Blues Intergovernmental Council
Final Socioeconomic Report

2022

Revisions made August 2023

Eastern Oregon University

REV

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Ecosystem Workforce Program
a program of Oregon State University and University of Oregon

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About The Report

This work supports ongoing efforts to revise the Blue Mountain Forest Plans (BMFP). As part of that effort, the Blues Intergovernmental Council (or BIC) was convened by the Eastern Oregon Counties Association and US Forest Service (USFS). The BIC consists of leaders from Federal, State, Local and Tribal Governmental entities. This group requested an analysis highlighting the substantial differences between economies of the region. Such an analysis would then open the door to forest planning sensitive to the differential socio-economic impacts that communities might experience across eastern Oregon and southeastern Washington under varying alternatives in the new Forest Plans for each of the Blue Mountain National Forests (the Malheur, Umatilla, and Wallowa-Whitman National Forests).

In response, the Rural Engagement and Vitality (REV) Center (a partnership of Eastern Oregon University and Wallowa Resources) was contracted to produce baseline community profiles, a risk/opportunity index of the focal counties, and scenario modeling using IMPLAN. The county-level profiles provide standardized, consistent, and easily updated data that supports the rest of the analysis in this document, and allows for comparisons between counties. The risk/opportunity index is built from an analysis of each county's exposure to changes in USFS management, and their resilience in the face of significant socio-economic shocks. The scenario modeling estimates job and revenue effects to each county based on key activity levels within potential Forest Plan alternatives – including forest harvest level, livestock grazing, restoration contracting, and recreation.

This Revised August 2023 Report includes minor changes to the FInal Report, originally issued in 2022. The changes include a qualifying statement about the IMPLAN analysis on Page 12, and a complete list of references supporting the information and analysis.

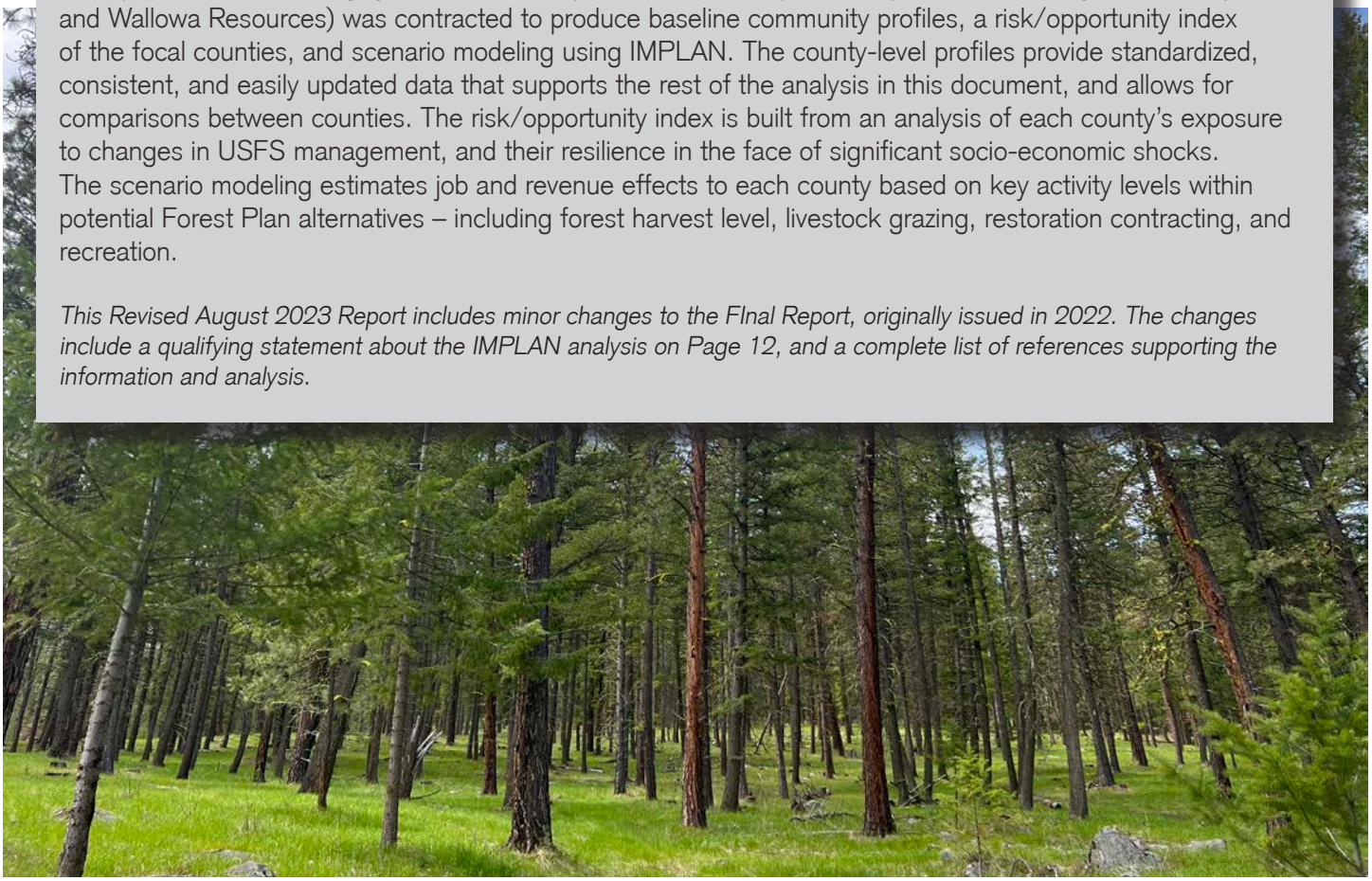


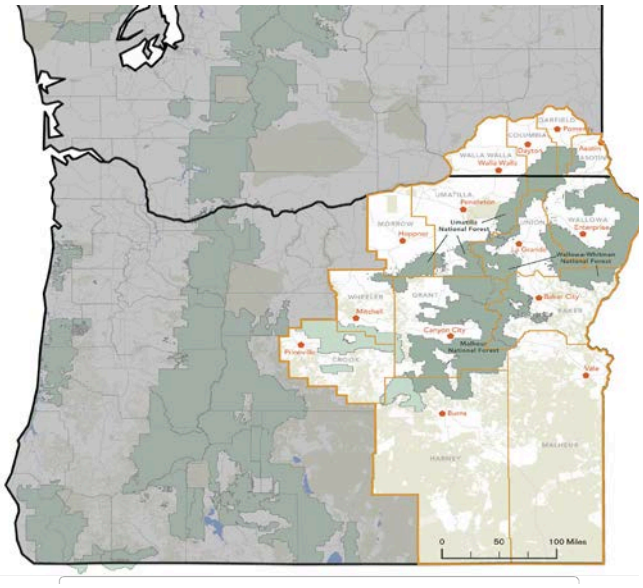
Photo courtesy of Jessica Tomasini

Regional Context

The Blue Mountain region has a rich and diverse cultural history of human habitation that spans more than 10,000 years. The region was historically occupied by several American Indian Tribes.

Through their Treaty Rights and cultural practices, these Tribes maintain strong ties to each of the three Blue Mountain national forests and the larger regional landscape. These rights and practices include the region's archaeological and historical resources, as well as the gathering of herbs and plants, hunting and fishing, grazing and access to water, and other traditional uses. Tribal members also continue to practice religious activities within the national forests. All of these rights and activities depend on the maintenance of healthy forests, shrublands, and grasslands across the Blue Mountains.[1]

Three national forests (Malheur, Umatilla and Wallowa-Whitman) administered by the USFS occupy 17% of the region's total land area and encompass over 70% of the forested acres. There are significant differences in federal land administered by the USFS per county – ranging from close to 0% in Malheur and Walla Walla counties to 55% and 57% in Grant and Wallowa counties, respectively.



Blue Mountain Region of Oregon and Washington

14 counties outlined in orange. County seats are represented by orange dots. Three national forests are in dark green. White areas are private land. Other shades are other public lands.

This project is focused on ten counties in Oregon,[2] and four in Washington, and refers to this area as the Blue Mountain Region. In 2020, this region of 46,227 square miles had a total population of 296,094. The land area is larger than that of eighteen states.[3] Its population density of 11.03 people per square mile would rank 47th compared to the 50 states; only Montana, Wyoming and Alaska have a lower population density.[4] Its median household income is $49,853.50 – which would rank

[1] USDA-USFS-PNW, 2018.
[2] Oregon counties: Baker, Crook, Grant, Harney, Malheur, Morrow, Umatilla, Union, Wallowa and Wheeler. Washington counties: Asotin, Columbia, Garfield, and Walla Walla.
[3] Rhode Island, Delaware, Connecticut, Hawaii, New Jersey, Massachusetts, New Hampshire, Vermont, Maryland, West Virginia, South Carolina, Maine, Indiana, Kentucky, Tennessee, Virginia, Ohio, and Pennsylvania.
[4] The sub-region of Oregon counties alone has a population density of 6.39 people per square mile which would rank 48th – ahead of only Wyoming and Alaska.

48th of all states; exceeding that of Mississippi and West Virginia.[5]

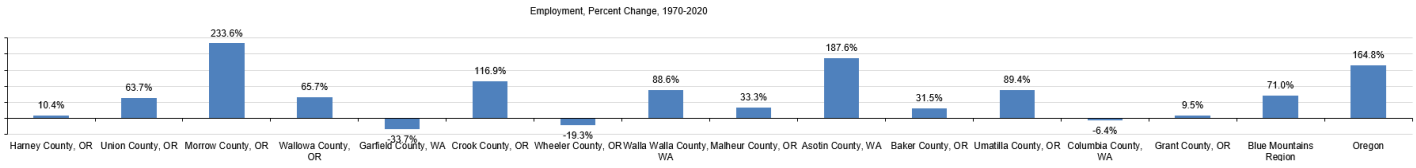
The region's socio-economic conditions and trends differ widely by county, and between communities within each county. Headwaters Economics Three Wests project characterizes six of the fourteen counties (Baker, Grant, Harney, Union, Wallowa and Wheeler – all in Oregon) as isolated rural counties without easy access to major population centers to support economic activity. These counties tend to have more volatile income levels, including higher seasonal fluctuations in employment, lower job earnings, and fewer high wage service sector jobs. New analysis generated for this report categorizes five of these isolated rural counties with above average exposure to changes in USFS management, e.g. they derive more community income from USFS lands than the regional average. The Three Wests characterizes five of the region's counties (Crook (OR), Garfield (WA), Malheur (OR), Morrow (OR), and Umatilla (OR) as connected counties; i.e. they have a rural setting but are well connected to major population centers via air, rail, river and/or interstates. These counties have relatively low-income volatility, tend to be gaining high wage service jobs and experiencing faster increases in job earnings. One of these counties (Crook) has above average exposure to USFS management. Three of the counties (Asotin, Columbia, and Walla Walla – all in Washington) are considered metro counties with more stable income, higher earnings per job, and more high wage service jobs. One of these (Columbia) has marginally above average exposure to USFS management.[6]

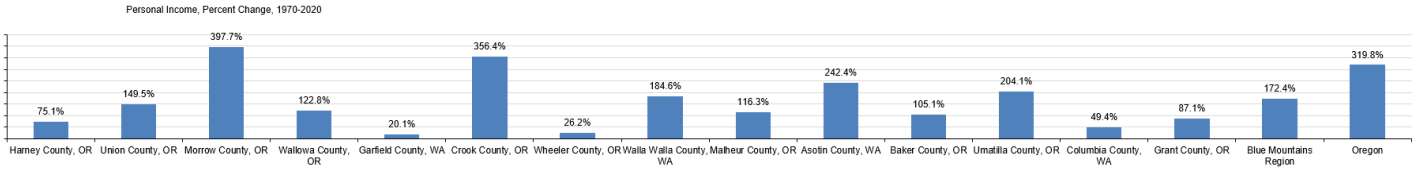
Economic growth in the Blue Mountain Region has been slower than in Oregon, Washington, and the U.S. overall. Over 1970-2020, these counties experienced radically different population trends. Morrow and Crook counties experienced the most rapid growth over the past 50 years at 162% and 149% respectively. The fourteen-county region as a whole had an average population growth of 49% - just under half that experienced for Oregon (102%). Five counties experienced growth rates between 35-73% - Umatilla (73%), Asotin (65%), Walla Walla (45%), Union (36%) and Malheur (33%). Wallowa (15%), Baker (8%) and Grant (1%) experienced modest change, while Wheeler (-25%), Garfield (-21%), and Columbia (-9%) experienced population declines. Similar differences between the counties were experienced with respect to employment change and personal income change as seen below.[7]

These differences are reflected in different ratings of resilience discussed in this report. Resilience is the capacity of a county (or community) to resist or recover from economic downturn. This analysis combined with USFS exposure analysis establishes a risk/opportunity index for each of the 14 counties in the Blue Mountain Region. Grant, Wallowa and Wheeler are likely to experience the greatest impact (positive or negative) from changes in USFS management due to high degrees of exposure, and lower relative resilience. Walla Walla, Malheur and Umatilla are likely to experience the least impact from changes in the management of the Blue Mountain national forests, due to lower exposure and higher relative resilience. All fourteen counties will realize unique risks and opportunities.[8]

The USFS impacts the regional and local economies through their staffing levels and locations, management plans and activities (e.g. timber sales, service contracts, grazing, etc.), and "county payments" including those in lieu of property tax and in relation to historic timber harvest levels. These payments support various county functions including road maintenance (supporting public access to the federal lands), law enforcement and public safety (including search and rescue), public school districts, and other services.

The national forests in the Blue Mountains have a long history of providing timber and other forest products to





[5] The median household income for the ten Oregon counties of $42,741 would rank last behind all fifty states.
[6] Headwaters Economics' EPS, 2015.
[7] Headwaters Economics' EPS, 2022.
[8] Maille, 2022.

address local community and national needs. Until recently, the wood products industry was a significant economic factor across much of the region. Increased environmental protection and changing mill technology contributed to significant declines in the wood products industry and associated businesses. Annual timber volume harvested from the national forests in the Blue Mountains, excluding fuelwood, declined dramatically from a high of over 700 million board feet in the late 1980's to less than 70 million board feet in recent years. Annual gross receipts (adjusted for inflation) generated by the three Blue Mountain National Forests declined from a high of $162 million in 1990 to an annual average of $3 million for the period 2009-2018.[1, 9, 10]

The loss of supply led to the closure of multiple sawmills across the region, and subsequent losses of forest contractors and equipment. For several counties in this region, the forest products sector was their largest private sector payroll provider. Across the region, unemployment rates trended at or near the state's highest level for years following the decline in harvests. As working families moved away, the impacts cascaded through the community – affecting small businesses, schools, health care services, and real estate values – as well as civic and youth-oriented organizations.[11, 12, 13]

These impacts were exacerbated by declines in USFS staffing and investment. Between 1992 and 2006, the three Blue Mountain National Forests lost between 55-60% of their staffing. Over the last 10-15 years, USFS jobs have remained relatively stable – and remain an important source of employment in some counties. This reduced capacity constrains the USFS ability to manage and maintain forest infrastructure, including roads, trails and campsites, and to plan and implement forest and watershed restoration projects. All three National Forests have fought to retain local capacity in key resource and planning positions.[14]

Over the past decade, the level of timber harvest off national forest system lands varied significantly in each county. Timber harvests off the Malheur National Forest in Grant County accounted for 32% of the total volume during that time ten-year time period for the region. No timber harvest volume was generated in Malheur County. Timber harvests from five other counties (Baker, Crook, Harney, Union and Wallowa) contributed an additional 56% of the total regional volume. The remaining 12% of volume was spread across the seven other counties.[15, 16]

In addition to timber harvest operations, many regional contractors secure work from the USFS for fire suppression equipment and crews, as well as service contract work – including road work, post-fire and habitat restoration projects, noxious weed management, trail and campsite work, and various biological and archeological surveys. Restoration work has increased over the last two decades with increased state and federal investments to reduce wildfire risks, and protect and restore critical habitat. In several counties, the value and jobs impact of service contracting exceeds that derived from timber harvest.

Over the period 2010-2021, the USFS awarded $116.6 million in service contract work across the region. Of this total, $62.9 million (54%) went to contractors based in the region, and $53.7 million (46%) went to contractors outside the region. Of the total secured by regional contractors, $40,143,899 was secured by local contractors – i.e. contractors based in the same county that the contract work was located.

Grant County was the source of the most USFS contract value in dollars by a significant margin. Grant County also had the highest rate of local capture – with its resident contractors securing 63% (or $29 million) of the contract value issued by the USFS in Grant County. USFS timber sales and service contracting in Grant County exceed that of any other county in the region by a large margin. USFS activities have helped sustain greater public and private sector investment and workforce capacity in Grant County's forest sector.

The combined dollar value for the seven other counties[17] that benefitted from local contract awards was just under $11 million – of these Union County was the top performer capturing $4 million in local contracts. Five counties[18] realized no local contractor awards – two of these also had no contracts issued. The concentration of contract awards in Grant County was driven by equipment-intensive work. Labor, material and technically intensive work had broader distributions across the region – as did contracts for suppression and pre-suppression work.[19]

Grazing has been a part of the landscape since the 1860s when the first miners and homesteaders entered the area. Although livestock grazing on National Forest

[9] Headwaters Economics, 2019a.
[10] Headwaters Economics, 2019b.
[11] Helvoigt et al, 2003.
[12] Christoffersen, 2011.
[13] Oregon Blue Book, 2021.
[14] USDA-USFS-PNW, 2007.
[15] ODF, 2019.
[16] WA-DNR, 2018.
[17] Baker, Crook, Harney, Morrow, Umatilla, Union, and Wallowa.
[18] Asotin, Columbia, Garfield, Malheur and Walla Walla.
[19] USDA-USFS-PNW, 2021.

System lands has decreased since 1990 due to changes in utilization standards and the resolution of resource conflicts, the ranching industry remains an important part of the local community, culture, and economy. Ranchers are permitted to graze livestock throughout the national forest during late spring, summer, and early fall. Grazing on public land is often an integral component of overall ranch operations. Fees collected from grazing contribute toward county receipts and are reinvested into range improvements.[1]

Livestock production occurs throughout the region. Malheur, Morrow and Harney counties have the largest head counts. Of these three, national forest lands are a particularly significant source of grazing forage for Harney county. The smallest head counts are found in Asotin, Columbia and Garfield counties.[20]

Residents and visitors alike seek out the national forests year-round for recreational opportunities. Activities range from backcountry hiking and staying in developed campgrounds, to hunting, fishing, wildlife watching, rock climbing, off-highway vehicle use, whitewater rafting, and horseback riding. Hunters travel the national forests in search of elk, deer, and antelope during the appropriate season in the late summer and fall and in doing so contribute to local economies. The national forests also provide winter sports opportunities such as snowmobiling, cross-country skiing, and downhill skiing. Natural resources can also generate wealth via tourism. When comparing the percentage of full and part-time jobs in tourism and travel (aka "Tourism sensitive" industries) in 2018, Harney and Baker counties generate the most local benefit from recreation, and Garfield and Morrow counties the least. Umatilla, Malheur, Crook, and Union counties had measurably more recreation jobs than the regional average.[1]

The last few years have also seen significant increases in recreation use – catalyzed by COVID restrictions on work and entertainment, and by the rising trend in remote work. This trend, along with the popularity of vacation rentals (like AirBnB), is impacting the housing market – driving up median prices, and contributing to a broad spread shortage in workforce housing.[21, 22]

Many people depend on the national forests directly or indirectly for a wide range of goods and services. Some commercial uses include wood for sawmills and fuel, forage for livestock, water for drinking and irrigating downstream crops, recreational opportunities for outfitters and guides, minerals, and energy. Other nontimber products include Christmas trees, firewood, poles, plants, herbs, traditional cultural plants, and mushrooms. Goods and services also include benefits to society as a whole through clean water and natural water storage.[1]

There is a strong interdependency between the Forest Service's need for forest management work and the degree to which local industries, infrastructure, employment (including youth), skilled workforce, and other factors provide for this need. Similarly, the larger social, economic and ecological resilience of this region depends on the condition, function and diverse benefit streams arising from the matrix of public, private and tribal lands. This matrix of forest lands provides a broad range of cultural, commercial, and non-commercial goods, services and associated values. Given the size and importance of the national forests in the region, changes in USFS management affect the challenges and opportunities accruing to adjacent landowners – which will generate feedback loops to the national forests. Recognizing this is important to sustaining and restoring the ecological integrity of the national forests and social and economic conditions of the communities.

[20] USDA NSS, 2021.
[21] Lehner, 2018.
[22] Runberg, 2022.

Poppies by Mt. Vernon. Photo courtesy of Grant County.

Risk/Opportunity Index Overview

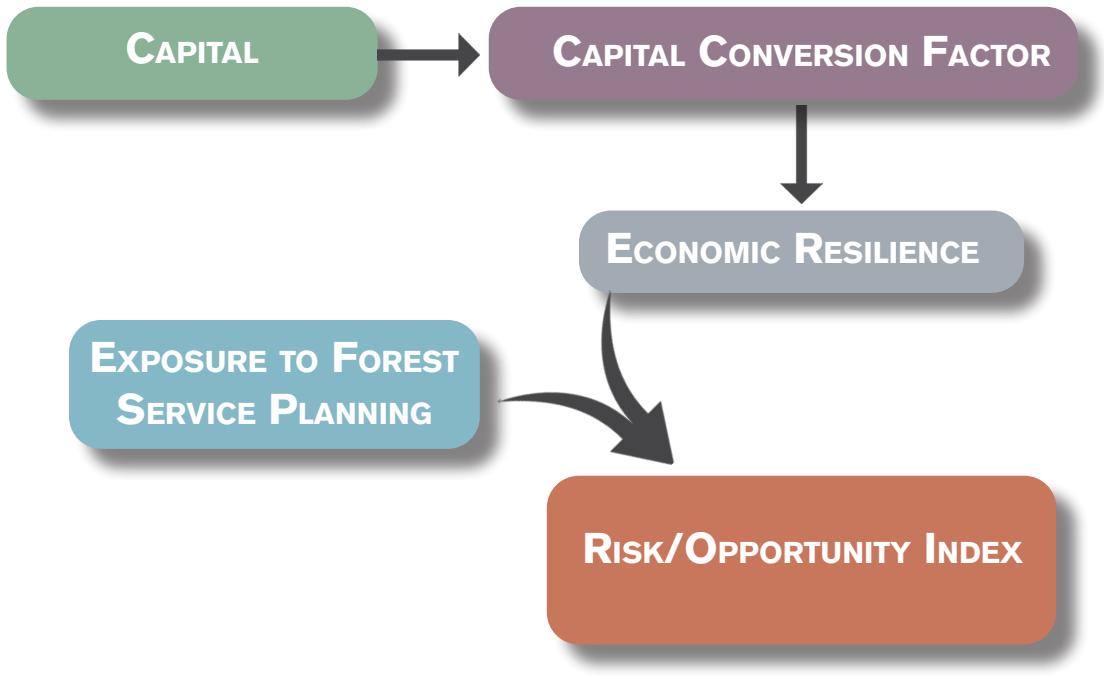
The Forest Service has recognized the need to account for the substantial differences between counties in the Blue Mountains Region when developing forest plans. The "Risk/Opportunity Index" (ROI) is part of our response to this need.

The Risk/Opportunity Index is a measure of a county's relative susceptibility to economic damage or benefit resulting from a shift in planning in the national forestland of the Blue Mountains.

As presented in Figure 1, the ROI has two parts. The first part is a measure of the location's economic "resilience". For the purposes of this report resilience is the ability of a county to withstand or recover from an outside disruption to its economy. We model resilience as a function of the natural, monetary, and human/social capital a county has, as well as the ability of the county to convert its capital into economic resilience.

The second part of the index, "exposure", estimates a county's economic ties to the national forests of the Blue Mountains. The idea here is that a location may be deemed "resilient" but have close ties to Forest Service lands or forest-based industries, and thus still be somewhat vulnerable economically to changes in forest planning. Alternatively, a location that is resilient but not closely tied to activities in the national forests may be less vulnerable to such shifts. See the attached Risk/Opportunity Index Final Report for a full listing and description of the components of resilience and exposure used in the ROI.

Figure 1: Schematic Overview of the Risk/Opportunity Index



Methodology

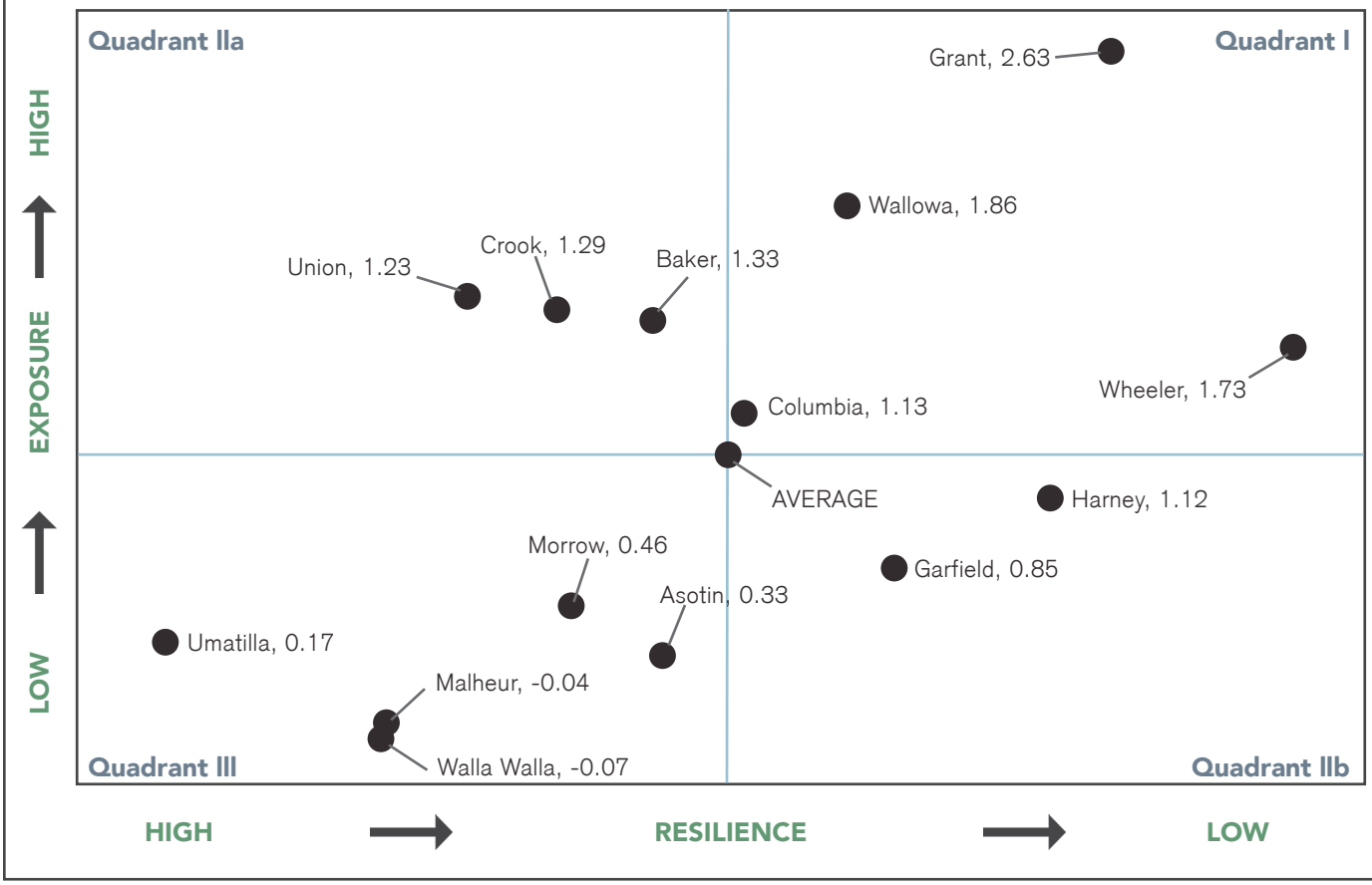
In assembling the ROI, we started with a review of the extensive literature surrounding indices of economic vulnerability. Based on this literature we constructed a beta version of the ROI and engaged county-level stakeholders, primarily county commissioners, in a review of the beta version of their county's ROI. The beta-testing phase included reviews in 4 representative counties. It provided input for refinement of the index, and the ensuing roll-out of a preliminary ROI report for each of the 14 counties of the study area.

The final stage of development for the ROI involved ground-truthing where stakeholders in each of the counties were invited to provide feedback on their respective preliminary ROI report. This resulted in 5 ground-truthing meetings held in 4 counties. Feedback from the ground-truthing sessions is included in the attached Risk/ Opportunity Index Appendix. Finalized versions of the county ROI reports are presented in the attached "County ROI Reports".

Overview of Results

Figure 2 is a graphical representation of the resulting ROI values for each county. We see that the index does indeed discriminate between counties on the basis of exposure to Forest Service management and economic resilience. Counties in the lower left-hand quadrant are high in resilience and low in exposure, thus, their ROI values range from -0.10 to 0.45. Opposite these counties, in the upper right-hand quadrant are three counties with low resilience and high exposure. These counties have ROI values of between 1.72 and 2.62. The intermediate ROI values span the upper left- and lower right right-hand quadrants. Given the four possible combinations of resilience and exposure, there are four general descriptions of the risks and opportunities facing counties depending on where the ROI places them.

Figure 2: County Risk/Opportunity Index



Overview of Results (cont.)

In addition, the information embodied in a given county's ROI allows us to highlight specific county-level risks and opportunities in some cases. The general and county-level risks and opportunities are presented in the attached "County ROI Reports".

Looking across the 14 counties of the study we have the following cross-county observations:

- There is indeed substantial variation between counties on the dimensions we considered—economic resilience and exposure to Forest Service activities.
- As measured by the ROI, there is a statistically significant negative relationship between county-level economic resilience and exposure to Forest Service activities. Additional inquiry indicates that this negative relationship is linked to Forest Service payments as a percentage of county budgets.
- Examining the evolution of incomes across the 14 counties of the study, we find that counties fall into two camps—those where earnings per job are tracking per capita income, and those where earnings per job (epj) are not tracking per capita income (pci). The counties where epj are not tracking income, uniformly receive the highest value for their Risk/Opportunity Index. They are also contiguous, representing a block of counties extending from Wallowa County southeast through Crook and Harney counties. We think this divergence of epj and pci in these counties signals what could be an economic transition during which the Forest Service may be able to exert significant positive economic influence.

These cross-county observations are described in detail in the attached Risk/Opportunity Index Appendix.

La Grande, Union County. Photo Courtesty of Wallowa Resources.

IMPLAN Overview

We utilized a software program called IMPLAN to provide insight into the potential economic impact of changes in forest management activities on four industries: Grazing, Recreation, Timber, and Stewardship Contracting. Results describing impacts at the county level can be found in the County-specific section of this report.

IMPLAN (impact analysis for planning) is the leading provider of economic impact data and analytical applications. The software serves the economic data needs of researchers, policy makers, decision makers, advocates, business leaders, governments, and more. IMPLAN was created by academics to serve the needs of the United States Forest Service in the 1970's, but has been transformed today to serve as a solution-provider for anyone interested in better understanding their economy.

Malhuer River North Fork. Photo courtesy of Grant County.

IMPLAN is a regional economic analysis software and data application that is designed to estimate the impact or ripple effect of a given economic activity or the contribution of some existing activity within a specific geographic area. The software utilizes an economic modeling technique called Input-Output analysis, which is a type of applied economic analysis that tracks the interdependence among various producing and consuming industries of an economy. It measures the relationship between a given set of demands for final goods and services and the inputs required to satisfy those demands.

IMPLAN has been a standard tool for academic and professional economists for decades. The methods used to produce IMPLAN's economic data set and economic impact estimates have been widely published both in professional publications as well as peer-reviewed academic journals. Many of these methods are considered standard best practices in a wide variety of applied economic fields today.

Revision included August 2023

The IMPLAN analysis utilized in this report did not include any Direct Impacts to the processing sectors and support activities sectors within the Blue Mountain counties. The only sector within IMPLAN analyzed for Direct Impacts was Sector 16 (Commercial Logging). We recognize that there are Direct Impacts to Sectors 132 (Sawmills), 134 (Veneer and Plywood Manufacturing), 136 (Reconstituted wood products manufacturing) and Sector 19 (Support Activities for Agriculture and Forestry) associated with management activities on the forests of the Blue Mountains. In this report, we did not have access to data tracking the downstream flows of goods and services, such as how much of any harvest within one county was also processed by a mill in that same county, or an adjacent county. If significant lumber volume generated on federal lands was processed by local mills, then the employment and sales numbers may be significantly higher than stated in this report. This gap in our analysis will be addressed in a future edition of the BIC Socioeconomic Report. This additional analysis is critical to the Forest Plan Revision process.

Brief Regional Reflection

Timber: The current state of Commercial Logging would need to be significantly altered based upon the current size of the activity on the National Forest (NF) land. Changing it only 10 or 20% is relatively minor, considering where the industry is at. There is economic benefit to Stewardship Contracting work, as it tends to draw additional work that is labor-intensive and paid well. Grant money is attracted for that work as well. The challenge is scalability and management in order to have meaningful economic impact consistently over time.

Grazing activity and access to NF land can be improved by both new permitted allotments and the use of unused allotments. Additional AUMs drive some economic activity, but each county relies to a different degree on NF land for their ranching activity.

Recreation based economies are on the rise and draws outside money as the export is recreation. The challenge is the low-wage work that accompanies this industry and the potential costs from over-use of the natural environment by non-local and local enthusiasts. Access to forest lands without disturbing the resources is also a potential challenge.

History of resource extraction and what is next? Resource-based manufacturing economies played a large role in the economic development of the region. It is apparent through this analysis that the earnings in recreation and tourism-based economies does not compete when comparing earnings per job and the access to living wage work. This analysis highlights the needs of strategic thinking in terms of rural economic growth and development that replace living wage incomes of the past. Does forest management have a role to play in the development of these jobs?

Potential for non-extractive economies. As stated above, the potential in non-resource extractive economies is there, but incomes in many of these industries (hotels, restaurants, etc.) is low. Recruiting businesses and manufacturing facilities that develop capital for recreation, agriculture and forest management could be a driver of economic activity that raises the standard of living.

Differential degree to which Forest Service management may impact economic development. It is important to note that some counties are more impacted by the management activity of the national forests than others. Many communities that have historical ties to commercial logging, for instance, have seen drastic changes in their economic viability since the 1970s. Consideration has to be made also that decreases in logging on NF land began before the 1990 period as well. Global competitive economic pressure, technological change in the capital-intensive logging industry and reliance of timber as a resource have all changed during this period of time, along with legislation. These factors have affected the commercial timber communities the most, with only spillover effects on communities not relying on timber. This lost timber revenue has been a severe economic challenge to overcome.

What does IMPLAN measure what does it not measure? IMPLAN measure economic activity measured by dollars flowing through the local economy driven by a change in economic activity. For economic activity to be measured, it must have a price. IMPLAN does not measure non-economic activity very well. For example, what is the economic value of hunting for elk? There is a dollar-based impact answer to that and a value-based answer. The economic value of elk hunting goes far beyond the dollars that have flowed into the community through non-local hunters travelling to the region and spending their money. There is also economic value in local residents hunting with their families that generates very little throughput economic value. This is an important consideration.

Maps Overview

Who Gets the Work

This section offers a series of ten maps that illustrate the differential impact of restoration contracting in each of the 14-counties included in this study. Map 1 defines the 14 counties in the Blue Mountain region. The next nine maps break down the restoration contract awards by county in various ways – including total awards, the awards by type of contract, and details about the number of contractors in each county securing this work, and how much work is otherwise secured by contractors based within or outside the region.

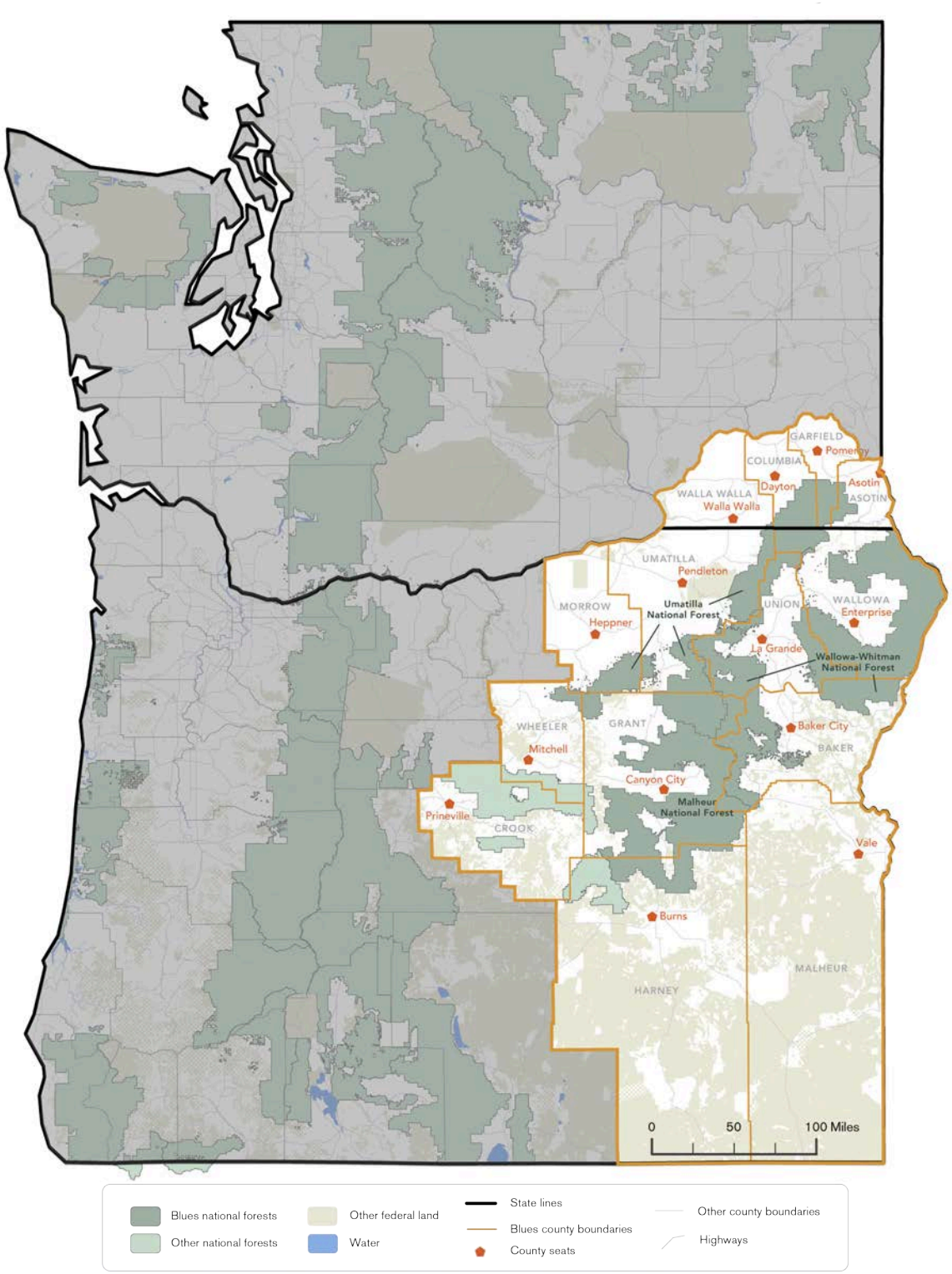
The maps help visualize the differential value of restoration contracting to each county – based on the number of contracts and the proportion of work captured by local contractors. This data also contributes to our understanding of local contractor capacity to undertake different types of restoration work, and of USFS contracting practices and policies that might influence local economic benefit.

The maps were created by the Ecosystem Workforce Program of the University of Oregon using 2010-2021 service contract data from the U.S Forest Service.

Wallowa County Fuels Reduction Contractor. Photo Courtesty of Wallowa Resources.

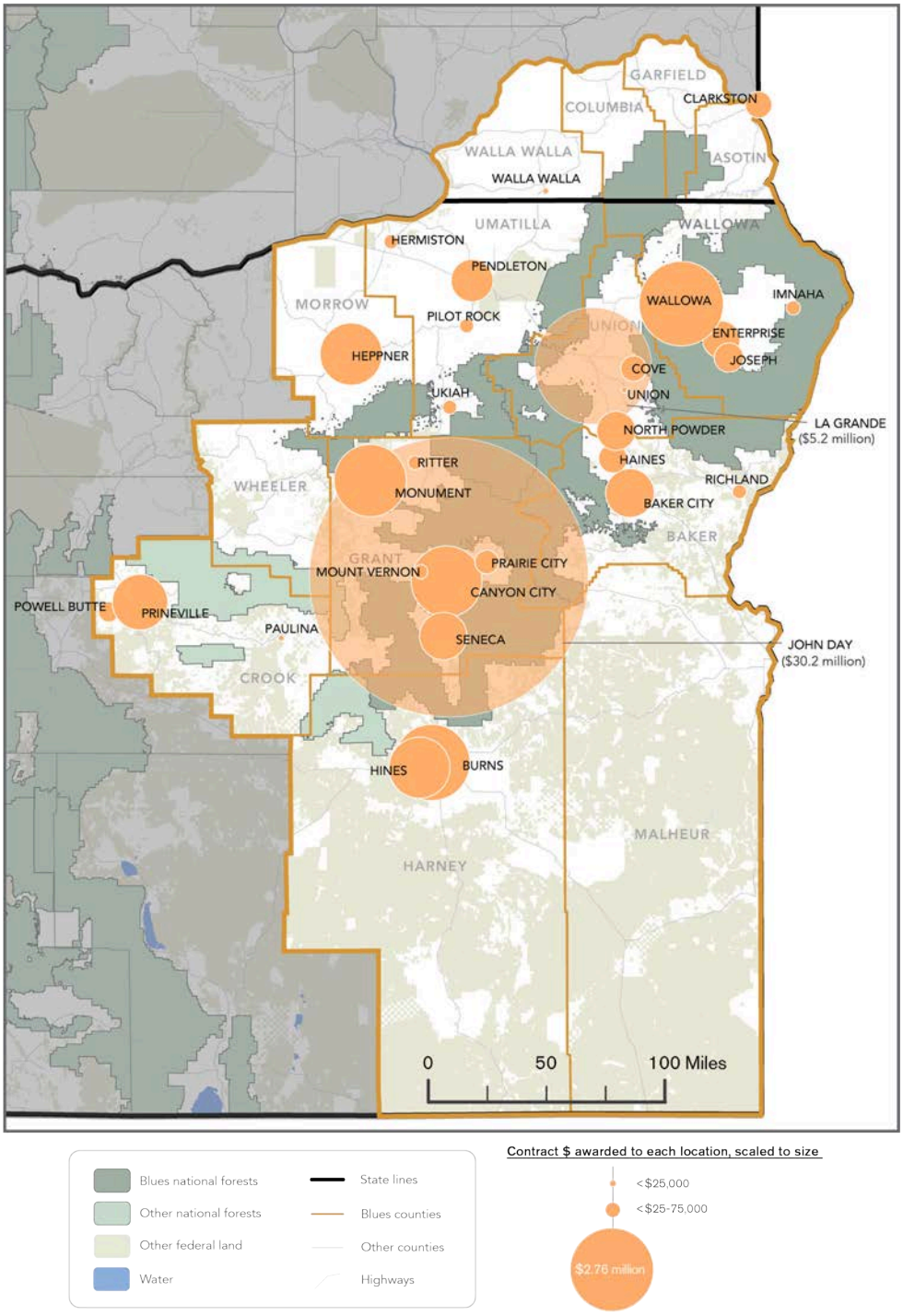
- Map 1 -

Blues national forests and counties in the context of Oregon and Washington states



- Map 2 -

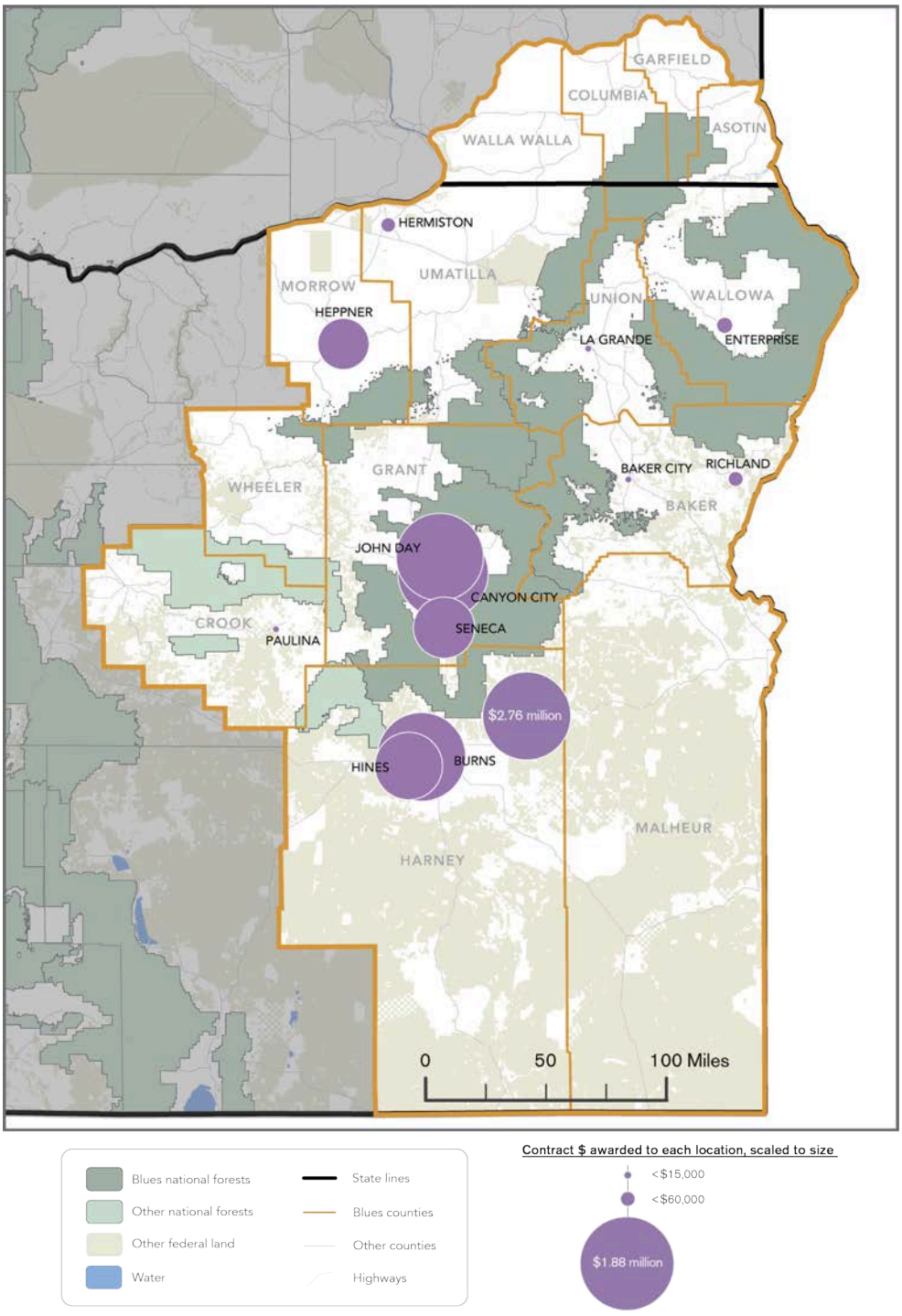
Restoration contract dollars from Blues national forests awarded to contractors in Blues counties, FY 2010-2021



This map displays what towns in the Blue Mountain counties have contractors who performed restoration service contracts within the Blue Mountain region from 2010-2021. The circles represent the scale of how many dollars were received, the largest circle being the town that received the most money, John Day at $30.2 million.

- Map 3 -

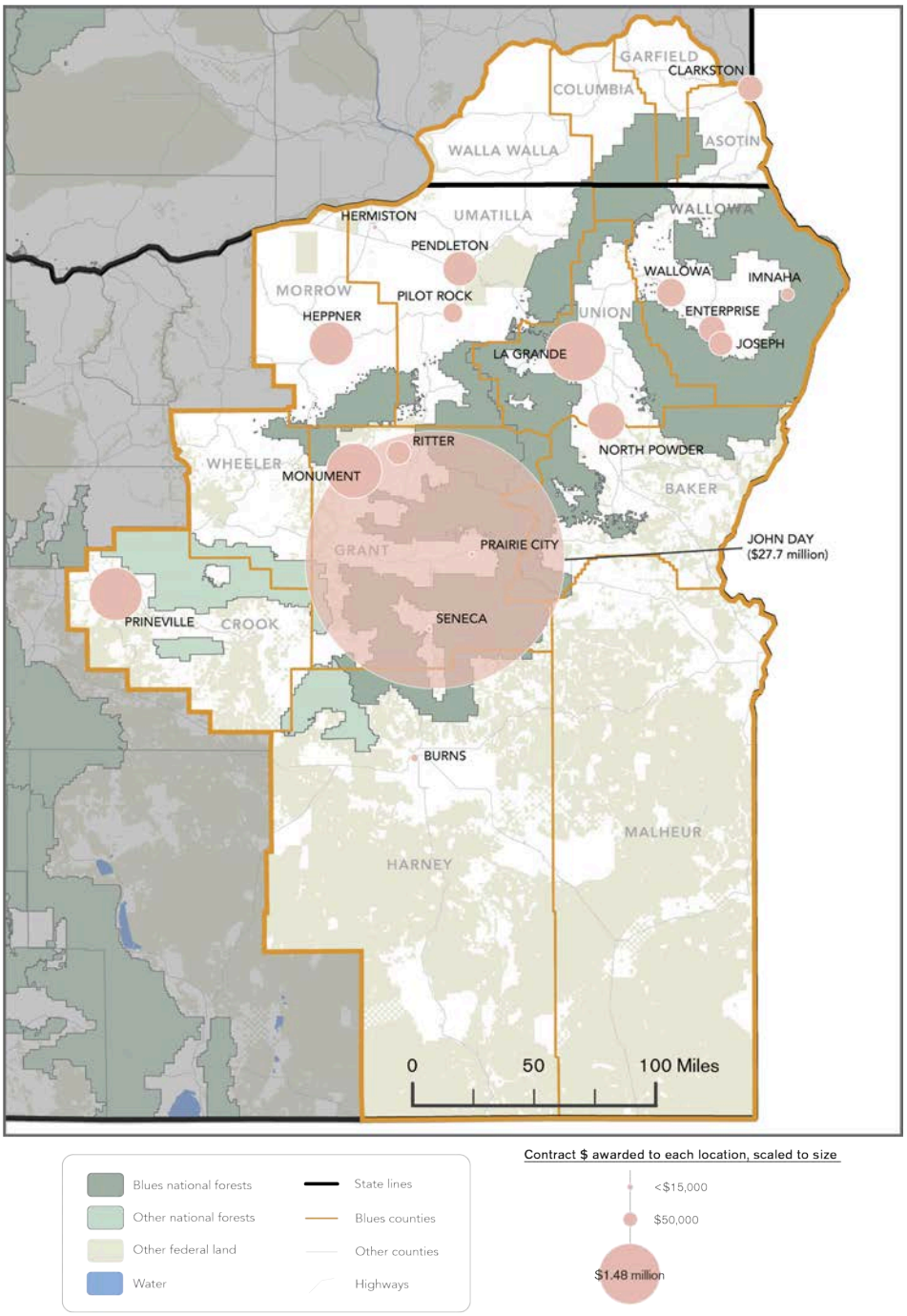
Restoration contract dollars from labor-intensive work on Blues national forests awarded to contractors in Blues counties, FY 2010–2021



This map shows the amount of dollars received from labor intensive service contracts performed in the Blue Mountain region by contractors within the region. The U.S. Forest Service defines labor intensive service contracts as those on the ground requiring extensive hand labor including but not limited to tree planting, tree thinning, tree pruning, cone collection, and other forestry related services.

- Map 4 -

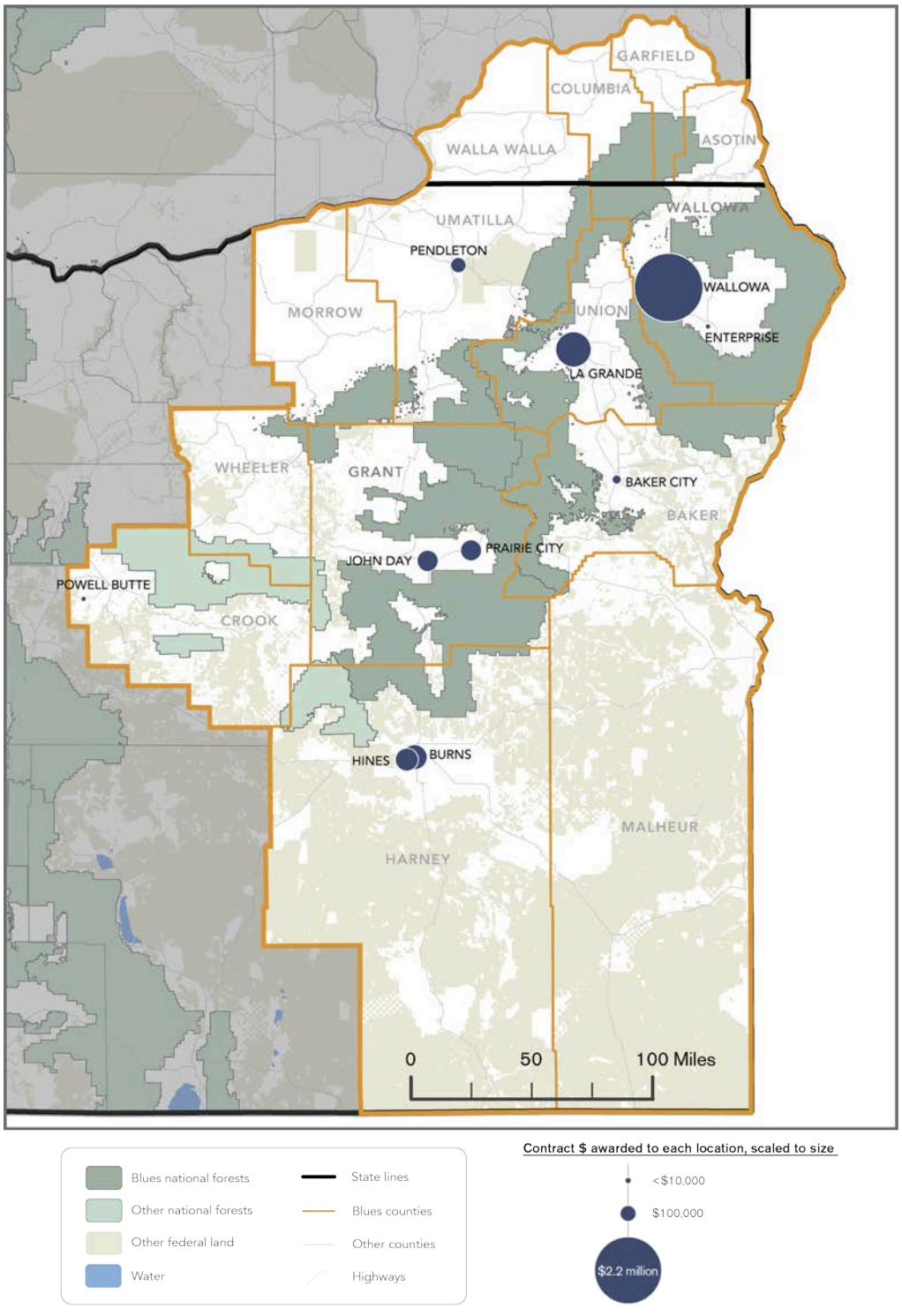
Restoration contract dollars from equipment-intensive work on Blues national forests awarded to contractors in Blues counties, FY 2010–2021



This map displays the amount of dollars received from equipment intensive service contracts performed in the Blue Mountain region by contractors within the region. This includes any tree thinning or forest services performed by machinery equipment.

- Map 5 -

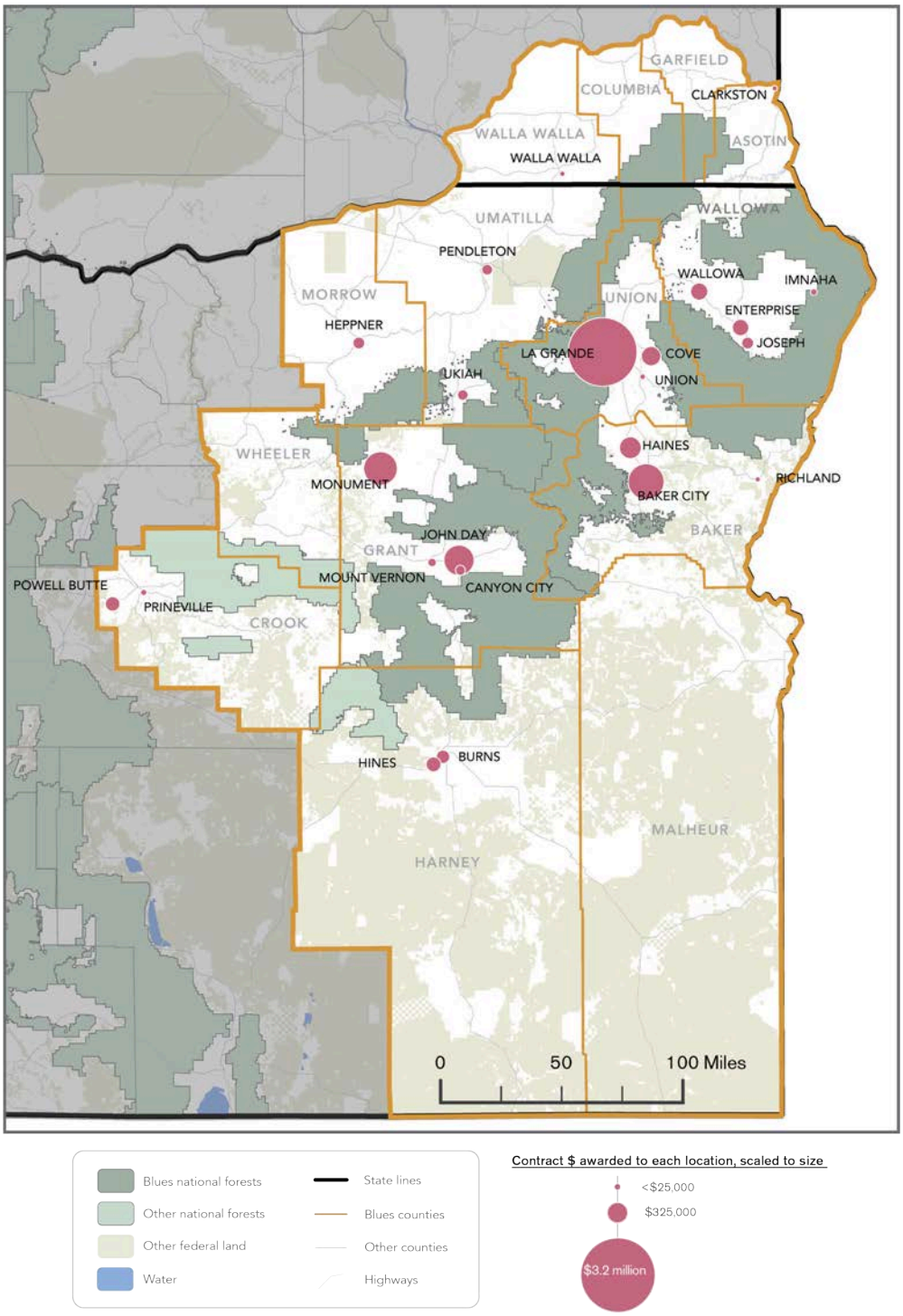
Restoration contract dollars from material-intensive work on Blues national forests awarded to contractors in Blues counties, FY 2010–2021



This map shows the amount of dollars received from material intensive service contracts performed in the Blue Mountain region by contractors within the region.

- Map 6 -

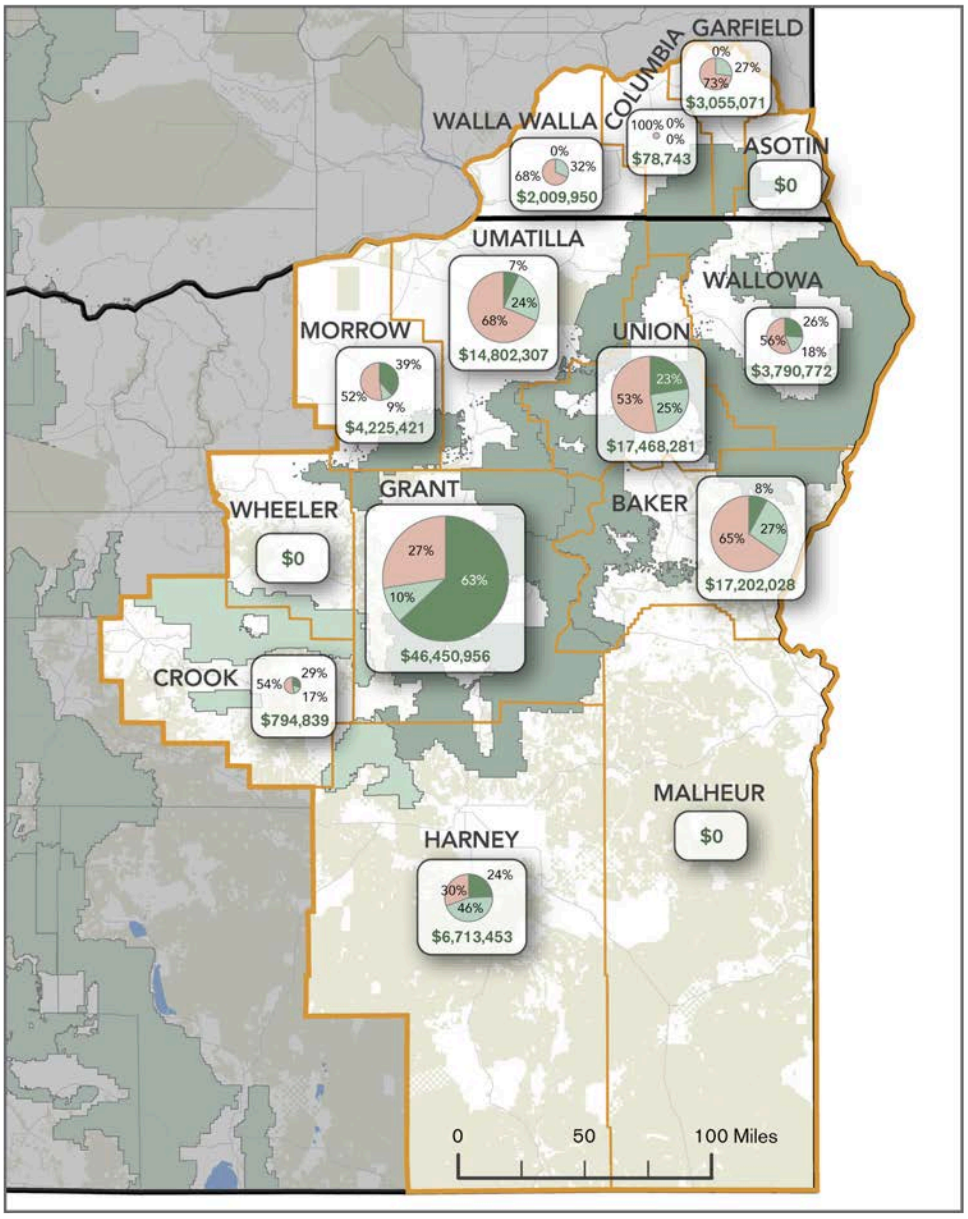
Restoration contract dollars from technically-intensive work on Blues national forests awarded to contractors in Blues counties, FY 2010–2021



This map displays the amount of dollars received from technically intensive service contracts performed in the Blue Mountain region by contractors within the region.

- Map 7 -

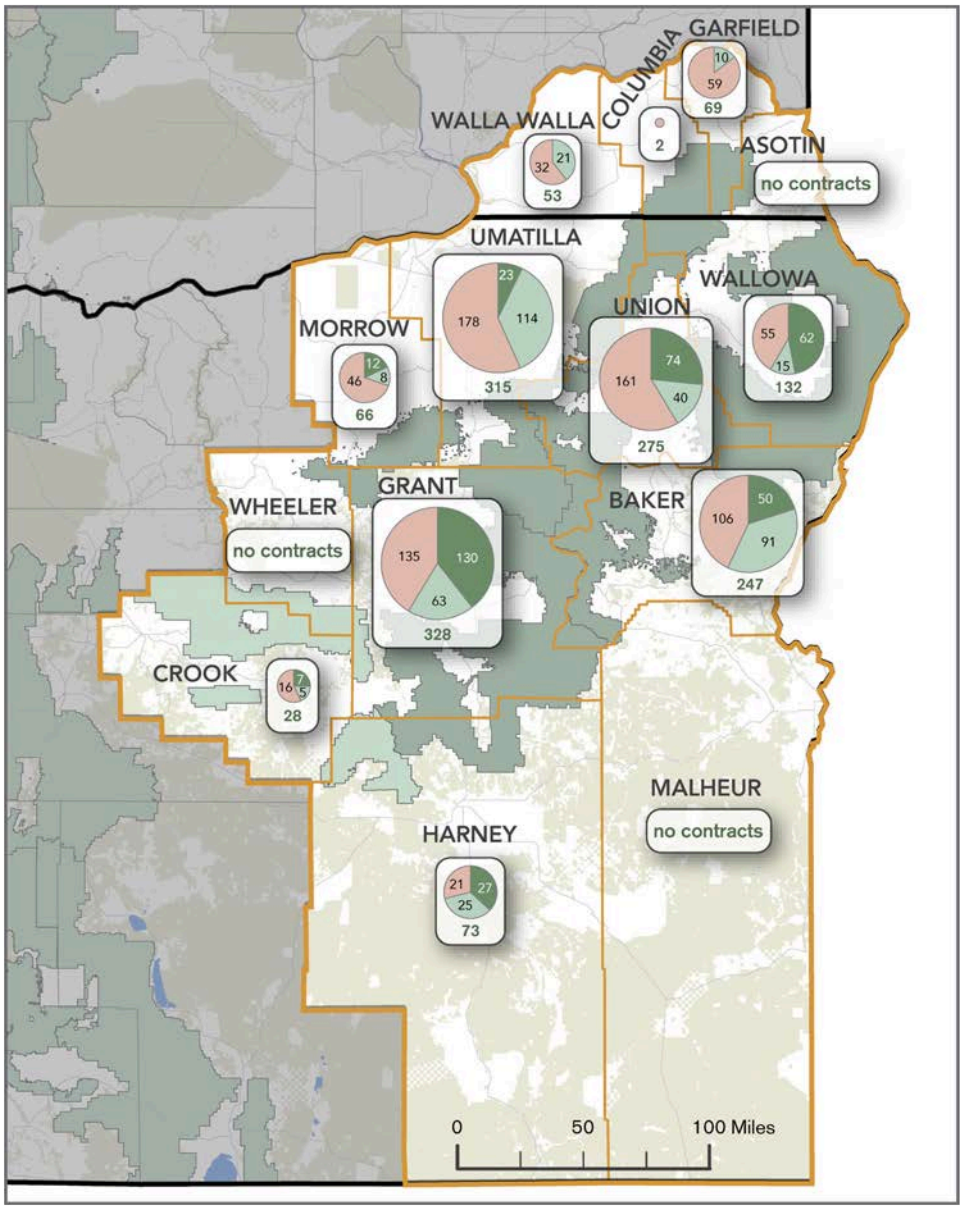
Dollar amount of contracts awarded for restoration work on Blues national forests in each county, and how much of that is awarded to contractors a) in the county, b) in other Blues counties, and c) outside of the Blues area



This map displays the distribution of the dollar amounts from restoration contracts performed in each county by where the contractors who performed the service is located, within the county it was performed in, within the Blue Mountain county region, or outside the region.

- Map 8 -

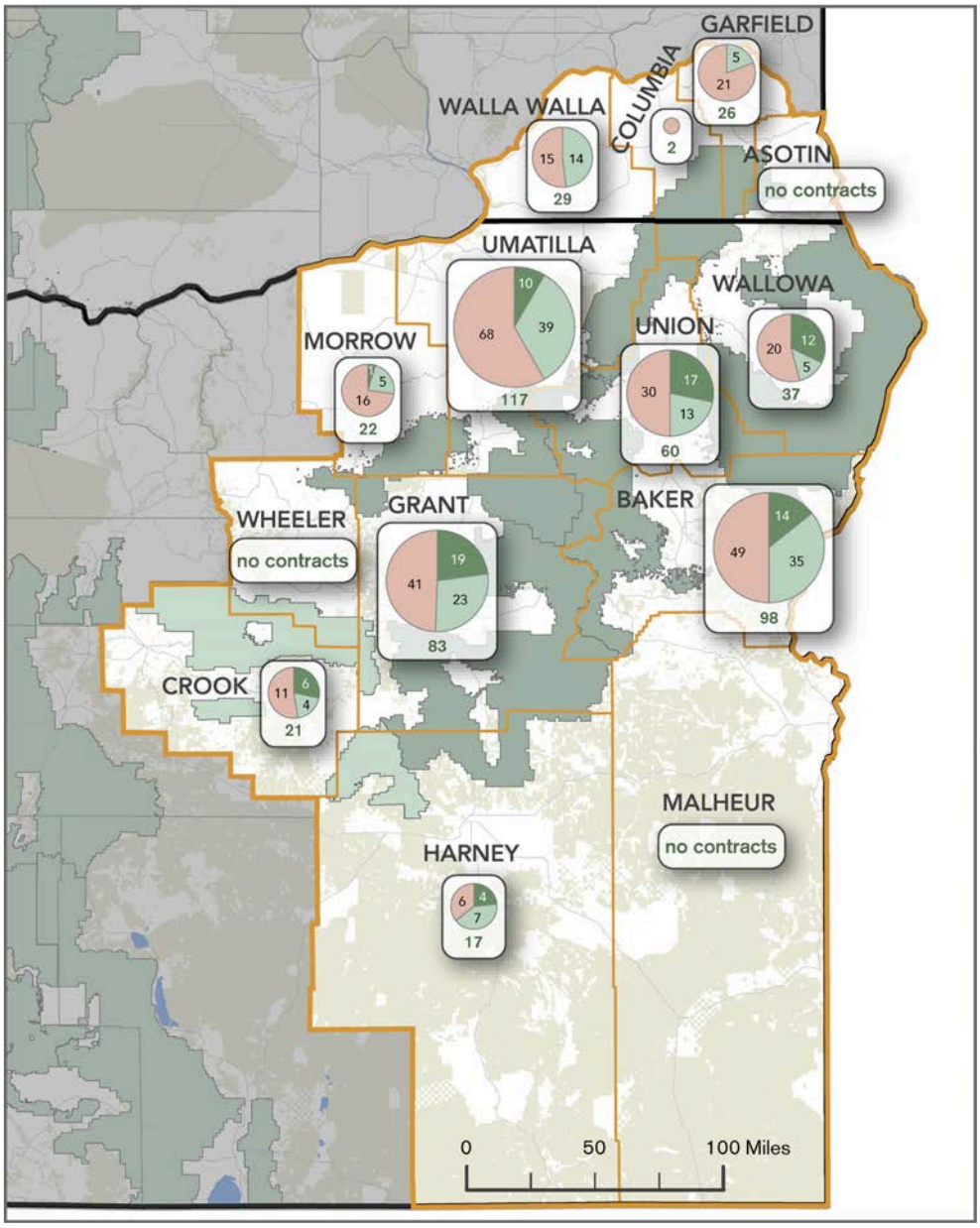
Number of contracts awarded for resoration work on Blues national forests in each county, and how many of those are awarded to contractors a) in the county, b) in other Blues counties, and c) outside of the Blues area



This map displays the distribution of the amount of restoration contracts performed in each county by where the contractors who performed the service is located, within the county it was performed in, within the Blue Mountain county region, or outside the region.

- Map 9 -

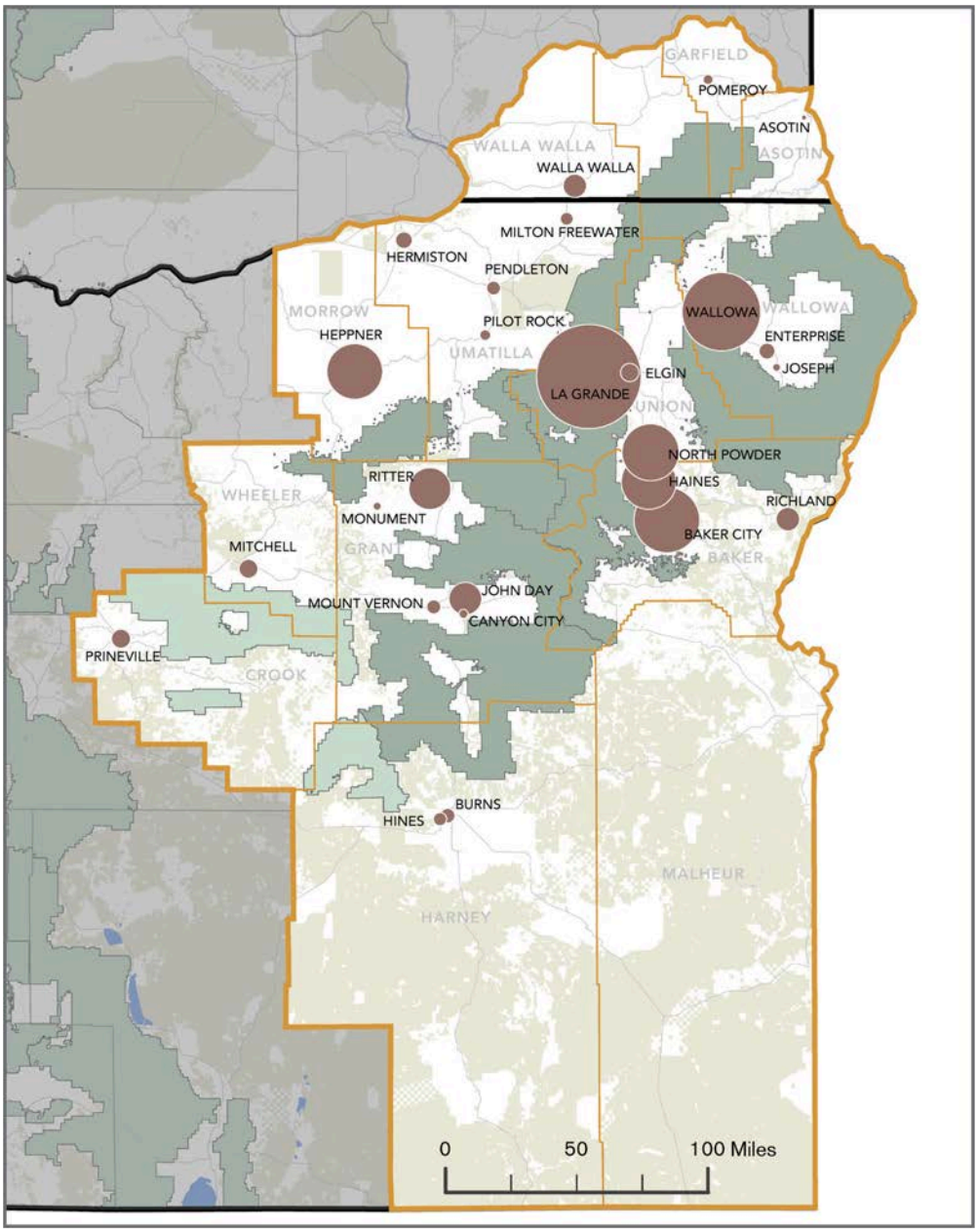
Number of contractors awarded restoration contracts for work on Blues national forests in each county, and how many of those are awarded to contractors a) in the county, b) in other Blues counties, and c) outside of the Blues area



This map displays the distribution of the amount of contractors used to perform restoration contracts in each county by where the contractor who performed the service is located, within the county it was performed in, within the Blue Mountain county region, or outside the region.

- Map 10 -

Dollars from F003 contracts (suppression and pre-suppression) on Blues national forests awarded to contractors in Blues counties, FY 2010–2021



This map displays the amount of dollars received from fire suppression and pre suppression activities service contracts performed in the Blue Mountain region by contractors within the region, based on the Product Service Code "F003 fire suppression/presuppression". The map does not represent all fire suppression contracts, only those that were included in the FPDS service contract database.

County Specific

The following pages contain information that is specific to the 14 counties that were included in this project. Each of these counties contains a portion of one or more of the three National Forests that make up the Blues Region and therefore have some potential for economic impact by forest management decisions on these forests. The purpose of these county-level reports is to differentiate those impacts within the region.

This section is organized with the 10 Oregon counties in alphabetical order followed by the four Washington counties in alphabetical order. For each county, there are approximately six pages that contain the following information: a general description of the county with forest-related demographics, the results of the Risk/Opportunity Index analysis, and the results of the IMPLAN scenario modeling.

Background information is provided on the next two pages to help readers better understand the county specific Risk/Opportunity Index and the IMPLAN scenario modeling that is found in this section.

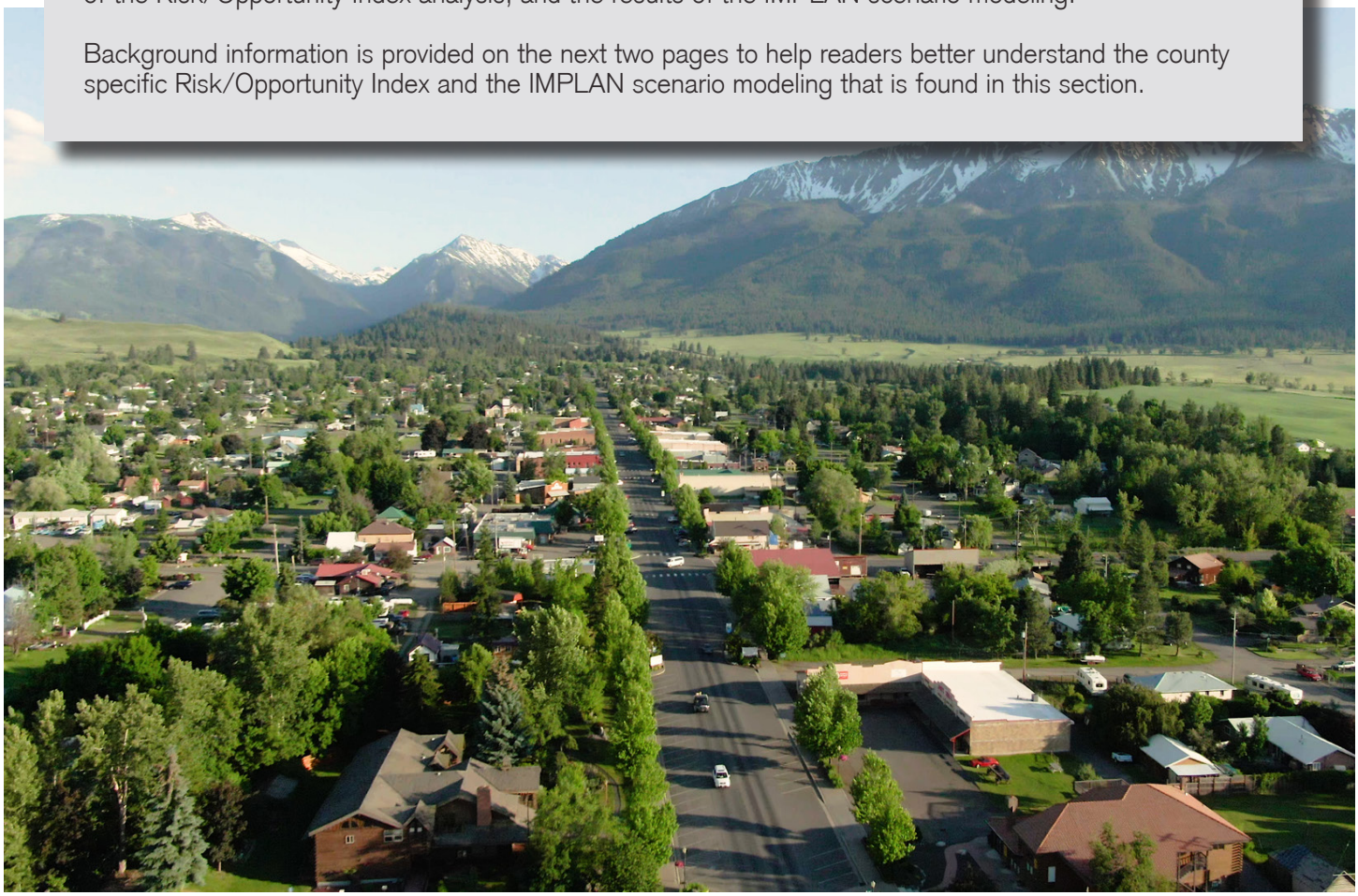


Photo Courtesty of Wallowa Resources.

Risk Opportunity Index Factors and Descriptions

Index Factor	Description
Capital	This is what a community has that can be put to use to build economic resilience. The ROI considers three types of capital; social/human, monetary, and natural.
Capital Conversion	What are the things that facilitate a community putting its capital to use building economic resilience? Oftentimes this is infrastructure, like roads and railroads that enable residents to connect to markets, and to exchange ideas/information. It can also be healthcare that enables residents to stay healthy and, therefore, more productive and competitive.
Resilience	Resilience is estimated based on Capital and Capital Conversion. It is a measure of how well a community can resist or recover from an economic downturn relative to other counties in the region. This depends on how much capital it has as well as how easily it can convert capital to economic wealth.
Exposure	Focusing on the Forest Service (FS), our "exposure" measure estimates how insulated a community is from changes to FS management. This depends partly on how much community income is related to FS lands and the extent of FS land ownership in the county.
Risk Opportunity Index (ROI)	The ROI combines county resilience and exposure to respond to the question "Is this community's economy susceptible to change related to Forest Service management?" A higher index indicates a county is more likely to experience significant impact, either positive or negative. A low index implies that the county is less likely than its neighbors to see significant impacts to its economy.

IMPLAN Scenario Modeling

Context for the four categories included in the analysis

GRAZING

According to Forest Service data, the multipliers differ for grazing by state. In the State of Oregon for beef and cattle ranching, every 1000 AUMs[1] generate 2.57 jobs and $160,422 of economic output after the multiplier effects. In the State of Washington, every 1000 AUMs generate 3.3 jobs and $177,000 of economic output. Therefore, if the plan increases available AUMs (either through new allotments or increased use of existing allotments), we can expect to see these numbers per 1000 AUMs. For sheep and goat ranching, these numbers increase significantly to 10.66 jobs and $194,000 of economic output per 1000 AUMs in Oregon and 19.41 jobs and $288,000 of economic output per 1000 AUMs in Washington.

RECREATION

Recreational industries and activities have increased precipitously over the past 25 years. Many resource-based economies have turned to attracting tourists and outdoor enthusiasts to bring economic activity to their respective regions. Access to the forests for hunting, berry and mushroom picking and hiking lead to health impacts that are not measured here directly. The IMPLAN analysis measures the dollars from direct spending primarily from those outside the region. The value of recreation for local residents should be taken into consideration as well, as these benefits are more difficult to monetize, but absolutely carry economic benefits to the region. The dollars per job is generally lower in tourism

[1] AUM stands for Animal Unit Month meaning the amount of forage needed for an "animal unit" grazing for one month.

industries, so the dollars required to generate significant economic activity is higher. That being said, the tourism and recreation industry has a sizable impact on some of the counties that contain National Forest land.

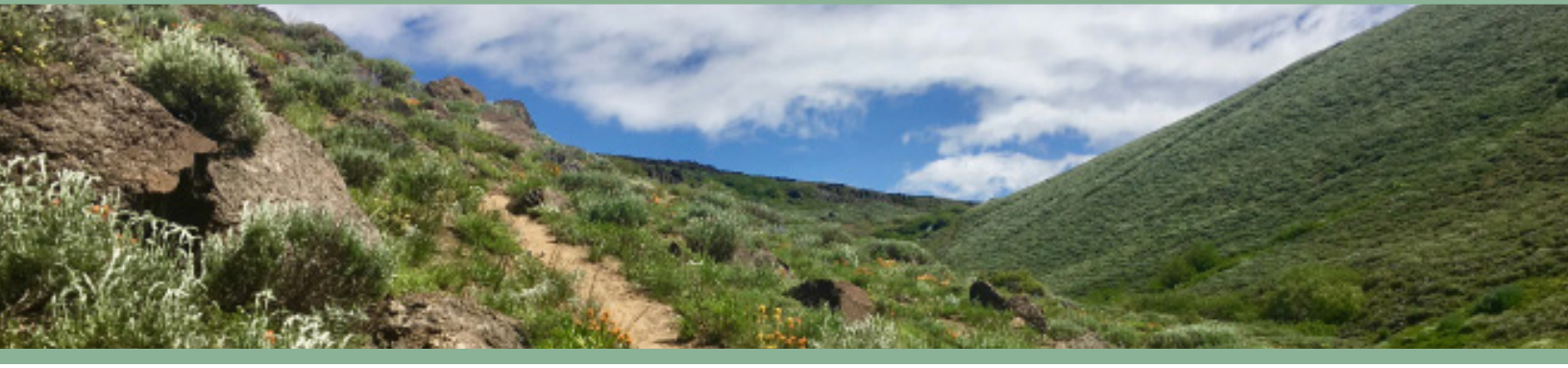
TIMBER

Timber refers to commercial logging operations.

STEWARDSHIP CONTRACTING

Stewardship contracting is a way to "achieve ecological restoration goals while simultaneously providing economic benefits to local communities" (Daniels, et.al, 2018). Stewardship contracting combines commercial sales of forest products with dollars for ecological restoration, including pre-commercial thinning, trail maintenance, and hazard fuels reduction. Using retained receipts, local counties and forests can achieve multiple objectives and have a greater economic impact due to the restoration work performed. If only commercial logging takes place without the stewardship contracting, the economic effect may be isolated to only a small number of sectors, whereas including the restoration work widens the economic impact across several industries including forest products, timber tract production, landscape and horticultural services and watershed restoration. A prior study estimated that equipment-intensive watershed restoration resulted in 15.7 jobs and an additional $2,380,000 for every $1 million of public investment (Nielsen-Pincus and Moseley, 2013). Using the framework from a case study in the Mt. Hood National Forest (Daniels, et. al. 2018), it was estimated that a $281,445 contract generated $73,464 of services and $207,981 of retained receipts. The retained receipts were then leveraged with grant money and in-kind donations from restoration partners to generate an additional $319,888 of economic activity.

Photo courtesy of Jessica Tomasini



BAKER COUNTY, OREGON

BLUES COUNTY PROFILES

Baker County was created in 1862 from part of Wasco County. The boundaries for the county were finalized in 1901 after portions were removed to form Union and Malheur County. Baker County was named after one of Oregon's first Senators and Colonel in the Union Army, Edward Baker, who died in the Battle of Balls Bluff in 1861. The area rose in popularity with settlers due to gold mining operations, and at one point Baker County was the largest producer of gold in the Northwest. After the gold rush, the county's primary industries have been agriculture, timber, and recreation. Baker County's highest point is the peak of Red Mountain at 9,560 feet, and about a third of the land is covered in forest.

Baker County quick facts

Date established: September 22, 1862

County seat: Baker City, population 10,010 (2020)

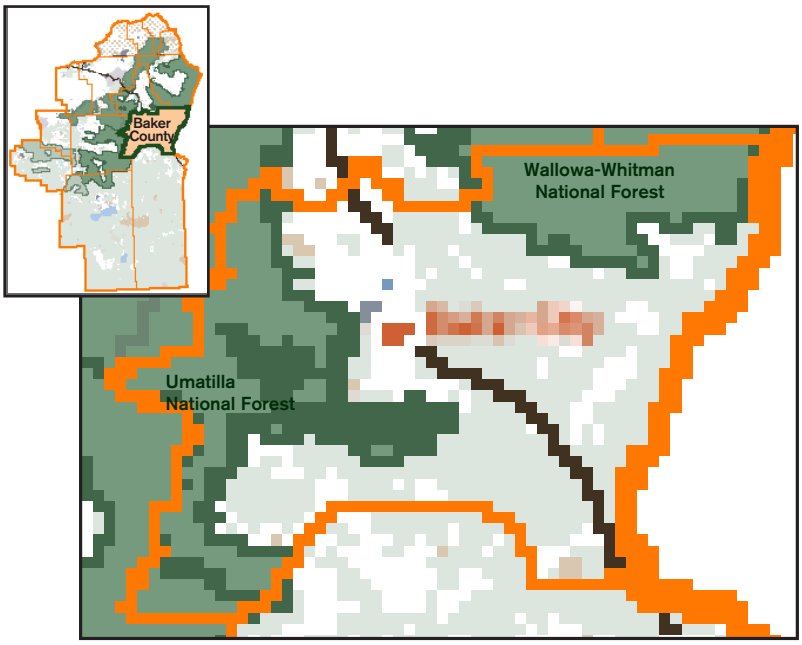
Size: 3,089 square miles

2020 population: 16,910 people

Economy: Agriculture, forest products, manufacturing, recreation

Public land coverage: 50% of county

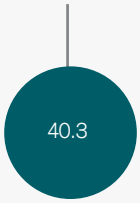
Forest Service land: 647,288 acres, 23% of county



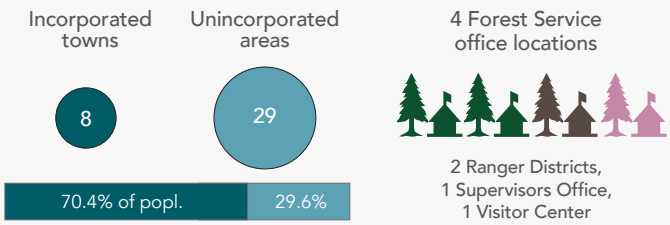
Population & acres of national forest

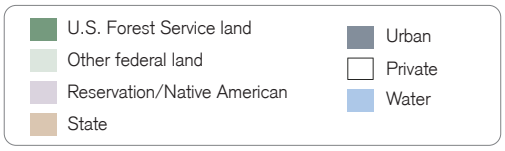
(each person= 5,000 people
each tree= 10,000 acres)

Acres of national forest per county resident

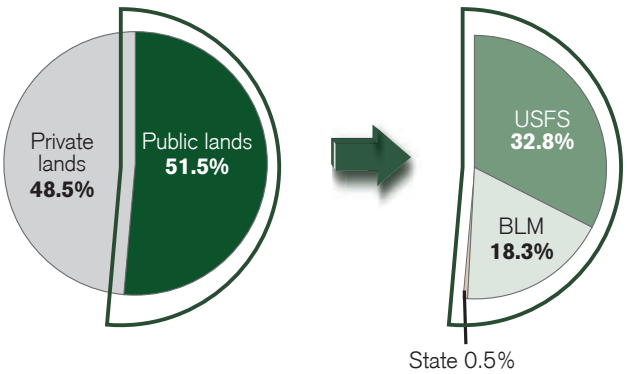


Population centers and Forest Service offices



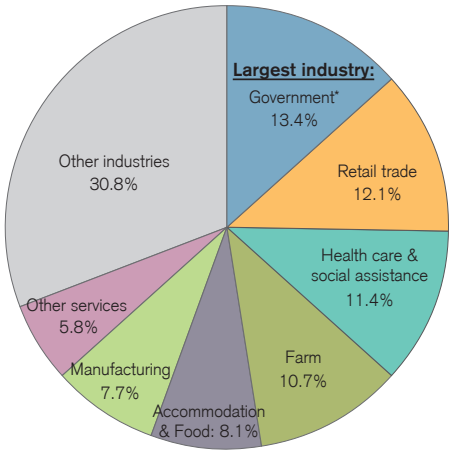


Land ownership



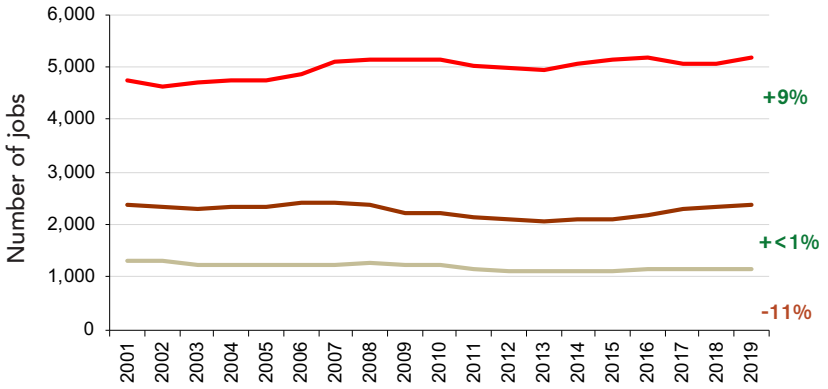
KEY INDUSTRIES:

7 largest industries by number of jobs (2019):



8,779 jobs (2019)

Employment by major industry category and % change, 2001-2019



Services Related — Non-Services Related — Government

Service-related includes: Industries such as retail trade, finance, health care & social assistance, accommodation & food, and education services

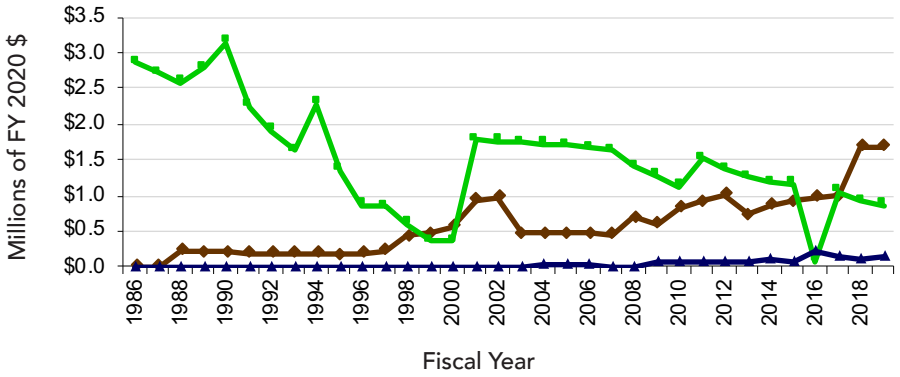
Non-Service Related includes: Industries such as farming, mining, and manufacturing

Government includes: Federal, military, state, and local government employment; government enterprise*

**Government may not include all public employment; some industries that may have public employees (e.g. health care, education services) are classified as service-related industries.*

FEDERAL LAND PAYMENTS:

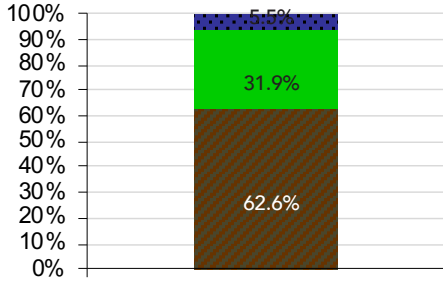
Components of federal land payments per FY, 1986–2019



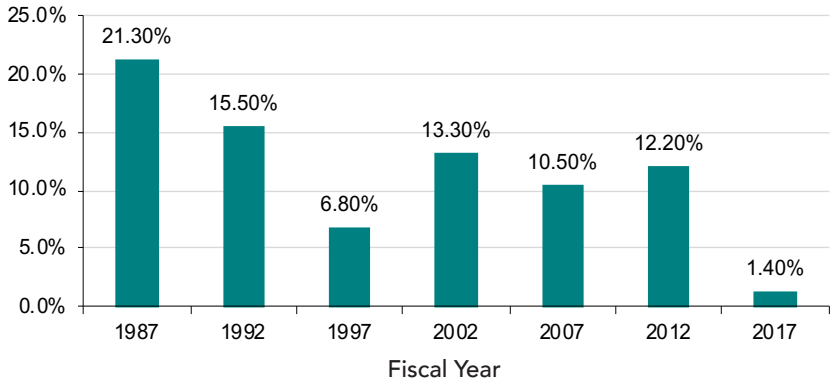
Legend: Payment components

- Forest Service revenue sharing
- PILT (Payments in Lieu of Taxes)
- Bureau of Land Mangement revenue sharing

Components of federal land payments, FY 2019



Federal land payments as % of total general government revenue during select years



Risk/Opportunity Index (ROI) Summary for Baker County[1]

Description	County Measure (average of counties)
Baker County's capital index of 0.96 is above the average of the 14 counties in the study region. In Baker County, all types of capital work to increase the county's potential resilience above average, however, a strong endowment in natural resources, and specifically in irrigation water and scenic amenities are the primary drivers.	**Capital** **0.96** (0.94)
Compared with other counties, Baker County has a higher than average "conversion factor" of 0.62, or rather, its residents face slightly lower barriers to converting the capital that the county has available into resilience. More specifically, Baker County is lacking access to an airport, broadband Internet, and a metro area, with the remaining determinants, e.g., an Interstate highway, and hospital, working in the county's favor. This may allow residents to convert the potential wealth of the county to actual wealth and well-being a bit more easily than the average of all counties.	**Conversion Factor** **0.62** (0.57)
The capital index conditioned on the conversion factor, results in a relative resilience index for Baker County of 1.04, or about four percent greater than the average across the 14 counties of the study area[2]. This is consistent with Baker County's above average capital index and conversion factor, and it implies that the county would resist a bit more, and recover a bit more quickly from, an economic shock.	**Economic Resilience** **1.04** (1.00)
With an exposure index of 1.37, the Baker County economy is more exposed to Forest Service planning decisions than the average county in the study area. While the individual measures of exposure are all above average, among the study counties Baker county draws the third most labor income as a percentage of total labor income from forest related industries.	**Exposure** **1.37** (1.00)
The ROI for Baker County is 1.33. This places Baker County among the counties with an intermediate score, and implies that the economy of the County is more susceptible to economic impacts related to changes in Forest Service planning than the average county in the study area.	**R/O Index** **1.33** (1.00)

[1] See attached "Risk/Opportunity Index Appendix" for a full breakdown of these measures and explanation of how they were calculated.
[2] Because we want to differentiate between counties, we divide the raw measure for economic resilience and exposure by the average of the 14 counties. This also results in a final county ROI that is relative to the 14 counties.

Scatter Plot: Risk Opportunity Index for Baker County

The scatter plot above maps out Baker County's exposure, resilience and resulting ROI in the context of the remaining counties of the study area. In general, counties in quadrant II have an intermediate ROI of between 0.80 and 1.40. This indicates that, relative to the remaining counties, their economies are moderately susceptible to Forest Service planning decisions. In addition, the ROI places Baker County in quadrant IIa indicating that the county's high exposure to Forest Service activity, rather than exceptionally low resilience, is the reason for this intermediate ROI value.

Given this relative position, in general terms, risk to the Baker County economy involves shifts in Forest Service activities that could reduce benefits to the economy. The opportunity that Baker County's position represents relates to refining Forest Service activities with an eye towards building additional economic resilience.

To the extent that the ROI is a descriptive rather than prescriptive tool, additional insights are limited and need to be considered with care. With this caution in mind, we offer the following:

- Earnings per job across the counties of the study area tend to lag state-wide averages. In this already depressed environment, Baker County has the third lowest estimated earnings per job. To the extent that Forest Service planning can shift resources towards activities that would boost this measure, the potential for a positive impact on County resilience would be increased.
- Baker County's ROI points toward the importance of water for irrigation. Unfortunately, many climate forecasts predict an extended period of lower-than-average rainfall. Forest Service management is one of many tools that can be engaged to compensate for, and mitigate against, potential degradation of this key resource. Modelling from the PNW lab in Wenatchee and regional universities suggest the potential for improved capture, storage and late summer release of precipitation from well-designed restoration treatments.

Baker County Analysis

Grazing

In Baker County, beef and cattle ranching accounts for $45.4 million of annual output, with 344.39 jobs and average wages of $36,588 per year.

Current Industry Snapshot (includes feedlots and dual-purpose ranching and farming):

2021 Industry Output Baker County	**Employment**	**Average Employee Compensation**	**Economic Output**
	344.39	**$36,588/yr**	**$45.4 million**

Economic Benefit of Additional Grazing

Additional 1000 AUMs (either new or currently not in use and placed in use)	**Jobs**	**Economic Output**
	2.57	$160,422

2017 Forest Service Data Adjusted for Inflation

Recreation

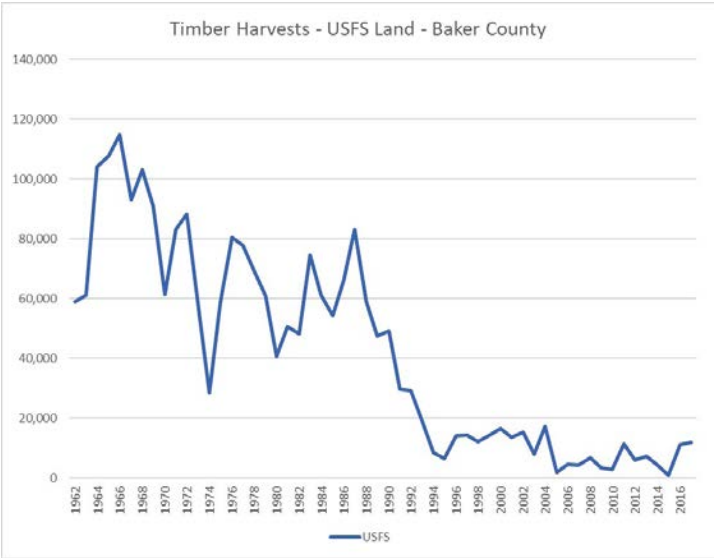
The following analysis measures the impact to Baker County from lodging, restaurants, grocery purchases and fuel primarily, with some assessment of general tourism spending. This data estimates the effect of a 10% increase in visitation and spending (regardless of use).

Baker County Tourism Impact from 10% Growth in Tourism on FS Land

Employment	**Output**
6.02	**$493,206**

Timber

Baker County has a rich history in commercial timber production. In line with the rest of the region, timber has seen a precipitous drop in production and output since 1990 due to environmental legislation, global competition and capital and technological enhancements within the industry.



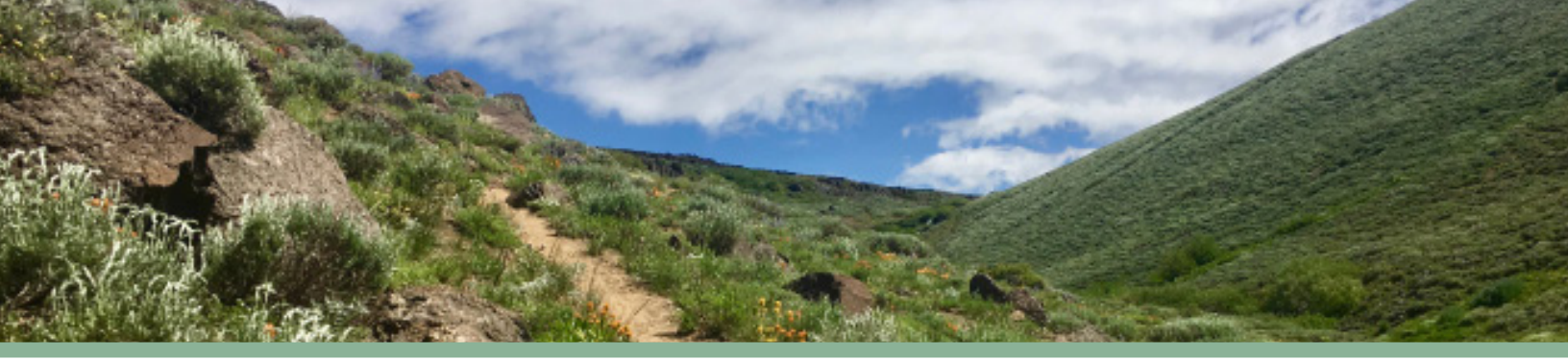
Timber (cont.)

The following data looks at the current industry snapshot, the 1990 estimate if it were duplicated today, and both 10% and 20% changes to the current level of output in the Forest Service managed lands. These results were successfully checked with the TREAT model that the Forest Service economists use for verification (Sorenson, et.al 2015):

Baker County			Employment	Output
Current Commercial Logging			18.97	$1.24 million
Share in National Forest Land	47.7%			$591,480
		1990 FS Direct Output	Employment	Output
Total Economic Impact of 1990 Output Levels (est. 8x current production/ output)		$2.3 million	63.65	$3.9 million
10% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	0.90	$25,794.45	$29,250.12	$59,431.00
2 - Indirect	0.19	$5,290.00	$6,144.40	$9,885.39
3 - Induced	0.13	$4,026.05	$7,874.53	$15,147.98
	1.21	**$35,110.73**	**$43,269.05**	**$84,464.39**
20% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	1.80	$51,742.85	$60,518.47	$121,950.00
2 - Indirect	0.37	$10,612.04	$22,051.53	$33,918.32
3 - Induced	0.26	$8,076.69	$22,508.38	$41,124.86
	2.43	**$70,433.57**	**$86,797.43**	**$169,434.98**

Stewardship Contracting in Baker County

In Baker County, there have been $17,202,028 of contracts since 2010, covering 247 projects for an average of $69,643 per contract. According to the Mt. Hood study these contracts should generate economic activity, primarily affecting commercial thinning and trucking directly, but each contract should generate service work as well. The retained receipts could be used for restoration work in the forest. The additional restoration and service work has a higher multiplier and would result in additional economic activity. If the economic benefits were similar, each $63,000 contract should result in potentially over $500,000 in output and 6 jobs (Daniels, Neilsen-Pincus, Paruszkiewicz, & Poage, 2018).



CROOK COUNTY, OREGON

BLUES COUNTY PROFILES

Crook County is located in the geographic center of Oregon. The county has just one incorporated population center (Prineville) with several other significant unincorporated communities (Powell Butte, Post, and Paulina). Half of the county is public land, which is primarily federally-owned between the BLM and the Forest Service. The county is a prime destination for thousands of annual visitors that come to hunt, fish, boat, sightsee, and go rockhounding in and around the county's streams, reservoirs, and Ochoco Mountains.

Crook County quick facts

Date established: October 24, 1882

County seat: Prineville, population 10,355 (2020)

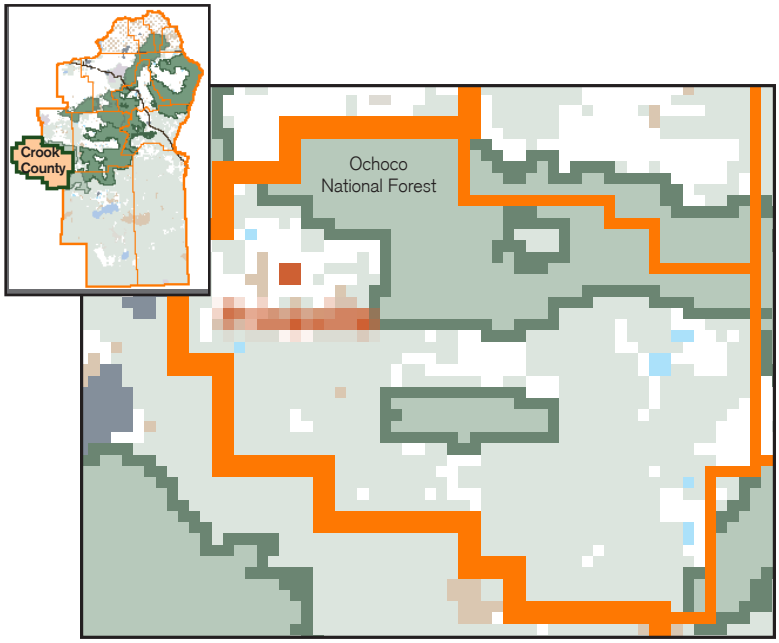
Size: 2,991 square miles

2020 population: 23,440 people

Economy: Forest products, agriculture, livestock raising, recreation/tourism services, manufacturing, wholesale trade

Public land coverage: 50% of county

Forest Service land: 434,238 acres, 23% of county



Population & acres of national forest

(each person= 5,000 people
each tree= 10,000 acres)

23,440 people

434,238 acres

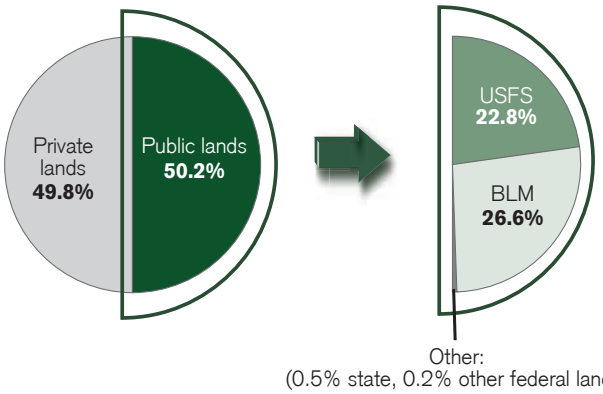
Acres of national forest per county resident

18.8

Population centers and Forest Service offices

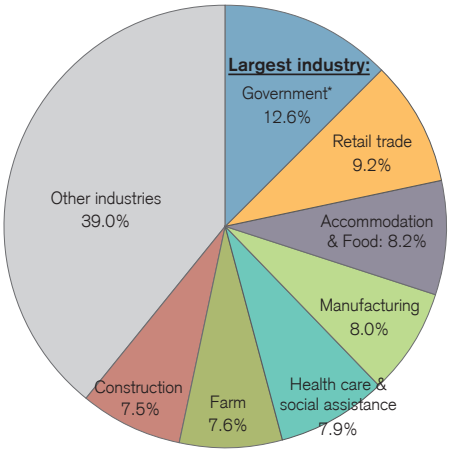
Incorporated towns	Unincorporated areas	4 Forest Service office locations
1	8	2 Ranger Districts, 1 Supervisors Office, 1 Research Station Office
56.7% of popl.	43.6% of popl.	

Land ownership



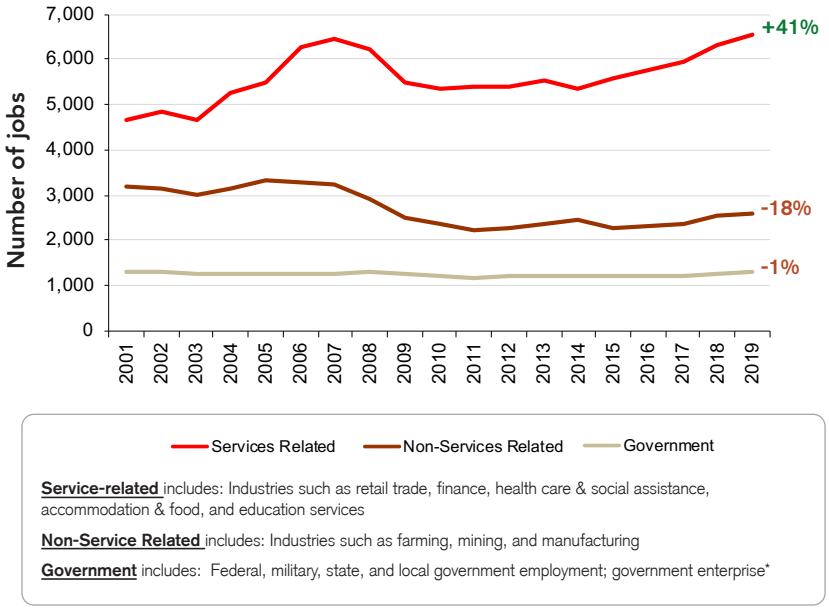
KEY INDUSTRIES:

7 largest industries by number of jobs (2019):



10,257 jobs (2019)

Employment by major industry category and % change, 2001–2019



Service-related includes: Industries such as retail trade, finance, health care & social assistance, accommodation & food, and education services

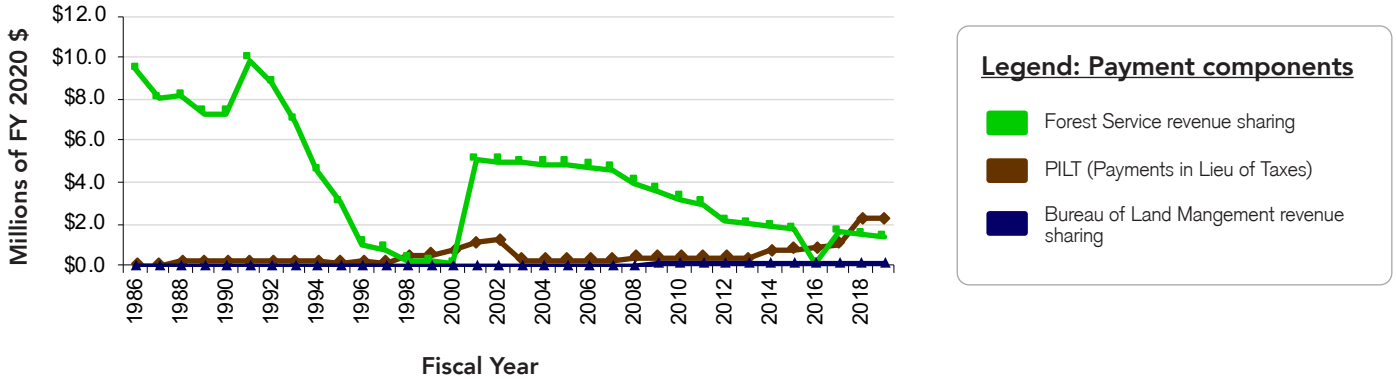
Non-Service Related includes: Industries such as farming, mining, and manufacturing

Government includes: Federal, military, state, and local government employment; government enterprise*

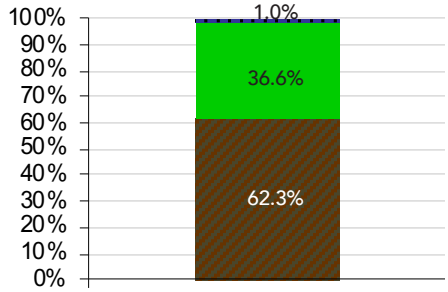
**Government may not include all public employment; some industries that may have public employees (e.g. health care, education services) are classified as service-related industries.*

FEDERAL LAND PAYMENTS:

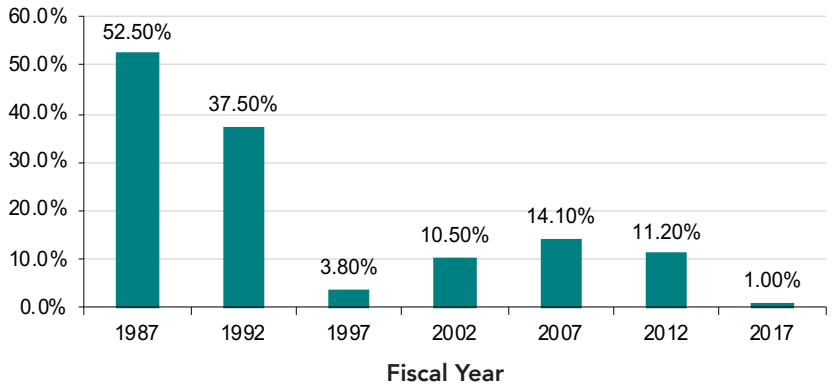
Components of federal land payments per FY, 1986–2019



Components of federal land payments, FY 2019



Federal land payments as % of total general government revenue during select years

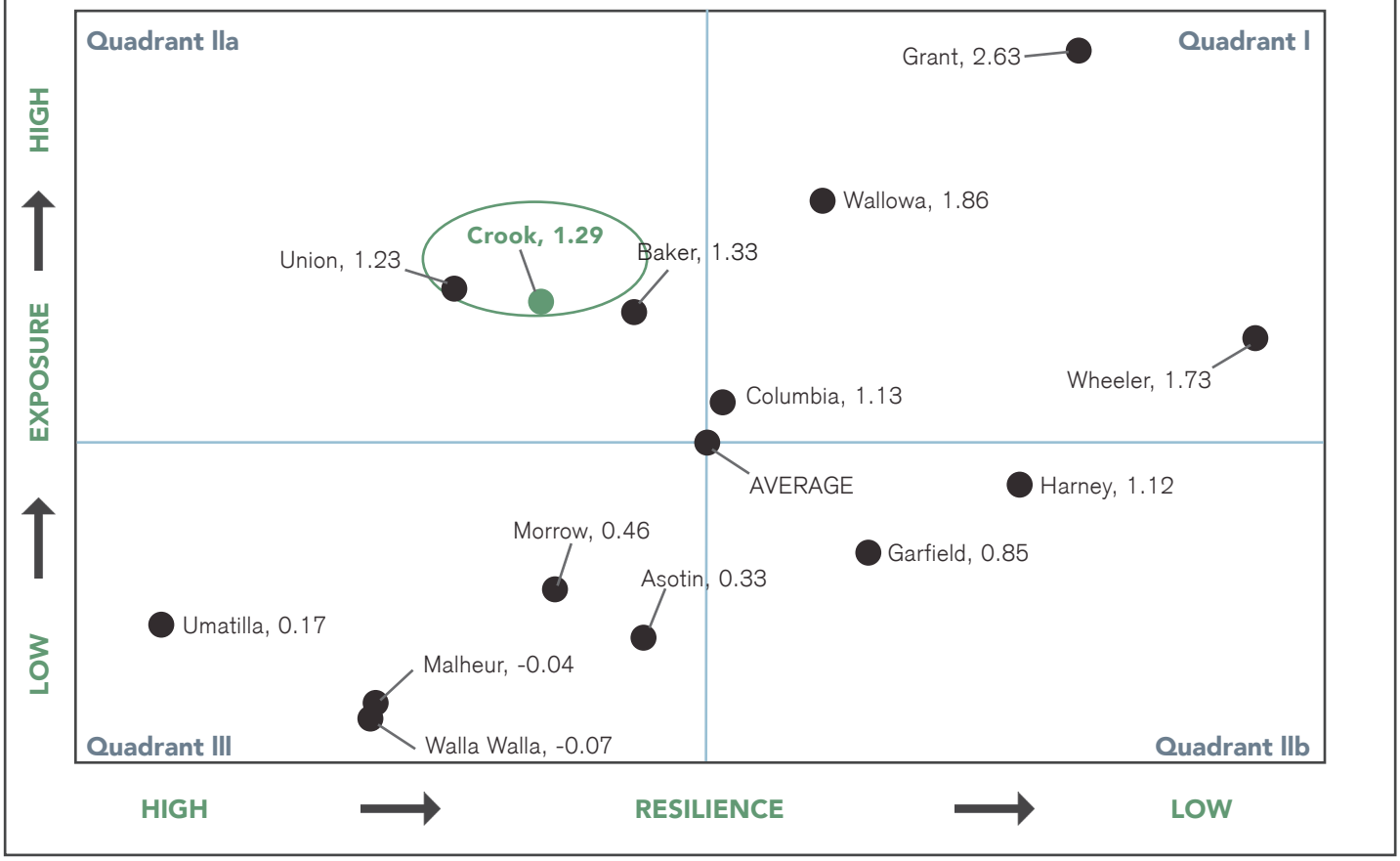


Risk/Opportunity Index (ROI) Summary for Crook County[1]

Description	County Measure (average of counties)
Crook County's capital index of 1.02 is above the average of 0.94 for the 14 counties in the study region. This stems from the fact that Crook County's endowment of capital is uniformly above average across the three classifications of capital. As the primary drivers of this result, the County has second highest measure of monetary capital, and within the natural capital classification, the second greatest use of irrigation water.	**Capital** **1.02** **(0.94)**
Compared with other counties, Crook County has a higher than average "conversion factor" of 0.62, or rather, County residents enjoy a slight relative advantage in converting the county's capital into resilience. More specifically, Crook County lacks an Interstate highway, freight railroad, and is somewhat limited with respect to access to a metro area with the remaining determinants all working in the county's favor.	**Conversion Factor** **0.62** **(0.57)**
The capital index conditioned on the conversion factor, results in a relative resilience index for Crook County of 1.11, about 10% greater than the average across the 14 counties of the study area[2]. This is consistent with the County's above average capital index and conversion factor, and implies that among these counties Crook County is slightly less susceptible to a downturn in the face of an economic shock.	**Economic Resilience** **1.11** **(1.00)**
The Crook County economy has an elevated exposure to FS planning with an index of about 1.39, or about 39% more than the average across counties in the study area. This stems from the relatively high percentage of income Crook County draws from forest related industries—the highest percentage among the study area counties, and enough to more than offset the relatively limited extent of Forest Service land.	**Exposure** **1.39** **(1.00)**
The ROI for Crook County is 1.29. This places Crook County among the counties with an intermediate score, and implies that the economy of the County is more susceptible to economic impacts related to changes in Forest Service planning than the average county in the study area.	**R/O Index** **1.29** **(1.00)**

[1] See attached "Risk/Opportunity Index Appendix" for a full breakdown of these measures and explanation of how they were calculated.
[2] Because we want to differentiate between counties, we divide the raw measure for economic resilience and exposure by the average of the 14 counties. This also results in a final county ROI that is relative to the 14 counties.

Scatter Plot: Risk Opportunity Index for Crook County



The scatter plot above maps out Crook County's exposure, resilience and resulting ROI in the context of the remaining counties of the study area. In general, counties in quadrant II have an intermediate ROI of between 0.80 and 1.30. This indicates that, relative to the remaining counties, their economies are moderately susceptible to Forest Service planning decisions. In addition, the ROI places Crook County in quadrant IIa indicating that the county's high exposure to Forest Service activity, rather than exceptionally low resilience, is the reason for this intermediate ROI value.

Given this relative position, in general terms, risk to the Crook County economy involves shifts in the extensive Forest Service activities that could reduce benefits to the economy. The opportunity that Crook County's position represents relates to refining Forest Service activities with an eye towards building additional economic resilience.

To the extent that the ROI is a descriptive rather than prescriptive tool, additional insights are limited and need to be considered with care. With this caution in mind, we offer the following:

- Of the 14 counties in the study area Crook County has the largest share of income coming from industry related to Forest Service lands. Of this, the disproportionate driver is income from timber and ranching related undertakings. To the extent possible, Forest Service activities that maintain this level of income seem likely to also support Crook County maintaining its current level of economic resilience.
- Crook County is somewhat of an outlier relative to the other counties in this study. Evidence of this lies in the population and income trends presented in the attached "Risk/ Opportunity Index Report". More specifically, although the ROI places Crook County in an intermediate location, unlike its neighboring counties, incomes and population growth more closely track those of the state as a whole. This may be due to its location adjacent to the expanding economy of Deschutes County. In the case of Crook County this may raise an important question. Specifically, how might the economy of Crook County respond to Forest Service planning activities and economic pressure from Deschutes County given that the economy of Deschutes is benefiting from outdoor recreation while that of Crook County has the highest fraction of total labor income generated by timber and ranching.
- In estimating Crook County's ROI we see that water for irrigation is an important source of economic resilience. Unfortunately, many climate forecasts predict an extended period of lower-than-average rainfall. Forest Service management is one of many tools that can be engaged to compensate for, and mitigate against, potential degradation of this key resource. Modelling from the PNW lab (Wenatchee) and regional universities suggest the potential for improved capture, storage and late summer release of precipitation from well-designed restoration treatments.

Crook County Analysis

Grazing

In Crook County, beef and cattle ranching accounts for $28.5 million of annual output, with 157 jobs and average wages of $28,563 per year.

Current Industry Snapshot (includes feedlots and dual-purpose ranching and farming):

2021 Industry Output Crook County	**Employment**	**Average Employee Compensation**	**Economic Output**
	157.05	**$28,563/yr**	**$28.5 million**

Economic Benefit of Additional Grazing

Additional 1000 AUMs (either new or currently not in use and placed in use)	**Jobs**	**Economic Output**
	2.57	$160,422

2017 Forest Service Data Adjusted for Inflation

Recreation

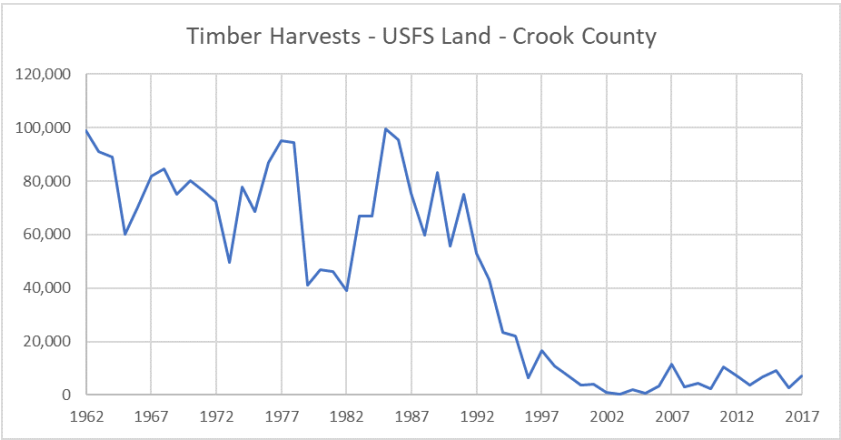
The following analysis measures the impact to Crook County from lodging, restaurants, grocery purchases and fuel primarily, with some assessment of general tourism spending. This data estimates the effect of a 10% increase in visitation and spending (regardless of use).

Crook County Tourism Impact from 10% Growth in Tourism on FS Land

Employment	**Output**
<1	**$13,526**

Timber

Crook County has a rich history in commercial timber production. In line with the rest of the region, timber has seen a precipitous drop in production and output since 1990 due to environmental legislation, global competition and capital and technological enhancements within the industry.



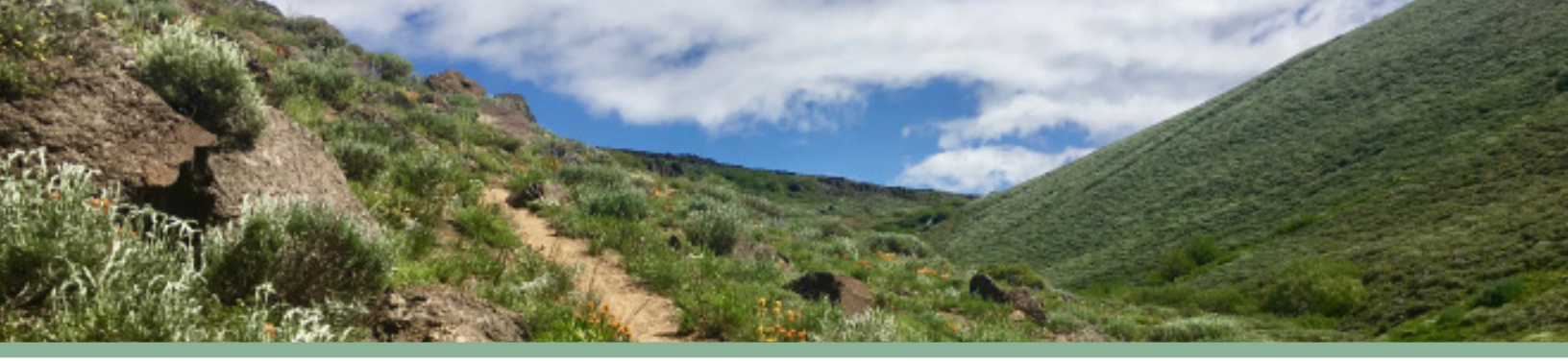
Timber (cont.)

The following data looks at the current industry snapshot, the 1990 estimate if it were duplicated today, and both 10% and 20% changes to the current level of output in the Forest Service managed lands. These results were successfully checked with the TREAT model that the Forest Service economists use for verification (Sorenson, et.al 2015):

Crook County			Employment	Output
Current Commercial Logging			81.8	$7.99 million
Share in National Forest Land	51.9%			$4.14 million
		1990 FS Direct Output	Employment	Output
Total Economic Impact of 1990 Output Levels (est. 8x current production/ output)		$33.12 million	546.37	$53.4 million
10% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	4.21	$273,230.80	$276,492.10	$417,990.45
2 - Indirect	1.66	$57,133.73	$72,859.23	$115,562.97
3 - Induced	0.99	$36,916.97	$75,260.09	$137,584.79
	6.86	**$367,281.50**	**$424,611.42**	**$671,138.21**
20% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	8.43	$546,461.60	$552,984.21	$835,980.91
2 - Indirect	3.31	$114,267.46	$145,718.46	$231,125.94
3 - Induced	1.98	$73,833.94	$150,520.17	$275,169.57
	13.73	**$734,563.00**	**$849,222.84**	**$1,342,276.42**

Stewardship Contracting in Crook County

In Crook County, there have been $794,839 of contracts since 2010, covering 28 projects for an average of $28,387 per contract. According to the Mt. Hood study these contracts should generate economic activity, primarily affecting commercial thinning and trucking directly, but each contract should generate service work as well. The retained receipts could be used for restoration work in the forest. The additional restoration and service work has a higher multiplier and would result in additional economic activity. If the economic benefits were similar, each $28,387 contract should result in potentially over $258,322 in output and 3 jobs (Daniels, Neilsen-Pincus, Paruszkiewicz, & Poage, 2018).



GRANT COUNTY, OREGON

BLUES COUNTY PROFILES

Grant County has more acres of national forest per county resident (222 acres/resident) than any other county in Oregon and Washington. The county was named after General Ulysses S. Grant, commander of the Union Army, and was established in 1864 from portions of Wasco and Umatilla County. Grant County was the largest county in the state before being broken up to form Lake, Harney, and Wheeler county. When gold was discovered on Whiskey Flat in 1862, approximately 1,000 miners arrived within ten days to camp along Canyon Creek, and it is estimated that $20 million in gold was mined from the area. Agriculture became the predominant industry activity after the gold rush, as well as timber and recreation due to its location along the John Day River..

Grant County quick facts

Date established: October 14, 1864

County seat: Canyon City, population 705 (2020)

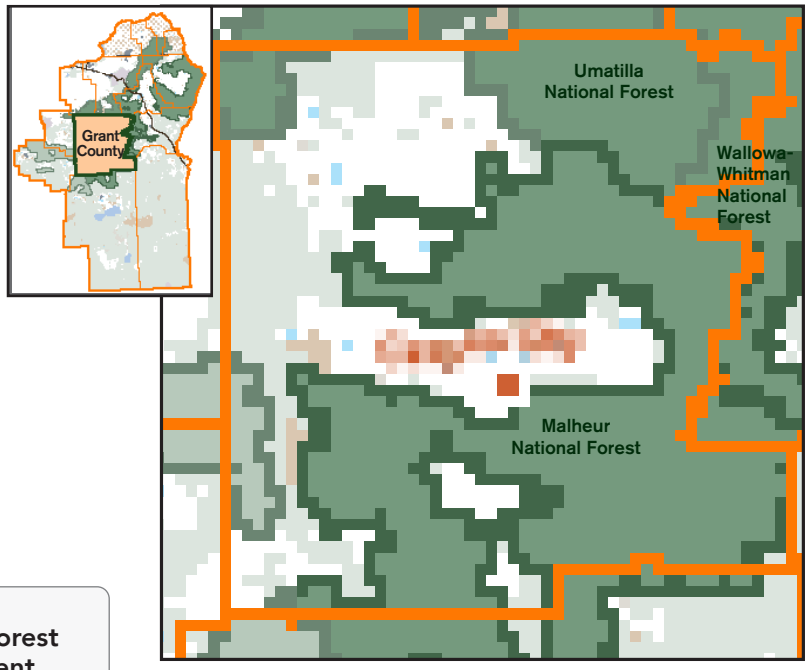
Size: 4,528 square miles.

2020 population: 7,315 people

Economy: Forest products, agriculture, hunting, livestock, recreation

Public land coverage: 62.1% of county

National forest coverage: 1,593,053 acres, 55% of county



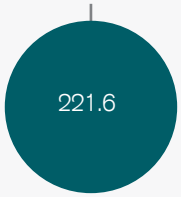
Population & acres of national forest

(each person= 5,000 people
each tree= 10,000 acres)

7,315 people

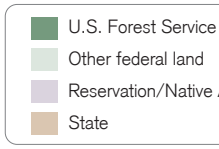
1,593,053 acres

Acres of national forest per county resident

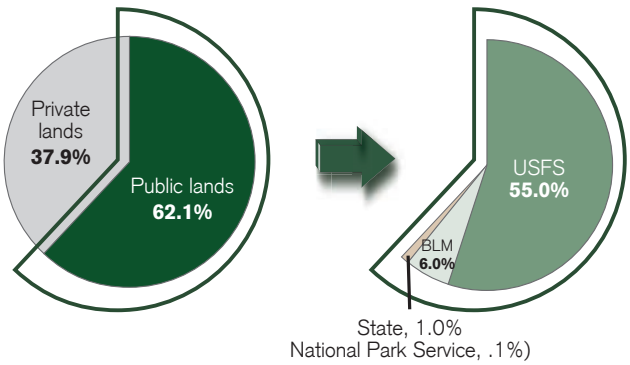


Population centers and Forest Service offices

Incorporated towns	Unincorporated areas	3 Forest Service office locations
9	18	
67.1% of popl.	32.9%	2 Ranger Districts, 1 Supervisors Office

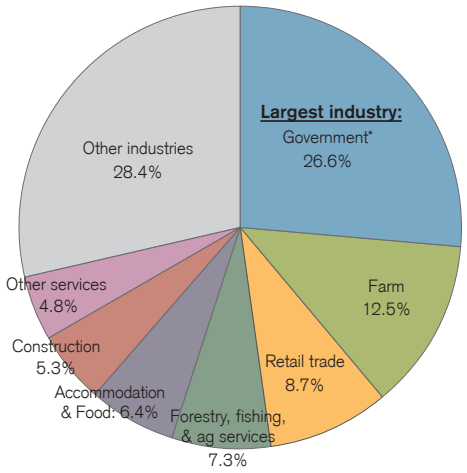


Land ownership



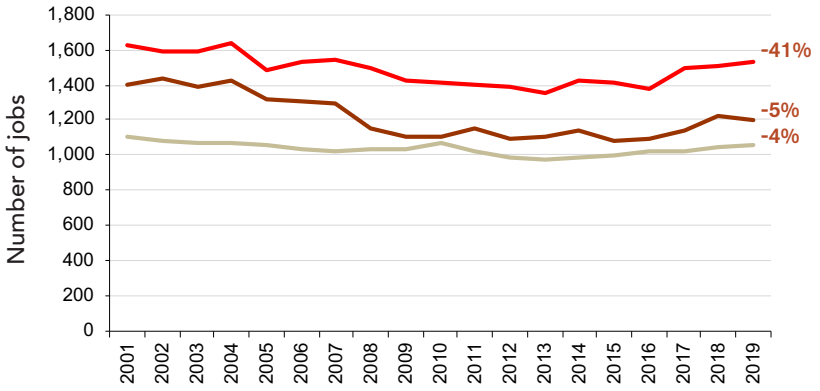
KEY INDUSTRIES:

7 largest industries by number of jobs (2019):



3,968 jobs (2019)

Employment by major industry category and % change, 2001–2019



Services Related — Non-Services Related — Government

Service-related includes: Industries such as retail trade, finance, health care & social assistance, accommodation & food, and education services

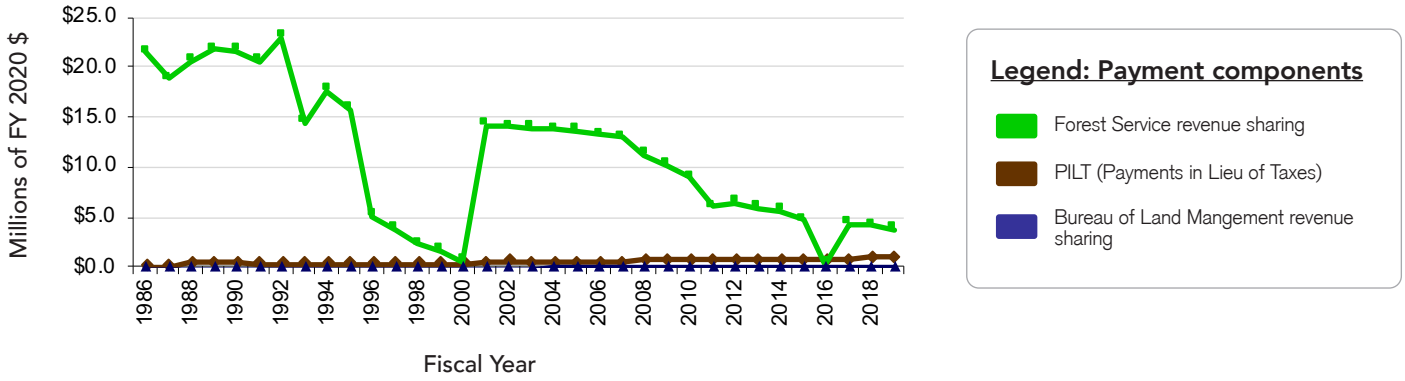
Non-Service Related includes: Industries such as farming, mining, and manufacturing

Government includes: Federal, military, state, and local government employment; government enterprise*

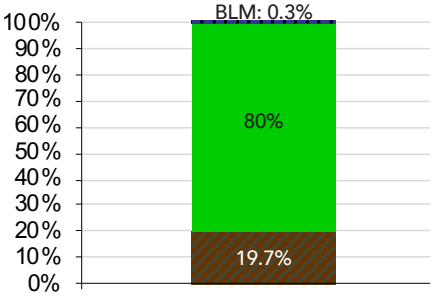
**Government may not include all public employment; some industries that may have public employees (e.g. health care, education services) are classified as service-related industries.*

FEDERAL LAND PAYMENTS:

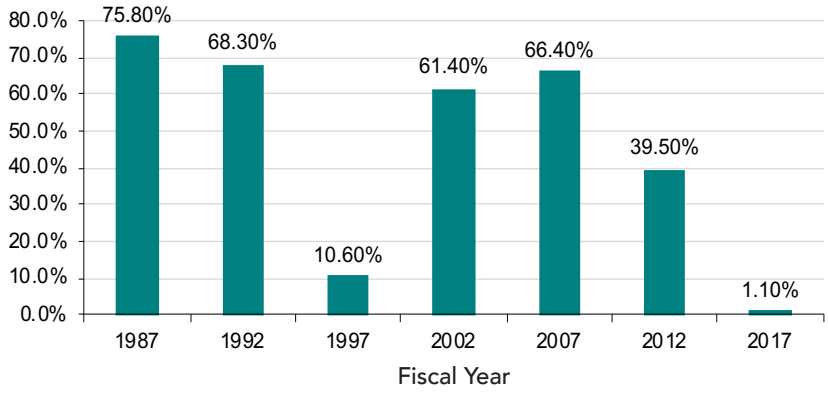
Components of federal land payments per FY, 1986–2019



Components of federal land payments, FY 2019



Federal land payments as % of total general government revenue during select years

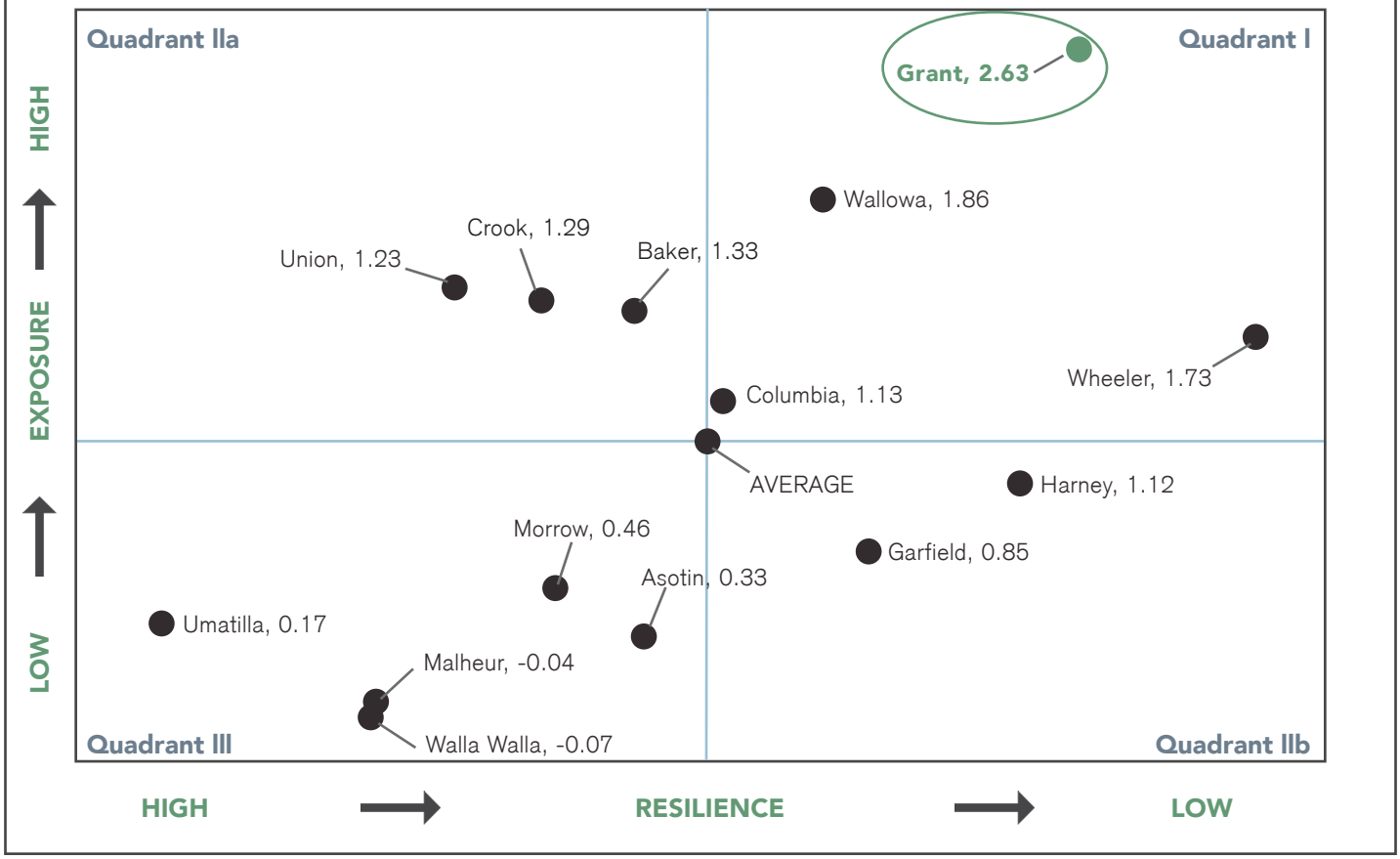


Risk/Opportunity Index (ROI) Summary for Grant County[1]

Description	County Measure (average of counties)
With a sub-index value of 0.86, Grant County's potential resilience is below the average of the 14 counties in the study region. This seems to be driven primarily by its relatively high housing costs and poverty rate, along with a low population density and labor force employment rate. A relative advantage in natural capital, stemming from higher than average farmland per person and the acres of Type C Federal land, keeps potential resilience from going lower.	**Capital** **0.86** (0.94)
Compared with other counties, Grant County has a conversion factor of 0.25, indicating that residents face relatively high barriers to converting the county's capital into resilience. While Grant County has a health care facility and better than average broadband Internet access, all other attributes, e.g. interstate highway, freight railroad, airport, are lacking.	**Conversion Factor** **0.25** (0.57)
The capital index conditioned on the conversion factor, results in a relative resilience index for Grant County of 0.72. This is the second lowest resilience index of all counties in the study area. This follows directly from Grant County's relatively low capital sub-index and low conversion factor, and it implies that the county would experience steeper economic downturns, and recover more slowly from an economic shock.	**Economic Resilience** **0.72** (1.00)
Grant County is among the most exposed with regard to Forest Service planning decisions. In fact, the final exposure index of 2.34 is the highest of the 14 counties. Based on this assessment, relative to the remaining counties, the Grant County economy has over twice the exposure to Forest Service planning decisions.	**Exposure** **2.34** (1.00)
The ROI for Grant County is 2.63. This implies that the economy of Grant County is relatively susceptible to economic impacts related to changes in Forest Service policies. This is in fact the highest estimate of the ROI of the 14 counties.	**R/O Index** **2.63** (1.00)

[1] See attached "Risk/Opportunity Index Appendix" for a full breakdown of these measures and explanation of how they were calculated.
[2] Because we want to differentiate between counties, we divide the raw measure for economic resilience and exposure by the average of the 14 counties. This also results in a final county ROI that is relative to the 14 counties.

Scatter Plot: Risk Opportunity Index for Grant County



The scatter plot above maps out Grant County's exposure, resilience and resulting ROI in the context of the remaining counties of the study area. In general, counties grouped in quadrant I have a high ROI between 1.70 and 2.70 indicating that they are low in economic resilience and high in exposure to Forest Service activities. This implies that, relative to the remaining counties, their economies are the most susceptible to Forest Service planning decisions.

Given this relative position, in general terms, the Grant County economy is among those most likely to suffer negative consequences in the face of shifts in Forest Service management that reduce economic benefits. With the elevated exposure of the County economy in mind, opportunities to build resilience are weighted towards shifting of current Forest Service activities towards those that more effectively build economic resilience.

To the extent that the ROI is a descriptive rather than prescriptive tool, additional insights are limited and need to be considered with care. With this caution in mind, we offer the following:

- The ROI does not consider the possibility that some attributes of the economy may have "thresholds" that, once surpassed, result in outsized declines in economic resilience. This is a concern in the case of Grant County in light of the County's status as having the highest exposure measure and the highest overall ROI estimate.

- The ROI considers acres of farmland per person an important part of a county's natural capital. While this is quite intuitive in general, in the case of high desert counties like Grant County it may be problematic. More specifically, the farmland in Grant is more likely to be managed extensively rather than intensively. It is, therefore, less economically productive per acre. It follows that the ROI estimate for Grant may underestimate somewhat the actual ROI for the county.

Grant County Analysis

Grazing

In Grant County, beef and cattle ranching accounts for $21.2 million of annual output, with 194.70 jobs and average wages of $37,463 per year.

Current Industry Snapshot (includes feedlots and dual-purpose ranching and farming):

2021 Industry Output Grant County	**Employment**	**Average Employee Compensation**	**Economic Output**
	194.70	**$37,463/yr**	**$21.2 million**

Economic Benefit of Additional Grazing

Additional 1000 AUMs (either new or currently not in use and placed in use)	**Jobs**	**Economic Output**
	2.57	$160,422

2017 Forest Service Data Adjusted for Inflation

Recreation

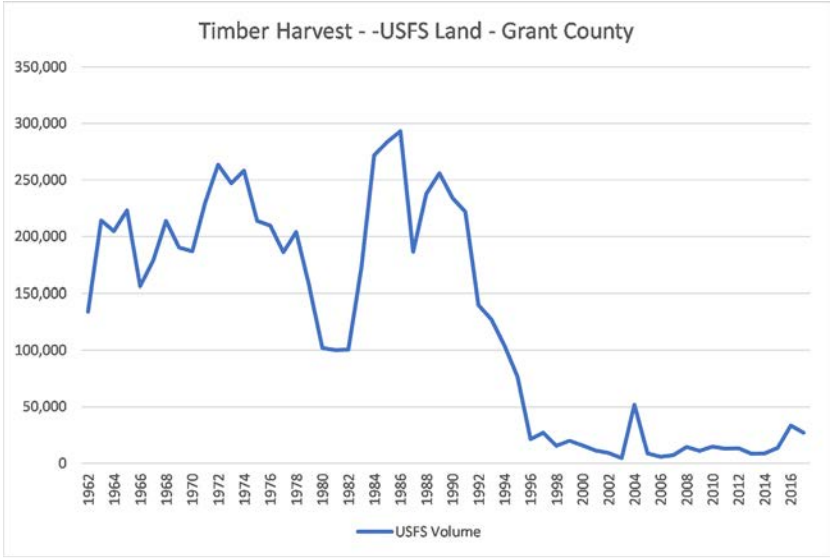
The following analysis measures the impact to Grant County from lodging, restaurants, grocery purchases and fuel primarily, with some assessment of general tourism spending. This data estimates the effect of a 10% increase in visitation and spending (regardless of use).

Grant County Tourism Impact from 10% Growth in Tourism on FS Land

Employment	**Output**
1.28	**$95,907**

Timber

Grant County has a rich history in commercial timber production. In line with the rest of the region, timber has seen a precipitous drop in production and output since 1990 due to environmental legislation, global competition and capital and technological enhancements within the industry.



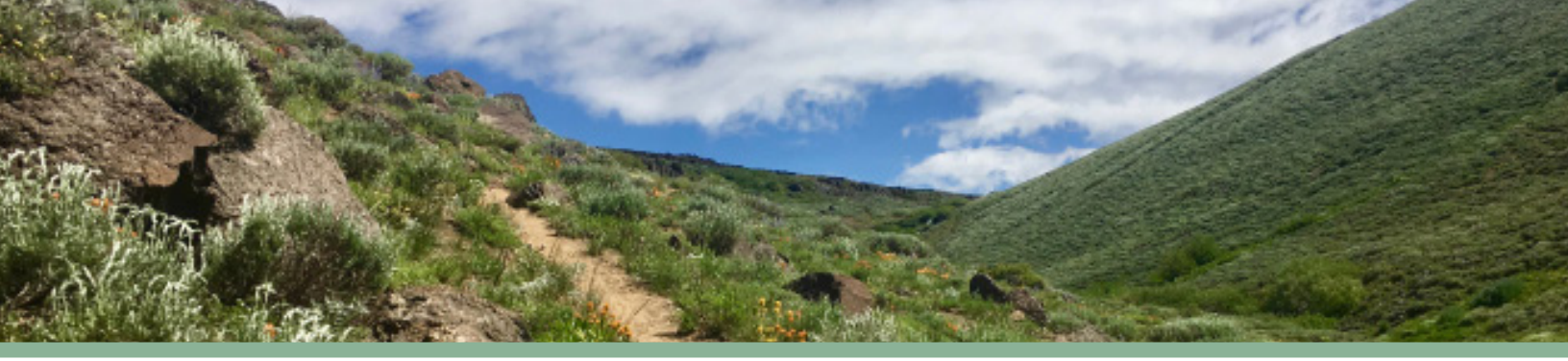
Timber (cont.)

The following data looks at the current industry snapshot, the 1990 estimate if it were duplicated today, and both 10% and 20% changes to the current level of output in the Forest Service managed lands. These results were successfully checked with the TREAT model that the Forest Service economists use for verification (Sorenson, et.al 2015):

Grant County			Employment	Output
Current Commercial Logging			138	$13.7 million
Share in National Forest Land	52.90%			$7.25 million
		1990 FS Direct Output	Employment	Output
Total Economic Impact of 1990 Output Levels (est. 8x current production/ output)		$57.9 million	956.09	$8.6 million
10% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	7.21	$492,970.73	$483,783.46	$724,730.00
2 - Indirect	3.18	$97,828.42	$103,525.86	$142,791.85
3 - Induced	1.62	$46,365.95	$108,757.91	$210,405.14
	12.01	**$637,165**	**$696,067**	**$1,077,927**
20% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	14.42	$985,941.45	$967,566.92	$1,449,460.00
2 - Indirect	6.37	$195,656.84	$207,051.72	$285,583.71
3 - Induced	3.23	$92,731.89	$217,515.82	$420,810.27
	24.02	**$1,274,330**	**$1,392,134.46**	**$2,155,853.98**

Stewardship Contracting in Grant County

In Grant County, there have been $46,450,956 of contracts since 2010, covering 328 projects for an average of $141,618 per contract. According to the Mt. Hood study these contracts should generate economic activity, primarily affecting commercial thinning and trucking directly, but each contract should generate service work as well. The retained receipts could be used for restoration work in the forest. The additional restoration and service work has a higher multiplier and would result in additional economic activity. If the economic benefits were similar, each $141,618 contract should result in potentially over $1.12 million in output and 15 jobs (Daniels, Neilsen-Pincus, Paruszkiewicz, & Poage, 2018).



HARNEY COUNTY, OREGON

BLUES COUNTY PROFILES

Harney is the largest of the 14 Blues Counties, as well as the largest county in Oregon and the 10th largest in the lower 48 states. Located in the high desert in the southeast corner of Oregon, the county also has the lowest population density of all the counties, with just 0.7 people per square mile. Most of the population is concentrated in the Burns-Hines area, and 75% of the county is public land. More than 100,000 beef cattle live on the county's vast ranges, and an abundance of game, campsites, fishing, and bird watching opportunities have stimulated fast-growing recreational activities in the county.

Harney County quick facts

Date established: February 25, 1889

County seat: Burns, population 2,783 (2020)

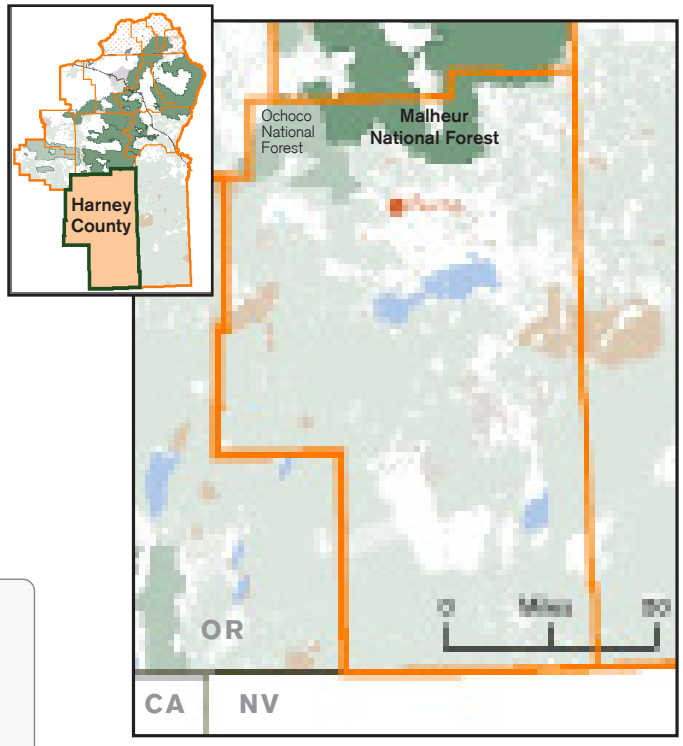
Size: Harney is Oregon's largest county at 10,228 square miles.

2020 population: 7,280 people

Economy: Forest products, manufacturing, livestock, agriculture

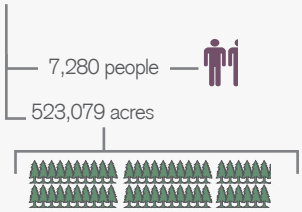
Public land coverage: 75% of county

Forest Service land: 523,079 acres, 8% of county



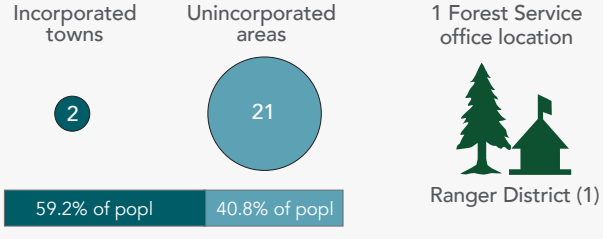
Population & acres of national forest

(each person= 5,000 people
each tree= 10,000 acres)

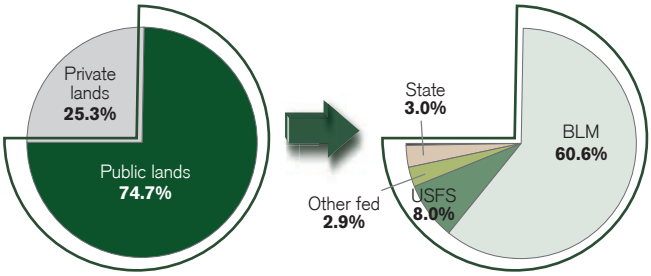


Acres of national forest per county resident

Population centers and Forest Service offices

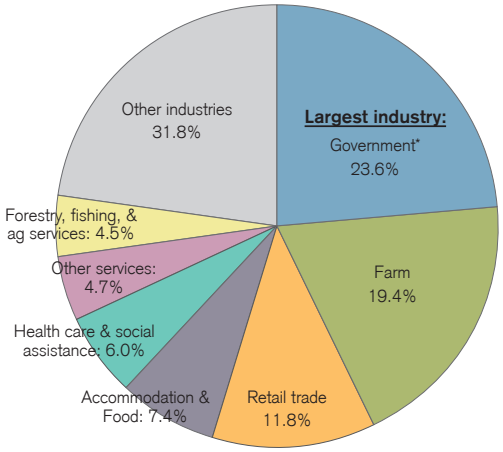


Land ownership



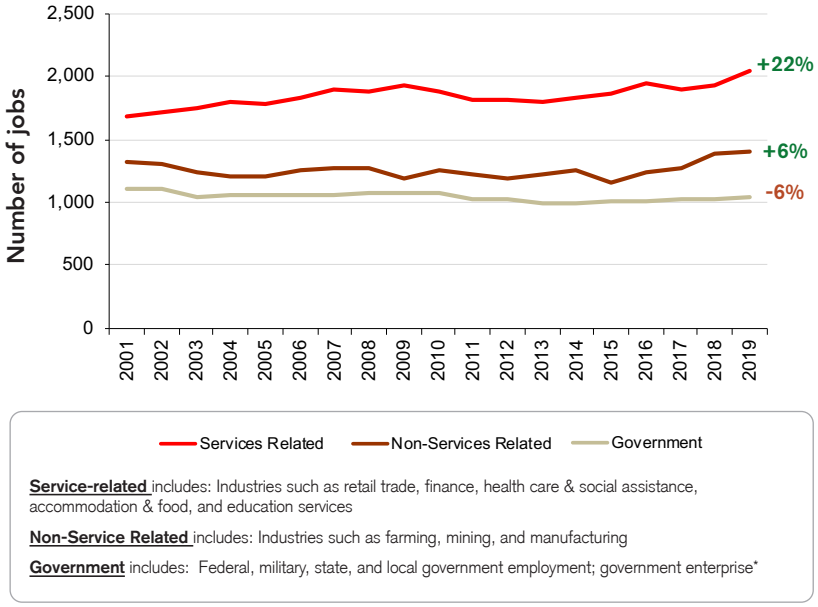
KEY INDUSTRIES:

7 largest industries by number of jobs (2019):



4,408 jobs (2019)

Employment by major industry category and % change, 2001–2019



Service-related includes: Industries such as retail trade, finance, health care & social assistance, accommodation & food, and education services

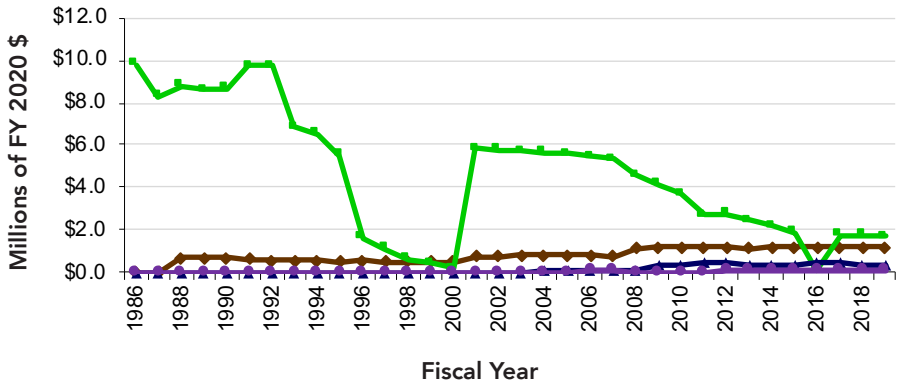
Non-Service Related includes: Industries such as farming, mining, and manufacturing

Government includes: Federal, military, state, and local government employment; government enterprise*

**Government may not include all public employment; some industries that may have public employees (e.g. health care, education services) are classified as service-related industries.*

FEDERAL LAND PAYMENTS:

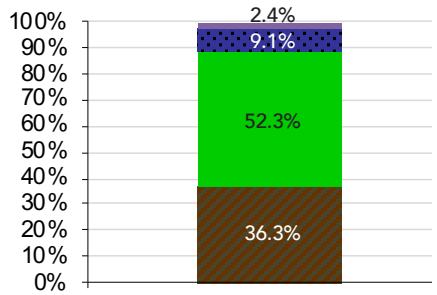
Components of federal land payments per FY, 1986–2019



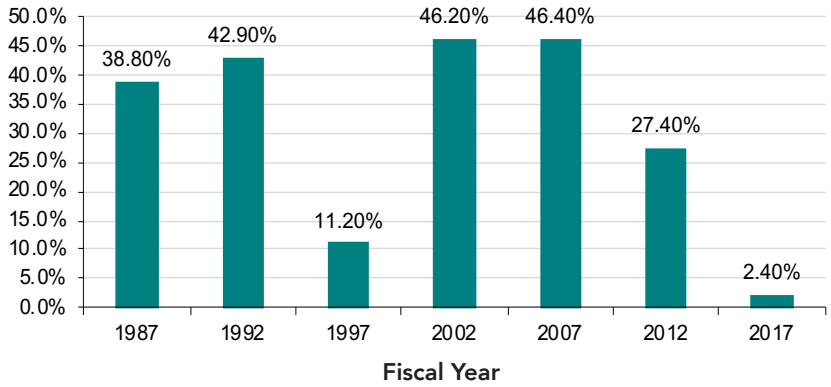
Legend: Payment components

- Forest Service revenue sharing
- PILT (Payments in Lieu of Taxes)
- Bureau of Land Mangement (BLM) revenue sharing
- US Fish and Wildlife Service (FWS) Refuge payments

Components of federal land payments, FY 2019



Federal land payments as % of total general government revenue during select years

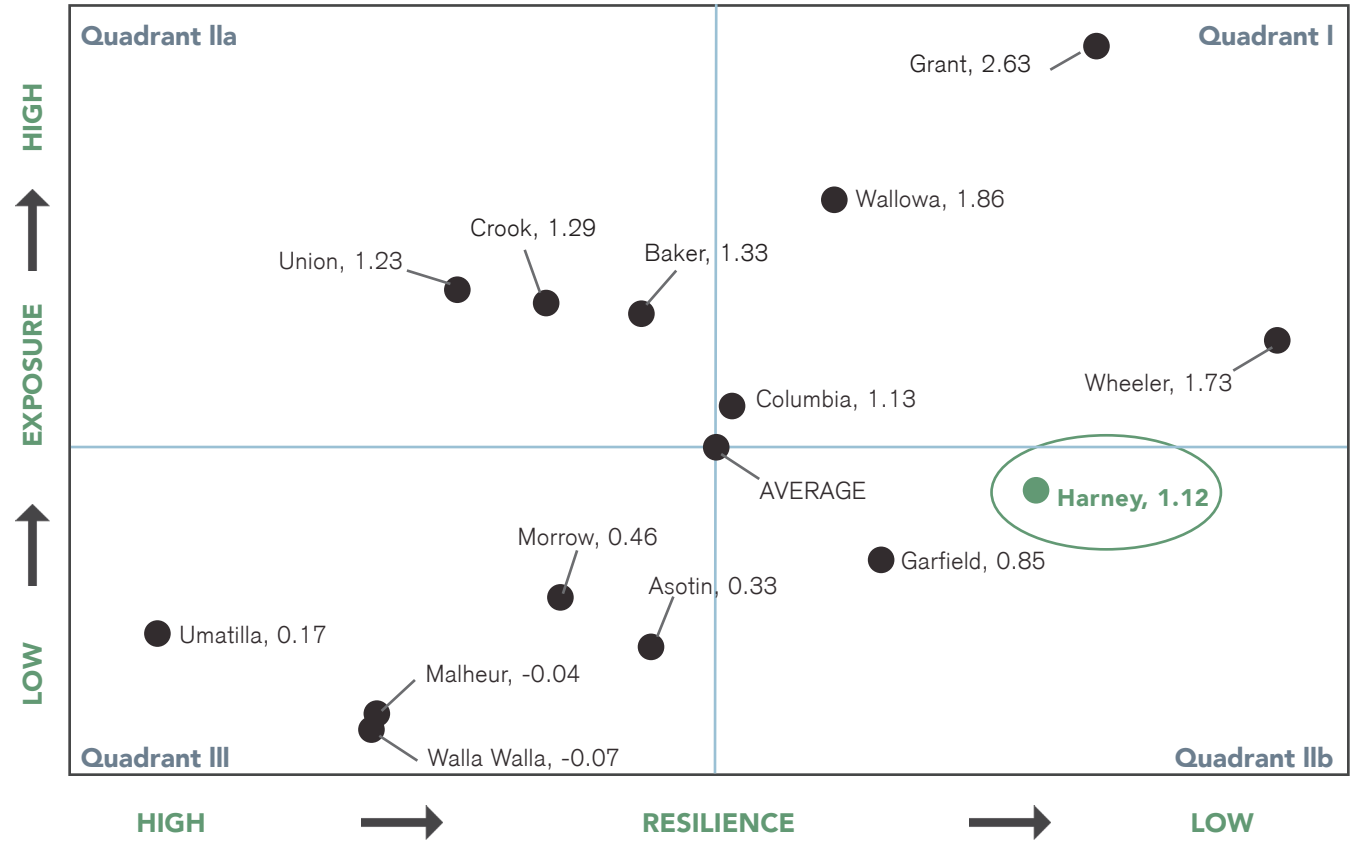


Risk/Opportunity Index (ROI) Summary for Harney County[1]

Description	County Measure (average of counties)
Based on Harney County's endowment of these forms of capital, its potential resilience is 0.95; slightly greater than the average of the 14 counties in the study region. This seems to be driven primarily by its endowment of natural resources, and more specifically, by a high farmland per person and income from tourism. These attributes compensate for challenges related to relatively high housing costs and low population density.	**Capital** **0.95** (0.94)
Compared with other counties, Harney County residents face high barriers to converting the county's capital into resilience. More specifically, Harney County is lacking nearly every element of infrastructure that would allow it to easily capitalize on its potential wealth. This leaves residents to generate wealth without support structures like broadband Internet, the Interstate highway system, freight railroad, or an airport.	**Conversion Factor** **0.18** (0.57)
The capital index conditioned on the conversion factor, results in a relative resilience index for Harney County of 0.75, the third lowest of all counties in the study area[2]. This is driven primarily by the County's low conversion factor, and it implies that the county would experience steeper economic downturns in the face of, and recover more slowly from, an economic shock.	**Economic Resilience** **0.75** (1.00)
In the case of Harney County, across the three measures of exposure—income, land area and Federal payments—the Harney County economy is slightly less exposed to Forest Service planning decisions. Its exposure index is 0.87 against the average value of 1 across the 14 study counties. Although the County has extensive Federal land coverage, a relatively small portion of this is Forest Service land. The limited extent of Forest Service land is the primary driver of the limited exposure of Harney County.	**Exposure** **0.87** (1.00)
The ROI for Harney County is 1.12. This implies that the economy of Harney County may be slightly more susceptible to economic impacts related to changes in Forest Service policies than the average of the 14 counties. The case of Harney County is interesting in that low resilience is accompanied by low exposure, and thus an approximately average RO index value.	**R/O Index** **1.12** (1.00)

[1] See attached "Risk/Opportunity Index Appendix" for a full breakdown of these measures and explanation of how they were calculated.
[2] Because we want to differentiate between counties, we divide the raw measure for economic resilience and exposure by the average of the 14 counties. This also results in a final county ROI that is relative to the 14 counties.

Scatter Plot: Risk Opportunity Index for Harney County



The scatter plot above maps out Harney County's exposure, resilience and resulting ROI in the context of the remaining counties of the study area. In general, counties in quadrant II have an intermediate ROI of between 0.80 and 1.30. This indicates that, relative to the remaining counties, their economies are moderately susceptible to Forest Service planning decisions. In addition, the ROI places Harney County in quadrant IIb indicating that the county's low economic resilience, rather than exceptionally high exposure to Forest Service activity, is the reason for this intermediate ROI value.

Given this combination of low exposure and low economic resilience, the Harney County economy is vulnerable to shifts in Forest Service planning that reduce benefits to economy. In addition, given the low exposure to Forest Service activities, opportunity of boosting benefits to economy by restructuring current activities is relatively limited. Conversely, the opportunity to build economic resilience via additional Forest Service activity is high so long as these activities effectively target resilience.

To the extent that the ROI is a descriptive rather than prescriptive tool, additional insights are limited and need to be considered with care. With this caution in mind, we offer the following based on the County ROI and the ground truthing session held with stakeholders in the County:

- Among the counties with a below average exposure to Forest Service planning, Harney County has the least resilient economy as estimated by the ROI. This may put a premium on resilience-building activities for the County beyond what the direct ROI value implies.

- Harney County's ROI points toward the economic importance of water for irrigation. Unfortunately, many climate forecasts predict an extended period of lower-than-average rainfall. Forest Service management is one of many tools that can be engaged to compensate for, and mitigate against, potential degradation of this key resource. Modelling from the PNW lab (Wenatchee) and regional universities suggest the potential for improved capture, storage and late summer release of precipitation from well-designed restoration treatments.

- The ROI includes "acres of farmland per person" as part of its estimate of natural capital. In the case of Harney County this may overestimate the economic value of natural capital because much of the land is arid. Consequently, it is more extensive agriculture

and less economically productive. This measure is further skewed by the low population of Harney County, which makes farmland per person seem favorable. This implies that the ROI may have overestimated the value of County natural capital, and thus overestimated its economic resilience and underestimated its final ROI value.

- The exposure factor shows Harney county with limited extent of Forest Service land. This underestimates the economic importance of this land by 1) ignoring the greater productivity (more animal unit months (AUMs)) of this land relative to the high desert land, and 2) using percentages where a small percentage is actually a large land area given Harney county's size. Were exposure conditional on productivity Harney county would show as more exposed.

- The ROI may underestimate the vulnerability of Harney county economy because the overall economy is small, and because cattle ranching provides a large portion of the overall income. Consequently, a small shift in AUMs would impact an important source of income in a small economy. The index does not account for such a non-linear impact. More generally, the ROI does not consider non-linear effects. This could be important in the case of Harney county in that it is among the least resilient of the region. Consequently, the effects of an economic shock may be magnified in the case of Harney county.

- The way that 10-year stewardship contracts have been awarded have hurt the Harney county economy because the contracts have gone to neighboring counties. This could represent a potential approach to restructuring of current activities with the aim of boosting resilience.

- The benefits of tourism may be over-estimated. Much of the County tourism seems to be drive-through resulting in limited additional economic impact in the county. The main exception to this could be hunting. This is important because the ROI for the county shows tourism playing an important role. Thus, the ROI may overstate the positive role that this income can play.

Harney County Analysis

Grazing

In Harney County, beef and cattle ranching accounts for $58.4 million of annual output, with 130 jobs and average wages of $36,739 per year.

Current Industry Snapshot (includes feedlots and dual-purpose ranching and farming):

2021 Industry Output Harney County	Employment	Average Employee Compensation	Economic Output
	130.48	**$36,739/yr**	**$58.4 million**

Economic Benefit of Additional Grazing

Additional 1000 AUMs (either new or currently not in use and placed in use)	Jobs	Economic Output
	2.57	$160,422

2017 Forest Service Data Adjusted for Inflation

Recreation

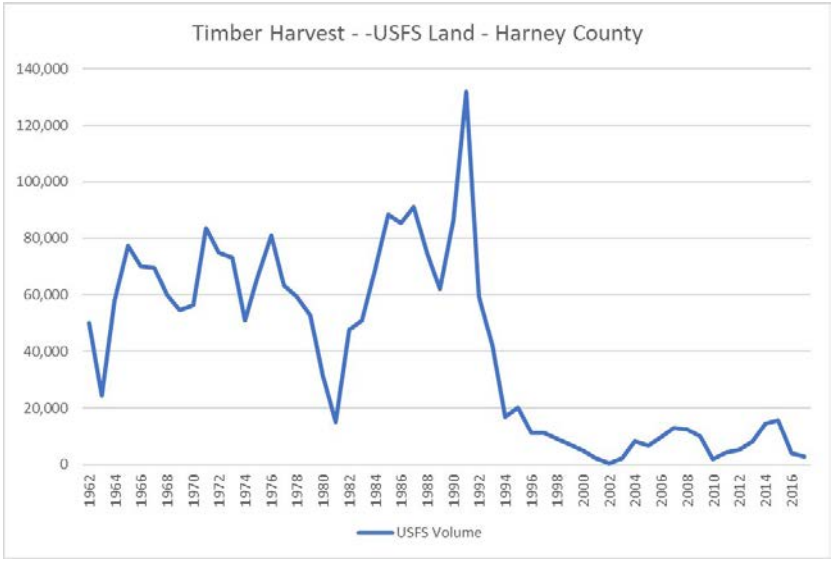
The following analysis measures the impact to Harney County from lodging, restaurants, grocery purchases and fuel primarily, with some assessment of general tourism spending. This data estimates the effect of a 10% increase in visitation and spending (regardless of use).

Harney County Tourism Impact from 10% Growth in Tourism on FS Land

Employment	Output
3.97	**$327,632**

Timber

Harney County has a rich history in commercial timber production. In line with the rest of the region, timber has seen a precipitous drop in production and output since 1990 due to environmental legislation, global competition and capital and technological enhancements within the industry.



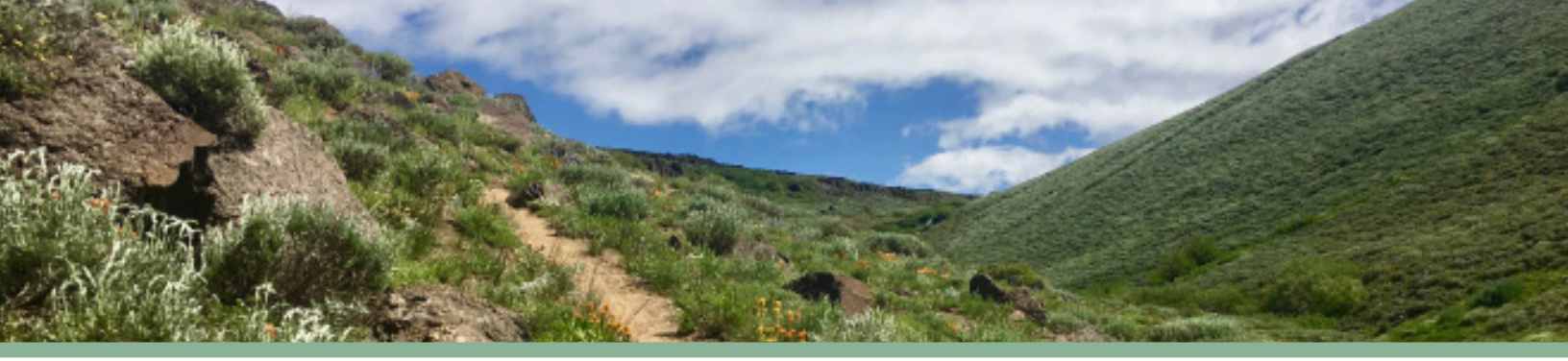
Timber (cont.)

The following data looks at the current industry snapshot, the 1990 estimate if it were duplicated today, and both 10% and 20% changes to the current level of output in the Forest Service managed lands. These results were successfully checked with the TREAT model that the Forest Service economists use for verification (Sorenson, et.al 2015):

Harney County			Employment	Output
Current Commercial Logging			21.15	$1.32 million
Share in National Forest Land	81.1%			$1.07 million
		1990 FS Direct Output	Employment	Output
Total Economic Impact of 1990 Output Levels (est. 8x current production/ output)		$8.56 million	220.23	$16.6 million
10% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	1.72	$44,126.59	$51,858.36	$109,521.54
2 - Indirect	0.53	$24,077.66	$29,318.81	$42,599.69
3 - Induced	0.20	$6,394.96	$14,819.78	$26,757.44
	2.45	**$74,599.21**	**$95,996.95**	**$178,878.66**
20% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	3.44	$88,253.17	$103,716.72	$219,043.07
2 - Indirect	1.06	$48,155.32	$58,637.62	$85,199.38
3 - Induced	0.40	$12,789.92	$29,639.56	$53,514.87
	4.90	**$149,198.42**	**$191,993.91**	**$357,757.33**

Stewardship Contracting in Harney County

In Harney County, there have been $6,713,453 of contracts since 2010, covering 73 projects for an average of $91,965 per contract. According to the Mt. Hood study these contracts should generate economic activity, primarily affecting commercial thinning and trucking directly, but each contract should generate service work as well. The retained receipts could be used for restoration work in the forest. The additional restoration and service work has a higher multiplier and would result in additional economic activity. If the economic benefits were similar, each $92,000 contract should result in potentially over $836,000 in output and 8 jobs (Daniels, Neilsen-Pincus, Paruszkiewicz, & Poage, 2018).



MALHEUR COUNTY, OREGON

BLUES COUNTY PROFILES

Malheur County has less Forest Service land than any other county in the Blues region, with only one one-tenth of one percent, while also being the second largest county in Oregon at 9,874 square miles. It was named after the Malheur River, and from the southern section of Baker County in 1887. The county was first settled in 1860 by cattle ranchers and miners, and in the 1890s Basque communities settled in the area to primarily raise sheep. The main economic activity in Malheur County is livestock, agriculture, and food processing.

Malheur County quick facts

Date established: February 17, 1887

County seat: Vale, population 2,783 (2020)

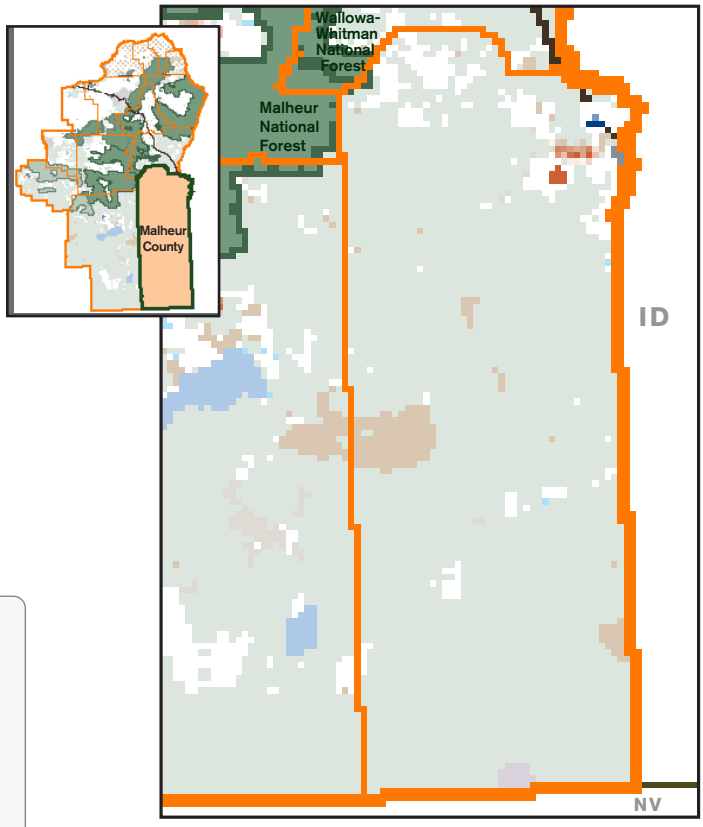
Size: 9,926 square miles

2020 population: 32,105 people

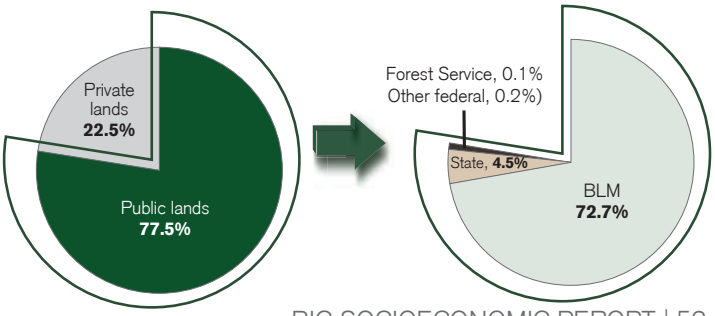
Economy: Agriculture, livestock, food processing, recreation

Public land coverage: 75% of county

Forest Service land: 3,814 acres, 0.1% of county

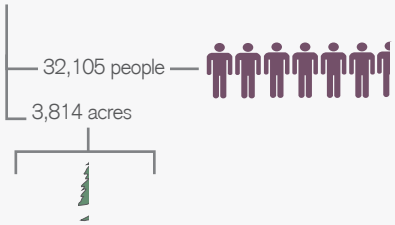


Land ownership



Population & acres of national forest

(each person= 5,000 people
each tree= 10,000 acres)



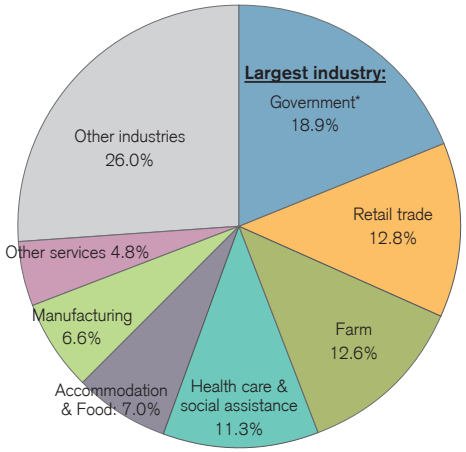
Acres of national forest per county resident

Population centers and Forest Service offices

Incorporated towns	Unincorporated areas	1 Forest Service office location
2	20	-NONE-
54.4% of popl	45.6% of popl	

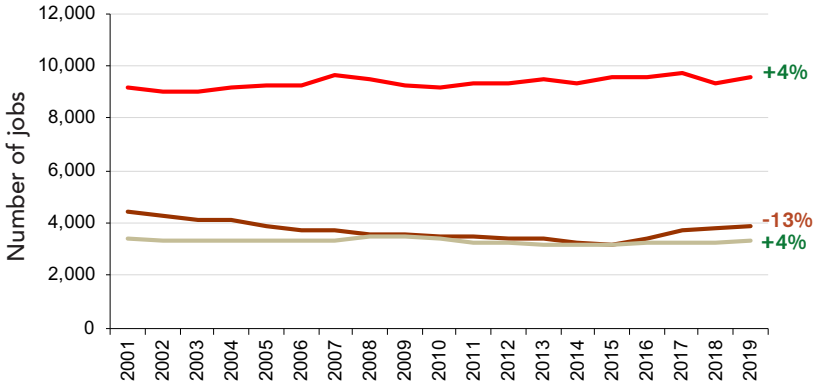
KEY INDUSTRIES:

7 largest industries by number of jobs (2019):



17,532 jobs (2019)

Employment by major industry category and % change, 2001–2019



Services Related — Non-Services Related — Government

Service-related includes: Industries such as retail trade, finance, health care & social assistance, accommodation & food, and education services

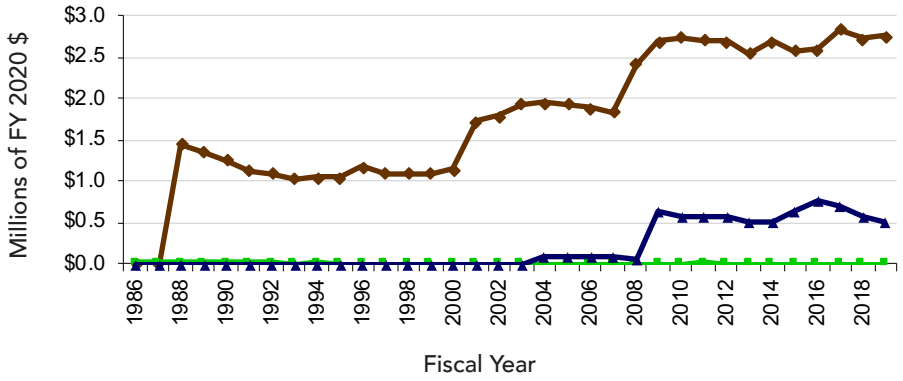
Non-Service Related includes: Industries such as farming, mining, and manufacturing

Government includes: Federal, military, state, and local government employment; government enterprise*

**Government may not include all public employment; some industries that may have public employees (e.g. health care, education services) are classified as service-related industries.*

FEDERAL LAND PAYMENTS:

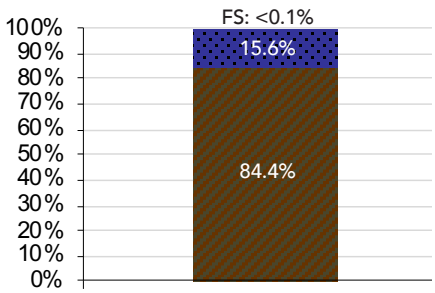
Components of federal land payments per FY, 1986–2019



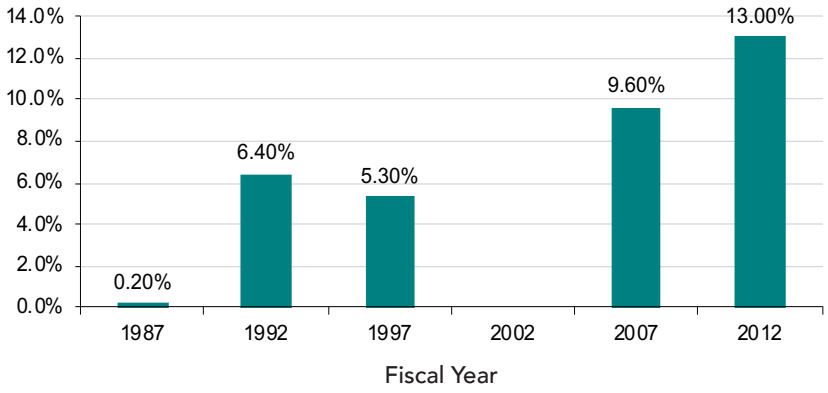
Legend: Payment components

- PILT (Payments in Lieu of Taxes)
- Bureau of Land Mangement revenue sharing
- Forest Service revenue sharing

Components of federal land payments, FY 2019



Federal land payments as % of total general government revenue during select years

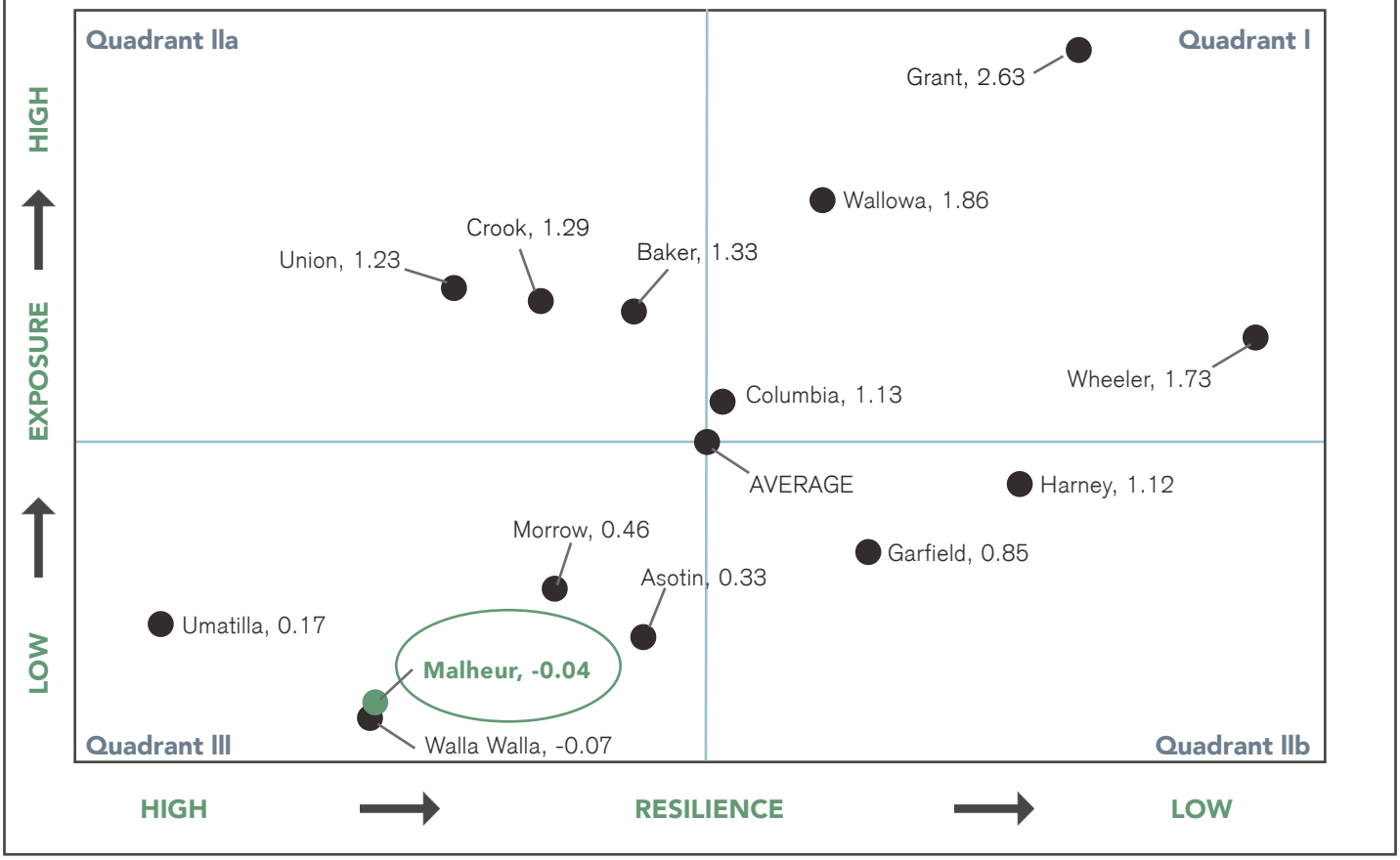


Risk/Opportunity Index (ROI) Summary for Malheur County[1]

Description	County Measure (average of counties)
With a sub-index value of 0.97 compared to the average of 0.94, Malheur County's potential resilience is slightly higher than that of the 14 counties in the study region. This result is driven primarily by the elevated monetary and natural capital, and specifically, the second highest number of firms and the highest usage of irrigation water. This is offset somewhat by a relatively low rate of home ownership and educational attainment, and elevated poverty rate which registers as the highest among the 14 counties.	**Capital** **0.97** **(0.94)**
With a conversion factor of 0.86, Malheur County residents face fewer challenges on average than the other counties in converting capital resources into resilience. More specifically, Malheur County has approximately average metro area and broadband internet access, with the remaining determinants, e.g., presence of an Interstate, freight railroad, college, all working in the County's favor.	**Conversion Factor** **0.86** **(0.57)**
The capital index conditioned on the conversion factor, results in a relative resilience index for Malheur County of 1.20, about 20% higher than the average across the 14 counties of the study area[2]. This follows directly from the results presented above, and it implies that among the study counties, the Malheur County economy is less susceptible to a downturn in the face of an economic shock.	**Economic Resilience** **1.20** **(1.00)**
Malheur County economy is significantly less exposed than the average across counties, with a relative exposure index of about 0.16, or about 84% lower than the average across counties in the study area. In the case of Malheur County, this result stems from the fact that the County has the least Forest Service land, and consequently also lowest level of Forest Service related payments of the 14 counties in the study area.	**Exposure** **0.16** **(1.00)**
The ROI for Malheur County is -0.04[3]. This is the second lowest index score of the 14 counties, and reflects the County's high resilience score (and therefore low vulnerability) combined with its low exposure to Forest Service planning. The interpretation of this index score is that the County is less susceptible to economic impacts related to changes in Forest Service planning than the average for counties in the study area.	**R/O Index** **-0.04** **(1.00)**

[1] See attached "Risk/Opportunity Index Appendix" for a full breakdown of these measures and explanation of how they were calculated.
[2] Because we want to differentiate between counties, we divide the raw measure for economic resilience and exposure by the average of the 14 counties. This also results in a final county ROI that is relative to the 14 counties.
[3] The negative value of the County ROI results from converting the resilience index from increasing to decreasing. Because the County exposure and resilience index were both low before this conversion, the conversion resulted in a negative final ROI.

Scatter Plot: Risk Opportunity Index for Malheur County



The scatter plot above maps out Malheur County's exposure, resilience and resulting ROI in the context of the remaining counties of the study area. In general, counties in quadrant III have a ROI of less than 0.80. This indicates that, relative to the remaining counties, their economies are relatively resilient and less exposed to Forest Service planning decisions than other counties of the study area.

Given their relatively high economic resilience and low exposure to Forest Service activities, counties in this quadrant are least likely to suffer negative consequences to their economy were the Forest Service to shift activities away from the county. Conversely, the low current exposure allows for the greater opportunity to boost benefits to the economy through increasing Forest Service exposure so long as it effectively targets economic resilience.

To the extent that the ROI is a descriptive rather than prescriptive tool, additional insights are limited and need to be considered with care. With this caution in mind, we offer the following:

- Malheur County is very large and much of its business activity and infrastructure is concentrated in the northeast section of the County. Because of this size and the uneven distribution of important economic assets across the landscape it may be important to consider localized differences in economic resilience. Put differently, there are large expanses of Malheur County that, if they were to be treated as separate counties, may well score significantly lower in terms of economic resilience. In this respect Malheur County's low ROI may not apply to large areas of the county.

- Malheur County's ROI points toward the importance of water for irrigation. Unfortunately, many climate forecasts predict an extended period of lower-than-average rainfall. This issue is all the more pressing given the extent of arid land in Malheur County's which makes it all the more important to protect the water resource. Forest Service management is one of many tools that can be engaged to compensate for, and mitigate against, potential degradation of this key resource. Modelling from the PNW lab (Wenatchee) and regional universities suggest the potential for improved capture, storage and late summer release of precipitation from well-designed restoration treatments.

Malheur County Analysis

Grazing

In Malheur County, beef and cattle ranching accounts for $98.5 million of annual output, with 283.08 jobs and average wages of $38,504 per year.

Current Industry Snapshot (includes feedlots and dual-purpose ranching and farming):

2021 Industry Output Malheur County	**Employment**	**Average Employee Compensation**	**Economic Output**
	283.08	**$38,504/yr**	**$98.5 million**

Economic Benefit of Additional Grazing

Additional 1000 AUMs (either new or currently not in use and placed in use)	**Jobs**	**Economic Output**
	2.57	$160,422

2017 Forest Service Data Adjusted for Inflation

Recreation

The following analysis measures the impact to Malheur County from lodging, restaurants, grocery purchases and fuel primarily, with some assessment of general tourism spending. This data estimates the effect of a 10% increase in visitation and spending (regardless of use).

Malheur County Tourism Impact from 10% Growth in Tourism on FS Land

Employment	**Output**
.82	**$64,997**

Timber

Malheur County has a rich history in commercial timber production. In line with the rest of the region, timber has seen a precipitous drop in production and output since 1990 due to environmental legislation, global competition and capital and technological enhancements within the industry.

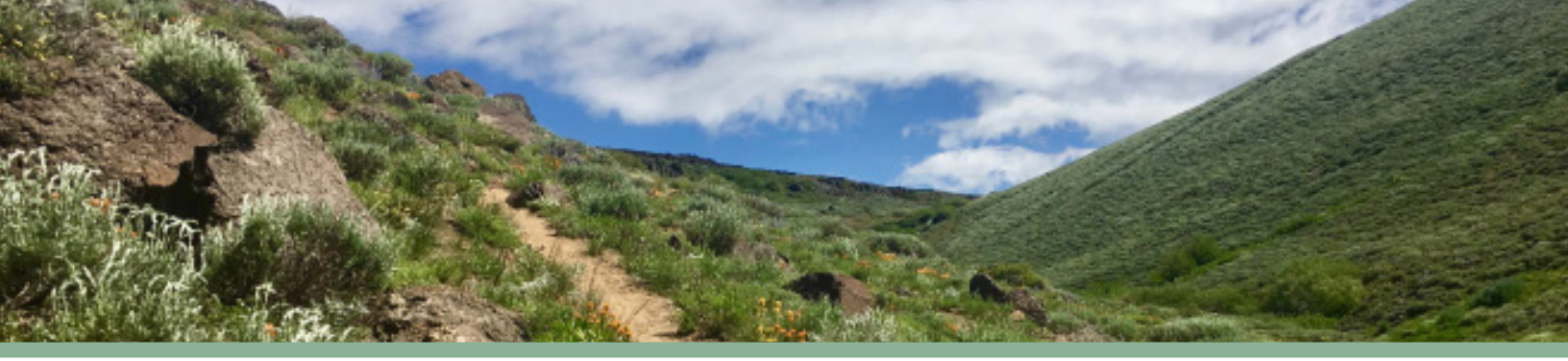
Timber (cont.)

The following data looks at the current industry snapshot, the 1990 estimate if it were duplicated today, and both 10% and 20% changes to the current level of output in the Forest Service managed lands. These results were successfully checked with the TREAT model that the Forest Service economists use for verification (Sorenson, et.al 2015):

Malheur County			Employment	Output
Current Commercial Logging			28.8	$4.05 million
Share in National Forest Land	0%			N/A
		1990 FS Direct Output	Employment	Output
Total Economic Impact of 1990 Output Levels (est. 8x current production/ output)		N/A	N/A	N/A
10% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
20% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output

Stewardship Contracting in Malheur County

There has not been any stewardship contracting in Malheur County.



MORROW COUNTY, OREGON

BLUES COUNTY PROFILES

Morrow County was created in 1885, and was named after Jackson Lee Morrow, an early settler and member of the Legislative Assembly in the county. The county was created from portions of Umatilla and Wasco County, and its northern border is the Columbia River. Early settlers were cattle ranchers who were drawn to the area by its myriad of rye grass. Ranching declined in the early 1900s due to overgrazing and lack of land, which spurred the growth of agricultural endeavors. The primary industries in Morrow County are agriculture, food processing, utilities, and lumber.

Morrow County quick facts

Date established: February 16, 1885

County seat: Heppner, population 1,295 (2020)

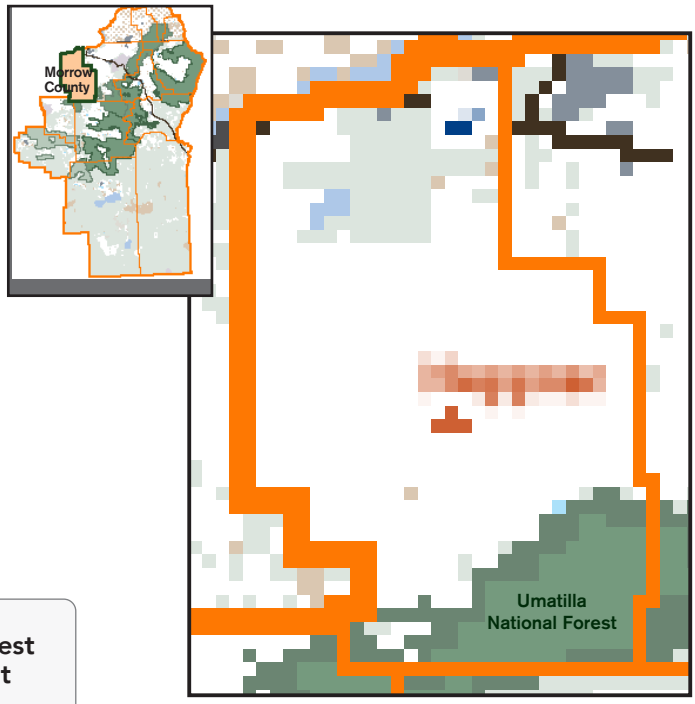
Size: 2,049 square miles

2020 population: 12,825 people

Economy: Agriculture, food processing, dairies, utilities, forest products, livestock, recreation

Public land coverage: 16.1% of county

Forest Service land: 144,198 acres, 11% of county

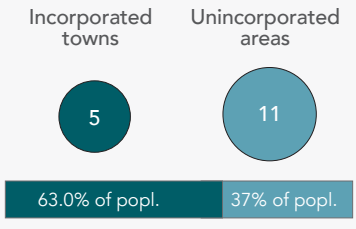


Population & acres of national forest

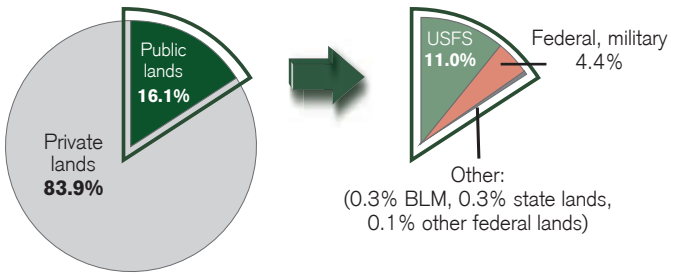
(each person= 5,000 people
each tree= 10,000 acres)

Acres of national forest per county resident

Population centers and Forest Service offices

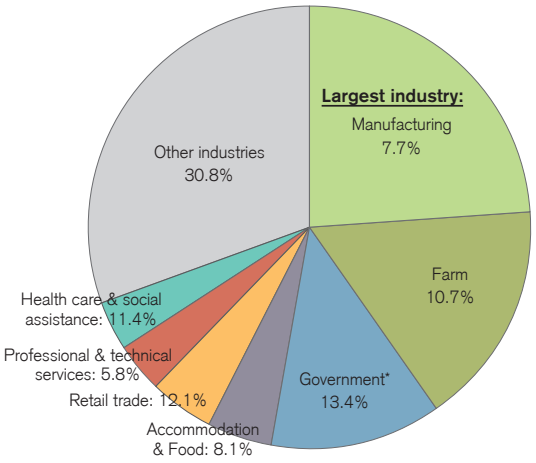


Land ownership



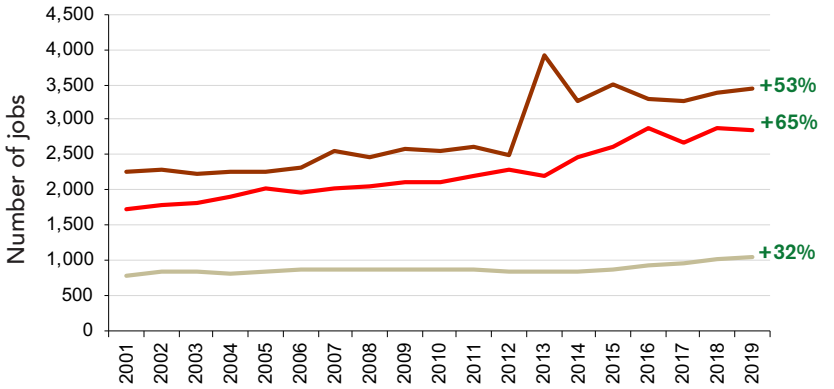
KEY INDUSTRIES:

7 largest industries by number of jobs (2019):



8,281 jobs (2019)

Employment by major industry category and % change, 2001–2019



Services Related — Non-Services Related — Government

Service-related includes: Industries such as retail trade, finance, health care & social assistance, accommodation & food, and education services

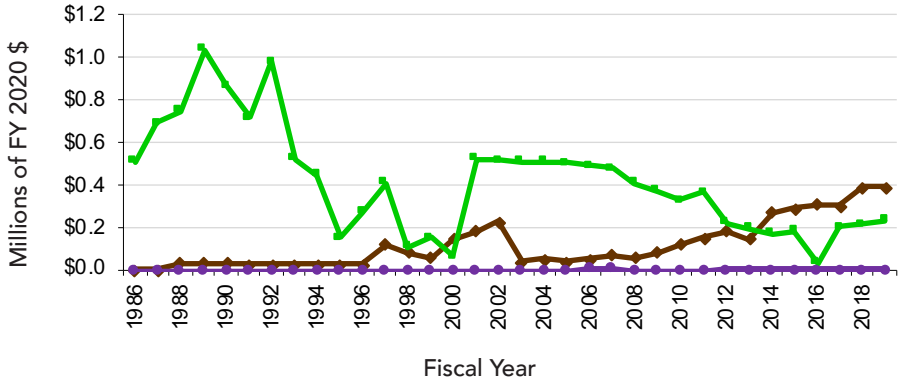
Non-Service Related includes: Industries such as farming, mining, and manufacturing

Government includes: Federal, military, state, and local government employment; government enterprise*

**Government may not include all public employment; some industries that may have public employees (e.g. health care, education services) are classified as service-related industries.*

FEDERAL LAND PAYMENTS:

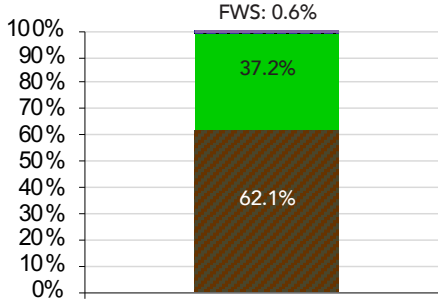
Components of federal land payments per FY, 1986–2019



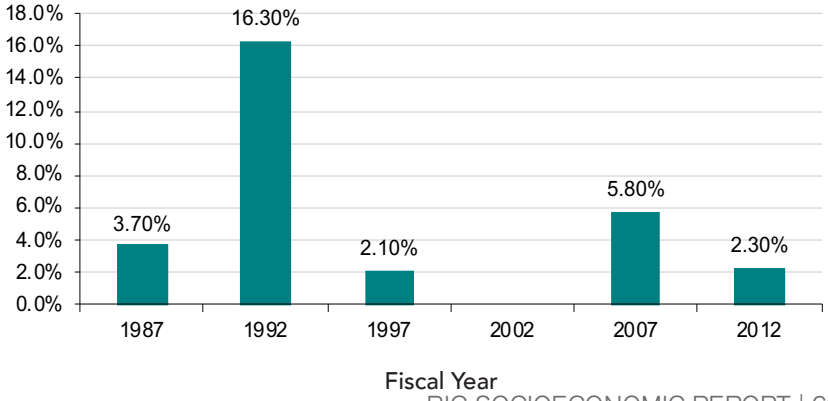
Legend: Payment components

- Forest Service revenue sharing
- PILT (Payments in Lieu of Taxes)
- US Fish and Wildlife Service (FWS) Refuge payments

Components of federal land payments, FY 2019



Federal land payments as % of total general government revenue during select years

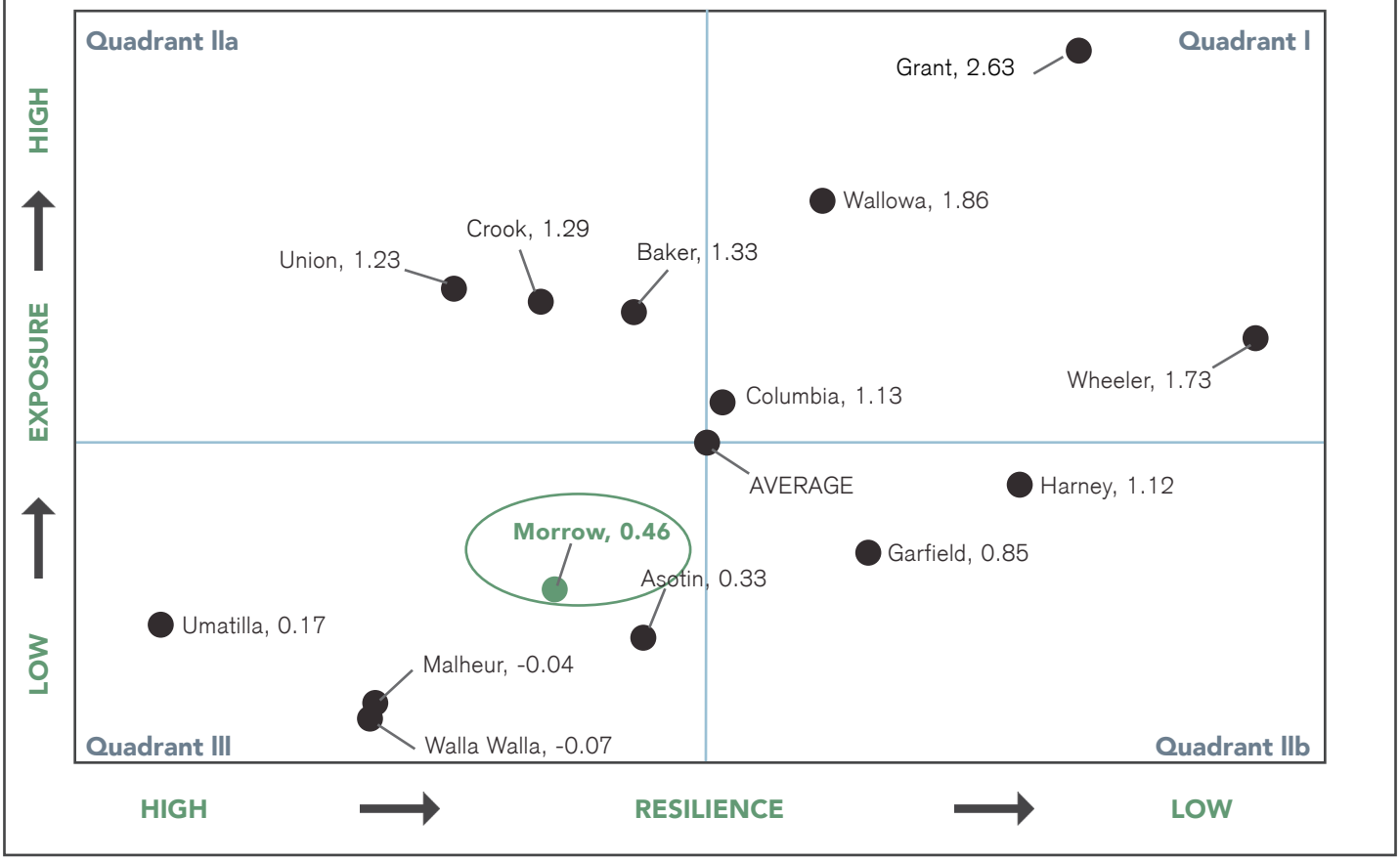


Risk/Opportunity Index (ROI) Summary for Morrow County[1]

Description	County Measure (average of counties)
With a sub-index value of 0.90 compared to the average of 0.94, Morrow County's potential resilience is slightly lower than that of the 14 counties in the study region. This is the case across the three classifications of capital examined. This result is driven primarily by the relatively low rate of home ownership, lowest of the counties in the study area, and also the low level of scenic amenities relative to the other counties.	**Capital** **0.90** (0.94)
Morrow County has a conversion factor of 0.84, indicating that County residents face fewer challenges on average than the other counties of the study area in converting capital resources into resilience. More specifically, Morrow County has somewhat limited metro area and broadband internet access, with the remaining determinants, e.g., presence of an Interstate, freight railroad, college, all working in the County's favor.	**Conversion Factor** **0.84** (0.57)
The capital index conditioned on the conversion factor, results in a relative resilience index for Morrow County of 1.11, about 11% higher than the average across the 14 counties of the study area[2]. This follows directly from the results presented above, and it implies that among these counties, Morrow County is slightly less susceptible to a downturn in the face of an economic shock.	**Economic Resilience** **1.11** (1.00)
The Morrow County economy is less exposed, with a relative exposure index of about 0.57, or about 43% lower than the average across counties in the study area. In the case of Morrow County, this result stems from the fact that the County has less Forest Service land, and consequently also a low level of Forest Service related payments, compared to the other counties in the study area.	**Exposure** **0.57** (1.00)
The ROI for Morrow County is 0.46. The interpretation of this index score is that the County is less susceptible to economic impacts related to changes in Forest Service planning than the average for counties in the study area.	**R/O Index** **0.46** (1.00)

[1] See attached "Risk/Opportunity Index Appendix" for a full breakdown of these measures and explanation of how they were calculated.
[2] Because we want to differentiate between counties, we divide the raw measure for economic resilience and exposure by the average of the 14 counties. This also results in a final county ROI that is relative to the 14 counties.

Scatter Plot: Risk Opportunity Index for Morrow County



The scatter plot above maps out Morrow County's exposure, resilience and resulting ROI in the context of the remaining counties of the study area. In general, counties in quadrant III have a ROI of less than 0.80. This indicates that, relative to the remaining counties, their economies are relatively resilient and less exposed to Forest Service planning decisions than other counties of the study area.

Given their relatively high economic resilience and low exposure to Forest Service activities, counties in this quadrant are least likely to suffer negative consequences to their economy were the Forest Service to shift activities away from the county. Conversely, the low current exposure allows for greater opportunity to boost benefits to economy through increasing Forest Service exposure so long as it effectively targets economic resilience.

Morrow County Analysis

Grazing

In Morrow County, beef and cattle ranching accounts for $90 million of annual output, with 127.79 jobs and average wages of $64,128 per year.

Current Industry Snapshot (includes feedlots and dual-purpose ranching and farming):

2021 Industry Output Morrow County	Employment	Average Employee Compensation	Economic Output
	127.79	**$64,128/yr**	**$90 million**

Economic Benefit of Additional Grazing

Additional 1000 AUMs (either new or currently not in use and placed in use)	Jobs	Economic Output
	2.57	$160,422

2017 Forest Service Data Adjusted for Inflation

Recreation

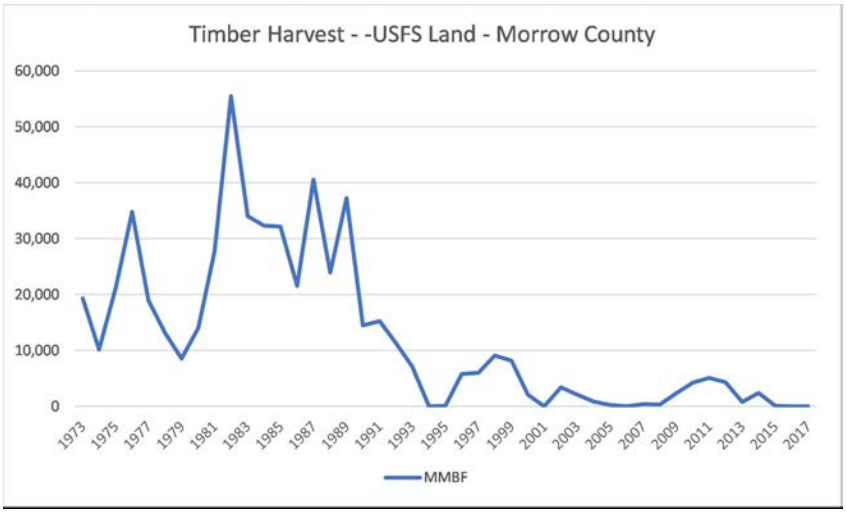
The following analysis measures the impact to Morrow County from lodging, restaurants, grocery purchases and fuel primarily, with some assessment of general tourism spending. This data estimates the effect of a 10% increase in visitation and spending (regardless of use).

Morrow County Tourism Impact from 10% Growth in Tourism on FS Land

Employment	Output
<1	**$25,958**

Timber

Morrow County has a rich history in commercial timber production. In line with the rest of the region, timber has seen a precipitous drop in production and output since 1990 due to environmental legislation, global competition and capital and technological enhancements within the industry.



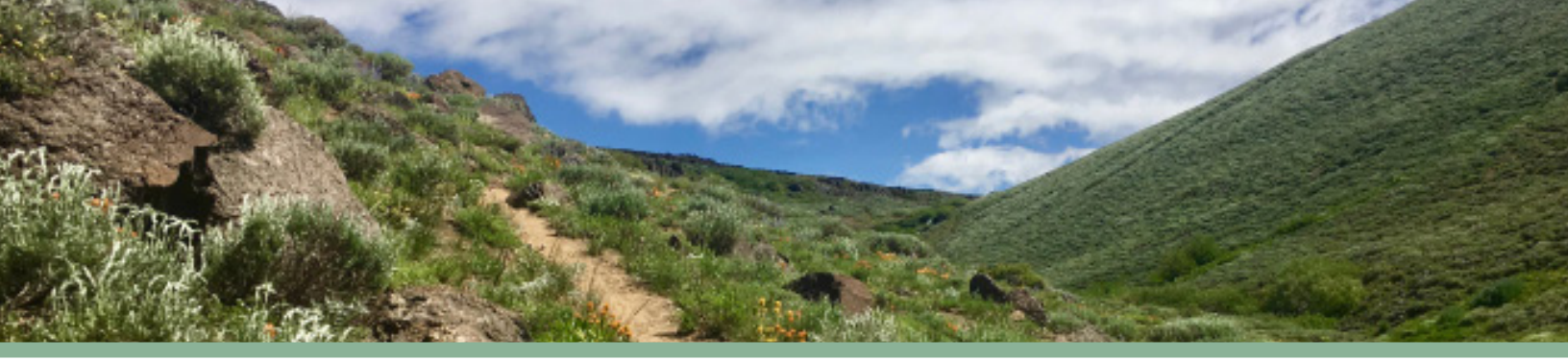
Timber (cont.)

The following data looks at the current industry snapshot, the 1990 estimate if it were duplicated today, and both 10% and 20% changes to the current level of output in the Forest Service managed lands. These results were successfully checked with the TREAT model that the Forest Service economists use for verification (Sorenson, et.al 2015):

Morrow County			Employment	Output
Current Commercial Logging			86.78	$8.78 million
Share in National Forest Land	16.9%			$1.48 million
		1990 FS Direct Output	Employment	Output
Total Economic Impact of 1990 Output Levels (est. 8x current production/ output)		$11.87 million	174.81	$16.3 million
10% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	1.44	$102,376.87	$99,584.12	$148,000.00
2 - Indirect	0.61	$20,205.42	$22,690.13	$33,545.55
3 - Induced	0.13	$4,862.07	$12,776.29	$21,957.31
	2.18	**$127,444.35**	**$135,050.55**	**$203,502.86**
20% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	2.88	$204,753.74	$199,168.25	$296,000.00
2 - Indirect	1.21	$40,410.83	$45,380.27	$67,091.09
3 - Induced	0.26	$9,724.13	$25,552.57	$43,914.63
	4.36	**$254,888.70**	**$270,101.09**	**$407,005.72**

Stewardship Contracting in Morrow County

In Morrow County, there have been $4,225,421 of contracts since 2010, covering 66 projects for an average of $64,021 per contract. According to the Mt. Hood study these contracts should primarily affect commercial thinning and trucking directly, but each contract should generate service work as well. The retained receipts could be used for restoration work in the forest. The additional restoration and service work has a higher multiplier and would result in additional economic activity. If the economic benefits were similar, each $64,021 contract should result in potentially over $512,172 in output and 6 jobs (Daniels, Neilsen-Pincus, Paruszkiewicz, & Poage, 2018).



UMATILLA COUNTY, OREGON

BLUES COUNTY PROFILES

Umatilla County is the most populated of the Blues counties, with over 80,000 residents in 2020. It was created out of part of Wasco County in 1862, and was later broken up to form Grant, Morrow, Union, and Wallowa County. Umatilla County is home to the Confederated Tribes of the Umatilla Indian Reservation, a union of the Cayuse, Umatilla, and Walla Walla Native American tribes who speak Sahaptin and Weyíiletpuu and traditionally inhabited the region. Pioneers of the Oregon Trail passed through Umatilla County, and the gold rush of 1862 increased settlements of miners and cattle ranchers in the area. The county's primary industry is agriculture, however food processing, manufacturing and tourism have increased as it is home to the famous Pendleton Round-Up.

Umatilla County quick facts

Date established: September 27, 1862

County seat: Pendleton, population 17,025 (2020)

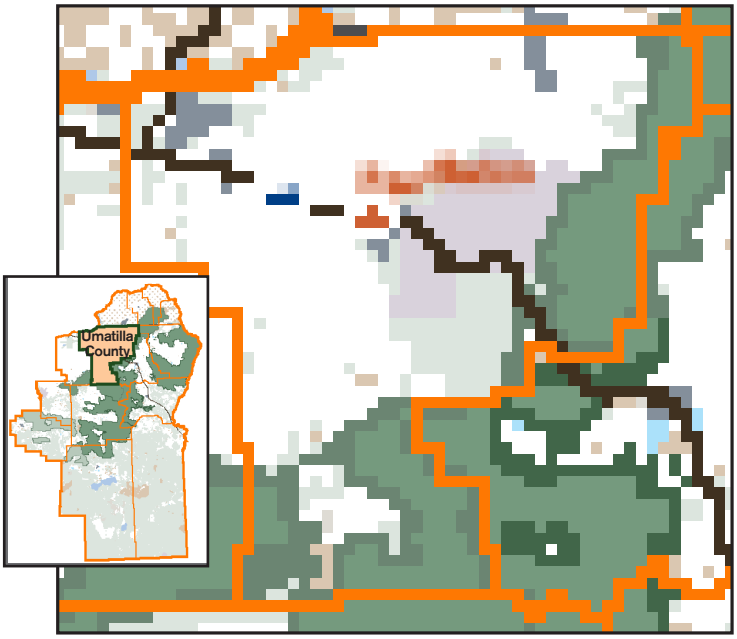
Size: 3,231 square miles.

2020 population: 81,495 people

Economy: Agriculture, food processing, forest products, manufacturing, recreation, aggregate production, wind power generation, and a growing tourism sector

Public land coverage: 36.1% of county

National forest coverage: 403,047 acres, 19.5% of county



Population & acres of national forest

(each person= 5,000 people
each tree= 10,000 acres)

81,495 people

403,047 acres

Acres of national forest per county resident

4.94

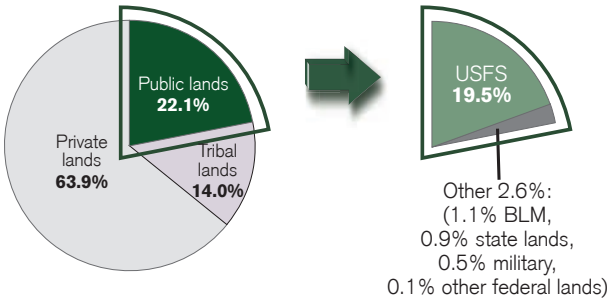
Population centers and Forest Service offices

Incorporated towns	Unincorporated areas	2 Forest Service office locations
12	29	1 Ranger District, 1 Supervisors Office,

72.7% of popl. | 27.3%

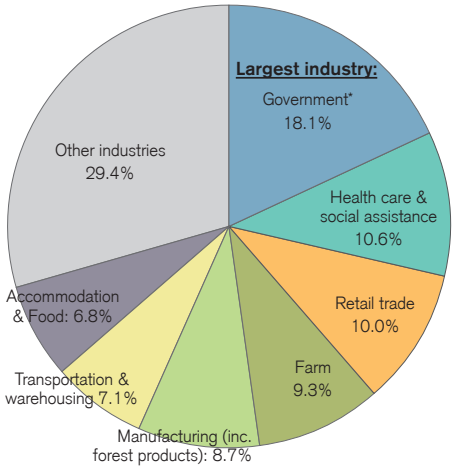
U.S. Forest Service land
Other federal land
Reservation/Native American
State
Urban
Private
Water

Land ownership



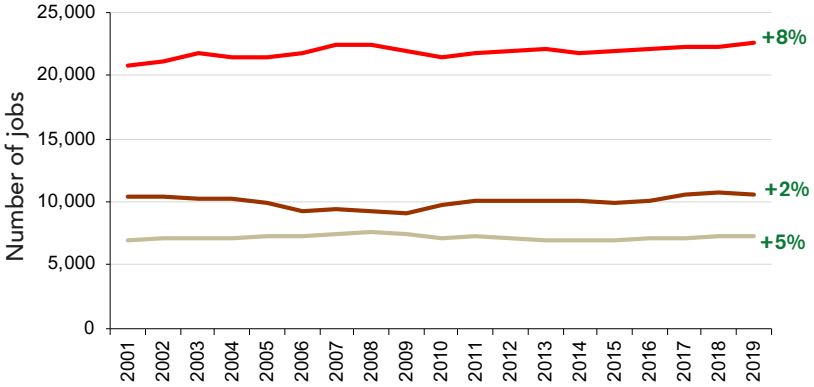
KEY INDUSTRIES:

7 largest industries by number of jobs (2019):



40,556 jobs (2019)

Employment by major industry category and % change, 2001–2019



Services Related — Non-Services Related — Government

Service-related includes: Industries such as retail trade, finance, health care & social assistance, accommodation & food, and education services

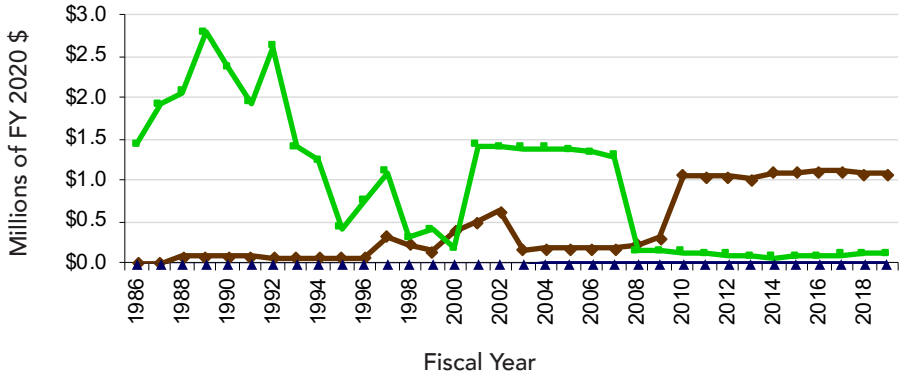
Non-Service Related includes: Industries such as farming, mining, and manufacturing

Government includes: Federal, military, state, and local government employment; government enterprise*

**Government may not include all public employment; some industries that may have public employees (e.g. health care, education services) are classified as service-related industries.*

FEDERAL LAND PAYMENTS:

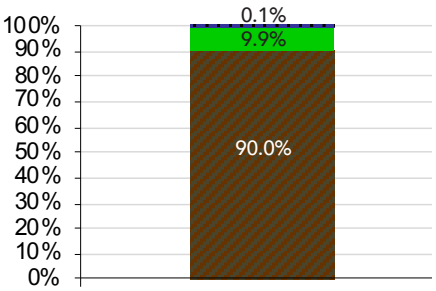
Components of federal land payments per FY, 1986–2019



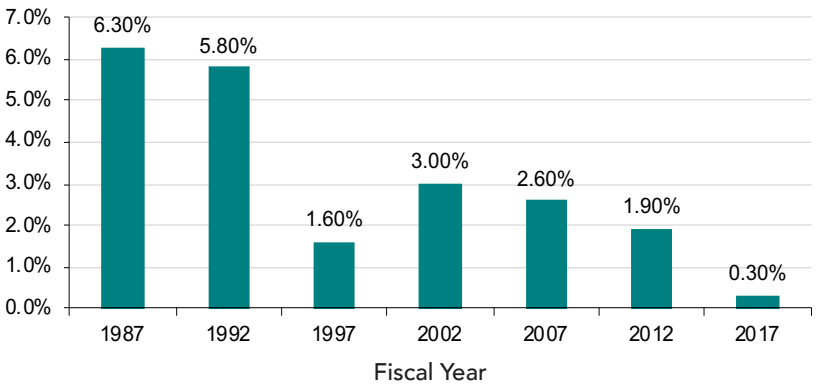
Legend: Payment components

- Forest Service revenue sharing
- PILT (Payments in Lieu of Taxes)
- Bureau of Land Mangement revenue sharing

Components of federal land payments, FY 2019



Federal land payments as % of total general government revenue during select years

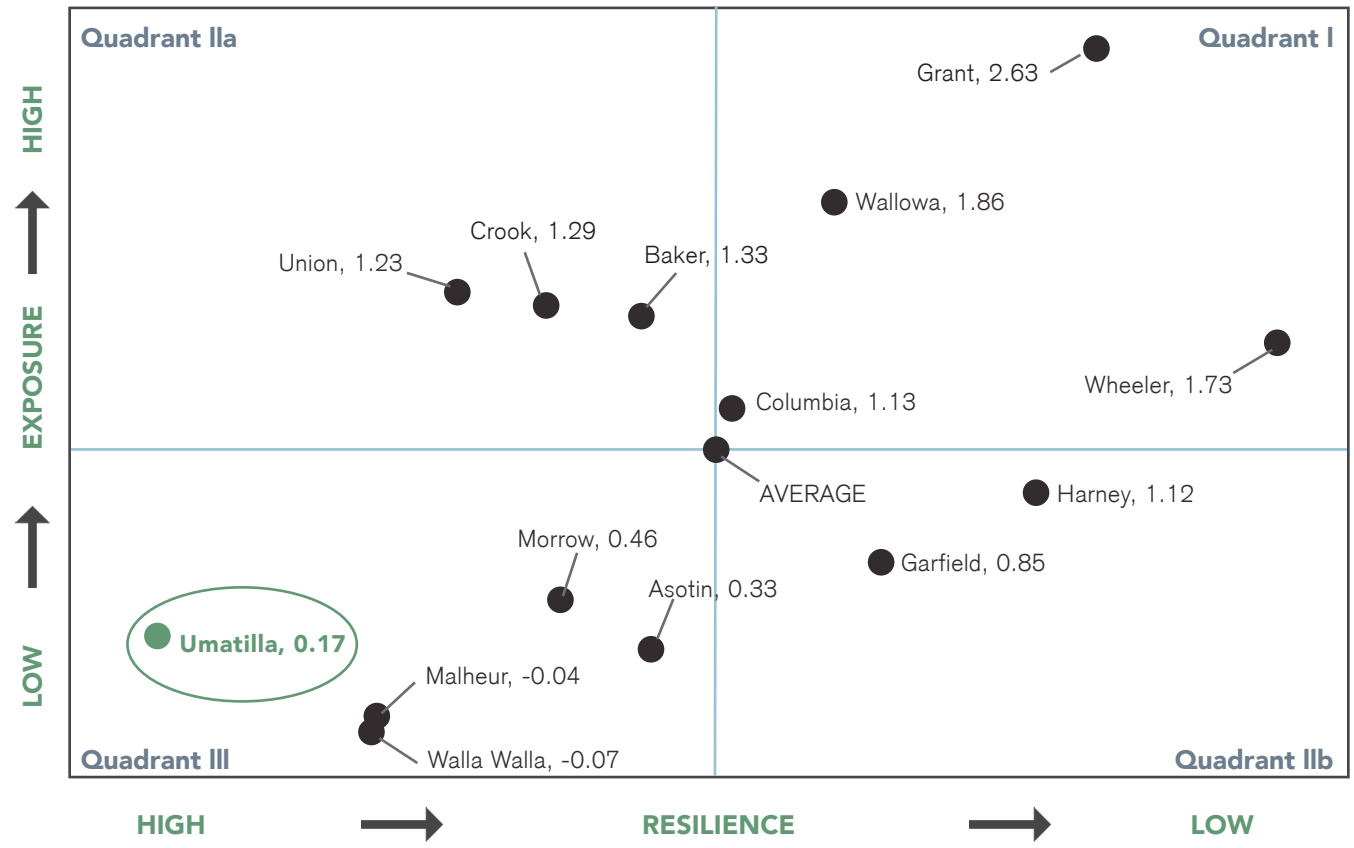


Risk/Opportunity Index (ROI) Summary for Umatilla County[1]

Description	County Measure (average of counties)
With a sub-index value of 1.12 compared to the average of 0.94, Umatilla County's potential resilience is slightly higher than the average of the 14 counties in the study region. Although it has the third highest poverty rate of the 14 counties, overall the County benefits from a relatively high population density, the second highest of the counties in the study area.	**Capital** **1.12** (0.94)
Compared with other counties, Umatilla County has a conversion factor of 0.92, the highest of the 14 counties in the study area, which indicates Umatilla County residents face relatively fewer challenges than the other counties in converting capital resources into resilience. More specifically, Umatilla County marks as either "present" or is above average for each attribute, e.g., presence of an Interstate, freight railroad, college.	**Conversion Factor** **0.92** (0.57)
The capital index conditioned on the conversion factor, results in a relative resilience index for Umatilla County of 1.44, about 43% highest of the 14 counties of the study area. This follows directly from the results presented above, and it implies that among these counties, Umatilla County is somewhat less susceptible to a downturn in the face of an economic shock.	**Economic Resilience** **1.44** (1.00)
The Umatilla County economy is less exposed, with a relative exposure index of about 0.62, or about 38% lower than the average across counties in the study area. In the case of Umatilla County, this result stems primarily from the fact that the County draws substantially lower Forest Service related payments compared to the other counties in the study area.	**Exposure** **0.62** (1.00)
The ROI for Umatilla County is 0.17. The interpretation of this index score is that Umatilla County is less susceptible to economic impacts related to changes in Forest Service planning than the average for counties in the study area.	**R/O Index** **0.17** (1.00)

[1] See attached "Risk/Opportunity Index Appendix" for a full breakdown of these measures and explanation of how they were calculated.
[2] Because we want to differentiate between counties, we divide the raw measure for economic resilience and exposure by the average of the 14 counties. This also results in a final county ROI that is relative to the 14 counties.

Scatter Plot: Risk Opportunity Index for Umatilla County



The scatter plot above maps out Umatilla County's exposure, resilience and resulting ROI in the context of the remaining counties of the study area. In general, counties in quadrant III have a ROI of less than 0.80. This indicates that, relative to the remaining counties, their economies are relatively resilient and less exposed to Forest Service planning decisions than other counties of the study area.

Given their relatively high economic resilience and low exposure to Forest Service activities, counties in this quadrant are least likely to suffer negative consequences to their economy were the Forest Service to shift activities away from the county. Conversely, the low current exposure allows for greater opportunity to boost benefits to economy through increasing FS exposure so long as it effectively targets economic resilience.

To the extent that the ROI is a descriptive rather than prescriptive tool, additional insights are limited and need to be considered with care. With this caution in mind, based on observations made in developing the ROI and a ground truthing session we offer the following:

- Native American lands exert an important influence on the access to public land in Umatilla County. In practice, the result is often more limited access to Forest Service land for recreation and game management. Consequently, the income generating potential of these lands is diminished relative to similar land in other counties. This is not accounted for in the ROI, and may represent an opportunity to refine Forest Service activities with an eye toward increased access and income.

- Umatilla County includes quite a lot of land that is public but with special restrictions. This includes portions along the Columbia, McNary Dam, and the Umatilla Army Depot, for example. To the extent that these lands are lumped in with less restricted public lands in calculating the ROI, their utility to the County economy may be overstated, implying that Umatilla County is slightly less economically resilience than reflected by its current ROI value.

- Umatilla County has very distinct boundaries related to Forest Service exposure/dependence. The Pendleton area has a significant Forest Service personnel

presence. The Ukiah region has significant Forest Service lands. The area around Milton-Freewater is intermediate—the Forest Service presence there is moderate. The western portion of the county has very little Forest Service presence. Thus, portions of Umatilla County are more "exposed" to Forest Service management than other parts of the county. In developing its forest plan, the Forest Service needs to consider this within-county diversity of influence.

- Umatilla County has forest inventory that could be more intensively managed. Possible priority areas include recreation development, for example, Ukiah cabins, downhill skiing at Spout Springs, additional cross-country skiing, and flood restoration. According to residents a dollar of additional exposure could generate more than a dollar of resilience assuming it is used properly, i.e., via additional recreation development and commercial harvest that avoids forest deterioration.

Umatilla County Analysis

Grazing

In Umatilla County, beef and cattle ranching accounts for $33.9 million of annual output, with 150.69 jobs and average wages of $39,869 per year.

Current Industry Snapshot (includes feedlots and dual-purpose ranching and farming):

2021 Industry Output Umatilla County	Employment	Average Employee Compensation	Economic Output
	150.69	**$39,869/yr**	**$33.9 million**

Economic Benefit of Additional Grazing

Additional 1000 AUMs (either new or currently not in use and placed in use)	Jobs	Economic Output
	2.57	$160,422

2017 Forest Service Data Adjusted for Inflation

Recreation

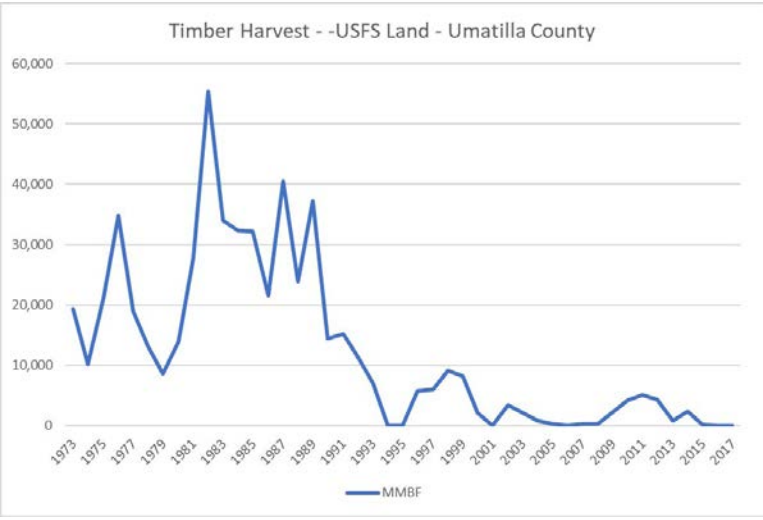
The following analysis measures the impact to Umatilla County from lodging, restaurants, grocery purchases and fuel primarily, with some assessment of general tourism spending. This data estimates the effect of a 10% increase in visitation and spending (regardless of use).

Umatilla County Tourism Impact from 10% Growth in Tourism on FS Land

Employment	Output
4.42	**$382,859**

Timber

Umatilla County has a rich history in commercial timber production. In line with the rest of the region, timber has seen a precipitous drop in production and output since 1990 due to environmental legislation, global competition and capital and technological enhancements within the industry.



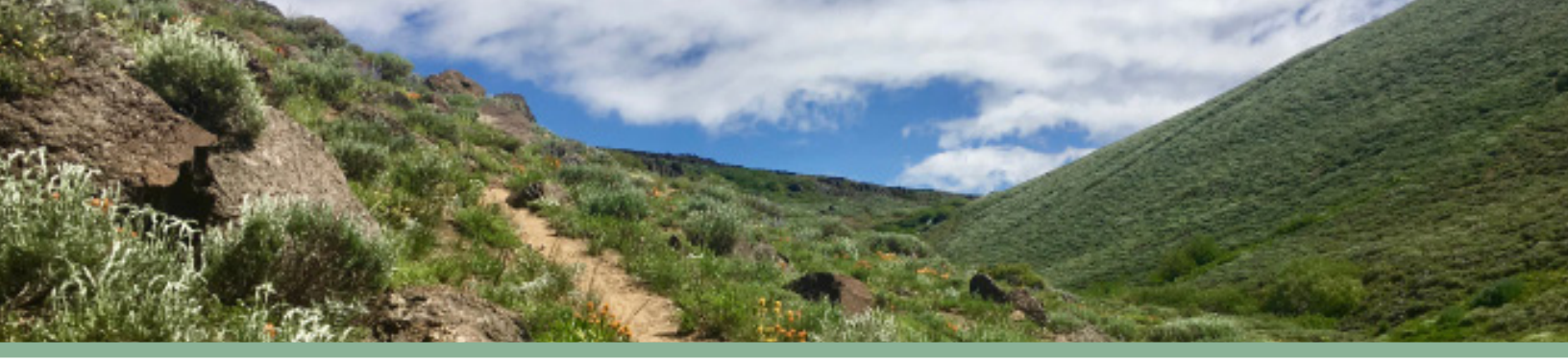
Timber (cont.)

The following data looks at the current industry snapshot, the 1990 estimate if it were duplicated today, and both 10% and 20% changes to the current level of output in the Forest Service managed lands. These results were successfully checked with the TREAT model that the Forest Service economists use for verification (Sorenson, et.al 2015):

Umatilla County			Employment	Output
Current Commercial Logging			75	$16.9 million
Share in National Forest Land	16.20%			$2.74 million
		1990 FS Direct Output	Employment	Output
Total Economic Impact of 1990 Output Levels (est. 8x current production/ output)		$21.9 million	201.31	$34.7 million
10% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	1.19	$231,671.14	$233,936.28	$273,780.00
2 - Indirect	0.38	$16,391.10	$17,638.06	$24,374.30
3 - Induced	0.95	$41,295.08	$75,532.70	$134,077.44
	2.53	**$289,357.32**	**$327,107.03**	**$432,231.73**
20% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	2.39	$463,342.28	$467,872.55	$547,560.00
2 - Indirect	0.76	$32,782.21	$35,276.11	$48,748.59
3 - Induced	1.91	$82,590.16	$151,065.39	$268,154.87
	5.06	**$578,714.64**	**$654,214.06**	**$864,463.47**

Stewardship Contracting in Umatilla County

In Umatilla County, there have been $14,802,306 of contracts since 2010, covering 315 projects for an average of $46,991 per contract. According to the Mt. Hood study these contracts should generate over $372,638 of economic activity, primarily affecting commercial thinning and trucking directly, but each contract should generate service work as well. The retained receipts could be used for restoration work in the forest. The additional restoration and service work has a higher multiplier and would result in additional economic activity. If the economic benefits were similar, each $46,991 contract should result in potentially over $372,638 in output and 5 jobs (Daniels, Neilsen-Pincus, Paruszkiewicz, & Poage, 2018).



UNION COUNTY, OREGON

BLUES COUNTY PROFILES

Union County was established in 1864 and named after the community's support of the Union Army during the Civil War. Increased settlements in the Grand Ronde Valley led to the creation of Union County out of a section of Baker County. Initial settlers were focused on mining the area, however, when mining became more popular in the neighboring Baker County, Union became a predominantly farming based county. In addition to farming, the area's economic activity grew in cattle and sheep raising, as well as timber. Union County is also home to Eastern Oregon University, a large contributor to employment and income in the area.

Union County quick facts

Date established: October 14, 1864

County seat: La Grande, population 13,460 (2020)

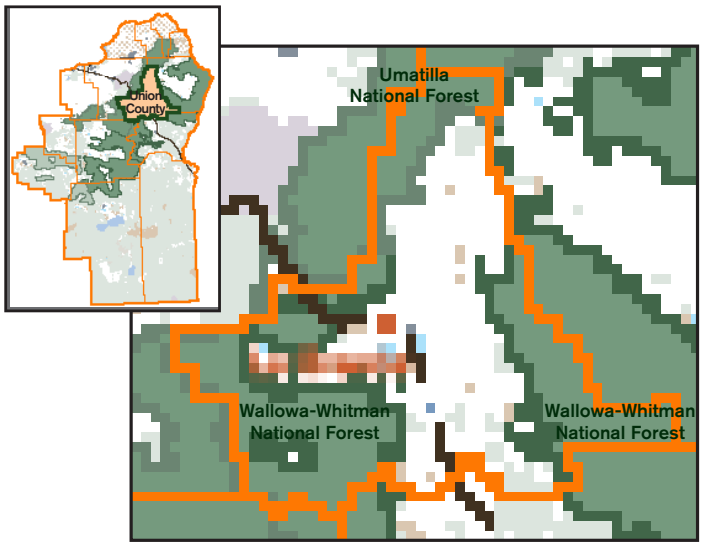
Size: 2,038 square miles

2020 population: 26,840 people

Economy: Agriculture, forest products, education, government

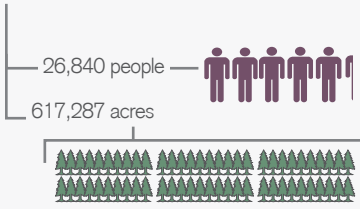
Public land coverage: 48.7% of county

National forest coverage: 617,287 acres; 47.3% of county



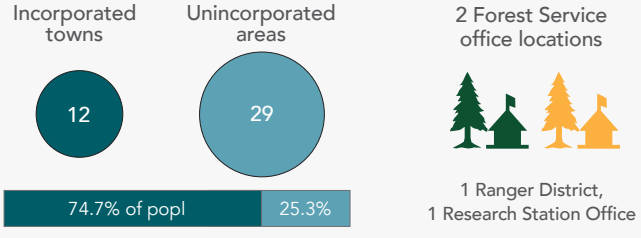
Population & acres of national forest

(each person= 5,000 people
each tree= 10,000 acres)

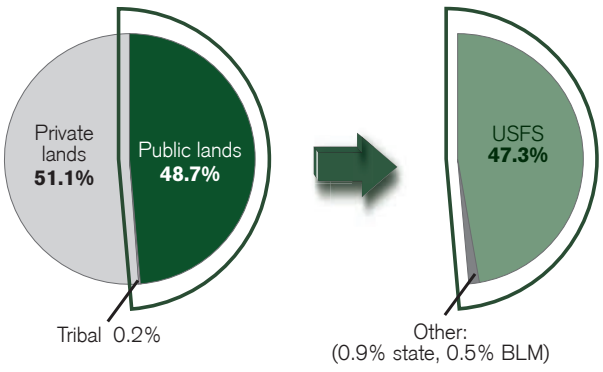


Acres of national forest per county resident

Population centers and Forest Service offices

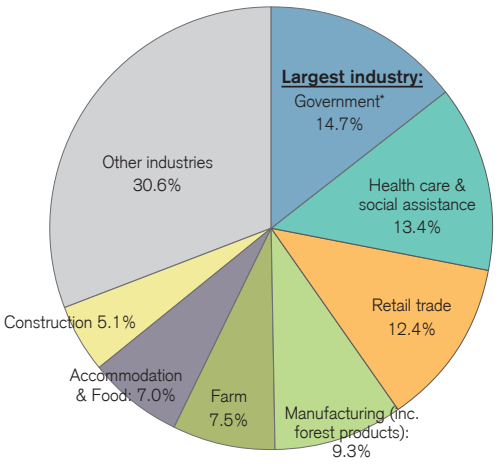


Land ownership



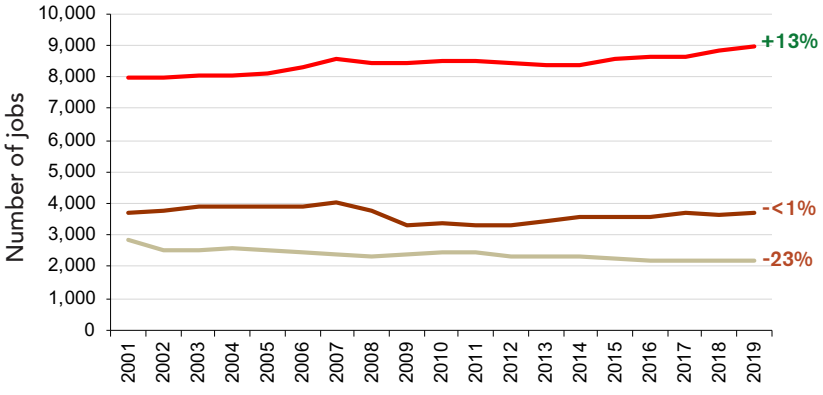
KEY INDUSTRIES:

7 largest industries by number of jobs (2019):



14,898 jobs (2019)

Employment by major industry category and % change, 2001-2019



Services Related — Non-Services Related — Government

Service-related includes: Industries such as retail trade, finance, health care & social assistance, accommodation & food, and education services

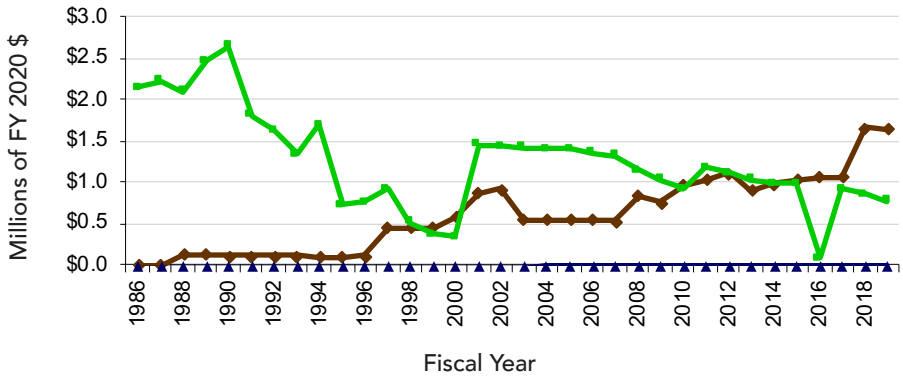
Non-Service Related includes: Industries such as farming, mining, and manufacturing

Government includes: Federal, military, state, and local government employment; government enterprise*

**Government may not include all public employment; some industries that may have public employees (e.g. health care, education services) are classified as service-related industries.*

FEDERAL LAND PAYMENTS:

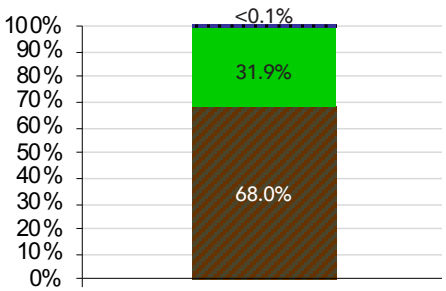
Components of federal land payments per FY, 1986–2019



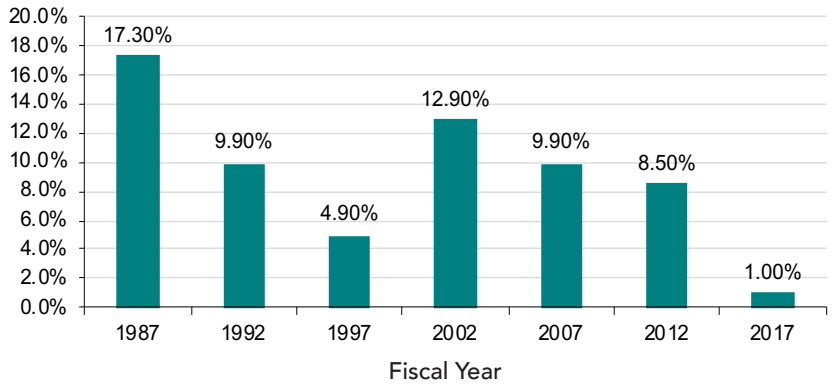
Legend: Payment components

- Forest Service revenue sharing
- PILT (Payments in Lieu of Taxes)
- Bureau of Land Mangement revenue sharing

Components of federal land payments, FY 2019



Federal land payments as % of total general government revenue during select years



Risk/Opportunity Index (ROI) Summary for Union County[1]

Description	County Measure (average of counties)
Union County's capital index of 1.03 is above the average of 0.94 for the 14 counties in the study region. This is driven primarily by the County's higher than average population density, number of firms and use of water for irrigation. These measures more than compensate for relatively low estimates of farmland per person and economic diversity.	**Capital** **1.03** (0.94)
Compared with other counties, Union County has a higher than average "conversion factor" of 0.71, or rather, its residents face relatively lower barriers to converting the capital that the county has available into resilience. Looking at the detail table, Union County is lacking a commercial airport and has slightly lower broadband access, but the remaining attributes more than make up for these challenges.	**Conversion Factor** **0.71** (0.57)
The capital index conditioned on the conversion factor, results in a relative resilience index for Union County of 1.17, higher than the average across all the counties.[2] Given Union County's above average capital index and conversion factor this is expected, and it implies that the county would resist more, and recover quicker from, an economic shock.	**Economic Resilience** **1.17** (1.00)
Union County has nearly double the average percentage of Forest Service land. This coupled with the slightly aboveaverage estimates related to income and federal payments result in a relative exposure index of 1.41 for Union County—about 41% higher than the average, implying that, relative to the remaining counties, the Union County economy is more exposed to Forest Service planning decisions.	**Exposure** **1.41** (1.00)
The ROI for Union County is 1.23, substantially higher than the average of the counties, implying that the economy of Union County is relatively susceptible to economic impacts related to changes in Forest Service policies. The primary driver of this is the high exposure due to significant Forest Service land coverage.	**R/O Index** **1.23** (1.00)

[1] See attached "Risk/Opportunity Index Appendix" for a full breakdown of these measures and explanation of how they were calculated.
[2] Because we want to differentiate between counties, we divide the raw measure for economic resilience and exposure by the average of the 14 counties. This also results in a final county ROI that is relative to the 14 counties.

Scatter Plot: Risk Opportunity Index for Union County

The scatter plot above maps out Union County's exposure, resilience and resulting ROI in the context of the remaining counties of the study area. In general, counties in quadrant II have an intermediate ROI of between 0.80 and 1.30. This indicates that, relative to the remaining counties, their economies are moderately susceptible to Forest Service planning decisions. In addition, the ROI places Union County in quadrant IIa indicating that the county's high exposure to Forest Service activity, rather than exceptionally low resilience, is the reason for this intermediate ROI value.

Given this relative position, in general terms, risk to the Union County economy involves shifts in Forest Service activities that could reduce benefits to the economy. The opportunity that Union County's position represents relates to refining Forest Service activities with an eye towards building additional economic resilience.

To the extent that the ROI is a descriptive rather than prescriptive tool, additional insights are limited and need to be considered with care. With this caution in mind, we offer the following:

- The elements comprising the ROI include the percentage of county land under Forest Service management. In the case of Union County, the Forest Service controls slightly more that 43% of the total land. This places the county among those with the highest percentage of Forest Service holdings. Consequently, a few observations gained during the follow-up ground truthing session for Union County may be useful. The first is that recreation is correctly flagged as important in Union County. Continued development of the forest with recreation in mind could benefit the county, for example, investing in restoration that supports recreation development. Also, given the extent of Forest Service land, the low levels of harvest over the past two decades, and the increasing risk of wildfire, it is possible to increase harvest levels and benefit the recreation resource. Lastly, maintaining or increasing harvest levels would also benefit the county by helping to maintain investments in human capital and technology related to logging and milling, and sustain the job and income benefits generated by this sector.

- Union County's ROI points toward the importance of water for irrigation. Many climate forecasts predict an extended period of lower-than-average rainfall. Forest Service management is one of many tools that can be engaged to compensate for, and mitigate against, potential degradation of this key resource. Modelling from the PNW lab (Wenatchee) and regional universities suggest the potential for improved capture, storage and late summer release of precipitation from well-designed restoration treatments.

Union County Analysis

Grazing

In Union County, beef and cattle ranching accounts for $14.8 million of annual output, with 64.3 jobs and average wages of $38,000 per year.

Current Industry Snapshot (includes feedlots and dual-purpose ranching and farming):

2021 Industry Output Union County	Employment	Average Employee Compensation	Economic Output
	64.3	**$38,000/yr**	**$14.8 million**

Economic Benefit of Additional Grazing

Additional 1000 AUMs (either new or currently not in use and placed in use)	Jobs	Economic Output
	2.57	$160,422

2017 Forest Service Data Adjusted for Inflation

Recreation

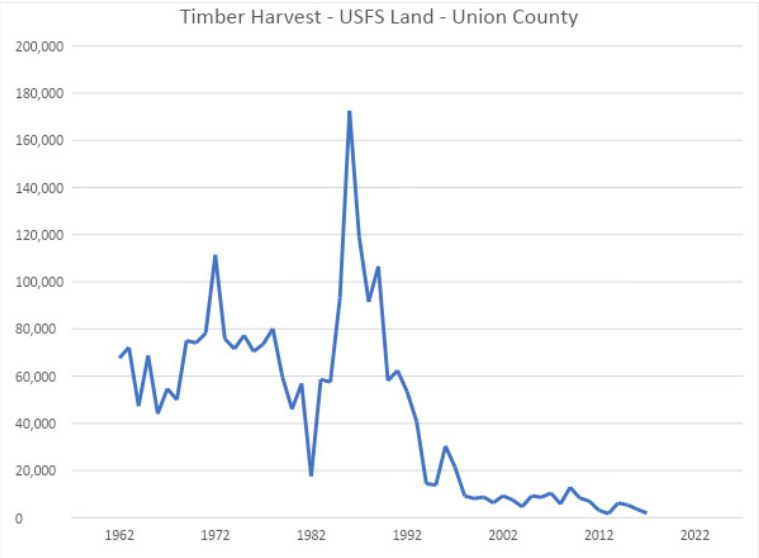
The following analysis measures the impact to Union County from lodging, restaurants, grocery purchases and fuel primarily, with some assessment of general tourism spending. This data estimates the effect of a 10% increase in visitation and spending (regardless of use).

Union County Tourism Impact from 10% Growth in Tourism on FS Land

Employment	Output
3.97	**$327,632**

Timber

Union County has a rich history in commercial timber production. In line with the rest of the region, timber has seen a precipitous drop in production and output since 1990 due to environmental legislation, global competition and capital and technological enhancements within the industry.



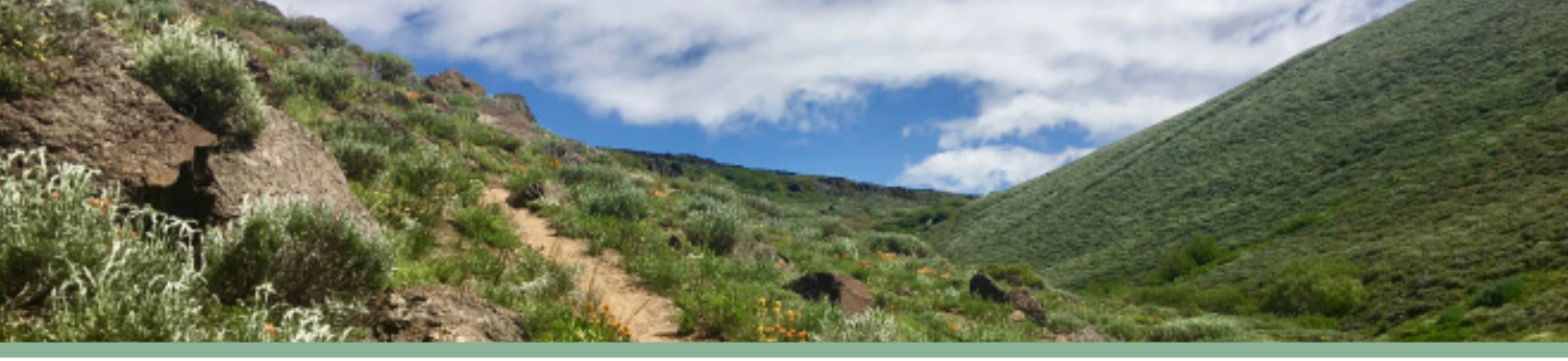
Timber (cont.)

The following data looks at the current industry snapshot, the 1990 estimate if it were duplicated today, and both 10% and 20% changes to the current level of output in the Forest Service managed lands. These results were successfully checked with the TREAT model that the Forest Service economists use for verification (Sorenson, et.al 2015):

Union County			Employment	Output
Current Commercial Logging			51.56	$3.38 million
Share in National Forest Land	18.20%			$615,160
		1990 FS Direct Output	Employment	Output
Total Economic Impact of 1990 Output Levels (est. 8x current production/ output)		$4,921,280	119.37	$7.95 million
10% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	0.92	$26,846.87	$30,259.23	$60,975.00
2 - Indirect	0.40	$9,713.96	$11,025.77	$16,959.16
3 - Induced	0.16	$6,226.93	$11,254.19	$20,562.43
	1.48	**$42,787.76**	**$52,539.19**	**$98,496.59**
20% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	1.84	$53,693.74	$60,518.47	$121,950.00
2 - Indirect	0.79	$19,427.92	$22,051.53	$33,918.32
3 - Induced	0.33	$12,453.86	$22,508.38	$41,124.86
	2.96	**$85,575.52**	**$105,078.38**	**$196,993.18**

Stewardship Contracting in Union County

In Union County, there have been $17,468,281 of contracts since 2010, covering 275 projects for an average of $63,521 per contract. According to the Mt. Hood study these contracts should generate over $500,000 of economic activity, primarily affecting commercial thinning and trucking directly, but each contract should generate service work as well. The retained receipts could be used for restoration work in the forest. The additional restoration and service work has a higher multiplier and would result in additional economic activity. If the economic benefits were similar, each $63,000 contract should result in potentially over $500,000 in output and 6 jobs (Daniels, Neilsen-Pincus, Paruszkiewicz, & Poage, 2018).



WALLOWA COUNTY, OREGON

BLUES COUNTY PROFILES

The Wallowa County area was claimed by the Nez Perce as its hunting and fishing grounds. The Nez Perce used the word "Wallowa" to designate a tripod of poles that supported fish nets. The first white settlers came to the area in 1871, and Wallowa County was carved from Union County by a legislative act county in 1887. The county's landscape is marked by mountains reaching almost 10,000' elevation, and deep canyons such Hells Canyon, which is carved by the Snake River and is the deepest gorge in the nation. Many tourists visit the county for its rugged scenery and excellent outdoor recreation opportunities.

Wallowa County quick facts

Date established: February 11, 1887

County seat: Enterprise, population 1,995 (2020)

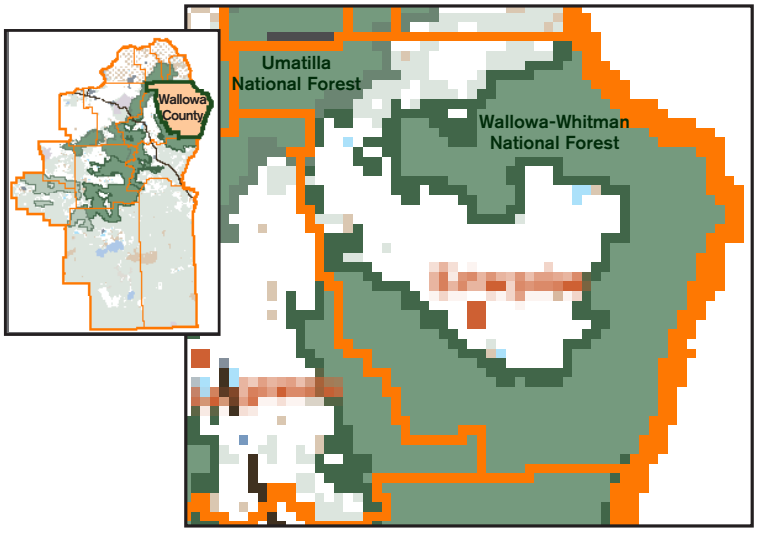
Size: 3,153 square miles

2020 population: 7,160 people

Economy: Agriculture, art, livestock, forest products, recreation

Public land coverage: 58.8% of county

National forest coverage: 1,151,544 acres; 57.1% of county



Population & acres of national forest

(each person= 5,000 people
each tree= 10,000 acres)

7,160 people

1,151,554 acres

Acres of national forest per county resident

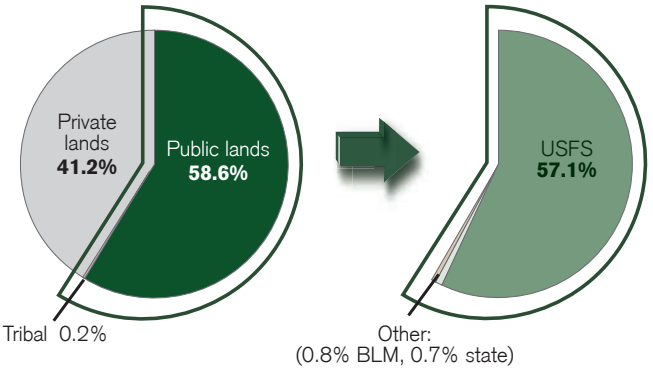
163.3

Population centers and Forest Service offices

Incorporated towns	Unincorporated areas	1 Forest Service office location
4	15	1 Ranger District

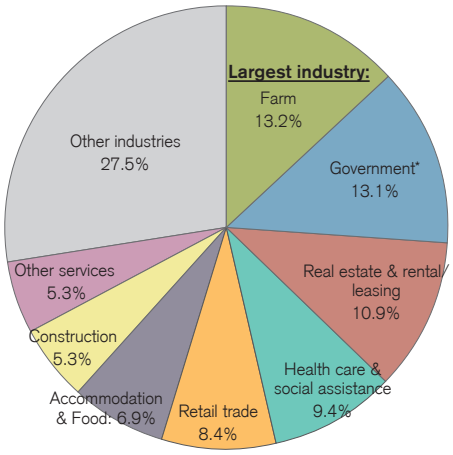
58.9% of popl | 41.1% of popl

Land ownership



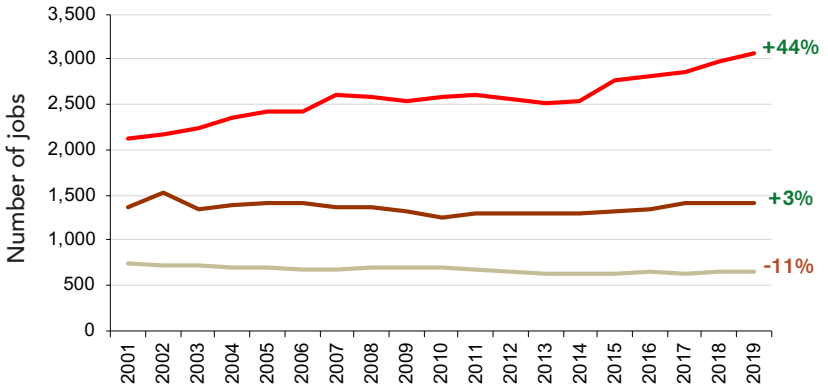
KEY INDUSTRIES:

8 largest industries by number of jobs (2019):



5,066 jobs (2019)

Employment by major industry category and % change, 2001-2019



Services Related | Non-Services Related | Government

Service-related includes: Industries such as retail trade, finance, health care & social assistance, accommodation & food, and education services

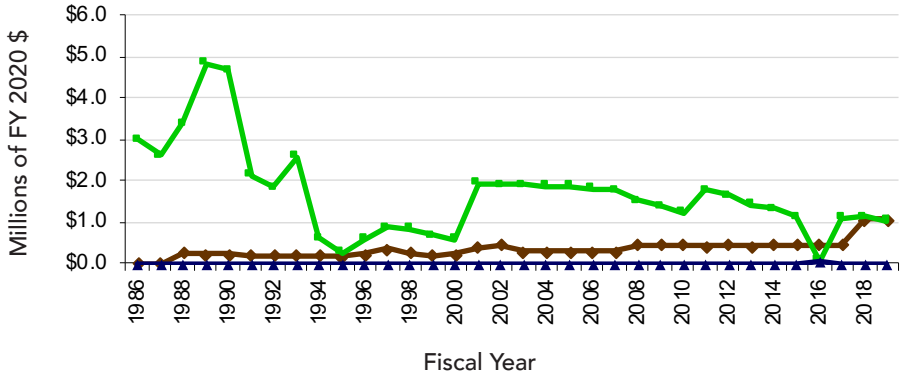
Non-Service Related includes: Industries such as farming, mining, and manufacturing

Government includes: Federal, military, state, and local government employment; government enterprise*

**Government may not include all public employment; some industries that may have public employees (e.g. health care, education services) are classified as service-related industries.*

FEDERAL LAND PAYMENTS:

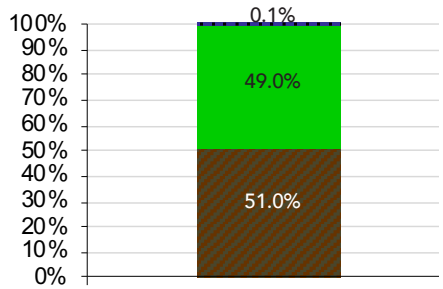
Components of federal land payments per FY, 1986–2019



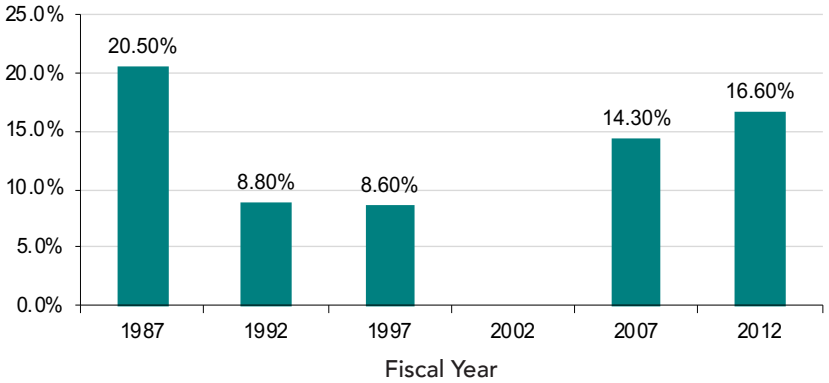
Legend: Payment components

- Forest Service revenue sharing
- PILT (Payments in Lieu of Taxes)
- Bureau of Land Mangement revenue sharing

Components of federal land payments, FY 2019



Federal land payments as % of total general government revenue during select years

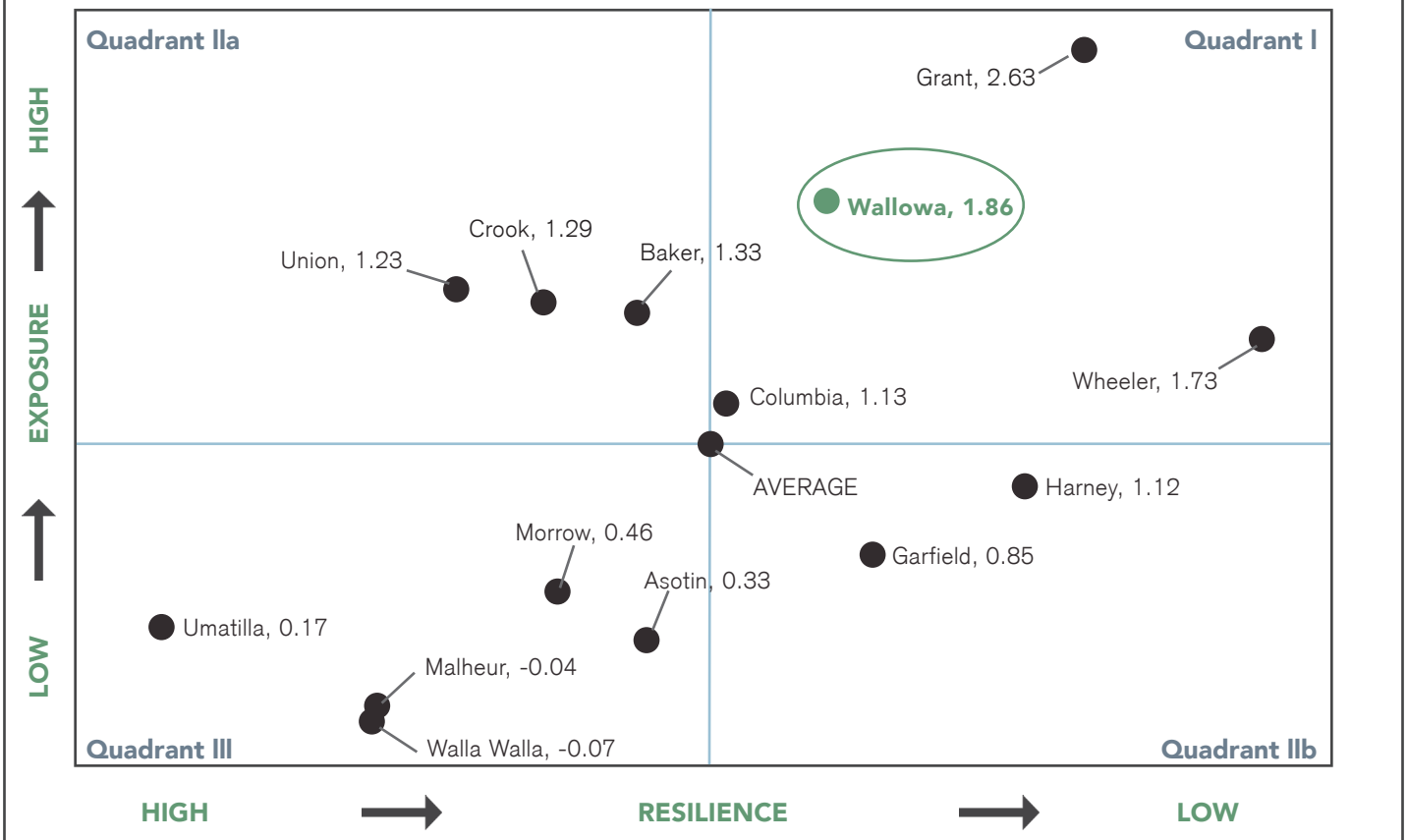


Risk/Opportunity Index (ROI) Summary for Wallowa County[1]

Description	County Measure (average of counties)
Wallowa County's sub-index value of 0.93 indicates that the County's potential economic resilience is slightly lower than the average across the 14 counties in the study region. This result is driven primarily by the relatively high number of vulnerable households and the second lowest earnings per job of the study counties. Wallowa County's potential resilience is boosted somewhat by its significant use of irrigation waters.	**Capital** **0.93** (0.94)
Compared with other counties, Wallowa County's conversion factor of 0.28, indicates that County residents face relatively substantial challenges in converting capital resources into economic resilience. More specifically, Wallowa County marks as "not present" five of the seven attributes, e.g. Interstate highway, metro access, college..., used to gauge links to the outside economy.	**Conversion Factor** **0.28** (0.57)
The capital index conditioned on the conversion factor, results in a relative resilience index for Wallowa County of 0.79, about 21% lower than the average of the 14 counties in the study area. This follows directly from the results presented above, and it implies that among these counties, the Wallowa County economy is more susceptible to an extended downturn in the face of an economic shock.	**Economic Resilience** **0.79** (1.00)
Based on these measures Wallowa County economy is more exposed, with an overall relative exposure index of about 1.65, or about 65% higher than the average across counties in the study area. Indeed, Wallowa County has over twice the average percentage of Forest Service land, and consequently, also a high percentage of Federal payments. This results in an exposure to Forest Service planning that is the second highest of the 14 counties in the study area.	**Exposure** **1.65** (1.00)
The ROI for Wallowa County is 1.86. This is the second highest RO index of the 14 counties, and reflects the County's limited resilience score combined with its very high exposure to Forest Service planning. The interpretation of this index score is that the County is more susceptible to economic impacts related to changes in Forest Service planning than the average for counties in the study area.	**R/O Index** **1.86** (1.00)

[1] See attached "Risk/Opportunity Index Appendix" for a full breakdown of these measures and explanation of how they were calculated.
[2] Because we want to differentiate between counties, we divide the raw measure for economic resilience and exposure by the average of the 14 counties. This also results in a final county ROI that is relative to the 14 counties.

Scatter Plot: Risk Opportunity Index for Wallowa County

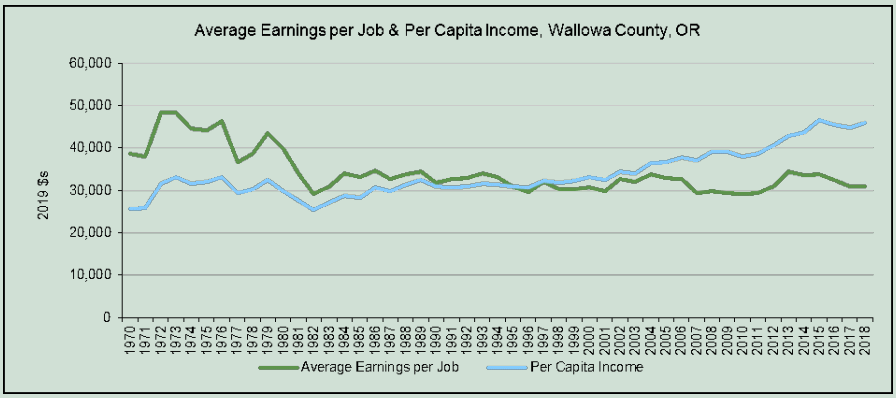


The scatter plot above maps out Wallowa County's exposure, resilience and resulting ROI in the context of the remaining counties of the study area. In general, counties grouped in quadrant I have a high ROI between 1.70 and 2.70 indicating that they are low in economic resilience and high in exposure to Forest Service activities. This indicates that, relative to the remaining counties, their economies are the most susceptible to Forest Service planning decisions.

Given this relative position, in general terms, the Wallowa County economy is among those most likely to suffer negative consequences in the face of shifts in Forest Service management that reduce economic benefits. With the elevated exposure of the County economy in mind, opportunities to build resilience are weighted towards shifting of current Forest Service activities towards those that more effectively build economic resilience.

To the extent that the ROI is a descriptive rather than prescriptive tool, additional insights are limited and need to be considered with care. With this caution in mind, we offer the following based on observations gained through construction of the County's ROI and the ground truthing session held with Wallowa County stakeholders:

- The RO Index does not account for the fact that the population in Wallowa County is experiencing a demographic shift as aging retirees move into the area. The graph below is evidence of this shift. It shows that earnings per job has stayed at slightly more than $30,000/year since 1980, while the county per capita income, which would include retiree income, has risen steadily (Source: Headwaterseconomics.com). This brings up a number of important issues. First, the ROI focuses on earnings per job, which downplays the importance of the role retiree incomes may play. While the ROI is sensitive to the impact that an influx of retirees can have on house prices, specifically, by including a measure of housing cost burdened and home ownership rates, a final interpretation of the ROI for Wallowa County should consider the implications of retiree incomes on county economic resilience. Also, the ROI does not consider how resilience measures



are trending. Against the backdrop of the above graph the implications for economic resilience of this shift need special attention.

- The RO Index places Wallowa County in Quadrant 1—low resilience and high exposure. Given this position, the generic recommendation related to Forest Service planning is to consider refining on-going Forest Service activities to more effectively target economic resilience. The ground truthing discussion participants provided the following specifics.

    1. The Sustainable Rural Schools payment as well as Payments in Lieu of Taxes have experienced dramatic swings in recent years. Meanwhile, Wallowa County's economy is among the smallest of the 14 counties based on the number of establishments, and given the extensive Forest Service land in the county, the county receives an important portion of its public budget from these payment programs. For planning purposes, it is important that the stream of payments be maintained and stabilized.
    2. Similarly, income from, and investment into, the production of forest products has been hurt by low and unpredictable harvest levels. There may also be grazing allotments that are closed simply because the process for awarding them is very slow. We think that there is room to increase income and reduce income variability without a significant tradeoff in recreation, by increasing timber and beef production, and that this could lead to a more resilient economy.

- Wallowa County's ROI points toward the importance of water for irrigation. Unfortunately, many climate forecasts predict an extended period of lower-than-average rainfall. Forest Service management is one of many tools that can be engaged to compensate for, and mitigate against, potential degradation of this key resource. Modelling from the PNW lab (Wenatchee) and regional universities suggest the potential for improved capture, storage and late summer release of precipitation from well-designed restoration treatments.

Wallowa County Analysis

Grazing

In Wallowa County, beef and cattle ranching accounts for $21.8 million of annual output, with 134.88 jobs and average wages of $31,000 per year.

Current Industry Snapshot (includes feedlots and dual-purpose ranching and farming):

2021 Industry Output Wallowa County	Employment	Average Employee Compensation	Economic Output
	134.88	**$31,000/yr**	**$21.8 million**

Economic Benefit of Additional Grazing

Additional 1000 AUMs (either new or currently not in use and placed in use)	Jobs	Economic Output
	2.57	$160,422

2017 Forest Service Data Adjusted for Inflation

Recreation

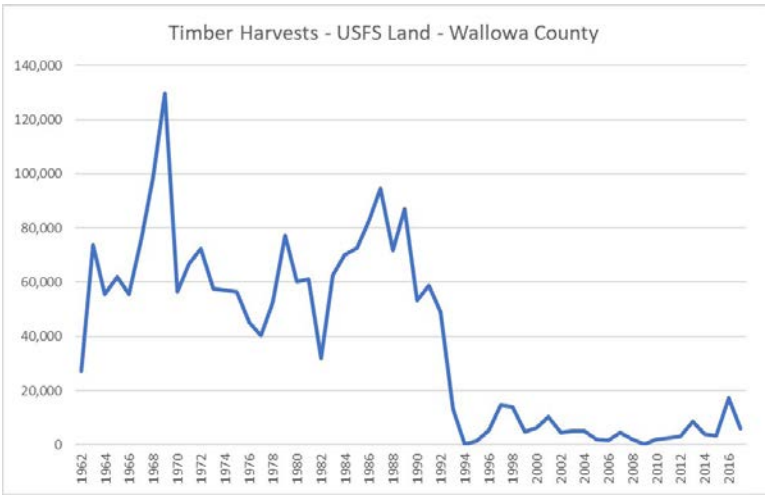
The following analysis measures the impact to Wallowa County from lodging, restaurants, grocery purchases and fuel primarily, with some assessment of general tourism spending. This data estimates the effect of a 10% increase in visitation and spending (regardless of use).

Wallowa County Tourism Impact from 10% Growth in Tourism on FS Land

Employment	Output
2.99	**$249,553**

Timber

Wallowa County has a rich history in commercial timber production. In line with the rest of the region, timber has seen a precipitous drop in production and output since 1990 due to environmental legislation, global competition and capital and technological enhancements within the industry.



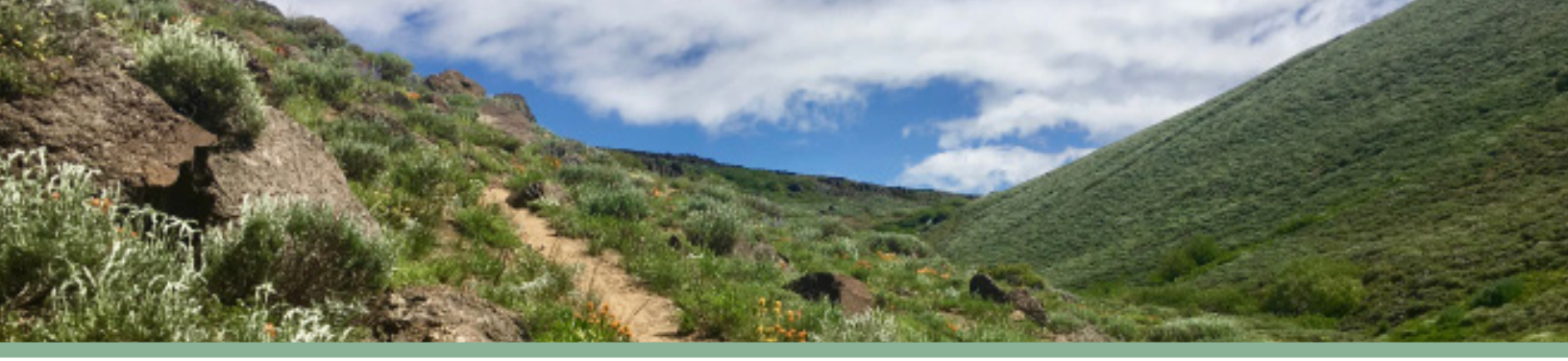
Timber (cont.)

The following data looks at the current industry snapshot, the 1990 estimate if it were duplicated today, and both 10% and 20% changes to the current level of output in the Forest Service managed lands. These results were successfully checked with the TREAT model that the Forest Service economists use for verification (Sorenson, et.al 2015):

Wallowa County			Employment	Output
Current Commercial Logging			76.67	$7.07 million
Share in National Forest Land	13.20%			$933,240
		1990 FS Direct Output	Employment	Output
Total Economic Impact of 1990 Output Levels (est. 8x current production/ output)		$7.47 million	140.85	$11.57 million
10% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	1	$60,817.63	$60,119.98	$93,770.53
2 - Indirect	0.51	$8,376.83	$11,582.37	$19,925.45
3 - Induced	0.26	$6,888.17	$15,449.60	$30,768.05
	1.76	**$76,082.63**	**$87,151.95**	**$144,464.03**
20% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	2.00	$121,635.26	$120,239.96	$187,541.06
2 - Indirect	1.01	$16,753.67	$23,164.75	$39,850.89
3 - Induced	0.51	$13,776.33	$30,899.20	$61,536.09
	3.53	**$152,165.26**	**$174,303.91**	**$288,928.05**

Stewardship Contracting in Wallowa County

In Wallowa County, there have been $3,790,771 of contracts since 2010, covering 132 projects for an average of $28,717 per contract. According to the Mt. Hood study these contracts should generate economic activity, primarily affecting commercial thinning and trucking directly, but each contract should generate service work as well. The retained receipts could be used for restoration work in the forest. The additional restoration and service work has a higher multiplier and would result in additional economic activity. If the economic benefits were similar, each $28,000 contract should result in potentially over $254,800 in output and 3 jobs (Daniels, Neilsen-Pincus, Paruszkiewicz, & Poage, 2018).



WHEELER COUNTY, OREGON

BLUES COUNTY PROFILES

Wheeler county was formed from parts of Grant, Gilliam, and Crook Counties in 1899. It has the smallest population of all Oregon counties, with a population of just 1,440 in 2020, based mostly in its three incorporated population centers (Fossil, Mitchell, and Spray). The county is known for multiple points of geologic and scenic interest, including the Painted Hills, John Day Fossil Beds, and the John Day River. Wheeler County contains parts of the Ochoco and Umatilla National Forests.

Wheeler County quick facts

Date established: February 17, 1899

County seat: Fossil, population 475 (2020)

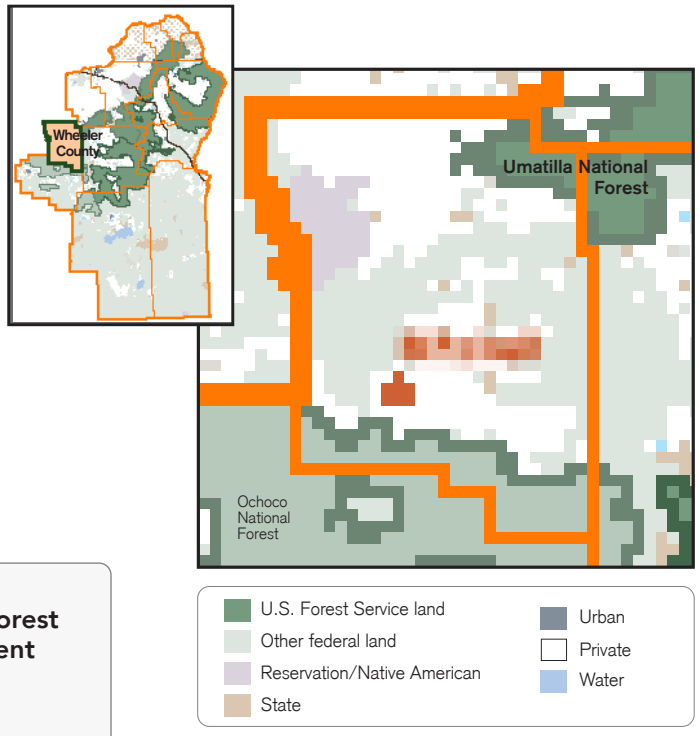
Size: 1,715 square miles

2020 population: 1,440 people

Economy: Livestock, tourism

Public land coverage: 28.8% of county

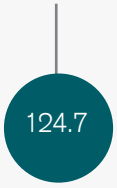
Forest Service land: 169,345 acres, 15% of county



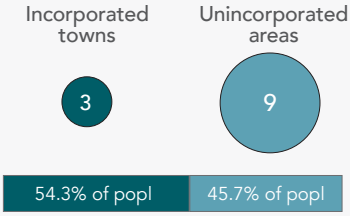
Population & acres of national forest

(each person= 5,000 people
each tree= 10,000 acres)

Acres of national forest per county resident



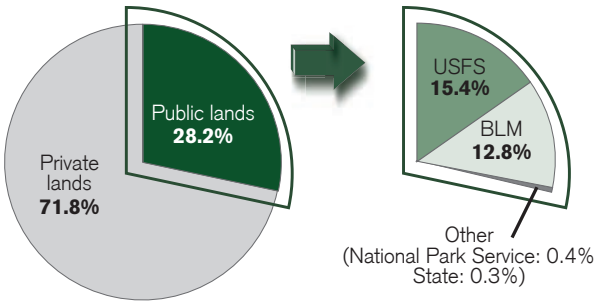
Population centers and Forest Service offices



Forest Service office locations:

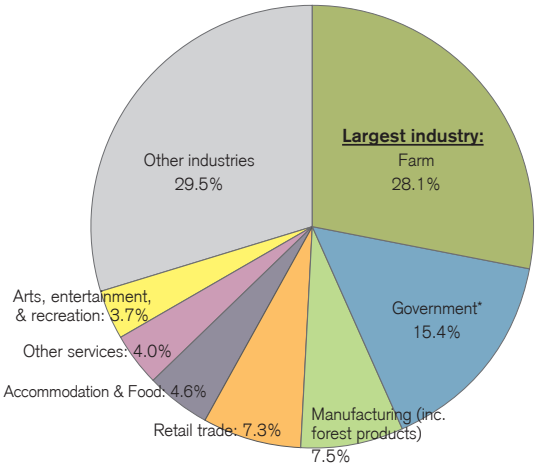
-NONE-

Land ownership



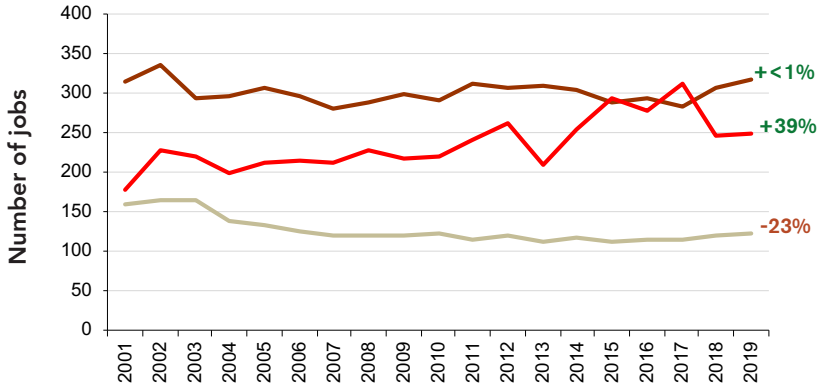
KEY INDUSTRIES:

7 largest industries by number of jobs (2019):



8,779 jobs (2019)

Employment by major industry category and % change, 2001–2019



Services Related — Non-Services Related — Government

Service-related includes: Industries such as retail trade, finance, health care & social assistance, accommodation & food, and education services

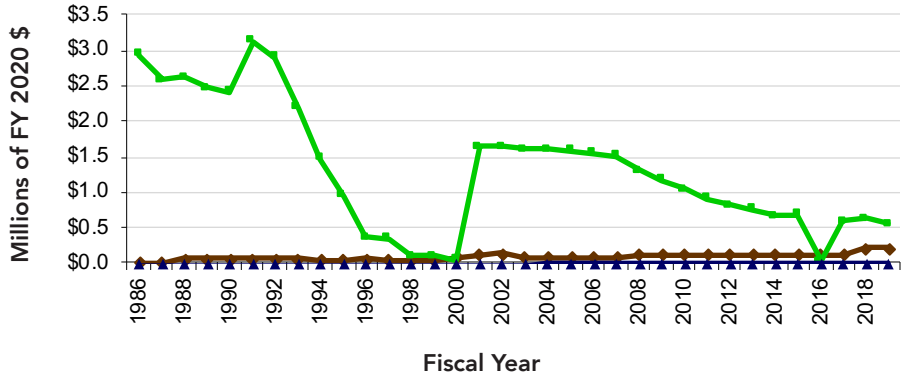
Non-Service Related includes: Industries such as farming, mining, and manufacturing

Government includes: Federal, military, state, and local government employment; government enterprise*

**Government may not include all public employment; some industries that may have public employees (e.g. health care, education services) are classified as service-related industries.*

FEDERAL LAND PAYMENTS:

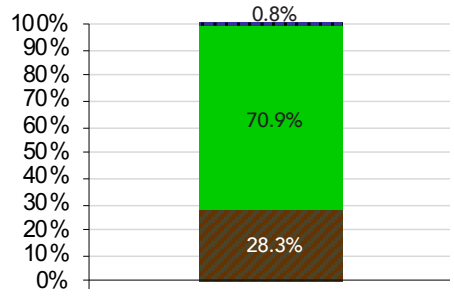
Components of federal land payments per FY, 1986–2019



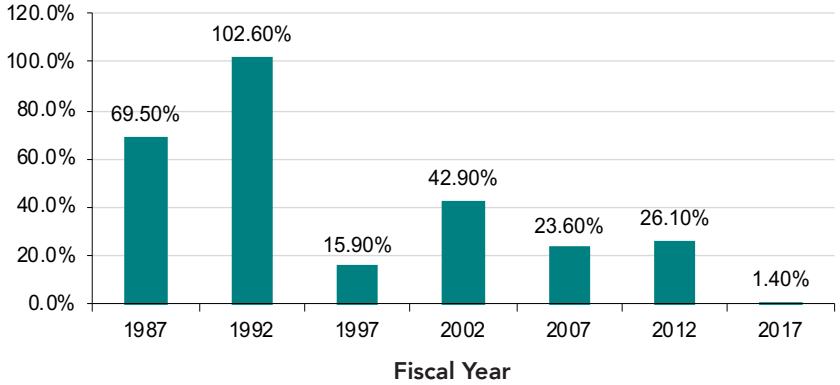
Legend: Payment components

- Forest Service revenue sharing
- PILT (Payments in Lieu of Taxes)
- Bureau of Land Mangement revenue sharing

Components of federal land payments, FY 2019



Federal land payments as % of total general government revenue during select years



Risk/Opportunity Index (ROI) Summary for Wheeler County[1]

Description	County Measure (average of counties)
With a sub-index value of 0.83 compared to the average of 0.94, Wheeler County's potential resilience is lower than the average across the 14 counties in the study region. More specifically, of these counties, Wheeler County has the second lowest level of educational attainment, population density, and number of firms while its earnings per job estimate is less than one-half the average of the 14 counties. These limitations are somewhat mitigated by a very high estimate of farmland per person.	**Capital** **0.83** **(0.94)**
Compared with other counties, Wheeler County residents face substantial challenges in converting capital resources into resilience. More specifically, Wheeler County records either "not present" or "0" for all seven attributes, e.g. Interstate highway, metro access, broadband internet, college, used to gauge links to the outside economy. Of the 14 counties in the study area, Wheeler County is the only one assigned a zero for its conversion factor.	**Conversion Factor** **0.0** **(0.57)**
Wheeler County has a resilience index of 0.55, about 44% lower than the average of the 14 counties in the study area and the lowest of this study[2]. This follows directly from the results presented above, and it implies that among these counties, the Wheeler County economy is quite susceptible to a downturn in the face of an economic shock.	**Economic Resilience** **0.55** **(1.00)**
With an overall relative exposure index of about 1.28, or 28% higher than the average, Wheeler County economy is somewhat more exposed than the other counties in the study area. While Wheeler County earns relatively little income from its forestland, this is more than made up for by the high level of Forest Service related payments as a percentage of the County budget.	**Exposure** **1.28** **(1.00)**
The ROI for Wheeler County is 1.73. This is the third highest RO index of the 14 counties, and reflects the County's very low resilience score combined with its above average measure of exposure to Forest Service planning. The interpretation of this index score is that the County is more susceptible to economic impacts related to changes in Forest Service planning than the average for counties in the study area.	**R/O Index** **1.73** **(1.00)**

[1] See attached "Risk/Opportunity Index Appendix" for a full breakdown of these measures and explanation of how they were calculated.
[2] Because we want to differentiate between counties, we divide the raw measure for economic resilience and exposure by the average of the 14 counties. This also results in a final county ROI that is relative to the 14 counties.

Scatter Plot: Risk Opportunity Index for Wheeler County

The scatter plot above maps out Wheeler County's exposure, resilience and resulting ROI in the context of the remaining counties of the study area. In general, counties grouped in quadrant I have a high ROI between 1.70 and 2.70 indicating that they are low in economic resilience and high in exposure to Forest Service activities. This implies that, relative to the remaining counties, their economies are the most susceptible to Forest Service planning decisions.

Given this relative position, in general terms, the Wheeler County economy is among those most likely to suffer negative consequences in the face of shifts in Forest Service planning that reduce economic benefits. With the elevated exposure of the County economy in mind, opportunities to build resilience are weighted towards shifting of current Forest Service activities towards those that more effectively build economic resilience.

To the extent that the ROI is a descriptive rather than prescriptive tool, additional insights are limited and need to be considered with care. With this caution in mind, we offer the following:

- The ROI does not consider the possibility that some attributes of the economy may have "thresholds" that, once surpassed, result in outsized declines in economic resilience. This is a concern in the case of Wheeler County in light of the County's status as having the lowest estimated resilience.

- The ROI considers acres of farmland per person an important part of a county's natural capital. While this is quite intuitive in general, in the case of high desert counties like Wheeler County it can be problematic. More specifically, the farmland in Wheeler tends to be managed extensively rather than intensively. It is, therefore, less economically productive. It follows that the ROI estimate for Wheeler may be overly optimistic, especially since farmland per person is one measure that contributes significantly to the County's potential economic resilience.

Wheeler County Analysis

Grazing

In Wheeler County, beef and cattle ranching accounts for $9.18 million of annual output, with 56 jobs and average wages of $39,397 per year.

Current Industry Snapshot (includes feedlots and dual-purpose ranching and farming):

2021 Industry Output Wheeler County	Employment	Average Employee Compensation	Economic Output
	56	**$39,397/yr**	**$9.18 million**

Economic Benefit of Additional Grazing

Additional 1000 AUMs (either new or currently no tin use and placed in use)	Jobs	Economic Output
	2.57	$160,422

2017 Forest Service Data Adjusted for Inflation

Recreation

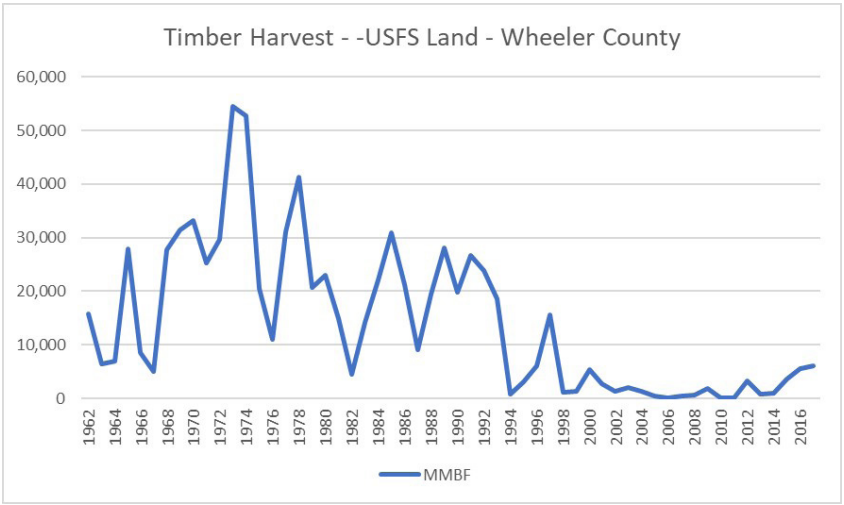
The following analysis measures the impact to Wheeler County from lodging, restaurants, grocery purchases and fuel primarily, with some assessment of general tourism spending. This data estimates the effect of a 10% increase in visitation and spending (regardless of use).

Wheeler County Tourism Impact from 10% Growth in Tourism on FS Land

Employment	Output
<1	**$46,552**

Timber

Wheeler County has a rich history in commercial timber production. In line with the rest of the region, timber has seen a precipitous drop in production and output since 1990 due to environmental legislation, global competition and capital and technological enhancements within the industry.



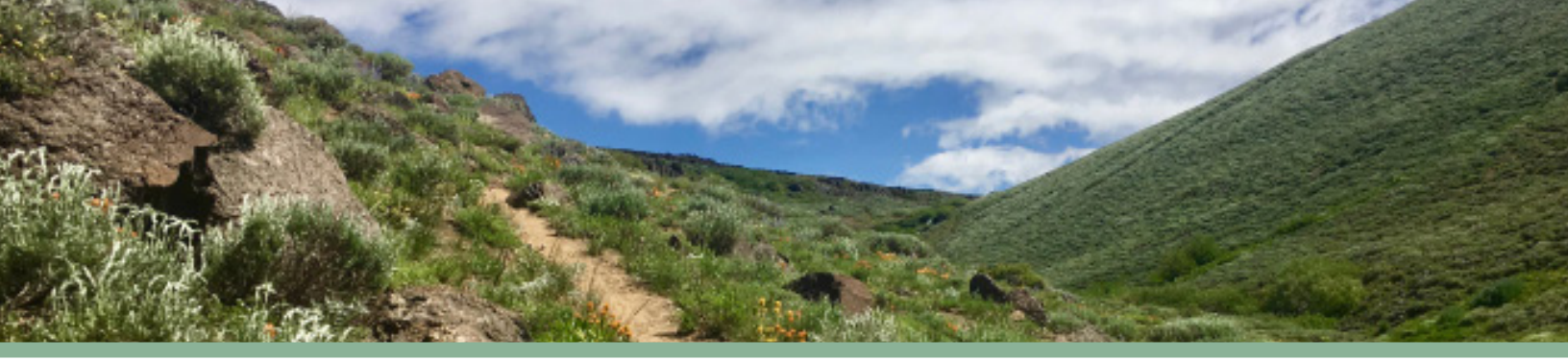
Timber (cont.)

The following data looks at the current industry snapshot, the 1990 estimate if it were duplicated today, and both 10% and 20% changes to the current level of output in the Forest Service managed lands. These results were successfully checked with the TREAT model that the Forest Service economists use for verification (Sorenson, et.al 2015):

Wheeler County			Employment	Output
Current Commercial Logging			N/A	N/A
Share in National Forest Land	N/A			N/A
		1990 FS Direct Output	Employment	Output
Total Economic Impact of 1990 Output Levels (est. 8x current production/ output)		$3.0 million	50.22	$3.8 million
10% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
20% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output

Stewardship Contracting in Wheeler County

There have not been any Stewardship contracts in Wheeler County.



ASOTIN COUNTY, WASHINGTON

BLUES COUNTY PROFILES

Asotin Asotin County is the smallest of the Blues counties at just 636 square miles. The name "Asotin" derives from the Nez Perce word meaning "eel". The Nez Perce tribes lived in Asotin County for many years and named the area after the abundance of eel in Asotin Creek. In 1805, Lewis and Clark passed through the county on their way to the Pacific Ocean and on their way back to Missouri. The first white settlers arrived during the 1860s, but it wasn't until 1883 that Asotin County was formed from the eastern part of Garfield County. The county has elevations as low as 740 feet in their fertile agricultural region in the north part of the county. In the southern part of the county, elevations rise higher than 6,000 feet in Asotin County's portion of the Blue Mountains.

Asotin County quick facts

Date established: October 27, 1883

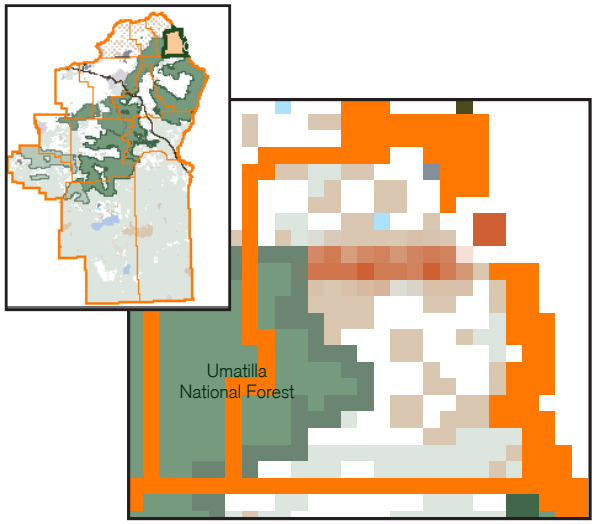
County seat: Asotin, population 1,280 (2019)

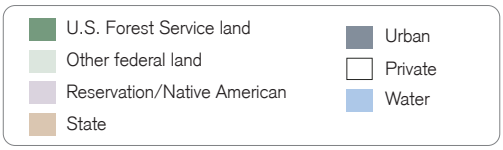
Size: 636 square miles

2019 population: 22,520 people

Public land coverage: 21.9% of county

National forest coverage: 54,256 acres; 13.2% of county



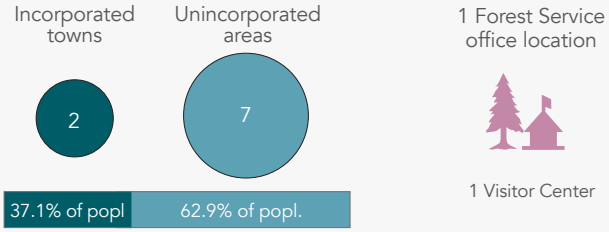


Population & acres of national forest

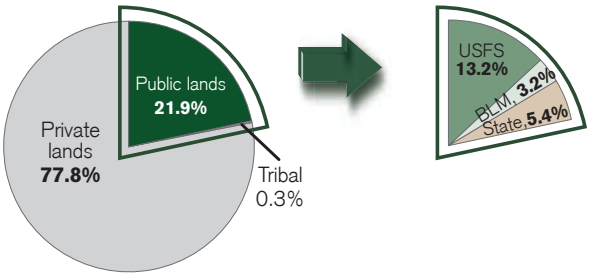
(each person= 5,000 people
each tree= 10,000 acres)

Acres of national forest per county resident

Population centers and Forest Service offices

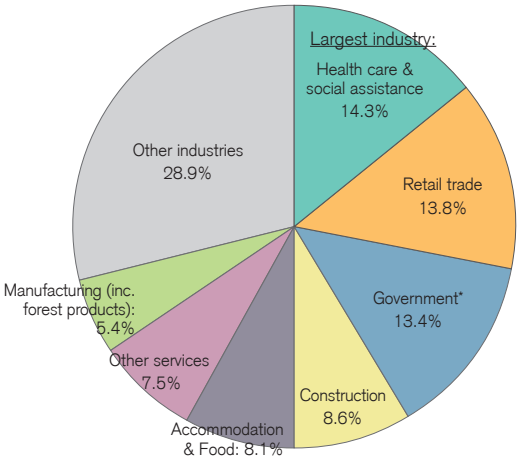


Land ownership



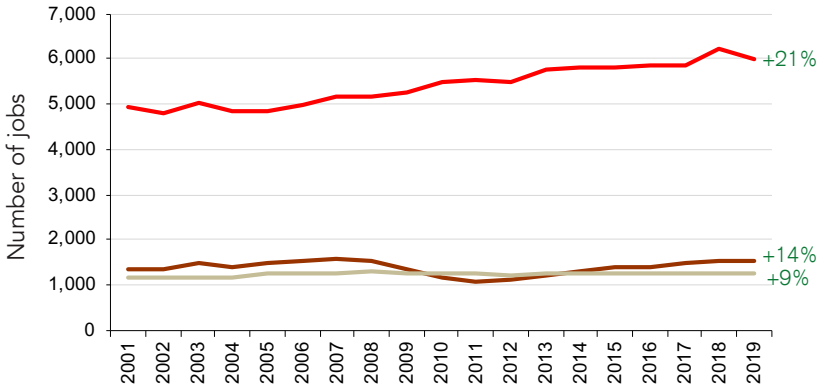
KEY INDUSTRIES:

8 largest industries by number of jobs (2019):



9,437 jobs (2019)

Employment by major industry category and % change, 2001–2019



Services Related — Non-Services Related — Government

Service-related includes: Industries such as retail trade, finance, health care & social assistance, accommodation & food, and education services

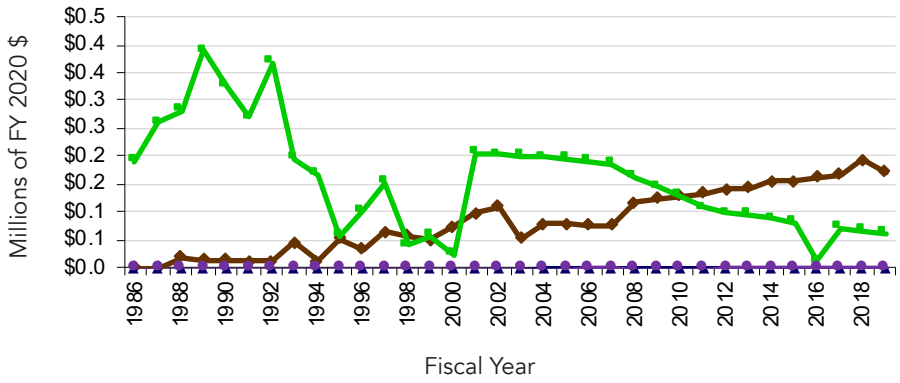
Non-Service Related includes: Industries such as farming, mining, and manufacturing

Government includes: Federal, military, state, and local government employment; government enterprise*

**Government may not include all public employment; some industries that may have public employees (e.g. health care, education services) are classified as service-related industries.*

FEDERAL LAND PAYMENTS:

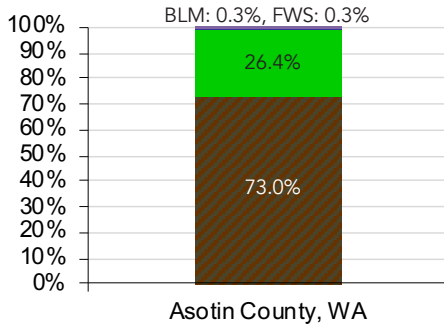
Components of federal land payments per FY, 1986–2019



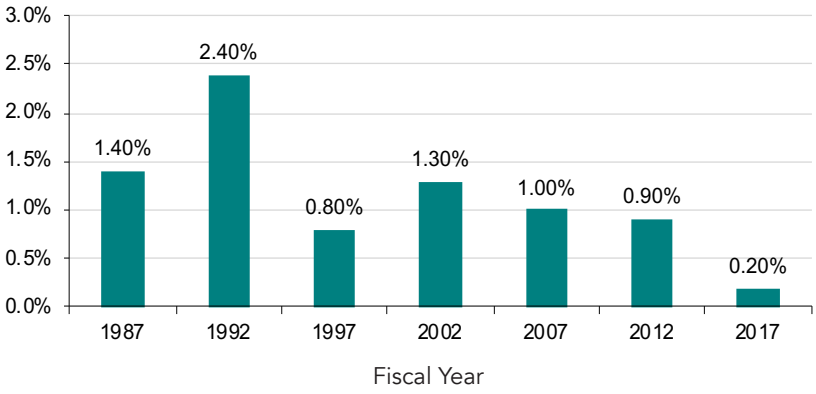
Legend: Payment components

- PILT (Payments in Lieu of Taxes)
- Forest Service revenue sharing
- Bureau of Land Mangement (BLM) revenue sharing
- US Fish and Wildlife Service (FWS) Refuge payments

Components of federal land payments, FY 2019



Federal land payments as % of total general government revenue during select years

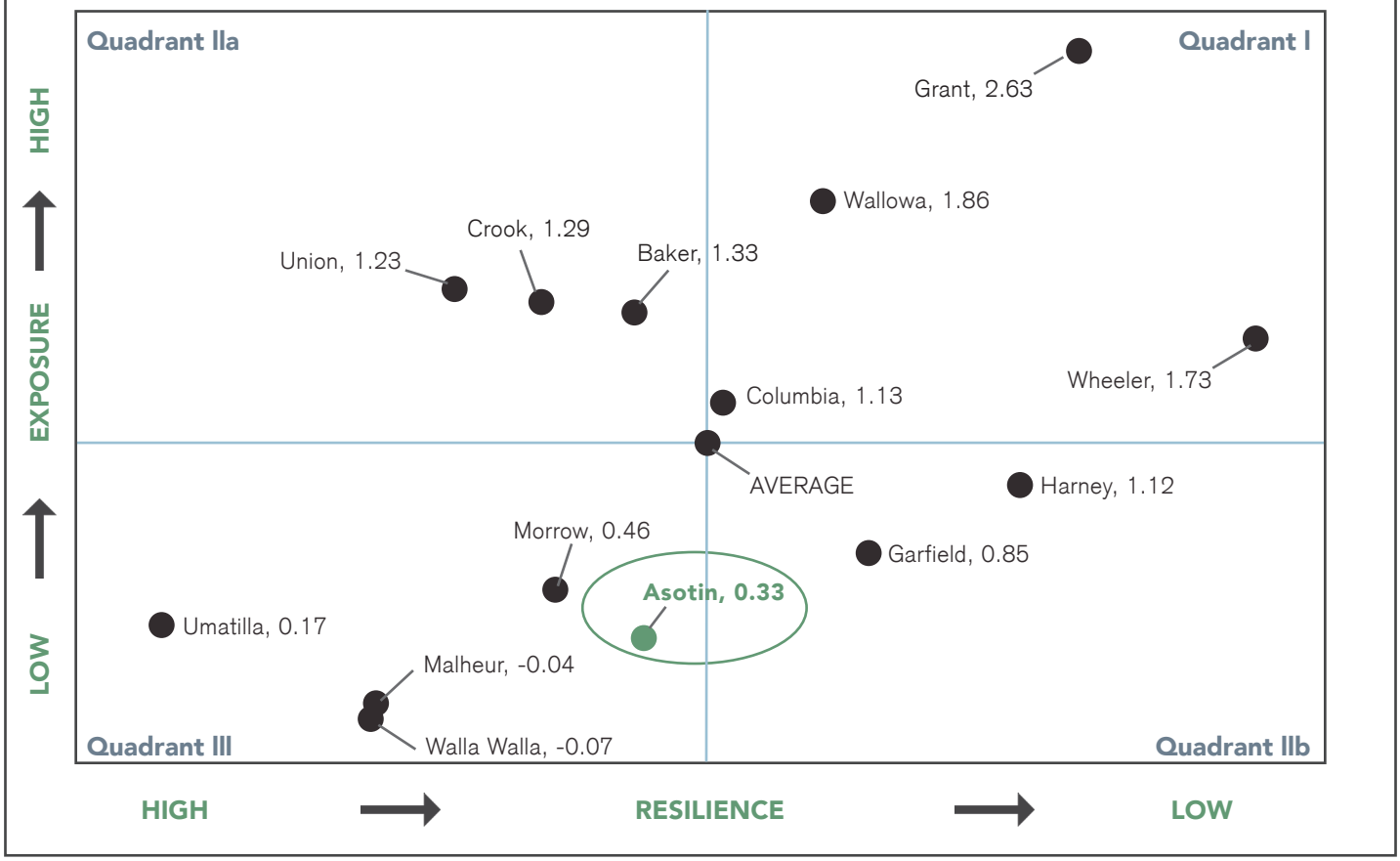


Risk/Opportunity Index (ROI) Summary for Asotin County[1]

Description	County Measure (average of counties)
At 0.94 Asotin County's capital sub-index is very close to the average of the 14 counties in the study region. More specifically, a relative deficit in natural resource capital is the result of limited farmland per person and irrigation water usage. However, this is compensated for by above average social/human capital stemming from low housing costs and the highest population density of any of the counties.	**Capital** **0.94** (0.94)
Compared with other counties, with a conversion factor of 0.67 Asotin County residents face relatively low barriers to converting the County's capital into economic resilience. More specifically, of the elements making up the conversion factor, Asotin County is lacking only a university/college, and a local Interstate highway. The county also scores highly in terms of access to a metro area. Overall, this allows residents to convert the potential wealth of the county to actual wealth and well-being somewhat more easily than the average of all counties.	**Conversion Factor** **0.67** (0.57)
The capital index conditioned on the conversion factor, results in a relative resilience index for Asotin County of 1.05, or about six percent greater than the average across the 14 counties of the study area[2]. This is consistent with the results presented above, and it implies that facing an economic shock the County economy would demonstrate an average level of resistance and recovery.	**Economic Resilience** **1.05** (1.00)
With an exposure index of 0.38 the Asotin County economy is significantly less exposed to Forest Service planning decisions than the average county of the study area. In fact, with respect to exposure Asotin is the third least exposed of the 14 counties.	**Exposure** **0.38** (1.00)
The ROI for Asotin County is 0.33. This is the third lowest ROI of the 14 counties, and it implies that the economy of the County may be less susceptible to economic impacts related to changes in Forest Service planning than the average of the 14 counties.	**R/O Index** **0.33** (1.00)

[1] See attached "Risk/Opportunity Index Appendix" for a full breakdown of these measures and explanation of how they were calculated.
[2] Because we want to differentiate between counties, we divide the raw measure for economic resilience and exposure by the average of the 14 counties. This also results in a final county ROI that is relative to the 14 counties.

Scatter Plot: Risk Opportunity Index for Asotin County



The scatter plot above maps out Asotin County's exposure, resilience and resulting ROI in the context of the remaining counties of the study area. In general, counties in quadrant III have a ROI of less than 0.80. This indicates that, relative to the remaining counties, their economies are relatively resilient and less exposed to Forest Service planning decisions than other counties of the study area.

Given their relatively high economic resilience and low exposure to Forest Service activities, counties in this quadrant are least likely to suffer negative consequences to their economy were the Forest Service to shift activities away from the county. Conversely, the low current exposure allows for greater opportunity to boost benefits to economy through increasing Forest Service exposure so long as it effectively targets economic resilience.

To the extent that the ROI is a descriptive rather than prescriptive tool, additional insights are limited and need to be considered with care. With this caution in mind, we note that, although Asotin County has a low ROI, in terms of economic resilience it is the least resilient of the counties in quadrants IIa and III. This may lend additional importance to the opportunity elements of the risk-opportunity framework. More specifically, it may make sense to prioritize Forest Service planning activities that boost the exposure of Asotin County so long as they support additional economic resilience.

Asotin County Analysis

Grazing

In Asotin County, beef and cattle ranching accounts for $7.4 million of annual output, with 71.31 jobs and average wages of $32,436 per year.

Current Industry Snapshot (includes feedlots and dual-purpose ranching and farming):

2021 Industry Output Asotin County	**Employment**	**Average Employee Compensation**	**Economic Output**
	71.31	**$32,436/yr**	**$7.4 million**

Economic Benefit of Additional Grazing

Additional 1000 AUMs (either new or currently not in use and placed in use)	**Jobs**	**Economic Output**
	3.3	$177,000

2017 Forest Service Data Adjusted for Inflation

Recreation

The following analysis measures the impact to Union County from lodging, restaurants, grocery purchases and fuel primarily, with some assessment of general tourism spending. This data estimates the effect of a 10% increase in visitation and spending (regardless of use).

Asotin County Tourism Impact from 10% Growth in Tourism on FS Land

Employment	**Output**
<1	**$26,812**

Timber

Asotin County has a rich history in commercial timber production. In line with the rest of the region, timber has seen a precipitous drop in production and output since 1990 due to environmental legislation, global competition and capital and technological enhancements within the industry.

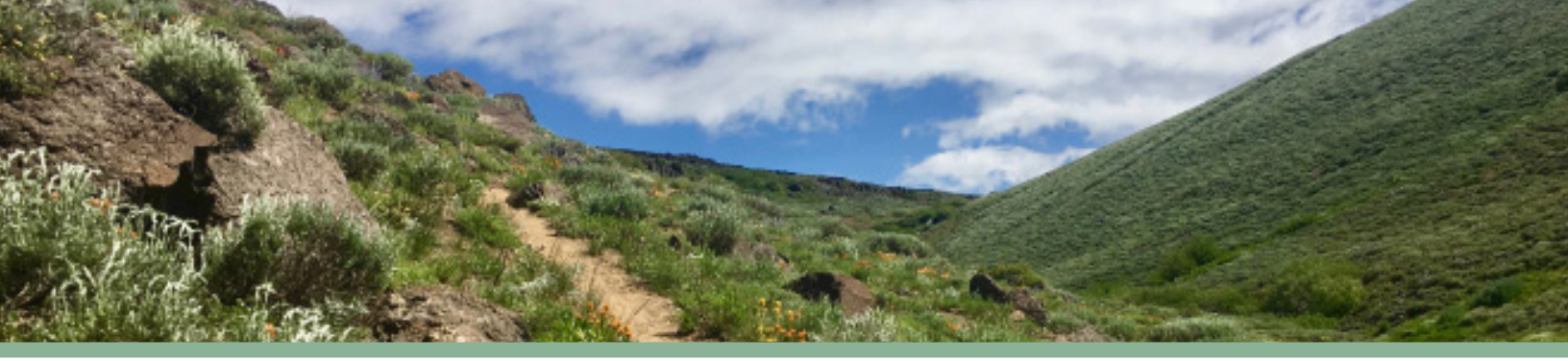
Timber (cont.)

The following data looks at the current industry snapshot, the 1990 estimate if it were duplicated today, and both 10% and 20% changes to the current level of output in the Forest Service managed lands. These results were successfully checked with the TREAT model that the Forest Service economists use for verification (Sorenson, et.al 2015):

Asotin County			Employment	Output
Current Commercial Logging			31.2	$3.1 million
Share in National Forest Land	3.5%			$108,500
		1990 FS Direct Output	Employment	Output
Total Economic Impact of 1990 Output Levels (est. 8x current production/ output)		$868,000	13.45	$1.3 million
10% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	0.11	$8,307.77	$7,250.13	$10,850.00
2 - Indirect	0.04	$1,645.89	$1,639.28	$2,259.46
3 - Induced	0.02	$1,010.42	$2,020.66	$3,500.10
	0.17	**$10,964.08**	**$10,910.08**	**$16,609.56**
20% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	0.21	$16,615.54	$14,500.27	$21,700.00
2 - Indirect	0.08	$3,291.77	$3,278.56	$4,518.92
3 - Induced	0.04	$2,020.84	$4,041.32	$7,000.20
	0.34	**$21,820.15**	**$21,820.15**	**$33,219.12**

Stewardship Contracting in Asotin County

There has not been any stewardship contracting in Asotin County.



COLUMBIA COUNTY, WASHINGTON

BLUES COUNTY PROFILES

Columbia County was created from a portion of Walla Walla County in 1875. Columbia County's terrain varies dramatically, with the Northern portion of the county's elevation being as low as 504 feet on the Snake River and surrounded by valleys and hills. While in the Southern part of the county, Columbia becomes a forest with an elevation as high as 6,041 feet at Oregon Butte. The area near the Snake River was home to bands of Nez Perce, Yakama, Walla Walla, Umatilla, and Wanapum people. The first white settlers arrived in the 1850s, but settlements quickly increased in the early 1870s . The main economic activity in the area has been agriculture, specifically asparagus, green peas, wheat, garbanzo beans, and grass seed. Columbia County is also home to the oldest working courthouse and the oldest surviving railroad station in the state of Washington.

Columbia County quick facts

Date established: November 29, 1875

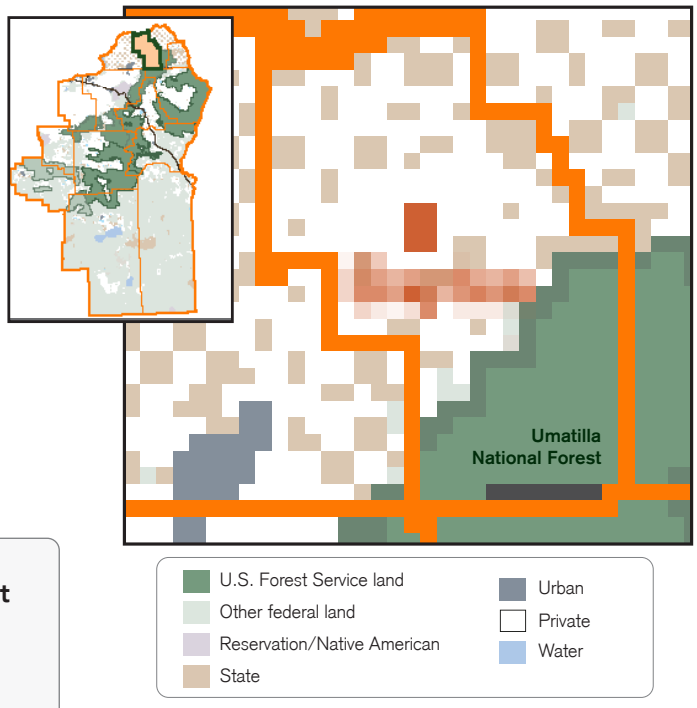
County seat: Dayton, population 2,560 (2019)

Size: 868 square miles

2019 population: 4,160 people

Public land coverage: 30.3% of county

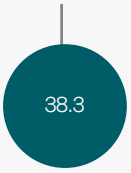
National forest coverage: 159,208 acres; 28.5% of county



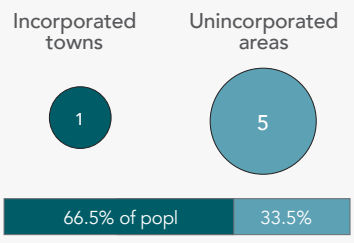
Population & acres of national forest

(each person= 5,000 people
each tree= 10,000 acres)

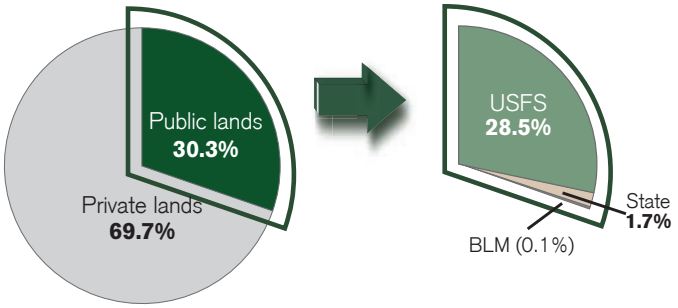
Acres of national forest per county resident



Population centers and Forest Service offices

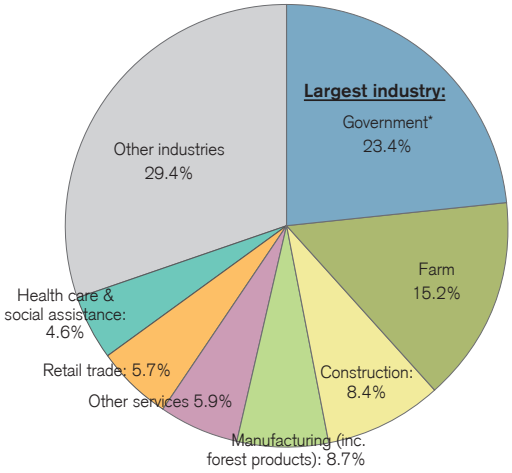


Land ownership



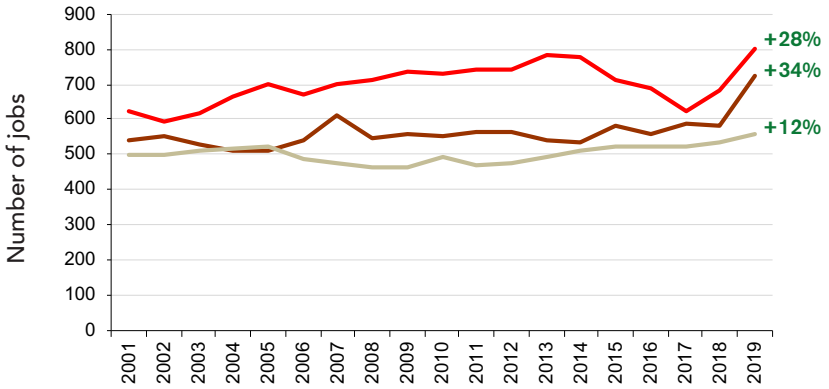
KEY INDUSTRIES:

7 largest industries by number of jobs (2019):



2,389 jobs (2019)

Employment by major industry category and % change, 2001-2019



Services Related — Non-Services Related — Government

Service-related includes: Industries such as retail trade, finance, health care & social assistance, accommodation & food, and education services

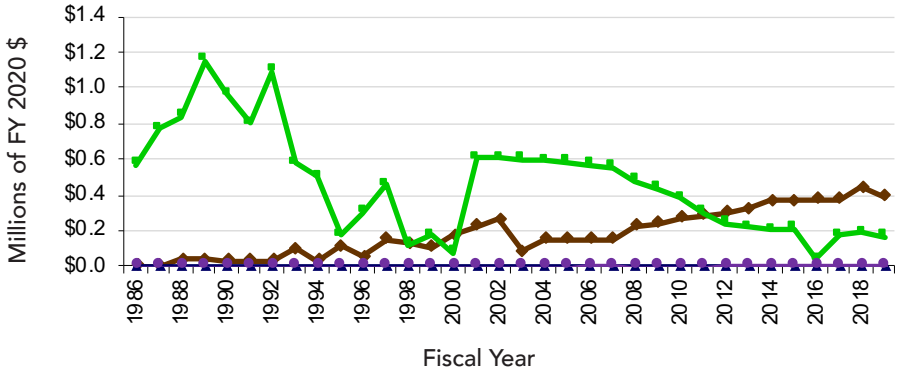
Non-Service Related includes: Industries such as farming, mining, and manufacturing

Government includes: Federal, military, state, and local government employment; government enterprise*

**Government may not include all public employment; some industries that may have public employees (e.g. health care, education services) are classified as service-related industries.*

FEDERAL LAND PAYMENTS:

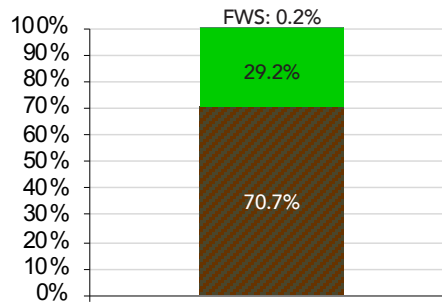
Components of federal land payments per FY, 1986–2019



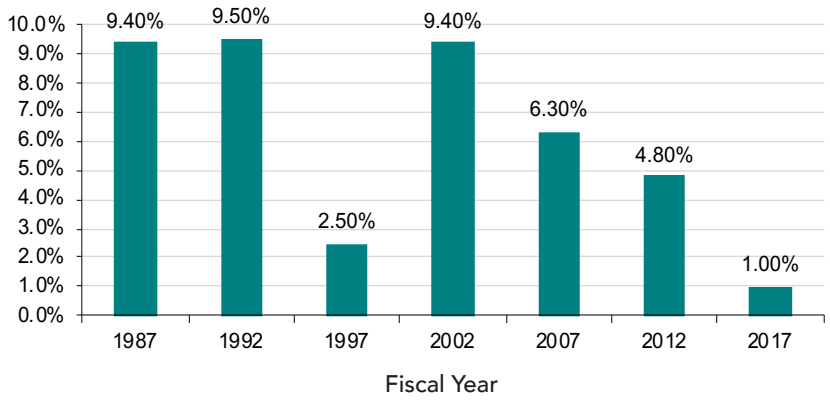
Legend: Payment components

- Forest Service revenue sharing
- PILT (Payments in Lieu of Taxes)
- US Fish and Wildlife Service (FWS) Refuge payments

Components of federal land payments, FY 2019



Federal land payments as % of total general government revenue during select years

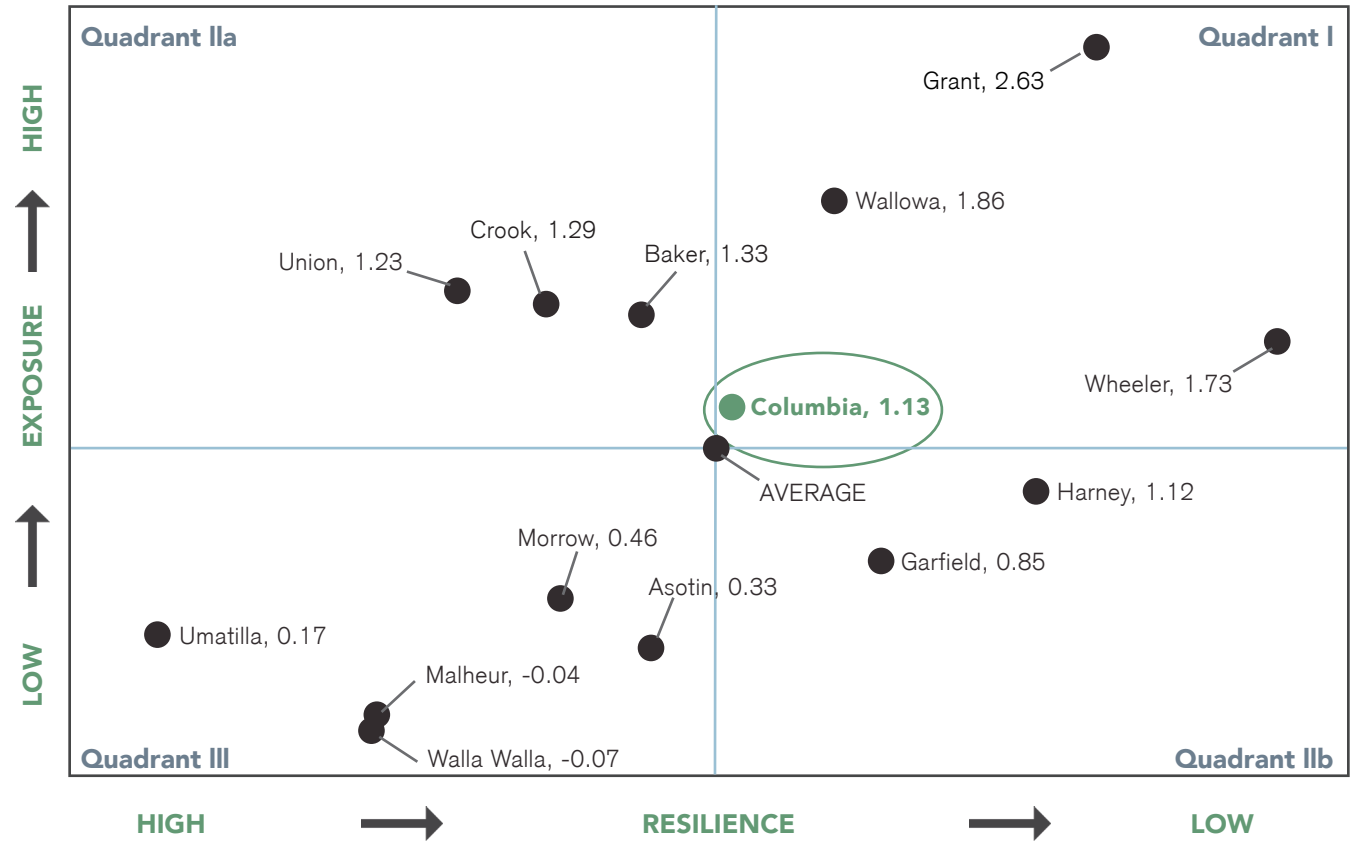


Risk/Opportunity Index (ROI) Summary for Columbia County[1]

Description	County Measure (average of counties)
Columbia County's potential resilience is slightly below the average of the 14 counties in the study region with an index value of 0.89. Although the County has a high level of educational attainment, this advantage is tempered by the relatively high poverty rate and the low number of firms in the County. With respect to Columbia County's natural capital, it has the second lowest use of irrigation water which also pulls this component of the index down.	**Capital** **0.89** (0.94)
With a conversion factor of 0.68, Columbia County residents enjoy a slight relative advantage in converting the County's capital into resilience. More specifically, Columbia County lacks a university or college, and an Interstate highway, with the remaining determinants, e.g., a freight railroad, airport access, and hospital facilities, all working in the county's favor.	**Conversion Factor** **0.68** (0.57)
The capital index conditioned on the conversion factor, results in a relative resilience index for Columbia County of 0.99, essentially equal to the average across the 14 counties of the study area[2]. This is consistent with the results presented above, and it implies that facing an economic shock the County economy would demonstrate an average level of resistance and recovery.	**Economic Resilience** **0.99** (1.00)
Columbia County economy has slightly elevated exposure with an index of about 1.12, or rather, about 12% more than the average county in the study area. The primary driver in this case is the relatively high percentage of income the County draws from forest related industry, which is enough to offset the relatively low level of Forest Service payments.	**Exposure** **1.12** (1.00)
The ROI for Columbia County is 1.13. This places Columbia County among the counties with an intermediate score, and implies that the economy of the County is slightly more susceptible to economic impacts related to changes in Forest Service planning than average county in the study area.	**R/O Index** **1.13** (1.00)

[1] See attached "Risk/Opportunity Index Appendix" for a full breakdown of these measures and explanation of how they were calculated.
[2] Because we want to differentiate between counties, we divide the raw measure for economic resilience and exposure by the average of the 14 counties. This also results in a final county ROI that is relative to the 14 counties.

Scatter Plot: Risk Opportunity Index for Columbia County



The scatter plot above maps out Columbia County's exposure, resilience and resulting ROI in the context of the remaining counties of the study area. It shows Columbia County positioned in the middle of those counties with an intermediate ROI of between 0.80 and 1.30. This indicates that, relative to the remaining counties, its economy is moderately susceptible to Forest Service planning decisions. In addition, the ROI places Columbia County between quadrants IIa and IIb. This indicates that, unlike the other counties with an intermediate ROI value, Columbia County's position is the result of having an intermediate level of exposure to Forest Service activities and an intermediate level of economic resilience.

Given this relative position, in general terms, risk to the Columbia County economy is not weighted toward the potential impacts of shifts in extensive Forest Service activities, nor are they tempered by a relatively high economic resilience. Likewise, the opportunities afforded to Columbia County involve a balance of refining of current Forest Service activities to more effectively build resilience, and supplementing current activities so long as these contribute to economic resilience. Regardless, we note that the economy of Columbia County is not among those assessed as "resilient" by the ROI.

Columbia County Analysis

Current Industry Snapshot (includes feedlots and dual-purpose ranching and farming):

2021 Industry Output Columbia County	**Employment**	**Average Employee Compensation**	**Economic Output**
	28.43	**$41,587/yr**	**$2.97 million**

Economic Benefit of Additional Grazing

Additional 1000 AUMs (either new or currently not in use and placed in use)	**Jobs**	**Economic Output**
	3.3	$177,000

2017 Forest Service Data Adjusted for Inflation

Columbia County Tourism Impact from 10% Growth in Tourism on FS Land

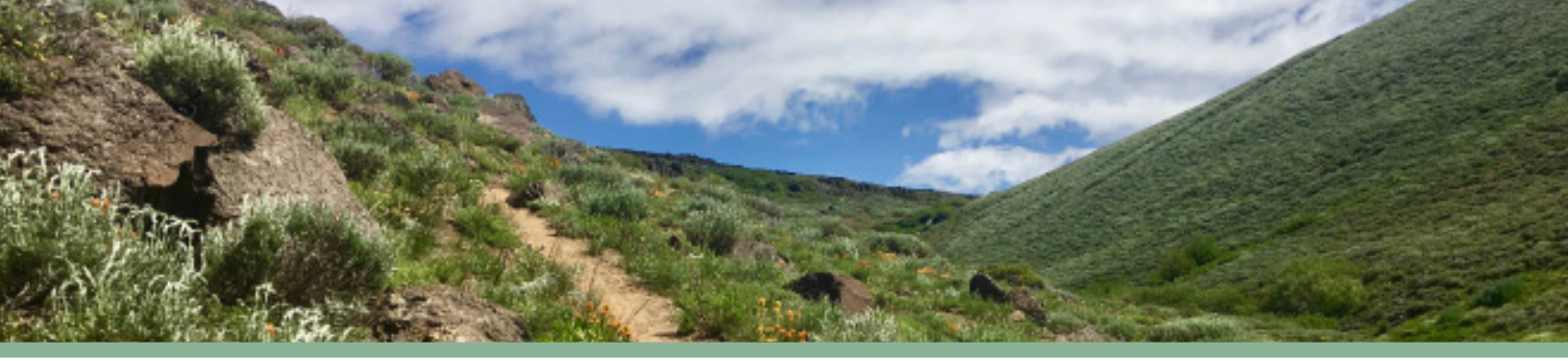
Employment	**Output**
<1	**$24,054**

Timber

Columbia County has very little timber production

The following data looks at the current industry snapshot, the 1990 estimate if it were duplicated today, and both 10% and 20% changes to the current level of output in the Forest Service managed lands. These results were successfully checked with the TREAT model that the Forest Service economists use for verification (Sorenson, et.al 2015):

Columbia County			Employment	Output
Current Commercial Logging			1.36	$121,549
Share in National Forest Land	3.5%			N/A
		1990 FS Direct Output	Employment	Output
Total Economic Impact of 1990 Output Levels (est. 8x current production/ output)		N/A	N/A	N/A
10% Change to Current Commercial Logging Activity in National Forest				
20% Change to Current Commercial Logging Activity in National Forest				



GARFIELD COUNTY, WASHINGTON

BLUES COUNTY PROFILES

Garfield County was founded in 1881, and was named after President James A. Garfield. For many years Native American tribes used the Nez Perce trail through Garfield County, and it was eventually also used by Lewis and Clark on their return trip in 1806. The county is primarily an agricultural based economy, and white settlers began to build farms there in the late 1860s. Wheat is the dominant crop of the area, however, barley, peas, and bluegrass seed have been popular crops over the years as well. Garfield County's terrain is generally fertile plains, with the rugged Blue Mountains located in the southern part of the county.

Garfield County quick facts

Date established: November 29, 1881

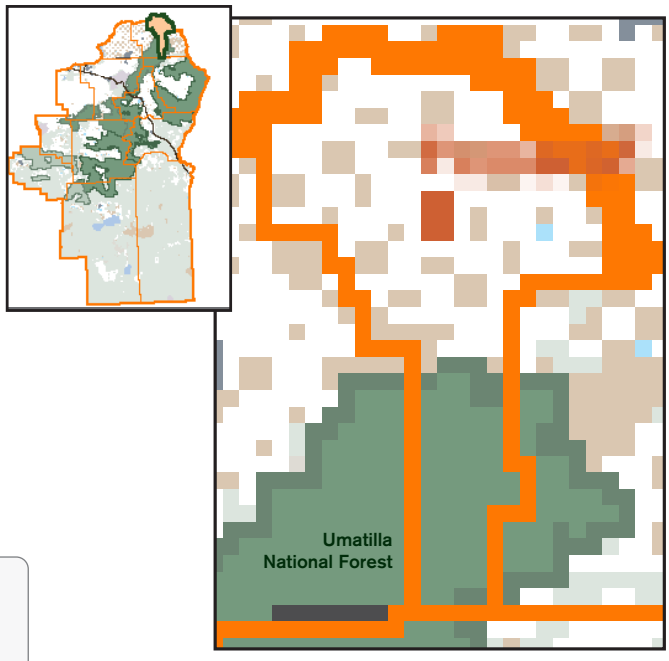
County seat: Pomeroy, population 1,400 (2019)

Size: 711 square miles

2019 population: 2,220 people

Public land coverage: 23.2% of county

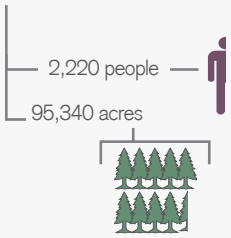
National forest coverage: 95,340 acres; 20.8% of county



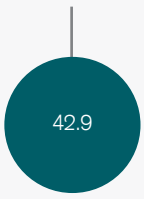
U.S. Forest Service land
Other federal land
Reservation/Native American
State
Urban
Private
Water

Population & acres of national forest

(each person= 5,000 people
each tree= 10,000 acres)



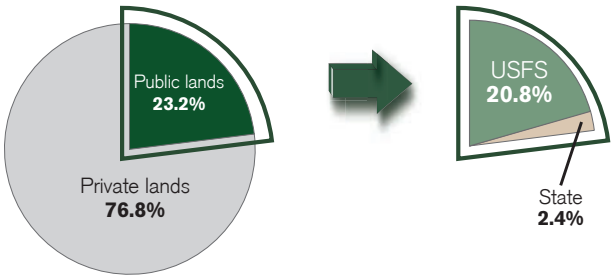
Acres of national forest per county resident



Population centers and Forest Service offices

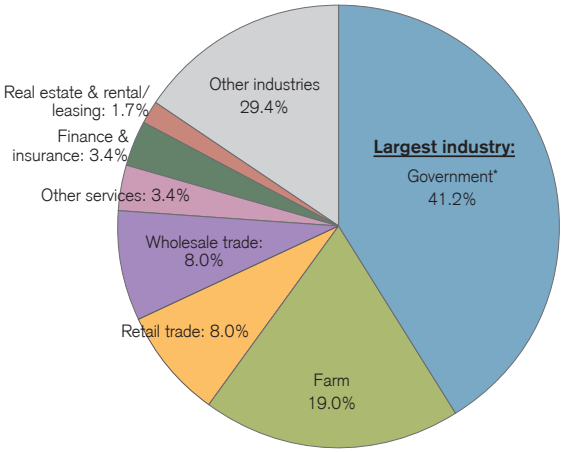
Incorporated towns	Unincorporated areas	Forest Service office locations:
1	5	-NONE-
56.6% of popl	43.4% of popl	

Land ownership



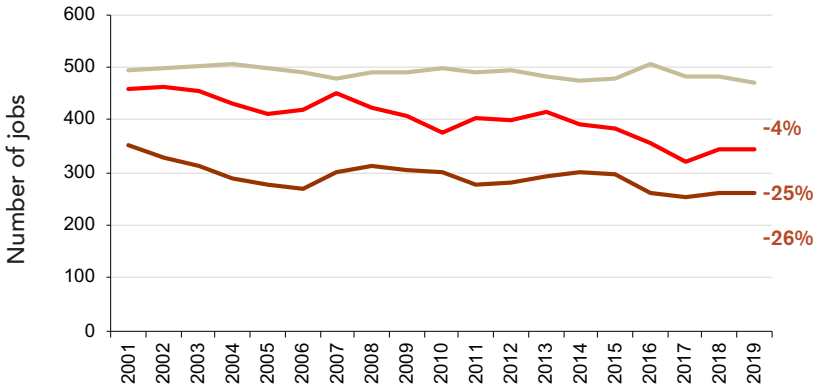
KEY INDUSTRIES:

7 largest industries by number of jobs (2019):



1,144 jobs (2019)

Employment by major industry category and % change, 2001–2019



Services Related — Non-Services Related — Government

Service-related includes: Industries such as retail trade, finance, health care & social assistance, accommodation & food, and education services

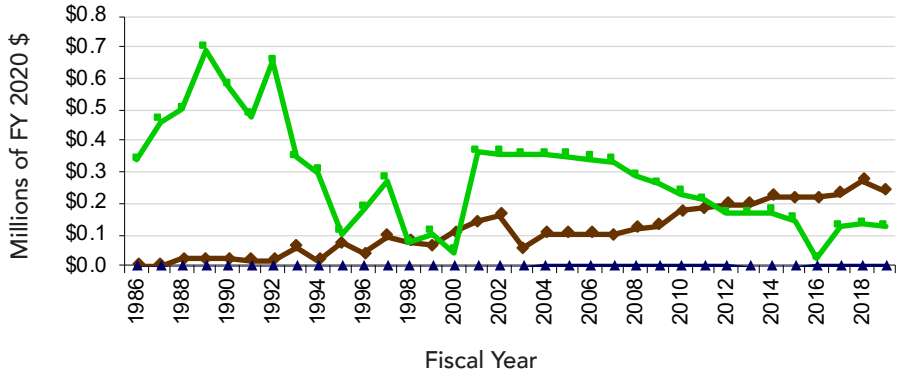
Non-Service Related includes: Industries such as farming, mining, and manufacturing

Government includes: Federal, military, state, and local government employment; government enterprise*

**Government may not include all public employment; some industries that may have public employees (e.g. health care, education services) are classified as service-related industries.*

FEDERAL LAND PAYMENTS:

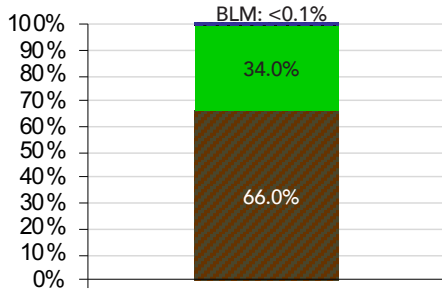
Components of federal land payments per FY, 1986–2019



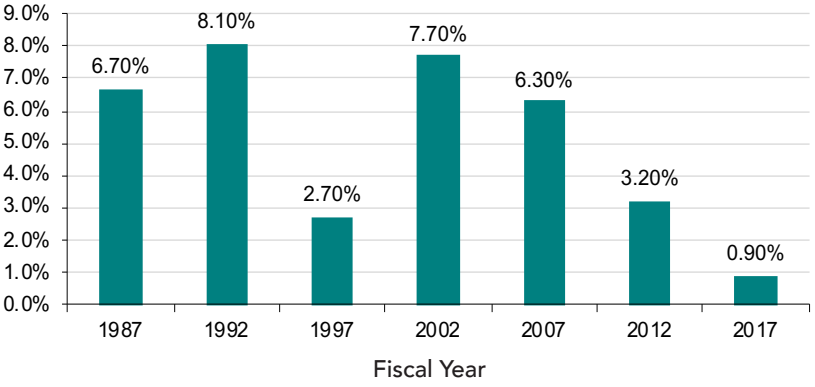
Legend: Payment components

- Forest Service revenue sharing
- PILT (Payments in Lieu of Taxes)
- Bureau of Land Mangement revenue sharing

Components of federal land payments, FY 2019



Federal land payments as % of total general government revenue during select years

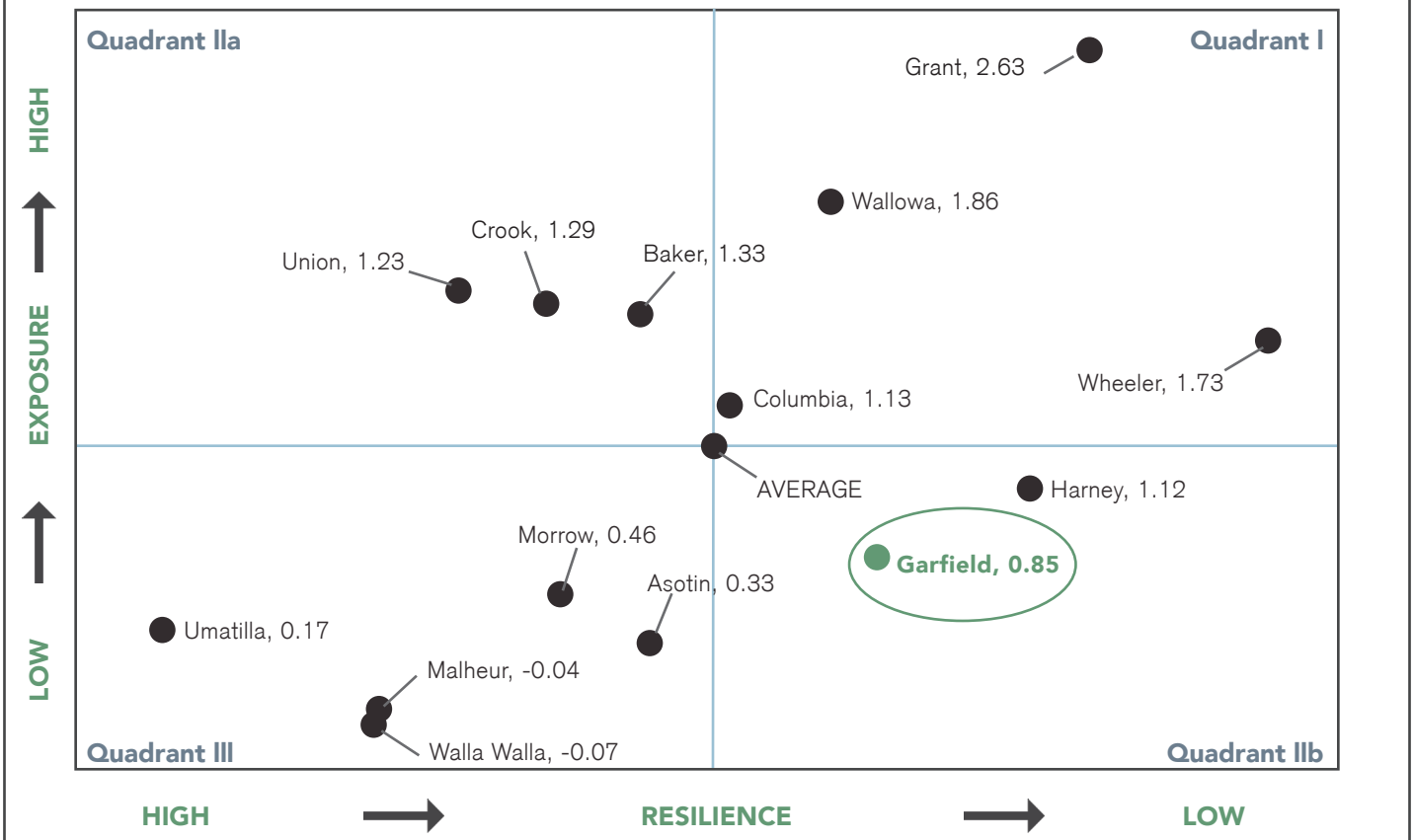


Risk/Opportunity Index (ROI) Summary for Garfield County[1]

Description	County Measure (average of counties)
With an index value of 0.81 compared to the average of 0.94, Garfield County's potential resilience is lower than the average of the 14 counties in the study region. This result is driven primarily by the relatively low number of firms and scenic amenities, both of which register as the lowest among the 14 counties. This is offset somewhat by elevated social/human capital, and specifically, a high rate of educational attainment and moderate housing costs.	**Capital** **0.81** **(0.94)**
Compared with other counties, with a conversion factor of 0.59, Garfield County residents face about the same level of challenge as the other study counties in converting capital resources into resilience. More specifically, Garfield County lacks an Interstate highway, university or college, and has limited access to a metro area, with the remaining determinants all working in the County's favor.	**Conversion Factor** **0.59** **(0.57)**
The capital index conditioned on the conversion factor, results in a relative resilience index for Garfield County of 0.86, about 14% lower than the average across the 14 counties of the study area[2]. This follows directly from the County's current endowment of capital and its conversion factor, and it implies that among these counties, Garfield County is slightly more susceptible to a downturn in the face of an economic shock.	**Economic Resilience** **0.86** **(1.00)**
Based on these measures, the Garfield County economy is less exposed than the average across counties, with a relative exposure index of about 0.71, or about 29% lower. In the case of Garfield County, there is no single driver of this result. Rather, all the measures put some downward pressure on the County's exposure estimate.	**Exposure** **0.71** **(1.00)**
The ROI for Garfield County is 0.85. This places Garfield County among the counties with a roughly intermediate score, and implies that the economy of the County is slightly less susceptible to economic impacts related to changes in Forest Service planning than the average for counties in the study area.	**R/O Index** **0.85** **(1.00)**

[1] See attached "Risk/Opportunity Index Appendix" for a full breakdown of these measures and explanation of how they were calculated.
[2] Because we want to differentiate between counties, we divide the raw measure for economic resilience and exposure by the average of the 14 counties. This also results in a final county ROI that is relative to the 14 counties.

Scatter Plot: Risk Opportunity Index for Garfield County



The scatter plot above maps out Garfield County's exposure, resilience and resulting ROI in the context of the remaining counties of the study area. In general, counties in quadrant II have an intermediate ROI of between 0.80 and 1.30. This indicates that, relative to the remaining counties, their economies are moderately susceptible to Forest Service planning decisions. In addition, the ROI places Garfield County in quadrant IIb indicating that the county's low economic resilience, rather than exceptionally high exposure to Forest Service activity, is the reason for this intermediate ROI value.

Given this combination of low exposure and low economic resilience, the Garfield County economy is vulnerable to shifts in Forest Service planning that reduce benefits to economy. In addition, given the low exposure to Forest Service activities, opportunity of boosting benefits to economy by restructuring current activities is relatively limited. Conversely, the opportunity to build economic resilience via additional Forest Service activity is high so long as these activities effectively target resilience.

To the extent that the ROI is a descriptive rather than prescriptive tool, additional insights are limited and need to be considered with care. With this caution in mind, we offer the following observation. Among the counties with a below average economic resilience, Garfield County also has the lowest exposure to Forest Service activities as estimated by the ROI. In addition, it is geographically isolated from its neighbors to the south, and the least economically resilient of the study counties in Washington. This may put a premium on resilience-building activities for this county beyond what the direct ROI value implies.

Garfield County Analysis

Grazing

In Garfield County, beef and cattle ranching accounts for $7.06 million of annual output, with 38.98 jobs and average wages of $33,623 per year.

Current Industry Snapshot (includes feedlots and dual-purpose ranching and farming):

2021 Industry Output Garfield County	**Employment**	**Average Employee Compensation**	**Economic Output**
	38.98	**$33,623/yr**	**$7.06 million**

Economic Benefit of Additional Grazing

Additional 1000 AUMs (either new or currently not in use and placed in use)	**Jobs**	**Economic Output**
	3.3	$177,000

2017 Forest Service Data Adjusted for Inflation

Garfield County Tourism Impact from 10% Growth in Tourism on FS Land

Employment	**Output**
<1	**$45,437**

Timber

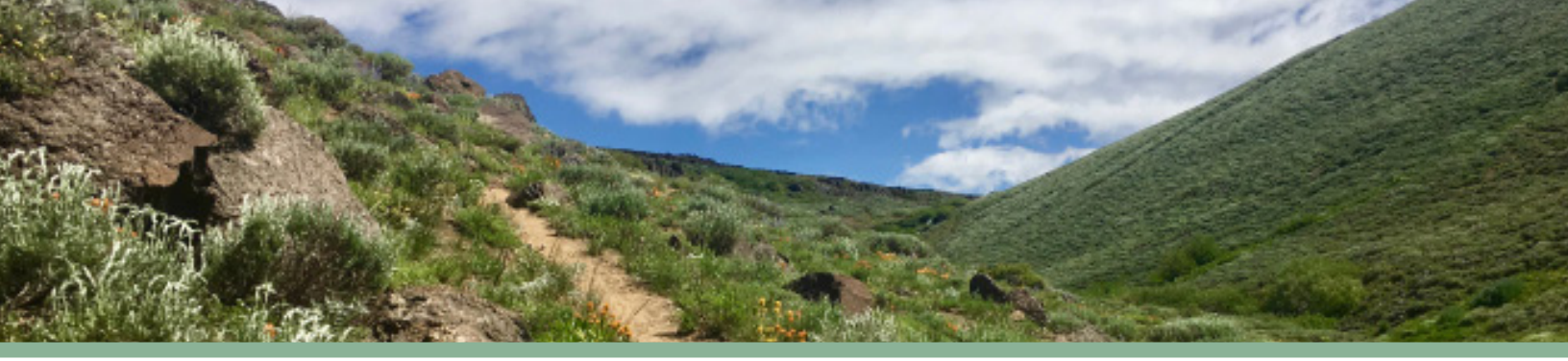
Garfield County has very little timber production.

The following data looks at the current industry snapshot, the 1990 estimate if it were duplicated today, and both 10% and 20% changes to the current level of output in the Forest Service managed lands. These results were successfully checked with the TREAT model that the Forest Service economists use for verification (Sorenson, et.al 2015):

Garfield County			Employment	Output
Current Commercial Logging			N/A	N/A
Share in National Forest Land				N/A
		1990 FS Direct Output	Employment	Output
Total Economic Impact of 1990 Output Levels (est. 8x current production/ output)		N/A	N/A	N/A
10% Change to Current Commercial Logging Activity in National Forest				
20% Change to Current Commercial Logging Activity in National Forest				

Stewardship Contracting in Garfield County

There has not been any stewardship contracting in Garfield County.



WALLA WALLA COUNTY, WASHINGTON

BLUES COUNTY PROFILES

Walla Walla County was established in 1854 from a portion of Skamania County. The name "Walla Walla" derives from a Nez Perce and Cayuse word meaning running. The Walla Walla region became popular for fur trading, and was one of the first areas to be permanently settled by white settlers with the establishment of Fort Walla Walla by the North West Fur Company in 1818. The county grew in economic activity with the establishment of the private college Whitman College, as well as growth in agriculture, railroads, and manufacturing. Farming, manufacturing, and higher education are still predominant industries in the county today, as well as a rapidly growing wine industry.

Walla Walla County quick facts

Date established: April 25, 1854

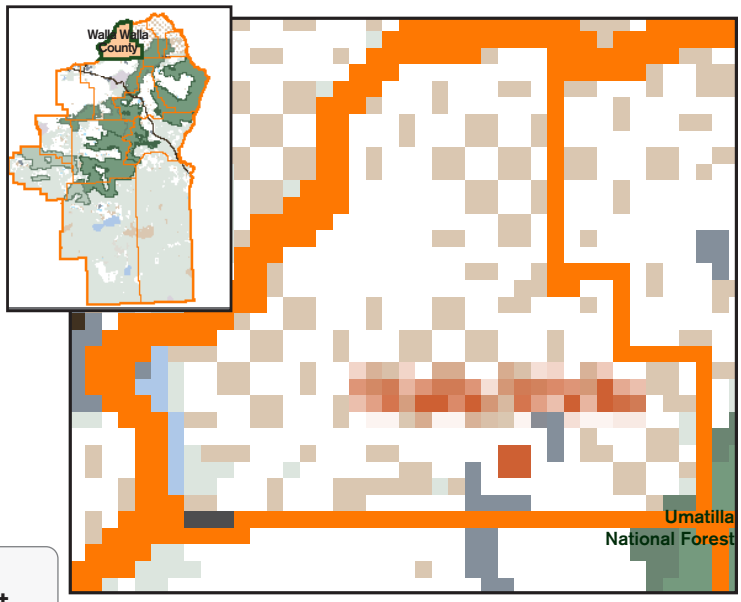
County seat: Walla Walla, population 34,240 (2019)

Size: 1,270 square miles

2019 population: 62,200 people

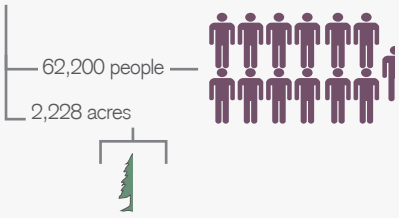
Public land coverage: 4.4% of county

National forest coverage: 2,228 acres; 0.3% of county



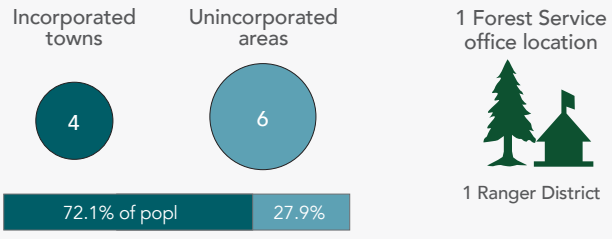
Population & acres of national forest

(each person= 5,000 people
each tree= 10,000 acres)

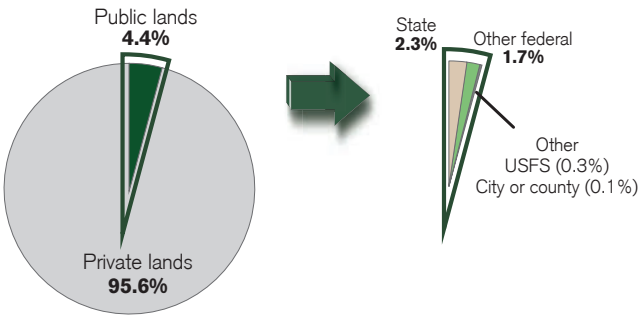


Acres of national forest per county resident

Population centers and Forest Service offices

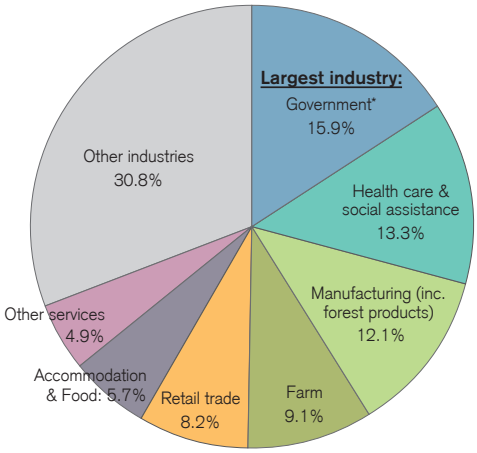


Land ownership



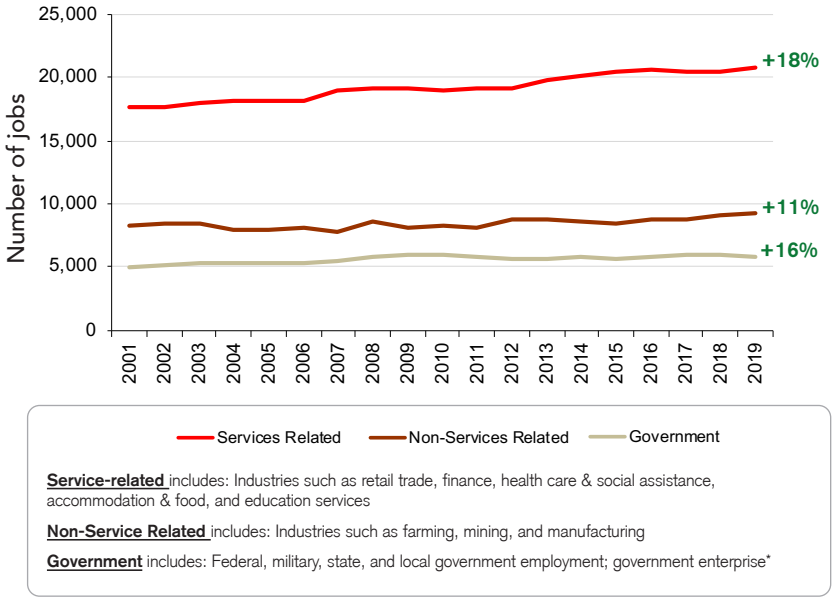
KEY INDUSTRIES:

7 largest industries by number of jobs (2019):



36,827 jobs (2019)

Employment by major industry category and % change, 2001–2019



Services Related — Non-Services Related — Government

Service-related includes: Industries such as retail trade, finance, health care & social assistance, accommodation & food, and education services

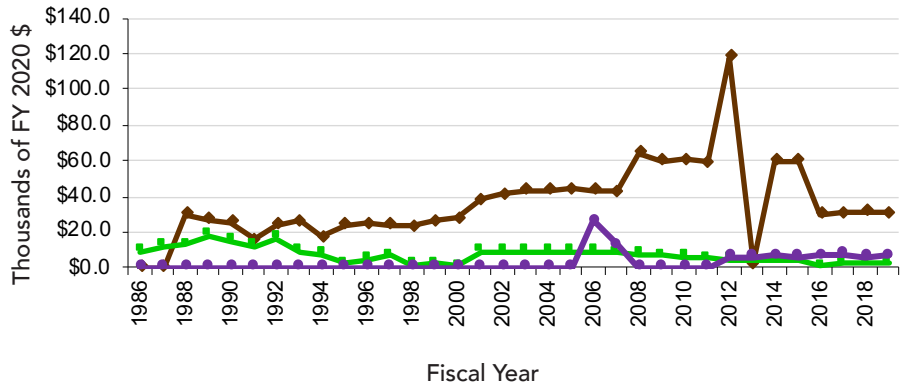
Non-Service Related includes: Industries such as farming, mining, and manufacturing

Government includes: Federal, military, state, and local government employment; government enterprise*

**Government may not include all public employment; some industries that may have public employees (e.g. health care, education services) are classified as service-related industries.*

FEDERAL LAND PAYMENTS:

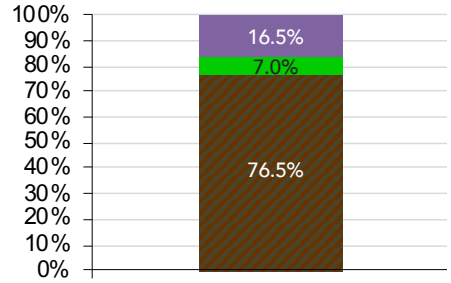
Components of federal land payments per FY, 1986–2019



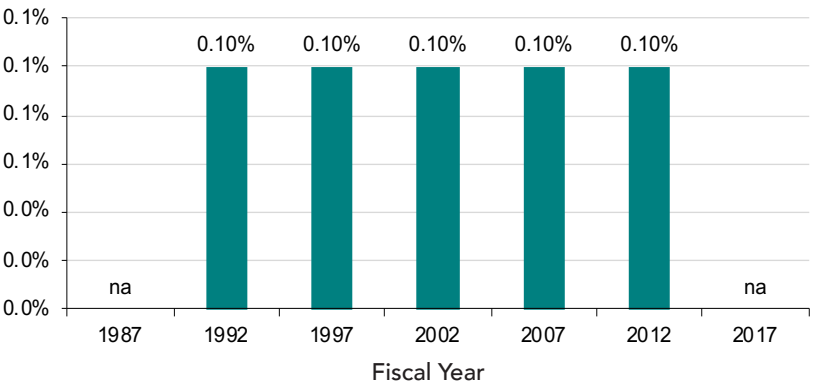
Legend: Payment components

- Forest Service revenue sharing
- PILT (Payments in Lieu of Taxes)
- US Fish and Wildlife Service (FWS) Refuge payments

Components of federal land payments, FY 2019



Federal land payments as % of total general government revenue during select years

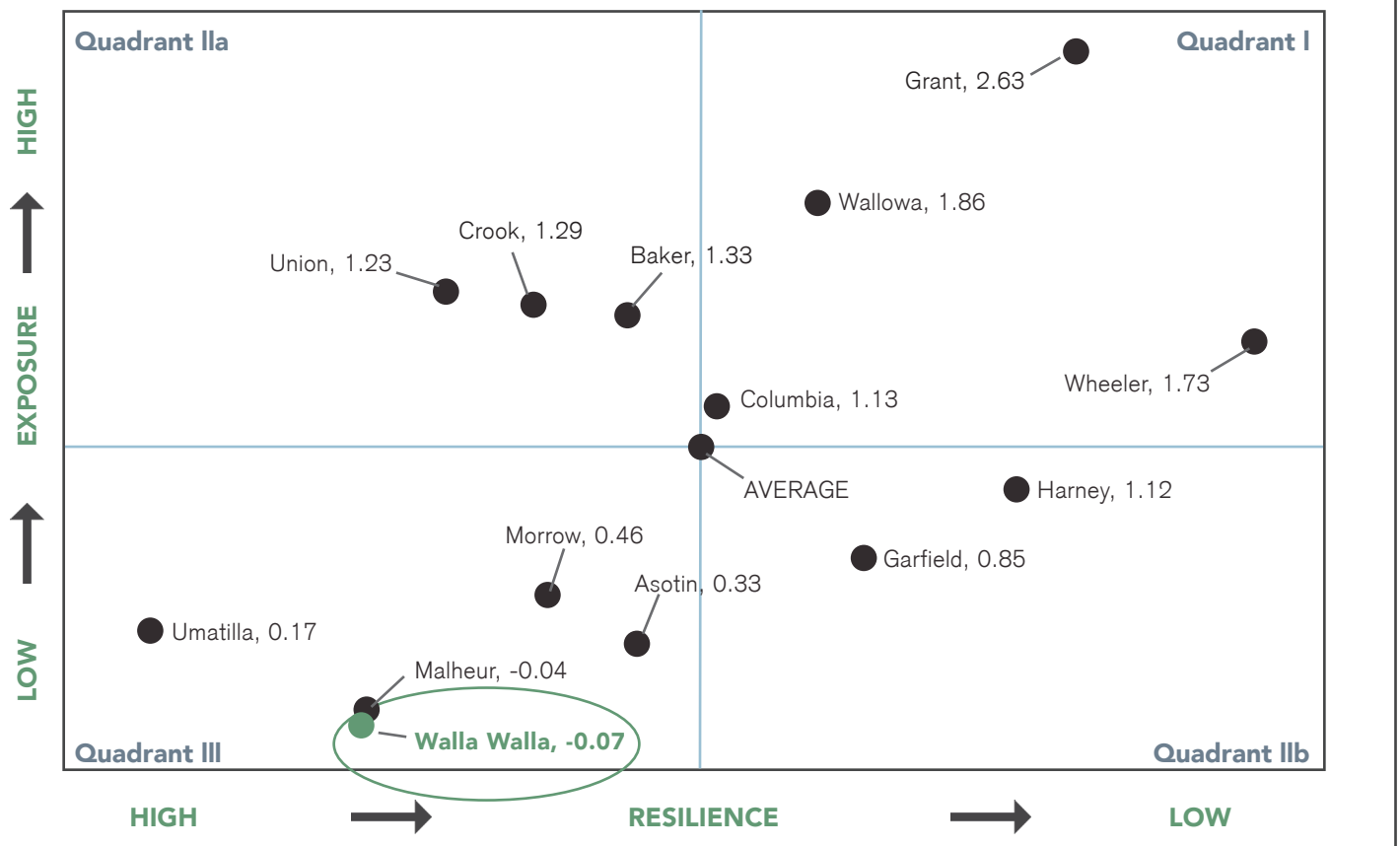


Risk/Opportunity Index (ROI) Summary for Walla Walla County[1]

Description	County Measure (average of counties)
Walla Walla County's capital sub-index of 0.99 is slightly higher than the average across the 14 counties in the study region. This result is driven primarily by the high number of firms operating in the County along with the high earnings per job. These combine to give the County the highest index value for monetary capital, and offsets the relatively low index value for natural capital.	**Capital** **0.99** (0.94)
Compared with other counties, with a conversion factor of 0.82, Walla Walla County residents face relatively fewer challenges than the other counties in converting capital resources into economic resilience. More specifically, Walla Walla County marks as either "present" or is above average for nearly every attribute, e.g., presence of an Interstate, freight railroad, college, contributing to the conversion factor. Indeed, the only attribute lacking is an Interstate highway.	**Conversion Factor** **0.82** (0.57)
The capital index conditioned on the conversion factor, results in a relative resilience index for Walla Walla County of 1.21, about 21% higher than the average of the 14 counties in the study area[2]. This follows directly from the county's capital and conversion factor, and it implies that among these counties, the Walla Walla County economy is somewhat less susceptible to a downturn in the face of an economic shock.	**Economic Resilience** **1.21** (1.00)
Walla Walla County economy is less exposed, with a relative exposure index of about 0.13, or about 87% lower than the average across counties in the study area. More precisely, for each of the three measures, Walla Walla County has either the lowest or second lowest index value. This results in an exposure to Forest Service planning that is the lowest of the 14 counties in the study area.	**Exposure** **0.13** (1.00)
The ROI for Walla Walla County is -0.07[3]. This is the lowest RO index of the 14 counties, and reflects the County's high resilience score (and therefore low vulnerability) combined with its low exposure to Forest Service planning. The interpretation of this index score is that the County is less susceptible to economic impacts related to changes in Forest Service planning than the average for counties in the study area.	**R/O Index** **-0.07** (1.00)

[1] See attached "Risk/Opportunity Index Appendix" for a full breakdown of these measures and explanation of how they were calculated.
[2] Because we want to differentiate between counties, we divide the raw measure for economic resilience and exposure by the average of the 14 counties. This also results in a final county ROI that is relative to the 14 counties.
[3] The negative value of the County ROI results from converting the resilience index from increasing to decreasing. Because the County exposure and resilience index were both low before this conversion, the conversion resulted in a negative final ROI.

Scatter Plot: Risk Opportunity Index for Walla Walla County



The scatter plot above maps out Walla Walla County's exposure, resilience and resulting ROI in the context of the remaining counties of the study area. In general, counties in quadrant III have a ROI of less than 0.80. This indicates that, relative to the remaining counties, their economies are relatively resilient and less exposed to Forest Service planning decisions than other counties of the study area.

Given their relatively high economic resilience and low exposure to Forest Service activities, counties in this quadrant are least likely to suffer negative consequences to their economy were the Forest Service to shift activities away from the county. Conversely, the low current exposure allows for greater opportunity to boost benefits to economy through increasing Forest Service exposure so long as it effectively targets economic resilience.

Walla Walla County Analysis

Grazing

In Walla Walla County, beef and cattle ranching accounts for $40.49 million of annual output, with 126.33 jobs and average wages of $50,075 per year.

Current Industry Snapshot (includes feedlots and dual-purpose ranching and farming):

2021 Industry Output Walla Walla County	**Employment**	**Average Employee Compensation**	**Economic Output**
	126.33	**$50,075/yr**	**$40.49 million**

Economic Benefit of Additional Grazing

Additional 1000 AUMs (either new or currently no tin use and placed in use)	**Jobs**	**Economic Output**
	3.3	$177,000

2017 Forest Service Data Adjusted for Inflation

Recreation

The following analysis measures the impact to Walla Walla County from lodging, restaurants, grocery purchases and fuel primarily, with some assessment of general tourism spending. This data estimates the effect of a 10% increase in visitation and spending (regardless of use).

Walla Walla County Tourism Impact from 10% Growth in Tourism on FS Land

Employment	**Output**
1.99	**$195,863**

Timber

Walla Walla County has very limited timber production.

Timber (cont.)

The following data looks at the current industry snapshot, the 1990 estimate if it were duplicated today, and both 10% and 20% changes to the current level of output in the Forest Service managed lands. These results were successfully checked with the TREAT model that the Forest Service economists use for verification (Sorenson, et.al 2015):

Walla Walla County			Employment	Output
Current Commercial Logging			18.48	$2.97 million
Share in National Forest Land	3.5%			$103,950
		1990 FS Direct Output	Employment	Output
Total Economic Impact of 1990 Output Levels (est. 8x current production/ output)		$831,600	9.33	$1.35 million

10% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	0.06	$8,765.47	$8,254.42	$10,395.00
2 - Indirect	0.02	$560.08	$636.91	$959.12
3 - Induced	0.04	$1,609.62	$3,288.31	$5,608.24
	0.12	**$10,935.18**	**$12,179.64**	**$16,962.35**

20% Change to Current Commercial Logging Activity in National Forest				
Impact	Employment	Labor Income	Value Added	Output
1 - Direct	0.13	$17,350.95	$16,509.84	$20,790.00
2 - Indirect	0.03	$1,120.17	$1,273.81	$1,918.23
3 - Induced	0.07	$3,219.24	$6,576.63	$11,216.47
	0.23	**$21,870.36**	**$24,359.28**	**$33,924.71**

Stewardship Contracting in Walla Walla County

In Walla Walla County, there have been $2,009,905 of contracts since 2010, covering 53 projects for an average of $37,923 per contract. According to the Mt. Hood study these contracts should generate over $265,465 of economic activity, primarily affecting commercial thinning and trucking directly, but each contract should generate service work as well. The retained receipts could be used for restoration work in the forest. The additional restoration and service work has a higher multiplier and would result in additional economic activity. If the economic benefits were similar, each $37,923 contract should result in potentially over $265,000 in output and 4 jobs (Daniels, Neilsen-Pincus, Paruszkiewicz, & Poage, 2018).

Appendices

This section describes methods and sources for the development of the Risk Opportunity Index, IMPLAN scenario modeling, and the "Who Gets the Work" maps.

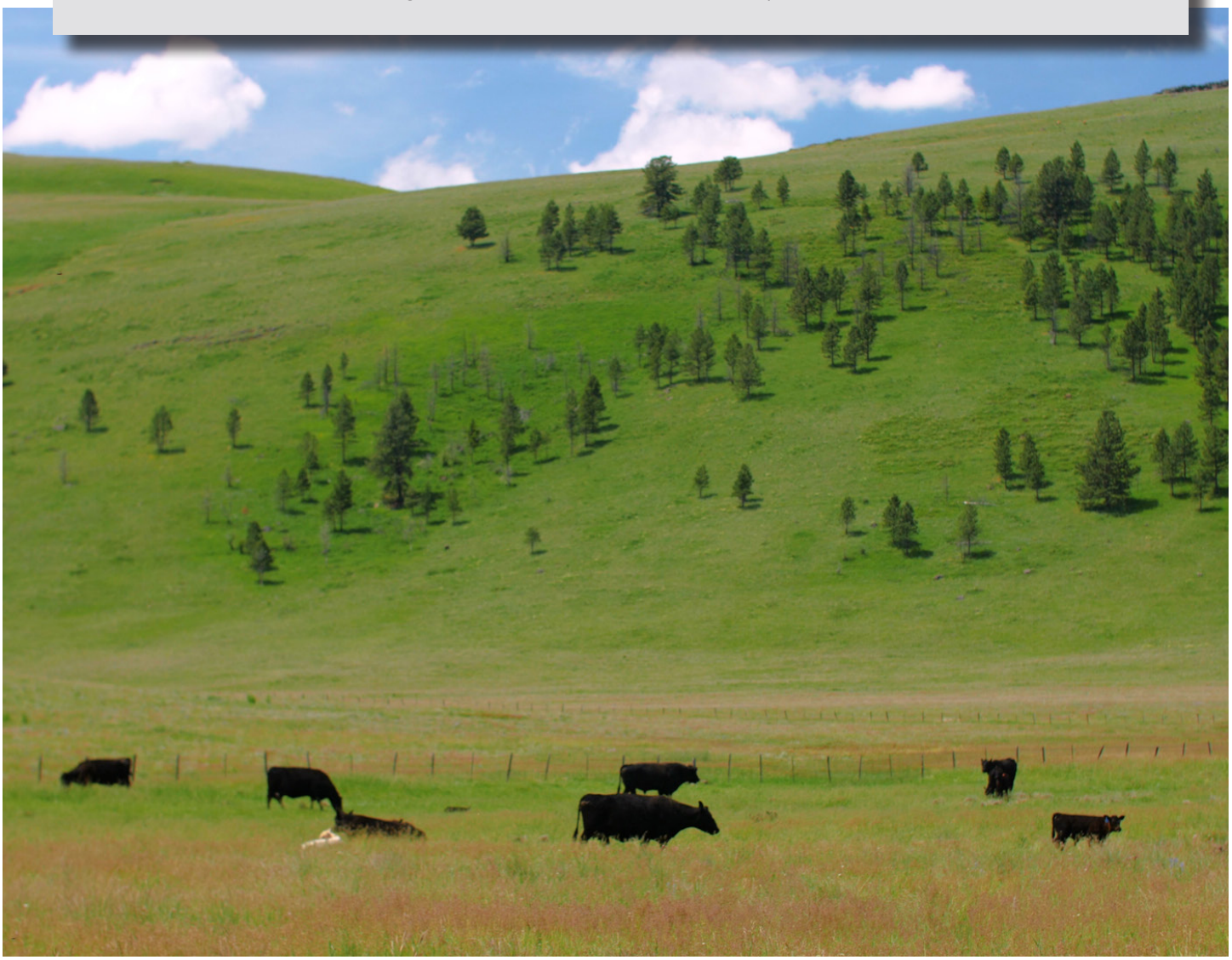


Photo Courtesty of Wallowa Resources.

Risk/Opportunity Index - Appendix

Executive Summary

This sub-report describes the "Risk/Opportunity Index" (ROI). This index characterizes the 14 counties of eastern Oregon and southeast Washington in terms of 1) their exposure to management activities on Forest Service land and 2) their overall economic resilience. After preliminary research and internal reviews, a beta version of the ROI was created and examined by stakeholders in four counties. Feedback from these sessions was incorporated into a final version which was then "ground-truthed" via five additional county-level meetings in four counties. The resulting 14 county summaries and this final report were presented to the Blues Interagency Council in March of 2022.

Key observations resulting from this work include:

- There are substantial differences between the counties in the study both in terms of their exposure to management of Forest Service lands and their economic resilience.
- The ROI is a relative measure comparing each county to the other counties of the study area. When examined against Oregon and Washington state averages, these counties are generally less resilient and more exposed than the average county in their respective States.
- Because the ROI is a county-level instrument it may mask relevant within-county differences. It is also a snapshot based on near term information that could mask important trends. Consequently, to make use of the ROI we recommend county stakeholders and Forest Service personnel engage in discussions focusing on the county exposure-resilience tradeoffs and synergies modelled by the ROI.
- Examining the economies of these counties revealed some interesting patterns including an observed negative relationship between economic resilience and exposure to management of Forest Service lands, a divergence between earnings per job and per capita income in some counties, and a relationship between disadvantaged populations and the ROI. These observations are discussed in the following report.

1. Introduction

The Risk/Opportunity Index (ROI) is a measure of a county's relative economic sensitivity to changes in management activities on the three national forests of the Blue Mountains. As such it has two parts. The first part is an estimate of the location's economic "resilience". For the purposes of this report resilience is the ability of a county or a community to withstand or recover from an outside shock to its economy (1). The second part of the index, "exposure", considers a county's economic ties to the national forests of the Blue Mountains. The idea here is that a location may be deemed "resilient" but have close ties to Forest Service lands or forest-based industries, and thus still be somewhat vulnerable economically to changes in forest management activities. Alternatively, a location that is resilient but not closely tied to activities in the national forests may be less vulnerable to such shifts.

The ROI addresses a need, identified by the Forest Service and counties of the region, to account for the differences between the economies of the counties that share the Wallowa-Whitman, Umatilla, and Malheur National Forests. The ROI is, therefore, a relative measure. Among the fourteen counties of the study region the ROI estimates which are the most and least economically resilient, and which are most and least exposed to management on Forest Service lands.

In the following sections we describe how the ROI was assembled and summarize the sources and thinking underlying each element part of the index. This is followed by a discussion of the ROI in the context of Washington's and Oregon's state economies, links to marginalized populations, and suggestions for putting the ROI to use.

2. Procedure

2.1 PRELIMINARY REVIEW

Initial work on development of the ROI consisted of a review of the literature on existing indices. There is a plethora of indices in the published literature profiling various forms of economic vulnerability and resilience. Many gauge resilience or vulnerability to environmental change (2) (3), or natural disasters (4) (5), while others to an economic shock (6) (7).

Of particular relevance to this study was the work of Horne and Hayes who developed a measure of socio-economic resilience for counties in the Columbia Basin (8). Their work was helpful in that it related directly to the region of the current study and provided an example that included direct measures of reliance on forage and timber. A second index that was exceptionally useful was the Index of Economic Opportunity (9). This measure profiled county economies of the region under study, and used many of the indicators incorporated into the ROI. It is also a "relative" measure, so it gauges economic opportunity relative to other counties within its study area. Based on tools like these, we assembled a preliminary version of the ROI. Key issues to address in this stage involved determining what specific elements to include in the ROI, how each of these elements would be represented, and how they would be aggregated.

2.2 ASSEMBLING A PRELIMINARY VERSION OF THE ROI—BASE ECONOMIC RESILIENCE

Development of the preliminary version of the ROI required settling on the general structure of the index. Based on the literature and economic intuition we opted for a two-branched structure as presented in Figure 1. One branch consisted of a measure of county-level economic resilience where economic resilience was a function of three forms of capital, human/social, monetary, and natural, as well as the county's ability to convert this capital into economic resilience. The other branch consisted of county-level exposure to management on Forest Service lands.

Selection of the measures that make up the economic resilience measure of the ROI proceeded in two stages. The initial selection of measures, for example earnings per job, and acres of farmland per person, was guided by the literature and practical economic intuition. For example, economic diversity is often cited as an important constituent of a resilient economy (10) (11), and was thus included in the ROI. However, it did little to differentiate between counties because in practice nearly identical values were generated by counties with many establishments and counties with few establishments. Thus, the "number of establishments" was introduced to the economic resilience measure as a complement to economic diversity. These two measures together outperformed either one taken on its own.

After the candidate measures were selected we conducted a series of sensitivity analyses and internal reviews. Ultimately, the measures put forth in the preliminary version of the ROI were as parsimonious as possible, intuitive, and generated resilience values that were reasonably stable.

Aggregation of the measures also had to be intuitive and result in stable values. Our approach to aggregation took the general form of:

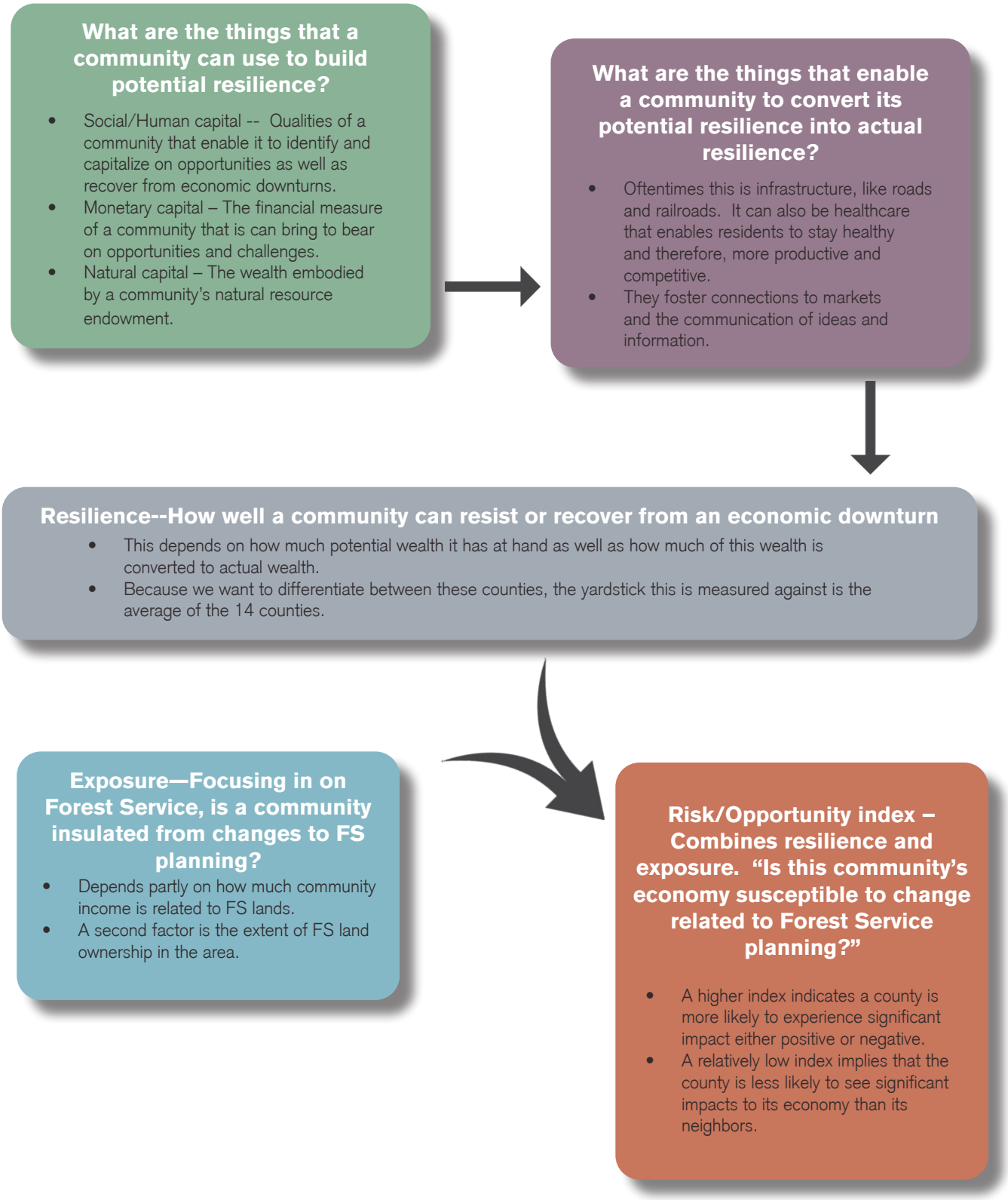
$$(1) \quad Sub-index\ 1 = county\ measure\ i / average\ across\ counties\ of\ measure\ i$$

$$(2) \quad Sub-index\ 2 = \left(\sum_i^{N\ measures} Sub-index\ 1_i\right)/N$$

$$(3) \quad Base\ Capital\ Index = \left(\sum_i^{N\ forms\ of\ capital} Sub-index\ 2_i\right)/N$$

Equation 1 shows that each measure of base, or "potential", economic resilience is estimated in relative terms based on average values across all the counties. Equation 2 generates the index related to each form of capital. For human/social capital and monetary capital there are 5 measures each, while natural capital is based on 4 measures. Equation 3

Figure 1: Schematic Overview of the Risk/ Opportunity Index



indicates that base capital index is a simple average of the capital-based indices.

The nature of the measures sometimes required transformation. For example, given the goal of estimating relative resilience, "poverty rate" was converted to "non-poverty rate" by simple subtraction. There were also challenges related to the magnitude of the differences between a county's measure and the average of the counties. When necessary, some measures were converted to natural logarithms to avoid a single measure being so large that it dominated the index.[1] These individual transformations are detailed in the description of the measures in the Results section below.

Lastly, none of these measures or forms of capital are weighted. Oftentimes measures are weighted in an index (see for example (9)). In developing the ROI we decided against weighting to facilitate easier interpretation of the values and to maintain transparency.

2.3 ASSEMBLING A PRELIMINARY VERSION OF THE ROI—THE CONVERSION FACTOR AND FINAL ECONOMIC RESILIENCE

After calculating county base capital indies, each county's base capital was conditioned on a "conversion factor". The measures that make up the conversion factor represent a sampling of attributes within a county that enable it to convert its base capital into actual economic resilience. For example, a farm that is able to transport its produce to outside markets more easily is more economically productive than it would be if it could not do this due to isolation. To account for this, we use a "conversion factor"—a number that estimates a county's ability to "convert" its base capital into actual resilience and wealth. It takes the general form:

$$(4) \quad County\ conversion\ factor = \left(\sum_i^{N\ converters} Converter_i\right)/N$$

where each converter took a value between one and zero. For example, if a county had an Interstate highway within its borders it was given a 1, and alternatively, a 0, while Broadband access was reported as a percentage. A detailed description of the measures used in the conversion factor are provided below in the Results section.

Each county's base capital was conditioned on its conversion factor as follows:

$$(5) \quad County\ economic\ resilience = (0.5 \times Base\ Capital\ Index \times County\ conversion\ factor) + (0.5 \times Base\ Capital\ Index)$$

In this formulation the conversion factor acts on fifty percent of the base capital. The intuition underlying this, is that a county where the listed converters are completely absent still participates in the greater market to some degree, and therefore, it would be a mistake to say the county brings zero capital to bear on its economic resilience. We adopted the rate of fifty percent because it avoids weighting the conversion factor in a way that may seem to favor a given set of counties.

In many studies of economic resilience, the elements making up the conversion factor are defined as infrastructure

[1] To note is that this transformation shifts the interpretation of the given index value. Specifically, the average across counties for these measures is not equal to 1.

or "built capital". However, authors have acknowledged that built capital seems to play a different role in economic resilience. For example, rather than being a source of wealth, built capital may enhance the development of other capitals (10). To the extent that our "conversion factor" is a novel approach to the treatment of built capital, we conducted a series of sensitivity analyses. We found that when we treated the elements of the conversion factor as a fourth form of capital the county resilience indices grew closer, or rather, low resilience counties gain a bit, while high resilience counties lost a bit. Further inquiry showed that the conversion factor was negatively correlated with the natural capital sub-index of the economic resilience (see also, (10)). This implies that by treating built capital as a converter rather than simply another form of capital, we may avoid over-valuing natural capital's contribution to economic resilience. This tentative conclusion was supported by a second sensitivity analysis that examined the effect of different levels of exposure to the conversion factor, e.g., allowing the conversion factor to act on 25% of base capital and 75% of base capital. We found that as the importance of the conversion factor grew, counties with high values for natural capital saw the steepest declines in measured economic resilience.

The final measure of county economic resilience is calculated as shown in equation 6.

$$(6) \quad Relative\ county\ economic\ resilience = \frac{county\ economic\ resilience}{average\ county\ economic\ resilience}$$

Consequently, the interpretation of a given county's measure of economic resilience is as a percentage of the average.

2.4 ASSEMBLING A PRELIMINARY VERSION OF THE ROI—EXPOSURE TO FOREST SERVICE PLANNING

As mentioned above, the ROI combines county relative economic resilience with that county's exposure to management on Forest Service lands. In deciding on the elements that would make up the exposure measure of the ROI we relied on the same the process employed in developing the economic resilience measure—a combination of what was presented in the literature, economic intuition informed by our familiarity with the region, suggestions by outside preliminary reviewers, and sensitivity analyses. Also like the economic resilience measure, we worked to build an exposure measure that was as parsimonious as possible, intuitive, and generated values that were reasonably stable. The final measure took the form presented in equation 7.

$$(7) \quad County\ exposure\ index = \left(\begin{array}{c} \frac{\left(\frac{\left(\sum_i^{N\ measures} income\ measure\ i\right)}{Total\ labor\ income}\right)}{(County\ average)} + \\ (Forest\ Service\ land\ as\ \%\ of\ county\ total / County\ average) + \\ (Forest\ Service\ related\ Federal\ payments\ as\ \%\ of\ county\ budget / County\ average) \end{array} \right| 3 \Bigg)$$

Note that, like the measures of resilience, the exposure measure is relative to the average across the 14 counties. Also, the constituent parts of the measure are equally weighted. A detailed description of the measures use in the exposure index are provided below in the Results section.

2.5 ASSEMBLING A PRELIMINARY VERSION OF THE ROI—CALCULATING THE ROI

Combining the measures of resilience and exposure gives us a measure of the county's "risk/opportunity" related to management on Forest Service lands. In evaluating alternative approaches to aggregating these measures (simple summation, arithmetic mean, geometric mean), we concluded that summing the two is preferred. This is based on simple correlations showing the relationship between the sum and the resilience and exposure measures is either higher or almost identical to the relationships of the alternatives to the resilience and exposure measures. All three approaches result in nearly identical ranking of risk/opportunity. It is also the simplest and easiest to interpret.

In general, the potential impact of a shift in management of Forest Service land on a county's economy is an increasing function of exposure, but a decreasing function of resilience. Thus, for the purposes of calculating the ROI we use "1 minus the resilience index". The resulting resilience number represents a county's susceptibility to an economic shock—the higher the value, the less resilient it is. With the above in mind, the final ROI is the sum of a county's exposure and 1 minus resilience where higher numbers represent greater risk and/or opportunity as presented in equation 8.

$$(8) \quad \text{RO } Index = (1 - Economic\ resilience\ index) + (Exposure\ index)$$

2.6 BETA-TESTING

The preliminary version of the ROI was subjected to beta testing in four counties. The counties were selected to be somewhat representative of the region from north to south, and with three in Oregon and one in Washington. To prepare for the sessions, each county received a preliminary ROI report that included background on the ROI and a two-page summary of the county's ROI. A sample two-page summary is presented in Attachment 1 of this sub-report. For space purposes, the remaining background information is not included.

Beta testing sessions took place over Zoom. The sessions lasted about 1.5 hours. Participation ranged from one county commissioner to multiple county commissioners and county stakeholders. Two important observations came from these sessions. Overall, the ROI did a good job of presenting the county economy and the profile of the Forest Service activity level in that county. In addition, session participants provided excellent insights that we were able to incorporate into the final version of the ROI. This latter observation was expected given the complexity of each county's economy, and it emphasized the need to conduct a robust ground-truthing phase as part of the deployment of the ROI.

2.7 FINALIZING THE ROI AND GROUND-TRUTHING

We refined the ROI based on the feedback gained though beta testing, and composed a version of the ROI for each county in the study area. In response, five sessions were held in four counties, with participation once again ranging from one county commissioner to multiple commissioners and stakeholders. Excellent insights were provided in these sessions. Notes taken during the sessions were shared with session participants and are included in Attachment 2 of this sub-report. These insights informed the final versions of the county ROI summaries presented in the overall report.

These notes reveal an important observation. The ROI is tailored to the conditions of eastern Oregon and southeast Washington counties. However, even at this level the ROI estimates still glaze over between and within county differences. The ground truthing sessions, as anticipated, were essential in closing the gap between the estimation provided by the ROI, and the economic constraints and opportunities facing a specific county.

3. Results

The discussion below provides a detailed description of the measures used to calculate the final versions of the county ROI estimates.

3.1 SOCIAL/HUMAN CAPITAL

Social and human capital is the "people generated" value of a community. More specifically, social capital is based on the relationships between community members, and generally the stronger these relationships the more economically resilient a community is. Human capital is a related idea having to do with the knowledge and skills of community members. This is seen as a source of economic resilience and prosperity. We estimate this capital by:

- Marginalized households – This is measured as 1 minus the percentage of "potentially vulnerable households", defined as households occupied by a person 65 years old or older and living alone, single female-headed households, and households without a car in 2018 (11). We assume that they represent a group of people who, given their more tenuous economic position, are less able to contribute to the community in terms of resources, energy, or ideas.
- Homeownership (12) – Higher rates of home ownership are related to higher levels of social capital (13). This information is made somewhat less useful by the possibility that some homeownership is actually a second home, and these are not explicitly accounted for in the social capital literature to our knowledge.
- Education (14) – This is the percentage of residents with an Associate's degree or higher in 2019. Education is positively related to both increasing competitiveness and increasing social capital (13).
- Housing cost burdened, 2018 (15) – High housing costs, when mortgage payments are more than 30% of household income, can diminish a community's command over resources. When housing costs are low families have more disposable income to meet their needs and support their community. This can be an important issue for a community transitioning to a recreation economy. To convert this to a measure of resilience we calculate one minus "Percent Housing Cost Burdened" based on mortgage payments and 5-year estimates. Thus, the higher the number, the less burdened a county is with high housing costs.
- Population density – This is measured by county population in 2019 (16) divided by the county land area in 2010 (17). The lower the density, the fewer are the relationships/exchanges between members of the community. This is also an estimate of "agglomeration" economies, or rather, the boost in economic productivity observed when interactions between people increase (18). Because the magnitude of this estimate can vary dramatically, sub-index 1 is calculated as the natural logarithm of county population density divided by the natural logarithm of the average population density. In cases of very low population density this can return a negative value, however, because the sub-index is averaged with the remaining sub-indices the effect on resilience is consistent with the other measures.

Monetary capital represents the financial resources of the community. This is directly related to the command over resources that the community has. It is also linked to uncertainty since households and communities with relatively limited financial resources tend to face more uncertain futures, and adjust behaviors accordingly, e.g. decrease spending. Some of these measures are often converted to logarithmic form in the literature. This index is based on linear estimates to create additional space between the counties and to acknowledge that some county incomes are quite low. The estimate of monetary capital is based on:

- Poverty rate (19) -- The 2019 poverty rate helps to account for the important fraction of people in a community who are significantly constrained with respect to income, but may otherwise escape other measures of overall wealth, for example, where housing costs are low but incomes are also low. To be consistent with our other measures we use 1 – "Percentage of People in Poverty".
- Average earnings per job (20) – A direct measure of the earnings of workers in the community in 2018, reported in 2019 dollars. By using this measure of income, we focus on the wage earners in an area rather than a broader measure, e.g. per capita income, which can include incomes from retirees and other non-working members of the community. In addition, all else equal, higher pay per job can imply greater competitiveness.
- Employment (21) – We estimate the fraction of the labor pool that is working in 2018 calculated as one minus unemployment. Taken together with earnings per job this can help us discern locations where the labor force may be almost fully employed, but also face low wages. To note is that these figures can differ when seasonality is considered, however, to our knowledge seasonally adjusted unemployment rates are not available for the subject counties in Washington. Therefore, we use non-seasonally adjusted figures for consistency.
- Economic diversity – This is both important and difficult to interpret, for example, as the geographic scale of the

analysis increases, so can the value taken by a diversity measure (8). Also, there are locations where economic diversity is low but economic performance is high, and economic diversity has been associated with both increasing resilience and decreasing stability (22). However, research indicates that broadly speaking, more diverse economies fare better in the face of an economic shock (23). Our measure here is the Shannon-Weaver Diversity Index (24) where a value of "1" would result if each industry with an economy had an equal number of employees. While this measure is broadly used, it also has weaknesses. For example, it is a measure of how evenly jobs are spread among sectors of an economy. Consequently, an economy with 10 workers in each industry will return the same diversity score as an economy with 10,000 workers in each sector. This is a concern given the disparity in size of the county economies in the region. Our calculations are based on 2019 estimated employee numbers across the thirteen main industries of a county economy: agriculture, forestry, fishing & hunting, mining; construction; manufacturing; wholesale trade; retail trade; transport, warehousing, and utilities; information; finance and insurance, and real estate; professional, scientific and management, administrative/waste management services; education, health care, and social assistance; arts, entertainment, recreation, accommodations, and food; other services, except public administration; and public administration (25).

- Number of establishments (26)– This estimates the number of single or multiple establishment enterprises, and is a measure of how firms have adjusted to a market (27). We assume that overall community wealth is positively related to the number of establishments within that community. Informal investigation indicates that this number is closely related to the overall number of jobs in a given area. This measure also provides an important compliment to our diversity measure in that it is a measure of the overall size of the economy, where we assume size and resilience are positively related.

Natural capital is the natural resources within a county that residents can access or capitalize on. Some of the components are measured in logarithmic form to recognize the diminishing returns nature of additional resources. It is estimated here by:

- Production land per person – This is composed of the acres of cropland, woodland, permanent pasture and rangeland in 2017 (28), summed and divided by the county population in 2019 (29). Because the magnitude of these estimates can vary dramatically, sub-index 1 is calculated as the natural logarithm of this acreage per person divided by the natural logarithm of the average acreage per person.
- Water resources per person – This is estimated as the sum of self-supplied total groundwater and surface water irrigation resources in 2015 (30) divided by county population in 2019 (16). Because the magnitude of these estimates can vary dramatically, sub-index 1 is calculated as the natural logarithm of total irrigation water per person divided by the natural logarithm of the average total irrigation water per person.
- Forest Service land more available for commodity production – This is estimated by the acres of Type C (less restrictive management protocols) Forest Service land in the county (31). For example, this classification excludes wilderness areas and wild and scenic rivers and national parks where such production is often quite limited, and consequently may have less of an economic impact on come counties (32). Because the magnitude of these estimates can vary dramatically, sub-index 1 is calculated as the natural logarithm of acres of Type C land in the county divided by the natural logarithm of the average acres of Type C land.
- Scenic amenities importance -- Natural resources can also generate wealth via tourism. To account for this, we use a percentage of county full and part-time jobs in tourism and travel, or rather, "Tourism sensitive" industries in 2018 (33).

Table 1 presents the final values for the sub-indices, and base resilience for each county presented below.

Table 1: Disaggregated Base Resilience Indices

Measure	Asotin	Baker	Columbia	Crook	Garfield	Grant	Harney	Malheur	Morrow	Umatilla	Union	Walla Walla	Wallowa	Wheeler
Social/human capital														
1 - Percent vulnerable households	1.05	0.98	1.01	1.02	1.10	1.04	1.00	0.89	1.06	0.91	0.98	0.94	0.98	1.03
Percent home ownership	1.03	1.03	0.98	1.05	1.04	1.03	1.05	0.85	1.02	0.95	0.94	0.94	1.01	1.10
1 - Percent housing cost burdened	1.13	0.97	0.97	0.96	1.16	0.84	0.93	1.01	1.08	1.04	1.05	1.07	0.98	0.82
Education	1.06	1.03	1.37	0.97	1.24	0.83	0.91	0.73	0.56	0.89	1.11	1.37	1.16	0.76
Population density	1.70	0.79	0.73	1.00	0.54	0.22	-0.15	0.54	0.83	1.52	1.23	0.80	0.40	-0.12
Monetary capital														
1 - Poverty rate	1.02	1.02	1.03	1.01	1.05	0.95	1.04	0.91	1.00	0.96	1.00	1.00	1.01	1.00
Average annual earnings per job	1.09	0.83	1.19	1.06	1.16	0.94	0.85	0.96	1.34	1.10	1.00	1.29	0.71	0.46
Labor force employment	1.01	1.00	0.99	1.00	0.99	0.98	0.99	1.01	1.01	1.00	1.00	1.00	0.99	1.02
Number of firms	1.01	1.39	0.30	1.52	0.11	0.47	0.68	1.66	0.46	1.23	1.56	3.12	0.30	0.18
Economic diversity	0.98	1.03	1.00	1.02	1.00	0.98	0.96	1.03	1.02	1.03	0.98	0.98	1.03	0.97
Natural Capital														
Farmland per person	0.54	0.86	0.91	0.78	1.08	1.00	1.20	0.80	1.02	0.63	0.59	0.51	0.96	1.34
Irrigation water per acre of cropland	0.17	0.58	0.49	1.14	0.16	0.91	1.07	1.15	0.86	0.84	1.05	0.74	1.04	0.99
Acres of Federal land with least commercial use restrictions	0.75	0.99	0.78	0.99	0.77	1.03	1.12	1.10	0.86	0.91	0.94	0.00	0.92	0.89
Scenic amenities	1.05	1.38	0.84	1.14	0.25	0.77	1.57	1.14	0.64	1.15	1.10	0.89	1.03	1.06
Sub-index 2														
Social/Human	1.19	0.96	1.01	0.99	1.01	0.79	0.74	0.80	0.91	1.06	1.05	1.02	0.90	0.72
Monetary	1.02	1.05	0.90	1.12	0.86	0.86	0.90	1.11	0.96	1.06	1.11	1.47	0.80	0.72
Natural	0.62	0.95	0.75	1.01	0.56	0.92	1.23	1.04	0.84	0.88	0.91	0.53	0.98	1.07
Base Resilience Index	0.94	0.98	0.88	1.04	0.81	0.86	0.96	0.98	0.90	1.00	1.02	1.01	0.89	0.83

3.2 CONVERSION FACTOR

After refinements gained via the beta testing and ground truthing session, these are the elements of the final conversion factor:

- Hospital (0/1) – To register as present, a county needs to have a health facility where residents can come for regular medical examinations. We assume that such a facility will help to maintain a productive workforce. These were tallied based on a simple Internet search.
- University/College (0/1) – Counties with a university or community college are represented by "1" here. We assume that they are important converters of potential human capital into actual human capital. These were tallied based on an Internet search.
- Interstate (0/1) – We assume that counties with an interstate highway passing through them are significantly more connected to outside markets than those that are not. This tally is based on current road maps. This is a coarse measure given that residents in a county without an interstate highway may actually be closer to such a highway than some residents in a large county with such a highway.
- Airport (0/1) -- The development status of a given location is partly related to airport access. More specifically, being within 100 miles of a major airport has been linked to additional development (34). With this in mind, where the county seat is within 100 miles of an airport as estimated by "Google Directions", and that airport is classified as

"primary", or rather, boards at least 10,000 fare paying passengers per year by the Federal Aviation Administration (35) the county receives a "1", and otherwise a "0".

- Railroad (0/1) – As is the case with interstate highways, we assume that counties with a freight railroad passing through them are more connected to outside markets and receive a "1". This information was gathered from the County Transportation Profiles put together by the Bureau of Transportation Statistics (36). Where the stated value in the table below does not match the value reported on the Bureau's website, we used more up-to-date local information.
- Metro Area proximity – This measure makes use of the Rural-Urban Continuum Codes" developed by the USDA Economic Research Service (37). This scheme assigns values of 1 to 9 based on a county population and/or proximity to a population center, where 1 represents the most urban, and 9 the most rural. To render this consistent with our index, we use the relationship (-0.125 x continuum code)+(1.125). For example, the most rural county has a continuum code of "9", and this equation converts this to a "0" while the most urban continuum code is "1" and the equation returns a value of "1".
- Broadband (%) – This accounts for the business activity that can now be conducted over the Internet. The information comes from Federal Communication Commission's "Mapping Broadband Health in America" (38). While this information has been updated in 2017, in general we assume broadband coverage is changing quickly, so it will be important to monitor these percentages.

Summing these measures and dividing by the maximum possible score gives us a the final "conversion" factor for each county presented below.

Table 2: Conversion Factors

Factor	Asotin	Baker	Columbia	Crook	Garfield	Grant	Harney	Malheur	Morrow	Umatilla	Union	Walla Walla	Wallowa	Wheeler
Hospital (0/1)	1	1	1	1	1	1	1	1	1	1	1	1	1	0
University/College (0/1)	0	1	0	1	0	0	0	0	1	1	1	1	0	0
Interstate (0/1)	0	1	0	0	0	0	0	1	1	1	1	0	0	0
Airport Access	1	0	1	1	1	0	0	1	1	1	0	1	0	0
Railroad (0/1)	1	1	1	0	1	0	0	1	1	1	1	1	1	0
Metro area access	0.75	0.25	0.75	0.37	0.12	0	0.25	0.37	0.37	0.62	0.25	0.75	0	0
Broadband (%)	0.95	0.06	1	0.98	1	0.73	0	0.64	0.49	0.81	0.72	1	0.95	0
Conversion Factor	0.67	0.62	0.68	0.62	0.59	0.25	0.18	0.86	0.84	0.92	0.71	0.82	0.28	0

3.3 FINAL RESILIENCE INDEX

Combining the base resilience for each county with the county's conversion factor as described in the Procedure section above, gives us the final resilience indices presented below.

Table 3: Final Resilience Index

	Asotin	Baker	Columbia	Crook	Garfield	Grant	Harney	Malheur	Morrow	Umatilla	Union	Walla Walla	Wallowa	Wheeler
Unstandardized resilience index	0.78	0.78	0.74	0.83	0.65	0.54	0.56	0.90	0.83	1.08	0.88	0.90	0.59	0.41
Standardized resilience index	1.05	1.04	0.99	1.11	0.86	0.72	0.75	1.20	1.11	1.28	1.17	1.21	0.79	0.55

3.4 EXPOSURE TO MANAGEMENT ON FOREST SERVICE LANDS

To estimate an area's exposure to Forest Service planning we use 1) labor incomes stemming from production related to forest lands, as well as labor incomes from tourism sensitive businesses, 2) the extent of Forest Service land in the county, and 3) the fraction of county government revenue most closely related to Forest Service payments. Each of these is summarized below.

- **Labor income:** Looking at the importance of income, for each county we sum the labor incomes for the forest-linked industries listed below. We then divide this by the total labor income in the county to get that fraction of the county's labor income derived from production most likely to be related to forest lands. The incomes used for this calculation are generated using IMPLAN software. Note that this does not account for additional, or rather "induced", incomes that this income can generate in a community. It is therefore a conservative estimate of economic importance.

  To estimate the importance of income from forest-related tourism to an area, we sum the labor incomes from the travel-sensitive industries listed below, and divide this by the total labor income to get the fraction of county labor income related to tourism. To account for the fact that not all tourism is related to public lands, we multiplied the tourism-related fraction of total labor income by the percent of Federal land in the county (39). This gives us a rough measure of the importance of natural resource-related tourism in an area.

Forest-linked industries

Beef cattle ranching and farming, including feedlots and dual-purpose ranching
Forestry, forest products, and timber tract production
Commercial logging
Commercial hunting and trapping
Support activities for agriculture and forestry
Sawmills
Wood preservation
Veneer and plywood manufacturing
Engineered wood member and truss manufacturing
Reconstituted wood product manufacturing
Wood windows and door manufacturing
Cut stock, resawing lumber, and planing
Other millwork, including flooring
Wood container and pallet manufacturing
Manufactured home (mobile home) manufacturing
Prefabricated wood building manufacturing
All other miscellaneous wood product manufacturing
Pulp mills
Paper mills

Travel and tourism-sensitive industries

Hotels and motels, including casino hotels
Other accommodations
Full-service restaurants
Limited-service restaurants

- **Extent of Forest Service land:** To complement the above income-based measure, we include the percent of Forest Service land in the county (39). This acknowledges the fact that some areas have a significant portion of public land that is not Forest Service land, and given the context of the ROI, in practical terms the extent of Forest Service land ownership in the area is closely related to the area's exposure.

- **Forest Service payments:** To the extent that payments to county governments for Forest Service land are an important source of revenue, a county can be considered exposed to Forest Service planning decisions. We account for this by estimating the percentage of a county's budget coming from Forest Service payments, and more specifically, Payments in Lieu of Taxes (PILT), and Forest Service revenue sharing.

  Because PILT is related to Federal land ownership in general, we condition county PILT payments on the percentage of total Federal land that is Forest Service land in the county. This is calculated by multiplying the total PILT payment to the county by the percentage of Federal land in the county that is Forest Service land. This dollar amount is added to the second component of Forest Service related payments, Forest Service revenue sharing. The sum of these two is then divided by the total county revenue to arrive at the percentage of each county budget that is linked to Forest Service payments.

Estimated PILT dollars are based on 2019 payments converted to 2020 dollars as reported by the US Department of Interior (40). Estimated county revenue is also presented in A Profile of Federal Land Payments (40). The land ownership estimates come from the US Geological Survey, Gap Analysis Program, (31).

These three measures entail an empirical challenge. Specifically, the extent of Forest Service land varies over a wider range than the other measures. This can confer an implicit weight to this part of the exposure measure. To address this challenge the exposure index has been standardized so that each county's final exposure index in row 10 is relative to the average of the counties, and the three elements contribute equally. The final exposure index for each county is presented in the Table below.

Table 4: Exposure Index

	Asotin	Baker	Columbia	Crook	Garfield	Grant	Harney	Malheur	Morrow	Umatilla	Union	Walla Walla	Wallowa	Wheeler	AVERAGE
1. Fraction of total labor income generated by timber and ranching	0.031	0.115	0.117	0.154	0.045	0.129	0.072	0.039	0.084	0.065	0.073	0.022	0.058	0.012	0.073
2. Fraction of total labor income from tourism sensitive incomes conditioned on public lands ownership[1]	0.006	0.015	0.006	0.011	0.003	0.016	0.007	0.000	0.001	0.007	0.018	0.001	0.028	0.003	0.009
3. Total income percentage (1+2)	0.037	0.130	0.124	0.165	0.048	0.145	0.079	0.039	0.086	0.072	0.091	0.023	0.086	0.016	0.081
4. FS land as a percentage of total land	0.132	0.328	0.285	0.228	0.207	0.550	0.080	0.001	0.110	0.195	0.473	0.027	0.571	0.154	0.239
5. FS-related Federal payments as percent of total county budget	0.002	0.022	0.013	0.023	0.013	0.058	0.026	0.000	0.004	0.003	0.022	0.000	0.029	0.059	0.020
6. Relative Total income percentage	0.456	1.592	1.517	2.033	0.590	1.777	0.965	0.476	1.054	0.888	1.115	0.286	1.057	0.191	1
7. Relative FS land as a percentage of total land	0.555	1.373	1.194	0.955	0.869	2.304	0.335	0.003	0.461	0.817	1.983	0.113	2.393	0.645	1
8. Relative FS-related Federal payments as percent of total county budget	0.120	1.138	0.662	1.190	0.676	2.942	1.306	0.001	0.190	0.149	1.119	0.001	1.499	3.006	1
9. Raw exposure index	1.131	4.103	3.373	4.178	2.136	7.023	2.607	0.480	1.705	1.853	4.217	0.401	4.950	3.843	3.000
10. Standardized exposure index	0.377	1.368	1.124	1.393	0.712	2.341	0.869	0.160	0.568	0.618	1.406	0.134	1.650	1.281	1

3.5 COUNTY RISK/OPPORTUNITY INDEX

The final ROI for each county is presented below. Note that the ROI can take on a negative value when, as in the case of Walla Walla, a county has a high resilience index, and low exposure. Although a bit surprising, the interpretation of such a result is the same as for the ROI of the other counties.

Table 5: Risk/Opportunity Index

Element	Asotin	Baker	Columbia	Crook	Garfield	Grant	Harney	Malheur	Morrow	Umatilla	Union	Walla Walla	Wallowa	Wheeler
Resilience	1.05	1.04	0.99	1.11	0.86	0.72	0.75	1.20	1.11	1.44	1.17	1.21	0.79	0.55
Exposure	0.38	1.37	1.12	1.39	0.71	2.34	0.87	0.16	0.57	0.62	1.41	0.13	1.65	1.28
RO index[1]	0.33	1.33	1.13	1.29	0.85	2.63	1.12	-0.04	0.46	0.17	1.23	-0.07	1.86	1.73

[1]Calculated as (1-resilience index) + exposure index

Table 5 is the scatter plot of county ROI values with resilience on the x-axis and exposure on the y-axis. Dividing this space by average resilience and average exposure creates four quadrants. Graph 1 is helpful in that it provides information on the constraints and opportunities of counties with a similar ROI, for example Harney and Columbia Counties, but with quite different levels of exposure and resilience. This framework has been described elsewhere as vulnerability versus resilience (41) where in our case a county would be deemed vulnerable if it is highly exposed to Forest Service management. The quadrants are interpreted in Table 6.

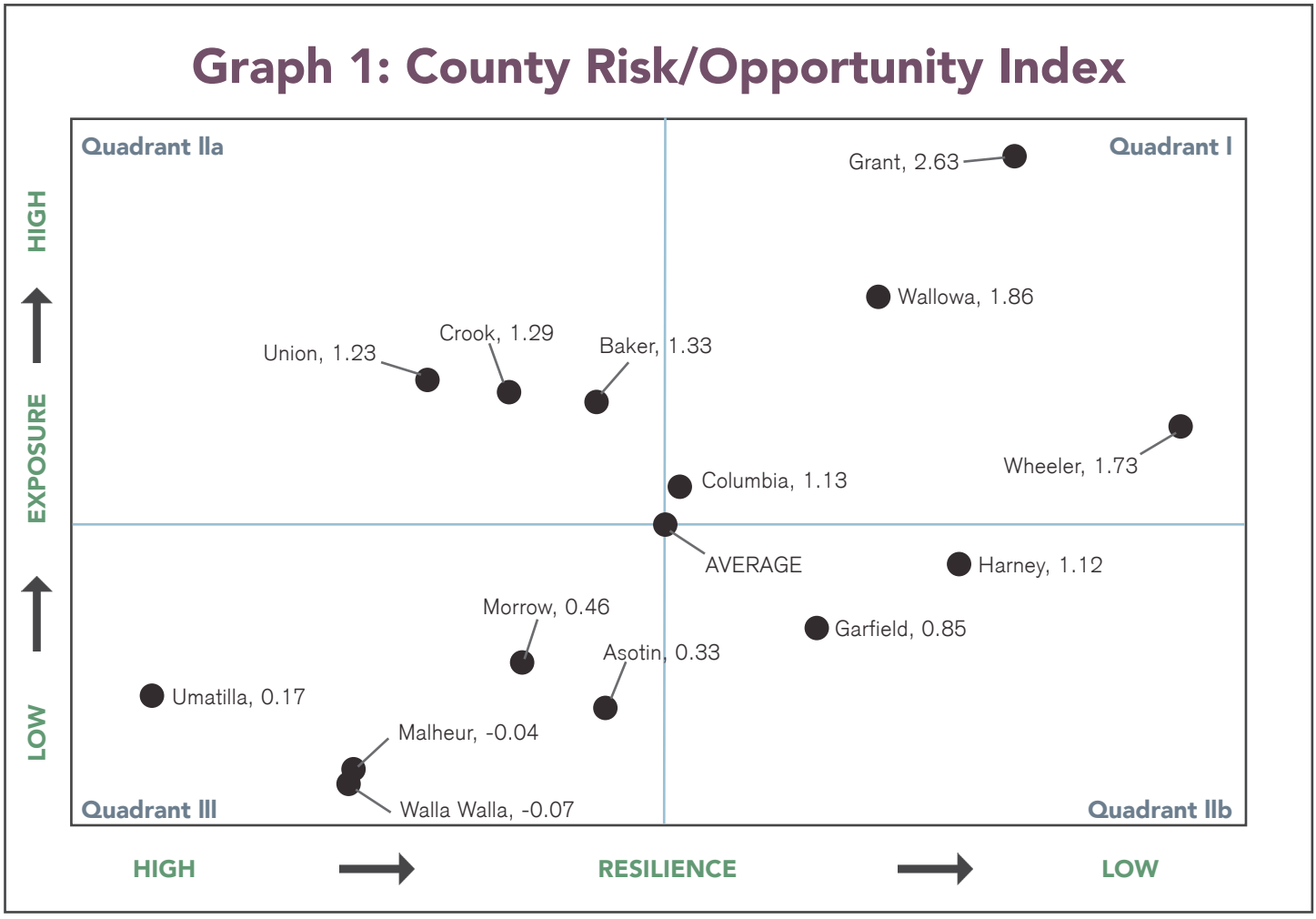


Table 6: A mapping of risks and opportunities

Quadrant	General Risk / Opportunity Profile
I	Risk: Least economically resilience and therefore, most likely to suffer negative consequences to economy given shifts in Forest Service planning that reduce economic benefits. Opportunity: Already high exposure so opportunity to generate additional benefits via increasing exposure is lowest. Opportunity of boosting benefits to economy is highest with respect to restructuring of current Forest Service activities.
IIa	Risk: Given relatively high resilience, risk of negative consequences to economy from shifts in Forest Service planning that reduce benefits to economy is less than average. Opportunity: Currently high exposure so opportunity is low with respect to additional benefits from an increase in exposure. Opportunity of boosting benefits to economy is relatively high with respect to reorienting/restructuring of current Forest Service planning.
IIb	Risk: Most likely to suffer negative consequences to economy given shifts in FS planning that reduce benefits to economy of Forest Service activities. Opportunity: Given low exposure, opportunity to generate important economic benefits via additional exposure is high. Opportunity of boosting benefits to economy by restructuring of current Forest Service activities is low given current low exposure.
III	Risk: Given relatively high economic resilience, least likely to suffer negative consequences to economy given shifts in Forest Service planning that reduce support or increase cost related to Forest Service planning activities. Opportunity: Given low current exposure, there is limited opportunity with respect to restructuring of current Forest Service exposure to boost benefits economy. Conversely this allows for the greater opportunity to boost benefits to economy through increasing Forest Service exposure.

4. Discussion

4.1 THE ROI, THE GREATER ECONOMY AND MARGINALIZED POPULATIONS

Tables 7 and 8 put the ROI values in a broader economic context, which helps to address questions like "How do these counties compare to the larger economy?" and "Are there equity concerns that the ROI misses or highlights?" Table 7 shows that earnings per job decrease as the ROI increases, but this is expected since earnings per job is a part of the index, albeit a small part. Importantly, it also shows that changes in earnings per job and changes in population tend to decrease as the ROI increases. Where there is an exception, as in the case of intermediate ROI values and the trend in earnings and population, it can be understood by examining the data on a county-by-county basis. Crook County experienced substantial population growth despite its intermediate ROI, likely due to the growth within the Bend and Prineville area. When population growth in Crook County is removed, the average population growth for the remaining counties falls to -0.075% which is in line with the other counties in the "intermediate RO index" group. When a county-by-county examination does not shed light on an outlier, it points to the need for additional discussion and analysis. This is the case for the earnings per job trend. Of the five counties with an intermediate ROI two have relatively high income growth, averaging over 27%, while the remaining three counties saw income growth of about 8.5%.

Additional context is given by comparing the earnings and population data from the counties with those of Oregon and Washington States overall. We see that for each measure the counties on average have performed well below the average of their respective States. This highlights the fact that the ROI is a relative measure discriminating between the fourteen counties. For example, performing well in terms resilience does not necessarily mean that a given county's economy should be considered prosperous or "resilient" in a general sense, but rather, it seems more resilient than the average of the fourteen counties under analysis.

Table 7: Risk/Opportunity Index and Economic Context

	Earnings per job, 2018 (20)	Earnings per job change, 2000-18 (20)	Population change[1], 2000-19 (16)
High R/O index (high exposure and low resilience)	$32,043	4.22%	-2.025
Intermediate R/O Index (high exposure or low resilience)	$46,109	16.1%	3.14
Low R/O index (low exposure and high resilience)	$50,520	9.62%	2.4
Benchmark 1, Oregon State	$61,662	12.2%	10.1
Benchmark 2, Washington State	$75,962	19.8%	13.2

[1] Calculated from Annual Estimates of the Resident Population for Counties in Oregon: April 1, 2010 to July 1, 2019, CO-EST2019-ANNRES-41 (and for Washington counties CO-EST2019-ANNRES-53), U.S. Census Bureau, Population Division, March 2020 release.

In discussing the ROI it is also important to consider marginalized populations. Table 8 shows two measures already included in the index—the percentage of vulnerable people, and the percentage of county residents falling below the poverty threshold. The table indicates that the high and intermediate ROI counties seem to perform well with respect to the percentage of people in these populations, while low ROI counties more closely track Oregon and Washington state averages. To the extent that people in these classifications seek opportunity, we hypothesize that the elevated percentages present in low ROI counties is the result of in-migration from these demographic groups to these more robust economies.

Table 8: Risk/Opportunity Index and Marginalized Populations

	Vulnerable Population, 2019[1] (11)	Poverty rate, 2019 (19)	Non-White, 2019 (42)	Hispanic, 2019 (42)
High RO index (Quadrant I, high exposure and low resilience)	17%	15%	6.1%	4.9%
Intermediate RO Index (Quadrants IIa and IIb, high exposure or low resilience)	16%	12%	8.6%	5.4%
Low RO index (Quadrant III, low exposure and high resilience)	21%	16%	11.7%	24.4%
Benchmark 1, Oregon State	22%	13%	15.7%	13%
Benchmark 2, Washington State	20%	11%	24.6%	12.7%

[1] The vulnerable population consists of people 65 years or older living alone, single-female headed households, and households without a car.

We also see a pattern with historically marginalized racial and ethnic groups. More specifically, the percentages of non-white and Hispanic people seem to increase in size as the ROI decreases. Limited data precludes a statistical analysis, so we need to interpret this information carefully. An interesting working hypothesis is that the economies in counties associated with high and intermediate ROI values lack sufficient income-earning opportunity to attract people from these demographic groups. Regardless, the fact that there does seem to be a link between the ROI and marginalized populations indicates that changes to management on Forest Service lands ought to consider potential impacts on these populations.

4.2 EXAMINING THE LINK BETWEEN EXPOSURE AND RESILIENCE

The scatterplot in Graph 1 appears to show a negative relationship between exposure to management on Forest Service lands and county economic resilience. With this observation in mind, we ran a simple regression of county resilience

estimates on the county exposure index values. The results for regression 1 presented in Table 9 show that this relationship is statistically significant.

Table 9: Exposure versus resilience, dependent variable "relative resilience"

Regression	Coefficient on independent variables[1]				R^2
	Exposure	*Income*	*Land area*	*Forest Service Payments*	
1	-0.205**	--	--	--	0.27**
2	--	0.086	0.003	-0.219***	0.70***

1 *, p<0.1; **, p<0.05; ***, p<0.01

To follow-up we ran a second regression, regression 2 in Table 9, this time with exposure broken down into its constituent parts (rows 6, 7, and 8 from Table 4). This regression indicates that the explanatory power of the regression flows through the variable Forest Service Payments. The regression also passes a visual inspection of the error terms and a test for multicollinearity. Interpreting this result; controlling for forest related income and Forest Service land area, there is a statistically significant negative relationship between the percentage of a county's budget related to the Forest Service, and the county's economic resilience.

A sample size of 14 counties is too small, and the regression is too simple, to establish causality with confidence. A plausible explanation for the observed relationship is that Forest Service payments are responding to the economic conditions across the Blue Mountain region by allocating greater payments to the least resilient counties. This could result in a negative relationship. If this is the case, then causality runs in the other direction--low resilience leading to high payment levels. While this is consistent with the data, to our knowledge, the Forest Service criteria and formulas generating the level of county payments are not prioritizing less economically resilient counties.

Alternatively, the observed payment--resilience relationship could also be spurious. In this case, the payments and resilience have no direct causal link, but are both related to something else that is not in the model. For example, the resource orientation adopted by a county long ago could generate higher payments today while having funneled capital into a sector that is now less economically productive. Historically Forest Service payments provided revenue towards county government functions. The payment levels were influenced by the total amount of public land with an adjustment factor based on population size, and by revenues from commodity sales and other activities. This was to offset the lost development potential and tax revenue that public ownership entails. The significant decline in timber harvest across the Blue Mountain national forests in the early 1990's resulted in sharp declines in county payments. These declines were mitigated, and stabilized, by the Secure Rural Schools and Community Self-Determination Act (SRS) of 2000. However, the current negative relationship between Forest Service payments and economic resilience suggests that additional research aimed at untangling the factors at play could help the Forest Service in targeting these payments.

It is important to note that this is a cross-sectional analysis. Therefore, it shows how economic resilience changes across a range of exposure values. It does not show how resilience in each county would change given a change in exposure. Such an analysis would require county-level panel data; an interesting possibility for further research.

4.3 PUTTING THE ROI TO WORK

The ROI provides county-level information on economic resilience and exposure to Forest Service management. This has raised the question "So how should the ROI be used?" For example, if a county sees an increase in the extent of Forest Service-related work, all else equal, this would generate an increase in the county's ROI estimate—should this be considered a "good outcome"?

Responding to this question requires going beyond the general descriptions in Table 6, by considering how the ROI value

would change if management on Forest Service lands were to shift. We offer these two guidelines.

First, increases in, or shifts of, Forest Service inputs to a county ought to be tailored to boost economic resilience. Put differently, increasing exposure to Forest Service activities would be a "good thing" when it results in an increase in economic resilience. This may or may not generate a net decrease in the ROI for the county, but it would generate a lefttward shift of the county's position in Graph 1.

Second, determining the actions most likely to result in the largest gain in economic resilience likely calls for county-level discussions. Such discussion could unearth opportunities and constraints relevant to that county. More specifically, during ground-truthing sessions Commissioners and stakeholders significantly enriched the findings of the ROI and identified shortfalls. For example:

- We saw that analysis at the county-level can mask significant within-county differences. This is especially important in eastern Oregon and southeast Washington given the presence of very large counties, large geographic features, and a mosaic of jurisdictions.
- Some counties are undergoing an economic transition. For example, participants in the Wallowa County ground truthing session (see Attachment 2 of this sub-report) described a demographic shift as retirees move into the county. Also, several counties are experiencing a divergence between earnings per job and per capita income. Periods of transition like this may represent an opportunity for the Forest Service to exert significant positive economic influence.
- The ROI is linear and therefore does not identify economic "tipping points" where a seemingly small change could generate out-sized consequences for a county. The ROI does flag counties with exceptionally low resilience or high exposure where such tipping points are more likely to be present, however, additional precision requires discussion at the county level.
- Lastly, measures in the ROI perform well when taken as a whole. However, in each county any of the individual measures could be misleading. An example of this is the measure "acres of farmland per person". In general, given the importance of agriculture in the region this is a good measure. However, there is a significant difference between the economic productivity of extensively managed high desert predominant in some areas, and intensively managed farmland located in other areas. The ROI does not make this distinction.

Issues like these highlight the idea that the ROI could be used as a vehicle to refine and target Forest Service management activities more precisely.

The complete references used in building the risk-opportunity index, and analyzing the results, are included in the Reference section on page 143.

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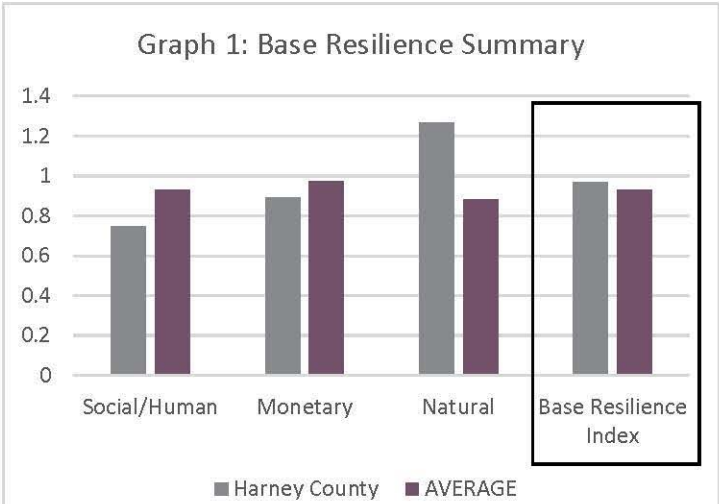
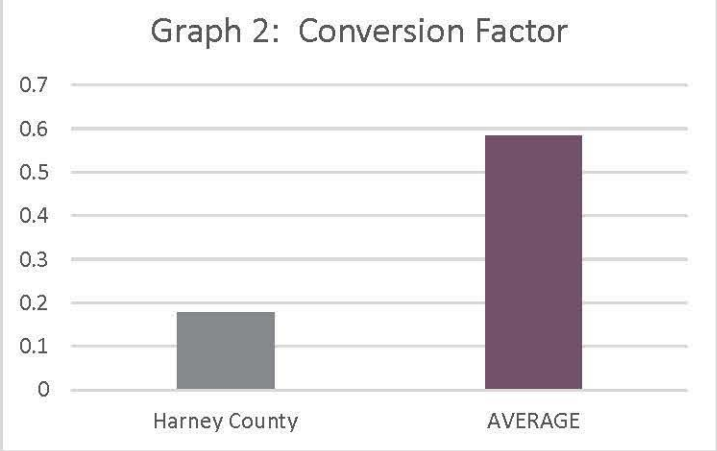
Attachment 1: Sample Preliminary Risk/Opportunity Index Summary

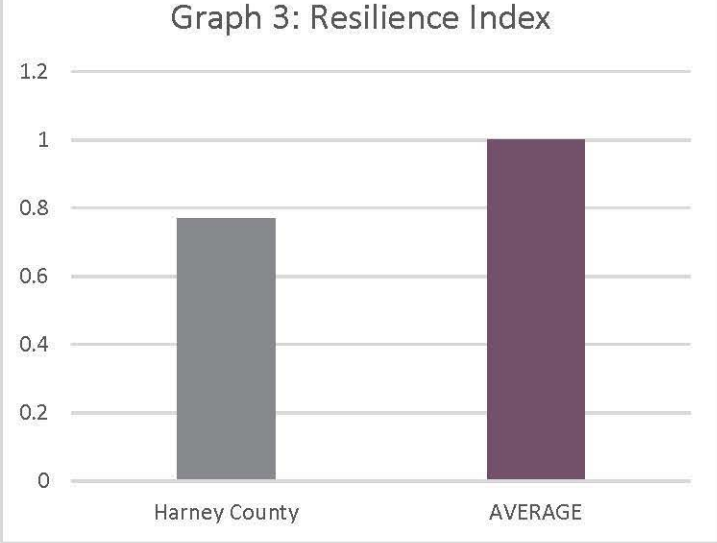


Graph 1 indicates that Harney County's potential resilience is slightly greater than the average of the 14 counties in the study region. This seems to be driven primarily by its endowment of natural resources, and more specifically, by a high farmland per person and income from tourism. These attributes make up for challenges related to relatively high housing costs and low population density.

For additional information see Attachment section 3.2.

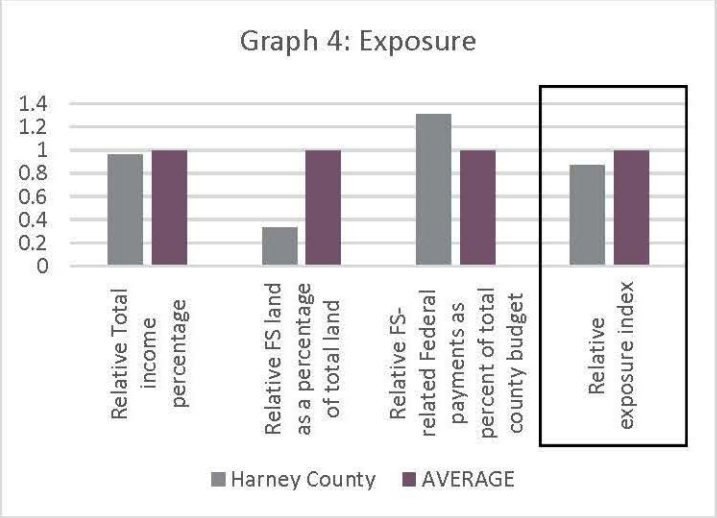


Graph 2 indicates that Harney County residents face high barriers to converting the county's capital into resilience. More specifically, looking at the attached detail table, Harney County is lacking nearly every piece of infrastructure that would allow it to easily capitalize on its potential wealth. This leaves residents to generate wealth without support structures like broadband Internet, the interstate highway system, freight railroad, or an airport. For additional information see Attachment section 3.3.



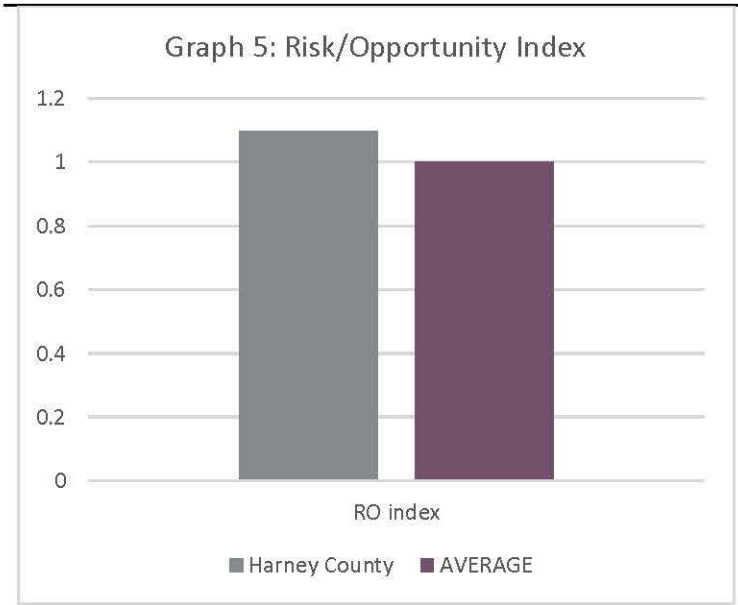
Based on Graph 3, the resilience base index conditioned on the conversion factor results in a resilience index for Harney County of 0.77, the third lowest of all counties in the study area. This is driven primarily by the County's low conversion factor, and it implies that the county would experience steeper economic downturns, and recover more slowly from, an economic shock.

For additional information see Attachment section 3.4.



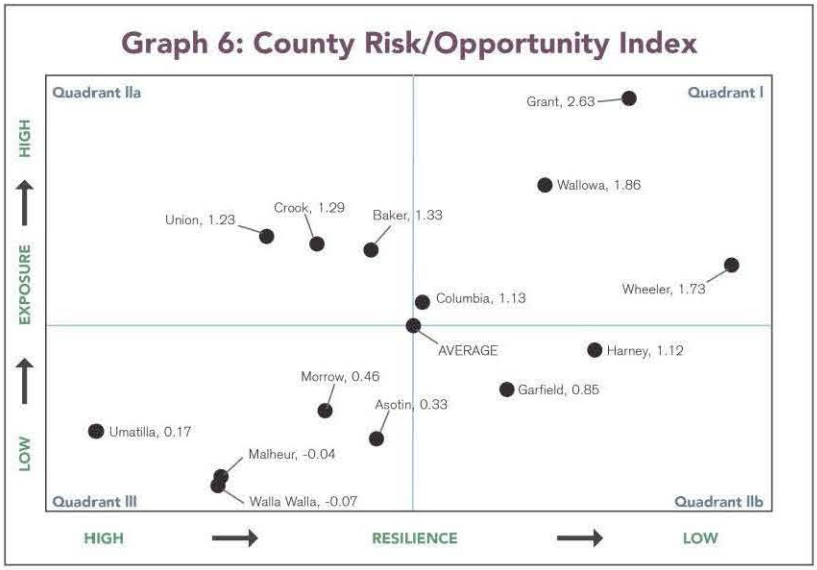
Graph 4 indicates that across the three measures of exposure—income, land area and Federal payments—the Harney County economy is slightly less exposed to Forest Service planning decisions. Its exposure index is 0.85 against the average value of 1 across the 14 study counties. Although the County has extensive Federal land coverage, a relatively small portion of this is Forest Service land. The limited extent of Forest Service land is the primary driver of the limited exposure of Harney County.

For additional information see Attachment section 3.5.



Graph 5 shows that combining the standardized resilience and exposure indices from graphs 3 and 4 as explained in section 3.6 generates a RO index 1.10. This implies that the economy of Harney County may be slightly more susceptible to economic impacts related to changes in Forest Service policies than the average of the 14 counties. The case of Harney County is interesting in that low resilience is accompanied by low exposure, and thus an approximately average RO index value.

For additional information see Attachment section 3.6.



Graph 6 shows each county's RO index in a scatter plot of exposure versus resilience. Harney County appears in Quadrant IIb of Graph 6, reflecting the county low resilience and low exposure. Given this resilience, there is elevated risk that economic shocks imposed on the county could result in significant and/ or protracted economic downturns. Because exposure is low, the Forest Service is in a position to boost resilience given appropriate planning. For additional information see Attachment section 3.6.

Attachment 2: Notes from Ground Truthing Sessions

Ground truthing session, Harney County, 9/21/21.

To be considered in the final assessment of the RO Index and Harney County

- Acres of farmland per person is not a good metric. Arid land cannot produce in the same way as farmland in other climates so it does not reflect their circumstances well. Agricultural statistics service might be a better tool for providing commodity value as opposed to acre value. Some counties can practice intensive agriculture while Harney County's is weighted more towards extensive agriculture practices on high desert. This is important with respect to the index in a number of ways. While the county is rich in farmland, much of this is less economically productive that other counties in the region. The index considers cropland per person without accounting for this lower productivity. The index value is further skewed by the low population of Harney County, which makes farmland per person seem favorable. Consequently, the portion of the index assessing natural capital paints an overly rosy picture of the county.
- Exposure factor shows Harney county with limited extent of Forest Service land. This underestimates the importance of this land by 1) ignoring the greater productivity (more AUMs…) of this land relative to the high desert land, and 2) using percentages where a small percentage is actually a large land area given Harney county's size. Were exposure conditional on productivity Harney county would show as more exposed.
- Index may underestimate the vulnerability of Harney county economy because the overall economy is small, and because cattle ranching provides a large portion of the overall income. Consequently, a small shift in AUMs would impact the largest source of income in an already small economy. The index does not account for such a non-linear impact. More generally, the RO Index does not consider non-linear effects. This could be important in the case of Harney county in that it is among the least resilient of the region. Consequently, the effects of an economic shock may be magnified in the case of Harney county.
- The way that 10-year stewardship contracts have been awarded have hurt the Harney county economy because the contracts have gone to neighboring counties. This could represent a restructuring of current activities with the aim of boosting resilience.
- The benefits of tourism may be over-estimated. Much of our tourism seems to be drive-through resulting in limited additional economic impact in the county. The main exception to this could be hunting. This is important because the RO Index for the county shows tourism playing an important role. Thus, the RO Index may overstate the positive role that this income can play. Also, because this part of the RO Index is based on percentages, and the county economy is quite small tourism income is actually not a large stream of revenue.
- The index includes a large value for water resources. This is correct, but does not reflect the tenuous nature of the resource in the future. Therefore, the portion of the RO Index that is based on county water resources currently over-estimates the value of this important resource in the coming years.

For consideration when composing the overall final RO Index report

- Convert "baseline resilience" to something like "base capital" and make sure that labels on capital in the table match labels in the in-text descriptions.
- Clarify/emphasize that when looking at the 14 counties in a bigger economic context we see an entire region that is under stress. Therefore, even when considered relatively resilient, a county economy is still underperforming relative to the State economy. This can be addressed by moving the "context" section up front. This would clarify where the 14 counties stand relative to economies of Oregon and Washington, while allowing the RO index to function as required to discern differences between the 14 counties of the region.
- To the extent possible, consider the NEPA process in composing final report.
- Need to adjust the label for vulnerable households, and emphasize that this is an official designation that does not necessarily mean people within this group are not active members of the community. Also clarify that the link/causal factor is income--falling incomes drive social problems.
- To the extent possible, try to organize the final report to reduce the need to search for info.

Other important items to consider that are not directly part of the RO index report

- With past performance in mind, the RO index does not say where we were or where we want to be, but is more of a snapshot. Consequently, it is important to put the current economic status of the county in historical context. Note that the team is planning to add a county timeline to each county's report.

Ground truthing session, Umatilla County, 10/28/21.

To be considered in the final assessment of the RO Index for Umatilla County

- Native American lands exert an important influence on the access to public land in the county and this is not reflected in the RO Index. In practice, the result is often more limited access to Forest Service land for recreation and game management. Consequently, the income generating potential of these lands is diminished relative to similar land in other counties, so the RO Index needs to consider this in its analysis of Umatilla County.
- Looking at the placement of Umatilla County relative to the other counties in term of resilience and exposure, the county seems to be about where it should be. The scatter plot based on exposure and resilience is especially helpful in this respect.
- Umatilla County includes quite a lot of land that are public but with special restrictions. This includes portions along the Columbia, McNary Dam, and the Umatilla Army Depot, for example. It is important that the RO Index consider the special nature of these lands in its final analysis
- Umatilla County has very distinct boundaries related to Forest Service exposure/dependence. The Pendleton area has a significant FS personnel presence. The Ukiah region has significant FS lands. The area around Milton-Freewater is intermediate—the FS presence there is moderate. The western portion of the county has very little FS presence. Thus, portions of Umatilla County are more "exposed" to FS planning that other parts of the county. Ideally, discussion of the FS in Umatilla County should reflect this diversity of impacts.
- Looking forward, Umatilla County has forest inventory that we could take greater advantage of but we seem to be "playing it safe". Perhaps a priority should be recreation development, for example, Ukiah cabins, downhill skiing at Spout Springs, additional cross-country skiing. Also, according to the FS recent flooding events have restricted access to portions of forestland.
- Given the inventory that we have that is not being taken advantage of more exposure could generate additional resilience--we are facing increasing returns to exposure, or rather, a dollar of additional exposure can generate more than a dollar of resilience assuming it is used properly. We can and should drive up the economic benefits to the county via additional recreation development and commercial harvest, while managing to avoid forest deterioration.

For consideration when composing the overall final RO Index report

- The conversion factor does not show actual dollars, and more specifically, private-sector dollars. It would be helpful to relate the current scatter plot of counties to a scatter plot that accounted for the importance of government versus private sector economy.
- While the RO Index shows some counties are resilient relative to other counties in the region, fact is that by many measures all of these counties have weaker economies than Oregon and Washington as a whole. Make sure to highlight the need to shift the overall average of counties in the region in a positive direction.
- To RO Index does not consider the size of the public sector relative to the private sector. This is important in that some support services like mental health draw from tax revenue. If the Federal government were to be removed completely from the RO Index calculation would there still be a county economy?

Ground truthing session, Union County, 8/13 and 9/22

To be considered in the final assessment of the RO Index and Union County

- The RO Index does not capture the idea that the human capital (skills/knowledge) related to logging would be at risk given even slight decrease in harvest level. Investment in new technology is also critical given the advances in

logging and milling. Injecting uncertainty into these investment decisions by the possibility of shifting harvest levels makes these investments harder to justify. Thus, the importance of stable harvest levels needs to be highlighted in the case of Union County.

- Housing issues produce an odd result in the index for Union County. Despite a serious squeeze on availability and steep increases in prices, the index reports almost average rates of home ownership and slightly above average performance with respect to housing costs. Either the index is biased downward for Union County, Union county perceptions are mistaken, or the 14-county region is uniformly being squeezed with respect to these same issues.
- The conversion factor seems quite accurate, and if anything could, by weighting it equally, underestimate the importance of the goods exported (mill production and grass seed) via freight railroad.
- Recreation is rightly presented as important in Union County. It is important to note that this may provide some guidance on future beneficial Forest Service activities in the county. Specifically, an emphasis could shift towards restoration in support of recreation. Increases in other activity on Forest Service land, e.g., harvest levels, would also be desirable and can be done without compromising the recreation resource.

For consideration when composing the overall final RO Index report

- A useful descriptor for "exposure" in the report would be "leverage".

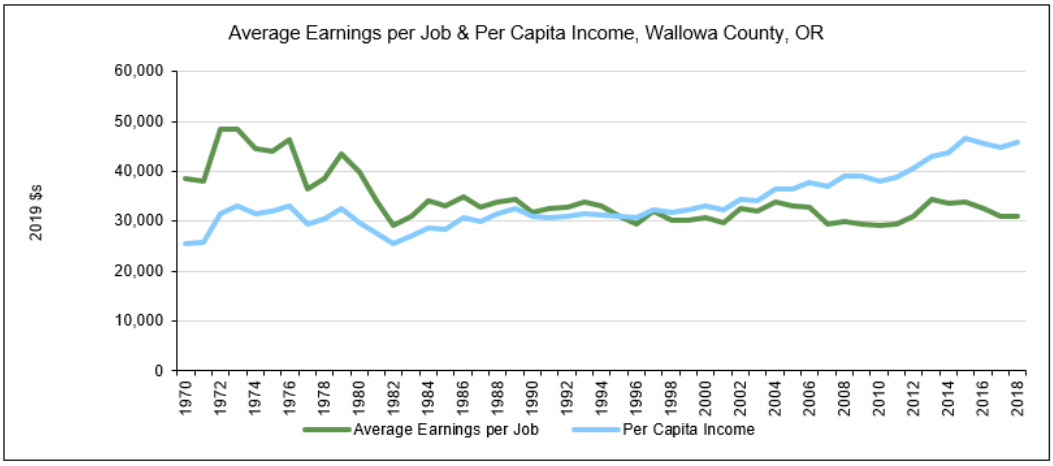
Ground truthing session, Wallowa County, 10/25/21.

Examining the RO Index and Wallowa County

- Overall, the RO Index seems to profile Wallowa County reasonably well—it is good to see the Wallowa County statistics put down in black and white.
- The RO Index does not account for the fact that the population is experiencing a demographic shift as aging retirees move into the area perhaps due to higher housing costs elsewhere. These retirees also boost income. This brings up a number of important issues.

  First, the RO Index focuses on earnings per job, which downplays the importance of the role retiree incomes may play. A final interpretation of the RO Index for Wallowa County should consider the implications of retiree incomes on county resilience. On a related note, the RO index is sensitive to the impact that an influx of retirees can have on house prices, specifically, by including a measure of housing cost burdened and home ownership rates.

  The graph below is evidence of this demographic shift. It shows that earnings per job has stayed at slightly more than $30,000/year since 1980, while the county per capita income, which would include retiree income, has risen steadily (Source: Headwaterseconomics.com).



With a county economy that may be in transition we should note that the RO index for does not consider how resilience measures are trending. Against the backdrop of the above graph the implications of this shift on economic resilience need special attention.

- The RO Index for Wallowa County is based on a conversion factor that credits the county with a freight railroad. Interestingly, despite the official Bureau of Transportation website saying Wallowa County has a freight railroad, during the ground-truthing session the participants said that this information is out-of-date. The railroad has not carried freight for some years, and its return to service is not anticipated. The conversion factor for Wallowa County will be adjusted to reflect this, and the change will result in a slight decrease in county resilience.

- The RO Index places Wallowa County in Quadrant 1—low resilience and high exposure. Given this position, the generic recommendation related to Forest Service planning is to consider refining on-going Forest Service activities to more effectively target economic resilience. The discussion participants provided the following specifics.
    - The Sustainable Rural Schools payment as well as Payments in Lieu of Taxes have experienced dramatic swings in recent years. Meanwhile, Wallowa County's economy is among the smallest of the 14 counties based on the number of firms, and given the extensive Forest Service land in the county, the county receives an important portion of its public budget from these payment programs. For planning purposes, it is important that the stream of payments be maintained and stabilized.
    - Similarly, income from, and investment into, the production of forest products has been hurt by low and unpredictable harvest levels. There may also be grazing allotments that are closed simply because the process for awarding them is very slow. We think that there is room to increase income and reduce income variability without a significant tradeoff in recreation, by increasing timber and beef production, and that this could lead to a more resilient economy.

Attachment 3: County ROI Summaries

The county summaries are in the "County Specific Information" section of the overall report.

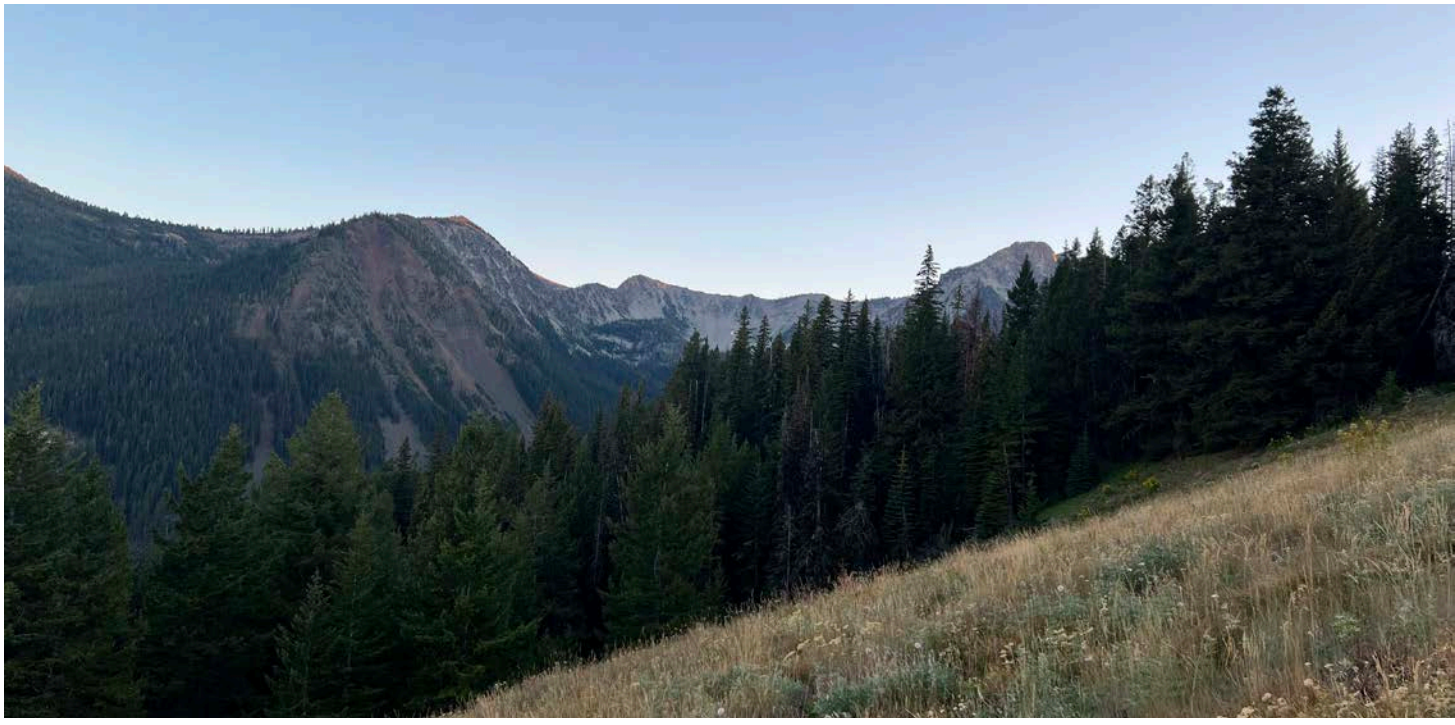


Photo courtesy of Jessica Tomasini

Economic Impact Analysis - Appendix

The socioeconomic team was tasked with determining potential impacts via changes in direct expenditures due to scenarios within the forest plan for three major stakeholders: grazing, recreation and timber.

Grazing includes all AUMs that are permitted by the Forest Service and utilized by the private sector. Permitted areas are allotments where cattle may graze. This analysis is looking at additional AUMs of economic activity, which may be new allotments or the use of unused current allotments. Recreation measures changes to recreational activity as an economic impact, regardless of how this recreation is increased. Access roads are one such example, which potentially increases some activity, but reduces others. This analysis is only focused on the economic impact of an increase of the recreational dollars for any and all recreational uses.

It is also important to note that for the IMPLAN analysis, the greatest economic impact is from outside dollars coming in to the region, much like an "export industry" of tourism and recreation. People from outside the region bring their dollars to spend as they utilize the forest. Local use, which is important, does not have the sort of economic impact that can be measured by IMPLAN analysis, but is covered in other areas of this report. The timber analysis includes commercial timber production and the potential for stewardship contracting. Opening more areas for commercial timber production will have an economic impact that is measured by percentages (i.e. 10%, 20% increases), but will not have a large effect, as timber production within National Forest land is at a low level.

This report includes the 1990 level as a reverence point to understand just how much lower the current level is from levels in the past. Stewardship contracting has a measurable economic impact, as discussed in recent work looking at two contracts in the Mt. Hood National Forest. This report uses the multipliers and estimates from that report to estimate the impact on local counties in the Blue Mountain region. Since stewardship contracting has a greater overall economic benefit per dollar spent, this approach is economically viable.

Grazing

To calculate the grazing portion of the county estimates, data from IMPLAN was used to generate the total size of the beef cattle ranching industry, using "beef cattle ranching and farming" industry 11. This data gives us the total industry output, employment and average employee compensation. The second portion, the "economic benefit of additional grazing" was data obtained via the Forest Service data. We do not have data on the share of industry 11 that depends fully, or even partially on grazing permits. If we had the share of the industry 11 that depended upon grazing permits in National Forest land, we could estimate the impact of grazing access or permit issuance to the overall industry and run a scenario analysis.
The equation would be the following:

$$Economic\ Impact = BeefInd_i(G_i) * .10 \text{ run through MRIO}$$

Where BeefInd = beef and cattle industry in county i,
G= Grazing as a percent of overall beef and cattle industry in county i.

Total permitted grazing of commercial livestock in Region 6 (National Forest land in Washington and Oregon) was 508,510 AUMs in 2021. Total permitted grazing of commercial livestock in Oregon was 429,141 AUMs in 2021. Total permitted grazing of commercial livestock in Washington was 78,536 AUMs in 2021.
As noted in the county output, for every 1000 AUMs, there is an estimated 2.57 jobs and $160,422 of economic output in Oregon and 3.3 jobs and $177,091 in Washington.

Recreation

Utilizing the survey data provided by the Forest Service, broken up into National Forests. Using these numbers from each National Forest, we had to determine a per-county estimate and this was accomplished using a 2020 Travel Oregon tourism study to determine the relative share of tourism impact per county that shares the National Forest. It is important to note that we are only concerned with the impact of the National Forest itself, so the Travel Oregon study was only utilized to determine relative shares between counties, not absolute impacts.

Once relative shares were determined, multiply relative shares against the total economic value in the National Forest in question to determine relative impact per county. Multiply this value by 10% for the impact desired and run through the relevant industry classifications (lodging, restaurants, gasoline, etc.) to determine economic impact per county using a multi-region input-output model (MRIO). The MRIO is used to capture any spillover effects from activity. Finally, report out a 10% change in economic activity from recreation within the county.

Economic Impact=SNFRI.x run through MRIO*

Where S = Survey Data, NF = National Forest, RI = relative impact of tourism per county, x = impact (10% change or 20% change)

Timber

Commercial timber activity on National Forest land has declined dramatically since the mid-1980s. Reasons for this drop are due primarily to legislation, competitive pressures from international markets, and productivity gains in the industry. Overall, the commercial logging sector is expected to increase employment 7% by 2030, but many of the job gains will come in the administrative occupations. Fallers, for instance, are expected to decline during this same period. During the peak of timber production in the pre-1990 period, the share of output taking place on forest service land was around 50-63%, depending on the county. Since that time, the share on average has declined to 10-15% of overall industry activity. This can be seen by looking at the graph on timber harvest in each county. This is a large part of the overall narrative that drives the economic dynamic moving forward. As resource-based industries decline in output and increase in productivity, there are less jobs and lower real wages in these industries. Changing the timber harvest in the region by 10 or 20% is not likely to have a very large impact, as can be seen from the output provided.

The output calculation provided for each county utilizes the county level industry data for the Commercial Logging sector in IMPLAN, sector 16. This data is then multiplied times the share of logging taking place on National Forest land. This value is used to derive the 10% and 20% change that is used in the IMPLAN analysis. The employment and output numbers are derived from this calculation.
The model is the following:

*Economic Impact={CLFSLi*x} run through MRIO*

Where CL = Commercial Logging Sector, FSL = Forest Service land, i = county, x = impact (10 or 20 percent)

An additional variable was used to calculate the level, had 1990 levels of logging been maintained. This number is likely unrealistic, as there are significant additional variables outside of the control of the forest plan which would make this number unattainable such as global market pressures and technology change. This number is for reference only to better understand the economic changes that have been realized at the local level within the BIC counties.

Stewardship Contracting

Stewardship contracting is a way to "achieve ecological restoration goals while simultaneously providing economic benefits to local communities" (Daniels, et.al, 2018). Stewardship contracting combines commercial sales of forest products with dollars for ecological restoration, including pre-commercial thinning, trail maintenance, and hazard fuels reduction. Using retained receipts, local counties and forests can achieve multiple objectives and have a greater economic impact due to the restoration work performed. If only commercial logging takes place without the stewardship contracting, the economic effect may be isolated to only a small number of sectors, whereas including the restoration work widens the economic impact across several industries including forest products, timber tract production, landscape and horticultural services and watershed restoration. A prior study estimated that equipment-intensive watershed restoration resulted in 15.7 jobs and an additional $2,380,000 for every $1 million of public investment (Nielsen-Pincus and Moseley, 2013).

Using the framework from a case study in the Mt. Hood National Forest (Daniels, et. al. 2018) estimated that a $281,445 contract generated $73,464 of services and $207,981 of retained receipts. The retained receipts were then leveraged with grant money and in-kind donations from restoration partners to generate an additional $319,888 of economic activity.

While stewardship contracting is effective at achieving many of the goals it sets out to achieve regarding restoration and extraction, the economic impact is only effective to the degree that the work utilizes local contractors for the work. There are other areas in this report that speak to the dollars spent and where they flow, and what the economic impacts of those dollars are to certain communities.

Photo © Kendrick Moholt Photography.

Who Gets the Work Maps - Appendix

The "Who Gets the Work Maps" were created using a 2010-2021 Oregon and Washington service contract report from Sam.gov. The data were refined to only include contracts where the "Contract Office Name" and/or "Funding Office Name" was either the Malheur, Umatilla, or Wallowa-Whitman forests. It was further refined and all the contracts where the "Place of Performance" was outside of the Blue Mountain counties were removed from the spreadsheet. An additional spreadsheet was created for contract data with a "Place of Performance" within the three forests that is under a product/service code not included in the "Forest Management Service Contracting Database filters" and all non forest management contracts were removed from the main data spreadsheet. The product/service code C130 was included in the main analysis even though it was not listed in the forest management service contract database filter because it is called "restoration" and falls under "Support for Forestry Work" in the NAICS code system.

The remaining service contracts were then assigned a ranking based on the relationship between "Place of Performance" and the "Vendor Address City", 1 being the place of performance and the vendor location are within the same county, a 2 being that the place of performance and vendor are within the Blue Mountain region, and 3 being the vendor is outside of the region. The data was then further refined to remove all service contracts with a negative or zero amount in the "Base and All Options Value (Total Contract Value)" because there is no useful data from zero or negative contracts and the total contract value accounted for the modifications. The remaining contracts were then separated based on their ranking and any duplicate contracts were removed. The data were then totaled for each city that had a vendor perform a service contract in the Blue Mountain region, the types of work that was performed, and then totals were created for each county in the Blue Mountain region of all the restoration contracts and where the vendor who performed them was located. The data were used by the Ecosystem Workforce Program to create each of the maps.

Photo Courtesty of Jessica Tomasini

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Land Use - Economic Profile System: Land Use under Land Management Reports https://headwaterseconomics.org/apps/economic-profile-system/

Incorporated vs Unincorporated town graphics – US Census Buerea

Key Industries - Economic Profile System: Socioeconomic spreadsheet under Comprehensive Reports. https://headwaterseconomics.org/apps/economic-profile-system/

Federal Land Payment graphics - Economic Profile System: Federal Land Payments under Land Management Reports https://headwaterseconomics.org/apps/economic-profile-system/

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