# *Jonah Interagency Mitigation and Reclamation Office Strategic Plan*

## EXECUTIVE SUMMARY

The Jonah Interagency Mitigation and Reclamation Office (JIO) provides land management recommendations in support of the adaptive management process, as outlined in the Jonah Infill Drilling Project Area (JIDPA) Record Of Decision (ROD). JIO selects and manages off-site mitigation projects and provides the funding necessary to mitigate impacts to various resources in the JIDPA. JIO executes plans, monitoring, and other activities to ensure the effectiveness of on-site monitoring and off-site mitigation are in accordance with the Record of Decision for the Jonah Infill Drilling Project.

The adaptive management process is used to maximize the effectiveness of monitoring and mitigation efforts. An essential component of this process consists of monitoring and evaluation of actions which then leads to land management recommendations.

Resources viable for off-site mitigation identified in the ROD include: wildlife, air quality, cultural/paleontological, livestock grazing, and recreation. The JIO prioritized areas for potential wildlife mitigation within the Upper Green River Basin. These “Focus Areas” are areas which lend themselves toward maximizing habitats and species’ benefits. Projects within the Focus Areas are preferred, but not required for consideration. However, all wildlife mitigation projects must be within the mitigation boundary as identified in Figures 1 & 2 located in the appendices.

This document defines how JIO meets the aforementioned obligations and provides a framework for implementation of the adaptive management process to minimize unforeseen impacts and maximize the benefits of off-site compensatory mitigation. This document is reviewed and modified throughout the year during strategic planning efforts of the JIO.

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# PART ONE: MITIGATION

The following is a compensatory mitigation strategy that guides development, design, and execution to mitigate various resources impacted by the JIDPA. Impacts viable for off-site mitigation projects identified in the ROD include: wildlife, air quality, cultural/paleontological, livestock grazing, and recreation. [1]

## WILDLIFE

### Goal

Maintain, preserve and/or enhance up to 90,000 acres of sagebrush-steppe habitat for native wildlife, with emphasis on sage grouse, antelope, and SGCN species; and ensure access to habitat by pronghorn.

### Objective 1

Achieve a landscape mosaic of native vegetation species diversity and successional stages capable of supporting all native wildlife species while ensuring habitat conditions maintain or increase sage grouse populations.

### Strategies

1. Implement baseline vegetation inventory in Focus Areas (refer to Figure 1 in appendix) and other areas of importance (e.g. project areas) to determine habitat conditions and needs. The inventory will use ecological site descriptions and similarity indices to aid in determining site potential.
2. Coordinate with other ongoing efforts to aid strategy #1(e.g. Statewide Sage-grouse habitat mapping strategy).
3. Utilize baseline inventory to develop specific vegetation goals and objectives for project areas. (Refer to Appendix 5.3: Sample Goals and Broad Vegetation Objectives)
4. Utilize the inventory as basis for future vegetative monitoring relative to projects and success.
5. Use various treatment methods to provide a variety of habitat block sizes (successional and/or age classes) designed to support sustainable populations of native wildlife species. (Refer to Appendix 5.5: Tools for Habitat Enhancement)

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[1] Not all resource impacts identified in the ROD need to be addressed with off-site mitigation. Where an impact is adequately mitigated on-site, off-site compensatory mitigation is unnecessary.

6. Ensure nesting and early brood-rearing needs of sage-grouse are addressed by following WGFD guidelines for habitat management for sage-grouse (Bohne et. al. 2007).

7. Fund grazing-related structures and needs (e.g. water, fences, etc.) and grazing management practices that are designed to allow management strategies tiered towards the above goal and objective.

8. Utilize existing BMP's and other information such as the recent publication "Greater Sage-grouse Habitat and Livestock Grazing Management with emphasis on Nesting and Early Brood-rearing," to guide these efforts (Grazing-Grouse Working Group – 2008).

9. Provide seasonal deferment or rest rotation management in areas where feasible and are a part of a cooperative planning effort with private operators, BLM range staff and/or the Office of State Lands and Investments.

10. Work with various partners to solicit/develop projects that accomplish goals via project proposal submissions.

11. Work with landowners, agencies and other potential partners (permittees, livestock groups, Natural Resource Conservation Service, Soil Conservation Districts, Ducks Unlimited, Rocky Mountain Elk Foundation, various conservation organizations, etc.) to implement various practices that enhance/improve/protect sagebrush habitats and habitat needs for sagebrush dependent/obligate species.

**Monitoring/Evaluation**

Monitor vegetation treatments using methodologies and transect locations that are utilized in the baseline inventory.

Within project areas, monitor wildlife species of interest over time. Include specific monitoring to address changes in abundance of migratory bird species and pygmy rabbits. Utilize data currently being collected with other efforts (e.g. pronghorn flights, sage-grouse lek counts, etc.).

**Objective 2**

Provide water sources where needed to support a wide distribution of wildlife species across the landscape.

**Strategies**

1. Evaluate existing water availability and identify locations where water is desirable for wildlife.

2. Compliment any water development with areas reserved or enhanced further for wildlife (e.g. fenced out riparian areas), especially sage-grouse (e.g. enhancement of vegetation utilizing developed water source).

**Monitoring/Evaluation**

Utilize existing personnel (WGFD, BLM or others) for simple abundance measurements and/or measurements of wildlife use associated with these specific projects. Methods may also include the use of remote cameras.

**Objective 3**

Maintain migration corridors sufficient to allow unimpeded seasonal movements of migratory wildlife.

**Strategy**

Inventory fences located in pronghorn migration corridors systematically.

Contract out work for fences that need modification.

**Monitoring/Evaluation**

1. Evaluate any additional problems in areas of fence modifications and modify as needed.

**Objective 4**

Coordinate with other efforts related to landscape scale needs for wildlife species considered in this plan.

**Strategies**

1. Communicate and coordinate with entities such as the Wyoming Landscape Conservation Initiative, Statewide Sage-grouse Habitat Mapping efforts, area Sage-grouse working groups, Wyoming Game and Fish Department, Bureau of Land Management, and others.

2. Continue to pursue informational sources within these and other groups that may aid in the identification of other strategies which could be added to this plan.

3. Work with other entities to identify needed research that relates to the impacted species and JIO mitigation targets.

**Funding and Monitoring Strategy**

16.5 Million dollars are dedicated towards wildlife mitigation. As of December 2008, JIO committed $13,474,530 out of the $16,500,000. A majority of those funds include the purchase of conservation easements tied to conservation planning on associated BLM grazing allotments as well as private land. Therefore, $3,025,469 remains for additional wildlife mitigation projects. JIO plans to use the remaining funds for enhancing the areas that are now under conservation easements/plans and to design a monitoring plan that will validate the effectiveness of projects implemented. This plan DOES NOT exclude other opportunities that may be a good use of these funds.

A baseline vegetation inventory has been or will be conducted on all the grazing allotments and private land that are associated with funded projects. Baseline vegetation data will not be collected without the partnership and cooperation of all involved. This includes the grazing permittee(s), the BLM, or other interested parties. In these areas, the livestock producers/ landowners and the JIO have an agreement to do what is reasonably possible for range and wildlife habitat improvement. It has been challenging to warrant any kind of treatments to enhance habitat without having vegetation data and a record of available resources needed for management (fence lines, watering facilities, springs, etc.). Some data will be available in the winter of 2008-09 and the remainder for current projects will be available in 2009-10. As new projects emerge, this timeline may be extended.

In some cases, the local NRCS office is involved and has collected a resource inventory (similar to the JIO baseline data collection) and works with the landowner to develop conservation plans. These conservation plans can then be presented to JIO for approval or for more negotiation with the landowner to strengthen components for wildlife habitat improvements. For instances when the data from the JIO collection effort is used, the JIO, BLM Mitigation team, and other interested parties, in coordination with the project applicant (usually livestock producer) will analyze the data and develop projects to enhance the areas. Projects may include various treatments to the landscape to enhance habitat and range conditions. Detailed strategies to be used are outlined in the “Wildlife Mitigation Goals Strategies” section 1.1 of this document. The BLM mitigation team will assist in development of the project and will oversee NEPA analysis.

These types of projects are developed by the JIO and their partners and therefore render the application process and grant agreement unnecessary. All projects will be reported to the Directors of JIO Executive Committee for oversight and will be opened for discussion prior to implementation. BLM personnel will oversee that all BLM standards and specifications are applied when a project occurs on BLM administered land. The JIO and/or BLM will contract the necessary work and will act as the Project Manager of each project.

In coordination with JIO and the BLM Mitigation Team, a draft monitoring plan will be developed by the Spring of 2009. This monitoring information will be used to determine

the effectiveness of JIO wildlife mitigation overall. Monitoring for JIO mitigation may continue past the sunset of the JIO and funds will be reserved for those efforts.

# AIR QUALITY

## Goal

Improve conditions outside of the Jonah Field that may adversely affect visibility in nearby Class I airsheds.

## Strategy

1. Reduce the creation of particulates, NOx and sulfates from areas within the Upper Green River Valley.

## Monitoring and Evaluation

Please reference: http://www.wy.blm.gov/jonah_office/monitoring/AirQuality2008.pdf

Appendix: Air Quality Terminology and Air Quality Project Ideas

# RECREATION

## Goal

Enhance opportunities for the public to enjoy high quality outdoor recreation experiences through improvements to public access, recreation information, and facility enhancements that provide substantial recreational user benefits.

## Objective

Develop partnerships between industry, private recreation providers, counties, non-governmental organizations, State of Wyoming and Federal agencies that improve recreation opportunities, benefit public health, protect important natural resources and enhance regional tourism.

## Strategies

1. Secure public access for recreation purposes where existing access across private, county or state lands does not exist. This includes the acquisition and or negotiation of ROW's, easements and/or agreements.

2. Expand recreation values where significant public benefit would result from the consolidation of public, private, county or state lands.

3. Improve existing recreation trails or assist with the development of appropriate motorized, non-motorized and multiple use trail systems or special use areas.

4. Reduce impacts at existing undeveloped river accesses.

5. Improve public use information products that enhance the enjoyment of recreation opportunities and reduce impacts to natural resources and impacts to private land (maps, signs, brochures, user guides, interpretive sites, web based services etc.).

6. Support public access and facility enhancement projects.

## Monitoring and Evaluation

JIO shall perform annual surveys and/or open meetings with the public and our partners to monitor desires, problems and successes of recreation projects. Information will be evaluated and incorporated into an annual report inclusive of possible mitigation solutions and adaptive management recommendations.

## Funding Strategy

The JIO has dedicated $250,000 towards recreational mitigation.

# LIVESTOCK

## Goal

Reduce or eliminate livestock conflicts (death, illness, or loss of production) on the JIDPA between livestock and Jonah Infill related activities.

## Objective

Temporarily attract or relocate livestock to locations away from development areas.

## Strategies

1. Provide funding for alternative pasture outside the Jonah Field.
2. Enhance livestock grazing management and utilization through practices such as water development, fencing, habitat improvement projects, and development of grazing management plans where management will provide for improved vegetation health for livestock.

## Monitoring and Evaluation

JIO will conduct annual interviews with the grazing permittees in the Sand Draw, Stud Horse Butte Common, and Boundary Allotments. Reports will be developed that review all conflicts that occurred between livestock and Jonah activities. Possible solutions to resolve these conflicts will be discussed by JIO and/or BLM with the grazing permittee and possibly lead to adaptive management changes regarding livestock mitigation.

## Funding Strategy

$1,000,000 has been committed to funding livestock mitigation. This figure was derived by the cost of relocating the AUM's available within the Jonah Infill area to other grazing pasture during the development phase of the field (approximately 7 years).

# CULTURAL/PALEONTOLOGICAL MITIGATION

## Goal

Enhance the understanding of archeological and paleontological resources that provide an integrated, holistic and meaningful view of the archaeology and/or paleontology of the Upper Green River Basin.

## Objective

Conserve and understand archaeological resources and the paleontological environment of the Upper Green River Basin.

## Strategies

1. Provide funding to enhance and/or conserve archeological and/or paleontological artifacts and to provide for educational purposes.

## Monitoring and Evaluation

Engage with the Pinedale Anticline Working Group Cultural/Historic Task Group (PAWG-CHTG) to evaluate JIO cultural mitigation success. The PAWG-CHTG group, composed of local concerned citizens, oil and gas representatives and BLM representatives, makes an ideal mechanism to obtain funding feedback and gauge success. Prepare an annual report documenting project funding and progress.

## Funding Strategy

The JIO has dedicated $250,000 towards recreational mitigation.

## PART TWO: ADAPTIVE MANAGEMENT STRATEGY

The following table outlines the key issues along with required documentation that will be used for monitoring and evaluation to determine the need for change for the Jonah Infill Drilling Project Area (JIDPA).

| Key Issue | Required Documentation | Monitoring & Evaluation |
|---|---|---|
| Determine long-term impacts on nesting raptors, greater sage-grouse lek attendance, and occurrence of other sagebrush-obligate species. | Operators monitor nesting of raptors, including ferruginous hawk, bald eagle, and burrowing owl; greater sage-grouse lek attendance; and occurrence of other sagebrush-obligate species within the JIDPA in coordination with Authorized Officer and the JIO. | Monitoring reports are reviewed on an annual basis and any needed adaptive management recommendations are determined. |
| Monitor Wildlife Populations within the Jonah Field | Operators have implemented a Wildlife Monitoring Plan and submit an annual report. | Monitoring reports are reviewed on an annual basis and any needed adaptive management recommendations are determined. |
| Ensure reclamation results in the return of habitat function and healthy ecosystems. | Not determined at this time | Develop a system to evaluate the effectiveness of reclamation on habitat. (HEP and HSI) |
| Ensure grazing and browsing does not impede reclamation success. | Grazing/browsing utilization is noted during annual reclamation monitoring. | Locations with severe grazing or browsing may require fencing. Livestock mitigation has been used to lessen this impact. |
| Ensure accelerated reclamation. | Operators are required to submit annual reclamation reports detailing the vegetative composition and condition of all locations, including pipelines. | A database developed by USGS is utilized to track reclamation success and will identify locations that are not progressing and need additional reclamation attention. |
| Ensure surface disturbance allowances are not exceeded. | Operators are required to submit surface disturbance reports with GIS compliant data on July 1st and January 1st of each year. If photo imaging and digitizing is utilized, reports are submitted annually. | Data is incorporated into a database that tracks detailed operator surface disturbance. Once field development has reached 75% of maximum (14,020 acres), disturbance reports will be required on a quarterly or monthly basis to ensure maximum disturbance allowances are not exceeded. |
| Ensure the county will be able to predict the influx of transient workers attracted by Jonah development. | Operators submit 3 year drilling forecast on January 31st of each year. | Once 3 year drilling forecasts are submitted by each operator, a comprehensive report will be supplied to County officials by February of each year. |
| Determine impacts of development on livestock grazing. | JIO conducts annual reports of conflicts between livestock and development activities within the JIDPA. | If impacts occur, mitigation funding is used to relocate livestock away from development activities. |

| Key Issue | Required Documentation | Monitoring & Evaluation |
|---|---|---|
| The modeling indicated potential significant adverse visibility impacts in various Class I areas using a reasonable-but-conservative scenario. | BLM may run an air dispersion model, comparable to the model run for the AQIAS, to reassess air quality impacts. Also, operators will submit annual operating plans that report the emissions from all emitting units. | BLM's performance objective for visibility will be attained if actual visibility impact monitored by the Bridger Wilderness IMPROVE aerosol sampler complies with the reasonable progress goal of the Wyoming Regional Haze State Implementation Plan. Annual operating plans will be analyzed by WDEQ and BLM. |
| In cooperation with the JIO established under the ROD, BLM will review ozone data collected in the area. If in the future air monitoring were to show ozone exceedances attributable at least in part to sources in the Jonah field, BLM will consult with WDEQ-AQD, EPA, USFS, and NPS to determine whether adaptive management would be needed to mitigate impacts. | Ozone data collected at monitoring sites (see http://www.wy.blm.gov/jonah_office/monitoring/AirQuality2008.pdf) and tracked emissions. | Operators will provide BLM with information on their drill rigs, including drilling days, horsepower, load factors, and emissions factors within 10 days of the completion of drilling operations for each well. These reports will be analyzed quarterly. |
| Water wells will be tested annually for static water level, general chemical constituents as determine by the AO, and TPH, using WDEQ-approved methods. | Annual reports will be provided by the operators to the JIO, BLM, WDEQ, and WSEO communicating aforementioned values. | The operator-submitted annual reports will be analyzed by WDEQ. If corrective action is warranted, a program will be put in place. |
| Determine the effectiveness of mitigation | Work in progress | Design and implement a monitoring program to measure and validate whether project-specific objectives have been met. Conduct annual reviews to determine effectiveness of mitigation. Game and Fish population data will be used to determine any correlations with mitigation projects and wildlife populations. |
| Validate, coordinate, and oversee research | No required documentation | If the monitoring data collected cannot be analyzed or interpreted because of a lack of scientific understanding, the JIO can approach research organizations to help answer the questions. |

# PART THREE: SUCCESSION AND MONITORING PLAN

The life of the JIO is anticipated to last five to fifteen years. Therefore, it is important to consider what will happen to the information and data collected during the JIO project.

**Goal**

To ensure the viability of information and data collected as part of the JIO project exceeds the expected duration of the JIO.

**Objectives**

Initiate, in cooperation with USGS, a database repository for baseline and monitoring information collected during JIO's lifetime.

Include in JIO projects a cooperative agreement outlining the responsibilities of partnering agencies beyond the lifetime of JIO.

Selection and utilization of appropriate software or reporting standards to insure that all data collected is stored and utilized in meeting the monitoring commitments contained in Environmental Impact Statements and other environmental documents.

**Strategies**

Ensure data collection methods meet minimum threshold standards.

Publish data collected within the purview of JIO to the Jonah Infill Database.

**Monitoring and Evaluation**

The Agency Managers committee, or representatives, of the JIO will ensure that cooperative agreements, adopted as part of funded projects, will encompass agency responsibilities or commitments, as deemed appropriate, beyond the life of the JIO.

# PART FOUR: JIO BUDGET

The JIO is funded by and manages a $24.5 million monitoring and mitigation fund committed by EnCana Oil & Gas (USA), Inc., BP America Production Company, and potentially others. $16.5 million is dedicated for off-site wildlife mitigation. The remaining $ 8 million is to be used for other mitigation efforts, monitoring, and JIO office support.

**Goal**

JIO will provide oversight and administration of funds available for operation, reclamation, monitoring, and mitigation, offsite and onsite, to ensure appropriate utilization of committed funds as per the Record of Decision.

**Objective**

Off-site mitigation for direct surface disturbance impacts to wildlife is necessary at a minimum rate of 3:1 (off-site treatments to on-site disturbance); with the goal of off-site treatments being to provide improvements and/or protection to other comparable habitat areas within relatively close proximity to the JIDPA. As an example, if the development approved 10,000 acres of direct surface disturbance, a minimum of 30,000 acres of off-site habitat treatment would be required. For other impacted resources that could not be adequately mitigated on-site, off-site mitigation would be considered acceptable on a 1:1 basis. Under no circumstances would implementation of off-site mitigation measures obviate the Operator's requirement to comply with all on-site mitigation and monitoring, outcome-based performance objectives, COAs, BMPs, and/or Operator-committed practices.

**Strategies**

1. Develop an auditable budget tracking system to account for administration and execution of project funds.

2. Establish a budget and mitigation and monitoring programs for Air, Water, Wildlife, Livestock and Reclamation.

3. Coordinate and track ongoing research being conducted in the Jonah Project area.

4. Provide advice and recommendations on environmental monitoring and needed science to document the effects of energy development.

**Monitoring and Evaluation**

At least once per year, the Agency Managers committee, consisting of the agency heads or representatives, and a single member of each of the oil and gas industry proponents involved in the Project Office will meet. At this annual oversight meeting, progress will be evaluated, and direction, coverage and staffing for the next year would

be considered and adopted. The budget is updated and provided to the managers on a quarterly basis for review.

# PART FIVE: OUTREACH

Outreach is an effort by an organization to connect its ideas or practices to the efforts of other organizations, groups or the general public. In order for the Jonah Interagency Organization (JIO) to be successful, it is important to have an outreach component to its strategic plan. Outreach takes on an educational component and engagement strategy both internal (within the federal and state organizations) and external (general public and interest groups).

**Goals:**

To assure that both internal and external audiences are informed of the activities, progress and success of the JIO.

**Objective (Internal)**

Through education and communication efforts, state and federal organizations have a better understanding and knowledge of JIO activities and how they can partner.

**Strategies:**

- Attend staff meetings at all agencies involved in partnership and report out – message should continue to be that we are all working for the same goal.
- Re-initiate JIO staff meetings on a regular basis in order to maintain open and good communication.
- Prepare project reports and share with agencies.

**Objective (External)**

Through education and communication efforts, the general public and interest groups have a better understanding and knowledge of JIO activities and successes.

**Strategies:**

- Place signs with JIO name at project sites that are funded through JIO.
- Create an annual report that can be circulated to the general public and interest groups.
- The web site is currently underutilized – showcase projects on the web site.
- Have better distribution of the newsletter.
- Utilize the local newspaper – more stories and reporting on activities and successes. Contact reporters and develop a rapport and invite on field tours.

- Host field tours of projects for general public.
- Utilize radio for interviews and to share progress and success.
- Create display booth for educational displays at fairs, conferences, events.
- Utilize the USGS database for public information regarding on-site monitoring.

# APPENDICES

## IMPACTED WILDLIFE SPECIES

Species affected by the Jonah Infill have been identified in the Final Environmental Impact Statement for the Jonah Infill Drilling Project Area (FEIS JIDPA). Discussions of impacts occur in that report, as well as species-specific information regarding the significance of those impacts. For practical purposes, the JIO has highlighted two specific impacts as being high priority, including sage-grouse seasonal habitats (in particular nesting and brood-rearing) and pronghorn migration corridors. A copy of the FEIS JIDPA may be obtained through the Pinedale Bureau of Land Management.

## FOCUS AREAS

Prioritized areas for mitigation are illustrated in Figures 1 and 2. Figure 1 illustrates JIO Focus areas where emphasis will be placed on those objectives tied to the enhancement of sagebrush habitats/communities. Figure 2 illustrates pronghorn migration corridors where objectives are tied to maintaining, protecting, or enhancing migratory corridors for pronghorn antelope.

Various partners participated in the development of the focus areas delineated in Figure 1. These included WGFD, BLM, WDA, The Nature Conservancy (TNC), the local sage-grouse working group and others. The focus areas identify areas utilized by most species impacted in the Jonah Field. Projects addressed by JIO within these focus areas will meet the following guidelines:[2]

1. Landscape areas predominantly covered by sagebrush communities.

2. Areas providing habitat for the Wyoming Game and Fish Department's sagebrush associated Species of Greatest Concern (SGCN) or other species dependent upon sagebrush for a part of their habitat needs (i.e., crucial range for pronghorn, etc.).

3. Areas of known important Greater Sage-Grouse populations and associated habitats (i.e. refer to regional sage-grouse planning efforts and working groups).

4. Priority habitats identified in the Strategic Habitat Plan (WGFD 2001), and crucial and overlapping crucial ranges for big game, 2-mile sage-grouse lek buffers; nesting/early brood-rearing habitats (where mapped) and/or sage-grouse winter concentration areas (when identified), and other important

[2] Projects are not required to be within the focus area to be considered. However all JIO mitigation projects must be within the JIO mitigation boundary as identified in Figure 1.

habitats for sagebrush obligate/dependent wildlife species not identified within other categories.

5. Pronghorn migratory corridors (both within and outside of “focus areas”).

6. Low to moderate potential for mineral development.

Focus areas were delineated utilizing numerous sources, including the TNC prioritization model, Upper Green River Basin Sage-grouse Conservation Plan, Pinedale BLM Resource Management Planning efforts, Game & Fish Strategic Habitat Plan, and identified sage-grouse seasonal habitat information. The following is a brief description of these areas:

Ryegrass/Bench Corral: Focus Area encompasses all lands south of Horse Creek, west of the Green River, north of North Piney Creek and onto the U.S. Forest Service administered lands where occupied habitat exists. This area was also delineated as an evaluation area in the Upper Green River Basin Sage Grouse Conservation Plan.

Wind River Front: Focus Area encompasses all lands south of Fall Creek, east of Highway 191, north of the Big Sandy River and onto the U.S. Forest Service administered lands where occupied habitat exists. This area is a combination of portions of the Upper Green River/Pinedale Front and East Fork Evaluation Areas in the Upper Green River Basin Sage Grouse Conservation Plan.

FIGURE 1- FOCUS AREAS

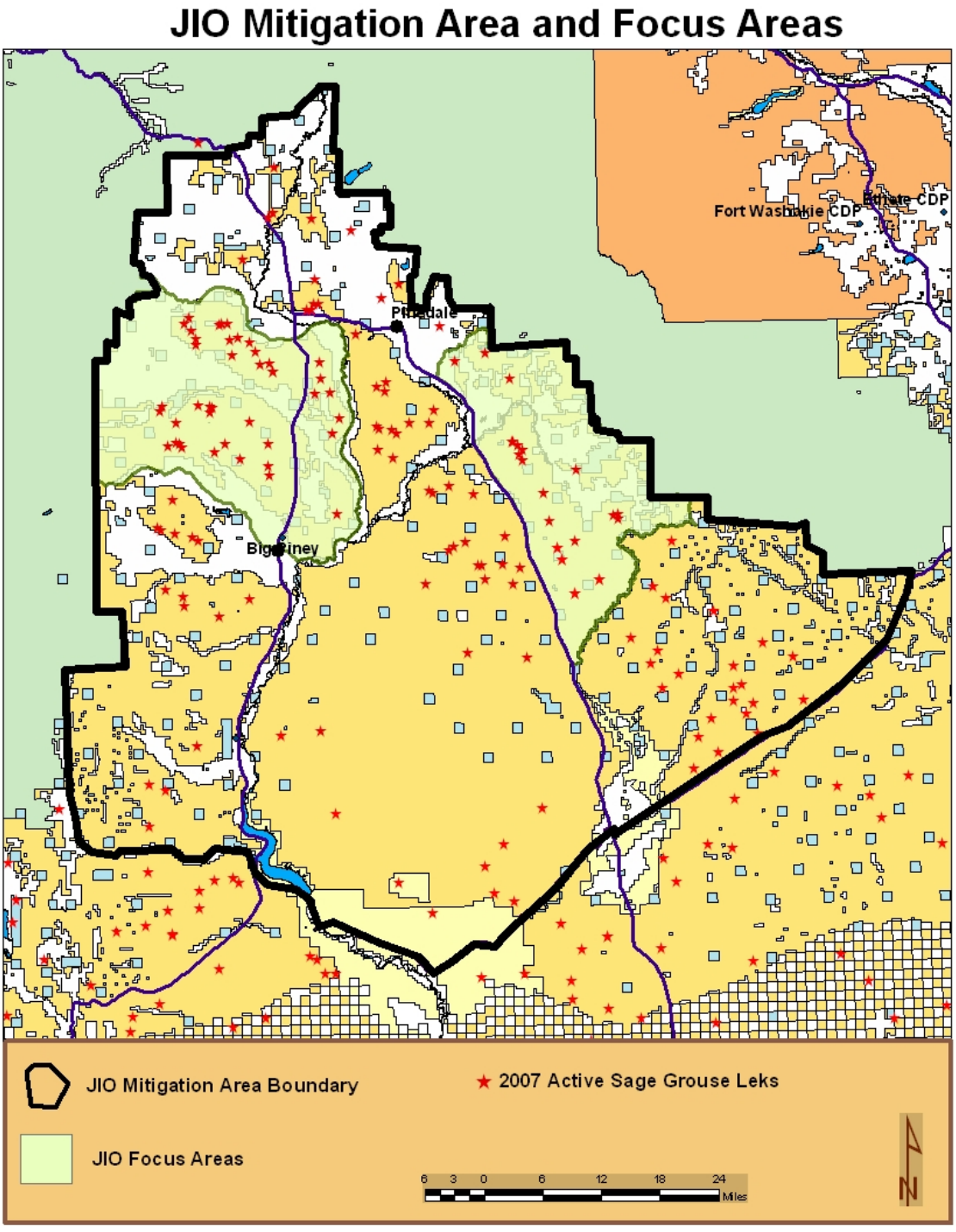
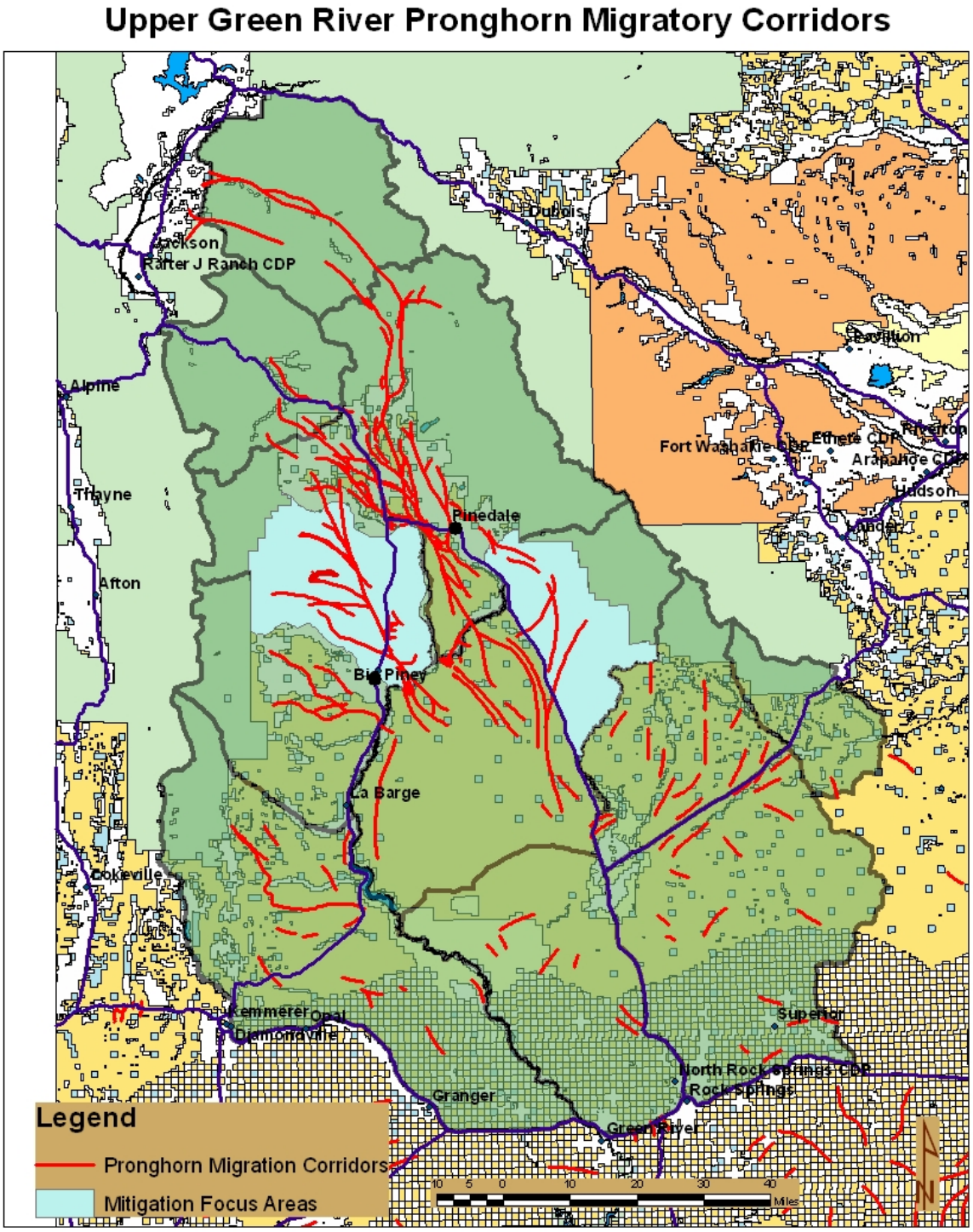


FIGURE 2- PRONGHORN MIGRATORY CORRIDORS



## SAMPLE GOALS AND BROAD VEGETATION OBJECTIVES

**Goal 1**

Promote a healthy, productive mosaic of shrub age classes and canopy covers with a diversity of plant species in sustainable sagebrush communities

- Provide a healthy sustainable understory of native grasses and forbs
- Provide healthy, vigorous, and sustainable native shrubs and trees
- Provide adequate residual vegetation and litter to sustain plant and soil health and vigor, sediment capture, energy dissipation, groundwater recharge, and cover for ground nesting birds and small mammals
- Provide a healthy biotic community by ensuring that the appropriate kinds and amounts of soil organisms, plants, and animals to support the hydrologic and nutrient cycles, and energy flow are maintained or enhanced
- Provide healthy sustainable vegetation, soils, hydrology, and water cycling to sustain health, free-ranging populations of fish and wildlife (included in WGFD objectives)

**Goal 2**

Maintain and/or improve migration corridors for pronghorn and other big game species that use the Bench Corral area.

- Inventory all fences for wildlife compatibility within the project area and replace/improve where necessary
- Prevent an increase in road density by determining and maintaining (or reducing where possible) current road densities within the project area
- Avoid construction of new facilities (i.e. water developments, corrals, etc.) within identified migration corridors unless agreed upon by all cooperators
- WGFD will work to maintain big game numbers to ensure sustainability of healthy sagebrush, other shrubs, riparian habitats and grass and forb under-story for sage-grouse, rangeland, and watershed health

## ECOLOGICAL SITE DESCRIPTION-BASED OBJECTIVES

The following objectives are based upon ecological site descriptions, index similarities, and associated site potential. They are based on the best current information available from various sources.

1. Use ecological site descriptions, similarity indices, and further data collection efforts as approved by signatory partners to address, and as needed to refine the following objectives:
    a. **Loamy Sites (Ly 10-14W)**

i. **Big Sage/Bunchgrass** – Objective of >45% of area in this transition state – This state represents "best" sage-grouse nesting cover and would contain sagebrush canopy cover of >15%, coupled with a good native perennial bunchgrass component. Ecological Site Potential in the range of 55-75% (high fair to low good condition). A minimum of 5-6 native perennial grasses (2-3 should be tall bunchgrasses) and 4-5 native perennial forb species should be available on-site[1].

ii. **Bunchgrass/Big Sage** – Objective of <25% of area in this transition state – This state represents high quality brood-rearing habitat, including early brood-rearing and some, although limited, nesting and security cover for sage-grouse. Ecological Site Potential would be higher than 70%. Canopy cover of sagebrush could range from > 5 to <15 percent cover. A minimum of 5-6 perennial native grasses (2-3 should be tall, perennial bunchgrasses) and 5 perennial native forb species should be available on site.[1]

iii. **Bunchgrass** – Objective of <15% of area in this transition state. This state represents an earlier seral stage which would be illustrative of natural perturbations or past treatment areas. This stage would probably contain the highest herbaceous component and diversity of forbs, but would not contain adequate nesting cover for sage-grouse. If these sites are a result natural perturbations or treatments, they should be adjacent to good sagebrush nesting and security cover and early and late brood-rearing areas. A minimum of 5-6 perennial native grasses (2-3 tall, perennial bunchgrasses) and 6 perennial native forb species should be available on site.[1]

iv. **Big Sage/Rhizomatous Wheatgrass** – Objectives of <50% of area in this transition state over the short-term (10-15 years) and <20% of area in this transition state over the long-term (>15 years). This stage is stable, and with a well managed good quality understory will provide and meet minimum standards for sage-grouse nesting and brood rearing habitat and is desirable for the short term. Over the long term slowly convert and manage toward a big sage/bunchgrass transition state and manage towards an objective of having this transition stage covering <20% of the area. A minimum of 4-6 perennial native grass species and >4 perennial forb species should be available on site.[1]

**v. Other less desirable transition states include:**

1. Big Sage/Bare Ground (<5% of the area).
2. Rabbitbrush (<5% of area).

b. **Shallow Loamy Sites (SwLy 10-14W)**

i. **Big Sage/Bunchgrass** – Objective of >30% of area in this transition state. This state represents a community which would provide quality brood-rearing habitat for sage-grouse with limited nesting and security cover. Ecological site potential should be in a range of 55-65% (low to high good condition). A minimum of 4-5 native perennial grasses (at least two should be native perennial bunchgrasses) and 5 native perennial forb species should occur on the site.[1]

ii. **Bunchgrass/Big Sage** – Objective of >20% of area in this transition state. This state represents areas in high ecological condition and from a sage-grouse perspective would represent high quality brood-rearing habitat, due to native perennial forb abundance and overall vegetative diversity. Ecological site potential would be greater than 70%. A minimum of 5 native perennial grasses (at least two should be native perennial bunchgrasses) and 6 native perennial forb species should be present on site.[1]

iii. **Bunchgrass** – Objective of >10% of area in this transition state. Similar to loamy sites, this state represents areas that may have had some disturbance or treatment, but have not recovered to a condition that represents the bunchgrass/big sage transition state. A minimum of 5 native perennial grasses at least two should be native tall perennial bunchgrasses) and 6 native perennial forb species should be present on site.[1]

[1]Specific vegetative parameters related to the number of native perennial grasses and native perennial forbs relates to the "diversity" aspect of vegetative communities, rangeland and watershed health and wildlife habitat health so important to a myriad of wildlife species which use these communities and which have been suggested by ecologists to occur in may similar systems. If these need changed over time based on ongoing data collection, this will be done by those agencies cooperating on this project with permittee concurrence.

c. **Shallow Clayey – (SwCy 10-14W)**

i. These sites contain early sagebrush (*Artemisia longiloba*) communities. The overall objective is to maintain native perennial plant and litter cover and diversity of perennial species within 70% of ecological potential for the site. Ground cover[2] will be maintained in the 40-50% range and some emphasis will be placed on forb production within these sites. A minimum of one transect will be read on a representative site to monitor this objective. Current WGFD data collection efforts in these communities have suggested that there can be up to 7 native perennial grass species and 15 native perennial forb

1. Ground cover – this can be defined as the percentage of material (e.g., litter, standing dead vegetation, gravel/rocks, vegetation and biological crusts) excluding bare soil, covering the land surface.
2. There have been suggestions that these sites have greater potential for producing forbs, so some experimentation may be implemented on smaller scales to determine the feasibility of increasing forb production. If successful, this may be applied on a larger scale.

d. **Riparian Communities – perennial and intermittent drainages**

i. Increase riparian greenline and maximize riparian species as they relate to site potential for these areas. Key species will include native sedge, grass, forb, and shrub species. Increase willow abundance, health and composition to within 80% of potential for the site. Enhance the groundwater aquifer where feasible with projects designed to thin or reduce sagebrush, increase herbaceous cover and reduce bare ground.

## TOOLS FOR HABITAT ENHANCEMENT

**Conservation Easements with Conservation Plans** – This concept includes numerous options/practices for mitigating impacts to the most crucial habitats. These options/practices include maintaining open space, excluding subdivisions and keeping an agricultural base of operations compatible with wildlife, and preparation of a management plan and/or vegetative objectives that address the needs of impacted species.

**Grazing/AUM Management Program** – This practice could include many options, to improve habitat quality for wildlife. Some options might include: (1) paying for private grazing AUMs to provide rest and/or treatments on public lands; (2) providing for rest/treatments and once completed, turning the land back to grazing use; or (3) establishing forage reserves (grass banks) to provide management flexibility for habitat treatments and livestock grazing. Other grazing management options include electric fencing to provide pasture systems, herding, water developments, etc. These could all be utilized to better manage/control grazing animals to improve range/habitat conditions.

**Habitat Improvements** – These options may be considered as standard procedures for managing habitat, or for off-site mitigation where important habitats could potentially be improved to restore habitat functions impacted in other areas. The costs are subject to site-specific adjustments based on the true cost of implementation. If monetary assessments are made, the amounts should be calculated based on the true or fair cost

of implementation. Before habitat treatments are applied, qualified personnel should evaluate the prospective site to determine its condition, improvement potential, and ecologically appropriate treatments. Early consultation with the WGFD can greatly assist with planning and selection of treatments. In particular the Department has developed specific management objectives for sagebrush and sage grouse habitats (Wyoming Interagency Vegetation Committee 2002, Bohne et. al. 2006). Cost figures may be obtained through Department personnel or through the local NRCS office.

***Long Term (>15 years)***

Water Developments (as needed by wildlife)

Springs/Seeps – Longevity of approx. 20 years.

Wetland Development - Longevity of 25+ years.

Ponds/Reservoirs – Longevity of 25 years.

Guzzlers

Wells/Windmills

Prescribed Burning [Consult Wyoming Interagency Vegetation Committee (2002) and Bohne et al. (2006) for precautions in occupied sage grouse habitat].

> Longevity – 15 years in herbaceous vegetation types. Treated areas require proper pre- and post-burn grazing control and management (two growing seasons of rest). Within shrub ecosystems, burned areas generally will not recover to a functional seral stage for 10-20 years and this process can take much longer in some ecosystems (e.g., xeric *Artemisia tridentata wyomingensis*). The beneficial effect may last an additional 20-30 years.

Herbicide Treatments

> Use to change vegetative composition and/or set back seral stage of succession to benefit wildlife. Longevity – 15 years in herbaceous vegetation types. Within shrub ecosystems, treated areas generally will not recover to a functional seral stage for 10-20 years and this process can take much longer in some ecosystems (e.g., xeric *Artemisia tridentata wyomingensis*). The beneficial effect may last an additional 20-30 years.

Cutting/Chopping Regeneration (only relevant in sagebrush systems for JIO efforts)

Aspen –Longevity of 50 years.

Conifer – Thinning/Clear cutting – Longevity – 20-40 years.

Sagebrush/Mountain shrub – 15+ years.

Willow –Longevity – 25+ years.

Seeding – grass, legumes, forbs into permanent cover - Longevity – 25+ years

Planting shrubs and trees (shelterbelts and thickets) – Longevity – 25+ years.

Sagebrush seeding or transplanting

Fencing – Longevity – 25 years.

Stream bank protection and In-stream structures – Bank stabilization, log and rock revetments and over-pours, boulders, sheet pilings for small streams - Longevity is variable but should last more than 15 years.

Beaver transplanting – designed to raise water table and improve riparian.

***Short Term (<15 years)***

Fertilization – Longevity – 3 years.

Food Plots – Longevity – 1 to 3 years.

Range pitting – Longevity – 10 years.

In-stream structures – Longevity – 8 years.

Inter-seeding – Longevity – 10-15 years.

Herding/Moving Livestock, with the owner's or permittee's concurrence – to improve riparian or range conditions. Longevity – 1 year but the effects could be up to 2 to 5 years.

Fencing (temporary) – such as electrical

Pothole Blasting

## PROJECT IDEAS FOR WILDLIFE

***Large Scale***

1. Acquire grass bank areas that could provide for rest from treatments, and/or provide for greater options for the management of livestock (i.e. rest-rotation, deferred rotation, etc.).

2. Join existing projects where goals are compatible with those of the JIO.

3. Work with other entities, such as Upper Green River Land Trust, TNC, Rocky Mountain Elk Foundation, pronghorn and sage-grouse interests, etc. to fund conservation easements that address mitigation goals. Assist with the development of conservation planning associated with the easements.

***Small Scale***

1. Treat sagebrush in mosaic patterns by prescribed burning, chemical treatment (thinning), or mechanical treatment (thinning or mosaics). Complement these treatments with inter-seeding native forbs and grasses and grazing management plans.

2. Implementation of rotational grazing strategies with deferment system and monitoring (could be enhanced by use of temporary cross-fencing and water developments).

3. Enhanced reclamation in areas previously reclaimed to incorporate greater vegetative diversity (especially shrubs and forbs).

4. Increase visibility or otherwise modify fences documented to cause wildlife mortalities, or where needed on important migratory corridors or bottlenecks.

5. Protect (fencing or other protection) natural springs or man-made water sources to maintain flows, extend the life of the water sources and provide herbaceous food and cover.

6. Enhance herbaceous understory diversity and structure within established sagebrush habitats; including re-establishment of native, cool-season bunch grasses and forb species, on a landscape scale.

## SPECIES OF GREATEST CONSERVATION NEED IN ECOREGIONS WITH MODERATE OR HIGH POTENTIAL FOR OIL AND GAS DEVELOPMENT *

Sagebrush and shrubland species of greatest conservation need (Wyoming)

Mammals:

Swift Fox
Pygmy Rabbit
White-tailed Prairie Dog
Spotted Ground Squirrel
Wyoming Ground Squirrel
Idaho Pocket Gopher
Plains Pocket Gopher
Great Basin Pocket Mouse
Olive-backed Pocket Mouse
Sagebrush Vole
Spotted Bat

Birds:

Greater Sage-grouse
Columbian Sharp-tailed Grouse
Ferruginous Hawk
Mountain Plover
Long-billed Curlew
Sage Thrasher
Sage Sparrow
Brewer's Sparrow

Amphibians

Great Basin Spadefoot
Great Plains Toad
Plains Spadefoot
Woodhouse's Toad

Reptiles:

Cliff Tree Lizard
Greater short-horned lizard
Northern Plateau Lizard
Northern Sagebrush Lizard
Bullsnake
Great Basin Gophersnake
Midget Faded Rattlesnake
Plains Black-headed Snake
Prairie Rattlesnake
Rubber Boa
Smooth Green Snake

Grassland species of greatest conservation need (Wyoming)

Mammals:

Swift Fox

Black-tailed Prairie Dog

Black-footed Ferret

Pocket Mouse

Olive-backed Pocket Mouse

Plains Harvest Mouse

Plains Pocket Mouse

Prairie Vole

White-tailed Prairie Dog

Plains Pocket Gopher

Birds:

Long-billed Curlew

Upland Sandpiper

Mountain Plover

Ferruginous Hawk

Short-eared Owl

Burrowing Owl

Dickcissel

Grasshopper Sparrow

Chestnut-collared Longspur

McCown's Longspur

Lark Bunting

Bobolink

Reptiles:

Bullsnake

Common Garter Snake

Eastern Yellow-bellied Racer

Great Basin Gophersnake

Pale Milksnake

Plains Black-headed Snake

Plains Garter Snake

Plains Hog-nosed Snake

Prairie Rattlesnake

Smooth Green Snake

Amphibians

Plains Spadefoot

Great Plains Toad

Woodhouse's Toad

Wetland (lentic) and riparian species of greatest conservation need (Wyoming)

Mammals:

River Otter
Moose
Meadow Jumping Mouse
Hayden's Shrew
Preble's Shrew
Pygmy Shrew
Water Shrew
Water Vole
Pallid Bat
Hoary Bat
Silver-haired Bat
Spotted Bat
Townsend's Big-eared Bat
Little Brown Myotis
Long-eared Myotis
Long-legged Myotis
Fringed Myotis
Northern Myotis

Birds:

American Bittern
American White Pelican
Bald Eagle
Barrow's Goldeneye
Black Tern
Black-crowned Night Heron
Canvasback
Caspian Tern
Clark's Grebe
Common Loon
Forster's Tern
Franklin's Gull
Great Blue Heron
Sandhill Crane
Harlequin Duck
Lesser Scaup
Northern Pintail
Swainson's Hawk
Trumpeter Swan
Virginia Rail
Western Grebe
White-faced Ibis
Willow Flycatcher
Yellow-billed Cuckoo

Amphibians

Boreal Chorus Frog
Boreal Toad
Great Basin Spadefoot
Great Plains Toad
Northern Leopard Frog
Plains Spadefoot
Tiger Salamander
Woodhouse's Toad

Reptiles:

Northern Sagebrush Lizard
Western Painted Turtle
Western Spiny Softshell Turtle
Intermountain Wandering Garter Snake
Plains Garter Snake
Plains Hog-nosed Snake
Prairie Rattlesnake

Mollusks and Crustaceans:

California Floater
Crayfish
Freshwater Snails

Jackson Lake Springsnail

Land Snails

Shrimp

## BIOLOGY AND HABITAT REQUIREMENTS FOR SAGE-GROUSE

Numerous references could be cited to summarize sage-grouse habitat needs/requirements. Much of this information exists in the Upper Green River Basin Sage-grouse Conservation Plan which is where much of the following was derived. The following is a brief synopsis of some of the work that has been done, however, other literature should also be used to aid in the identification of on-the-ground needs by sage-grouse during their seasonal life cycle:

Breeding Habitat - Lek-Nesting Relationships - In an analysis of sage-grouse studies conducted in 7 areas in Wyoming since the mid-1990s, Holloran and Anderson (In press) found that 45% of nests were located within 2miles (3km) of the lek where the hen was bred, and 64% of the nests were within 3 mile(5 km) of the lek. Nests closer to leks were more likely to be predated than nests farther from leks. Nests greater than 8.5 km from a lek had an average nest success of 61% compared to 44% success for nests less than 8.5 km from a lek (Holloran and Anderson In press).

Pre-nesting Habitat - Habitats used by pre-laying hens are also part of the general breeding habitat. These areas provide forbs that are high in calcium, phosphorus, and protein, all of which are necessary for egg production. The condition and availability of these areas are thought to have a significant effect on reproductive success (Barnett and Crawford 1994, J. A. Crawford, Oregon State University retired, personal communication, M. J. Holloran, University of Wyoming, personal communication).

Nesting Habitat - Sagebrush Height - *In Wyoming, higher shrub canopy cover and taller live sagebrush occurred in nest areas compared to random sites (Holloran et al. 2005). Holloran (1999) found mean height of nest shrubs 18.2 inches (46.4 cm) was greater than the mean height of shrubs in the surrounding area.*

Herbaceous Vegetation - *In Wyoming, vegetation plots at nest sites had taller residual grass height (Holloran 1999), more live and residual grass cover (Lyon 2000), more total herbaceous and total forb cover (Lyon 2000) and less bare ground (Lyon 2000, Slater 2003) compared to random plots. An analysis of sage-grouse nest site selection from 7 study areas in Wyoming indicates that residual grass height should be a minimum of 3.9 inches (10 cm) in Wyoming big sagebrush dominated sites (Holloran et al. 2005) compared to 7 inches (18 cm) minimum live perennial herbaceous vegetation height recommended by Connelly et al. (2000) in breeding habitats. Hens nesting in these cover conditions experience higher nest success rates than those nesting under inferior cover conditions (Wallestad and Pyrah 1974, Delong et al. 1995, Holloran et al. 2005).*

Grass and forb cover at nest sites may provide scent, visual, and physical barriers to predators (DeLong et al. 1995). Average live grass heights at nests range from 6 to 13 inches (15-33 cm), and average grass cover at nests ranges from 3 to 51% (Wakkinen 1990, Gregg 1991, Schroeder 1995, Apa 1998, Connelly et al. 2000a) based on vegetation measured at nest sites immediately after hatching. In addition to providing

cover for concealment, succulent forbs in the diet of sage-grouse hens provide protein and other nutrients necessary for successful reproduction (Barnett and Crawford 1994).

Most nesting habitat can be identified as patches of sagebrush with 15-30% canopy cover. Productive nesting habitat in Wyoming big sagebrush has an understory with an herbaceous canopy cover of at least 15%. Productive nesting habitat in mountain big sagebrush stands and mesic Wyoming big sagebrush should have at least 25% canopy cover for herbaceous vegetation. Suitable habitat is defined as sagebrush stands with at least 15% canopy cover of grasses and at least 10% canopy cover of a diversity of forbs. The average height of current year's growth should be at least 7 inches (18 cm) by early June. Residual grasses from the previous year provide cover for nesting at the time of nest site selection by the hen and should be at least 3.9 inches (10 cm) in height in potential nesting habitat in these two vegetation types (Heath et al. 1987, Holloran 1999, Lyon 2000, Slater 2003, Holloran et al. 2005).

Brood-rearing Habitat - Early brood-rearing generally occurs relatively close to nest sites. Sage-grouse use the denser patches of sagebrush for nesting and the smaller openings and patches of sagebrush with a relatively sparse canopy and a good herbaceous understory as feeding sites in early brood-rearing habitat. However, movements of individual broods may be highly variable (Connelly 1982, Gates 1983). Optimum early brood habitat, similar to that of breeding, consists of sagebrush stands that are 11 to 32 inches (30-80 cm) tall with a canopy cover of 10 to 25% and an herbaceous understory of 15% grass canopy and 10% forb canopy. For brood-rearing, however, this type of habitat need only be found on at least 40% of the area. Hens with broods may use relatively open sagebrush habitats with less canopy cover (about 14%) than optimum nesting habitat (Martin 1970, Wallestad 1971), but they need an understory canopy cover of at least 15% of grasses and forbs (Sveum et al. 1998). Chick diets include forbs and invertebrates (Drut et al. 1994). Insects, especially ants and beetles, are an important component of early brood-rearing habitat (Drut et al. 1994, Fischer et al. 1996a). Brood-rearing habitats having a wide diversity of plant species tend to provide an equivalent diversity of insects that are important chick foods. Hens with broods tend to select these types of areas. A combination of more residual grass and total forb cover, and shorter effective vegetation height were the best predictors of early brood-rearing use compared to available habitat in the Bates Hole area in central Wyoming (Holloran 1999). In the Pinedale study area in west-central Wyoming, early brood-rearing locations had less live sagebrush density, live sagebrush and total shrub canopy cover, and bare ground compared to available habitat (Lyon 2000). Total herbaceous cover was 24.8% at early brood locations compared to 9.1% at random locations (Lyon 2000).

In late June or July, as sagebrush habitats dry and herbaceous plants mature, hens usually move their broods to more moist sites where more succulent vegetation remains available (Gill 1965, Klebenow 1969, Savage 1969, Connelly and Markham 1983, Gates 1983, Connelly et al. 1988, Fischer et al. 1996b ). Examples of such habitats include

low sagebrush types (such as A. nova and A. arbuscula), riparian habitats along streams and wet meadows, hay and alfalfa fields adjacent to sagebrush habitats (Savage 1969, Martin 1970, Connelly and Markham 1983, Gates 1983, Connelly et al. 1988). Where available, hens may move their broods to higher elevations to take advantage of more succulent vegetation in the mountain sagebrush communities and the abundance wet meadows and riparian habitats in the foothill zones. However, in years with good summer precipitation, hens with broods tend to remain dispersed in the sagebrush communities where succulent forbs are available until late summer when plant desiccation and maturation occurs (Martin 1970, Wallestad 1971, Fischer et al. 1996b, Holloran 1999). Groups of adult males and barren hens tend to congregate in these more mesic habitats in late June to July in most years. Diet of sage-grouse chicks changes from insects to forbs during this shift to summer brood-rearing habitats (Patterson 1952, Klebenow 1969, Peterson 1970, Drut et al. 1994).

Winter Habitat - Sage-grouse winter habitats are relatively similar throughout most of their range. Because their winter diet consists almost exclusively of sagebrush, winter habitats must provide adequate amounts of sagebrush available above the snow. Sagebrush canopy can be highly variable (Patterson 1952, Eng and Schladweiler 1972, Wallestad et al. 1975, Beck 1977, Robertson 1991). Sage-grouse tend to select areas with both high canopy and taller Wyoming big sagebrush and feed on plants highest in protein content (Remington and Braun 1985, Robertson 1991). It is critical that sagebrush be exposed at least 10 to 12 inches (25-35 cm) above snow level to provide food and cover for wintering sage-grouse (Hupp and Braun 1989). If snow covers the sagebrush, the birds move to areas where sagebrush is exposed. Sage-grouse winter habitats should allow access to sagebrush under all snow conditions when considered at a landscape scale (Connelly et al. 2000a).

## AIR QUALITY TERMINOLOGY

The 1997 Clean Air Act (CAA) amendments declared "as a National Goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I Federal areas in which impairment results from manmade air pollution." The CAA gives federal managers the affirmative responsibility, but no regulatory authority, to protect air quality-related values, including visibility, from degradation.

Federal Class I areas are defined in the Clean Air Act as national parks over 6,000 acres and wilderness areas and memorial parks over 5,000 acres, established as of 1977. The nearest Class I areas to the Jonah field are the Bridger and Fitzpatrick Wilderness Areas.

Two types of visible impairment can be caused by emission sources: plume impairment and regional haze. Plume impairment occurs when a section of the atmosphere becomes visible due to the contrast or color difference between a discrete pollutant plume and a viewed background, such as a landscape feature. Regional haze occurs when pollutants from widespread emission sources become mixed in the atmosphere and travel long distances.

Visibility is quantified in terms of the deciview (dv), which is defined as a change in visibility that is perceptible to the average human, and in terms of the standard visible range (SVR), which is defined as the distance that an average human can see. Visibility data are calculated for each day, ranked from cleanest to haziest, and reported into three categories:

- 20% cleanest: mean visibility for the 20% of days with the best visibility
- Average: the annual mean visibility
- 20% haziest: mean visibility for the 20% of days with the poorest visibility

A wide variety of pollutants can impact visibility, including particulate matter, nitrogen dioxide, nitrates (compounds containing NO3), and sulfates (compounds containing SO4). Fine particles suspended in the atmosphere decrease visibility by blocking, reflecting, or absorbing light.

**Particulate matter (PM)** refers to the small particles (i.e., soil particles, pollen, etc.) suspended in the air that settle to the ground slowly and may be re-suspended if disturbed. Ambient air particulate matter standards are based on the size of the particle. The two types of particulate matter are:

- **PM10** (particles with diameters less than 10 micrometers): small enough to be inhaled and capable of causing adverse health effects.

- **PM2.5** (particles with diameters less than 2.5 micrometers): small enough to be drawn deeply into the lungs and cause serious health problems. These particles are also the main cause of visibility impairment.

Sources of particulate matter in the gas field include drilling rig engines and fugitive dust emissions due to wind and vehicle traffic.

**Nitrogen dioxide (NO2)** is a highly reactive compound formed at high temperatures during fossil fuel combustion. At high concentrations, it can form a red-brown gas. At concentrations in excess of the EPA air quality standard, it is a respiratory irritant; however, all areas of the United States are in compliance with this air quality standard. During fossil fuel combustion, NO is released into the air which reacts in the atmosphere to form NO2. NO plus NO2 is a mixture of nitrogen gases, collectively called nitrogen oxides (NOx). NOx emissions can convert to ammonium nitrate particles and nitric acid which can cause visibility impairment and atmospheric deposition. Nitrogen dioxide can contribute to "brown cloud" conditions and ozone formation, and can convert to ammonium (NH4), nitrate particles (NO3), and nitric acid (HNO3). In the gas field, NOx is emitted by drilling rig engines, wellhead engines and process burners. It is also emitted during well completion and recompletion.

**Sulfur dioxide (SO2)** and **sulfates (SO4)** form during combustion from trace levels of sulfur in coal or diesel fuel. Sulfur dioxide also participates in chemical reactions and can form sulfates and sulfuric acid in the atmosphere. In the gas field, the primary source of SO2 is drilling rig engines.

## POTENTIAL AIR QUALITY PROJECTS

Excerpt from the Record of Decision, Jonah Infill Drilling Project, Sublette County, Wyoming:

*"Ongoing and future natural gas development projects in the region are contributing to observed changes in air quality and negatively impacting the nearby Class I wilderness airsheds. Also of concern are the potential health effects on worker and area residents, the potential for excessive acid deposition, the potential impacts to nighttime stargazing, and BLM's authority for requiring air quality mitigation."*

*Mitigation measures designed to reduce potential visibility impacts are anticipated to also reduce impacts to lake chemistry and atmospheric deposition. The modeling indicated potential significant adverse visibility impacts in various Class 1 areas…"*

Each of the projects discussed below has a nexus to the Jonah Infill Record of Decision's establishment of an off-site impact mitigation fund, for the purpose of using mitigation dollars to improve air quality in the Upper Green River Basin. The off-site impact mitigation fund is expressly authorized to be used for projects approved by BLM (through the JIO Managers' Group) to offset potential air quality impacts resulting from the Jonah Infill drilling project, including "…air quality improvement and Air Quality Related Values (AQRV) projects." [ROD, Appendix B, Operator Committed Practices].

The projects discussed below are projects which have been identified by staff from the Jonah Infill Office, and which have been reviewed and deemed desirable from an air quality impact mitigation potential, by the Wyoming DEQ, Air Quality Division. Other projects may be identified by the JIO staff or others as beneficial to local air quality, but the following projects should be pursued as candidates for funding under the JIO off-site impact mitigation fund.

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**Wood Stove Change-Out Program**

- Encourage the voluntary replacement or upgrading of older wood and/or oil-burning stoves and heating systems in residences and commercial establishments, to reduce emissions of particulate matter (soot and smoke). The picture shows a business in Pinedale that would be a candidate for this program.

- Soot and smoke emissions present a health risk, and also contribute to

impaired visibility in the Upper Green River Basin.

- Such a project would be designed to offer an economic incentive (a cash payment) to offset the costs to an individual or business for the upgrade, and the project would need to be structured to operate within a specified budget amount. The project could be managed by one or more of the towns in the county, or by the county itself, or by an independent organization such as a service club, community group, or business association.

- To ensure the project operates within a specified budget, the project could be designed as a lottery with a fixed number of awards given to selected applicants; on a first-come, first-served basis until all funds have been awarded; or using other established award rules, perhaps giving preference to the elderly or fixed income families.

**Vapor Recovery Systems on a WYDOT Re-Fueling Station**

- Install a vapor recovery system at a WYDOT re-fueling station to prevent gasoline vapors from escaping into the air and contributing to air pollution. Gasoline vapors contain VOCs (volatile organic compounds). VOCs contribute to ozone formation.

- Ozone can cause inflammation and irritation of the respiratory tract, particularly during heavy physical activity. Breathing ozone can trigger a variety of health problems including chest pain, coughing, throat irritation, and congestion. It can worsen bronchitis, emphysema, and asthma. Ground-level ozone also can reduce lung function and inflame the linings of the lungs. Repeated exposure may permanently scar lung tissue.

- WYDOT is a significant user of gasoline and diesel fuel which is dispensed from several DOT facilities in Sublette County, including a facility in Pinedale. This project would, with cooperation from WYDOT, help fund the installation of a vapor recover system at the department's Pinedale facility resulting in a significant reduction in emissions of VOC's. The project would also demonstrate the technology to other fuel dealers. The technology is in widespread use in urban areas of the country but not in Wyoming. The project would be managed by WYDOT, who we believe may have access to matching funds.

**Dust Suppression/Treatment of High Population Density Roads**

- Treat high population density roads with a dust suppressant such as magnesium chloride, asphalt, road oil, etc., to reduce emissions of particulate matter (dust).

- Dust presents a health risk and contributes to impaired visibility in the Upper Green River Basin. Particle pollution is made up of a number of components, including road dust. Road dust is a significant source of particles with a mean

aerodynamic size less than 10 microns in diameter. These particles contribute to visibility impairment and, in high enough concentrations, cause adverse health effects.

- Although dust control on roads within the Jonah Infill Project area is the responsibility of EnCana and others, the development of the Project has caused a general increase in vehicle traffic on dirt roads throughout the County. These roads include both County roads, which have been built to County specifications and are maintained by Sublette County, and other roads which are not maintained by the County. In both cases, there is insufficient money available to treat and maintain all dirt roads to effectively limit excessive road dust. This project would provide Jonah off-site impact mitigation funding to help improve the County's ability to mitigate dust from heavily traveled roads, and roads with higher population densities.

- Sublette County currently expends significant County dollars to treat and maintain dirt roads throughout the county, and maintains a special grant fund which allows owners of non-County roads to upgrade those roads to meet County road standards. Sublette County also participates in a state-funded program (the Construction Mitigation Assistance Grant program), which provides financial assistance to counties to improve dust management on dirt roads. Depending upon the preferences of Sublette County, this project could provide supplemental funding to extend the reach of the County's current road treatment activities, or to allow additional non-County roads to be upgraded and maintained to reduce road dust.

**Retrofitting County Equipment**

- Purchase emissions retrofit equipment for school buses and road maintenance equipment (snow plows, graders, etc.) to reduce tailpipe emissions of NOx, SOx and particulate matter.

- All of these pollutants contribute to visibility impairment in the Upper Green River Basin. Vehicle tailpipe emissions are generally higher for the larger engines typically found in school buses and in heavy equipment used in road construction and maintenance, and many of the engines in such applications are older, higher polluting gas and diesel engines. Emission retrofit devices are available to reduce emissions from these older engines, and a fleet-wide project to retrofit older County equipment would provide substantial emission benefits in Sublette County.

- The logical project manager for this project would be Sublette County. Matching grants are available through EPA, and JIO staff could assist the County in securing additional EPA funding to maximize any Jonah off-site mitigation funding dedicated to the project.

**Book Donation**

- Provide funds to the various libraries (public and school libraries) for purchase/acquisition of publications which provide information to the public about air quality matters. The objective of this project would be to increase public awareness about air quality matters, and to provide information concerning actions that can be taken to reduce air pollution.

- Although it is not possible to project any direct improvement in local air quality as a consequence of providing funding to local libraries to supplement their collections dealing with the environment, JIO staff believe that there is sufficient benefit to the project to justify its inclusion in this list of allowable off-site air quality impact mitigation measures. Improving public access to information about the environment will allow for a more informed public.

- Since this project is envisioned as a relatively simple pass-through grant process, it could be applied for and administered by JIO staff.

**Community Outreach Effort**

- Encourage community involvement while launching a "What Can I Do?" Campaign. Oftentimes, people want to do what they can to lessen their contribution to environmental challenges. This campaign would offer concrete opportunities for people to lessen their contribution to air pollution in the Upper Green River Basin, and could include components such as:

    - Advertising and Campaign Launch
    - Program to encourage snowmobile tune-ups (reduces particulate matter)
    - Support for local recycling initiatives
    - Advertising to explain "What are VOCs?", and
    - Campaign to encourage people to "Don't Top-Off" when fueling (reduces VOCs)
    - Promotions for Carpooling, Winter Driving Tips, Reduce Idling Time (reduces particulate matter, NO2, VOC, SO2, nitrates, and sulfates),
    - Contests among students for the best essay on protection of the environment, and
    - Promotion of any of the community air quality projects funded by Jonah off-site mitigation funds

- Again, although it is not possible to quantify any direct improvement in local air quality as a consequence of providing funding to a general community outreach effort, JIO staff believe that there is sufficient benefit to the project to justify its inclusion in this list of allowable off-site air quality impact mitigation measures.

- Because of the general nature of a community outreach effort such as envisioned by this project, and because it is the DEQ Air Quality Division's overall mission to improve air quality (both throughout the state, but also as part of its responsibilities as a JIO member), it is proposed that the AQD representative on the JIO staff, Jennifer Frazier, be tasked as the project manager for this effort. Ms. Frazier would be responsible for preparing the Jonah mitigation fund grant application, and for securing the services of various community organizations and community leaders to develop and carry out the several component pieces of the outreach effort.

# REFERENCES

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