# Economic Values and Contributions of Roadless Areas

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Cover and inside cover photo: Backcountry skiers in West Slope Tetons IRA

Credit: Evan Hjerpe

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# Table of Contents



## Figures and Tables

# Economic Values and Contributions of Roadless Areas

## Executive Summary

Inventoried Roadless Areas are similar to Wilderness areas in many respects, yet lack the protections provided to Wilderness areas. Although some protection was provided to Inventoried Roadless Areas (IRAs) by President Clinton's 2001 Roadless Rule, these protections have been continually challenged by industry and states, and conflicting judicial decisions have created uncertainty regarding how IRAs should be managed. Sound IRA management decisions are best made with full information regarding the economic values of the goods and services that may be derived from these areas. This report presents an analysis of the values provided by the lower 48 states' 41.9 million acres of IRAs, assuming they are maintained in their present roadless condition.

Benefits derived from IRAs may be classified into six categories: direct use, passive use, science & education, offsite, biodiversity conservation, and ecological services. We provide estimates for recreational use (a type of direct use) and passive use values of IRAs including existence values, option values, and bequest values. Because data and research are available for Wilderness areas but not for IRAs, we use estimates from the existing literature pertaining to Wilderness areas to develop estimates of the passive use value and recreational value of the 41.9 million IRA acres in the continental U.S. Using Wilderness visitation rates as the best proxy for IRA visitation likely results in conservative estimates since IRAs are more accessible and less remote than Wilderness areas. Key findings include:

- Inventoried Roadless Areas provide ample recreation opportunities including hiking, backpacking, mountain biking, skiing, bird watching, fishing, and hunting.
- We derived an estimated consumer surplus per person per trip of $38 for single-day trips and $85 for multi-day trips.
- Based on an estimated 11.4 million IRA visits during 2017, IRA recreation generated an estimated $500 million of economic value to recreationists.
- We found an average passive use value across Wilderness studies of $74, indicating the minimum amount the average household would be willing to pay annually to preserve all IRAs.
- Extrapolating this average household value to all US households (except those living in poverty) and accounting for distance to IRAs, yields an estimated annual passive use benefit of $8 billion.

In addition to these economic benefits, roadless areas result in regional economic impacts and contributions. Visitors to IRAs spend money in gateway communities for supplies, meals, and lodging, which in turn results in the creation of jobs, income, and output. The economic contributions of IRA visitor spending represent the transfer of jobs and income to rural areas that often struggle to establish healthy economies. Using Wilderness visitation and spending as proxies for IRA visitor spending, we estimate the following regional economic contributions from IRA visitor expenditures:

**Table ES1: Regional Economic Contributions of IRA Visitors for Selected States (Total Effects)***

| State | FTE Employment | Labor Income ($Millions 2018) | Total Value Added ($Millions 2018) | Output ($Millions 2018) |
|---|---|---|---|---|
| New Mexico | 500 | 16.38 | 25.13 | 47.90 |
| Oregon | 260 | 11.35 | 14.09 | 27.44 |
| Washington | 210 | 9.03 | 14.76 | 24.70 |
| Tennessee | 50 | 2.22 | 3.19 | 5.74 |
| West Virginia | 40 | 1.33 | 2.05 | 3.65 |

*Includes direct, indirect, and induced effects.

Likewise, communities adjacent to IRAs experience greater amenity migration impacts than those not near IRAs. When amenity migrants relocate to regions near IRAs, they bring businesses and transfer income with them and help raise property taxes. IRAs also provide for high quality ecosystem services that help communities avoid costs in water filtration while providing adjacent communities with greater amounts of drinking water, clean air, recreational opportunities, and cultural services.

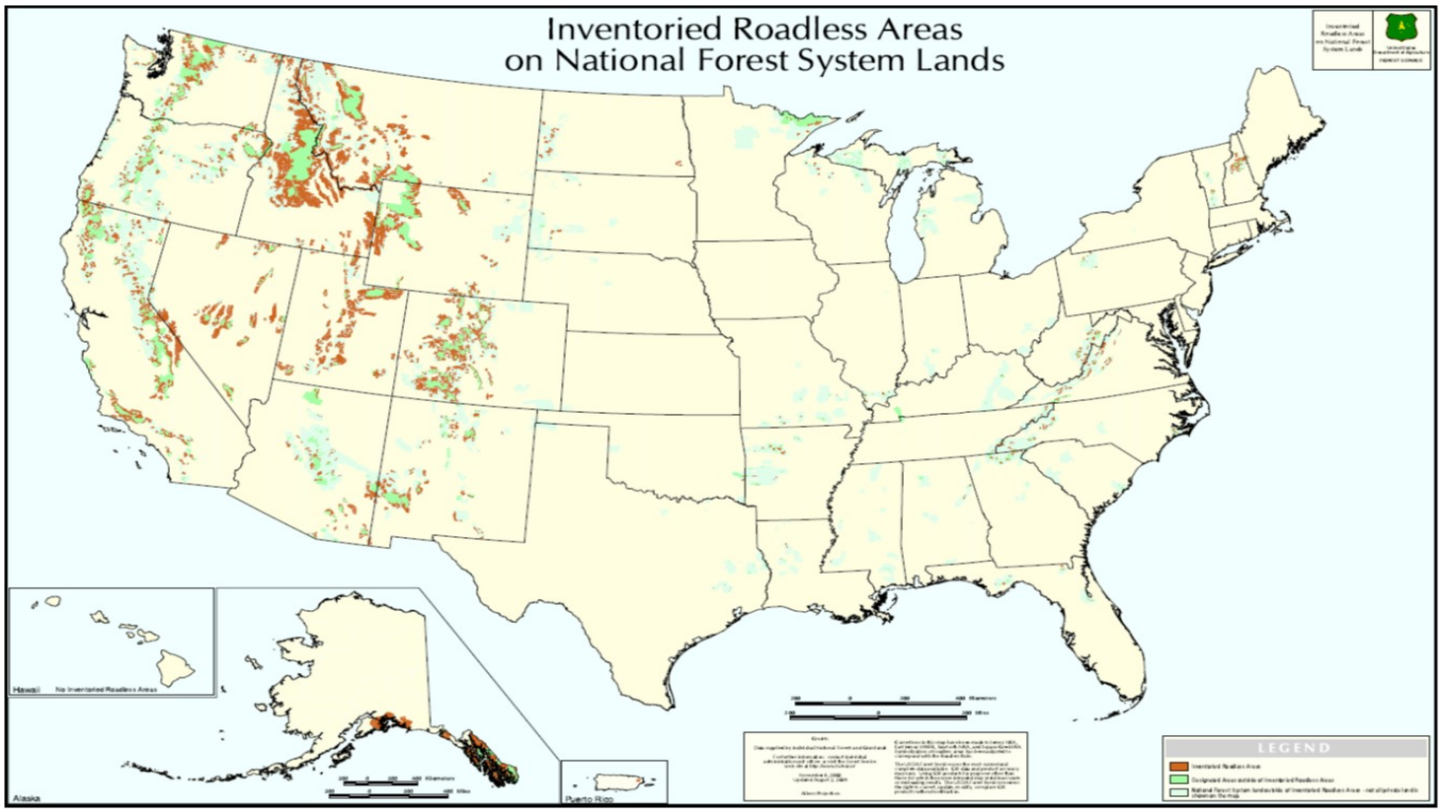
IRAs are a critical component of protected public lands in the U.S. In total, roadless areas provide approximately $8.5 billion in recreation and passive use benefits at a minimum. Roadless areas also spur substantial regional economic contributions in terms of employment, income, and output and make rural communities more attractive for amenity migrants. IRAs offer spiritual enrichment and provide a refuge for fish, wildlife, and all biodiversity. Keeping roadless areas undeveloped will protect the numerous economic values and contributions afforded by IRAs. These economic values and contributions should be fully considered when addressing policy decisions that may affect roadless areas.

Borah Peak IRA, Source: Evan Hjerpe

# 1. Economics of Protecting Inventoried Roadless Areas

Inventoried Roadless Areas (IRAs) are defined as undeveloped areas at least 5,000 acres in size that were inventoried by the USDA Forest Service during the 1970s and meet the minimum requirements for consideration for Wilderness designation.[1] IRAs comprise approximately one-third of Forest Service (FS) lands and are largely concentrated in the Western United States (Figure 1). Roughly 41.9 million acres of IRAs are located in the continental US and are the focus of the analysis herein. Roadless areas gained protection under President Clinton's 2001 Roadless Area Conservation Rule (commonly referred to as the Roadless Rule), which restricts or prohibits activities such as road construction and timber harvesting, with some exceptions.

Although IRAs have been protected since 2001, there have been continued efforts by states and industries to diminish or remove protections and open the areas to mining, timber harvesting, and other extractive industries. In 2005 President Bush issued the States Petition Rule, which allows governors to petition for a special roadless area rule for a portion or all of their state, in essence reversing the Roadless Rule. Idaho and Colorado subsequently adopted state roadless area rules, and Alaska plans to finalize a state roadless rule in 2020. Conflicting judicial decisions have created uncertainty regarding how IRAs are to be managed, and economic development continues to be an argument used to justify reducing protections given to these areas.




Source: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5126836.pdf

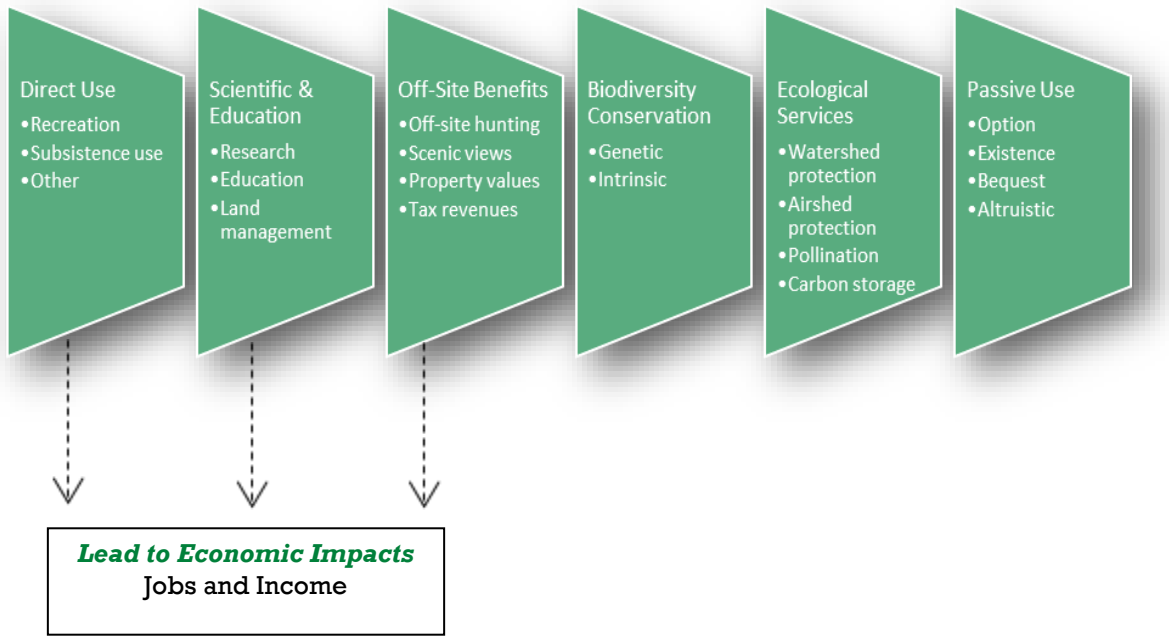
Decisions regarding future management of IRAs are best made with full information regarding the economic values of the assorted goods and services that can potentially be derived from the areas, including the values associated with various forms of direct use of the land (such as timber harvesting, mining, grazing, recreation, and scientific study), as well as values associated with various forms of indirect or passive use (such as the conservation of biodiversity, the benefit people derive from knowing such places will exist for future generations, carbon sequestration, and wildlife habitat). Whereas markets and values are well established for some uses of natural areas (e.g. mining and timber harvesting), markets and values do not exist for indirect or passive uses. Rather, nonmarket valuation methods must be used to value amenities provided by natural area preservation. During the last few decades, economists have worked to develop and apply methods for estimating natural-area nonmarket values. In the remainder of this section we provide an overview of the direct and indirect uses of IRAs and other natural areas, and in the next section summarize the literature pertaining to the associated economic values and estimate the recreational and passive use values of IRAs.

Protecting roadless areas from development and resource extraction can yield a wide array of benefits, including recreational use, wildlife habitat, biodiversity, opportunities for scientific study, and assorted ecological services (e.g. watershed and airshed protection). Some of these values are derived from direct interaction with an area (such as the value ascribed to a fishing trip), while others are derived through indirect interaction or passive use (such as improved visibility of the night sky or the knowledge that one may have the opportunity to visit the area sometime in the future). Total economic value is the sum of direct (or onsite) and indirect (or offsite or passive) use values. Using a slightly modified version of the categories used by Morton (1998), Loomis and Richardson (2001), and Holmes et al. (2015), and building on the previous research on roadless areas by Loomis and Richardson (2000), we parse benefits into six categories: *direct use, science & education, offsite, biodiversity conservation, ecological services*, and *passive use* (see Figure 2).

*Direct use benefits* and *passive use benefits* are two areas in which economists have focused their efforts to estimate economic value. *Direct use benefits* include direct onsite use of an area for recreation (hiking, backpacking, kayaking, bird watching, hunting, guided rafting, etc.) or subsistence purposes. *Passive use benefits* are typically expressed by economists as the sum of option, bequest, and existence values. Option value is the value derived from having the option of visiting an area sometime in the future. For example, a person may benefit from knowing they have the option of visiting Denali National Park sometime in the future. Existence value is the value derived from knowing the area exists, even if one has no plans to ever visit the area. For example, knowing areas exist where polar bears can live is of value to many people. Bequest value is value derived from knowing an area will be preserved for future generations. As an example, knowing the Grand Canyon will exist for future generations (rather than being dammed and converted into a reservoir) is of value to many people.

*Scientific and educational benefits* derived from roadless and other natural areas take several different forms. Natural areas provide opportunities for scientists to study wildlife and habitats in a relatively undisturbed state, which can yield valuable understandings of ecosystems and the impacts of human development.

## Figure 2: Economic Benefits of Roadless Areas




Additionally, new medicines and agricultural crop genetic improvements are regularly derived from plant and animal species found in natural areas. Natural areas also offer opportunities for study of the impacts of various land management practices.

*Offsite benefits* take several different forms. Offsite fishing, hunting, and wildlife watching are enhanced due to the fish and wildlife habitat provided by roadless areas. These areas can provide critical habitat for migratory species that may then provide direct and indirect use benefits to people in other areas. Roadless areas also offer scenic views and other amenity values that may be enjoyed offsite, and which increase nearby private property values and thereby tax revenues.

There are genetic and intrinsic values derived from *biodiversity conservation*. The conservation of biodiversity for the purpose of preserving genetic, ecosystem, and species diversity has gained attention in recent decades, and is increasingly being considered in both management decisions and legislation. A similar but separate category of roadless area benefits – termed *ecological benefits* – encompasses benefits derived from intact healthy ecosystems. Intact ecosystems provide healthy and productive watersheds (which can be a low-cost source of high quality water for urban consumption) and air sheds, as well as carbon storage, pollination, and pest control. Furthermore, to the extent that roadless areas are associated with lower levels of vehicular travel relative to non-roadless areas, the resulting improved air quality can ultimately lower the incidence and severity of numerous health impairments, such as asthma, lung cancer, and respiratory infections. In addition, there is growing evidence that better air quality is associated with

lower levels of criminal activity. A community located in proximity to a roadless area may therefore have lower crime rates than a similar community located in an area with a dense road network and lots of vehicular traffic.

Economic benefits, be they direct or indirect, can be quantified in monetary terms. As noted previously, economists' efforts to measure and quantify the value of natural areas have been largely concentrated on quantifying direct recreational use benefits, offsite property value increases, and passive-use benefits. The methods used to quantify benefits vary. Recreation benefits are estimated using one of two methods, the travel cost method or the contingent valuation method. Hedonic methods are used to quantify home buyers' willingness to pay for homes in close proximity to natural areas, and thus the higher residential property values that result. Passive use benefits are estimated using the contingent valuation method.

In addition to the economic benefits discussed above, local and regional communities also derive *economic impacts* – jobs and income – from preserving roadless areas. For example, when recreationists visit an area and purchase goods and services (such as food, gas, lodging, and recreational equipment), these expenditures cycle into and through the economy and translate into increased income and jobs for the local and regional economies. Such impacts also stem from scientific and educational uses of roadless areas. The measurement of economic impacts is accomplished through economic impact analysis, or economic contribution analysis, which focuses on expenditures made by recreationists, scientists, and educators and translates these expenditures into jobs and income for the local and regional economies. Additional details pertaining to how economic impacts are measured are provided in Section 3.

## 2. Recreation and Passive Use Values of Inventoried Roadless Areas

The protection of Wilderness areas, roadless areas, and other natural areas provides economic value to society through *direct use, science & education use, biodiversity conservation*, *ecological services*, *offsite benefits*, and *passive use*. Economists have conducted empirical research to provide estimates of some of these benefits, in particular recreational use (a kind of *direct use*) and *passive use benefits*. Although our interest is in roadless areas, economic research has focused on Wilderness areas, in part due to a lack of data for roadless areas. Value estimates for Wilderness areas serve as reasonable proxies for roadless area values, as Wilderness and roadless areas are similar in many respects. By definition Inventoried Roadless Areas must be roadless and roadless areas and Wilderness areas provide many of the same services and opportunities. This section summarizes the literature pertaining to the economic values of Wilderness area recreational use and passive use and estimates the associated values for Inventoried Roadless Areas.

### *2.1 Estimates of Recreation Values*

Wilderness areas, roadless areas, national forests, and other natural areas are visited and enjoyed by millions of people each year. Recreationists derive value from time spent hiking, backpacking, kayaking, rafting, bird watching, rock climbing, etcetera, and federal agencies are required to consider the economic value of

**Table 1. Wilderness Area Onsite Recreation Values ($/person/trip)**

| Study | Year published | State(s) | Consumer Surplus ($2018) Single-Day Use | Multi-Day Use |
|---|---|---|---|---|
| Smith & Kopp | 1980 | CA | | 89 |
| Walsh & Gilliam | 1982 | CO | 43 | 258 |
| Walsh et al. | 1984 | CO | | 131 |
| Rosenthal & Walsh | 1986 | CO | 27 | |
| Leuschner et al. | 1987 | NC | 17 | 23 |
| Prince & Ahmed | 1989 | VA | 19 | |
| Walsh et al. | 1989 | CO | | 85 |
| Barrick & Beazley | 1990 | WY | | 23 |
| Hellerstein | 1991 | MN | | 46 |
| Halstead et al. | 1991 | NH | | 10 |
| Englin & Shonkwiler | 1995 | WA | | 38 |
| Richer & Christensen | 1999 | CA | | 6 |
| Englin et al. | 2008 | CA | | 229 |
| Weber et al. | 2012 | AZ | 32 | |
| Sardana et al. | 2016 | USFS Region 8* | 91 | |

* USFS Region 8 encompasses Texas, Oklahoma, Arkansas, Louisiana, Kentucky, Virginia, Tennessee, North Carolina, South Carolina, Mississippi, Alabama, Georgia, and Florida.

recreation in their management plans. Since the late 1970s economists have conducted numerous studies that provide estimates of individual net economic value (consumer surplus) derived from onsite Wilderness recreation. The majority of studies have used the travel cost method (TCM) to derive these estimates, while others have used the contingent valuation method (CVM). Most existing studies have been conducted on Wilderness areas managed by the USFS and located in the Western US.

Table 1 summarizes studies published in either books or peer-reviewed journals that provide estimates of consumer surplus (CS) derived from Wilderness area recreation visits. We exclude estimates published in non-refereed reports, theses, or dissertations, and thereby mitigate concerns regarding the sensitivity of estimates to the particulars of site heterogeneity, research methods, and underlying assumptions, and whether such complexities were appropriately addressed.[2] Each study listed in Table 1 provides an estimate of the consumer surplus derived from a single-day trip, multi-day trip, or both. Estimated CS values per person per Wilderness trip vary from $6 to $258 (all estimates have been inflated to 2018 dollars). Single-day Wilderness trips have an estimated average CS of $38, while multi-day Wilderness trips have an estimated average CS of $85. We assume individuals recreating in IRAs derive the same CS from that experience as do individuals recreating in Wilderness areas, and therefore use these Wilderness-based CS values to estimate the value of recreation in Inventoried Roadless Areas.

To derive an estimate of Inventoried Roadless Areas' total recreation value requires a measure of recreation visits made to IRAs. However, as noted previously, these data are not collected and are therefore unavailable. Due to the noted similarities between IRAs and Wilderness areas, visitation estimates to Wilderness areas are the best available proxy. While Wilderness visitation and IRA visitation are unlikely to be a perfect

match, we feel that using Wilderness visitation rates results in similar, but conservative, estimates of IRA visitation. Roadless areas are typically more accessible and less remote than Wilderness areas, offering backcountry recreational opportunities in a slightly more front-country setting and offering a wider array of recreational activities.

The USDA Forest Service's National Visitor Use Monitoring (NVUM) system yields statistically reliable estimates of visits to Wilderness areas and defines a visit as the entry of one person to the national forest to participate in recreation activities for an unspecified period of time. NVUM is the preeminent outdoor recreation database of visitation, forest use, and expenditure profiles in the world. In 2016 an estimated 8.4 million visits were made to the 30.8 million acres of USFS-designated Wilderness in the lower 48 states, equivalent to 0.273 visits per Wilderness acre. We assume this same level of per-acre visitation occurred on the 41.9 million acres of IRA lands, yielding approximately 11.4 million visits to Inventoried Roadless Areas. According to NVUM estimates detailed in Hjerpe et al. (2017), approximately 12% of USFS Wilderness visits (1.4 million visits) are multi-day trips, while the remaining 88% (10 million visits) are single-day trips. Multiplying the average consumer surplus values for single- and multi-day trips by the relevant estimated number of trips yields a total annual IRA recreation benefit of nearly $500 million.

## *2.2 Estimates of Passive Use Values*

Although many people may never visit designated Wilderness or Inventoried Roadless Areas, they may still derive passive use values (bequest, option, and existence values) from these areas. During the past few decades several studies have been published that provide estimates of passive use values for Wilderness areas. The earliest of these studies, published by Walsh et al. in 1984, measured the option, existence, and bequest values, as well as recreation values, of Colorado Wilderness areas by asking survey respondents what they would be willing to pay to preserve the 1.2 million acres of designated Wilderness existing in Colorado at the time of the study. To estimate the value of potential Colorado Wilderness areas, survey respondents were also asked what they would be willing to pay to preserve additional roadless areas as Wilderness, such that the total amount of Colorado Wilderness was increased to 2.6 million, 5 million, or 10 million acres. Respondents were asked to allocate their willingness to pay (WTP) to recreation, option, existence, and bequest values, thereby allowing recreation values to be estimated separately from passive use values.

Two studies of Wilderness area passive-use values were published in 1990. Pope and Jones's (1990) study estimated Utah residents' willingness to pay for the designation of BLM land as Wilderness. Using an approach like that used by Walsh et al., the authors estimated the total economic value of Wilderness protection by asking respondents their willingness to pay for the designation of different quantities of BLM land as Wilderness (2.7, 5.4, 8.1, and 16.2 million acres). Results were similar to those derived by Walsh et al. Barrick and Beazley's (1990) study estimated the option value of preserving and preventing oil and gas drilling in northwestern Wyoming's Washakie Wilderness Area (approximately 700,000 acres in size). Two separate option values were estimated – one from a survey of onsite users, and a second from a survey of non-visiting urban and rural households throughout the US. The estimated WTP for onsite users was notably higher than that for offsite non-users.

Three additional studies were published in the early- to mid-1990s. Gilbert et al. (1992) is the only study assessing the passive use value of a Wilderness area located in the eastern US. The study assessed the value of preserving Vermont's nearly 18,000-acre Lye Brook Wilderness Area. Diamond et al. (1993) and McFadden (1994) published similar studies that assessed passive use values (option, existence, and bequest) of Wilderness areas threatened by logging. Both studies estimated the passive use value of the Selway Bitterroot Wilderness Area in Idaho. The Diamond et al. study also estimated passive use values associated with the Washakie Wilderness in Wyoming and the Bob Marshall Wilderness Area in Montana.[3]

Since the mid-1990s, no additional studies have been published that provide passive use value estimates for US Wilderness areas. Table 2, similar to that published by Holmes et al. (2015) but updated to 2018 dollars, summarizes the Wilderness area passive use studies published to date. Comparison of the studies' passive use estimates is not possible, as each study is constructed differently – each uses a different development scenario as an alternative to preservation, as well as different base populations and sampling frames. Additionally, most studies listed in Table 2 present the estimated passive use value for a specific Wilderness area, while others present the passive use value of all Wilderness areas in a particular state. Following Bowker et al. (2014) we assume if a household were willing to pay a given amount to preserve a particular Wilderness area (or all Wilderness areas in a specific state), the household would be willing to pay that amount to preserve all U.S. Wilderness areas. That is, if a household were willing to pay $82 each year to preserve passive use benefits from the Selway-Bitterroot Wilderness in Idaho, it is reasonable to assume the household would pay at least $82 to for passive use benefits from *all* U.S. Wilderness areas. Practically speaking, however, the household would likely be willing to pay more than $82 for passive use benefits from all U.S. Wilderness areas. This assumption therefore yields a conservative estimate. Because we use Wilderness areas

**Table 2. Annual household WTP for Wilderness Area Passive Use**

| Study | Year published (data year) | Wilderness area(s) | Value type | Annual household WTP ($2018) |
|---|---|---|---|---|
| Walsh et al. | 1984 (1980) | 10 million ac. (CO) | option, existence, bequest (sum) | $29, $34, $35, ($97) |
| Pope and Jones | 1990 (1986) | 1.9 million ac. (UT) | option, existence, bequest (sum) | ($121) |
| Barrick and Beazley | 1990 (1983) | 700,000 ac. Washakie (WY) | option | $116 onsite, $23 offsite |
| Gilbert et al. | 1992 (1990) | 18,000 ac. Lye Brook (VT) | option, existence, bequest (sum) | $2, $3, $6, ($12) |
| Diamond et al. | 1993 (1991) | 1.3 million ac. Selway Bitterroot (ID); 700,000 ac. Washakie (WY); 1.1 million ac. Bob Marshall (MT) | option, existence, bequest (sum) | ($92, $55, $68) |
| McFadden | 1994 (1990) | 1.3 million ac. Selway Bitterroot (ID) | option, existence, bequest (sum) | ($82) |

Total passive use values are provided in parentheses ($). Updated from Holmes et al. (2015).

as a proxy for IRAs, the average passive use value across studies ($74) serves as an approximation for the amount the average household would be willing to pay annually to preserve all Inventoried Roadless Areas.[4]

Passive uses of natural areas are by definition public goods; users cannot exclude others from using the good, and one person's use of the good does not diminish or detract from another person's use. Thus, unlike market goods, consumers do not compete for passive use values; all individuals and/or households can have a passive use value without negatively affecting the passive use value derived by others. Because passive use values are thereby additive, it is appropriate to extrapolate the average per-household $74 passive use value to all 126.2 million US households, resulting in an estimated total annual passive use benefit of $9.3 billion. We modify this estimate to account for (a) the inability of those living in poverty to pay for Wilderness preservation and (b) the decline in WTP that may occur as a result of living far away from Wilderness areas.[5] We reduce the extrapolation by 12.3% to account for households living below the poverty line in 2017, as these households have no discretionary income. We assume 50% of US households live sufficiently far from Wilderness areas to result in a 5% decrease in their passive use value.[6] These assumptions yield a conservative total annual passive use benefit of $8 billion.

## 3. Regional Economic Contributions of Roadless Areas

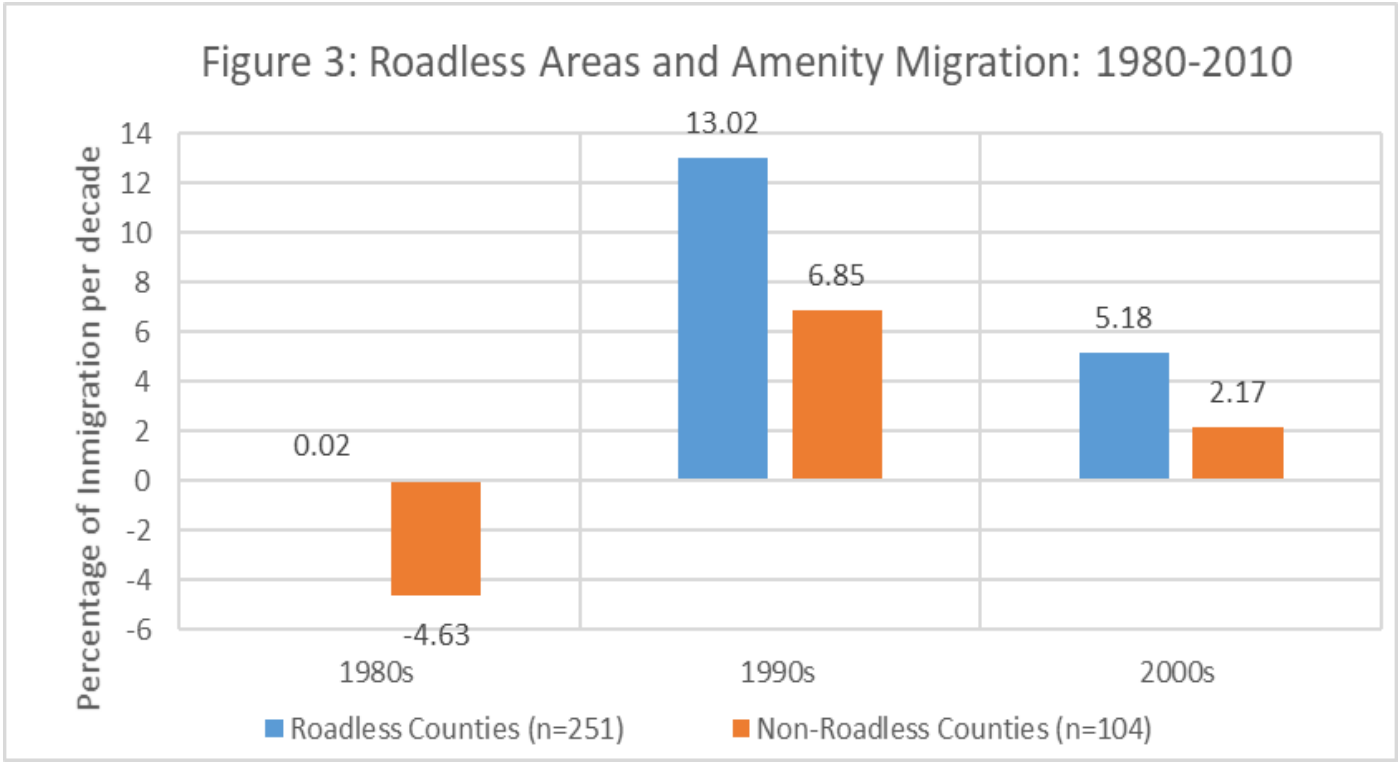
In this section, we provide regional economic perspectives of roadless areas to complement the national perspectives presented in the previous sections. The economic benefits of protecting roadless areas discussed in Sections 1 and 2 can be collectively termed as ecosystem services, or the benefits to mankind supplied by IRAs. Roadless ecosystem services generate the multiple use and passive use values described earlier, and also result in regional economic impacts and contributions.

To examine economic impacts and prominent ecosystem services of roadless areas, we present multiple regional perspectives. Economic impacts are different from direct use and passive use values. Economic impacts, or contributions,[7] are measures of jobs, output, and income generated by the services and goods produced for visitors and recreationists in roadless areas. Because employment and income represent transfers of wealth from region to region, they are not considered as benefits like passive and direct use values. Increases in employment in one region result in decreases in employment in another region---a zero sum process. Likewise, amenity migration and development associated with rural areas attract business income and transfer payments to areas with natural amenities. But, amenity migrants boost regional income and wealth in their new locales and depress regional income and wealth from the areas that they left.

Visitors recreating in IRAs spend money in gateway communities for last minute supplies, fishing licenses, gas, dinner at restaurants, or for lodging in nearby campgrounds. This spending is important out-of-region money for rural communities located adjacent to IRAs. Visitor spending creates direct effects by generating revenue, or output, for businesses through the sale of goods and services. These direct effects spur indirect effects, or demand for regional supply of goods and services needed by the businesses to operate. For example, a restaurant serving dinner and drinks to IRA recreationists requires raw materials such as food and

fuel to provide the final service to diners. The amount of local supplies used by the restaurant represent the indirect effects of IRA visitor expenditures. Finally, induced effects are generated when employee wages are spent locally on goods and services such as when restaurant staff purchase local groceries or entertainment. Economic impact (or contribution) analysis is the method for measuring direct, indirect, and induced effects.

Amenity migration is another way that rural communities adjacent to protected public lands can attract wealth and income. Public lands in general have been shown to be strongly associated with amenity migration (e.g., Power and Barrett 2001). While roadless areas are part of the broader set of public lands, the relationship between IRAs and net migration is notable. With 96% of national roadless acres being in the Western US (excluding Alaska), we analyzed all rural Western counties (<250,000 people, n = 355) to determine descriptive statistics for roadless areas and amenity development. The results show a strong association between counties containing roadless areas and their average net migration for over three decades.[8] Counties without IRAs, on the other hand, have barely seen increases in net migration. In total, counties with IRAs have averaged 6.1% net migration per decade from 1980-2010. Rural Western counties without roadless areas have averaged only 1.5% net migration over the same time period. Figure 3 illustrates the differences in average net migration rates between rural Western counties with and without IRAs for three decades.



## *3.1 Economic Contribution Analysis of IRA Visitation for Five States*

As we used Wilderness visitation as a proxy for IRA visitation, we also use Wilderness regional expenditures as a proxy for IRA visitor spending. While there are certainly some differences in Wilderness and IRA visitor spending, we know there are similarities in the two types of visitors and recreation activities. Both Wilderness areas and roadless areas are largely undeveloped, offering backcountry recreation and solitude. While some roadless areas include motorized recreation, much of the roadless recreation is non-motorized like Wilderness recreation. Both offer better fish and wildlife habitat than more developed lands, leading to niche fishing, hunting, equestrian, and wildlife photography opportunities.

While there are similarities in Wilderness and IRA recreation, there are also differences in the two that suggest our estimates of IRA visitor spending are quite conservative. Despite roadless areas not having roads, they tend to be more accessible and closer to the road system than Wilderness areas. While some roadless areas are used just as gateways to Wilderness, many are destination recreational areas themselves, particularly for day use. Many roadless areas allow mountain biking, mechanized activity not allowed in Wilderness. Some roadless areas offer motorcycle and ATV trail access, and roadless areas are often more accessible for backcountry skiing. These more equipment-intense recreation activities lead to greater regional visitor spending when compared to spending by hikers and backpackers. Additionally, IRAs sometime contain concessionaire-operated huts or yurts utilized by backcountry skiers, hikers, and mountain bikers. This type of commercial activity is typically not allowed in Wilderness.

As such, Wilderness visitor spending is the best available proxy with which to estimate IRA regional economic contributions. Despite the margin of error in using Wilderness visitation and spending to estimate IRA visitor spending, we view our estimates of IRA regional economic contributions to be conservative and far superior to no estimates at all. Much of the policy debate on roadless areas currently attributes almost zero value for IRA regional economic contributions, as the economic values are generally missing from the discussion. Our estimates provide a starting point for IRA economic values.

Wilderness visitation data were collated from USDA Forest Service's National Visitor Use Monitoring (NVUM) program. Beyond visitation data, NVUM surveys are used to also understand the regional economic impacts and contributions of various types of national forest visitors. NVUM sampling design includes surveying visitors at four distinct site types, one of which is Wilderness sites, but also includes day use developed sites, overnight use developed sites, and general forest areas (Zarnoch et al. 2011). Additionally, a portion of NVUM surveys include a supplemental set of spending questions (White et al. 2013). Visitors are asked to estimate expenditures made within 50 miles of their national forest destination for recreation and tourism spending for fuel, restaurants, snacks, or sporting goods.

Hjerpe et al. (2017) utilized NVUM expenditure data to construct average Wilderness visitor spending profiles. The Wilderness visitor spending profiles were weighted averages of trip types (such as local versus

non-local) and trip durations (such as day use or overnight on the forest), where approximately 12% of Wilderness visitors took overnight or multi-day trips, while the remaining 88% were day use visitors (see Hjerpe et al. 2017 Appendix A). We assume a similar ratio of day use to overnight use for IRA visitors and have updated Wilderness visitor spending to 2016 dollars and used these Wilderness spending profiles as proxies for IRA visitor regional spending (Table 3).

For the five states highlighted below, we measure the regional economic contributions by taking the estimated annual state IRA visits and applying the average Wilderness expenditure profile per visit. For each state, we used the regional estimate of visits per acre of Wilderness from NVUM and apply it to the number of IRA acres in the state. Total annual state IRA expenditures, made locally, were then analyzed in IMPLAN and applied to a statewide-economy. While NVUM data indicate that only 30% of Wilderness visits came from non-locals, or visitors from greater than 50 miles away, the origin of visitors is of less concern for a statewide contribution analysis that simply measures the overall role of IRA recreation spending among a larger economy.

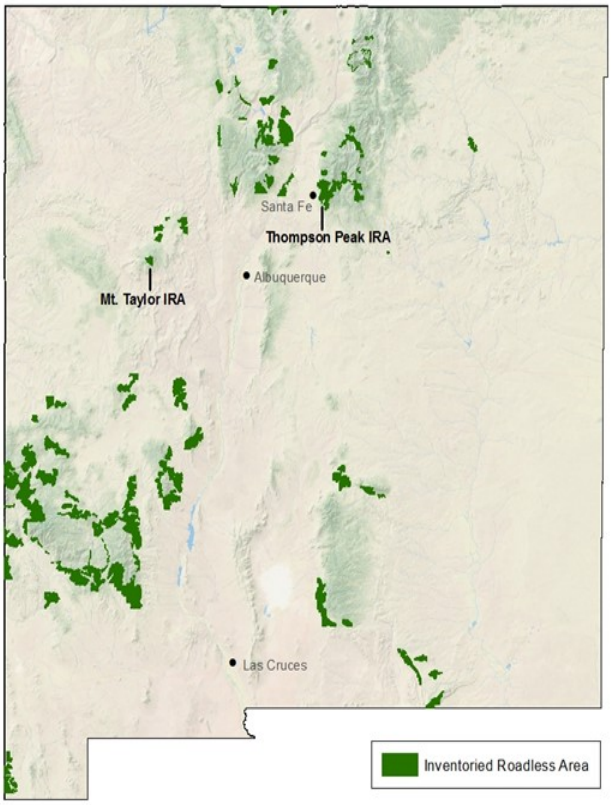
IMPLAN is economic modeling software that tracks changes in final demand throughout a regional economy. The software contains region-specific input-output models where all industry sectors are both buyers and suppliers of goods and services. IMPLAN is a common model used for economic contribution analysis and is particularly suited for estimating contributions from outdoor recreation and rural communities (Bergstrom et al. 1990). IMPLAN's social accounting matrix contains producer prices for commodities, excluding the retail margins or markups placed on the final sale of retail goods. Thus, in our analysis, all retail purchases

**Table 3: IRA Visitor Expenditures by Spending Category (In-region*)**

| Spending Category | IMPLAN Sector | Estimated Expenditures Per IRA Visit ($2016) |
|---|---|---|
| | | |
| Motel | Hotels and Motels (499) | 9.34 |
| Camping | Other Accommodations (500) | 2.53 |
| Restaurant | Food Services and Drinking Places (501) | 9.43 |
| Groceries | Retail Stores – Food and Beverage (400) | 9.53 |
| Gas and oil | Retail Stores – Gas Stations (402) | 11.89 |
| Other transportation | Scenic and Sightseeing Transportation (414) | 0.36 |
| Entry fees | Other Federal Government Enterprises (520) | 2.33 |
| Recreation and entertainment | Other Amusement and Recreation Industries (496) | 2.48 |
| Sporting Goods | Retail Stores – Sporting Goods (404) | 3.01 |
| Souvenirs and other expenses | Retail Stores -- Miscellaneous (405) | 2.21 |
| | | |
| **Total** | | **53.10** |

*Source:* Adapted from Hjerpe et al. 2017.

were margined to convert purchaser prices into producer prices. Finally, IMPLAN provides employment estimates in terms of full and part-time jobs. But, IMPLAN also provides industry-specific ratios to convert full and part-time jobs to full time equivalents (FTEs). For the ten industry sectors used in our expenditure profiles, conversion ratios from full and part-time jobs to FTEs range from .81 to .95, with an average conversion ratio of .87 for all ten industries.




### 3.1.1 New Mexico Roadless Economic Contributions

New Mexico has 1.5 million acres of IRAs dispersed across the state, with numerous acres in the Gila National Forest in southwest New Mexico and in national forests in the northern mountains. We highlight ecosystem services coming from two New Mexico

Hikers in Mt. Taylor IRA, Source: New Mexico Meanders WordPress.com

IRAs in particular, Mt. Taylor and Thompson Peak IRAs, as they are good examples of the cultural and provisioning ecosystem services prevalent and protected in all New Mexico IRAs.

Mt. Taylor is located in the Four Corners region in the Cibola National Forest. It is a stratovolcano and is northeast of the town of Grants, NM. Mt. Taylor IRA offers tremendous hiking with long-ranging views across desert landscapes and helps protect cultural ecosystem services, especially those related to spiritual and religious beliefs. Mt. Taylor is considered sacred to multiple southwestern Native American tribes and is known as *Tsoodzil* to the Navajo, representing one of the cardinal directions and boundaries of Navajo homelands.

Thompson Peak IRA is adjacent to Santa Fe and is located within the Santa Fe National Forest. The IRA allows for quick, roadless hiking access from Santa Fe, birding, and rugged mountain biking opportunities. Aside from protecting important recreation and wildlife habitat, Thompson Peak IRA protects important headwaters, including those leading into McClure Reservoir, an important source of drinking water for Santa Fe. Thompson Peak IRA helps restrict sedimentation and erosion into municipal drinking water supplies, leading to thousands of dollars in avoided costs that would need to be spent on water filtration if greater sedimentation occurred. Maintaining roadless protections for Thompson Peak and all New Mexico IRAs is critical to protecting numerous ecosystem services that provide myriad benefits to the public.

While cultural, supporting, and provisioning ecosystem services are important economic benefits of New Mexico IRAs, visitation and recreation lead to additional economic impacts or contributions for communities adjacent to IRAs. IRA visitors, local and non-local, spend money associated with their visit in rural communities, supporting regional employment, income, and output. From NVUM, we use the ratio of visits per acre of Wilderness for Region 3, or .583 visits per acre. We estimate that the 1.5 million acres of New Mexico IRAs generate about 875,000 annual visits. Many of these visits are local day-use trips, but a number include non-local and overnight backpacking and hunting trips. Applying the Wilderness expenditure profile to annual New Mexico IRA visits shows that almost 600 total full and part-time jobs, or about 500 FTE jobs, are attributable to New Mexico IRA visitation when including indirect and induced effects (Table 4).

**Table 4: Estimated Total Effects and Multipliers for New Mexico IRA Visitor Expenditures ($2018)**

| Impact Type | Employment | Labor Income ($Millions) | Total Value Added ($Millions) | Output ($Millions) |
|---|---|---|---|---|
| Direct Effect | 444 | 11.05 | 14.84 | 28.63 |
| Indirect Effect | 61 | 2.44 | 4.73 | 9.32 |
| Induced Effect | 77 | 2.89 | 5.57 | 9.96 |
| **Total Effect** | **582** | **16.38** | **25.13** | **47.90** |
| | | | | |
| **Multiplier Effect** | **1.31** | **1.48** | **1.69** | **1.67** |

*Source:* IMPLAN3.1, New Mexico Region 2016, Type SAM Multipliers

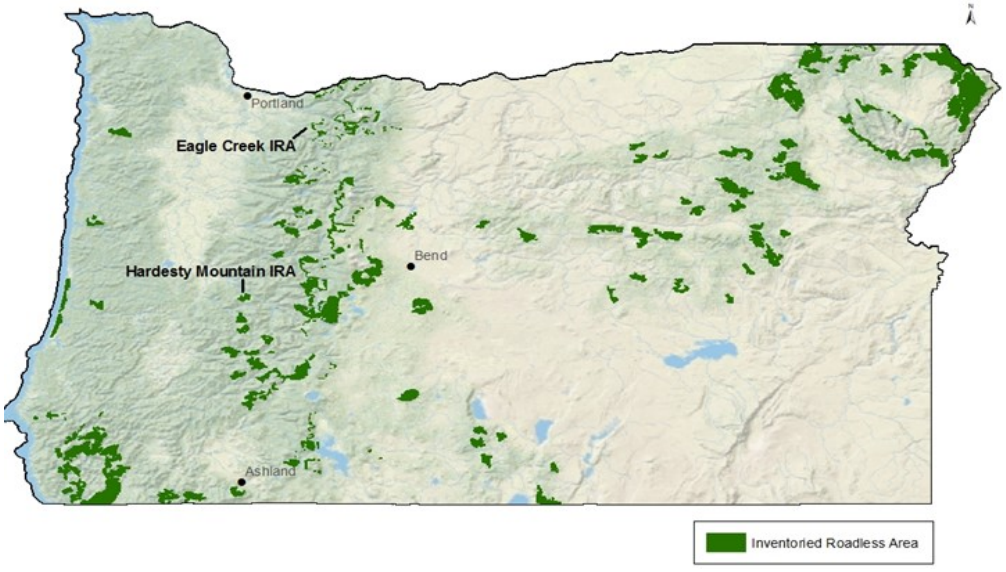
### 3.1.2 Oregon Roadless Economic Contributions

Oregon contains almost 1.9 million acres of IRAs. Oregon IRAs are well dispersed across the state, offering recreational opportunities in numerous unique geographies. We highlight two Oregon IRAs, Eagle Creek and Hardesty, but note that many Oregon IRAs offer hiking, backcountry and cross-country skiing, equestrian use, and hunting opportunities.

Eagle Creek IRA is located in the Mt. Hood National Forest above the Columbia Gorge National Scenic Area. Eagle Creek IRA's proximity to both the city of Portland and Wilderness areas makes it a popular option for hiking to waterfalls and those seeking solitude. Cultural ecosystem services focused on recreation are most prominently on display in Eagle Creek IRA, affording options for city dwellers to escape to protected natural areas. These cultural ecosystem services evoke both market impacts and the nonmarket values discussed in the first two sections.

Hardesty Mountain IRA is located on the Umpqua and Willamette National Forests. Like Eagle Creek IRA, Hardesty Mountain IRA offers steep hiking and mountain biking with quick access to a highly populated city, Eugene. With some remaining old growth forests and productive soils of the West slope of the Cascades, Hardesty Mountain IRA provides a key role in carbon sequestration, water filtration, and climate regulation. These regulating ecosystem services play a critical role is limiting climate change effects and providing for wide-ranging biodiversity from native trillium wildflowers to rough-skinned newts.

Aside from the nonmarket values generated from Oregon IRA ecosystem services, there are numerous marketed economic impacts and contributions that are generated. Oregon IRA visitors take overnight and day trips to recreate in IRAs and inject money into rural communities by purchasing camping and fishing supplies. Incorporating regional Wilderness visitation rates of .218 visits per acre for Region 6, we estimate that Oregon's 1.9 million acres of IRAs spur about 400,000 annual visits. These visits result in about $27 million of total regional output and 300 total full and part-time jobs, or about 260 FTE jobs when including indirect and induced effects.



Hardesty Mountain IRA, Source: Brian Jenkins, summitpost.org

**Table 5: Estimated Total Effects and Multipliers for Oregon IRA Visitor Expenditures ($2018)**

| Impact Type | Employment | Labor Income ($Millions) | Total Value Added ($Millions) | Output ($Millions) |
|---|---|---|---|---|
| Direct Effect | 204 | 6.61 | 6.01 | 13.30 |
| Indirect Effect | 42 | 2.33 | 3.87 | 6.96 |
| Induced Effect | 55 | 2.41 | 4.20 | 7.18 |
| **Total Effect** | **300** | **11.35** | **14.09** | **27.44** |
| | | | | |
| **Multiplier Effect** | **1.47** | **1.72** | **2.34** | **2.06** |

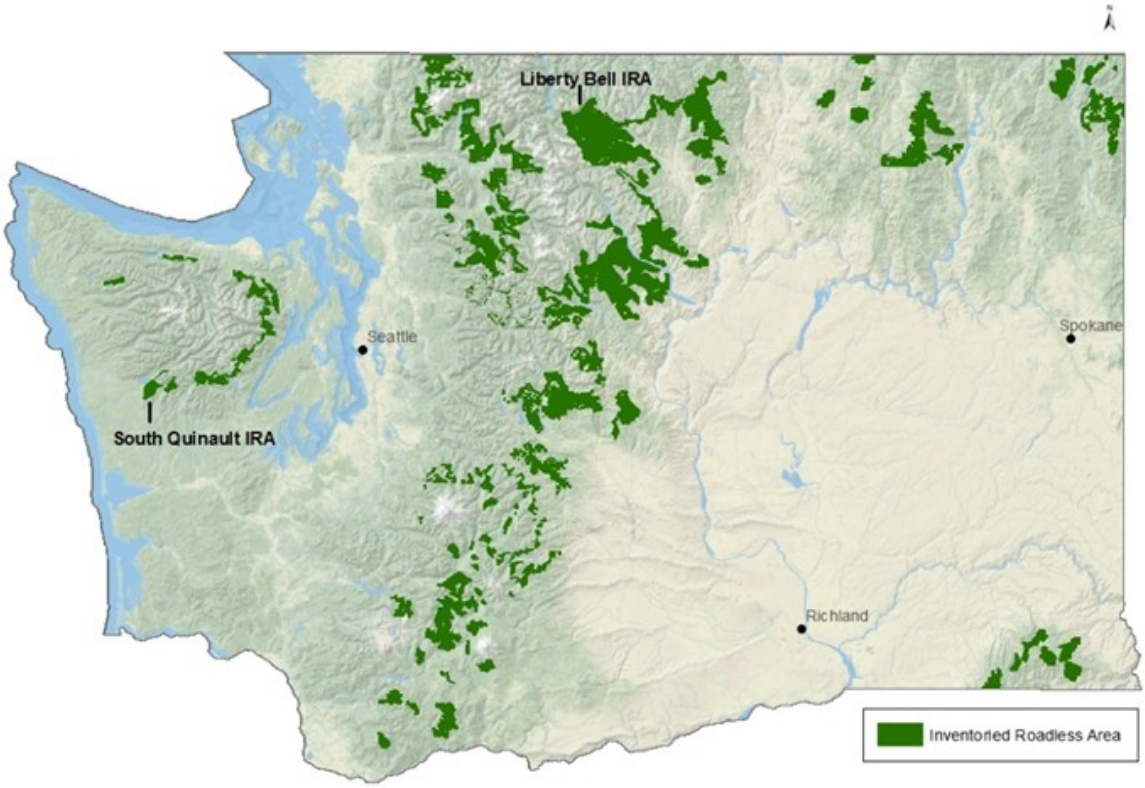
*Source:* IMPLAN3.1, Oregon 2016, Type SAM Multipliers

### 3.1.3 Washington Roadless Economic Contributions

Washington has over 1.9 million acres of IRAs primarily throughout the Cascades, but also across the state. We showcase two Washington IRAs, Liberty Bell IRA in the Okanogan National Forest and South Quinault Ridge IRA in the Olympic National Forest.

Liberty Bell IRA is in the northern Cascades and includes a group of spires and mountains renowned for rock climbing and backcountry skiing. The area is adjacent to North Cascades National Park. Liberty Bell IRA provides a high alpine refuge for biodiversity affected by climate change. The spectacular recreation opportunities in Liberty Bell IRA provide numerous cultural ecosystem services related to spiritual health, adventure, exercise, and the pursuit of solitude.

South Quinault Ridge IRA is located on the Olympic Peninsula. South Quinault Ridge is fairly unique in the type of ecosystem being protected as it contains old growth temperate rainforest. Coastal temperate rainforests provide for abundant biodiversity and carbon sequestration. Coastal temperate rainforests are also traditional salmon forests, where the connectivity of headwater slopes play a critical role in watershed health. South Quinault Ridge IRA limits the amount of erosion and sedimentation into the overall Quinault River system, a salmon-filled watershed. Salmon, and fish and wildlife in general, are economically valued for a number of services, from providing existence values to affording recreation and commercial fishing



opportunities. If South Quinault Ridge IRA were allowed to be roaded and utilized for timber harvest, erosion and sedimentation would greatly increase in the Quinault watershed. Keeping South Quinault roadless pays many dividends that are not always counted.

While the uniqueness of roadless coastal temperate rainforest in the Lower 48 provides extensive consumer surplus to recreationists and passive use values to society, Washington IRAs also generate extensive regional economic contributions. Based on NVUM estimates, there are .218 visits per acre of Wilderness in Region 6. We estimate that Washington's more than 1.9 million acres of IRAs spur about 420,000 annual visits by recreationists who purchase goods and services in the small towns adjacent to IRAs. IRA visitor spending in Washington results in 175 direct full and part-time jobs annually. When including indirect and induced effects, Washington IRA visitors help support about 240 full and part-time jobs throughout rural Washington, or about 210 FTE jobs, as well as $25 million in regional output.

Liberty Bell IRA, Source: Ron Clausen

**Table 6: Estimated Total Effects and Multipliers for Washington IRA Visitor Expenditures ($2018)**

| Impact Type | Employment | Labor Income ($Millions) | Total Value Added ($Millions) | Output ($Millions) |
|---|---|---|---|---|
| Direct Effect | 175 | 5.45 | 8.33 | 13.72 |
| Indirect Effect | 27 | 1.71 | 2.98 | 5.24 |
| Induced Effect | 36 | 1.87 | 3.45 | 5.74 |
| **Total Effect** | **238** | **9.03** | **14.76** | **24.70** |
| | | | | |
| **Multiplier Effect** | **1.36** | **1.66** | **1.77** | **1.80** |

*Source:* IMPLAN3.1, Washington 2016, Type SAM Multipliers

### 3.1.4 Tennessee Roadless Economic Contributions

There are 18 IRAs and 85,000 acres of roadless areas in Tennessee, generally along the eastern border in the Appalachian Mountains. We highlight two Tennessee IRAs, the Upper Bald River IRA and the Joyce Kilmer Slickrock Addition IRA.

Upper Bald River IRA is located in the Cherokee National Forest of eastern Tennessee. Though difficult to access and with limited visitors, the Upper Bald River IRA is unique among IRAs due to its wildness. By mapping the degree of human modification and protected areas, Belote et al. (2017) identified the wildest lands in the Lower 48 and extended this research to IRAs. The Upper Bald River IRA was found to be in the 1% of wildest places left in Tennessee. Additionally, the Upper Bald River IRA protects important headwaters for the Bald River, waters that flow into the Tellico River and then the Tennessee River. Wildness provides numerous provisioning, regulating, supporting, and cultural ecosystem services. Protected headwaters provide free water filtration and water supply to society. Wildness provides important cultural ecosystem services associated with scientific knowledge and education. Wild areas can be used as a scientific control to help us understand how to better manage natural disturbances. Combined with immense biodiversity values and spiritual values, the Upper Bald River IRA is a region that should never be developed.

The Joyce Kilmer Slickrock Addition IRA is located just to the south of the Great Smoky Mountains National Park, along the Tennessee and North Carolina border. Located in the Cherokee National Forest, the Joyce Kilmer Slickrock Addition IRA provides access to the Wilderness area by the same name and is renowned for giant hardwood forests. Backpacking, hiking, and birding are common activities in this roadless area.

Joyce Kilmer Slickrock Addition IRA, Source: Bill and Laura Hodge

**Table 7: Estimated Total Effects and Multipliers for Tennessee IRA Visitor Expenditures ($2018)**

| Impact Type | Employment | Labor Income ($Millions) | Total Value Added ($Millions) | Output ($Millions) |
|---|---|---|---|---|
| Direct Effect | 43 | 1.29 | 1.66 | 3.03 |
| Indirect Effect | 7 | 0.41 | 0.66 | 1.21 |
| Induced Effect | 11 | 0.53 | 0.87 | 1.50 |
| **Total Effect** | **61** | **2.22** | **3.19** | **5.74** |
| | | | | |
| **Multiplier Effect** | **1.43** | **1.72** | **1.92** | **1.90** |

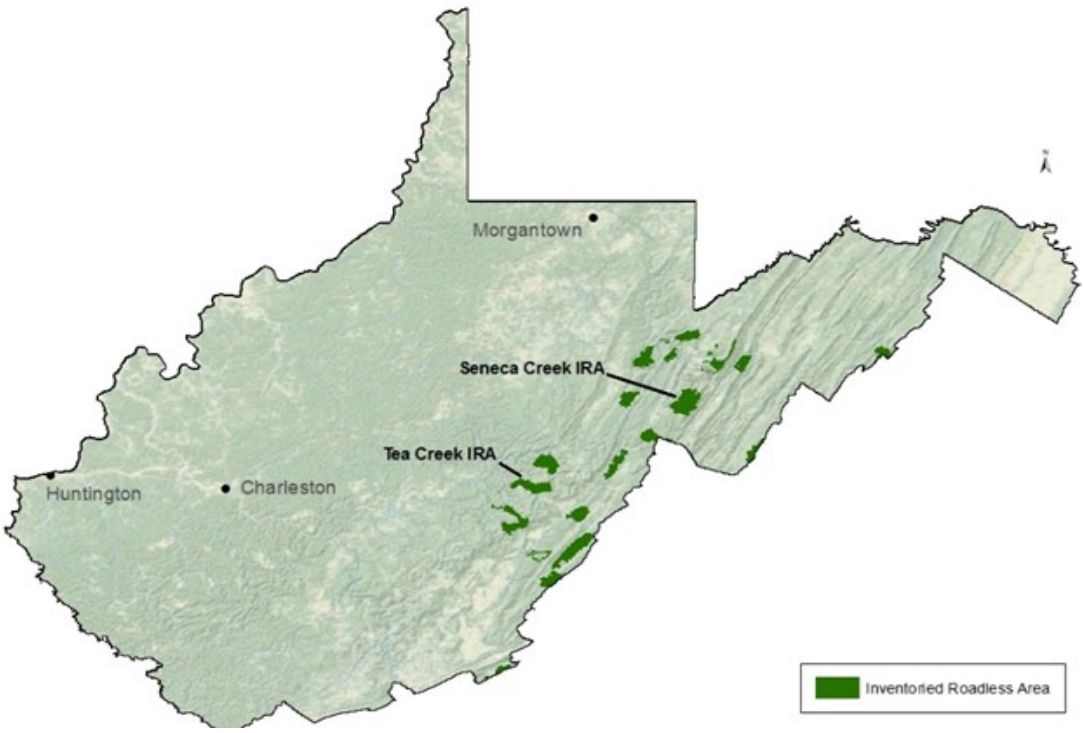
*Source:* IMPLAN3.1, Tennessee 2016, Type SAM Multipliers

Tennessee IRAs provide protection to valuable ecosystems and native biodiversity. These services generate immense use and passive use values. But Tennessee IRAs also provide recreation opportunities that generate regional economic contributions. Regional Wilderness visitation rates in Region 8 are approximately 1.09 visits per acre annually. We estimate that Tennessee IRAs experience over 90,000 annual visits, based on 85,000 acres of IRAs in the state. In Table 7, we illustrate the employment and income spurred by IRAs throughout the state of Tennessee, showing over 60 full and part-time jobs, or over 50 FTE jobs when including total effects.

### 3.1.5 West Virginia Roadless Economic Contributions

West Virginia contains about 180,000 acres of roadless areas, generally confined to the eastern part of the state. We highlight two West Virginia IRAs, Seneca Creek and Tea Creek. Both roadless areas offer a different form of backcountry recreation, mountain biking. West Virginia roadless areas offer spectacular backcountry, non-motorized recreation opportunities. These recreation opportunities bring welcomed new forms of economic development based on the production of goods and services for forest visitors.

Seneca Creek IRA is located on the Monongahela National Forest, is known for its native brook trout and wild rainbows, and has been included in the top 100 trout streams of the U.S. Seneca Creek is also known for its mountain biking and is included as an International Mountain Bicycling Association (IMBA) Epic ride. Particularly in a region so devasted by past coal mining, recreational opportunities in protected natural areas are scarce and a critically important part to diversifying a resource-based economy.



Tea Creek IRA is also located on the Monongahela National Forest. Like Seneca Creek, Tea Creek is a destination for mountain bikers and has been home to sanctioned mountain bike races. Tea Creek IRA includes a suite of non-motorized trails utilized by backpackers, bikers, hunters, and fishermen. Cultural ecosystem services are most prominent in Tea Creek, but biodiversity and conservation values are also prevalent in all IRAs that allow for greater fish and wildlife habitat and connectivity. Native hardwoods in Tea Creek include oak, maple, beech, birch, and hickory.

If West Virginia roadless areas were to be opened to roads and development such as oil and gas exploration, many of the ecosystem services provided would be at risk. Loss of IRA protections in West Virginia would also jeopardize recreational and tourism spending in rural communities. Utilizing NVUM estimates of Wilderness visitation rates of .386 visits per acre for Region 9, we estimate that there are about 70,000 annual visits to West Virginia IRAs. These visits result in more than $3.6 million in regional output, generating 44 full and part time jobs (or about 40 FTE jobs) when including total effects.

Seneca Creek IRA, Source: Tim Haggerty

**Table 8: Estimated Total Effects and Multipliers for West Virginia IRA Visitor Expenditures ($2018)**

| Impact Type | Employment | Labor Income ($Millions) | Total Value Added ($Millions) | Output ($Millions) |
|---|---|---|---|---|
| Direct Effect | 34 | 0.91 | 1.29 | 2.29 |
| Indirect Effect | 4 | 0.19 | 0.33 | 0.62 |
| Induced Effect | 6 | 0.23 | 0.43 | 0.74 |
| **Total Effect** | **44** | **1.33** | **2.05** | **3.65** |
| | | | | |
| **Multiplier Effect** | **1.30** | **1.46** | **1.59** | **1.60** |

*Source:* IMPLAN3.1, West Virginia 2016, Type SAM Multipliers

# 4. Conclusions

Inventoried Roadless Areas are an important component of this country's public lands – IRAs not only provide opportunities for recreation and scientific study, but also provide numerous ecological services, support biological conservation and diversity, can increase property values in nearby areas, and provide various nonuse benefits to society. Despite the many benefits and economic values provided by roadless areas, the protections given them are limited and have been subject to continual efforts to diminish or remove the protections. The research presented herein provides estimates of a subset of the economic values associated with maintaining, in their undeveloped state, the 41.9 million acres of IRAs located in the conterminous 48 states. Specifically, we estimate the economic value of benefits derived from recreational use and passive uses of IRAs. Although IRAs yield additional benefits to society (e.g. ecological services and biological diversity), estimates of the economic values associated with these benefits are more difficult to quantify and are not generally available in the literature.

Economic research pertaining specifically to IRAs is limited by a lack of available data. However, because IRAs are similar to Wilderness areas in many respects, we use Wilderness area values as a proxy for IRAs. In 2017 recreational use of IRAs in the conterminous 48 states generated an estimated $500 million in consumer surplus. Passive use benefits, which are public goods (meaning that one individual's passive use does not reduce another individual's passive use), are additive and notably larger than recreational benefits. We estimate that IRAs provide $8 billion in passive use benefits to US households annually. Thus, recreational use and passive uses of IRAs yield a total of nearly $9 billion in economic benefits each year.

Recreationists' visits to Roadless areas not only result in $500 million of consumer surplus, but also impact and contribute to nearby economies due to expenditures made in gateway communities for last minute supplies, fishing licenses, gasoline, meals, lodging, etcetera. Visitors' expenditures for goods and services have direct, indirect, and induced impacts on jobs, income, and output. We use IMPLAN to estimate the magnitude of these economic contributions on the regional economies of five states – New Mexico, Oregon, Washington, Tennessee, and West Virginia. The IMPLAN models are populated using visitation and expenditure data obtained from the USDA Forest Service's National Visitor Use Monitoring (NVUM) program. Because roadless area acreage is much higher in the Western US than the Eastern US, the economic contributions of roadless areas are also much greater in the Western US. But the scarcity of protected lands in the Eastern US makes IRA regional contributions in the East an important method for diversifying regional economic portfolios. We find that visits to IRAs in the three western states consistently result in the creation of approximately 200-400 jobs, labor income of $9-16 million, and output of $25-48 million. Impacts in the two eastern states are notably smaller; recreationists' expenditures create approximately 40-60 jobs, $1-2 million of income, and about $4-5 million of regional output.

Although the research presented herein estimates only a subset of the benefits derived from maintaining

roadless areas in their undeveloped state, it is clear that society benefits greatly from their existence; recreation and passive uses alone provide billions of dollars in economic benefits to US citizens. Not included in our estimate are the economic benefits associated with subsistence use, science & education, offsite uses, biodiversity conservation, or ecological services. Furthermore, IRAs provide a means of transferring jobs, income, and output to rural areas that otherwise often struggle to establish healthy economies. Finally, some IRAs also hold significant cultural, spiritual, and religious importance to Native communities.

Smoky Mountains IRA, Source: Evan Hjerpe

## 5. Endnotes

1. Available at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_000250.pdf.

2. A study conducted in North Carolina (Casey et al. 1995) yielded recreation values notably higher (4 to 20 times greater) than those derived in other studies. We therefore consider the Casey et al. study to be an outlier and exclude it from our analysis.

3. One other study conducted in Utah, Keith et al. 1996, yielded passive use values far greater than those derived in any other study; annual household WTP values were 10 to 45 times greater than those derived in other studies. We therefore consider the Keith et al. study to be an outlier and exclude it from our analysis.

4. When calculating this average we omit the Barrick and Beazley 1990 study, as they provide an estimate for option value only; Barrick and Beazley do not estimate existence or bequest value and therefore do not provide an estimate of the full passive use value.

5. Loomis and Gonzalez-Caban (1996) find that WTP for California and Oregon old-growth forest protection declines by 1% for each 1000 mile increase in distance.

6. Although by necessity somewhat arbitrary, these values were chosen to provide a conservative but reasonable estimate of the impacts of distance on WTP.

7. Economic impact analysis and economic contribution analysis are very similar in regard to measuring the amount of jobs, income, and output associated with a particular set of economic activities. The difference in the terminology is a technical methodology separation where impact analysis measures the gain or loss of an economic activity and where contribution analysis measures the effects of ongoing economic activity.

8. Net migration was recorded from the U.S. Census Bureau and IRAs were overlaid using U.S. Geological Survey, Gap Analysis Program (GAP). May 2016. Protected Areas Database of the United States (PAD-US), version 1.4 Combined Feature Class.

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