United States
Department of
Agriculture

**Forest Service**

Colorado
National Forests

November 2015

# Rulemaking for Colorado Roadless Areas

## Supplemental Draft Environmental Impact Statement

**Colorado National Forests with roadless areas include:**
Arapaho and Roosevelt; Grand Mesa, Uncompahgre, and Gunnison; Manti-La Sal (portion in Colorado); Pike and San Isabel; Rio Grande; Routt; San Juan; and White River National Forests

## Commonly Used Acronyms

2012 FEIS - 2012 Rulemaking for Colorado Roadless Areas Final Environmental Impact Statement
BLM - Bureau of Land Management
BTU – British thermal unit
$CO_2$ – Carbon dioxide
$CO_2$eq - Carbon dioxide equivalent
CRAs - Colorado Roadless Areas
EPA - Environmental Protection Agency
ESA - Endangered Species Act
FEIS- Final Environmental Impact Statement
GHG - Greenhouse Gas
GMUG - Grand Mesa, Uncompahgre, and Gunnison
IPM - Integrated Planning Model
LAA - May affect, likely to adversely affect
MAII - May adversely impact individuals, but not likely to result in a loss of viability, nor cause a trend toward federal listing
MDW - Methane Drainage Wells
NEPA - National Environmental Policy Act
NI – No impact
NFS - National Forest System
$NO_X$ - Generic term for the mono-nitrogen oxides NO and $NO_2$ gases
OSMRE - Office of Surface Mining Reclamation and Enforcement
SCC - Social Cost of Carbon
SDEIS - Supplemental Draft Environmental Impact Statement
SEIS – Supplemental Environmental Impact Statement
USDA- United States Department of Agriculture

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at http://www.ascr.usda.gov/complaint_filing_cust.html and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by:

(1) mail: U.S. Department of Agriculture
Office of the Assistant Secretary for Civil Rights
1400 Independence Avenue, SW
Washington, D.C. 20250-9410;
(2) fax: (202) 690-7442; or
(3) email: program.intake@usda.gov

USDA is an equal opportunity provider and employer.

# Rulemaking for Colorado Roadless Areas
# Supplemental Draft Environmental Impact Statement

| | |
|---|---|
| **Lead Agency:** | USDA Forest Service |
| **Cooperating Agencies:** | Bureau of Land Management,<br>Colorado Department of Natural Resources,<br>Office of Surface Mining Reclamation and Enforcement |
| **Responsible Official**: | Secretary of Agriculture |
| **For Information, Contact:** | Ken Tu<br>USDA Forest Service<br>Colorado Roadless Rule<br>(303) 275 – 5156<br>www.roadless.fs.fed.us |

**Summary:** The U.S. Department of Agriculture, U.S. Forest Service, in cooperation with the State of Colorado, proposes to reinstate the North Fork Coal Mining Area exception of the Colorado Roadless Rule on approximately 19,700 acres of National Forest System lands on the Grand Mesa, Uncompahgre, and Gunnison National Forests. The proposal is a response to deficiencies outlined by the District Court of Colorado in *High Country Conservation Advocates v. United States Forest Service*. 52 F.Supp.3d 1174, 1196 (D.Colo. 2014). This Environmental Impact Statement supplements the 2012 Final Environmental Impact Statement for the Colorado Roadless Rule with additional analyses. Three Alternatives are addressed in detail in this Environmental Impact Statement. Alternative A is the No Action Alternative, and would continue the current management under the Colorado Roadless Rule without a North Fork Coal Mining Area exception. Alternative B (proposed action), would reinstate the North Fork Coal Mining Area exception, allowing temporary road construction for coal mining related activities. Alternative C (exclusion of "wilderness capable" lands) would establish the North Fork Coal Mining Area exception, but exclude lands identified as "wilderness capable" during the 2007 Grand Mesa, Uncompahgre, and Gunnison Forest Plan revision process. In addition, all alternatives include boundary correction of Colorado Roadless Areas based on new information obtained since the promulgation of the 2012 Colorado Roadless Rule.

# Contents

**Chapter 1 Purpose of and Need for Action ..... 1**

*Background ..... 1*

*Purpose of and Need for Action ..... 1*

*Proposed Action ..... 1*

*Decision Framework ..... 2*

*Public Involvement ..... 2*

*Tribal Consultation ..... 2*

*Issues ..... 3*

*Scope of Analysis ..... 3*

**Chapter 2 Alternatives, Including the Proposed Action ..... 9**

*Alternatives Considered but Eliminated from Detailed Study ..... 9*

*Features Common to All Alternatives ..... 11*

Colorado Roadless Area Boundary Correction ..... 11

Federal and State Requirements ..... 11

Forest Plans ..... 12

Project-Specific Environmental Analysis ..... 12

Reserved and Outstanding Rights ..... 12

Existing Land Use Authorizations ..... 12

Other Forest Activities ..... 12

*Alternative A: The No Action Alternative ..... 13*

*Alternative B: Proposed Action ..... 15*

North Fork Coal Mining Area Boundary Changes ..... 15

*Alternative C : ..... 17*

North Fork Coal Mining Area Boundary Changes ..... 17

*Comparison of Alternatives ..... 19*

**Chapter 3 Affected Environment and Environmental Consequences ..... 23**

*Coal Resources ..... 23*

Federal Coal Program Process ..... 24

Affected Environment ..... 24

Environmental Consequences ..... 28
Cumulative Effects ..... 30
*Air Resources and Greenhouse Gas Emissions* ..... *31*
Scope of Analysis ..... 31
Direct and Indirect Emissions ..... 31
Cumulative effects ..... 40
*Climate Change* ..... *43*
Guidance for Climate Change Analysis ..... 44
Existing Condition ..... 44
Affected Environment ..... 46
Direct, Indirect, and Cumulative Effects ..... 47
*Threatened, Endangered, Proposed, and Sensitive Species* ..... *49*
Analysis Methods ..... 49
Threatened and Endangered Species and Critical Habitats Considered in this SDEIS ..... 54
Analysis of the Effects of the Alternatives ..... 55
Cumulative Effects ..... 62
*Economics* ..... *69*
Study Area for Economic Analysis ..... 69
Analysis Methods and Assumptions ..... 70
Affected Environment ..... 86
Environmental Effects ..... 93
**Chapter 4 Preparers, EIS Distribution, and Consultation ..... 102**
*List of Preparers* ..... *102*
Other Contributors to the SDEIS ..... 103
*Consultation* ..... *104*
Tribal Consultation ..... 105
**Chapter 5 References Cited ..... 106**
**Index ..... 113**
**Appendix A Opinions from Federal District Court of Colorado on Colorado Roadless Rule and West Elk Coal Mine ..... A-1**
**Appendix B Issues ..... B-1**
**Appendix C Legal and Regulatory Framework for Federal Coal Resource Management ..... C-1**

**Appendix D Background of the Roadless Issue ..... D-1**

**Appendix E Economic Analysis Methodology.....E-1**

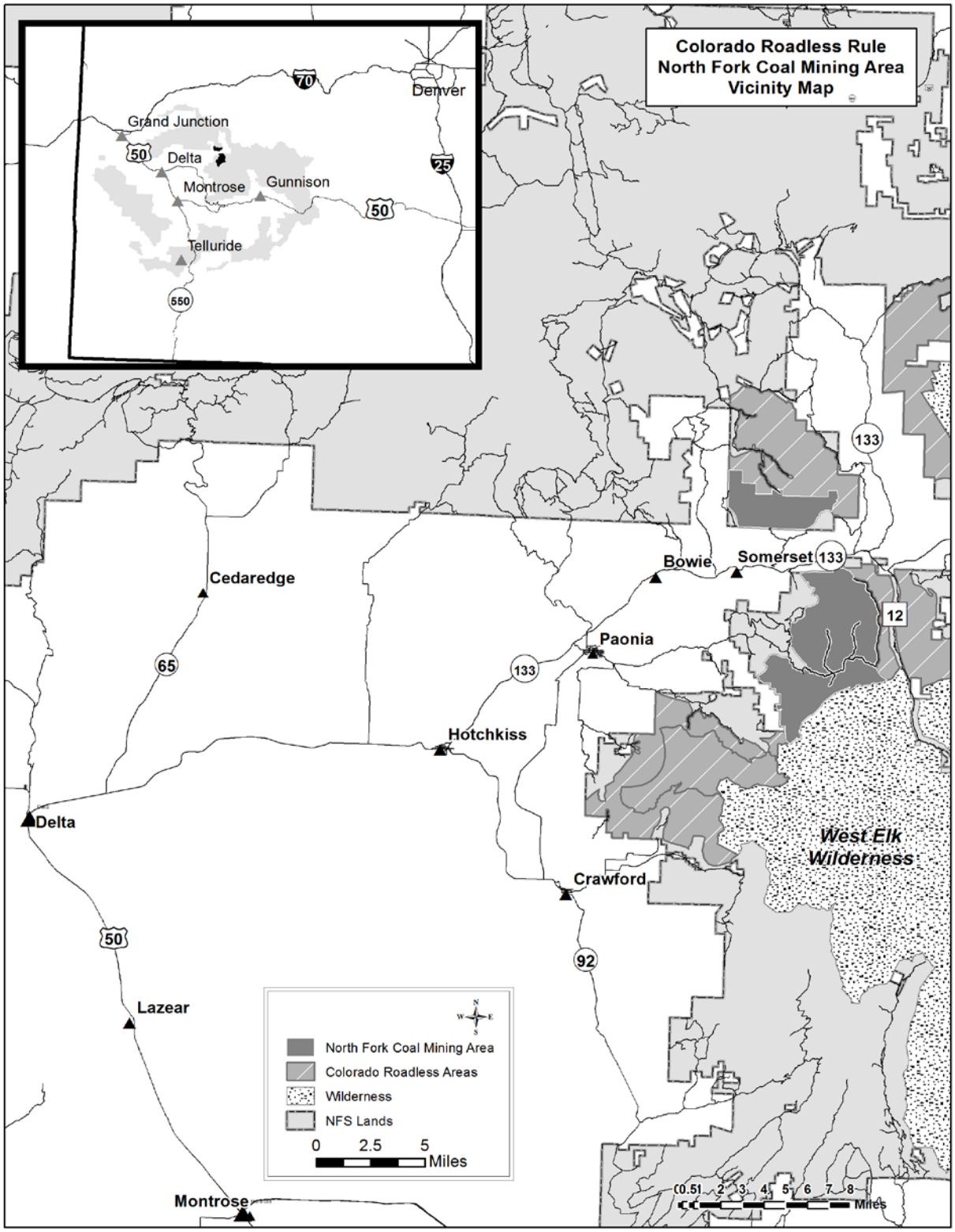


*Figure i-1. North Fork Coal Mining Area vicinity map*

# Chapter 1 Purpose of and Need for Action

## *Background*

On Mexican July 3, 2012, the U.S. Department of Agriculture (USDA or Department), promulgated the Colorado Roadless Rule, a state-specific regulation for management of 4.2 million acres of Colorado Roadless Areas (CRAs) on National Forest System (NFS) lands (77 FR 39576). The State of Colorado, USDA, U.S. Forest Service, and the public worked in partnership to find a balance between conserving roadless area characteristics for future generations and allowing management activities within CRAs that are important to Colorado's citizens and economy. One State-specific concern was to avoid foreclosing exploration and development of coal resources on the Grand Mesa, Uncompahgre, and Gunnison (GMUG) National Forests. The Colorado Roadless Rule addressed this by defining the North Fork Coal Mining Area and developing an exception that allows temporary road construction for coal-related activities within that defined area.

In July 2013, High Country Conservation Advocates, WildEarth Guardians, and Sierra Club (see Appendix A) challenged the U.S. Forest Service's decision to consent to the Bureau of Land Management (BLM) modifying two existing coal leases, the BLM's companion decision to modify the leases, BLM's authorization of an exploration plan in the lease modification areas, and the North Fork Coal Mining Area exception of the Colorado Roadless Rule (36 CFR 294.43(c)(1)(ix)).

In June 2014, the District Court of Colorado found the environmental documents supporting the four decisions to be in violation of the National Environmental Policy Act (NEPA) due to analysis deficiencies (See Appendix A). In September 2014, the District Court of Colorado vacated the lease modifications, the exploration plan, and the North Fork Coal Mining Area exception of the Colorado Roadless Rule.

This Supplemental Draft Environmental Impact Statement (SDEIS) is a limited scope document that updates the May 2012 Rulemaking for Colorado Roadless Areas Final Environmental Impact Statement (2012 FEIS). This SDEIS addresses the deficiencies identified by the District Court of Colorado in *High Country Conservation Advocates v. United States Forest Service* (see Appendix A), and in conjunction with the 2012 FEIS, discloses the environmental consequences of reinstating the North Fork Coal Mining Area exception into the rule.

## *Purpose of and Need for Action*

The overarching purpose and need for reinstating the North Fork Coal Mining Area exception is the same as the 2012 purpose and need statement for the Rule. However, the specific purpose and need for reinstating the North Fork Coal Mining Area exception is to provide management direction for conserving approximately 4.2 million acres of CRAs while addressing the State's interest in not foreclosing exploration and development of coal resources in the North Fork Coal Mining Area.

## *Proposed Action*

The proposed action (Alternative B) is to reinstate the North Fork Coal Mining Area exception as written in 36 CFR 294.43(c)(1)(ix) on 19,700 acres of NFS lands. The exception provides for temporary road construction and reconstruction for coal exploration and/or coal-related surface activities within the North Fork Coal Mining Area. The exception also provides that such roads may

be used for collection/transport of coal mine methane. The exception defines that buried infrastructure, including pipelines, needed for the capture, collection and use of coal mine methane could be located within the rights-of-way of temporary roads that are necessary for coal-related surface activities, including the installation and operation of methane venting wells subject to site-specific permitting. No upper tier acre CRAs are designated in the North Fork Coal Mining Area under this alternative. Upper tier are a subset of CRAs which have limited exceptions to provide a high-level of protection.

## Decision Framework

The Secretary of Agriculture will decide whether to reinstate the North Fork Coal Mining Area exception and on what areas the exception could be applied. The decision involves a choice among the three alternatives analyzed in detail in this SDEIS, which means determining whether to do one of the following:

1. Take no action. No North Fork Coal Mining Area exception would be promulgated. CRA's would be managed according to the Colorado Roadless Rule without the exception, and the North Fork Coal Mining Area would be managed the same as other non-upper tier CRAs. (Alternative A).
2. Promulgate the North Fork Coal Mining Area exception and apply it to about 19,700 acres of CRAs (Alternative B).
3. Promulgate the North Fork Coal Mining Area exception and apply it to about 12,600 acres of CRAs (Alternative C).
4. Whether to correct CRA boundaries and have the North Fork Coal Mining Area boundary align with CRA boundaries.

## Public Involvement

The U.S. Forest Service published a Notice of Intent to prepare a supplemental environmental impact statement (EIS) in the *Federal Register* on April 7, 2015 which initiated a 45 day comment period ending on May 22, 2015. No public meetings were held during the initial comment period due to the extensive public participation process that occurred with the development of the Colorado Roadless Rule. In addition to the Notice of Intent, the U.S. Forest Service sent about 1,400 hard copy letters and 43,000 emails to individuals and organizations known to be interested in the Colorado Roadless Rule to solicit comments. Approximately 119,400 comment letters were received, of which about 250 were unique letters.

## Tribal Consultation

In addition to the outreach to the general public for comments on the Colorado Roadless Rule, the U.S. Forest Service contacted the three tribes most likely to be concerned or directly impacted by the proposed rule. Those tribes included the Ute, Ute Mountain Ute, and Southern Ute Tribes. The U.S. Forest Service sent background information on the proposal to reinstate the North Fork Coal Mining Area exception and offered government-to-government consultation meetings with each of the Tribes. The Tribes provided no formal comments and did not request any meetings.

## *Issues*

The June 2014 District Court of Colorado's opinion in *High Country Conservation Advocates v. United States Forest Service* (see Appendix A) and public comments were used to identify key issues. Key issues are environmental issues that will be studied in detail and are needed to make an informed decision in conjunction with the 2012 FEIS. The following are the key issues carried through the SDEIS analysis:

- **Greenhouse Gas (GHG) Emissions** – Public comments and the District Court of Colorado ruling (See Appendix A) suggested the need for a quantitative GHG analysis. Additional analyses related to GHGs will be evaluated.
- **Climate Change** – The environmental issue behind the GHG emissions concern is climate change. The quantitative GHG emissions analysis will be put into context of climate change for an informed decision.
- **Social Cost of Carbon** – Public comments and the District Court of Colorado ruling (See Appendix A) suggested the use of the social cost of carbon (SCC) protocol to evaluate costs of increased carbon emissions generated by the proposal. Based on public comments and the Court ruling, the SCC will be evaluated.
- **Coal Economics** – Corrections and proposed changes to the North Fork Coal Mining Area boundary and changes in demographics/economic trends throughout the State of Colorado affect the 2012 estimated economic outputs. Additional economic modeling and data will be considered to address new information for the coal resources.
- **Fisheries** – After a NEPA sufficiency review, of the 2012 FEIS, it was determined that new information has emerged regarding the genetics of cutthroat trout in the southern Rockies. Supplemental analyses will be needed to address this new information and comments received from the public.
- **Federally Listed Threatened, Endangered, Proposed, and Sensitive Species** – After a NEPA sufficiency review, of the 2012 FEIS, it was determined several species have been listed and critical habitat designated under the Endangered Species Act (ESA) that affect CRAs. In addition, the Regional Forester updated the sensitive species list in August 2013. Supplemental analyses will be needed under ESA and consultation with U.S. Fish and Wildlife Service has been reinitiated for the entire Colorado Roadless Rule. This will require a state-wide review under ESA of all 4.2 million CRA acres.

Issues raised by the public and considered by the interdisciplinary team that are not included for detailed study in this SDEIS are briefly described in Appendix B.

## *Scope of Analysis*

The scope of analysis is the extent the proposed actions and potential impacts will be considered in the SDEIS. The following were considered in determining the scope of the analysis for this SDEIS:

- The June 2014 District Court of Colorado decision identified analysis deficiencies (See Appendix A);
- A review of the 2012 FEIS in context of changed circumstances and/or new information;

- Council on Environmental Quality guidance for programmatic analyses (Final Guidance for Effective Use of Programmatic NEPA Reviews, 79 FR 76986); and
- Public comments, which are reflected in the key issues and issues considered but not included for detailed study.

In June 2014, the District Court of Colorado found the 2012 FEIS to be in violation of NEPA due to three deficiencies. These deficiencies were:

- The 2012 FEIS failed to disclose the GHG emissions from mine operations;
- The 2012 FEIS failed to disclose the GHG emissions resulting from combustion of North Fork Valley coal; and
- The 2012 FEIS failed to address a report about coal substitution submitted during the public comment period for the Revised Draft Environmental Impact Statement ending in October 2011.

Based on the Court identified deficiencies this SDEIS includes a quantitative GHG emissions analysis of both mine operations and end use, and addresses the report submitted during the 2011 comment period.

As part of the supplemental review process, the 2012 FEIS was reviewed in context of changed circumstances and new information. The 2012 FEIS and the associated project record are incorporated by reference for this proposed rule. The Colorado Roadless Rule interdisciplinary team determined that the majority of the analyses in the 2012 FEIS did not warrant supplementation due to changed circumstances and/or new information. However, the interdisciplinary team determined the need to supplement portions of the following analyses:

- GHG emissions due to new information;
- Climate change due to new information;
- Economics due to new information and changed circumstances;
- Federally listed wildlife species due to changed circumstances; and
- Fisheries due to new information.

Programmatic and tiered environmental reviews are valuable for providing timely and efficient environmental analyses. In December 2014, the Council on Environmental Quality provided guidance to Federal agencies on use of programmatic NEPA reviews. The Council on Environmental Quality defines the term, “programmatic review”, as any broad or high-level NEPA review of proposed policies, plans, programs, or projects for which subsequent actions will be implemented based on site or project specific NEPA review at the time the action is proposed. The Colorado Roadless Rule establishes regulations for management of roadless areas, thus the programmatic level of review for the Colorado Roadless Rule is central to this SDEIS. The Colorado Roadless Rule provides management direction for conserving and managing 4.2 million acres of CRAs by restricting tree cutting, sale, and removal; road construction and reconstruction; and use of linear construction zones within CRAs with narrowly focused exceptions, such as the North Fork Coal Mining Area exception.

The Colorado Roadless Rule is not a coal mining rule; rather it is a roadless conservation rule that accommodates activities within CRAs that are important to the State of Colorado. Similarly, the

proposal to reinstate the North Fork Coal Mining Area exception is a provision of the Colorado Roadless Rule that does not authorize or permit coal mining. The exception merely removes the prohibition of temporary road construction so as to not foreclose the option of coal mining in the North Fork Coal Mining Area. Exploration for coal, coal leasing or subsequent mining may or may not occur in the North Fork Coal Mining Area based on other factors unknown at this time.

The North Fork Coal Mining Area exception was part of the Colorado Roadless Rule as it was originally promulgated. Similar to other portions of the Colorado Roadless Rule, the North Fork Coal Mining Area exception is a broad level, programmatic action that addresses the ability to construct or reconstruct temporary roads for coal exploration or coal-related surface activities in the North Fork Coal Mining Area at the landscape level, while not making any irreversible or irretrievable commitments of coal or other resources, nor authorizing any project level activity. The exception frames the scope of subsequent site-specific activities over the long term. The full range of exploration or development over the long term in the North Fork Coal Mining Area – where, if, when, and how coal exploration or development may occur, as well as any needed temporary roads to provide for that coal exploration or development – is currently an unknown at this programmatic level. Unless or until site-specific applications are received, it is neither reasonable nor efficient to attempt to estimate the full range of site-specific environmental impacts that might occur in this area over the long term. This would be akin to estimating project specific timber sale impacts in a forest plan when the plan zones an area for timber production. Rather, when or if specific proposals to lease or explore are received, these proposals will undergo site-specific environmental analysis, tier to this programmatic landscape environmental review, and incorporate any regulatory requirements that result from this rulemaking. Until that time, this programmatic review, based on the best reasonable estimates and analysis, will guide the environmental analysis of the potential on ground effects.

With respect to federal coal resource management in the North Fork Coal Mining Area, site-specific environmental analyses and subsequent decisions (including some made by other agencies such as the BLM) are required before any exploration, mining, or other on-the-ground activity can occur. If and when specific coal exploration requests or applications for leasing action are received by the BLM, those proposals will then undergo site-specific environmental analysis in accordance with the requirements of NEPA. Analyses would be conducted by the U.S. Forest Service and BLM to support: the U.S. Forest Service in deciding whether to grant or deny consent to BLM's leasing of NFS lands and in conditioning leases to protect non-mineral (i.e. surface) resources; the BLM's independent decision to lease (which would convey the right to develop the coal resources); and the BLM's decisions to allow exploration activities to provide site-specific information for leasing or specific mine plans. There would also be environmental review for proposed, specific mine permitting actions in which the Office of Surface Mining Reclamation and Enforcement (OSMRE) and Colorado Division of Reclamation, Mining and Safety are involved. At each of these stages, additional information is gathered as the proposed activity becomes more site-specific and addresses applicable legal and regulatory requirements. At each stage of analysis or review, there is an opportunity to mitigate focused and site-specific impacts as the proposed activity becomes more certain. In addition, at each of these stages of analyses or review, there is opportunity for public input and comments based on NEPA or other requirements.

Programmatic reviews support policy level decisions when there are limitations in available information and uncertainty regarding the timing, location, and environmental impacts of subsequent

implementing actions. This rulemaking effort to reinstate the North Fork Coal Mining Area exception to the Colorado Roadless Rule is appropriate for a narrowly focused programmatic NEPA review pursuant to Council on Environmental Quality guidance because while this rulemaking will guide the use of Federal resources in the North Fork Coal Mining Area over the long-term, site-specific decisions are not made at the rulemaking stage. At the present time, the scope and extent of potential future coal exploration or leasing proposals are unknown; thus the site-specific environmental effects of these proposals cannot be reasonably foreseen. While the U.S. Forest Service can use the best estimates based on current information, as shown by the changes between 2012 and present day, these estimates are not always accurate. It is currently unknown:

- if and how exploration activities might occur;
- how much coal might be developed from this area;
- when the coal might be developed;
- the specific quality of that coal;
- the specific methane content of that coal;
- the extent of methane drainage wells (MDWs) and associated temporary roads needed to ensure safe working conditions in underground mines based on specific mine plans;
- the specific locations of MDWs and temporary roads;
- the specific end users of the coal;
- where and how the coal could reach its destination; and
- where and what type of facilities could combust the coal.

While site-specific environmental analysis occurs at the project level, programmatic NEPA reviews can and do address the broad environmental issues relating to commensurate program level, landscape scale decision making. For most resources, and in particular surface resources, the cause and effect relationship is generally limited to the proximity of the action and/or the spatial extent of the defined impact. However, in contrast to surface resources, air quality impacts related to GHG emission impacts are diffuse and highly variable, with the effects cumulative and global in nature. Because the overall magnitude of human caused GHGs is so large, the link between any single project's contribution to the national or global emissions is usually not possible to determine. Therefore, the impacts on the environment from GHG emissions are best analyzed at a broader scale, as such this SDEIS contains a quantitative analysis of GHG emissions for the mine operations and coal combustion of coal.

Some public comments received during the initial scoping period requested the U.S. Forest Service disclose a more detailed analysis than the 2012 FEIS of impacts of the reinstatement of the North Fork Coal Mining Area exception to water quality, aquatic habitat, wildlife habitat, specific species, visual quality, location of wetlands, etc. As explained above, these resources are more appropriately examined when a project level application for exploration or leasing action is received. Currently, about 60% of the North Fork Coal Mining Area is unleased with only one lease application and two lease modification proposals. Given the absence of a site-specific mining proposal over the majority of the area, it is not reasonable or useful to attempt to speculate or foresee how, when, or whether this coal would be mined. A lease proposal received 50 years from now likely could have different environmental effects than a lease proposal evaluated today. At the time a site-specific proposal is

received, there will be an associated public involvement process for each of the subsequent NEPA analyses or reviews. The U.S. Forest Service has the discretion to deny consent to coal leasing action, and to impose necessary terms and conditions to protect specific surface resources as terms of consent if the site-specific environmental consequences demonstrate they are warranted.

The 2014 Council on Environmental Quality guidance on programmatic reviews states that one of the purposes of programmatic reviews is to provide greater efficiencies to federal agencies in complying with NEPA. While environmental impacts should be disclosed as soon as information is reasonably available and at the earliest practicable stage, it is not reasonable or efficient to develop numerous speculative potential exploration or leasing scenarios, nor is the public served by developing worst case or hypothetical activity scenarios for the North Fork Coal Mining Area. It is more reasonable and efficient to limit detailed site-specific impact analyses when and if specific proposals are before the agency. This is particularly true in the case of coal leasing, where it is necessary to conduct site-specific resource analyses using a reasonably foreseeable mining scenario to assist in determining if lease stipulations needed for surface resource protections. Consistent with Council on Environmental Quality guidance, this SDEIS will defer detailed site-specific analyses to project level analyses.

# Chapter 2 Alternatives, Including the Proposed Action

This chapter describes the three alternatives considered in detail in this SDEIS. This chapter compares alternatives and describes alternatives dismissed from detailed study.

## *Alternatives Considered but Eliminated from Detailed Study*

NEPA regulations require Federal agencies to explore and evaluate all reasonable alternatives to a proposed action and to briefly discuss the reasons for eliminating alternatives from detailed study (40 CFR 1502.14). The responsible official reviewed and weighed the following alternatives during the analysis process. Therefore, the eliminated alternatives contribute to the range of reasonable alternatives and a reasoned choice, even though they were eliminated from detailed study. The following list describes the alternatives considered but eliminated from detailed study, and the reason(s) why these alternatives were eliminated from detailed study:

- **Methane ($CH_4$) capture and reduction.** This alternative would require the capture or use of waste methane gas from coal mining operations as a mitigation measure. This alternative was dismissed from detailed analysis because critical design criteria that bear upon the feasibility of such capture mitigation are too speculative at this time. The infrastructure necessary to safely and efficiently capture waste mine methane for this purpose is closely associated with preliminary mine planning which typically is considered when lands are being evaluated for leasing. Furthermore, the BLM, with statutory authority to manage federal mineral resources under the mineral leasing laws (inclusive of coal and natural gas resources), issued an advanced notice for proposed rulemaking for waste mine methane capture, use, sale or destruction on April 29, 2014. In its notice, BLM is seeking feedback on technical, economic, and environmental aspects of mine waste methane capture as it considers the application of mitigation to coal leases. The USDA believes that BLM's effort will provide valuable insight into development of sound public policy on mitigating the effects of waste mine methane. Therefore the Department is deferring this issue to the required environmental review that is performed when specific lands are being considered for leasing, with the expectation that the analysis will be better informed by specifics of a capture system and the results of BLM's waste mine methane rulemaking effort. Reinstatement of the North Fork Coal Mining Area exception (Alternatives B and C) allows for infrastructure for the capture or use of methane.
- **Require a carbon offset for coal extracted.** This alternative would require a mitigation measure to require lease stipulations on any coal originating from the North Fork Coal Mining Area include a carbon offset. Under this alternative, any coal removed from the North Fork Coal Mining Area would require a reduction of GHGs elsewhere. This alternative was dismissed from detailed analysis because the requirement for a carbon offset is dependent upon the directed use of a national carbon offset market (cap-and-trade system). While there are several cap-and-trade markets in the United States, the use of which is not being foreclosed as an option with the exception; no congressionally mandated cap-and-trade market exists. The directed use of a cap-and-trade system is beyond the scope of roadless area conservation, the purpose and need for this rule.

- **Increased upper tier acreage.** This alternative would include the reclassification of more acreage in the Colorado Roadless Rule as upper tier. Upper tier areas are CRAs with limited exceptions to provide a high level of protection. This alternative was dismissed from detailed analysis because the July 2012 final Colorado Roadless Rule designated 1,219,200 acres as upper tier after careful consideration, which included five formal public input periods that generated 312,000 public comments. The USDA, at this time, does not see a need to revisit the decision on the amount of upper tier acres and is dismissing this alternative from detailed study because resources or forest uses haven't substantially changed since the 2012 FEIS to warrant reconsideration.
- **Limit sale of coal to Integrated Gasification Combined Cycle or Carbon Capture and Storage facilities.** This alternative would require a stipulation to limit the sale of extracted coal from coal leases within the North Fork Coal Mining area to facilities using Integrated Gasification Combined Cycle or Carbon Capture and Storage technologies. Integrated Gasification Combined Cycle technology turns coal into a gas via a gasifier. Once the coal is converted to a gas, impurities are removed which results in lower emissions of sulfur dioxide, particulates, and mercury. Carbon Capture and Storage technology involves the capture of carbon dioxide burned for electrical generation. Once captured the gas is then stored in geologic formations. This alternative was dismissed from detailed analysis because the EPA recently adopted the Carbon Pollution Standards for Existing Power Plants (known as the Clean Power Plan) which addresses this issue. In addition, expanding the scope of the Colorado Roadless Rule to regulations affecting coal markets is not desired for a regulation that focuses on activities occurring on NFS lands and roadless area conservation and is beyond the purpose and need for this rule.
- **Factor GHG and climate effects when determining the value of coal.** This alternative would require the U.S. Forest Service to incorporate the costs of GHG emissions and the resultant climatic effects when determining the price of unmined coal. While this SDEIS will assume a value of coal for the purposes of the economic analysis, and in the context of the SCC, this alternative was dismissed from further analysis because the price of coal is determined by market forces and setting a price of coal is not within the purpose and need of this SDEIS.
- **Energy efficiency measures and renewable energy.** This alternative would require the U.S. Forest Service direct its resources to energy efficiency measures, the development of NFS lands for renewable energy projects, and potential allowance of road construction in roadless areas for renewable energy projects. While the U.S. Forest Service has implemented a program to upgrade its facilities using renewable energy features, a broad across the board shift of resources is a matter of national policy and there is currently no policy directing such a broad shift of resources. In addition this alternative was dismissed from further analysis because it is the policy of the Federal government to foster and encourage private enterprises in orderly and economic development of domestic mineral resources to satisfy industrial, security and environmental needs. See Appendix C for a list of federal laws and policies that direct the exploration and development of mineral resources. In addition, this alternative is beyond the purpose and need for this rule.

- **Increased recreational opportunities rather than industrial use.** This alternative would open the North Fork Coal Mining Area to development of recreational opportunities, such as hiking and biking trails, instead of the potential development of mineral resources. This alternative was dismissed from detailed analysis because this option is not foreclosed by the Colorado Roadless Rule, and the decision to construct trails and other recreational facilities in the area is a forest plan or project level decision and not a Departmental decision.
- **Exclusion of the Pilot Knob Roadless Area.** This alternative would remove the Pilot Knob Roadless Area from the acreage considered to be the North Fork Coal Mining Area. The basis for this suggested alternative was that the only operating coal mine in the Pilot Knob Roadless Area, the Elk Creek Mine, has idled production operations. This alternative was dismissed from detailed analysis because Oxbow Mining, LLC has continued to show interest to mine in the area as recently as the scoping period for this SDEIS, and even if Oxbow Mining closes their operations in the area, another company could operate in this area. In addition, inclusion of the Pilot Knob Roadless Area meets the purpose and need for this SDEIS.

## *Features Common to All Alternatives*

This section describes the features that are common to all alternatives analyzed in detail in this EIS.

### Colorado Roadless Area Boundary Correction

All alternatives, including the no-action alternative, propose to administratively correct CRA boundaries associated with the North Fork Coal Mining Area (36 CFR 294.47(b)). Roads that existed prior to 2012 in the vicinity of the North Fork Coal Mining Area were re-inventoried with global positioning system technology which allows for more accurate boundary location of CRAs. The boundaries of the CRAs would be adjusted to match the actual location of roads on the ground. The administrative correction to CRAs associated with the North Fork Coal Mining Area would entail:

- Adding 65 acres based on a more accurate mapping of the national forest boundary along the Pilot Knob CRA and more accurate inventory of forest roads 711, 711.3B, and 711.3c.
- Subtracting 35 acres based on a more accurate inventory of forest roads 711, 711.3B, and 711.3c.

The Colorado Roadless Rule recognized that CRA boundaries would need to be corrected to remedy errors and account for improvements in mapping technology. Procedures for correcting CRA boundaries require public notice and a 30-day comment period. No associated environmental documentation process pursuant to NEPA is required for administrative corrections. This is due to the recognition that these corrections are minor, such as the proposed correction associated with the North Fork Coal Mining Area. Differences of 30 acres are too insignificant to warrant effects analyses in context of the 4.2 million acres of CRA within the State of Colorado. Even in context of the North Fork Coal Mining Area, a 30 acre difference is less than 0.2% of the area and is inconsequential in terms of environmental impacts.

### Federal and State Requirements

Management of NFS lands in Colorado are governed by a variety of federal statutes, regulations, executive orders, and the U.S. Forest Service directive system (manuals and handbooks). In addition,

some state laws and regulations apply on NFS lands within the State. The selection of any of the alternatives in this would not affect the applicability of any federal or state requirements.

## Forest Plans

The National Forest Management Act and its implementing regulations at 36 CFR 219, obligate the U.S. Forest Service to develop, amend, or revise plans for each national forest. Forest plans provide guidance for management activities on a national forest, including establishing forest-wide management requirements and direction applicable to the entire forest or to specific management areas. When guidance in a forest plan is more restrictive than direction described under the alternatives, actions must be consistent with the more restrictive direction. For example, if a forest plan standard prohibits road construction where it is allowed under a roadless rule alternative, road construction cannot occur.

None of the alternatives compel the U.S. Forest Service to amend or revise any forest plan. In addition, none of the alternatives limit the authority of a responsible official to amend or revise a forest plan. However, a responsible official would not be able to modify or reduce the restrictions of the adopted rule through a forest plan amendment or revision.

## Project-Specific Environmental Analysis

None of the alternatives authorize any projects or other ground-disturbing activities to occur. Specific projects that include the leasing, exploration or development of coal, or other resources, must undergo site-specific environmental analysis required by NEPA and required permitting conducted by the Colorado Division of Reclamation, Mining and Safety.

## Reserved and Outstanding Rights

Under all alternatives, the reasonable exercise of reserved or outstanding rights for access, occupancy, and use of NFS lands within roadless areas would not be affected. The rights include those that exist by law, by treaty, or by other authority. They include, but are not limited to, the right to provide reasonable access across NFS lands to private property, mining claims for locatable minerals under the 1872 Mining Law, and land uses protected by Native American treaty rights.

## Existing Land Use Authorizations

“Authorizations” refer to land uses allowed under a special use permit, contract, or similar legal instrument. Numerous types of lands and recreation-related authorizations are issued for occupancy and use of NFS lands. All of the alternatives allow for the continuation, transfer, or renewal of existing land use authorizations for activities in roadless areas. “Existing authorizations” are those that are issued before the effective date of the final rule. Private recreational activities do not require an authorization and are not affected by any alternative.

Existing coal leases would continue pursuant to the terms and stipulations of the lease. None of the alternatives revoke, suspend or modify any existing coal leases within the North Fork Coal Mining Area (36 CFR 294.48(a)).

## Other Forest Activities

Activities that are otherwise not prohibited under the alternatives (other than tree cutting, sale, or removal; road construction and reconstruction; and use of linear construction zones) are permissible

in roadless areas, if not restricted by other law, regulations, and policies. These activities include, but are not limited to, the following:

- Motorized and non-motorized trail construction or maintenance;
- Public hunting, fishing, camping, or other dispersed recreational uses;
- Use of a motorized vehicle on a trail open to motorized use;
- Mountain biking on a trail open to mechanized use;
- Prescribed burning, including tree cutting for fireline construction to manage a prescribed fire; and
- Livestock grazing.

## *Alternative A: The No Action Alternative*

This alternative is the no action alternative as required by NEPA, and reflects continuation of current management (see Figure 2-3) consistent with the District Court ruling to vacate the North Fork Coal Mining Area exception to the Colorado Roadless Rule (See Appendix A). The District Court of Colorado's ruling only changed management of CRAs in the North Fork Coal Mining Area, but left the remainder of the rule intact. Currently, the North Fork Coal Mining Area is being managed the same as non-upper tier CRAs. Valid existing coal leases can operate in accordance with the terms of the leases. This alternative would continue current management, with the general prohibitions on tree cutting, sale, and removal; road construction/reconstruction; and use of linear construction zones within CRAs, with some of those activities permitted under certain exceptions as defined in 36 CFR 294 Subpart D.

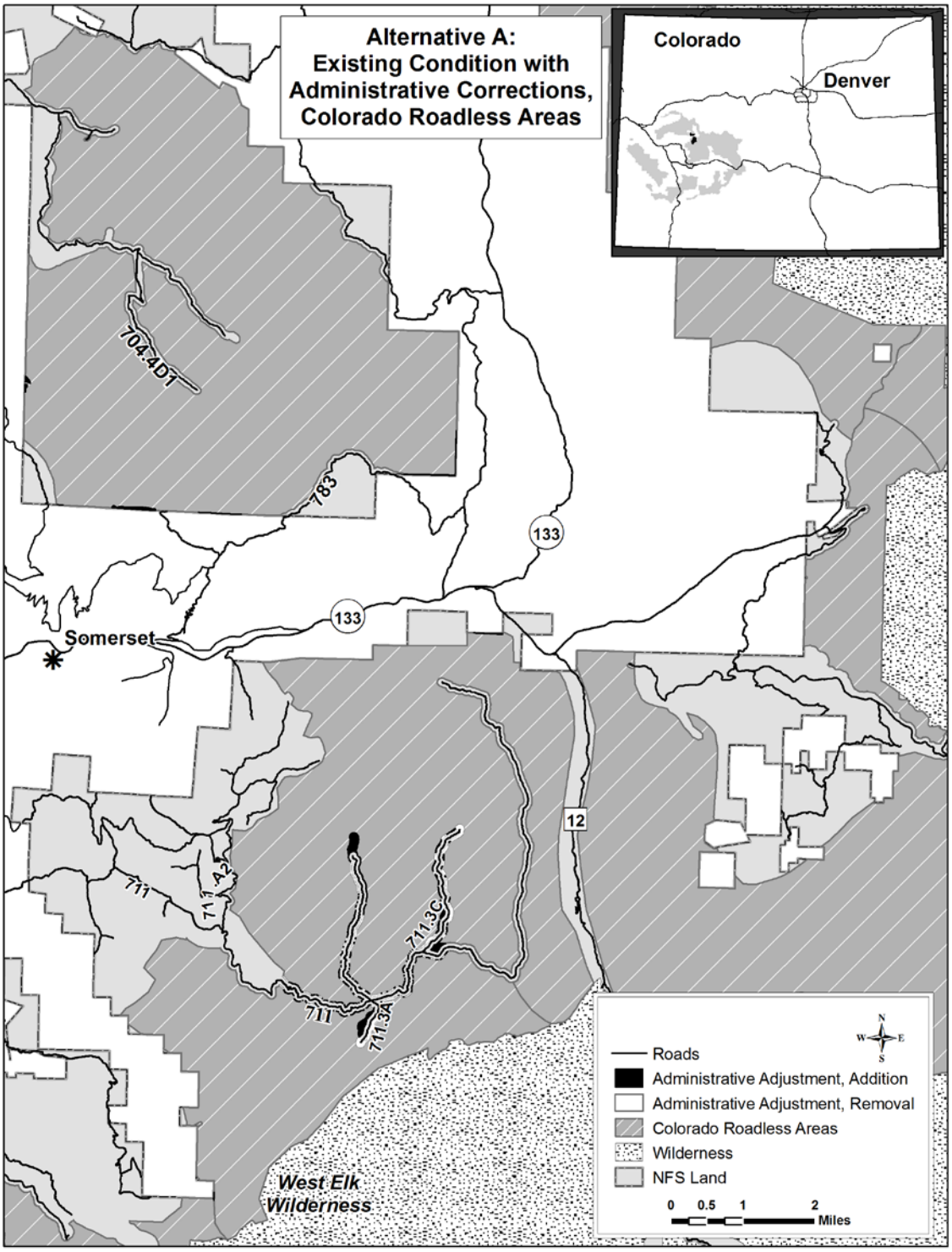


*Figure 2-1. Map of Alternative A, Colorado Roadless Areas Near the Analysis Area with Administrative Corrections*

## *Alternative B: Proposed Action*

Alternative B is the proposed action and preferred alternative, see Figure 2-2. This alternative would reinstate the North Fork Coal Mining Area exception as written in 36 CFR 294.43(c)(1)(ix). Specifically, the following clause would be reinstated:

> *A temporary road is needed for coal exploration and/or coal-related surface activities for certain lands within Colorado Roadless Areas in the North Fork coal mining area of the Grand Mesa, Uncompahgre, and Gunnison National Forests as defined by the North Fork coal mining area displayed on the final Colorado Roadless Areas map. Such roads may also be used for collecting and transporting coal mine methane. Any buried infrastructure, including pipelines, needed for the capture, collection, and use of coal mine methane, will be located within the rights-of-way of temporary roads that are otherwise necessary for coal-related surface activities including the installation and operation of methane venting wells.*

Alternative B would apply to an area similar to the North Fork Coal Mining Area described in the 2012 FEIS. No upper tier acres would be included in the North Fork Coal Mining Area under this alternative. The difference would be changes from an administrative correction to the North Fork Coal Mining Area boundary as described below.

### North Fork Coal Mining Area Boundary Changes

Alternative B proposes to administratively change the North Fork Coal Mining Area boundary to align it to the CRA boundary and to resolve two errors that occurred during the development of the 2012 FEIS. These errors included:

- Changes to CRAs between the Draft Environmental Impact Statement and Revised Draft Environmental Impact Statement – specifically the CRA boundaries were updated but the corresponding match between the CRA boundary and North Fork Coal Mining Area boundary was not made, resulting in numerous inadvertent “slivers” along the boundary.
- Due to an error calculating acres made during the preparation of the 2012 FEIS, an area of about 470 acres was subtracted from the North Fork Coal Mining Area total acreage twice. With this error the final North Fork Coal Mining Area acreage was incorrectly reported as 19,100 acres in the FEIS but should have been reported as 19,500 acres. This error did not physically change the North Fork Coal Mining Area, but the correctly reported total acres increases.

The change to the North Fork Coal Mining Area boundary would entail:

- Adding 409 acres to align the North Fork Coal Mining Area with CRA boundaries.
- Removing 254 acres to align the North Fork Coal Mining Area with CRA boundaries.
- Total size of the North Fork Coal Mining Area would be about 19,700 acres.

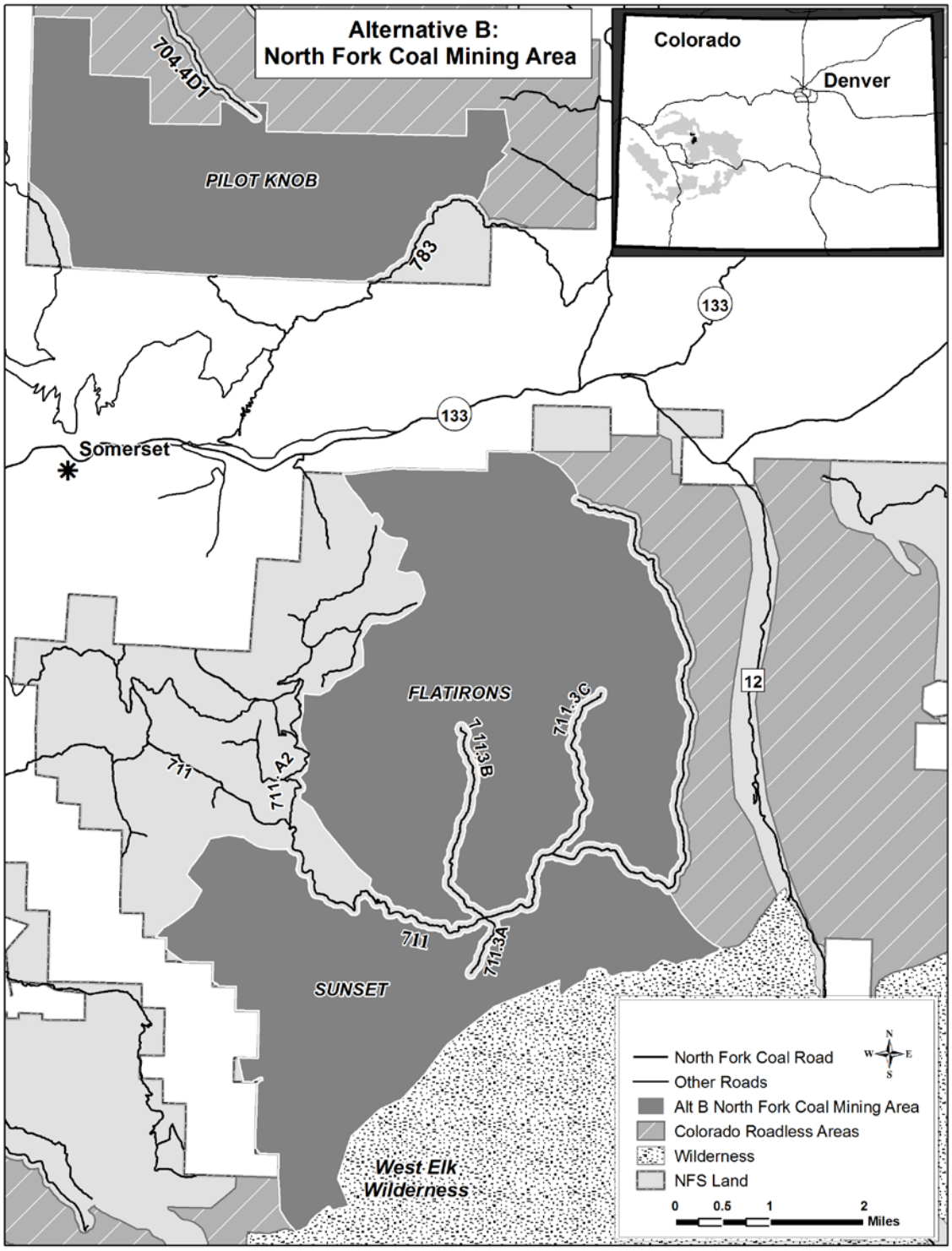


*Figure 2-2. Map of Alternative B, the North Fork Coal Mining Area*

## *Alternative C :*

Alternative C is similar to Alternative B in that it would reinstate the North Fork Coal Mining Area exception as written in 36 CFR 294.43(c)(1)(ix). Specifically, the following clause would be reinstated:

> *A temporary road is needed for coal exploration and/or coal-related surface activities for certain lands within Colorado Roadless Areas in the North Fork coal mining area of the Grand Mesa, Uncompahgre, and Gunnison National Forests as defined by the North Fork coal mining area displayed on the final Colorado Roadless Areas map. Such roads may also be used for collecting and transporting coal mine methane. Any buried infrastructure, including pipelines, needed for the capture, collection, and use of coal mine methane, will be located within the rights-of-way of temporary roads that are otherwise necessary for coal-related surface activities including the installation and operation of methane venting wells.*

### North Fork Coal Mining Area Boundary Changes

Alternative C would apply to an area similar to that of Alternative B, except areas identified as "wilderness capable" in the 2007 GMUG Forest Plan revision effort would be excluded from the North Fork Coal Mining Area. No upper tier acres would be included in the North Fork Coal Mining Area under this alternative. Changes to the North Fork Coal Mining Area boundary would include administrative corrections to resolve the three errors described in Alternative B and a boundary change to exclude the area identified as "wilderness capable".

During the 2007 GMUG plan revision effort, the capability of potential wilderness areas was defined as the degree to which that area contains the basic characteristics that would make it suitable for wilderness. Characteristics considered in the 2007 revision evaluation included:

> Environmental – the degree to which an area appears to be free from disturbance so that the normal biological processes continue and the degree to which the area provides a visitor opportunity for solitude and a sense of remoteness.
>
> Challenge – the degree to which the area offers visitors opportunity to experience adventure and self-reliance, often measured by physical character of the land (terrain and vegetation) and proximity to sights and sounds of developments and travel systems.
>
> Manageability of boundaries – consideration of the ability to manage the area as wilderness, factors considered are size, shape and juxtaposition to external influences.
>
> Special features – the area's capability to provide other values such as geologic, scenic, or cultural features.

The Sunset Roadless Area, identified as "wilderness capable", was not recommended for wilderness in the 2007 GMUG revision effort due to mineral values and boundary management issues. The Flatirons Roadless Area, identified as "wilderness capable", was not recommended for wilderness in the 2007 GMUG revision effort because it was less than minimum size of 5,000 acres. If selected, Alternative C removes these "wilderness capable" acres from the North Fork Coal Mining Area, but would not recommend them for wilderness. Any evaluations and further recommendations would be completed during the GMUG forest plan revision process.

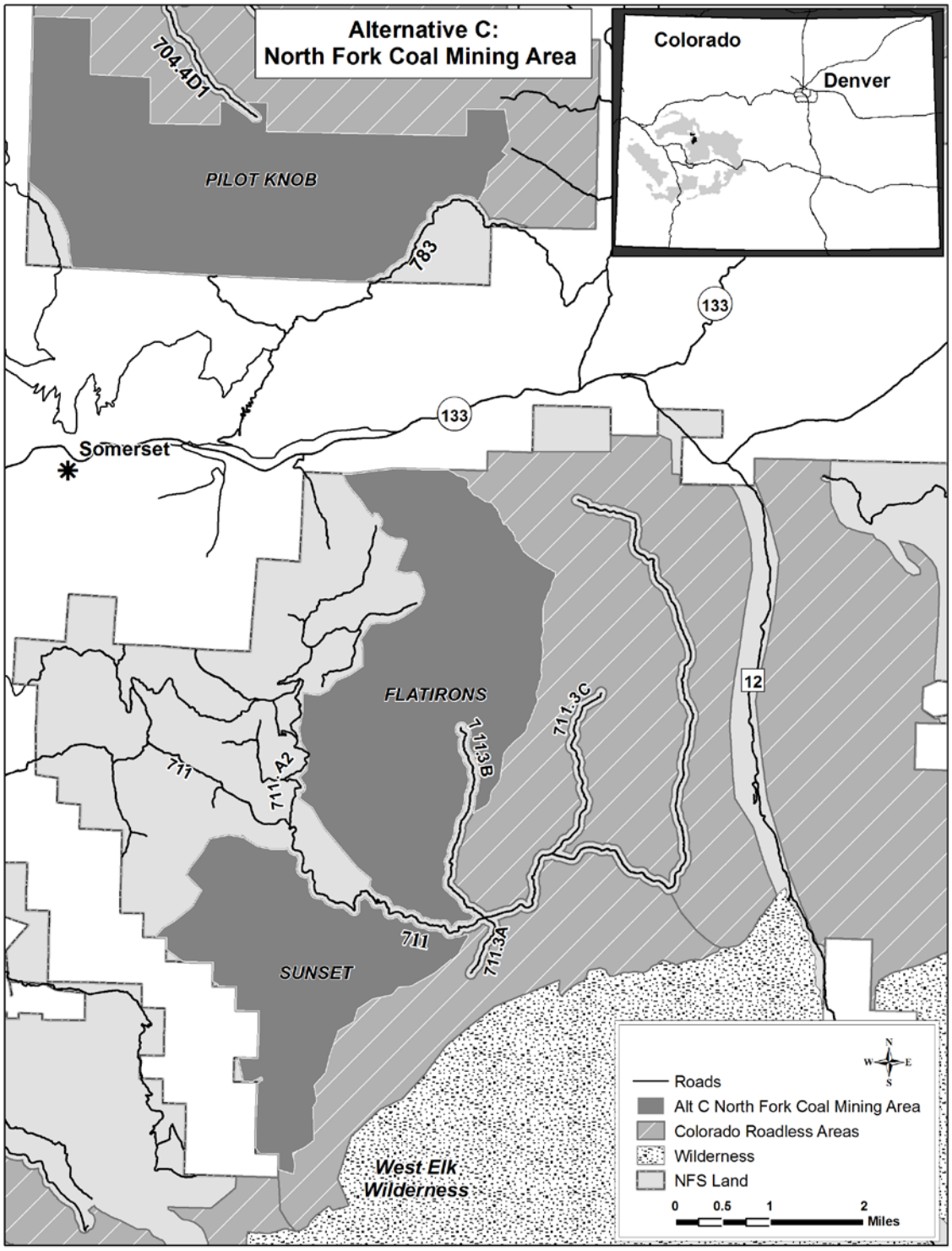


*Figure 2-3. Map of Alternative C, the North Fork Coal Mining Area excluding "wilderness capable" lands*

## *Comparison of Alternatives*

This section provides a comparative summary of each alternative from two perspectives. Table 2-1 compares each alternative by key issue. Table 2-2 compares each alternative by potential environmental consequence.

***Table 2-1.*** *Comparison of Alternatives*

| *Descriptor* | *Alternative A: No Action with CRA Boundary Corrections* | *Alternative B: Proposed Action Reinstatement of North Fork Coal Mining Area with CRA Boundary Corrections* | *Alternative C: Exclusion of "Wilderness Capable" Lands with CRA Boundary Corrections* |
|---|---|---|---|
| Roadless area management direction | 2012 Colorado Roadless Rule without the North Fork Coal Mining Area exception | 2012 Colorado Roadless Rule with the North Fork Coal Mining Area exception | 2012 Colorado Roadless Rule with the North Fork Coal Mining Area exception |
| Administrative correction to roadless area boundaries due to mapping errors | Yes | Yes | Yes |
| North Fork Coal Mining Area lands available for temporary road construction | No – North Fork Coal Mining Area (19,500 acres) would be managed as non-upper tier CRAs | Yes – 19,700 acres | Yes – 12,600 acres |
| "Wilderness Capable" lands excluded | Not Applicable | No | Yes |
| Addresses State of Colorado's interest in not foreclosing coal development | No | Yes | Yes |
| Valid existing coal leases would continue in accordance with the terms of the leases | Yes | Yes | Yes |

**Table 2-2.** *Comparison of Alternatives by Potential Environmental Consequences (Refer to Chapter 3 for Details)*

| *Issue or Affected Resource* | *Alternative A: No Action with CRA Boundary Corrections* | *Alternative B: Proposed Action Reinstatement of North Fork Coal Mining Area with CRA Boundary Corrections* | *Alternative C: Exclusion of Wilderness Capable Lands from proposed North Fork Coal Mining Area with CRA Boundary Corrections* |
|---|---|---|---|
| **Coal** | | | |
| Size of North Fork Coal Mining Area (acres) | 19,500 (All acres managed as non-upper tier) | 19,700 | 12,600 |
| North Fork Coal Mining Area not under lease (acres) | 15,600 | 15,700 | 8,600 |
| Estimated recoverable coal not under lease (tons) | 171 million (Not recoverable with today's technology) | 172 million | 95 million |
| Estimated years of production (for the average production scenario) | 2 (existing leases) | 17 | 9.5 |
| Estimated miles of temporary roads (for total production) | 5 (existing leases) | 36 for exploration<br>72 for development | 20 for exploration<br>39 for development |
| Estimated number of MDWs (for total production) | Between 15 to 30; ranging from about 4.5 to 9 acres of disturbance (existing leases) | Between 240 and 480; ranging from about 72 to 144 acres of disturbance | Between 130 and 260; ranging from about 39 to 78 acres disturbance |
| **Air Resources - GHG Emissions** | | | |
| Range of annual GHG emissions from reinstatement of the exception (metric tons) | Not Applicable (unleased coal resource inaccessible with current technology and thus no additional GHG emissions, existing leases part of the environmental baseline) | 13.7 - 43.2 million | 13.7 - 43.2 million (assumed to be produced at the same rate per year as Alternative B) |
| Total GHG emissions assuming all coal in land available for road construction is produced (tons $CO_2$eq) | 31 million (only coal in existing leases) | 449 - 486 million | 245 - 265 million |
| **Climate** | Unleased coal resources inaccessible, thus no additional GHG emissions beyond the environmental baseline | Greatest increase in GHG emissions among all alternatives. Greatest increase in atmospheric concentrations of GHGs. | Increase in GHG emissions and atmospheric concentrations more than Alternative A and less than Alternative B |

| *Issue or Affected Resource* | *Alternative A: No Action with CRA Boundary Corrections* | *Alternative B: Proposed Action Reinstatement of North Fork Coal Mining Area with CRA Boundary Corrections* | *Alternative C: Exclusion of Wilderness Capable Lands from proposed North Fork Coal Mining Area with CRA Boundary Corrections* |
|---|---|---|---|
| | Climate change part of the environmental baseline | | |
| **Threatened, Endangered, and Sensitive Species** | | | |
| No effect | Lesser prairie-chicken, Southwestern willow flycatcher (critical habitat), Yellow-billed cuckoo (proposed critical habitat), Uncompahgre fritillary butterfly, Pagosa skyrocket, Grizzly bear, Grey wolf, Black-footed ferret, Ute ladies'-tresses, Osterhout milkvetch, Penland beardtongue, Colorado butterfly plant, North Park phacelia, Ute ladies'-tresses orchid, Colorado butterfly plant, North Park phacelia | | |
| May affect, not likely to adversely affect | Gunnison sage-grouse , Mexican spotted owl (species and critical habitat), Southwestern willow flycatcher (species and critical habitat), Yellow-billed cuckoo (species and critical habitat), Greenback cutthroat trout, Pawnee montane skipper, Canada lynx, Preble's meadow jumping mouse (species and critical habitat), DeBeque phacelia (species), Penland alpine fen mustard, Colorado hookless cactus | | |
| May affect, likely to adversely affect | Bonytail chub, Humpback chub, Razorback sucker, Colorado pikeminnow | | |
| **Economics** | | | |
| Value of production (annual average) | $37 million | $254 - 598 million | $254 - 598 million |
| Employment (annual average) | 142 jobs | 986 - 2,320 jobs | 986 - 2,320 jobs |
| Labor income (annual average) | $11 million | $78 – 183 million | $78 – 183 million |
| Present Net Value (millions of 2014 dollars) | | | |
| Forest Boundary | Alternative A | Alternative B – Alternative A | Alternative C – Alternative A |
| Lower Estimate* | Due to the use of electric power generation cost savings as a proxy for benefits, results are provided only for Alternatives B and C, relative to Alternative A (i.e., cost savings cannot be characterized for stand-alone alternatives). | $334 | $272 |
| 3% Discount Avg (Lower)** | | $423 | $329 |
| 3% Discount Avg (Upper)** | | $772 | $450 |
| Upper Estimate* | | $791 | $456 |
| National Boundary | Alternative A | Alternative B – Alternative A | Alternative C – Alternative A |

| *Issue or Affected Resource* | *Alternative A: No Action with CRA Boundary Corrections* | *Alternative B: Proposed Action Reinstatement of North Fork Coal Mining Area with CRA Boundary Corrections* | *Alternative C: Exclusion of Wilderness Capable Lands from proposed North Fork Coal Mining Area with CRA Boundary Corrections* |
|---|---|---|---|
| Lower Estimate* | Due to the use of electric power generation cost savings as a proxy for benefits, results are provided only for Alternatives B and C, relative to Alternative A (i.e., cost savings cannot be characterized for stand-alone alternatives). | -$1,879 | -$968 |
| 3% Discount Avg (Lower)** | | $215 | $191 |
| 3% Discount Avg (Upper)** | | $2,127 | $1,440 |
| Upper Estimate* | | $2,171 | $1,440 |
| Global Boundary | Alternative A | Alternative B – Alternative A | Alternative C – Alternative A |
| Lower Estimate* | Due to the use of electric power generation cost savings as a proxy for benefits, results are provided only for Alternatives B and C, relative to Alternative A (i.e., cost savings cannot be characterized for stand-alone alternatives). | -$12,468 | -$6,861 |
| 3% Discount Avg (Lower)** | | -$3,363 | -$1,819 |
| 3% Discount Avg (Upper)** | | -$1,624 | -$811 |
| Upper Estimate* | | $1,920 | $1,317 |

**Lower and upper estimates are drawn from results from all production schedules (low, average, permitted), and using all the SCC values except the following: 10th percentile SCC values in Forest or National Boundary stances; 5% average SCC values in the Forest Boundary stances, as SCC values in these cases were lower than typical carbon credit prices.*

***Ranges for average SCC values for 3% discount rates are singled out as representative of mid points.*

# Chapter 3 Affected Environment and Environmental Consequences

This chapter, along with the 2012 FEIS, summarizes the environmental, social and economic impacts of implementing the reinstatement of the North Fork Coal Mining Area exception. Although the reinstatement of the North Fork Coal Mining Area exception does not authorize or permit any coal mining, the act of removing prohibitions of temporary road construction would increase the likelihood of coal mining in the North Fork Coal Mining Area. This analysis is based on the increased likelihood. It is unknown how much, where, and when coal mining could occur. This analysis assumes all of the estimated recoverable coal resources would be mined across the entire North Fork Coal Mining Area. This represents the maximum impact that could occur. In addition, this analysis assumes the coal would be mined at a steady rate until exhausted. Three production rates were assumed to facilitate analyses: low scenario (~5.3 million tons annually) based on 2014 production rates; average scenario (~10 million tons annually) based on average annual production from 2001-2014; and permitted level scenario (15 million tons annually) based on the maximum rates authorized under current air quality permits.

The descriptions of effects are based on best available information available at the time of this writing, programmatic projections and assumptions, and professional judgement. Specific amounts, areas, and costs used to describe effects are only estimates and could change during implementation of the rule.

The possible effects of future mining, should it occur, within the North Fork Coal Mining Area on GHG emissions are examined in two different sections within this chapter. The section entitled *Air Resources and Greenhouse Gas Emissions* discloses possible total gross emissions of GHGs (carbon dioxide, methane, and nitrous oxide) that might result if all available coal under each of the alternatives were to be extracted and completely combusted. This section looks only at possible emissions from North Fork coal production and combustion, and does not consider how other sources of energy for electricity production and their GHG emissions might be affected by the availability of North Fork Coal Mining Area coal in the energy supply market. The *Economics* section includes an analysis of how the availability or absence of North Fork Coal Mining Area coal in the energy supply market might affect the mixture of energy sources used to generate electricity within the U.S. electricity market, and assesses the net impact on carbon dioxide emissions that might result from those changes.

## *Coal Resources*

For the coal resource, potential effects of the SDEIS are framed in context of the Colorado Roadless Rule facilitating access to federal coal resources in CRAs through the exception to construct or reconstruct temporary roads. It is assumed accessibility to these federal coal resources currently depends on access with temporary roads to satisfy regulatory requirements for exploration, facilitate resource monitoring, and to support lease development needs such as installing facilities to ensure safe working conditions at underground mines.

## Federal Coal Program Process

Federal coal resource management falls under the purview of the U.S. Department of the Interior - BLM. The legal and regulatory framework governing management of federal coal resources is briefly described below; Appendix C gives a more detailed description.

Coal in the North Fork Coal Mining Area is federal coal managed by the BLM. Private industry explores for and develops federal coal resources through a mineral leasing system managed by the BLM, which includes issuing licenses to conduct exploration, and issuing leases that convey exclusive rights to produce federal coal. The U.S. Forest Service has a role as a surface managing agency in BLM's process to consent to BLM leasing NFS lands for development of federal coal resources, and to prescribe conditions for use and protection of surface resources on exploration licenses and leases. When requested by the BLM, the U.S. Forest Service considers specific lands for lease as applications are made by industry through BLM's regulatory-based leasing process.

Actual exploration activity, mining or mining-related surface uses may only occur when specific approvals for such are granted either by the BLM (on exploration licenses, and in certain cases for exploration on leases); or when leased lands are made part of an approved coal mining permit. In Colorado, coal mining permits are issued by the Colorado Division of Reclamation Mining and Safety with oversight from the OSMRE. If federal coal resources are involved, pursuant to 30 CFR 746, OSMRE prepares and submits, to the Assistant Secretary for Land and Minerals Management, a decision document recommending approval, disapproval, or conditional approval of the mining plan. The Assistant Secretary for Land and Minerals Management then approves, disapproves or conditionally approves the mining plan. The U.S. Forest Service participates in the Colorado Division of Reclamation Mining and Safety and OSMRE permitting process under roles and responsibilities assigned to the federal land managing agency in OSMREs regulations.

This SDEIS does not analyze any specific lands for exploration licensing or leasing, nor does it analyze any site-specific surface activities. The SDEIS analyzes the reinstatement of the North Fork Coal Mining exception. U.S. Regulatory requirements of the Colorado Roadless Rule would be included on future coal actions in the North Fork Coal Mining Area if and when specific projects are proposed. It is unknown if, when or who may submit future applications for coal exploration or leasing.

## Affected Environment

The North Fork Coal Mining Area lies within the GMUG National Forests, and encompasses 19,700 acres within the Somerset Coalfield where potentially mineable coal resources are known to occur in CRAs and where existing leases overlap with CRAs. Outer boundaries of the North Fork Coal Mining Area were defined by where coal resources lie 3,500 feet below the land surface or shallower, or where geologic data indicated potentially mineable coal is not present.

Coal in the North Fork Coal Mining Area is bituminous, with energy content ranging from 10,000 BTU to over 13,000 BTU (British Thermal Unit) (Carroll, 2004). The coal has low ash and mercury content, and is low in sulfur. Because of the low sulfur content, the coal is considered to be Clean Air Act "compliant" and "super-compliant coal", meaning that the coal emits less than 1.2 pounds of sulfur dioxide per million BTU when burned (compliant), or less than 1.0 pound of sulfur dioxide per million BTU when burned (super compliant).

While three coal mines exist in the area, two underground mines, the Elk Creek Mine (operated by Oxbow Mining, LLC) and the West Elk Mine (Operated by Mountain Coal Company, LLC, an affiliate of Arch Coal Inc.) currently hold federal coal leases and conduct operations within the North Fork Coal Mining Area. Only the West Elk Mine is currently producing coal, having produced about 5.2 million tons in 2014 (Colorado Division of Reclamation, Mining and Safety, 2015). The Elk Creek Mine idled production operations in 2014 due to mining difficulties and underground safety issues. Both mines construct and use temporary roads and MDWs on existing leases in the North Fork Coal Mining Area as necessary.

As of 2015, there were about 13,300 acres of NFS lands on the GMUG National Forests under lease for coal, about 4,000 acres of which are in CRAs within the North Fork Coal Mining Area. An estimated 5 miles of temporary road were constructed in CRAs on existing leases since enactment of the Colorado Roadless Rule in July 2012 using the North Fork Coal Mining exception for temporary road construction prior to the vacatur.

Since 2003, production from mines with leases in the North Fork Coal Mining Area represented between 23% and 37% of the total coal production in Colorado. Between 2003 and 2013, coal production from Colorado accounted for between 2.3% and 3.5% of total U.S. coal production.

According to the BLM, in 2015, there was one coal lease-by-application, for an additional coal seam(s) for and area under lease (Elk Creek Mine), and two coal lease modification applications on file (West Elk Mine) for NFS lands within the North Fork Coal Mining Area. In addition, there was one coal lease modification (Elk Creek Mine) pending final issuance from the BLM within the North Fork Coal Mining Area.

### ***Coal Resource Estimation***

The coal resource estimations were made in consultation with the BLM Colorado State Office. Specific coal resource information for the North Fork Coal Mining Area is limited at this SDEIS stage, therefore for the purposes of this programmatic SDEIS, exploration data and coal resource occurrence from adjacent existing mine operations were used to estimate coal resources within the North Fork Coal Mining Area. More discrete coal resource data will not be available unless or until an application to explore, or to lease lands is made in the future (see Appendix C). For the purposes of analysis, the generalized assumptions used were determined to provide a reasonable estimate of potential coal resources in the area, and is a suitable level of information for a programmatic analysis.

Estimations of recoverable coal resources were made based on BLMs standard approach using the equation below to estimate in-place resource:

Acres multiplied by 1,830 tons of coal per Acre minus feet multiplied by Height of mining horizon (ft)

Recoverable coal resources were then estimated at 60% of in-place resources. The estimations assumed a 10 foot mining horizon to reasonably depict the mineable coal seam thickness present in the North Fork Coal Mining Area. The estimations for the SDEIS differ from those present in the 2012 FEIS because of currently available resource information that was not available during the 2012 FEIS. Where the 2012 FEIS assumed a 20 foot mining horizon, additional coal data from exploration and mining to date on leases adjacent to or within the North Fork Coal Mining Area were used by BLM to refine mining horizon thickness to 10 feet. Similarly, a 60% recoverability factor was used

for the SDEIS as a reasonable estimation based on recovery rates from the existing mines. Estimations of coal in existing leases accounted for some coal resources having already been recovered from those leases, thus the estimations reflect the amount of coal resources remaining. Table 3-1 shows acreage of the North Fork Coal Mining Area, leased acreage, and acreage with coal resources remaining by alternative.

***Table 3-1.*** *Comparison of Coal Resources by Alternative within the North Fork Coal Mining Area*

| *North Fork Coal Mining Area and Existing Coal Leases (Acres rounded to the nearest hundred)* | | | | | | *Coal Resource Estimation (Tons rounded to nearest the million)* | | | |
|---|---|---|---|---|---|---|---|---|---|
| | ***Existing Coal Leases [1] (NFS Acres)*** | | | | | ***Coal not under lease*** | | ***Coal remaining in Existing Leased acres*** | |
| | Total Area | Existing Leases | Not under lease (2014) | Already produced | Coal reserves remaining | In place coal (tons) | Recoverable (tons) | In place coal (tons) | Recoverable coal (tons) |
| Alt A | 19,500 | 3,900 | 15,600 | 2,900 | 1,000 | 285 million | 171 million* | 18 million | 11 million |
| Alt B | 19,700 | 4,000 | 15,700 | 2,900 | 1,100 | 287 million | 172 million | 20 million | 12 million |
| Alt C | 12,600 | 4,000 | 8,600 | 2,900 | 1,100 | 157 million | 94 million | 20 million | 12 million |

**Not recoverable with today's technology*

The U.S. Forest Service does not have jurisdiction over private lands with private mineral estate. Access to private lands and private coal resources is not dependent on the Colorado Roadless Rule, and neither are private coal resources subject to the U.S. Department of the Interior's leasing process. A private mineral holder could choose to submit permit application materials to the Colorado Division of Reclamation Mining and Safety at any time and request approval to produce the private coal resources, and/or construct surface facilities on the private lands.

### ***Estimated Projections for Temporary Road Construction and Reconstruction***

For the purposes of analysis, the SDEIS assumes accessibility to federal coal resources depends on ability to construct temporary roads to satisfy regulatory requirements for exploration (BLM regulations establish that a certain amount of exploration data must be available in order for the BLM to consider leasing. Such data is not available for this SDEIS, any future consideration of leasing within the North Fork Coal Mining Area would require additional exploration data. The analysis also assumes that without road access, coal exploration requirements could not be met at this time, and safe and economic development of coal resources in the North Fork Coal Mining Area also may not occur at this time.

Typical coal-related surface uses are assumed to potentially include exploration drilling and associated temporary road construction, coal mine methane management facilities including methane drainage wells (MDW) with associated temporary access roads, ventilation shaft and escape-ways with temporary access roads, resource monitoring facilities and mine infrastructure facilities with associated temporary access roads. Placement of surface facilities, including temporary roads, could

be precluded on portions of coal leases or exploration licenses in roadless areas where resource protection conditions limit surface use to protect other resources.

Certain coal-related surface facilities and associated roads may exist on the landscape for many years (20 to 30) in the case of ventilation shafts, monitoring or other facilities and life-of-mine roads, or may be of shorter term (less than 2, or 3 to 5 years) in the case of exploration holes or methane drainage wells, and other short term uses. All coal-related roads are considered temporary roads, which are decommissioned and reclaimed once no longer needed for purposes of the lease. Experience in decommissioning and reclaiming temporary roads constructed on coal leases and exploration licenses in the area shows that reclamation practices are effective in returning the NFS lands and resources to on-going uses that support land management plan direction. Over the long term, decommissioning temporary roads by restoring the corridor to approximate original contour, replacing topsoil resources and revegetating the lands return to roadless character.

About 1.5 miles of temporary road for each 640-acre section was assumed as a reasonable estimation of temporary roads for exploration purposes in unexplored areas, with respect to temporary road mileage estimations,. For Alternative A, no temporary road miles for exploration were estimated, as prohibitions for road construction or reconstruction in areas outside existing leases are in effect. For Alternative B, the unleased acreage represents about 24, 640 acre sections. Assuming 1.5 miles of temporary road construction per section for exploration purposes, the temporary road construction is estimated at 36 miles. For Alternative C, the unleased acreage represents about 13, 640 acre sections, for which the estimation of temporary road construction for exploration is about 20 miles.

Since early 2001, construction and/or reconstruction of temporary roads have been needed to support construction of MDWs to remove methane (an explosive gas) from the underground mines operating in the Somerset Coalfield. These wells are part of a mine operator's Mining Safety and Health Administration – approved ventilation plan, and are needed to meet Mining Safety and Health Administration requirements for safe methane levels in underground mines to ensure worker safety. Thus, for the purposes of the SDEIS, it was assumed that road access could be needed for lease development purposes (i.e., surface facilities) to promote safe and efficient recovery of the coal resources. Based on information from existing operations, between 10 and 20 methane drainage well locations per 640 acre section were estimated, and temporary road miles to support these facilities were estimated using an assumption of 3 miles of temporary road per 640 acre section. Thus, for unleased acres in the North Fork Coal Mining Area, about 72 miles of temporary road are estimated under Alternative B, and 39 miles are estimated under Alternative C for construction of MDWs. Table 3-2 displays estimated temporary road miles and estimated surface disturbance by alternative.

***Table 3-2.*** *Comparison of Temporary Road Mileage, Number of Methane Drainage Wells, and Disturbance Acres for methane Drainage Wells by Alternative*

| | *Estimated Temporary Road Mileage* | *Estimated Number of MDWs; projected disturbance* | *Estimated Disturbance Acreage from MDWs as Percent of Overall North Fork Coal Mining Area* |
|---|---|---|---|
| Alternative A | ~ 5 for lease development | Between 15 to 30; ranging from about 4.5 to 9 acres | Less than 0.5% of existing leased acreage |

| | *Estimated Temporary Road Mileage* | *Estimated Number of MDWs; projected disturbance* | *Estimated Disturbance Acreage from MDWs as Percent of Overall North Fork Coal Mining Area* |
|---|---|---|---|
| Alternative B | ~36 miles for exploration<br>~72 miles for lease development | Between 240 and 480; ranging from about 72 to 144 acres | Less than 1% of North Fork Coal Mining Area |
| Alternative C | ~ 20 miles for exploration<br>~39 miles for lease development | Between 130 and 260; ranging from about 39 to 78 acres | Less than 1% of North Fork Coal Mining Area |

For the SDEIS, the U.S. Forest Service conducted a geographic information system-based statistical review of temporary road construction related to MDWs at existing operations. This review showed there is large variability in temporary road mileage densities, ranging from 0.06 to 11.6 mi/mi$^2$. The statistical analysis also showed that the average temporary road density is 2.33 mi/mi$^2$ with a median of 1.87 mi/mi$^2$, and that more than half of the sample set fell below 2 mi/mi$^2$. The potential for large variability demonstrates that it is not reasonable to make precise projections of temporary road miles for rule development purposes within the North Fork Coal Mining Area. Further, since the statistical analysis showed an average of 2.33 mi/mi$^2$ and a median of less than 2 mi/mi$^2$, the 3 mile per section (or mi/mi$^2$) estimation carried forward from the 2012 FEIS was found to be statistically greater than the sample median, and thus represents a conservative, and reasonable estimate for the purposes of the programmatic SDEIS.

Road construction activity related to coal exploration or for other surface uses typically occurs intensively for one to several years, and then slows. There are typically gaps of time where no road construction or other activity occurs. Temporary roads used for coal exploration or surface uses (such as MDWs) are typically decommissioned as soon as they are no longer needed according to practices of contemporaneous reclamation. Therefore, it is assumed that only a portion of overall disturbance could be in place at a given time. Some roads may remain on the landscape for the duration of mining in a particular area or lease, and could be dependent on production plans and monitoring required in the State-approved mining permit. Temporary roads constructed for these purposes are for approved administrative uses only, and are not open for public use.

For the purposes of analysis, the SDEIS also assumes surface disturbance related to MDW pad locations.

## Environmental Consequences

This analysis assumes that if temporary road construction or reconstruction is prohibited in the North Fork Coal Mining Area, then recovery of the federal coal resources could be severely limited, resulting in the coal resources being rendered not producible from either safety, technological or productivity standpoints at this time. For the purposes of this analysis, these effects are framed in terms of overall ‘accessibility’ to coal resources, in which accessibility is linked to the ability to construct or reconstruct roads for exploration or lease development purposes.

The analysis area is the North Fork Coal Mining Area as defined for each alternative.

### ***Alternative A – Direct and Indirect Effects***

Alternative A assumes that the North Fork Coal Mining Area exception would not be reinstated. Without ability to construct or reconstruct roads, an estimated 172 million tons of recoverable coal on 15,600 acres of unleased lands in the North Fork Coal Mining Area could become inaccessible at this time. This amount represents about 17% of the overall coal tonnage produced in the U.S. in 2013.

Given the assumption that temporary roads are necessary to safely and economically develop federal coal resources in the North Fork Coal Mining Area, only coal in existing leases could be produced with currently available technology. In this alternative, the North Fork Coal mining Area includes 19,500 acres, about 3,900 of which are currently under lease. Of the leased acres, an estimated 1,000 acres have coal resources remaining, which are estimated to contain about 11 million tons of recoverable coal resources (see Table 3-1).

Alternative A projects construction of an estimated five miles of temporary road to support developing the coal remaining in existing leases. According to the Colorado Roadless Rule, temporary road construction is subject to requirements that minimize effects to surface resources, prevent unnecessary or unreasonable surface disturbance and comply with lease stipulations, Forest Plan direction, regulation and laws. The temporary roads would be for administrative use only closed to the public, and only open to coal operators, their contractors, and the U.S. Forest Service, other Federal and State agencies with jurisdictional authority over coal mining activities, and emergency personnel. The Colorado Roadless Rule establishes that temporary roads be decommissioned by obliteration, and reclaimed to productive conditions, and according to requirements in the applicable lease, license, or permit. Coal mine permit conditions call for reclaiming disturbed lands to support the post-mining land use, based on the Forest Plan direction.

### ***Alternative B – Direct and Indirect effects***

Alternative B proposes to reinstate the North Fork Coal Mining Area exception to the Colorado Roadless Rule. With the ability to construct and reconstruct temporary roads for coal mining-related purposes, an estimated 172 million tons of federal coal resources on 15,700 acres of unleased lands in the North Fork Coal Mining Area could be accessible. This amount of coal represents about 17 years of production assuming an average production rate of 10 million tons per year.

Alternative B projects 36 miles of temporary road for exploration purposes, and 72 miles for lease development activity in the 15,700-acre North Fork Coal Mining Area. Temporary road construction or reconstruction needed for exploration licenses, or for lease development purposes would follow the provisions of the Colorado Roadless Rule for construction, operation, decommissioning and reclamation, and other requirements (such as required by a mine permit) as described in Alternative A.

With reinstatement of the North Fork Coal Mining Area exception, infrastructure that may be needed to support coal mine methane management projects (collection) could be placed within the rights-of-way of temporary roads that were otherwise needed for coal-related surface activities (36 CFR 294.43(c)(1)(ix) . This could result in temporary roads remaining on the landscape for a longer period of time to support the pipeline infrastructure needed for methane management facilities.

### ***Alternative C – Direct and Indirect effects***

Alternative C considers reinstating the North Fork Coal Mining Area exception on about 12,600 acres. With the ability to construct and reconstruct temporary roads for coal mining-related purposes, an estimated 95 million tons of federal coal resources on 8,600 acres of unleased lands in the North Fork Coal Mining Area could become accessible. This amount of coal represents about 9.5 years of production assuming an average production rate of 10 million tons per year.

Alternative C projects about 20 miles of temporary road for exploration purposes, and 39 miles for lease development activity in the 12,600-acre North Fork Coal Mining Area. Temporary road construction or reconstruction needed for exploration licenses or for lease development purposes would follow the provisions of the Colorado Roadless Rule for construction, operation, decommissioning and reclamation, and other requirements as described in Alternatives A and B.

With reinstatement of the North Fork Coal Mining Area exception, infrastructure that may be needed to support coal mine methane management projects (collection) could be placed within the rights-of-way of temporary roads that were otherwise needed for coal-related surface activities (36 CFR 294.43(c)(1)(ix) . This could result in temporary roads remaining on the landscape for a longer period of time to support the pipeline infrastructure needed for methane management facilities.

## Cumulative Effects

The cumulative effects analysis assumes that for all alternatives, the Rule does not affect accessibility to federal coal resources on leased or unleased NFS lands not within the North Fork Coal mining Area, nor on adjacent non-NFS lands.

Under any alternative, because the exception only applies to the North Fork Coal Mining Area, coal resources in CRAs on other national forest units, or in areas of the GMUG National Forests outside the North Fork Coal Mining Area, are considered inaccessible; including undetermined amounts of coal resources in roadless areas on:

- the Pike-San Isabel National Forest;
- Routt National Forest;
- White River National Forest;
- portions of the Pagosa Springs Coalfield on the San Juan National Forest;
- Coal in other coalfields on the GMUG National Forests including the Carbondale, Crested Butte, Tongue Mesa, Grand Mesa fields where they overlap with CRAs;
- an estimated 163 million tons of recoverable coal in the portion of the Grand Mesa coalfield that overlaps with the Currant Creek CRA;
- a portion of the Flatirons CRA east of the North Fork Coal Mining Area containing an estimated 52 million tons of recoverable coal.

Inaccessibility of these resources represents lost opportunities to explore for and develop this coal.

All alternatives assume some level of potential temporary road construction, related to the amount of acreage currently under lease, or that could be accessible by alternative under the Rule, thus Alternative A assumes less temporary road construction than Alternatives B and C. For either action alternative, it was assumed all disturbances to be temporary, not occur simultaneously, and that requirements to decommission and reclaim the road corridor to the approximate original contour,

replacing topsoil resources and revegetated when no longer needed apply. Over the long term, roadless area characteristics would return.

For Alternatives B and C, cumulative effects include recovery of coal remaining in existing leases within the North Fork Coal Mining Area. Under these alternatives, an estimated 1,100 acres of existing leases in the North Fork Coal Mining Area have remaining coal resources, and contain an estimated 12 million tons of recoverable coal (Table 3-1). Temporary road needs are projected to be about 5 miles, and methane drainage well needs are projected to be between 15 and 30, with up to an estimated range of disturbance between 4 and 9 acres. The analysis assumed that all construction, operation and reclamation requirements are the same as described for Alternative A.

The Energy Information Administration projects that coal will supply about 34% of the U.S. electrical generation needs, and projects a small increase in demand for domestic coal resources through 2030. About 10% of the national coal resources come from federal lands. Under current mining conditions, temporary road construction and reconstruction prohibitions under Alternative A will restrict access to federal coal resources, decreasing availability of these resources to help meet projected coal resource needs.

## *Air Resources and Greenhouse Gas Emissions*

This section discloses possible GHG emissions that could result under the three alternatives being considered related to the exception allowing for temporary road construction for coal exploration and coal related surface activities within the North Fork Coal Mining Area. When considering the results presented here, it is important to understand that many uncertainties exist regarding the potential for future coal extraction. Because this decision does not authorize any ground-disturbing activities, any additional coal-related development on unleased lands would need to be authorized under subsequent decisions subject to additional NEPA analysis. It is not known when or how much development might occur, particularly when considering activities that might occur well into the future. In order to estimate possible GHG emissions, many assumptions about future development activities were made that may not hold true. Therefore, the GHG emissions presented here should be considered as estimates only, not predictions of what could occur.

### Scope of Analysis

The focus of this air analysis is to remedy deficiencies outlined by the District Court of Colorado (See Appendix A) regarding estimates of potential GHG emissions and to provide the information and level of analysis required by NEPA to make an informed decision whether to reinstate the North Fork Coal Mining exception. As already highlighted in Chapter 1, the scope of this analysis is specific to the North Fork Coal Mining Area as defined in the Colorado Roadless Rule.

### Direct and Indirect Emissions

This section discloses the direct and indirect GHG emissions that might result should coal be produced from the mines within the North Fork Coal Mining Area under the three alternatives. These include emissions that might result from the mining activity itself, as well as those that might result from activities that could occur after the coal is produced, including transportation of the coal and combustion in an industrial facility, most likely an electrical generating facility.

In order to provide some projected estimate of the amount of GHG emissions that might be emitted under the three alternatives, assumptions were made about possible annual coal production rates using

existing mines operating in the area. They are referred to here as the low, average, and permitted level production scenarios. Under all three scenarios, it was assumed that the rate of production (i.e., the tons of coal produced annually) would remain constant from year to year.

- The low scenario assumed that production rates would be the same as the actual 2014 production rates reported by the two mines that have existing operations in the area. These rates were 0 tons for the Elk Creek Mine and approximately 5.3 million tons annually for the West Elk Mine.
- An average scenario assumed an average production of 10 million tons annually. Based on the average production by the two existing mines between 2001 and 2014.
- The permitted level scenario is the maximum mining rates authorized by the current mines' air quality permits, 15 million tons annually. The Elk Creek Mine is permitted for no more than 7 million tons of coal production per year, and the West Elk Mine is permitted for no more than 8.5 million tons production per year.

The low and permitted production scenarios provide upper and lower bounds for the annual GHG emissions estimates under the three alternatives. However, the total amount of coal that could be produced is different for each alternative, and thus the total GHG emissions associated with coal production is different for each alternative.

### ***Alternative A***

Under Alternative A, the current court vacatur of the North Fork Coal Mining Area exception (See Appendix A) would remain in effect. With no exception for temporary road construction for coal-related activities for future leases, this analysis assumes that unleased coal resources within the North Fork Coal Mining Area would be inaccessible, and thus would not be produced; however this may become feasible with changes in technology. Temporary roads are necessary for lease development purposes such as installing MDWs to vent methane associated with coal seams, allowing workers to safely access the underground coal. Without road access, the unleased coal resources within the North Fork Coal Mining Area are considered inaccessible, and thus will have no additional GHG emissions from producing the unleased coal resources.

There are existing leases totaling about 11 million tons of coal that that is assumed will be produced. There would therefore be GHG emissions under Alternative A resulting from coal produced from the existing leases. Annual rates of GHG emissions were calculated as described in the following discussion for Alternative B, but the duration of mining would be shorter and thus the total GHG emissions would be lower than for either of the other alternatives. Under Alternative A, the mining duration would be approximately 2 years under the low production scenario, 1 year under the average production scenario, and 1 year under the permitted production scenario. In total, under Alternative A, approximately 31 million metric tons of GHGs could be emitted. For this alternative, given that the time needed to produce the currently leased coal within the North Fork Coal Mining Area is not expected to be more than 2 years under the assumptions made here, the average and permitted production scenarios are extremely unlikely as only one of the two mines is currently producing.

### ***Alternative B***

Under Alternative B, the North Fork Coal Mining Area exception would be reinstated. The exception would allow for temporary road construction for exploration and coal-related surface activities on unleased lands within the North Fork Area.

Under this alternative it is estimated that approximately 172 million tons of recoverable coal resources lie within the 19,700 acres of the North Fork Coal Mining Area. However, there are currently no proposed projects being considered under this analysis, the timing and amount of any future development is not known at this time, and it is unknown how long any future production would continue. There are many factors that influence the likelihood of additional development over the planning horizon for this analysis. These include changes in demand for coal resulting from economic variability, the replacement of coal used in electricity generation by natural gas and other sources, changes in the regulatory environment, unforeseen difficulties in accessing coal within the area, and other factors (see coal section).

In order to provide some estimate of the amount of GHG emissions that might be emitted under Alternative B, several assumptions had to be made. For this alternative, it was conservatively assumed that all 172 million tons of coal could be produced. In order to estimate how long this might take, the three scenarios were used, low, average, and permitted level. Under all three scenarios, it was assumed that the rate of mining (i.e., the tons of coal produced annually) would remain constant from year to year.

Under Alternative B, the mining durations for each production scenario could be approximately 33 years under the low scenario, 17 years under the average scenario, and 11 years under the permitted level scenario under the assumption that all of the coal could be produced continuously at a constant rate. These estimates of possible mining duration do not include the mining of the 11 million tons that are already under lease as discussed under Alternative A.

**Methodology**

GHG emissions estimated in this analysis include carbon dioxide, methane, and nitrous oxide ($N_2O$). The GHG calculation methodology estimated lifecycle GHG emissions from potential underground mining as the sum of:

- GHG emissions from extraction of the coal and transportation to market in the U.S., referred to interchangeably as the emissions from "upstream" or "production" processes (these emissions include methane releases from the mine during coal mining);
- GHG emissions from shipping some portion of the coal overseas; and
- GHG emissions from combustion of the coal in an electrical utility or other industrial facility.

In order to estimate possible GHG emissions that might result from coal mining in a reasonable way, this analysis used a tool developed by experts at the U.S. Department of Energy's National Energy Technology Laboratory to estimate GHG emissions from the upstream processes. The National Energy Technology Laboratory implements a broad spectrum of energy and environmental research and development programs (http://www.netl.doe.gov/). Laboratory personnel are experts in coal, natural gas, and oil technologies and their impacts, analysis of energy systems, and international energy issues. As part of its mission, the laboratory has developed software tools to estimate lifecycle GHG emissions associated with the extraction and use of fossil fuels.

This analysis used one of these tools, known as the Upstream Dashboard (Skone, 2015), to create emissions factors that account for GHG emissions (carbon dioxide, methane, and nitrous oxide) for the upstream processes associated with coal mining. The upstream processes accounted for by the tool include mining the coal and transporting it by rail within the U.S. It was assumed in this analysis that coal is shipped only by rail within the U.S. The dashboard tool also includes methane emissions from the mine that occur during mining operations. Appendix C of the National Energy Technology Laboratory document entitled *Life Cycle Analysis of Natural Gas Extraction and Power Generation DOE/NETL-2014/1646* (DOE, 2014) describes all of the processes included in the raw material acquisition and transportation portions of the tool. The tool accounts for emissions from all phases of the mining operations, to include construction of the mine and associated facilities, operation of the mine itself and various coal handling facilities, coal mine methane emissions, and transport of the coal via train. This tool is appropriate for use in this type of programmatic analysis as it was developed by experts in the field of energy and it accounts for a comprehensive suite of GHG-producing activities associated with coal production from typical gassy underground mines.

There are three key parameters a user needs to enter into the dashboard in order to calculate estimated emissions factors for GHGs. The first key parameter to choose is the Intergovernmental Panel on Climate Change year and time horizon (IPCC, 2015). The Intergovernmental Panel on Climate Change periodically releases updated reports on the current state of climate change science that include the Panel's latest recommendations on the global warming potential of various GHGs. The global warming potential of a gas is defined by EPA as "a measure of the total energy that a gas absorbs over a particular period of time (usually 100 years), compared to carbon dioxide" (EPA, 2015). For example, a global warming potential of 30 for a given GHG would indicate that it will absorb approximately 30 times as much energy as an equivalent amount of carbon dioxide over a given time period. The Intergovernmental Panel on Climate Change reports different values for the global warming potential of GHGs depending on the time period that is assumed. The 100-year time horizon is typically used by EPA so the Intergovernmental Panel on Climate Change 100-year global warming potentials given in its most recent (2013) report were selected in the dashboard tool. These values have changed slightly since this version of the Upstream Dashboard was created, so the Dashboard emissions factors in mass units were multiplied separately by their global warming potential values. The global warming potential values used in this analysis were 36 for methane and 298 for nitrous oxide. Amounts of different GHGs can then be expressed in terms of their carbon dioxide equivalent ($CO_2$eq) by multiplying the amount of each gas by its global warming potential value. Because the global warming potentials of different gases are relative to that of carbon dioxide, the global warming potential of carbon dioxide is always equal to 1.

The second parameter is the amount of methane emitted per ton of coal produced. As mentioned previously, in order to provide some projected estimate, assumptions were made using existing mines operating in the area. Methane emissions from the mines in the North Fork Coal Mining Area have proven to be highly variable and not closely tied to production. The dashboard assumes a default value of 422 standard cubic feet of methane per ton of coal produced for a typical gassy mine. Although it is not known whether the same mines now operating in the area will continue to operate in the future, or whether they will operate in a similar manner, some assumptions had to be made in order to derive a reasonable estimate of possible future methane emissions. Because the production scenarios were based upon possible future mining rates for the existing Elk Creek and West Elk

mines, reported methane emissions data from those two mines were used to reasonable estimates of possible future methane emissions from mines within the North Fork Coal Mining Area. Available methane release data for the West Elk and Elk Creek mines were downloaded from EPA's facility GHG data web site (EPA, 2015), in tons of $CO_2$eq. The site contained three years' worth of data (2011-2013). EPA's standard value for the global warming potential of methane is 25, so the reported methane emissions in $CO_2$eq were divided by 25 to obtain tons of methane. The resulting emissions in tons of methane were then converted to standard cubic feet using an average value for the density of natural gas (as listed on the Upstream Dashboard tool's Unit Reference tab). Finally, the ratio of methane emitted in standard cubic feet to tons of coal produced was calculated using the reported coal production in tons for those years.

The range of annual values for methane emissions in standard cubic feet /ton of coal over the three year period were 257-429 for the West Elk mine, and 412-933 for the Elk Creek mine. An average was computed for the years of available data for each mine in order to be reasonably representative of typical emissions by summing all of the annual methane emissions and dividing by the sum of the annual coal production. The emissions from Elk Creek for 2013 were excluded from the calculation because coal production dropped substantially in that year due to the mine idling and the data from that year are not likely to be representative of typical operations. The resulting averages obtained for methane emissions in standard cubic feet /ton coal were 898 for Elk Creek and 327 for West Elk. These values were entered into the Upstream Dashboard tool and emissions factors for the three GHGs were obtained. Greenhouse gas estimates were obtained by multiplying the emissions factors by the annual coal production using the production assumptions for each of the three scenarios described above.

The last key user-entered parameter in the Upstream Dashboard tool is the transport distance and type. Rail was chosen with a transport distance of 4,000 miles (round trip). This allows for transport one-way of up to 2,000 miles, which includes most of the U.S., including the Midwest, all of the western U.S., and potential export locations in Long Beach, Vancouver Canada, and New Orleans. This round-trip might not quite account for the distances to ship to some locations on the eastern seaboard, such as Maine and Florida, but it includes many areas where potential customers are located, including Texas, the southeastern U.S., Arizona, the Midwest, the Tennessee Valley Authority, western Kentucky, and Mississippi. The 4,000 mile round trip distance is therefore conservative and likely to be an overestimate of typical domestic transport distances.

The user also chooses the type of fuel being produced in the Upstream Dashboard tool. There are two options available for coal. Illinois No. 6 coal was chosen to be representative of a gassy underground mine. The only other option would represent a surface coal mine such as a Powder River Basin coal mine, which would have lower methane emissions.

Once the user enters the parameters listed above, the Upstream Dashboard tool produces values called emissions factors that can be used to estimate GHG emissions associated with production and transportation of the coal. The emissions factors are expressed in terms of mass of carbon dioxide per unit mass of coal produced. The user chooses the desired units for the emissions factor. For this analysis the chosen output unit for the emissions factors was kilograms of $CO_2$eq per ton of coal produced.

Three emissions factors were produced by the tool for GHGs (for methane, carbon dioxide, and nitrous oxide) in units of kilograms of $CO_2$eq per ton of coal. Different emissions factors were obtained for each mine for methane, since the amount of methane emitted per ton of coal produced that was used in the Upstream Dashboard tool was specific to each. The emissions factors were then multiplied by the corresponding coal production totals under the three production scenarios to estimate upstream GHG emissions for all three GHGs.

The analysis also estimated GHG emissions that could result from combustion of the coal. Emissions factors for coal combustion were obtained from the Energy Information Administration's website (Hong and Slatick, 1994). Like the National Energy Technology Laboratory, the Energy Information Administration is an agency of the U.S. Department of Energy. Table FE4 at this site gives average carbon dioxide emissions factors by state and coal rank in units of pounds of carbon dioxide per million BTU. The term coal "rank" refers to how far the coal has progressed in its change from plant material to carbon. (University of Kentucky, 2012). Coal ranks include lignite, sub-bituminous, bituminous, and anthracite. The value of 206.2 listed for bituminous coal was used.

Emissions calculations for carbon dioxide resulting from coal combustion using these emissions factors assumed all of the coal was combusted. The amount of carbon dioxide that could result from coal combustion was estimated by multiplying the emissions factor by the energy content of the coal and the amount of coal produced. The equation for this calculation is (carbon dioxide emissions in tons) = (coal production in tons) multiplied by (2000 lbs/ton) multiplied by (energy content BTU/lb) multiplied by (emissions factor lbs carbon dioxide/1,000,000 BTU).

Finally GHG emissions resulting from shipping of coal to overseas locations were estimated. To estimate the fraction of future U.S. coal production that might be exported, 2004-2013 production and export data were obtained from the Energy Information Administration's website (DOE, Energy Information Administration, 2015), using its data exploration tool and the fraction of coal exported in each year was computed. To be conservative, the upper end of the range for the coal export fraction was chosen as the proportion of coal production exported has increased in recent years. The value chosen was 0.12, or 12% of coal produced in a given year.

The National Energy Technology Laboratory Upstream Dashboard tool does not currently include emissions from overseas shipping of coal. The developers of the Upstream Dashboard tool separately calculated an emissions factor to use in estimating GHG emissions from shipping coal overseas (Skone, 2015). This emissions factor is expressed in terms of tons of carbon dioxide per ton of coal per nautical mile. They also provided a draft GHG lifecycle analysis report that included shipping distances from likely ports that might be used to ship coal overseas (including the U.S. cities of Long Beach, New Orleans, and Baltimore, and the Canadian city of Vancouver, British Columbia) to destinations overseas. The longest distance given in the report (10,500 km one-way from Vancouver to Shanghai) was chosen to represent the average shipping distance for exported coal. Shipping carbon dioxide emissions were then estimated by multiplying the emissions factor by the estimated amount of coal being shipped and the round-trip distance. The equation for this calculation is (carbon dioxide emissions from shipping) = (coal produced) multiplied by (fraction of coal exported) multiplied by (shipping distance one-way multiplied by 2) multiplied by (shipping emissions factor). GHGs from rail transport of exported coal from a receiving port overseas to a final destination were not estimated as this is:

- beyond the scope of the analysis,
- overly speculative given the variety of potential final destinations, and
- small in comparison with the other sources of GHG emissions considered here.

**Results**

The three parts of the GHG emissions estimates (upstream processes, overseas transport, and combustion emissions) were computed for the three scenarios described earlier to estimate the potential range of possible GHG emissions. Estimates for annual emissions of GHGs for these three scenarios are displayed in Table 3-3. Note that the emissions estimates have been rounded and the column totals do not exactly equal the sum of the entries. Estimates for annual gross emissions of GHGs for the three scenarios in Table 3-3 are for extraction and combustion of North Fork Coal Mining Area coal. Net annual emissions of GHG emissions under Alternatives B and C will be lower after accounting for decreases in production and consumption of substitute sources of energy from other coal and natural gas supply and demand regions. Net emissions of carbon dioxide are described in the economic section, Table 3-19.

***Table 3-3.*** *Estimated Annual Gross Lifecycle GHG Emissions From Potential Coal Mining Within the North Fork Coal Mining Area Under Three Production Scenarios, in metric tons of $CO_2$eq*

| *Emissions Estimates - Metric Tons $CO_2$eq.* | | | |
|---|---|---|---|
| | Low Scenario | Average Scenario | Permitted Scenario |
| Coal Production (tons) | 5,300,000 | 10,000,000 | 15,500,000 |
| Carbon dioxide --combustion | 11,600,000 | 22,000,000 | 34,500,000 |
| Carbon dioxide --extraction | 100,000 | 200,000 | 300,000 |
| All--rail transport | 600,000 | 1,200,000 | 1,800,000 |
| Methane--extraction | 1,200,000 | 4,200,000 | 6,300,000 |
| Nitrous oxide --extraction | 0 | 0 | 0 |
| Carbon dioxide --overseas shipping | 100,000 | 200,000 | 300,000 |
| **Total** | **13,600,000** | **28,100,000** | **43,200,000** |

It is important to keep in mind that the annual emissions estimates given in Table 3-3 are based upon hypothetical coal production values and therefore do not indicate what future annual GHG emissions will actually be. At no time during the years from 2003 through 2014 (the years for which production data from both mines were readily available online) did production reach the maximum permitted rate at either of the currently operating mines used to derive the production scenarios. The highest annual production rate for the West Elk Mine during that period occurred in 2012 at 6.9 million tons, and the highest production rate over the same period for the Elk Creek Mine occurred in 2005 at 6.5 million tons. Combined production for both mines during the 2003-2014 timeframe peaked in 2004 at 13.1 million tons and has generally decreased since then, reaching a low in 2014. The maximum

production rate assumed under the permitted level scenario represents an upper bound that could be reached under ideal market and production conditions. Using the high and low hypothetical production values while holding other assumptions about emissions (such as methane released per ton of coal produced) constant, the range in annual GHG emissions from both mines varies from 13.6 million metric tons on the low end to 43.2 million metric tons on the high end. Actual annual values are likely to fall somewhere between these two estimates. The substantial difference in the high and low estimates gives some idea of how large the uncertainty is when making estimates of future annual GHG emissions that could result from mining and combustion of North Fork Coal Mining Area coal.

The estimates in Table 3-3 indicate the relative contributions of different processes to the total potential GHG emissions. They show that the most significant contributor to GHG emissions is coal combustion, followed by methane emissions during coal mining. The other contributors to the total GHG emissions estimates (from coal production and transportation) are much smaller. This is illustrated in Figure 3-1. The production emissions shown in the figure include mining operations and domestic transportation by rail.

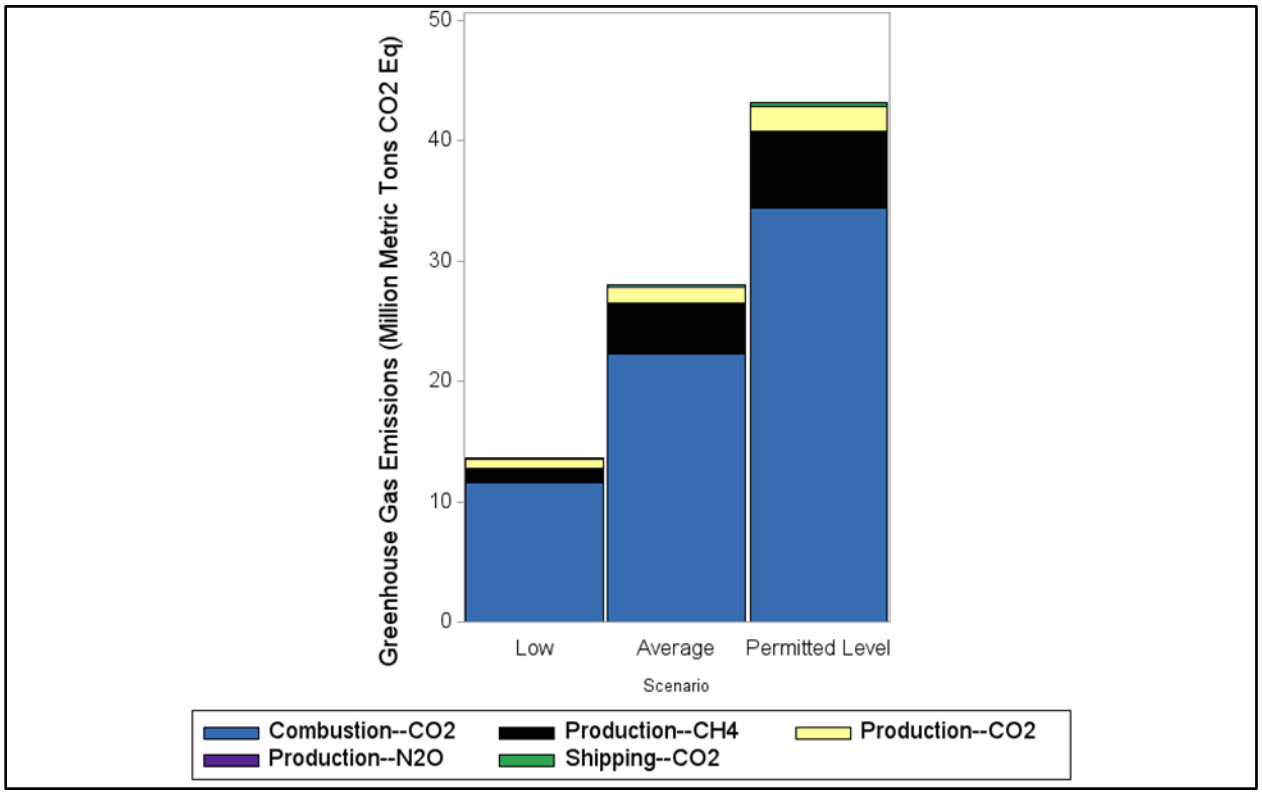


*Figure 3-1. Estimated Annual GHG Emissions Under the Low, Average, and Permitted Level Scenarios.*

In addition to the uncertainty in estimating future coal production and resulting combustion and production emissions, there is uncertainty in the estimate of methane produced during mining. The methane emissions estimates were computed as an average over the period of available data, with the exception of the last year at Elk Creek, when production at the mine stopped. In general, methane emissions are variable and not closely tied to production levels. When expressed in terms of volume

per ton of coal, the methane emissions factor varied by a factor of roughly 1.7 to 2.2 for the two mines over three years.

Emissions from coal production were conservatively estimated. The Upstream Dashboard tool includes emissions from mine construction and a whole range of processes that could occur at the mine sites. This conservative tool was chosen because mining operations and processes could change during roughly 11 to 33 years covered under this analysis, and this tool includes a comprehensive suite of processes that might be included. Not all of these processes are likely to occur in any particular year. Nonetheless the contributions of mining operations to the total GHG inventory are relatively small when compared with contributions from methane venting emissions and coal combustion, and thus changes in the assumptions about mining operations would have less of an impact on emissions uncertainty. Transportation of coal to market has the smallest contribution to total GHG emissions estimates, and thus changing the distances assumed to lower values that would probably better represent typical distances would have negligible impacts to the total GHG estimates.

As discussed earlier, the total potentially recoverable unleased coal within the North Fork Coal Mining Area is approximately 172 million tons under alternative B. Under the permitted level production scenario, it could take approximately 11 years to recover all of this coal; under the low production scenario this could take approximately 33 years. If all of this coal were recovered and combusted the total gross accumulated GHG emissions could range from approximately 449 to 486 million metric tons $CO_2$eq, depending up the production scenario. This range represents lower and upper bounds for total gross emissions of greenhouse gases (including carbon dioxide, methane, and nitrous oxide) under the assumption that all available unleased coal is recovered and completely combusted, not accounting for changes in production and consumption of substitute sources of coal and natural gas. It does not mean that this will actually occur, or that it is likely to occur.

Net emissions of GHGs from producing and consuming the 172 million tons of unleased reserves under Alternative B are expected to be lower, after accounting for decreases in production and consumption of substitute sources of coal and natural gas, resulting from energy market responses to increases in North Fork Coal Mining Area supplies. The economic section, Table 3-19, discusses potential substitution effects, and projects net cumulative emissions of carbon dioxide only, that are lower than gross carbon dioxide emissions under Alternative B (as derived from information in Table 3-3). No substitution is assumed to occur for Alternative A, implying gross emissions are equal to net emissions for Alternative A. Note that for the estimates of net carbon dioxide emissions in the economic section, the calculation of a portion of those emissions (those from combustion) used an emissions factor expressed in terms of tons of carbon dioxide per gigawatt-hour, which is different than the form of the combustion emissions factor used here. For a discussion of this calculation, see Appendix E (Table E-14).

### ***Alternative C***

Under Alternative C, the North Fork Coal Mining Area exception would be reinstated. The exception would allow for temporary road construction on 12,600 acres of unleased coal reserves within the North Fork Coal Mining Area. For this alternative, there would be approximately 95 million tons of unleased coal resources within the North Fork Coal Mining Area that could potentially be made available for leasing. Under Alternative C, the mining durations for each production scenario would be approximately 18 years under the low scenario, 10 years under the average scenario, and 6 years

under the permitted level scenario under the assumption that all of the coal could be produced continuously at a constant rate. These estimates of possible mining duration do not include the mining of the 11 million tons that are already under lease as discussed under Alternative A.

Because the annual production scenarios analyzed for Alternative C are the same as those for Alternative B, the estimates of possible annual GHG emissions associated with possible future mining activities are the same as well. However, the possible duration of mining and total GHG emissions estimates over the time it could take to produce all 95 million tons would be different. If all coal were produced and combusted, the total accumulated GHG emissions could range from approximately 245 to 265 million metric tons $CO_2$eq, depending up the production scenario. This range represents lower and upper bounds for total emissions of GHGs under the assumption that all unleased coal available under Alternative C is recovered and completely combusted. It does not mean this will actually occur, or that it is likely to occur.

Net emissions of GHGs from producing and consuming the 165 million tons of unleased reserves under Alternative C are expected to be lower, after accounting for decreases in production and consumption of substitute sources of coal and natural gas, resulting from energy market responses to increases in North Fork Coal Mining Area supplies. The economic section, Table 3-19, discusses potential substitution effects, and projects net cumulative emissions of carbon dioxide that are lower than gross carbon dioxide emissions under Alternative C (as derived from information in Table 3-3).

Note that for the estimates of net carbon dioxide emissions in the economic section, the calculation of a portion of those emissions (those from combustion) used an emissions factor expressed in terms of tons of carbon dioxide per gigawatt-hour, which is different than the form of the combustion emissions factor used here. For a discussion of the economic calculation, see Appendix E (Table E-14).

## Cumulative effects

### ***Alternative A***

Under Alternative A, without access, it is unlikely there would be additional coal leases and thus no additional GHG emissions from producing unleased coal resources that would contribute cumulatively to the volume of GHGs in the atmosphere from all other sources.

### ***Alternatives B and C***

Under Alternatives B and C, GHG emissions estimated from future production, transportation and combustion of additional North Fork Coal Mining Area coal associated with access would contribute cumulatively to the volume of GHGs in the atmosphere from all other sources. Due to the relatively long half-lives for GHGs in the atmosphere (including roughly 100 years for carbon dioxide and 12 years for methane) these gases once emitted become globally distributed where they contribute to the global atmospheric GHG loading. It is not possible at this time using global climate models to predict the contribution to warming or other climate change effects (such as changes in the timing and distribution of precipitation or other weather events) from possible coal production on a local scale such as the North Fork Coal Mining Area. The climate change section the 2012 FEIS, and updated for this SDEIS, discussed potential future impacts in broad terms that might result from climate change.

In order to provide some context for understanding potential contributions of GHG emissions that might result from producing additional coal within the North Fork Coal Mining Area to cumulative impacts, it is helpful to compare the annual GHG emissions estimates to GHG emissions from all sources on various national, regional, and local scales. Nationally, the largest categories of GHG emissions are fossil fuel combustion for electrical power generation (estimated at 2,040 million metric tons $CO_2$eq in 2013) and for transportation (estimated at 1,718 million metric tons $CO_2$eq in 2013). Combined GHG emissions under the low, average, and permitted level scenarios in $CO_2$eq are estimated at roughly 13.5 million metric tons $CO_2$eq, 28 million metric tons $CO_2$eq, and 43 million metric tons $CO_2$eq, respectively. Total 2013 GHG emissions for the U.S. in 2013 were estimated to be 6,673 million metric tons $CO_2$eq. The estimated maximum possible annual GHG emissions for North Fork Coal Mining Area is approximately equivalent to 0.6% of 2013 total U.S. GHG emissions.

Figure 3-2 displays the estimated emissions under the three production scenarios compared with Colorado coal combustion (not all of the North Fork Coal Mining Area emissions will actually occur in Colorado due to transport and combustion elsewhere), fossil fuel combustion, and total GHG emissions estimates for 2010. It also includes U.S. GHG emissions due to coal combustion at stationary sources (such as electrical generating facilities and cement plants). Colorado reported 2010 total GHG emissions estimates of 130 million metric tons $CO_2$eq, emissions from fossil fuel combustion of 96 million metric tons $CO_2$eq, and emissions from coal combustion of 36 million metric tons. National GHG emissions due to coal combustion at stationary sources were estimated be EPA to be 1,658 million metric tons $CO_2$eq in 2013.

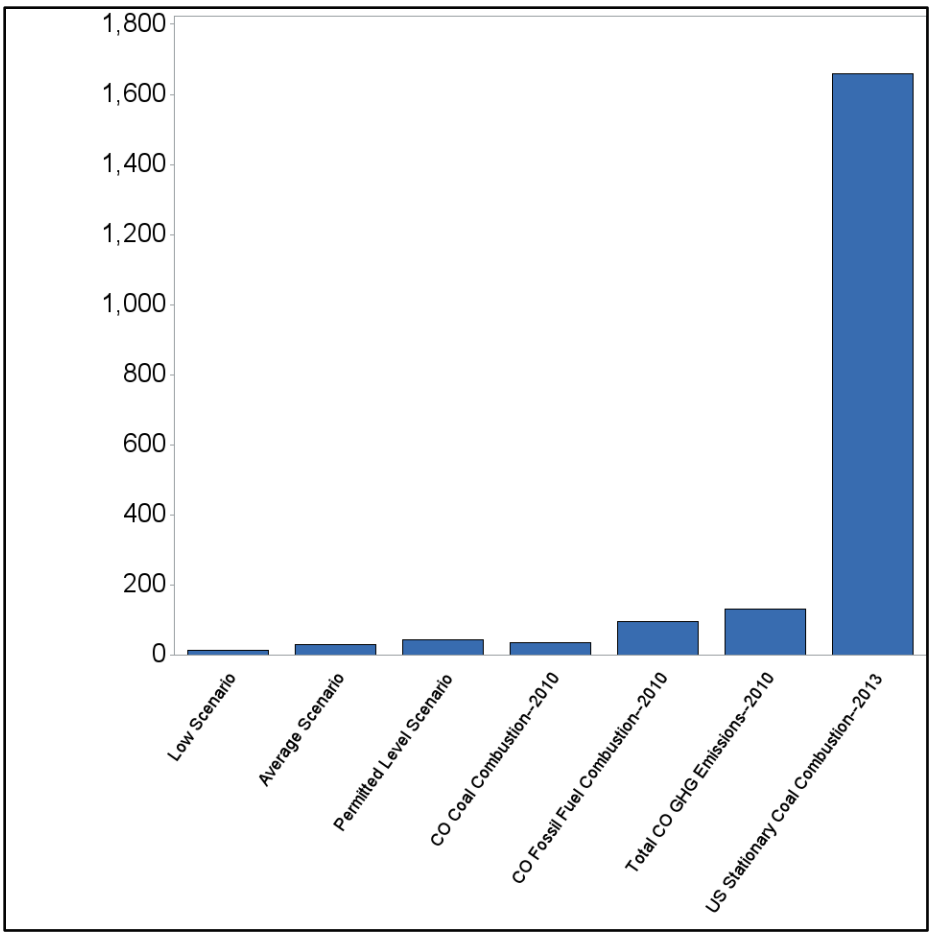


*Figure 3-2. Comparison of Possible Annual GHG Emissions Due to North Fork Area Coal Mining Under Different Production Scenarios With Other Regional and National Emissions Categories (Millions of Metric Tons $CO_2$eq)*

Methane emissions that occur during mining operations comprise a significant portion of the GHG emissions resulting from mining of coal within the North Fork Coal Mining Area (second only to the carbon dioxide released when the produced coal is combusted). As discussed earlier, methane emissions are highly variable and not closely tied to coal production. Emissions can vary substantially depending on the rank (or classification) of the coal, the particular seam being produced, and the depth and thickness of that seam. The amount of methane emitted from the Elk Creek and West Elk Mines expressed in terms of volume per ton of coal produced varied considerably between 2011 and 2013.

In order to help put the methane emissions into perspective, it is more meaningful to consider the actual emissions from 2011 to 2013 relative to other sources of methane emissions during that time. Nationally, the two largest categories of methane emissions in 2013 were enteric fermentation at 165 million metric tons $CO_2$eq and natural gas systems at 157 million metric tons $CO_2$eq. Table 3-4 shows reported methane emissions compared with estimated U.S. methane emissions from all sources and coal mining. Values in Table 3-4 are given in $CO_2$eq, with 25 used as the global warming potential for methane. The data show that combined methane emissions from the two mines were about 0.3 percent of estimated national methane emissions from all sources and 3 percent of national

coal mining methane emissions in 2012, which was the last year of full operation for the Elk Creek Mine.

***Table 3-4.*** *Methane Emissions in the North Fork Valley Compared to U.S. Methane Emissions, 2011- 2013 (Millions of Metric Tons $CO_2$eq)*

| | North Fork Coal Mining Area Reported Methane Emissions | | U.S. Methane Emissions | |
|---|---|---|---|---|
| Year | Elk Creek Mine | West Elk Mine | All Sources | Coal Mining |
| 2011 | 1.34 | 1.24 | 660.9 | 71.2 |
| 2012 | 1.15 | 0.92 | 647.6 | 66.5 |
| 2013 | 0.09 | 0.75 | 636.3 | 64.6 |

Another way of examining the GHG emissions estimates is to look at how they compare to the approximate emissions from sources familiar to us in everyday life. The EPA has created a GHG equivalencies calculator that allows the user to enter a quantity of GHG emissions and relate them to the average annual GHG emissions from more familiar types of sources such as passenger vehicles, gallons of gasoline consumed, or homes. These equivalencies are based upon average values for each type of source, such as a typical passenger vehicle driven an average number of miles, or a typical house or power plant, so these equivalencies are only approximate. Table 3-5 below shows selected results from the EPA equivalency calculator for each of the three production scenarios.

***Table 3-5.*** *Approximate Equivalency of Estimated GHG Emissions to Annual Emissions from Different Sources for the Three Production Scenarios.*

| Scenario | Coal Fired Power Plants | Barrels of Oil | Gallons of Gasoline | Number of Passenger Vehicles | Number of Homes |
|---|---|---|---|---|---|
| Low | 3.6 | 31,727,356 | 1,535,137,054 | 2,872,161 | 1,244,778 |
| Average | 7.4 | 65,282,626 | 3,158,718,240 | 5,909,796 | 2,561,271 |
| Permitted Level | 11.3 | 100,439,298 | 4,859,783,729 | 9,092,400 | 3,940,593 |

## *Climate Change*

Evidence of human-caused climate change continues to grow, and is widely accepted throughout the scientific community. The fifth Intergovernmental Panel on Climate Change assessment recognizes anthropogenic (human caused) and non-anthropogenic (non-human caused) contributions to climate change. Anthropogenic influences have made substantial contributions to observed warming trends since the 1950s.

- Human influence on the climate system is clear, and recent anthropogenic emissions of GHGs are the highest in history. Recent climate changes have had widespread impacts on human and natural systems.
- GHGs, including carbon dioxide and methane, respectively account for approximately 76% and 16% of annual global emissions that are attributable to human activity (IPCC, 2014).

Both result from coal mining and the transportation and combustion of coal, among other things, and are quantified, estimated, and evaluated in detail in the Air Resources section of this SDEIS.

## Guidance for Climate Change Analysis

The quantitative information provided in the Air Resources section is commensurate with recommendations in the draft guidance from the Council on Environmental Quality for climate change analysis during the NEPA process (CEQ, 2014), which provides a reference point of 25,000 metric tons, annually, of $CO_2$eq to consider quantification of GHGs. The reasonably foreseeable GHG emissions from upstream activities, overseas transportation, and combustion are reasonably foreseeable to the possible development of future coal leases. These associated GHG emissions are described in various contexts, such as state and national emissions and atmospheric concentrations, which help describe the cumulative effects of this proposed rule.

Climate Change Considerations in Project Level NEPA Analysis (USDA, 2009), provides additional guidance on both the effect of a proposed action on climate change, and the effect of climate change on a proposed action. The reasonably foreseeable potential impacts of this Rule on climate change are more relevant considerations than climate change impacts on the proposed rule. For example, slight warming trends or changes in precipitation (impacts from climate change) do not affect the proposed rule. Further, the proposed rule only provides an exception to allow for road construction after subsequent analyses and decisions. It does not authorize any activity that could be affected by climate change. Climate change impacts on a proposed action might be more meaningful for other types of actions, such as tree species selection for reforestation, invasive species eradication, or threatened and endangered species conservation.

## Existing Condition

### ***Temperature Trends and Greenhouse Gases***

Temperature and precipitation patterns continue to be impacted by climate change. Impacts are variable throughout the world, and the U.S. In the lower 48 states, 7 of the 10 warmest years have occurred since 1998. The 10 warmest years on record globally, have all occurred since 1998 (White House, 2013).

Climate researchers use data, as well as models to predict future trends in temperature and precipitation. Climate projection models vary based on many assumptions, including future concentrations of GHGs in the atmosphere. Current concentrations of carbon dioxide are approximately 400 parts per million (NASA, 2015). Pre-industrial era concentrations varied between 200 and 280 parts per million. As concentrations of GHGs increase, temperature also increases. The close correlation between temperature and atmospheric GHGs is represented in the Figure 3-3.

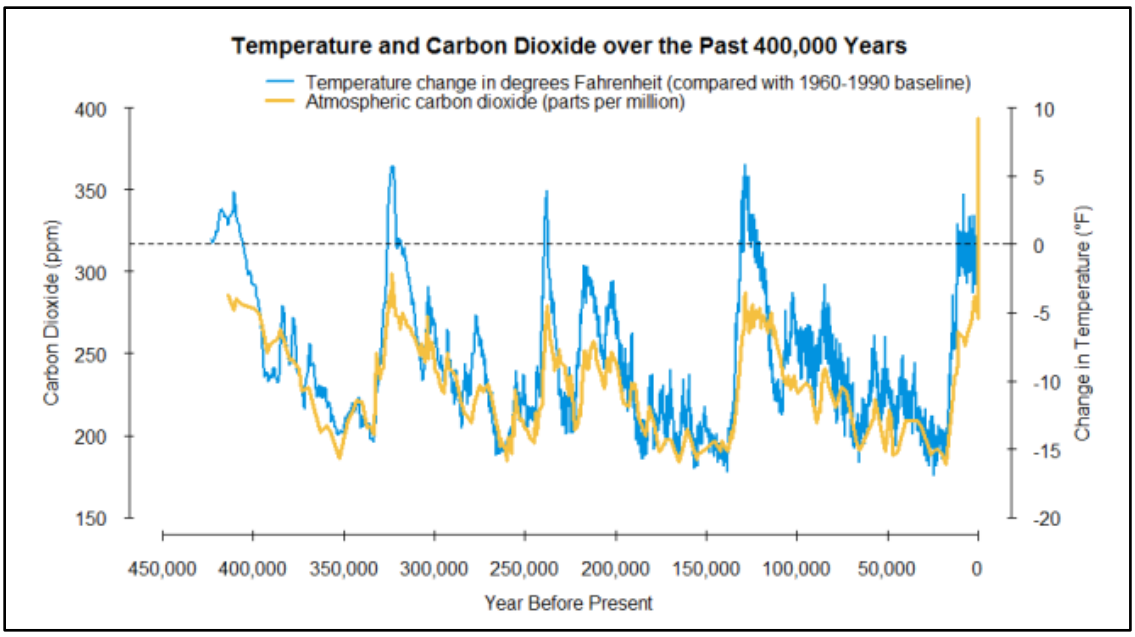


*Figure 3-3. Data from NOAA's National Climatic Data Center and the Mauna Loa Observatory*

The potential impacts of climate change will depend on the amount of global emissions, which are a cumulative effect of human actions, associated with future leasing and mining of coal that leads to combustion. Future emission scenarios (see Figure 3-4) could depend on whether developed and developing countries transition to lower carbon energy sources, or implementing cleaner technologies to develop traditional fossil fuel resources (IPCC, 2014).

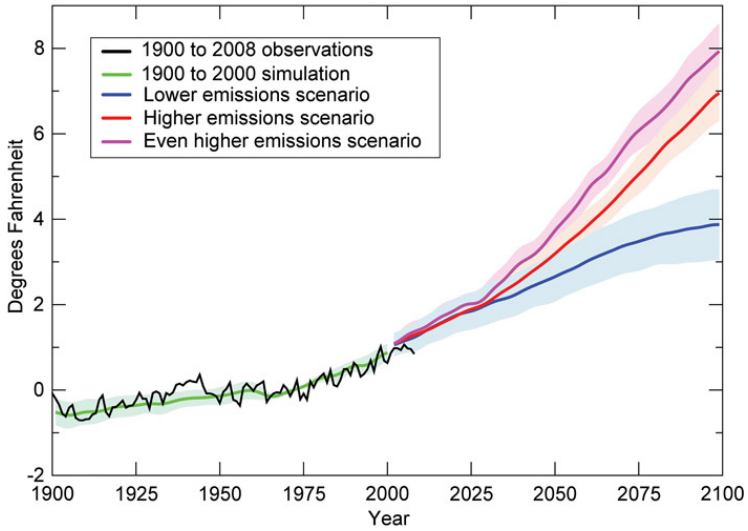


*Figure 3-4. Potential Emission Scenarios: U.S. Global Change Resource Program, 2009*

## ***Climate Change Impacts***

Climate change impacts vary greatly depending on location and type of impact. For example, sea-level rise is a more direct threat to low-lying countries in Asia and Oceania, than to National Forests in Colorado. However, warmer temperatures and the proliferation of destructive insects are more

meaningful to National Forests in Colorado. Climate change impacts have wide-ranging effects beyond lands managed by the U.S. Forest Service. Other impacts include changes in agricultural production, ocean acidification, and threats to national security (DOD, 2015).

The Colorado Climate Change Vulnerability Study (University of Colorado-Boulder, 2015) summarized observed and predicted impacts specific to Colorado including, but not limited to:

- Increase in average annual temperatures by 2 degrees Fahrenheit over the past 30 years, and an additional increase of 2.5 to 5.5 degrees by mid-century;
- Snowmelt and peak runoff have shifted 1 to 4 weeks earlier over the past 30 years; an additional 1-3 weeks earlier are expected by mid-century; and
- More frequent drought conditions

Although there have been severe floods in Colorado in the past few years, there is no historical evidence of increasing trends in heavy precipitation events, flooding, or annual precipitation statewide. However, climate projections predict decreases in streamflow by 2050 for major rivers in the state (University of Colorado-Boulder, 2015). The report continues by assessing vulnerability and generally negative impacts in key sectors, including agriculture, transportation, outdoor recreation and tourism, and public health. Projected impacts to the skiing industry are especially important for Colorado, as climate change threatens the snowpack through changes in winter precipitation and snowmelt.

The U.S. Forest Service and other land management agencies evaluate strategies and implement techniques to adapt to climate change. Land managers often respond to drought, floods, fire, and destructive insects; many climate change adaptation tactics are responses to these events. Larger culverts mitigate flood damage; silvicultural techniques promote forest health; and timber harvesting can reduce hazardous fuels in the wildland-urban interface. However, the projected scope and scale of climate change impacts lack precedence in the modern era of land management. It will be difficult to address the scale of climate change impacts with traditional techniques at familiar project-level scales.

## Affected Environment

### ***Climate Change Adaptation***

The Colorado Roadless Rule provides management direction for conserving roadless area characteristics within roadless areas, in Colorado. It balances roadless area protection with needs to reduce the risk of wildfire; explore and develop coal resources in the North Fork Coal Mining Area; permit and maintain water conveyance structures; and special considerations for ski areas.

Climate change exacerbates many stressors which impact roadless area characteristics identified in the Colorado Roadless Rule (listed in Table 3-6). Forest fire occurrence and intensity is increasing, so treating fuels to reduce wildfire allows the agency to adapt to new conditions (USGRCP, 2014). Permitting and maintaining water conveyance structures in roadless areas is an important consideration for water provision. Water quality, timing of run-off are all increasingly complex because of climate change. Specific ski area accommodations within CRAs allows for some flexibility and adaptation, which allow adjustments to business practices for ski area operators (University of Colorado-Boulder, 2015).

***Table 3-6.*** *Climate Change Impacts to Roadless Areas*

| *Roadless Area Characteristics* | *Potential Impacts from Climate Change* |
|---|---|
| High quality or undisturbed soil, water, or air | Increasing wildfires correspond to increasing smoke;<br>Burned soils and vegetation loss increases erosion and decreased productivity;<br>Increased sediment loads in waterways post wildfire. |
| Sources of public drinking water | Fire frequency and intensity likely lead to sedimentation of reservoirs and other sources of drinking water;<br>Changes in perception regimes leads to increased uncertainty of water availability. |
| Diversity of plant and animal communities | Non-native species often outcompete native species under warmer and drier conditions. |
| Habitat for threatened, endangered, proposed, candidate, and sensitive species | CRAs may serve as climate change refuges for species; however, this function could be compromised by impacts from climate change as ecosystems shift upward in elevation and northward in latitude. |
| Primitive, semi-primitive, non-motorized and semi-primitive motorized classes of dispersed recreation | Potential changes in types of recreational opportunities in CRAs, such as decreased opportunities for cold-water fisheries, winter recreation, and alpine wildflower viewing. |
| Reference Landscapes | Climate change may change the notion of using protected areas as reference landscapes; |
| Natural-appearing landscapes with high scenic quality | Some CRA natural appearing landscapes have been compromised by recent insect and disease outbreaks. Dead and downed trees may negatively affect scenic quality. |
| Traditional cultural properties and sacred sites | Some sacred sites may have increased vulnerability with increasing wildfire, especially when "undiscovered" with few opportunities for mitigation or protection;<br>Some additional cultural sites may be discovered as snowpack recede at higher elevations;<br>Newly exposed cultural sites and artifacts are at risk of theft |
| Locally identified unique characteristics | Climate change may change the composition and distribution of non-timber forest products (mushrooms, medicinal roots, etc.). |

*Information summarized from multiple vulnerability assessments, including Climate Change Impacts in the United States (USGRCP, 2014); The Threat of Carbon Pollution: Colorado (White House, 2015); and Colorado Climate Change Vulnerability Study (University of Colorado-Boulder, 2015).*

## Direct, Indirect, and Cumulative Effects

Reasonably foreseeable GHG associated the proposed action would add to atmospheric concentrations that cause climate change. However, is difficult to say how much atmospheric concentrations will increase as a result of these subsequent decisions. It is even more problematic - likely impossible - to link emissions associated with this project to a specific increase in temperature, or changes in precipitation. The Council on Environmental Quality recognizes that individual agency actions will unlikely have climate change effects, but that climate change is exacerbated by a series of smaller decisions, "program-by-program and step-by-step" (CEQ, 2014). Anthropogenic climate change is inherently a problem of cumulative effects.

Human-caused climate change is not the direct result of any particular project, but rather a result of incremental emissions from many actions over many decades, throughout the world. Reasonably foreseeable emissions from projects subsequent to this rulemaking, increase atmospheric

concentrations of GHG that cause climate change. The reasonably foreseeable quantity of GHGs makes this an important consideration of human-caused emissions. However, climate change will continue happening, regardless of this project or any other single project.

The overall estimated GHG emissions (including carbon dioxide, methane, and nitrous oxide) from reasonably foreseeable activities associated with the proposed rule range from about 13.7 to 43.2 million metric tons of per year. The average scenario is 28.1 million metric tons of $CO_2$eq annually. Methane accounts for 1.2 to about to 6.3 million metric tons $CO_2$eq, with an average scenario of 4.2 million metric tons of $CO_2$eq. To put this into context, the GHG footprint from the U.S. Forest Service business operations (including vehicles, building energy use, employee air and ground travel, and employee commuting) is approximately .3 million metric tons $CO_2$eq (USDA Forest Service, 2014). Therefore, reasonably foreseeable GHG emissions from future activities are equivalent to approximately 94 times the annual operational GHG footprint of the entire agency. Projected methane emission alone, under the average scenario, is about 14 times the annual GHG footprint from U.S. Forest Service business operations.

The total United States GHG emissions in 2013 were 6,673 million metric tons of $CO_2$eq. Therefore, the average annual reasonably foreseeable emissions associated with this rule could be the equivalent of .4% of US emissions in 2013. The methane venting component could be equivalent of .06% of US emissions in 2013.

The State of Colorado produced approximately 130 million metric tons of $CO_2$eq in 2010 from combined sectors of agriculture, waste management, industrial processes, gas production, coal mining and abandoned mines, residential and commercial fuel use, transportation, and electric power (CODEPH, 2014). Therefore, the average reasonably foreseeable annual emissions associated with the proposed rule could be equivalent to 22% of Colorado's 2010 GHG emissions. Some of these emissions would occur within Colorado and some outside of Colorado. The methane venting component, which would occur within the State, would be equivalent to about 3.1% of Colorado's 2010 GHG emissions.

It is important to consider that inventory methodology for Colorado's emissions and total U.S. emissions differ from the estimates offered in the Air Resource Report for the proposed action. For example, coal combustion associated with the proposed action may not happen in Colorado, or the United States. Therefore, it is not appropriate to resolve that the proposed action is responsible for a certain percentage of total State or National emissions. However, it is useful information that puts this project in a meaningful context.

There are reasonably foreseeable emissions from subsequent decisions, associated with tree-cutting and other vegetation for surface preparation, including roads and drainage pads. These considerations are significantly smaller than the primary GHG components of mining and venting, transportation, and combustion. Areas of surface disturbance may be revegetated after they are no longer needed. As trees and vegetation reestablish, they will grow and sequester carbon through photosynthesis. It is important to note that U.S. forests (including NFS lands), function as a carbon sink, and effectively offset approximately 13% of national emissions in 2013 (EPA, 2015).

### ***Alternative A***

There would be no reasonably foreseeable increase in emissions associated with coal mining, transportation, and combustion associated with this "no-action" alternative. Therefore, there are no

increases to atmospheric concentrations of greenhouse gases. This alternative has no impact on climate change, and climate change has no impact on this alternative.

Climate change is part of the environmental baseline and will continue in the absence of this project. Part of the baseline in the North Fork area includes mining on existing leases that contain an estimated 11.2 million tons of coal, and emissions associated with mining. However, the reduced emissions from choosing this alternative would not likely lessen impacts of climate change.

#### ***Alternative B***

This alternative has no direct effects on emissions or climate change. However, reasonably foreseeable activities of coal mining, transportation, and combustion would increase the atmospheric concentrations of GHGs. Detailed estimated volumes of GHGs are provided in the air section under various production scenarios. However, it is difficult to estimate how much this will increase concentrations of GHGs, or any climate change impacts described above. Reasonably foreseeable emissions with Alternative B are greater than the other alternatives evaluated in this SDEIS. They are greater than Alternative C because of the duration of the mining activity to 2051. This alternative does not require methane capture, but leaves open the opportunity to evaluate it during subsequent steps of the leasing process. Methane capture or destruction would reduce GHG emissions associated with this alternative.

This alternative would likely have no effect on climate change impacts in CRAs, or other NFS lands. Anthropogenic climate change is not the result of any individual activity, but rather it is the result of many activities spanning many decades.

#### ***Alternative C***

Alternative C has no direct effects on emissions or climate change. However, reasonably foreseeable activities of coal mining, transportation, and combustion will increase the atmospheric concentrations of GHGs. Detailed estimated volumes of GHGs are provided in the air section under various production scenarios. However, it is difficult to estimate how much this will increase atmospheric concentrations of GHGs, or any climate change impacts described above. Emissions from subsequent activities associated with Alternative C are less than Alternative B, because of the shorter duration of the mining activity through 2036. This alternative does not require methane capture, but leaves open the opportunity to evaluate it during subsequent steps of the leasing process. Methane capture or destruction would reduce the reasonably foreseeable GHGs associated with this alternative.

This alternative would likely have no effect on climate change impacts in CRAs, or other NFS lands. Anthropogenic climate change is not the result of any individual activity, but rather it is the result of many activities spanning many decades.

## *Threatened, Endangered, Proposed, and Sensitive Species*

### Analysis Methods

The scope of analysis is different than the other resources in this SDEIS because changed circumstances and new information require re-consultation on the Colorado Roadless Rule. The scope of analysis in this section includes a broad review of the Colorado Roadless Rule to ensure the earlier conclusions about effects to ESA-protected species and Regional Forester sensitive species and habitats still hold today. Consequently, this SDEIS:

- reviews the conclusions and determinations of effect to ESA-protected species and Regional Forester sensitive species evaluated in 2012, and
- evaluates any new species and habitats that have changed status under the ESA or as Regional Forester sensitive since the 2012 FEIS.

This section will consider:

- effects to listed or sensitive species and habitats in a manner or to an extent not previously considered for the 2012 Rule and Section 7 consultation,
- any modifications to the Colorado Roadless Rule proposed under the current alternatives that might represent effects to listed or sensitive species or protected habitats not previously considered in 2012, and
- potential effects to newly listed or sensitive species or protected habitats since the 2012 Rule. Reinitiating Section 7 consultation on the 2012 Colorado Roadless Rule has been requested of the U.S. Fish and Wildlife Service, in the event the evaluation concludes new effects or severity of effects to ESA-protected species not previously considered in 2012, including the species affected by ESA decisions since the 2012 FEIS.

The rationale and conclusions of effect about special status species for the 2012 FEIS generally apply given the relatively short time that has elapsed. However, new information has emerged that compels a reconsideration of a portion of the earlier analyses and determinations on threatened, endangered, proposed, and sensitive species. In particular, several species analyzed for the 2012 FEIS have changed status under the ESA, including new listings and critical habitat decisions. Since 2012, there have been additions to the Regional Forester's sensitive species list for the Rocky Mountain Region requiring consideration.

For example, Gunnison sage-grouse were listed as a Threatened Species under the ESA in December 2014, supplanting its prior classification as a Regional Forester's Sensitive Species in the Rocky Mountain Region. There were several species on the Regional Forester's Sensitive Species list in 2012 that have since been listed under the ESA. New information may also include changes to a species known range that may result in a species changing from a sensitive to a threatened or endangered species. For example, new genetic testing methods have resulted in expansion of the known range of the greenback cutthroat trout to the Western Slope, including the GMUG National Forests. Populations that were previously thought to be Colorado River cutthroat trout, a Regional Forester's Sensitive Species for the Rocky Mountain Region, are now designated as greenback cutthroat trout, which is a threatened species under the ESA.

### ***Fish Analysis Methods***

Some of the newest information since 2012 germane to the current SDEIS and evaluation of alternatives relates to fish in and downstream of the North Fork Coal Mining Area. The new analysis here is focused on the North Fork Coal Mining Area and incorporation of the new information and implications to determinations of effect for listed and sensitive fish species.

Some of the newest information since 2012 is germane to the current SDEIS and evaluation of alternatives relates to fish in and downstream of the North Fork Coal Mining Area. The new analysis is focused on the North Fork Coal Mining Area and incorporation of the new information and implications to determinations of effect for listed and sensitive fish species. Information on the

distribution of non-game fishes in this analysis area was taken from several sources: Colorado Parks and Wildlife stream sampling records, GMUG National Forests stream sampling records, U.S. Forest Service, the Rocky Mountain Region Sensitive Species Evaluations, and personal observations in the field. There are four non-game sensitive species present in watersheds that originate on the GMUG National Forests (Table 3-7). These species are known to inhabit larger riverine habitats downstream from NFS lands. Of the four non-game species listed in Table 3-7, only mountain sucker has been observed on the GMUG National Forests. There are no records of mountain suckers on NFS lands upstream of Paonia, Colorado, which includes the North Fork Coal Mining Area.

***Table 3-7.*** *Sensitive fish species present on or downstream from the GMUG National Forests*

| *Species* | *Habitat* | *Present in North Fork Coal Mining Area?* |
|---|---|---|
| Bluehead Sucker | Low-elevation rivers: North Fork Gunnison, Gunnison, Uncompahgre. | No |
| Colorado River Cutthroat Trout | High-elevation rivers and streams; removed from human influence and non-native fishes | Yes |
| Flannelmouth Sucker | Low-elevation rivers: North Fork Gunnison, Gunnison, Uncompahgre. | No |
| Mountain Sucker | Mid-elevation rivers and streams. | No |
| Roundtail Chub | Low-elevation rivers: Colorado, Gunnison, Uncompahgre. | No |

The GMUG National Forests maintains records of the distribution and size of Colorado River cutthroat trout conservation populations in the North Fork of the Gunnison watershed. This includes both the Colorado River cutthroat trout blue lineage (Region 2 Sensitive Species) and Colorado River cutthroat trout green lineage (protected as Threatened under ESA). Spatial data describing the location of conservation populations were overlaid onto a map of the North Fork Coal Mining Area in a GIS. The total stream length occupied by conservation populations in the North Fork of the Gunnison watershed was calculated. These data were compared to the total stream length of occupied habitat on the GMUG National Forests and in Colorado. Data for the GMUG National Forests were taken from the most recent Forest-level status assessment for native cutthroat trout (Dare et al. 2011). Data for the state of Colorado were taken from the most recent range-wide status assessment for Colorado River cutthroat trout (Hirsch et al. 2013).

Recent developments in genetic analysis of cutthroats in the southern Rockies have revealed that several native cutthroat trout populations present around the North Fork Coal Mining Area have characteristics consistent with the greenback cutthroat trout, a federally-threatened species (Metcalf et al. 2012). This is a change from the 2012 analysis (Dare, Matthew R., personal communication; Dare et al. 2011), and new information on cutthroat trout is considered under Alternatives B and C.

### ***Assumptions for the Supplemental Analysis***

None of the alternatives would authorize any individual ground-disturbing actions, nor would they have direct effects on listed species or critical habitats. The indirect effects of implementing the regulation later in time are estimated based on projections of probable actions, and are evaluated primarily in qualitative and comparative terms.

The estimates of effects of the management direction and potential future activities are programmatic in nature. Future actions would be subject to their own site-specific analysis, ESA Section 7 consultation, and decision-making procedures. Design criteria or mitigation measures would be

incorporated into future project planning and implementation as needed to avoid or minimize adverse effects to threatened, endangered, proposed, and sensitive species, or their critical habitats to the extent possible.

### ***Regional Forester Sensitive Species Considered in this SDEIS***

U.S. Forest Service sensitive species are those identified by a Regional Forester for which population viability is a concern (Forest Service Manual 2670.5). U.S. Forest Service policy is to conserve sensitive species so that they do not become endangered or threatened as a result of U.S. Forest Service authorized activities, and to maintain their habitats so they are well-distributed on NFS lands (Forest Service Manual 2670.22). Sensitive species therefore receive special emphasis and management attention. The list of sensitive species incorporates those that have been identified as candidates for listing under the ESA, as well as many of those identified in Colorado's species of greatest conservation need (Colorado Division of Wildlife 2006; Colorado Parks and Wildlife revised list of Species of Greatest Conservation Need 2015 draft), of particular concern globally and within the state by the Natureserve network, Fish and Wildlife Service's Birds of Conservation Concern, and others.

Most of the species that remain U.S. Forest Service sensitive today, were carried forward through the complete analysis at that time due to known or likely occurrence in CRAs, or potentially indirectly affected outside the CRAs by management activities occurring within. Some were dismissed from further consideration early in the 2012 FEIS, due to the lack of any impacts expected to them because their habitat is unlikely to occur in the CRAs. All of these 2012 determinations will be re-visited again later in the effects analysis discussions.

The Regional Forester's sensitive species list has also undergone some changes since 2012 as a result of updates in 2013 and 2015 (the list is updated every two to three years). Species are added or removed from the list if there is substantial new information germane to the criteria for designation of a species as "sensitive". Additionally, by regional policy a change in ESA status can add or remove a species from the sensitive species list. For example, ESA candidate species are automatically added to the sensitive list, while species that have been the subject of proposed or final ESA listing rules are removed from the list and managed under ESA requirements. Candidate species have no ESA requirements and are evaluated as U.S. Forest Service sensitive species. Newly listed or proposed species are evaluated by their ESA status in the biological evaluation. Species removed from the list since 2012 are Gunnison sage-grouse, lesser prairie-chicken, New Mexico meadow jumping mouse, narrowleaf grapefern, and whitebristle cottongrass. Table 3-8 identifies the species that have been added since 2012 to the sensitive species list and their primary habitats and threats.

***Table 3-8.*** *Changes to the Rocky Mountain Regional Forester's sensitive species list affecting national forests and grasslands in Colorado since the 2012 Colorado Roadless Rule*

| *Species* | *Key Habitat Requirements & Threats* | *Colorado National Forest Known or Suspected* |
|---|---|---|
| *ADDITIONS* | | |
| monarch butterfly | Wholly dependent on milkweeds for breeding and larval feeding; probably widespread in the Region including NFS lands in Colorado although abundance is unknown. Primary threats are loss of milkweed habitat, exacerbated by disease, predation, overutilization for commercial and educational purposes, | Arapaho-Roosevelt<br>GMUG (Grand Mesa, Uncompahgre, Gunnison)<br>Manti-La Sal (CO portion)<br>Pike-San Isabel |

| *Species* | *Key Habitat Requirements & Threats* | *Colorado National Forest Known or Suspected* |
|---|---|---|
| | extensive habitat loss, and climate change and extreme weather events. | Rio Grande<br>Routt<br>San Juan<br>White River |
| western bumblebee | Need 3 types of habitat to survive: plants on which to forage for pollen and nectar, nesting sites, and places to overwinter. Threats are likely loss or fragmentation of habitat, pesticide use, climate change, overgrazing, competition with honey bees, low genetic diversity, and introduction of non-native pathogens. | Arapaho-Roosevelt<br>GMUG<br>Manti-La Sal (CO portion)<br>Pike-San Isabel<br>Rio Grande<br>Routt<br>San Juan<br>White River |
| violet milkvetch | Sagebrush and sage steppe rangelands; dry stony hillsides and benches, commonly on granite, often about oak thickets, in the pinyon-juniper and ponderosa pine zones, in oak-pinyon forests, or among sagebrush, 5800-8100 feet. Threats not well understood though available information suggests high rarity and potential vulnerability. | San Juan |
| Mancos Shale packera | Barren shale habitat; currently known from only 3 occurrences within one mile of each other in Dolores Co., including on the Dolores Ranger District. Threats may include grazing practices, recreational use of the habitat, off-road vehicle traffic, road maintenance and improvements, and water impoundments. | San Juan |

The black-tailed prairie dog, burrowing owl, and Sandhill goosefoot (*Chenopodium cycloides*) are still not known in CRAs and the original "no impact" determinations for them continue to apply. Habitat of the Plains topminnow is not expected to occur in CRAs and therefore no impact is expected from implementation of the Colorado Roadless Rule or exception for the North Fork Coal Mining Area. The Mancos shale packera is currently known only at three locations and is not known to occur in CRAs. However, as a recently-described species and newly-designated sensitive species with much to learn about the full distribution of members of the species and its habitat, the plant is carried forward for further evaluation of the alternatives. Records of the monarch butterfly, western bumblebee, and violet milkvetch are also lacking for CRAs. However, in general there are poor site-specific records for these species. It is reasonable to infer that given their habitats and wide distribution, they could, and likely do, occur in CRAs. They are also carried forward for further consideration during the evaluation of the alternatives.

Since 2012 more recent fish surveys have verified a population of Colorado River cutthroat trout, a Regional Forester sensitive species, in the East Fork of Minnesota Creek just outside the boundary of the North Fork Coal Mining Area and in the Hoodoo Creek tributary on the southern boundary of the area. While Colorado River cutthroat trout were evaluated in 2012 and programmatically determined to be potentially impacted by roadless area management, new information confirms members of the species are directly associated with the North Fork Coal Mining Area. Current effect determinations are discussed in the analysis of the alternatives

Finally, the greater sage-grouse was the subject of a west-wide interagency planning effort by the U.S. Forest Service and BLM to develop management direction in federal land use plans to conserve the species across its range. Of Colorado national forests, the Routt is the only one involved in this effort, although several other national forests in the state are known to have habitats and seasonal use by greater sage-grouse. On September 21, 2015, the U.S. Fish and Wildlife Service Director

determined that the species remains relatively abundant and well-distributed across its range and that protection for it under the ESA is no longer warranted. The greater sage-grouse currently remains a Regional Forester sensitive species in the Rocky Mountain Region.

## Threatened and Endangered Species and Critical Habitats Considered in this SDEIS

Currently there are no new species proposed for listing under the ESA that affect the national forests in Colorado. The U.S. Fish and Wildlife Service concurred on all of the U.S. Forest Service "not likely to adversely affect" determinations (March 28, 2012 letter).

Species that were the subject of ESA listing or critical habitat decisions since the 2012 Rule are presented in Table 3-9. All of the species since affected by listing decisions were evaluated as Regional Forester sensitive species in the biological evaluation for the 2012 Rule.

On September 26, 2013, the U.S. Fish and Wildlife Service proposed a revision of designated critical habitat for the contiguous United States Distinct Population Segment of the Canada lynx. On September 12, 2014, the Service issued final revised critical habitat which did not include any areas in the southern Rockies ecoregion, including Colorado and the national forests in the state.

Most of the "no effect" determinations and rationales in Table 3-9 continue to apply today. No new information regarding occurrence of these species and their habitats related to CRAs has emerged since 2012 that would invalidate these earlier conclusions and the rationales that led to them. Consequently, the determination continues to be "no effect" for grizzly bear, gray wolf, black-footed ferret, yellowfin cutthroat trout, whooping crane, piping plover, least tern, pallid sturgeon, Osterhout milkvetch (*Astragalus osterhoutii*), Penland beardtongue (*Penstemon penlandii*), North Park phacelia (*Phacelia formosula*), Colorado butterfly plant (*Gaura neomexicana ssp. coloradensis*), Ute ladies'-tresses orchid (*Spiranthes diluvialis*), and Pagosa skyrocket (*Ipomopsis polyantha*). The determination for Pagosa skyrocket also reflects a review of the final critical habitat designated for the species since 2012 to confirm that critical habitat does not occur in or directly associated with the CRAs or North Fork Coal Mining Area. These species are not carried forward for further analysis of the alternatives.

***Table 3-9.*** *Species listing or critical habitat decisions under the ESA affecting national forests in Colorado since the 2012 Colorado Roadless Rule*

| *Species* | *ESA Decisions Since the 2012 CRR* | *2012 Status* | *2012 Determination** | *Rationale* |
|---|---|---|---|---|
| DeBeque phacelia | Final Critical Habitat 8/3/2012 | ESA Threatened with Proposed Critical Habitat | Not likely to adversely modify | Not known to occur in CRAs but might be affected by invasive spread from CRA mgmt. |
| Pagosa skyrocket | Final Critical Habitat 8/3/2012 | ESA Endangered with Proposed Critical Habitat | No effect | Not known or likely to occur in CRAs, or to be affected by their management |
| Gunnison sage-grouse | Threatened 11/20/2014 Final Critical Habitat 11/20/2014 | Forest Service Sensitive | May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal | Rule including exceptions may have some beneficial and minor adverse impacts |

| *Species* | *ESA Decisions Since the 2012 CRR* | *2012 Status* | *2012 Determination** | *Rationale* |
|---|---|---|---|---|
| | | | listing | |
| Yellow-billed cuckoo (western DPS) | Threatened 10/3/2014 Proposed Critical Habitat 8/15/2014 | Forest Service Sensitive | No impact | Habitat not expected to occur in CRAs |
| Lesser prairie chicken | Threatened 4/10/2014 | Forest Service Sensitive | No impact | Habitat not expected to occur in CRAs |
| NM meadow jumping mouse | Endangered 6/10/2014 Final Critical Habitat 2/27/2015 | Forest Service Sensitive | No impact | Habitat not expected to occur in CRAs |
| Southwestern willow flycatcher | Final Revised Critical Habitat 1/2/2013 | ESA Endangered | Not likely to adversely affect (species);Proposed Critical Habitat not evaluated | No Critical Habitat proposed or designated on NFS lands in Colorado |

For the species in Table 3-9, the ESA actions since 2012 have no bearing on the rationale that led to no effect/impact determinations for Pagosa skyrocket (already discussed), yellow-billed cuckoo (western DPS), lesser prairie chicken, and New Mexico meadow jumping mouse. No new information has emerged about occurrence of these species or their habitats in CRAs or the North Fork Coal Mining Area, or expected to be affected by management. This includes consideration of the proposed critical habitat for the western yellow-billed cuckoo and final designated critical habitat for the New Mexico meadow jumping mouse. Therefore, along with the Pagosa skyrocket, the western yellow-billed cuckoo, lesser prairie chicken, New Mexico meadow jumping mouse and any proposed or final critical habitats for them should not be affected by the Colorado Roadless Rule and the North Fork Coal Mining Area. These species also will not be carried forward for further analysis under the alternatives. Finally, revised critical habitat for the southwestern willow flycatcher was proposed at the time of the 2012 Colorado Roadless Rule, but not for any of the national forests in Colorado and was not analyzed. The final critical habitat designated in January 2013 similarly did not include the Colorado forests, and effects to its critical habitat are not addressed further under the alternatives.

Based on an initial reconsideration of the 2012 analysis of the Colorado River listed fishes (humpback chub, bonytail chub, Colorado pikeminnow, razorback sucker) and the Colorado Roadless Rule exception for the North Fork Coal Mining Area, our conclusion is that these fishes should be carried forward for further analysis under the current alternatives to confirm the earlier “no effect” determinations still apply. All other listed species and critical habitats in Table 3-9 are addressed under the alternatives.

## Analysis of the Effects of the Alternatives

The biological evaluation for the 2012 FEIS generally summarized the potential effects on wildlife, fish and sensitive plants from management activities similar to those permissible under the exceptions to the Colorado Roadless Rule, including the North Fork Coal Mining Area: road construction and reconstruction; tree-cutting and removal activities; oil; gas and coal resource operations; and development of linear construction zones. The 2012 Colorado Roadless Rule does not authorize any ground-disturbing activities, and proposed activities would continue to be subject to site-specific evaluations. The extent to which effects occur locally to habitat and populations could depend on site-specific factors, such as the type, location, timing, duration, frequency, and magnitude of the

management actions. Some of the potential impacts described programmatically here would likely be avoided or reduced through site-specific planning and implementation, which could include design criteria and/or mitigation measures aimed at conserving threatened, endangered, and sensitive species. Section 7 consultation with the U.S. Fish and Wildlife Service will continue to occur when the U.S. Forest Service determines a proposed activity may affect a listed species or critical habitat.

Road construction, reconstruction, maintenance, tree cutting, and removal can affect habitat by reducing habitat availability and effectiveness, causing habitat fragmentation, facilitating the spread of non-native invasive species, and increasing human-caused disturbance and mortality. Oil and gas and mining operations and development of linear construction zones can remove or degrade habitat, increase fragmentation, facilitate new introductions or increase the spread of non-native invasive species, increase noise and other human-caused disturbance, and increase the potential for road-related mortality of wildlife due to vehicle collisions.

Fragmentation of sensitive plant habitat can result from a wide array of management actions in and around roadless areas. Habitat fragmentation has been cited frequently as a concern for fish and wildlife, and its impact on plants can vary widely depending on the species' breeding system, capacity for migration, and other factors (Lienert, 2004). Although some plant species are able to persist in very small populations over long periods of time, there is also evidence for the disruption of plant–pollinator relationships in fragmented landscapes (Harris and Johnson, 2004). The causes may include a lack of nesting sites for insect pollinators or reduced pollinator visits to small plant populations, which can lead to lower seed production, with subsequently reduced seedling establishment and eventually smaller plant populations or local extirpation of populations. Habitat fragmentation can also affect plant populations through a loss of genetic diversity within populations (USDA Forest Service, University of California; 2006).

### ***Alternative A – No Action***

**Sensitive Species**

Because roads are not authorized in CRAs other than under the exceptions, it is reasonable to continue to conclude that the 2012 Colorado Roadless Rule is overall positive over the long term for conservation of species of special concern like Regional Forester sensitive species, compared to non-roadless area environments. There is some potential for localized and short–term negative effects to local occurrences and individuals from implementation of the management exceptions. Conversely, species that thrive in early seral conditions brought about by disturbance may not necessarily benefit from higher protections of areas.

This alternative prohibits additional temporary road construction and reconstruction by leaving the unleased acres as non-upper tier roadless areas. It does not compromise the 2012 determinations of "May adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing" (MAII) for the sensitive species evaluated at that time. Implementation of this alternative could be expected to be more beneficial to some species directly or indirectly associated with the North Fork Coal Mining Area. This is because of the removal of potential conflicts between these species and their habitats, associated with the temporary road construction permitted under Alternative B or C. This local benefit if realized would improve the conservation value of the Colorado Roadless Rule for those species compared to Alternative B, potentially in meaningful ways at a localized scale. It would, however, not have a noticeable

disproportionate impact on the programmatic conclusions for the Colorado Roadless Rule without the North Fork Coal Mining Area exception that would compel a change to a determination of "No impact" for sensitive species across the scale of the Colorado Roadless Rule and analysis area in 2012. As concluded in 2012 and holds today, some positive and negative effects to these species are anticipated with implementation of the entire Colorado Roadless Rule and management exceptions. Though the temporary road exception for North Fork Coal Mining Area was one piece contributing to the 2012 effects analyses and determinations, there is no indication that it disproportionately influenced them. The Colorado Roadless Rule and its suite of management exceptions contributed to that collective MAII determination that was conservatively applied to all of the sensitive species at that time. It is reasonable to expect that effect determination continues to be appropriate for the sensitive species addressed in 2012 and that have retained their sensitive designation since then. This is the case even recognizing the potential for more localized benefits to some of these species under Alternative A compared to Alternative B, the current preferred alternative. Alternative B may have less local conservation value than Alternative C, which reduces the North Fork Coal Mining Area and therefore the area to which the road exception applies.

It is reasonable to conclude the MAII determination for the Colorado Roadless Rule and the current alternative should be applied to the new species added to the Regional Forester's sensitive species list since 2012. There currently is a scarcity of data concerning their association directly with the CRAs. However, their association is assumed given our understanding of their natural history and habitats. Activities allowed under the Colorado Roadless Rule management exceptions and ongoing activities in the North Fork Coal Mining Area under this alternative even without the exception for that area, could have some local or temporary direct or indirect effects on these species and their habitats. The probability of negative impacts should be minimized if not avoided altogether by the site-specific analysis, implementation of Best Management Practices, project design criteria and mitigation measures, and decision-making procedures that will continue to apply to future activities in the roadless areas and North Fork Coal Mining Area under this and all alternatives. Hence, the MAII determination continues to apply and is appropriate under Alternative A for those sensitive species evaluated in 2012, as well as the species designated sensitive during updates to the Regional Forester's list in 2013 and 2015. The exception is Gunnison sage-grouse that is now listed under the ESA and addressed under that status in the next section.

**Threatened and Endangered Species**

Listed species that were the subject of Section 7 consultation for the 2012 Colorado Roadless Rule included the Southwestern Willow Flycatcher, Mexican Spotted Owl, Pawnee Montane Skipper, Uncompahgre Fritillary, Canada Lynx, Preble's Meadow Jumping Mouse, Greenback Cutthroat Trout, Penland's Alpine Fen Mustard, Colorado Hookless Cactus, and DeBeque Phacelia. For all of these species, the U.S. Forest Service determination was "May affect, not likely to adversely affect." As with the sensitive species, the determinations were an outcome of considering the Colorado Roadless Rule network across the state and various management exceptions allowed within that network. None of the determinations singled out the temporary road exception for the North Fork Coal Mining Area as having a disproportionate influence on one or more of those determinations. The information provided for these species on habitats and threats in those evaluations has also not substantially changed since then. Therefore, continuation of the Colorado Roadless Rule without the temporary road exception under Alternative A may have some localized or temporary conservation

values to species occurring there compared to Alternative B. However, our overall conclusion is that the 2012 programmatic determinations of effect for these species across the roadless network continue to apply to the Colorado Roadless Rule including under Alternative A

*Colorado River listed fishes.* The endangered bonytail chub *(Gila elegans)*, Colorado pikeminnow *(Ptychocheillus lucius)*, humpback chub *(Gila cypha)*, and razorback sucker *(Xyrauchen texanus)*, are native to the Colorado River and its larger tributaries. These four species are found in warm-water environments and are not present in CRAs. Impoundment and diversion of water on NFS lands can affect these species. Development of coal resources sometimes requires small, one-time water depletions associated with well drilling, dust abatement, and other construction activities. The determination of effect for these fishes in 2012 was "no effect." Our conclusion is that the 2012 determinations may have been in error, or at least should have been included in dialogue with the U.S. Fish and Wildlife Service during consultation but was not because of that determination (U.S. Forest Service is not required to consult on "no effects"). Development of coal resources sometimes requires small, one-time water depletions associated with MDW drilling and other construction activities. We base our current conclusion on the fact that water depletions in the Gunnison River basin have the potential to negatively affect all four of these downstream fishes, native to the Colorado River watershed. Water depletions are likely to occur from mining activities under all three alternatives under consideration. The Service has previously issued a Biological Opinion that all water depletions in the Gunnison River basin could adversely affect Colorado River fishes.

Continued water depletions associated with mining activities in the area designated as the North Fork Coal Mining Area are likely to be sufficiently small to be within the requirements of the forest-wide 2007 Programmatic Biological Opinion from the U.S. Fish and Wildlife Service for small, one-time water depletions on the GMUG National Forests. Most of the minor depletions on the forest in recent years have been related to coal mining activities. The 2007 programmatic opinion establishes an annual cap of 100 acre-feet depleted forest-wide and no more than 50 acre-feet per project. Each year the Forest reports the total volume of water depletions that are associated with resource development. Should water depletions within the North Fork Coal Mining Area not meet the criteria necessary to be covered by the Programmatic Biological Opinion, the U.S. Forest Service would need to reinitiate consultation with the U.S. Fish and Wildlife Service and the third parties involved would need to enter into a Recovery Agreement for the Colorado River recovery program. This change in the U.S. Forest Service's programmatic determination from "no effect" to "likely to adversely affect" for the Colorado River listed fishes between 2012 and now will be addressed during the reinitiation of Section 7 consultation with the U.S. Fish and Wildlife Service.

*Gunnison sage-grouse.* At the time of the 2012 Colorado Roadless Rule, the Gunnison sage-grouse was a U.S. Forest Service sensitive species. Shortly after in August 2012, the GMUG National Forests entered into a cooperative Candidate Conservation Agreement with the U.S. Fish and Wildlife Service and several other federal and state agencies and local governments for the Gunnison Basin that contains 87% of the known remaining population of the grouse. In July 2013 the U.S. Fish and Wildlife Service issued a Conference Opinion on the Agreement. On November 20, 2014, the Service listed the species as threatened and designated final critical habitat for it. Some of that critical habitat overlaps CRAs on the GMUG National Forests, though not the North Fork Coal Mining Area. On December 8, 2014, the Service adopted the 2013 Conference Opinion as a final Biological Opinion.

The 2012 effects analysis for the Gunnison sage-grouse concluded that adoption of the Colorado Roadless Rule "May adversely impact individuals, but is not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing." This is the appropriate determination when there is potential for a mix of beneficial and minor negative impacts to a sensitive species. The rationale at the time was that overall the Colorado Roadless Rule protections and ongoing project-level evaluations to avoid and minimize local negative effects of activities under the management exceptions, would be positive for the Gunnison sage-grouse and its conservation. Any impacts to individuals or their habitat were projected to be minor and temporary, if they occurred at all, and ameliorated as needed during the project-level planning and evaluations.

There is nothing to suggest that the 2014 listing of the Gunnison sage-grouse under the ESA compromises the 2012 conclusions, or the Colorado Roadless Rule now represents a substantial threat to the grouse or its critical habitat. To the contrary the Colorado Roadless Rule protections, ongoing activity evaluations and consultations as needed for management activities in the CRAs and North Fork Coal Mining Area, and the ongoing affirmative efforts on the GMUG National Forests under the Candidate Conservation Agreement all lead to our conclusion that adverse effects of the Colorado Roadless Rule to the Gunnison sage-grouse or its critical habitat are unlikely. The absence of the temporary road exception for the North Fork Coal Mining Area under Alternative A has little bearing on that conclusion or in comparison to the other alternatives with no known birds or critical habitat near the North Fork Coal Mining Area. Some impacts may occur from activities in other CRAs as projected in 2012, but are expected to be minor to unlikely.

*DeBeque phacelia*. At the time of the evaluation of the 2012 Colorado Roadless Rule, the DeBeque phacelia was listed as threatened with proposed critical habitat. Later that year on August 3, 2012, the U.S. Fish and Wildlife Service designated final critical habitat. No critical habitat is near the North Fork Coal Mining Area.

The parcels of final designated critical habitat are located in the same roadless areas and parcels as the proposed habitat in 2012. No new information would indicate that the species and its final critical habitat would now be adversely affected, but there may still be some potential effect as described in 2012 related to implementation of activities under the management exceptions. That is largely speculative at this point and would be subject to future site-specific evaluations and section 7 consultation, as needed. Because the species or its critical habitat is not known from or near the North Fork Coal Mining Area, Alternative A does not alter these conclusions.

### ***Alternative B***

**Sensitive Species**

Similar to conclusions under Alternative A, the North Fork Coal Mining Area exception under Alternative B, by itself does not compromise the 2012 programmatic determinations (MAII) for the sensitive species evaluated at that time. This alternative is the same as the one selected for the 2012 FEIS and given the relatively short interim period of time, the analyses, rationales, and determinations of effect then largely apply today. Implementation of this Alternative would not result in additional localized conservation value to species overlapping the area affected by the temporary road exception like Alternative A. However, that difference as discussed also under Alternative A would not disproportionately affect the overall determinations for the 2012 Colorado Roadless Rule and its exceptions, including the one for the North Fork Coal Mining Area under Alternative B. It is also

reasonable to conclude the MAII determinations for the species analyzed in 2012 would also apply to the monarch, western bumblebee, Mancos shale packera, violet milkvetch for similar reasons presented under Alternative A.

Notwithstanding the points and conclusions above, newer information for sensitive fishes in and near the North Fork Coal Mining Area has emerged since the 2012 Colorado Roadless Rule. No known U.S. Forest Service sensitive fish populations were known to occur in the North Fork Coal Mining Area. No known threatened fish populations were known to occur in the watershed in which the North Fork Coal Mining Area is located. The East Fork of Minnesota Creek and its tributary Hoodoo Creek support a conservation population of Colorado River cutthroat trout. Hoodoo Creek borders the North Fork Coal Mining Area and the East Fork of Minnesota Creek is within the same watershed as the southern end of the North Fork Coal Mining Area. The total length of habitat occupied within and around the North Fork Coal Mining Area by Colorado River cutthroat trout is 2.9 miles. Therefore, erosion occurring in this portion of the North Fork Coal Mining Area could result in habitat degradation in these streams. Road-stream crossings could fragment stream habitat isolating trout in Hoodoo Creek from the surrounding watershed. Project-level design features and best management practices will be necessary in this part of the North Fork Coal Mining Area, in order to minimize the chance for substantial negative effects on Colorado River cutthroat trout. While this may not affect the overall determination of impact for this species under the Colorado Roadless Rule and Alternative B for the Colorado Roadless Rule network, proper consideration of the Colorado River cutthroat trout in further site-specific planning of the coal mining-related activities will likely be important in conservation of local individuals and populations.

**Threatened and Endangered Species**

The 2012 “may affect” determinations and Section 7 consultation for the species listed in Alternative A were an outcome of considering the entire Colorado Roadless Rule, network of roadless areas, and management exceptions including the exception for temporary roads in the North Fork Coal Mining Area. As discussed under Alternative A, the rationales for those determinations did not single out impacts associated with the temporary road exception and related future mining activities for the North Fork Coal Mining Area. The arguments and determinations continue to apply under Alternative B, with the exception of the greenback cutthroat trout discussed below.

*Greenback cutthroat trout*. For the 2012 analysis, greenback cutthroat trout were known only to occur on the eastern slope in Colorado and there were no known populations on the western slope of Colorado, including on the GMUG National Forests.

Based on more recent cutthroat genetics investigations in the southern Rockies, there are now believed to be 12 Conservation Populations of greenback cutthroat trout present in the watershed in which the North Fork Coal Mining Area is located. The total length of habitat occupied by greenback cutthroats in the surrounding watershed is 39 miles. None of these populations occupy habitat within or directly downstream of the North Fork Coal Mining Area. Assuming design features and appropriate best management practices are implemented as development occurs in the North Fork Coal Mining Area, there is no reason to assume that reinstatement of the temporary road exception under Alternative B will now adversely affect the greenback cutthroat trout despite the new information.

*Gunnison sage-grouse*. The discussion under Alternative A largely applies to Alternative B as well. Despite Alternative B having the largest area affected by the temporary road exception among the three alternatives, it will not represent an increased threat to the Gunnison sage-grouse.

*DeBeque phacelia*. The discussion under Alternative A largely applies to Alternative B as well. While there may be some potential for indirect impact to populations or habitat from invasive plants spreading from adjacent roadless areas that may be affected by these activities (though even that is uncertain), the likelihood of those effects occurring or being anything other than temporary or minor, if they do occur, is small. Since the species and its critical habitat is not known from within or even nearby the area any conclusions regarding the effect to the DeBeque phacelia and its critical habitat from implementation of the Colorado Roadless Rule are not changed under Alternative B.

### ***Alternative C***

**Sensitive Species**

Similar to conclusions under Alternatives A and B, this alternative does not change the overall programmatic determinations of effect for the species evaluated in 2012 and the species added to the sensitive species list since then. The size of the North Fork Coal Mining Area is reduced under this alternative and likely to benefit and enhance local conservation value compared to the other alternatives. Alternative C retains the temporary road exception similar to Alternative B, but not available under Alternative A, while substantially reducing the size of the North Fork Coal Mining Area compared to A and B and the area to which the road exception applies compared to B.

Any enhanced species conservation value, or maintenance of values, under Alternative C, or any of the other alternatives, is an important consideration. No single species analyses or determinations of effect were disproportionately affected by the temporary road exception for the North Fork Coal Mining Area. This Alternative would likely add to the conservation value of the Colorado Roadless Rule by improving local conservation value, but not to a degree that would change the overall programmatic determinations for the state-wide Colorado Roadless Rule network for the 2012 sensitive species or the new ones. That conclusion is not intended to infer that higher local conservation value for at risk species if realized, is not important or something to consider in the selection of the alternatives based on all legal, policy and management considerations. The conclusion does reflect the expectation, as in 2012, that the Colorado Roadless Rule under all of the alternatives will have a mix of positive and negative effects to some species under all of the management exceptions, including even for a smaller North Fork Coal Mining Area. But the degree of effects as discerned programmatically are considered to be positive under roadless designation, with some localized or temporary negative effects that should be avoided or minimized by ongoing project-level reviews and design features for species.

**Threatened and Endangered Species**

As discussed under Alternative A, the rationales for determinations did not single out impacts associated with the temporary road exception for the North Fork Coal Mining Area. The arguments and determinations continue to apply under Alternative C, with the exception of the greenback cutthroat trout discussed below.

The following is an additional discussion and analyses specific to listed fish under Alternative C.

*Greenback cutthroat trout*. The discussion for Alternative B remains the same for Alternative C. There is no reason to assume that reinstatement of the temporary road exception under Alternative C, even for a reduced size of North Fork Coal Mining Area, will adversely affect the greenback cutthroat trout despite the new information.

*Gunnison sage-grouse.* The discussion under Alternatives A and B apply for C as well. Although the size of the North Fork Coal Mining Area is substantially reduced here, the road exception and other management exceptions continue to apply across the Colorado Roadless Rule. Critical habitat does not overlap the North Fork Coal Mining Area but does for other roadless areas and potentially could affect the Gunnison sage-grouse and its critical habitat in those other areas. Any likelihood of this happening will be addressed in future project-level analyses and Section 7 consultation between the affected national forest and the U.S. Fish and Wildlife Service.

*DeBeque phacelia*. The discussion under Alternative A and B applies to Alternative C as well. Since the species and its critical habitat is not known from within or even nearby the area any conclusions regarding the effect to the DeBeque phacelia and its critical habitat from implementation of the Colorado Roadless Rule are not changed under Alternative C.

## Cumulative Effects

Reasonably foreseeable future trends that could impact fish, wildlife, and plant species include climate change, increasing population growth and development, increasing recreation demand, and increasing energy demand.

### ***Climate Change***

Climate change can be expected to alter the distribution of plants and other species (Hansen et al. 2001, IPCC; IPCC, 2007). Some species will be more vulnerable to the effects of climate change than others (Millar et al. 2007).

Alpine species may be among those in the most uncertain situations. With climate change, tree lines will move higher in elevation. Alpine habitats will contract in size and mountain-top patches will become increasingly isolated. Alpine plants and animals will have little opportunity to migrate to higher terrain; some are already on the highest peaks in Colorado and are isolated from other potentially suitable habitat.

Average annual temperature increases due to increased GHGs such as carbon dioxide will likely lead to reduced spring snowpack, more precipitation falling as rain rather than as snow, and earlier spring peak runoff (Backlund et al., 2008). For species such as White-Tailed Ptarmigan and Wolverine that rely on cold, snowy environments, warmer temperatures could lead to significant decreases in available habitat and lowered reproduction and survival. More variable flows and temperatures in streams and rivers will profoundly affect aquatic species such as greenback cutthroat trout.

Climate change is affecting the timing of biological events such as pollination, flowering, and migration. For example, pollinators may be capable of shifting northward, but may leave some plant species incapable of producing viable seeds. Earlier flowering dates subject the plants to frost resulting in significantly lower seed production (Inouye, 2008). Reduced seed production can lead to changes in plant community composition, which may alter habitat suitability for some plants, pollinators, and other animals. Bird migration, which formerly was synchronized with maximum food availability, may now occur too late, resulting in lowered reproductive success and survival.

Climate change is likely to exaggerate the scale and intensity of natural disturbances such as wildfire and bark beetle epidemics. Larger and more intense fires and insect outbreaks can be expected in Colorado in the future. While many adult animals are mobile enough to flee burning areas or seek refuge, the young of the year are often vulnerable to injury and mortality from fire (Smith, 2000). Amphibians, insect larvae, small mammals, or ground-nesting birds also may not survive the direct effects of an intense fire. Colorado forests currently are experiencing significant mortality as a result of severe mountain pine beetle and spruce beetle outbreaks. Larger, more severe wildland fires could occur in and around roadless areas in the future.

Additional stressors such as competition from invasive species or changes in land use will further challenge the ability of plants and animals to adapt to climate change (USDA , 2001).

### ***Increasing Human Population Growth and Development***

Colorado's residential population in 2006 was 4.8 million and is projected to be 7.3 million by 2030 (DOLA State Demography Office, 2007). The increased demands these residents will place on the lands surrounding roadless and wilderness areas will increase the importance of the roadless and wilderness areas in providing habitat for wildlife, fish and rare plants. Increasing population and associated resource demands could also limit options for any future protection of new roadless acres. Roadless areas will likely continue to provide some of the best aquatic and terrestrial wildlife habitat in Colorado into the future, as well as relatively weed–free habitats for rare plants.

The effects of population growth on fish and wildlife are evident in the amount of habitat that has been converted or fragmented by human development across the state. Much of this development has been in lower elevation areas that have historically provided habitat that allowed species such as bears and ungulates to survive harsh winters. Providing for the intact structure and function of high-value but limited availability of low and middle elevation roadless areas is important now and will be essential in the future. Human-associated encroachment is expected to continue to erode habitat availability and effectiveness, and increase disturbance and fragmentation.

Increasing demand for water will also present fragmentation as well as quantity and quality of aquatic systems. It is becoming increasingly difficult to "balance" the need for water by municipal users with the requirements of native fish for abundant, clear water and clean substrate throughout the year.

Colorado's Comprehensive Wildlife Conservation Strategy provides a foundation for sustaining Colorado's wildlife and the habitats upon which they depend (Colorado Division of Wildlife, 2006).

The strategy provides general direction for wildlife conservation and a stimulus to engage partners in conservation of Colorado's wildlife resources. These efforts will increase the probability of terrestrial species' habitats on private lands remaining stable over the long term. However, considering the growth rate of the state and the high demand for resources available in Colorado, some private lands will continue to experience impacts on natural resources from urbanization and development, resource demands (for example, minerals), and recreation. Some effects that result in lower habitat quality on non-federal land may increase the importance of but also limit the potential effectiveness of habitat conservation and restoration on federal lands.

### ***Increasing Recreation Demand***

The growing population will continue to be drawn to the natural beauty, seclusion, and undeveloped nature of roadless and wilderness areas in Colorado for enjoyment of outdoor recreation pursuits.

Recreational demand will continue to increase, likely increasing the use of roadless and wilderness areas.

Recreational activities can affect the quality and quantity of habitat, displace wildlife from core habitats, create physiological stress, fragment habitats, and increase the establishment and spread of invasive species and pathogens. Secluded and undisturbed habitats are likely to experience unpredictable or increasing human presence and the unintentional introduction of invasive species. Thus, increases in recreational use could compound the effects of increased road construction on many fish, wildlife, and rare plant species, and introduce additional non-native invasive plants and animals that threaten native populations.

### Increasing Energy Demand

Oil, gas, and coal reserves are among the economically important natural resources found within the roadless areas and surrounding lands in Colorado. The national focus on energy independence combined with the high demand for energy has resulted in a surge of exploration and development of those resources across the state. Energy exploration and development is occurring on both private and federal lands, including areas within or in proximity to roadless areas. Many of the areas where exploration and development are occurring historically have provided valuable habitat for fish, wildlife or rare plants, and in some cases habitat critical to the survival of individuals and populations of species. Development of private lands may displace animals onto adjacent NFS lands, accentuating the need to provide effective habitat that is free from disturbance.

Pipelines and other distribution systems needed to transport these products may be routed across the national forests. This development results in direct loss of habitat as well as indirect effects of disturbance during construction and operation, which may become permanent for above-ground structures.

The current interest in wood fiber and biofuels as economical energy sources is anticipated to increase, placing additional demand on NFS resources. It can be anticipated that harvesting wood fiber to meet increasing demand will increase as technology improves. Tree harvest and sale requires road infrastructure, resulting in the associated impacts on wildlife and rare plants that have been thoroughly discussed previously in this document.

Development of wind energy and associated interstate transmission lines are anticipated to receive increasing focus in the nation's effort to become energy independent, and national forests are beginning to receive inquiries about tower placement. Mortality of migrating bats and a variety of birds by striking wind towers has been documented in numerous locations. Like other infrastructure development in previously undisturbed habitats, these structures directly remove habitat and may reduce habitat effectiveness, cause displacement of wildlife, and fragment habitat, thus adding adverse cumulative effects to the activities in the proposed alternatives.

### Analysis of Cumulative Effects

The cumulative effect of the increased road density made possible by Alternatives B or C would, with other actions, result in increased habitat degradation or fragmentation. Temporary road construction within the North Fork Coal Mining Area would still be subject to project-specific NEPA review. Design criteria and best management practices could be implemented at the project-specific level to minimize the chance for project-specific negative impacts.

Outside of the North Fork Coal Mining Area, continued implementation of the 2012 Colorado Roadless Rule for CRAs would maintain relatively large blocks of undisturbed aquatic and terrestrial habitat. Therefore, the primary cumulative impact of the 2012 Colorado Roadless Rule would be beneficial. Future proposals for activity within CRAs would be subject to project-specific NEPA at which time an analysis of how a project could lead to the deterioration of roadless characteristics within the affected CRA.

### ***Determinations of Effect for Sensitive Species***

The possible determinations of effect for sensitive species are

- No impact (NI);
- Beneficial impact;
- May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing (abbreviated MAII);
- Likely to result in a loss of viability in the planning area, or in a trend toward federal listing.

For Alternative A, the determination of effect represents an evaluation of the Colorado Roadless Rule since its implementation in 2012. Determinations made based on this analysis are consistent with determinations made in 2012. Alternatives B and C describe a change in roadless for a specific portion the GMUG National Forests. For Sensitive Species not present on the GMUG the reclassification of the North Fork Coal Mining Area will have no impact. For Sensitive Species present on forest lands within and adjacent to the North Fork Coal Mining Area Alternatives B and C may adversely impact individuals but are not likely to result in the loss of viability of the species within the Planning Area. When the effects of an alternative are not expected to be significant and the species and its habitat will remain well distributed, the overall determination of effect is MAII.

***Table 3-10.*** *Determinations of impact for Regional Forester sensitive species by alternative. Species identified with an asterisk are known or suspected to occur within or adjacent to the North Fork Coal Mining Area. Species are identified as to whether the determination of impact has changed or not since 2012, or represents a new species and determination since then. Species that have changed status from sensitive to ESA since 2012 are presented in Table 3-11.*

| *Species* | *Alternative A* | *Alternative B* | *Alternative C* |
|---|---|---|---|
| **AMPHIBIANS** | | | |
| **No Change in 2012 Determination Regardless of Alternative** | | | |
| Boreal toad | MAII | MAII | MAII |
| Northern leopard frog | MAII | MAII | MAII |
| Wood frog | MAII | MAII | MAII |
| New or Changed Determinations | None | None | None |
| **BIRDS** | | | |
| **No Change in 2012 Determination Regardless of Alternative** | | | |
| American peregrine falcon | MAII | MAII | MAII |
| Bald eagle | MAII | MAII | MAII |
| Black swift | MAII | MAII | MAII |
| Boreal owl | MAII | MAII | MAII |
| Brewer's sparrow | MAII | MAII | MAII |
| Burrowing owl | NI | NI | NI |
| Columbian sharp-tailed grouse | MAII | MAII | MAII |

| Species | Alternative A | Alternative B | Alternative C |
|---|---|---|---|
| Ferruginous hawk | MAII | MAII | MAII |
| Flammulated owl | MAII | MAII | MAII |
| Greater sage-grouse | MAII | MAII | MAII |
| Lewis's woodpecker | MAII | MAII | MAII |
| Loggerhead shrike | MAII | MAII | MAII |
| Mountain plover | MAII | MAII | MAII |
| Northern goshawk | MAII | MAII | MAII |
| Northern harrier | MAII | MAII | MAII |
| Olive-sided flycatcher | MAII | MAII | MAII |
| Purple martin | MAII | MAII | MAII |
| Sage sparrow | MAII | MAII | MAII |
| White-tailed ptarmigan | MAII | MAII | MAII |
| **New or Changed Determinations** | None | None | None |
| **FISHES** | | | |
| **No Change in 2012 Determination Regardless of Alternative** | | | |
| Bluehead sucker | MAII | MAII | MAII |
| Colorado River cutthroat trout | MAII | MAII | MAII |
| Flannelmouth sucker | MAII | MAII | MAII |
| Mountain sucker | MAII | MAII | MAII |
| Rio Grande cutthroat trout | MAII | MAII | MAII |
| **New or Changed Determinations** | | | |
| Plains topminnow | MAII | MAII | MAII |
| **INVERTEBRATES** | | | |
| **No Change in 2012 Determination Regardless of Alternative** | | | |
| Rocky Mountain capshell snail | MAII | MAII | MAII |
| Susan's purse-making caddisfly | MAII | MAII | MAII |
| Hudsonian emerald dragonfly | MAII | MAII | MAII |
| Nokomis fritillary | MAII | MAII | MAII |
| **New or Changed Determinations** | | | |
| Monarch butterfly | MAII | MAII | MAII |
| Western bumblebee | MAII | MAII | MAII |
| **MAMMALS** | | | |
| **No Change in 2012 Determination Regardless of Alternative** | | | |
| American hog-nosed skunk | MAII | MAII | MAII |
| Townsend's big-eared bat | MAII | MAII | MAII |
| Gunnison's prairie dog | MAII | MAII | MAII |
| Spotted bat | MAII | MAII | MAII |
| North American wolverine | MAII | MAII | MAII |
| Hoary bat | MAII | MAII | MAII |
| River otter | MAII | MAII | MAII |
| American marten | MAII | MAII | MAII |
| Fringed myotis | MAII | MAII | MAII |
| Bighorn sheep | MAII | MAII | MAII |
| Pygmy shrew | MAII | MAII | MAII |
| Kit fox | MAII | MAII | MAII |
| Swift fox | MAII | MAII | MAII |
| **New or Changed Determinations** | None | None | None |
| **PLANTS** | | | |
| **No Change in 2012 Determination Regardless of Alternative** | | | |
| Stonecrop gilia - *Aliciella sedifolia* | MAII | MAII | MAII |
| Rydberg's golden columbine - *Aquilegia chrysantha* | MAII | MAII | MAII |
| Siberian sea thrift - *Armeria maritima* ssp. *sibirica* | MAII | MAII | MAII |
| Missouri, or Archuleta milkvetch | MAII | MAII | MAII |

| *Species* | *Alternative A* | *Alternative B* | *Alternative C* |
|---|---|---|---|
| *Astragalus missouriensis var. humistratus* | | | |
| Aztec milkvetch - *Astragalus proximus* | MAII | MAII | MAII |
| Ripley's milkvetch - *Astragalus ripleyi* | MAII | MAII | MAII |
| Smooth northern-rockcress - *Braya glabell* | MAII | MAII | MAII |
| Lesser panicled sedge - *Carex diandra* | MAII | MAII | MAII |
| Livid sedge - *Carex livida* | MAII | MAII | MAII |
| Lesser yellow lady's slipper - *Cypripedium parviflorum* | MAII | MAII | MAII |
| Clawless, or Garys Peak draba - *Draba exunguiculata* | MAII | MAII | MAII |
| Gray's draba - *Draba grayana* | MAII | MAII | MAII |
| Smith's draba - *Draba smithii* | MAII | MAII | MAII |
| English sundew - *Drosera anglica* | MAII | MAII | MAII |
| Roundleaf sundew - *Drosera rotundifolia* | MAII | MAII | MAII |
| Chamisso's bristlegrass, or Chamisso's cottongrass - *Eriophorum chamissonis* | MAII | MAII | MAII |
| Slender bristlegrass, or Slender cottongrass - *Eriophorum gracile* | MAII | MAII | MAII |
| Plains rough fescue - *Festuca hallii* | MAII | MAII | MAII |
| Scarlet gilia - *Ipomopsis aggregata* ssp. *weberi* | MAII | MAII | MAII |
| Fremont's bladderpod - *Lesquerella pruinosa* | MAII | MAII | MAII |
| Colorado tansyaster - *Machaeranthera coloradoensis* | MAII | MAII | MAII |
| Rocky Mountain, Budding, or Weber monkeyflower - *Mimulus gemmiparus* | MAII | MAII | MAII |
| Bill's neoparrya - *Neoparrya lithophila* | MAII | MAII | MAII |
| Pikes Peak, or Rocky Mountain alpineparsley - *Oreoxis humilis* | MAII | MAII | MAII |
| Mancos shale packera - *Packera mancosana* | MAII | MAII | MAII |
| Kotzebue's grass of Parnassus - *Parnassia kotzebuei* | MAII | MAII | MAII |
| Degener's beardtongue - *Penstemon degeneri* | MAII | MAII | MAII |
| Harrington's beardtongue - *Penstemon harringtonii* | MAII | MAII | MAII |
| Rock, or Rocky Mountain cinquefoil - *Potentilla rupincola* | MAII | MAII | MAII |
| Greenland primrose - *Primula egaliksensis* | MAII | MAII | MAII |
| Porter's false needlegrass - *Ptilagrostis porteri* | MAII | MAII | MAII |
| Ice cold buttercup - *Ranunculus karelinii* (formerly *grayi*) | MAII | MAII | MAII |
| Dwarf raspberry - *Rubus arcticus ssp. acaulis* | MAII | MAII | MAII |
| Sageleaf, or sage willow - *Salix candida* | MAII | MAII | MAII |
| Autumn willow - *Salix serissima* | MAII | MAII | MAII |
| Sphagnum - *Sphagnum angustifolium* | MAII | MAII | MAII |
| Baltic sphagnum - *Sphagnum balticum* | MAII | MAII | MAII |
| Cathedral Bluff meadow-rue - *Thalictrum heliophilum* | MAII | MAII | MAII |
| Lesser bladderwort - *Utricularia minor* | MAII | MAII | MAII |
| Selkirk's violet - *Viola selkirkii* | MAII | MAII | MAII |
| **New or Changed Determinations** | | | |
| Violet milkvetch – *Astragalus iodopetalus* | MAII | MAII | MAII |
| Mancos Shale packera - *Packera mancosana* | MAII | MAII | MAII |

## ***Determinations of Effect for Threatened and Endangered Species***

The possible determinations of effect for Threatened and Endangered Species are:

- No effect (NE)
- May affect, not likely to adversely affect (NLAA)
- May affect, likely to adversely affect (LAA)

***Table 3-11.*** *Determinations of effect for threatened and endangered species for the Colorado Roadless Rule and North Fork Coal Mining Area alternatives. Species identified with an asterisk are known or suspected to occur within or adjacent to the North Fork Coal Mining Area*

| *Species* | *Alternative A* | *Alternative B* | *Alternative C* |
|---|---|---|---|
| **BIRDS** | | | |
| **No Change in 2012 Determination Regardless of Alternative** | | | |
| Mexican spotted owl | NLAA (species & critical habitat) | NLAA (species & critical habitat) | NLAA (species & critical habitat) |
| Southwestern willow flycatcher | NLAA | NLAA | NLAA |
| Whooping crane | NE | NE | NE |
| Piping plover | NE | NE | NE |
| Least tern | NE | NE | NE |
| **New or Changed Determinations** | | | |
| Gunnison sage-grouse | NLAA (species & critical habitat) | NLAA (species & critical habitat) | NLAA (species & critical habitat) |
| Lesser prairie-chicken | NE | NE | NE |
| Southwestern willow flycatcher | NE (final critical habitat) | NE (final critical habitat) | NE (final critical habitat) |
| Western yellow-billed cuckoo | NE (species & critical habitat) | NE (species & critical habitat) | NE (species & critical habitat) |
| **FISHES** | | | |
| **No Change in 2012 Determination Regardless of Alternative** | | | |
| Greenback cutthroat trout* | NLAA | NLAA | NLAA |
| Pallid sturgeon | NE | NE | NE |
| Yellowfin cutthroat trout | NE | NE | NE |
| **New or Changed Determinations** | | | |
| Bonytail chub | LAA | LAA | LAA |
| Humpback chub | LAA | LAA | LAA |
| Razorback sucker | LAA | LAA | LAA |
| Colorado pikeminnow | LAA | LAA | LAA |
| **INVERTEBRATES** | | | |
| **No Change in 2012 Determination Regardless of Alternative** | | | |
| Uncompahgre fritillary butterfly | NLAA | NLAA | NLAA |
| Pawnee montane skipper | NLAA | NLAA | NLAA |
| **New or Changed Determinations** | None | None | None |
| **MAMMALS** | | | |
| **No Change in 2012 Determination Regardless of Alternative** | | | |
| Canada lynx* | NLAA | NLAA | NLAA |
| Preble's meadow jumping mouse | NLAA (species & critical habitat) | NLAA (species & critical habitat) | NLAA (species & critical habitat) |
| Grizzly bear | NE | NE | NE |
| Grey wolf | NE | NE | NE |
| Black-footed ferret | NE | NE | NE |
| **New or Changed Determinations** | | | |
| New Mexico meadow jumping mouse | NE (species & critical habitat) | NE (species & critical habitat) | NE (species & critical habitat) |
| **PLANTS** | | | |
| **No Change in 2012 Determination Regardless of Alternative** | | | |
| Pagosa skyrocket *Ipomopsis polyantha* | NE | NE | NE |
| DeBeque phacelia | NLAA | NLAA | NLAA |

| *Species* | *Alternative A* | *Alternative B* | *Alternative C* |
|---|---|---|---|
| *Phacelia submutica* | | | |
| Penland alpine fen mustard *Eutrema penlandii* | NLAA | NLAA | NLAA |
| Colorado hookless cactus *Sclerocactus glaucus* | NLAA | NLAA | NLAA |
| Ute ladies'-tresses orchid *Spiranthes diluvialis* | NE | NE | NE |
| Osterhout milkvetch *Astragalus osterhoutii* | NE | NE | NE |
| Penland beardtongue *Penstemon penlandii* | NE | NE | NE |
| Colorado butterfly plant *Gaura neomexicana* ssp. *coloradensis* | NE | NE | NE |
| North Park phacelia *Phacelia formosula* | NE | NE | NE |
| **New or Changed Determinations** | | | |
| DeBeque phacelia *Phacelia submutica* | NE (critical habitat) | NE (critical habitat) | NE (critical habitat) |
| Pagosa skyrocket *Ipomopsis polyantha* | NE (critical habitat) | NE (critical habitat) | NE (critical habitat) |

## *Economics*

This section supplements the 2012 FEIS economic analysis to address new information and changed circumstances that have occurred since the Colorado Roadless Rule became effective on July 12, 2012. The sections that follow describe the economic study area; the methods used to analyze economic effects; the affected environment; and the potential economic effects that could result under the three alternatives. There are two distinct economic effects analyses presented in this section:

- impact or distributional analysis which estimates employment and income effects to the local study area and
- efficiency analysis which estimates the value of benefits and costs to society as a whole.

The results of these two distinct analyses are presented separately because they are neither interchangeable nor can they be aggregated.

When considering the results presented here, it is important to understand that many uncertainties exist regarding the potential for future coal extraction. Because this decision will not authorize any ground disturbing activities, any additional coal-related development on unleased lands would need to be authorized under a subsequent decision that would require additional NEPA analysis. It is not known when or how much development might occur, particularly when considering activities that might occur well into the future. In order to estimate possible economic effects many assumptions about future development activities were made that may come to fruition. Therefore, the economic analysis presented here should be considered estimates based on best available data to compare between alternatives, not predictions of what will actually occur.

### Study Area for Economic Analysis

The study area for the 2012 FEIS included five western slope counties in the study area: Delta, Garfield, Mesa, Montrose, and Rio Blanco. Gunnison County, while it contains coal mines potentially affected by this action, was not included in the 2012 FEIS study area for economic impacts because

mine operations and employee spending occur down valley from the mines. Garfield and Rio Blanco counties are unlikely to be affected by coal operations, but were originally included because of potential effects to oil and gas activity in the FEIS. Continuation of these five counties would have facilitated comparability of economic analysis between the 2012 FEIS and this supplement. But due to public comments, Gunnison County has been added to the study area for the affected environment in the supplemental analysis. See figure 3-5 for a map of the economic study area.

***Figure 3-5.*** *Colorado Roadless Supplemental: Economic Study Area*

The boundaries for the supplemental evaluation of benefits and costs varies as noted in the methodology section, and extend beyond the boundaries of the economic study area.

## Analysis Methods and Assumptions

### ***Scope of Analysis***

The focus of this economic analysis is on the deficiencies outlined by the District Court of Colorado in *High Country Citizens Alliance*, 52 F. Supp. 3d. at 1196, changes in economic trends and information related to those deficiencies, meeting the requirements of NEPA, and substantive scoping comments (see Chapter 1).

As already highlighted in Chapter 1, the scope of this analysis is specific to the North Fork Coal Mining Area as defined in the Colorado Roadless Rule. The economic evaluations in this SDEIS

address economic impacts (production value, employment, and earnings) to the local study area and net benefits (or efficiency analysis) as separate analyses. Employment is not considered a measure of benefits (in this supplement, nor the 2012 FEIS), but instead is offered as a descriptor of distributional impacts of the decision on local or regional economies and populations, consistent with Office of Management and Budget circular A-4, as well as Forest Service Manual 1970 and Forest Service Handbook 1909.17. Discussions of benefit and cost analysis are provided to respond to questions associated with court identified deficiencies associated with the original rule-making; benefit and cost analysis discussions extend the scope and methodology of this economic study well beyond the traditional scope of benefit and cost analysis performed for public land use decisions and are not required by NEPA (40 CFR 1502.23). Presentation of benefit and cost analysis for this programmatic action is not intended to establish precedence for the general application of these approaches to mineral leasing or other project-level decisions.

The timeframe of the economic impact analysis is a 15-year period, consistent with U.S. Forest Service planning efforts, and the timeframe used in the 2012 FEIS. The timeframe extends to 2054 for discussions of benefits and costs, which is a separate analysis. The potential mining of recoverable coal from the North Fork Coal Mining Area is the focus of this economic analysis of the supplement.

The other resources discussed in the economic analysis of the 2012 FEIS do not require supplemental analysis.

### ***Existing Conditions and Gross North Fork Coal Production***

The following analysis and discussion of both economic impacts to the local area and the benefits and costs to society begin with assumptions about future schedules of coal mine production. These projections determine the extent to which temporary road construction or reconstruction could be permitted, but make no determinations about coal activity on specific NFS lands. However, this supplemental analysis assumes that temporary road construction permissions could result in changes in coal reserves accessible under leases, and changes in future production of coal from NFS lands. In reality, any coal activity would require additional project-level decisions based on additional NEPA analysis.

**Data sources** include Colorado Department of Local Affairs; State Demography Office, U.S. Census Bureau; Energy Information Administration; Colorado Division of Reclamation, Mining and Safety; Headwaters Economics Human Dimension Toolkit; IMPLAN (IMpact Analysis for PLANning) model; and from the Integrated Planning Model (IPM) model.

The most recent economic data available for this analysis are from 2013. Economic conditions in the local study area have changed since that time. And therefore may not fully reflect conditions in 2015. This supplemental analysis focuses on the relative differences so that alternatives, can be compared using the best available datasets.

Production of recoverable coal has been estimated, using the low, average, and permitted production scenarios of coal output based on production data from past mine activity, existing permits, and estimates of recoverable coal reserves (see coal section for details). While future mining activity is not known, the three production scenarios have been projected to serve as reasonable estimates. Annual outputs within each of the three scenarios are kept consistent over time until reserves are exhausted, so the ending year varies across the three scenarios. The 2012 FEIS assumed three coal

mines would be operating in the North Fork Coal Mining Area; for this supplemental analysis, past and current data is being used from existing mines, but no assumption is made of the number of mines that may be operating or could bid on future leases within the North Fork Coal Mining Area.

Aggregate annual coal production rates are assumed to be constrained by any individual mine operation and permitted capacity, implying that the period of time to extract the coal within the North Fork Coal Mining Area would vary as a function of the amount of reserves made available under each alternative. Table 3-12 shows the projected schedules of gross North Fork Coal Mining Area coal mine production under the low, average, and permitted production scenario, necessary to exhaust accessible reserve amounts under each alternative.

***Table 3-12.*** *Estimated Schedule of Gross North Fork Coal Mining Area Extraction (millions of tons)*

| Production Rate | Beginning Year (Production) | Ending Year (Production) | Total Years | Total Production (millions of tons) |
|---|---|---|---|---|
| **Alternative A** | | | | |
| Low Scenario | 2016 (5) | 2018 (0.8) | 3 | 11 |
| Average Scenario | 2016 (10) | 2017 (1) | 1 | 11 |
| Permitted Scenario | 2016 (11) | --- | 1 | 11 |
| **Alternative B** | | | | |
| Low Scenario | 2016 (5) | 2051 (2) | 36 | 184 |
| Average Scenario | 2016 (10) | 2034 (4) | 19 | 184 |
| Permitted Scenario | 2016 (11) | 2027 (13) | 12 | 184 |
| **Alternative C** | | | | |
| Low Scenario | 2016 (5) | 2036 (2) | 21 | 106 |
| Average Scenario | 2016 (10) | 2026 (6) | 11 | 106 |
| Permitted Scenario | 2016 (11) | 2022 (13) | 7 | 106 |

## ***Economic Impact Analysis Methodology***

Economic impact analysis is defined as “the net change in economic activity associated with an industry, event, or policy in an existing regional economy” (Watson et al. 2007). An input-output analysis is a means of examining production, supply-chain, and employment relationships within an economy, both between businesses and between businesses and final consumers. An input-output model captures all monetary market transactions of production in a given time period. IMPLAN is a proprietary input-output modeling system composed of both software and data (MIG, Inc. 2013). The system, developed by the U.S. Forest Service in the 1970’s and is widely used today by academic, government, non-profit, and private researchers and practitioners because it is a reliable and reasonable portrayal of regional economies and economic impacts. IMPLAN has been used and cited in hundreds of academic publications and presentation since its inception.

By using U.S. Forest Service expenditure data, resource output data, and other economic information, IMPLAN can estimate, among other things, the jobs and income that are supported by NFS management activities. Direct employment and labor income accrue to mine employees and their

families. Additional employment and income in the economy is generated by mine purchases in the local supply-chain (indirect effects) and household spending of employee earnings (induced effects). Together the direct, indirect, and induced effects comprise the total economic impact to the local economy.

To estimate the potential economic impacts of activities by alternative in the North Fork Coal Mining Area, an input-output model was developed using the IMPLAN modeling system. The IMPLAN model was then customized using employment data provided by the Colorado Department of Local Affairs, State Demography Office. Model production value, employment, and labor income was further customized to capture economic conditions and interactions in the coal mining industry using a variety of sources (see Appendix E). The IMPLAN model includes Delta, Garfield, Mesa, Montrose, and Rio Blanco Counties. Gunnison County is not included in the IMPLAN model. Opportunities for business and household spending in Gunnison County are located in the Gunnison-Crested Butte corridor, which is more distant and difficult to reach compared with down-valley counties. Crested Butte and Gunnison are 2-hour drives from the mines, while Delta is well under an hour and Grand Junction – a major urban center – is 1.5 hours. Kebler Pass, the primary route between the mines and Crested Butte, is closed in the winter. In addition, rail lines from the mines do not pass through the Crested Butte-Gunnison corridor, but down the North Fork Valley. Thus, while the mines and some employees are physically located in Gunnison County, they are economically connected with communities in Delta, Montrose, and Mesa Counties.

As with the model developed for the FEIS, coal mines located just east the Delta-Gunnison county line were incorporated into the final models. This customization resulted in industry interactions with sectors and households located in the five-county area. Other Gunnison County industries were not included for the reasons described earlier. This customizing included techniques identical to those used for the 2012 FEIS.

Production for the coal sector within the mining industry was based on average prices for 2013 reported by the Energy Information Administration, the Colorado Division of Reclamation, Mining, and Safety, and the Colorado Mining Association.

### ***Benefits and Social Costs Methodology***

Unlike the economic impact analysis which estimates the regional job and income impacts, this section considers domestic benefits and costs realized by citizens of Colorado and the United States. This section further expands the scope of the discussion by considering the potential costs, or damages of GHG emissions and climate change, to domestic and global population. It was not feasible to quantify the global benefits of coal consumption for global populations (only domestic populations).

This analysis assesses the benefits and costs of offering additional coal leases in the North Fork Coal Mining Area if the exception is reinstated allowing access (see minerals section for details about specific mining operations and production). The “Existing Conditions and Gross Production” section above contains assumptions about the schedule and magnitude of annual coal production and continued mine production.

**Overview of Benefit Cost Framework**

This discussion of potential benefits and costs focuses on estimating the discounted present net value of increased accessibility of North Fork Coal Mining Area bituminous coal (via temporary road construction/reconstruction) through the federal mineral leasing program. Present net value is used as an indicator of financial efficiency, or a partial economic efficiency of a project; it represents one factor to be used in conjunction with many other factors in the decision-making process. Present net value combines a project's benefits and costs that occur throughout the life of the project and discounts them into an amount that is equivalent to all economic activity in a single year. A positive present net value indicates that the alternative is financially efficient. A present net value analysis is not intended to be a comprehensive analysis that incorporates all known market and non-market benefits and costs. Many of the values associated with a natural resource management project are best handled apart from, but in conjunction with, a limited present net value framework. The non-market benefits and costs associated with this project are discussed throughout the various resource sections of the SDEIS and 2012 FEIS.

This analysis assumes that increased accessibility to North Fork Coal Mining Area reserves could result in continued production and consumption (electricity generation) of North Fork Coal Mining Area coal that varies across alternatives. Estimates of present net value are based on the benefits (i.e., net coal value to producers; changes in efficiency of electric power provision to consumers) and the social costs (i.e., potential damages of carbon dioxide emissions from production, transportation, consumption, and export of coal) of continued production and consumption of North Fork Coal Mining Area coal.

Traditional benefit and cost analysis for U.S. Forest Service actions concentrates on benefits and costs to the public, of making lands or resources available for alternative uses. These analyses customarily characterize benefits and costs of resource use or extraction within NFS lands, where the U.S. Forest Service has the regulatory ability to manage and mitigate activities and effects (both beneficial and adverse). Benefits can be described in terms of willingness-to-pay for use of, or access to resources (e.g., minerals, forage, timber stumpage) on NFS lands. Likewise, costs can be described for ancillary adverse effects or damages that occur as a direct result of actions taken to use or access the forest.

It is rare that the U.S. Forest Service would incorporate indirect benefits and social costs of downstream uses of resources extracted or derived from National Forest lands as a result of the permitted activity, into a benefit cost or financial efficiency analysis because:

- The efficiency or effectiveness of downstream resource use (and therefore the benefits and costs of downstream use) will vary, is driven by complex markets, and is beyond the administrative control of the U.S. Forest Service, and
- Other non-Forest Service rules, regulations, policy, or institutions are in place to manage and mitigate potential social damages of downstream uses, in the interest of public welfare.

For example, the U.S. Forest Service relies on estimates of the stumpage value of timber removed from a National Forest into analyses of financial efficiency for timber sales, but does not attempt to incorporate the value of finished wood products into benefit and cost analysis. To incorporate downstream wood product values would require the agency to make assumptions about types and efficiency of mills. Stumpage values may be calculated from information about downstream revenue

and anticipated harvest costs (e.g., residual value stumpage appraisal method), however those downstream revenues are not used to represent benefits in efficiency analyses.

Likewise, the U.S. Forest Service does not estimate the potential damages of wastewater effluent from downstream wood processing facilities; to do so would require the agency to assume that existing rules and policy put in place by other institutions (water quality standards and effluent guidelines) are *not sufficient* to mitigate the damages of wastewater in the interests of the public. For example, a decision to not allow a timber sale based on perceived downstream damages from increased wastewater effluent from processing plants, even if those plants are in compliance with existing wastewater regulations, implies that the U.S. Forest Service assumes additional wastewater controls (i.e., not allowing timber sale) are needed to adequately mitigate downstream damages. The same situation applies in the case of downstream coal-fired electric generation facilities, with air emissions that are in compliance with existing regulations, and using coal extracted from NFS lands. Even if existing rule and policy are perceived as being inadequate, it is difficult for the U.S. Forest Service to adopt an implicit regulatory role for mitigating downstream damages or beneficial uses for which it has limited or no legal basis.

In order to address court identified deficiencies in the 2012 FEIS, GHG emissions from combustion of coal under this programmatic action have been examined in this analysis, including benefits and social costs for downstream uses of resources. The boundaries of the analysis was expanded beyond that of the typical benefit and cost analysis to address these downstream benefits and costs. This analysis is presented for informational purposes and has limited utility in the overall decision context due to uncertainty and assumptions necessary to estimate benefits and costs.

This analysis considers the use of SCC values. SCC is a process for estimating the global social benefits of carbon dioxide emission reductions expected from proposed guidelines using the estimates presented in the 2015 Technical Support Document: Technical Update of the SCC for Regulatory Impact Analysis Under Executive Order 12866 (IWG, 2015). SCC estimates were first published in a 2010 technical support document (IWG, 2010), after the initial draft EIS and regulatory impact analysis for the Colorado Roadless Rule, including a temporary road construction exemption for the North Fork Coal Mining Area, was published in July 2008 but before release of the revised draft EIS in April 2011.

SCC values are referred to as “SCC estimates.” The SCC is a metric that estimates the monetary value of impacts associated with marginal changes in carbon dioxide emissions in a given year. It includes a wide range of anticipated climate impacts, such as net changes in agricultural productivity and human health, property damage from increased flood risk, and changes in energy system costs, such as reduced costs for heating and increased costs for air conditioning. SCC values were developed to be used to assess the avoided damages as a result of regulatory actions (i.e., benefits of rulemakings that have an incremental impact on cumulative global carbon dioxide emissions).

In order to assess ‘net cumulative’ emissions, it is necessary to consider how production and consumption of coal and natural gas in other supply and electricity demand regions, outside of the larger North Fork area (or the ‘Colorado – Uinta’ supply region) will change (i.e., decrease) in response to changes in production of North Fork Coal Mining Area coal. Accounting for these market substitution effects will provide a more reliable estimate of net cumulative changes in GHG emissions from overall production and consumption of energy beyond the boundary of the GMUG

National Forests (and the North Fork Coal Mining Area). SCC values are also estimated to reflect damages to global populations, not just the U.S. public, implying an additional atypical expansion or dimension to traditional benefit and cost analysis for U.S. Forest Service actions.

The steps for conducting the benefit cost analysis to estimate the ranges of present net values for increasing North Fork coal reserves under Alternatives B and C, relative to Alternative A, are summarized in the following steps:

1 - Gross Changes in North Fork Coal Mining Area Production: Project changes (i.e., increases) in annual coal production from the North Fork Mining Area, by year, over a period of years necessary to exhaust available North Fork reserves.

The maximum period of time estimated to exhaust North Fork reserves is estimated to be 2015 to 2054 (see section "Net Energy Production, Consumption, and Exports – Accounting for Market Substitution" and Appendix E for details).

Schedules of annual coal production are estimated under three production rate assumptions: Low, Average, and Permitted (maximum) (see the section "Existing Conditions and Gross North Fork Coal Production").

2 - Net Changes in Domestic (National) Coal and Gas Production: Project net change in annual national production of (i) underground-mined coal, (ii) surface-mined coal, and (iii) natural gas, resulting from increased production of North Fork coal and accounting energy market substitution. Projected net changes are calculated by multiplying projected annual North Fork Coal Mining Area production for each year from 2016 to 2054 (from Step 1) by 'substitution response factors' (e.g., change in tons of surface coal produced nationally per ton increase in North Fork production).

'Substitution response factors' are estimated for Alternatives B and C by calculating:

$$= \frac{Total\ change\ in\ National\ coal\ or\ gas\ production\ (2016 - 2054)}{Total\ change\ in\ North\ Fork\ Coal\ Mining\ Area\ coal\ production\ (2016 - 2054)}$$

Changes in national production are modeled using the IPM framework and changes in North Fork Coal Mining Area coal production are estimated in Step 1. See the section "Net Energy Production, Consumption, and Exports – Accounting for Market Substitution" for details. See Appendix E (Summary of Input Assumptions; Table E-14) for examples of substitution response factors and an application of using response factors to calculate decreases in substitute fuel production, in response to increases in North Fork Coal Mining Area production.

Net decreases in renewable fuel production are also modeled, but substitution response factors are not necessary because GHG emissions from renewable fuel production and use are conservatively assumed to be zero. As a consequence, any portion of gross increases in GHG emissions from North Fork Coal Mining Area coal production that substitute for renewable energy (i.e., result in a decrease in renewable

energy production) are therefore assumed to be net or cumulative increases in GHG emissions for the purposes of calculating GHG damages.

Increases in North Fork Coal Mining Area coal production are estimated to result in decreases in national surface coal and natural gas production, due to market substitution, as modeled using the IPM framework. As a consequence, substitution response factors for surface coal and natural gas are negative. Substitution response factors for underground coal production are positive, reflecting increases in North Fork Coal Mining Area production under Alternatives B and C.

Substitution response factors are assumed to be the same for Low, Average, and Permitted North Fork Coal Mining Area production scenarios.

3 - Net Changes in Domestic (National) Electricity Production from Coal and Gas: Project net changes in annual national electricity generation from combustion of (i) underground and surface coal combined and (ii) natural gas, resulting from electricity market responses to increased supply of North Fork Coal Mining Area coal. Projected net changes are calculated by multiplying projected annual North Fork Coal Mining Area production for each year from 2016 to 2054 (from Step 1) by 'substitution response factors' (e.g., change in GWh electricity from coal (or gas) per ton increase in North Fork Coal Mining Area production). See Appendix E (Summary of Input Assumptions; Table E-14) for examples of substitution response factors and an application of using response factors to calculate decreases in electricity generation from substitute fuel sources, in response to increases in North Fork Coal Mining Area production. This analysis projects changes in the mixture of fuels types used to generate electricity, not changes in total electricity generation across all fuel sources. Total electricity generation across all fuel sources, by year, is assumed to remain the same across alternatives,

'Substitution response factors' are estimated for Alternatives B and C by calculating:

$$= \frac{Total\ change\ in\ National\ Electricity\ (GWh)\ from\ coal\ (or\ gas)\ (2016-2054)}{Total\ change\ in\ North\ Fork\ Coal\ Mining\ Area\ coal\ production\ (2016-2054)}$$

Changes in national electricity generation from coal and gas are modeled using the IPM framework and changes in North Fork Coal Mining Area coal production are estimated in Step 1. See the section "Net Energy Production, Consumption, and Exports – Accounting for Market Substitution" for details.

Net decreases in electricity from renewable fuel are also modeled, but substitution response factors are not necessary because GHG emissions from use of renewable fuel are conservatively assumed to be zero. As a consequence, any portions of gross increases in GHG emissions from increases in electricity generation from added North Fork coal that substitute for electricity generated from renewable energy (i.e., result in a decrease in electricity generated from renewable energy) are therefore assumed to be net or cumulative increases in GHG emissions for the purposes of calculating GHG damages.

Increases in North Fork coal production are estimated to result in decreases in national electricity generation from gas, due to market substitution, as modeled using the IPM framework. As a consequence, the substitution response factors for natural gas is negative. The substitution response factor for coal is positive, reflecting increases in availability of North Fork Coal Mining Area coal to electricity sector under Alternatives B and C.

Substitution response factors are assumed to be the same for Low, Average, and Permitted North Fork Coal Mining Area production scenarios.

4 - Net Changes in Coal Exports: Project net change in annual national coal exported. Projected net changes are calculated by multiply projected annual North Fork Coal Mining Area production for each year from 2016 to 2054 (from Step 1) by 'substitution response factors' (e.g., change in tons coal exported per ton increase in North Fork Coal Mining Area production).

The calculation procedures in Steps 2 and 3 are also applied for changes in coal exports. Substitution response factors are positive. 'Substitution response factors' are estimated for Alternatives B and C by calculating:

$$= \frac{Total\ change\ in\ Coal\ Exports\ (tons) from\ IPM\ output\ (2016 - 2054)}{Total\ change\ in\ North\ Fork\ Coal\ Mining\ Area\ coal\ production\ (2016 - 2054)}$$

5 - Net Changes in Domestic Carbon Dioxide Emissions from Coal and Gas Production and Consumption: Estimate net changes in carbon dioxide emissions by multiplying carbon dioxide emission factors for production, consumption, and coal transportation by annual net coal and gas production and consumption from Steps 2 and 3, for each year from 2016 to 2054. Examples of emission factors, as well as carbon dioxide emission calculations using emission factors are provided in Table E-14 in Appendix E.

Emission factors are assumed to be same as those used in the Air section of this report. Coal transportation emission coefficients are estimated based on a 1,800 mile roundtrip (900 mile one-way) distance domestically, and a 10,000 roundtrip (5,000 mile one-way) for exported coal. Domestic distance is derived from projected locations of coal consumed, as modeled using the IPM framework. Exported coal is assumed to be consumed for electricity generation using the same emission factor as used for domestic coal consumption.

6 – Domestic and Global Social Costs of Net Changes in Carbon Dioxide Emissions: Estimate social costs of annual net changes in carbon dioxide emissions by multiplying aggregated net carbon dioxide emissions by Social Cost of Carbon (SCC) values, by year (recalling that real SCC values increase with time). For details about SCC values and rationale for changes in SCC values, see the section "Social Cost of Greenhouse Gas Emissions" below.

Net carbon dioxide emissions are aggregated using different assumptions for the Forest Boundary, Domestic, and Global benefit cost accounting stances (see the "Benefit and Social Cost Accounting Stances" section).

Five different SCC value schedules are considered in this report, resulting in a range of social costs, for each of the three North Fork Coal Mining Area production scenarios. The range of SCC values used in calculations varies across benefit cost accounting stances. See the section "Social Costs of Greenhouse Gas Emissions" for details.

7 – Domestic Benefits of Coal Production and Electricity Generation: Estimate the benefits of coal production under the Forest Boundary stance by multiplying gross North Fork Coal Mining Area coal production (Step 1) by the net value of North Fork Coal Mining Area coal mined (see the section "Benefits of Coal Reserves" for details). For the Domestic and Global boundary stances, annual domestic benefits are assumed equal to annual domestic power generation cost savings. Annual cost savings are calculated by multiplying annual gross changes in North Fork Coal Mining Area coal production by 'cost saving response factors' (e.g., change in national electricity generation cost per ton increase in North Fork Coal Mining Area production). Response factors are derived from IPM modeling results as detailed in the section "Benefits of Coal Reserves".

Global benefits from increases in consumer surplus for non-U.S. populations, associated with consumption of increased U.S. coal exports resulting from availability of North Fork Coal Mining Area coal reserves could not be estimated and are therefore assumed to be zero under the Global accounting stance. Domestic (U.S.) benefits from electricity cost savings are retained under the Global accounting stance (as described in "Benefit and Social Cost Accounting Stances").

8 – Discounted Benefits, Social Costs, and Present Net Values: Annual social costs and benefits from steps 6 and 7 are discounted at rates consistent with SCC value discount rates (e.g., a discount rate of 3% is used if SCC values are based on a 3% discount rate). Discounted costs and benefits are summed for 2016 to 2054 to estimate present net values for different combinations of North Fork production scenario and SCC values, thereby generating a range of PNV results for each Alternative.

Details about these steps are provided in sections below, as well as Appendix E. Appendix E includes a discussion about the uncertainty and sensitivity associated with some of the key assumptions.

### ***Benefit and Social Cost Accounting Stances***

To account for, and describe in a transparent manner, the incremental effects of damages (and benefits) of downstream uses and activities beyond NFS lands, as well as domestic and global damages associated with net cumulative carbon dioxide emissions (as represented by SCC values), this analysis estimates present net value for three benefit-cost accounting stances; Forest Boundary, National Boundary, and Global Boundary. It also models net changes in national coal and natural gas production as well as consumption (for electric power generation) to account for market substitution responses to increases in Colorado-Uinta coal production. The three accounting stances are:

Forest Boundary (GMUG NFS lands):

- Benefits are represented by net value of gross coal production from the North Fork Coal Mining Area (not accounting for substitution).
- Social costs are represented by the aggregate domestic SCC value of carbon dioxide emissions from mining activity associated with gross North Fork Coal Mining Area coal production. Domestic SCC values are assumed to be 7% to 23% of total SCC values, as described in the technical support document (IWG, 2010).

National Boundary (Domestic):

- Benefits are represented by (i) domestic power generation cost savings resulting from increased North Fork Coal Mining Area reserves (accounting for substitution), and (ii) the net value of coal exports resulting from North Fork Coal Mining Area production (accounting for domestic substitution, but not foreign substitution).
- Social costs are represented by the aggregate SCC value of carbon dioxide emissions from (i) net coal and natural gas production, coal transportation, and domestic coal and natural gas consumption (accounting for substitution), and (ii) coal exported, including overseas transport and consumption for electric power (accounting for domestic substitution but not foreign substitution effects). Domestic SCC values are assumed to be 7% to 23% of total SCC values, as described in the technical support document (IWG, 2010)

Global Boundary:

- Benefits are represented in the same manner as the National Boundary. No effort was made to capture the benefits of potential power generating efficiency gains in foreign countries.
- Social costs are represented in the same manner as the National Boundary, with the exception that 100% of the global SCC values are used. The benefits of coal consumption include electricity generated as a result of that consumption; however, for this analysis, the amount of electricity generated is assumed to remain constant across alternatives (see discussion of IPM modeling framework in Appendix E). Changes in electricity generation are therefore not used to characterize benefits; instead, reductions in cost to achieve fixed levels of electricity demand are the basis for describing benefits for the domestic and global accounting stances.

**Net Energy Production, Consumption, and Exports – Accounting for Market Substitution**
Changes in gross production and consumption of coal from the North Fork Coal Mining Area are expected to have an effect on production and consumption of other fuel sources, including alternative supplies of coal, natural gas, and other energy supplies such as renewables, especially in later years of the analysis. As a consequence, this supplemental analysis attempts to characterize market responses and substitution effects in order to estimate net changes in energy production and consumption. Net changes will provide a more reliable basis for estimating cumulative net GHG emissions, and subsequent social costs.

This supplemental analysis uses the IPM of U.S. energy supply and power generation (IPM, 2015; ICF, 2015a; see Appendix E) to predict how production and consumption of other sources of coal and natural gas, as well as alternative sources of energy (e.g., renewables, bio/waste fuel) respond to, substitute, or offset for changes in the supply of low sulfur bituminous coal from the North Fork Coal Mining Area. The IPM model predicts the mixture of non-renewable fuels (e.g., bituminous coal,

subbituminous coal, other coal, natural gas, petroleum-based) and alternative fuels (e.g., renewables, nuclear, biomass, landfill gas) that will minimize the cost of achieving a given or pre-established schedule of annual power (e.g., electricity) demand over time (this analysis looks at the period 2016 to 2054). The IPM model is used to project the least-cost mixture of fuel types, by supply region and/or State, to meet a given amount of power demand. Based on data regarding fraction of coal coming from underground versus surface mines, by coal supply sub-region (Mine Safety and Health Administration, Part 50 data for 2008 to 2013, (ICF, 2015b)) it is possible to extrapolate percentage of coal production that comes from underground and surface mines (thereby providing the basis to estimate GHG emissions, by mine type).. IPM uses dynamic linear programming to model how electricity demand is met through a mix of generation and transmission in each region, as well as transmission between regions. The North American version of IPM includes international coal demand and coal supply regions to forecast global coal production and movement (i.e., IPM models domestic production and consumption of coal, as well as coal imports and exports). IPM relies on sets of coal and other forms of energy supply (e.g., natural gas) curves, for specific types of energy and specific supply sub-regions.

The IPM framework is used to establish a baseline mixture of fuel supplies that satisfy demand, based on EPA's v5.13 base case; the base case conditions are assumed to reflect the baseline mixture of fuels under Alternative A (i.e., without increasing the availability of North Fork Coal Mining Area coal reserves). EPA uses IPM to analyze the impact of air emission policy on the U.S. electric power sector. As part of those analyses, EPA publishes its assumptions and other information regarding its use of IPM. This supplemental analysis uses EPA's coal supply curves from EPA's v5.13 IPM base case (see EPA's v5.13 documentation at http://www.epa.gov/airmarkets/programs/ipm/psmodel.html) with some adjustments and augmentations (ICF, 2015a; Appendix E) to represent baseline coal/energy production and consumption for the nation under Alternative A.

The IPM baseline conditions can be modified to simulate the effects of increasing North Fork Coal Mining Area coal reserves under Alternatives B and C. The IPM framework relies on a set of energy supply curves that describe how much of each energy type is available and at what cost, for different supply sub-basins around the country. Within the Colorado-Uinta supply region, there is a supply curve for low-sulfur bituminous coal which includes the available reserves for the individual coal mines within the North Fork Valley, as well as expected supply or mining costs for those mines.

To simulate the effects of Alternative B, the available reserves for the North Fork Coal Mining Area was increased, allowing the IPM framework to re-calculate the least cost mixture of fuels needed to generate the given (fixed) amount of power demand. The results indicate that overall electricity generation remains the same, relative to baseline conditions, as expected given that the IPM framework assumes no change in demand. However, the mixture of fuels shifts, including increases in production and consumption of underground coal, and decreases in production and consumption of substitute fuel sources such as surface coal, natural gas, and renewable energy. As a consequence, added electrical generation from North Fork Coal Mining Area underground coal sources is offset by reductions in electrical generation by substitute fuel sources under Alternative B (and C).

IPM modeling results also provide estimates of aggregate costs of electricity production; electricity generation costs are lower under Alternative B, compared to A, as expected, given the increased availability (and flexibility) of fuels that electricity generators can select from to minimize costs.

These cost savings, or cost reductions, are the basis for estimating benefits under Alternative B, compared to A, for the Domestic and Global boundary benefit cost stances.

To predict substitution responses associated with increased North Fork Coal Mining Area coal production under Alternative B (and C), the available coal reserves for the supply curve that includes the relevant mines currently operating within the study area is increased by 172 million tons. This IPM modeling scenario is referred to as the "add reserves" scenario. Details about this, as well as other IPM modeling scenarios are provided in Appendix E.

IPM output demonstrates how production and consumption of other coal supplies, as well as natural gas and renewable energy supplies change in response to increases in North Fork Coal Mining Area reserves under Alternative B. IMP results indicate that the added 172 million tons of reserves are exhausted by 2054. IPM results are used to estimate aggregate change in production (or consumption) of alternative energy sources from 2016 to 2054 as well as aggregate change in Colorado-Uinta basin coal production over the same period as described above. Changes in Colorado-Uinta basin coal production are assumed to represent changes in North Fork Coal Mining Area coal production (since the only change made to the model was a change in reserves for North Fork Coal Mining Area coal).

IPM modeling results are used to calculate a 'substitution' response factors for energy production are calculated by dividing aggregate changes in national underground coal, surface coal, and natural gas production by aggregate change in Colorado-Uinta basin production (e.g., +0.5 million tons in total national underground coal production/million tons of Colorado-Uinta basin coal production; -0.5 million tons of total national surface coal production/million tons of Colorado-Uinta coal production).

Response factors are negative for surface coal and natural gas because these are substitutes, in part, for underground coal. As the availability of underground coal increases (under Alternative B), electricity generators are expected to respond by consuming greater amounts of underground coal and reduced amounts of substitute sources of energy. See the summary of benefit cost analysis steps outlined in the section "Overview of Benefit Cost Framework".

Substitution response factors for energy consumption (i.e., power generation) are calculated in a similar manner by dividing aggregate changes in national power generation from coal and natural gas by aggregate change in Colorado-Uinta basin coal production (e.g., 500 GWh from coal combustion/million tons of Colorado-Uinta basin coal production). Substitution response factors are multiplied by projected changes in gross North Fork Coal Mining Area coal production to estimate net national changes in coal and natural gas production and consumption, in preparation for estimating changes in carbon dioxide emissions. Examples of substitution response factors for the "add reserves" scenario are provided in Appendix E.

**Net Cumulative Carbon Dioxide Emissions**

Net cumulative carbon dioxide emissions are estimated by multiplying carbon dioxide emission factors by estimates of net coal and natural gas production and consumption levels for each year, production schedule, and alternative. The carbon dioxide emission factors for production (e.g., tons carbon dioxide /ton underground coal produced; tons carbon dioxide /Bcf gas) and for consumption (e.g., tons carbon dioxide /GWh generated from coal; tons of carbon dioxide /GWh generated from gas) were obtained from the same sources as those used to estimate emissions in the air section of this report (see Appendix E).

**Benefits of Coal Reserves**

Net value of gross coal production under the Forest Boundary accounting stance is estimated by subtracting projected coal mining costs from projected coal prices. Coal prices are assumed to be the annual coal prices estimated from the IPM base case scenario for Alternative A (base case), and annual coal prices estimated from the IPM 'Add Reserves' scenario (see the section "Net Energy Production, Consumption, and Exports – Accounting for Market Substitution") for Alternatives B and C. Appendix E provides examples of the range of coal prices from 2016 to 2054, as projected by the IPM framework. Coal mining costs are assumed to be equivalent to the weighted average of coal mining costs per ton cited for the two existing coal mines as represented in the IPM supply curve for the North Fork Coal Mining Area for 2016. Real coal mining costs are assumed to grow at a rate of 2% per year which is the assumed a mid-point of the growth rates of the IPM model (1% to 2.5%) (see Appendix E).

Domestic power generation cost savings for the national and global boundary stances are estimated by calculating aggregate cost for generating electricity from all sources (including transportation and transmission costs) for the nation from 2016 to 2054 for the EPA v5.13 base case and 'add reserves' scenario. The section above (Net Energy Production, Consumption, and Exports – Accounting for Market Substitution) and appendix E provide details about IPM modeling scenarios. Given that substitution and market response modeling under the IPM framework assumes electricity demand is fixed at pre-established levels, benefits from increases in electricity generation resulting from increased availability of coal reserves cannot be calculated. Benefits, under the domestic and global accounting stances are therefore based on estimated reductions in costs of meeting fixed electricity demand. Benefits are therefore based on changes in cost (i.e., cost savings) associated with shifts in mixtures of fuels used to generate electricity, while social costs are based on changes in social cost of carbon dioxide emissions associated with those same shifts in mixtures of fuels (for the domestic and global, but not forest boundary accounting stances).

The difference in aggregate costs for these scenarios is assumed to be aggregate cost savings resulting from the additional North Fork Coal Mining Area reserves. Total aggregate cost savings are divided by total aggregate change in Colorado-Uinta basin coal production (also from the difference in the IPM base case and 'add reserves' scenarios) to obtain a cost savings response factor. Response factors are multiplied by annual differences in North Fork Coal Mining Area coal production between Alternatives B and A (and Alternatives C and A) to estimate costs savings for each year of North Fork Coal Mining Area production for Alternatives B and C, relative to Alternative A, for each of the three production scenarios. Due to the nature of these calculations, benefits based on domestic power generation cost savings are estimated only for differences between alternatives, not individual alternatives.

**Social Costs of Greenhouse Gas Emissions**

This supplemental analysis demonstrates the application of SCC values to smaller-scale GHG emissions from potential expansion of coal production from the North Fork Coal Mining Area coal leases that could be the indirect result of this rulemaking: reinstating an exception that could allow for temporary road construction that could enable future expansion of coal mine operations.

SCC estimates represent global measures because emissions of GHGs from within the United States contribute to damages around the world. The total SCC values therefore account for global damages caused by GHG emissions. Climate change presents a problem that the United States alone cannot

solve. This supplemental demonstration considers global damages, as represented by application of the full value of SCC estimates to projected carbon dioxide emissions, of the alternative rule-making actions. This implies that the United States government is considering the marginal damages of this decision on other countries, recognizing that there are no assurances that other countries are considering the marginal damages of their coal production decisions on the United States (other countries may be accounting for even greater marginal GHG global damage estimates).

Given uncertainty about reciprocal consideration of GHG damages in decision-making by other countries, this supplemental analysis discusses GHG damages in the context of (i) total or global SCC estimates and (ii) domestic (U.S.) damages represented by applying 7% to 23% of SCC estimates. Estimating the percent of damages accruing to the U.S. public is difficult; however the basis for the use of a range of 7% to 23% is information provided in the SCC technical support document, as described in Appendix E.

Discussion of these accounting stances is intended to help the decision maker and the public understand the relative importance of considering GHG damages as a global problem, in comparison to the more traditional domestic benefit cost stance adopted for regulatory impact analysis and NEPA effects analysis for public land management decision-making. Presenting differences between domestic and global damages also helps demonstrate potential distributional issues (e.g., equity) if there are variations in how countries account for the impact of their decisions and actions on the global community (recalling that distributional impacts are part of regulatory impact analysis per the Office of Management and Budget Circular A-4).

Social costs for this analysis are estimated using the range of SCC estimates for all three discount rates (2.5% to 5.0%) as well as the 95th percentile estimate for 3% discount rate, presented in the 2015 SCC technical support document, Table 3-13. SCC estimates for several discount rates are included because the literature shows that the SCC is sensitive to assumptions about the discount rate, and because consensus does not exist on the appropriate rate to use in an intergenerational context (where costs and benefits are incurred by different generations). The SCC values increase over time because future emissions are expected to produce larger incremental damages as physical and economic systems become more stressed in response to greater climate change (i.e., real marginal damages of a unit of carbon dioxide emissions increases with time). Note that the Interagency Working Group estimated the growth rate of the SCC directly using the three integrated assessment models rather than assuming a constant annual growth rate. This helps to ensure that the estimates are internally consistent with other modeling assumptions.

***Table 3-13.*** *SCC – Revised Social Cost of $CO_2$, 2010-2050 (2007$/metric ton $CO_2$)*

| *Discount Rate* | | | | |
|---|---|---|---|---|
| | **5.0%** | **3.0%** | **2.5%** | **3.0%** |
| **Year** | - - - - - - - - - - - - - - - - - - - Average - - - - - - - - - - - - - - - - - - - | | | 95th |
| **2010** | 10 | 31 | 50 | 86 |
| **2015** | 11 | 36 | 56 | 105 |
| **2020** | 12 | 42 | 62 | 123 |
| **2025** | 14 | 46 | 68 | 138 |
| **2030** | 16 | 50 | 73 | 152 |

| *Discount Rate* | | | | |
|---|---|---|---|---|
| **2035** | 18 | 55 | 78 | 168 |
| **2040** | 21 | 60 | 84 | 183 |
| **2045** | 23 | 64 | 89 | 197 |
| **2050** | 26 | 69 | 95 | 212 |

*Source: IWG, 2015.*

From the U.S. EPA, the U.S. Forest Service obtained the Monte Carlo simulation results used to generate the 95th percentile SCC estimates for the 3% discount rate (as cited in IWG, 2015) and calculated the 10th percentile SCC estimates. Social costs for this supplemental analysis are also calculated using the 10th percentile SCC values. This 10$^{th}$ percentile SCC value was used to provide a lower bound to the SCC analysis. The Forest Service felt that it would be reasonable to provide a lower bound SCC values to 'complete' the range of SCC values based on a 3% discount rate (i.e., IWG, 2015 refers to average and 95$^{th}$ percentile SCC values based on 3% discount rate, but provides no corresponding lower percentile SCC value). The 10th percentile SCC values were only used to calculate social costs for the global accounting stance. Domestic 10th percentile SCC values (i.e., 7% to 23% of global 10th percentile SCC values) are lower than typical ranges of market prices for carbon credits and therefore too low to be representative of social costs.

In order to estimate the dollar value for emissions, the SCC estimate for each emissions year was applied to changes in carbon dioxide emissions for that year, and then discounted back to the analysis year using the same discount rate used to estimate the SCC. This analysis considered the climate impacts of only carbon dioxide emission change. The climate impacts of other pollutants were not calculated as the SCC guidelines from the U.S. Interagency Working Group has only considered estimates for the SCC. While carbon dioxide is the dominant GHG emitted by the energy sector, the Working Group recognizes the representative facilities within these comparisons may also have different emission rates for other climate forcers that will serve a role in determining the overall social cost of energy generation.

The 2010 SCC Technical Support Document noted a number of limitations to the SCC analysis, including the incomplete way in which the integrated assessment models capture catastrophic and non-catastrophic impacts, their incomplete treatment of adaptation and technological change, uncertainty in the extrapolation of damages to high temperatures, and assumptions regarding risk aversion. Current integrated assessment models do not assign value to all of the important physical, ecological, and economic impacts of climate change recognized in the climate change literature due to a lack of precise information on the nature of damages and because the science incorporated into these models understandably lags behind the most recent research. The limited amount of research linking climate impacts to economic damages makes the modeling exercise even more difficult. Another source of uncertainty are gaps in the ability of current SCC estimates to account for the ripple or compounding effects that projected damages to some goods and services may have on indirect production of other goods and services, or the overall productivity of global economies. These individual limitations do not all work in the same direction in terms of their influence on the SCC estimates, though taken together they suggest that the SCC estimates are likely conservative. The Intergovernmental Panel on Climate Change, Fourth Assessment Report (IPCC, 2007) concluded

that "It is very likely that [SCC estimates] underestimate the damage costs because they cannot include many non-quantifiable impacts."

Updated SCC (IWG, 2015) estimates and the discussion of their limitations currently represents the best available compilation of information about the social benefits of carbon dioxide reductions to inform regulatory impact analysis for actions that directly affect or change cumulative global GHG emissions. This SDEIS demonstrates the application of these SCC estimates to smaller-scale land management decisions that indirectly affect GHG emissions. The new versions of the models used to estimate the values for this supplemental analysis offer some improvements in these areas, although work in this area is ongoing. EPA and other agencies continue to engage in research on modeling and valuation of climate impacts with the goal to improve these estimates. Additional details are provided in Appendix E.

The social costs of climate change presented in this supplemental analysis are associated with changes in carbon dioxide emissions only. If coal leases were and mining did take place in the future, it could also have an impact on the emissions of other pollutants that affect the climate. The air section includes potential emissions of methane and nitrous oxide, but the social costs of these emissions are not quantified. Both predicting climate impacts of emissions and estimating the social costs of these other pollutants is complex. The climate impacts of these other pollutants have not been calculated for the action alternatives proposed activities. The federal government's Interagency Working Group's estimates used in this analysis are designed to assess only the damages of climate change associated with changes in carbon dioxide emissions.

The social costs of $CO_2$ emission from action alternatives are estimated for the three benefit cost stances using the SCC values presented in the most current SCC Technical Support Document (IWG, 2015). One hundred percent of the SCC estimates cited in the technical support document are used to represent global damages under the global boundary stance. Seven to 23% of the SCC estimates are used to represent National (domestic) boundary, based on information cited in the original technical support document (IWG, 2010) (see Appendix E).

**Non-Monetized Social Costs**

Other benefits and costs are not monetized in this analysis. Due to current data and modeling limitations, estimates of the costs from carbon dioxide emissions do not include impacts like ocean acidification or potential tipping points in natural or managed ecosystems. Unquantified costs may also include climate effects from emissions of non- carbon dioxide GHGs and ancillary impacts from carbon emission on ecosystem (see climate change section).

Damages associated with GHG other than carbon dioxide (e.g., methane) and damages to other goods and services that may not be directly addressed in the methods used to derive SCC estimates will be discussed qualitatively, and in the context of sensitivity analysis.

## Affected Environment

The existing economic conditions in the economic impact study area necessary to set context for comparison of alternatives and consideration of the decision, are described below. The six counties included in the study area include Delta, Garfield, Gunnison, Mesa, Montrose, and Rio Blanco as the counties most likely to be directly or indirectly effected by any of the alternatives.

## ***Population of Study Area***

Long-term, steady growth of a population is generally an indication of a healthy, prosperous economy. Population growth can benefit the general population of a place, especially by providing economic opportunities. Figure 3-6 highlights the population trends and forecasted growth of the 6-county study area produced by the Colorado Department of Local Affairs, Demography Office. Population estimates (2000, 2005, 2010) are produced annually with the most recent estimate available is for the year 2013. Population forecasts (2015, 2020, 2025, 2030, 2035, 2040) are produced annually by the Demography Office with the most recent forecasts displayed in Figure 3-6 produced in October, 2014 (DOLA, 2015a).

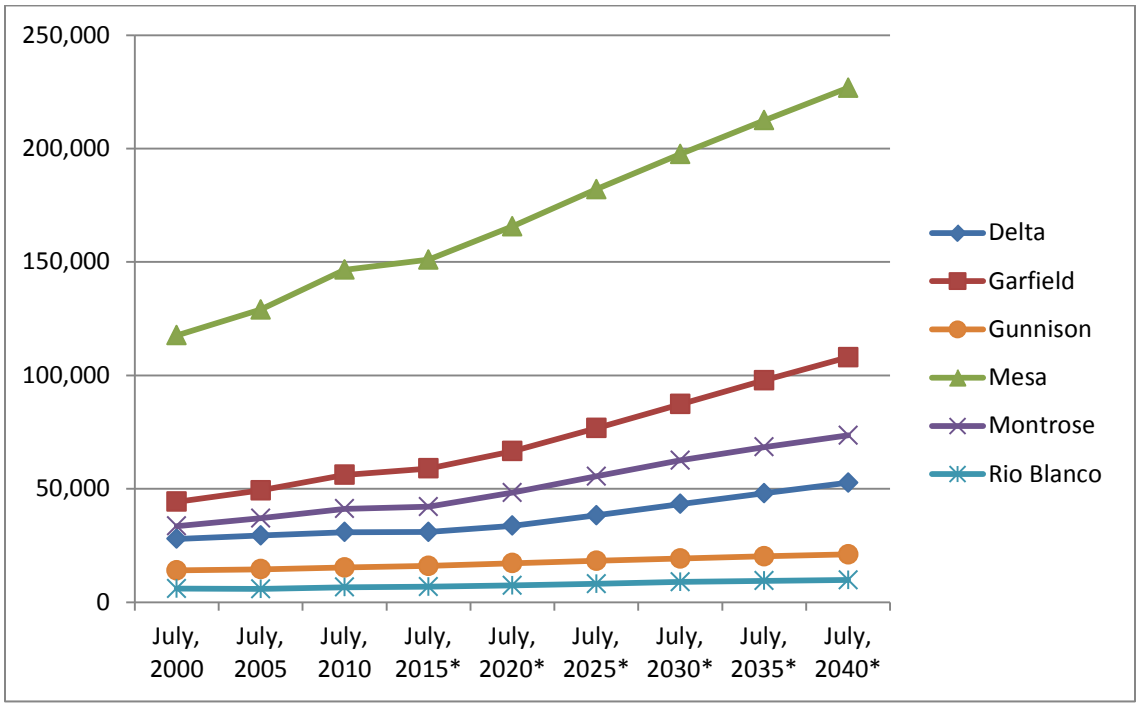


*Figure 3-6. Estimated and Forecasted Population Totals for the 6-County Study Area, 2000 – 2040.*

**Years forecasted*

*Source: DOLA, 2015a.*

All six counties in the study area grew between 2000 and 2010, and are forecasted to continue to grow over the next several decades. Mesa County, the largest county in the study area, continues to grow at the highest rate of the six counties. Garfield County is also forecasted to show steady increase in population in future years. Delta and Montrose Counties show similar patterns. Gunnison and Rio Blanco Counties show limited growth throughout the time period. Currently, much of the growth in the study area is from domestic migration (about 68% for the study area), people from within the U.S. moving to the study area. This migration rate is much higher than the domestic rate of the State, about 51% of total state growth. Indicating the area is a place people are interested in relocating to, especially Mesa County.

2013 population counts for each of the study area counties from the Colorado Demography Office are highlighted below (DOLA, 2015a):

| | |
|---|---|
| Delta County | 30,299 people |
| Garfield County | 57,298 people |
| Gunnison County | 15,454 people |
| Mesa County | 147,811 people |
| Montrose County | 40,754 people |
| Rio Blanco County | 6,778 people |

### ***Employment and Income in the Economic Study Area***

Understanding which industries are responsible for the employment and income in an area is important for grasping the type of economy that exists. Table 3-14 highlights the total employment and labor income for the 6-county study area in 2013 for major industry sectors. The table also highlights the average labor income (labor income per job) for the 6-county study area and for the State of Colorado for comparison. The overall average labor income in 2013 in the 6-county study area was $41,431 compared to the State average of $55,427. Industry average labor income for mining, construction, manufacturing, information, transportation and government (not including estimated industries) all show higher average labor income than both the State and the study area total employment averages. The largest study area industries in terms of employment (not including estimated industries) include construction, retail trade, real estate/rental/leasing, accommodation/food services, and government.

***Table 3-14.*** *Total employment and labor income by industry for the 6-county study area for Colorado, 2013*

| Sector | *Employment (Jobs)* | *Labor Income (1000's of 2013$s)* | *Labor income/job (2013 dollars)* | |
|---|---|---|---|---|
| | ***2013 6-County Study Area*** | | ***Study Area*** | ***Colorado*** |
| **Total Employment/Labor Earnings** | 176,431 | 7,309,689 | 41,431 | 55,427 |
| **Non-services related** | ~37,116 | ~1,933,688 | ~52,099 | 70,126 |
| Farm | 5,930 | 45,741 | 7,713 | 32,851 |
| Forestry, fishing, & related activities | ~1,316 | ~34,019 | ~25,850 | 27,206 |
| Mining (including fossil fuels) | 9,502 | 871,168 | 91,683 | 129,103 |
| Construction | 14,322 | 705,570 | 49,265 | 57,853 |
| Manufacturing | 6,046 | 277,189 | 45,847 | 76,550 |
| **Services related** | ~115,054 | ~3,937,186 | ~34,220 | 49,743 |
| Utilities | ~809 | ~84,865 | ~104,901 | 148,982 |
| Wholesale trade | ~4,453 | ~270,070 | ~60,649 | 86,963 |
| Retail trade | 19,423 | 574,568 | 29,582 | 32,895 |
| Transportation and warehousing | 5,330 | 330,277 | 61,966 | 66,888 |

| Sector | *Employment (Jobs)* | *Labor Income (1000's of 2013$s)* | *Labor income/job (2013 dollars)* | |
|---|---|---|---|---|
| Information | 1,866 | 85,711 | 45,933 | 124,948 |
| Finance and insurance | 7,107 | 251,905 | 35,445 | 59,215 |
| Real estate and rental and leasing | 10,330 | 131,884 | 12,767 | 16,650 |
| Professional and technical services | 8,760 | 370,766 | 42,325 | 78,163 |
| Mgt of companies and enterprises | 1,268 | 47,799 | 37,696 | 129,107 |
| Administrative and waste services | 8,270 | 235,722 | 28,503 | 36,223 |
| Educational services | ~1,777 | ~34,565 | ~19,451 | 34,071 |
| Health care and social assistance | ~17,257 | ~867,300 | ~50,258 | 54,608 |
| Arts, entertainment, and recreation | 4,530 | 66,126 | 14,597 | 25,916 |
| Accommodation and food services | 13,651 | 297,331 | 21,781 | 25,388 |
| Other services, except public admin | 10,223 | 351,290 | 34,363 | 38,207 |
| **Government** | 24,084 | 1,357,331 | 56,358 | 66,003 |

*The employment and income data presented here was obtained from the U.S. Department of Commerce; Bureau of Economic Analysis's Regional Economic Information System (REIS) and represents the latest data that are currently available for counties in the United States (2013). REIS data was used because it provides estimates of all employment in a region, those who are wage and salary employees and those who are self-employed. Some data are withheld by the federal government to avoid the disclosure of potentially confidential information. Headwaters Economics uses supplemental data from the U.S. Department of Commerce to estimate these data gaps. These values are indicated with tildes (~).*
*Source U.S. Department of Commerce. 2014. Bureau of Economic Analysis, Regional Economic Accounts, Washington D.C. Tables CA25N and CA05N.*
*Headwaters Economics, Economic Profile System- Human Dimensions Toolkit, downloaded 8/14/2015.*

The data in Table 3-14 is the latest available, 2013, and does not include the most recent events within the 6-county area that would impact the mining sector. Layoffs that have occurred within the coal mining industry, as well as other layoffs within the study area in oil/gas, and dairy production. The impact of the loss of direct jobs within any sector would be followed by changes to other sectors as the ripple effects of lost wages work their way through the economy. All data presented in this analysis represents a snapshot in time of the study area. Hiring, layoffs, and restructuring in any industry occur, and will continue to occur in the study area economy. Data presented here is best available, knowing that industries will continue to change with trends and markets and the larger economy.

Any new layoffs within a community can be difficult. Some areas work to diversify, people finding or creating other opportunities in the same area. Layoffs from an industry can impact everything from real estate to the school system if people choice to leave the area. For example, the school

district in Paonia is making adjustments to the coal industry layoffs as enrollment has dropped from 5,500 in 2009 to 4,800 in 2015 (Webb, 2015).

Unemployment within the 6-county study area has been higher than the State average for several years. Table 3-15 displays the most recent monthly unemployment rates available for 2015 for both the State of Colorado and the study area from the Bureau of Labor Statistics.

***Table 3-15.*** *2015 monthly unemployment rates for Colorado and 6-county study area*

| | *January* | *February* | *March* | *April* | *May* | *June* | *July* |
|---|---|---|---|---|---|---|---|
| Colorado | 4.7% | 4.7% | 4.5% | 4.4% | 4.3% | 4.5% | 4.0% |
| 6-County Study Area | 5.8% | 5.9% | 5.8% | 5.6% | 5.5% | 5.8% | 5.1% |

*Source: Bureau of Labor Statistics, 2015.*

The average earnings per job measure is the compensation of the average job, total earnings divided by total employment. Full-time and part-time jobs are counted at equal weight. Employees, sole proprietors, and active partners are included. Per capita income is an important measure of economic well-being. Per capita income is total personal income divided by population. Because total personal income includes non-labor income sources (dividends, interest, rent and transfer payments), it is possible for per capita income to be relatively high due to the presence of retirees and people with investment income. Because per capita income is calculated using total population and not the labor force as in average earnings per job, it is possible for per capita income to be relatively low when there are a disproportionate number of children and/or elderly people in the population.

For the 6-county study area, per capita income was $37,830 in 2013, compared to Colorado's State per capita income of $47,647. The study area labor earnings were about 59% of personal income, compared to the State average of 66%, the unearned income in the study area, which accounts for, 41% of total personal income, consists of dividends, rent and interest (23% of total personal income) and government transfer payments, such as Social Security (18%), payments often associated with retirees. These payments are consistent with the presence of a population of people/retirees who are living in the study area by choice, for reasons not related to the need for employment. Retirees bringing their investment income into a community demand a variety of services from medical/health care to housing, entertainment and services. Such demands can create a new source of economic opportunity for communities.

### ***Federal Revenues (coal royalties) of the Study Area***

Royalty rates for coal are managed by the BLM, and the required minimum royalty rate for underground mines is 8 %. For all types of coal leases, BLM is authorized to reduce the royalty for the purpose of encouraging the recovery of federal coal, and in the interest of conservation of federal coal and other resources, whenever it is necessary to promote development, or when the lease cannot be successfully operated under its terms, but in no case can the royalty on a producing federal lease be reduced to zero 43 C.F.R. §§3473.3-2(e), 3485(c)(1) (2013). The BLM may approve royalty rate reductions for new leases; in Colorado for 2012 the effective royalty rate was 5.6% for underground mines.

Mineral royalties collected by the federal government are disbursed to a variety of funds. About half (49%) of the royalties of onshore lease revenue go to the state in which the lease is located. Forty percent of the total is disbursed to the National Reclamation Fund (used to fund water resource

management projects in the U.S.), and the remaining 10 percent goes to the U.S. Treasury. Of the royalties paid to Colorado, 50% goes to state public school funding, and 10% funds the Water Conservation Board. The remaining 40% is put into local impact programs with half going directly to the counties and town or local mining area districts and the other half is available through a grant program for local governments (DOLA, 2015). In addition, section 402 of the Department of Interior's Abandoned Mine Reclamation Program requires coal operators to pay 13.5 cents per ton or 10% of the value of non-lignite coal produced (underground), whichever is less, and 50% of the reclamation fees collected are returned to the States where is was collected (30 U.S.C. 1232).

### ***Coal, Production and Markets***

Coal provided to the U.S. economy from any source, including roadless areas in Colorado, has national as well as local implications. This section briefly describes the economic context within which coal from the North Fork Coal Mining Area may be provided to the nation in the future. Additional information is provided in the Coal section of this SDEIS and in Appendix E.

**North Fork Area Coal Characteristics**

The North Fork area includes coal from the area around the North Fork of the Gunnison River in west central Colorado. The North Fork Coal Mining Area of Colorado is part of the larger Uinta Basin, which includes western Colorado and eastern Utah. See the coal section for a description of North Fork coal.

**Disposition of North Fork Coal and Potential for Substitution**

Annual production of low sulfur bituminous coal from the Rocky Mountain coal region (Colorado and Utah) was approximately 40 million tons in 2012 (EIA, 2015). Average annual production for the Rocky Mountain coal region is projected to be approximately 28.3 million tons on average over a 15 year period from 2013 to 2027, a 36% decrease in production, as estimated using projected production from the Annual Energy Outlook (AEO) 2014 Reference case (EIA, 2014). Increases in average annual production from the North Fork area under Alternatives B and C, over the next 15 years (2016-2030) are approximately 15% to 40% of the projected AEO annual coal production from the Rocky Mountain region. For the U.S. as a whole, bituminous coal is projected to decrease by 1.4%, while low sulfur coal production is estimated to decrease by 8.9% over that same period. Projected production from the North Fork area is estimated to be 0.45% to 1.1% of all coal and 1% to 2.4% of all bituminous coal produced in the U.S. in 2013 (EIA, 2015).

The mine mouth price of North Fork Coal Mining Area is less than coal of similar characteristics from Central Appalachia and the low sulfur content is important for meeting air emissions requirements. The mine mouth price of Uinta Basin coal over 2008 to 2014 has been in the $30 to $40/ton range, except for late 2008 and early 2009 when Uinta Basin coal prices were between $50 and $70/ton during a general commodity price surge (Bloomberg, 2015). In contrast, Central Appalachian coal prices have been in the range of $50 to $80/ton in the same period, and surged to over $120/ton in 2008 (Bloomberg, 2015).

Based on coal consumption data for 2008-2014 compiled from Energy Information Administration form 923, 31 coal fired power plants have been identified as potential consumers of North Fork Coal Mining Area coal (see Appendix E). These plants have received Uinta basin coal in 2013 or 14 and are not fully retiring. They are located across 14 States in the southeast (AL, FL, GA, MD, MS), central/Appalachia region (KY, TN), the Midwest (MI, WI), the intermountain and southwest region

(AZ, CO, UT), and California. At least one plant in each of these States, except Maryland, has received North Fork Coal Mining Area coal.

Some North Fork Coal Mining Area coal may be consumed at industrial facilities, but the amount is significantly less than amounts used for power generation; all North Fork Coal Mining Area coal is assumed to be consumed for power generation for the purposes of this supplement.

Uinta basin coal exports between 2008 and 2014 are estimated to range from five to 10 million tons per year, which is 10% to 20% of total coal production from the Uinta basin (analysis of emissions in air section assumed 12% export based on recent data, which is within the range of 10-20%). As demand for coal in Asia is expected to increase, it is likely that exports from Uinta basin, including the North Fork Coal Mining Area will continue to occur, or even increase if U.S. coal demand declines in the long-run.

Change in consumption of fuels by power generating facilities, in response to changes in fuel prices, varies by supply region (e.g., natural gas-coal elasticity ranges from 0.05 to 0.38; -0.14 to -0.22 for coal's own price elasticity), as expected given differing market, technology, policy, and demand conditions across regions (see Appendix E). However, consumption of coal is generally, relatively unresponsive to prices (inelastic). This variation may increase when smaller sub-regions are considered, as the characteristics and impacts of smaller numbers of (or even individual) power generating facilities become more dominant.

The possible substitutes for North Fork Coal Mining Area coal at coal-fired power plants depend on a number of factors. At one extreme, only coal that has the same characteristics as the North Fork Coal Mining Area coal might be considered possible substitutes. However, other factors such as coal plant location, boiler design, coal handling and grinding equipment, air permit requirements, and environmental controls, all play an important role in determining the types of coal that might be substitutes for North Fork coal. Finally, other fuels may substitute for the consumption of North Fork Coal Mining Area coal for the production of electric power. These fuels include biomass, hydro, natural gas, nuclear, solar, or wind.

Eleven of the plants that are potential consumers of North Fork Coal Mining Area coal use a mixture of both bituminous and subbituminous coal, and thus could be able to substitute both types of coal for North Fork Coal Mining Area coal (see Appendix E). For coal plants that consume North Fork Coal Mining Area and other bituminous coal exclusively, the substitution options will be limited to other sources of bituminous coal, subject to the limitations of location as discussed above. These plants also may be able to substitute higher sulfur coal, such as from the Illinois Basin, depending on their air permit requirements and installed environmental controls. Coal plants consuming only bituminous coal can make modifications to use subbituminous coal, although this is not an option for all plants. Coal plants with environmental controls, such as sulfur dioxide ($SO_2$) scrubbers, bag houses, and $NO_X$ controls, have more options for the types of coal that they can consume and still meet their emissions limits versus coal plants without these controls. Over the last 15 years, there has been a slow erosion of demand for low sulfur Central Appalachian coal as more and more plants install sulfur dioxide scrubbers and are able to switch to higher sulfur alternatives from Northern Appalachia and the Illinois Basin. For coal plants with sulfur dioxide scrubbers, substitutes for North Fork Coal Mining Area coal might include lower sulfur coal from Central Appalachia and the Uinta Basin as well as higher sulfur coal from the Illinois Basin (see Appendix E).

## Environmental Effects

Whether the estimated economic impacts or benefits and costs of each alternative actually occur depends on many variables, some within the U.S. Forest Service control, such as approval of surface activities during leasing activities, and many outside U.S. Forest Service control, such as the future of coal prices, continued environmental regulatory trends, or natural gas prices. Such uncertainties are why it is difficult to predict the potential impacts of a programmatic plan. The following section estimates the economic effects to serve as a comparison between alternatives and a reasonable portrayal of the potential impacts.

### ***Economic Impacts***

Economic impacts, sometimes called distributional effects, include consequences to jobs and labor income within the economic study area. Jobs and income estimates for the economic impact area were completed using an IMPLAN model of estimated coal outputs by alternative. The economic impacts of each alternative are based on estimates of coal that may be leased and produced within the North Fork Coal Mining Area over the 15-year period. All recoverable coal within the North Fork Coal Mining Area was assumed to be economically viable. The coal reserves are located in Gunnison County adjacent to the existing Elk Creek and West Elk mines. For the purpose of this analysis, the past production data for these two mines was used, but no assumptions are made that in the future new or different mines may operate in the area.

Analysis for the 2012 FEIS included the Bowie mine, as the scope of analysis for the 2012 FEIS was at a state-wide scale, and the alternatives included consideration of an alternative to manage roadless areas according to existing Forest Plans. In addition, the North Fork Coal Mining Area (as outlined in Chapter 1) changed from the DEIS, the RDEIS, and the 2012 FEIS, with some original areas included within the North Fork Coal Mining Area being of concern to the Bowie Mine. The boundaries of the North Fork Coal Mining Area have been decreased and those areas of interest to Bowie remain within CRAs, but are no longer within the North Fork Coal Mining Area. In this supplemental analysis, only past production data for Elk Creek and West Elk mines are included, as the Bowie mine is no longer affected by the North Fork Coal Mining Area; data for Bowie mine has not been included in this supplemental analysis.

Output, employment, and labor income impacts in the economic impact area from estimated coal production within the North Fork Coal Mining Area are shown in Tables 3-16 through 18. All indicators are expressed on an average annual basis over a 15-year analysis period (2016-2030). Only those impacts associated with potential development and production from the North Fork Coal Mining Area are included. The three tables highlight a range of production that may occur within the North Fork Coal Mining Area, Table 3-16 displays the low scenario of 5.2 million tons/year, Table 3-17 shows the average scenario of 10 million tons/year and Table 3-18 is the permitted scenario of 15 million tons/year (see Table 3-12 for details of each scenario).

Tables 3-16 through 18 displays an estimate of the direct, indirect, and induced effects for the output (production value), employment, and labor income by alternative. Direct effects are realized by the extraction and sale of coal. Indirect effects are realized by local companies that provide goods and services to coal mining operations. Induced effects result from local spending of employee income paid by the companies directly and indirectly affected by mining activities.

The tables display an annual average impact. It should be noted that with only current leases, coal production would cease in one to three years under alternative A, with no additional lease opportunities production would end with current leased coal. Coal production under alternative B could continue if leases were obtained, production could continue for an additional 12-36 years depending on the scenario. Alternative C displays the same annual average impacts as alternative B, but the timeframes under all three scenarios are shorter due to the decreased size of the North Fork Coal Mining Area. Under the scenarios in Alternative C, coal could be available for an additional 7 to 21 years.

Employment for the action alternatives may range between about 1,000 total jobs (direct, indirect, and induced) to 2,300 total jobs, depending on the production level (low, average, permitted). The impact could likely last over more years under alternative B than alternative C due to the overall amount of coal available over time with a larger coal mining area. Similar output estimates are displayed for the value of production and labor income.

***Table 3-16.*** *Average Annual Economic Impacts Estimated by Alternative for North Fork Coal Mining Area Coal 2016-2030 (2013 dollars), Coal Production – Low Scenario*

| *Activity/Effects* | *Value of Production ($ millions)* | | | *Employment (jobs)* | | | *Labor Income ($ millions)* | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Alt A** | **Alt B** | **Alt C** | **Alt A** | **Alt B** | **Alt C** | **Alt A** | **Alt B** | **Alt C** |
| **Direct** | 27 | 190 | 190 | 68 | 475 | 475 | 8 | 55 | 55 |
| **Indirect** | 5 | 32 | 32 | 24 | 165 | 165 | 1 | 10 | 10 |
| **Induced** | 5 | 32 | 32 | 50 | 346 | 346 | 2 | 12 | 12 |
| **Totals** | 37 | 254 | 254 | 142 | 986 | 986 | 11 | 78 | 78 |

***Table 3-17.*** *Average Annual Economic Impacts Estimated by Alternative for North Fork Coal Mining Area Coal 2016-2030 (2013 dollars), Coal Production – Average Scenario*

| *Activity/Effects* | *Value of Production ($ millions)* | | | *Employment (jobs)* | | | *Labor Income ($ millions)* | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Alt A** | **Alt B** | **Alt C** | **Alt A** | **Alt B** | **Alt C** | **Alt A** | **Alt B** | **Alt C** |
| **Direct** | 27 | 366 | 366 | 68 | 913 | 913 | 8 | 107 | 107 |
| **Indirect** | 5 | 61 | 61 | 24 | 318 | 318 | 1 | 20 | 20 |
| **Induced** | 5 | 62 | 62 | 50 | 665 | 665 | 2 | 24 | 24 |
| **Totals** | 37 | 489 | 489 | 142 | 1,897 | 1,897 | 11 | 150 | 150 |

***Table 3-18.*** *Average Annual Economic Impacts Estimated by Alternative for North Fork Coal Mining Area Coal 2016-2030 (2013 dollars), Coal Production – Permitted Scenario*

| *Activity/Effects* | *Value of Production ($ millions)* | | | *Employment (jobs)* | | | *Labor Income ($ millions)* | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Alt A** | **Alt B** | **Alt C** | **Alt A** | **Alt B** | **Alt C** | **Alt A** | **Alt B** | **Alt C** |
| **Direct** | 27 | 448 | 448 | 68 | 1,117 | 1,117 | 8 | 130 | 130 |
| **Indirect** | 5 | 74 | 74 | 24 | 389 | 389 | 1 | 24 | 24 |
| **Induced** | 5 | 76 | 76 | 50 | 814 | 814 | 2 | 29 | 29 |
| **Totals** | 37 | 598 | 598 | 142 | 2,320 | 2,320 | 11 | 183 | 183 |

Federal mineral royalties have been estimated (8% for all new leases) using total production. Current leases (alternative A) would continue under the BLM's negotiated rate of 5.6%. Royalty payments, not including rents or bonus payments, at 8% to Colorado (49% of the total) from coal from the North Fork Coal Mining Area are estimated at $0 for Alternative A (no new leases), about $6.8 million for Alternative B and $0.5 million for Alternative C. It is likely that any new leases could undergo negotiations with the BLM and result in a lower rate, but that is not known at this time. Economic impacts to the local study area shown in Tables 3-16 through 3-18 do not include government spending of Federal mineral payments to the state or local jurisdictions.

**Summary of Economic Impacts**

Alternative A - under the no action alternative, without the temporary road construction exception within the North Fork Coal Mining Area, no additional coal production is likely. Depending on production rates, current operations within CRAs would be completed in one to three years. Approximately 140 total jobs and associated labor income would be lost with no additional production associated with the North Fork Coal Mining Area would be likely. Such declines within the coal mining industry would likely create job losses to secondary businesses and additional social impacts to community structure. Although not all communities within the economic study area would be affected the same, some communities have diversified economies, attracted retiree populations, or are less dependent on coal mining. Those communities that are still dependent on coal mining would be most directly affected.

Alternatives B and C – under either of the action alternatives, future coal production is likely within the North Fork Coal Mining Area with the reinstatement of the temporary road construction exception. Depending on production rates, additional coal production could be completed in 7 to 36 years. Potential effects would be relatively short-term to the economic study area. Continued opportunities for coal development in the North Fork Coal Mining Area under Alternative B or C could result in production for a stable workforce over the production time, as well as continued royalty payments to the State of Colorado. These economic impacts are estimated for gross North Fork Coal Mining Area coal production. External forces and trends may still have a greater impact in the future in terms of coal prices and natural gas substitution.

## ***Benefits, Social Costs, Substitution, and Present Net Value Results***

**Net Energy Production, Consumption, Exports, and Carbon Dioxide Emissions**

Changes in net energy production and consumption, as well as carbon dioxide emissions associated with production and consumption that occurs between 2016 and 2054 (see table 3-12), is summarized in Table 3-19. These results demonstrate the substitution that could occurs across supply and demand regions in response to increased production of coal within the North Fork Coal Mining Area under alternatives B and C.

***Table 3-19.*** *Changes in the Mixture of Energy Production, Electricity Generation, and CO2 Emissions for Alternatives B and C, Compared to Alternative A (totals for 2016 – 2054)*

| | *Alternatives* | |
|---|---|---|
| | *B-A* | *C-A* |
| **Change in Gross North Fork Coal Production (1)** | | |
| Total Coal Production – millions tons | 172 | 95 |
| **Change in Net Domestic Energy Production (2)** | | |
| National Underground Coal – millions tons | 91 | 50 |
| National Surface Coal (millions tons) | -23 | -13 |
| Total National Coal (millions tons) | 68 | 37 |
| National Natural Gas (BCF) | -271 | -149 |
| **Change in Net Domestic Electricity Generation by Fuel Type (3)** | | |
| Electricity from Coal (GWh) | 112,168 | 61,585 |
| Electricity from Natural Gas (GWh) | -71,677 | -39,354 |
| Electricity from Renewable Energy (GWh) | ≈-40,000 | ≈-22,000 |
| Total Electricity Generation (GWh) | ≈0 | ≈0 |
| **Change in Coal Exports (shipped and consumed)** (4) | | |
| Coal Exports (millions tons) | 17 | 9 |
| **Change in Net $CO_2$ Emissions (Million tons)** | | |
| From Production of Coal and Natural Gas | 1.1 | 0.6 |
| *From Domestic Consumption of Coal* | *118* | *65* |
| *From Domestic Consumption of Gas* | *-43* | *-24* |
| From Domestic Consumption of Coal and Gas | 75 | 41 |
| From Transportation of Coal | 10 | 5 |
| From Exported Coal Transport plus Combustion | 45 | 25 |
| Total $CO_2$ Emissions | 131 | 72 |

(1) Based on schedules of North Fork Production, by Alternative (see Table 3.12)

(2) Net energy production reflects decreases in production of substitute sources of fuel, including sources of underground coal from other supply regions, in response to increases in North Fork underground coal production.

(3) Changes in aggregate electricity generation across energy sources are assumed to be zero, reflecting IPM modeling assumptions of fixed demand across alternatives.

(4) Changes in net carbon dioxide emissions in this table are used to estimate social costs of carbon dioxide emissions for the domestic and global accounting stances in Table 3-21 (see the section "Overview of Benefit Cost Framework" for calculation steps).

Table 3-19 displays the assumption that total gross production of underground coal from the North Fork Coal Mining Area increases by 172 million tons over the period 2016 to 2054 for Alternative B, compared to Alternative A. Production from other substitute sources of underground coal around the nation are likely to decrease, in many cases, in response to this increases in North Fork Coal Mining Area underground coal production. These decreases offset, in part, some of the 172 million tons of underground coal production from the North Fork Coal Mining Area, resulting in net domestic underground coal production of 91 million tons. These results are estimated using response coefficients derived from IPM modeling results; see the section "Overview of Benefit Cost Framework".

In a similar fashion, production of substitute sources of surface coal and natural gas across the country are estimated to decrease by 23 million tons and 271 BCF, in response to increases in North Fork Coal Mining Area coal production. Total electricity generation is assumed to remain constant across alternatives, so change in total electricity generation is equal to zero for Alternative B, compared to A. However, the mix of energy sources used to generate the electricity changes, in response to increases in North Fork Coal Mining Area coal production. Electricity generated from coal (underground and surface mined) is estimated to increase by approximately 112,000 GWh, while electricity generation from natural gas decreases by approximately 72,000 GWh. Decreases in electricity generation from renewable energy sources makes up the remaining balance of approximately 40,000 GWh.

These shifts in the mixtures of energy used to generate electricity, as well as the production of different types of energy will change carbon dioxide emissions. Table 3-19 indicates that total carbon dioxide emissions increase by 131 million tons under Alternative B, compared to A. Changes in carbon dioxide emissions are estimated by multiplying changes in net energy production, net electricity generation, and coal exports by respective carbon dioxide emission factors, as explained in benefit cost steps outlined in the section "Overview of Benefit Cost Framework". More details are provided in Appendix E.

**Substitution Methane**

The three alternatives could result in differences in the estimated methane emissions from future coal mining. The IPM modeling produced estimates of future changes in the mix of energy used to create electrical grid power under each of the alternatives. These results were used to estimate changes in methane emissions from the estimates of surface and subsurface coal needed to generate electricity. The model-predicted changes in net coal production above and below ground were multiplied by average emissions factors obtained from the Department of Energy's Upstream Dashboard tool to estimate changes in methane emissions.

Results for alternatives B and C for years 2016-2030 are displayed in Table 3-20. Positive values indicate increases in methane emissions (due to net increases in production), and negative values indicate decreases in methane emissions (due to net decreases in production). Annual changes were summed for all years in the analysis period and total net emissions changes for above and below ground coal production over the 15-year period are reported in the table. Average annual net changes in methane emissions are also shown.

***Table 3-20.*** *Total net change in methane emissions due to changes in surface and underground coal mining, alternatives B and C, and annual production scenario, 2016-2030*

| *Alternative-Scenario* | *Change in methane emissions due to changes in underground coal mining* | *Change in methane emissions due to changes in surface coal mining* | *Total net change in methane emissions* | *Average annual net change in methane emissions* |
|---|---|---|---|---|
| | millions of metric tons of $CO_2$eq | | | |
| **B-Low** | 14.9 | -0.3 | 14.5 | 1.0 |
| **B-Average** | 27.0 | -0.7 | 26.3 | 1.8 |
| **B-Permitted** | 32.7 | -0.8 | 31.8 | 2.1 |
| **C-Low** | 14.0 | -0.3 | 13.7 | 0.9 |
| **C-Average** | 19.5 | -0.4 | 19.1 | 1.3 |
| **C-Permitted** | 19.5 | -0.4 | 19.1 | 1.3 |

To obtain an emissions factor for methane emissions for typical surface mining operations, the Powder River profile was selected and the Upstream Dashboard default of 51 cubic feet per ton was used. The methane emissions factor in pounds per ton of coal produced was then multiplied by the net change in surface coal mining for each year of the economic model results from 2016 through 2030 for all three alternatives and all three levels of possible annual coal production. The methane emissions factor for subsurface coal operations was also obtained from the Upstream Dashboard using the Illinois Number 6 coal mine as a profile. To determine a reasonable value to enter into the Dashboard for methane emissions in cubic feet per ton, methane emissions data from the two North Fork mines were used as described elsewhere in this document to obtain a production-weighted average, but for this estimate the production and emissions data from both mines were combined to obtain an average value of 463 cubic feet per ton. (The default in the Upstream Dashboard, representing a national average for underground coal production, is 422 cubic feet per ton.) Differences in methane emissions in were converted to $CO_2$eq using the IPCC 2013 100-year global warming potential of 36.

## ***Cumulative Effects***

**Discounted Benefits, Social Costs, and Present Net Values**

The ranges of benefits and social costs of alternatives evaluated in this supplemental analysis are shown in Table 3-21 below. Calculations and discounting are described under the 'Benefit and Social Cost Accounting Stances', as well as the 'Overview of Benefit Cost Framework' sections above. In summary, discounted benefits are the net value of gross North Fork coal production (see Table 3-19) (under the Forest Boundary accounting stance) and domestic power generation cost savings resulting from estimated changes in the mixture of fuels used to generate electricity under Alternative B(under the national and global boundary stances). Discounted social cost are based on IWG's SCC values (IWG, 2015), carbon dioxide emissions summarized in Table 3-19, and carbon dioxide emission factors, as summarized in calculation steps described in the section "Overview of Benefit Cost Framework". Details are provided in Appendix E.

Due to the use of electric power generation cost savings as a proxy for benefits, results are provided only for Alternatives B and C, relative to Alternative A (i.e., cost savings cannot be characterized for stand-alone alternatives). Ranges are shown to account for the variation across production schedules (low, average, permitted), SCC value assumptions (five levels), and three accounting stances.

***Table 3-21.*** *Summary of Discounted Benefits and Social Costs Results (million 2014$)*

| | *Alternative B – Alternative A** | | *Alternative C – Alternative A** | |
|---|---|---|---|---|
| | Discounted Benefits | Discounted Social Costs | Discounted Benefits | Discounted Social Costs |
| **Forest Boundary** | | | | |
| Lower Estimate (a) | $340 | -$7 | $277 | -$4 |
| 3% Discount Avg (Lower) (b) | $453 | -$30 | $347 | -$18 |
| 3% Discount Avg (Upper) (b) | $782 | -$10 | $456 | -$6 |
| Upper Estimate (a) | $807 | -$16 | $465 | -$9 |
| **National Boundary** | | | | |
| Lower Estimate (a) | $1,284 | -$3,163 | $792 | -$1,760 |
| 3% Discount Avg (Lower) (b) | $1,284 | -$1,069 | $792 | -$601 |
| 3% Discount Avg (Upper) (b) | $2,410 | -$282 | $1,609 | -$169 |
| Upper Estimate (a) | $2,614 | -$443 | $1,609 | -$169 |
| **Global Boundary** | | | | |
| Lower Estimate (a) | $1,284 | -$13,751 | $792 | -$7,652 |
| 3% Discount Avg (Lower) (b) | $1,284 | -$4,646 | $792 | -$2,611 |
| 3% Discount Avg (Upper) (b) | $2,410 | -$4,034 | $1,609 | -$2,420 |
| Upper Estimate (a) | $2,410 | -$489 | $1,609 | -$293 |

**The sum of discounted benefits and discounted social costs may not be exactly equal to PNV results in Table 3-22 due to rounding.*
*(a)Lower and upper estimates are drawn from results from all production schedules (low, average, permitted), and using all the SCC values except the following: 10th percentile SCC values in Forest or National Boundary stances; 5% average SCC values in the Forest Boundary stances, as SCC values in these cases were lower than typical carbon credit prices.*
*(b) Ranges for average SCC values for 3% discount rates are singled out as representative of mid points.*

Benefit results under the national and global boundary stances are identical, as benefit calculations are based on the same assumptions for these stances (i.e., domestic electricity generation cost savings plus net value of coal exports). Benefit are lower for Forest boundary assumptions, but social costs are substantially lower for the Forest Boundary compared to national and global stances. These results demonstrate that a majority of carbon dioxide emissions and social costs are due to downstream consumption of coal, as well as overseas transport and consumption of coal. Production of coal (i.e., mining) accounts for relatively lower amounts of carbon dioxide social costs.

Discounted benefits and costs are added to estimate present net values in Table 3-22. Under the traditional Forest boundary stance, present net value results are positive. Present net value results under the national boundary stance, where social costs are accounting for damages to the U.S. public only, range from positive to negative. Midpoint present net value estimates, as represented by average SCC values (assuming a 3% discount rate) are positive, ranging from $215 million to $2.2 billion for Alternative B, relative to Alternative A. When considering alternative assumptions as part

of sensitivity analysis (see Appendix E), including consideration of potential social costs of methane, midpoint PNV estimates based on average SCC values for the Forest Boundary and National Boundary stances have the potential to become closer to zero or neutral (e.g., lower bound PNV based on average SCC values for a 3% discount rate may drop below zero while upper bound PNV based on average SCC values remain positive).

Present net value results estimated under the global stance are primarily negative, with values as low as negative $12 billion in net damages to positive $1.9 billion in net benefits for Alternative B, compared to A. PNV ranges from negative $6.8 billion to positive $1.3 billion for Alternative C, relative to A. Midpoint present net value estimates range from negative $0.8 to negative $3.4 billion in net damages for alternative B and C, compared to A.

Comparison of the results between the national and global stances demonstrates the significance of considering the damages of domestic GHG emissions on the global community and underlines the need to address GHG emissions within an international context. Decisions based solely on present net value results for the national or forest boundary stances may suggest that, if concerns are limited to potential GHG damages to the U.S. population, the proposed action is acceptable (or neutral). If decisions account for the potential impacts of the proposed action on populations outside the U.S., as represented by the Global boundary stance, then present net value results suggest that no-action might be the preferred alternative. It is clear from the broad range of results in Table 3-23, as well as sensitivity discussions in Appendix E, that there is substantial uncertainty associated with efforts to characterize net benefits that account for GHG emissions

***Table 3-22.*** *Present Net Values (million 2014$)*

| | *Alternative B – Alternative A** | *Alternative C – Alternative A** |
|---|---|---|
| | *millions of 2014 dollars* | |
| **Forest Boundary** | | |
| Lower Estimate (a) | $334 | $272 |
| 3% Discount Avg (Lower) (b) | $423 | $329 |
| 3% Discount Avg (Upper) (b) | $772 | $450 |
| Upper Estimate (a) | $791 | $456 |
| **National Boundary** | | |
| Lower Estimate (a) | -$1,879 | -$968 |
| 3% Discount Avg (Lower) (b) | $215 | $191 |
| 3% Discount Avg (Upper) (b) | $2,127 | $1,440 |
| Upper Estimate (a) | $2,171 | $1,440 |
| **Global Boundary** | | |
| Lower Estimate (a) | -$12,468 | -$6,861 |
| 3% Discount Avg (Lower) (b) | -$3,363 | -$1,819 |
| 3% Discount Avg (Upper) (b) | -$1,624 | -$811 |
| Upper Estimate (a) | $1,920 | $1,317 |

** PNV results may not be exactly equivalent to the sum of discounted benefits and costs from Table 3-21 due to rounding.*

*(a)Lower and upper estimates are drawn from results from all production schedules (low, average, permitted), and using all the SCC values except the following: 10th percentile SCC values in Forest or National Boundary stances; 5% average SCC values in the Forest Boundary stances, as SCC values in these cases were lower than typical carbon credit prices.*

*(b) Ranges for average SCC values for 3% discount rates are singled out as representative of mid points.*

It is important to stress that while the concept of PNV attempts to compare the benefits and costs of decision to society; this present analysis is merely illustrative in nature, providing a reasonable portrayal of possible cumulative effects of rulemaking. Since reinstating an exception that could allow for temporary road construction – that could enable future expansion of coal mine operations – does not directly result in costs or benefits, plenteous assumptions and scenarios were necessary in order to approximate any indirect economic effects. As such, estimates under each alternative, as presented in Tables 3-21 and 3-22 stemmed from three different accounting stances, three possible production schedules, and fifteen possible series of SCC values (by three different discount rates; 10th and 95th percentile values; global vs. two different sets of domestic values). Understandably, this gave rise to an expansive range of results. Plausibly, additional PNV estimates exist by further adjusting variables, thus adding to the permutations of scenarios / assumptions. Therefore, it could be misleading to draw any inferences regarding the 'likelihoods' of any given net benefit value(s) based solely on the results presented in Tables 3-21 and 3-22 above. Ultimately, calculations used – and associated benefit cost results – in this cumulative economic analysis are not intended to be probabilistic in nature, but illustrative.

# Chapter 4 Preparers, EIS Distribution, and Consultation

## List of Preparers

Primary contributors were those who were primarily responsible for preparing the SDEIS, preparing significant background material, or managing the process.

*Primary Contributors to the SDEIS*

| Name | Organization | SDEIS Contribution | Education | Years of Relevant Experience |
|---|---|---|---|---|
| Archibald, Jeffrey | ICF International | Economics Modeling | M.S. Engineering<br>M.B.A<br>B.A. Physics | 20 |
| Cleary, Dennis | U.S. Forest Service, Rocky Mountain Regional Office | GIS Analysis and maps | M.S. Soil Science/Agronomy<br>B.S. Watershed Science/Hydrology | 25 |
| Dare, Matt | U.S. Forest Service,<br>Grand Mesa, Uncompahgre and Gunnison National Forests | Threatened and Endangered Species | Ph.D. Zoology and Physiology<br>M.S. Biology<br>B.S. Biology | 14 |
| Gaugush, Sam | U.S. Forest Service,<br>Washington Office | Process Management | J.D. Environmental and Natural Resources Law<br>B.A. Sociology | 6 |
| Geschiere, Aaron | ICF International | Economics Modeling | B.S. Economics<br>B.S Environmental Science | 4 |
| Janowsky, Bill | U.S. Forest Service, Rocky Mountain Regional Office | Threatened and Endangered Species | M.S. Fisheries Management<br>B.S. Forest Biology | 24 |
| Johnson, Tyler | U.S. Forest Service, Rocky Mountain Regional Office | Threatened and Endangered Species | M.S. Forest Ecology<br>B.S. Biology | 10 |
| Mattson, Liane | U.S. Forest Service, Washington Office | Coal Resource and Management | B.S. Geological Engineering | 24 |
| McDonald, Peter | U.S. Forest Service, Rocky Mountain Regional Office | Threatened and Endangered Species | M.S. Biology<br>B.S. Agriculture | 25 |
| Miller, Chris | U.S. Forest Service<br>Washington Office | Economic Analysis | Ph.D Economics<br>M.P.H. Environmental Toxicology<br>B.S. Resource Ecology | 20 |
| Miller, Debra | U.S. Forest Service, Rocky Mountain Regional Office | Air Quality | M.S. Forest Sciences<br>B.S. Aerospace Engineering | 15 |

| *Name* | *Organization* | *SDEIS Contribution* | *Education* | *Years of Relevant Experience* |
|---|---|---|---|---|
| Mortenson, Niccole | U.S. Forest Service, Grand Mesa, Uncompahgre, and Gunnison National Forests | Process Management<br>Comment Analysis | B.S. Natural Resource Conservation | 23 |
| Pooler, Jason | U.S. Forest Service, Rocky Mountain Regional Office | Process Management | M.S. Natural Resources<br>B.S. Biology | 4 |
| Robertson, Jason | U.S. Forest Service, Rocky Mountain Regional Office | Process Management | B.S. Environmental Health & Safety | 25 |
| Schaefers, Julie | U.S. Forest Service, Rocky Mountain Regional Office | Process Management, Economic Report | M.S. Natural Resource Economics<br>B.S. Forestry Management | 24 |
| Schillie, Trey | U.S. Forest Service, Rocky Mountain Regional Office | Climate Change | M.S. Environmental Management B.S. Geography | 14 |
| Stearly, Mike | U.S. Forest Service, Rocky Mountain Regional Office | Public Affairs | Marketing | 10 |
| Strebig, Chris | U.S. Forest Service, Rocky Mountain Regional Office | Public Affairs | B.A. Journalism | 15 |
| Tu, Ken | U.S. Forest Service, Rocky Mountain Regional office | Process Management | B.S. Forest Management | 30 |
| Wang, Fei | ICF International | Economics Modeling | M.A. International Affairs<br>B.A. Economics | 3 |
| Westby, Molly | U.S. Forest Service, Rocky Mountain Regional Office | Cultural Resources | M.A. Anthropology | 15 |

## Other Contributors to the SDEIS

The following people contributed to the SDEIS by providing oversight, guidance, document reviews, or other information. They are U.S. Forest Service employees, except where otherwise noted.

*Other SDEIS Contributors*

| *Name* | *Primary Contribution* | *Office* |
|---|---|---|
| Abing, Tim | Leasable Minerals-Oil and Gas/Geothermal | Washington Office |
| Bedwell, Jim | Process Management | Rocky Mountain Regional Office |
| Carlson, Joan | Water | Rocky Mountain Regional Office |
| Phil DeSenze | Public Affairs | Rocky Mountain Regional Office |
| Dressler, Don | Ski Areas | Rocky Mountain Regional Office |
| Dyer, Desty | Mineral Resource Consultation | Bureau of Land Management |
| Fracasso, Mike | Paleontological Resources | Washington Office |
| Free, Kyle | Mineral Resource Consultation | Bureau of Land Management |
| Hamilton, Cherie | Soils | Rocky Mountain Regional Office |

| Name | Primary Contribution | Office |
|---|---|---|
| Johnson, Tyler | Threatened, Endangered, and Sensitive Plants | Rocky Mountain Regional Office |
| Liu, Karen | Economic Review | EMC, Ecosystem Management Coordination |
| Ludwig, Scott | Abandoned Mines and Public Safety | Rocky Mountain Regional Office |
| Magwire, Craig | Process Management | Rocky Mountain Regional Office |
| McClure, Tom | Rangeland Management | Rocky Mountain Regional Office |
| Miller, Nancy | Objections | Rocky Mountain Regional Office |
| Ng, Kawa | Economic Analysis | WO - Ecosystem Management Coordination |
| Pearce, Hal | Invasive Plants | Rocky Mountain Regional Office |
| Randall, Bob | Colorado Department of Natural Resources Consultation | Colorado Department of Natural Resources |
| Retzlaff, Mike | Economic Modeling | Economic Insights of Colorado |
| Ryon, Deb | Lands, Special use Areas | Rocky Mountain Regional Office |
| Sorkin, Jeff | Air Resource | Rocky Mountain Regional Office |
| Sporl, Chris | Scenic Quality, Dispersed/Developed Recreation | Rocky Mountain Regional Office |
| Swain, Ralph | Established and Recommended Wilderness/Wilderness Study Areas, Roadless Areas | Rocky Mountain Regional Office |
| Thompson, Bob | Saleable/Locatable Minerals | Washington Office |
| Truex, Rick | Terrestrial Species and Habitat | Rocky Mountain Regional Office |
| Underhill, Jeff | Forest Health, Timber Management | Rocky Mountain Regional Office |
| Verde, Ann Marie | Transportation-Roads | Rocky Mountain Regional Office |
| Walters, Carmel | Geological Resources | Washington Office |
| Williams, Thomas | Geothermal Resources | Rocky Mountain Regional Office |
| Wilmore, Brenda | Fire and Fuels | Rocky Mountain Regional Office |
| Winter, Susan | Economic Modeling | WO - Ecosystem Management Coordination |
| Yankoviak, Brenda | Congressionally Designated Trails | Rocky Mountain Regional Office |
| Zornes, Jim | Process Management | Rocky Mountain Regional Office |

## Consultation

The following organizations and agencies assisted in this process, or were contacted for information in identifying issues and developing aspects of the SDEIS.

- **Colorado Department of Natural Resources:** The Colorado Department of Natural Resources worked closely with the U.S. Forest Service as a cooperating agency to develop the proposed rule revisions.

- **Colorado State Historic Preservation Office:** The U.S. Forest Service notified the Colorado State Historic Preservation office of the proposed rule and the agency determined that the proposed rule would have no potential to affect historic properties.
- **Office of Surface Mining Reclamation and Enforcement:** The Office of Surface Mining Reclamation and Enforcement worked closely with the U.S. Forest Service as a cooperating agency for their expertise in coal mining and permitting process.
- **U.S. Bureau of Land Management:** The BLM worked closely with the U.S. Forest Service as a cooperating agency for their expertise in coal resources and lease management.
- **U.S. Department of Energy, National Energy Technology Laboratory**: The Forest Service contacted the National Energy Technology Laboratory (NETL) for assistance in estimating greenhouse gas emissions associated with extraction and transportation of coal. The NETL provided guidance in the use of their Upstream Dashboard tool and in estimating lifecycle greenhouse gas emissions.
- **U.S. Fish and Wildlife Service:** In May of 2015 the U.S. Forest Service met with USFWS Acting Colorado Field Supervisor to agree on a strategy for initiation of Section 7 consultations, as the U.S. Forest Service began the SDEIS in response to the 2012 court decision. Also in May of 2015, the U.S. Forest Service submitted a proposed species list for analysis in a supplemental Biological Assessment for the SDEIS.
- **U.S. Environmental Protection Agency:** The U.S. Forest Service contacted the U.S. Environmental Protection Agency (EPA) early on in the process to gain a better understanding of the issues involved with the SCC model and then again during the comment analysis phase. During the comment analysis phase the U.S. Forest Service consulted with the EPA regarding the methane capture and flaring mitigation measure.

## Tribal Consultation

The United States has a unique relationship with Indian Tribes, as provided in the Constitution of the United States, treaties, and Federal statutes. This relationship extends to the Federal government and its management of public lands. The U.S. Forest Service strives to ensure that its consultation with Native American Tribes is meaningful, and in good faith. Information applying to the proposed Colorado Roadless Rule was mailed to the Ute, Ute Mountain Ute, and Southern Ute Indian Tribes during release of the Notice of Intent. An introductory letter with background information on the proposed Colorado Roadless Rule was sent to Tribes based on their current proximity to the action area, their current use of lands in the action area, and their historic use of lands within the action area with information; on how to access the Notice of Intent online, and an offer for additional information or consultation meetings. No responses from any of the Tribes were received.

# Chapter 5 References Cited

Backlund, P., et al. (2008). *Executive summary. In the effects of climate change on agriculture, land resources, water resources, and biodiversity. A report by the U.S. climate change science program and the subcommittee on global change research.* Washington, D.C., USA. 362 pp.

Carroll, Christopher J. (2004). *2003 Summary of coal resources in Colorado*. Colorado Geological Survey Special Publication 54. Colorado Division of Natural Resources.

Cleary, Dennis and Ng, Kawa. (2015). GIS methodology and descriptive statistics used for temporary road density estimates.

Colorado Mining Association. (2014). *2014 Colorado coal production and employment*. Available from https://www.coloradomining.org/mining-in-colorado/coal-reports/

Colorado, Department of Local Affairs (DOLA), Division of Local Governments, Financial Assistance Programs, Energy and Mineral Impact Fund. (2015). *Federal mineral lease distribution, 2015*. Denver, CO. Retrieved August 18, 2015 from https://www.colorado.gov/pacific/dola/node/98951

Colorado, Department of Local Affairs (DOLA), Division of Local Governments, State Demography Office. (2015). *Population Totals for Colorado Counties*. Denver, CO. Retrieved August 13, 2015 from https://www.colorado.gov/pacific/dola/population-totals-colorado-counties

Colorado, Department of Local Affairs (DOLA), Division of Local Governments, State Demography Office. (October 2007). *Totals for Colorado and sub-state regions.* Retrieved April 2008 from http://dola.colorado.gov/dlg/demog/index.html.

Colorado Department of Public Health and Environment (CDPHE). (October 2, 2014). *Colorado greenhouse gas inventory—2014 update including projections to 2020 & 2030*. Available from https://www.colorado.gov/pacific/sites/default/files/AP-COGHGInventory2014Update.pdf

Colorado Division of Reclamation, Mining and Safety (DRMS). Online coal production data. Retrieved December 2014 and May 2015 from http://mining.state.co.us/Reports/Reports/Pages/Coal.aspx.

Colorado Division of Reclamation, Mining, and Safety (DRMS). (2015). *Colorado coal production*. Denver, CO. Retrieved August, 2015 from http://mining.state.co.us/Reports/Reports/Pages/Coal.aspx

Colorado Division of Wildlife. (2006). *Colorado's comprehensive wildlife conservation strategy and wildlife action plans*. 328 p. Available from www.teaming.com/wildlife-action-plan/colorado

Colorado Department of Public Health and Environment (CDPHE), (2014). *Colorado Greenhouse Gas Inventory: 2014 Update, Including Projections to 2020 & 2030*. Denver, CO. Retrieved September 1, 2015 from https://www.colorado.gov/pacific/sites/default/files/AP-COGHGInventory2014Update.pdf

Colorado Greater Sage-grouse Steering Committee. (2008). *Colorado greater sage-grouse conservation plan.* Colorado Division of Wildlife, Denver, Colorado, USA. Available

from http://wildlife.state.co.us/WildlifeSpecies/SpeciesOfConcern/Birds/Pages/GreaterSageGrouseConsPlan2.aspx

Colorado River Cutthroat Trout Conservation Team (CRCT). (2006). *Conservation strategy for Colorado river cutthroat trout (Oncorhynchus clarki pleuriticus) in the States of Colorado, Utah, and Wyoming.* Available from http://cpw.state.co.us/Documents/Research/Aquatic/pdf/CRCT_Conservation_Strategy_Jun06.pdf.

Council on Environmental Quality (CEQ). (December, 2014). Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts. Available from https://www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance

Dare, M., et al. (2011). *Cutthroat trout (Oncorhynchus clarkii) species and conservation assessment for the Grand Mesa, Uncompahgre, and Gunnison National Forests.* Grand Mesa, Uncompahgre, and Gunnison National Forests, Delta, Colorado. 26 pp.

Dare, Matthew R. *Personal communication.* Fisheries Program Manager, Grand Mesa, Uncompahgre and Gunnison National Forests, Delta, CO.

Dinsmore, S.J. (December 8, 2003). *Mountain plover (Charadrius montanus): A technical conservation assessment.* U.S. Department of Agriculture, Forest Service, Rocky Mountain Region. Available from http://www.fs.fed.us/r2/projects/scp/assessments/mountainplover.pdf

Forman, R. T. T. and Alexander, L. E. (1998). *Roads and their major ecological effects.* Annual Review of Ecology and Systematics. 29:207-231.

Furniss, M.J.; Roelofs, T.D.; and Yee, C.S. (1991). *Road construction and maintenance.* Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats. American Fisheries Society. Bethesda, MD.

Gruver, J.C.; and Keinath, D.A. (October 25, 2006). *Townsend's Big-eared Bat (Corynorhinus townsendii): A technical conservation assessment*. U.S. Department of Agriculture, Forest Service, Rocky Mountain Region. Available from http://www.fs.fed.us/r2/projects/scp/assessments/townsendsbigearedbat.pdf

Gunnison Sage-grouse Rangewide Steering Committee. (2005). *Gunnison sage-grouse rangewide conservation plan.* Colorado Division of Wildlife, Denver, Colorado. Available from http://wildlife.state.co.us/SiteCollectionDocuments/DOW/WildlifeSpecies/SpeciesOfConcern/GunnisonSageGrouse/ConsPlan/0RCPCover06.pdf

Hansen, A.; et al. (2001). *Global changes in forests: Responses of species, communities, and biomes.* Bioscience. 51(9): 765-779.

Harris, L.F.; Johnson, S. (2004). *The Consequences of habitat fragmentation for plant–pollinator mutualisms*. International Journal of Tropical Insect Science. 24: 29-43.

Headwaters Economics. (2015). *Economic profile system-human dimension toolkit, A profile of socioeconomic measures for Delta, Garfield, Mesa, Montrose, and Rio Blanco Counties*. Retrieved August 14, 2015 from http://headwaterseconomics.org/tools/eps-hdt

Hirsch, et al. (2013). *Range-wide status of Colorado River Cutthroat Trout (Oncorhynchus clarki pleuriticus): 2010.* Available

from http://cpw.state.co.us/Documents/Research/Aquatic/CutthroatTrout/CRCTRangewideAssessment-08.04.2013.pdf

Hong, B.D. and Slatick, E.R. (1994). *Carbon dioxide emissions factors for coal*. Energy Information Administration Quarterly Coal Report, January-April. Retrieved April 7, 2015 from http://www.eia.gov/coal/production/quarterly/co2_article/co2.html

ICF International (ICF), 2015a. (2015). *IPM model framework, methods, and key assumptions*. Report prepared by ICF International Inc. (J. Archibald) for USDA Forest Service. Fairfax VA, USA.

ICF International (ICF), 2015b. (2015). *IPM model results and key answers*. Prepared by ICF International Inc. (J. Archibald) for USDA Forest Service. Fairfax VA, USA.

Inouye, D. (2008). *Effects of climate change on phenology, frost damage, and floral abundance of montane wildflowers. Ecology*. 89(2): 353–362.

Integrated Planning Model (IPM). (2015). *Integrated Planning Model: Dot Net IPM Version 12.3*. As maintained by ICF International Inc. Fairfax VA, USA.

Interagency Working Group (IWG) on Social Cost of Carbon. (May 2013, Revised July 2015). *Technical update of the social cost of carbon for regulatory impact analysis under executive order 12866*. Interagency Working Group on Social Cost of Carbon, with participation by Council of Economic Advisers, Council on Environmental Quality, Department of Agriculture, Department of Commerce, Department of Energy, Department of Transportation, Environmental Protection Agency, National Economic Council, Office of Energy and Climate Change, Office of Management and Budget, Office of Science and Technology Policy, and Department of Treasury. Available from https://www.whitehouse.gov/sites/default/files/omb/inforeg/scc-tsd-final-july-2015.pdf

Interagency Working Group (IWG) on Social Cost of Carbon. (February, 2010). *Social cost of carbon for regulatory impact analysis under executive order 12866*, Interagency Working Group on Social Cost of Carbon, with participation by Council of Economic Advisers, Council on Environmental Quality, Department of Agriculture, Department of Commerce, Department of Energy, Department of Transportation, Environmental Protection Agency, National Economic Council, Office of Energy and Climate Change, Office of Management and Budget, Office of Science and Technology Policy, and Department of Treasury. Available from http://www.epa.gov/otaq/climate/regulations/scc-tsd.pdf

Intergovernmental Panel on Climate Change (IPCC). (2015). *Fifth assessment report (AR5)*. Available from http://www.ipcc.ch/

Intergovernmental Panel on Climate Change (IPCC). (2014). *Summary for policymakers*. In: Climate Change 2014 Synthesis Report. Available from https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf

Intergovernmental Panel on Climate Change (IPCC). (2007). *Summary for policymakers*. In: Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge

University Press, Cambridge, UK, 7-22. Available from www.ipcc.ch/ipccreports/assessments-reports.htm.

Lienert, J. (2004). *Habitat fragmentation effects on fitness of plant populations: A review*. Journal for Nature Conservation. 12: 53-72.

Metcalf, J.L., et al. (2012). *Historical stocking data and 19th century DNA reveal human-induced changes to native diversity and distribution of cutthroat trout.* Molecular Ecology (2012).

Millar, C.; Stephenson, N.; Stephens, S. 2007. *Climate change and forests of the future: Managing in the face of uncertainty*. Ecological Applications. 17(8): 2145-2151.

Miller, Debra. (September 4, 2015). CO2_estimates_all.sas.

Miller, Debra. (April 16, 2015). Export and production EIA data.xlsx.

Miller, Debra. (September 8, 2015). EPA methane data.xlsx.

Minnesota IMPLAN Group. (2013). *IMPLAN Professional Version 2.0*, Regional economic impact modeling software and data.

National Aeronautics and Space Administration (NASA), (2015). *Vital Signs of the Planet*. Retrieved September 10, 2015 from http://climate.nasa.gov/

National Research Council (2009). Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use. National Academies Press.

Office of Management and Budget. (September 17, 2003). *Circular A-4, Regulatory Analysis*. Available from https://www.whitehouse.gov/omb/circulars_a004_a-4/

Proctor, Cathy. (November 3, 2014). *Layoffs at Colorado coal mine hit 150*. Denver Business Journal.

Skone, Timothy J. (April 10, 2015) *E-mail message to Debra Miller- Re: co2 from combustion.*

Smith, B.E. and D.A. Keinath. (January 16, 2007). *Northern Leopard Frog (Rana pipiens): A technical conservation assessment.* USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/northernleopardfrog.pdf

SNL Financial. (2015). *Coal price forecast as of May 18, 2015*. Available from www.SNL.com

Spackman, S. 1997. *Colorado Rare Plant Field Guide*. Colorado Natural Heritage Program.

Stein, B.A., L.A. Kutner and J.S. Adams. (2000). *Precious Heritage: The Status of Biodiversity in the United States.* A joint project of The Nature Conservancy and the Association for Biodiversity Information. Oxford University Press, New York, NY. 399 pp.

Taylor, K.; Mangold, J.; Rew, L. (2011). Weed Seed Dispersal by Vehicles. Montana State University Extension; MT201105AG.

University of Colorado - Boulder, Colorado State University and Western Water Assessment (2015). *Colorado climate change vulnerability study.* A report submitted to the Colorado Energy Office. Available at http://wwa.colorado.edu/climate/co2015vulnerability/

University of Kentucky, Kentucky Geological Survey. (2012). *Classification and rank of coal.* Available from https://www.uky.edu/KGS/coal/coalkinds.htm

U.S. Department of Agriculture (USDA), Forest Service. (2015). *Economic specialist report, Social cost of carbon workbook: Supplemental roadless area conservation rule for Colorado*. Region 2, USDA Forest Service, Denver, CO.

U.S. Department of Agriculture (USDA), Forest Service. (2012). *Forest Service Sustainable Operations Progress Report*. March 2012. Available from http://www.fs.fed.us/sustainableoperations/documents/2011-sustainable-operations-progress-report.pdf

U.S. Department of Agriculture (USDA), Forest Service. (July 4, 2012). Roadless Area Conservation; Applicability to the National Forests in Colorado. 77 Federal Register 39,576-01. Available from http://www.fs.usda/gov/roadless

U.S. Department of Agriculture (USDA), Forest Service. (May, 2012). Roadless Areas Conservation; National Forest System Lands in Colorado, Final Environmental Impact Statement. Available from http://www.fs.usda/gov/roadless

U.S. Department of Agriculture (USDA), Forest Service. (2011). *Roadless Area Conservation: National Forest System Lands in Colorado, Proposed rule; Regulatory impact analysis and cost-benefit analysis*. February 3, 2011.

U.S. Department of Agriculture (USDA), Forest Service. (2010). Economic Specialist Report: Proposed Roadless Area Conservation Rule for Colorado. Region 2, USDA Forest Service, Denver, CO.

U.S. Department of Agriculture (USDA), Forest Service. (2009). *Climate Change Considerations in Project Level NEPA Analysis*. January 13, 2009. Available from http://www.fs.fed.us/emc/nepa/climate_change/includes/cc_nepa_guidance.pdf

U.S. Department of Agriculture (USDA), Forest Service; University of California. (2006). *What is genetic erosion and how can it be managed?* In: Rogers, D., ed. Why we care about genetics, vol. 11. Davis, CA: Forest Service National Forest Genetics Laboratory and University of California Genetics Resources Conservation Program. Available from www.grcp.ucdavis.edu/projects/geneticfactsheets/

U.S. Department of Agriculture , Global Change Program Office (USGRCP). (2001). *Forests: the potential consequences of climate variability and change.* A report to the national forest assessment group for the U.S. Global Change Research Program. Washington, DC. 8 p. www.usgcrp.gov/usgcrp/library/nationalassessment/forests/

U.S. Department of Commerce, Bureau of Economic Analysis. (2014). *Regional Economic Accounts, Tables CA25N and CA05N*. Washington D.C.

U.S. Department of Defense (DOD). (July, 2015). *Report on National Security Implications of Climate-Related Risks and a Changing Climate*. Available at http://www.defense.gov/pubs/150724-Congressional-Report-on-National-Implications-of-Climate-Change.pdf

U.S. Department of Energy (DOE), Energy Information Administration. (2015). *Annual coal report 2013.* Washington, DC. Retrieved on August, 2015 from http://www.eia.gov/coal/annual/

U.S. Department of Energy (DOE), Energy Information Administration. (2015). *Average weekly coal commodity spot prices*. Washington, DC. Retrieved on August, 2015 from http://www.eia.gov/coal/

U.S. Department of Energy (DOE), Energy Information Administration. (2015). *Annual energy outlook 2015: With projections to 2040*. DOE/EIA-0383. Retrieved May 7, 2015 and July 22, 2015 from http://www.eia.gov/forecasts/aeo/pdf/0383(2015).pdf

U.S. Department of Energy (DOE), Energy Information Administration. (2014). *Annual energy outlook 2014 with projections to 2040*. Washington, DC. Available from http://www.eia.gov/forecasts/archive/aeo14/

U.S. Department of Energy (DOE), Energy Information Administration. *Online annual U.S. coal production data.* Retrieved May 7, 2015 from http://www.eia.gov/beta/coal/data/browser/

U.S. Department of Energy (DOE), National Energy Technology Laboratory. (May 29, 2014). *Life Cycle Analysis of Natural Gas Extraction and Power Generation*, DOE/NETL-2014/1646. Available from http://www.netl.doe.gov/File%20Library/Research/Energy%20Analysis/Life%20Cycle%20Analysis/NETL-NG-Power-LCA-29May2014.pdf

U.S. Department of Energy (DOE), Energy Information Administration. (2013). *International Energy Outlook*. Retrieved January 2015 from http://www.eia.gov/oiaf/aeo/tablebrowser/#release=IEO2013&subject=0-IEO2013&table=15-IEO2013&region=4-12&cases=Reference-d041117

U.S. Department of Energy (DOE), National Energy Technology Laboratory. (September, 2010). *Methane Emissions from Mining Illinois Basin Coals*. DOE/NETL-2010/1445. Available from http://www.netl.doe.gov/File%20Library/Research/Energy%20Analysis/Publications/DOE-NETL-2010-1445-QGESSMethaneEmissionsIllns.pdf

U.S. Department of Interior (DOI), Bureau of Land Management. (2015). Legacy Rehost 2000 database, 2015. Retrieved April/May 2015.

U.S. Department of Interior (DOI), Fish and Wildlife Service. (2007). Memorandum outlining Programmatic Biological Opinion regarding water depletions on the Grand Mesa, Uncompahgre, and Gunnison National Forests.

U.S. Department of Labor, Bureau of Labor Statistics. (2015). *Local Area Unemployment Statistics.* Washington, D.C.

U.S. District Court of Colorado. (2014). *High Country Conservation Advocates, et al. v. USDA and USDI*. 152 F. Supp. Ed. At 1196. June 27, 2014. Available from http://www.fs.usda.gov/roadmain/roadless/coloradoroadlessrules

U.S. Environmental Protection Agency (EPA). (April, 2015). *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2013*. EPA 430-R-15-004. Washington, DC. Retrieved April 15, 2015 from http://www.epa.gov/climatechange/emissions/usinventoryreport.html

U.S. Environmental Protection Agency (EPA). (2015) *Glossary of Climate Change Terms*. Retrieved September 8, 2015 from http://www3.epa.gov/climatechange/glossary.html

U.S. Environmental Protection Agency (EPA). (2015). http://ghgdata.epa.gov/ghgp/main.do

U.S. Environmental Protection Agency (EPA). (2015). 2013 *Greenhouse Gas Emissions from Large Facilities. Available from* http://ghgdata.epa.gov/ghgp/main.do

U.S. Environmental Protection Agency (EPA). (2015). *Greenhouse Gas Equivalencies Calculator*. Retrieved September 4, 2015 from http://www.epa.gov/cleanenergy/energy-resources/calculator.html

U.S. Environmental Protection Agency (EPA). (2015). *Sources of Greenhouse Gas Emissions, Electricity Sector Emissions*. Retrieved September 2, 2015 from http://www.epa.gov/climatechange/ghgemissions/sources/electricity.html

U.S. Global Change Research Program. (2014). *Climate Change Impacts in the United States: The Third National Climate Assessment.* Available from http://s3.amazonaws.com/nca2014/high/NCA3_Climate_Change_Impacts_in_the_United%20States_HighRes.pdf

Watson, et al. (2007). *Determining economic contributions and impacts: What is the difference and why do we care?* The Journal of Regional Analysis and Policy. 37(2):1-15.

Webb, Dennis (2015). *More layoff hit bowie coal mine*. Grand Junction Sentinel. September 29, 2015. (downloaded 9/30/2015) Available http://www.gjsentinel.com/news/articles/more-layoffs-hit-bowie-coal-mine

White House. (2013). *The President's Climate Action Plan*. Available from https://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf

White House. (2014). *The Threat of Climate Pollution: Colorado*. Retrieved May 7, 2015 from https://www.whitehouse.gov/sites/default/files/docs/state-reports/climate/Colorado%20Fact%20Sheet.pdf

## Index


2001 Roadless Rule, D-3
  background of roadless issue, D-3, D-4
  issues, B-10
2005 State Petition Rule, D-4
2012 FEIS
  affected environment, 23
    air resources, 43
    coal resources, 26, 29
    economics, 75, 76, 77, 82, 102
    threatened, endangered, proposed, and sensitive species, 53, 56
  Alternative, 17
  alternatives considered but dismissed from detailed study, 11
  analysis methods and assumptions, E-2
  background, 1
  economics, E-2
  issues, 4, B-4, B-5, B-6, B-7, B-10, B-11, B-12
  scope of analysis, 4
  affected environment, 60, 64
acres
  alternative C, 2
  boundary correction, 13, 17
  coal under lease, 25
  comparision of alternatives, 22
  comparision of coal by alternative, 26
  estimations of recoverable coal, 26
  existing leases, 32
  proposed action, 2
  road mileage, 28
additional provisions, D-2
administrative corrections, 13, 19
affected environment
  air, 33
  climate change, 45
  climate change adaptation, 48
  climate change impacts, 48
  coal, 24
  coal resource estimation, 26
  critical habitats, 58
  economic benefits and costs, 80
  economics, 75
  energy demand, 70
  federal coal program process, 24
  fish analysis, 54
  population, 95
  population growth and development, 69
  projections for temporary road construction, 27
  recreation, 69
  regional forester sensitive species, 55
  temperature trends and greenhouse gases, 46
  threatened, endangered, proposed, and sensitive species, 52
Affected Environment and Environmental Consequences, 23
air, 33
  cumulative effects, 42
  direct and indirect emissions, 33
  methodology, 35
  results, 39
  scope of analysis, 33
all alternatives
  boundary correction, 12
  economics
    environmental effects, 101
    impacts, 101
  reserved and outstanding rights, 14
  road construction, 32
Alterantive A
  economics
    net energy, 89
  threatened, endangered, proposed, and sensitive species, 61
Alternative A
  air
    cumulative effects, 42

climate change
direct, indirect, and cumulative effects, 51
coal
direct and indirect effects, 30
description, 15
air, 34
economics, 79
benefits of coal, 91
impacts, 102
present net values, 108
summary of impacts, 104
Alternative B
air
methodology, 35
results, 39
climate change
direct, indirect, and cumulative effects, 51
coal
direct and indirect effects, 30
economics, E-23
description, 17
air, 34
economics, 79
impacts, 102
net energy, 89
present net value, 108
summary of impacts, 104
threatened, endangered, proposed, and sensitive species, 64
Alternative C
air, 42
direct and indirect effects, 41
climate change
direct indirect, and cumulative effects, 52
coal
direct and indirect effects, 31
description, 19
economics, 79
impacts, 102
present net value, 108
summary of impacts, 104
threatened, endangered, proposed, and sensitive species, 66
alternatives, 10
Alternative A, 15
Alternative B, 17
Alternative C, 19
boundary correction, 12, 17
considered but eliminated, 10
features common to all alternatives, 12
federal and state requirements, 13
forest plans, 13
land use authorizations, 14
other forest activities, 14
outstanding rights, 14
project-specific, 14
Alternatives B
air, 42
amendment
forest plan, 13
analysis
2012 FEIS, 7
coal estimation, 26
costs of greenhouse gas, 91
deficiencies, 1, 4
economic methodology, E-1
fish, 54
greenhouse gas, 5, 7
issues, 3
methane substitution, 106
programatic, 6
project-specific, 14
road construction, 27
scope, 4
site-specific, 6
analysis areas
Alternative B, 16
Alternative C, 21
appendices
background of roadless issue, D-1
coal laws, C-1

court opinions, A-1
economic methodology, E-1
issues, B-1
approval
other agencies, 24, 27
aquatic species
climate change, 68
assumptions, 23
air, 33, 34, 35, 36, 37, 40, 41
climate change, 46
coal, 26
economics, 76, 77, 78, 81, 82, 89, 93, 102, 108, 109, 110
threatened, endangered, proposed, and sensitive species, 55
authorizations, 14
benefits
coal reserves, 91
cost accounting, 87
discounted benefits, 107
methods and assumptions, E-3
present net value, 104
social costs, 80
big game, B-6
biodiversity, B-6
biofuels, 70
birds, 64, 68, 70
Birds of Conservation Concern, 55
black-tailed prairie dog, 57
bonytail chub, 62
boundary changes, 19
boundary correction, 12, 17
burrowing owl, 57
Canada Lynx, 62
candidate species, 56
carbon dioxide, 11, 35, 36, 38, 41, 42, 44, 47, 50, 81, 82, 83, 87, 90, 92, 94, 95, 104, 108, E-9, E-17, E-18, E-19, E-25
Clean Air Act, 25
climate change, 3, 5, 36, 43, 45, 46, 47, 48, 50, 51, 56, 67, 81, 93, B-5, B-6, B-11, B-12, E-17, E-19
adaptation, 48
affected environment, 48
direct, indirect, and cumulative effects, 50
existing condition, 46
guidance, 46
impacts, 48
temperature trends and greenhouse gases, 46
coal, 24
affected environment, 25
cumulative effects, 31
environmental consequences, 29
federal coal program, 24
resource estimation, 26
road projections, 27
coal laws
exploration and leasing, C-1
other laws, C-3
permitting, C-2
Colorado
Colorado Division of Reclamation, Mining and Safety, 6
Colorado Parks and Wildlife, 54
Colorado Roadless Rule, 2, 5
counties, 76, 80, 95, 96, 99, E-1, E-2
District Court of Colorado, 3, 4
Division of Reclamation Mining and Safety, 24, 27
petition, B-2, B-4, D-4, D-5
Senate Bill 05-243, D-5
State of, 5
Wildlife Conservation Strategy, 69
Colorado Coal Rules, C-2
Colorado Division of Reclamation, Mining and Safety, C-3
Colorado Hookless Cactus, 62
Colorado Mined Land Reclamation Board for Coal Mining, C-2
Colorado Parks and Wildlife, 54
Colorado pikeminnow, 62
Colorado Raodless Areas (CRA's)

threatened, endangered, proposed, and sensitive species, 62
Colorado Roadless Areas (CRAs)
Alternative A, 15
alternatives considered but elminated, 11
background, 1
boundary correction, 12, 17
climate change, 52, 56
coal, 24, 25, 31
decision framework, 2
issues, 4
proposed action, 2
purpose and need, 2
scope of analysis, 5
threatened, endangered, proposed and sensitive species, 57
Colorado Roadless Areas (CRA's)
economics, 102, 104
Flatirons CRA, 20, 32, B-4, B-8, B-12
Pilot Knob CRA, 12, B-1
Sunset CRA, 19, B-2
threatened, endangered, proposed, and sensitive species, 58, 59, 61, 63, 71
Colorado Surface Coal Mining Reclamation Act, B-3
comments, 3, 4, 6, 7, 11, 76, 77, B-1, B-5, E-17
Comments, B-11
communities, 80, 99, 104, B-1
animal, 49, D-3
comparision of alternatives, 22
by environmental consequence, 23
competition, 56, 68
connectivity, B-6
Consultation, 113
costs
benefit cost framework, 81
benefits and costs, 80
coal mining costs, E-24
economics
benefits and social cost accounting stances, 87
non-monetized social costs, 94
present net value, 104
social costs and present net values, 107
social costs methods and assumptions, E-3
social costs of greenhouse gas, 91
greenhouse gas, 11
social cost of carbon, 3
Council on Environmental Quality, 4, 5, 6, 8, 46, 50
counties
economics, 76
affected environment, 95
analysis methodology, 80
coal royalties, 99
population, 96
study area assumptions, E-1
critical habitat, 4, 58
analysis methods, 53
assumptions, 55
effects of the alternatives, 60, 63, 64, 66, 67
species considered, 58, 59
cultural sites, 49
cumulative effects
air, 42
climate change, 50
Alternative A, 51
Alternative B, 51
Alternative C, 52
coal, 31
economics, 107
present net values, 107
threatended, endangered, proposed, and sensitive species
analysis, 71
threatened, endangered, proposed, and sensitive species, 67
cutthroat trout, 4, 53, 54, 55, 57
Debeque phacelia, 62, 64, 66, 67
decision framework, 2
definition
global warming potential of a gas, 36

programatic review, 5
definitions
economic impact analysis, 79
wilderness, D-1
demand
coal, 32, 35, 39, E-5, E-6
IPM modeling, E-4
coal demand vs origional present net value, E-23
coal modeling, E-9
electricity demand regions, 83, E-4
energy, 70
fixed demand, E-22
for resources, 69
for water, 69
natural gas, E-5
power demand, 88, 89
recreation, 69
U.S. Energy Demand Forcast, E-10
development
air
Alternative B, 35
air, 34
coal, 31
coal
Alternative B, 30
lease needs, 24
methane drainage wells (MDWs), 28, 34
road construction, 27
dispersed recreation, 49
distribution
climate change, 68
fish, 54
Mancos shale packera, 57
systems, 70
disturbance
animal, 60, 61, 69, 70
climate change, 68
surface disturbance, 28, 30, 32, 51
diversity
communities, 49, D-3
Division of Reclamation, Mining and Safety, C-3
drilling
coal, 27, 63, B-5
drinking water, 49, D-3
dust, 63, B-4
economics
affected environment, 95
analysis methods, 77
benefit and social cost accounting, 87
benefit cost framework, 81
benefits and social costs, 80
benefits of coal, 91
coal characteristics, 99
coal disposition, 99
coal royalties. See federal revenues
costs of greenhouse gases, 91
costs of greenhouse gasses, 94
cumulative effects, 107
data sources, 78
employment, 96
environmental effects, 101
existing conditions, 78
federal revenues, 99
impact analysis methodology, 79
impacts, 101
income, 96
market substitution, 88
markets, 99
methane, 106
net carbon dioxide, 90
net energy, 104
observed carbon values, E-18
population, 95
present net value, 104
sensitivity, E-21
production, 99
scope, 77
social cost of carbon, E-17
study area, 76
summary of impacts, 104
effects

air, 33
climate change, 50
coal, 29, 31
economics, 101
threatened, endangered, proposed, and sensitive species, 60, 67
electricity generation, 35
benefits of coal, 86
coal demand, E-9
coal elasticity, E-12, E-13
emission factor, 86
global boundary, 88
IPM modeling, 89, 91
issues, B-4
net changes, 84
net energy, 106
power system cost savings, E-25
present net values, 108
substitute fuel, 84
eliminated alternatives, 10
emissions
affected environment
greenhouse gas, 23
air
assumptions, 35
direct and indirect emissions, 33
greenhouse gas, 33
results, 39
scope of analysis, 33
air methodology
greenhouse gas, 35
alternatives considered but eliminated
greenhouse gas, 11
sulfur dioxide, 11
climate change
Alternative A, 51
Alternative B, 51
Alternative C, 52
incremental, 50
potential impacts, 47
upstream activities, 46
economics
coal, 82
coal, 81
cumulative net, 88
IPM, E-4
limits, E-14
methane, E-25
methane substitution, 106
net changes in carbon dioxide, 86
net cumulative, 83, 90
net energy, 104
non-monetized costs, 94
renewable fuel, 84
social costs, 91, 94
issues
climate change, 3
greenhouse gas, 3
scope
greenhouse gas, 4, 7
total U.S. greenhouse gas emissions, 50
employment, 76, 77, 96
Endangered Species Act (ESA), 4
affects, 62, 64
analysis methods, 52
assumptions, 55
critical habitat, 58
energy, 70
coal laws, C-1
efficiency, 12
net energy production, 104, E-3
energy exploration, 70
Energy Information Administration, 32, 78, 80, 100, E-3
Energy Policy Act of 2005, B-2
environmental consequences, 23
air, 33
climate change, 45
coal, 24
economics, 75
threatended, endangered, proposed, and sensitive species, 52
Executive Order
12866, 82

exploration
Alternative B, 17
Alternative C, 19
coal
environmental consequences, 30
coal estimation, 26
federal coal program process, 24
project-specific analysis, 14
proposed action, 2
purpose and need, 2
scope of analysis, 5
temporary roads, 27, 29
extraction, 33, 35, 39, 76, 81, 102, 114, E-26
Federal Register, 2, B-10
fire, 15, 49, 68, B-1, B-8
fish, 4, 5, 14, 54, 57, 59, 60, 63, 65, 67
Fish and Wildlife Service, 4, 57, 58, 60, 63, 64
Flatirons CRA, 20, 32, B-4, B-7, B-8, B-12
forest plan
coal, 30
economics
impacts, 102
revision, 19, 20
forest plans, 13, D-2
Forest Service sensitive species, 55, 56, 63
fossil fuels, 35, B-5, E-13, E-19
fragmentation, 56, 60, 69, 71, B-7
gas, E-5
gas consumption, E-3
gas production, E-3
genetic diversity, 56, 60
geothermal, E-9
Grand Mesa, Uncompahgre, and Gunnison (GMUG) National Forests. 1, 19, 20, 25, 31, 53, 54, 63, 65, 83, 87, B-8
grazing, 15, 56, B-6
greater sage-grouse, 57
Green River, E-1
Greenback Cutthroat Trout, 62, 65, 67
greenhouse gases, 33, 41, 45, 46, 68, 80, 91, B-5
growth rate, 69, 91, 92
Gunnison sage-grouse, 53, 56, 62, 63, 66, 67
health
public, 48
historic, 114
humpback chub, 62
hunting, 14
Illinois Basin, 101, E-14
impacts, 101
IMPLAN
analysis methodology, 79, 80
analysis methods and assumptions, E-2
customized IMPLAN, E-2, E-3
economic impacts, 101
existing conditions, 78
issues, B-9
study area assumptions, E-1
income
benefits and social costs, 80
customized IMPLAN, E-3
economic impacts, 101, 102
economics, 76
impact analysis methodology, 80
study area, 96, 98
summary of impacts, 104
Indian. See Native American
industry
benefits and costs methods, E-3
economic impact methodology, 79, 80
economic study area, 96
federal coal program, 24
IPM modeling, E-4
study area, 98
summary of economic impacts, 104
insects
climate change, 48
Integrated Planning Model (IPM), 78
benefit and social cost accounting, 88
benefit cost framework, 84
benefits of coal reserves, 91
coal reserves, E-7
IPM modeling, E-4
IPM scenarios, E-15

market substitution, 88
methane substitution, 106
modeling coal demand, E-9
modeling coal production, E-7
natural gas, E-5
net energy production, 106, E-3
invasive species, 60, 68, 70
inventoried roadless areas (IRAs), D-3
involvement, 2
issues, 3, B-1
climate change, 3
coal, B-2
coal economics, 3
cumulative effects, B-10
federally listed species, 4
fisheries, 4
greenhouse gas, 3
greenhouse gasses and climate change, B-5
insects and disease, B-6
miscellaneous, B-11
purpose and need, B-1
recreation and scenery, B-8
renewable energy, B-5
roadless areas and values, B-7
rulemaking, B-10
social cost of carbon, 3
socio-economics, B-9
soils, water and wish, B-5
wilderness, B-8
wildlife, B-6
jobs
economic impacts, 101, 102
impact analysis methodology, 80
study area, 98
summary of economic impacts, 104
land and resource management plans. See forest plans
land management, 48, 92, 94, C-2, C-3
land management plan. See forest plan
land use, 68
authorizations, 14
economics, 78
environmental consequences, 30
issues, B-3
legal and regulatory framework, C-2, C-3
regional forester sensitive species, 57
landscapes
background of roadless issue, D-3
climate change, 49
effects of the alternatives, 60
issues, B-7
leasable minerals, C-1
leases
air
cumulative effects, 42
direct and indirect emissions, 34
AlternativeA, 15
alternatives considered but eliminated, 10, 11
background, 1
climate change, 46
Alternative A, 51
coal
Alterantive A, 30
cumulative effects, 32
coal resource estiamtion, 25, 26
economic impacts, 102
economics
benefits and social costs, 81
coal royalties, 99
economic impacts, 103
existing conditions, 78
social costs of greenhouse gas, 92, 94
existing land use authorizations, 14
federal coal program, 24
issues, B-2, B-4, B-8, B-9, B-11, B-12
leagal and regulatory framework, C-1, C-2
projections for temporary road construction, 27
scope of analysis, 6
licenses, 24, 27, 31, C-1
linear construction zones, 5, 14, 15, 60, B-10
lines
rail, 80

transmission, 70
list of preparers, 111
litigation, D-1, D-2, D-3, D-4
livestock, 15
mammals, 68
management
Alternative A, 15
Alternative C, 19
background of roadless issue, D-3
climate change
direct, indirect, and cumulative effects, 51
climate change adaptation, 48
climate change impacts, 48
coal
Alterantive C, 31
Alternative A, 31
economics
analysis methodology, 80
benefit cost framework, 81
coal royalties, 99
federal and state requirements, 13
federal coal program, 24
forest plans, 13
legal and regulatory framework, C-1
projections for temporary roads, 27
threatened, endangered, proposed, and sensitive species
assumptions, 55
effects of the alternatives, 60, 62
regional forester sensitive species, 55
effects of the alternatives, 61
critical habitats, 59
effects of the alternatives, 62, 65, 66, 67
regional forester sensitive species, 57
Management
economics
scope, 77
methane
air
Alternative A, 34
Alternative B, 35, 40
cumulative effects, 42
Alterantive C, 19
Alternative B, 17
alternatives considered but elminated, 10
climate change, 46
direct, indirect, and cumulative effects, 50, 52
coal
Alterantive C, 31
Alternative B, 31
cumulative effects, 32
temporary road construction, 27
economics
consideration of methane, E-25
cumulative effects, 109
methane substitution, 106, 107
social costs of greenhouse gas, 94
issues, B-5, B-9
proposed action, 2
scope of analysis, 7
methane drainage wells (MDWs), 63
air, 34
scope of analysis, 7
temporary road construction, 28
Mexican Spotted, 62
miles
temporary road, 25, 28, 30, 32
minerals, C-3
leaseable, C-1
locatable, 14
mines
air
cumulative effects, 44
direct and indirect emissions, 33, 34, 36, 39
climate change
direct, indirect, and cumulative effects, 51
coal, 24
affected environment, 25
resource estimation, 26
temporary roads, 28

economics
analysis methodology, 80
benefits of coal, 91
coal royalties, 99
economic impacts, 101
existing conditions, 79
net energy production, 88
study area, 76
study area assumptions, E-1
legal and regulatory framework, C-3
methane substitution, 107
scope of analysis, 7
mitigation, 55, 60, 62, E-19
alternatives considered but eliminated, 10
models
climate, 43, 46
economic, 80, 87, 92, E-1, E-4, E-15, E-17, E-18
mortality, 60, 68, 70
motorized trail, 14
mountain pine beetle, 68
mountain sucker, 54
National Energy Modeling System, E-4
National Energy Technology Laboratory, 35, 36
National Environmental Policy Act (NEPA)
air, 33
Alternative A, 15
background, 1
boundary corrections, 13
climate change, 46
economics, 76
issues, 4, B-4
project-specific analysis, 14
scope of analysis, 4
National Forest Management Act, D-2
National Forest System (NFS) lands
alternatives considered but eliminated, 11
background, 1
background of the roadless issue, D-1
climate change, 51, 52
coal, 24, 28, 31
economics, 78, 81, 87, E-13
existing land use authorizations, 14
federal and state requirements, 13
issues, B-2, B-7
legal and regulatory framework, C-1
reserved and outstanding rights, 14
scope of analysis, 6
threatened, endangered, proposed, and sensitive species, 54, 55, 63, 70
national forests, 70
Colorado, 48, 57, 58, 59
National Reclamation Fund, 99
Native American, 14, 114
native fish, 69
natural gas, 37, 39, 42, 44, 83, 85, 87, 88, 90, 101, 106, E-5
need for action, 1
NEPA
background of roadless issue, D-2
NFS lands
proposed action, 2
no action
alternative, 2, 15
non-motorized, D-3
non-motorized trail, 14
non-upper tier, 2, 15, 61
North Fork Coal Mining Area
air
cumulative effects, 42
direct and indirect emissions, 33
scope of analysis, 33
Alternative B, 17
Alternative C, 19
alternatives considered but eliminated, 10
background, 1
background of the roadless issue, D-5
boundary correction, 12
climate change, 49
coal
affected environment, 25
environmental consequences, 29
federal coal program, 24

decision framework, 2
economics, E-1
affected environment, 99
analysis methods, 77
environmental effects, 101
existing land use authorizations, 14
issues, 3, B-1
proposed action, 2
purpose and need, 1
scope of analysis, 5
threatened, endangered, proposed, and sensitive species
effects of the alternatives, 60
analysis methods, 54
cumulative effects, 71
tribal consultation, 3
Northern Ute, 3
occupied habitat, 54
Office of Surface Mining Reclamation and Enforcement (OSMRE), 6, 24, C-2
oil and gas, 60, 76, B-8
operations
mine, 4, 7, 26, 76, 92, 110
Other Contributors to the SDEIS, 112
Pawnee Montane Skipper, 62
Penland's Alpine Fen Mustard, 62
permitting, 2, 6, 14, 24, B-3, C-1, C-2
petition, B-2, B-4, D-4
Pike-San Isabel National Forest, 32
Pilot Knob CRA, 13, B-1
pipelines, 2, 17, 70
plants
air
cumulative effects, 70
alpine, 68
cumulative effects, 68
distribution, 68
invasive, 66, 70
rare, 70
sensitive, 60
policies, 5, 12, 14, E-3, E-4
population
economics, 77, 81, 95, 96, 98, 104, 109
growth, 67, 69, 95
power plant, 45, 100, E-7, E-9, E-12, E-14
Preble's Meadow Jumping Mouse, 62
preparers, 111
Preparers, EIS Distribution, and Consultation, 74–111
present net value
benefit cost framework, 81
present net value (PNV), 87, 109, E-21, E-23, E-24, E-25
preservation, D-1
primitive, D-3
processes
biological, 19
industrial, 51
production, 35
upstream, 35, 39, 41
productivity, 29, 83, 94, E-18
prohibitions, 15, 23, 28, 32
projections, 55, 78
climate, 48
coal demand, E-9
programatic, 23
road, 27, 29, B-4
projects
management, 31, 99
project level analysis, 5, 14, 25, 34, 50
renewable energy, 12
proposed action, 2, 17
proposed rule, 3, 10, 46, 50, 51, D-5
public
comments, 3, 4, 7, 11, E-17
involvement, 8
number of comments, 3
public health, 48
public involvement, 2
purpose, 1
purpose of and need for action, 1
razorback sucker, 62
reclamation, 28, 29, 31, 32, B-3, C-2
record

distribution, 54
project, 5, E-1
sampling, 54
recreation, 48, 69
alternatives considered but eliminated, 12
demand, 67
dispersed, 14, D-3
issues, B-8
land use authorizations, 14
reference landscapes, D-3
references, 115
References Cited, 115
Regional Forester
analysis methods, 53
background on the roadless issue, D-3
critical habitats, 58
effects of the alternatives, 61
issues, 4
regional forester sensitive species, 55
regquirements
federal and state, 13
regulations
BLM, 27, C-1
Colorado Roadless Rule, 11
emissions, E-9
federal and state, 13
mining, 24, C-2
National Forest Management Act, 13, D-2, D-4
NEPA, 10
roadless, 5
wastewater, 82
renewable energy, 12, 84, 89, 106, B-5, E-13
requirements
air permit, E-13, E-14
Colorado Roadless Rule, C-3
emissions, 100
ESA, 56
exploration, 27
forest plan, 13
mine, 28
NEPA, 6, 77
permit, 101, C-3
procedural, D-2
reclamation, 31, 32
regulatory, 6, 24, 25, 27
road construction, 30
resources
air, 33
coal, 24
economics, 75
mineral, 78
oil and gas, 76
wildlife, 52
Responsible Official, i, 10, 13
restoration, 69
revenue, 82, 99
rights, 24, C-3
treaty, 14
rights-of-way, 2, 31
rivers, 48, 68
road construction, 27
roadless area characteristics, 1, 32, 48, B-4, B-10, B-11, D-3
Roadless Area Conservation National Advisory Committee, D-5
roadless area review and evaluation, D-1
roadless areas. See Colorado Roadless Areas (CRAs)
roads
air
direct and indirect emissions, 34
Alternative B, 17
Alternative C, 19
background of the roadless issue, D-4
boundary correction, 12
climate change
direct , indirect, and cumulative effects, 51
coal, 24
affected environment, 25
environmental consequences, 30, 31
temporary road construction, 27
proposed action, 2

scope of analysis, 5
threatened, endangered, proposed, and sensitive species
effects of the alternatives, 61
threatened, endangered, proposed, and sensitive species
effects of the alternatives, 65
Routt National Forest, 32
rule
alternatives, 10
promulgation of, D-5
proposed, 3, 5, 10, 46, 50, D-5
safety, 25, 28, 29
San Juan National Forest, 32
Sandhill goosefoot, 57
scenic quality, 49, D-3
scope, 4
air, 33
climate change, 48
economics, 77
threatened, endangered, proposed, and sensitive species, 52
semi-primitive, D-3
semi-primitive motorized, D-3
sensitive species, 52, 55, 61, 64, 66, 71, D-3
fish, 54
issues, 4
social cost of carbon, E-17
soils, 49, B-5
Southern Ute, 3
Southwestern Willow Flycatcher, 62
species
aquatic, 68
candidate, 56
invasive, 46, 60, 68, 70
non-native, 49
sensitive, 54, 55, 61, 64, 66, 71
terrestrial, 69
threatened and endangered, 52, 58, 62, 65, 67, 74
state
petition, B-4, D-4
requirements, 13
streamflow, 48
structure
community, 104
conveyance, B-1
water conveyance, 49
suckers
mountain, 54
Sunset CRA, 19, B-2, B-7, B-8
Sunset trail, B-9
Surface Mining Control and Reclamation Act of 1977, B-3, C-2
surface uses, 24, 27, 29
task force, D-5
temporary roads, 2
air
Alterantive A, 34
Alternative B, 17
Alternative C, 19
coal, 24
affected environment, 25
Alternative A, 30
Alternative B, 30
Alternative C, 31
temporary road construction, 27
sope of analysis, 5
terrestrial species, 69
threatened and endangered species, 58, 62, 65, 67, 74
threatened, endangered, proposed, and sensitive species
Alternative A
threatened and endangered species, 62
sensitive species, 61
Alternative B
sensitive species, 64
threatened and endangered species, 65
Alternative C
sensitive species, 66
threatened and endangered species, 67
analysis methods, 52
analysis of cumulative effects, 71

assumptions, 55
climate change, 68
critical habitats, 58
cumulative effects, 67
determinations of effect
sensitive species, 71
determinations of effect
threatened and endangered species, 74
effects of alternatives, 60
endangered species, 58
energy demand, 70
fish analysis, 54
population growth and development, 69
recreation, 69
regional forester sensitive species, 55
timber, 6, 48, 82
total acres, 17
tourism, 48
tree cutting, 5, 15, 60, D-3, D-4
trends, 67, 77, 95, 98, 101, E-19
Tribal Consultation, 3, 114
Tribes, 3, 114
Uinta basin, 91, 100, E-10
Uinta Basin, 99, 100, E-5, E-14, E-15, E-16
upper tier, 2, 11
Upstream Dashboard tool, 37, 38, 41, 106
Ute, 3
Northern Ute, 3
Southern Ute, 3
Ute Mountain Ute, 3
vegetation, 19, 49, 51, B-11
vehicle use, B-9
water, D-3
conveyance structures, 49
demand, 69
environments, 62
issues, B-5
management, 99
quality, 7
wastewater, 82
watershed, 54, 65, 66
website
Energy Information Administration, 38
EPA, E-4
White River National Forest, 32
wilderness, 69, D-1
issues, B-8
wilderness capable, 19, 21
Wilderness Act, D-1
wildland fire, 68

# Appendix A **Opinions from Federal District Court of Colorado on Colorado Roadless Rule and West Elk Coal Mine**

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLORADO
Judge R. Brooke Jackson

Civil Action No. 13-cv-01723-RBJ

HIGH COUNTRY CONSERVATION ADVOCATES,
WILDEARTH GUARDIANS, and SIERRA CLUB,

Plaintiffs,

v.

UNITED STATES FOREST SERVICE,
UNITED STATES DEPARTMENT OF AGRICULTURE,
UNITED STATES BUREAU OF LAND MANAGEMENT,
UNITED STATES DEPARTMENT OF THE INTERIOR,
DANIEL JIRÓN, in his official capacity as Regional Forester for the U.S. Forest Service's Rocky Mountain Region,
SCOTT ARMENTROUT, in his official capacity as Supervisor of the Grand Mesa, Uncompahgre, and Gunnison National Forests, and
RUTH WELCH, in her official capacity as the Bureau of Land Management's Colorado State Office Acting Director,

Defendants, and

ARK LAND COMPANY, INC., and
MOUNTAIN COAL COMPANY, L.L.C.,

Intervenor-Defendants.

---

ORDER

---

The North Fork Valley in western Colorado is blessed with valuable resources. The area hosts several coal mines as well as beautiful scenery, abundant wildlife, and outstanding recreational opportunities. And as is sometimes the case in rich places like this, people disagree about how to manage the development of those resources. In the case before the Court, the plaintiff environmental organizations seek judicial review of three agency decisions that together

authorized on-the-ground mining exploration activities in a part of the North Fork Valley called the Sunset Roadless Area. These exploration activities are scheduled to begin on July 1, 2014. Plaintiffs allege that these three agency decisions failed to comply with the National Environmental Policy Act ("NEPA") and the Administrative Procedure Act ("APA") and must be set aside. The Court has subject matter jurisdiction pursuant to 28 U.S.C. § 1331 and 5 U.S.C. §§ 701-706.

## I. BACKGROUND

### A. The National Environmental Policy Act ("NEPA")

The National Environmental Policy Act is one of our country's foundational environmental statutes. The law, however, does not prescribe any substantive environmental standards per se. Rather NEPA is a procedural statute designed to ensure public participation and transparent decisionmaking by federal agencies. *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989). Before taking major action, NEPA requires federal agencies to prepare an Environmental Impact Statement ("EIS"). 42 U.S.C. § 4332(2)(C). An EIS must take a "hard look" at the potential environmental impacts of the agency's proposed action. *Robertson*, 490 U.S. at 350; *New Mexico ex rel. Richardson v. Bureau of Land Management*, 565 F.3d 683, 713 (10th Cir. 2009).

"The EIS must also 'rigorously explore and objectively evaluate all reasonable alternatives' to a proposed action in comparative form, so as to provide a 'clear basis for choice among the options.'" *WildEarth Guardians v. U.S. Forest Serv.*, 828 F. Supp. 2d 1223, 1236 (D. Colo. 2011) (quoting 40 C.F.R. § 1502.14). "Reasonable alternatives are those which are 'bounded by some notion of feasibility,' and, thus, need not include alternatives which are remote, speculative, impractical, or ineffective. *Id.* at 1236-37 (quoting *Utahns for Better*

*Transp. v. U.S. Dep't of Transp.*, 305 F.3d 1152, 1172 (10th Cir. 2002) and citing *Custer Cnty. Action Ass'n v. Garvey*, 256 F.3d 1024, 1039-40 (10th Cir. 2001)). "The EIS also must briefly discuss the reasons for eliminating any alternative from detailed study." *Id.* (citing 40 C.F.R. § 1502.14(a)). To determine whether alleged deficiencies in an EIS merit reversal, the Court applies "a rule of reason standard (essentially an abuse of discretion standard)." *Utahns for Better Transp.*, 305 F.3d at 1163.

NEPA does not require an explicit cost-benefit analysis to be included in an EIS. 40 C.F.R. § 1502.23 ("[T]he weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations"); *see also Oregon Natural Res. Council v. Marsh*, 832 F.2d 1489, 1499 (9th Cir. 1987), *rev'd on other grounds*, 490 U.S. 360; *North Carolina Alliance for Transp. Reform, Inc. v. U.S. Dep't of Transp.*, 151 F. Supp. 2d 661, 692 (M.D.N.C. 2001). However, where such an analysis is included it cannot be misleading. *Hughes River Watershed Conservancy v. Glickman*, 81 F.3d 437, 446-48 (4th Cir. 1996) ("it is essential that the EIS not be based on misleading economic assumptions"); *Johnston v. Davis*, 698 F.2d 1088, 1094-95 (10th Cir. 1983) (disapproving of misleading statements resulting in "an unreasonable comparison of alternatives" in an EIS).

As an alternative or precursor to an EIS, an agency may prepare an environmental assessment ("EA") to "[b]riefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact." 40 C.F.R. § 1508.9(a)(1). The EA, while typically a more concise analysis than an EIS, must still evaluate the "need for the proposal, . . . alternatives as required by [NEPA] section 102(2)(E), [and] the environmental impacts of the proposed action and alternatives." 40 C.F.R. § 1508.9(b). If the

agency concludes that the action will not cause significant impacts, it may issue a Finding of No Significant Impact ("FONSI") and need not prepare an EIS. 40 C.F.R. § 1508.13.

**B. Coal Leasing on Federal Land**

The BLM manages coal leases underlying Forest Service Land pursuant to the Mineral Leasing Act, 30 U.S.C. § 181 *et seq.* Because the Forest Service retains management authority over the surface lands overlying these leases, the BLM must first obtain the consent of the Forest Service before approving leases. 30 U.S.C. §§ 201(a)(3)(iii), 207(a); 43 C.F.R. § 3425.3(b).

Prior to granting consent, the Forest Service is authorized to impose conditions to protect forest resources. *Id.* To be sure, conservation is not the Forest Service's sole mission. *The Lands Council v. McNair*, 537 F.3d 981, 990 (9th Cir. 2008) ("Congress has consistently acknowledged that the Forest Service must balance competing demands in managing National Forest System lands. Indeed, since Congress' early regulation of the national forests, it has never been the case that the national forests were ... to be set aside for non-use.") (citing *United States v. New Mexico*, 438 U.S. 696, 716 n. 23 (1978)) (internal quotation marks omitted).

The Forest Service and BLM lease modifications are subject to the same dual-agency permitting process. 43 C.F.R. § 3432.3(d). A different set of regulations govern the process of exploring for coal—whether inside or outside of an existing lease. An exploration plan can be approved without a separate license if the area to be explored lies within an existing lease. 43 C.F.R. § 3480. If, however, the area to be explored lies outside an existing lease, exploration requires a separate exploration license. 43 C.F.R. § 3410.

**C. The Sunset Roadless Area**

The Sunset Roadless Area contains 5,800 acres of relatively undeveloped forest and scrub land in a part of western Colorado called the North Fork Valley. Mount Gunnison and the

West Elk Wilderness lie to the east. The parties cannot agree about whether the area should be called pristine or disturbed. It appears undisputed that there have been human activities in the area making it less pristine than the nearby West Elk Wilderness Area. *See, e.g.*, FSLeasing-0046963, 0046967.[1] But at the same time the area is undoubtedly wild, relatively empty, and home to diverse flora and fauna. *See* FSLeasing-0046800, -0046987, and -0047275.

Recreational opportunities are available in the area as well, although the parties dispute how many opportunities are available and the quality of those opportunities. At a minimum, there are two trails in the area—the Sunset Trail and Trail 8152—though they do not receive heavy use. FSLeasing-0046955, 0046836 (characterizing the Sunset Trail as "a non-system nonmotorized trail that is mostly overgrown with minimal use by the public"). The area is more popular for dispersed recreational activities. *See* BLM_EP-13602; BLM_EP-13885-86 (noting that the area "is heavily used during hunting season" and nearby areas are "widely used" for dispersed recreation).

Next door to the Sunset Roadless Area sits the West Elk coal mine. This underground mine has been operating since 1981 mostly beneath public lands managed by the Forest Service. *See WildEarth Guardians v. U.S. Forest Serv.*, 828 F. Supp. at 1227.

**D. <u>The Parties</u>**

Plaintiffs in this case are a collection of non-profit, environmental groups. Since 1977, High Country Conservation Advocates has been operating in the Gunnison area, working to advance its members' interest in preserving natural values and open space in Gunnison County. [Second Amended Compl., ECF No. 30 at 4.] Plaintiff WildEarth Guardians is a "non-profit

[1] I adopt the citation convention used by the parties in this case. There are four administrative records. I refer to the Forest Service Lease Modifications record as "FSLeasing-xxxx," the BLM's Lease Modifications record as "BLM_mods-xxxx," to the Exploration Plan record as "BLM-EP-xxxx," and to the Colorado Roadless Rule record as "CRR-xxxx."

environmental organization dedicated to protecting and restoring the wildlife, wild places, and wild rivers throughout the American West." *Id.* These groups participated in the public comment process associated with the Lease Modifications and Exploration Plan challenged in this case. *Id.* at 5. Members of these organizations recreate in the Sunset Roadless Area and nearby public lands; they visit for the opportunity to enjoy the solitude and quiet of the area as well as the opportunity to hike, camp, and observe wildlife. *Id.* Plaintiff Sierra Club, which joined as a plaintiff later in the litigation, is a national environmental non-profit group that shares similar conservation goals as the other plaintiffs in this case. In addition, the Sierra Club is dedicated to "transition[ing] the nation away from coal and toward clean energy solutions." *Id.*

As explained above, the BLM and Forest Service cooperatively manage coal mining operations in the Sunset Roadless Area. Their decisions authorizing on-the-ground exploration activities—and the resulting harm to plaintiffs' interests—are the basis for this case. Ark Land Company and Mountain Coal Company (sometimes referred to collectively as "Arch Coal") are the companies that currently own leases in West Elk Mine and who petitioned for and received the Lease Modification at issue in this case. Arch Coal's motion to intervene as a defendant was granted on July 8, 2013. [ECF No. 15.]

**E. <u>The Agency Decisions</u>**

Three interconnected decisions enabled on-the-ground mining exploration in the Sunset Roadless Area. First, in 2012 the Colorado Roadless Rule ("CRR") superseded the National Roadless Rule (66 Fed. Reg. 3244 (Jan. 12, 2001)) and provided an exemption for temporary road construction or reconstruction associated with coal mining in the North Fork Valley. 36 C.F.R. § 294.43(c)(1)(ix). The CRR represented a trade-off of sorts between extractive industries in Colorado who sought to loosen the restrictions of the National Roadless Rule and

conservationists and environmental groups that wanted to preserve those protections. 77 Fed. Reg. 39,576, 39,576 (July 3, 2012) (noting that the rule strikes "a balance between conserving roadless area characteristics for future generations and allowing management activities within CRAs [Colorado Roadless Areas] that are important to the citizens and economy of the State of Colorado"). Ultimately the CRR extended roadless protections to a vast amount of acreage that was previously unprotected under the national rule in exchange for various concessions from environmentalists. One of these concessions included an exemption for road construction related to coal mining on about 20,000 acres of previously protected land including the Sunset Roadless Area.[2] The CRR explicitly states that one of its purposes is to facilitate coal mining and exploration in the North Fork Valley. *Id.* It does not directly authorize such activities, however, but explains that any individual project must undergo site-specific environmental analysis and approval.

Second, the Bureau of Land Management approved modifications to leases held by Ark Land Company and Mountain Coal Company, LLC adding new lands to preexisting leases for the West Elk mine. The modification area comprises 1,701 acres out of the 5,800 in the Sunset Roadless Area. FSLeasing-0046963. Arch Coal filed applications for the modifications in early 2009, and the BLM approved them in November 2011. The Forest Service, as the managing agency for overlying lands, consented to these Lease Modifications. The decision to grant the modification was accompanied by an Environmental Assessment ("EA"). Plaintiffs successfully appealed this decision through the Forest Service administrative process, and the agencies began preparing a full EIS on the Lease Modifications. On August 2, 2012, the Forest Service approved the modifications. Plaintiffs filed a second administrative appeal which was denied on

[2] A helpful, concise history of the CRR can be found in Judge Boasberg's opinion in *Ark Initiative v. Tidwell*, 895 F. Supp. 2d 230, 233-35 (D.D.C. 2012).

November 7, 2012. FSLeasing-0065327-77. Then it was BLM's turn to approve the modifications, which it did on December 27, 2012. BLM-mods-009831.

Plaintiffs briefly pursued an administrative appeal with the BLM, but withdrew its appeal when the Interior Board of Land Appeals declined to issue a decision within 45 days. *See* 43 C.F.R. § 4.21(b)(4). The lease modifications went into effect on April 1, 2013. That set the stage for the third and final agency decision in this case.

That third decision occurred after Arch Coal submitted a proposed Exploration Plan to the BLM in April 2013. BLM_EP-000096-179. This plan contained details on Arch's planned exploration of the land newly acquired under the lease modification. As relevant to this litigation, Arch plans to build approximately 6 miles of roads and to clear vegetation for several drill pads. Arch will use the resulting exploratory wells to determine the extent of the underlying coal seam and make a decision about whether to extend mining operations into this area. No one knows for sure whether there is recoverable coal in the exploration area. The agencies prepared an EA and approved the plan on June 27, 2013. BLM_EP-016168-215, EP-016219-21, EP-000467. The following day, BLM petitioned the Land Board to put its approval of the plan into full force and effect. That petition was subsequently denied. Plaintiffs filed this suit on July 2, 2013. At the time they included motions for emergency relief. Those motions were withdrawn after Arch promised not to begin exploration activities until the summer of 2014. [ECF No. 27.]

## II. PROCEDURAL BACKGROUND

As explained above, plaintiffs initiated this suit in July 2013. The Court granted Arch Coal leave to intervene in the case on July 8, 2013. ECF No. 15. After it became clear that Arch Coal would not begin exploration activities until the summer of 2014, the parties drafted a joint case management plan. Plaintiffs filed their opening brief on March 20, 2014. Shortly

thereafter, plaintiffs became concerned that the Court would not have enough time to rule on the merits of the case before construction began on July 1, 2014 because the merits were not scheduled to be fully briefed until May 2, 2014. Therefore the plaintiffs filed a motion for a preliminary injunction on April 9, 2014 to protect their interests. A third joint case management plan [ECF No. 68] explained the timing crunch and set a May 20 deadline for briefing related to the preliminary injunction. The case was transferred to me on May 15, 2014 at which point I requested that the parties schedule oral argument on the motion for a preliminary injunction. The underlying merits case became ripe for review before the hearing, however, and therefore the merits case became the focus of the hearing on June 19, 2014. The motion for a preliminary injunction is now moot, and I proceed to a decision on the merits of plaintiffs' administrative appeal.

## III. ANALYSIS

By law, this Court may only set aside an agency's decision if after a review of the entire administrative record the Court finds that the decision was "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law." 5 U.S.C. § 706(2)(A); *see also Davis v. Mineta*, 302 F.3d 1104, 1111 (10th Cir. 2002).

> An agency's decision is arbitrary and capricious if the agency (1) entirely failed to consider an important aspect of the problem, (2) offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise, (3) failed to base its decision on consideration of the relevant factors, or (4) made a clear error of judgment. Deficiencies in an EIS that are mere "flyspecks" and do not defeat NEPA's goals of informed decisionmaking and informed public comment will not lead to reversal.

*New Mexico ex rel. Richardson*, 565 F.3d at 704 (internal quotation marks and citations omitted). Plaintiffs bear the burden of proof on the question of whether an agency's decision was arbitrary or capricious. *Citizen's Comm. to Save Our Canyons v. Krueger*, 513 F.3d 1169, 1176 (10th Cir.

2008) (noting that the agency's decision is presumed valid). I am fully aware that the agencies' decisions—as long as they are neither arbitrary nor capricious—are entitled to deference and that this Court cannot substitute its own judgment for the agency's judgment. *Vt. Yankee Nuclear Power Corp. v. Natural Res. Def. Council*, 435 U.S. 519, 555 (1978). And I further recognize that "deference to the agency is especially strong where the challenged decisions involve technical or scientific matters within the agency's area of expertise." *Wyoming v. U.S. Dep't of Agric.*, 661 F.3d 1209, 1246 (10th Cir. 2011) (quoting *Morris v. U.S. Nuclear Regulatory Comm'n*, 598 F.3d 677, 691 (10th Cir. 2010)). But the Court will not "defer to a void." *Oregon Natural Desert Ass'n v. Bureau of Land Mgmt.*, 625 F.3d 1092, 1121 (9th Cir. 2010).

**a. <u>Plaintiffs Have Standing to Bring All Claims.</u>**

There is a relatively narrow standing issue that must be resolved at the outset of this case. The plaintiff environmental groups undoubtedly have standing to challenge most of the agency decisions in this case, and by and large their standing is uncontested. Arch Coal alone, however, argues that the plaintiffs lack standing to challenge the CRR because the alleged deficiency in the rule inadequate analysis of impacts from various greenhouse gas ("GHG") emissions is unrelated to the concrete harm giving rise to plaintiffs' standing—i.e. harm to recreational values in the Sunset Roadless Area. I find this argument unconvincing and find that plaintiffs have standing to bring each of the claims in this case.

The basic components of standing are well-settled.

> First, the plaintiff must have suffered an injury in fact—an invasion of a legally protected interest which is (a) concrete and particularized, and (b) actual or imminent, not conjectural or hypothetical. Second, there must be a causal connection between the injury and the conduct complained of—the injury has to be fairly traceable to the challenged action of the defendant, and not the result of the independent action of some third party not before the court. Third, it must be likely, as opposed to merely speculative, that the injury will be redressed by a favorable decision.

*Lujan v. Defenders of Wildlife*, 504 U.S. 555, 560–61 (1992) (internal citations, quotation marks and alterations omitted).

In this case it is apparent that the plaintiffs will suffer an injury in fact if bulldozing begins in the Sunset Roadless Area, that the injury is traceable to the three interrelated decisions by the agencies to open up the area to coal exploration, and that a favorable decision invalidating any one of the rules would prohibit Arch Coal from moving forward with its exploration plan, thereby redressing plaintiffs' injury. Arch, however, suggests that a proper standing analysis must also trace the concrete injury to the particular legal theory advanced by the plaintiff. In this case, therefore, Arch would like to see plaintiffs demonstrate why the allegedly inadequate analysis of climate change in the CRR will cause harm to plaintiffs' recreational interests. Because plaintiffs admittedly cannot draw such a line between the alleged deficiency and the particular harm they face, Arch argues they lack standing to bring such a challenge.

This attempt to raise the bar on standing by requiring additional proof beyond injury, causation, and redressability has been rebuffed by other courts including the U.S. Supreme Court. The Court of Appeals for the D.C. Circuit rejected an identical argument last year. In that case, the district court

> found [that plaintiffs] lacked standing to raise the argument because they could not demonstrate a link between their members' recreational and aesthetic interests, "which are uniformly local, and the diffuse and unpredictable effects of [greenhouse gas] emissions." The district court therefore seemed to require that the specific type of pollution causing the Appellants' aesthetic injury—here, local pollution—be the same type that was inadequately considered in the FEIS. In this respect, we think it sliced the salami too thin.

*WildEarth Guardians v. Jewell*, 738 F.3d 298, 306-07 (D.C. Cir. 2013) (internal citations omitted) (citing *Duke Power Co. v. Carolina Envtl. Study Grp. Inc.*, 438 U.S. 59, 78-79 (1978) (holding that, except in taxpayer standing cases, a plaintiff who has otherwise demonstrated

standing need not demonstrate a nexus between the right asserted and the injury alleged)). The court went on to explain that vacatur of the allegedly deficient FEIS would redress the plaintiff's injury regardless of the "specific flaw" in the agency's decision. *Id.* at 307; *see also WildEarth Guardians*, 828 F. Supp. 2d at 1235 (D. Colo. 2011) (rejecting the idea that a plaintiff in a similar challenge to an agency coal leasing decision "must specifically allege a personalized injury resulting from climate change, rather than from the project itself"). Like these other courts, I find that requiring High Country Conservation Advocates to prove more than injury, causation, and redressability would be inappropriate and lacks precedential support. I find that plaintiffs have standing to challenge the CRR even if their argument that the rule failed to adequately analyze climate change impacts does not share a nexus with the concrete injury to their recreational interests.

**b. <u>Lease Modification FEIS.</u>**

Plaintiffs allege three NEPA violations in the Lease Modification FEIS: (1) the agencies failed to disclose the impact to adjacent public and private lands in sufficient detail, (2) the agencies failed to disclose the social, environmental, and economic impacts of GHG emissions resulting from the lease modifications, and (3) the agencies failed to analyze direct volatile organic compound ("VOC") emissions associated with methane venting on the modified lease. Overall, as the record demonstrates, the agencies did an excellent job of disclosing the effects of the Lease Modifications and analyzing those effects. Nonetheless, their explanation of the social, economic, and environmental effects of methane emissions from the development of the Lease Modification was arbitrary and appears to have either "entirely failed to consider an important aspect of the problem, . . . offered an explanation for its decision that runs counter to

the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise." *New Mexico ex. rel. Richardson*, 565 F.3d at 704.

i. The Lease Modification FEIS Adequately Disclosed Impacts to Adjacent Lands.

By approving the Lease Modifications, the agencies made it possible for Arch to recover nearby coal on adjacent public and private lands that otherwise would have been permanently bypassed. The fact that this additional coal might now be recoverable and might be developed, while not a direct impact of the Lease Modification, is nonetheless a foreseeable indirect impact of the approval. The FEIS discloses the indirect impacts in some detail, but Plaintiffs argue that the level of detail is insufficient to disclose fully the values that would be impacted by the development of adjacent lands.

No one disputes that foreseeable development resulting from an agency decision is an indirect impact that must be analyzed. 40 C.F.R. § 1508.25(c) (requiring the EIS to analyze direct, indirect, and cumulative impacts from a federal action). *See Davis*, 302 F.3d at 1122-23 (characterizing the growth-inducing effect of agency's approval of a highway project as an indirect impact requiring analysis). There are natural limits to the amount of forecasting that can be done, of course, and agencies are required only to make "a reasonable, good faith, objective presentation of those impacts sufficient to foster public participation and informed decision making." *Colo. Envtl. Coal. v. Dombeck*, 185 F.3d 1162, 1177 (10th Cir. 1999) (citation omitted). I turn now to the agencies' discussion of the impacts to adjacent lands.

In this case, the FEIS discloses that development of the modification will lead to the production of 5.6 million tons of coal from adjacent private lands and 3.3 million tons from adjacent federal lands. FSLeasing-0046776 at 0046851. Moreover the document quantifies the

economic benefits expected from the modifications and extended mine life as approximately $1,075,102,400 based on an estimated price of $40 per ton of coal. FSLeasing-0046776 at 0046987-88. As far as the possible impacts to surface resources, the agencies noted that the adjacent lands were to the north and west of the modification area and assumed that the effects on these lands would be proportional to the effects on land within the Lease Modification. FSLeasing-0046917. The FEIS then multiplied the assumed proportion of vegetation loss by what it knew to be the proportions of overlying vegetative cover in adjacent lands likely to be affected by the modification. FSLeasing-0046918 ("For private lands and adjacent parent lease areas, a total of 63 additional acres of vegetation loss is estimated. Of this, there would be approximately 41 acres of oak, 19 acres of aspen, 2 acres of spruce/fir, and 2 acres of shrub types").[3] The agencies explained that more detailed disclosures would be impossible before approval of a more specific mine plan. FSLeasing-0046776 at 0047327 ("At this leasing stage there are no mine plans approved for the private lands as they rely solely on a preliminary design as is the case on the lease modification areas, so it is impossible to determine exactly where, of [sic] if, surface disturbance would occur."). Regarding subsidence, specifically, several unknowns—such as the thickness of the coal seam and the amount and characteristics of the overburden (the material above the seam)—added further uncertainty to the agencies' forecasts. FSLeasing-0055550-54.

[3] The FEIS also disclosed a variety of other surface effects on adjacent lands. *See generally* FSLeasing-0046851, -0046887–88, -0046898–99, -0046901–51, -0046957–58, -0046981–83; -0046848 (coal production on adjacent private lands), -0046849, -0046887–89, -0046893–94, -0046919–21 (subsidence on private lands), -0046871 (methane drainage wells on private lands), -0046897–900 (soil impacts on private lands), -0046906, -0046909, -0046912 (surface water impacts from subsidence on private land), -0046907–08, -0046910–11, -0046913 (ground water impacts from subsidence on private land), -0046915 (cumulative impacts to water, including activities on private lands), -0046918 (methodology for estimating vegetation impacts on private lands).

Plaintiffs admit that the FEIS disclosed the fact that mining would take place on adjacent lands, but they argue that the agencies erred by omitting any discussion of the "location and extent" of the mining. [ECF No. 62 at 24.] They wish for something more specific than the general "north" and "west" provided by the FEIS. FSLeasing-0046776 at 0046848. They argue that in order to evaluate properly what environmental values might be affected the agency must disclose details about the likely location of the adjacent mining. Furthermore they challenge the assumption that effects on adjacent private lands would be proportional to the effects on public lands because the private land owners might not be bound by the sorts of environmental constraints facing the agencies.

Plaintiffs claim that the agencies had maps in their possession that could have provided this more detailed information. They cite, for example, a map depicting the modification area that disclosed details like vegetation cover. FSLeasing-0046776 at 0046916. Plaintiffs claim that similar maps for the adjacent lands were in the Forest Service's possession. FSLeasing-0055539 (Arch Coal's map of projected mine layout); FSLeasing-0055650 (Forest Service map depicting possible subsidence from the modification).

The Court has reviewed these maps, and they appear to be quite general and speculative. *See* E-mail from Kathy Welt to Ryan Taylor, FSLeasing-0055540-41 ("The blue projections are the [longwall] panel layouts that are our best estimates based on available drill hole data. The finer, gray line is the maximum panel layout within the lease mod areas should future exploration data from within the lease mod areas show that the panels can/should be extended there."). Indeed, the Court cannot see how either of these maps could have disclosed any more information than the general effects already disclosed by the agencies.

Moreover, it was reasonable, and not arbitrary, for the agencies to project that the indirect effects on adjacent lands would be similar to the effects within the current lease area. Plaintiffs offer no evidence suggesting that the surface of the adjacent area differs in such a way that subsidence will have substantially different effects on those areas. Their best argument is that perhaps mining operations will be performed in a less sensitive manner without agency oversight. Such speculation is more of a flyspeck than an accusation of arbitrariness or capriciousness. Moreover even if the Forest Service had included its map of projected subsidence, there is no indication that the map would have allowed plaintiffs to better understand the values that would be affected by the expansion. Again, all it depicts is what the agencies already disclosed: that mining on adjacent lands would occur somewhere to the north and west of the existing lease area and that it would be too speculative to try to determine the precise location of surface effects. *See, e.g.*, FSLeasing-0047327–29 (response to comments seeking more detailed analysis of surface effects).

**ii. The Lease Modification FEIS Inadequately Disclosed the Effects of GHG Emissions.**

While the agencies provided an adequate disclosure of effects on adjacent lands, their treatment of the costs associated with GHG emissions from the mine was arbitrary and capricious. The agencies apparently do not dispute that they are required to analyze the indirect effects of GHG emissions in some fashion, but they contend that their general discussion of the effects of global climate change was sufficient under NEPA. The FEIS, however, justifies this approach with a statement that is incorrect and ignores evidence in the record. And the post-hoc rationales provided by counsel in this case, even if they could save the FEIS, suffer from problems of their own.

One of the foreseeable effects of the Lease Modification approval is the likely release of methane gas from the expanded mining operations. As explained above, an EIS must disclose and evaluate all of the effects of a proposed action direct, indirect, and cumulative. NEPA further defines impacts or effects to include "ecological[,] . . . economic, [and] social" impacts of a proposed action. 40 C.F.R. § 1508.8(b). The agencies do not argue that they could ignore these effects. In fact, they acknowledged that there might be impacts from GHGs in the form of methane emitted from mine operations and from carbon dioxide resulting from combustion of the coal produced. FSLeasing-0046776 at 0046808 ("Effects on climate change may occur from mining coal which stem from the release of methane . . . and release of CO2 caused by the burning of coal that is mined"). Beyond quantifying the amount of emissions relative to state and national emissions (FSLeasing-0046874) and giving general discussion to the impacts of global climate change (FSLeasing-0046880), they did not discuss the impacts caused by these emissions. Instead, they offered a categorical explanation that such an analysis is impossible.

> Standardized protocols designed to measure factors that may contribute to climate change, and to quantify climatic impacts, are presently unavailable . . . .
>
> Predicting the degree of impact any single emitter of [greenhouse gases] may have on global climate change, or on the changes to biotic and abiotic systems that accompany climate change, is not possible at this time. As such, . . . the accompanying changes to natural systems cannot be quantified or predicted at this time.

FSLeasing-0046880.

But a tool is and was available: the social cost of carbon protocol. Interagency Working Group on Social Cost of Carbon, Technical Support Document (Feb. 2010): *see* FSLeasing-0041245 at 0041403, 0041404. The protocol—which is designed to quantify a project's contribution to costs associated with global climate change—was created with the input of several departments, public comments, and technical models. FSLeasing-0041245 at 0041403,

0041404-06. The protocol is provisional and was expressly designed to assist agencies in cost-benefit analyses associated with rulemakings, but the EPA has expressed support for its use in other contexts. *See* Sarah E. Light, *NEPA's Footprint: Information Disclosure as a Quasi-Carbon Tax on Agencies*, 87 Tul. L. Rev. 511, 545-46 & n.160 (Feb. 2013) (noting the EPA recommendation to the State Department to "explore . . . means to characterize the impact of the GHG emissions, including an estimate of the 'social cost of carbon' associated with potential increases of GHG emissions" in connection with the State Department's review of the Keystone XL pipeline).

In case there was any doubt about the protocol's potential for inclusion in the Lease Modification EIS, the agencies included it in the draft EIS. FSLeasing-0009871 at 0010035-0010040). The draft weighed several specific economic benefits—coal recovered, payroll, associated purchases of supplies and services, and royalties—against two costs: the cost of disturbing forest and the cost of methane emissions from the mine (measured in terms of dollars per ton of carbon dioxide as estimated by the social cost of carbon protocol). FSLeasing-0010040 (coming out to $6.9 million in impacts from GHG emissions at a price of $21 per ton of carbon dioxide). The BLM included a similar analysis in its preliminary EA on the Lease Modifications. BLM_mods-7213 at 7261.

As noted above, these attempts at quantification of the Lease Modification's contribution to the costs of global climate change were abandoned in the FEIS. The analysis was removed, in part it seems, in response to an email from one of the BLM's economists that pointed out that the social cost of carbon protocol is "controversial."

> Placing quantitative values on greenhouse gas emissions is still controversial. Social cost estimates for a ton of carbon dioxide emitted range from $5 to over $800 (Interagency Working Group 2010; F. Ackerman & E. Stanton, Climate Risks and Carbon Prices: Revising the Social Costs of Carbon, 2010).

> Considering the 1.23 million tons of carbon dioxide equivalent emissions [from methane] the West Elk mine emits annually, the cost could range from a moderate $6 million per year to an overwhelming $984 million per year.

Email of D. Epstein, Economist, BLM State Office to N. Mortenson, Forest Service (July 19, 2012 6:08 PM), *see* FSLeasing-0116520 at 0116526. The final, however, retained the quantification of the *benefits* associated with the Lease Modifications and even added some additional benefits. FSLeasing-0046776 at 0046985-88.

Therefore the FEIS, on its face, offers a factually inaccurate justification for why it omitted the social cost of carbon protocol. A tool existed, and indeed it was in the draft EIS. This justification "runs counter to the evidence before the agency [and] is so implausible that it could not be ascribed to a difference in view or the product of agency expertise. . . ." *New Mexico ex rel. Richardson*, 565 F.3d at 704.

Furthermore, this error is more than a mere "flyspeck." The agencies expressly relied on the anticipated economic benefits of the Lease Modifications in justifying their approval. *See* FSLeasing-0069890 at 0069898) (explaining that the no-action alternative was not chosen because "it does not achieve social and economic objectives in the area. Estimates suggest nearly a billion dollars in lost revenues, royalties, payroll and local payment for goods and services would be foregone by implementing this Alternative").

Even though NEPA does not require a cost-benefit analysis, it was nonetheless arbitrary and capricious to quantify the *benefits* of the lease modifications and then explain that a similar analysis of the *costs* was impossible when such an analysis was in fact possible and was included in an earlier draft EIS. *Compare* FSLeasing-0046776 at 0046985-88 (final) *with* FSLeasing-0009871 at 0010035-10040 (draft); *see also* 40 C.F.R. § 1502.23; *Hughes River Watershed Conservancy*, 81 F.3d at 446-48 ("it is essential that the EIS not be based on misleading

economic assumptions"); *Sierra Club v. Sigler*, 695 F.2d 957, 979 (5th Cir. 1983) (agency choosing to "trumpet" an action's benefits has a duty to disclose its costs). In effect the agency prepared half of a cost-benefit analysis, incorrectly claimed that it was impossible to quantify the costs, and then relied on the anticipated benefits to approve the project.

The agencies, of course, might have been able to offer non-arbitrary reasons why the protocol should not have been included in the FEIS. They did not.[4] Any post-hoc rationalizations provided by the agencies in this litigation are irrelevant to the question of whether the agencies complied with NEPA at the time they made their respective decisions. *New Mexico ex rel. Richardson*, 565 F.3d at 704 ("In considering whether the agency took a 'hard look,' we consider only the agency's reasoning at the time of decisionmaking, excluding post-hoc rationalization concocted by counsel in briefs or argument.").

I believe the agencies' post-hoc arguments raised in this litigation further illustrate the arbitrariness of their actions. First, as I mentioned above, the agencies argue that the protocol is provisional and designed for rulemakings, not NEPA documents. The Interagency Working Group's own materials confirm these facts. *See* FSLeasing-0041405 ("[A]ny effort to quantify and monetize the harms associated with climate change will raise serious questions of science, economics, and ethics and should be viewed as provisional."); FSLeasing-0041407 (noting that the protocol is "specifically designed for the rulemaking process"). Whether the provisional

[4] The BLM's Record of Decision approving the Lease Modification, which came after the Forest Service's consent to the Modifications and played no role in the earlier decision, does offer a slightly more descriptive explanation for why the protocol was not used. BLM_mods-9817 at 9848 (explaining that "the benefit-cost analysis was removed from the FEIS because it was determined not to provide accurate analysis to inform USFS and BLM decisions"). This post-hoc justification by the BLM does not change the fact that the Forest Service ignored evidence before it. The BLM's explanation also does not explain why the quantified analysis of benefits was retained while the accompanying quantification of costs was omitted. Finally, the BLM's ROD also fails to explain why, if the protocol was deemed inaccurate, the agency could possibly have been justified in omitting it entirely, thereby effectively setting the cost of those emissions at $0.

nature or the declaration that the protocol was designed for rulemaking might have served as a non-arbitrary reason for removing the protocol from the draft is a hypothetical question that the record does not present. I will note, however, that even had such reasons been included, they do not explain why these agencies believed the protocol was inaccurate or not useful in this instance. Likewise, even if the agencies had argued the protocol was controversial because it is imprecise, the only evidence in the record that appears to support that rationalization is the economist's email noting that there is no scientific consensus about the exact dollar amount to assign to carbon emissions. *See supra* Email of D. Epstein, Economist, BLM State Office to N. Mortenson, Forest Service (July 19, 2012 6:08 PM). As he noted, there is a wide range of estimates about the social cost of GHG emissions. But neither the BLM's economist nor anyone else in the record appears to suggest the cost is as low as $0 per unit. Yet by deciding not to quantify the costs at all, the agencies effectively zeroed out the cost in its quantitative analysis. *See Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1217 (9th Cir. 2008) (holding that NEPA requires agencies to analyze the effects of its actions on global climate change); *id.* at 1200 (finding it arbitrary and capricious to assign a cost of $0/ton to emissions when none of the identified estimates was that low); *Border Power Plant Working Grp. v. U.S. Dep't of Energy*, 260 F. Supp. 2d 997, 1028-29 (S.D. Cal. 2003) (same).

Second, the agencies cite cases where courts upheld decisions to omit quantitative analyses of the effect of a project's GHG emissions in favor of a more generalized qualitative analysis of those effects. But in two of those cases, the protocol was never suggested as a possible tool, and the courts appear to have based their holdings, at least in part, on the fact that no such tool existed at the time. *See WildEarth Guardians v. Jewell*, 738 F.3d 298, 309 (D.C. Cir. 2013) ("Because current science does not allow for the specificity demanded by the

Appellants, the BLM was not required to identify specific effects on the climate in order to prepare an adequate EIS."); *WildEarth Guardians v. U.S. Forest Serv.*, 828 F. Supp. 2d 1223, 1240 (D. Colo. 2011) ("WildEarth has not identified any method in the record (or elsewhere) that would enable the Forest Service to describe with particularity how the project would contribute to overall climate change."). The other cases involved alleged deficiencies that are not at issue in this case. *See Barnes v. U.S. Dep't of Transp.*, 655 F.3d 1124, 1139, 1140 (9th Cir. 2011) (upholding an EIS that did not analyze climate effects "specific to the locale" because such an analysis is impossible); *Audubon Naturalist Soc'y v. U.S. Dep't of Transp.*, 524 F. Supp. 2d 642, 708 (D. Md. 2007) (upholding an EIS that did not adopt mitigation measures for climate change effects). I am not persuaded by these cases, or by anything in the record, that it is reasonable completely to ignore a tool in which an interagency group of experts invested time and expertise. Common sense tells me that quantifying the effect of greenhouse gases in dollar terms is difficult at best. The critical importance of the subject, however, tells me that a "hard look" has to include a "hard look" at whether this tool, however imprecise it might be, would contribute to a more informed assessment of the impacts than if it were simply ignored.

In short, the agencies might have justifiable reasons for not using (or assigning minimal weight to) the social cost of carbon protocol to quantify the cost of GHG emissions from the Lease Modifications. Unfortunately, they did not provide those reasons in the FEIS, and their post-hoc attempts to justify their actions, even if the Court were permitted to consider them, are unpersuasive. Therefore I find that the FEIS's proffered explanation for omitting the protocol was arbitrary and capricious in violation of NEPA.

iii. The Lease Modification FEIS Adequately Considered the Effect of Possible VOC Emissions.

Plaintiffs also claim the FEIS devoted insufficient attention to the possibility of volatile organic compound ("VOC") emissions from the methane wells[5] that would almost certainly be drilled as a part of the Lease Modification. Methane itself is not a precursor to VOCs, but hexane, propane, and a variety of other chemicals that often accompany coal-bed methane do have the potential to create VOCs. 40 C.F.R. § 51.100 (s)(1). The agencies acknowledged that VOC pollution is a "key" issue, but they made no effort to quantify potential VOC pollution in the FEIS. BLM_mods-9817 at 9826; *see also* BLM_mods7213 at 7222 (preliminary EA); FSLeasing-0046776 at 0046872-73.

The parties devote several pages of briefing to this issue. In a nutshell, the defendants argue that VOC emissions are highly variable; that existing data (which are sparse and relatively old) suggest that regardless of the variability those emissions are low; and that the only evidence suggesting emissions may be significant and worthy of additional study is the plaintiffs' faulty mathematical extrapolation using the old data. In response, the plaintiffs claim that their math is reasonable, existing facilities are unlikely to detect whether local VOC emissions are high, and in any event, the agencies have an obligation to go out and collect more data to determine whether VOC emissions are significant.

Just because the agencies called VOC pollution a "key" issue does not mean VOC pollution is likely to be significant. The agencies also offered several seemingly non-arbitrary reasons why the existing data are too variable and the emissions are too low to be useful in

[5] These methane wells are designed to vent methane from the underground mine for safety reasons. They are unrelated to the exploratory wells Arch plans to drill in order to determine the extent of the underlying coal seam.

modeling the effect of the Lease Modifications. FSLeasing-0046873, -0047305–07 (VOC concentrations too variable and too low for accurate modeling). The agencies also note that nearby air monitoring stations have not revealed any local exceedances of VOC limits. FSLeasing-0046857–58. Given that the rate of mining is expected to remain the same, the agencies concluded that VOC emissions were unlikely to change. *Id.* Moreover, the disagreement between the agencies and plaintiffs about the accuracy of plaintiffs' mathematical forecasting based on the old data from West Elk Mine strikes this Court as precisely the type of technical disagreement where deference to the agency is most important. *Cf. Wyoming*, 661 F.3d at 1246.

After deferring to the agencies' conclusions that current data do not support the modeling that plaintiffs request, the only remaining issue is whether the agencies were under an obligation to obtain additional information on VOC emissions. *See* 40 C.F.R. § 1502.22(a) (stating that an agency "shall" obtain additional information if it "is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant"). The agencies explain that obtaining more data on VOC emissions would not be essential to a choice among alternatives given that there is no evidence (with the exception of plaintiffs' disputed extrapolations) that emissions could be significant if the Lease Modifications were approved. Plaintiffs suggest that if the data were not essential, the agency would nonetheless be required to make a set of explicit findings to that effect. But strict, technical compliance with Section 1502.22 has never been required as long as other information in the agency documents reveals that the missing information is not essential. *See Colo. Envtl. Coal.*, 185 F.3d at 1172–73 (courts are "unwilling to give a hyper-technical reading of [40 C.F.R. §1502.22] to require the [agency] to include a separate, formal disclosure statement in the environmental impact statement to the effect that . . .

data is incomplete or unavailable") (citation omitted); *WildEarth Guardians*, 828 F. Supp. 2d at 1240 (agency satisfied Section 1502.22 where it stated that additional information on climate impacts was unavailable but that available information indicates impacts would not be significant). Here, the rest of the record, including the absence of any local exceedances and the relatively low levels of VOC emissions from the old data, indicates that VOC pollution will not be significant, and I find that the agency did not act arbitrarily by deciding not to obtain additional evidence of VOC emissions.

**c. Colorado Roadless Rule FEIS.**

Plaintiffs allege three NEPA violations in the Colorado Roadless Rule: (1) the agencies failed to disclose GHG pollution from the operation of mines that would occur pursuant to the rule, (2) the agencies failed to disclose GHG pollution from combustion of coal from the North Fork Valley exemption, and (3) the agencies failed to address, acknowledge, or respond to an expert report criticizing the agencies' assumptions about GHG pollution from the exemption.

Before delving into the details of the CRR, I note that the rule appears to be the product of exactly the kind of collaborative, compromise-oriented policymaking that we want in America. Broadly speaking, the CRR balances important conservation interests with the also important economic need to develop natural resources in Colorado. Not everyone got what they wanted out of the rule, but perhaps that is a sign that the political process worked as intended. All of this, however, is more or less beside the point in this litigation. The narrow question this Court must answer is whether the CRR and the North Fork exemption comply with NEPA's disclosure and analysis requirements. The specific issue is whether the agencies took a "hard look" at the rule's contribution to climate change, not whether the rule is a good idea or a bad idea. For the reasons that follow, I find that the agency failed to take a hard look at these effects,

notwithstanding the fact that the CRR appears to be a generally thorough, well-reasoned compromise.

i. The CRR FEIS Failed to Disclose the GHG Emissions from Mine Operation.

The CRR states that increased methane emissions are a foreseeable result of the rule. CRR-0154023 at 0154161. The agencies nonetheless declined to quantify these emissions or analyze their impacts. The agencies justified this choice by arguing that mining activity under the rule is speculative, and emission rates depend on mine-specific factors that will not be understood until exploration occurs. CRR-0153244 (preparation of emissions inventories not feasible). Instead, the agencies used a ranking of one to four stars to compare the potential GHG emissions between the alternatives proposed by the CRR. CRR-0154023 at 0154169-71.

As plaintiffs point out, however, the proffered explanation that future activities are too speculative to analyze is belied by the agencies' decision to include detailed projections and analysis of tax revenue, employment statistics, and other environmental interests. CRR-0154023 at 0154350. It is arbitrary to offer detailed projections of a project's upside while omitting a feasible projection of the project's costs. *See Scientists' Inst. for Pub. Info., Inc. v. Atomic Energy Comm'n*, 481 F.2d 1079, 1097 (D.C. Cir. 1973); *Sigler*, 695 F.2d at 979 ("There can be no 'hard look' at costs and benefits unless all costs are disclosed."). In a nutshell, the agencies cannot claim that they are unable to predict the impacts of methane emissions because activities occurring under the rule are too speculative and then turn around and calculate down to the job and the nearest $100,000 the economic impacts of the rule.[6]

[6] The agencies also object to plaintiffs' desired analysis by suggesting that the FEIS focused primarily on local and regional costs and benefits and that including an inventory of GHG emissions would inappropriately refocus the cost analysis on global costs. The careful quantification of economic benefits did, however, include regional and national benefits. CRR-0154352-59 (quantifying contributions to state

The agencies also claim that the task of projecting emissions from mine operations under the CRR would be too complex. However, the agencies' own projected coal removal and associated economic analysis in the FEIS was based on existing data from only three mines West Elk, Bowie #2, and Elk Creek. CRR-0154023 at 0154102. According to the FEIS, these three mines are the only ones that will be expanded under the rule. CRR-154023 at 0154348. The agencies already possess data on methane emissions from these three mines. CRR-0154023 at 0154166. This explanation, therefore, appears to be nothing more than an ipse dixit.

Of course, mine-specific emissions factors were separately offered as a potential excuse for not projecting GHG emissions. However, "[r]easonable forecasting and speculation is . . . implicit in NEPA, and we must reject any attempt by agencies to shirk their responsibilities under NEPA by labeling any and all discussion of future environmental effects as 'crystal ball inquiry.'" *Scientists' Inst. for Pub. Info.*, 481 F.2d at 1092. Such projections were possible as demonstrated by an expert opinion that used data from existing North Fork mines to extrapolate expected emissions under the extended mine lives enabled by the CRR. Power Report, CRR-0137587 at 0137603. The agencies made similar forecasts based on existing data in earlier litigation surrounding the West Elk Mine, undercutting the argument that such forecasts are impossible. *WildEarth Guardians*, 828 F. Supp. 2d at 1231. Therefore, the decision to forgo calculating the reasonably foreseeable GHG emissions associated with the CRR was arbitrary in light of the agencies' apparent ability to perform such calculations and their decision to include a detailed economic analysis of the benefits associated with the rule.

---

and federal tax coffers); CRR-0154347-52 (quantifying induced economic benefits to Colorado and the United States). The plaintiffs are not asking the agencies to quantify the global costs associated with the increased GHG pollution resulting from development under the CRR: they merely request an inventory of the quantity of the gases that are likely to be released. This request does not skew the analysis.

ii. The CRR FEIS Failed to Disclose the GHG Emissions Resulting from Combustion of North Fork Valley Coal.

Plaintiffs also object to the CRR FEIS's omission of any estimate of GHG emissions associated with combustion of coal. They argue that the agencies' proffered explanations are unsupported by the record and therefore arbitrary. Those explanations were that 1) power plants have varying degrees of efficiency, and therefore any prediction about carbon emissions associated with combustion would be speculative, 2) currently unavailable technology like carbon capture and sequestration might be widely adopted by the time the coal is burned, and 3) the overall amount of coal consumed by the marketplace would remain unchanged because there are perfect substitutes for North Fork Coal. CRR-0154023 at 0154170-71.

I agree with plaintiffs that these explanations are unsupported by the record. First, it makes no sense for the agencies to claim that it is too speculative to predict coal combustion emissions data under the CRR. The agencies projected emissions from future mining and coal combustion in other situations, like the West Elk Lease Modification FEIS. *See* FSLeasing-0046876 78. The agencies attempt to distinguish projections associated with individual leases by arguing that

> it is one thing to consider the potential combustion of coal projected to be produced from identified leases, as in the cases cited by Plaintiffs, but quite another to project the effects of the combustion of coal that may or may not be produced over a wide area from mines that may or may not be developed simply by virtue of a broad rule governing road construction which is the analysis Plaintiffs demand here.

Fed. Def.'s Response Br., ECF No. 72 at 35. This attempt misses the mark. The agency cannot—in the same FEIS—provide detailed estimates of the amount of coal to be mined (CRR-0154023 at 0154112-13) and simultaneously claim that it would be too speculative to estimate

emissions from "coal that may or may not be produced" from "mines that may or may not be developed." The two positions are nearly impossible to reconcile.

The only plausible difference between the ability to forecast emissions under the Lease Modifications and forecasting under the CRR is possible variations in powerplant efficiency. But this possibility did not stop the agencies from making estimates of emissions from coal produced by the West Elk mine in the Lease Modifications. And indeed, West Elk is one of only three mines identified for possible development under the CRR. CRR-0154023 at 0154102. There is no reason to believe that variations in powerplant efficiency posed no obstacle to making reasonable estimates of emissions associated with the Lease Modifications but that those same variations in efficiency posed an insurmountable hurdle to making estimates from coal combustion associated with the three identified mines in the North Fork exemption.

Second, the agencies' contention that new technology might reduce carbon emissions from future coal combustion strikes this Court as anything but a "hard look." The agency cannot rely on unsupported assumptions that future mitigation technologies will be adopted. *Cf. New York v. Nuclear Regulatory Comm'n*, 681 F.3d 471, 478-79 (D.C. Cir. 2012) (finding a NEPA violation where the agency decided to ignore future impacts based only on "reasonable assurance[s]" that the impacts would be avoided later); *see also Neighbors of Cuddy Mountain v. U.S. Forest Serv.*, 137 F.3d 1372, 1381 (9th Cir. 1998) (holding that an EIS discussion of mitigation violated NEPA in part because it was "not clear whether any mitigation measures would in fact be adopted").

Third and finally, the agencies argue that the same amount of coal will be burned whether or not the CRR exempts the North Fork Valley. The agency concluded that there would be perfect substitution between coal provided by the North Fork Valley and coal mined elsewhere.

In other words, coal is a global commodity, and if the coal does not come out of the ground in the North Fork consumers will simply pay to have the same amount of coal pulled out of the ground somewhere else overall GHG emissions from combustion will be identical under either scenario. The agencies reached this conclusion in part by relying on a U.S. Department of Energy report forecasting a small annual increase in the demand for coal. CRR-0080586. Based on that assumption, the agency concluded that perfect substitution would occur.

I cannot make sense of this argument, and I am persuaded by an opinion from the Court of Appeals for the Eighth Circuit that rejected a nearly identical agency justification for not analyzing the future effects of coal combustion. In *Mid States Coalition for Progress v. Surface Transportation Board*, the court held that an agency violated NEPA when it failed to disclose and analyze the future coal combustion impacts associated with the agency's approval of a railroad line. 345 F.3d 520, 549 (8th Cir. 2003). In that case—like this one—the agency argued that emissions would occur regardless of whether the railroad line were approved because "the demand for coal will be unaffected by an increase in availability and a decrease in price." *Id.* The court rejected this argument as "illogical at best" and noted that "increased availability of inexpensive coal will at the very least make coal a more attractive option to future entrants into the utilities market when compared with other potential fuel sources, such as nuclear power, solar power, or natural gas." *Id.* The same dynamic is at play here. The production of coal in the North Fork exemption will increase the supply of cheap, low-sulfur coal. At some point this additional supply will impact the demand for coal relative to other fuel sources, and coal that otherwise would have been left in the ground will be burned. This reasonably foreseeable effect must be analyzed, even if the precise extent of the effect is less certain. *Id.* at 549-50.[7]

[7] I am unpersuaded by the agencies' attempts to distinguish *Mid States*. The fact that *Mid States* was decided in the context of identified rail lines does not distinguish it from this case where the agencies had

iii. The CRR FEIS Failed to Address Dr. Power's Expert Report.

Plaintiffs raise a third objection to the FEIS that is closely related to the issue of whether it was arbitrary to omit a discussion of the effects of coal combustion. The plaintiffs contend that the agencies failed to address, respond to, or acknowledge an expert report that they submitted on the topic of forecasting GHG emissions, thereby violating NEPA's instruction to respond to "any responsible opposing view which was not adequately discussed in the draft statement." 40 C.F.R. § 1502.9(b).

Dr. Thomas Michael Power's report, put simply, raises the same arguments discussed above about the ability to forecast emissions from coal combustion. His report indicates, contrary to the agencies' assumptions about perfect substitution, that consumers would be unable to perfectly substitute and that overall emissions would be higher if the CRR were approved. CRR-0137587 at 0137606-09.

The agencies argue that Dr. Power's report was categorized as Public Concern 2-195, CRR-0138670–73, and addressed in the CRR FEIS Response to Comments at CRR-0153244. It is true that the report and its criticisms are reprinted as Public Concern 2-195. The stickier issue is whether the agency adequately responded to the report. The response makes no mention of Dr. Power's report and, perhaps more importantly, it does not address the criticism that perfect

---

existing data from three identified mines and were able to provide a detailed forecast of the amount of coal that would come out of those mines pursuant to the CRR. I also see no significant difference between the definition of foreseeability in the Eighth and Tenth Circuit NEPA jurisprudence. *Compare Mid States*, 345 F.3d at 549 (reasonable foreseeability means that an event is "sufficiently likely to occur that a person of ordinary prudence would take it into account") *with Utahns for Better Transp.*, 305 F.3d at 1176 (reasonable foreseeability includes effects that "are sufficiently likely to occur"). The Tenth Circuit adds the caveat that "[e]ven as to impacts that are sufficiently likely to occur such that they are reasonably foreseeable and merit inclusion, the FEIS need only furnish such information as appears to be reasonably necessary under the circumstances for evaluation of the project." *Utahns for Better Transp.*, 305 F.3d at 1176. The caveat does not modify the definition of reasonable foreseeability, however. It merely adds a reasonable limitation on what foreseeable effects must be included in the FEIS by clarifying that only relevant and foreseeable effects must be included. Here, the agencies do not explain why the effect of coal combustion, if foreseeable, is nonetheless not relevant to an analysis of the project.

substitution is unlikely. The response merely noted that quantitative analysis of GHG emissions was too speculative at this programmatic stage and postponed more detailed analysis at the project level. CRR-0153244. The agencies do not argue that Dr. Power's report was not a "responsible opposing view." Moreover the substance of his report is not addressed by the portion of the record cited by the agencies. This failure to engage with Dr. Power's report violates 40 C.F.R. § 1502.9(b).

**iv. <u>Exploration Plan Environmental Assessment</u>**

Finally, plaintiffs allege two NEPA violations in the Exploration Plan Environmental Assessment ("EA"): (1) the agencies failed to take a hard look at the plan's effects on recreation interests, and (2) the agencies failed to consider two reasonable alternatives to the plan. Failure to adequately evaluate effects on recreational interests is grounds to overturn a NEPA document. *Nat'l Parks & Conservation Ass'n v. Fed. Aviation Admin.*, 998 F.2d 1523, 1533 (10th Cir. 1993).

The Lease Modification FEIS explicitly acknowledged that exploration and drilling could affect recreational activities but postponed such an analysis until those "activities are specifically proposed." BLM_EP-013386 at 013567-68; FSLeasing-0046776 at 0046957-58. Yet when the agencies had an opportunity to evaluate proposed on-the-ground activities, they determined that effects on recreation "will not be analyzed," BLM_EP-016168 at 016182-83, despite the fact that such values are present, *id.* at 016183. Confusingly, the EA explains that there are no recreational facilities in the exploration area. *Id.* Yet the same document reveals the presence of two trails—the Sunset Trail and Trail 8152—in the area. BLM_EP-016175. Proposed roads and drill pads will be located near these trails and in some instances will be placed on top of them. *Id.* (drill pad SST-1 is located on top of Trail 8152). Therefore the proffered reason for

foregoing an analysis of recreational values is simply wrong. There are recreational facilities in the area. It seems all but certain that they will be affected by the proposed exploration activities.[8]

The fact that the EA was "tiered" to the recreational analysis in the Leasing Modification FEIS changes nothing. First, the FEIS explicitly postpones site-specific analysis until later proposals (see discussion in the preceding paragraph). Plaintiffs refer to this as a shell-game. While I am sure the agencies did not mean to deceive anyone, their logic is hard to follow. If site-specific analysis was to be postponed, then it should have been performed at a later opportunity. It makes no sense for the agency to then turn around and "tier" their analysis to an early analysis that never took place.

The agencies claim that the EA performed a de facto analysis of all of the same factors that would be considered in an analysis of recreational interests: effects on wildlife, vegetation, and scenic resources. BLM_EP-016188–97, BLM_EP-016201–02. Intervenor defendants further argue that these factors are the only way to measure the experience of a person engaging in dispersed recreational activities like off-trail hiking or hunting. [ECF No. 74 at 17.] That may be true, but the EA and Leasing Modification FEIS do not make this argument. Therefore it is impossible for this Court to know whether the agencies did in fact do this analysis. And as post hoc justifications for agency decisions, these explanations cannot support the agencies' action. *Colo. Envtl. Coal. v. Salazar*, 875 F. Supp. 2d at 1249-50.

[8] At oral argument, the defendants suggested that Trail 8152 is an unnamed user path that does not appear on some maps of the area and that plaintiffs are just now seizing upon its existence in a desperate move to try to find errors in the EA. The trail appears on the very same map that the agencies used in the EA, however. Rather than a late-breaking, insignificant flyspeck, this looks like a clearly marked trail (whether it gets much use, the Court cannot say) that the agencies themselves have been aware of since before they approved the Exploration Plan.

Furthermore it appears that the agencies dismissed at least one reasonable alternative proposed by plaintiffs without providing an explanation for the dismissal. "The existence of a viable but unexamined alternative renders an alternatives analysis, and the EA which relies upon it, inadequate." *Diné Citizens Against Ruining Our Env't*, 747 F. Supp. 2d at 1256; *Wilderness Soc'y v. Wisely*, 524 F. Supp. 2d 1285, 1310-12 (invalidating an EA for failing to explain why a no action alternative was dismissed). However, "NEPA does not require an agency to analyze the environmental consequences of alternatives it has in good faith rejected as too remote, speculative, or [] impractical or ineffective." *Lee v. U.S. Air Force*, 354 F.3d 1229, 1238 (10th Cir. 2004) (internal citations and quotation marks omitted).

Plaintiffs suggested a modified plan that eliminated a section of road that appeared to be redundant. BLM_EP-000469 at 000477. The agencies claim to have considered the alternative but declined to offer a full analysis because the alternative was not viable. Federal Defendant [Response Br., ECF No. 72 at 43.] They further explain that the redundant road is critical to worker safety in the event of a disaster requiring multiple exit options. *Id.* This appears to be a perfectly valid reason. However this justification appears nowhere in the agencies' documents until this litigation.[9]

Plaintiffs also claim their proposal to eliminate borehole SST-10 was ignored. The agencies, however, tangentially addressed this proposal in the EA when they explained why the proposal to limit the project to four holes was unacceptable. The EA notes that such a limitation "would not provide the necessary information on the coal." BLM_EP-016180. This explanation, while it verges on non-responsive, nonetheless explains why this alternative was rejected as inconsistent with the purpose of the project. The Court finds that the agencies

[9] It is not, as defendants claimed at oral argument, obvious from the face of the maps that the redundant road is necessary for safety purposes.

properly considered and explained their rejection of the proposed elimination of borehole SST-10.

**v. Remedies**

Both defendants ask the Court not to address the remedy for any NEPA violations at this time but instead to receive additional briefing on that subject. Plaintiffs reply that they do not object to deferring remedy briefing until after the Court's ruling on the merits. No one has informed the Court as to what the mystery is about the remedy or what menu of options the Court might have. Under the Administrative Procedure Act the Court is directed to hold unlawful and to set aside agency action found to be arbitrary, capricious or otherwise not in according to law. 5 U.S.C. § 706(2)(A). Thus, "vacatur" of the non-compliant agency action appears to be mandatory.

I nevertheless acknowledge that the parties, who are intimately familiar with the case, might have suggestions that the Court has not considered. The Court directs counsel to confer and attempt in good faith to reach agreement as to remedies. If agreement is not reached, the parties may submit additional briefing concerning remedy no later than 30 days from today's date. This will consist of one brief for the plaintiffs collectively, one for the government defendants collectively, and one for the intervenors collectively. The three briefs may be no longer than 10 pages including everything from the caption to the certificate of service.

However, one aspect of the remedy is both clear and immediate and is imposed upon the issuance of this order. The intervenor defendants are immediately enjoined from proceeding with the Exploration Plan in any manner that involves any construction, bulldozing or other on-the-ground, above-ground or below-ground disturbing activity in the subject area.

## IV. Conclusion

Plaintiff's petition for review of agency action is granted and sustained. As indicated immediately above, the intervenor defendants are immediately enjoined from proceeding with the Exploration Plan in any manner that involves any construction, bulldozing or other on-the-ground, above-ground or below-ground disturbing activity in the subject area. The government defendants' approval of the Exploration Plan is vacated. Plaintiffs' motion for the entry of a preliminary injunction [ECF No. 71] is moot. The Court will hold in abeyance any further remedial orders pending either notification that the parties have reached an agreement or the receipt and evaluation of supplemental briefs on remedy.

DATED this 27th day of June, 2014.

BY THE COURT:

R. Brooke Jackson
United States District Judge

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLORADO
Judge R. Brooke Jackson

Civil Action No. 13-cv-01723-RBJ

HIGH COUNTRY CONSERVATION ADVOCATES,
WILDEARTH GUARDIANS, and SIERRA CLUB,

Plaintiffs,

v.

UNITED STATES FOREST SERVICE,
UNITED STATES DEPARTMENT OF AGRICULTURE,
UNITED STATES BUREAU OF LAND MANAGEMENT,
UNITED STATES DEPARTMENT OF THE INTERIOR,
DANIEL JIRÓN, in his official capacity as Regional Forester for the U.S. Forest Service's Rocky Mountain Region,
SCOTT ARMENTROUT, in his official capacity as Supervisor of the Grand Mesa, Uncompahgre, and Gunnison National Forests, and
RUTH WELCH, in her official capacity as the Bureau of Land Management's Colorado State Office Acting Director,

Defendants, and

ARK LAND COMPANY, INC., and
MOUNTAIN COAL COMPANY, L.L.C.,

Intervenor-Defendants.

---

ORDER

---

On June 27, 2014, this Court issued an order finding that the Forest Service and Bureau of Land Management (collectively "federal defendants") failed to comply with the National Environmental Policy Act ("NEPA") in three interrelated agency actions: the promulgation of the Colorado Roadless Rule with an exemption for the North Fork Valley, the issuance of lease modifications to permits held by intervenor-defendants Ark Land Company, Inc. and Mountain

Coal Company, L.L.C. (collectively "Arch Coal"), and the approval of an Exploration Plan authorizing road building and drilling in the lease modification area. ECF No. 91. The Court postponed its decision on the appropriate remedies for these violations until the parties had a chance to confer and, if necessary, submit additional briefing on the topic. The parties have since filed their briefs, and the Court is prepared to issue a final order in this administrative appeal.

## I. Applicable Law

Vacatur is the normal remedy for an agency action that fails to comply with NEPA. *See* 5 U.S.C. § 706(2)(A) (directing reviewing courts to "hold unlawful and set aside agency action, findings, and conclusions found to be . . . arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law"); *Citizens to Preserve Overton Park, Inc. v. Volpe*, 401 U.S. 402, 413-14 (1971) ("In all cases agency action must be set aside if the action was 'arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law' or if the action failed to meet statutory, procedural, or constitutional requirements.").

The APA does not, however, deprive reviewing courts of traditional equitable powers when fashioning a remedy. *See* 5 U.S.C. § 702 (noting that nothing in the Administrative Procedure Act deprives reviewing courts of the power to apply equitable factors to its remedies analysis); *see also* Ronald M. Levin, *"Vacation" at Sea: Judicial Remedies and Equitable Discretion in Administrative Law*, 53 Duke L.J. 291, 374-75 (2003) (discussing the importance of remand without vacation as a remedy in administrative appeals, but noting that it is a departure from the norm and urging caution in its use). Some circuits employ a two-step test to determine whether equity counsels against vacatur, although it appears that the Tenth Circuit has not specifically addressed whether such a test applies in this circuit. *See, e.g.*, *Allied-Signal, Inc.*

*v. U.S. Nuclear Regulatory Comm'n*, 988 F.2d 146, 150-51 (D.C. Cir. 1993) (weighing the severity of the legal violation against the potential negative effects of vacatur).[1]

## II. Remedies in This Case

### a. Exploration Plan

The parties agree, at least in principle, that the Sunset Trail Exploration Plan should be vacated. The defendants do not explain whether or how they object to the specific language proffered by plaintiffs. Therefore the Court adopts the plaintiffs' language.

### b. Lease Modifications

Again, vacatur appears to be the typical remedy here. Defendants request a temporary injunction on activities taken pursuant to the lease modifications pending compliance with the NEPA violations identified in the Court's previous order. The parties have identified several cases where leases or lease modifications violated environmental review statutes. In some cases the reviewing court vacated the underlying leases. *See, e.g.*, *Pit River Tribe v. U.S. Forest Serv.*, 469 F.3d 768, 788 (9th Cir. 2006). In others the court merely temporarily enjoined activity pursuant to the lease while the responsible agency rectified other errors on remand. *See Connor v. Burford*, 848 F. 2d 1441, 1460-61 (9th Cir. 1988); *Native Village of Point Hope v. Salazar*, 730 F. Supp. 2d 1009, 1019 (D. Alaska 2010); *Mont. Wilderness Ass'n v. Fry*, 408 F. Supp. 2d 1032, 1038 (D. Mont. 2006)

---

[11] Defendants rely heavily on *Monsanto Co. v. Geertson Seed Farms*, 561 U.S. 139 (2010) in their briefs. While *Monsanto* undoubtedly controls where a plaintiff is "seeking a permanent injunction," the case is largely inapplicable here. *Id.* at 156. In *Monsanto*, neither party challenged the District Court's vacatur of the agency's decision to completely deregulate the Round-up Ready Alfalfa ("RRA"). *Id.* ("Because petitioners and the Government do not argue otherwise, we assume without deciding that the District Court acted lawfully in vacating the deregulation decision."). Rather on appeal the case centered on whether the District Court's *additional remedial measures*—enjoining the agency from deregulating RRA pending completion of an EIS and enjoining any planting of RRA in the meantime—were permissible. In the instant case, the Court sees no need to enter such sweeping remedial measures, and indeed the plaintiffs do not ask for any. Rather the Court will hew to the narrow remedy of vacating each offending action and remanding to the agency for further proceedings.

While it appears that this Court has a great deal of discretion in crafting a remedy, many of the cases cited by the defendants in support of their argument against vacatur involved materially different facts. In *Colorado Environmental Coalition v. Office of Legacy Management*, 819 F. Supp. 2d 1193, 1217 (D. Colo. 2001) *amended by* 2012 WL 628547 (D. Colo. Feb. 27, 2012), the court left in place leases issued pursuant to a flawed programmatic planning document but also explained that the plaintiffs had failed to demonstrate why the decision to issue the leases without further review was arbitrary and capricious. In the instant case, the Court has already concluded that the lease modifications themselves—not just the programmatic exception to the CRR—violated NEPA. Defendants' citation to *Colorado Environmental Coalition v. Salazar*, 875 F. Supp. 2d 1233 (D. Colo. 2012) is similarly unpersuasive. In that case, Chief Judge Krieger declined to vacate the leases at issue because of concerns that the decision to issue the leases was not challenged (as it was in the instant case) and that not all the parties that would be affected by vacatur of the leases were before the court (not a concern in the instant case). *Id.* at 1259.[2]

Finally, in the instant case, where several interrelated agency decisions all contained significant NEPA violations, I view skeptically any argument that a simple remand and temporary injunction is all that is needed to remedy the agencies' errors. This case is more like a Gordian knot that needs cutting than a simple tangle that the government can untie with a little

[2] Defendants offer a slew of other cases not necessarily involving leases or lease modifications purportedly demonstrating that the equities favor something less than vacatur in this case. They are likewise distinguishable as presenting much clearer facts in favor of remand without vacation than are present in the instant case. *See California Communities Against Toxics v. U.S. E.P.A.*, 688 F.3d 989, 993-94 (9th Cir. 2012) (vacatur and resulting delay would cause much needed powerplant to stay off line and might cause blackouts and additional air pollution due to the use of diesel generators); *Milk Train, Inc. v. Veneman*, 310 F.3d 747, 756 (D.C. Cir. 2002) (noting that the agency might never recover previously collected fees if the underlying rule was vacated, suggesting that the "egg has already been scrambled and there is no apparent way to restore the status quo ante"); *Allied-Signal, Inc. v. U.S. Nuclear Regulatory Comm'n*, 988 F.2d 146, 150-51 (D.C. Cir. 1993) (noting that the agency might not be able to recoup fees under a replacement rule).

extra time. I am also not sure that the agency's decision on remand is a foregone conclusion. The agencies might, depending on how they calculate the effect of greenhouse gas emissions, decide to forgo granting the lease modifications altogether. Then again, maybe they will reach the same conclusion they reached before this appeal. The outcome is not clear, and while it is not the Court's responsibility to mandate a particular outcome, NEPA's goals of deliberative, non-arbitrary decision-making would seem best served by the agencies approaching these actions with a clean slate. Because I do not find that equitable considerations tip the scales in favor of a temporary injunction, and because I believe vacation will best serve the deliberative process mandated by NEPA, the Court orders that the lease modifications be vacated.

Arch Coal writes separately to emphasize that it would like a narrowly tailored injunction against the lease modifications such that the company will be permitted to perform activities that do not trigger the CRR. Arch provides no details about these activities, nor does it explain how, if the North Fork Exception to the CRR violated NEPA, *any* activity pursuant to the lease modification could avoid relying upon the offending part of the CRR. After all, without the exception, it is not clear whether the agency defendants would ever approve lease modifications in the North Fork Valley. The main purpose of requiring the agencies to comply with NEPA is to give them a chance to perform a complete, non-arbitrary review of the exception. How the agency comes out in that review—which is an outcome that no one can predict at this time—will determine how the agency will approach subsidiary decisions like the decision to grant Arch's lease modification application. Absent more detail about the activities that Arch wishes to pursue on the lease modifications, I cannot assume that there are any activities that are so divorced from the CRR that the agencies are guaranteed to approve them in their forthcoming

environmental analysis. Therefore the Court finds that vacatur of the agencies' approvals of the lease modifications is the appropriate remedy in this case.

**c. Colorado Roadless Rule ("CRR")**

Again, vacatur appears to be the standard remedy in this case given that the Court has already found that the North Fork Exception to the CRR is not compliant with NEPA. That said, equitable considerations might be especially weighty when deciding how to deal with such a carefully crafted compromise. Plaintiffs seek severance of the North Fork Exception and vacation of that provision only. Federal defendants ask the Court to leave the exception in place and to refrain from enjoining the CRR except insofar as the Court orders the agencies to let the plaintiffs know of any ground disturbing activities in the exception area.

Yet again, I am unconvinced that the equities require something less than vacatur of the North Fork Exception, 36 C.F.R. § 294.43(c)(1)(ix). The CRR contains a severability clause, 36 C.F.R. § 294.48(f), suggesting the possibility that the agencies would prefer severance of the exception rather than invalidation of the entire CRR.

In the Tenth Circuit, a reviewing court "may partially set aside a regulation if the invalid portion is severable. A regulation is severable if the severed parts operate entirely independently of one another, and the circumstances indicate the agency would have adopted the regulation even without the faulty provision." *Arizona Pub. Serv. Co. v. U.S. E.P.A.*, 562 F.3d 1116, 1122 (10th Cir. 2009) (internal quotation marks omitted).

The defendants appear to concede that the CRR could operate independently without the North Fork Exception. Their position on whether the agencies would have promulgated the rule without the exception is less clear, however. At times, they suggest that the complexity of the CRR and the political wrangling required to create it demonstrate that the North Fork Exception

is a sort of linchpin holding together the entire rule. They offer no specific evidence that the agencies viewed the CRR or the exemption in this way. They also, at times, appear to argue the opposite. *See* ECF No. 98 at 7 ("Overall, the circumstances do not indicate that the Forest Service would have abandoned or substantially modified the CRR as applied to areas of the state outside the North Fork Coal Mining Area, in the absence of the North Fork Exception.").

I conclude that the severability clause creates a presumption that the North Fork Exception is severable, that the CRR could operate independently of the exception, and that while there is mixed evidence regarding whether the agency would have wished the CRR to operate without the exception, nothing in the record indicates a strong preference that the CRR be totally abandoned without the exception.[3] Therefore the Court orders the severance and vactur of the North Fork Exception.

## III. Conclusion

Therefore the Court orders the following:

1. The federal defendants' June 27, 2013 approvals of the Sunset Trail Area Coal Exploration Plan are vacated, and any and all actions pursuant to those approvals are permanently enjoined.
2. The federal defendants' August 2, 2012 and December 27, 2012 approvals of Arch Coal's lease modifications are vacated.
3. The North Fork Exception to the Colorado Roadless Rule, 36 C.F.R. § 294.43(c)(1)(ix), is severed from the remainder of the CRR and is vacated.

[3] Defendants advance a related argument that vacatur of the exception would be inequitable because such an action by the Court would cause problems operating on the parent leases. I find this concern overblown given the presence of a grandfather clause in the CRR, 36 C.F.R. § 294.48(a), (b), exempting permits, leases, and project decisions made prior to July 3, 2012. I note also that defendants never explain what these potential problems on the parent leases might be or how they cannot be saved by the grandfather clause.

DATED this 11th day of September, 2014.

BY THE COURT:

R. Brooke Jackson
United States District Judge

# Appendix B **Issues**

This appendix briefly describes the issues received during the public comment period for the proposed reinstatement of the North Fork Coal Mining Area exception to the Colorado Roadless Rule. Issues included in this appendix are the issues considered but not carried forth into detailed study. Suggested alternatives raised during public comment are addressed in Chapter 2. Pursuant to 40 CFR 1501.7(a)(3) this appendix discusses why these issues were not considered significant or how they are addressed in other documents.

## *Purpose and Need*

**It is unclear why there is a pressing need to not foreclose exploration and development of the coal resources where there is no immediate need for those resources** – The purpose of this proposal is to establish regulations to conserve roadless area values across the State of Colorado while not foreclosing coal mining opportunities within roadless areas in the North Fork Valley. This rule governs not just for today, but for as long as the rule is in existence. In addition, it takes years to develop regulations such as the Colorado Roadless Rule. In the case of coal, it takes many additional years after the regulations are developed to lease, explore and permit mining.

**Road construction in roadless areas runs counter to the purpose of the roadless rule** – It is correct that road construction adversely affects roadless characteristics and one of the purposes of the Colorado Roadless Rule is to conserve roadless areas over the long term. However, another purpose of the rule is to address state specific concerns, which includes not foreclosing exploration and development of coal resources in the North Fork Coal Mining Area. The Colorado Roadless Rule sought to balance these seemingly opposing purposes through a collaborative, compromise-oriented process.

The Colorado Roadless Rule established a management framework for roadless areas in the state through a collaborative, compromise-oriented process. The process considered state-specific concerns related to wildfire, water systems and conveyance structures, ski areas, access to electrical transmission infrastructure, and opportunities for coal exploration and development. In addressing state- specific concerns, the Colorado Roadless Rule included provisions that allow for temporary road construction and reconstruction for these certain activities, among them facilitating exploration and development of coal resources in the North Fork Coal Mining Area. The Rule has provisions for decommissioning and restoring the affected landscape once temporary roads are no longer needed for their established purpose (36 CR Part 294.93(d)(2)).

**There is no demonstrated need for opening Pilot Knob Roadless Area to coal development. In addition, the exception would only benefit one company** – During the public scoping period, Oxbow LLC provided comments maintaining their interest in coal mining opportunities within the Pilot Knob CRA. However, the proposed reinstatement of the North Fork Coal Mining Area exception is not for the benefit of any specific mining company. The state specific concern is the stability of local economies in the North Fork Valley recognizing the contribution coal mining provides to those communities. Coal mining opportunities in this area is a means of providing community stability. Even if an existing coal company in the area is no longer interested or able to mine, another company could take advantage of the opportunity.

**There is no need to access additional coal with the price of oil and natural gas at record lows** – The USDA has continued responsibility to manage resources on NFS lands. This rulemaking responds to existing legal and regulatory direction to facilitate access to domestic mineral resources, and responds to the State of Colorado's interest in not foreclosing exploration and development of the coal resources in the North Fork Coal Mining Area. In addition, it takes years to develop regulations such as the Colorado Roadless Rule. In the case of coal, it takes many additional years after the regulations are developed to lease, explore and permit mining. Commodity prices fluctuate widely. Thus initiating rulemaking only when coal prices are high would be inefficient, unwise, and poor management.

**According to Arch Coal staff, if they were unable to explore the proposed lease modifications by 2013 then they would likely bypass coal there. Given that the likelihood of coal exploration will not occur until 2017 at the earliest, then West Elk will bypass the coal and have no need to enter the Sunset Roadless Area** – The proposed lease modifications are a small portion of the Sunset Roadless Area. This rulemaking responds to existing legal and regulatory direction to facilitate access to domestic mineral resources, and responds to the State of Colorado's interest in not foreclosing exploration and development of the coal resources in the North Fork Coal Mining Area. Bypassing some coal does not foreclose the option of mining other coal in the area. In addition, the West Elk mine has slowed production and is considering mining other reserves (coal seams) under existing leases.

## *Coal*

**The U.S. Forest Service should not propose new coal mines when there is a surplus of coal in the United States and one-third of coal plants are retiring or are retired** – The Department of Agriculture is not proposing any additional coal mining, rather it is proposing rulemaking that would facilitate temporary road construction and reconstruction, if needed, for coal related activities within the North Fork Coal Mining Area. This rulemaking responds to the State of Colorado's interest in not foreclosing exploration and development of the coal resources in the North Fork Coal Mining Area. Private industry makes business decisions based on coal markets and the demand for coal.

**Arch Coal does not need the North Fork coal** – This proposed rule is not focused on Arch Coal or its needs for coal, although Arch Coal has expressed a desire to modify existing leases. Rather it is consistent with the State's petition for a state-specific roadless rule. In addition, the inclusion of the North Fork Coal Mining Area is consistent with Federal minerals development laws such as Mineral Leasing Act of 1920, the Federal Coal Leasing Act of 1976, and the Energy Policy Act of 2005. The development of mineral resources is within the national interest of the United States.

**Arch Coal will sell the coal to China, or other overseas markets, where it will have greater environmental effects** – Market forces will determine where coal is sold. The Forest Service does not regulate coal markets. The Forest Service did not analyze environmental effects in China because the logical point to break off environmental analyses for a roadless rule is roadless areas since the majority of environmental impacts would occur there. However, burning of coal in China does have a greater impact to air quality that it does in the U.S.

**Reclamation of sites must consider higher elevation effects on growing seasons, which limits recovery time each year and slows down the overall recovery time** – The Colorado Roadless Rule

contains provisions for decommissioning temporary roads and restoring the affected landscape (36 CFR Part 294.43(d)(2) that would apply if the exception is reinstated, and require decommissioning to a natural state that would incorporate site-specific needs. The Colorado Roadless Rule acknowledges the long-term nature of the activities. Additionally, federal coal permitting regulations at 30 CFR Part 700, and the state coal statutes require reclamation coal coal-related disturbances to an approved post mining land use, which accounts for site-specific conditions. Site-specific assessments of impacts and reclamation occur at the project level analyses. In addition, reclamation of temporary roads and well pads has been occurring in this area for many years and has proven to be successful. This past experience is taken into account when estimating recovery time.

**Many commenters raised issues related to open pit mining such as Appalachian type coal mining. Commenters were concerned with mountain top removal and massive destruction associated with open pit mining** – This proposed action is about rulemaking for roadless area management, it does not contemplate open pit mining. Further, the Surface Mining Control and Reclamation Act of 1977 established that surface mining is prohibited on national forests west of the 100$^{th}$ meridian.

**Arch Coal may leave the area scarred considering their stock just dropped 22% in one month** – The Surface Mining Control and Reclamation Act of 1977, its implementing regulations at 30 CFR Part 700 and the Colorado Surface Coal Mining Reclamation Act (Title 34, Article 33 of the Colorado Statutes) address reclamation bonding for coal activities.

**The U.S. Forest Service should make mining operators fund and held accountable for infrastructure development, maintenance, cleanup, and reclamation** – The Surface Mining Control and Reclamation Act of 1977, its implementing regulations at 30 CFR Part 700 and the Colorado Surface Coal Mining Reclamation Act (Title 34, Article 33 of the Colorado Statutes) govern coal mining operations in the state. All coal mining operations are permitted through the Colorado Division of Reclamation, Mining and Safety, who is responsible for ensuring a permitted mine operator accountable for their activities and reclamation. See Appendix C.

**The U.S. Forest Service should provide oversight to the mining operation** – Regulations at 30 CFR Part 900 (implementing the Surface Mining Control and Reclamation Act of 1977) establish that oversight of coal mining operations in Colorado is in the purview of the State of Colorado. Operation oversight is in the purview of the Colorado Division of Reclamation, Mining and Safety according to the Colorado Surface Coal Mining Reclamation Act (Title 34, Article 33 of the Colorado Statutes). Mine safety is under the purview of the Mining Safety and Health Administration, and federal coal production is monitored by the BLM.

**The coal industry has the worst safety record of any industry in America** – The Department of Labor's Mine Safety and Health Administration is responsible for safety and health standards in the nation's mines. Additional safety and health standards for mining and/or compliance with those standards are outside the scope of this analysis.

**The U.S. Forest Service should ensure the safety of coal miners by providing access to the North Fork Coal Mining Area** – The Mine Safety and Health Administration is responsible for safety and health standards in the nation's mines. However, the USDA recognizes that, based on today's technology, roads are necessary to safely mine coal in this area. The Colorado Roadless Rule attempts to balance this need with the goal of conserving roadless values across the State.

**The environmental impacts of coal dust, coal tar and coal ash must be disclosed** – Coal mining in the North Fork Valley is underground and thus coal dust associated with mining is not a significant environmental issue. Coal dust associated with processing and transport of coal occurs but was not analyzed because it is not a significant issue in context of NEPA because the coal processing and transport of coal from the North Fork Valley will continue for some unknown length of time regardless of which alternative is selected. In addition, coal dust from transport is largely a site-specific impact and it is unknown where the coal will go.

Coal tar is a byproduct of coking coal for steel production. Generally the coal from the North Fork Coal Mining Area is thermal coal used for electricity generation. Therefore impacts of coal tar are not relevant to this analysis.

Coal ash is the remains of coal burned at power plants to produce electricity. Impacts of coal ash disposal were not addressed in this SDEIS because coal ash disposal has been addressed by the Environmental Protection Agency in a final rule published in April 2015. This rule promulgated a nation-wide set of regulations and analyzed the environmental impacts associated with coal ash disposal.

**The pending exploration or development plans in the Flatirons area needs to be addressed** – There are no new proposed coal leases within the Flatirons CRA. The effects of future leases and coal mining activities are reflected in the 2012 FEIS and this SDEIS through estimated road projections and coal production rates, which is sufficient for a programmatic analysis.

**The impacts of transportation of coal must be assessed** – Areas outside of roadless areas were generally not part of the study area in 2012 because the logical point to break off environmental analyses was roadless areas for a roadless rule since the majority of impacts would be limited to roadless areas. However, the GHG emissions related to the transport of coal is analyzed in this SDEIS because GHG emissions are best analyzed at a broader scale and are analyzed to address the court identified deficiencies (See Appendix A).

**There are likely hundreds of millions of tons of coal and thousands of acres beyond the 19,100 acre North Fork Coal Mining Area with CRAs that were not included in the exception area** – The purpose of the Colorado Roadless Rule is to conserve roadless area characteristics while providing for state specific concerns. The State did not express concern with coal recovery in other locations outside the North Fork Valley. The State petition originally included about 55,000 acres of roadless areas in the North Fork Valley to be addressed by the Colorado Roadless Rule. However, based on public comments the North Fork Coal Mining Area has been reduced in an attempt to balance between roadless conservation and the concern to not foreclose coal mining opportunities in the North Fork Valley.

**Inseam coal mine drilling should be considered** – BLM advises that there is no proposal for in-seam drilling and this rule would not foreclose that option. In-seam drilling is not a replacement for vertical drilling from the surface.

**The proposal is illegal because coal is not included in the Mining Act of 1872** – Coal is a leasable mineral and managed under the Mineral Leasing Act of 1920, as amended, not under the Mining Act of 1872. See Appendix C.

## *Renewable Energy*

**The U.S. Forest Service should replace fossil fuels with cleaner energy sources, such as solar and wind** – The replacement of fossil fuels with cleaner energy sources is outside the scope of this analysis because that is a national policy issue and outside the authority of the Department or U.S. Forest Service. Renewable energy is assumed to be a substitute for a portion of coal when estimating net GHG emissions in the economic analysis for the SDEIS.

## *Soil, Water & Fish*

**Impacts to soils should be disclosed** – Impacts to soils are generally best addressed at the project level. The 2012 FEIS sufficiently addressed impacts of soils in a general programmatic fashion.

**The U.S. Forest Service should consider that coal bed methane has the potential to pollute water** – The coal in the North Fork Valley are not coal bed methane reservoirs therefore development of coal bed methane is not expected to occur in this area. The permitting process for coal mining ensures impacts to water pollution are minimized.

**Location and number of wetlands, streams, downstream water resources, water availability/storage and important fish habitat should be analyzed** – The 2012 FEIS sufficiently addressed impacts to wetland, streams, water resources, and fisheries in a general programmatic fashion. For this SDEIS, a NEPA sufficiency review determined the need to further analyze impacts to Threatened and Endangered Species. This resulted in a revised Biological Opinion. More site-specific analyses of stream and water resources, outside the scope of the Biological Opinion, would occur if and when new coal actions are considered.

## *Air, Greenhouse Gases and Climate Change*

**Impacts to Class I airshed in adjacent West Elk Wilderness should be analyzed** – The 2012 FEIS sufficiently addressed impacts of air quality in a general programmatic fashion. More site-specific analyses of local air impacts would occur if and when new coal actions are considered.

**Air quality and volatile organic compound emissions should be analyzed** – The 2012 FEIS sufficiently addressed air quality and volatile organic compound emissions in a qualitative manner. In addition, more site-specific analyses of local air impacts would occur if and when new coal actions are considered.

**Greenhouse gas pollution from vehicles used to commute to coal mines should be analyzed** – GHG emissions from direct operations of coal mines are analyzed in detail in this SDEIS. However, analyzing GHG emissions from commuting workers is at a level of detail that is unnecessary for this programmatic analysis and not useful to the decision maker. In addition, for a complete analysis it would be necessary to determine new commuting patterns for displaced coal workers, which is highly uncertain.

**Environmental impacts of transporting North Fork Valley coal to domestic and international users should be analyzed** – This SDEIS estimates GHG emissions resulting from transport of coal to users. However, other environmental impacts of transporting coal to users are not analyzed in detail because they are outside the scope of this analysis and are highly speculative because mode and extent of transport is unknown.

**Include a cradle-to-grave analysis that considers all fossil fuel inputs as well as outputs to calculate the contributions to climate change and resulting impacts** – This SDEIS estimates GHG emissions from coal operations, transport and combustion of coal to address court identified deficiencies. The analysis accounts for the majority of the GHGs resulting from coal mining in the North Fork Coal Mining Area if it were to be entirely mined. Other inputs and outputs that would contribute to climate change from mining North Fork coal are minor and would not substantially change the relative difference between alternatives.

## *Insects & Disease*

**Opening the area in the West Elks up to extraction will be allowing bark beetle plague to spread in a whole new area** – Road construction/reconstruction, well pad development and underground coal mining are unrelated to the spread of bark beetles.

## *Wildlife*

**Impacts to general wildlife, predators, big game, connectivity, and biodiversity should be analyzed** – The 2012 FEIS sufficiently addressed impacts to general wildlife in a programmatic fashion. Federally listed aquatic and terrestrial wildlife are analyzed in detail in this SDEIS. Site-specific impacts could be addressed during project level analyses if and when a proposal is received.

**Coal mining is beneficial for livestock and wildlife by creating open areas for grazing** – Site-specific analysis could address the adverse and beneficial impacts if and when a proposal is made. However, reclamation of temporary roads and well pads has occurred in the area for years and has proven to be successful. Experience has shown that these reclaimed areas do provide forage which would be considered at the project level analysis.

**Deer herds in Colorado are in steep decline and predation, development, and human disturbance are prime suspects** – Mule deer herds are in decline in parts of western Colorado and are the focus of Colorado Parks and Wildlife's West Slope Mule Deer Initiative. Site-specific considerations for mule deer habitat needs could be addressed during project level NEPA if determined to be an issue warranting analyses and are beyond the scope of this programmatic analysis.

**Forest fragmentation has a very serious effect on wildlife and forest bird populations because it allows predators and nest parasites into deep woods** – The potential negative effects of forest fragmentation on certain wildlife and species were disclosed in the 2012 FEIS. Site-specific effects could be addressed at project level NEPA analysis if and when a proposal is received.

## *Roadless Areas & Values*

**The U.S. Forest Service should address keeping undeveloped roadless free from industrial use due to disruption to and value of local economies dependent on tourism, vast landscapes, wildlife, and recreational opportunities** – The purpose of the Colorado Roadless Rule is to address conservation of roadless characteristics across 4.2 million roadless acres while addressing state specific concerns. The Under Secretary for the Department of Agriculture determined in 2012 that setting aside a small portion of the 4.2 million acres of roadless areas for coal mining purposes would not disrupt roadless values for tourism, vast landscapes, wildlife and recreational opportunities. Impacts of these values are disclosed in the 2012 FEIS.

**Building roads and well pads in roadless destroys roadless values and should not be allowed** – Impacts to roadless characteristics was addressed in the 2012 FEIS. Site-specific analysis of impacts to roadless characteristics could occur if and when a site-specific proposal is brought forth. The allowance or temporary road construction is an attempt to balance the need to conserve roadless values while addressing state specific concerns. In addition, reclamation of temporary roads and well pads has been occurring in this area for many years and has proven to be successful. This past experience indicates that roadless values can be temporarily impacted and restored through proper reclamation.

**The U.S. Forest Service needs to disclose the NEPA analyses for justifying the location of the Sunset and Flatiron roadless boundaries** – The 2012 Colorado Roadless Rule (77 FR 39576) recently set the boundaries for CRAs after a long and involved public process and compromises. This supplemental analysis is not revisiting prior decisions on roadless boundaries other than to make technical corrections to boundaries associated with the North Fork Coal Mining Area based on updated mapping reflecting actual road locations.

**The area under consideration has been labeled roadless under false pretense because the area has seen heavy equipment and roads use in the past during the construction of stock ponds. This demonstrates the area can have roadless attributes after reclamation** – The 2012 Colorado Roadless Rule (77 FR 39576) recently set the boundaries for CRAs after a long and involved public process and compromises. This supplemental analysis is not revisiting prior decisions on roadless boundaries other than to make technical corrections to boundaries associated with the North Fork Coal Mining Area.

**Roads in roadless areas is contrary to the preservation of publicly owned lands** – The management purpose and administration of NFS lands are articulated in the Organic Administration Act and further expanded in the Multiple Use-Sustained Yield Act. Additional laws provide direction to the U.S. Forest Service in the management of these lands. Development of roadless areas is not necessarily contrary to the statutory purposes of NFS lands and the Secretary of Agriculture and U.S. Forest Service have broad discretion to determine the appropriate mix of uses of these lands pursuant to these statutes.

**The fragmentation of roadless areas by roads renders the areas no longer roadless and opens them up to further fossil fuel development** – Temporary roads and associated well pads that could be constructed within the North Fork Coal Mining Area would alter roadless characteristics in the area. However, after coal mining is complete, temporary roads and well pads would be reclaimed. Reclamation of temporary roads and well pads has been occurring in this area for many years and has proven to be successful. Past reclamation efforts indicate roadless values can be restored over time. Oil and gas development would be subject to the Colorado Roadless Rule and there is no provision for road construction for new oil and gas leases.

## *Wilderness*

**The U.S. Forest Service does not have the authority under the Wilderness Act of 1964 to allow roads in a roadless area without express authorization of the U.S. Congress** – The Wilderness Act of 1964 governs Congressionally designated Wilderness lands. Roadless areas are not Wilderness areas and the Wilderness Act does not apply to these lands.

**Roadless areas need to be designated as wilderness** – The Department and U.S. Forest Service do not have the authority to designate roadless areas as wilderness, which is reserved only to Congress.

**The SEIS must account for possible damage to wilderness capable lands for those areas identified as capable wilderness** – Impacts to areas identified as wilderness capable lands in the 2007 roadless evaluation process for the GMUG forest plan revision effort would have similar impacts as other areas within the North Fork Coal Mining Area if road construction or reconstruction were to occur. If road construction or reconstruction were to occur site-specific impacts would be assessed in a project level analysis if and when a proposal is received.

Areas identified as wilderness capable in the Flatirons and Sunset CRAs were determined to be "not available" and were not recommended for inclusion in the wilderness system in 2007. However, an alternative is included in this SDEIS that excludes areas identified as "wilderness capable".

**Wilderness areas and coal mining are not compatible. Coal mining is not appropriate in wilderness areas** – Lands within the North Fork Coal Mining Area and CRAs are not designated wilderness.

## *Recreation & Scenery*

**Increased likelihood for forest fires may result from allowing vehicular traffic and people camping in an area that is currently roadless** – Roads would not be open to the public for recreational purposes under the proposed North Fork Coal Mining Area exception (36 CFR 294.43(d)(4)).

**Once roads are made, people will drive off-road vehicles and other vehicles in, even if posted for no public use** – Roads would not be open to the public for recreational purposes under the proposed North Fork Coal Mining Area exception (36 CFR 294.43(d)(4)). Mining permits require successful reclamation before bonds are released. Use of these routes by motorized vehicles would be a violation of motor vehicle use regulations. Enforcement of closures is a local operational issue.

**Analyze the visual/aesthetic impacts** –The 2012 FEIS sufficiently addressed impacts to scenic quality in a general programmatic fashion. Site-specific analysis of impact to scenic quality could occur if and when a site-specific proposal is brought forth.

**Methane drainage wells will produce methane pollution near the Sunset trail** – The Sunset trail is not an officially designated NFS trail and thus is not managed as such. However, users of the area would not notice or be directly affected by methane emitted from any nearby wells since the methane would be dilute and not pose a safety hazard. Methane is non-toxic, odorless, colorless, and does not affect visual quality.

## *Socio-Economics*

**The IMPLAN model has limitations and requires further disclosure, customization, and analysis** – IMPLAN was used to show a marginal difference between alternatives. For relatively small changes that may not affect the underlying structure of an economy, a linear system of equations can adequately estimate non-linear relationships - again, looking to show marginal differences between alternatives.

**Assumptions on royalty rates must be disclosed and the declining rate must be explained** – Royalties on federal coal resources are managed by the BLM and all new leases would have a rate of

8%. It is not known at this time what adjustments the BLM may or may not make to future lease royalty rates. For the purposes of this SDEIS the regulatory-based 8% rate for new leases was assumed. All existing leases and associated coal would be analyzed considering the adjusted royalty rate of 5.6%.

**The U.S. Forest Service should better explain their cost determination factors** – The Mineral Leasing Act gave the Department of the Interior authority for mineral leasing. The BLM manages the competitive coal leasing process, and levies rents, royalties and bonus bids on federal coal resources as defined in the BLM regulations at 43 CFR 3400. See Appendix C.

**The SEIS should analyze the social cost of methane**– There is no standard or accepted methods of analyzing the social cost of methane. However, estimated methane emissions have been quantified and the social cost of carbon has been analyzed.

**The economic impacts of transporting coal to domestic and international end users must be analyzed** – Such analysis is outside the scope/outside the study area. The direct, indirect and induced economic impacts from U.S. Forest Service actions are considered within the study area a study area based on accepted regional economic impact modeling protocol.

**The SEIS must analyze the environmental and economic implications of coal export activities** – Such analysis is outside the scope of this analysis. The direct, indirect and induced economic impacts from U.S. Forest Service actions are considered within the study area - modeling impacts outside of that would be highly speculative.

## *Cumulative Effects*

**The U.S. Forest Service should consider the cumulative effects of mining and burning fuel as it pertains to human health, financial costs of cleaning the water supply, and of providing medical service to those injured by the coal industry. In addition the U.S. Forest Service should have the coal companies fund medical treatment for those impacted by mining** – The effects of mining and burning coal to human health, financial costs of cleaning water supplies, and providing medical services to those injured by the coal industry are highly speculative, would not provide meaningful information to improve a decision and outside the scope of this analysis. The impacts to site-specific water supplies could be addressed in site-specific NEPA analyses if determined to be a significant issue.

**The cumulative effects of coal mining and gas development within the larger landscape of the Upper North Fork Valley must be considered** – The cumulative effects of coal mining and gas development across the 4.2 million acres of CRAs were assessed in the 2012 FEIS. Areas outside of roadless areas were generally not part of the study area in 2012 because the logical point to break off environmental analyses was roadless areas for a roadless rule because the majority of impacts would be contained to roadless areas.

## *Rulemaking*

**The U.S. Forest Service must update the regulatory impact analysis and cost-benefit analysis** – Regulatory impact analyses are only required for significant rulemaking. The Office of Management and Budget determines the significance and determined this proposed rule to be not significant.

**The Colorado Roadless Rule is less protective than the 2001 Rule as demonstrated by the predicted amount of miles of road and linear construction zones that may be built** – This was addressed in the Final Rule and Record of Decision for the Colorado Roadless Rule published in the Federal Register on July 3, 2012. The Colorado Roadless Rule provides a higher degree of protection by designating about 459,100 acres as roadless which were not covered by the 2001 Roadless Rule. The Colorado Roadless Rule designated 1,219,200 acres as upper tier, which are acres where exceptions to road construction and tree cutting are more restrictive and limiting than the 2001 Roadless Rule. In addition, the use of linear construction zones was not restricted in the 2001 Roadless Rule. The Colorado Roadless Rule addresses the use of linear construction zones and encourages placement of linear facilities outside of roadless areas or co-locating facilities if they must be constructed in CRAs.

**Coal extraction should not be allowed in roadless areas because wind and solar projects are not allowed** – The overall purpose of the Colorado Roadless Rule is to conserve roadless area characteristics while providing for state specific concerns. Wind and solar energy projects were not raised as state specific concerns and thus were not provided for within CRAs.

**The U.S. Forest Service should not delay reinstatement of the North Fork Coal Mining Area exception because it jeopardizes the viability of coal reserves** – The Department must adhere to rulemaking and environmental compliance laws and regulations to reinstate the exception. Opportunities for coal recovery in some areas of the North Fork Coal Mining Area could be forgone, depending on the length of time it takes to reinstate the exception.

**The roadless rule exists to keep roads out of wilderness areas** – Roads in wilderness areas are prohibited by the Wilderness Act. The Secretary of Agriculture has broad discretion to determine how roadless areas should be managed. In the case of the Colorado Roadless Rule, the Secretary seeks to balance the desire to maintain roadless area characteristics while addressing state specific concerns.

## *Miscellaneous*

**Fracking** – Comments regarding fracking are outside the scope of this supplemental analysis because no fracking is being proposed and fracking is not associated with coal exploration or other surface uses.

**Since the focus of the North Fork Coal Mining Area exception is narrowly drawn to the North Fork Valley, the SEIS should focus analysis on individual projects. The 2012 FEIS was overly broad that doesn't provide thorough analysis of impacts. Tiering has limits which are stretched when an agency relies on a broad programmatic EIS to address actions that have more focused, foreseeable impacts** – Outside of existing leases, there are only one lease-by-application, two lease modification applications and one lease modification pending within the North Fork Coal Mining Area. It is unknown if and when a project proposal would be brought forth and the extent of any future proposals. In addition, a project proposal brought forth now could look substantially different than a proposal brought forth two decades from now due to advancements in technology.

Despite the limited focus of this SDEIS, this is still a landscape level, programmatic analysis that does not approve, authorize or compel any activities within the North Fork Coal Mining Area. No irreversible or irretrievable commitments of resources are made with the Rule. One of the purposes

of programmatic analyses is to facilitate an expeditious path towards decisions of proposed actions (79 FR 76986) through a tiered analysis and decision making process. Tiering is a means to eliminate duplicative analyses and to focus on the issues ripe for the decision (40 CFR 1502.20). Programmatic NEPA reviews streamline decision making by allowing agencies multi-faceted actions, such as the Colorado Roadless Rule, "without becoming immersed in all the details of future site or project specific proposals" (CEQ, 2014). Appropriate site-specific analyses for future coal mining activities could occur if and when a new proposal is brought forth.

Programmatic reviews do not relieve the agency from taking a "hard look" at the environmental consequences. However, site or project specific impacts do not need to be fully evaluated so long as enough detail is provided to make a reasoned choice between alternatives (CEQ, 2014). In this case, a high level of detail is not necessary to make a reasoned choice on whether temporary roads should or should not be allowed for coal mining related activities at a landscape level. The key environmental concerns related to the decision are being addressed, which include coal resource availability, GHG emissions, climate change, listed federal species and coal economics. Other resources, such as soil, water, vegetation, general wildlife, etc., impacts will correspond to the extent of the proposal (i.e. Alternative A will have the least impact since only existing leases could be produced; Alternative B could have the most impact since the area for allowing temporary road construction is the largest; and Alternative C could be in between A and B since the acreage allowing temporary road construction is between A and B). The nature and types of impacts for the other resources were disclosed in the 2012 FEIS and is sufficient for the decision maker to make a reasoned choice. The site or project specific impacts could be reviewed at a later tier of analysis.

**The U.S. Forest Service needs to provide the NEPA documents that supported the decision to construct routes 711.3B, 711.3C and portions of FR711 in the Flatirons area** – These roads existed prior to the enactment of NEPA and thus no NEPA documentation exists for the construction of these roads.

**The EIS should document when the temporary nature of the activities will come to an end and how termination will be enforced** – The exact time coal activity could come to an end if the North Fork Coal Mining Area is reinstated is unknown. However, estimated coal resources would be exhausted at a low production scenario in about 35-40 years. This could vary depending on future coal demand. Reclamation is covered by the permitting agencies and would be complete before the lease is terminated. Termination of a lease is managed by the BLM; termination of liability under coal mining permits is managed by the State of Colorado.

**Impacts of coal burning on high alpine watersheds from acid deposition of nitrogen must be disclosed** – This type of analysis would be highly speculative because it is so far downstream of a decision related to roadless conservation with limited exceptions for temporary road construction and reconstruction. Information such as location of where the coal would be combusted, efficiency of combustion, quality of coal, and many other factors would need to be known to conduct such an analysis. Such analysis is best performed during the permitting process for power plant projects.

**The SEIS should not consider assumed impacts from future development of potential reserves since the size and potential of these reserves remains unknown and will require future, site-specific analysis** – Although the extent of reserves is unknown and future site-specific analyses would occur if and when a project proposal is received, it is known that the reinstatement of the North

Fork Coal Mining Area exception would facilitate access to area with potentially recoverable coal resources. General impacts of this increased potential were disclosed in the 2012 FEIS.

**The Federal Government should undertake policies to reduce, not expand, our emissions of GHGs** – Policy development for the entire Federal Government is outside the scope of this analysis.

**This proposal is inconsistent with the Administration's position on climate change and the President's Clean Power Plan** – The climate change analysis references and considers *The President's Climate Action Plan* (The White House, 2013); *The Threat of Climate Pollution: Colorado* (The White House, 2014); and the *Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts* (CEQ, 2014). The programmatic nature of this decision does not authorize coal mining in the North Fork Coal Mining Exception Area. This is not a coal leasing decision; any future coal leases if and when they are received would be reviewed and subject to site-specific analyses. The President's Clean Power Plan focuses on the generation of electricity (power plants), whereas this decision considers temporary road construction and reconstruction to facilitate access to federal coal resources. This level of analysis is consistent with the draft CEQ guidance (December 2014) on how to consider the effects of GHG emissions and climate change in evaluations of federal actions under NEPA.

# Appendix C Legal and Regulatory Framework for Federal Coal Resource Management

The authority to manage exploration and development of mineral and energy resources within NFS lands is jointly shared between the Secretary of the Interior and the Secretary of Agriculture. The Secretary of the Interior is statutorily charged with the administration of the mineral leasing laws. Consequently, the Department of the Interior issues mineral leases for NFS lands. In addition, the Secretary of the Interior has the authority to approve operations for the benefit of mineral leases issued for NFS lands.

Federal coal resources are managed under separate laws that pertain to leasing the coal resource, and then for authorizing (i.e. permitting) development of those resources. In both cases, Congress gave the Department of the Interior primary authority for implementing these laws.

The U.S. Forest Service policy with respect to leasable minerals, such as coal, is to cooperate with the Department of the Interior in administering lawful exploration and development of these minerals. While the U.S. Forest Service is mainly involved with surface resource management, it recognizes that mineral exploration and development are ordinarily in the public interest and can be compatible in the long term, if not immediately, with the purposes for which the NFS lands are managed (Forest Service Manual 2822.03).

## *Exploration and Leasing*

The responsibility for federal coal exploration, leasing and lease management is carried out for the Department of the Interior by the BLM. The BLM works to ensure that the development of coal resources is done in an environmentally sound manner and is in the best interests of the Nation.

The authority for exploring federal coal resources and issuing coal leases within NFS lands reserved from the public domain is the Mineral Leasing Act of 1920, as amended by the Federal Coal Leasing Amendments Act of 1976, 30 USC 181 & 201-09. These statutes provide that the Secretary of the Interior may issue coal leases for such reserved lands "only upon the consent of the [U.S. Forest Service] and upon such conditions as it may prescribe with respect to the use and protection of the non-mineral interests in those lands." (30 USC 201(a)(3)(A)(iii)).

The authority for issuing coal leases for acquired NFS lands is the Mineral Leasing Act for Acquired Lands, 30 USC 351-359. That statute provides that the Secretary of the Interior may issue coal leases for acquired lands only "with the consent of [the Secretary of Agriculture] and subject to such conditions as [he] may prescribe to insure the adequate utilization of the lands for the primary purposes for which they have been acquired or are being administered." (30 USC 352.)

The BLMs implementing regulations governing coal are set forth at 43 C.F.R. Parts 3400 through 3480. These regulations lay out the BLMs regulatory procedures for exploration licensing, competitive leasing, noncompetitive leases, licenses to mine, management of existing leases, environment, coal management provisions and limitations (including fees, rentals, and royalties), and coal exploration and mining operations rules. In these regulations, the U.S. Forest Service participates in BLMs process according to roles and responsibilities defined for the surface managing

agency. As a surface managing agency, The U.S. Forest Service has specific authority under the Federal Coal Leasing Amendments Act to prescribe conditions for use and protection of NFS lands in an exploration license, and the authority to consent to BLM issuing leases, and to prescribe conditions for use and protection of non-mineral interests in the lands.

## Permitting

The Surface Mining Control and Reclamation Act of 1977 (30 USC 1201), established a regulatory program to ensure that surface coal mining operations are conducted and reclaimed in an environmentally sound manner, established a nationwide program to protect society and the environment from adverse effects of coal mining, strikes a balance between environmental protection and coal production, and assured that lands disturbed for coal mining purposes are reclaimed as contemporaneously as possible. The Surface Mining Control and Reclamation Act also established OSMRE within the Department of the Interior to carry out the provisions of the law. OSMRE's regulations (30 CFR 700) also establish that the federal land management agency is responsible for determining the post-mining land use, protecting non-mineral resources, requiring conditions within its jurisdiction to regulate coal mining and reclamation activities, and where land containing leased Federal coal is under the surface jurisdiction of a Federal agency other than the Department, concur in the terms of the mining plan approval. When leased Federal coal is proposed to be produced, pursuant to 30 CFR 746, OSMRE prepares a mining plan decision document in support of its recommendation to the Assistant Secretary for Land and Minerals Management. For approved Federal coal mining plans that are proposed to be modified, OSMRE prepares a mining plan decision document for a mining plan modification. The ASLM reviews the mining plan decision document and decides whether or not to approve the mining plan or mining plan modification, and, if approved, what conditions, if any, may be required.

A key provision of Surface Mining Control and Reclamation Act allows individual states to gain primacy for coal mine permitting, subject to a regulatory program consistent with the Surface Mining Control and Reclamation Act approved by the OSMRE, and formalized by state-federal cooperative agreements. Such is the case in Colorado, whereby the Colorado Department of Natural Resources, through the Division of Reclamation, Mining and Safety regulates and permits coal mining operations in the state with oversight from the OSMRE. Colorado's cooperative agreement with OSMRE is codified in 30 CFR Part 906.

The Division of Reclamation, Mining and Safety operates its program according to the Colorado Surface Coal Mining Reclamation Act (Title 34, Article 33 of the Colorado Statutes), and the Regulations of the Colorado Mined Land Reclamation Board for Coal Mining (Colorado Coal Rules) pursuant to the Colorado Surface Coal Mining Reclamation Act. The Colorado Coal Rules set out requirements for permitting, performance standards (including reclamation), bonding, and inspections and enforcement. The Colorado Coal Rules set out procedures for reclamation, and require that disturbed land be returned to approximate pre-mining slope and general nature of pre-mining topography, and be revegetated with an effective and permanent vegetative cover that supports the post-mining land use. On federal lands the Colorado Roadless Rules acknowledge that the post-mining land use must be compatible with the federal land management plan. The Colorado Roadless Rules also establish requirements, standards and criteria for measuring revegetation success.

In coal mine permitting actions, the U.S. Forest Service interacts with the Division of Reclamation, Mining and Safety and/or the OSMRE according to roles and responsibilities assigned to the federal land management agency in the state-federal cooperative agreement. In Colorado, the U.S. Forest Service as a federal land management agency, has responsibility during permitting actions to determine if the action provides for the post-mining land use consistent with the applicable land management plan, and to determine the adequacy of measures to protect Federal resources not covered by the rights granted by the federal coal lease (30 CFR Part 906, Appendix B). If a permitting action also requires the OSMRE to consider a federal mining plan approval under the Mineral Leasing Act, as amended, and per 30 CFR 746, the U.S. Forest Service has a role to concur to the terms of approval.

Procedurally, the Colorado Division of Reclamation, Mining and Safety is responsible for managing the permitting process, engaging other state and federal agencies for review, and approving the permitting action. The Colorado Division of Reclamation, Mining and Safety, with oversight from OSMRE, is responsible for conducting compliance inspections, and taking necessary enforcement actions on coal mining operations in Colorado. OSMRE is responsible for establishing and ensuring compliance with safety and health standards, minimizing health hazards, and promoting improved safety and health conditions in the Nation's mines.

## *Other Mineral-Related Laws*

The federal agencies must also comply with other mining and mineral-related laws when managing federal coal resources. In the Mining and Minerals Policy Act of 1970 (30 USC 21(a)), the Congress declared (in part) that it is the continuing policy of the Federal Government in the national interest to foster and encourage private enterprise in developing economically sound and stable domestic mining, minerals, metal and mineral reclamation industries, and in the orderly and economic development of domestic mineral resources and reserves to assure satisfaction of industrial security and environmental needs.

# Appendix D **Background of the Roadless Issue**

## *Wilderness Act*

On September 3, 1964 Congress passed the Wilderness Act (P.L. 88-577, 78 Stat 890 as amended) to preserve and protect some federal public lands in their natural condition for current and future generations of Americans. The Act defined wilderness as:

> *[A]n area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain.*

In addition, the Act further defined wilderness as:

> *[A]n area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve it natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.* 16 U.S.C. 1131.

The Wilderness Act established the National Wilderness Preservation System (Wilderness System) and reserved the authority to designate areas for inclusion in the Wilderness System only to Congress. In addition, the Act directed the Secretary of Agriculture to review NFS lands for suitability or non-suitability of "primitive" areas for inclusion in the Wilderness System within ten years after the enactment of the Act. The findings were to be reported to the President who in turn would advise Congress on the recommendations on which areas should be officially designated wilderness.

## *Roadless Area Review and Evaluation*

To meet the requirement of the Wilderness Act the U.S. Forest Service began a process, known as Roadless Area Review and Evaluation (RARE I), in 1972. In October 1973 RARE I was completed. RARE I considered 1,449 areas containing about 56 million acres but identified only 274 areas containing about 12.3 million acres as candidates for inclusion into the National Wilderness Preservation System. Controversy and litigation immediately followed the completion of RARE I. One of the major concerns with RARE I was the methodology the U.S. Forest Service utilized to disqualify roadless areas from consideration for inclusion. The U.S. Forest Service utilized Section 4 (Limitations of Use and Activities) of the Wilderness Act as the basis of disqualification for consideration, which substantially limited the amount considered. In addition, there were concerns regarding the completeness of the inventory, level of public participation, and procedural requirements of the recently enacted NEPA.

These concerns led the U.S. Forest Service to conduct a second Roadless Area Review and Evaluation (RARE II) starting in 1977. The U.S. Forest Service modified their review and evaluation process and changed the primary criterion for inclusion into the roadless inventory from whether or not the areas should be wilderness based on Section 4 of the Wilderness Act to strictly was the area suitable based on the definition of wilderness from Section 2(c) of the Wilderness Act. This

expanded the review to 2,919 roadless areas containing over 62 million acres. In addition, the public was invited to provide input on the review and evaluation. In January of 1979, the U.S. Forest Service completed RARE II and recommended about 15 million acres for Wilderness designation, 12 million acres for further consideration, and 36 million acres for non-wilderness uses.

Once again, controversy and litigation followed the completion of the RARE II. The State of California challenged the adequacy of the RARE II EIS. The District Court for the Eastern District of California enjoined the U.S. Forest Service from further development in 47 roadless areas in *California v. Block* (483 F. Supp. 465, E.D. Cal. 1980) based on NEPA deficiencies. The Ninth Circuit Court of Appeals affirmed the District Court injunction in *California v. Block* (690 F.2d 753, 9th Cir. 1982).

## National Forest Management Act

On October 22, 1976 the National Forest Management Act was enacted to provide additional provisions (amending the Forest and Rangeland Renewable Resources Planning Act of 1974) for developing, amending and periodically revising land and resource management plans (forest plans). National Forest Management Act directed the adoption of regulations to guide forest planning to accomplish goals set by Congress under the principles of the Multiple Use-Sustained Yield Act of 1960 (16 U.S.C. 1604(g)). In 1979 the U.S. Forest Service adopted regulations for forest planning (36 CFR 219) and in 1982 the U.S. Forest Service revised those regulations. As a result of *California v. Block*, the U.S. Forest Service on September 7, 1983 revised 36 CFR 219 to include provisions for roadless area review and evaluation during the forest planning process. In addition a provision was removed that prohibited consideration in the forest planning process of wilderness potential of RARE II areas that had been made available for non-wilderness multiple-use.

From 1983 to 2001, the roadless issue has generally been addressed on a forest-by-forest basis through a two-tier planning process: forest planning and project planning. A forest plan would review and update the roadless inventory; evaluate each individual roadless area; and make a recommendation for inclusion in the Wilderness System. A U.S. Forest Service Handbook (FSH) was developed to guide the review and evaluation of lands for potential wilderness during the forest planning process (FSH 1909.12,7). During project planning, site-specific impacts of proposed actions on roadless areas would be evaluated (if roadless was a significant issue) in context of the wilderness evaluation criteria outlined in FSH 1900.12. Generally, project proposals for development of roadless areas were controversial and often litigated.

## 2001 Roadless Area Conservation Rule

On October 13, 1999 President Clinton directed the Secretary of Agriculture to develop regulations for the long-term conservation of most or all roadless areas. On January 12, 2001 the Roadless Area Conservation Rule (2001 Roadless Rule or 2001 Rule) was issued and was to take effect on March 13, 2001 but was subsequently delayed by the Bush Administration. The nation-wide rule applied to about 58.5 million acres of NFS lands across the U.S. and prohibits road construction, reconstruction, and tree cutting with certain limited exceptions. The 2001 Roadless Rule recognized that road construction, reconstruction, and tree cutting have the greatest likelihood of impacting roadless areas. In addition, the 2001 Roadless Rule defined nine roadless area characteristics, which include:

1. High quality or undisturbed soil, water, and air;

2. Sources of public drinking water;
3. Diversity of plant and animal communities;
4. Habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of lands;
5. Primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation;
6. Reference landscapes;
7. Natural appearing landscapes with high scenic quality;
8. Traditional cultural properties and sacred sites; and
9. Other locally identified unique characteristics.

Controversy and litigation immediately followed the issuance of the 2001 Roadless Rule. Litigation and associated injunctions caused confusion and uncertainty around roadless area management. To address the confusion and uncertainty, the Bush Administration issued a series of interim directives until a new policy for roadless area protection could be developed.

The 2001 Roadless Rule fundamentally changed the U.S. Forest Service's approach to roadless area management that had been in place since 1983. First, rather than addressing the roadless area issue at the local forest level, the 2001 Roadless Rule established a nation-wide policy on how roadless areas are to be managed. Forest Supervisors and Regional Foresters no longer have the discretion to allocate inventoried roadless areas to non-wilderness multiple-use management areas during the forest planning process when the process called for road construction or tree cutting to reach desired conditions.

Second, it changed the concept of roadless areas from an inventory for supporting evaluation of areas for inclusion in the Wilderness System to a management area allocation. The 2001 Roadless Rule included "substantially altered" areas that were classified as roadless in RARE II but during intervening two decades roads emerged and were impacted by tree cutting. These substantially altered areas would have likely been removed from consideration during the evaluation for potential wilderness during the forest planning process. The term "inventoried roadless areas" became synonymous with the direction and boundaries of the 2001 Roadless Rule.

The new FSH 1909.12, Chapter 70, was developed to clarify the new National Forest Management Act implementing regulations (2012 version of 36 CFR 219), and no longer refers inventory of lands to be considered in a forest plan, potential wilderness evaluation, as a "roadless inventory". This change differentiated the management area allocation from the inventory for supporting evaluation of areas for inclusion in the Wilderness System. FSH 1909.12 does not apply to roadless rulemaking because U.S. Forest Service direction does not apply to the Secretary of Agriculture and wilderness evaluation and roadless rulemaking are two separate distinct processes with different outcomes. The wilderness evaluation process results in recommendations for areas to be included in the Wilderness System. Roadless rulemaking results in management area allocations in which road construction, reconstruction and tree cutting are prohibited with a limited set of exceptions.

## *2005 State Petition Rule*

On May 13, 2005 the State Petition Rule (also known as the 2005 Roadless Rule or 2005 Rule) was issued, which allowed the governor of a state to recommend roadless area policy in a state petition to

the Secretary of Agriculture. Once again, controversy and litigation immediately followed the issuance of the State Petition Rule and it was enjoined on September 20, 2006. Four states filed petitions with the Secretary under the State Petition Rule before it was enjoined: North Carolina, South Carolina, New Mexico, and California. These four states requested protection of roadless areas under the 2001 Roadless Rule or something similar. It was determined that state petitions could proceed under the Administrative Procedure Act (APA). Therefore Idaho and Colorado filed petitions after the injunction under the APA, and both states requested departure from the 2001 Roadless Rule.

The Idaho Roadless Rule was issued on October 16, 2008. Again, similar to all the large roadless efforts, controversy and litigation immediately followed the release of the Idaho Roadless Rule. However, the District Court of Idaho affirmed the Idaho Roadless Rule.

## *Colorado Roadless Rule*

Litigation surrounding both the 2001 Roadless Rule and State Petition Rule created instability around roadless area management. The main cause of the instability was injunctions placed on the implementation of the 2001 Roadless Rule and for a short period conflicting court orders between the District Court of Northern California and District Court of Wyoming in which the 2001 Roadless Rule was concurrently in effect and enjoined nation-wide. Figure C-1 displays when the 2001 Roadless Rule was in effect in the State of Colorado.

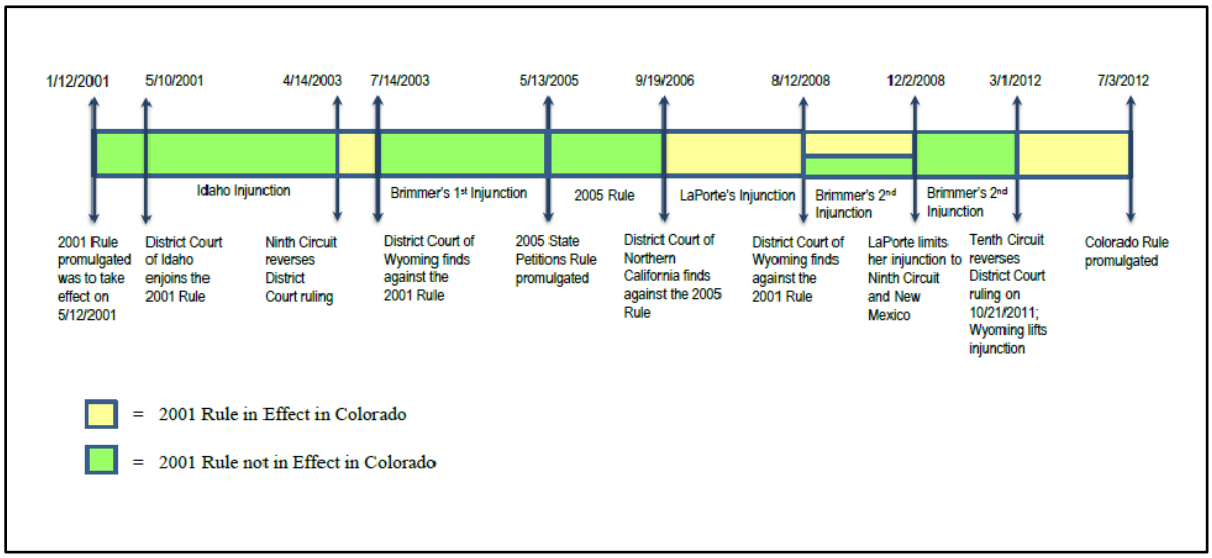


*Figure D-1: 2001 Roadless Rule in Effect*

Ongoing uncertainty of roadless policy in the U.S. was a key factor that influenced the State of Colorado to initiate a state specific petition. On June 8, 2005, then-Governor Bill Owens signed Colorado Senate Bill 05-243 which directed the formation of a 13-person bipartisan task force to make recommendations to the Governor on how to manage roadless areas on NFS lands in the state. On July 14, 2005 the State of Colorado announced it would submit a petition requesting regulatory protections for roadless areas within the state. On November 13, 2006 Governor Owens submitted a petition to the Secretary of Agriculture utilizing the task force's recommendations as the basis.

After Colorado's petition was submitted, Bill Ritter, Jr. was elected Governor of Colorado. On April 11, 2007, Governor Ritter resubmitted the 2006 petition with minor modifications. In June 2007 the State of Colorado and U.S. Forest Service presented the petition to the Department's Roadless Area Conservation National Advisory Committee (RACNAC). Based on the committee's review and report, the Secretary of Agriculture directed the U.S. Forest Service to cooperate with the State of Colorado to initiate rulemaking for roadless area conservation in the state.

On July 25, 2008 the U.S. Forest Service published a proposed rule and DEIS to establish direction for conserving roadless areas on NFS land in Colorado. On July 3, 2012 a final rule was published and became effective immediately. Since promulgation of the Colorado Roadless Rule, two lawsuits have been filed. One is still in judicial review at the time of this writing and the other resulted in the vacatur of the North Fork Coal Mining Area exception. This SDEIS seeks to reinstate the North Fork Coal Mining Area exception by addressing the court identified NEPA deficiencies (See Appendix A).

# Appendix E **Economic Analysis Methodology**

This Appendix further highlights the methods, assumptions and detailed information and models used for the economic analysis. Additional information is also available in the planning record for those with specific interests in the analysis process.

## *Study Area Assumptions*

**The U.S. Forest Service included Gunnison County in the economic impact analysis**

In support of the SDEIS, a 2013 IMPLAN model was customized using techniques similar to those used for the IMPLAN model employed for the Colorado Roadless Rule FEIS. Fundamentally, coal mines located in Gunnison County, just east of the county line with Delta County, were added to the model of the economic impact study area. Reason for the adding the mines is that all labor and local material/service inputs to the Gunnison County mines flow from counties to the west and not from within Gunnison County. The mines are located in the far northwestern corner of the county, which are not easily accessible from the central business corridor of Gunnison County. Economic linkages of these coal mines extend west down the North Fork Valley to Montrose and Grand Junction, not east to the cities of Gunnison and Crested Butte.

## *Analysis Methods and Assumptions*

### North Fork Coal Production

**North Fork Coal Mining Area Coal Substitutes- Characteristics**

North Fork Coal Mining Area coal is a bituminous coal that is characterized by low sulfur content and a heat content of about 12,000 Btu/lb. Other coal with similar characteristics includes coal from Utah, the Green River area of Colorado and Wyoming, Central Appalachia, and Colombia. Table E-1 provides a comparison of the heat and sulfur contents of these coals. Note that other coal characteristics also play a role in determining suitability for consumption at a particular coal-fired plant, but rank, sulfur content, and heat content are the primary determinants. The other characteristics include chlorine and mercury content, percent ash, and the percent of other trace metals and minerals.

***Table E-1.*** *Comparison of Coal Characteristics*

| *Basin* | *State* | *Sulfur Content (lb* sulfur dioxide*/MMBtu)* | *Heat Content (MMBtu/ton)* |
|---|---|---|---|
| Uinta | Colorado | 0.8 | 24.0 |
| Uinta | Utah | 0.6 | 23.4 |
| Green River | Colorado | 0.9 | 22.7 |
| Green River | Wyoming | 1.1 | 22.0 |
| Central Appalachia | Kentucky (eastern) | 1.0 | 25.0 |
| Central Appalachia | Virginia | 1.0 | 25.9 |
| Central Appalachia | West Virginia (southern) | 1.1 | 24.4 |
| Colombia | Imported | 0.6 | 21.6 |

*Source: IPM, 2015*

## Economic Impact Analysis Methods and Assumptions

**The U.S. Forest Service used the IMPLAN modeling system to conduct economic impact analysis**

- IMPLAN is a proprietary economic modeling system that includes both input-output modeling software and accompanying data sets based on publicly available secondary sources. The system was initially designed and developed by the U.S. Forest Service in the 1970's, then privatized in the 1990s. Agency tools and protocols have been designed to fully utilize the IMPLAN modeling system.
- The U.S. Forest Service is one of several Federal agencies that make data available to the IMPLAN Group, LLC owner of the IMPLAN modeling system, for development of the annual IMPLAN dataset.
- The U.S. Forest Service utilizes detailed protocols for editing and adjusting IMPLAN to work with agency resource data/corporate databases. IMPLAN is built on an MS Access database that allows U.S. Forest Service economists and contractors to complete analysis with specific data sets, such as using employment data from the Colorado Demography Office for IMPLAN modeling when working on projects in the state of Colorado.

**The U.S. Forest Service/Economic Insights of Colorado, LLC (EIC) customized IMPLAN for the impact analysis:**

- The U.S. Forest Service provided EIC with a 2013 model for Delta, Garfield, Mesa, Montrose, and Rio Blanco counties in Colorado using only IMPLAN data sets.
- The U.S. Forest Service received access to 2013 confidential employment data from the Colorado Department of Local Affairs, State Demography Office for the 5 counties. (This data set includes confidential employer information that cannot be released without approval by State Demography Office, and was returned to State Demography Office after use.)
- EIC updated the State Demography Office -IMPLAN customization procedure used for the 2012 FEIS because the IMPLAN sector scheme changed from 440 sectors in the 2012 FEIS data set to 536 sectors in the 2013 data set. The primary task accomplished by the procedure was to crosswalk employment data from State Demography Office sector definitions to 2013 IMPLAN sector definitions.
- EIC acquired additional county-specific 2013 coal mining data on production, employment, payroll, and prices from the Colorado Division of Reclamation, Mining, and Safety; Colorado Mining Association; and Energy Information Administration. Data for the coal mining sector in Gunnison County were added to the 5-county aggregation. Thus, coal mining data assembled and used for the analysis include both proprietary and confidential information that cannot be released without approval by the IMPLAN Group, LLC and Colorado State Demography Office. Based on these data, EIC made final estimates of production value, employment, and labor income for the entire coal mining sector (IMPLAN Industry #22) throughout the study area, including Gunnison County, and further customized the IMPLAN model.

- The resulting updated model was returned to the U.S. Forest Service for final calculation of study area multipliers, and then returned to EIC for analysis. At the 2-digit NAICS level, there are no confidentiality disclosures with the model. Individual IMPLAN sectors with small employment totals were reviewed by the U.S. Forest Service and State Demography Office for confidentiality disclosures before releasing to public.

## Benefits and Social Costs Methods and Assumptions

### ***Net Energy Production, Consumption, and Exports – Accounting for Market Substitution***

The IPM framework is used to model energy market response and substitution effect resulting from projected increases in availability of North Fork Coal Mining Area coal supplies (ICF 2015a and 2015b). IPM modeling results are used to estimate substitution response factors (e.g, response per million tons Colorado-Uinta coal produced) for the following:

- National underground coal production (million tons)
- National surface coal production (million tons))
- National natural gas production (Bcf)
- National coal consumption (Gwh from coal)
- National natural gas consumption (Gwh from gas)
- Coal exports (million tons)
- National power-generation cost savings ($)

IPM is an engineering and economic model of the coal and power sectors, supported by an extensive database of coal and power data parameters. The model has the ability to add new electricity-generating capacity in response to demand growth and policies, such as renewable portfolio standards. It is widely used to assess domestic and international coal production, transportation, and consumption, and the operations and economics of the U.S. electric power industry. The model also characterizes the U.S. natural gas industry. IPM is a multiregional model in terms of electricity demand regions, fuel demand regions, and coal supply regions that provides detailed results on a plant, regional, or national level. ICF International has maintained IPM since the mid-1970s.

The IPM model uses the National Energy Modeling System inputs and allows for smaller changes in coal supply, like the North Fork Coal Mining Area. The National Energy Modeling System does not accurately model smaller changes in supply.

In order to gain access to the IPM model, the U.S. Forest Service contracted with ICF International, a private, for-profit company with several General Services Administration contracts with the federal government in place. The model is proprietary, but the assumptions, methods, documentation, and results are available in this appendix and with additional detail, in the planning record for those interested.

**Coal Demand, Supply, and Substitution – IPM Modeling**

IPM does not extrapolate from historical conditions. Rather, it provides a least-cost forecast for a given set of current and future conditions that determine how the industry will function. The optimization routine that IPM uses has dynamic effects—it looks ahead at future years and simultaneously evaluates decisions over an entire specified time horizon, typically 20 to 40 years.

IPM uses a dynamic linear programming structure to model how electricity demand is met through a mix of generation and transmission in each region, as well as the transmission between regions. The North American version of IPM is divided into roughly 110 power demand regions, including eight Canadian provinces. The North American version of the model also includes international coal demand and coal supply regions to forecast global coal production and movement. A complete accounting of the all IPM model assumptions and methods is available in the planning record.

EPA uses IPM to analyze the impact of air emissions policies on the U.S. electric power sector. As part of this analysis, EPA publishes its assumptions and other information regarding its use of IPM on its website. Although this documentation provides insight into EPA's assumptions, the data and assumptions used by ICF in this analysis are not necessarily the same as used by EPA. However, ICF did use many of the EPA assumptions as described in more detail in Section 1.2 of documentation available in the planning record (ICF, 2015a).

For this analysis ICF is using EPA's coal supply curves from EPA's v5.13 IPM case (http://www.epa.gov/airmarkets/powersectormodeling.html). Because EPA only models the United States and does not include international representation beyond coal imports from Colombia and coal production from Canada, ICF has developed coal supply curves for each of the international supply regions used in the model, except for Canada. These international coal supply curves were adjusted over time at the average rate that the EPA domestic supply curves were adjusted. On average, the domestic EPA supply curves increase in cost by 1.5% annually. Thus the international supply curve costs were also increased by 1.5% per year. The coal prices that the EPA coal supply curves produce in the Base Case Scenario are shown in Table E-2 for Wyoming, Montana, Colorado, and Utah, which are regions from which coal might be supplied if North Fork Coal Mining Area coal was not available. Coal prices in 2016 for Wyoming Powder River Basin 17.6 MMBtu/ton coal are expected to be around $10.3/ton (2012$) and rising to $11.6/ton by 2018 (SNL, 2015). Thus, the EPA supply curves for Wyoming Powder River Basin coal result in prices somewhat higher than market expectations for 2016 and close to market expectations for 2018, as of mid-2015. Coal prices in 2016 for Utah coal are expected to be $40.8/ton (2012$) and rising to $41.2 by 2018. EPA's coal supply curves were most likely developed in 2013, at which time the Uinta Basin coal prices were in the $35/ton range. Thus, the EPA supply curves result in Uinta Basin coal prices that are below market expectations for the next few years. Since 2013, coal prices in general have declined by 10% to 20%, although some prices started declining in 2012 and others, such Powder River Basin coal fell 20% to 30% in 2012 and have been gradually increasing. Coal prices have decreased recently due to lower demand because of milder weather and because of being displaced by natural gas, which has been at historically low prices. In the mid- to long term, which is the focus of this analysis, coal prices are expected to increase above the low prices observed in 2015.

***Table E-2.*** *Coal Prices in the Base Case No Action Alternative (2012$/short ton)*

| *Year* | *Wyoming Powder River Basin, 17.6 MMBtu/ton* | *Montana Powder River Basin, 18.2 MMBtu/ton* | *Colorado Uinta, 23.58 MMBtu/ton* | *Utah Uinta, 23 MMBtu/ton* |
|---|---|---|---|---|
| 2016 | 11.17 | 11.48 | 27.38 | 25.01 |
| 2018 | 11.73 | 12.08 | 28.53 | 25.91 |
| 2020 | 12.33 | 12.75 | 30.15 | 27.03 |

| *Year* | *Wyoming Powder River Basin, 17.6 MMBtu/ton* | *Montana Powder River Basin, 18.2 MMBtu/ton* | *Colorado Uinta, 23.58 MMBtu/ton* | *Utah Uinta, 23 MMBtu/ton* |
|---|---|---|---|---|
| 2025 | 13.95 | 14.56 | 33.02 | 29.77 |
| 2030 | 15.74 | 17.87 | 36.53 | 33.13 |
| 2040 | 20.20 | 21.54 | 42.90 | 40.07 |
| 2050 | 25.86 | 28.69 | 56.06 | 49.88 |

*Source: SNL, 2015.*

However, of equal importance is that a cohesive view of the coal markets and coal prices is used in the analysis. Such a cohesive approach is obtained by using the EPA coal supply curves in their entirety.

**Natural Gas**

This analysis incorporates the natural gas module that EPA used in its IPM v5.13 Base Case. Using the natural gas module allows natural gas prices to adjust to changes in demand. Table E-3 shows the natural gas prices at Henry Hub, which is a major natural gas pricing point in Louisiana.

***Table E-3.*** *Natural Gas Prices in the No Action Alternative (2012$/MMBtu)*

| *Year* | *Henry Hub (2012$/MMBtu)* |
|---|---|
| 2016 | 4.79 |
| 2018 | 5.77 |
| 2020 | 5.18 |
| 2025 | 5.75 |
| 2030 | 5.84 |
| 2040 | 7.17 |
| 2050 | 9.11 |

*Source: IPM, 2015.*

**International Coal Demand**

International coal demand in the model is represented by a forecast of a region's or country's total thermal coal demand. ICF used the most recent EIA forecast available, which was EIA's 2013 International Energy Outlook for the international demand forecast. The EIA data was used because it is a publicly available source and because it provides coal demand forecast data in sufficient detail for the countries of interest. Table E-4 show the demand forecast for selected Asian countries.

***Table E-4.*** *Comparison of Alternatives*

| *Year* | *China* | *India* | *Japan* | *South Korea* | *Taiwan* |
|---|---|---|---|---|---|
| 2016 | 76,248 | 11,841 | 3,190 | 2,013 | 1,633 |
| 2017 | 79,543 | 12,111 | 3,190 | 1,992 | 1,641 |
| 2018 | 81,449 | 12,325 | 3,182 | 1,977 | 1,650 |

| Year | China | India | Japan | South Korea | Taiwan |
|---|---|---|---|---|---|
| 2019 | 83,174 | 12,675 | 3,188 | 1,961 | 1,658 |
| 2020 | 84,961 | 13,109 | 3,190 | 1,945 | 1,666 |
| 2021 | 87,254 | 13,482 | 3,190 | 1,947 | 1,675 |
| 2022 | 89,458 | 13,821 | 3,184 | 1,939 | 1,683 |
| 2023 | 91,682 | 14,187 | 3,173 | 1,927 | 1,691 |
| 2024 | 94,198 | 14,592 | 3,164 | 1,919 | 1,700 |
| 2025 | 96,410 | 14,904 | 3,151 | 1,899 | 1,708 |
| 2026 | 97,989 | 15,251 | 3,142 | 1,873 | 1,717 |
| 2027 | 99,672 | 15,641 | 3,131 | 1,843 | 1,725 |
| 2028 | 101,448 | 15,965 | 3,119 | 1,814 | 1,734 |
| 2029 | 103,146 | 16,280 | 3,105 | 1,781 | 1,743 |
| 2030 | 104,764 | 16,591 | 3,089 | 1,751 | 1,751 |
| 2031 | 106,167 | 16,951 | 3,077 | 1,754 | 1,760 |
| 2032 | 107,315 | 17,306 | 3,063 | 1,757 | 1,769 |
| 2033 | 108,297 | 17,659 | 3,042 | 1,757 | 1,778 |
| 2034 | 109,033 | 18,010 | 3,022 | 1,760 | 1,787 |
| 2035 | 109,484 | 18,346 | 3,001 | 1,761 | 1,796 |
| 2040 | 110,921 | 20,018 | 2,857 | 1,715 | 1,841 |
| 2050 | 117,440 | 24,153 | 2,642 | 1,680 | 1,935 |
| 2016–2019 CAGR | 2.94% | 2.29% | -0.02% | -0.87% | 0.50% |
| 2020–2029 CAGR | 2.18% | 2.44% | -0.30% | -0.97% | 0.50% |
| 2030–2050 CAGR | 0.57% | 1.90% | -0.78% | -0.21% | 0.50% |
| 2016–2050 CAGR | 1.28% | 2.12% | -0.55% | -0.53% | 0.50% |

*CAGR = cumulative average growth rate*

**Coal Reserves**

Coal reserves both domestically and internationally are an important companion input to annual coal production capacity in the coal supply curves. Over time as the reserves on a step on the coal supply curve are exhausted the solved equilibrium price must solve higher on the coal supply curve, thus generally pushing prices higher over time, all else equal.

The domestic coal reserve estimates used in this analysis are included in the EPA coal supply curves adopted from EPA's v5.13 IPM documentation. International reserve data is generally of lower quality and can be inconsistent between sources. If multiple sources of reserve estimates were available, the analysis used the higher estimates, as technological improvements tend to make resources available that might have been un-economic previously.

**Modeling Coal Production (ICF, 2015b)**

The IPM framework optimizes coal production, transportation, and consumption to meet given levels of demand. For this purpose, the model uses coal supply curves developed for EPA, which provide supply curves for 34 different domestic coal supply basins. The international coal supply curves for 25 international supply basins were developed by ICF and added to the domestic supply curves to allow for global coal modeling. Coal supply curves are developed for 15 coal types distinguished by rank and sulfur content. There are multiple coal supply curves for each supply basin corresponding to the major coal quality types in that region. The supply curves consist of a series of supply "steps" that consist of a production cost, annual production capacity, and a coal resource limit. These supply curves are then incorporated into IPM. Each coal power plant in IPM is assigned to its own coal demand region in the model.

Coal varies by heat content, sulfur dioxide content, hydrogen chloride content**,** and mercury content among other characteristics. To capture differences in the sulfur and heat content of coal, a two letter "coal grade" nomenclature is used. The first letter indicates the "coal rank" (bituminous, subbituminous, or lignite) with their associated heat content ranges (as shown in Table E-5). The second letter indicates their "sulfur grade," i.e., the $SO_2$ ranges associated with a given type of coal. (The sulfur grades and associated sulfur dioxiode ranges are shown in Table E-6).

***Table E-5.*** *Coal Rank Heat Content Ranges*

| *Coal Type* | *Heat Content (Btu/lb)* | *Classification* |
|---|---|---|
| Bituminous | >10,260–13,000 | B |
| Subbituminous | >7,500–10,260 | S |
| Lignite | Less than 7,500 | L |

***Table E-6.*** *Coal Grade Sulfur Dixoide Content Ranges*

| *Sulfur Dioxide Grade* | *Sulfur Dioxide Content Range (lbs/MMBtu)* |
|---|---|
| A | 0.00–0.80 |
| B | 0.81–1.20 |
| D | 1.21–1.66 |
| E | 1.67–3.34 |
| G | 3.35–5.00 |
| H | > 5.00 |

*Notes; MMBtu = pounds per million metric BTU*

IPM includes integrated U.S. and international coal market modeling. Figures E-1 and E-2 show the domestic and international coal supply regions. The modeling platform captures terminal capacity limits, international shipping costs, steam coal supply, and demand from both electricity and non-electricity sectors.

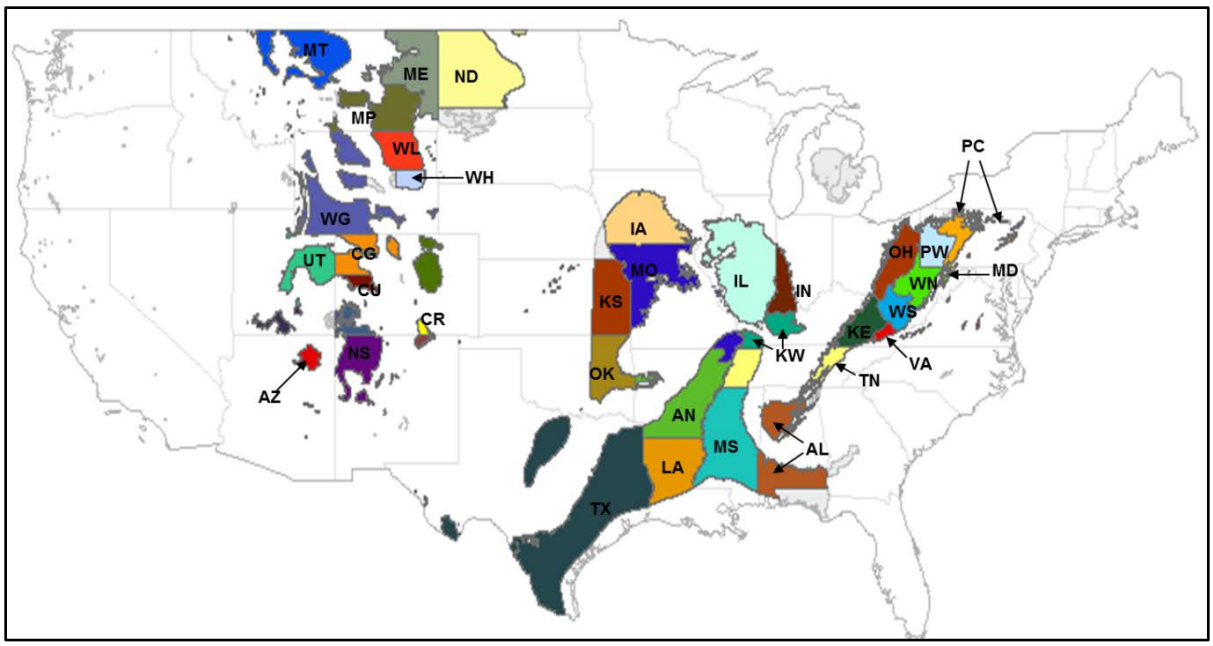


*Figure E-1. Domestic Coal Supply Regions*

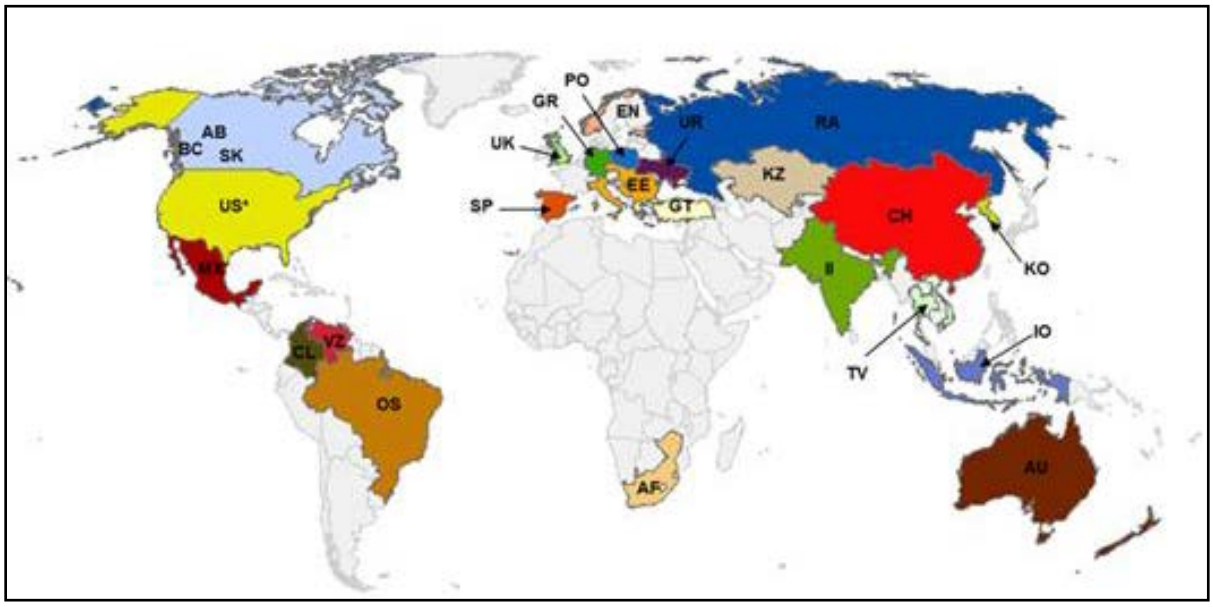


*Figure E-2. International Coal Supply Regions*

**Modeling Coal Demand (ICF, 2015b)**

Using IPM, coal demand is determined in the United States and Canada by the dispatch of existing coal-fired power plants, and elsewhere by projections of coal demand by country. Within a model run, IPM calculates thermal coal consumption for each coal-fired electricity generation plant in the United States and Canada. Thermal coal consumption and coal prices are determined by the supply and demand economics of meeting the electricity demand in each electric demand region and nationally. The plant specific coal consumption and coal supply region price projections result in an

integrated and consistent analysis in IPM of the electricity demand; natural gas supply and prices; air emissions regulations for nitrogen oxides, sulfur dioxide, hydrogen chloride, and mercury; carbon dioxide policy alternatives, and renewable portfolio standards and explicit modeling of renewable generation options.

If the future electricity demand cannot be met by existing power plants, IPM will determine the type and amount of new generating capacity required to meet the electricity demand on a least cost basis. The different types of capacity that can be added consist of combustion turbines, combined cycles, nuclear units, wind plants, coal-fired units, solar PV and thermal, geothermal, biomass, landfill gas, and hydro. Thus, if IPM determines that new coal plants in the United States and Canada are necessary, it will increase coal demand. IPM can also determine that it is most economical to retire existing coal plants, which would decrease coal demand. This is only applicable in the United States and Canada, as coal plants are modeled explicitly in only these countries. Using this structure, IPM is able to model explicitly the shifts in coal demand related to environmental mandates, natural gas prices, and coal production and transportation costs. For example, if natural gas prices are low, more electricity will be generated by natural gas-fired combined cycles, and coal consumption will be lower than in a case with higher natural gas prices. Outside of the United States and Canada, coal demand is estimated using historical coal consumption data, expected coal plant construction, and economic growth on a country-by-country basis.

Table E-7 shows the coal demand forecast for China, the rest of the Pacific Basin, and the United States. As the forecast shows, China will continue to be the largest thermal coal consumer through 2038.

***Table E-7.*** *Comparison of Alternatives*

| *Year* | *China*[a] | *Hong Kong*[a] | *India*[a] | *Japan*[a] | *South Korea*[a] | *Taiwan*[a] | *United States*[b] |
|---|---|---|---|---|---|---|---|
| 2018 | 81,449 | 339 | 12,325 | 3,182 | 1,977 | 1,650 | 17,423 |
| 2025 | 96,410 | 351 | 14,904 | 3,151 | 1,899 | 1,708 | 15,237 |
| 2030 | 104,764 | 360 | 16,591 | 3,089 | 1,751 | 1,751 | 13,386 |
| 2040 | 110,921 | 379 | 20,018 | 2,857 | 1,715 | 1,841 | 9,604 |
| 2050 | 117,441 | 398 | 24,153 | 2,642 | 1,680 | 1,935 | 7,919 |

*Notes:*

[a] *International total coal demand obtained from EIA International Energy Outlook 2013 and metallurgical coal demand was subtracted to obtain the thermal coal demand.*

[b] *The U.S. demand is from the Base Case Scenario of this analysis.*

In terms of non-electricity sector demand for thermal coal, IPM includes domestic and international forecasts that serve as the demand for this coal. IPM has an international coal supply and demand representation that enables it to project coal exports out of and imports into the United States and other countries. Table E-8 summarizes the overall U.S. electricity demand forecast.

***Table E-8.*** *U.S. Energy Demand Forecast*

| Year | Energy Demand (TWh) |
|---|---|
| 2016 | 4,048.7 |
| 2018 | 4,134.6 |
| 2025 | 4,390.0 |
| 2030 | 4,535.1 |
| 2040 | 4,887 |

*Notes: Source: EPA IPM V5.13 documentation*
*TWh = terawatt hours*

**Disposition of North Fork Coal and Potential for Substitution (ICF, 2015b)**

The current consumers of Uinta basin coal, as determined by those plants that have used Uinta Basin coal in 2013 or 2014, are 31 of the 45 plants identified as potential consumers of Uinta Basin coal. Table E-9 shows the 31 coal plants that have received some Uinta Basin coal during 2013 and 2014 and that are not fully retiring. This exhibit also shows the amount of Uinta Basin coal and other coal that each plant has consumed. Plants that have used Uinta Basin coal are indicated by an asterisk (*).

***Table E-9.*** *Coal Plants that have Consumed Uinta Basin Coal – Coal Consumption*

| Plant Name | Plant State | Average Annual Coal Consumption 2008-2014 (tons) | | | ***Total Average Annual Coal Consumption 2008-2014 (tons)*** |
|---|---|---|---|---|---|
| | | *Uinta Basin* | *Other Bituminous Coal* | *Other Subbituminous Coal* | |
| E C Gaston* | AL | 45,023 | 3,571,188 | 0 | 3,616,211 |
| Apache Station* | AZ | 156,718 | 0 | 1,047,626 | 1,204,344 |
| Coronado | AZ | 8,313 | 48,584 | 3,400,349 | 3,457,246 |
| Argus Cogen Plant* | CA | 650,050 | 0 | 0 | 650,050 |
| Cherokee* | CO | 1,646,617 | 0 | 0 | 1,646,617 |
| Craig | CO | 4,650,659 | 0 | 0 | 4,650,659 |
| Hayden* | CO | 1,489,825 | 0 | 0 | 1,489,825 |
| Valmont* | CO | 424,559 | 0 | 0 | 424,559 |
| Crystal River* | FL | 19,182 | 2,053,076 | 0 | 2,072,258 |
| Bowen* | GA | 11,116 | 6,842,178 | 0 | 6,853,295 |
| Shawnee*^ | KY | 2,129,996 | 54,367 | 1,773,102 | 3,957,465 |
| Herbert A Wagner^ | MD | 1,761 | 676,870 | 23,650 | 702,280 |
| Escanaba Mill* | MI | 26,671 | 3,777 | 0 | 30,448 |
| James De Young*^ | MI | 35,202 | 6,438 | 15,262 | 56,901 |
| TES Filer City Station* | MI | 41,513 | 112,386 | 0 | 153,899 |
| Wyandotte | MI | 8,949 | 44,439 | 18,566 | 71,954 |
| Jack Watson^ | MS | 76,529 | 1,346,555 | 0 | 1,423,085 |
| Victor J Daniel Jr*^ | MS | 763,347 | 372,054 | 787,880 | 1,923,281 |
| North Valmy* | NV | 646,764 | 0 | 751,374 | 1,398,138 |
| Bull Run* | TN | 112,220 | 999,191 | 0 | 1,111,410 |
| Cumberland* | TN | 762,999 | 4,092,146 | 0 | 4,855,455 |
| Gallatin* | TN | 10,165 | 4,227 | 1,063,052 | 1,077,444 |
| Kingston* | TN | 17,544 | 1,206,530 | 1,160,087 | 2,384,161 |
| Bonanza | UT | 1,912,214 | 0 | 0 | 1,912,214 |
| Hunter | UT | 4,274,184 | 0 | 0 | 4,274,184 |
| Huntington | UT | 2,745,725 | 0 | 0 | 2,745,725 |
| Intermountain Power Project* | UT | 5,097,421 | 0 | 0 | 5,097,421 |
| Kennecott Power Plant | UT | 104,790 | 0 | 0 | 104,790 |
| Sunnyside Cogen | UT | 237,139 | 0 | 0 | 237,139 |

| Plant Name | Plant State | Average Annual Coal Consumption 2008-2014 (tons) | | | ***Total Average Annual Coal Consumption 2008-2014 (tons)*** |
|---|---|---|---|---|---|
| | | *Uinta Basin* | *Other Bituminous Coal* | *Other Subbituminous Coal* | |
| Associates | | | | | |
| Elm Road Generating Station* | WI | 7,065 | 865,985 | 210,489 | 1,083,540 |
| Green Bay West Mill* | WI | 93,649 | 141,637 | 0 | 235,286 |
| **Totals** | | **28,207,909** | **22,441,628** | **10,251,747** | **60,901,284** |

*Source: Energy Information Administration Form 923*

** Plant has consumed North Fork coal during at least one year between 2008 and 2014.*

*^ Plant was not scrubbed as of 2015.*

Over the next few years, power plants that do not have sulfur dioxide scrubbers may be potential customers for North Fork Coal Mining Area coal, due to the low sulfur content of this coal. The low sulfur content of the North Fork Coal Mining Area coal allows these plants to meet their air permit requirements without the use of scrubbers. However, all of these plants are expected to retire or add scrubbers by 2018, and thus do not represent a long-term source of demand for North Fork Coal Mining Area coal.

Some North Fork Coal Mining Area coal also may be consumed at industrial facilities, although the quantity is significantly less than the amount used for power generation. EIA provides data on the amount of coal consumed for industrial purposes in Colorado. These data show that on average 310,000 tons of coal were consumed by industrial users in Colorado in 2012 and 2013 out of a total of 19,330,000 tons consumed for all purposes in Colorado, including power generation.

Some North Fork Coal Mining Area coal may also be exported to Asian countries through ports in California and to Europe via ports in the Gulf Coast. Although the amount of North Fork Coal Mining Area coal currently exported is not available, the amount of total Uinta Basin coal exports can be estimated based on the difference between production, as reported to the Mining Safety and Health Administration, and deliveries, as reported in the EIA Form 923 data. Using this method shows that Uinta Basin coal exports between 2008 and 2014 have been in the range of five to 10 million tons per year, which is approximately 10 to 20% of total coal production from the Uinta Basin. As demand for coal in Asia is expected to continue to increase, especially in China and India, it is likely that exports of North Fork Coal Mining Area coal and other Uinta Basin coal will continue in the future. If U.S. coal demand declines in the long term, the relative percentage of North Fork Coal Mining Area and Uinta Basin coal that is exported will likely increase.

**Coal Elasticity**

Electricity generation is typically price inelastic because many power plants are designed to operate with a particular fuel type and must operate within certain ranges because of reliability and environmental restrictions (compliance). Table E-10 shows the estimated U.S. natural gas-coal elasticity of substitution is 0.14, ranging from 0.05 to 0.38, suggesting lower potential for natural gas as a substitute for coal (i.e., displacing coal) if the affordability or availability of coal were to change. The regional elasticity is lower (0.05) for the Western Electric Coordinating Council (includes all states west of and including Montana, Wyoming, Colorado, and New Mexico), indicating lower ability to switch between coal and natural gas, due in part to coal being the dominating fuel used in power generation in the mountain states, while California and the Pacific Northwest currently satisfy

energy demand through hydropower and natural gas fueled plants. The Western Electric Coordinating Council elasticity is lower than that of the Southeastern States Reliability Corporation (southeastern states and Illinois) where current generating and transmission infrastructure favors plants fueled by lower cost energy sources (i.e., flexibility exists for generating energy among plants that use different fuels).

***Table E-10.*** *Estimated Elasticities of Substitution (cross-price) for Gas and coal for Relevant National Energy Modeling System* Regions

| *NERC Region* | *States and Provinces* | *Gas- Coal Elasticity; Coal Own Price Elasticity (2)* | *Notes* |
|---|---|---|---|
| Midwest Reliability Organization | ND, SD, MN, NE, WI, Saskatchewan, Manitoba | 0.08; -0.11 (not significant at 90% confidence level) | Generation capacity in Midwest Reliability Organization heavily skewed toward coal. |
| Southeastern States Reliability Corporation | Southeast states (not FL) and includes IL, MO, KY,TN, MS and VA (1) | 0.38; -0.22 ** | Infrastructure favors plants fueled by lowest cost energy (flexibility). |
| Western Electric Coordinating Council | All west of and including MT, WY, CO, UT, NM; Alberta, BC | 0.05; -0.14** | Low flexibility. Generation dominated by coal in mountain states; hydro and natural gas dominates in Pacific NW and CA. |
| United States | All | 0.14; -0.11** | |

*** = Significant at 95% confidence level;*

*Source: "Fuel Competition in Power Generation and Elasticities of Substitution" Energy Information Administration (EIA, June 2012).*

*(1) Midwest Reliability Organization excludes the southeast corner of Wisconsin near Chicago; Southeastern States Reliability Corporation includes portions of Missouri, Arkansas, and Louisiana west of Mississippi River; it excludes Florida, Nebraska, Illinois (Chicago), and eastern/western portions of Kentucky and Virginia.*

*(2) Gas and Coal Elasticity = percent change in ratio of natural gas consumed (X1) to coal consumed (X2) in response to percent change in price of coal to natural gas: %dif(Xg/Xc)/%dif(Pc/Pg). C Elasticity = %d(Xc)/%Pc.*

EIA (June 2012) estimates of 'own price elasticity of demand for each fuel type (e.g., likelihood that power generators will change their demand for coal in response to a change in coal price) are also shown in Table E-10 The coal price elasticity in the Western Electric Coordinating Council region, similar to that of the U.S., is equally not very responsive to changes in coal prices. Relatively low coal price elasticity values indicate that increases in the availability and corresponding decreases in prices may not trigger significant changes in production and consumption of coal.

Substitution may differ when looking at smaller sub-areas of electricity generation, including subsets of facilities consuming coal from the two existing North Fork mines.

**Potential fuel substitutes for North Fork Coal Mining Area coal**

When opportunities for expanded coal production from NFS lands are created under Alternatives B and C, a number of chain reactions may occur related to production and consumption of fuels, related to power generation. Chain reactions may include some degree of responses such as:

- An increase in the consumption of the coal for power generation,

- A decrease in the consumption of other substitute fossil fuels (including alternative coal sources in some cases), including natural gas,
- A decrease in the consumption of alternative fuel such as nuclear and renewable energy sources, and,
- An increase in total electricity production, reflecting the net effect of increased availability of coal fuel inputs for power generation.

The possible substitutes for North Fork Coal Mining Area coal at coal-fired power plants depend on a number of factors. At one extreme, only coal that has the same characteristics as the North Fork Coal Mining Area coal might be considered possible substitutes. However, other factors such as coal plant location, boiler design, coal handling and grinding equipment, air permit requirements, and environmental controls, all play an important role in determining the types of coal that might be substitutes for North Fork coal. Finally, other fuels may substitute for the consumption of North Fork Coal Mining Area coal for the production of electric power. These fuels include biomass, hydro, natural gas, nuclear, solar, or wind.

For those coal plants located east of the Mississippi River, where transportation costs from Central Appalachia would be lower than for a coal plant further west, substitutes for North Fork Coal Mining Area coal would include coal from Central Appalachia, as well as other Uinta Basin mines in Colorado and Utah. Coal plants near coastal ports might also be able to substitute North Fork Coal Mining Area coal with Colombian coal. However, for coal plants in the western U.S., substitutes for North Fork Coal Mining Area coal would only be from other western coal supply regions, such as Colorado, Utah, or Wyoming, as the transportation costs for coal from Central Appalachia or Colombia would make coal from these locations too expensive to be a viable option.

The design of a coal-fired power plant's boiler dictates the rank of coal that the plant can consume. The three ranks of coal used primarily for power generation are bituminous, subbituminous, and lignite. Due to the lower heat content of subbituminous and lignite coal compared to bituminous coal, the boilers for plants burning these types of coal are larger than boilers at coal plants consuming only bituminous coal. The boilers are designed larger because a greater amount of subbituminous coal must be consumed to generate the same amount of electric power as bituminous coal. Thus plants designed to burn bituminous coal only cannot switch to burning subbituminous coal exclusively. However, those plants may be able to blend in a portion of subbituminous coal along with the bituminous coal. Eleven of the plants that are potential consumers of North Fork Coal Mining Area coal (see Table E-9) use a mixture of both bituminous and subbituminous coal, and thus would be able to substitute both types of coal for North Fork Coal Mining Area coal.

For coal plants that consume Uinta Basin coal and other bituminous coal exclusively, the substitution options will be limited to other sources of bituminous coal, subject to the limitations of location as discussed above. These plants also may be able to substitute higher sulfur coal, such as from the Illinois Basin, depending on their air permit requirements and installed environmental controls.

Coal plants consuming only bituminous coal can make modifications to use subbituminous coal, although this is not an option for all plants. For example, subbituminous coal requires more space for stockpiles or the plant must be able to handle more frequent deliveries. Also subbituminous coal tends to be softer and dustier, which requires somewhat different coal handling and grinding equipment than that used for bituminous coal. Thus coal plants currently consuming only bituminous coal would

need to make capital investments to allow them to blend in the subbituminous coal. Such investments might be economic if the coal plant has a relatively long remaining life and there are not physical or technical restrictions on the use of subbituminous coal. These investments are unlikely at all but a small number of plants.

Coal plants with environmental controls, such as sulfur dioxide scrubbers, bag houses, and nitrogen oxide controls, have more options for the types of coal that they can consume and still meet their emissions limits than coal plants without controls. The impact of environmental controls on coal consumption can be observed in the amount of Central Appalachian coal that has been consumed. Over the last 15 years, there has been a slow erosion of demand for low sulfur Central Appalachian coal as more and more plants install sulfur dioxide scrubbers and are able to switch to higher sulfur alternatives from Northern Appalachia and the Illinois Basin. The pace of decline in demand has accelerated in the last six years to the point that demand for Central Appalachian coal has been cut in half since 2002. The low natural gas prices over the last four years have contributed to the decline in Central Appalachian coal demand. The combination of scrubber installations and low natural gas prices has had a synergistic effect on the decline in coal demand, causing a greater decline than would have been caused by these events separately.

Five of the 31 plants listed in Table E-9 do not currently have scrubbers; however, three of those five have plans to install scrubbers in the next three years. For coal plants with sulfur dioxide scrubbers, substitutes for North Fork coal might include lower sulfur coal from Central Appalachia and the Uinta Basin as well as higher sulfur coal from the Illinois Basin and Northern Appalachia. Illinois Basin coal has historically had prices similar to Uinta Basin coal, although Northern Appalachian coal has typically been sold at a $10 to $15/ton premium to Uinta Basin coal, in part due to its somewhat higher heat content. The higher price of Northern Appalachian coal makes it somewhat less likely than Illinois Basin coal to be a substitute for North Fork coal.

**IPM Scenarios**

Three scenarios were analyzed in this study. The three scenarios differ only in how the coal supply curve for the Colorado Uinta Basin is treated. Two of the three scenarios were analyzed due to the uncertainty about whether the coal supply curves include the North Fork coal reserves or not, while the third scenario models a reduced production quantity out of the North Fork. The U.S. Forest Service contacted the EPA to clarify whether or not the coal supply curves include the North Fork coal reserves made available as a result of the 2012 Colorado Roadless rule. EPA was not able to provide a definitive answer, although they believed that the supply curves do include the North Fork reserves in question. However, upon review of coal supply curves for North Fork mines within the baseline IPM modeling conditions, it appears that baseline reserves are not capable of including the additional NR reserves, given that baseline reserves are less than what they would be if the additional reserves were included. As a consequence, the U.S. Forest Service feels there is equal evidence suggesting that North Fork Coal Mining Area coal reserves are not included in baseline reserves. To account for uncertainty about reserves, as well as potential ranges in mine production rates (i.e., unconstrained and low production), the sections below describe three IPM modeling scenarios, including the changes made to the Colorado Uinta Basin coal supply curve.

**"Reserves Added" Scenario**

In the Reserves Added scenario, the North Fork Coal Mining Area coal reserves were added to the existing coal supply curve reserves. The underlying assumption in this scenario is that the coal supply curves do not already include the 172 million tons of reserves that would be accessed under the Proposed Action. In this scenario, 172 million tons of reserves were added to steps 1 and 2 of the coal supply curve. Steps 1 and 2 of the coal supply curve are assumed to represent the Elk Creek and West Elk mines in the North Fork area of the Colorado Uinta Basin. The 172 million tons of reserves were divided between the two steps based on a rough estimate of the mine area overlap with the roadless areas. Thus step 1 was allocated 66.32 million tons (38.6 %) of reserves and step 2 was allocated 105.68 million tons (61.4%) of reserves. Table E-11 shows the No Action and adjusted Proposed Action reserve amounts.

***Table E-11.*** *Adjustments to Coal Supply Curve for Reserves Added Scenario*

| *Step* | *Annual Production (million tons)* | *Original Reserves –No Action (million tons)* | *Reserves – Proposed Action (million tons)* | *Change in Reserves (million tons)* |
|---|---|---|---|---|
| 1 | 7.0134 | 15.9265 | 82.2465 | 66.32 |
| 2 | 6.3851 | 131.3236 | 237.0036 | 105.68 |
| 3 | 0.4176 | 0.1850 | 0.1850 | 0 |
| 4 | 0.3084 | 1.0000 | 1.0000 | 0 |
| 5 | 5.5443 | 29.4234 | 29.4234 | 0 |

**"Reserves Removed" Scenario**

In the Reserves Removed scenario, the North Fork coal reserves were removed from the existing coal supply curve reserves. The underlying assumption in this scenario is that the coal supply curves include the North Fork reserves that would be accessed under the Proposed Action. In this scenario, the reserves for steps 1 and 2 of the coal supply curve were set to zero. Steps 1 and 2 of the coal supply curve are assumed to represent the Elk Creek and West Elk mines in the North Fork area of the Colorado Uinta Basin. Table E-12 shows the No Action and adjusted, Proposed Action reserve amounts. Note that the reserves for steps 1 and 2 are less than the total estimated reserves (172 million tons) that would be made accessible under the Proposed Action, which is why the reserves for these two steps were set to zero. The difference in the reserve estimates may be due to the fact that the coal supply curves used in this analysis were created in 2013 and thus did not have access to the most current reserve estimates.

***Table E-12.*** *Adjustments to Coal Supply Curve for Reserves Removed Scenario*

| *Step* | *Annual Production (million tons)* | *Original Reserves – Proposed Action (million tons)* | *Reserves – No Action (million tons)* | *Change in Reserves (million tons)* |
|---|---|---|---|---|
| 1 | 7.0134 | 15.9265 | 0 | -15.9265 |
| 2 | 6.3851 | 131.3236 | 0 | -131.3236 |
| 3 | 0.4176 | 0.1850 | 0.1850 | 0 |
| 4 | 0.3084 | 1.0000 | 1.0000 | 0 |
| 5 | 5.5443 | 29.4234 | 29.4234 | 0 |

**"Production Limited" to 5.2 Million Tons (and Reserves Added) Scenario**

In the Limited Production scenario, the North Fork coal production was limited to 5.2 million tons per year in both the No Action and Proposed Action Alternatives, as shown in the Annual Production column in Table E-12. The Proposed Action then has the reserves for steps 1 and 2 of the coal supply curve increased by a total of 172 million tons, as was done for the Reserves Added scenario. Steps 1 and 2 of the coal supply curve are assumed to represent the Elk Creek and West Elk mines in the North Fork area of the Colorado Uinta Basin. Table E-13 shows the No Action and adjusted, Proposed Action reserve amounts.

***Table E-13.*** *Adjustments to Coal Supply Curve for Limited Production Scenario*

| *Step* | *Annual Production (million tons)* | *Original Reserves – Proposed Action (million tons)* | *Reserves – No Action (million tons)* | *Change in Reserves (million tons)* |
|---|---|---|---|---|
| 1 | 2.6 | 15.9265 | 82.2465 | 66.32 |
| 2 | 2.6 | 131.3236 | 237.0036 | 105.68 |
| 3 | 0.4176 | 0.1850 | 0.1850 | 0 |
| 4 | 0.3084 | 1.0000 | 1.0000 | 0 |
| 5 | 5.5443 | 29.4234 | 29.4234 | 0 |

## ***Social Cost of Carbon***

A range of five SCC estimates or values are used in this analysis. Four values are from the 2015 SCC Technical Support Document (IWG, 2015) (e.g., $12, $42, $62, and $123 per metric ton of $CO_2$ emissions in the year 2020, in 2007 dollars). The estimates were adjusted to 2014 dollars using a GDP Implicit Price Deflator, (http://www.gpo.gov/fdsys/pkg/ECONI-2013-02/pdf/ECONI-2013-02-Pg3.pdf). The first three values are based on the average SCC from three integrated assessment models (IAMs), at discount rates of 5, 3, and 2.5 %, respectively. The fourth value is the 95th percentile of the SCC from all three models at a 3 % discount rate. It is included to represent higher-than-expected impacts from temperature change further out in the tails of the SCC distribution (representing less likely, but potentially catastrophic, outcomes). The fifth SCC value was adopted for this analysis to represent a 10$^{th}$ percentile of the SCC at a 3 % discount rate. The 10$^{th}$ percentile SCC values are only applied at the global boundary stance as noted in the main text.

The SCC estimates used in this analysis were developed over many years, using the best available scientific information, and with input from the public. The EPA and other federal agencies have considered the extensive public comments on ways to improve SCC estimation received via the notice and comment period that was part of numerous rulemakings since 2006. In addition, OMB's Office of Information and Regulatory Affairs recently sought public comment on the approach used to develop the SCC estimates.

An interagency process that included the EPA and other executive branch entities used three integrated assessment models (IAMs) to develop SCC estimates and selected four global values for use in regulatory analyses. The SCC estimates were first released in February 2010 and updated in 2015 using new versions of each IAM (IWG, 2015).

When attempting to assess the incremental economic impacts of carbon dioxide emissions, the analyst faces a number of serious challenges. A report from the National Academies of Science (National Research Council, 2009) points out that any assessment will suffer from uncertainty, speculation, and

lack of information about (1) future emissions of GHG, (2) the effects of past and future emissions on the climate system, (3) the impact of changes in climate on the physical and biological environment, and (4) the translation of these environmental impacts into economic damages (National Research Council, 2009). As a result, any effort to quantify and monetize the harms associated with climate change will raise serious questions of science, economics, and ethics and should be viewed as provisional.

SCC values are estimates of the monetary value of impacts associated with marginal changes in carbon dioxide emissions in a given year. It includes a wide range of anticipated climate impacts, such as net changes in agricultural productivity and human health, property damage from increased flood risk, and changes in energy system costs, such as reduced costs for heating and increased costs for air conditioning. It is typically used to assess the avoided damages as a result of regulatory actions (i.e., benefits of rulemakings that lead to an incremental reduction in cumulative global carbon dioxide emissions). While this analysis does not represent regulatory action that seeks to reduce carbon emission standard specifically, the SCC and carbon dioxide is nonetheless incorporated as part of the benefit-cost analysis due to the level of interests.

*Domestic versus Global Values (IWG, 2010, as cited in IWG, 2015)*

Because of the distinctive nature of the climate change problem, the SCC Technical Support Document focuses on a global measure of SCC. This stance is the same as that taken for past interim values, but it otherwise represents a departure from past practices, which tend to put greater emphasis on a domestic measure of SCC (limited to impacts of climate change experienced within U.S. borders). As a matter of law, consideration of both global and domestic values is generally permissible; the relevant statutory provisions are usually ambiguous and allow selection of either measure. Recognizing the need for a global solution to the global and trans-boundary problem of GHG damages, the United States has been involved in seeking international agreements to reduce emissions and in encouraging other nations to take significant steps to reduce emissions. When these considerations are taken as a whole, the interagency group concluded that a global measure of the benefits from reducing U.S. emissions is preferable.

As an empirical matter, the development of a domestic SCC is greatly complicated by the relatively few region-or country-specific estimates of the SCC in the literature. One potential source of estimates comes from the FUND model. The resulting estimates suggest that the ratio of domestic to global benefits of emission reductions varies with key parameter assumptions. For example, with a 2.5 or 3 percent discount rate, the U.S. benefit is about 7-10 % of the global benefit, on average, across the scenarios analyzed. Alternatively, if the fraction of GDP lost due to climate change is assumed to be similar across countries, the domestic benefit would be proportional to the U.S. share of global GDP, which is currently about 23 %. On the basis of this evidence, the interagency workgroup determined that a range of values from 7 to 23 % should be used to adjust the global SCC to calculate domestic effects. Reported domestic values should use this range. It is recognized that these values are approximate, provisional, and highly speculative.

*Modeled versus Revealed/Observed Carbon Values*

SCC (dollars per ton carbon dioxide) estimates have been derived using combinations of models for linking GHG emissions, atmospheric carbon stocks, global temperature changes, and losses in goods, services, and/or some measure of public or consumer welfare (IWG, 2010; 2013; 2015). Models are

comprehensive and substantial effort has been made to aggregate modeling results and demonstrate robustness (in the context of significant levels of uncertainty). It can be argued that these values are more representative of the range and nature of damages associated with GHG emissions, given their basis in damage functions. However, these values do not reflect observations of public exchange and do not reflect tradeoffs among the costs and benefits of GHG mitigation perceived by the public associated with carbon credit programs and trading.

Observed values for carbon mitigation or sequestration (or prices for emissions) are driven by GHG policy and mitigation programs, speculation about future GHG policy and regulation (Federal and State), and public perceptions about potential climate change impacts, as represented by current and evolving policy and regulatory trends. These prices can be framed as prices paid for the right to emit GHGs and as mechanisms or incentives to promote more efficient use of fossil fuels. Observed or revealed prices are more consistent with traditional market-based values (i.e., the result of some form of exchange) which is the preferred method for evaluating non-market benefits, when possible, in accordance with current U.S. Forest Service direction (FSH 1909.17; FSM 1970), as well as Office of Management and Budget circulars for conducting cost benefit analysis in support of rule-making (OMB, 2003).

Examples of auction clearing prices for the Regional Greenhouse Gas Initiative for nine north eastern states have ranged from $1.93 (2012) to $4.72 (2014) $/short ton CO2 (downloaded 5/26/2015). California Carbon Allowance Futures, cap and trade program have ranged in value from $11 to $23 since 2012 (nominal $). The current allowance price is $12.64/ton CO2 (downloaded May 26, 2015). The 3 percentage point adjustment upwards for cost of capital in the Energy Information Agency's Annual Energy Outlook 2014 reference case, to account for higher risks for investments that do no install carbon capture, is roughly equivalent to an emission fee of $15/metric ton of carbon dioxide (for plants that do not invest in carbon capture and storage). These examples demonstrate that observed values or prices for carbon have ranged from approximately $2 to $23 per ton.

The 10$^{th}$ percentile SCC values, for a 3 percent discount rate, as well as SCC values based on 5 percent discount rates, under the national boundary stance are at or below the lower range of observed carbon credit values; as a result, 10th percentile SCC value sand SCC values based on 5 percent discount rates are not used to estimate social costs for the national boundary stance.

### ***Example Input Assumptions and Calculations for "Reserves Added" Scenario***

Table E-14 presents examples of input assumption values for SCC calculations performed under the "Reserves Added" IPM modeling scenario. Input assumptions are constant for all values except coal minemouth prices and coal mine costs. Substitution response factors for production, consumption, and cost savings, as well as coal minemouth prices, vary across IPM modeling scenarios; all other input values remain the same across SCC calculations based on other IPM modeling scenarios. For details about inputs and calculations, see calculation worksheets (USDA Forest Service, 2015__).

***Table E-14.*** *Input Values for "Reserves Added" Scenario*

| *Net Coal/Natural Gas Production - After Substitution (from coal market modeling substitution response)* | | |
|---|---|---|
| *Substitution Response Coefficients* | *2016* | *2054* |
| Net mmton underground coal production/mmton NF coal production | 0.528 | 0.528 |
| Net mmton surface coal production/mmton NF coal production | -0.134 | -0.134 |
| Net bcf natural gas production/mmton NF coal production | -1.57 | -1.57 |
| *Net Coal/Natural Gas Combustion for Domestic Electricity Generation (from IPM modeling substitution)* | | |
| *Substitution Response Coefficients* | *2016* | *2054* |
| Net coal GWh gen/mm ton NF coal production | 651 | 651 |
| Net gas GWh gen/mm ton NF coal production | -416 | -416 |
| GWh/mm ton NF coal production | 2340 | 2340 |
| *Coal shipped and consumed overseas (exported) (from IPM modeling results)* | | |
| *Response Coefficients* | *2016* | *2054* |
| mm tons exported/mm tons Colorado-Unita coal production | 0.1 | 0.1 |
| *SCC Prices (IWG, 2015; 3% 10th values derived by FS from data provided by EPA)* | | |
| *SCC Prices 2007$/metric ton)* | *2016* | *2050* |
| 3% 10$^{TH}$ | | |
| 5% average | 4 | 9 |
| 3% average | 11 | 28 |
| 2.5% average | 38 | 72 |
| 3% 95$^{th}$ | 57 | 99 |
| *Coal Minemouth Price, 2012$/Ton (Rocky Mountain supply region)* | *2016* | *2054* |
| Undiscounted (2012 $) | 27.4 | 61.3 |
| *Coal Mine Cost, 2012$/Ton (Rocky Mountain region)* | *2016* | *2054* |
| Undiscounted (2012 $) | 20.1 | 51.4 |
| *Energy Use/Power System Cost Savings (from IPM Modeling results)* | *2016* | *2054* |
| Undiscounted Cost/mmton NF coal | 22.6 | 22.6 |
| *Carbon Dioxide Emission Rates (tons CO2/ton coal; BCF gas; GWh)(see air section)* | *2016* | *2054* |
| Coal Production, underground (tons/ton) | 0.02 | 0.02 |
| Coal Production, surface (tons/ton) | 0.006 | 0.006 |
| Production of natural gas (tons/bcf) | 3,546 | 3,546 |
| Combustion of coal (tons/GWh) | 1,055 | 1,055 |
| Combustion of natural gas (tons/GWh) | 605 | 605 |
| Coal transportation, domestic (tons/ton transported) | 0.06 | 0.06 |
| Coal transportation, exported (tons/ton transported) | 0.15 | 0.15 |

The substitution response factors in Table E-14 are used to project energy market behavior in response to increased availability of North Fork coal reserves, as described in the Economics section (Analysis and Methods – Overview of Benefit Cost Framework) in Chapter 3. Substitution response factors are multiplied by the changes in gross annual change in North Fork production under Alternative B (or C) relative to Alternative A, for a given year, to estimate changes in each energy source production and consumption at a national (or domestic) scale. These changes are referred to as 'net' changes because they account for both negative and positive changes in substitute energy sources, triggered by gross changes in North Fork coal production. Estimated net changes in annual energy production and consumption are multiplied by corresponding carbon dioxide emission rates (Table E-14) to calculate annual carbon dioxide emissions. Annual carbon dioxide emissions are then multiplied by SCC values (see Social Cost of Carbon section above and the section "Social Cost of Greenhouse Gas Emissions" in Chapter 3) to calculate annual ranges of social costs or damages.

> *Example of Production Substitution: The substitution response factor for natural gas production (i.e., -1.57 billion cubic feet natural gas per million tons of North Fork coal – Table E-14) is multiplied by a projected increase in North Fork coal production of 13 million tons in 2027, under the 'permitted' North Fork production scenario for Alternative B (see Table 3-12) to estimate a decrease of -20 billion cubic feet of domestic natural gas production in 2027. This decrease in natural gas production is multiplied by that carbon dioxide emission rate for production of natural gas (3,546 tons carbon dioxide per bcf natural gas – Table E-14) to estimate a decrease of 70,926 tons of carbon dioxide emissions from natural gas production for 2027.*
>
> *Example of Combustion and Electricity Generation Substitution: The substitution response factor for electricity generation from natural gas combustion (i.e., -416 GWh generated from Natural Gas per million tons of North Fork coal – Table E-14) is multiplied by a projected increase in North Fork coal production of 13 million tons in 2027, under the 'permitted' North Fork production scenario for Alternative B (see Table 3-12) to estimate a decrease of -5300 GWh electricity from natural gas in 2027. This decrease is multiplied by that carbon dioxide emission rate for electricity generation from natural gas (-605 tons carbon dioxide per GWh from natural gas – Table E-14) to estimate a decrease of 3,200,000 tons of carbon dioxide emissions from electricity generation from natural gas for 2027.*

### ***Sensitivity Discussion***

The following inputs are evaluated to determine sensitivity of the present net value (PNV) estimates to key input assumptions:

- Substitution response factors based on IPM modeling scenarios
- Fixed demand and percent of North Fork Coal Mining Area coal production subject to substitution
- Coal values as affected by coal mine costs, and
- Power generation cost savings

Each of these four assumption areas are adjusted to demonstrate potential sensitivity of PNV results to baseline assumptions used in primary results presented in the main body of the report.

*Substitution Response Coefficients*

Ranges of Present Net Value (PNV) results are provide in Table E-15 for substitution response factors derived from each of the three IPM modeling scenarios discussed above. Substitution response factors for the "Reserves Added" IPM scenario are used for the summary results in the main body of this report.

PNV estimates using the "Reserves Added" coefficients are mostly of a magnitude that is in between the PNV estimates using coefficients from the other two IPM scenarios (i.e., PNV from "Reserves Added" are often midpoints). PNV estimates from "Remove Reserves" and "Limited Production" scenarios range from being 136% lower to 109% higher than PNV estimates from the "Reserves Added" scenario. In the following exceptions, use of the "Reserves Added" scenario results in:

- Lowest PNV derived from (i) 3% Average SCC values in the Forest and National Boundary stances, as well as (ii) all SCC values in the National Boundary stance (see underlined values in Table E-15), and
- Highest lower-bound PNV derived from all SCC values in the Global boundary stance (see bold values in Table E-15).

In all cases, the sign (positive or negative) of the PNV results under the "Reserves Added" scenario are the same as signs of PNV for the other two IPM modeling scenarios, suggesting that PNV results are generally robust across all three IPM modeling scenarios. The only exception being upper bound PNV results using the 3% Average SCC values under the Global Boundary stance where PNV ranges from negative to just slightly positive under the "Reserves removed" scenario coefficients.

***Table E-15.*** *Present Net Value Results Across IPM Modeling Scenarios (million 2014$)*

| *IPM Scenario* | *Reserves Added* | | *Reserves Removed* | | *Limited Production* | |
|---|---|---|---|---|---|---|
| | | | *Alternatives* | | | |
| | *B-A* | *C-A* | *B-A* | *C-A* | *B-A* | *C-A* |
| **Forest Boundary** | | | | | | |
| Lower Estimate | $334 | $272 | $289 | $132 | $552 | $429 |
| 3% Avg (Lower) | *$423* | $329 | $473 | $211 | $714 | $514 |
| 3% Avg (Upper) | $772 | $450 | $804 | $312 | $734 | $527 |
| Upper Estimate | $791 | $456 | $834 | $320 | $789 | $553 |
| **National Boundary** | | | | | | |
| Lower Estimate | *-$1,879* | -$968 | -$464 | -$116 | -$1,859 | -$964 |
| 3% Avg (Lower) | *$215* | *$191* | $2,041 | $1,271 | $521 | $445 |
| 3% Avg (Upper) | $2,127 | $1,440 | $4,147 | $2,765 | $1,338 | $935 |
| Upper Estimate | $2,171 | $1,440 | $4,340 | $2,820 | $1,338 | $935 |
| **Global Boundary** | | | | | | |
| Lower Estimate | **-$12,468** | **-$6,861** | -$13,132 | -$7,165 | -$13,755 | -$8,038 |
| 3% Avg (Lower) | -$3,363 | -$1,819 | -$2,239 | -$1,134 | -$3,409 | -$1,913 |
| 3% Avg (Upper) | -$1,624 | -$811 | -$341 | $72 | -$3,409 | -$1,913 |
| Upper Estimate | $1,920 | $1,317 | $3,899 | $2,617 | $1,076 | $779 |

*"B-A" = Difference between Alternatives B and A, etc.*

*Underlined italics and **bold values** are minimums and maximum values respectively for the three IPM scenarios.*

*Fixed Demand and Percent of NF Coal Subject to Substitution*

As noted in the description of the IPM modeling framework above, the IPM model minimizes the cost of meeting fixed schedules of energy demand over time. The modeling assumption of fixed demand implies that demand for energy (e.g., to generate electricity) is not allowed to increase in response to increased supplies. This assumption is expected to be a valid given the relatively inelastic nature of coal demand. However, the sensitivity of the results to this assumption are evaluated by estimating PNV (under the "Reserves Added" substitution response coefficients, using different percentages of gross North Fork coal production that are subjected to substitution. For the results summarized in the main text, 100% of additional North Fork Coal production under Alternatives B and C are multiplied by substitution response coefficients. For this sensitivity analysis, a fraction of additional North Fork coal production is assumed to represent an increase in energy demand and is therefore not multiplied by substitution response coefficients (i.e., a fraction of additional North Fork production is produced and consumed as additional energy, not substitute energy). This approach is not necessarily an ideal means for capturing the effects of variable demand; however, it provides a means for demonstrating potential sensitivity of PNV results to this assumption for the purposes of this analysis. General equilibrium models are necessary to project changes in coal and other energy sources that reflect response to changes in both supply and demand.

As noted in sections above, coal own price elasticity (i.e., percent change in demand/percent change in price) for the nation has been estimated to range from -0.11 (U.S. average) to -0.14 and -0.22 for the western and southeastern energy demand regions. Percent changes in Rocky Mountain coal minemouth prices ranged from -5 % to -23 % based on a comparison of prices under baseline and proposed action conditions for the "Reserves Added" IPM modeling scenario. Multiplying the highest elasticity value (-0.22) by the highest percent change in price (-0.23) results in an estimated percent change in coal demand of approximately 5%. When 5% of North Fork coal production under Alternative B is assumed to represent a net increase in coal demand, and therefore not subject to substitution, PNV results are slightly lower but still similar to the original summary PNV results (see Table E-16). For both cases, all PNV are positive except lower bound values for National Boundary stance and all values for the Global stance (i.e., there is no difference in sign of PNV estimates).

***Table E-16.*** *Comparison of Modified PNV for 5% Increase in Coal Demand VS Original PNV for Fixed Demand, for "Reserves Added" Scenario (million 2014$)*

| | Modified PNV Results | | Original PNV Results | |
|---|---|---|---|---|
| | Alternatives | | | |
| | B-A | C-A | B-A | C-A |
| **Forest Boundary** | | | | |
| Lower Estimate | $334 | $272 | $334 | $272 |
| 3% Avg (Lower) | $423 | $329 | $423 | $329 |
| 3% Avg (Upper) | $772 | $450 | $772 | $450 |
| Upper Estimate | $791 | $456 | $791 | $456 |
| **National Boundary** | | | | |
| Lower Estimate | -$2,306 | -$1,206 | -$1,879 | -$968 |
| 3% Avg (Lower) | $71 | $110 | $215 | $191 |
| 3% Avg (Upper) | $2,089 | $1,417 | $2,127 | $1,440 |
| Upper Estimate | $2,111 | $1,417 | $2,171 | $1,440 |

| | Modified PNV Results | | Original PNV Results | |
|---|---|---|---|---|
| | Alternatives | | | |
| | B-A | C-A | B-A | C-A |
| **Global Boundary** | | | | |
| Lower Estimate | -$14,325 | -$7,894 | -$12,468 | -$6,861 |
| 3% Avg (Lower) | -$3,990 | -$2,172 | -$3,363 | -$1,819 |
| 3% Avg (Upper) | -$2,169 | -$1,138 | -$1,624 | -$811 |
| Upper Estimate | $1,854 | $1,277 | $1,920 | $1,317 |

Lower bound PNV estimates derived from 3% average SCC values start to become slightly negative, when the percentage of North Fork coal production representing increased demand is doubled to 10%, though upper bound PNV estimates remains positive for 3% average SCC values (as is the case for the original PNV results).

This sensitivity analysis, as well as the analysis in general for National and Global stances, relies on electricity generation cost savings as a surrogate for benefits for domestically consumed coal under the National and Global boundary stances, justified in part by assumptions that coal demand is inelastic. As the percentage of North Fork coal production assumed to represent increased demand, grows, the reliability of using cost savings as a surrogate for benefits weakens.

*Coal Values and Coal Mining Costs*

Undiscounted North Fork coal underground mining costs are assumed to range from $20/ton in 2016 to $54/ton by 2054, resulting in estimated net coal values of approximately $6/ton in 2016 to $0.1/ton by 2054, after subtracting mining costs from projected coal minemouth prices (under the "Reserves Added" scenario).

To evaluate the sensitivity of PNV results to coal values for the Forest Boundary stance (for National and Global boundaries, coal values are applied only to exported coal and therefore have less impact), coal mining costs are increased by a reasonable percent (so as not to result in too many negative net coal values over the period of analysis). When coal mining costs are increased by 15%, lower bound PNV estimates start to become slightly negative, as shown in Table E-17. PNV derived from 3% average SCC values remains positive. However, a 15% increase in mining costs results in discounted North Fork coal values that range from a high of $2.80/ton in 2016, to less than $1 by 2032, and become negative by 2036 for Alternative B. These coal values are lower than what might be reasonably expected.

***Table E-17.*** *Comparison of Modified PNV for 15% Increase in Coal Mining Cost VS Original PNV Estimates for "Reserves Added" Scenario (million 2014$)*

| | *Modified PNV Results* | | *Original PNV Results* | |
|---|---|---|---|---|
| | *Alternatives* | | | |
| | *B-A* | *C-A* | *B-A* | *C-A* |
| **Forest Boundary** | | | | |
| Lower Estimate | $14 | $22 | $334 | $272 |
| 3% Avg (Lower) | $46 | $58 | $423 | $329 |
| 3% Avg (Upper) | $266 | $169 | $772 | $450 |
| Upper Estimate | $269 | $170 | $791 | $456 |

*Power System Cost Savings*

As noted in the methodology section in the main body of this report, power system cost savings are adopted as a surrogate for measuring the benefits of increased availability of North Fork coal for electricity generation. Cost savings response factors ($ cost savings to generate electricity per million tons of additional North Fork Coal produced) are derived from modeling output for each of the three IPM scenarios noted above. Cost savings response coefficients range from a low of $22.6/ton North Fork Coal under the "Reserves Added" scenario (used for the summary results in the main text) to $29/ton under the "Limited production" scenario, to a high of $42/ton under the "Remove reserves" scenario. Cost savings response coefficients, based on the "Reserves Added" scenario, are reduced by a fixed percentage to evaluate sensitivity of PNV results to this input.

For a 25% reduction in cost savings, lower bound PNV estimates derived from 3% average SCC values, under the National boundary, start to become negative; upper bound PNV estimates derived from 3% average SCC values remain positive (see Table E-18). Upper bound PNV estimates derived from 3% average SCC values start to become negative only when cost savings decrease by approximately 90%; discounted cost savings coefficients range from $2.30/ton to $0.30/ton.

***Table E-18.*** *Comparison of Modified PNV for 25% Decrease in Cost Savings VS Original PNV Estimates for "Reserves Added" Scenario (million 2014$)*

| | *Modified PNV Results* | | *Original PNV Results* | |
|---|---|---|---|---|
| | *Alternatives* | | | |
| | *B-A* | *C-A* | *B-A* | *C-A* |
| **Forest Boundary** | | | | |
| Lower Estimate | $334 | $272 | $334 | $272 |
| 3% Avg (Lower) | $423 | $329 | $423 | $329 |
| 3% Avg (Upper) | $772 | $450 | $772 | $450 |
| Upper Estimate | $791 | $456 | $791 | $456 |
| **National Boundary** | | | | |
| Lower Estimate | -$2,181 | -$1,155 | -$1879 | -$968 |
| 3% Avg (Lower) | -$86 | $5 | $215 | $191 |
| 3% Avg (Upper) | $1,536 | $1,046 | $2,127 | $1,440 |
| Upper Estimate | $1,536 | $1,046 | $2,171 | $1,440 |
| **Global Boundary** | | | | |
| Lower Estimate | -$12,769 | -$7,047 | -$12,468 | -$6,861 |
| 3% Avg (Lower) | -$3,664 | -$2,006 | -$3,363 | -$1,819 |
| 3% Avg (Upper) | -$2,215 | -$1,205 | -$1,624 | -$811 |
| Upper Estimate | $1,329 | $923 | $1,920 | $1,317 |

*Consideration of Methane Emissions*

Based on the carbon dioxide and methane emission results in Tables 3-19 and 3-20 in the main text, inclusion of $CO_2$eq of methane emissions, can result in an increase in a 20% increase in estimated $CO_2$eq emissions for combined production and combustion under the national boundary stance. For the Forest boundary stance, where only those emissions from production (extraction) of coal are

considered, $CO_2$eq emissions can increase by a factor of x20 when including methane emissions in the calculations.

As noted in the 2015 technical support document for SCC values (IWG, 2015), SCC values are designed to be applied only to carbon dioxide emissions and not methane emissions. As a consequence, it is not necessarily appropriate to apply SCC values to $CO_2$eq emissions for methane. However, for sensitivity purposes, carbon dioxide emission factors were increased for underground and surface coal production by relevant percentages, based on values in Table 3-19 and 3-20, to incorporate the $CO_2$eq emissions of methane shown in Table 3-20 in social cost calculations for Alternatives B and C. Lower bound PNV estimates for 3% average SCC values became negative while upper bound PNV estimates for 3% average SCC values remained positive – implying that average PNV estimates are near zero or neutral for both the National boundary as well as the Forest Boundary stances.

*Summary*

Sensitivity analysis suggests that PNV results will vary as a result of changes in assumptions about substitution response coefficient values, fixed demand, coal values, cost savings response coefficients, and consideration of methane emissions from coal production. However, sensitivity analysis demonstrates that substantial changes in assumptions are needed to affect the sign (positive/negative) of PNV estimates, particularly the signs of midpoint PNV estimates derived from 3% average SCC values. The results suggest that PNV summaries presented in the main text, under the “Reserves Added” scenario are reliable for demonstrating potential ranges of net benefits for Alternatives B and C. Substantial uncertainty remains an important consideration in characterizing potential net benefits of actions involving GHG emissions.