BUREAU OF BUSINESS AND ECONOMIC RESEARCH
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THE IMPACT OF TIMBER HARVEST DECLINES ON THE RAVALLI COUNTY ECONOMY

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1. Executive Summary: The Impact of Timber Harvest Declines on the Ravalli County Economy

As in many western communities with a timber heritage, the forest industry in Ravalli County in southwestern Montana has undergone dramatic changes, growing substantially in the decades after World War II and contracting since the 1990s (Keegan et al. 2006). Just 17 primary wood products facilities were operating in Ravalli County during 2014 (Hayes and Morgan 2017) and capacity to process timber was 13 million board feet (MMBF) Scribner, with the majority of that capacity in the log home sector. By contrast, in 1988 the county's 29 active facilities had a capacity of 91 MMBF – seven times larger than today.

The dramatic decline in timber capacity was driven by declines of similar magnitude in timber harvests. In the late 1980s, total timber harvest in Ravalli County averaged just over 34 MMBF per year. In the five most recent years with available data (2012-16) average annual harvest was under 10 MMBF.

With approximately 88 percent of the total forestland in Ravalli County under National Forest System (NFS) management, the policies and decisions affecting the Bitterroot National Forest (BNF) timber harvest have been a significant contributor to these industry trends. Between the late 1980s and today, harvests of BNF timber have declined 71 percent. Federal timber harvest reductions and low levels of harvest throughout the western U.S. are a direct result of the complex mix of evolving federal land management policies, agency budgets, environmental laws and case law developed from repeated litigation of federal forest management activities – particularly timber related activities (Keele et al. 2006; Miner et al. 2014; Morgan and Baldridge 2015; Keele and Malmsheimer 2018).

This study considers the impact of BNF timber harvest reductions on a) the local forest products industry, and b) the county economy as a whole. We consider what kind of local production capacity could have been sustained if management policies and timber harvest levels for the BNF had remained consistent with harvest levels of the late 1980s. Using an economic model, we estimate the level of economic activity – in terms of jobs, income, production and sales – that could have occurred in the county if policy decisions to reduce those harvests had not been made.

A comparison of this level of economic activity and the one that exists today, provides an estimate of the economic impacts of land management policy, which led to reduced timber harvest levels on the BNF.

Summary of Results

Our basic finding is that NFS land management decisions affecting timber harvests from the BNF have had significant economic implications for the Ravalli County economy. More specifically, we find that the reductions in timber harvests from the BNF that have occurred since the late 1980s have caused:

- A loss of 514 jobs in the Ravalli County economy overall, including 214 jobs in sawmills, log home production, logging and other forestry activities with a direction connection to the processing of timber harvested locally.
- A loss of $32.6 million annually in income received by Ravalli County households, including $28.3 million in annual disposable income.
- A decline in economic output – measured by gross receipts of businesses and other organizations – of $113 million per year.
- A population decline of 825 people, including 176 school-aged children.

Table 1.1 The Economic Impact of Decreased Timber Harvest
Impacts Summary

Category	Units	Impact
Total Employment	Jobs	514
Personal Income	$ Millions	32.6
Disposable Pers. Income	$ Millions	28.3
Output	$ Millions	113.0
Population	People	825

About the Bureau of Business and Economic Research

The Bureau of Business and Economic Research (BBER) was founded as the research arm of the University of Montana's College of Business in 1948. As set forth in its mission statement,

"The purpose of the bureau is to serve the general public, as well as people in business, labor and government, by providing an understanding of the economic environment in which Montanans live and work."

Over the years, BBER has become one of the most sought-after sources of information and analysis on the Montana economy. It has published the Montana Business Quarterly, its award-winning research magazine, since 1962.

BBER's Forest Industry Research Program (FIRP) is a leading provider of timber harvest, forest industry data and analysis in the western U.S. Since the 1970s, FIRP has worked with the U.S. Forest Service's (USFS) Forest Inventory and Analysis (FIA) program, Rocky Mountain and Pacific Northwest Research

Stations and National Forest Systems to provide information on the status of the western wood products industry, trends in timber harvest and utilization, timber harvesting and hauling costs, delivered log prices, costs associated with litigation of timber sales and the economic impacts of forest industry activity. Other clients of FIRP include the Montana Department of Natural Resources and Conservation (DNRC), the Oregon Department of Forestry (ODF) and the California Department of Forestry and Fire Protection (CalFire).

2. Introduction and Overview

Ravalli County, located in southwestern Montana, is bounded by the Sapphire Mountains on the east and the Bitterroot Range on the west, encompassing the Bitterroot Valley, with the Bitterroot River and its tributaries. The county is approximately 2,400 square miles in area with over 1.54 million acres of land. 1.11 million acres (72 percent) are in the Bitterroot National Forest (BNF) managed by the National Forest System (NFS). Agricultural pursuits have been a mainstay of the economy since the mid-19th century. Timber harvesting and wood products have been a part of the agricultural scenery since the first sawmill was constructed near Stevensville in the mid-1840s (Flanagan 2003). As in many western communities with a timber heritage, the forest industry in Ravalli County has undergone dramatic change, growing substantially in the decades after World War II and then contracting since the 1990s (Keegan et al. 2006). With approximately 88 percent of the forestland in Ravalli County under NFS management, the policies and decisions affecting the BNF timber harvest also impact the forest industry and overall economy of the county.

Methods

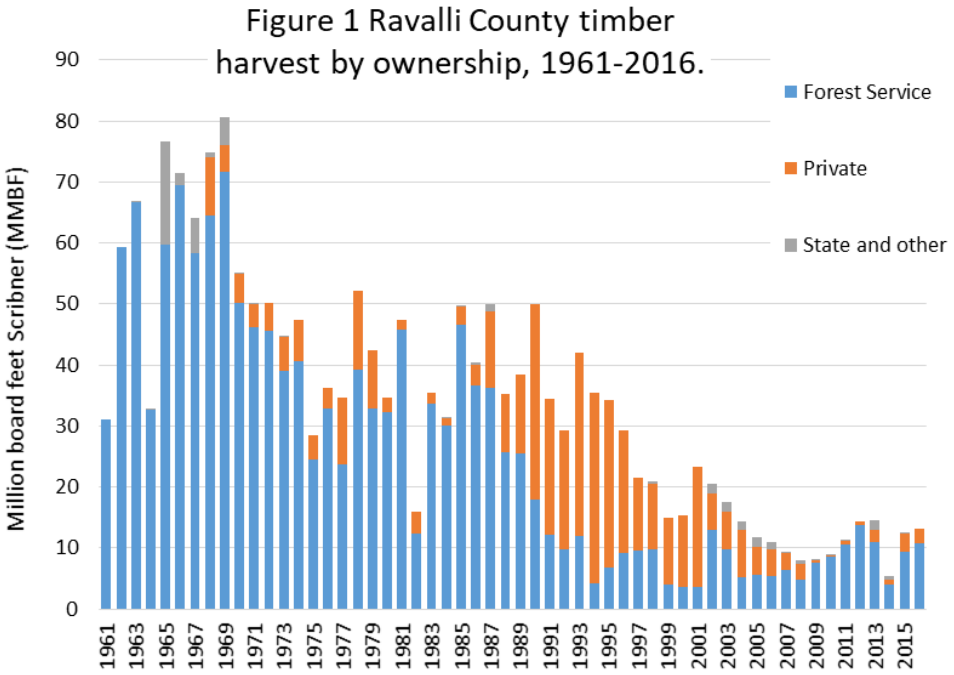
The University of Montana's Bureau of Business and Economic Research (BBER) has been monitoring the forest industry in Montana since the 1970s, conducting quarterly and annual surveys of the state's largest mills and periodic censuses of primary wood products facilities (Keegan 1980; Keegan et al. 1983, 1988, 1990, 1995, 2001; Spoelma et al. 2008; McIver et al. 2013; Hayes and Morgan 2017a, b; Marcille et al. 2017). With data from these surveys and other sources, BBER researchers are able to provide details about timber harvest and use, the structure of the primary wood products industry and economic contributions of the forest industry in Ravalli County at several specific points in time. Timber harvest information came from BBER's mill surveys, as well as USFS cut and sold reports and DNRC cut by county reports.

Most of the forest industry has traditionally been reported in three standard industrial classifications (SIC) as defined by the U.S. Office of Management and Budget (OMB): SIC 08 – forestry services, SIC 24 – lumber and wood products and SIC 26 – pulp, paper and allied products. Starting in 1998, the North American Industry Classification System (NAICS) replaced the SIC system (OMB 1998). The forest products industry can now be found in four categories: NAICS 113 – forestry and logging, NAICS 1153 – forestry support activities, NAICS 321 – wood product manufacturing and NAICS 322 – paper manufacturing. Employment and labor income data are published by the U.S. Department of Commerce, Bureau of Economic Analysis (BEA 2018a, b) and the U.S. Department of Labor, Bureau of Labor Statistics (BLS 2018). Data through 1997 are based on the SIC system, whereas data from 1998 to the present are based on NAICS.

Timber Harvest and the Forest Industry in Ravalli County

Prior to World War II, numerous small sawmills operated in the Bitterroot Valley. By 1945, 11 sawmills operated and together produced nearly 22 million board feet (MMBF) of lumber, the largest producing just over 5 MMBF (USFS 1947). Bitterroot National Forest (BNF) harvest was approximately 13 MMBF Scribner that year. During the post-war housing boom, the wood products industry expanded throughout the western states including Montana and timber harvests increased dramatically, particularly from national forests.

Although the primary wood products industry in Ravalli County is fairly diverse, sawmills and log home producers have had the greatest economic impact within the county's forest products industry over the last four decades. Ravalli County's sawmills accounted for 3 to 5.5 percent of Montana's total lumber production during the 1970s through 1990s, but since 2000 have produced just 0.1 percent of the state's lumber. In contrast, the county's log home builders have accounted for 40 to 75 percent of the state's log home production and sales from the 1970s through today. Log home sales have grown from about 25 percent of Ravalli County's primary wood products facilities sales during the 1970s and early 1980s, to more than 90 percent of sales since 2000.



Timber harvest volume in Ravalli County peaked in 1969 at just over 80 MMBF (Figure 1), with 88 percent coming from the BNF. Timber harvests averaged 44 MMBF during the 1970s and the BNF share was 85 to 90 percent each year. In 1976, the BNF harvested 32.9 MMBF or 91 percent of the total county harvest (36.3 MMBF), the majority of which was processed by sawmills in the county. There were 18 primary wood products facilities operating in Ravalli County during 1976 (Table 1), with sales of $44.2

million (in constant 2016 dollars1). Log homes accounted for about one-quarter of sales, almost $12 million (in constant 2016 dollars). The five sawmills in the county together produced 51 MMBF of lumber and capacity to process timber for all sectors was 74 MMBF Scribner. The forest industry in Ravalli County employed 455 people and labor income was just under $17.2 million (in constant 2016 dollars), accounting for 7.1 percent of employment and 9.4 percent of labor income in the county during 1976.

Table 1 – Active Ravalli County primary wood products facilities by year (sources: Keegan 1980; Keegan and others 1983, 1990, 1995, 2001; Spoelma and others 2008; McIver and others 2013; Hayes and Morgan 2017).

Survey year	Sawmills	Post and poles	Log homes	Log furniture	Other products[a]	All products
1976	5	4	7	0	2	18
1981	8	3	12	0	0	23
1988	9	5	13	0	2	29
1993	3	4	19	0	1	27
1998	3	4	21	7	0	35
2004	5	1	20	8	2	36
2009	2	1	9	3	2	17
2014	3	1	9	2	2	17

[a]Other products include biomass energy, planing mill, decorative bark and mulch, roundwood pulp-chip conversion, and fuel pellets.

Through the 1980s, BNF timber harvests averaged 32.5 MMBF, accounting for 85 percent of the total timber harvested in Ravalli County. In 1988, total harvest in the county was 35.2 MMBF Scribner and the BNF accounted for 73 percent (25.7 MMBF). The annual allowable sale quantity (ASQ) in the 1987 BNF forest plan was set at 33.37 MMBF (USFS 1987). The wood products industry had expanded to a total of 29 facilities, and timber-processing capacity was 91 MMBF (Table 2), 23 percent higher than in 1976. Primary product sales reached almost $73.5 million (in constant 2016 dollars) and log homes accounted for 44 percent of sales. The nine Ravalli County sawmills produced a total of 84.7 MMBF of lumber, the county's highest annual lumber production recorded by BBER. During 1988, the forest industry in Ravalli County employed 695 workers, with labor income of about $24.7 million (in constant 2016 dollars), accounting for 6.9 percent of employment and 10.4 percent of labor income in the county.

[1] Monetary values in this report were converted to constant 2016 dollars, using the U.S. Department of Commerce, Bureau of Economic Analysis personal consumption expenditures (PCE) price index (Table 2.4.4U).

Table 2 – Ravalli County timber harvest, processed, timber-processing capacity, primary wood product sales, forest industry employment and labor income, selected years.

Survey year	Timber harvested in county (MBF Scribner)	Timber processed in county (MBF Scribner)	Timber-processing capacity (MBF Scribner)	Primary wood products sales value ($1,000)[a]	Forest industry employees[b]	Forest industry labor income ($1,000)[a]
1976	36,259	47,196	74,307	44,239	455	17,192
1981	47,291	37,598	77,967	34,872	525	19,731
1988	35,239	65,230	91,408	73,484	695	24,680
1993	41,976	41,260	98,584	95,592	725	27,647
1998	20,890	42,533	60,059	123,332	671	36,686
2004	14,306	13,295	22,785	57,353	616	39,690
2009	8,047	2,385	15,271	10,967	358	18,675
2014	5,375	4,681	13,087	17,124	262	14,006

[a] Sales value and labor income in thousands of constant 2016 dollars.

[b] Forest industry includes forestry and logging, primary and secondary wood products manufacturing, and forestry support.

BNF timber harvests in the 1990s averaged 9.5 MMBF annually, a 70 percent decline from the previous decade and just 28 percent of the forest's ASQ. The BNF share of the county's harvest fell from over 80 percent to 30 percent. In this same period, timber harvests from private lands in Ravalli County tripled as landowners responded to local mills' demand for logs. Most of that timber is believed to have come from lands purchased from Plum Creek Timber by Darby Lumber. In 1998, total harvest in the county was 20.9 MMBF and the BNF accounted for almost 9.7 MMBF (46 percent). A total of 35 facilities operated in the county, but only three sawmills remained producing 42.6 MMBF of lumber. The number of log home producers had increased to 21 and log home sales reached a high of $93 million (in constant 2016 dollars) accounting for 76 percent of sales from the primary industry in Ravalli County. The closure of sawmills, including one large mill in Darby, created a decrease in the capacity to process timber from the 1993 high of 98.6 MMBF to 60 MMBF. Forest industry employment in Ravalli County was 671 workers during 1998, with the expansion of the log home industry replacing some of the employment lost from sawmill closures. Labor income for the forest industry in Ravalli County was nearly $37 million (in constant 2016 dollars), about 32 percent higher than in 1993. In 1998, the forest industry accounted for 4.2 percent of employment and 8.6 percent of labor income in the county. The substantially larger labor income proportion indicates that forest industry jobs tended to pay better than the average.

In September 1998, Darby Lumber - the last of the large sawmills in Ravalli County – closed, putting about 100 employees out of work (Rider 1998; 1999a,b; 2001). Speculation about whether this facility could have remained in operation with the low levels of harvest from BNF timberlands is complicated by allegations that sawmill ownership and management issues, in addition to timber harvest declines, contributed to the mill closure (Rider 1998, 2000). Regardless, BNF harvests did not regain previous levels and the mill was not purchased or reopened, contributing to the loss of nearly 40 MMBF of timber-processing capacity from the county between 1998 and 2004.

During the first decade of the new millennium, the BNF harvests averaged 6.6 MMBF (Figure 1) and ranged from 15 to 96 percent of the total annual harvest in the county. Harvest volumes in the county experienced a temporary boost after the fires of 2000 (Devlin 2001). The 2006 Proposed Land Management Plan for the BNF identified an ASQ of 7 to 10 MMBF per year (USFS 2006). In 2009, the

BNF harvested 7.5 MMBF, about 93 percent of the total harvest in Ravalli County. Just 17 primary wood products facilities operated in 2009 and capacity to process timber was 15.3 MMBF, with the majority of that capacity in the log home sector. Two small sawmills operated in the valley, together producing less than 300 thousand board feet (MBF) of lumber. The log home industry was hit hard by the Great Recession and subsequent contraction in the housing market, which had a severe impact on the western wood products industry (Keegan et al. 2012). Log home production in Ravalli County dropped from 6 million lineal feet (MMLF) and sales of $56 million (in 2016 constant dollars) during 2004 to less than 1 MMLF and sales of $9.7 million (in 2016 dollars) by 2009 (Table 2). Sales values of all primary products combined were just under $11 million (in 2016 dollars), down 80 percent in real terms from 2004. Total forest industry employment was 358 and labor income was $18.7 million (in 2016 dollars) during 2009, representing 1.8 percent of employment and 3.3 percent of labor income in the county.

The most recent BBER mill census was conducted in 2014. At the time, the BNF harvested just under 4 MMBF Scribner, accounting for 74 percent of the county's timber harvest. A total of 17 primary wood products facilities operated in 2014 (Table 3), with one additional sawmill and one less log furniture producer than in 2009. Timber-processing capacity in the county was just over 13 MMBF Scribner. Primary wood product sales rebounded to $17 million, boosted by improvements in log home sales, which topped $15.5 million. But forest industry employment continued to fall to 262, with labor income slipping to $14 million (in 2016 dollars). During 2014, the forest industry accounted for 1.3 percent of employment and 2.4 percent of labor income in Ravalli County, indicating that – despite three decades of declines in timber harvest and wood products sales – the county's forest industry still paid better than average wages.

Table 3 – Active Ravalli County Primary Wood Product Facilities after 2014 Montana Industry Census

Facility Name	Facility Type	Location City
Bachmann Enterprises	Log Home	Darby
Bearly Making It	Furniture	Hamilton
Bitterroot Valley Log & Timber, Inc.	Log Home	Victor
Creekside Log Creation	Furniture	Stevensville
Darby Public Schools	Biomass Energy	Darby
Finlay Lumber	Sawmill	Florence
Frontier Fencing	Post and Pole	Stevensville
Master Log Homes	Log Home	Darby
Montana Timber Structures	Log Home	Corvallis
Montana-Idaho Log & Timber	Log Home	Victor
Pioneer Log Homes	Log Home	Victor
Porterbilt Co., Inc.	Post and Pole	Hamilton
R & S Milling	Sawmill	Corvallis
Rocky Mountain Log Homes	Log Home	Hamilton
Small Diameter Logs Company	Log Home	Hamilton
Sula Log Homes	Log Home	Conner
Valley Board & Beam	Sawmill	Stevensville
Victor Public Schools	Biomass Energy	Victor

As the BNF timber harvest declined in Ravalli County, so did the wood products industry's timber-processing capacity. The result has been a reduced ability to use locally harvested timber. From the late 1970s through the 1990s, about 70 percent of the timber (mostly sawlogs used to make lumber) harvested in Ravalli County was processed in Ravalli County. During that time, timber volumes from the BNF dropped from over 30 MMBF Scribner to less than 10 MMBF and the proportion of timber coming from the BNF declined from over 90 percent to less than half of the county's total timber harvest.

When Darby Lumber closed in 1998, timber-processing capacity in the county declined substantially and the majority of the remaining capacity was in log home facilities, which have traditionally sourced substantial amounts of their wood from outside of Ravalli County. Since 2000, facilities in Ravalli County have processed less than 10 percent of the annual timber harvest in the county, with the majority of the timber and its potential economic contributions going to Missoula and other nearby counties. A 2004 BBER analysis of the timber-processing area for the BNF indicated 98 primary timber-processors were operating in the four-county area (i.e., Flathead, Lake, Missoula and Ravalli counties) served by BNF timber. The facilities had a combined timber-processing capacity of 527 MMBF Scribner (Keegan et al. 2004). A 2009 study revealed that as timber harvest levels declined and wood product facilities closed in Ravalli County between 1988 and 2004, the hauling distance for logs harvested in Ravalli County and the carbon emissions associated with hauling that timber increased as local mills closed (Healey et al. 2009). Logs from other counties and outside Montana account for the majority of timber processed by facilities in Ravalli County, particularly by the log home industry, which prefers standing dead lodgepole pine and spruce for making house logs.

Federal Land Management Policies Affecting Timber Harvest

Over the last three decades, the pattern of declining federal harvests and the associated reduction of local timber-processing infrastructure has not been unique to Ravalli County. Similar situations have occurred throughout Montana and other western states (Keegan et al. 2006; Spoelma et al. 2008; Simmons et al. 2014, 2016; Sorenson et al. 2016). The federal timber harvest reductions of the 1990s and continuing low levels of harvest throughout the subsequent decades are a direct result of a complex mix of evolving federal land management policies, agency budgets, federal environmental laws and case law developed from repeated litigation of federal forest management activities – particularly timber-related activities (Keele et al. 2006; Miner et al. 2014; Morgan and Baldridge 2015; Keele and Malmsheimer 2018). A brief examination of federal forest policies can help increase understanding of the changes in the BNF timber harvest.

Title 16 of U.S. Code covers the range of laws governing how the Forest Service (FS) and other agencies manage lands. The laws and policies have clearly changed over time, reflecting society's and Congressional desire to transition FS land management objectives from custodial management, to production forestry, and now for ecosystem management or ecological forestry (Cubbage et al. 1993; MacCleery 2008; Sample 2018). The Forest Reserve Act of 1891 (16 USC § 471) allowed the President to set aside forest lands under the USDI; these lands were later transferred to the USDA. The Organic Administration Act of 1897 (16 USC § 473 to 475, 477 to 482, 551) established the custodial management direction for the National Forest Reserves to protect and improve forests for the purpose of securing a permanent supply of timber and insuring conditions favorable to continuous water flow. The Bitter Root Forest Reserve was created in 1897, and became the BNF in 1907, with the creation of the USFS.

In 1819, the U.S. Supreme Court ruled that federal property was immune from state and local taxes (17 U.S. 4 Wheat. 316 [1819]). About one-third of the nation's land was in federal ownership and these lands contributed little to the tax base available to local governments. In 1908, what was commonly known as the Twenty Five Percent Fund Act (16 USC § 500) was passed and directed the newly formed USFS to initially share 10 percent, then 25 percent, of its revenues with local governments. This program lasted over 90 years and marked the beginning of the modern era of federal revenue sharing. The Refuge Revenue Sharing Act of 1935 (16 USC 715) provided for payments to counties in lieu of taxes, using revenues derived from the sale of products from refuges. The Knutson-Vandenberg Act of 1930 (16 USC § 576) authorized the Secretary of Agriculture to establish and operate nurseries, to collect or to purchase tree seed or young trees, to plant trees and to do all the things necessary for reforestation by planting or seeding national forests and for the additional protection, care and improvement of the resulting plantations or young growth. Knutson-Vandenberg (KV) funds are distributed annually to all national forests with planned work associated with this act's intentions. The BNF has received an average of $35,700 in KV funds annually since 2013, ranging from $94,900 in 2013 to -$2,800 in 2015[2].

The shift in USFS policies towards production came in 1960 with the Multiple-Use Sustained-Yield Act (16 USC 528 to 531). This act codified the policy that "national forests are established and shall be administered for outdoor recreation, range, timber watershed, and wildlife and fish purposes." Then in 1964, the Wilderness Act (16 USC § 1131 to 1136) was passed. This act created the National Wilderness Preservation System, of which Wilderness Study Areas (WSAs) are a component. Acreages recommend for wilderness on the BNF are 28,500 in the Blue Joint WSA (P.L. 95-150), zero acres in the Sapphire WSA (P.L. 95-150)3, and 52,300 in Selway-Bitterroot additions. They are managed by both the BNF and Lolo National Forest[3]. Also in 1964, Public Law 88-577 created both the Anaconda Pintler Wilderness and Selway-Bitterroot Wilderness, with 41,200 acres and 241,700 acres in Ravalli County, respectively. In 1968, Congress authorized the National Wild and Scenic Rivers System (16 USC 28) such that:

"certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations."

The National Wild and Scenic Rivers System includes the Selway River, a portion of which in managed by the BNF and accessed by Ravalli County.

Two years later in 1970 the National Environmental Policy Act (NEPA; 42 USC 55) was passed:

"to declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality."

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[2] Negative line items may be from financial adjustments made on prior year obligations. If a contract comes in cheaper than originally obligated, the excess funds are de-obligated resulting in funds not expended and the de-obligation sometimes shows in the next fiscal year.

[3] The recent confirmed discovery of wolverines in the Sapphire WSA in June 2018 (Missoulian, July 23, 2018) may impact acreage recommended for wilderness designation. Wolverines are currently listed by the US Fish and Wildlife Service as proposed threatened (https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=A0FA).

One year prior to the passage of NEPA saw the release of what is commonly called the Bolle Report (Bolle et al. 1970; Bolle 1989). The Bolle Report requested by Senator Lee Metcalf of Montana and presented to the Congress, was a scathing review of the BNF's forestry practices, which were found to place timber production above all other forest values. Arguably the Bolle Report influenced future legislation moving the USFS more towards considering non-timber forest values in management decisions. One of the most impactful pieces of federal legislation on forest management, including timber harvesting, in the U.S. West – the Endangered Species Act (ESA; 16 USC 35) – was signed into law in 1973. The ESA provides "a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions set forth" in this act.

Close on the heels of the ESA, NEPA and the Bolle Report came the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA; 16 USC 1600) that required the USFS "to protect, develop, and enhance the productivity and other values of certain of the Nation's lands and resources, and for other purposes." In 1979, Congress amended the Forest and Rangeland Renewable Resources Planning Act with the National Forest Management Act (16 USC 1600), finding, among other topics, that "the management of the Nation's renewable resources is highly complex and the uses, demand for, and supply of the various resources are subject to change over time." The NEPA, NFMA, and the ESA are frequently cited in litigation seeking to reduce timber harvesting on national forests (Keele et al. 2006).

As previously mentioned, revenue sharing programs are the primary vehicles of redistributing revenue from federal property among local counties containing such property. Historically, the 25 Percent Fund had been the biggest source of revenue-sharing payments. Following the Multiple-Use Sustained-Yield Act, subsequent legislation such as the NEPA and ESA directed the USFS to move more towards ecosystem management rather than production forestry. Because revenue-sharing payments are geared to the value of products sold and because that value fluctuates with product prices, federal revenue-sharing became an undependable source of revenue for local governments. To increase and stabilize the overall level of federal revenue-sharing payments, the Payments In Lieu of Taxes (PILT) legislation was passed in 1976 (31 USC 69). Administered by the USDI BLM, PILT provides a systematic, analytical framework to determine the amount of supplemental PILT payments a local government should receive from the treasury over and above revenue-sharing payments (USFS 2002).

In 1979, the Secretary of Agriculture issued the first planning regulations, commonly called the Planning Rule, under the National Forest Management Act to guide the planning process. In 1982, a revision of the 1979 Planning Rule occurred. Among other notable revisions, the concept of identifying project alternatives was born. The current BNF forest plan was completed in 1987 and set an annual ASQ of 33.37 MMBF Scribner (USFS 1987). By and large, the BNF sold significant quantities of timber in 1980s and early 1990s. Then in 1994, the Northwest Forest Plan was signed with an overall vision for the Pacific Northwest that would produce timber products while protecting and managing impacted species. Although the BNF and Region 1 are not within the bounds of the Northwest Forest Plan, by this time timber harvest on the BNF had already been in decline for years. In 2001, the USDA adopted what is commonly called the Roadless Rule. This rule established prohibitions on road construction, road reconstruction and timber harvesting in inventoried roadless areas (IRAs) on NFS lands. The intent of the Roadless Rule is to provide lasting protection for IRAs within the NFS in the context of multiple use management.

However, just prior to implementing the Roadless Rule, the often contentious issue of revenue-sharing emerged again. By 2001, payments to U.S. counties from the 25 Percent Fund totaled just over $15

million, which is considerably lower than the average annual payment of $248 million between 1977 and 2001 (USFS 2002).

In response to rapidly declining 25 Percent Fund payments, which was a direct result of the precipitous drop in timber harvest nationwide, Congress passed the Secure Rural Schools and Community Self-Determination Act of 2000 (16 USC 7101). Under the terms of the Secure Rural Schools Act, counties receiving 25 Percent Fund payments were given the option of continuing payment under the 25 Percent Fund or switching to Secure Rural Schools Act payments, which Ravalli County did. Secure Rural Schools Act payments are determined by computing the average of the high three 25 Percent Fund payment years. For each county, the percent of total payments from 1986 to 1999 was determined. The percentage distribution of historical payments to counties was then used to allocate each state's high three average among counties.

Also in 2000, another revision of the Planning Rule occurred. The re-revised rule described a new framework for NFS planning, made sustainability the foundation for NFS planning and management, required the consideration of the best available science during the planning process, and set forth requirements for implementation, monitoring, evaluation, amendment, and revision of land and resource management plans. A Proposed Land Management Plan for the BNF was completed in 2006 with an ASQ of 7 to 10 MMBF Scribner per year (USFS 2006). However, that proposed BNF plan was not finalized or implemented. In 2012, the Planning Rule was updated. The 2012 Planning Rule was designed to incorporate the concepts of adaptive management, scientific basis and public participation into forest planning. The 2012 Planning Rule acknowledged the need for flexibility and agility during times of change and provided a stronger commitment to involving the public throughout the planning process. It was also designed to require a holistic and integrated approach to management, recognizing that management needs for ecosystem resources are interrelated and that management for ecological, social and economic objectives are also interrelated. The BNF is anticipated to begin developing its new forest plan (with a new timber ASQ) around 2020, presumably under guidance of the 2012 Planning Rule.

Policy Analysis with the REMI Model

Economic impacts occur because of events or activities that create new expenditures. Spending which is new – which is over and above existing expenditures and does not simply displace spending elsewhere in the region – not only adds to economic activity in its own right, but it also induces further spending as the recipients of wages, sales and tax revenues spend a portion of their income in the local economy. Changes in the path of investment, migration and prices and wages are possible as well.

The basic tool used in this study to assess the economic impacts of reduced timber harvests is an economic model, calibrated to represent the interactions in the Ravalli County economy, leased from Regional Economic Models, Inc. The REMI model is one of the best known and most respected analytical tools in the policy analysis arena and has been used in more than 100 previous studies, as well as dozens of peer-reviewed articles in scholarly journals. It is a state-of-the-art econometric forecasting model that incorporates dynamic feedbacks between economic and demographic variables. The REMI model forecasts employment, income, expenditures and populations for counties and regions based on a model containing over 100 stochastic and dynamic relationships, as well as a number of identities. A full explanation of the design and operation of the model can be found in Treyz (Treyz, 1993).

The model used in this study disaggregated the state economy into five regions: Northwest, Southwest, North Central, South Central and Eastern. It explicitly recognizes trade flows that exist between these regions, as well as between the regions and the rest of the world. Statewide impacts reported here represent the totals for the five regions. The definition of the regions is shown in Figure 3.1 below.

Figure 3.1 Economic Regions

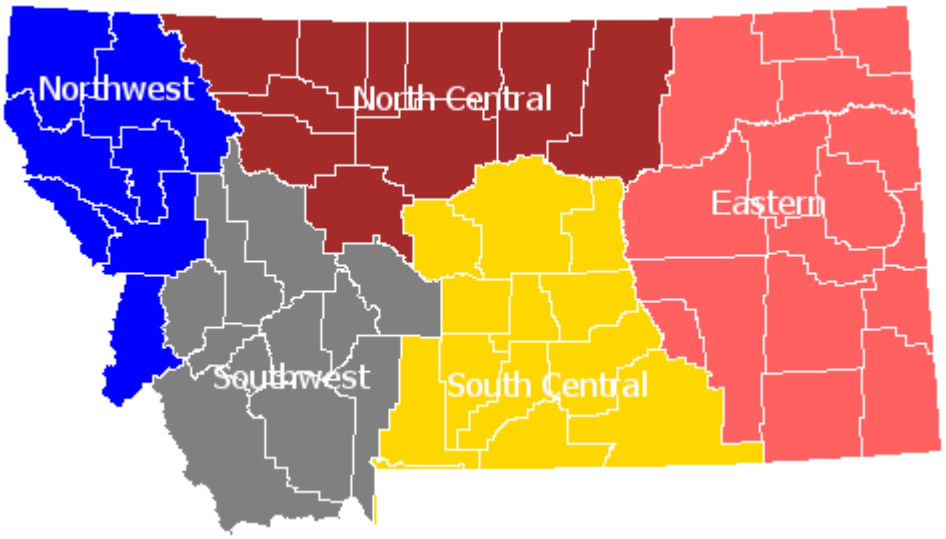
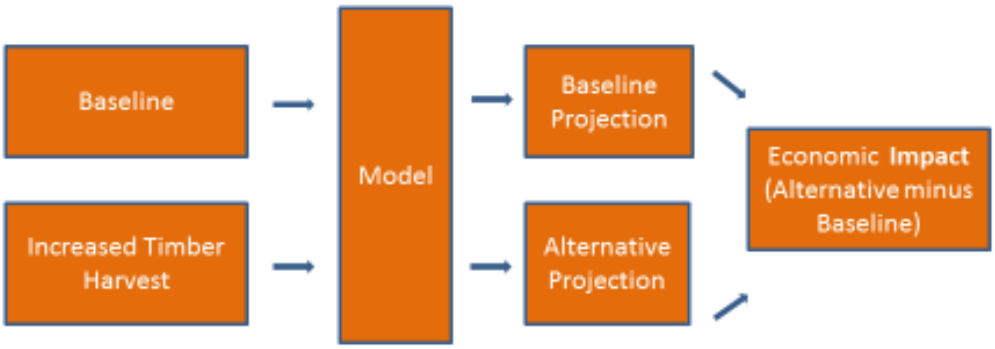


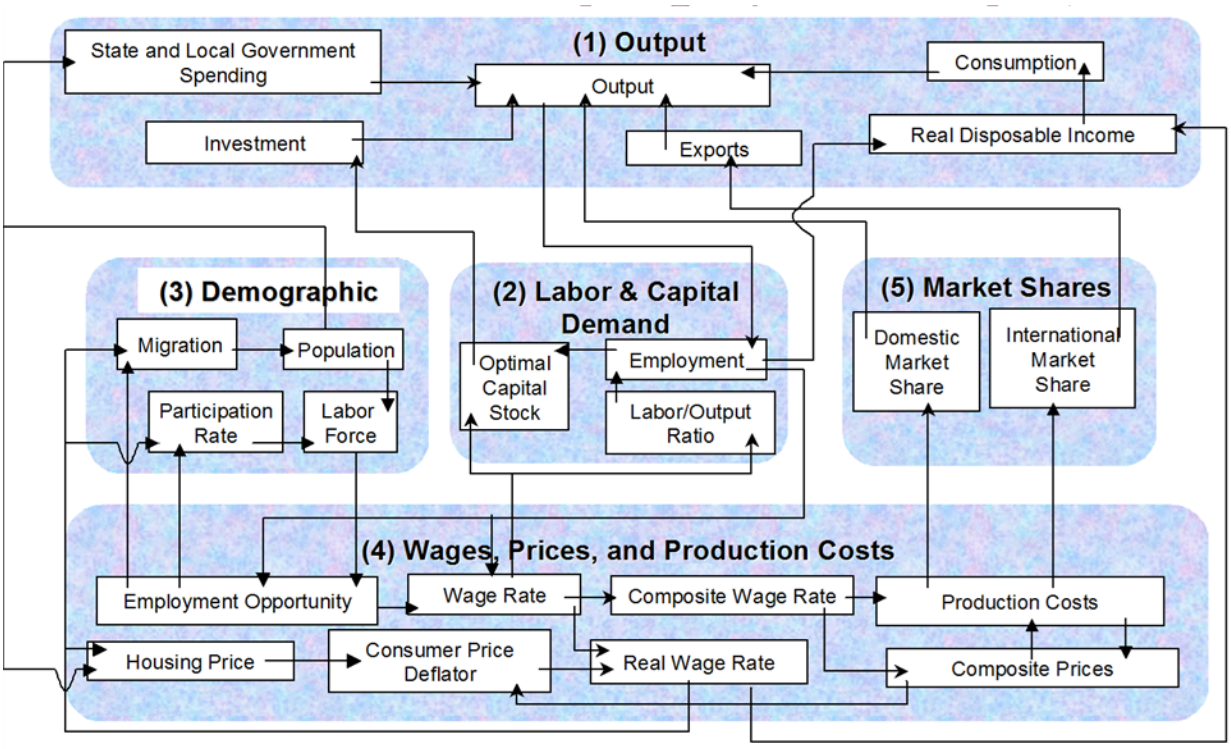
Figure 3.2 Policy Analysis with the REMI Model



The use of the model to derive the results of this study is illustrated graphically in Figure 3.2. First, a baseline projection for the economy is made using status quo assumptions that have current (lower) levels of timber harvests and wood products activity. The model is then used a second time with identical inputs – except that in this alternative scenario higher (late 1980s) harvests takes place as described in the next section. Thus, changes in the economy that take place in the event of increased timber harvests ultimately brings the economy to a new level of activity, reflecting not only the direct impacts of the higher forest-related activities, but how the rest of the economy reacts to those changes. The difference between the baseline (current/lower) and alternative (historic/higher) scenarios of the economy represents the economic impact of decreased timber harvests from the BNF.

The model utilizes historical data on production, prices, trade flows, migration and technological change to calibrate the relationship between five basic blocks of the regional economy as depicted in the figure on the following page: output, labor and capital demand, population and labor force, wages and prices and market shares. The changes in production, labor demand and intermediate demand caused by decreased harvests causes these blocks of the economy to react and adjust to a new equilibrium. As described above, the difference between the baseline and the alternate scenario is the ultimate impact of decreased timber harvests from the BNF.

Figure 3.3 REMI Model Linkages



The essential philosophy of the model is that regions throughout the country compete for investment, jobs and people. When events occur in a region they set off a chain reaction of actions causing dollar flows toward better investment and production opportunities, followed over time by a flow of workers and households toward employment opportunities and higher wages. The model embodies an 82-sector input-output matrix that describes the technological interdependence of production sectors of the economy, as well as extensive trade and capital flow data to determine the share of each sector's demand that can be met by local production.

As powerful and flexible as this tool is, the answers it provides are only as good as the questions posed to it. The majority of work in this study is carefully crafting the inputs used to construct a scenario of the economy that faithfully represents all of the events, income flows and other direct and indirect impacts that resulted from decreased timber harvests.

4. The Direct Effects of Decreased Timber Harvests

The major impacts of declining BNF harvest volumes on Ravalli County's wood products industry and economy – as evidenced by the forest industry changes detailed in the narrative above – occurred during the latter 1990s and 2000s. During the early- to mid-1990s, even as BNF harvest volume was falling, the success of the log home industry in Ravalli County, with substantial volumes of timber harvested outside the county, helped to offset some of the losses in Ravalli County's shrinking sawmill, forestry and logging sectors.

To better understand the economic impact on Ravalli County of the decline in timber harvest from the BNF, BBER researchers quantified the change in average annual harvest from the BNF; estimated the direct employment, wages, and product sales value in the forest industry associated with that volume of timber; and used the REMI model to calculate the broader impact on the county's overall economy. Rather than speculate what the change would be if timber harvest were to increase or which mills could have remained in business, this analysis sought to quantify the impact that the decline in harvest did have on the county's economy. While retrospective in nature, this research will help inform the Ravalli County Commission regarding future federal land management decisions (e.g., timber harvest levels in BNF plans) that have local economic implications.

The five-year (1985-1989) average annual harvest volume from the BNF immediately preceding the major declines of the 1990s was 34,152 MBF Scribner, which is slightly higher than the current ASQ (33.37 MMBF) set in the 1987 Forest Plan. The most recent five-year (2012-2016) average annual harvest was 9,774 MBF Scribner, which is within the ASQ range outlined in the 2006 Proposed BNF Land Management Plan. The change in harvest between the late 1980s and current (2012-2016) period represents an average annual harvest volume reduction of 24,378 MBF Scribner. Direct response coefficients (Sorenson et al. 2016) and an assumed product mix of 95 percent sawlogs and 5 percent house logs and other wood products were used to estimate the direct jobs and wages of forest industry workers associated with the harvesting and processing of the timber. The direct response coefficients indicate that 8 to 10 jobs in the forest industry are associated with each 1 MMBF Scribner of timber harvested. The number of jobs varies somewhat depending on what types of facilities receive the timber and what mix of wood products are manufactured. Product recovery ratios (e.g., how much lumber is produced from each unit of timber) and product prices from BBER mill studies (McIver et al. 2013; Hayes and Morgan 2017b,c) were used to estimate primary product sales values.

Table 4 - Forest industry direct impacts of 24,378 MBF Scribner timber harvest

Sector	Employees	Wages ($1,000)[a]	Sales ($1,000)[a]
Forestry & logging	78.0	3,342	N/A
Sawmills	117.3	5,027	19,222
Other facilities	19.3	621	4,236
Total	214.7	8,990	23,458

[a] Wages and sales in constant 2016 dollars.

The direct forest industry impact of 24.3 MMBF Scribner of timber harvest from the BNF was estimated to be more than 214 jobs, $8.9 million in wages and primary wood product sales of more than $23 million

(Table 4). Thus, on an annual basis, an additional 78 forestry and logging jobs, 117 sawmill jobs and 19 jobs in other primary wood products facilities could be supported by the harvest of 24.3 MMBF Scribner. Not all of these jobs, wages and product sales would have been generated in Ravalli County, but it is possible that a significant portion – perhaps 100 or more sawmill workers, several dozen loggers and others – could have been retained in the county if one of the larger sawmills in Darby had remained in business. These direct responses within the forest industry were then applied to the REMI model to estimate the total economic impact on the broader (Ravalli County) economy.

It is unlikely that the BNF annual harvest will increase by 24 MMBF given the current BNF land base, pending forest plan, agency policies, as well as budget and staffing of the BNF. However, increasing timber offered by this amount would meet the BNF's current ASQ of 33.4 MMBF. Timber planned has only exceeded the ASQ once since 1982 and that was the second year following the 2000 fires. About 72 percent of the BNF is in administratively withdrawn IRAs or Congressionally designated Wilderness and about 40 percent of the acres suitable for timber production were burned during the 2000 fire season (USFS 2006). The timber total sale program quantity (TSPQ) also referred to as an allowable sale quantity (ASQ) from the 2006 Proposed Land Management Plan ranged from 76 to 93 million board feet (MMBF) per decade (USFS 2006) or roughly 7.6 to 9.3 MMBF annually, which is about what the BNF has been harvesting since 2000. The next iteration of the BNF forest plan will set the bar for what amount of timber can be expected to be offered from the BNF. This report's quantification of direct forest industry and broader Ravalli County economic impacts associated with the current (2012-2016) and historic (1985-1989) timber harvest levels, as well as the corresponding current (1987) ASQ and proposed (2006) TSPQ, should provide the county commissioners and the BNF with an understanding of the historic range of variability and potential future economic impacts stemming from BNF timber harvest.

Increased harvest of the types of timber that Ravalli County's existing forest industry specializes in (e.g., dead lodgepole and spruce used by the log home industry) may have more immediate impacts on the county's existing wood products facilities, while an overall increase in harvest volume would impact local logging and log hauling operations, larger out-of-county facilities, as well as the remaining facilities in Ravalli County.

5. The Impact of Timber Harvest Declines on the Ravalli County Economy

This analysis envisions two economic trajectories for Ravalli County. The baseline, status quo, scenario holds current economic activity constant with timber harvests at the 9.8 MMBF level that has been the average for the years 2012-16. The second, alternative scenario, considers how the economy could have evolved with annual timber harvests 24.7 MMBF higher, thus holding total harvest volumes at the average level experienced in the 1985-89 period. In the alternative scenario, some of the timber processing capacity lost after that period instead remains in the county economy, supporting production and jobs. The difference between the alternative and the baseline is the total impact of decreased harvests. We describe those impacts in this section.

Results Summary

Our basic finding is that had timber harvests continued at late 1980s levels, more of the wood products industry in Ravalli County would have survived and as a result, the overall economy would have more jobs, income and population today. A comparison of actual economic activity with what we estimate could have occurred had harvest not decreased reveals that:

- 514 additional permanent, year-round jobs could exist in the county economy today if timber harvests from BNF land had not been reduced.

- Ravalli County households in total could be receiving $32.6 million more in income annually if higher time harvests had occurred, with $28.3 million of that increase representing disposable, after-tax, income.

- Ravalli County businesses could have realized $113.0 million more in value-added economic production annually.

- The population in the county would likely be higher by 825 people, including 170 school-aged children, if higher levels of timber harvest had been maintained.

All of these impacts represent the difference between two scenarios for the county economy – the actual level of activity and what could have occurred with timber harvests that had not decreased. Going forward, we would expect growth in the local economy in both scenarios due to events in other local industries. These impact findings do not change that fact, rather they indicate that the economy with decreased timber harvests is smaller by the magnitudes shown in Table 5.1.

Table 5.1 The Economic Impact of Decreased Timber Harvest Impacts Summary

Category	Units	Impact
Total Employment	Jobs	514
Personal Income	$ Millions	32.6
Disposable Pers. Income	$ Millions	28.3
Output	$ Millions	113.0
Population	People	825

Employment Impacts

The reductions in economic activity that resulted from reduced timber harvests are not confined to the wood products industry. The direct impacts of harvests which support the production in area sawmills, log home manufacturing, logging and other related areas propagate across the rest of the economy as wages, vendor payments and taxes paid by wood products companies are received as income by local households, businesses and governments.

Table 5.2 The Economic Impact of Decreased Timber Harvest Employment Impacts

Industry	Impact
Forestry, Fishing, Related Activities, and Other	94
Retail Trade	51
Real Estate and Rental and Leasing	12
Professional and Technical Services	21
Health Care and Social Assistance	27
Manufacturing	136
Accommodation and Food Services	33
Other Private Employment	84
Government	58
TOTAL	**514**

The economic footprint of decreased timber harvests spreads beyond the forestry and manufacturing (lumber mill) industries, as shown from the pattern of employment impacts displayed in Table 5.2. While the 136 lost manufacturing jobs supported by harvests reflects the lost sawmill capacity supported by the lower timber volume, the table reveals the breadth of economic sectors with no direct connection to wood products that show employment gains.

Less income in the county produces less spending, so the decreased employment in retail trade, accommodations and food and even health care are not surprising. Perhaps more surprising is the decreased employment in government, which is concentrated in local government services. This is due to lower tax revenues, as well as a smaller population base. The latter is especially important as it leads to a lower K-12 school population and hence the decrease in demand for teachers. Other local services are impacted by smaller population as well.

Personal Income Impacts

Lower employment levels lead to lower income to households. This can be immediately seen from the details on personal income impacts shown in Table 5.3. There is a $22.6 million dollar decrease in annual net earnings – or income related to employment – that is attributable to the decreases in employment, hours and wage rates caused by the reduced timber harvests.

But the table makes clear that the income received by Ravalli County households as a result of decreased harvests is greater than the gains associated with employment. Components of so-called unearned income, consisting of rental income, dividends and other property income, as well as transfer payments, were reduced by declining timber harvests as well. This is due to the smaller county population, as well as a decrease in the county capital stock caused by the smaller timber harvests.

The bottom line is that the spending power of the local population is reduced by more than the earnings from the jobs lost from reduced timber activity would suggest. This helps account for the decline in employment in jobs serving that population, as described above.

Table 5.3 The Economic Impact of Decreased Timber Harvest
Personal Income Impacts ($ millions)

Category	Impact
Total Earnings by Place of Work	26.7
Total Wage and Salary Disbursements	19.6
Supplements to Wages and Salaries	5.8
Employer contributions for employee pension and insurance funds	3.7
Employer contributions for government social insurance	2.1
Proprietors' income with inventory valuation and capital consumption adjustments	1.2
Less: Contributions for government social insurance	4.0
Employee and self-employed contributions for government social insurance	1.9
Employer contributions for government social insurance	2.1
Plus: Adjustment for residence	-0.1
Gross In	0.2
Gross Out	0.2
Equals: Net earnings by place of residence	22.6
Plus: Property Income	5.1
Personal Dividend Income	1.5
Personal Interest Income	2.6
Rental Income of Persons	0.9
Plus: Personal current transfer receipts	4.9
Equals: Personal Income	32.6
Less: Personal current taxes	4.3
Equals: Disposable personal income	28.3

Compensation Impacts

Further insight on the nature of the impacts brought on by the decreased timber harvests can be gained by examining earnings impacts in greater detail. As depicted in Table 5.4, earnings is composed of three components. The largest is wages and salaries, which are the monies paid to payroll workers at companies in the county. Those decrease by $19.6 million per year compared to the constant harvest scenario. Other labor income, which mostly consists of the cash contributions made for health, retirement and other benefits, is added to wages and salaries to arrive at compensation. Finally, adding business owner income, as well as non-employee compensation, produces earnings. As is shown in the table, earnings are estimated to be $26.7 million lower in the local economy due to the decreased timber harvests.

Table 5.4 The Economic Impact of Decreased Timber Harvest
Compensation Impacts

Category	Units	Impact
Wages and Salaries	$ Millions	19.6
Compensation	$ Millions	25.4
Earnings	$ Millions	26.7
Earnings per Job, Lost Jobs	$ Dollars	51,839

It is also possible to determine the average earnings per year of the 514 net lost jobs that could have been present in the local economy if timber harvests had not declined. The average, computed at $51,839 per year for each job, represents an average of the higher paid, full time jobs in sawmills, as well as the pay of jobs lost in lower paying industries such as retail trade. In 2016, the average earnings of all jobs in Ravalli County was $30,021. Thus the jobs that would have been supported by higher timber harvests pay two thirds more than the average job in the county.

Output Impacts

Businesses in the local economy also saw impacts from decreased timber harvests. One way to measure this is through output, defined as gross receipts for businesses and other organizations (with the exception of retail and wholesale trade where markup is instead presented). The pattern of impacts by this measure also is spread broadly across industries in the local economy as shown in Table 5.5. Health care providers, for example, currently realize $3.2 million less in gross revenues per year compared to what than they could have received had timber harvest remained at the historic level.

Table 5.5 The Economic Impact of Decreased Timber Harvest
Output Impacts, $ Millions

Industry	Impact
Forestry, Fishing, and Related Activities	14.5
Mining	0.1
Utilities	0.9
Construction	3.0
Manufacturing	64.7
Wholesale Trade	3.0
Retail Trade	4.5
Transportation and Warehousing	0.8
Information	0.6
Finance and Insurance	1.1
Real Estate and Rental and Leasing	2.2
Professional, Scientific, and Technical Services	2.6
Management of Companies and Enterprises	0.9
Administrative and Waste Management Services	1.0
Educational Services	0.0
Health Care and Social Assistance	3.2
Arts, Entertainment, and Recreation	0.2
Accommodation and Food Services	2.1
Other Services, except Public Administration	1.0
Government	6.3
TOTAL	**113.0**

In comparison to the pattern of impacts across industries evidenced from the employment impacts, however, the output impacts are more heavily concentrated in the two industries directly affected by increased timber availability: forestry and manufacturing. 70 percent of the $113 million in total output impacts occur in those two industries. This reflects the comparatively higher capital intensity of those industries, which results in higher productivity and higher wages.

Population Impacts

Changes in economic opportunities can result in population shifts through migration. Higher wages (in terms of spending power) and improved job opportunities are associated with higher rates of in-migration, while declines can turn migration trends in the opposite direction. So we can expect that had timber harvest remained at their levels of the late 1980s that rates of outmigration could have been lower and the population of Ravalli County would be even higher today.

Table 5.6 The Economic Impact of Decreased Timber Harvest
Population Impacts

Age Cohort	Population Decrease
Ages 0-14	212
Ages 15-24	103
Ages 25-64	475
Ages 65+	35
TOTAL	**825**

The decrease in total county population of 825 people is concentrated in the working age group aged 25-64 years as shown in Table 5.6 Since this is age cohort that is most likely to migrate due to economic opportunity this is not surprising. Included among the population losses due to decreased timber harvests are 170 school-aged children.

Summary

The results presented in this section make it clear that the Ravalli County economy would likely have been larger, more prosperous and more populous if timber harvests from the BNF had been maintained at their average annual amounts during the years 1985-89. Not only would those harvest amounts have supported the continued operation of significant sawmill and other timber processing capacity, as described in the previous section, but the operations of that capacity would have resulted in 514 more jobs, $32.6 million in annual personal income, $133 million in economic output per year and 825 more people in the Ravalli County today.

6. Summary and Conclusions

Over the last three decades, federal land management policies have evolved as a result of Congressional actions and mandates, agency (i.e., USFS) decisions, judicial reviews and public activism. In Ravalli County, the result has been a cycle of declining timber harvest from the BNF that has led to significant reduction in wood processing facilities and the loss of associated economic benefits generated by their activities. In addition to these direct impacts on the forest industry, there has been a loss of revenue associated with timber harvest to local governments without a permanent solution. This analysis indicates that the annual harvest reduction of 24.5 MMBF Scribner of timber locally has resulted in a loss of $113 million of annual economic output, over $32 million in annual income and more than 500 jobs.

Since the majority of timber currently harvested in Ravalli County is processed outside the county, efforts to increase the volume of timber harvested by the BNF would not be likely to return the full economic benefits generated by the industry of the past. Furthermore, it is unlikely that significant investments to replace the milling infrastructure that existed in the 1980s will be made. Federal forest treatments to reduce fire danger and restore the overall health of the county's forested ecosystems are of great value and should continue. It seems it would be desirable for local planners hoping to recapture some of the lost economic benefits to engage in a strategy of working with BNF land managers and existing local wood products stakeholders to help craft projects that will meet the needs of the land managers and promote contributions to the local economy, including the remaining wood products industry.

The next forest plan will determine what amount of timber can be expected from the BNF under current and anticipated future conditions. This report's quantification of direct forest industry and broader Ravalli County economic impacts associated with the current (2012-16) and historic (1985-89) timber harvest levels, as well as the corresponding current (1987) ASQ and proposed (2006) TSPQ, should provide the county commissioners and the BNF with an understanding of the historic range of variability and potential future economic impacts stemming from BNF timber harvest.

Increased harvest of the types of timber that Ravalli County's existing forest industry specializes in (e.g., dead lodgepole and spruce used by the log home industry or smaller-diameter material used for posts and poles) may have more immediate impacts on the county's existing wood products facilities, while an overall increase in harvest volume would impact local logging and log hauling operations, larger out-of-county facilities (e.g., Pyramid Mountain Lumber in Seeley Lake or Willis Enterprises in Bonner), as well as the remaining facilities in Ravalli County.

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