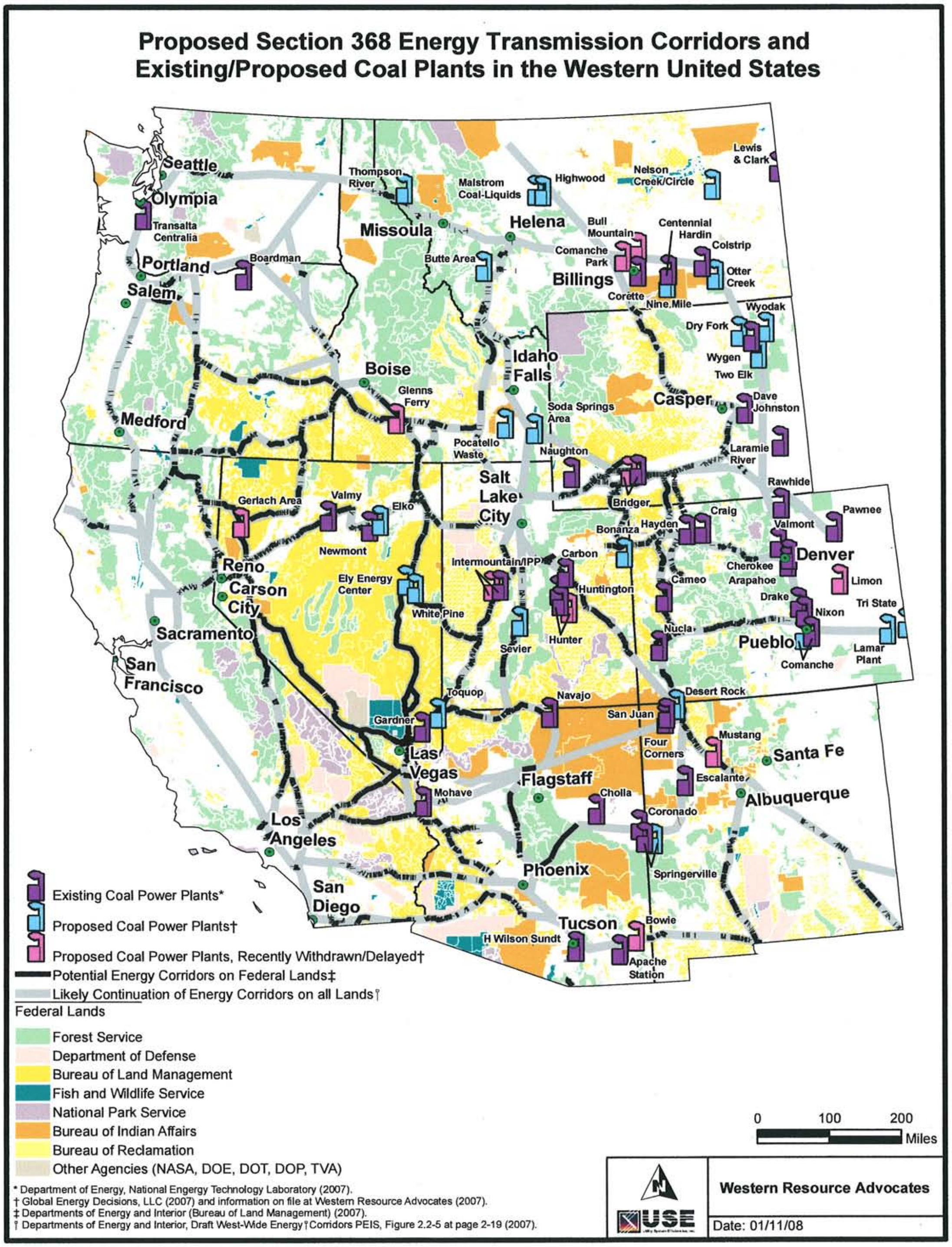
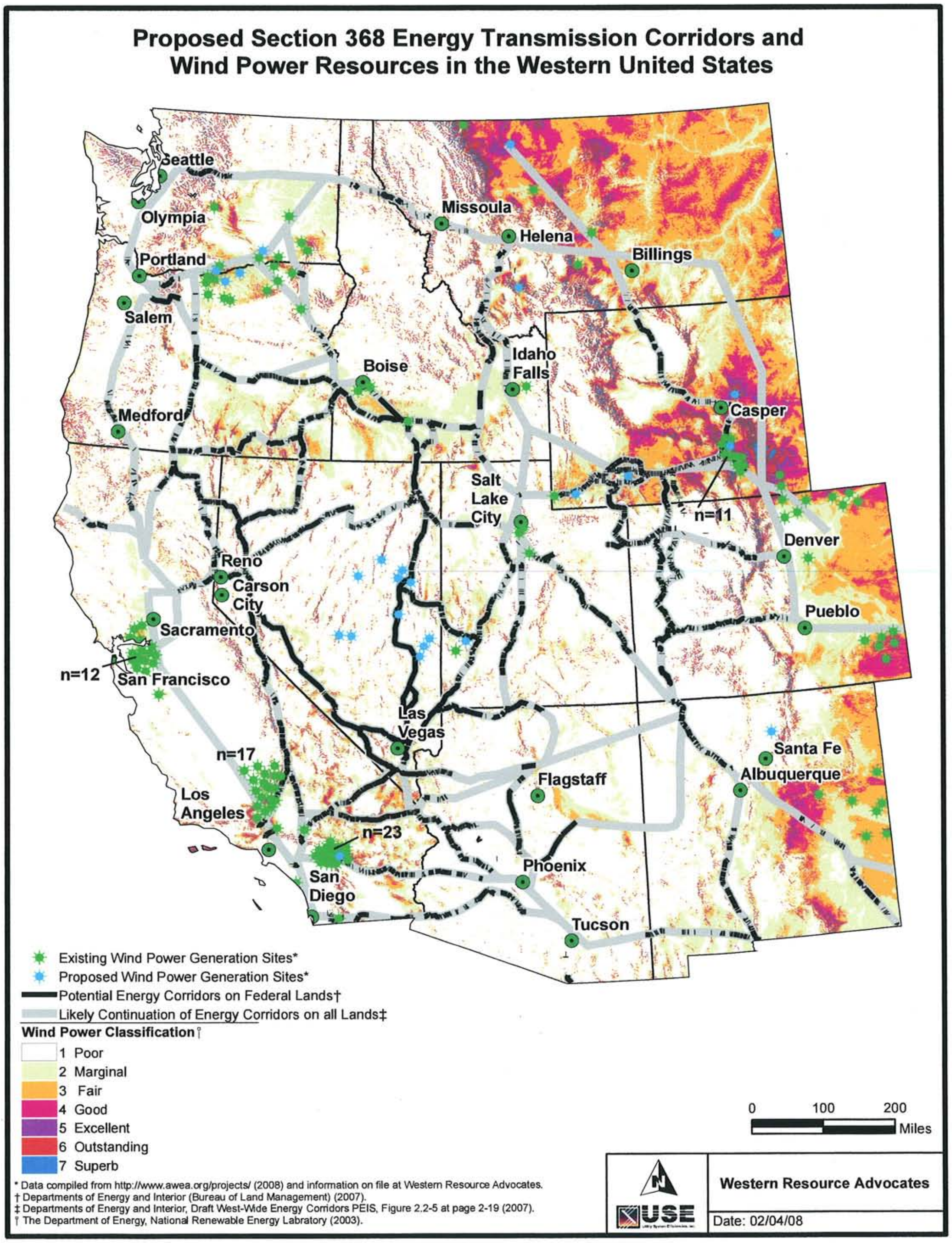
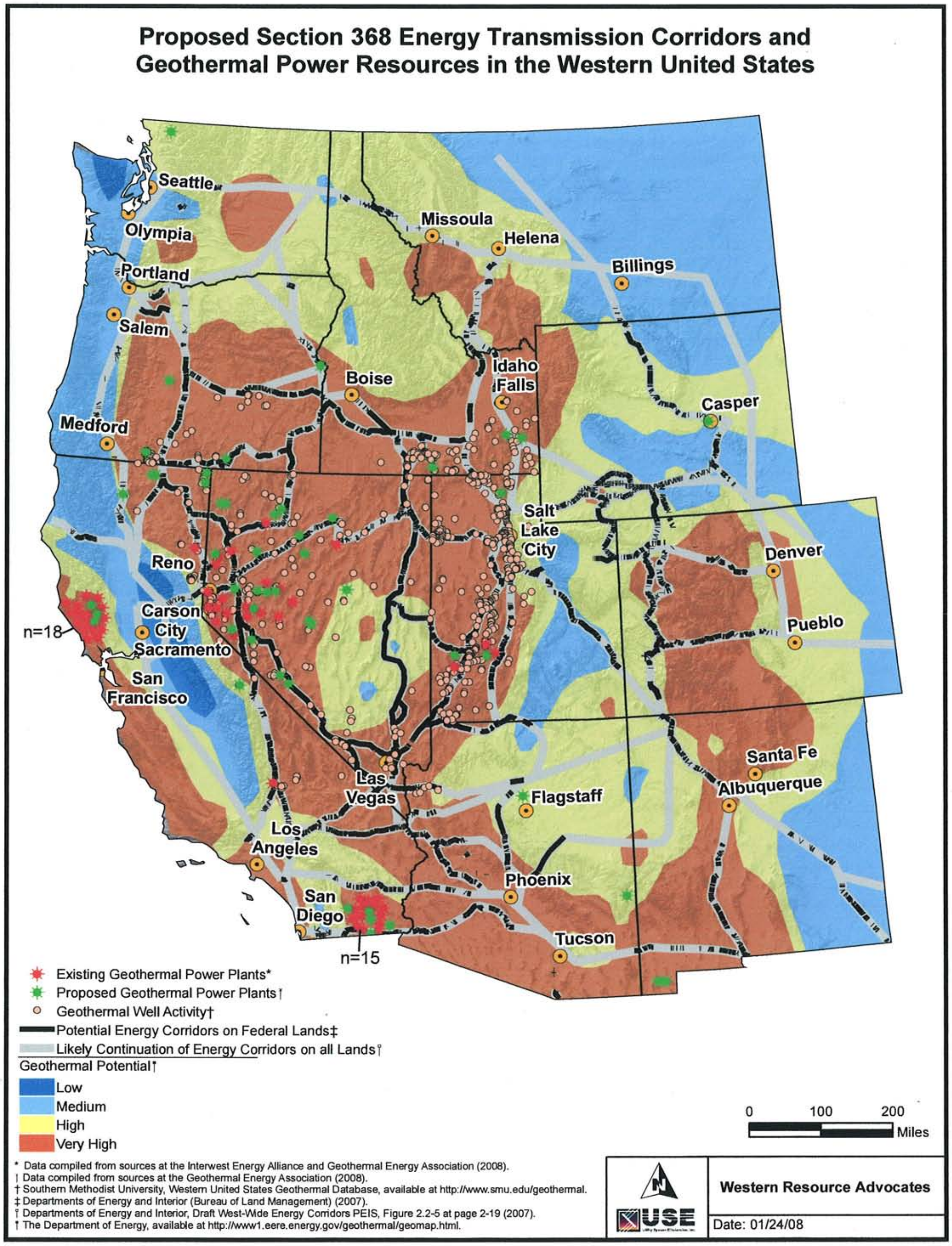
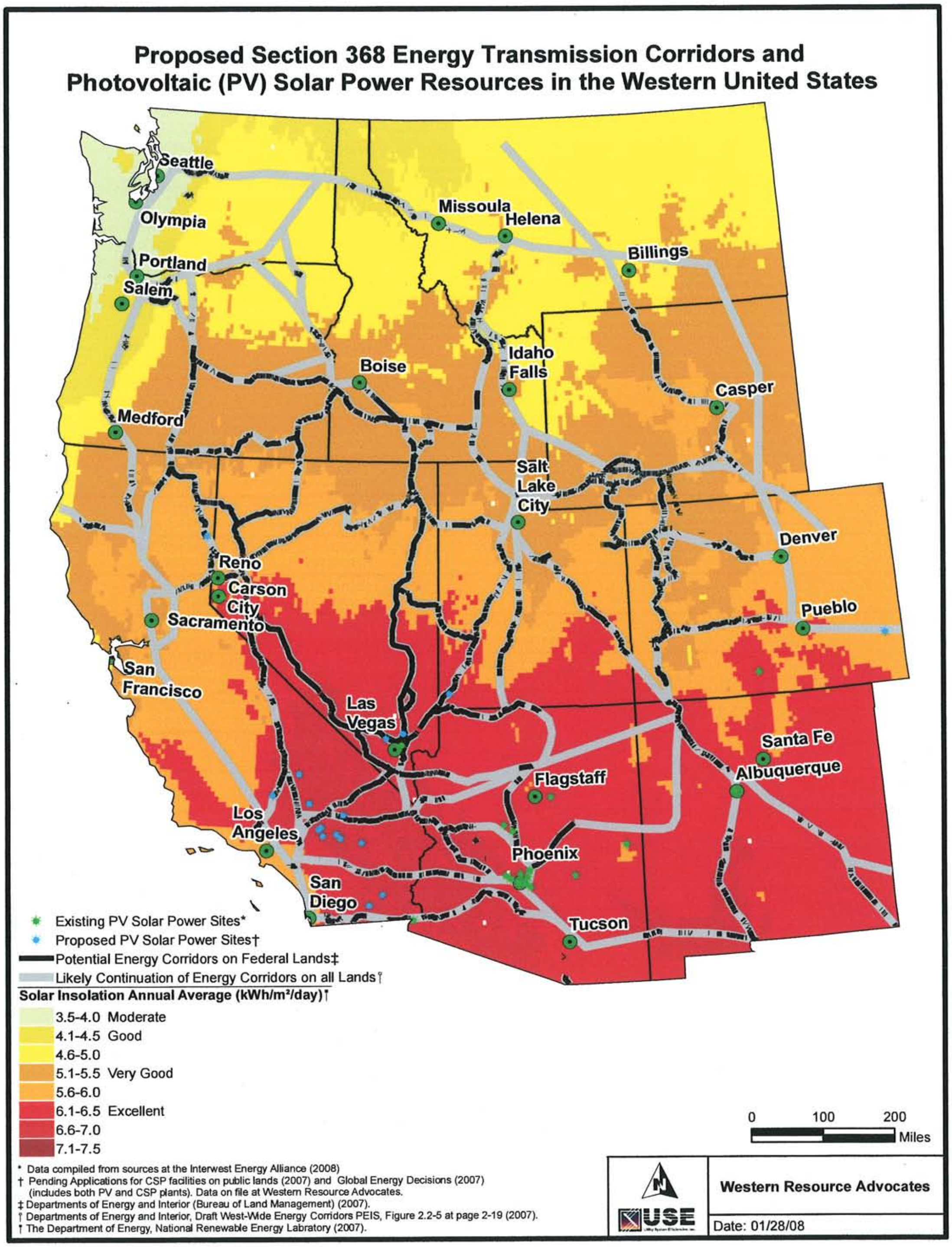
# APPENDIX C

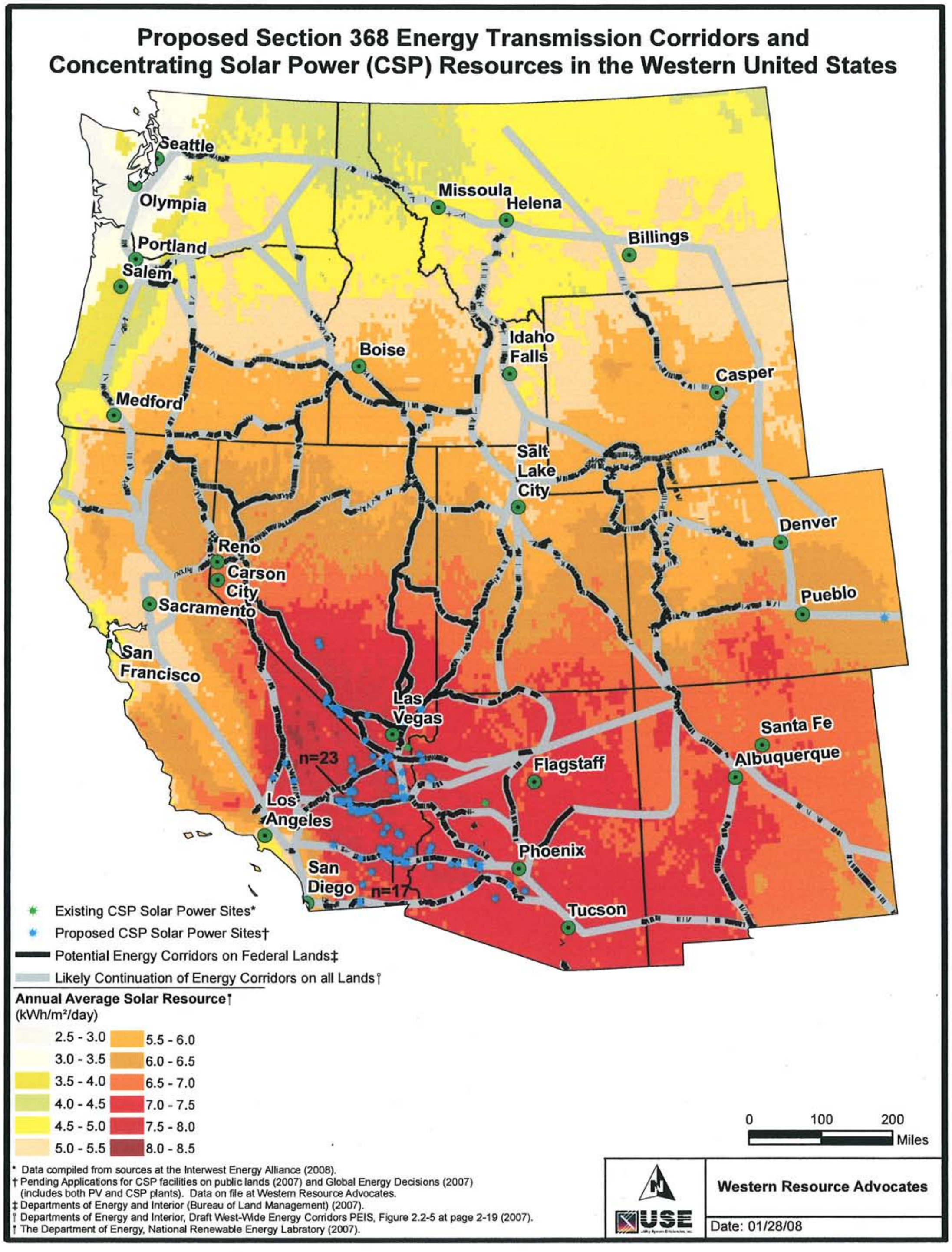

Proposed Section 368 Energy Transmission Corridors and
Existing/Proposed Coal Plants in the Western United States
Seattle
Olympia
Transalta Centralia
Portland
Salem
Boardman
Medford
Thompson River
Missoula
Malstrom Coal-Liquids
Highwood
Nelson Creek/Circle
Lewis & Clark
Helena
Bull Mountain
Centennial Hardin
Colstrip
Butte Area
Comanche Park
Billings
Otter Creek
Corette
Nine Mile
Wyodak
Dry Fork
Wygen
Two Elk
Boise
Glenns Ferry
Idaho Falls
Soda Springs Area
Pocatello Waste
Casper
Dave Johnston
Laramie River
Naughton
Salt Lake City
Bridger
Rawhide
Pawnee
Gerlach Area
Valmy
Elko
Newmont
Bonanza
Hayden
Craig
Valmont
Denver
Cherokee
Arapahoe
Limon
Carbon
Intermountain/IPP
Reno
Carson City
Ely Energy Center
White Pine
Huntington
Cameo
Drake
Nixon
Tri State
Hunter
Sevier
Nucla
Pueblo
Comanche
Lamar Plant
Sacramento
San Francisco
Toquop
Navajo
Desert Rock
San Juan
Gardner
Las Vegas
Four Corners
Mustang
Santa Fe
Flagstaff
Escalante
Albuquerque
Mohave
Cholla
Coronado
Los Angeles
Springerville
Phoenix
San Diego
Tucson
Bowie
H Wilson Sundt
Apache Station
Existing Coal Power Plants*
Proposed Coal Power Plants†
Proposed Coal Power Plants, Recently Withdrawn/Delayed†
Potential Energy Corridors on Federal Lands‡
Likely Continuation of Energy Corridors on all Lands†
Federal Lands
Forest Service
Department of Defense
Bureau of Land Management
Fish and Wildlife Service
National Park Service
Bureau of Indian Affairs
Bureau of Reclamation
Other Agencies (NASA, DOE, DOT, DOP, TVA)
0 100 200
Miles
Western Resource Advocates
Date: 01/11/08
* Department of Energy, National Engergy Technology Laboratory (2007).
† Global Energy Decisions, LLC (2007) and information on file at Western Resource Advocates (2007).
‡ Departments of Energy and Interior (Bureau of Land Management) (2007).
† Departments of Energy and Interior, Draft West-Wide Energy † Corridors PEIS, Figure 2.2-5 at page 2-19 (2007).



Proposed Section 368 Energy Transmission Corridors and Wind Power Resources in the Western United States
Seattle
Olympia
Portland
Salem
Medford
Missoula
Helena
Billings
Boise
Idaho Falls
Casper
Salt Lake City
n=11
Denver
Pueblo
Reno
Carson City
Sacramento
n=12
San Francisco
Las Vegas
n=17
Los Angeles
n=23
San Diego
Santa Fe
Albuquerque
Flagstaff
Phoenix
Tucson
Existing Wind Power Generation Sites*
Proposed Wind Power Generation Sites*
Potential Energy Corridors on Federal Lands†
Likely Continuation of Energy Corridors on all Lands‡
Wind Power Classification
1 Poor
2 Marginal
3 Fair
4 Good
5 Excellent
6 Outstanding
7 Superb
0 100 200
Miles
* Data compiled from http://www.awea.org/projects/ (2008) and information on file at Western Resource Advocates.
† Departments of Energy and Interior (Bureau of Land Management) (2007).
‡ Departments of Energy and Interior, Draft West-Wide Energy Corridors PEIS, Figure 2.2-5 at page 2-19 (2007).
The Department of Energy, National Renewable Energy Labratory (2003).
Western Resource Advocates
USE
Date: 02/04/08

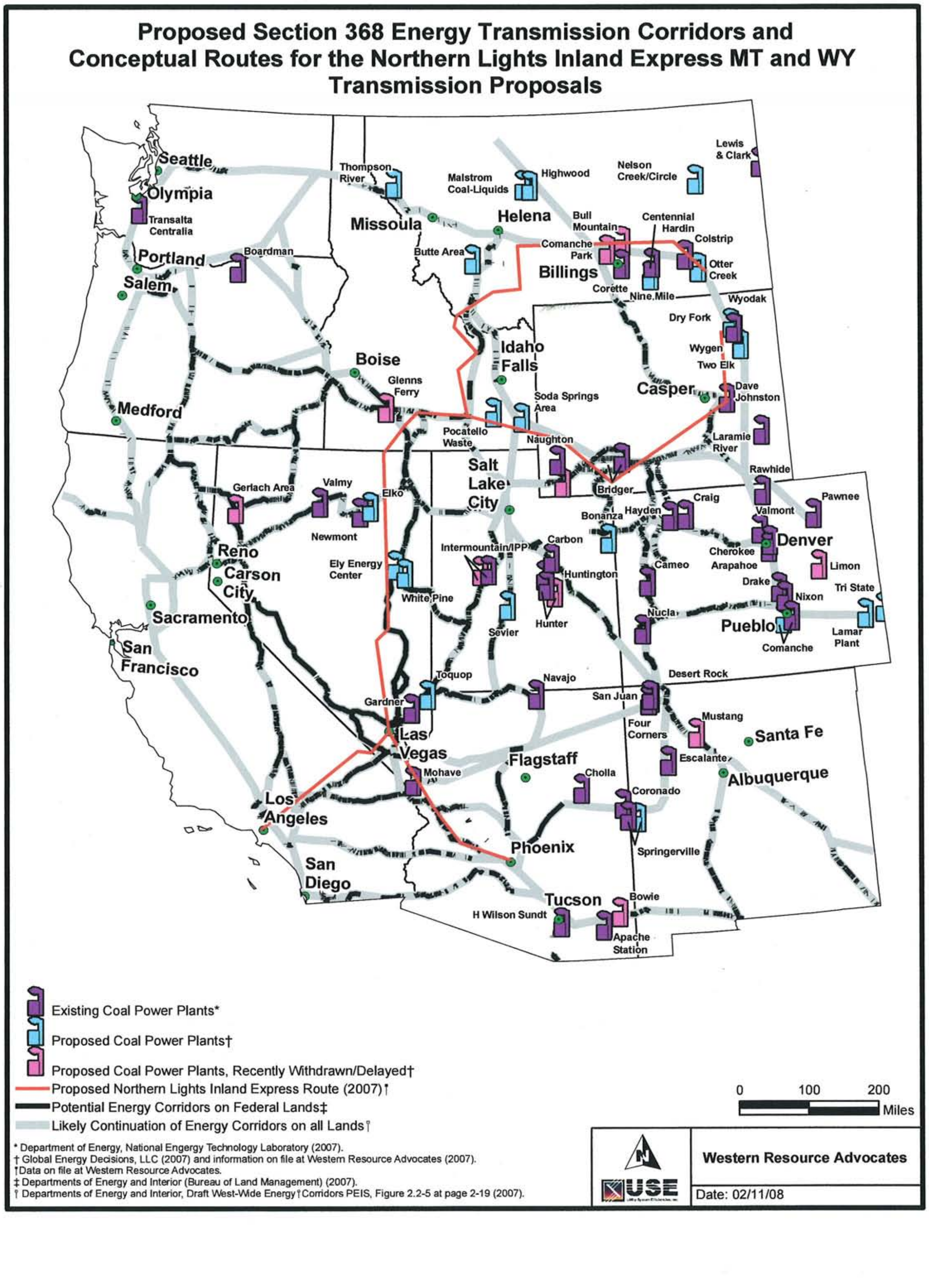

Proposed Section 368 Energy Transmission Corridors and
Geothermal Power Resources in the Western United States
Seattle
Olympia
Portland
Salem
Medford
Missoula
Helena
Billings
Boise
Idaho Falls
Casper
Salt Lake City
Denver
Pueblo
Reno
Carson City
Sacramento
San Francisco
n=18
Las Vegas
Flagstaff
Santa Fe
Albuquerque
Los Angeles
San Diego
Phoenix
Tucson
n=15
Existing Geothermal Power Plants*
Proposed Geothermal Power Plants ⁑
Geothermal Well Activity†
Potential Energy Corridors on Federal Lands‡
Likely Continuation of Energy Corridors on all Lands⸸
Geothermal Potential⸸
Low
Medium
High
Very High
0 100 200
Miles
* Data compiled from sources at the Interwest Energy Alliance and Geothermal Energy Association (2008).
⁑ Data compiled from sources at the Geothermal Energy Association (2008).
† Southern Methodist University, Western United States Geothermal Database, available at http://www.smu.edu/geothermal.
‡ Departments of Energy and Interior (Bureau of Land Management) (2007).
⸸ Departments of Energy and Interior, Draft West-Wide Energy Corridors PEIS, Figure 2.2-5 at page 2-19 (2007).
† The Department of Energy, available at http://www1.eere.energy.gov/geothermal/geomap.html.
Western Resource Advocates
USE
Date: 01/24/08

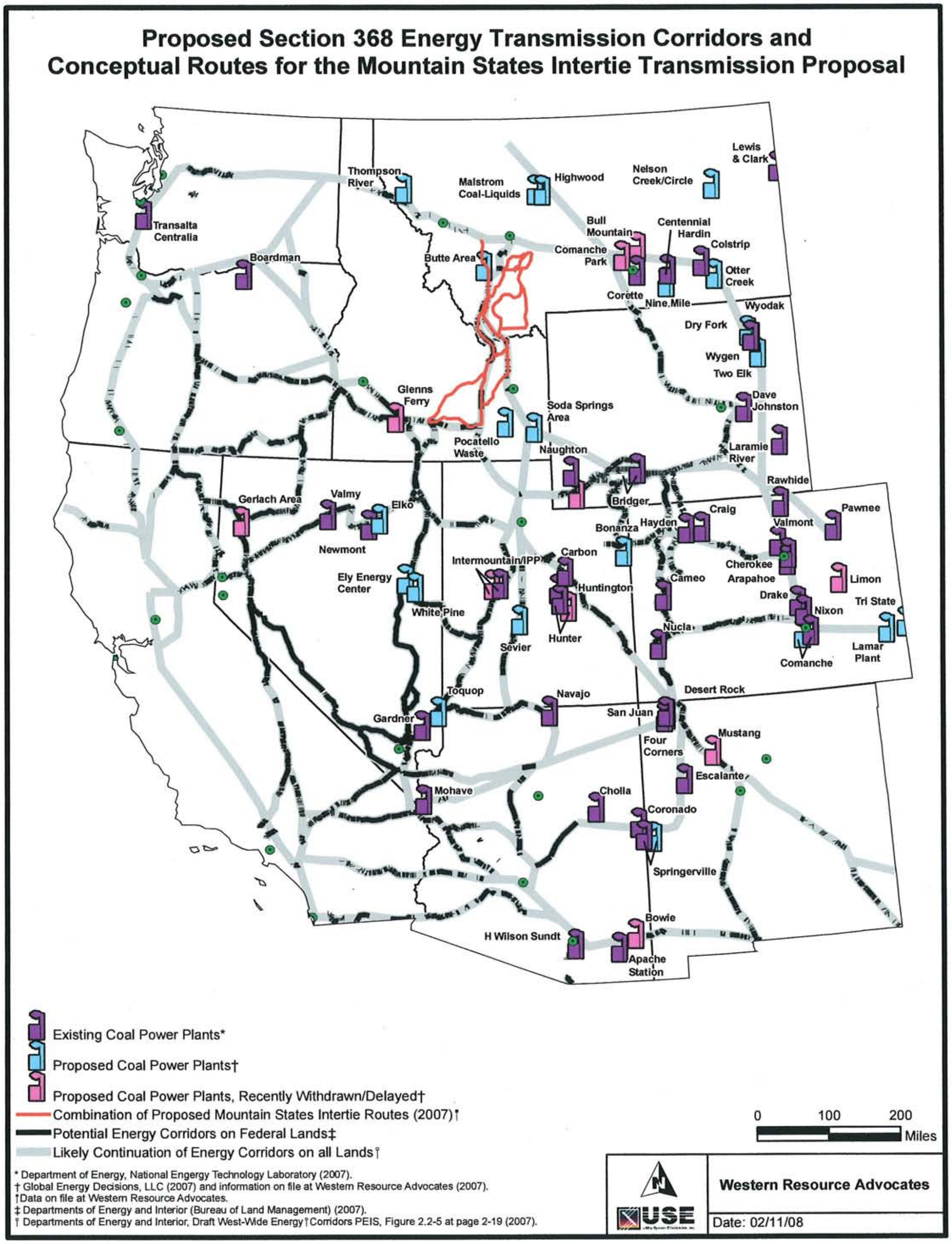

Proposed Section 368 Energy Transmission Corridors and
Photovoltaic (PV) Solar Power Resources in the Western United States
Seattle
Olympia
Portland
Salem
Medford
Boise
Missoula
Helena
Billings
Idaho Falls
Casper
Salt Lake City
Denver
Pueblo
Reno
Carson City
Sacramento
San Francisco
Las Vegas
Los Angeles
San Diego
Flagstaff
Phoenix
Tucson
Santa Fe
Albuquerque
Existing PV Solar Power Sites*
Proposed PV Solar Power Sites†
Potential Energy Corridors on Federal Lands‡
Likely Continuation of Energy Corridors on all Lands
Solar Insolation Annual Average (kWh/m²/day)
3.5-4.0 Moderate
4.1-4.5 Good
4.6-5.0
5.1-5.5 Very Good
5.6-6.0
6.1-6.5 Excellent
6.6-7.0
7.1-7.5
* Data compiled from sources at the Interwest Energy Alliance (2008)
† Pending Applications for CSP facilities on public lands (2007) and Global Energy Decisions (2007) (includes both PV and CSP plants). Data on file at Western Resource Advocates.
‡ Departments of Energy and Interior (Bureau of Land Management) (2007).
Departments of Energy and Interior, Draft West-Wide Energy Corridors PEIS, Figure 2.2-5 at page 2-19 (2007).
The Department of Energy, National Renewable Energy Labratory (2007).
0 100 200
Miles
USE
Western Resource Advocates
Date: 01/28/08



Proposed Section 368 Energy Transmission Corridors and
Concentrating Solar Power (CSP) Resources in the Western United States
Seattle
Olympia
Missoula
Helena
Portland
Salem
Billings
Idaho Falls
Boise
Casper
Medford
Salt Lake City
Denver
Reno
Carson City
Sacramento
Pueblo
San Francisco
Las Vegas
Santa Fe
Albuquerque
n=23
Flagstaff
Los Angeles
Phoenix
San Diego
n=17
Tucson
Existing CSP Solar Power Sites*
Proposed CSP Solar Power Sites†
Potential Energy Corridors on Federal Lands‡
Likely Continuation of Energy Corridors on all Lands
Annual Average Solar Resource
(kWh/m²/day)
2.5 - 3.0
3.0 - 3.5
3.5 - 4.0
4.0 - 4.5
4.5 - 5.0
5.0 - 5.5
5.5 - 6.0
6.0 - 6.5
6.5 - 7.0
7.0 - 7.5
7.5 - 8.0
8.0 - 8.5
0 100 200
Miles
Western Resource Advocates
Date: 01/28/08
* Data compiled from sources at the Interwest Energy Alliance (2008).
† Pending Applications for CSP facilities on public lands (2007) and Global Energy Decisions (2007) (includes both PV and CSP plants). Data on file at Western Resource Advocates.
‡ Departments of Energy and Interior (Bureau of Land Management) (2007).
Departments of Energy and Interior, Draft West-Wide Energy Corridors PEIS, Figure 2.2-5 at page 2-19 (2007).
The Department of Energy, National Renewable Energy Labratory (2007).

# ATTACHMENT 1

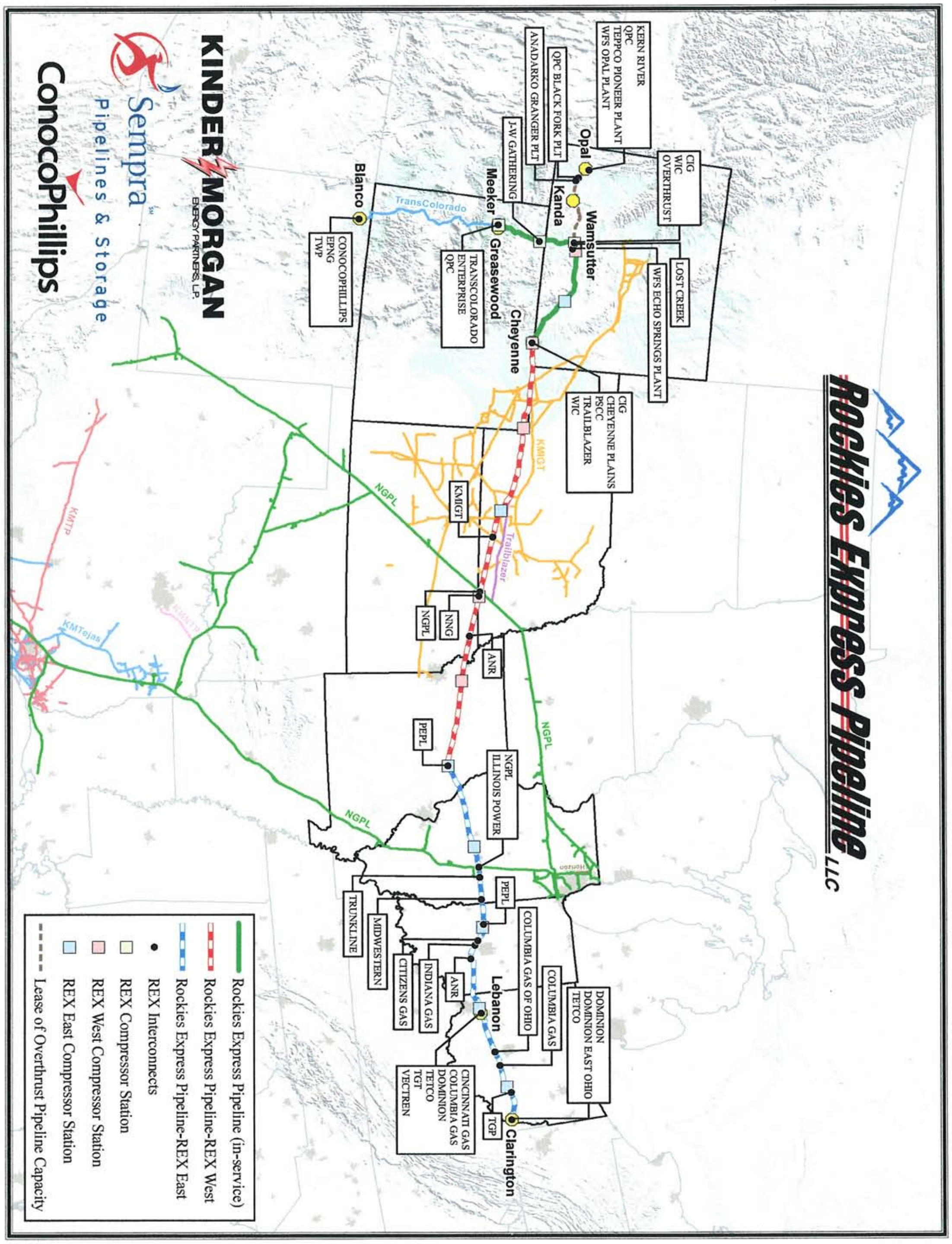

Proposed Section 368 Energy Transmission Corridors and Conceptual Routes for the Northern Lights Inland Express MT and WY Transmission Proposals
Seattle
Olympia
Transalta Centralia
Portland
Salem
Boardman
Medford
Thompson River
Missoula
Malstrom Coal-Liquids
Highwood
Nelson Creek/Circle
Lewis & Clark
Helena
Butte Area
Bull Mountain
Centennial Hardin
Colstrip
Comanche Park
Billings
Corette
Nine Mile
Otter Creek
Wyodak
Dry Fork
Wygen
Two Elk
Casper
Dave Johnston
Laramie River
Boise
Glenns Ferry
Idaho Falls
Soda Springs Area
Pocatello Waste
Naughton
Salt Lake City
Bridger
Rawhide
Craig
Hayden
Bonanza
Pawnee
Valmont
Denver
Cherokee
Arapahoe
Limon
Drake
Nixon
Tri State
Pueblo
Comanche
Lamar Plant
Gerlach Area
Valmy
Elko
Newmont
Reno
Carson City
Ely Energy Center
White Pine
Intermountain/IPP
Carbon
Huntington
Hunter
Cameo
Nucla
Sevier
Sacramento
San Francisco
Toquop
Navajo
Desert Rock
San Juan
Four Corners
Mustang
Santa Fe
Gardner
Las Vegas
Mohave
Flagstaff
Escalante
Albuquerque
Cholla
Coronado
Springerville
Los Angeles
Phoenix
San Diego
Tucson
Bowie
H Wilson Sundt
Apache Station
Existing Coal Power Plants*
Proposed Coal Power Plants†
Proposed Coal Power Plants, Recently Withdrawn/Delayed†
Proposed Northern Lights Inland Express Route (2007)↑
Potential Energy Corridors on Federal Lands‡
Likely Continuation of Energy Corridors on all Lands†
0 100 200 Miles
* Department of Energy, National Engergy Technology Laboratory (2007).
† Global Energy Decisions, LLC (2007) and information on file at Western Resource Advocates (2007).
↑Data on file at Western Resource Advocates.
‡ Departments of Energy and Interior (Bureau of Land Management) (2007).
† Departments of Energy and Interior, Draft West-Wide Energy†Corridors PEIS, Figure 2.2-5 at page 2-19 (2007).
Western Resource Advocates
Date: 02/11/08

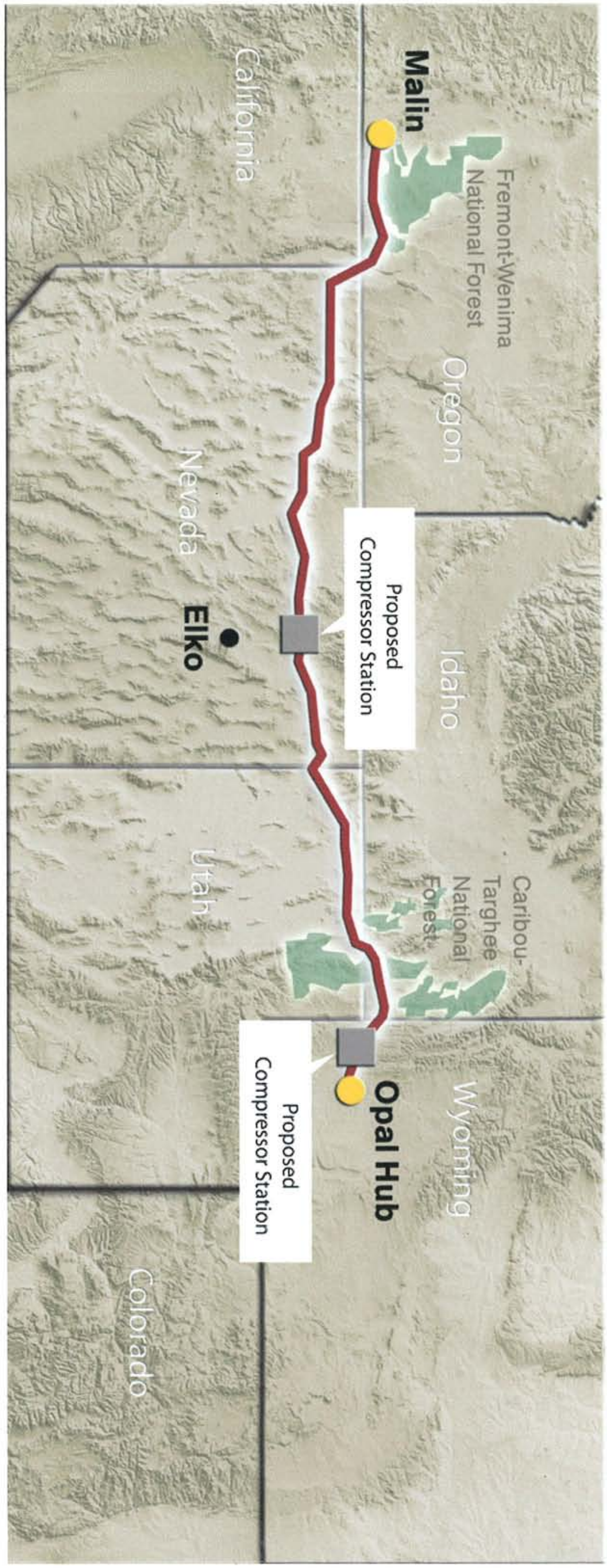

Proposed Section 368 Energy Transmission Corridors and
Conceptual Routes for the Mountain States Intertie Transmission Proposal
Lewis & Clark
Thompson River
Malstrom Coal-Liquids
Highwood
Nelson Creek/Circle
Transalta Centralia
Bull Mountain
Centennial Hardin
Colstrip
Boardman
Butte Area
Comanche Park
Otter Creek
Corette
Nine Mile
Wyodak
Dry Fork
Wygen
Two Elk
Glenns Ferry
Dave Johnston
Soda Springs Area
Pocatello Waste
Naughton
Laramie River
Rawhide
Bridger
Valmy
Gerlach Area
Elko
Craig
Pawnee
Bonanza
Hayden
Valmont
Newmont
Intermountain/IPP
Carbon
Cherokee
Arapahoe
Limon
Ely Energy Center
Cameo
Huntington
Drake
Tri State
White Pine
Nixon
Nucla
Sevier
Hunter
Lamar Plant
Comanche
Toquop
Navajo
Desert Rock
Gardner
San Juan
Mustang
Four Corners
Escalante
Mohave
Cholla
Coronado
Springerville
Bowie
H Wilson Sundt
Apache Station
Existing Coal Power Plants*
Proposed Coal Power Plants†
Proposed Coal Power Plants, Recently Withdrawn/Delayed†
Combination of Proposed Mountain States Intertie Routes (2007)†
Potential Energy Corridors on Federal Lands‡
Likely Continuation of Energy Corridors on all Lands†
0 100 200 Miles
* Department of Energy, National Engergy Technology Laboratory (2007).
† Global Energy Decisions, LLC (2007) and information on file at Western Resource Advocates (2007).
†Data on file at Western Resource Advocates.
‡ Departments of Energy and Interior (Bureau of Land Management) (2007).
† Departments of Energy and Interior, Draft West-Wide Energy†Corridors PEIS, Figure 2.2-5 at page 2-19 (2007).
USE
Western Resource Advocates
Date: 02/11/08

# ATTACHMENT 2

# Project Summary

- New 500kV AC transmission project from Wyoming to Northern Arizona
- Upgrade Southern Navajo Transmission System and possible 3rd line from Navajo to Phoenix
- Integrate with other planned projects
  - Dine Navajo Transmission Project
  - Palo Verde-Devers #2
  - EOR 9000+ Upgrades
  - Palo Verde-North Gila #2
- Provide access to coal and wind resources in Wyoming


Rockies Express Pipeline LLC
KERN RIVER
QPC
TEPPCO PIONEER PLANT
WFS OPAL PLANT
CIG
WIC
OVERTHRUST
LOST CREEK
WFS ECHO SPRINGS PLANT
QPC BLACK FORK PLT
ANADARKO GRANGER PLT
J-W GATHERING
Opal
Kanda
Wamsutter
Meeker
Greasewood
Blanco
Cheyenne
TransColorado
CONOCOPHILLIPS
EPNG
TWP
TRANSCOLORADO
ENTERPRISE
QPC
CIG
CHEYENNE PLAINS
PSCC
TRAILBLAZER
WIC
KMIGT
Trailblazer
NGPL
NNG
ANR
PEPL
NGPL
ILLINOIS POWER
KMTP
KMTejas
TRUNKLINE
MIDWESTERN
CITIZENS GAS
INDIANA GAS
ANR
COLUMBIA GAS OF OHIO
COLUMBIA GAS
DOMINION
DOMINION EAST OHIO
TETCO
Lebanon
CINCINNATI GAS
COLUMBIA GAS
DOMINION
TETCO
TGT
VECTREN
TGP
Clarington
KINDER MORGAN
ENERGY PARTNERS, L.P.
Sempra
Pipelines & Storage
ConocoPhillips
Rockies Express Pipeline (in-service)
Rockies Express Pipeline-REX West
Rockies Express Pipeline-REX East
REX Interconnects
REX Compressor Station
REX West Compressor Station
REX East Compressor Station
Lease of Overthrust Pipeline Capacity



Malin
California
Fremont-Wenima
National Forest
Oregon
Nevada
Proposed
Compressor Station
Elko
Idaho
Utah
Caribou-
Targhee
National
Forest
Proposed
Compressor Station
Opal Hub
Wyoming
Colorado

# ATTACHMENT 3

ORIGINAL

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
**REGION 8**
**999 18TH STREET- SUITE 300**
**DENVER, CO 80202-2466**
**Phone 800-227-8917**
**http://www.epa.gov/region08**



June 23, 2005

Ref: 8EPR-N

Magalie R. Salas, Secretary
Federal Energy Regulatory Commission
888 First Street, NE, Room 1A
Washington, D.C. 20426

Re: Piceance Basin Expansion Pipeline, DEIS 20050082; FERC Docket No. CP05-54-000

Dear Ms. Salas:

In accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, Region 8 of the Environmental Protection Agency (EPA) has reviewed and rated the *Draft Environmental Impact Statement (DEIS) for the Piceance Basin Expansion Project*, dated May 2005. The project is a 142 mile long natural gas pipeline from Meeker, Colorado to Wamsutter, Wyoming. The new 24-inch diameter pipeline proposed by Wyoming Interstate Company (WIC) will include increasing compression at the existing Colorado Interstate Gas (CIG) Greasewood Compressor Station, valve and metering facilities, and associated facilities.

Based on the procedures EPA uses to evaluate the potential effects of proposed actions and the adequacy of the information in the DEIS, the project will be listed in the Federal Register in the category EC-2 (EC - Environmental Concerns, 2 - Insufficient Information). This rating means that the review identified environmental impacts that should be avoided in order to fully protect the environment and the DEIS does not contain sufficient information to thoroughly assess environmental impacts that should be avoided to fully protect the environment.

EPA's concerns with the project are the impacts to ecosystems in northwestern Colorado and northeastern Utah (Piceance and Uinta Basins) from actions connected to or induced by the WIC Pipeline. Of particular concern are:

- loss of wildlife habitat,
- habitat fragmentation,
- erosion reducing water quality,
- soil loss
- invasive and noxious weeds and
- air quality (regionally).

Increased gas transportation capacity will facilitate increased density and intensity of gas development. Increased transportation capacity will also increase the rate of gas development. The FEIS should examine the indirect environmental impacts associated with increasing capacity for natural gas transportation and identify mitigation that will be implemented to reduce these impacts. Although the Piceance Basin DEIS did include a section on the cumulative impacts of oil and gas in the Piceance Basin, the analysis did not identify the indirect impacts that will be induced by increasing gas transportation capacity nor was any mitigation identified for impacts other than the impacts directly resulting from construction of the pipeline. Information is available on some of the indirect impacts from BLM's environmental analysis of oil and gas development. To date, the environmental impacts from oil and gas development have not been analyzed in a holistic manner for this area resulting in segmentation of the environmental analysis. The Roan Plateau DEIS is the most recent BLM environmental analysis for gas development. Unfortunately the Roan Plateau analysis only covers a small area that will be feeding into the proposed WIC pipeline and does not include increased leasing resulting from additional pipeline capacity. Similarly, the Vernal Utah Field office has completed a DEIS /Resource Management Plan which looks at some of the impacts of gas development in the Uinta Basin.

We are concerned by the segmenting of several gas pipeline projects currently proposed in the Piceance Basin. Many of these pipelines and other facilities appear to be "interdependent parts of a larger action and depend on the larger action for their justification" as discussed in the CEQ regulations regarding connected actions at 40 CFR 1508.25 (a)(1)(iii). The overall need for the project appears to be to construct facilities to increase natural gas production and transportation from northeastern Utah and northwestern Colorado to national markets.

In addition to the WIC and Entrega pipelines, there is a proposal by EnCana to build a 205 mile long pipeline from the Utah/Colorado border and southwest of the proposed Roan Plateau development to a new gas plant in Meeker near the termini of the Entrega pipeline (the Meeker Hub compression station). There is also a recent BLM Environmental Assessment for the "Meeker Pipeline and Gas Plant Project". Additional pipeline proposals are described in Table 3.12-1 and Figure 3.12-1 on pages 3-121 and 3-122 in the DEIS. It appears that the federal government has a major role in permitting/approving these pipelines and gas development. We recommend that the EIS be revised to look at all the interconnected natural gas transportation projects in the area and the additional natural gas development that will be induced by increasing pipeline capacity.

If you have any questions about these comments, please contact Dana Allen at (303) 312-6870. We appreciate your interest in our comments.

Sincerely,

Larry Svoboda, Director
NEPA Program
Ecosystem Protection and Remediation

Enclosure

cc: Gas Branch1, JPJ11.1, FERC

## U.S. Environmental Protection Agency Rating System for Draft Environmental Impact Statements

### Definitions and Follow-Up Action*

#### Environmental Impact of the Action

**LO - - Lack of Objections:** The Environmental Protection Agency (EPA) review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

**EC - - Environmental Concerns:** The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce these impacts.

**EO - - Environmental Objections:** The EPA review has identified significant environmental impacts that should be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no-action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

**EU - - Environmentally Unsatisfactory:** The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the Council on Environmental Quality (CEQ).

#### Adequacy of the Impact Statement

**Category 1 - - Adequate:** EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis of data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

**Category 2 - - Insufficient Information:** The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses or discussion should be included in the final EIS.

**Category 3 - - Inadequate:** EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the National Environmental Policy Act and or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

* From EPA Manual 1640 Policy and Procedures for the Review of Federal Actions Impacting the Environment February, 1987.

# ATTACHMENT 4

# California Fire Officials Fault Power Line Sparks for Largest San Diego Wildfire

**Saturday , November 17, 2007**

Associated Press

SAN DIEGO —

California's state fire agency said that sparking power lines ignited the largest of the wildfires that ravaged Southern California last month. The fire killed two people, burned over 300 square miles (777 square kilometers) and destroyed more than 1,000 homes.

The fire, which blew into the heart of north San Diego from chaparral-covered canyons to the east, merged with a smaller fire also caused by power line sparks, according to the California Department of Forestry and Fire Protection.

State authorities previously blamed a third fire on downed power lines. That fire burned through nearly 15 square miles (39 square kilometers) in a rural area near the community of Fallbrook, destroying 206 homes and damaging avocado groves.

All three fires are in the service area of San Diego Gas & Electric Co., which serves 3.4 million customers in San Diego and southern Orange counties.

The company, a unit of San Diego-based Sempra Energy, says it adhered to regulations in maintaining the low-voltage power lines that caused the fires.

"We believe at the time of the fires our power lines were in compliance with all regulations," said spokeswoman Stephanie Donovan. "When we have the kind of extreme conditions we faced here in San Diego at the end of October, it creates a huge hazard for everybody, including the electrical system."

The state agency said it would not elaborate on the findings until it completes its investigation, said spokeswoman Roxanne Provaznik.

Two families who lost homes in the fires have filed suit in state court against SDG&E, saying the utility failed to clear brush around its power poles and did not insulate power lines to prevent them from sparking. The plaintiffs are seeking class-action certification.

No cause has been determined for another fire that killed eight people, seriously injured four firefighters and a teenage boy, and consumed hundreds of homes in the rural communities along the U.S.-Mexico border east of San Diego.

The fires burned more than 780 square miles (2,020 square kilometers) in Southern California, destroying more than 2,000 homes.

# ATTACHMENT 5

http://www.denverpost.com/news/ci_3576313

Article Launched: 3/07/2006 01:00 AM

denver & the west

Inspections lagging amid oil, gas boom

By Kim McGuire and Jeffrey A. Roberts
Denver Post Staff Writers
DenverPost.com

While the number of operating oil and gas wells has climbed 30 percent to 29,000 since 2000, Colorado Oil and Gas Conservation Commission inspections have not kept pace.

That has led some landowners to worry that violations are not being flagged.

The state has just eight inspectors - one for every 3,625 wells. Wells are inspected on average once every 3 1/2 years, the commission estimates.

By comparison, Wyoming has one inspector for every 2,750 wells and New Mexico has one for every 2,100, according to state data.

"We know that every day there are accidents and incidents in the field - just look at the commission's reports," said Peggy Utesch, a member of the Grand Valley Citizens Alliance, a Garfield County-based citizens group.

"Well, if they can inspect once every three years, how are they possibly going to catch it all?" she asked.

A Denver Post analysis of about 43,000 inspections between 2000 and 2005 found that wells passed inspection 87 percent of the time. But when inspectors responded to citizen complaints, the failure rate rose to 40 percent from 13 percent.

Critics say the higher failure rate is a sign the that oil- and gas-field mishaps occurring outside landowners' watchful eyes might be falling through the regulatory cracks.

Commission officials say responding to public complaints is a top priority, which is why inspection failure rates climb when residents who live near wells voice concerns.

They say serious incidents are rare and major problems are detected.

In 2005, the commission added two new employees, bringing the total number of field inspectors to eight.

The legislature's Joint Budget Committee has recommended giving the commission $848,000 to pay for 12 new employees, including two more inspectors, to help them keep up with the crush of drilling activity and permit requests.

"That's a direct reflection of what we think the resources need to be to get us in the direction we should go in for the next few years," said Brian Macke, the commission's director.

This year, an estimated 3,000 new wells are slated to be drilled, and the commission ended 2005 with a backlog of 757 applications for drilling permits, according to the commission.

The inspection rate in Colorado has slipped from having about one out of 2.9 wells inspected each year in 2000 to one of 3.3 wells in 2005, according to commission data.

Field inspectors are so swamped with routine inspections and responding to complaints, they seldom inspect wells as they're being constructed, Macke said.

"We rely heavily on company reports they attest to, that they send to us," Macke said. "It would be good to increase our percentage of visually observing those types of operations."

Commission staff say they work hard to ensure operators comply with the rules, which cuts down the number of violations they cite each year.

If the commission does cite a violation - a more serious offense than failing an inspection - it's usually for a well pad that hasn't been cleaned or signs that haven't been posted, they say.

After those are resolved, it's up to the individual inspector to decide what warrants attention, they say.

Over the years, Jack Wyscaver had compiled a long list of complaints against the West Virginia-based operator drilling on his 160-acre spread near Kersey. After Wyscaver persuaded one of the commission's environmental protection specialists to visit his property, a notice of violation was quickly issued against the company.

"It just goes to show that if the public doesn't complain, nothing will ever get done," Wyscaver said. "Some operators will really test the limits."

Craig Van Kirk, the head of the petroleum engineering department at the Colorado School of Mines, said it's difficult to say whether oil and gas operations are receiving adequate scrutiny.

Much depends on what kind of wells the inspectors are checking, not just how frequently, he said.

"If you're a smoker, you should probably see a doctor more than a nonsmoker," Van Kirk said. "Wells are the same. Those in high-pressure fields should probably be evaluated more than those that are not. Ones that are new should probably need more frequent inspections than old, proven ones."

While the majority of Colorado operators are passing inspections, 20 companies have violation rates that exceed 50 percent, The Post's analysis shows.

Commission staff say most of those companies are small producers that buy wells at the end of the life cycle, take what's left and sometimes leave the well pads in poor shape.

In at least three cases, the commission has seized companies' bonds to make sure their messes got cleaned up.

Residents of the heavily drilled Western Slope say state regulators can't let up on operators - pointing to such incidents as the 2004 gas seep that resulted in the release of benzene into Divide Creek in Garfield County.

The commission fined the operator, EnCana Corp., more than $371,000 for the seep, which polluted many local water wells.

More troubling, residents say, is when the commission doesn't sanction operators that create problems on their property.

Nancy Jacobsen and Gary Gagne, whose ranch is just south of Silt, say they caught EnCana, in the spring of 2003, filling in a waste pit on their property without first pumping out the liquids.

But a commission inspector told the couple he couldn't sanction the company because the couple had stopped the company from finishing the job.

"I tell people it doesn't matter if you catch a company red-handed doing something they shouldn't," said Jacobsen. "Billy Jack ain't coming to help."

At the time, EnCana officials said the company could have allowed the liquids to evaporate but wanted to clean up the pit as quickly as possible.

"Overall, the state's regulations are very clear regarding routine inspections and general operations," said Doug Hock, an EnCana spokesman.

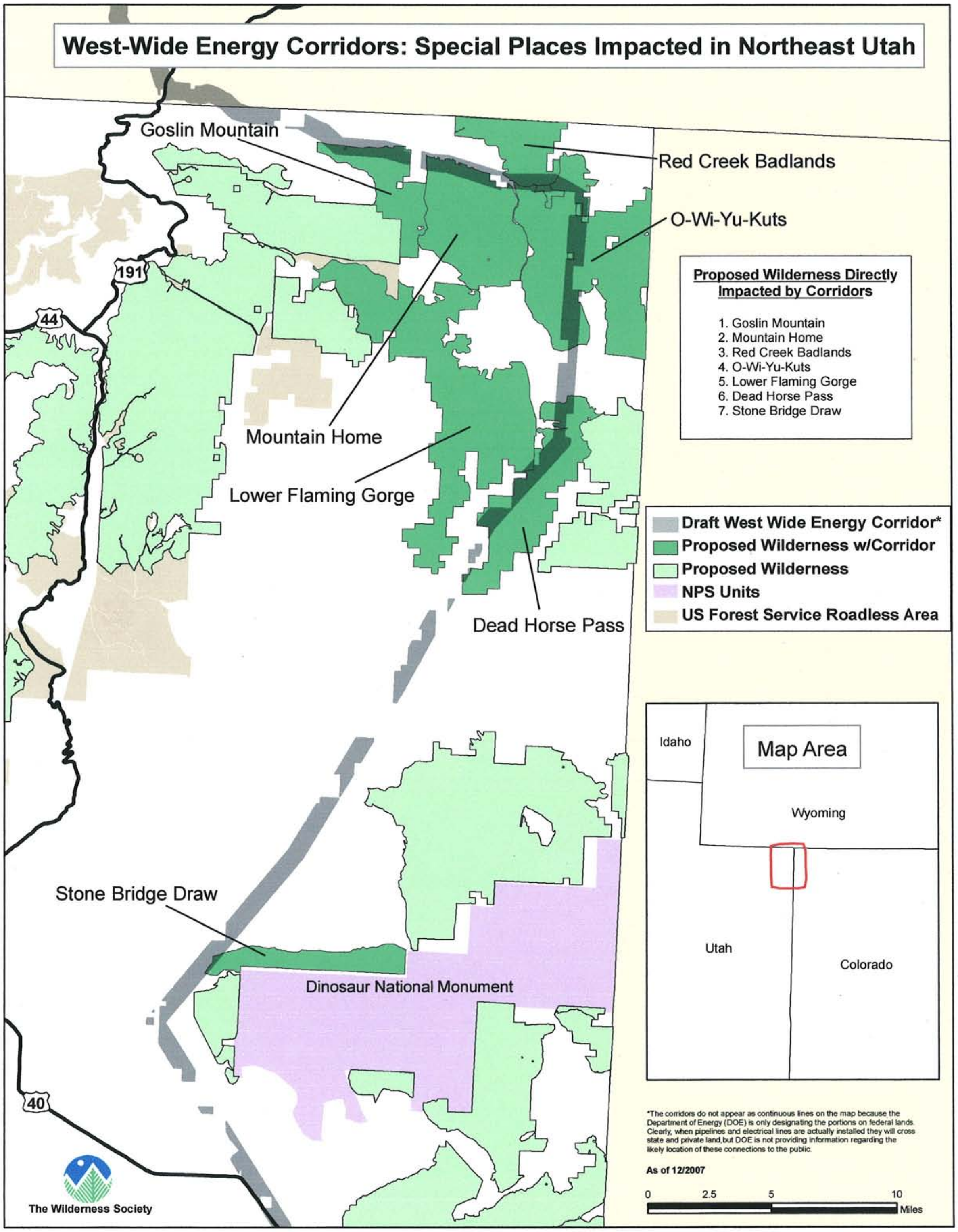
Hock said EnCana and the commission have been able to work together to come up with a new cement procedure designed to prevent seeps like the one that tainted Divide Creek.

The Grand Valley Citizens Alliance is now teaching residents how well pads should be cleaned. That way, said Utesch, of Garfield County, residents can provide an extra set of eyes to check up on operators.

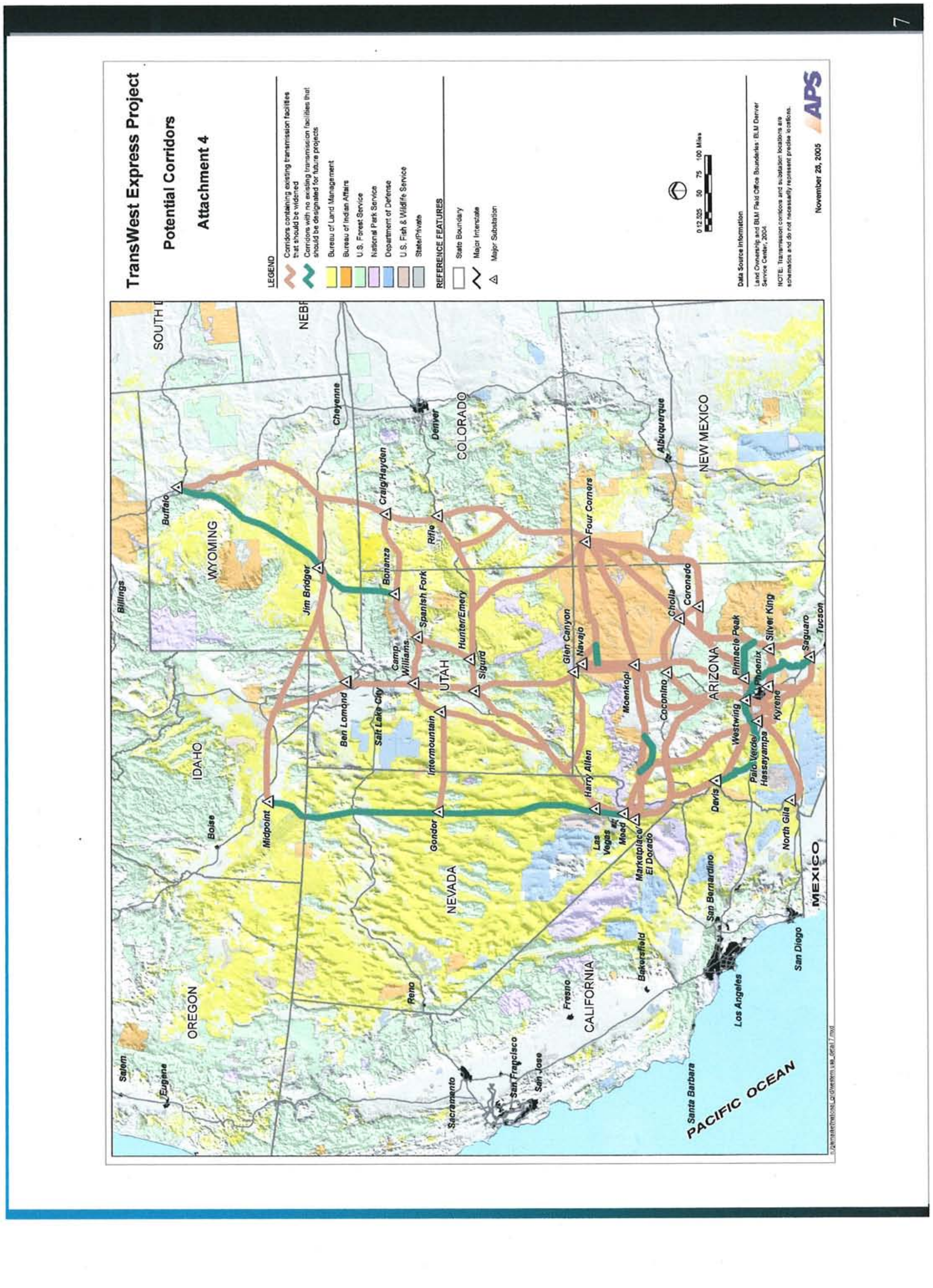
"Having more people on the ground can't hurt," she said.

*Staff writer Kim McGuire can be reached at 303-820-1240 or kmcguire@denverpost.com.*

# ATTACHMENT 6


West-Wide Energy Corridors: Special Places Impacted in Northeast Utah
Goslin Mountain
Red Creek Badlands
O-Wi-Yu-Kuts
191
44
Mountain Home
Lower Flaming Gorge
Dead Horse Pass
Stone Bridge Draw
Dinosaur National Monument
40
Proposed Wilderness Directly Impacted by Corridors
1. Goslin Mountain
2. Mountain Home
3. Red Creek Badlands
4. O-Wi-Yu-Kuts
5. Lower Flaming Gorge
6. Dead Horse Pass
7. Stone Bridge Draw
Draft West Wide Energy Corridor*
Proposed Wilderness w/Corridor
Proposed Wilderness
NPS Units
US Forest Service Roadless Area
Idaho
Map Area
Wyoming
Utah
Colorado
*The corridors do not appear as continuous lines on the map because the Department of Energy (DOE) is only designating the portions on federal lands. Clearly, when pipelines and electrical lines are actually installed they will cross state and private land,but DOE is not providing information regarding the likely location of these connections to the public.
As of 12/2007
0 2.5 5 10
Miles
The Wilderness Society

# ATTACHMENT 7



TransWest Express Project
Potential Corridors
Attachment 4
LEGEND
Corridors containing existing transmission facilities that should be widened
Corridors with no existing transmission facilities that should be designated for future projects
Bureau of Land Management
Bureau of Indian Affairs
U.S. Forest Service
National Park Service
Department of Defense
U.S. Fish & Wildlife Service
State/Private
REFERENCE FEATURES
State Boundary
Major Interstate
Major Substation
0 12.525 50 75 100 Miles
Data Source Information
Land Ownership and BLM Field Office Boundaries: BLM Denver Service Center, 2004.
NOTE: Transmission corridors and substation locations are schematics and do not necessarily represent precise locations.
November 28, 2005
APS
OREGON
IDAHO
WYOMING
NEVADA
UTAH
COLORADO
CALIFORNIA
ARIZONA
NEW MEXICO
MEXICO
PACIFIC OCEAN
Buffalo
Jim Bridger
Bonanza
Craig/Hayden
Rifle
Four Corners
Midpoint
Gondor
Intermountain
Ben Lomond
Salt Lake City
Camp Williams
Spanish Fork
Hunter/Emery
Sigurd
Glen Canyon
Navajo
Moenkopi
Coconino
Cholla
Coronado
Pinnacle Peak
Silver King
Saguaro
Tucson
Phoenix
Kyrene
Westwing
Palo Verde
Hassayampa
Davis
North Gila
Harry Allen
Las Vegas
Mead
Marketplace
El Dorado
San Bernardino
Los Angeles
San Diego
Santa Barbara
Bakersfield
Fresno
Reno
Sacramento
San Francisco
San Jose
Eugene
Salem
Boise
Billings
Cheyenne
Denver
Albuquerque

# ATTACHMENT 8

THE
WILDERNESS
SOCIETY

ECOLOGY AND ECONOMICS
RESEARCH DEPARTMENT

# SOCIO-ECONOMIC FRAMEWORK FOR PUBLIC LAND MANAGEMENT PLANNING:

## INDICATORS FOR THE WEST'S ECONOMY

Michelle Haefele, Ph.D.
Pete Morton, Ph.D.
Nada Culver
March 2, 2006

## I. PURPOSE

This brief is submitted as part of the NEPA process for this land use proposal. It is intended to identify issues that must be analyzed in the plan and offer methodologies to assist agencies responsible for analyzing the socio-economic impacts of proposed land use decisions on Western economies.

In making land use decisions, federal agencies have an obligation under the National Environmental Policy Act (NEPA) to take a "hard look" at the environmental consequences of a proposed action, and the requisite analysis "must be appropriate to the action in question." This brief presents a framework and indicators to be used in analyzing the impact of public land management proposals on the economies of Western communities. Federal agencies cannot evaluate the consequences of proposed decisions or determine how best to avoid or mitigate negative impacts without adequate data and analysis. Through the application of the methodology we have provided below, using data collected from identified sources and measuring potential impacts through key indicators, federal agencies can better fulfill their obligations to evaluate the direct, indirect, and cumulative socio-economic impacts of various alternative decisions.

## II. INTRODUCTION

We have organized this paper to facilitate the identification of key issues related to the impact of federal public land decisions on Western economies, and to provide key indicators for analyzing the impacts of those decisions on the economy of the West. The first section describes the changing economy of the western region, and how public land management planners should evaluate the economic impacts of land management alternatives. Next, we present key economic indicators with which to measure the vigor of the West's economy and discuss the implications of these indicators for the selection and analysis of land management alternatives.[1] The third section presents sources of data that are readily available at the state and county level, to which land managers should refer when preparing economic analyses for public lands. Next we outline the methodology we recommend agencies use to analyze the economies of western communities, in order to fully account for information that is traditionally absent in public land management assessments. Finally we provide a detailed list of our NEPA scoping questions, including specific recommendations for analyzing economic trends and conditions affected by the proposed management decisions.

These analyses and methods provide a necessary, but by no means sufficient, framework for the evaluation of proposed land management decisions. Socio-economic impacts are only one facet of the total impact of such decisions on communities. Western federal public lands belong to all Americans, and in order to fully evaluate the merits of land management decisions a complete benefit-cost analysis, including non-market values, must be made. While the specific methods for benefit-cost analyses are beyond the scope of this brief, we expect the agency to implement benefit-cost analyses in addition to the requested socio-economic impact analyses outlined here.

## III. OVERVIEW OF THE WESTERN ECONOMY

In the last 30 years, the West has evolved from a region largely focused on extractive industries into a much more diverse area with a more diversified economy (Bennett and McBeth 1998, Johnson 2001). Table 1 shows the current proportion of total personal income from resource extraction industries in the Rocky Mountains. Recent research shows that most western counties are not "resource dependent," and have instead developed diversified economies

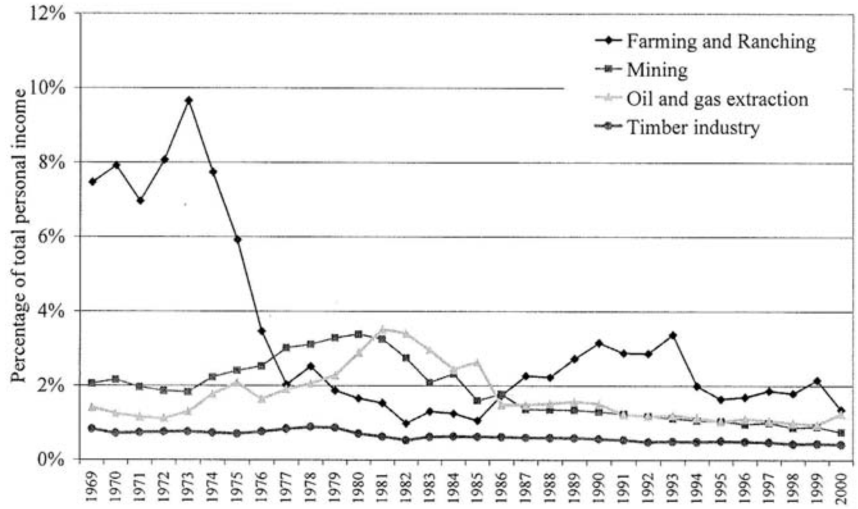
[1] We provide examples of the statistics and data available to analyze each of the key indicators. These examples focus on the five Rocky Mountain states, but the methods and analyses presented apply to other states throughout the region. The states we focus on in this brief are: Colorado, Montana, New Mexico, Utah, and Wyoming. The Western states, especially the Rocky Mountains, are currently facing accelerated development of oil and gas on their federal public lands while at the same time realizing the potential embodied in the amenity-based economy.

based on recreation, tourism, knowledge-based industries and the service sector. A recent study examining the impact of public lands on economic well-being in 11 western states found that only 3 percent of western counties could be classified as resource-extraction dependent (Rasker et al. 2004). Figure 1 shows the 30-year trend in resource extractive industry income in the Rocky Mountain Region. Public land management decisions all too often rely on a misconception of a resource-extraction-dependent rural West. Given the changing nature of the western economy, such assumptions exclude important non-extractive economic drivers and may even harm the economy of the region in the long run by depleting the natural capital responsible for the economic growth of Western communities.

Table 1. Extractive Industry Income as a Percentage of Total Personal Income (2003)

| | Colorado | Montana | New Mexico | Utah | Wyoming | Rocky Mountains |
|---|---|---|---|---|---|---|
| Farming and ranching | 0.77% | 1.19% | 2.52% | 0.73% | 2.11% | 1.14% |
| Mining (excluding oil and gas extraction) | 0.47% | 1.49% | 1.41% | 0.71% | 6.99% | 1.09% |
| Oil and gas extraction | 0.88% | 0.44% | 1.10% | 0.16% | 2.79% | 0.84% |
| Timber industry | 0.25% | 1.40% | 0.19% | 0.39% | 0.23% | 0.35% |
| Total extractive industry income | 2.37% | 4.52% | 5.22% | 1.99% | 12.11% | 3.43% |

*Source: Regional Economic Information System, Bureau of Economic Analysis (http://www.bea.doc.gov)*




*Source: Regional Economic Information System, Bureau of Economic Analysis*
Farming and Ranching: "Farm proprietors' income," "Farm earnings," "Agricultural services," and "Fishing"
Timber Industry: "Forestry," "Lumber and wood products," and "Paper and allied products"
Mining: Includes all segments of Mining sector except "Oil and gas extraction"
Note: The figure is based on SIC data for 1969-2000 in order to show the long-term trend. While not explicitly compatible, NAICS data for 2001-2003 show similar trends for extractive industry income and illustrate the general downward trend, even during the current oil and gas drilling boom in the Rockies.

Figure 1. Resource Extractive Industry Income in the Rocky Mountain Region

As the economies of rural communities in the West diversify, the framework for making public land management decisions must also evolve. Merely counting jobs in resource extraction is not a sufficient way to measure the economic impact of public land management decisions. Many of these communities have diversified economies that are no longer solely dependent on the export of fossil fuels or logs. Management plans for public lands need to account for all aspects of the economic and social systems of these communities, including recreation, tourism, and entrepreneurial businesses attracted to scenic locations, when evaluating alternatives.

There is a vast and growing body of research that indicates that the environmental amenities provided by public lands are an important economic driver in the rural West (Rudzitis and Johansen 1989; Johnson and Rasker 1993, 1995; Rasker 1994; Power 1995, 1996; Duffy-Deno 1998; Rudzitis 1999; Rasker et al. 2004; Holmes and Hecox 2004). In a letter to the President and the Governors of the western states, economists from universities and other organizations throughout the United States pointed out that, "The West's natural environment is, arguably, its greatest long-run economic strength" (Whitelaw et al. 2003).

The western United States is growing at a rate faster than any other region (U.S. Census Bureau 2001), and, counter to the norm, population growth has preceded employment growth in the rural West (Vias 1999), indicating that people migrate to the region for its amenity resources. Furthermore, counties with high levels of natural amenities (such as varied topography, access to water bodies, and a pleasant climate) are more likely to experience higher growth than those counties with fewer such amenities (McGranahan 1999). Along with that growth comes demographic change. As Shumway and Otterstrom (2001) point out, "Population change represents more than a simple redistribution of people; it is an indicator and, in many instances an instigator, of a wide range of economic, social, cultural, political/policy, and environmental changes." As more people move from urban areas to rural communities they bring with them expectations about how local public lands ought to be managed. Changing community values must be accounted for in land management planning.

Management plans for the public lands in the West must consider the increasing importance of industries and economic sectors that rely on these public lands, but not necessarily on the extraction of natural resources. As the population of the entire country grows, the presence of undeveloped lands becomes more and more important. Indeed, much recent research has concluded that the presence of protected public lands strengthen western rural economies by meeting growing needs for clean water, wildlife habitat and recreation opportunities (Power 1995, 1996; Rasker 1994; Rasker et al. 2004; Rudzitis 1999; Rudzitis and Johansen 1989; Johnson and Rasker 1993, 1995; Whitelaw et al. 2004).

## IV. KEY ECONOMIC INDICATORS OF THE WEST'S ECONOMY

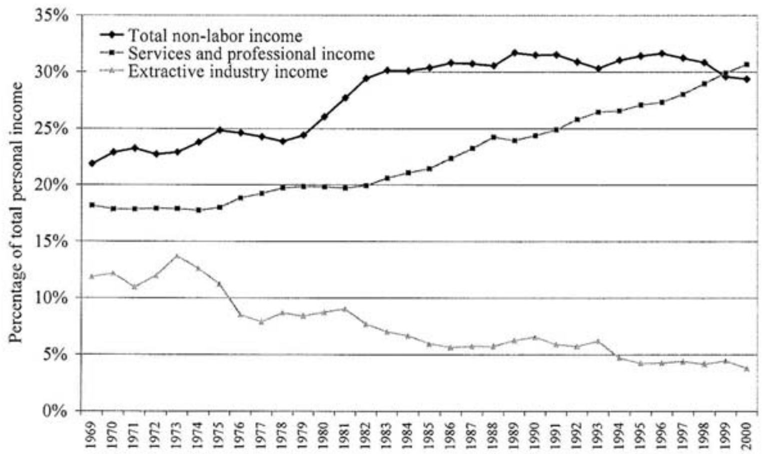
The West's economy is characterized by many indicators that must be considered in the economic analyses performed by land management agencies; we have selected only a few to focus on in this brief. These include the growing importance of non-labor income from investments and retirement; increasing employment in high technology, knowledge-based, and service industries; the important role that recreation and tourism plays in providing jobs and income; and the rise of small businesses and other entrepreneurial endeavors. Other features of the western economy include the decline in extractive industries, the increase in public awareness and appreciation of the environmental and recreation amenities of their home counties, and the diversification of rural economies. This section describes a concise set of indicators that land use planners should examine as part of the description of the socio-economic profile of an area, and presents example data from the Rocky Mountain states for each indicator.

### A. Non-labor income

A complete analysis of regional economic trends should include an analysis of total personal income, including all sources of income, rather than relying solely on employment. A full accounting of income is necessary to an understanding of the important role that non-labor income — such as retirement income, interest payments, rents, and profits — plays in the regional economy. Investment and retirement income makes up nearly one-quarter of total personal income in the Rockies, which would make it the top "industry" in the region. An economic impact analysis that excludes this income is inadequate and misleading.

Researchers have found that areas with high levels of natural amenities attract residents, many of whom rely on non-traditional sources of income (Duffy-Deno 1998, Nelson 1999, McGranahan 1999, Rudzitis 1999, Shumway and Otterstrom 2001, Lorah and Southwick 2003). When an investor living in a community receives dividends on his or her investments, that money represents an influx of income for the local community. The same thing is true of a retiree's income. Due to the high levels of natural amenities in the coastal and mountain regions of the West, these non-labor sources of income are concentrated in those areas (Nelson 1999).

An influx of retirees in those rural communities has been shown to have positive effects on both income and employment (Deller 1995), with non-labor income fueling increases in income and employment for many other sectors including health, financial and real estate services. Figure 2 shows the trend in total personal income for the five-state Rocky Mountain region. Service sector income has been rising in recent years while extractive industry income has fallen. Non-labor income makes up the largest proportion of total personal income.




*Source: Regional Economic Information System, Bureau of Economic Analsyis, US Department of Commerce*
Extractive industries: "Farm proprietors' income," "Farm earnings," "Agricultural services, forestry, fishing," "Mining," "Lumber and wood products," and "Paper and allied products"
Service and professional: "Services," "Eating and drinking places," and "Finance, insurance, and real estate"
Note: The figure is based on SIC data for 1969-2000 in order to show the long-term trend. While not explicitly compatible, NAICS data for 2001-2003 show similar trends for non-labor, service and professional, and extractive industry income.

Figure 2. Total Personal Income in the Rocky Mountains

Table 2. Non-labor income as a percentage of total personal income (2003)

| | Colorado | Montana | New Mexico | Utah | Wyoming | Rocky Mountain Region |
|---|---|---|---|---|---|---|
| Investment income [a] | 17% | 19% | 15% | 15% | 23% | 16% |
| Retirement income [b] | 6% | 11% | 10% | 7% | 9% | 7% |
| Income support [c] | 3% | 4% | 7% | 3% | 3% | 4% |
| Other [d] | 0.7% | 1.1% | 1.4% | 1.1% | 0.8% | 0.9% |
| All non-labor income | 26% | 35% | 33% | 26% | 36% | 28% |

*Source: Regional Economic Information System, Bureau of Economic Analysis (http://www.bea.doc.gov)*
[a] Dividends, interest, and rent
[b] Includes veterans' benefits, military benefits, and Medicare
[c] Income Maintenance, Supplemental Security Income, Family Assistance, Food Stamps, Medicaid, Unemployment
[d] Includes federal education and training assistance, settlements between individuals and businesses and transfer payments from non-profit institutions

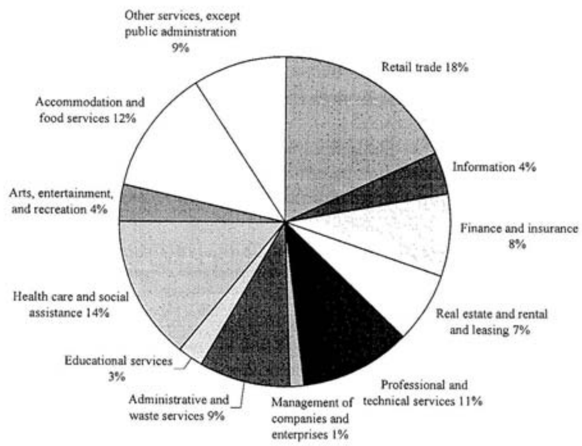
It should be noted that non-labor income also includes income support payments such as Medicaid, welfare and unemployment. However this category is consistently a small portion of total non-labor income and therefore a small portion of total personal income. Income support is less than 4 percent of total personal income and only 14 percent of non-labor income in the Rockies. It is important for a complete analysis of non-labor income to make a distinction between income support and other forms of non-labor income. Table 2 shows non-labor income, broken into its components as a percentage of total personal income for the five Rocky Mountain States. Investment and retirement income is the largest portion of non-labor income for each state, while income support reflects a much smaller portion.

A complete analysis of an area's economy must consider non-labor income, and a thorough evaluation of land management alternatives must consider the impacts of each alternative on non-labor income.

**B. Knowledge-Based, Service Sector and Other Non-Recreation Businesses**

Bennett and McBeth (1998) cite the emergence of a trend toward increasing western rural populations as early as the 1970s and state that this trend was partly motivated by the high quality of life in these areas. Johnson (2001) points out the importance of technology in this transition. He credits the advancement of technology with both the downward trend in extractive employment (where improved technology results in reduced labor requirements) and the potential (currently being realized in many communities) for economic growth and stability. Johnson points out that improving technology, especially in information and communication, also mitigates the constraints imposed by remoteness and permits employment in knowledge-based and service industries previously unavailable for rural residents.

Many of the counties in the Rocky Mountain West with economies that are characterized by a predominance of service industries have the highest incomes (Shumway and Otterstrom 2001). Over the past quarter-century, the U.S. economy has seen a shift from extractive and primary manufacturing industries to service oriented businesses. A common misconception about the service sector is that it includes only low paying jobs. This is not the case. The service sector in the West includes several high-paying industries, many of which are linked closely with the increase in non-labor income. Employment and income in the health care services increase as the number of retirees in an area increases. As people with investment income move into a region, the demand for financial, insurance, and real-estate service also increases.




*Source: Regional Economic Information System, Bureau of Economic Analysis (http://www.bea.doc.gov)*

Figure 3. Service and Professional Employment in the Rocky Mountains (2003)

The service sector includes occupations and industries that are classified as "knowledge based," defined by Henderson and Abraham (2004):

> "Knowledge-based activities emerge from an intangible resource that enables workers to use existing facts and understandings to generate new ideas. These ideas produce innovations that lead to increased productivity, new products and services, and economic growth."

Knowledge-based occupations have grown nationwide since 1980, with growth in the Rocky Mountain region being among the highest (Henderson and Abraham 2004). Local amenities that enhance quality of life are among the factors correlated with this growth. Other factors contributing to the growth of knowledge-based occupations are a high quality workforce, colleges and universities, infrastructure in the area, and the size and diversity of the local economy. These factors are likely to be interrelated and in many cases dependent on the quality of the environment and the availability of public lands, as cities and counties in the region leverage scenic amenities to attract high quality workers and knowledge-based industries. Other research confirms the role that amenities, including environmental and recreational amenities, play in attracting businesses to locations in the rural Rocky Mountain West (Whitelaw and Niemi 1989; Johnson and Rasker 1993, 1995). The most recent income data available from the Bureau of Economic Analysis (BEA) include a category called "information," which captures a good deal of the new knowledge-based industry. Land management decision makers should take advantage of these expanded industry classification categories when analyzing the potential impacts of public land management on the diverse economies of western counties.

A complete analysis of an area's economy must take into account the growth in income and employment in the service and professional sectors, and consider the impacts of each alternative on those sectors.

**C. Recreation & Tourism**

Many rural communities in the Rocky Mountain region have experienced firsthand the surge in demand for recreation experiences outdoors, especially on federal public lands. Moab, Utah is a good example. This town was once a dying mining center and is now a top destination for recreation seekers of all sorts. Other towns around the West have seen an upswing in migration and economic health as they become "discovered" by recreationists (Rasker, et al. 2003, 2004; Holmes and Hecox 2004).

A 2005 report by the Outdoor Industry Association estimates that 159 million Americans participate in outdoor recreation each year. A 2002 study by the same organization estimates annual spending on outdoor recreation at $18 billion. The public lands provide much of the open space that makes this important economic activity possible.

In 2000, the Forest Service estimated the economic impacts of their program areas. These estimates account for the impact a range of activities exerts on both income and employment. Recreation and protection programs account for a much greater economic impact than do extractive programs (Alward et al. 2003).

Table 3. Economic Significance of Forest Service Program Activities (for 1999)

| | Percentage of Total Value Added (GDP) | Percentage of Total Income | Percentage of Total Wages | Percentage of Total Jobs |
|---|---|---|---|---|
| Recreation and Landscape Protection<br>*Recreation, Heritage & Wilderness; Wildlife, Fish & Rare Plants; Watershed & Air Mgt; Ecosystem Mgt. Coord.; Access & Travel Mgt.* | 70% | 69% | 71% | 76% |
| Extraction of Commercial Resources<br>*Range Mgt.; Forest Mgt.; Minerals & Geology Mgt.* | 22% | 22% | 20% | 17% |
| Other<br>*Lands & Realty Mgt.; Fire & Aviation Mgt.; Law Enforcement; Facilities Mgt., General Admin.; S&P Forestry; R&D* | 9% | 9% | 8% | 7% |

*Source: Alward et al. 2003.*

Quality hunting and fishing opportunities require wildlife habitat, which generally means large areas of open land. As the population grows, these are increasingly found only on the federal and other public lands. Pickton and Sikorowski (2004) estimate that the total economic impact of hunting, fishing, and wildlife-watching in Colorado at over $1.8 billion, with corresponding employment at 33,000 full-time jobs. An April 2004 report from the Center for the Study of Rural America calls wildlife recreation "rural America's newest billion-dollar industry" (Henderson 2004), with wildlife-related activities boosting tourism, spurring business growth and contributing to increased property values. The U.S. Fish and Wildlife Service and the Census Bureau jointly track participation and expenditures on wildlife-related recreation. Nationwide these activities generate $108 billion for local economies. Much of these expenditures are in the Rocky Mountain West, with hunters, anglers, and wildlife watchers spending nearly $6 billion in the five-state region alone in 2001 (U.S. FWS and U.S. Census Bureau 2001). Table 4 presents the participation in and expenditures on wildlife recreation for Colorado, Montana, New Mexico, Utah and Wyoming.

Table 4. Participation and expenditures from hunting, fishing, and wildlife-associated recreation in the Rocky Mountains (2001)

| | Participation | Expenditures |
|---|---|---|
| Colorado | 2.1 million | $2 billion |
| Montana | 871,000 | $943 million |
| New Mexico | 884,000 | $1 billion |
| Utah | 1.1 million | $1.4 billion |
| Wyoming | 662,000 | $634 million |

*Source: U.S. Department of the Interior, U.S. Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau. 2001.*

A complete analysis of an area's economy must present data and analysis that fully account for the important role that tourism, recreation, hunting, and fishing play in ensuring a sustainable and diversified economy for rural western communities.

**D. Entrepreneurs**

All of the indicators previously discussed are related to the increasing entrepreneurial activity being experienced West-wide. Entrepreneurs in high technology and knowledge-based industries can often choose their location, and are likely to choose high-amenity locations (Rasker and Glick 1994, Snepenger et al. 1995, Johnson and Rasker 1995, Beyers and Lindahl 1996, Rasker and Hansen 2000, Low 2004, Henderson and Abraham 2004). Recreation- and tourism-oriented businesses are often founded by footloose entrepreneurs seeking to live and work in places rich in amenities. Retirees and others relying on investment income also choose amenity-rich locations that include certain businesses and services. These new migrants bring with them entrepreneurial opportunities for those who can provide the services they seek.


Figure 4. Rocky Mountain Personal Income by Type

Figure 4 shows personal income by type for the Rocky Mountain region. While wage and salary income is still the largest portion of total personal income, non-farm proprietors' income has shown an upturn in recent years.

As the proportion of total personal income from non-farm proprietors grows, implications for rural communities and for management of the public lands that surround them also grows. As Low (2004) points out: "Entrepreneurs create local jobs, wealth, and growth — and are themselves innovative users of other regional assets and resources." Furthermore, Low notes: "Entrepreneurs bolster a region's quality of life while promoting economic prosperity. Research has found a strong correlation between entrepreneurship and long-term regional employment growth."

Beyers and Lindahl (1996) specifically examine businesses which provide "producer services" and find these businesses are expanding rapidly in rural areas, and that most of them conduct much of their business interregionally or even internationally, bringing outside income into the rural region where they are located. These researchers also found that the decision to locate in rural areas is mostly for quality-of-life reasons, providing further evidence of the importance of such factors to local economies and the need to examine public land management activities and the potential impacts on quality of life.

A complete analysis of an area's economy must take into account the growing role of entrepreneurial businesses, and consider the impacts of each alternative on those businesses attracted by the environmental amenities provided by public lands in those communities.

**E. The Role of Protected Public Lands**

More and more people in the West, and all over the US, are able to choose where they live and work. Technology makes it easier for professionals to "telework" using electronic communications. Many businesses are able to conduct national or international commerce from any location they choose. Other entrepreneurs simple choose to live in a particular place and build a business in response to local needs. Retirees and others who collect non-labor income are not tied by a job to a specific location. All of these people seek an attractive place to live. More and more, as development pressures increase, public lands become a backdrop or setting which contributes to or even creates the amenities on which a community's economy will thrive and grow. Research supports the assertion that protected public lands contribute to rural economic health (Rudzitis and Johansen 1989, Rudzitis and Johnson 2000, Rasker et al. 2004).

Local communities with protected wildlands reap measurable benefits in terms of employment and personal income. For instance, the Sonoran Institute (Sonoran Institute 2004b) has found that protected lands have the greatest influence on economic growth in rural isolated counties that lack easy access to larger markets. From 1970 to 2000, real per capita income in isolated rural counties with protected land grew more than 60 percent faster than isolated counties without any protected lands.

These findings confirm earlier research showing that wilderness is in fact beneficial for local economies. Residents of counties with wilderness cite the presence of that wilderness as an important reason why they moved to the county, and long-term residents cite it as a reason they stay. Recent survey results also indicate that many firms decide to locate or stay in the West because of scenic amenities and wildlife-based recreation, both of which are strongly supported by wilderness areas (Morton 2000).

As noted by Freudenburg and Gramling (1994):

> "...it needs to be recognized as a serious empirical possibility that the future economic hope for resource-dependent communities of...the United States could have less to do with the consumption of natural resources than with their preservation."

This sentiment is reiterated by Deller et al. (2001):

> "Rural areas endowed with key natural resource amenities can manage those resources to capture growth more effectively. This may entail expansion beyond policies that have historically been focused on extraction of the resource base."

Resource managers, economic planners and community leaders must become aware of this potential. We therefore request that the NEPA process fully address the economic importance to local communities of protecting public wildlands from resource extraction.

## V. SOURCES OF DATA

This section presents selected sources of economic, demographic, and recreation data.

### A. Economic and Demographic Data

Data are available for several economic indicators by county from the U.S. Department of Commerce, Bureau of Economic Analysis and the U.S. Department of Labor, Bureau of Labor Statistics. The U.S. Census Bureau also tracks economic trends along with demographic trends, most by county as well. Economic profiles showing these and other trends by state, county, or groups of counties are available from the Sonoran Institute's Economic Profile System.

Federal economic and demographic data sources:

- Bureau of Economic Analysis (Department of Commerce): http://www.bea.doc.gov
  - Date on income, farm income, transfer payments, and employment for states, counties, and regions. Annual data, 1969-2000 (Standard Industry Classification) and 2001-2003 (North American Industry Classification System)
- Bureau of Labor Statistics (Department of Labor): http://www.bls.gov
  - Data on income, wage and salary, employment, unemployment rates by industry, for counties, states, and regions. Monthly data, 1990-2005
- Census Bureau (U.S. Department of Commerce): http://www.census.gov
  - Data on population, demographics, business, and economics for states and counties
- The Sonoran Institute Economic Profile System: http://www.sonoran.org
  - Generates detailed economic profiles, including trends in employment and income, farm income, economic resilience, and demographics for states, counties, or groups of counties. The companion, Economic Profile System — Community, will generate profiles to reflect just the rural or urban areas of a county.
- The National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, Census Bureau): http://www.census.gov/prod/www/abs/fishing.html
  - Data at the state level on participation in and expenditures for wildlife-associated recreation

Selected state economic and demographic data sources:

- Colorado Economic and Demographic Information System: http://www.dola.state.co.us/is/cedishom.htm
- Montana Census and Economic Information Center (CEIC): http://ceic.commerce.state.mt.us/
- New Mexico Labor Market Information: http://www.dol.state.nm.us/dol_lmif.html
- New Mexico Economic Development Data Center: http://ww1.edd.state.nm.us/index.php?/data/C31/
- Utah Governor's Office of Planning and Development, Demographic and Economic Analysis: http://www.governor.utah.gov/dea/
- Wyoming Department of Administration and Information, Economic Analysis Division: http://eadiv.state.wy.us/

### B. Recreation Data

Data on recreation use in the area where a land management plan is being developed is critical to making an informed decision. Surveys of users at recreation areas can be utilized to obtain information on the levels and types of recreation use. Information on users' expenditures in the area is also important to learn the overall impact of public lands recreation. Federal land management agencies collect some data on recreation use of public lands. The Bureau of Land Management's Recreation Information Management System (RIMS) and the USDA Forests Service's National Visitor Use Monitoring System (NVUMS) are two examples.

Other information may be obtained through surveys of local residents, recreation visitors and through using existing data on the recreation and tourism revenues to local businesses, and the value of these activities to participants. The lack of complete visitation data does not justify ignoring the jobs and income from recreation. Furthermore, the Data Quality Act requires use of the best available, reliable data on all impacts and affected sectors of the economy.

The National Survey on Hunting, Fishing and Wildlife-Associated Recreation (noted above) is also a source of state-wide data on participation in wildlife recreation that should be used to supplement more specific studies for the location in question. State agencies are also a source of data on fishing and hunting and other wildlife-associated recreation.

Colorado Division of Wildlife: http://wildlife.state.co.us/index.asp
Montana Fish, Wildlife, and Parks: http://fwp.state.mt.us/default.html
New Mexico Game and Fish: http://www.wildlife.state.nm.us/index.htm
Utah Division of Wildlife Resources: http://wildlife.utah.gov/index.php
Wyoming Game and Fish: http://gf.state.wy.us/

**C. Data Gaps and Other Issues**

Land managers may encounter gaps in county- or state-level economic data or may notice that data series are not continuous. These are not, however, obstacles to doing a thorough and comprehensive analysis of the trends in the economies of the local area.

**1. Disclosure Gaps**

Some data gaps are due to disclosure restrictions. The Bureau of Economic Analysis and the Bureau of Labor Statistics will suppress data in cases where disclosing it may reveal private information about individuals. For example, if only one business represents a specific industry in a given area, any data on employment and/or income in that industry will not be publicly disclosed since it may make it possible to identify an individual's or business' private information. Disclosure suppression is more likely to be a problem in counties with small populations. The Sonoran Institute suggests several potential techniques to address the issue of data gaps due to disclosure issues. The Economic Profile System will also automatically estimate the data gaps for major industry categories. These are described in detail in the User's Manual for the EPS (Sonoran Institute 2004b.)

**2. Other Data Gaps**

BEA and Bureau of Labor Statistics (BLS) data are sometimes not available for certain industries and/or certain years. Other data are suppressed, but are identified as falling within a range of values. Data gaps where an "L" appears instead of a number are described as follows:

Less than 10 jobs, but the estimates for this item are included in the totals, or
Less than $50,000 (for income data), but the estimates for this item are included in the totals

**3. Industry Classification Using SIC and NAICS**

Income and employment data from the Bureau of Economic Analysis and the Bureau of Labor Statistics for 1969-2000 are classified according to the Standard Industry Classification system (SIC), while the most recent data (2001 and forward) are classified by the North American Industry Classification System (NAICS). NAICS was developed jointly by the U.S., Canada, and Mexico in order to make statistics comparable across all three countries.

The NAICS provides greater detail for the service and professional sectors which are of growing importance in the rural West, and indeed all over the country. This classification scheme also includes some emerging industries such as "information" which includes the growing Internet and information phenomenon. The Bureau of Economic

Analysis' Regional Economic Information System (REIS) uses SIC to classify industries and the Sonoran Institute's EPS system uses SIC data from the REIS in order to show trend analyses, along with NAICS data.

## VI. RECOMMENDED METHODS FOR ANALYSIS

In general, it is inappropriate to examine a region's economy solely as a single point in time because economies are dynamic. To the extent that data are available, the economic profile of an area should be developed based on the trends in key economic indicators. This can help guide resource management by showing the likely future situation in an area and can point out periods of economic downturn. It may be instructive to look at other variables during these periods to see if there are correlations between land management activities and economic activity.

Looking at the changes in employment and income (including non-labor income) is important to understanding the overall direction in which an area's economy is moving. Trend analysis will show long-term patterns in income and employment that may be masked when looking at only a point in time. Data on employment and income are available from 1969-2000 from the BEA under the SIC system. The BEA changed to the NAICS in 2001, and reconstructed NAICS data for years prior to 2001 are not yet available. However, one can certainly look at a general picture of the economy over time by using both sets of data. This analysis should be applied to all the segments of the economy to see the long-term trends in both extractive and other industries along with non-labor income.

A lack of data on recreation activities on public lands should not be an excuse to avoid analysis of potential impacts of public land management decisions on the recreation sector. Several examples of research on recreation use, values to participants, and expenditures are available (a very limited sample includes: Fix and Loomis 1997, Chakraborty and Keith 2004, Cordell and Tarrant 2002, Kaval and Loomis 2003). Rosenberger and Loomis (2001) present a detailed bibliography of recreation valuation studies and present methods by which analysts can transfer estimates of the value of recreation in one area to other similar areas. Of course, the best way to truly understand the value of recreation in an area is to conduct a survey specifically focused on that area. At a minimum, such a survey should collect information on recreation visitation and expenditures. An estimate of the economic impacts of recreation can be made by multiplying the total number of recreation visitors in an area by the estimated expenditures per visitor day. These data should be collected and analyzed as part of a comprehensive analysis of the socio-economic impacts of land management.

## VII. RECOMMENDED ANALYSES

The preceding sections of this brief have presented the key indicators that must be included in a socio-economic impact analysis, identified data sources for conducting that analysis, and provided methods for completing an analysis that more accurately reflects the West's economy. In making land-use decisions, federal agencies have an obligation under NEPA to take a "hard look" at the environmental consequences of a proposed action, and the requisite analysis "must be appropriate to the action in question." [2] The impacts and effects of a proposed action, such as oil and gas development, that federal agencies are required to assess include: "ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative."[3] Under the Data Quality Act, federal agencies are required to use information that is of high quality and that is objective, useful, and verifiable by others.[4] The agency must also use "sound statistical and research" methods.[5]

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[2] 42 U.S.C. § 4321 et seq.; *Metcalf v. Daley*, 214 F.3d 1135, 1151 (9th Cir. 2000); *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 348 (1989).

[3] 40 C.F.R. § 1508.8.

[4] Treasury and General Government Appropriations Act for Fiscal Year 2001, Pub.L.No. 106-554, § 515. *See also*, Office of Management and Budget "Information Quality Guidelines," available at http://www.whitehouse.gov/omb/inforeg/iqg_oct2002.pdf and individual "Agency Information Quality Guidelines," available at http:/www.whitehouse.gov/omb/inforeg/agency_info_quality_links.html.

[5] *Ibid.*

Federal agencies cannot evaluate the consequences of proposed decisions or determine how best to avoid or mitigate negative impacts without adequate data and analysis. NEPA's hard look at environmental consequences must be based on "accurate scientific information" of "high quality."[6] Essentially, NEPA "ensures that the agency, in reaching its decision, will have available and will carefully consider detailed information concerning significant environmental impacts."[7] The Data Quality Act and the agencies' interpreting guidance expand on this obligation, requiring that influential information or decision-making input be based on "best available science and supporting studies conducted in accordance with sound and objective scientific practices."[8]

Through the application of the methodology, key indicators and data sources we have provided, federal agencies can better fulfill their obligations to evaluate the direct, indirect, and cumulative impacts of various alternative decisions. In this section, we have provided both general recommendations on the scope of the socio-economic impact analysis that should occur and specific inquiries to be made in this analysis. Again we note that completion of the socio-economic analyses outlined in this brief is necessary but not sufficient to fully evaluate a land management decision. A thorough benefit-cost analysis is also required and expected.

**We formally request that the NEPA analysis fully reflect and account for the following scoping comments:**

**A. The socio-economic analysis should include an analysis, graphs and discussion of historic personal income trends — including non-labor sources of income.**

The analysis of regional economic impacts must include an analysis of all sources of income, including non-labor income. A full accounting of all sources of income is necessary to understand the important role that retirement and investment income — as well as other sources of non-labor income, such as interest payments, rents, and profits — play in the regional economy. An economic impact analysis that excludes non-labor income is inadequate and misleading.

- **Specific Requests and Requirements for examining the Total Personal Income and the Importance of Non-Labor Income as Part of the NEPA Process:**

For all counties in the planning area, please show the role of non-labor income in the area's economy.

- Show the percentage of current total personal income that is non-labor income (excluding income support).
  - Analyze and discuss the role that retirement and investment income currently plays in the area's economy, including the spillover effects of non-labor income on businesses in the area.
  - Analyze and discuss the role that amenities, including recreation opportunities and environmental quality, currently play in attracting and retaining non-labor income to the area.
  - Analyze and discuss the potential impacts that public land management alternatives will have on the level and trend of investment and retirement income in the area.
- Show the trend in non-labor income (again excluding income support) as a percentage of total personal income.

[6] 40 C.F.R. § 1500.1(b).

[7] *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 349 (1989).

[8] Treasury and General Government Appropriations Act for Fiscal Year 2001, Pub.L.No. 106-554, § 515. *See also*, Office of Management and Budget "Information Quality Guidelines," available at http://www.whitehouse.gov/omb/inforeg/iqg_oct2002.pdf and individual "Agency Information Quality Guidelines," available at http://www.whitehouse.gov/omb/inforeg/agency_info_quality_links.html.

**B. The socio-economic analysis must include an analysis and discussion on the indirect role public lands play in the regional economy in attracting knowledge-based businesses, service sector business, recreation and tourism businesses, and other entrepreneurs.**

Public wildlands often define the character of an area and are an important component of the quality of life for local residents and future generations. Their protection enables the customs and culture of western communities to continue. The socio-economic analysis also must account for these economic benefits.

A growing number of economists are recognizing that protecting the quality of the natural environment is key in attracting new residents and businesses, and that therefore the environment is the engine propelling the regional economy. A letter to President Bush from 100 economists concludes, "The West's natural environment is, arguably, its greatest, long-run economic strength… A community's ability to retain and attract workers and firms now drives its prosperity. But if a community's natural environment is degraded, it has greater difficult retaining and attracting workers and firms" (Whitelaw et. al, 2003). Given these findings, we request that, as part of the economic impact analysis of management alternatives, the socio-economic analysis fully consider the indirect role of public lands in attracting and retaining non-recreational businesses and retirees and encouraging entrepreneurial efforts.

- **Specific Requests and Requirements for Examining the Role of Protected Public Lands in the Local Economy as Part of the NEPA Process:**

For all counties in the planning area, please show the role of various industries in the area's economy.

- Show the current distribution of employment and income by industry (for each industry, show employment as a percentage of total jobs and income as a percentage of total personal income).
  - Discuss the relative importance of each industry.
  - Analyze and discuss the impacts that public land management alternatives will have on non-extractive industries if extractive activities are accelerated on public lands in the area.
- Show a complete analysis of the segments of service and professional employment and income for the area.
  - Analyze and discuss the potential impacts of land management alternatives on these sectors of the economy.
- Show trends in employment and income by industry, including a detailed examination of the service and professional sectors.
  - Discuss the level of diversity in the region's economy. Discuss trends in income and employment that have led to the current mix of industries
  - Analyze and discuss the potential impacts of public lands management alternatives on the overall makeup of the economy of the area.
- Show trends in non-farm proprietor's income as a percentage of total personal income for the area.
  - Collect data on the various sectors that make up non-farm proprietors. Analyze the sectors where entrepreneurship is growing.
  - Analyze and discuss the factors that have attracted new businesses to the area.
  - Analyze and discuss the potential impacts that public land management alternatives will have on these sectors and the ability of proprietors to start and grow businesses.

**C. The socio-economic analysis must account for the economic importance of the recreation, hunting, and fishing that occurs on public land.**

The recreation opportunities provided by wilderness-quality lands also yield direct economic benefits to local communities. The socio-economic analysis must include an analysis of the income and jobs associated with recreation, hunting and fishing from each alternative.

- **Specific Requests and Requirements for Examining the Economic Importance of Recreation, Hunting and Fishing on Public Lands as Part of the NEPA Process:**

For all counties in the planning area, show the role of recreation, hunting and fishing in the area's economy.

- Collect data on participation in all recreation activities (hunting, fishing, hiking, camping, backpacking, biking, skiing, wildlife watching, boating, ORV use, etc.)
- Collect data on expenditures by recreation visitors in the region.
- Analyze the economic impact of hunters' and anglers' expenditures on area businesses and local economies.
- Analyze the economic impact of other recreationists' expenditures on area businesses and local economies.
- Show the impact of lodging taxes, sales taxes, and property taxes in the local economy.
- Analyze and discuss the impact of public land management alternatives on recreation, hunting, and fishing businesses.

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# ATTACHMENT 9

## Analysis of Proposed Wilderness Areas Impacted by Proposed West-Wide Energy Corridors

*(Based on best available GIS data; 12/2007)*

Units highlighted in yellow are directly intersected by a proposed corridor; units not highlighted are within 1-mile of the edge of a proposed corridor.

| State | Unit | Land Management Agency | Corridor Issue | Corridor Name/Number | Corridor Width (feet) | New or Previously Designated Corridor? | Uses Permitted? |
|---|---|---|---|---|---|---|---|
| Arizona | Margies Peak Proposed Wilderness | BLM | A corridor is within 1 mile of the northern boundary. | 115-208 | 5,280 | New | All |
| Arizona | Purgatory Pauite Proposed Wilderness Addition | BLM | A corridor is within 1 mile of the eastern boundary along a road. | 113-116 | 5,280 | Previously Designated | All |
| Arizona | Perry Mason Proposed Wilderness | BLM | A corridor is within 1 mile of the western boundary along 1-17 | 61-207 | 5,000 to 10,000 | New | All |
| Arizona | FID 21 and FID 22 Proposed Wilderness | BLM | A corridor bisects the Proposed Wilderness Areas not along a major road and the corridor is within them. | 113-116 | 5,280 | Designated previously | All |
| Arizona | Swansea Proposed Wilderness Additions | BLM | A corridor runs through the Proposed Wilderness Areas not along a major road. | 42-269 | 5,280 | Designated previously | All |
| Arizona | Harcuvar Mountains Proposed Wilderness Additions | BLM | A corridor runs through the Proposed Wilderness Areas not along a major road. | 42-269 | 5,280 | Designated previously | All |
| Arizona | Buckskin Mountain Proposed Wilderness | BLM | A corridor runs through the eastern portion of the Proposed Wilderness not along a major road. | 42-269 | 5,280 | Designated previously | All |
| Arizona | Face Mountain Proposed Wilderness | BLM | A corridor runs through the southern portion of the Proposed Wilderness not along a major road. | 115-238 | 3,500 | New | All |
| Arizona | Yellow Medicine Butte Proposed Wilderness | BLM | A corridor runs through the southern portion of the Proposed Wilderness not along a major road. | 115-238 | 3,500 | New | All |

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| Arizona | Black Butte East and West and Belmont Mountains Proposed Wilderness Areas | BLM | A corridor splits the Proposed Wilderness Areas and appears to be within them not along a major road. | 42-269 | 10,560 | Designated previously | All |
| Arizona | FID 14 Proposed Wilderness | USFS | A corridor runs through the Proposed Wilderness for about 3 miles not along a major road | 234-235 | 3,500 | New | All |
| Arizona | Black Canyon Proposed Wilderness Area | BLM | A corridor splits Agua Fria National Monument and the Proposed Wilderness Area along Interstate 17 and appears to be in the Proposed Wilderness. | 61-207 | Variable width | New | All |
| California | Middle Knob Proposed Wilderness | BLM | A corridor is within 1 mile of the eastern boundary of the Proposed Wilderness. | 23-106 | 3,500 | New | All |
| California | John Muir Proposed Wilderness | BLM | A corridor is within 1 mile of the western boundary of the Proposed Wilderness along a road. | 18-23 | 1,320 | New | All |
| California | San Francisquito Proposed Wilderness | USFS | A corridor is within 1 mile of the eastern boundary of the Proposed Wildreness along a road. | 264-265 | 1,000 | Previously Designated | Electric only |
| California | Condor Peak Proposed Wilderness | USFS | A corridor is within 1 mile of the northern boundary of the Proposed Wilderness. | 107-268 | 1,000 | Previously Designated | Electric only |
| California | Table Mtn. Proposed Wilderness | BLM | A corridor is within 1 mile of the southern boundary of the Proposed Wilderness along aroad. | 115-238 | 3,500 | New | All |
| California | Inyo Mtn. Proposed Wilderness | BLM | A corridor is within 1 mile of the western boundary of the Proposed Wilderness. | 18-23 | 1,320 | New | All |
| California | Horse Mountain Proposed Wilderness | USFS | A corridor is within 1 mile of the western boundary of the Proposed Wilderness along I-5. | 261-262 | 2,000 | New | Electric only |
| California | Snowstorm Mtn. Proposed Wilderness | BLM | A corridor is within 1 mile of the northeastern boundary of the Proposed Wilderness along US-395. | 15-104 | 3,500 | New | All |
| California | Chanchellula Proposed Wilderness | USFS | A corridor is within 1 mile of the southern boundary of the Proposed Wilderness along State Hwy 36. | 101-263 | 3,500 | New | All |

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| California | Beegum Proposed Wilderness | BLM | A corridor is within 1 mile of the northern boundary of the Proposed Wilderness along State Hwy 36. | 101-263 | 3,500 | New | All |
| California | American River Wildlands Proposed Wilderness | USFS | A corridor is within 1 mile of the northern boundary of the Proposed Wilderness along I-80. | 6-15 | 3,500 | Previously Designated | All |
| California | Mayfield Proposed Wilderness | USFS | A corridor splits the Proposed Wilderness in half not along a major road. | 3-8 | 1,0000 | New | All |
| California | Sulfer Creek Proposed Wilderness | USFS | A corridor runs though the southern portion of the Proposed Wilderness along State HWY 36. | 101-263 | 3,500 | New | All |
| California | Buffalo Smoke Proposed Wilderness | BLM | A corridor runs through the western portion of the Proposed Wilderness along US HWY 395. | 15-104 | 3,500 | New | All |
| California | South Fork Trinity Proposed Wilderness | USFS | A corridor runs through the western boundary of the Proposed Wilderness for about 3.5 miles along a road. | 101-263 | 3,500 | New | All |
| California | Hauser Mountain Proposed Wilderness Additions | BLM and USFS | A corridor runs through the middle of the Proposed Wilderness not on a road. | 115-238 | 1,000 | New | Electric only |
| Colorado | Yampa River Proposed Wilderness | BLM | A corridor runs through the northern boundary of the Proposed Wilderness not along a major road. | 133-142 | 3,500 | Previously Designated | All |
| Colorado | Roan Plateau Proposed Wilderness | BLM | A corridor runs through the eastern boundary of the Proposed Wilderness along State HWY 13. | 132-276 | 3,500 | New | Electric only |
| Colorado | South Shale Ridge Proposed Wilderness | BLM | A corridor runs through the eastern boundary of the Proposed Wilderness along US HWY 6. | 132-136 | 26,400 | Previously Designated | All |
| Colorado | San Miguel River Proposed Wilderness | BLM | A corridor runs through the northern boundary of the Proposed Wilderness not along a major road. | 130-131 (S) | 3,500 | New | All |
| Colorado | Badger Proposed Wilderness | BLM | A corridor runs through the southern boundary of the Proposed Wilderness not along a major road. | 87-277 | 3,500 | Previously Designated | All |

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| New Mexico | Organ Foothills Proposed Wilderness | BLM | A corridor runs through the western portion of the Proposed Wilderness not along a major road. | 81-272 | 3,500 | New | All |
| New Mexico | Penasco Canyon Proposed Wilderness | BLM | A corridor is within 1 mile of the eastern boundary of the Proposed Wilderness along 1-25. | 81-272 | 3,500 | New | All |
| New Mexico | Turtle Mtn. Proposed Wilderness | BLM | A corridor is within 1 mile of the eastern boundary of the Proposed Wilderness not along a major road. | 81-272 | 3,500 | New | All |
| New Mexico | Organ Mtns. Proposed Wilderness | BLM | A corridor is within 1 mile of the western boundary of the Proposed Wilderness not along a major road. | 81-272 | 3,500 | New | All |
| New Mexico | Gore Canyon Proposed Wilderness | BLM | A corridor is within 1 mile of the northern boundary of the Proposed Wilderness along 1-15 | 81-213 | 3,500 | New | All |
| New Mexico | San Luis Proposed Wilderness | BLM | A corridor is within 1 mile of the eastern boundary of the Proposed Wilderness not along a major road. | 80-273 | 3,500 | Previously Designated | All |
| New Mexico | Sierra Ladrones Complex Proposed Wilderness | BLM | A corridor runs through the eastern boundary of the Proposed Wilderness along US HWY 60. | 81-272 | 3,500 | New | All |
| New Mexico | Magdalena Mountains Proposed Wilderness | BLM | A corridor runs through the eastern boundary of the Proposed Wilderness not along a major road. | 81-272 | 3,500 | New | All |
| New Mexico | Chupadera Proposed Wilderness Addition | BLM | A corridor runs through the western tip of th Proposed Wilderness not along a major road. | 81-272 | 3,500 | New | All |
| New Mexico | Lordsburg Playa North Proposed Wilderness | BLM | A corridor runs through the middle of the Proposed Wilderness not on a road. | 81-213 | 3,500 | New | All |
| New Mexico | Polvadera Mtns. Proposed Wilderness | BLM | A corridor runs through the eastern edge of the Proposed Wilderness for about 2 miles along 1-25. | 81-272 | 3,500 | New | All |
| Oregon | Summit Lake Proposed Wilderness | USFS | A corridor runs through the northern boundary of the Proposed Wilderness not along a major road. | 230-248 | 3,500 | New | All |

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| Oregon | Dicks Spring, South Scyan Flat, Merritt Creek, Shake Creek, Scyan River, and Chocktook Creek Proposed Wilderness Areas. | USFS | A corridor splits these Proposed Wilderness Areas and appears to be in all not along a major road. | 7-11 | 3,500 | New | All |
| Oregon | Warners and Adobe Flats Proposed Wilderness | USFS | A corridor runs through the middle of the Proposed Wilderness not on a road. | 7-24 | 3,500 | New | All |
| Oregon | Horshoe Meado and Horshoe Creek Proposed Wilderness | USFS | A corridor runs through the middle of the Proposed Wilderness not on a road. | 7-24 | 3,500 | New | All |
| Oregon | North Fork Deep Creek Proposed Wilderness | USFS | A corridor runs through the middle of the Proposed Wilderness not on a road. | 7-24 | 3,500 | New | All |
| Oregon | Fish Creek Proposed Wilderness | USFS | A corridor runs through the northern boundary of the Proposed Wilderness not along a major road. | 230-248 | 3,500 | New | All |
| Oregon | Molalla Headwaters Dead Horse Canyon Proposed Wilderness | USFS | A corridor runs through the northern boundary of the Proposed Wilderness not along a major road. | 230-248 | 3,500 | New | All |
| Oregon | Lower Divine Canyon Proposed Wilderness | USFS | A corridor runs through the southern boundary of the Proposed Wilderness not along a major road. | 11-228 | 3,500 | Expansion of existing | All |
| Oregon | Coffeepot Creek Proposed Wilderness | USFS | A corridor runs through the southern boundary of the Proposed Wilderness not along a major road. | 11-228 | 3,500 | Expansion of existing | All |
| Oregon | Long Butte, Burnt Butte, and Coyote Flat Proposed Wilderness | BLM | A corridor splits these three Proposed Wilderness Areas and appears to be in all three not along a major road. | 7-11 | 1,500 | New | All |

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| Utah | Dead Horse Pass, Lower Flaming Gorge, O-Wi-Yu-Kuts, Mountain Home, and Red Creek Badlands Proposed Wilderness | USFS | A corridor splits the Proposed Wilderness areas not along a major road. | 126-218 | 3,500 | New | All |
| Utah | Coldspring Mountain Proposed Wilderness | BLM | A corridor runs through the middle of the Proposed Wilderness not on a road. | 126-218 | 3,500 | New | All |
| Utah | Beaver Dam Wash Proposed Wilderness | BLM | A corridor runs through the northwestern boundary of the Proposed Wilderness not on a road. | 113-114 | 3,500 | Previously Designated | All |
| Utah | Scarecrow Peak Proposed Wilderness | BLM | A corridor runs through the southeastern boundary of the Proposed Wilderness not on a road. | 113-114 | 3,500 | Previously Designated | All |
| Utah | Beaver Dam Mountains North Proposed Wilderness | BLM | A corridor runs through the northwestern boundary of the Proposed Wilderness not on a road. | 113-114 | 3,500 | Previously Designated | All |
| Utah | Square Top Mountains Proposed Wilderness | BLM | A corridor runs through the southeastern boundary of the Proposed Wilderness not on a road. | 113-114 | 3,500 | Previously Designated | All |
| Utah | Joshua Tree Proposed Wilderness | BLM | A corridor runs through the southern boundary of the Proposed Wilderness not along a major road. | 113-116 | 5,280 | Previously Designated | All |
| Utah | Beaver Dam Mountains East and West Proposed Wilderness | BLM | A corridor runs through the northeast boundary of the Proposed Wilderness not along a major road. | 113-116 | 5,280 | Previously Designated | All |
| Utah | Mountain Home Range North Proposed Wilderness | BLM | A corridor runs through the northeast boundary of the Proposed Wilderness along State HWY 21. | 110-114 | 3,500 | New | All |
| Utah | North and Central Wah Wah Mountains Proposed Wilderness | BLM | A corridor splits the Proposed Wilderness areas along Pine Valley Road. | 110-114 | 3,500 | New | All |

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| Utah | Desolation Canyon, Lost Spring Wash, and Price River Proposed Wilderness Areas | BLM | A corridor splits the Proposed Wilderness areas along US HWY 6. | 66-212 | 3,500 | New | All |
| Utah | Antelope Range Proposed Wilderness | BLM | A corridor intersects the northwest corner of the Proposed Wilderness not along a major road. | 113-114 | 3,500 | Previously Designated | All |
| Utah | Arches Adjacent Proposed Wilderness | BLM, NPS | A corridor runs through the Proposed Wilderness for about 2 miles along US Hwy 191 | 66-212 | 6,000 | New | All |
| Utah | Atchinson Mountain Proposed Wilderness | USFS | Corridor runs along border of the Proposed Wilderness for about 6 miles along a road. | 113-114 | 10,800 | Previously Designated | All |
| Utah | Bear Valley Peak - Little Creek Peak Proposed Wilderness | BLM | Corridor runs directly through Proposed Wilderness areas for about five miles not along a major road. | 116-206 | 3,500 | New | All |
| Utah | Behind the Rocks Proposed Wilderness | BLM | A corridor runs along the eastern boundary for about 11 miles along US Hwy 191. | 66-212 | Variable width | New | All |
| Utah | Brimhall Canyon Proposed Wilderness | USFS | Corridor runs along border of Proposed Wilderness for about 2 miles not along a major road. | 66-209 | 3,500 | Previously Designated | Electric-only |
| Utah | Bully Valley Mountains Proposed Wilderness | BLM | Corridor cuts across edge of Proposed Wilderness areas for about 1/3 of a mile not along a major road. | 113-114 | 3,500 | Previously Designated | All |
| Utah | Bullion Delano - City Creek Proposed Wilderness | USFS | Corridor cuts through edge of Proposed Wilderness areas for about 5 miles not along a major road | 116-206 | 3,500 | New | All |
| Utah | Cat Canyon Proposed Wilderness | BLM | A corridor cuts through the southern boundary of the Proposed Wilderness for about 1/3 mile. | 114-241 | 2,000 | Previously Designated | All |
| Utah | Chipman Peak Proposed Wilderness | USFS | Corridor cuts through edge of Proposed Wilderness for about 2.3 miles not along a major road. | 66-259 | 3,500 | New | All |

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| Utah | Circleville Mountain Proposed Wilderness | USFS | Corridor cuts through edge of Proposed Wilderness for about 3 miles not along a major road. | 116-206 | 3,500 | New | All |
| Utah | Cottonwood Basin Proposed Wilderness | BLM | Corridor cuts through edge of Proposed Wilderness areas for about 2/3 a mile not along a major road. | 116-206 | 3,500 | New | All |
| Utah | Cove Mountain Proposed Wilderness | USFS | Corridor cuts through edge of Proposed Wilderness for about 5 miles not along a major road. | 113-114 | 4,250-10,800 | Previously Designated | All |
| Utah | Duma Point Proposed Wilderness | BLM | A corridor cuts through the northern edge of the Proposed Wilderness for about 3.5 miles not along a major road. | 66-212 | 10,000 | New | All |
| Utah | Goldbar Canyon Proposed Wilderness | BLM | A corridor cuts through the northern edge of the Proposed Wilderness for about 3.5 miles not along a major road. | 66-212 | 2,500 to 5,500 | New | All |
| Utah | Gold Basin Proposed Wilderness | BLM | Corridor runs through Proposed Wilderness for about a mile not along road. | 66-212 | 5,000 | New | All |
| Utah | Goslin Mountain Proposed Wilderness | BLM | A corridor cuts throgh the northern boundary of the Proposed Wilderness for about 3.5 miles along a road | 126-218 | 3,500 | New | All |
| Utah | Hatch/Lockhart/Hart Proposed Wilderness | BLM | A corridor cuts through the eastern boundary of the Proposed Wilderness for about 4 miles along US Hwy 191 | 66-212 | Variable width | New | All |
| Utah | Lewis Peak Proposed Wilderness | USFS | Corridor cuts through edge of Proposed Wilderness for about a mile and a half not along | 256-257 | 3,000 | Previously Designated | All |
| Utah | Marysvale Peak Proposed Wilderness | BLM | Corridor cuts through edge of Proposed Wilderness areas for about 6.5 miles. | 116-206 | 3,500 | New | All |
| Utah | Mill Creek Proposed Wilderness | BLM | Corridor runs through Proposed Wilderness for about 2.7 miles not along a major road. | 66-212 | 4,200 | New | All |
| Utah | Paria Canyon Proposed Wilderness | BLM | A corridor cuts through the northern boundary of the Proposed Wilderness for about .6 miles | 68-116 | 3,500 | New | All |
| Utah | Pole Creek Proposed Wilderness | USFS | Corridor cuts through edge of Proposed Wilderness areas for about .7 miles not along a | 116-206 | 3,500 | New | All |

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| Utah | Racer Canyon / Mogutsu Proposed Wilderness | USFS | Corridor cuts through edge of Proposed Wilderness for about 9 miles along a road. | 113-114 | 10,000 | Previously Designated | All |
| Utah | Signal Peak Proposed Wilderness | BLM | Corridor cuts through edge of Proposed Wilderness areas for about 2.3 miles not along a major road. | 116-206 | 3,500 | New | All |
| Utah | South Mountain Proposed Wilderness | BLM/USFS | Corridor runs through western boundary of the Proposed Wilderness for about 3.5 miles not along a major road. | 116-206 | 3,500 | New | All |
| Utah | Stone Bridge Draw Proposed Wilderness | BLM | A corridor runs through the western boundary of the Proposed Wilderness for about 1 mile not along a major road. | 126-218 | 3,500 | New | All |
| Utah | Strawberry Ridge Proposed Wilderness | USFS | Corridor barely cuts through edge of Proposed Wilderness for about .1 miles not along a major road. | 66-259 | 3,500 | New | All |
| Utah | Tie Fork Proposed Wilderness | USFS | Corridors cut through edge of Proposed Wilderness for about 7 miles along a road and 7 miles not along a major road. | 66-212; 66-259 | 3,500 | New | All |
| Utah | Upper Kanab Creek Proposed Wilderness | BLM | A corridor intersects the Proposed Wilderness. | 116-206 | 3,500 | New | All |
| Utah | Vermillion Cliffs Proposed Wilderness | BLM | A corridor intersects the Proposed Wilderness along Johnson Canyon Road | 116-206 | 3,500 | New | All |
| Utah | Willard Proposed Wilderness | USFS | Corridor cuts through edge of Proposed Wilderness for about 1.1 miles not along a major road. | 256-257 | 2,640 | Previously Designated | All |
| Utah | Willard East Proposed Wilderness | USFS | Corridor cuts through edge of Proposed Wilderness for about .3 miles not along a major road. | 256-257 | 2,640 | Previously Designated | All |
| Utah | Willow Creek Proposed Wilderness | USFS | Corridor cuts through edge of Proposed Wilderness for about 3 miles not along a major road. | 66-259 | 3,500 | New | All |
| Utah | Dinosaur Additions Proposed Wilderness | BLM | Corridor is within 1 mile of the northestern boundary of the Proposed Wilderness not along a major road. | 126-218 | 3,500 | New | All |

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| Utah | Diamond Fork Proposed Wilderness | USFS | Corridor is within 1 mile of southern boundary of Proposed Wilderness along a road. | 66-209 | 3,500 | Previously Designated | Electric-only |
| Utah | Mapleton/Red Mountain Proposed Wilderness | BLM | Corridor is within 1 mile of southwest boundary of Proposed Wilderness along a road. | 66-209 | 3,500 | Previously Designated | Electric-only |
| Utah | Strawberry Canyons - Beehive Peak Proposed Wilderness | BLM | Corridor is within 1 mile of eastern boundary of Proposed Wilderness. | 116-206 | 3,500 | New | All |
| Utah | Glass Eye Canyon Proposed Wilderness | BLM | Corridor is within 1 mile of the western boundary of the Proposed Wilderness along Johnson Canyon Rd. | 116-206 | 3,500 | New | All |
| Utah | Burbank Hills Proposed Wilderness | BLM | Corridor is within 1 mile of the western boundary of the Proposed Wilderness along State Hwy 21. | 110-114 | 3,500 | New | All |
| Utah | Sand Ridge Proposed Wilderness | BLM | Corridor is within 1 mile of the western boundary of the Proposed Wilderness along State Hwy 287. | 114-121 | 2,000 | Previously Designated | All |
| Utah | Bourdette Draw Proposed Wilderness | BLM | Corridor is within 1 mile of the southwest boundary of the Proposed Wilderness along US Hwy 40. | 126-218 | 3,500 | New | All |
| Utah | Split Mtn. Benches Proposed Wilderness | BLM | Corridor is within 1 mile of the northwestern boundary of the Proposed Wilderness. | 126-218 | 3,500 | New | All |
| Utah | Grassy Mountains South Proposed Wilderness | BLM | Corridor is within 1 mile of the southeastern boundary of the Proposed Wilderness not along a major road. | 44-239 | 3,500 | New | All |
| Utah | Beaver Dam Mountains Wilderness | BLM | Corridor is within 1 mile of the eastern boundary of the Wilderness Area | 113-116 | 5,280 | Previously Designated | All |
| Utah | Hatch Mountain Proposed Wilderness | BLM | Corridor is within 1 mile of eastern boundary of Proposed Wilderness. | 116-206 | 3,500 | New | All |
| Washington | Eagle Rock IRA/Proposed Wild Sky Wilderness | USFS | A corridor is within 1 mile of the southwestern boundary of the IRA/Proposed Wilderness along | 102-105 | 3,000 | Previously Designated | Electric-only |
| Wyoming | Adobe Town Proposed Wilderness | BLM | A corridor cuts through the southeastern corner of the Proposed Wilderenss for about .6 miles | 73-133 | 3,500 | New | Undergr ound, |

# ATTACHMENT 10

## Analysis of US Forest Service Roadless Areas Impacted by Proposed West-Wide Energy Corridors

*(Based on best available GIS data; 12/2007)*

Units highlighted in yellow are directly intersected by a proposed corridor; units not highlighted are within 1-mile of the edge of a proposed corridor.

| State | Unit | Land Management Agency | Corridor Issue | Corridor Name/Number | Corridor Width (feet) | New or Previously Designated Corridor? | Uses Permitted? |
|---|---|---|---|---|---|---|---|
| Washington | Eagle Rock IRA/Proposed Wild Sky Wilderness | USFS | A corridor is within 1 mile of the southwestern boundary of the IRA/Proposed Wilderness along | 102-105 | 3,000 | Previously Designated | Electric-only |
| Arizona | Tumacocori USFS IRA | USFS | A corridor is within 1 mile of the eastern boundary. | 234-235 | 3,500 | New | All |
| Arizona | Hellsgate USFS IRA | USFS | A corridor is within 1 mile of the western boundary. | 62-211 | 3,500 | Previously Designated | All |
| California | Dobie Flat IRA | USFS | A corridor is within 1 mile of the eastern boundary of the IRA. | 3-8 | 3,500 | Previously Designated | All |
| California | Sears Flat IRA | USFS | A corridor is within 1 mile of the western boundary of the IRA. | 8-104 | 500 | New | All |
| California | Adams Peak IRA | USFS | A corridor is within 1 mile of the eastern boundary of the IRA. | 15-104 | 3,500 | New | All |
| California | Castle Peak IRA | USFS | A corridor is within 1 mile of the southern boundary of the IRA. | 6-15 | 3,500 | Previously Designated | All |
| California | Grouse Lakes IRA | USFS | A corridor is within 1 mile of the southern boundary of the IRA. | 6-15 | 3,500 | Previously Designated | All |
| California | Coyote Southeast IRA | USFS | A corridor is within 1 mile of the eastern boundary of the IRA. | 18-23 | 1,320 | New | All |
| California | Red Mountain IRA | USFS | A corridor is within 1 mile of the southeastern boundary of the IRA along a road. | 264-265 | 1,000 | Previously Designated | Electric only |
| California | North Fork American River IRA | USFS | A corridor is within 1 mile of the northern boundary of the IRA along I-80. | 6-15 | 3,500 | Previously Designated | All |
| California | Circle Mountain IRA | USFS | A corridor is within 1 mile of the eastern boundary along US Hwy 138 | 108-267 | 10,500 | Previously Designated | All |

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|---|---|---|---|---|---|---|---|
| California | South Fork IRA | USFS | A corridor runs through the southern portion of the IRA along State HWY 36 for about 2.5 miles. | 101-263 | 3,500 | New | All |
| California | Dog Creek IRA | USFS | A corridor runs through the eastern portion of the IRA along Interstate 5 for about 1.4 miles. | 261-262 | 2,000 | New | Electric only |
| California | Damon Butte IRA | USFS | A corridor runs through the eastern portion of the IRA along State HWY 139 for about 5 miles. | 8-104 | 3,500 | Previosly Designated | All |
| California | Deep Wells and Excelsior IRAs | USFS | A corridor splits Deep Wells and Excelsior IRAs not along a major road for about 5.5 miles | 18-23 | 1,320 | New | All |
| California | Cajon IRA | USFS | A corridor runs through the western portion of the IRA along Interstate 15 for about 1.3 miles. | 108-267 | 10,500 | Previously Designated | All |
| California | Ladd IRA | USFS | A corridor runs through the middle of the IRA not on a road. | 236-237 | 2,000 | Previously Designated | Electric only |
| California | Coldwater IRA | USFS | A corridor runs through the middle of the IRA not on a road. | 236-237 | 2,000 | Previously Designated | Electric only |
| Colorado | Bard Creek IRA | USFS | A corridor intersects the northern boundary of the IRA not along a road. | 144-275 | 500 | New | Electric-only |
| Colorado | Williams Fork IRA | USFS | A corridor runs along the northern boundary of the IRA for about a mile not along a major road. | 144-275 | 900 | New | Electric-only |
| Colorado | Byers Peak IRA | USFS | A corridor intersects the southern boundary of the IRA in several places not along a major road. | 144-275 | 900 | New | Electric-only |
| Colorado | Bard Creek IRA | USFS | A corridor runs along the northern boundary of the IRA for about 4 miles. | 144-275 | 200 | New | All |
| Colorado | Vasquez Adj. Area IRA | USFS | A corridor intersects the southwest corner of the IRA not along a major road. | 144-275 | 500 | New | Electric-only |
| Colorado | James Peak IRA | USFS | A corridor intersects the southeast corner of the IRA. | 144-275 | 200 | New | All |

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|---|---|---|---|---|---|---|---|
| Colorado | Roubideau IRA | USFS | A corridor runs along the eastern boundary of the IRA for about 2 miles not along a road. | 134-136 | 3500 | New | All |
| Idaho | Skitwish Ridge IRA | USFS | A corridor is within 1 mile of the southern boundary of the IRA not along a major road. | 229-254 | 3,500 | New | All |
| Idaho | Stevens Peak IRA | USFS | A corridor is within 1 mile of the northern boundary of the IRA along a road. | 229-254 | 3,500 | New | All |
| Idaho | Garfield Mtn. IRA | USFS | A corridor is within 1 mile o f the southwestern boundary of the IRA not along a major road. | 50-260 | 600 | Previously Designated | All |
| Idaho | Sublett IRA | USFS | A corridor is within 1 mile of the western boundary of the IRA not along a major road. | 49-202 | 3,500 | New | All |
| Idaho | Black Pine IRA | USFS | A corridor is within 1 mile of the eastern boundary of the IRA along a road. | 49-202 | 3,500 | New | All |
| Idaho | Wonderful Peak IRA | USFS | A corridor intersects the northern boundary of the IRA along a road | 229-254 | 3,500 | New | All |
| Montana | Wonderful Peak IRA | USFS | A corridor runs through the northern portion of the IRA along Interstate 90 for about 1 mile. | 229-254 | 3,500 | New | All |
| Montana | Gilt Edge-Silver Creek IRA | USFS | A corridor runs through the northern portion of the IRA along Interstate 90 for about 1 mile. | 229-254 | 3,500 | New | All |
| Montana | Italian Peak and Garfield Mountain IRAs | USFS | A corridor splits the two IRAs and appears to be within both not along a major road for about 1.3 miles. | 50-260 | 2,640 | Previously Designated | All |
| Nevada | Dune Creek Mtns. IRA | USFS | A corridor is within 1 mile of the western boundary of the IRA not along a major road. | 110-114 | 3,500 | New | All |
| Nevada | Excelsior Complex IRA | USFS | A corridor is within 1 mile of the western boundary of the IRA along State Hwy 167 | 110-114 | 3,500 | New | All |
| Nevada | Stirling Complex IRA | USFS | A corridor is within 1 mile of the western boundary of the IRA not along a major road. | 224-225 | 3,500 | New | All |

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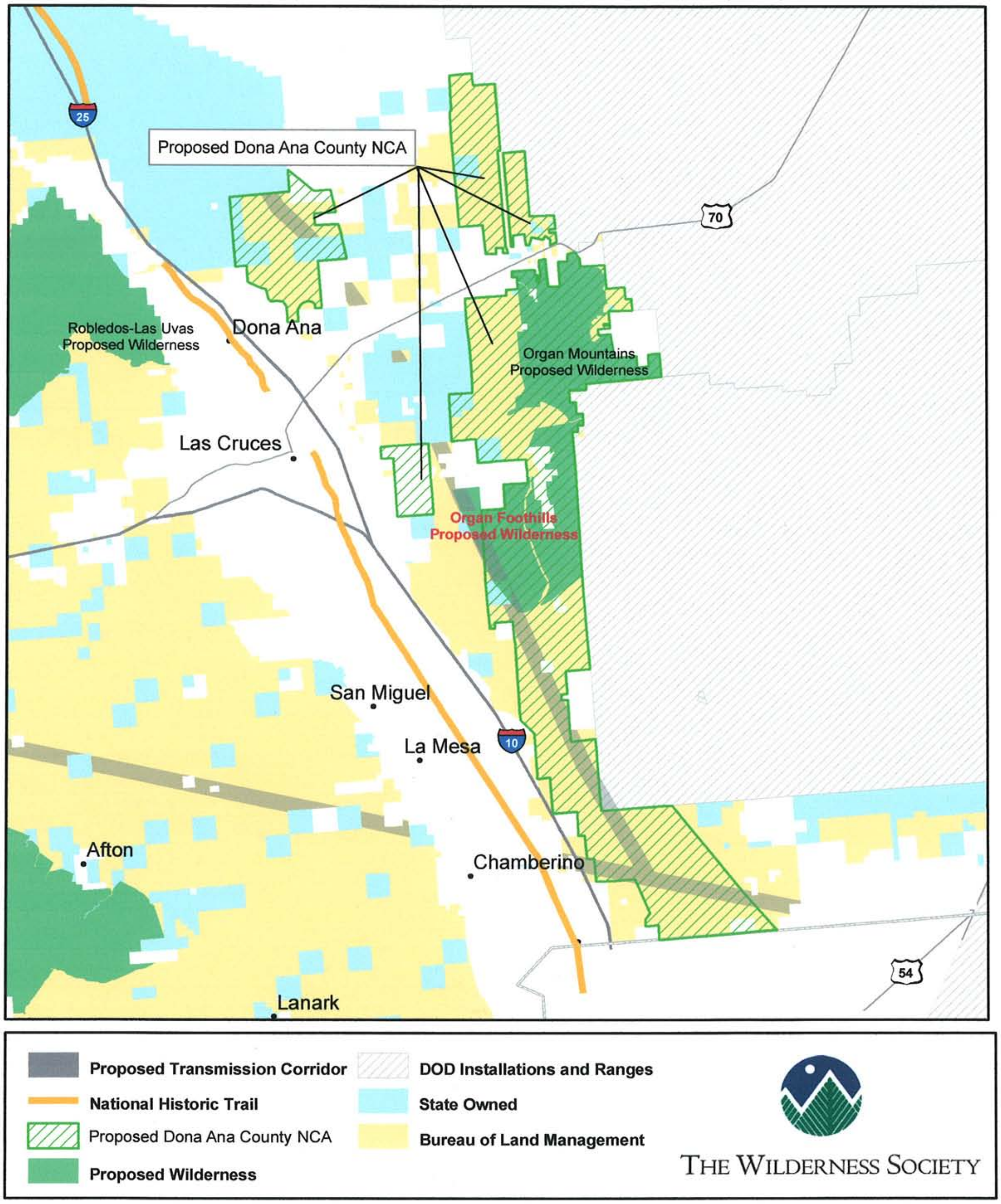
|---|---|---|---|---|---|---|---|
| Nevada | Long Valley IRA | USFS | A corridor intersects the southwest corner of the IRA along a road. | 18-23 | 3,500 | New | All |
| Nevada | Cave Creek, South Schell and Cooper IRAs | USFS | A corridor splits the three IRAs and appears to be within all three not along a major road for about 2.2 miles. | 110-114 | 3,500 | New | All |
| Nevada | Aurora Crater, Mt. Hicks, and Larken Lake IRAs | USFS | A corridor splits the three IRAs and appears to be within all three not along a major road for about 8.5 miles. | 18-23 | 3,500 | New | All |
| Oregon | Walla Walla River IRA | USFS | A corridor runs though the southern tip of the IRA for about .25 miles along State HWY 204. | 227-249 | 3,500 | New | Electric Only |
| Oregon | Crane Mountain IRA | USFS | A corridor runs though the middle of the IRA not along a major road for about 2 miles. | 7-24 | 3.500 | New | All |
| Utah | Willard and Lewis Peak IRAs | USFS | A corridor splits the two IRAs and appears to be within both along N. Ogden Canyon Rd. for about 2.1 miles and with the western boundary of Willard IRA for not on a road. | 256-257 | 2,640 | Previously Designated | All |
| Utah | 481015 IRA | USFS | A corridor cuts through the southern boundary of the IRA for about 1/3 mile. | 66-259 | 3,500 | New | All |
| Utah | 481017 IRA | USFS | Two corridors, one on the north and one on the south within the IRA -southern one is on US HWY 6. | North: 66-259, South: 66-212 | 3,500, 3,500 | New, New | All, All |
| Utah | 481008 IRA | USFS | A corridor runs through the southern portion of the IRA not along a major road for about 2.3 miles. | 66-259 | 3,500 | New | All |
| Utah | 481009 IRA | USFS | A corridor runs through the northern portion of the IRA not along a major road for about 6.5 miles. | 66-259 | 3,500 | New | All |
| Utah | Moody Wash IRA | USFS | A corridor intersects the southern boundary of the IRA for about 1/3 mile not along a major road. | 113-114 | 7,500 | Previously Designated | All |

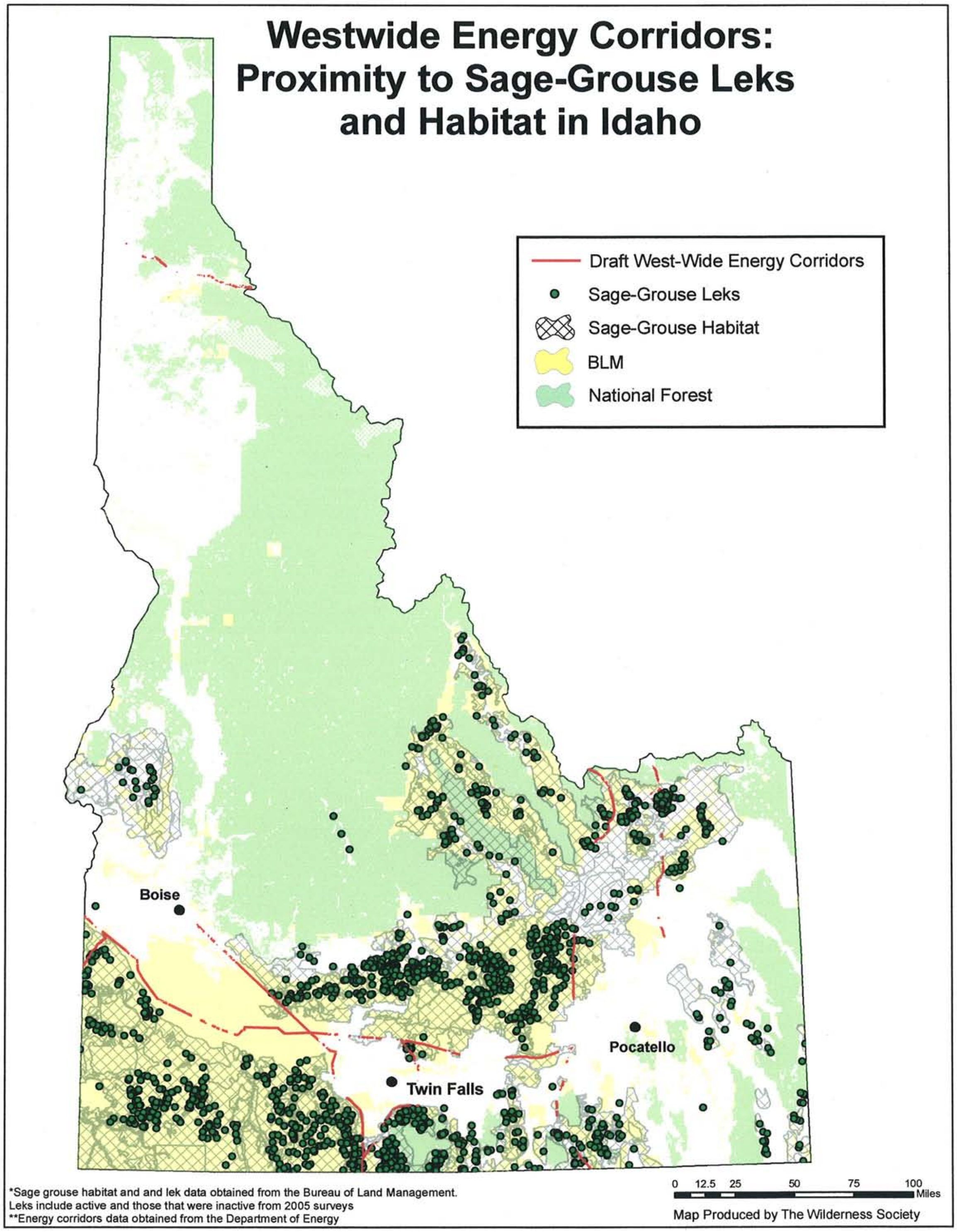
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Utah | Mogotsu, Atchinson, Gum Hill, and Cove Mountain IRAs. | USFS | A corridor splits the four IRAs and apears to be in each along State HWY 18 for about 15 miles. | 113-114 | Variable width | Previously Designated | All |
| Utah | Coal Hollow IRA | USFS | Corridor is within 1 mile of northern boundary of the IRA along a road. | 66-209 | 3,500 | Previously Designated | Electric-only |
| Utah | Signal Peak IRA | USFS | Corridor is within 1 mile of the western boundary of the IRA along I-70. | 116-206 | 3,500 | New | All |
| Utah | Marysvale Peak IRA | USFS | Corridor is within 1 mile of the western boundary of the IRA not along a major road. | 116-206 | 3,500 | New | All |
| Utah | City Creek IRA | USFS | Corridor is within 1 mile of the eastern boundary of the IRA along US Hwy 89. | 116-206 | 3,500 | New | All |
| Utah | Bull Valley IRA | USFS | Corridor is within 1 mile of the southeastern boundary of the IRA along Veyo Shoal Creek Road | 113-114 | 3,500 | Previously Designated | All |
| Washington | Alpine Lakes Adjacent IRA | USFS | A corridor is within 1 mile of the northern boundary fo the IRA along a road. | 102-105 | 500 | Previously Designated | Electric-only |
| Washington | Nason Ridge IRA | USFS | A corridor is within 1 mile of the southern boundary of the IRA along a road. | 102-105 | 500 | Previously Designated | Electric-only |
| Wyoming | 1035 IRA | USFS | A corridor runs through the IRA for about 3/4 mile. | 218-240 | 1,500 | New | Underground Only |
| Wyoming | 1036 IRA | USFS | A corridor runs through the IRA not along a major road for about 1.3 miles | 218-240 | 1,500 | New | Underground Only |

# ATTACHMENT 11

## Proposed Multi-Modal Transmission Corridor Through Organ Foothills Proposed Wilderness and Proposed Dona Ana County National Conservation Area (NM)



# ATTACHMENT 12


Westwide Energy Corridors:
Proximity to Sage-Grouse Leks
and Habitat in Idaho
Draft West-Wide Energy Corridors
Sage-Grouse Leks
Sage-Grouse Habitat
BLM
National Forest
Boise
Pocatello
Twin Falls
*Sage grouse habitat and and lek data obtained from the Bureau of Land Management.
Leks include active and those that were inactive from 2005 surveys
**Energy corridors data obtained from the Department of Energy
0 12.5 25 50 75 100 Miles
Map Produced by The Wilderness Society

# ATTACHMENT 13

WYOMING GAME AND FISH DEPARTMENT

5400 Bishop Blvd. Cheyenne, WY 82006
Phone: (307) 777-4600 Fax: (307) 777-4610
Web site: http://gf.state.wy.us



January 29, 2008

MEMORANDUM

TO: Terry Cleveland and John Emmerich

FROM: Tom Christiansen and Joe Bohne

COPY TO: Jay Lawson, Bill Rudd, Reg Rothwell, Bob Oakleaf

SUBJECT: Multi-State Sage-Grouse Coordination and Research-based Recommendations

As assigned by Assistant Director Emmerich, we have been working with other state fish and wildlife agencies in WAFWA Sage-Grouse Management Zones 1 and 2 (MT, CO, UT, SD, ND, WY) in order to coordinate interpretation of recent sage-grouse research related to oil and gas development.

Attached for your review, please find the latest and final document capturing the multi-state interpretation of the recent science related to sage-grouse conservation and oil and gas development. It has been well scrutinized by staff from MT, WY, CO, ND and UT and there is consensus on the content by the participants. South Dakota was unable to attend the initial meeting in Salt Lake City on January 8-9, but they have been provided with meeting notes and the resulting document.

It is our recommendation that WGFD acknowledge this document as the correct interpretation of the recently published sage-grouse research and use this information to update and augment department documents and policies. It should be used in the forthcoming discussions with the BLM regarding their update to their sage-grouse Instruction Memorandum. In addition, we suggest that in order for this document to serve the broadest purpose for sage-grouse conservation four additional actions are needed. First, the document should be shared with Governor Freudenthal's staff. Second, we recommend that the Director's Office enter into discussions with MT FWP Director Jeff Hagener to ensure consistency in the application of these recommendations between our border states, and especially with the WY and MT BLM State Field Offices. Third, we recommend the document be submitted to WAFWA's Sage-Grouse Technical Committee as well as the WAFWA Executive Committee for their consideration and use. Finally, we recommend this document be included with other materials sent to the USFWS for consideration in their review of the status of sage-grouse and measures in place to conserve those populations.

We look forward to your direction on how to proceed.

*"Conserving Wildlife - Serving People"*

**Using the Best Available Science to Coordinate Conservation Actions that Benefit Greater Sage-Grouse Across States Affected by Oil & Gas Development in Management Zones I-II (Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming)**

**Background**

Greater Sage-grouse are widely considered in scientific and public policy arenas to be a species of significant conservation concern. Loss, degradation and fragmentation of important sagebrush grassland habitats have negatively impacted sage-grouse populations. Much of this loss of habitat function is occurring in Sage-grouse Management Zones (MZ) 1 and 2 (Stiver et al. 2006) in Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming as a result of oil and gas development (Connelly et al. 2004). Oil and gas development is rapidly increasing within these areas. In response to those concerns, states and provinces are in various stages of completing or updating management plans in order to provide for long-term sage-grouse conservation. Special emphasis is being placed on oil and gas development as it rapidly spreads across much of the eastern range of sage-grouse.

The recent decision by B. Lynn Winmill, Chief U.S. District Judge (2007), which remands the original 2005 not warranted decision back to the USFWS for reconsideration, has highlighted the need for States to coordinate their application of best available science. Representatives from the state agencies with authority for managing fish and wildlife from the major sage-grouse and energy producing states comprising MZ 1 and 2 and sage-grouse researchers who have published new findings, met on January 8 and 9, 2008 in Salt Lake City. The objectives of the meeting were to better understand the application of most recent peer-reviewed science within the context of oil and gas development and coordinate and compare implementation of conservation actions utilizing that information.

**Review Process**

The participants at this meeting represented technical science and management advisors from each of the states. Researchers having the most recently peer reviewed and published articles concerning sage grouse and oil and gas development were invited to present their findings and answer questions. State agency participants agreed that the goal was not to establish state or regional policy or to determine the management actions that will be implemented in any or all states within MZ 1 or 2. Rather, the goal was to reach agreement on the conservation concepts and strategies related to oil and gas development that are supported by current published peer-reviewed and unpublished literature. If implemented, these concepts and strategies likely will not eliminate impacts to sage-grouse populations that result from energy development. However, when used in combination with other conservation measures, these actions may enhance the likelihood that sage-grouse populations will persist at levels that allow historical uses such as grazing and agriculture and maintain their current distribution and abundance, thereby avoiding the need to list sage-grouse under the federal Endangered Species Act.

Each researcher was invited to present their findings and to answer questions posed by the states. Following this, each state provided an overview of their review of the science and their resulting management actions and recommendations. The group then collectively reviewed, debated and agreed on the concepts and strategies supported by that science. The focus of the meeting was on five key issues: core areas, no-surface-occupancy zones, phased development, timing stipulations, well-pad densities, and restoration. Scientific data are available to inform many other issues related to sage-grouse management and conservation that were not reviewed (e.g., BMPs).

**Core Areas**

Identification and protection of core areas, sometimes also referred to as crucial areas, will help maintain or achieve target goals for populations including distribution and abundance.

Full field energy development appears to have severe negative impacts on sage-grouse populations under current lease stipulations (Lyon and Anderson 2003, Holloran 2005, Kaiser 2006, Holloran et al. 2007, Aldridge and Boyce 2007, Walker et al 2007, Doherty et al. 2008). Much of greater sage-grouse habitat in MZ 1 and 2 has already been leased for oil and gas development. These leases carry stipulations that have been shown to be inadequate for protecting breeding and wintering sage-grouse populations during full field development. (Holloran 2005, Walker et. al. 2007, Doherty et al. 2008) New leases continue to be issued utilizing these same stipulations. To ensure long-term persistence of populations and meet goals set by the states for sage-grouse, identifying and implementing greater protection within core areas from impacts of oil and gas development is a high priority.

In order to conserve core areas it is essential that they be identified and delineated. Sage-grouse populations occur over large landscapes comprising a series of leks and lek complexes with associated seasonal habitats. Therefore, core areas should capture the range required by a defined population to maintain itself. This concept is consistent with Crucial Wildlife Habitats recently endorsed by the Western Governor's Association (2007). Criteria that could be used to identify and map core areas include, but are not limited to: (1) lek densities, (2) displaying male densities, (3) sagebrush patch sizes, (4) seasonal habitats (breeding, summering, wintering areas), (5) seasonal linkages, or (6) appropriate buffers around important seasonal habitats.

Research indicates that oil or gas development exceeding approximately 1 well pad per square mile with the associated infrastructure, results in calculable impacts on breeding populations, as measured by the number of male sage-grouse attending leks (Holloran 2005, Naugle et al. 2006). Because breeding, summer, and winter habitats are essential to populations, development within these areas should be avoided. If development cannot be avoided within core areas, infrastructure should be minimized and the area should be managed in a manner that effectively conserves sagebrush habitats within that area.

**No Surface Occupancy (NSO)**

At the scale that NSOs are established, they alone will not conserve sage-grouse populations without being used in combination with core areas. The intent of NSOs is to maintain sage-grouse distribution and a semblance of habitat integrity as an area is developed.

*Breeding Habitat - Leks*

Research in Montana and Wyoming in coal-bed methane natural gas (CBNG) and deep-well fields suggests that impacts to leks from energy development are discernable out to a minimum of 4 miles, and that some leks within this radius have been extirpated as a direct result of energy development (Holloran 2005, Walker et al. 2007). Walker et al. (2007) indicates that the current 0.25-mile buffer lease stipulation is insufficient to adequately conserve breeding sage-grouse populations in areas having full CBNG development. A 0.25-mi. buffer leaves 98% of the landscape within 2 miles open to full-scale energy development. In a typical landscape in the Powder River Basin, 98% CBNG development within 2 miles of leks is projected to reduce the average probability of lek persistence from 87% to 5% (Walker et al. 2007). Only 38% of 26 leks inside of CBNG development remained active compared to 84% of 250 leks outside of development (Walker et al. 2007). Of leks that persisted, the numbers of attending males were reduced by approximately 50% when compared to those outside of CBNG development (Walker et al. 2007).

The impact analyses provided in Walker et al. (2007) are based on a 7-year dataset where probability of lek persistence is strongly related to extent of sagebrush habitat and the extent of energy development within 4 miles of the lek and the extent of agricultural tillage in the surrounding landscape. The estimated probabilities of lek persistence are only reliable for the length of the dataset, and it is not understood how other stressors (e.g., West Nile virus [Naugle et al. 2004], invasive weeds [Bergquist et al. 2007]) will cumulatively impact sage-grouse over longer time periods. While increased NSO buffers alone are unlikely to conserve sage-grouse populations, results from Walker et al. 2007 suggest they will increase the likelihood of maintaining the distribution and abundance of grouse and should increase the likelihood of successful restoration following energy development.

Additional information provided in Walker et al. (2007) allows managers and policy makers to estimate trade-offs associated with allowing development within a range of different distances from leks (Figures 1a and 1b). These probabilities will also need to be applied over larger landscapes in future analyses to better understand projected region- and state-wide population impacts under current and future development scenarios. Walker et al. (2007) studied lek persistence from 1997-2005 in relation to coal bed natural gas (CBNG) development in the Powder River Basin. These models are based on projected impacts of full-field development within (a) 2 miles and (b) 4 miles of the lek. We present results from these models (rather than models with impacts at smaller scales) because development within 2 and 4 miles of leks are known to decrease breeding populations as measured by the number of displaying males (Holloran et al. 2005, Walker et al. 2007), and 52% and 74-80% of hens are known to nest within 2 and 4 miles of leks, respectively (Holloran and Anderson 2005, Colorado Greater Sage-Grouse Conservation Plan Steering Committee 2008). Sizes of NSO buffers required to protect breeding populations may be underestimated because leks in CBNG fields have fewer males per lek and a time lag occurs (avg. 3-4 years) between development and when leks go inactive. As a result, it is expected that not only will lek persistence decline, the number of males per lek will also decline. In contrast, sizes may be overestimated where high lek densities cause buffers from adjacent leks to overlap. Additional time is required to develop models demonstrating the probabilities of lek persistence at well-pad densities less than full development.

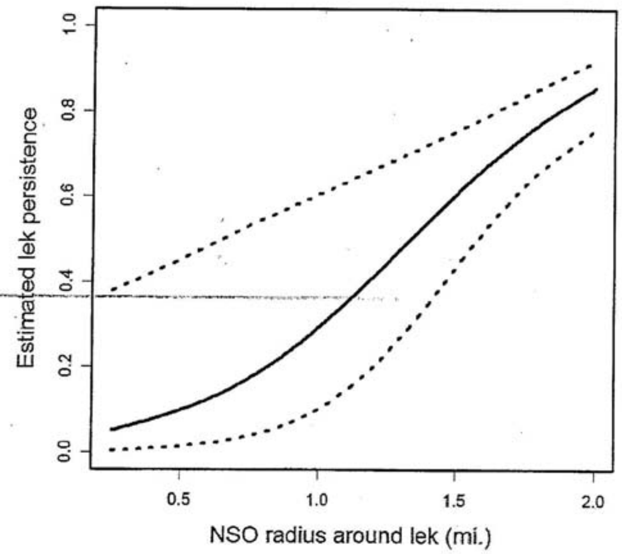



Figure 1a. Estimated probability of lek persistence (dashed lines represent 95% CIs) in fully-developed[1] coal-bed natural gas fields within an average landscape in the Powder River Basin (74% sagebrush habitat, 26% other habitats types) with different sizes of no-surface-occupancy (NSO) buffers around leks, assuming that only CBNG within 2 miles of the lek affects persistence. Buffer sizes of 0.25 mi., 0.5 mi., 0.6 mi., and 1.0 mi. result in estimated lek persistence of 5%, 11%, 14%, and 30%. Lek persistence in the absence of CBNG averages ~85%.

[1] Defined as entire area outside the NSO buffer, but within 2 miles, being within 350 meters of a well.

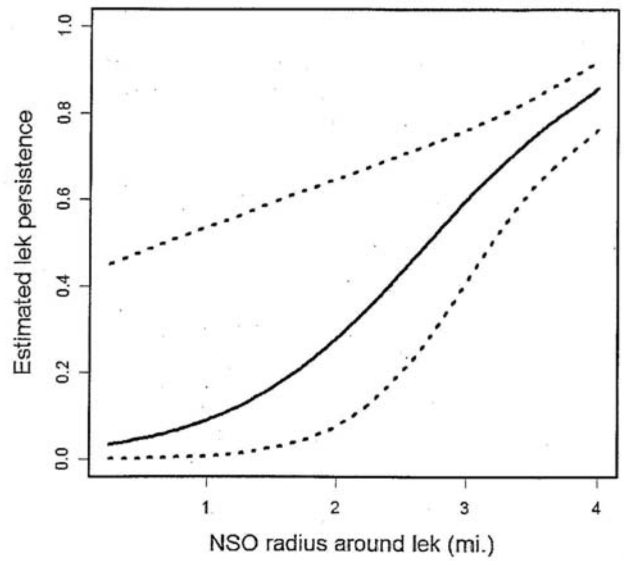



Figure 1b. Estimated probability of lek persistence (dashed lines represent 95% CIs) in fully-developed[2] coal-bed natural gas fields within an average landscape in the Powder River Basin (74% sagebrush habitat, 26% other habitats types) with different sizes of no-surface-occupancy (NSO) buffers around leks, assuming that only CBNG within 4 miles of the lek affects persistence. Buffer sizes of 0.25 mi., 0.5 mi., 0.6 mi., 1.0 mi., and 2.0 mi. result in estimated lek persistence of 4%, 5%, 6%, 10%, and 28%. Lek persistence in the absence of CBNG averages ~85%.

Figures 1a and 1b provide an illustration of the trade-offs between differing NSO buffers in relation to lek persistence in developing CBNG fields. The group does not offer a specific NSO recommendation but provides these graphs to guide decision-making.

*Breeding Habitat - Nesting and Early Brood-rearing*

Yearling female greater sage-grouse avoid nesting in areas within 0.6 miles of producing well pads (Holloran et al. 2007), and brood-rearing females avoid areas within 0.6 miles of producing wells (Aldridge and Boyce 2007). This suggests a 0.6-mile NSO around all suitable nesting and brood-rearing habitats is required to minimize impacts to females during these seasonal periods. In areas where nesting habitats have not been delineated, research suggests that greater sage-grouse nests are not randomly distributed. Rather, they are spatially associated with lek location within 3.1 miles in Wyoming (Holloran and Anderson 2005). However, a 4-mile buffer is needed to encompass 74-80% (Moynahan

[2] Defined as entire area outside the NSO buffer, but within 4 miles, being within 350 meters of a well.

2004, Holloran and Anderson 2005, Colorado Greater Sage-Grouse Conservation Plan Steering Committee 2008). These suggest that all areas within at least 4-miles of a lek should be considered nesting and brood-rearing habitats in the absence of mapping.

*Winter Habitat*

NSO or other protections may also need to be considered for crucial winter range. Survival of juvenile, yearling, and adult females are the three most important vital rates that drive population growth in greater sage-grouse (Holloran 2005, Colorado Greater Sage-Grouse Conservation Plan Steering Committee 2008). Although overwinter survival in sage-grouse is typically high, severe winter conditions can decrease hen survival (Moynahan et al 2006). Crucial wintering habitats can constitute a small part of the overall landscape (Beck 1977, Hupp and Braun 1989). Doherty et al. (2008) demonstrated that sage-grouse avoided otherwise suitable wintering habitats once they have been developed for energy production, even after timing and lek buffer stipulations had been applied (Doherty et al. 2008). For this reason, increased levels of protection may need to be considered in crucial winter habitats.

**Phased Development**

Population-level impacts and avoidance associated with energy development have been documented (Braun et al. 2002, Lyon and Anderson 2003, Holloran 2005, Kaiser 2006, Holloran et al. 2007, Aldridge and Boyce 2007, Walker et al 2007, Doherty et al. 2008). Phased development maximizes the amount of area within a landscape that is not being impacted by development at any one time, and can occur at multiple spatial scales (e.g., phased development of separate fields in a landscape, phased development of infrastructure within a single unit or field, or phased development within a single lease). Unitization, clustering, and geographically staggered development are all forms of phased development. As a tool to minimize impacts to sage-grouse, developing oil and gas resources by employing one of these phased methods may help maintain large, functional blocks of sage-grouse habitat.

**Timing Stipulations**

As with NSOs, at the scale that timing stipulations are established, they alone will not conserve sage-grouse populations without being used in combination with core areas. The intent of timing stipulations is to help maintain sage-grouse distribution and a semblance of habitat integrity as an area is developed. Timing stipulations are of lesser value at the scale of full-field development.

*Breeding Habitat - Leks*

Traffic during the strutting period when males are on a lek results in declines in male attendance when road-related disturbance is within 0.8 miles (Holloran 2005). The distance traveled by males from the lek during the breeding season has been reported in varying ways but generally averages 0.6 miles from a lek (Colorado Greater Sage-Grouse

Conservation Plan Steering Committee 2008 - see Appendix B). Additionally, females breeding on leks within 1.9 miles of natural gas development had lower nest initiation rates and nested farther from the lek compared to non-impacted individuals (Lyon and Anderson 2003), suggesting disturbance to leks influence females as well. Local variations may influence the application of specific dates, which are typically within a window of March 1 and May 31.

*Breeding Habitat - Nesting and Early Brood-rearing*

Often, timing stipulations (periods where no activity that creates disturbance are allowed) for breeding habitat have been applied using a radius around a lek. However, nesting and brood-rearing habitat is not uniformly distributed around the lek. Mapping of habitat would allow for more accurate application of this stipulation. Research on the distribution of nests relative to leks and on the timing of nesting indicates that timing stipulations to protect nesting hens and their habitat should be in place from March through June in mapped breeding habitat or (when nesting habitat has not been mapped) within 4 miles of active lek sites (Moynahan 2004, Holloran et al. 2005, Colorado Greater Sage-Grouse Conservation Plan Steering Committee 2008).

*Winter Habitat*

Research suggests that no surface occupancy should also be applied to important wintering habitats (Doherty et al. 2008), but if development occurs, impacts would be reduced if development activities were avoided between December 1 and March 15.

**Well-Pad Densities**

Leks tend to remain active when well-pad densities within 1.9 miles of leks are less than 1 pad per square mile (Holloran 2005) but leks tend to go inactive at higher pad densities (Holloran 2005, Naugle et al. 2006).

**Restoration**

The purpose of restoration in sage-grouse habitat should be the removal of infrastructure associated with energy development from the land surface and subsequent re-establishment of native grasses, forbs, and shrubs, including sagebrush, to promote natural ecological function. Restoration should reestablish functionality of seasonal habitats for sage-grouse. Thus a field should not be considered restored until sagebrush-grassland habitats have been reestablished.

**Future Needs**

Time did not allow for a detailed discussion of specific Best Management Practices for oil and gas development and restoration, seasonal habitat mapping, or future research. These topics are all recognized as needing action in the immediate future.

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Appendix 1.

**Participants (Alphabetical)**

Dr. Tony Apa, Colorado Division of Wildlife
Mr. Joe Bohne, Wyoming Game and Fish Department
Mr. Tom Christiansen, Wyoming Game and Fish Department
Mr. Jeff Herbert, Montana Department of Fish, Wildlife and Parks
Mr. Bill James, Utah Division of Wildlife Resources
Mr. Rick Northrup, Montana Department of Fish, Wildlife and Parks
Mr. Dave Olsen, Utah Division of Wildlife Resources
Mr. Aaron Robinson, North Dakota Game and Fish
Ms. Pam Schnurr, Colorado Division of Wildlife
Mr. T.O. Smith, Montana Department of Fish, Wildlife and Parks
Mr. Brett Walker, Colorado Division of Wildlife

**Invited Guests**

Dr. Matt Holloran, Wyoming Wildlife Consultants, LLC
Dr. David Naugle, University of Montana

# ATTACHMENT 14

# A Blueprint for Sage-grouse Conservation and Recovery

Prepared by

Clait E. Braun, Ph.D.

Grouse Inc.
Tucson, Arizona

**May 2006**

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***Abstract:*** The distribution of greater sage-grouse (*Centrocercus urophasianus*) has declined by at least 44% while overall abundance has decreased by up to 93% from presumed historic levels. These decreases are the result of habitat loss, fragmentation, and degradation. Federal and state public land management agencies currently are responsible for about 70% of the remaining sagebrush (*Artemisia* spp.) steppe, with the Bureau of Land Management and U.S. Forest Service managing most of these lands for multiple uses. The goals of strategies outlined here are to improve sagebrush habitats to increase greater sage-grouse abundance by at least 33% by 2015, and overall distribution of greater sage-grouse by at least 20% by 2030. The abundance goal is achievable following recommendations presented in this document while the distribution goal will be more difficult to obtain. Federal land management agencies are key to achieving both goals, as they are responsible for managing public lands, which support most of the remaining populations of greater sage-grouse. Improved vegetation management to restore degraded habitat (from domestic livestock grazing and development, such as from mining and gas/oil extraction) followed by reduction of habitat fragmentation has the greatest potential for maintaining and enhancing viable populations of greater sage-grouse. While the habitat management strategies and recommendations in this report focus on greater sage-grouse, they are also applicable to Gunnison sage-grouse (*Centrocercus minimus*).

## Introduction

Sage-grouse (*Centrocercus urophasianus, C. minimus)* are dependent upon sagebrush (*Artemisia* spp.) and were historically widespread and at least locally abundant (Patterson 1952, Schroeder et al. 2004). Concern about the decrease in the abundance of sage-grouse is not only recent (Connelly and Braun 1997, Braun 1998, Connelly et al. 2004) but also long-term (Hornaday 1916, Patterson 1952). Sagebrush was also historically widely distributed in western North America (Küchler 1964, Vale 1975, Miller and Eddleman 2001, Schroeder et al. 2004). In the United States, about 70% of the remaining sagebrush steppe and distribution of sage-grouse is on public land, with most (~50% of all publicly owned sagebrush steppe) managed by the U. S. Department of Interior, Bureau of Land Management (BLM) (Connelly et al. 2004). Thus, the BLM and the U.S. Forest Service (USFS) (U.S. Department of Agriculture) have the greatest potential to positively impact sage-grouse abundance and distribution provided effective policies and conservation actions are implemented that will benefit sagebrush steppe habitats. Overall, the "responsibility for maintaining sagebrush habitats and [sage-grouse] populations rests squarely on public land management agencies because most [of the] species' [home] range [is] owned publicly and managed by state or federal agencies" (Knick et al. 2003:627, Connelly et al. 2004).

## Statement of Problem

The abundance and distribution of greater sage-grouse (*Centrocercus urophasianus*) have declined. Sage-grouse historically occupied at least 1,247,004 km² in western North America of which at least 1,200,483 km² were occupied by greater sage-grouse (Schroeder et al. 2004). Greater sage-grouse now occupy about 668,412 km² of their estimated historical distribution and have been extirpated from 1 state (Nebraska) and 1 Canadian province (British Columbia) (Braun 1998). There are no data on historical numbers (pre-European settlement) but estimates range from at least 2 to 10 million birds (C. E. Braun, illustrated presentation to the Western Association of Fish and Wildlife Agencies, Jackson Hole, Wyoming, July 1998). Braun (1998) further presented estimated breeding population levels by state and province based on counts of male sage-grouse in spring 1998 as reported by state and provincial biologists. The total was presented as ~142,000 sage grouse (Braun 1998:141). This suggests a decrease of ~93% in overall abundance if the minimum historical estimate of 2 million sage grouse is used. Braun (1998) generally classified reasons for the apparent decrease in sage-grouse abundance as the result of habitat loss, habitat fragmentation, and habitat degradation. More recently, Connelly et al. (2004:13-4) indicated that of 41 populations defined for their analysis, 5 populations have been extirpated or have numbers too small to monitor, and 14 additional populations face a high risk of extinction. The vast majority of remaining sage-grouse are in only 8 populations. Additionally, Connelly et al. (2004: 6-67) reported that an examination of all trend data from the 1940s to 2003 "suggest a substantial decline in the overall sage-grouse population in North America." Sage-grouse populations declined at an overall rate of 2.0% per year from 1965 to 2003 (Connelly et al. 2004). These authors (2004:6-71) concluded, "Continued loss and degradation of habitat and other factors…do not provide causes for optimism."

**Goals**

With respect to conservation of sage-grouse and the species' habitats as well as other sagebrush obligate species, the overall goal of management of public lands should be to (1) maintain the present abundance and distribution of greater sage-grouse and (2) enhance the population viability of the species through habitat management that results in increased abundance and distribution. While it is necessary to understand past changes in abundance and distribution of greater sage-grouse, it is also important to understand the present status of the species and to work towards a goal of no net loss of sagebrush steppe presently or potentially useful to sage-grouse, no further loss of populations or subpopulations, and enhancement of sage-grouse numbers by one-third (33%) and overall distribution by one-fifth (20%) (from ~668,412 $km^2$ to 835,000 $km^2$). The abundance goal can likely be achieved by 2015 while the enhanced distribution goal is longer term (2030). Both desired increases (33% in abundance, 20% in distribution) were selected (by C. E. Braun) because they should be achievable, detectable, and measurable using current technology. A 20% increase in distribution was selected, as it should be detectable. Smaller increases in distribution are not likely to be detectable or measurable.

**Habitat Needs Overview**

The habitat needs of greater sage-grouse are reasonably well understood based on knowledge of what has been described as "used" by sage-grouse (extensive literature summarized in Braun et al. 1977, Connelly et al. 2000*b*, Braun et al. 2005). The basic seasonal periods relating to sage-grouse habitat needs have been described as winter (early to mid-December to early to mid-March), spring (early to mid-March to early to mid-June), summer (early to mid-June to late September), and fall (late September to early to mid-December) depending upon elevation and weather conditions (Braun et al. 2005). A summary (Braun et al. 2005) of the existing literature is attached as an appendix.

**Management of Development**

Development of sagebrush steppe could include agricultural uses (usually permanent loss), which includes converting sagebrush habitats to cropland, placement of ranch/farm buildings, or the replacement of native sagebrush habitats with seeded pasture lands. Development may also refer to permanent conversion of sagebrush habitats to urban, suburban, and exurban uses (housing), and related infrastructure. "Development" as used in this section refers primarily to energy development, which includes mining (coal, gold, trona, and other mineral deposits) and extraction of natural gas (including coal bed methane) and oil. The following are minimum recommendations for development in sage-grouse habitats as it has been documented that some populations of greater sage-grouse require larger areas for breeding, brood-rearing, winter-use, and security depending upon whether they are migratory or non-migratory (Connelly et al. 2000*b*).

**Noise**

Sage-grouse are known to select display sites (leks) that are highly visible and which have good acoustic properties (Patterson 1952, Connelly et al. 2000*b*, Lyon 2000, Braun et al. 2002). Sage-grouse numbers on leks within 1.6 km (1 mile) of coal bed methane (CBM) compressor stations in Campbell County, Wyoming, were consistently lower than on leks not affected by this disturbance (Braun et al. 2002). Holloran and Anderson (2005) reported that lek activity by sage-grouse decreased downwind of drilling activities, suggesting that noise had measurable negative impacts on sage-grouse. Roads also generate noise and Connelly et al. (2004) indicated there were no active sage-grouse leks within 2 km of Interstate 80 (I-80) across southern Wyoming and only 9 leks were known to occur between 2 and 4 km of I-80. Lyon and Anderson (2003) reported that oil and gas development influenced the rate of nest initiation of sage-grouse in excess of 3 km of construction activities. Clearly, the amount and (likely) frequency of noise associated with development has major negative effects on greater sage-grouse.

Consequently, all drilling activities for gas and oil development should be prohibited within 5.5 km (3.3 miles) of active leks and their associated nesting areas (Holloran 2005). Further, all existing and new compressor stations should add noise abatement devices (mufflers) to reduce audible noise within 5.5 km of active leks. The actual level of noise (measured in decibels) that would not negatively affect greater sage-grouse breeding and nesting activities is presently unknown.

**Physical Disturbance**

Greater sage-grouse are known to be negatively impacted by activities associated with mining, and oil and gas development (Remington and Braun 1991, Aldridge 1998, Lyon and Anderson 2003, Holloran and Anderson 2005). Besides the actual physical disturbance to the landscape caused by mining and oil and gas development activities, the impacts of roads are also negative for sage-grouse (Connelly et al. 2004). There are numerous examples of active leks being abandoned once road use associated with mining and gas/oil development increased in close proximity (< 1 km) to leks and nesting habitat (Braun 1986).

All surface activity should be prohibited within 5.5 km (Holloran and Anderson 2004, 2005) of active sage-grouse leks. No surface occupancy is preferred to simply limiting use of areas to specific periods, as the latter does not appear to benefit sage-grouse. Roads should not be placed within 5.5 km (3.3 miles) of active leks. If roads are present, they should be seasonally closed during the sage-grouse breeding season from 1 March to 20 June.

## Management of Fire

### Prescribed Fire

Fire has been demonstrated to be negative for greater sage-grouse (Hulet 1983; Connelly et al. 2000*a*, *b*; Nelle et al. 2000) as it destroys winter and nesting habitats. Use of fire has been promoted by public land management agencies (both BLM and USFS) to reduce sagebrush cover and increase forbs. However, the only presumed value of this practice is to improve brood-use areas or remove encroaching conifers. The problems with use of prescribed fire relate to control of the fire (escapement is frequent), what is actually burned versus what was desired to be burned, and size of the planned burn. Too often, what is burned is nesting or winter-use areas and burned areas are too large (> 20 ha).

Prescribed fire should not be used in areas where invasion of cheatgrass (*Bromus tectorum*) or other exotic species is likely. Burned areas should be smaller than 20 ha in size and no more than 20% of the landscape (128 ac per section [640 ac]) should be burned over a 30-year interval in taller sagebrush types. Burning should not be permitted in low sagebrush habitat types (i.e., *Artemisia arbuscula, A. longiloba, A. nova*). Burning that benefits sage-grouse will most likely be that which affects brood habitat. There should be a demonstrated need for additional brood habitat before use of prescribed fire is considered. The goal is to not exceed 20% fire coverage (128 ac per section [640 ac]) over a 30-year period regardless of the total area planned to be burned. Reseeding should not be necessary for prescribed burns, as areas should be sufficiently small so that surrounding sagebrush habitat can reseed the areas naturally.

### Wild Fire

All wild fires should be vigorously suppressed except in areas where juniper (*Juniperus* spp.) or pinyon pine (*Pinus edulis*) has invaded (>20 trees/ha). Most wild fires are negative for sage-grouse in the short-term. If wild fires occur, grazing by domestic livestock should be immediately suspended and should not be reinstated for a minimum of 3 years. The present 2-year rest period from grazing that is often prescribed on public lands following wild fires is not based on data. Replicated studies are needed across the gradient of moisture regimes and habitat types to learn if 3 years or more are adequate for ecosystem renewal following wild fire. Most areas burned by wild fire do not require reseeding, as disking and other forms of site preparation can be harmful to site restoration. These are practices that promote livestock grazing, not habitat restoration. If reseeding must be done to reduce soil erosion, it should occur in linear strips perpendicular to the prevailing wind except on steeper (>30%) slopes. Strips should be planted with dryland alfalfa, biennial sweet clover, native bunch grasses, and sagebrush seed in a ratio of 1 strip (10 m width) per 50 m. Areas closest to a potential fire source (roads or railroads) should be planted with a 20-m wide strip of fire resistant vegetation.

## Management of Grazing

Sound grazing management in sagebrush steppe should promote light use of herbaceous forage while having a neutral or positive impact on plant vigor. Further, proper livestock grazing should maintain or enhance desirable plant communities, improve vegetation palatability, increase native plant diversity, and promote residual vegetative cover. Extreme caution should be exercised in grazing sagebrush steppe until scientific evidence is obtained through replicated studies that demonstrate grazing improves, restores, or maintains the ecosystem. It is questionable if grazing of sagebrush-dominated rangelands that produce less than 448 kg per ha (400 lbs/ac) per year of herbaceous forage should be permitted. Domestic livestock grazing should not be permitted of any sagebrush steppe habitats that produce less than 224 kg per ha (200 lbs/ac) of herbaceous vegetation per year if successful sage-grouse nesting and brood rearing is an objective. Unfortunately, there are no replicated long-term studies of the effects of stocking rates for cattle in sagebrush grasslands (Holechek et al. 1999:12).

### Livestock

Grazing by domestic cattle can negatively impact nesting success of ground-nesting birds (Walsberg 2005). Several studies have demonstrated that greater sage-grouse nest success is higher where grass height and density is greater than at random sites (Wakkinen 1990, Gregg 1991). Thus, livestock grazing that reduces herbaceous cover in sagebrush steppe may negatively affect nest success of sage-grouse. Sites used by sage-grouse broods are characterized by higher plant species richness (Dunn and Braun 1986, Klott and Lindzey 1990, and others) with strong grass and forb components (Sveum et al. 1998). Excessive livestock use may damage these important areas.

Livestock stocking rates are most important in affecting forage use and residual herbaceous cover followed by timing of grazing and length of the grazing season. The most common prescription used by public land management agencies on public lands is that of 'moderate use'. Holechek et al. (1999:12) equated 'moderate use' to removal of an average of 43% (their Table 2) of the primary forage species. These authors found that moderate use resulted in rangeland deterioration in semi-arid grasslands. Holechek et al. (1999:15) recommended that no more than 30-35% use of annual herbaceous production would be necessary for improvement in rangeland vegetation versus the common recommendation of 50% use by the Natural Resources Conservation Service.

My recommendation, if livestock grazing is permitted on public rangelands, is to not exceed 25-30% utilization of herbaceous forage each year. Grazing should not be allowed until after 20 June and all livestock should be removed by 1 August with a goal of leaving at least 70% of the herbaceous production each year to form residual cover to benefit sage-grouse nesting the following spring. Twice-over grazing systems, where livestock pass through an area twice in a grazing season, should be avoided, and full rotation of each subdivision of an allotment or at least on a pasture basis should occur once every 4 years. Winter grazing is generally less negative for herbaceous vegetation and sage-grouse than grazing during the growing season. Care should be used in calculating stocking rates to ensure that no more than 25-30% forage utilization is achieved. Winter grazing should not be initiated until plant growth has ceased for the year and should generally occur in the 15 November to 1 March interval. Larger pastures with fewer fences are better than smaller pastures. Water and salt should be placed near fences or fence corners, as these areas (fences and fence corners) tend to 'naturally' attract livestock. The goal should be to reduce livestock impacts in the centers of pastures or allotments. Because fences are generally negative for sage-grouse (Connelly et al. 2004), placement of water and salt near fences can be used to concentrate livestock impacts in areas removed from the more valuable habitats for sage-grouse.

**Wildlife**

Native wildlife, primarily elk (*Cervus elaphus*), but also deer (*Odocoileus* spp.), pronghorn (*Antilocapra americana*), and hares (*Lepus* spp.), graze sagebrush steppe. Except in limited situations, such as within fenced pastures (to benefit domestic sheep which may prevent pronghorn movement), severe winter conditions, or unique situations (especially with hares), grazing by native wildlife species of particular sites is non-repetitive (unlike with domestic livestock). Hunting regulations by state and provincial agencies should keep populations of game animals within herd objectives. Management of elk can be difficult in achieving adequate harvests. State and provincial wildlife agencies should rigorously seek to manage elk within stated herd objectives or to reduce their numbers when sage-grouse habitat objectives are at risk. In areas where herd objectives cannot be met through legal hunting, reintroduction of native large predators should be considered.

'Wild' horses and burros also occupy some public lands and can cause habitat deterioration in areas important to sage-grouse. Efforts should be made to reduce or eliminate undocumented or permitted horses and burros on public lands important to sage-grouse where habitat deterioration is occurring.

**Management of Habitat Fragmentation**

Fragmentation of habitats useful for greater sage-grouse is not of recent origin, but only recently has it been accorded proper recognition (Braun 1998, Connelly et al. 2004). There are many factors that can fragment habitats from conversion of habitat type (agriculture adjacent to sagebrush steppe), to fences, power lines, roads, reservoirs, wild fire, and prescribed burns. Essentially, any land use, development, or treatment that subdivides blocks of intact sagebrush causes fragmentation. Management of sagebrush steppe should focus on maintaining large (>1 cadastral section [2.59 $km^2$ or 1 $mi^2$]) blocks of sagebrush steppe and preferably in excess of 20 cadastral sections [51.8 $km^2$ or 20 $mi^2$] in size. These blocks should conserve habitat at the landscape scale with at least 1 large block per Township (36 cadastral sections [93.2 $km^2$ or 36 $mi^2$]) throughout the sagebrush steppe. This recommendation is based on personal observations as well on published literature (Toepfer et al. 1990).

Continuity among habitat patches is desirable. Dispersal corridors should be preserved between and among blocks of habitats useful to greater sage-grouse. These corridors should be at least 1.6 km (1 mi) in width to reduce predator concentrations. Corridors should not contain roads, power lines, oil and gas developments, fences, or buildings.

## Management of Invasive Plant Species

Invasive plant species are becoming more widespread throughout public lands as a result of disturbance from livestock grazing, livestock feeding operations, roads, development, and other land uses. While there are numerous invasive species that may occur across the sagebrush steppe, those most important over large areas include cheatgrass, juniper and pinyon pine (both native species), as well as other exotic species. Control or elimination of exotic species should have the highest priority.

### Cheatgrass

Livestock management practices, fire, plowing/chaining, various types of development, and other practices have facilitated the spread of cheatgrass. Cheatgrass is palatable to livestock for only a short period during early growth in spring. It is a highly proficient seed producer and cannot be easily controlled by disking, plowing, grazing, or herbicides during the growing period or when mature. However, several pre-emergent herbicides have been demonstrated to reduce germination of cheatgrass (Connelly et al. 2000*b*). Reseeding cheatgrass-dominated areas with dryland alfalfa and native bunch grasses in strips (20 m width with every other strip being alfalfa/bunch grasses/biennial sweet clover/sagebrush) would appear to be effective in reducing cheatgrass abundance and may be more economical than use of herbicides.

### Pinyon/Juniper

Management of pinyon pine or juniper invasion can be achieved through cutting and burning (either or both) individual trees as well as use of prescribed fire over larger landscapes. Treatment of individual trees is most effective (but more expensive), as the live sagebrush and grass/forb understory is not burned (Commons et al. 1999).

## Management of Rangeland Seedings

Hundreds of thousands of hectares of former sagebrush steppe have been seeded with non-native forage species following plowing (to benefit livestock) or wild fire. Much of this area was reseeded with crested wheatgrass (*Agropyron cristatum*). Unfortunately, crested wheatgrass is of little use to sage-grouse as it provides poor cover and no food value. Sage-grouse seasonally consume forbs, insects, and sagebrush and do not eat grass seeds or leaves. Further, crested wheatgrass is a prolific seed producer with the ability to remain dominant on the landscape for periods exceeding 40 years. Crested wheatgrass is preferred forage for livestock and wild ungulates, especially during the growing period. It is capable of withstanding substantial grazing pressure and, once established, crested wheatgrass is difficult to replace with native bunchgrasses and sagebrush (due to competition and lack of seed sources).

Benign neglect has allowed portions (primarily the edges) of many seedings on public lands to revert in part to sage-grouse habitat. This is the result of sagebrush regeneration from seeds of live sagebrush in adjacent areas. Sage-grouse use these areas as density of sagebrush seedlings and canopy cover increases. Unfortunately, forb abundance in most crested wheatgrass seedings is very low (<3-5% cover) and sage-grouse use is mostly confined to foraging on young sagebrush plants. Crested wheatgrass seedings with less than 5% sagebrush canopy cover should be disked and reseeded in strips perpendicular to the prevailing wind to aid restoration of native habitats. Strips should be no more than 20 m in width in a ratio of 1 strip every 100 m. Strips should be planted with a mixture of dryland alfalfa, biennial sweet clover, native bunch grasses, and taller sagebrush (either mountain big sagebrush [*Artemisia tridentata vaseyana*] or Wyoming big sagebrush [*A. t. wyomingensis*] depending upon the site).

Biological control of crested wheatgrass seedings through manipulation of grazing intensity is possible but is negative to overall rangeland health as it results in severe overgrazing of all areas including adjacent native sagebrush steppe. This practice should not be promoted, as it will fail to control or eliminate crested wheatgrass. Chemical control of crested wheatgrass seedings also has little chance of success because of the abundant but dormant seed in the upper levels of the soil profile that are not affected by herbicides. Mechanical control through plowing or disking of the entire seeding followed by reseeding with desirable plant species also has little merit as it is expensive and exposes large expanses to wind erosion and exotic weeds. Plowing or disking (with or without reseeding) also has little chance of success because of the abundant amount of crested wheatgrass seed in the upper soil profile. Thus, the best scenario is to disk strips into crested wheatgrass seedings horizontal to the prevailing wind and replant desired vegetation (in strips) while protecting all larger sagebrush plants that may be present to serve as seed sources. Additional strips should be disked and reseeded at 3-5 year intervals depending upon site and results from the initial strips (adaptive management).

**Management of Roads**

Roads are known to reduce the value of potential breeding habitats for greater sage-grouse (Connelly et al. 2004), cause lek abandonment (Braun 1986), and lead to death (from collisions). Road densities are increasing within occupied sage-grouse habitats. A recent study in the Upper Green River Valley, Wyoming found that all remaining greater sage-grouse leks were within 5 km (3.1 miles) of a road and that 95% of the Jonah gas field had road densities greater than 3.2 km per 2.59 $km^2$ (2 miles/$mile^2$) (Thomson et al. 2005). Distinction should be made among primary roads (usually paved), secondary roads (mostly gravel), and trails (usually dirt, commonly expressed as 2-tracks). Primary roads are most negative for greater sage-grouse because of vehicle frequency, speed, and noise. Secondary roads can also be very negative depending again upon vehicle frequency, speed, and noise. Generally, trails are used seasonally and receive light vehicle use. Consequently, they are least problematic for sage-grouse.

Public land management agencies should have transportation plans for each forest, district, and resource area. Both permanent and seasonal road/trail closures are appropriate to reduce disturbance to sage-grouse during breeding activities and winter.

Most trails within occupied sage-grouse habitat should be closed during the breeding period and winter. Some secondary roads within 5 km of active leks should be closed during the 1 March-20 June period as well as during winter (December-February). All secondary roads and trails that traverse important sage-grouse areas should be reviewed and considered for permanent closure and revegetation.

Off-road vehicles (ORVs) should be prohibited except on designated trails and roads where sage-grouse use does not occur.

**Management of Structures**

Greater sage-grouse did not evolve with structures. Sage-grouse commonly collide with fences, and power lines have been demonstrated to be negative as they may result in collisions resulting in injury to or death of birds (Connelly et al. 2004). Structures can also provide perch locations for raptors, especially golden eagles (*Aquila chrysaetos*), which prey upon sage-grouse during all seasons of the year, and corvids that prey on nests. Prior to the advent of human-made structures, raptors and corvids in sagebrush steppe used elevated natural sites from which to hunt. The addition of power line poles, fences, hay equipment and stacks, and abandoned buildings have greatly expanded the number of suitable perches for raptors in a landscape that is mostly devoid of trees (Connelly et al. 2004). Historically, there were large expanses of suitable habitat for sage-grouse with few elevated perch sites.

Utility companies should be required to fit all potential perch sites (poles, towers) for golden eagles with devices to deter perching (including power poles associated with oil and gas development). All unused power poles (and towers) should be removed and consideration should be given to elimination (and removal) of unnecessary power lines that traverse sage-grouse habitats. Existing power lines should be placed in corridors that follow road systems, especially those that are paved, to minimize impacts on the landscape. First priority for fitting power poles with raptor guards and or for removal of power lines should be given to areas within 5.5 km (3.3 miles) of active leks (at least line of sight). Second priority should be given to known sage-grouse winter-use areas, especially along windswept ridges and near large expanses of sagebrush that are not typically covered by snow in winter. Raptor predation during summer and early fall is usually a local problem and more a product of habitat quality (i.e., sage-grouse are limited to few areas of suitable habitat) than at other times of the year.

Metal fence posts are preferable to wooden posts for fencing as the former better discourage raptors from using them as perches. Fencing within 2 km of active leks should be discouraged as sage-grouse are more likely to collide with them as they fly to and from leks, frequently at low levels and in low light. Fences designed to prevent domestic sheep from escaping pastures should be eliminated as walking sage-grouse frequently will follow and not readily fly over them. Fences in sage-grouse areas should be of no more than 3-strands of wire with both the top and bottom wires being barbless. All unnecessary fences should be removed (wire and posts). If fences known to result in sage-grouse mortality cannot be removed, the top wire should be marked with permanent visual flagging.

**Management of Vegetation**

Native sagebrush steppe vegetation should be given highest priority for management. Management should revolve around proper livestock grazing practices and not use of chemical or mechanical treatments. Grazing should be managed to ensure that sagebrush-dominated rangelands have the opportunity to recover from past management practices. The goal is to have healthy, self-sustaining native vegetation in which sagebrush comprises 10 to 25% of the vegetative canopy cover, grasses comprise 30-40%, and forbs comprise 15 to 20% of the ground cover. Holechek et al. (1999:15) indicate that livestock grazing, if the intent is to improve rangeland vegetative condition, should remove no more than 30-35% of the annual herbaceous growth. Some areas may require complete removal of livestock grazing for 3-5 years before grazing at lower stocking rates can resume. Improved management of grazing is the least expensive practice to restore degraded sagebrush steppe and should have the highest priority.

Chemicals such as 2,4-D and tebuthiuron have been widely used in attempts to eliminate or reduce sagebrush to increase livestock forage on public rangelands (Braun 1987, 1998). Use of 2,4-D has mostly been phased out for a variety of human health and environmental reasons (Braun 1998). Tebuthiuron is now favored for controlling sagebrush, especially to 'thin' sagebrush stands. Unfortunately, the effectiveness of this chemical is site dependent and is greatly affected by soil characteristics (Braun 1998) and continued livestock grazing. Application rates are critical and use of high rates or any chemical use on inappropriate soils can lead to total kill of sagebrush and forbs. For this reason, use of chemicals to 'thin' or control sagebrush is usually inappropriate for winter and breeding habitat.

Mechanical methods to manage sagebrush date to the 1930's and have involved brush beating, disking, chaining, and railing (Pechanic et al. 1954). These methods are relatively expensive and have mostly been used on small scales. They have the advantage of being able to be tailored to specific sites and will not 'escape' or 'drift' when compared to fire or use of chemicals. Of the available mechanical methods, use of brush beating is most appropriate as the desired results in terms of vegetation can reasonably be predicted. Brush beating or any other type of mechanical method to manage sagebrush should only be considered for 'better' range sites where vegetation response can be expected. These are normally areas where sagebrush canopy cover is >30%. Brush beating should be done in strips (usually 10-20 m in width) not to exceed one-quarter (25%) of the width of untreated strips. Strips should conform to the terrain and should not be straight lines but should be perpendicular to the prevailing wind. The design should result in a mosaic of sagebrush types with no more than 20-30% of the area being treated every 10-15 years (depending upon site). The goal is to set back sagebrush height (causing resprouting) and not death of all sagebrush plants. This can be accomplished by adjustment of the height of the mower blades. More recent advances such as the 'Dixie Harrow' and 'Lawson Aerator' may have merit but more scientific analysis of the results of using these devices is needed. Management of livestock grazing (reduction in or elimination of use for at least 2 years) is normally needed following brush beating or any mechanical treatment.

Use of fire to manage sagebrush steppe vegetation is usually inappropriate as it is difficult to control and frequently burns primarily winter and nesting habitats (Connelly et al. 2000*a*). Fire should generally be avoided or, at the least, restricted to small (<20 ha) sites where a lack of brood habitat has been documented to limit increases in sage-grouse populations.

**Management of Water**

Greater sage-grouse have been documented to use open water, especially during dry seasons. They readily eat snow in winter and forage during summer and fall on succulent vegetation in mesic sites. This vegetation may be adjacent to agricultural areas, riparian habitats, or where water is allowed to flow over land at springs and ponds. The need for so-called wildlife "guzzlers" is questionable, as studies have failed to demonstrate increases in sage-grouse density in areas with guzzlers (Connelly and Doughty 1989). Surface water flow in summer is important as it promotes growth of succulent forbs, which are attractive to greater sage-grouse. Pipes and tanks (for livestock) have no value for sage-grouse unless water is available at ground level or is allowed to spill onto the ground. There should be no emphasis placed on improving water distribution for livestock as this negatively affects sage-grouse habitats in most cases outside of ponds. All seeps and springs, and associated mesic sites should be fenced to exclude large grazing animals including domestic sheep, cattle, horses, and burros.

Livestock grazing has also impacted water tables by increasing sagebrush density and increasing soil erosion by reducing surface litter that slows runoff. Techniques useful to increasing water table levels include reduction of livestock grazing, sagebrush mowing, filling eroded drainages with (certified weed-free) straw bales, and creating check dams. These techniques are also useful in creating brood habitat for sage-grouse.

**Where Should Management Focus Be Placed?**

Areas with existing sage-grouse populations should have the highest priority for conservation. The best scenario for improved sage-grouse abundance and distribution is to conserve habitats with existing populations and then work outward from those core areas to improve habitats in more peripheral areas. GIS (Geographic Information Systems) derived maps of present vegetation and soil potential should be used with overlays of past and planned treatments to prevent too much area from being treated in a 10-15+ year period. The goal should be to increase sage-grouse abundance and distribution. Increases in abundance will be easier to achieve.

Areas contiguous to existing populations which do not presently have sage-grouse or which have very small populations (100-300 birds) should have second priority for management. Review of GIS maps of vegetation and soil potential will frequently identify factors that are depressing sage-grouse populations when compared to similar maps where sage-grouse still persist in some number. Treatments to improve abundance and distribution of populations will vary from area to area. Grazing practices and development are the most obvious factors depressing sage-grouse populations followed by fragmentation caused by vegetation treatments, including fire.

### How Should Success Be Measured?

Changes in abundance of greater sage-grouse are best measured by monitoring the number of active leks in a discrete area (leks/10 km²) over a 3-5 year period. Total number of males counted in a given area over a 3-5 year period can also be used. Changes in estimated nest success and percent young based on wing surveys of hunter-harvested birds (where appropriate) may also provide useful data (Autenrieth et al. 1982, Connelly et al. 2003). Changes in the proportion of young to adult (and yearling) hens in the harvest can also be used to detect improvement in sage-grouse production.

Changes in distribution of greater sage-grouse can be derived from intensive searches for active leks in areas (based on GIS derived maps of potential habitat) where sage-grouse were not present in the previous 3-5 years. Random transects to assess seasonal changes in distribution of sage-grouse fecal pellets can also be used to assess changes in distribution. Even presence or absence line transect counts of either sage-grouse or their sign (pellets) can be useful. These surveys should be made at 3-5 year intervals.

Changes in vegetation such as % bare ground, % forb coverage, % grass coverage, % sagebrush cover, as well as height of residual herbaceous material can be used to assess changes in vegetative composition and quality of habitats. However, vegetation surveys are labor intensive, costly, and may be affected by weather conditions, rodents, insects, and grazing animals. It is highly unlikely that short-term changes can be detected without standardized plots, which are marked and uniformly evaluated. This is not likely to be done on a consistent basis over large areas of western North America. It will be difficult to measure success in vegetation improvement except over time in very localized sites.

### Conclusions

Habitat conservation strategies to improve the abundance and distribution of greater sage-grouse have not been scientifically tested because of the reluctance of public land management agencies to invest in replicated management experiments over sufficiently large areas to be able to detect responses. However, sufficient information is available to make management recommendations given that negative responses of sage-grouse (decreases in abundance and distribution) are measurable. Habitat loss is certainly measurable as are fragmentation and degradation of habitats. The most notable changes in the sagebrush steppe since European settlement are associated with repetitive grazing by domestic livestock and developments (no matter how 'development' is defined). It is logical to expect improvement in sage-grouse abundance, at the least, with changes in policies, regulations, and practices involving grazing of domestic livestock and development. Both of these factors are managed by the key public land management agencies (BLM and USFS) that together control in excess of 60% of the remaining sagebrush steppe occupied by greater sage-grouse. Improvement in distribution will be more difficult as restoration of useful sagebrush habitats in areas that have been burned or plowed and seeded to exotic grasses will be exceedingly slow.

Management practices that significantly reduce wild fire, reduce grazing intensity and forage utilization, and reduce or eliminate the spread of introduced annuals have the best chance to positively impact abundance of greater sage-grouse. They will be the least expensive to implement. Development practices such as gas and oil exploration and production including surface infrastructure, which are obviously negatively affecting sage-grouse abundance and distribution, will be more expensive to change, but collectively changes in these practices could equal the gains expected to result from changes in livestock grazing practices.

Sufficient knowledge is available to begin implementing recommended practices that will positively affect greater sage-grouse. The key is to develop public support and the resolve within federal agencies to make the necessary changes.

**Recommendations**

-First priority for habitat management should be areas where larger sage-grouse populations are still present. Management practices chosen should maintain the present abundance and distribution of sage-grouse.

-The second priority for habitat management is for areas where sage-grouse populations are small (<300 birds or 100 males counted on a 3-year moving average). Management practices should enhance sage-grouse abundance and distribution.

-A third priority should be to improve habitats in areas adjacent to existing populations.

-Sagebrush steppe management should focus on maintaining large (>1 cadastral section and preferably >20 cadastral sections in size) blocks of sagebrush habitat per Township (36 cadastral sections).

-No surface occupancy should be allowed within 5.5 km of all active sage-grouse leks.

-No roads should be constructed within 5.5 km of active sage-grouse leks.

-Existing roads within 5.5 km of active sage-grouse leks should have seasonal closures (1 March-20 June).

-Prescribed fires should be no larger than 20 ha with no more that 40% of each cadastral section being burned over a 15-year period.

-Wild fires in sagebrush steppe should be vigorously suppressed except in areas with >20 invasive conifer trees per ha.

-Livestock grazing should be deferred for 3 years following fires for recovery of herbaceous native vegetation.

-Livestock grazing should not remove more than 25-30% of the annual growth of herbaceous vegetation with grazing delayed until after 20 June. True rest rotation systems should be used and winter grazing is preferred.

-Where wildlife (deer and elk) herd objectives cannot be achieved through legal hunting, reintroduction and expansion of populations of large predators should be encouraged.

-Rangeland seedings of exotic grasses should be converted using reseeded strips of native bunchgrasses, adapted subspecies or species of sagebrush, and dryland alfalfa.

-Power lines should be placed only into existing road/utility corridors.

-Power poles and other existing human structures should either be removed, if not used, or fitted with raptor-deterrence devices.

-Fences in sage-grouse use areas should be no more than 3 strands with the top and bottom wires being barbless. Unused fences should be removed.

-Use of chemicals to 'manage' sagebrush should not be permitted. If sagebrush is to be managed to reduce density or to enhance vigor, mechanical methods are preferred.

-Sage-grouse have not been shown to need open water. However, water should be allowed to flow (seep) over the ground to encourage growth of succulent forbs.

-Active leks per unit of area and total number of male sage-grouse counted at proscribed (4 counts per breeding period spaced at 7-10 day intervals) should be used as the measure of success of management treatments followed by changes in % bare ground, % forb coverage, % grass cover, % sagebrush canopy cover, and height of residual herbaceous vegetation.

-Sage-grouse pellet transects should be used to measure expansion of birds into vacant or former habitat.

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About The Author

Clait E. Braun has worked with sage-grouse as a researcher (1973-99) and consultant (2000-06), and has been a leader in publishing research and management articles on sage-grouse. Dr. Braun is a Certified Wildlife Biologist and has either worked in or extensively visited all states and provinces with current populations of sage-grouse. He retired from the Colorado Division of Wildlife where he was responsible for sage-grouse research from 1973 into 1999 and now operates Grouse Inc. providing professional guidance and reviews on sage-grouse and their habitats. This 'Blueprint' represents his professional experience and selected literature based on 30+ years of work with sage-grouse.

**Appendix**

Seasonal Habitat Requirements for Sage-grouse:

Spring, Summer, Fall, and Winter[1]

(Citation: Braun, C. E., J. W. Connelly, and M. A. Schroeder. 2005. Pages 38-42 *in* N. L. Shaw, M. Pellant, and S. B. Monsen, compilers. Sage-grouse habitat restoration symposium proceedings, 4-7 June 2001, Boise, Idaho, USA. U. S. Department of Agriculture, Forest Service, RMRS-P-38.)

[1]The contents of this 'Blueprint' document have not been reviewed or approved by either of the 2 coauthors of the published paper referenced in the Appendix.

# Seasonal Habitat Requirements for Sage-Grouse: Spring, Summer, Fall, and Winter

**Clait E. Braun**
**John W. Connelly**
**Michael A. Schroeder**

**Abstract**—Sage-grouse (*Centrocercus minimus, C. urophasianus*) are dependent upon live sagebrush (*Artemisia* spp.) for all life processes across their entire range. This paper describes habitats used by sage-grouse as documented in the scientific literature. The leaves of sagebrush are eaten by sage-grouse throughout the entire year and comprise 99 percent of their winter diets. Spring (late March through May) habitats are those with intermixed areas of taller (40 to 80 cm) sagebrush with canopy cover of 15 to 25 percent and taller (>18 cm) grass/forb cover of at least 15 percent. Sites used for display have shorter vegetation, frequently few or only short sagebrush plants, but with taller, more robust sagebrush within 100 to 200 m that is used for escape cover. Nesting cover mimics that used overall during spring but with clumps of tall (>50 cm), dense (about 25 percent) live sagebrush and abundant forbs (>10 to 12 percent cover). Early brood rearing areas are those within 200 m (initial 3 to 7 days posthatch) to 1 km (up to 3 to 4 weeks posthatch) of nest sites. Forbs and taller (>18 cm) grasses are important for broods; forbs provide succulent foods, grasses provide hiding cover, and the grass/forb mixture supports insects used by chicks. Summer use areas are those with abundant succulent forbs with live, taller (>40 cm), and robust (10 to 25 percent canopy cover) sagebrush useful for cover. These areas continue to be used into fall when sage-grouse move to higher benches/ridges where they forage on remaining succulent forbs such as buckwheat (*Eriogonum* spp.) and switch to more use of sagebrush leaves. Winter (early December to mid-March) use areas are often on windswept ridges, and south to southwest aspect slopes as well as draws with tall, robust live sagebrush. Height (25 to 35 cm) of sagebrush above the surface of the snow in areas used in winter is important, as is canopy cover (10 to 30 percent). Management of habitats used by sage-grouse should initially focus on maintaining all present use areas. Practices to enhance sagebrush habitats to benefit sage-grouse are reviewed, as is the need to annually monitor sage-grouse numbers along with systematic monitoring of the health of sagebrush ecosystems.

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## Introduction

Sage-grouse (*Centrocercus minimus, C. urophasianus*) historically occurred in at least 16 States and three Canadian Provinces (Aldrich 1963; American Ornithologists' Union 1957; Johnsgard 1973). They have been extirpated in five States and one Canadian Province (Braun 1998; Connelly and Braun 1997) and their overall distribution has become discontinuous (fig. 1). The changes in sage-grouse distribution have been attributed to loss, fragmentation, and degradation of habitats (Braun 1995, 1998; Connelly and Braun 1997), and it is probable that at least one-half of the original occupied area can no longer support sage-grouse (Braun 1998). Because of the reduced amount of available habitat, sage-grouse abundance has also markedly decreased with reported declines of 10 to 51 percent (Connelly and Braun 1997) and as much as 45 to 82 percent since 1980 (Braun 1998). The known decreases in distribution and abundance have led to concern about stability of sage-grouse populations and the health of sagebrush ecosystems upon which they depend. Petitions to list sage-grouse under the Federal Endangered Species Act have been filed for northern sage-grouse (*C. urophasianus*) and for Gunnison sage-grouse (*C. minimus*).

Sage-grouse are dependent upon ecosystems with vast and relatively continuous expanses of live, robust, taller sagebrushes (*Artemisia* spp.) with a strong grass and forb component. This dependency upon sagebrush, especially the subspecies of big sagebrush (*A. tridentata vaseyana, A. t. wyomingensis, A. t. tridentata*), low sagebrush (*A. arbuscula*), black sagebrush (A. *nova*), silver sagebrush (*A. cana*), and three-tip sagebrush (*A. tripartita*), as well as a variety of less apparent and abundant species, has been well documented (Patterson 1952; reviews by Braun and others 1977 and Connelly and others 2000a). Since the early 1960s, the sage-grouse/sagebrush relationship has focused attention by Western States and Provinces on the need to maintain healthy sagebrush-steppe communities over large expanses. Guidelines for maintenance of sage-grouse habitats were developed from the scientific literature (Braun and others 1977, completely revised by Connelly and others 2000a) and promoted by the Western States Sage-Grouse Technical Committee. The purpose of this paper is to present an overview of the habitat needs of sage-grouse based on the scientific literature, identify the issues that affect maintainance of useful habitats for sage-grouse, and discuss management strategies to maintain, enhance, and restore habitats

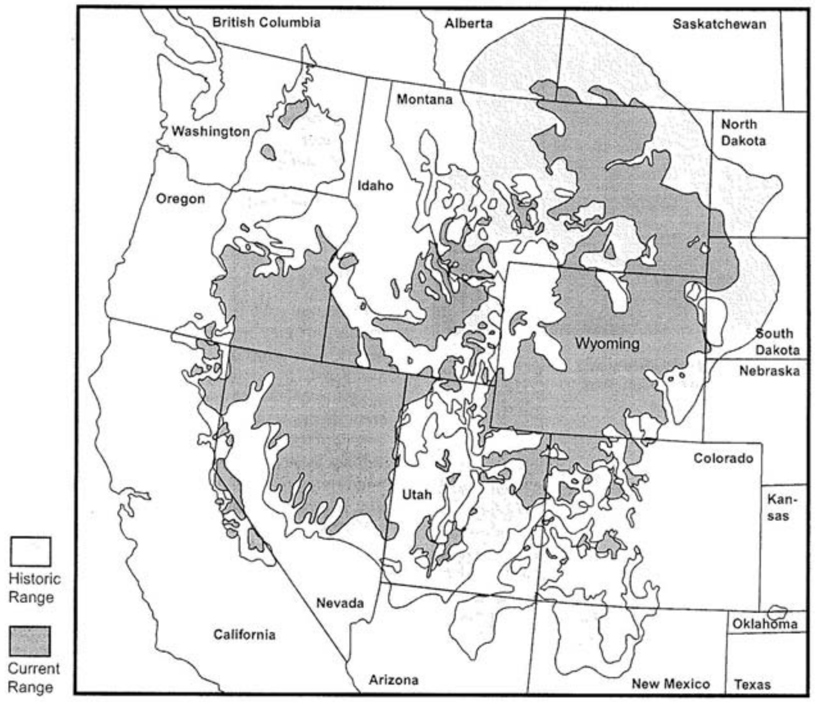


**Figure 1**—Historic and current distribution of sage-grouse (map prepared by M. A. Schroeder).

for sage-grouse. This paper draws extensively on the published *Guidelines to Manage Sage Grouse Populations and Their Habitats* (Connelly and others 2000a).

## Habitat Overview

### Spring

Timing of spring breeding activities of sage-grouse is dependent on elevation and amount of persistent snow cover. Attendance at leks may start in early to mid-March or, at higher elevations, in early April. Males may attend and display at leks until late May but most display and mating activities are greatly reduced by mid-May. Amount and depth of snow cover greatly influence sage-grouse breeding activities; thus, snow-free areas are important components of spring habitat. Habitats used by sage-grouse during the breeding period are those associated with foraging, leks, escape, and nesting. Depending upon moisture regimes, height of sagebrush in used habitats varies from 30 to 80 cm with canopy cover from 15 to 25 percent (Connelly and others 2000a). Lek sites typically have low amounts of sagebrush and appear relatively bare, but they may have extensive cover of low grasses and forbs. Taller, robust live sagebrush used as escape cover is normally within 100 to 200 m of active leks. The average distance from a nest to the nearest lek varies from 1.1 to 6.2 km, and the actual size of the breeding habitat appears largely dependent on the migratory characteristics of the sage-grouse population as well as distribution of sagebrush cover with respect to lek location (Connelly and others 2000a). Habitats selected for nesting are those with abundant (15 to 30 percent canopy cover) live, taller (30 to 80 cm) sagebrush plants within a community with >15 percent ground cover of taller (40 to 80 cm) grasses and forbs (Connelly and others 2000a). Early brood-rearing habitats (fig. 2) are normally those within 100 m to 1 km of nesting sites, especially areas with high plant species richness, moisture, and taller grasses and forbs (Connelly and others 2000a). Adult sage-grouse, while still foraging extensively on leaves of live sagebrush, eat leaves and flower parts of forbs during spring, as do chicks (Apa 1998; Drut and others 1994; Dunn and Braun 1986; Klott and Lindzey 1990).

### Summer

Habitats used by sage-grouse in summer (early to mid-June to mid to late September) are those that provide

**Figure 2**—Sage-grouse brood hen in good quality Wyoming big sagebrush habitat, North Park, Colorado (photograph by C. E. Braun).

adequate forage, especially succulent forbs, and cover useful for escape. These habitats may include those used for agriculture, especially for native and cultivated hay production, edges of bean and potato fields, as well as more typical sagebrush uplands and moist drainages. Taller (>40 cm) and robust (10 to 25 percent canopy cover) sagebrush is needed for loafing and escape cover as well as a source of food. Grass and forb ground cover can exceed 60 percent (hayfields). Provided moisture is available through water catchments or from succulent foliage, sage-grouse may be widely dispersed over a variety of habitats during this period (Connelly and others 2000a). As late summer approaches, there is movement from lower sites to benches and ridges (fig. 3) where sage-grouse forage extensively on leaves of sagebrush.

## Fall

Fall (late September into early December) is a time of change for sage-grouse from being in groups of hens with chicks or males and unsuccessful brood hens to separation into larger flocks frequently segregated by gender. Some birds may continue to use lower riparian or hayfield habitats, but there is movement onto higher, frequently north-aspect slopes where succulent native forbs, such as buckwheats, provide green forage. Use of sagebrush leaves for food becomes more common as does use of extensive stands (>20 percent canopy cover) of taller (>25 cm), live sagebrush (Connelly and others 2000a). Movements can be slow but there is a general shift toward traditional winter use areas (Connelly and others 1988).

## Winter

Flocks of sage-grouse are somewhat nomadic in early winter but may remain within chosen areas for periods of several weeks or more depending upon extent of snow cover and depth (Beck 1977; Hupp and Braun 1989b). Sagebrush height (>20 cm, but usually >30 cm, above the surface of the snow) is important as is the robust (>10 to 30 percent canopy cover) structure of live sagebrush (Connelly and others 2000a). Sage-grouse use a variety of sites in winter including windswept ridges with open (10 to 20 percent canopy cover) (fig. 4) stands of sagebrush to draws with dense (>25 percent canopy cover) stands. Quality of the snow can be important because sage-grouse are known to use snow roosts and burrows (Back and others 1987). Aspect is also important with south and southwest slopes most used in hilly terrain (Hupp and Braun 1989b). Leaves of live, vigorous sagebrush plants provide >99 percent of the foods eaten during the winter period (early December until early to mid-March) (Patterson 1952; Remington and Braun 1985; Wallestad and others 1975). Generally, winter is a time of body mass gain (Beck and Braun 1978), although severe winter conditions over prolonged intervals can reduce the amount of area available for foraging and cover (Beck 1977) and thus affect body condition (Hupp and Braun 1989a). Overall movement during winter may be extensive and home ranges can be large (Connelly and others 2000a). As winter wanes, flocks of sage-grouse move toward breeding areas that may be immediately adjacent to or far distant from winter use areas (Connelly and others 2000a).

**Figure 3**—Radio-tracking sage-grouse in high-elevation summer range with a stand of mountain big sagebrush in the background (photograph by J. W. Connelly).

**Figure 4**—Sage-grouse winter range in Wyoming big sagebrush habitat in North Park, Colorado (photograph by C. E. Braun).

## Issues

Decreases in distribution and abundance of sage-grouse have been ascribed to a complexity of factors (Braun 1987, 1998; Connelly and Braun 1997). The three major causes, (1) habitat loss (mostly permanent), (2) fragmentation (frequently permanent but reversible at times), and (3) degradation (usually can be corrected), are generally accepted but the latter two are poorly recognized and understood. Examples of permanent habitat loss include conversion of sagebrush rangelands to agricultural crops, town and subdivision developments, placement of power plants or surface mines, and reservoir construction. Fragmentation of habitats occurs with power lines, paved and other high-speed road development (including maintenance and improvement of farm roads), habitat-type conversion projects, fire, or any permanent development that reduces the size of existing habitat patches. Less understood are the impacts of fences, seasonal use trails, oil and gas wells with surface pipelines, noise, and so on. Some of these impacts can be resolved and sage-grouse will reoccupy some formerly disturbed areas (Braun 1987).

Distribution of habitat types useful to sage-grouse is also important, as these species are habitat specialists using a variety of areas within a larger landscape mosaic. Thus, not only is the quantity of sagebrush habitats important, but also the juxtaposition and quality of those habitats. All sagebrush habitats are not equal in their acceptability to sage-grouse, and location of areas used may affect sage-grouse distribution. Size of habitat patches is important and larger (>30 $km^2$) is better than smaller, although the spatial relationships of habitats for sage-grouse are not well understood. Sage-grouse use a mosaic of habitats that is normally present in sagebrush-steppe because of differences in soils, moisture, topography, aspect, insect defoliation, wildfires, and other factors. Sagebrush naturally regenerates as overmature plants die and seedlings become established. Use of the term "decadent" for sagebrush is generally inappropriate because it implies that sagebrush communities are not dynamic with a variety of age classes from seedlings to overmature. Since most sagebrush communities are resilient and represent a continuum of age classes within a mosaic of habitats, creation of "edge" to benefit sage-grouse is rarely needed. Because of human activities, the presence of too much edge (especially in straight lines) is more common than too little edge and results in degradation of sage-grouse habitats.

Sagebrush ecosystems have been managed through a variety of treatments from domestic livestock grazing, mechanical and chemical clearing or thinning, to use of prescribed fire (Braun 1998). Fire was a natural event in more mesic sagebrush communities but was infrequent as demonstrated by the lack of resprouting of big sagebrush, black sagebrush, and low sagebrush. Fire was more common in areas with three-tip sagebrush and silver sagebrush because both species resprout. Recent research suggests there is little gain in forage production of grasses and forbs after fire, because it can take longer than 30 years to return to preburn conditions (Wambolt and others 2001).

Treatments of sagebrush communities have primarily been conducted to benefit another treatment (livestock grazing). Use of some treatments has led to plantings of exotic grasses, invasion of areas by exotic plants, conifer invasion of sagebrush habitats, and increased fire frequency. Many, if not most, of these treatments have been applied to improve rangelands for domestic livestock but have had negative impacts on sagebrush communities and animals dependent on them (Braun and others 1976). Further, successive treatments have been applied to landscapes with little understanding of the cumulative effects that may impact both sagebrush-dependent animals, such as sage-grouse, and the overall health of the plant community. The impacts of natural events such as periodic drought are further exacerbated by human treatments of sagebrush communities. All of these issues emphasize the need for active protection of habitats presently used by sage-grouse as well as restoration of habitats that formerly supported sage-grouse populations.

## Sage-Grouse Habitat Management Strategies

The objectives of habitat management to benefit sage-grouse, in order of importance, should be (1) to protect and maintain existing occupied habitats, (2) enhance existing occupied habitats, (3) restore degraded habitats that still receive some sage-grouse use, and (4) rehabilitate significantly altered habitats that no longer support sage-grouse. Strategies to accomplish these objectives should include:

- Vigorous suppression of wildfire.
- Reconsideration of any use of prescribed fire.
- Proper livestock management (including reconsideration of time of grazing, stocking rates, season of use, and frequency of use).
- Use of nitrogen fertilizer, except in areas infested by annual weeds.
- Mechanical chopping of sagebrush.
- Fence type and placement.
- Water management.
- Rehabilitation and restoration techniques discussed in these proceedings.

At times, manipulation of some occupied sage-grouse habitat may be necessary to enhance the overall quality of a seasonal range. An example would be removing or reducing some sagebrush canopy cover in known breeding habitat to enhance a depleted understory. Removal of 57 percent of sagebrush cover resulted in a significant decline in a sage-grouse breeding population (Connelly and others 2000b) and degradation of early brood-rearing habitat (Fischer and others 1996). More recently, a wildfire that removed about 30 percent of the sagebrush cover in a breeding habitat resulted in a 60 percent decline in sage-grouse nest success (Connelly, unpublished data, 1998). Because of this information and the fact that wildfires, drought, and insect infestations cannot be predicted, any sagebrush removal efforts should affect a relatively small portion of the occupied habitat. Connelly and others (2000a) suggested that >80 percent of breeding and winter habitat with vegetative characteristics necessary for productive sage-grouse habitat should remain intact to adequately provide for the needs of sage-grouse. However, an even greater percentage should be protected if sage-grouse populations are declining or the population status is unknown. All proposed habitat manipulations should carefully consider the current condition of habitat, status of the sage-grouse population, and likely outcome of the vegetation treatment, including recovery time necessary for the area to again provide adequate habitat for sage-grouse nesting and early brood rearing.

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*Fernleaf biscuitroot*