APPENDIX N—TECHNICAL REPORT: SOCIAL AND ECONOMIC IMPACT ANALYSIS METHODOLOGY

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1—GENERAL ASPECTS OF THE METHODOLOGIES

1.1 Assumptions

The following basic assumptions underlie all of the social and economic analyses:

- Economic benefits to the socioeconomic study area (defined in Chapter 3 and the Socioeconomic Baseline Report), in terms of labor earnings and employment, would accrue from Bureau of Land Management (BLM) and United States Forest Service (Forest Service)-influenced activities such as oil and gas development, wind energy development, livestock grazing, and recreation.

- Employment and income (especially labor earnings) would continue to be a driver of economic and population growth in the socioeconomic study area.
- Housing supply and costs, and community infrastructure and services, may be constraints on population growth in some locations within the planning area.
- Tax and royalty revenues derived from activities on BLM and Forest Service-administered lands would continue to have fiscal implications for communities within the socioeconomic study area, the state, and the Federal Government.
- Activities and resources available in and around the planning area would continue to be important to the quality of life of current and future residents.
- The pace and timing of mineral development activities is dependent on a variety of factors outside the management decisions of BLM and Forest Service. These include national and international energy demand and prices, production factors within the planning area, and business strategies of operators. The Reasonable Foreseeable Development (RFD) scenario projects expected rates of well drilling, and the BLM Reservoir Management Group (RMG) has also estimated completion rates and production decline curves. Together these parameters allow for projection of future oil and gas production volumes for use in the economic impact analysis. Actual economic impacts could vary if actual development or production varies from the projections, or if prices change.
- The pace and timing of wind energy development activities is also dependent on a variety of factors outside the management decisions of BLM and Forest Service. These include demand for electricity, availability of transmission infrastructure capacity, prices for other energy sources such as coal for electricity generation, costs of wind energy generation technologies, production factors within the planning area, and business strategies of operators. The impacts analysis uses a wind deployment scenario developed from multiple sources. Actual impacts could vary if the rate of development over the study period is different.
- Demand for use of BLM and Forest Service-administered land for livestock grazing will continue through the study period.
- Demand for use of BLM and Forest Service-administered land for recreational activities, including off-highway vehicle (OHV) use, throughout the planning area will remain steady or increase through the study period.

The discussions below of the specific methodologies for each resource use provide additional assumptions used in the analyses.

1.2 Quantitative Economic Impact Analysis Using IMPLAN

The economic impact analysis uses two general approaches. These are quantitative analysis and qualitative analysis. The quantitative analysis approach is used when given adequate available information and resources. In this study, adequate data was available for four resource uses:

- Oil and gas development and production
- Wind energy development and production
- Livestock grazing
- Recreation

The basic strategy used in quantitative economic impact analysis is to first identify the primary impacts of an economic activity affected by management decisions. For instance, primary impacts include expenditures made by oil and gas companies to drill a well, and to complete the well for production.

Primary impacts also include the value of the oil and gas that is produced and sold. Next, where primary impacts can be quantified, they can generally also be run through an economic model to estimate the economic activity that is generated as the primary impact ripples through the economy, “upstream” to providers of goods and services necessary for production, and “downstream” as income generated from production is spent by the households that receive the income.

The upstream, downstream, and total effects are estimated in this study through use of the IMPLAN (IMPact analysis for PLANning) model. The IMPLAN model was originally developed by the Forest Service and is commonly used by the BLM and many other government and private sector organizations to estimate the total economic impacts of various activities, actions, and policies. The model tracks inter-industry and consumer spending in a local (or regional) economy, allowing estimation of indirect and induced economic impacts in the local economy that result from the original economic activity or a change in economic activity. Indirect impacts results from local inter-industry purchases caused by the direct impact, and induced impacts results from re-spending of labor income (i.e., local purchases by households of employees and proprietors of the affected industries). The re-spending represented by indirect and induced impacts is often referred to as the “multiplier effect.”

Outputs of the IMPLAN model include economic output, labor income, and employment. These are defined as follows:[1]

> **Employment (jobs) –** A job in IMPLAN equals the annual average of monthly jobs in that industry.[2] Thus, 1 job lasting 12 months equals 2 jobs lasting 6 months each, equals 3 jobs lasting 4 months each. It is important to note that IMPLAN, based on some of its data sources, does not distinguish between full-time and part-time jobs. Sectors with higher labor earnings per job are likely to reflect a high proportion of full-time jobs, while sectors with low labor earnings per job often reflect a significant number of part-time jobs.
>
> **Labor Income (earnings) –** All forms of employment income, including Employee Compensation (wages and benefits) and Proprietor Income.
>
> **Economic Output (gross regional economic output) –** Output represents the value of industry production. In IMPLAN these are annual production estimates for the year of the data set and are in producer prices. For manufacturers, output is sales plus or minus change in inventory. For service sectors production, output equals sales. For retail and wholesale trade, output equals gross margin, not gross sales.

By constructing “social accounts” that describe the structure and function of a specific economy, IMPLAN creates a *localized* model to investigate the consequences of projected economic activity in a geographic region – each of the selected BLM field offices and Forest Service planning units, or the state as a whole. The IMPLAN model uses data specific to the local economy wherever possible, but also uses some data based on national-level economic relationships. Therefore, the model benefits from “calibration” of some of its data to better reflect the local economy. For this study, IMPLAN was calibrated based on work the University of Wyoming has done with the model in Wyoming over many years and with data specific to this study. The specific IMPLAN impact analysis methodologies and assumptions for each resource use are described below.

The analyses used Version 3.0 of the IMPLAN modeling system. The IMPLAN model is managed by and available from the Minnesota IMPLAN Group (MIG, Inc. http://implan.com/V4/Index.php).

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1 *Based on the glossary available at the website of the Minnesota IMPLAN Group, the publisher of the IMPLAN model/software, http://implan.com/V4/index.php?option=com_glossary&Itemid=57.*

2 *This is the same definition used nationally by the Quarterly Census of Employment and Wages, United States Bureau of Labor Statistics, and United States Bureau of Economic Analysis.*

1.2.1 Study Areas

The economic impact analyses were conducted for federal lands administered by six BLM field offices and three Forest Service planning units in the state. The six BLM field offices included:

- Casper
- Kemmerer
- Newcastle
- Pinedale
- Rawlins
- Rock Springs

The three Forest Service planning units included:

- Bridger-Teton National Forest (BTNF)
- Medicine Bow National Forest (MBNF)
- Thunder Basin National Grassland (TBNG)

For the analyses of oil and gas, grazing, and recreation impacts, IMPLAN analyses were prepared for each of the six field offices and three planning units. The analysis for wind was conducted at the state level only. Each field office or planning unit IMPLAN analysis was based on a study area consisting of the counties in and around the field office or planning unit that could potentially be most directly impacted by the alternatives. Table 1 and Table 2 provide lists of the individual counties included in each IMPLAN model.

Table 1. Wyoming Counties Included in the BLM Field Office Study Areas

Casper Field Office	Kemmerer Field Office	Newcastle Field Office	Pinedale Field Office	Rawlins Field Office	Rock Springs Field Office
Converse Goshen Natrona Platte	Lincoln Sweetwater Uinta	Crook Weston Niobrara Campbell	Lincoln Sublette Sweetwater	Carbon Albany Laramie Sweetwater	Sweetwater Uinta Lincoln Sublette Fremont

Table 2. Wyoming Counties Included in the Forest Service Planning Unit Study Areas

Bridger-Teton National Forest	Medicine Bow National Forest	Thunder Basin National Grassland
Fremont Lincoln Sublette Sweetwater Teton	Albany Carbon Converse Platte	Campbell Converse Crook Niobrara Weston

Economic impacts for the entire state were also calculated for each resource use. The methodology used to appropriately address regional (study area) and state-level impacts is as follows: For each field office or planning unit, two IMPLAN models are constructed. The first is a primary model which includes the counties in the field office or planning unit study area. The second is a secondary model for the rest of the counties in the state not included in the specific study area. The secondary model is linked to the primary model through IMPLAN's Multi-Region Input-Output (MRIO) capabilities. For the field office or planning unit analysis, we report the primary model results. For the state-level analysis we report the primary model results for each field office or planning unit, plus the secondary model results for each office or unit and sum across all nine offices and units, to get the state totals. This accounts for the fact that the direct impacts may not be the same for all units which is what one would have to assume for one state model. This is the preferred approach recommended by MIG, Inc.

1.2.2 Timeframe of the Analyses

Economic impacts were estimated across an 8-year time period (2013-2020). This is the only period within the larger planning period for which the necessary quantitative input data was available for all four resource uses. Specifically, the oil and gas development projections were only available for all BLM field offices and Forest Service planning units for this period. All other analyses were scoped to the same period.

1.2.3 Base Year Dollars and Discounting

All dollar figures throughout the economic analysis are in constant 2011 dollars. This is the base year used in the IMPLAN model.

All dollar figures in the *summary* results tables of Chapter 4 represent the total value across the period 2013 to 2020. Values for future years are discounted to adjust for the "time value of money." This is an economic concept that refers to the value of a given amount of money being less in the future. Most people, presented with a choice, would rather have a dollar now than a dollar 10 years from now, or even one year from now because the dollar can be put to productive use now. When monetary costs and benefits of an action vary over time (e.g., for a capital project the costs are up-front but the benefits occur over many years), economists adjust for the time value of money by applying an annual discount rate to the amounts in future years. This is different than adjusting for inflation, which is a loss in money's value in the future due to a rise over time in prices for given products and services across the economy. The result of adjusting for the time value of money is known as the "present value." Providing present values for 2013-2000 for all the economic impact analyses allows for comparison – based on a reasonably lengthy period, and subject to some differences in approach noted in each resource use summary section – of the relative economic impacts of each resource use for each of the field offices and planning units.

The choice of a discount rate is a key analytical decision, because as the discount rate increases, the value of future dollars when "brought back to the present" decreases. Often economists use the discount rates recommended by the federal Office of Management and Budget (OMB) in OMB Circular A-94, "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs." OMB periodically updates the discount rates for the Circular in "Appendix C: Discount Rates for Cost-Effectiveness, Lease-Purchase, and Related Analyses for OMB Circular No. A-94." OMB pegs discount rates to interest rates on Treasury notes and bonds of specific maturities corresponding to the planning period for a particular economic analysis. As of the December 2012 edition of Circular A-94 Appendix C, the recommended annual real discount rate (a rate from which any inflation premium has been removed) for a 10-year planning period is 0.1 percent. This is a very low discount rate compared to discount rates economists have typically used over recent decades. It reflects the fact that interest rates on Treasury notes and bonds are at present extremely low, historically speaking. Therefore, BLM has chosen to use a more historically typical annual discount rate for this economic impact analysis. The rate used is 3.0 percent.

1.3 Qualitative Economic Impact Analysis

In the other approach, where primary impacts cannot be readily quantified, often the economic impacts can still be described qualitatively. In such cases, the focus of the analysis is to describe the type of impact in a base scenario (in this planning effort, Alternative A) and then assess the relative changes (qualitative indications of increases or decreases in costs or the value of production) that would be likely under other alternatives. This approach may be used with impacts to market values and is often used with impacts to nonmarket values. The term nonmarket values refers to the benefits individuals attribute to experiences of the environment or uses of natural and cultural resources that do not involve market transactions and therefore lack prices. Because these values are not priced, they are difficult to estimate but nonetheless BLM guidance calls for efforts to be made to identify and assess impacts to nonmarket values in the planning process (BLM Instruction Memorandum No. 2013-131, Guidance on Estimating Nonmarket Environmental Values, May 31, 2013).

Some of the management decisions under this planning action would result in increased costs to operators – the firms or individuals who undertake the activities – or to project proponents. The economic impacts of decisions that increase costs for operators and/or project proponents are many and can be complex. Cost increases may cut into profitability and drive delays to, reductions in, or cessation of operations or projects. However, where operations or projects are not delayed, reduced, or terminated, increased costs also represent increased economic activity. For instance, if restrictions under an Alternative result in a new power line having to take a longer route, additional expenditures for materials, equipment, and labor would be made. These increased expenditures would support some amount of additional income and employment. However, increased costs may also represent opportunity costs; that is, the project proponent or society may have benefited more if the additional funds were used in another way. In the socioeconomic analysis in Chapter 4, where management actions would potentially increase costs to operators or project proponents, these increased costs are pointed out and discussed qualitatively. Readers should keep in mind that these increased costs may negatively impact operators, may benefit others in society, and may incur opportunity costs.

1.4 Social Impact Analysis

Social impacts may be driven by economic impacts, such as when changes in employment due to management decisions lead to impacts on population, housing, and community services. Other impacts may be more purely social and cultural in nature and can include impacts on quality of life, recreation and amenity values, and traditional land uses and associated cultural values. Social impacts may be marginal or substantial, depending on the degree to which new and revised management actions alter the course set in previous BLM and Forest Service decisions.

Sometimes social impacts can be quantified; however, in this analysis social impacts are described qualitatively. This is because social impacts of BLM and Forest Service management decisions may vary considerably depending on the nature of the community, or communities, involved. For a planning effort that covers as large a geographic area as this effort, analysis of social impacts must necessarily use a broad brush.

A key aspect of the social impacts analysis approach is to address impacts based on the varying points of view of key types of stakeholders. The Socioeconomic Baseline Report identifies several broad categories of stakeholders to sage-grouse management decisions in Wyoming. These categories reflect different linkages people have to public lands. They also reflect distinct sets of attitudes, beliefs, values, opinions, and perceptions about public resources and the effects of various management policies and actions. Categorization of stakeholders is not meant to imply that all individuals and social groups fit neatly into a single category; many specific individuals or organizations may have multiple interests and would see themselves reflected in more than one stakeholder category. The point of categorization is to allow differentiation of social impacts based on broad differences in points of view. The social impacts analysis in Chapter 4 of the environmental impact statement (EIS) assesses the alternatives against the different points of view in the broad stakeholder categories.

1.5 Environmental Justice Impact Analysis

Definitions and methods for analysis of potential environmental justice (EJ) issues are described in the Socioeconomic Baseline Report. In short, the socioeconomic study area was screened to identify counties with minority and low-income populations that qualify as potential EJ populations based on guidance for EJ analysis from the Council on Environmental Quality. These counties and their potential EJ populations are noted in Chapter 3 of the EIS, as well as the Socioeconomic Baseline Report. Further assessment of the likelihood of impacts to these populations was conducted as described in Chapter 4 of the EIS.

CHAPTER 2—METHODOLOGIES BY RESOURCE USE

2.1 Oil and Gas

2.1.1 Introduction

The analysis for oil and gas economic impacts was divided into two phases of oil and gas economic activity:

- Development (Drilling and Completion)
- Production

The economic impacts were evaluated at both the study area and state level for each field office and planning unit. The MRIO analysis feature of IMPLAN was used to evaluate the economic impacts for each field office and planning unit at the state level.

It is very important to note that the analysis focuses only on *new* oil and gas wells on federal mineral estate within the sage-grouse core/priority habitat, general habitat, and connectivity habitat areas. This is because the management decisions under consideration in the Resource Management Plan (RMP) and the Land and Resource Management Plan (LRMP) (hereafter, land use plans [LUP]) amendments essentially only apply to new oil/gas leasing and not to the existing leases. The economic impact figures for the new oil and gas wells are a subset of the economic impacts of all oil and gas wells (new and existing) on federal mineral estate in each field office and planning unit, which in turn are a subset of the economic impacts of all oil and gas wells on all federal and non-federal mineral estate in each field office and planning unit (i.e., including wells on privately and state-owned mineral estate). Put another way, the impact estimates do *not* include the economic impacts of any wells (new and existing) on federal mineral estate outside of sage-grouse habitat areas,[3] nor of any wells (new and existing) on non-federal mineral estate. Nor do the figures include the economic impacts of production from *existing* wells on federal mineral estate within sage-grouse habitat areas; this existing production is not affected by the management decisions of this planning action.[4]

Likewise, the percentage differences for Alternatives B, C, D, and E in comparison to Alternative A only represent changes for new wells on federal mineral estate in habitat areas; they do *not* represent the percentage change to *total* economic activity resulting from all oil and gas development and production. The percentage change to total oil and gas related economic activity would be smaller, because while the absolute difference in dollars or jobs would be as shown in the tables in Chapter 4, the base for comparison, all oil and gas related economic activity, would be larger because it would include the

[3] *In some of the field offices and planning units, sage-grouse habitat covers most of the office/unit. In these cases, the economic analysis encompasses most if not all of the new wells on federal mineral estate projected for each alternative.*

[4] *Any restrictions resulting from this planning action would only be applied to new leases (i.e., currently unleased areas). Production rates from existing wells in already leased areas would not be affected. With respect to new wells within already leased areas, these wells may be affected by this planning action. Action # 57 provides that BLM will consider inclusion of stipulations to protect sage-grouse or their habitats as permit Conditions of Approval (COAs), where adequately protective stipulations are not already in place. Whether COAs will be placed on new wells in already leased areas, and to what extent COAs would impact economic activity, cannot be known or reasonably estimated; therefore, the economic impacts of Action # 57, if any, are not included in the quantitative economic impact analysis.*

contributions of existing wells on federal mineral estate within sage-grouse habitat areas, of wells on federal mineral estate outside of sage-grouse habitat areas, and of wells on non-federal mineral estate.

2.1.2 IMPLAN Model Modifications

The IMPLAN modeling system utilizes national production coefficients. To better reflect local production practices, the oil and gas sectors of each model were modified. In IMPLAN, oil and gas development and production is divided into three sectors:

Number	Sector Name
20	Oil and Gas Extraction
28	Drilling Oil and Gas Wells
29	Support Activities for Oil and Gas Operations

The following protocol was used to modify the individual sectors. Total output for the Oil and Gas Extraction Sector was based on county level production quantities reported by the Wyoming Oil and Gas Commission and state price forecasts from the State of Wyoming's Consensus Revenue Estimating Group (CREG 2012). Total output for the other two sectors was estimated from output per employee ratios derived from the United States Census Bureau's Economic Census. Employment estimates were based on United States Bureau of Labor Statistics (BLS) covered employment data. These estimates were adjusted to account for self-employment using United States Bureau of Economic Analysis (BEA) data. Earnings were also based on BLS data. These estimates were adjusted to account for benefits using BEA Survey of Current Business data. Intermediate payments for oil and gas production were scaled based on estimated cost of production for oil and gas production in the Rocky Mountain region.

2.1.3 Development (Drilling and Completion) Impacts

Information on the number of wells to be drilled by BLM field office or Forest Service planning unit for each alternative was obtained from the RFD estimates provided by the BLM's RMG. The RFD estimates were broken down between conventional and coal bed natural gas (CBNG) wells and by wells on federal minerals and non-federal minerals. Only the wells on federal minerals were considered in this analysis. The RFD also provided a breakdown of the number of wells drilled each year for each alternative for each field office or planning unit. The number of wells completed each year was based on completion rates developed from the BLM surface disturbance assumptions.

Table 3 summarizes the oil and gas well drilling and completion costs used in the analysis. Estimates of per well drilling and completion costs for conventional wells and CBNG wells were provided by each BLM field office or district office. Many of the estimates were based on data from industry collected for this planning effort. Cost estimates for Forest Service planning units were provided by nearby BLM staff. For the Forest Service planning units, it was assumed that no drilling would occur on the Medicine Bow National Forest during the period of the analysis (per the RFD) and that drilling costs on the Bridger-Teton National Forest would be comparable to those for the Pinedale Field Office. The figures in Table 3 represent "composite well" costs. That is, the differences between the costs of vertically drilled and directionally drilled conventional (non-CBNG) wells were accounted for, based on estimated proportions of each type of well. The percentage of horizontal wells assumed for each field office or planning unit was provided by RMG and was derived from Wyoming Oil and Gas Conservation Commission data. The data accounted for all wells spudded during a particular time period, after any CBNG were removed. The time period was 2000 to present in most cases. The exceptions were: 2008 to present for the Casper Field Office distribution area, and 2003 to present for the distribution areas for the Pinedale Field Office, Rawlins Field Office, and Rock Springs Field Office. The percentage of horizontal wells ranged from 0.6% in the Rawlins Field Office to 34.8% in the Thunder Basin National Grassland. In a few cases, cost differences between shallow and deeper vertical wells were also accounted for.

All cost estimates and assumptions were reviewed by the BLM's RMG. The final ratio between the cost of drilling and completion varied based on what was reported for each well category by the BLM field or district staff. Completion rates were estimated from BLM surface disturbance assumptions that were prepared by the RMG. Completion rates were multiplied by the number of wells drilled per year from the RFD to yield the number of wells completed per year.

The percent of total well costs that were spent within each field office/planning unit study area was estimated to be 89.0 percent for conventional drilling, 61.8 percent for conventional completion, 83.4 percent for CBNG drilling, and 54.4 percent for CBNG completion for all units. These percentages represent composite estimates developed from previous analysis of the LUPs for four of the six field offices included in the analysis. These estimates were applied to all field offices and planning units in this analysis. The percentage of local spending for completion was lower than the percentage for drilling because completion involves the purchase of more tangible inputs that are not readily available in the study areas. Overall, if a well was completed, 73.2 to 79.9 percent of the total costs of a conventional well were estimated to be spent locally depending on the ratio of drilling costs to completion costs and 64.1 to 77.6 percent of the total costs for CBNG wells were estimated to be spent locally (within the study area for field office) depending on the ratio of drilling costs to completion costs.

Table 3. Oil and Gas Well Cost and Completion Rates by Field Office/Planning Unit

	Convent. Drilling	Convent. Completion	Convent. Total	CBNG Drilling	CBNG Completion	CBNG Total
Total Costs Per Well						
Casper	$2,140,000	$1,430,000	$3,570,000	$100,000	$200,000	$300,000
Kemmerer	$1,260,000	$1,000,000	$2,260,000	$740,000	$185,000	$925,000
Newcastle	$550,000	$340,000	$890,000	$100,000	$200,000	$300,000
Pinedale	$2,652,000	$1,851,000	$4,503,000	$740,000	$185,000	$925,000
Rawlins	$1,130,000	$570,000	$1,700,000	$740,000	$185,000	$925,000
Rock Springs	$1,115,000	$1,426,000	$2,541,000	$740,000	$185,000	$925,000
BTNF	$2,652,000	$1,851,000	$4,503,000	$740,000	$185,000	$925,000
MBNF	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
TBNG	$1,430,000	$1,990,000	$3,420,000	$100,000	$200,000	$300,000
Local Spending Per Well - Percent						
Casper	89.0%	61.8%	78.1%	83.4%	54.4%	64.1%
Kemmerer	89.0%	61.8%	77.0%	83.4%	54.4%	77.6%
Newcastle	89.0%	61.8%	78.6%	83.4%	54.4%	64.1%
Pinedale	89.0%	61.8%	77.8%	83.4%	54.4%	77.6%
Rawlins	89.0%	61.8%	79.9%	83.4%	54.4%	77.6%
Rock Spr.	89.0%	61.8%	73.7%	83.4%	54.4%	77.6%
BTNF	89.0%	61.8%	77.8%	83.4%	54.4%	77.6%
MBNF	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
TBNG	89.0%	61.8%	73.2%	83.4%	54.4%	64.1%
Local Spending Per Well - Percent						
Casper	$1,904,346	$883,541	$2,787,887	$83,442	$108,794	$192,236
Kemmerer	$1,121,250	$617,861	$1,739,111	$617,474	$100,634	$718,108
Newcastle	$489,435	$210,073	$699,507	$83,442	$108,794	$192,236
Pinedale	$2,359,965	$1,143,661	$3,503,626	$614,474	$100,634	$718,108

	Convent. Drilling	Convent. Completion	Convent. Total	CBNG Drilling	CBNG Completion	CBNG Total
Rawlins	$1,005,556	$352,181	$1,357,747	$614,474	$100,634	$718,108
Rock Spr	$992,218	$881,070	$1,873,287	$617,474	$100,634	$718,108
BTNF	$2,359,965	$1,143,661	$3,503,626	$614,474	$100,634	$718,108
MBNF	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
TBNG	$1,272,530	1,229,543	$2,502,073	$83,442	$108,794	$192,236
Completion Rates						
Casper		80.0%			90.0%	
Kemmerer		86.4%			90.1%	
Newcastle		71.3%			87.0%	
Pinedale		90.6%			89.8%	
Rawlins		95.1%			90.1%	
Rock Spr		62.4%			80.4%	
BTNF		90.6%			89.8%	
MBNF		N.A.			N.A.	
TBNG		77.4%			90.1%	

The local spending (direct impact) figure per well for each field office or planning unit was parsed into various industrial sectors of the IMPLAN model based on breakdowns of the different types of costs for drilling and completion (each addressed separately) taken from various sources – mainly Authorizations for Expenditures (AFEs) provided by industry. The expenditure data was disaggregated across the following 11 IMPLAN sectors:

Number	Sector Name
28	Drilling Oil and Gas Wells
29	Support Activities for Oil and Gas Operations
36	Construction of Other New Nonresidential Structures
319	Wholesale Trade
335	Truck Transportation
351	Telecommunications
65	Commercial & Industrial Machinery & Equipment Rental & Leasing
367	Legal Services
369	Architectural, Engineering, & Related Services
389	Other Support Services
HH	Households

The IMPLAN model provided estimates of direct, indirect and induced output, employment, and labor earnings. Induced impacts were reduced by 60 percent for sectors 28 and 29 to account for non-local workers involved with drilling and completion of oil and gas wells in Wyoming. This estimate was based on information provided by industry for previous oil and gas economic impact analyses in Wyoming and is consistent with Wyoming Department of Employment data.

Once the economic impacts per well were estimated for drilling and for completion, those figures were multiplied by the total number of wells drilled or completed. The resulting figures were then summed to yield the total impacts of the development stage, by year and by field office or planning unit.

2.1.4 Production Impacts

Information on production of oil and gas was provided by the BLM's RMG and BLM field and district office staff. This information included the number of wells drilled each year by alternative for each field office or planning unit (from the RFD), the percent of wells that were oil versus gas, the percent of wells completed, production decline curves for oil and gas wells, and estimates of cross production from both oil and gas wells. This information was used to develop total oil and gas production estimates by year for each alternative and each field office or planning unit.

The procedure to determine total production was as follows. For each year, the number of wells completed was broken down into oil and gas wells based on the breakdown assumptions per field office and planning unit provided by BLM staff. For each well type, the average first year production rate (volume) from the annual decline curves for each field office and planning unit (as provided by RMG) was then applied to determine the total production from first-year wells. In subsequent years, the appropriate average production rates from the decline curves were applied to the number of second year wells, third year wells, and so on. Total production was then summed across all the well age cohorts for each year within the analysis period. Co-production volume was calculated based on the numbers of wells of each type and the co-production rates from the RMG, and added to the total production volume.

The production volume data was then multiplied by price estimates to estimate total annual sales value revenue streams for oil and gas production. The market prices for oil and gas were based on the State of Wyoming CREG's October 2012 forecasts for 2012–2018 oil and gas prices in Wyoming, expressed in 2011 dollars. These revenue streams were then entered into the IMPLAN models to estimate the total economic impacts from production.

Per unit ad valorem and severance tax revenues estimates were developed from per unit tax revenue rates from the Wyoming Department of Revenue's 2012 Annual Report. These estimated rates were applied to the forecasted market sales values, with the assumption that the Wyoming tax structure will remain constant over the analysis period. The estimates for Federal Mineral Royalties represents Wyoming's 48 percent share of the Federal Government's 12.5 percent royalty rate, which amounts to 6 percent of the market value. Table 4 summarizes the prices and tax revenue rate estimates used in the analysis.

Table 4. Prices and Tax Revenue Estimates for Oil and Gas Production

	Oil ($/BBL)	Gas ($/MCF)
Market Price (1)	$85.00	$4.10
Ad Valorem Tax (2)	$4.81	$0.19
Severance Tax (2)	$4.46	$0.18
Federal Mineral Royalties (3)	$5.10	$0.25

BBL: Barrel; MCF: Million Cubic Feet
(1) Average 2012-2018 CREG Forecast (October 2012)
(2) Wyoming Department of Revenue 2010 Annual Report adjusted to market prices
(3) Assumed Wyoming's share is 6 percent of market value

2.2 Wind Energy

2.2.1 Introduction

The wind energy economic analysis involved two major steps:

- Projecting the amount of wind energy development on BLM and Forest Service-administered land within the study period.
- Estimating the economic impacts of the projected levels of wind energy development. This effort required use of two economic models.

Each of these steps is described in detail below.

The analysis for wind energy economic impacts was divided into two phases of wind energy economic activity:

- Development (construction)
- Production (operation / generation of electricity)

The economic impact analysis for wind energy was conducted at the planning area level only. The level of uncertainty regarding amounts and locations of wind energy development in the planning area was considered too large to allow estimation of economic impacts by BLM field office or Forest Service planning unit. Of particular importance is the fact that wind energy development typically takes place as large projects involving hundreds of megawatts (MW) of capacity. Thus the amount of wind energy projected to be built on BLM and Forest Service-administered land in the planning area during the analysis period would mostly be built in a small number of large projects. It is difficult to foresee where these projects would be built (some in the current pipeline might not ultimately be built; others will come forward), and it is possible that they will not be distributed throughout the planning area in proportion to available wind resources due to locations of transmission lines, business strategies, etc.

The impact analysis did not address how much wind energy development would occur on sage-grouse habitat versus non-habitat. However, to the extent that specific management decisions prohibit or preclude wind energy development on sage-grouse habitat, this was encompassed in the analysis through reduction of the acreage considered available for wind energy development. These reductions impacted the projected amounts of wind energy development, given the assumptions described below.

2.2.2 Wind Energy Development Projections

Projections of the amount of wind energy to be developed over the planning period were based on an analysis by the National Renewable Energy Laboratory (NREL) of the United States Department of Energy. This analysis estimated wind resource availability under the different alternatives. NREL took the constraints of each alternative and overlaid them on wind resource data generated during the BLM wind energy Programmatic EIS analysis. The result of the NREL analysis was an estimate of total *potential* installed capacity (MW), on BLM and Forest Service-administered land in each field office and planning unit under each alternative.

The NREL analysis was sometimes referred to as a “Reasonable Foreseeable Development” (RFD) analysis, but was in fact a resource potential analysis. It indicated how much wind energy might ultimately be developable on BLM and Forest Service-administered land if all land available for wind energy development were developed. To convert resource potential by alternative to a reasonable estimate of wind energy development over a limited time period, additional analysis and assumptions were needed. The time period chosen for the analysis was 2013 to 2020, to match the analysis period used for the other resource uses.

Estimates of likely near-term wind energy development levels in Wyoming vary. One well-regarded study is a 2011 NREL report on Wyoming wind energy development commissioned by the Wyoming Infrastructure Authority (WIA). This study prepared a likely “infrastructure deployment scenario” in Wyoming over the period 2012–2021, and projected total development of 9,000 MW of generating capacity during that period (Lantz and Tegen 2011). The scenario was developed by WIA in conjunction with industry stakeholders, and reflected expected (as of 2011) market-driven development of wind energy generation and transmission to serve out-of-state loads. No major studies of wind energy development in Wyoming have been prepared since. Therefore, several industry experts were consulted in February–March 2013 for their current opinions on likely near-term development. The director of the WIA (Drain 2013) indicated that the 2011 projection is still a reasonable estimate of likely development over the next 10 years (2013–2022). The director of the Wind Energy Research Center (WERC) at the University of Wyoming (Naughton 2013) indicated that wind energy development will depend upon what happens with several major proposed electricity transmission projects. Development of new transmission capacity is essential to getting Wyoming wind energy to markets in other states, and thus is a prerequisite to high levels of wind energy development in the state. The WERC contact suggested that the minimum likely level of Wyoming wind development from 2013 to 2022 is 3,000 MW, and the maximum likely level is 10,000 MW. The wind energy lead in the BLM Wyoming State Office generally concurred with these opinions, but suggested that 4,000 MW is a better assumption for the minimum level of development. Thus, the 4,000 MW and 10,000 MW figures were used as "bookend" projections (low and high development scenarios) for the economic impact analysis.

The next step was to estimate how much of each bookend projection should be assumed to be developed on BLM and Forest Service-administered lands. First, it was assumed that all wind development in the state would occur within the planning area, which covers most of the state and almost all of the areas of Wyoming with high wind resource values. Second, it was assumed that wind energy development on BLM and Forest Service-administered lands would match the proportion of BLM/Forest Service "wind feasible" lands relative to all "wind feasible" lands (including private land and other government land) in the planning area. The definition of wind feasible lands excluded lands where wind development is administratively prohibited (e.g., wilderness areas, National Park Service and Fish and Wildlife Service managed lands, and various other protected or specially designated areas) and where it is physically unlikely (e.g., areas with slopes greater than 20%, wetland and water areas). The definition also reduced the amount of land considered available, if it was under certain management; for instance, only 50% of non-ridge crest Forest Service and Department of Defense lands remaining after application of the other constraints was considered available. Based on the various exclusions, BLM and Forest Service-administered wind feasible lands make up approximately 25% of all wind feasible lands in the planning area. Therefore, in the no action alternative (Alternative A) the amount of wind energy development on BLM and Forest Service-administered lands over the 10-year period from 2013 to 2022 was assumed to be 1,003 MW under the low bookend scenario and 2,507 MW under the high bookend scenario.

The amount of wind developed on BLM and Forest Service-administered lands in the action alternatives was based on the ratio between the resource potential from the NREL analysis for each action alternative and the resource potential for the no action alternative. For instance, under Alternative B, the resource potential from the NREL analysis was 10.1% of the resource potential for Alternative A. Therefore, it was assumed that Alternative B would see 10.1% of the wind energy development of Alternative A. Table 5 presents the different levels of wind energy projected for 2013–2022 for each alternative under the low and high development scenarios.

Table 5. Projected Wind Energy Development Scenarios, in Megawatts

Alternative	Low Development Scenario	High Development Scenario
Alternative A	1,003 MW	2,507 MW
Alternative B	101 MW	253 MW
Alternative C	101 MW	253 MW
Alternative D	784 MW	1,960 MW
Alternative E	101 MW	253 MW

MW: Megawatts

The final step was to develop the annual deployment projections. First, because no projects are currently approved on BLM and Forest Service-administered lands, it was assumed that development would start in 2015, wind energy generation would begin in 2016, and all projected capacity would be developed and generating electricity by 2022. The total development figures in Table 5 were then straight-line interpolated from 2015–2021 for development, and 2016–2022 for generation. Because the economic impact analysis study period ends in 2020, only the annual values through 2020 were used to develop the direct economic impacts that were entered into the IMPLAN model.

2.2.3 Economic Impact Analysis Approach

The analysis used two economic models to estimate the potential economic and fiscal impacts of BLM LUP sage-grouse management amendment decisions related to wind energy development and generation. First, in order to obtain the detailed per unit (MW) construction and operations expenditure information needed to conduct the economic impact analysis, industry standard information was accessed through a wind generation cost model – the Jobs and Economic Development Impact (JEDI) model from NREL. This information was adjusted to reflect the expenditure patterns for a typical wind project in Wyoming.

Secondly, in order to estimate the economic impacts of the project, the IMPLAN economic input-output model was used. Per unit (MW) construction and operations expenditure rates from the JEDI model were multiplied by the number of MWs of capacity constructed or in production in each year for each alternative in order to estimate direct expenditure impacts. The total direct expenditure estimates based on the JEDI model were entered into the IMPLAN model to estimate the indirect, induced, and total economic impacts of the project. As a part of the analysis, estimates of state and local tax revenues resulting from the project were developed based on current tax revenue rates. The following sections summarize the data points and assumptions used in the IMPLAN analysis of wind energy economic impacts. All dollar amounts are expressed in 2011 dollars.

2.2.4 Wind Energy Development (Construction) Inputs

The following economic data and assumptions and assumptions were used in the economic impact analysis:

- Construction expenditures are based on NREL's Wyoming JEDI model for a 100 MW wind project, with some adjustments for expenditure patterns for a typical wind project in Wyoming.
- 30 percent of construction workers are local (Wyoming Industrial Siting Department).
- Non-local constructions workers spend $59.54 per day for lodging and $47.06 per day for meals and incidental expenses (adjusted Federal Daily Per Diem Rates) during their stay in the area.
- Total cost of wind project development is $2,047,600 per MW with $326,328 per MW spent in Wyoming (per the adjusted NREL Wyoming JEDI model).
- 5.5 percent sales and use tax rate for installed equipment (Wyoming Department of Revenue).

The JEDI-based estimates of direct economic impacts for development were disaggregated across seven IMPLAN sectors to estimate the indirect, induced, and total economic impacts of the project. The seven IMPLAN sectors were:

Number	Sector Name
26	Sand, Gravel, and Clay Mineral Mining and Quarrying
161	Ready-Mix Concrete Manufacturing
323	Retail – Building Materials and Garden Supply
411	Hotels and Motels
413	Food Services and Drinking Places
N.A.	Employee Compensation
N.A.	State/Local Government – Non-Educational

2.2.5 Wind Energy Production (Generation) Inputs

The following economic data and assumptions and assumptions were used in the economic impact analysis:

- Operational expenditures are based on NREL's Wyoming JEDI model for a 100 MW wind project, with some adjustments for expenditure patterns for a typical wind project in Wyoming.
- 100 percent of operation workers are local.
- Total spending for operations is $24,409 per MW (adjusted NREL's Wyoming JEDI model).
- Local spending for operations is $17,935 per MW (adjusted NREL's Wyoming JEDI model).
- Generation tax based on $1.00 per MWh beginning after three years of production with a 35.0 percent capacity factor and a 98.0 percent availability factor.
- Property tax 62.9 mill levy assuming 20 year straight line depreciation for equipment.
- 5.5 percent sales and use tax rate on operation expenditures (Wyoming Department of Revenue).

The JEDI-based estimates of direct economic impacts for operations were disaggregated across nine IMPLAN sectors to estimate the indirect, induced, and total economic impacts of the project. The nine IMPLAN sectors were:

Number	Sector Name
31	Electrical Power Generation, Transmission, & Distribution
39	Maintenance & Repair of Nonresidential Structures
319	Wholesale Trade
320	Retail – Motor Vehicles and Parts
323	Retail – Building Supplies and Garden Supply
326	Retail – Gasoline Stations
N.A.	Employee Compensation
N.A.	State/Local Government – Non-Educational
N.A.	State/Local Government – Educational

2.3 Livestock Grazing

2.3.1 Introduction

The livestock grazing economic analysis involved three major steps:

- Estimating the amounts of forage utilized on BLM and Forest Service-administered lands in the planning area under each alternative.
- Estimating the economic value of forage use.
- Estimating the economic impacts based on the value of production.

Each of these steps is described in detail below. There is only one "phase" of economic activity for livestock grazing – livestock production. There is no "development" phase equivalent to the construction activities in the oil/gas and wind energy industries.

The analysis was based around cattle and sheep grazing, which were analyzed separately. Forage utilization for buffalo was combined with cattle forage utilization. Forage utilization for goats was combined with sheep forage utilization. Forage utilization for horses was excluded from the analysis. It was assumed that most forage utilization for horses occurs as support for a ranching operation and thus is a cost of production. Therefore, forage utilization for horses is accounted for in the livestock operations budgets used in developing the value of production for marketable livestock.

The economic impacts were evaluated at both the study area and state level for each field office and planning unit. The MRIO analysis feature of IMPLAN was used to evaluate the economic impacts for each field office and planning unit at the state level.

It is also very important to note that the forage utilization estimates, and thus the economic impact estimates, only represent livestock grazing in sage-grouse habitat. They do not represent the total impact of livestock grazing in each BLM field office or Forest Service planning unit. Because of this, the percentage decrease between the action alternatives and Alternative A would be less on a total impact basis than in the figures in Chapter 4, which are for sage-grouse habitat only.

2.3.2 Estimation of Forage Utilization

The economic impact estimates for livestock grazing were based on the 10-year average (2003–2012) of billed animal unit months (AUMs) of forage use for cattle, sheep, and other livestock for each BLM field office and Forest Service planning unit. One AUM is equal to the amount of forage consumed by a cow and calf during a 1-month grazing period. Billed forage use is the closest available proxy for actual forage use. Because billed use may exceed actual grazing use, the economic analyses may overstate the actual economic impacts of grazing to some degree.

Two procedures were used to estimate forage utilization specific to sage-grouse habitat. For Forest Service planning units, the procedure was as follows:

- Grazing in sage-grouse habitat was evaluated on an allotment basis, based on available geographic information system (GIS) data layers for the total Forest Service acres capable/suitable for grazing in each allotment, the Forest Service capable/suitable acres in each allotment that are in sage-grouse core/priority habitat, and the Forest Service capable/suitable acres in each allotment that are in sage-grouse general habitat.
- For each allotment, the percentage of land in each type of habitat was calculated relative to the total Forest Service acres capable/suitable for grazing.
- This percentage was then multiplied by the total AUMs in each allotment to determine the number of AUMs in each type of sage-grouse habitat in each allotment.
- The number of AUMs in each type of sage-grouse habitat were then summed for each Forest Service planning unit.

For BLM field offices, the GIS data necessary for an allotment-level analysis were not available. Therefore, grazing in sage-grouse habitat was evaluated on a field-office basis. This was done by determining the proportion of each field office's BLM-administered surface land[5] that is within each habitat type, and applying that same percentage breakdown to the total AUMs in the field office. This approach makes two assumptions: (1) all portions of the grazing allotments are suitable for grazing, and (2) all BLM-administered lands within the BLM field offices are within grazing allotments. While it is clear that these assumptions are not entirely accurate, BLM staff considered the methodology to be reasonable given the nature of a planning-level analysis and the lack of data that would permit a more precise methodology.

The forage utilization analyses were conducted separately for cattle and sheep. As noted earlier, bison AUMs were grouped with cattle AUMs, and goat AUMs were grouped with sheep AUMs. Horse AUMs were excluded from the analysis on the grounds that horses are factor of production rather than a marketable commodity.

The forage utilization estimates did not vary between Alternatives A, C, D, and E. While forage utilization could vary somewhat under these alternatives (e.g., due to differences in treatment of voluntary relinquishment of permits or grazing preference), the differences between the alternatives could not be

[5] *Other federal land for which grazing is managed by BLM was also included.*

quantified. In the case of Alternative C, the management decision to prohibit livestock grazing within sage-grouse priority habitat was quantifiable, and the economic impact analysis therefore reflects a lower level of forage utilization and economic production under this alternative.

2.3.3 Estimation of the Economic Value of Forage Use

The value of grazing in a specific area can be estimated based on the grazing use of the area in AUMs as describe above, and the value of an AUM. The direct value of production per AUM was estimated based on regional livestock production value data and ratios in the livestock economics literature. According to Workman (1986), it takes 16 AUMs to produce a marketable cow. Thus, the average value of an AUM can be estimated using data on the value of cattle production per bred cow and dividing by 16. A similar procedure can be used to estimate the value of an AUM used for sheep production, using 3.2 AUMs per ewe.

The value per AUM for cattle was based on a 10-year average (2002–2011) of the annual value of production per bred cow estimates from the United States Department of Agriculture (USDA) Economic Research Service's Commodity Cow-Calf Costs & Returns estimates for the Basin and Range and Northern Great Plains portions of the United States. The Casper Field Office, Newcastle Field Office, and Thunder Basin National Grassland are located in the Northern Great Plains region. All other field offices and planning units are located in the Basin and Range region. The methodology and data for calculation of the average value of cattle production from one AUM of forage are show in Table 6 and Table 7.

The direct value of production for sheep was based on the annual value of production per ewe from the most recent (2010) University of Idaho Cooperative Extension Service's Idaho Livestock Costs and Returns Estimates for range sheep (Gray and Painter 2010). This is the most analogous currently available data for Wyoming sheep production. The methodology and data for this calculation are shown in Table 8.

The figures for the value per AUM for cattle or sheep grazing were multiplied by the number of AUMs in sage-grouse habitat under each alternative and for each field office and planning unit. The result was the total economic value of livestock production, which was used as the direct impact input to the IMPLAN model.

Table 6. Value of an AUM for Cattle Production, Basin & Range Region

Year	Value of Production Per Bred Cow[1]	AUMs Per Cow[2]	Value of Production Per AUM	IMPLAN Inflator	Inflated Value of Production Per AUM*	Cow-Calf Adjustment[3]	Adjusted Value of Production per AUM
2002	$533.64	16	$33.35	1.230	$41.01	1.2	$49.21
2003	$609.07	16	$38.07	1.204	$45.84	1.2	$55.01
2004	$706.24	16	$44.14	1.171	$51.70	1.2	$62.04
2005	$752.44	16	$47.03	1.134	$53.31	1.2	$63.97
2006	$720.09	16	$45.01	1.098	$49.42	1.2	$59.31
2007	$681.50	16	$42.59	1.067	$45.45	1.2	$54.54
2008	$496.02	16	$31.00	1.044	$32.37	1.2	$38.84
2009	$472.00	16	$29.50	1.035	$30.53	1.2	$36.64
2010	$570.50	16	$35.66	1.021	$36.42	1.2	$43.70
2011	$648.59	16	$40.54	1.000	$40.54	1.2	$48.64

Year	Value of Production Per Bred Cow[1]	AUMs Per Cow[2]	Value of Production Per AUM	IMPLAN Inflator	Inflated Value of Production Per AUM*	Cow-Calf Adjustment[3]	Adjusted Value of Production per AUM
10-year Average							$51.19

[1] USDA Economic Research Service, Commodity Costs & Returns, data for Basin & Range region, cow-calf pair.
[2] Workman 1986.
[3] National Agricultural Statistical Service.
*Value times inflator.

Table 7. Value of an AUM for Cattle Production, Northern Great Plains Region

Year	Value of Production Per Bred Cow[1]	AUMs Per Cow[2]	Value of Production Per AUM	IMPLAN Deflator	Inflated Value of Production Per AUM*	Cow-Calf Adjustment[3]	Adjusted Value of Production per AUM
2002	$481.53	16	$30.10	0.831	$36.22	1.2	$43.46
2003	$561.31	16	$35.08	0.848	$41.37	1.2	$49.64
2004	$644.37	16	$40.27	0.872	$46.18	1.2	$55.42
2005	$692.18	16	$43.26	0.901	$48.01	1.2	$57.62
2006	$653.97	16	$40.87	0.930	$43.95	1.2	$52.74
2007	$628.65	16	$39.29	0.957	$41.06	1.2	$49.27
2008	$541.86	16	$33.87	0.978	$34.63	1.2	$41.55
2009	$519.55	16	$32.47	0.989	$32.83	1.2	$39.40
2010	$608.95	16	$38.06	1.000	$38.06	1.2	$45.67
2011	$703.61	16	$43.98	1.020	$43.11	1.2	$51.74
10-year Average							$48.65

[1] USDA Economic Research Service, Commodity Costs & Returns, data for Basin & Range region, cow-calf pair.
[2] Workman 1986.
[3] National Agricultural Statistical Service.
*Value divided by deflator. Note: 2010 was used as the base year here. The 10-year average, if 2011 were used as the base year, would be about 2% higher. Thus, the figures in Chapter 4 underestimate the economic impacts by about 2%. However, this difference is well within the margin of error of the economic impact analysis methodology.

Table 8. Value of an AUM for Sheep Production

Year	Value of Production Per Ewe[1]	AUMs Per Ewe (1/5)[2]	Value of Production Per AUM	IMPLAN Inflator	Inflated Value of Production Per AUM*
2010	$185.65	3.2	$58.02	1.000	$58.02

[1] University of Idaho Extension, Idaho Livestock Costs and Returns Estimates, Sheep—Range, gross receipts per ewe.
[2] Workman 1986.
* The value should be inflated to 2011 dollars, but the inflator used was for 2010. The value of production if 2011 dollars were used would be about 0.6 percent higher. Thus, the figures in Chapter 4 underestimate the economic impacts by about 0.6%. However, this difference is well within the margin of error of the economic impact analysis methodology.

2.3.4 IMPLAN Model Modifications

The value-added components of the All Other Crop Farming sector (sector 10) in IMPLAN were modified to better reflect hay production in the study area. The modifications were based on a grass hay operation budget from the University of Idaho (Painter 2011).

2.3.5 Livestock Production Impacts

The economic impacts of livestock grazing were estimated in IMPLAN using analysis-by-parts methodology. The total value of production from the steps described above was allocated to different IMPLAN sectors based on 2010 livestock production budgets from the University of Idaho (Gray et al. 2010; Gray and Painter 2010).

The costs of production were disaggregated across 14 IMPLAN sectors:

Number	Sector Name
2	Grain Farming
10	All Other Crop Farming
11	Cattle Ranching and Farming
14	Animal Production, Except Cattle, Poultry, and Eggs
19	Support Activities for Agriculture and Forestry
40	Maintenance & Repair Construction of Residential Structures
319	Wholesale Trade
335	Truck Transportation
354	Monetary Authorities and Depository Credit Intermediation
360	Real Estate
368	Accounting, Tax Preparation, Bookkeeping
379	Veterinary Services
417	Commercial and Industrial Machinery and Equipment Repair
N.A.	Employee Compensation

2.4 Recreation

2.4.1 Introduction

The tables in this subsection present two views of the economic effects of recreation. Economic impact measures only the effects of “new” income in the study area; in the case of recreation, economic impact is based on all spending of non-local residents on local recreation, and the spending by local residents that would be lost to other regions if the local BLM or Forest Service recreational opportunity did not exist (some spending by local residents would continue, using local substitute recreation opportunities). Economic contribution includes the effects of all expenditures made by local residents (roughly, individuals who live within the socioeconomic study area), as well as the role of spending from recreators from outside the study area. In other words, economic contribution is based on all spending of local residents on local recreation and all spending of non-local residents on local recreation. Economic impact is the measure used in the analyses above of oil and gas development and production, wind energy development and production, and livestock grazing. Local residents buy only a very small proportion of the total output of those industries, so a measure of economic contribution would be only slightly greater than the measure of economic impact. In the case of recreation, however, local residents make considerable recreation-related expenditures (gas, food, and so on while on local trips), so it is fair to include those expenditures in an analysis of the economic role of recreation. Put another way, expenditures by local and non-local recreationists alike help keep local businesses going.

The quantitative economic analyses in Chapter 4 for recreation consist of one set of figures for all alternatives for each geographic area. The estimates do not address differences between the alternatives. This is because the differences in management actions affecting recreation cannot be quantified. Differences in impacts between the alternatives are discussed qualitatively. It is also important to note that the analyses assume future recreation use levels (from 2013 to 2020) remain constant at recent actual use levels. This assumption may mean that the figures in Chapter 4 underestimate the economic effects of recreation over this period. Population trends in the Rocky Mountains and the U.S. generally would tend to indicate that travel and recreation will increase in the future; however, it is not entirely clear that outdoor recreation is increasing. Finally, readers should understand that the estimates of economic effects presented in Chapter 4 are for all recreation use in each field office or planning unit; insufficient information exists to allow estimation of recreation use on habitat areas only.

2.4.2 Estimation of Recreation Usage

For BLM field offices, recreation estimates were taken from the Recreation Management Information System (RMIS). Figures from the most recent year (fiscal year 2012) were used for all field offices except the Pinedale Field Office. For Pinedale, figures from fiscal year 2010 were used, due to 2011/2012 fire closures of certain recreation areas in that field office.

For Forest Service planning units, recreation estimates were taken from the most recent recreation survey report from the Forest Service National Visitor Use Monitoring (NVUM) program. The most recent available NVUM surveys were from fiscal year 2008 for the Bridger-Teton National Forest and for the Medicine Bow National Forest. The Thunder Basin National Grassland was included in the Medicine Bow National Forest NVUM survey, thus one economic impact analysis was completed that included both of these planning units together.

Recreation usage data is expressed in “visits.” A visit is defined as one individual who enters and recreates on a national forest unit (or BLM unit) for an indeterminate period of time. A visit ends when that individual spends a night off the national forest or BLM unit. The fact that some visits are of a single day or less, and some are for multiple days, is accounted for in the approach to estimating the direct impacts (expenditures) of visitors, as discussed below. Table 9 shows the total visits in each field office or planning unit and the year and source of the data.

Table 9. Total Non-Skiing Recreation Visits

Unit	Total Visits*	Year	Source
Casper Field Office	322,431	2012	BLM RMIS
Kemmerer Field Office	223,083	2012	BLM RMIS
Newcastle Field Office	8,220	2012	BLM RMIS
Pinedale Field Office	372,518	2010	BLM RMIS
Rawlins Field Office	226,251	2012	BLM RMIS
Rock Springs Field Office	426,439	2012	BLM RMIS
Bridger-Teton National Forest	1,522,797	2008	Forest Service NVUM
Medicine Bow National Forest and Thunder Basin National Grassland	955,669	2008	Forest Service NVUM

*Excluding downhill skiing visits, based on segmentation data from White et al. 2012.

2.4.3 Estimation of the Direct Economic Impacts of Recreation

In the case of the Forest Service planning units included in this planning action, the direct economic impacts or contributions were developed by multiplying the available NVUM recreation use data for the planning unit by the NVUM expenditure data applicable to the planning unit. In other words, the impacts or contributions are very closely based on the actual NVUM survey findings. The dollar values were updated from 2008 to 2011.

Due to the lack of recreation expenditure data for BLM field offices, Forest Service NVUM data were used to estimate the economic impact of recreation for all field offices and Forest Service planning units. The NVUM program provides a robust data source that is widely used for recreation economic impact analysis for areas besides Forest Service-managed lands. This is done by identifying national forest units that are reasonably analogous to another recreation management area, and applying the recreational expenditure data from NVUM to other area-specific recreation use data or estimates.

In order to match field offices with national forests, the recreation specialists at each office was asked to select a comparator forest from neighboring forests in the region. The following is a list of the comparator forest for each field office:

Field Office	Comparator Forest
Casper Field Office	Medicine Bow National Forest
Kemmerer Field Office	Wasatch-Cache National Forest
Newcastle Field Office	Dakota Prairie National Grasslands
Pinedale Field Office	Bridger-Teton National Forest
Rawlins Field Office	Medicine Bow National Forest
Rock Springs Field Office	Ashley National Forest

The NVUM recreation segment / expenditure data were applied to the BLM field offices as described below. All expenditures from NVUM as applied to the BLM field offices were assumed to be local (within the socioeconomic study area for each study area), based on how the NVUM data was collected (surveys asked interviewees for their expenses within 50 miles of the recreation site).

- Trip segment estimates from the comparator forest were used to allocate, by trip type, total field office recreation visit estimates from the BLM's RMIS.
- The estimates of number of visits by trip type were then converted to party visits and multiplied by averages days/nights per visit to estimate total party days/nights.
- Total party days/nights were multiplied by party spending per day/night to estimate direct spending by visitors, by segment. The party spending figures from NVUM are averages for high, medium, and low-expenditure forests (as applicable) and incorporate adjustments for different survey years across the forest units that are included. The NVUM researchers determined that expenditure figures based on averages across multiple forests are more reliable than individual forest expenditures.
- Party spending per visit was adjusted to 2011 dollars using IMPLAN inflators.
- Total direct spending across all segments was summed to yield the total direct economic contribution estimates.
- Total direct spending was adjusted (reduced) for the local trip segments to reflect estimated out-of-area substitution (based on national data). The remaining direct spending across all segments was then summed to yield the total direct economic impact estimates.

Table 10 shows the NVUM trip segment data and expenditures by trip segment used in the analysis. Table 11 shows an example of the calculation of total direct economic contribution or impact.

Table 10. Trip Segment Data and Expenditures by Trip Segment

Unit	Analog National Forest	NVUM Year	Non-Local Recreators			Local Recreators			Non-Primary
			Day	OVN on NF	OVN off NF	Day	OVN on NF	OVN off NF	
Distribution of National Forest Visits by Market Segment – excluding downhill skiing									
Casper FO	Medicine Bow NF	FY2008	14.1%	14.5%	9.9%	44.4%	4.1%	1.0%	12.0%
Kemmerer FO	Wasatch-Cache NF	FY2007	1.0%	4.6%	3.9%	78.4%	5.6%	0.0%	6.6%
Newcastle FO	Dakota Prairies NG[1]	FY2008	7.0%	0.0%	16.0%	50.0%	10.0%	5.0%	12.0%
Pinedale FO	Bridger-Teton NF	FY2008	5.0%	9.0%	21.0%	51.0%	1.0%	1.0%	12.0%
Rawlins FO	Medicine Bow NF	FY2008	14.1%	14.5%	9.9%	44.4%	4.1%	1.0%	12.0%
Rock Springs FO	Ashley NF	FY2007	10.0%	33.0%	2.0%	37.0%	9.0%	0.0%	9.0%
Bridger-Teton NF	Bridger-Teton NF	FY2008	5.0%	9.0%	21.0%	51.0%	1.0%	1.0%	12.0%
Medicine Bow NF & Thunder Basin NG	Medicine Bow NF (includes Thunder Basin NG)	FY2008	14.1%	14.5%	9.9%	44.4%	4.1%	1.0%	12.0%
Average Spending by Market Segment – excluding downhill skiing (2009$)									
Casper FO	Medicine Bow NF*		$63	$73	$117	$33	$68	$58	$33
Kemmerer FO	Wasatch-Cache NF**		$56	$60	$75	$32	$66	$48	$32
Pinedale FO	Bridger-Teton NF***		$88	$95	$160	$28	$87	$81	$28
Newcastle FO	Dakota Prairies NG*		$63	$73	$117	$33	$68	$58	$33
Rawlins FO	Medicine Bow NF*		$63	$73	$117	$33	$68	$58	$33
Rock Springs FO	Ashley NF*		$63	$73	$117	$33	$68	$58	$33
Bridger-Teton NF	Bridger-Teton NF***		$88	$95	$160	$28	$87	$81	$28
Medicine Bow NF & Thunder Basin NG	Medicine Bow NF (includes Thunder Basin NG)*		$63	$73	$117	$33	$68	$58	$33

[1] Trip segmentation for the Dakota Prairies NG was adjusted (final figures shown here) for application to the Newcastle Field Office based on input from the Outdoor Recreation Planner for the Buffalo and Newcastle Field Offices.
* Average spending forest
** Low spending forest
*** High spending forest
Acronyms: FY – Fiscal Year; NF – National Forest; NG – National Grassland; NVUM – National Visitor Use Monitoring program; OVN – Overnight
Primary Source: White et al. 2012

Table 11. Direct Recreation Expenditures Calculation Example: Rock Springs Field Office

Trip Type	Forest % of Non-Skier Visits	FO Individual Visits	Forest Average Party Size	FO Party Visits	Forest Average Days/ Nights	Party Days/ Nights	Forest Party Spending Per D/N (2009$)	IMPLAN Inflator	Forest Party Spending Per D/N (2011$)	Estimated Field Office Direct Economic Contribution	Forest Out of Area Substitution*	Estimated Field Office Direct Economic Impact
Non-Local												
Day Trips	10.0%	42,644	3.1	13,756	1.0	13,756	$62.65	1.035	$64.84	$891,983	100.0%	$891,983
OVN on Forest	33.0%	140,725	2.8	50,259	4.9	246,269	$72.95	1.035	$75.50	$18,594,074	100.0%	$18,594,074
OVN off Forest	2.0%	8,529	3.0	2,843	2.8	7,960	$116.86	1.035	$120.95	$962,786	100.0%	$962,786
Local												
Day Trips	37.0%	157,782	2.7	58,438	1.0	58,438	$33.02	1.035	$34.18	$1,997,157	17.0%	$339,517
OVN on Forest	9.0%	38,380	3.1	12,380	1.6	19,809	$67.70	1.035	$70.07	$1,387,991	36.0%	$499,677
OVN off Forest	0.0%	0	0.0	0	0	0	$57.56	1.035	$59.57	$0	46.0%	$0
Non Primary Visits												
Non Primary Visits	9.0%	38,380	2.4	15,991	1.0	15,991	$33.02	1.035	$34.18	$546,519	100.0%	$546,519
Total	100.0%	426,439	2.8	153,668		362,223				$24,380,511		$21,834,556

The NVUM national forest analog is the Ashley National Forest.
*Out-of-Area Substitution: The portion of spending of local recreation visitors that would be lost to the region in the absence of the local recreation opportunities. If local visitors were to go outside the region because of the absence of the local recreation opportunities (rather than spending their money on something else locally), their spending would constitute a loss to the local economy and should therefore be included in an impact analysis.
Acronyms: D/N – Day/Night; FO – Field Office; OVN: Overnight
Sources: Rock Springs Field Office total visits from BLM RMIS data, 2012. National Forest Out-of-Area Substitution: White and Stynes 2010. All other National Forest data: White et al. 2012, adjusted to 2011 dollars using IMPLAN inflators.

2.4.4 IMPLAN Model Modifications

No modifications were made to the IMPLAN model for recreation-related sectors. The coefficients used by the model for these sectors are generally considered reliable for Wyoming.

2.4.5 Recreation Impacts

As noted earlier, the economic importance of recreation in the BLM field offices and Forest Service planning units was considered both in terms of "economic contribution" which is a descriptive analysis that simply tracks the gross economic activity as the dollars cycle through the region's economy and "economic impact" which estimates the net economic activity that would be lost from the local economy without the resource. The total direct economic contributions or impacts were used in the IMPLAN model to estimate the indirect, induced, and total economic effects of recreation. Also, the recreation analysis differed from the other analyses in that it considered all recreation use (except for downhill skiing) for each field office or planning unit, not just the recreation use in areas affected by sage-grouse management.

The total direct economic contributions or impacts were entered into the IMPLAN model using expenditure distributions by trip types that were developed by the Forest Service from the NVUM surveys. The direct recreation spending was disaggregated across the following 10 IMPLAN sectors based on the spending distributions from NVUM:

Number	Sector Name
324	Retail – Food and Beverages
326	Retail – Gasoline Stations
328	Retail – Sporting Goods, Hobby, Book, Music
330	Retail – Miscellaneous
362	Automotive Equipment Rental and Leasing
410	Other Amusement and Recreation Industries
411	Hotels and Motels
412	Other Accommodations
413	Food Services and Drinking Places
429	Other Federal Government Enterprises

2.5 Nonmarket Values

The analysis of nonmarket values was partly quantitative and partly qualitative. Nonmarket values (consumer surplus value) associated with recreation were estimated quantitatively at a very high level using a methodology described below. Other nonmarket values were discussed qualitatively in Chapter 4.

2.5.1 Recreation Consumer Surplus Value Methodology

As discussed in the Socioeconomic Baseline Report, consumer surplus is the maximum dollar amount above any actual payments made that a consumer would be willing to pay to enjoy a good or service. It is a measure of the value recreationists receive that is not priced in markets. Consumer surplus values have been researched and defined in many studies in the economics literature for many recreation activities and many locations (see for example, Loomis 2005 and Rosenberger 2012). Values from this literature can be applied to new locations using a methodology known as "benefits transfer." Studies representing sites and recreation activities that are analogous to the site and activity under consideration are selected, and consumer surplus values are then applied to the new location. The values must be expressed in or converted to the same units (e.g., per visitor day) and generally multiple analogous studies are selected and their values averaged.

The benefits transfer approach has been applied in an analysis for Chapter 4 of the Northwest Colorado Greater Sage-Grouse Draft Land Use Plan Amendment / Environmental Impact Statement (BLM 2013). The authors of that analysis reviewed and selected from a large number of studies across in the Rocky Mountain and Great Basin area (Colorado, Utah, Wyoming, 31 Arizona, New Mexico, Idaho, Montana, and Nevada). The analysis selected studies relevant to the types of recreation activities taking place on BLM and Forest Service-administered lands, multiplied average values for each activity by the number of visitor days per activity, and then summed the results. The total estimated consumer surplus value based on the selected studies and recreation levels in recent years was $193.8 million in 2012 dollars, based on just over 4 million estimated recreation visitor days. Thus the overall average consumer surplus value was $48.36 per visitor day.

For the analysis of consumer surplus values associated with recreation in the Wyoming planning area, this EIS used the average consumer surplus value per day from the results of the Colorado Sage-grouse EIS. This figure was applied to estimated visitor days on BLM and Forest Service-administered lands in the planning area in Wyoming. If a more detailed approach (activity by activity, as in the Colorado Sage-grouse EIS) were used for this analysis for Wyoming, it is likely that many of the same nonmarket studies would be used. Thus the average consumer surplus value per day from the results of the Colorado Sage-grouse EIS is a reasonable proxy for this Wyoming EIS. In addition, the types of activities taking place on BLM and Forest Service-administered lands in the Wyoming planning area is likely to be very similar to that taking place on such lands in Colorado. The proportions of visitor days by activity probably differ across the two planning areas, but the differences would be unlikely to yield vastly different results in terms of total consumer surplus value.

Total visitor days for BLM field offices were taken directly from RMIS. Visitor days for the Forest Service planning units were calculated from NVUM data in order to remove downhill skiing visits. Table 12 and Table 13 show these calculations. National Forest visits were used as the basis for the calculations because the activity data showing hours by activity in the individual forest NVUM master reports is based on National Forest Visits rather than site visits.

Table 12. Calculation of Visitor Days, Bridger-Teton National Forest

Recreation Type	Total National Forest Visits*	Average Hours/Visit**	Total Hours (by multiplication)	Visitor Days (Hours/12)
All Visits	2,181,657	24.0	52,359,768	4,363,314
Downhill Skiing Visits	658,860	5.1	3,360,188	280,016
Non-Downhill Skiing Visits (by subtraction)	1,522,797	--	48,999,580	4,083,298

*White et al. 2012.
**Forest Service 2012a.

Table 13. Calculation of Visitor Days, Medicine Bow National Forest and Thunder Basin National Grassland

Recreation Type	Total National Forest Visits*	Average Hours/Visit**	Total Hours (by multiplication)	Visitor Days (Hours/12)
All Visits	990,331	28.3	28,026,367	2,335,531
Downhill Skiing Visits	34,662	5.1	176,774	14,731

Recreation Type	Total National Forest Visits*	Average Hours/Visit**	Total Hours (by multiplication)	Visitor Days (Hours/12)
Non-Downhill Skiing Visits (by subtraction)	955,669	--	27,849,593	2,320,799

*White et al. 2012.
**Forest Service 2012b.

Table 14 shows the total visitor days across the planning area, and the calculation of total consumer surplus. In round numbers, appropriate to the uncertainties inherent in the estimation of nonmarket values, the estimated total consumer surplus value is $362 million on an annual basis, and $2,543 million in net present value over the period 2013–2020. The calculation of consumer surplus is only provided at the planning area level, in order to even out any variations in the breakdown of different activity types by individual office or unit. The use of the average consumer surplus value per visitor day from the Colorado sage-grouse amendments EIS is likely to be more accurate at the planning area level than at the individual office or unit level. In addition, the figure was also only applied at the planning area level in the Colorado Sage-grouse EIS.

Table 14. Total Visits, Visitor Days, and Consumer Surplus Value

Field Office or Planning Unit	Year	Source	Total Visits	Visitor Days
Casper Field Office	2012	BLM RMIS	322,431	251,016
Kemmerer Field Office	2012	BLM RMIS	223,083	90,383
Newcastle Field Office	2012	BLM RMIS	8,220	9,289
Pinedale Field Office	2010	BLM RMIS	372,518	217,384
Rawlins Field Office	2012	BLM RMIS	226,251	238,303
Rock Springs Field Office	2012	BLM RMIS	426,439	280,842
Bridger-Teton National Forest	2008	Forest Service NVUM	1,522,797	4,083,298
Medicine Bow National Forest and Thunder Basin National Grassland	2008	Forest Service NVUM	955,669	2,320,799
Totals			4,057,408	7,491,315
Average Consumer Surplus Value per Visitor Day from Colorado Sage-grouse Amendment EIS				$48.36
Total Estimated Annual Consumer Surplus Value				**$362,273,127**
Total Estimated Consumer Surplus Value through 2020*				**$2,543,045,837**

*Based on a 3% discount rate applied to the annual consumer surplus value from 2013 to 2020

ACRONYMS LIST

AFE	Authorization for Expenditures
AUM	Animal Unit Month
BBL	Barrel
BEA	Bureau of Economic Analysis
BLM	Bureau Land Management
BLS	Bureau of Labor Statistics
BTNF	Bridger-Teton National Forest
CBNG	Coal Bed Natural Gas
CREG	Consensus Revenue Estimating Group
D/N	Day/Night
EIS	Environmental Impact Statement
EJ	Environmental Justice
EO	Executive Order
FO	Field Office
FY	Fiscal Year
GIS	Geographic Information System
IMPLAN	IMPact analysis for PLANning
JEDI	Jobs and Economic Development Impact
LQ	Location Quotient
LRMP	Land and Resource Management Plan
MBNF	Medicine Bow National Forest
MCF	Million Cubic Feet
MIG	Minnesota IMPLAN Group
MRIO	IMPLAN's Multi-Region Input-Output
MW	Megawatt
NF	National Forest
NG	National Grassland
NREL	National Renewable Energy Laboratory
NVUM	Forest Service National Visitor Use Monitoring
OHV	Off-Highway Vehicle
OMB	Office of Management and Budget
OVN	Overnight
RFD	Reasonable Foreseeable Development

RMG	Reservoir Management Group
RMIS	Recreation Management Information System
RMP	Resource Management Plan
TBNG	Thunder Basin National Grassland
USDA	United States Department of Agriculture
Forest Service	United States Forest Service
WERC	Wind Energy Research Center
WIA	Wyoming Infrastructure Authority

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