc/medialib/blm/wy/information/NEPA/pfodocs/jonah.Par.3665.File.dat/14chap8.pdf. Accessed June 4, 2010.

BLM. 2007a. Eagle Lake Proposed Resource Management Plan and Final Environmental Impact Statement, Glossary. Available online: www.blm.gov/ca/pdfs/eaglelake_pdfs/eaglelakeproposed-RMP-FEIS/web/ELFO%20PRMP%20Glossary.pdf. Accessed June 4, 2010.

BLM. 2007b. Little Snake Resource Management Plan and Draft Environmental Impact Statement, Glossary. Available online: http://www.blm.gov/pgdata/etc/medialib/blm/co/field_offices/little_snake_field/rmp_revision/documents.Par.14154.File.dat/10_LSDEIS_Chapter_7_SFS.pdf. Accessed June 4, 2010.

BLM. 2008a. WO-IM-2009-018 Process for Setting Priorities for Issuing Grazing Permits and Leases. Available online: http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2009/IM_2009-018.html.

BLM. 2008a. Final Environmental Impact Statement, West Antelope II Coal Lease Application, Chapter 7, Glossary. Available online: http://www.blm.gov/pgdata/etc/medialib/blm/wy/information/NEPA/cfodocs/westantelope/feis.Par.34701.File.dat/010chap7.pdf. Accessed June 4, 2010.

BLM. 2008b. Kemmerer Resource Management Plan and Final Environmental Impact Statement, Glossary.

BLM. 2008c. Paleontology in the Bighorn Basin. Available online: http://www.blm.gov/wy/st/en/field_offices/Worland/Tracksite/paleo.html. Accessed June 4, 2010.

BLM. 2008d. Proposed Resource Management Plan and Final Environmental Impact Statement for Public Lands Administered by the Bureau of Land Management Rawlins Field Office, Glossary. Available online: http://www.blm.gov/pgdata/etc/medialib/blm/wy/programs/planning/rmps/rawlins/feis.Par.43827.File.dat/013_Glossary.pdf. Accessed June 4, 2010.

BLM. 2008e. Upper Missouri Breaks National Monument Proposed Resource Management Plan and Final Environmental Impact Statement, Glossary. Available online: www.blm.gov/pgdata/etc/medialib/blm/mt/field_offices/lewistown/um_rmp/proposed_rmp/vol_iii.Par.59149.File.../glossary.pdf. Accessed June 4, 2010.

BLM. 2008f. West Tavaputs Plateau Natural Gas Full Field Development Plan Draft Environmental Impact Statement, Glossary. Available online: http://www.blm.gov/pgdata/etc/medialib/blm/ut/price_fo/Oil_Gas.Par.31669.File.dat/Chapter8.pdf. Accessed June 4, 2010.

BLM. 2009. Proposed Oil Shale and Tar Sands Resource Management Plan Amendments to Address Land Use Allocations in Colorado, Utah and Wyoming and Final Programmatic Environmental Impact Statement. Available online: ostseis.anl.gov/ Accessed June 4, 2010.

BLM and (USFS) U.S. Forest Service. 2001. Off-highway Vehicle Environmental Impact Statement and Proposed Plan Amendment for Montana, North Dakota, and Portions of South Dakota, Glossary. Available online: http://www.blm.gov/pgdata/etc/medialib/blm/mt/blm_programs/recreation/ohv_eis.Par.97778.File.dat/Glossary.pdf. Accessed June 4, 2010.

BOR (Bureau of Reclamation). No date. Glossary. Available online: http://www.usbr.gov/library/glossary/index.html. Accessed June 4, 2010.

Briske, David D., J.D. Derner, J.R. Brown, S.D. Fuhlendorf, W.R. Teague, K.M. Havstad, R.L. Gillen, A.J. Ash, and W.D. Willms. 2008. Rotational Grazing on Rangelands: Reconciliation of Perception and Experimental Evidence. Rangeland Ecology & Management, 61(1):3-17.

Brown, J.K. 1995. Fire regimes and their relevance to ecosystem management. Pages 171-178 In Proceedings of Society of American Foresters National Convention, Sept. 18-22, 1994, Anchorage, AK. Society of American Foresters, Wash. DC.

Brumley, John H. 1988. *Medicine Wheels on the Northern Plains: A Summary and Appraisal*, Archaeological Survey of Alberta, Manuscript Series No. 12, Edmonton, Alberta.

Caudle, C., DiBenedetto, J., Karl, M., Sanchez, H., and C. Talbot. 2013. Interagency Ecological Site Handbook for Rangelands. Available online: http://jornada.nmsu.edu/files/InteragencyEcolSiteHandbook.pdf.

Clark, T.W., and M.R. Stromberg. 1987. Mammals in Wyoming. University of Kansas – Museum of Natural History. Lawrence, Kansas. Pgs. 108-111.

County of Riverside. No Date. Multiple Species Habitat Conservation Plan. Chapter 10 Glossary, Acronyms, Abbreviations, and Index. Available online: http://www.tlma.co.riverside.ca.us/mshcp/volume4/10.html. Accessed June 4, 2010.

EnCana. 2005. Carbon Dioxide Miscible Flood. Available online: http://www.encana.com/operations/technology/ot_co2_miscible_flood.html.

Luce, R. 2003. Personal communication with Dave Roberts (USDI-BLM, Wyoming) regarding prairie dog "complexes." Sierra Vista, AZ.

National Park Service. No Date. Available online: http://home.nps.gov/yose/parkmgmt/upload/fmpappendix2.pdf.

NRCS (Natural Resource Conservation Service). 2003. National Range and Pasture Handbook. Available online: http://www.glti.nrcs.usda.gov/technical/publications/nrph.html. Accessed August 11, 2010.

Prichard, D., J. Anderson, C. Correll, J. Fogg, K. Gebhardt, R. Krapf, S. Leonard, B. Mitchell, and J. Staats. 1998. Riparian Area Management: A User Guide to Assessing Proper Functioning Condition and Supporting Science for Lotic Areas. U.S. Department of the Interior, Bureau of Land Management, U.S. Department of Agriculture, Forest Service, and Natural Resources Conservation Service Technical Reference 1737-15.

SOP (Society of Petrophysicists) and WLA (Well Log Analysts). No Date. Basement. Available online: http://www.spwla.org/library_info/glossary/reference/glossb/glossb.htm. Accessed June 4, 2010.

State of Wyoming. 1973. Wyoming Weed and Pest Control Act of 1973. Chapter 5. Available online: http://www.wyoweed.org/Documents/DocumentPage/wp_act.pdf. Accessed June 4, 2010.

Stiver, S.J., A.D. Apa, J.R. Bohne, S.D. Bunnell, P.A. Deibert, S.C. Gardner, M.A. Hilliard, C.W. McCarthy, and M.A. Schroeder. 2006. Greater Sage-Grouse Comprehensive Conservation Strategy. Western Association of Fish and Wildlife Agencies. Unpublished Report. Cheyenne, WY.

University of Arizona. No Date. Arizona Standards for Rangeland Health and Guidelines for Grazing Administration, Glossary. Available online: http://rangelandswest.arid.arizona.edu/rangelandswest/jsp/hottopics/legal/policy/azstandards/azstandardsglossary.jsp. Accessed June 4, 2010.

University of Wyoming. 1999. Soils of Albany County. Available online: http://ces.uwyo.edu/PUBS/b-1071AL.pdf. Accessed June 4, 2010.

Valentine, J.F. 1990. Grazing Management. San Diego, CA: Academic Press, Inc.

Whicker, A., and J.K. Detling. 1988. Ecological Consequences of Prairie Dog Disturbances. Bioscience 38 (11): 778-785.

WordIQ. No date. Great Basin, Definition. Available online: http://www.wordiq.com/definition/Great_Basin. Accessed June 4, 2010.