Economic Contribution of Outdoor Recreation

to Whatcom County, Washington

EARTH ECONOMICS

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The authors are responsible for the content of this report.

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Executive Summary

Stretching from the North Cascades and iconic Mount Baker down through the foothills to the Salish Sea, Whatcom County, in northwestern Washington, offers plentiful outdoor recreation opportunities. Residents and visitors alike can choose from a multitude of mountains, forest, lakes, rivers and open water, all made accessible by national, state and local agencies that provide parks and trails for people to enjoy the bounty. This abundance of outdoor choices also provides jobs and promotes economic activity. This report identifies the economic impact of outdoor recreation through an economic contribution analysis and further illustrates the value of recreational lands in Whatcom County through an ecosystem services valuation.

The economic contribution analysis demonstrates how money spent on outdoor recreation flows through the economy of Whatcom County, promoting exchange from one business to another. An estimated $705 million is spent on outdoor recreation in Whatcom County every year. With a portion of this expenditure flowing out of the county to suppliers, the yearly total economic contribution of recreation in Whatcom County is $585 million. Consumer outdoor recreation spending also supports a total of 6,502 jobs, which include both full-time and part-time jobs in sectors such as food and beverage services, retail, and general recreational services.

Further analysis found that Whatcom County recreation-related businesses such as gear manufacturers, boat builders, repair shops and tour operators directly support 3,728 jobs. These businesses have annual revenues of over $500 million and form an important hub of regional economic activity that contributes to the local tax base.

In addition to outdoor recreation's monetary contribution to Whatcom County's economy, there are a number of other benefits not accounted for within traditional economic analysis. These benefits include the overall satisfaction and increase in general quality of life that people experience by engaging in outdoor recreation, and the ecosystem services that recreational lands provide. Trees, water and animals provide ecosystem goods and services such as swimmable water, habitat, and aesthetic beauty. Whatcom County's 755,000 acres of public land provide many of these benefits. The combined total estimated value of these nonmarket benefits is between $6 billion and $10 billion a year. Considering the overall economic contribution, the business sector contribution and the nonmarket benefits presented in this report, investment in outdoor recreation in Whatcom County yields tremendous returns.

Introduction

Objectives of the Study

Because it is so closely tied to life enjoyment, the value of the recreation economy and the land and seascapes that produce it have often been underestimated in economic analysis. This report aims to fully value the recreational lands in Whatcom County through two main objectives:

1) Identify the impact of outdoor recreation-related expenditures and businesses through an economic contribution analysis.
2) Describe the additional benefits of recreational lands in Whatcom County through an ecosystem services valuation.

As public officials update comprehensive plans, determine new open space and park acquisitions, and prioritize economic development opportunities, the data presented in this report will be a critical component of those conversations. This study takes a high-level look at multiple aspects of the local recreation economy and presents data that will help public officials and local businesses make decisions about how best to utilize the natural resources available in Whatcom County.

This report can also be used as a benchmark to track the on-going impact of outdoor recreation on Whatcom County's economy.

Report Overview

The three Whatcom County analyses in this report are organized as follows:

- **Contribution by Outdoor Recreational Expenditures:** Examines the economic contribution and impact analyses, which are based on the calculated expenditures of recreational activities. Details the number of jobs supported in Whatcom County as a result of expenditures related to outdoor recreation.

- **Recreation Business Economy:** Determines the economic contribution of Whatcom County recreation businesses to the overall Whatcom County economy. These businesses, which range from marinas to bike shops, support a large amount of economic activity, jobs, and taxes.

- **Ecosystem Services in Recreational Lands:** Focuses on economic benefits beyond expenditures. Calculates the value placed on recreational opportunities beyond direct market expenditures. Other ecosystem services valued for Whatcom County include water quality improvements, aesthetic values, and habitat maintenance.

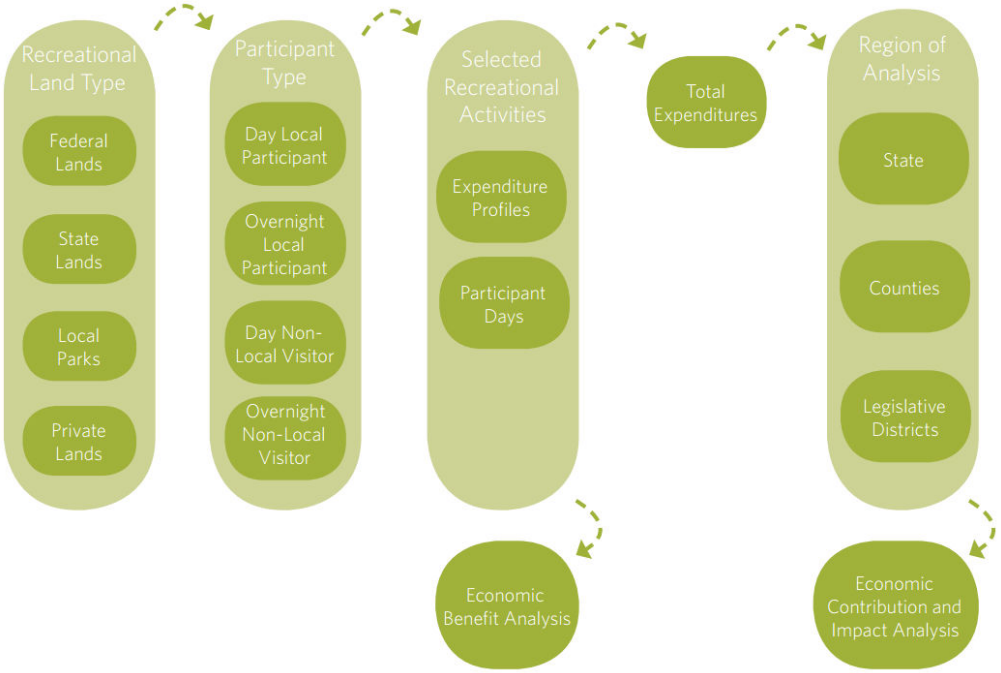
Chapter 1: Contribution from Outdoor Recreation Expenditures

In Whatcom County, residents and visitors can enjoy a variety of outdoor activities that include water sports, wildlife watching, winter sports, hiking, and more. Outdoor recreation can bring people together with friends and family or allow for moments of solitude. It can also bring economic benefits to the local economy. In this chapter, we outline the recreation-related expenditures that bring revenue to Whatcom County each year.

Methodology Overview

This economic analysis was conducted by estimating total visits to various recreational destinations and the incurred expenditures from these visits. The economic contribution was based on the calculated expenditures of recreational activities. Figure 1 below shows a schematic of the data components and the general path of the methodology, which involved five key steps.

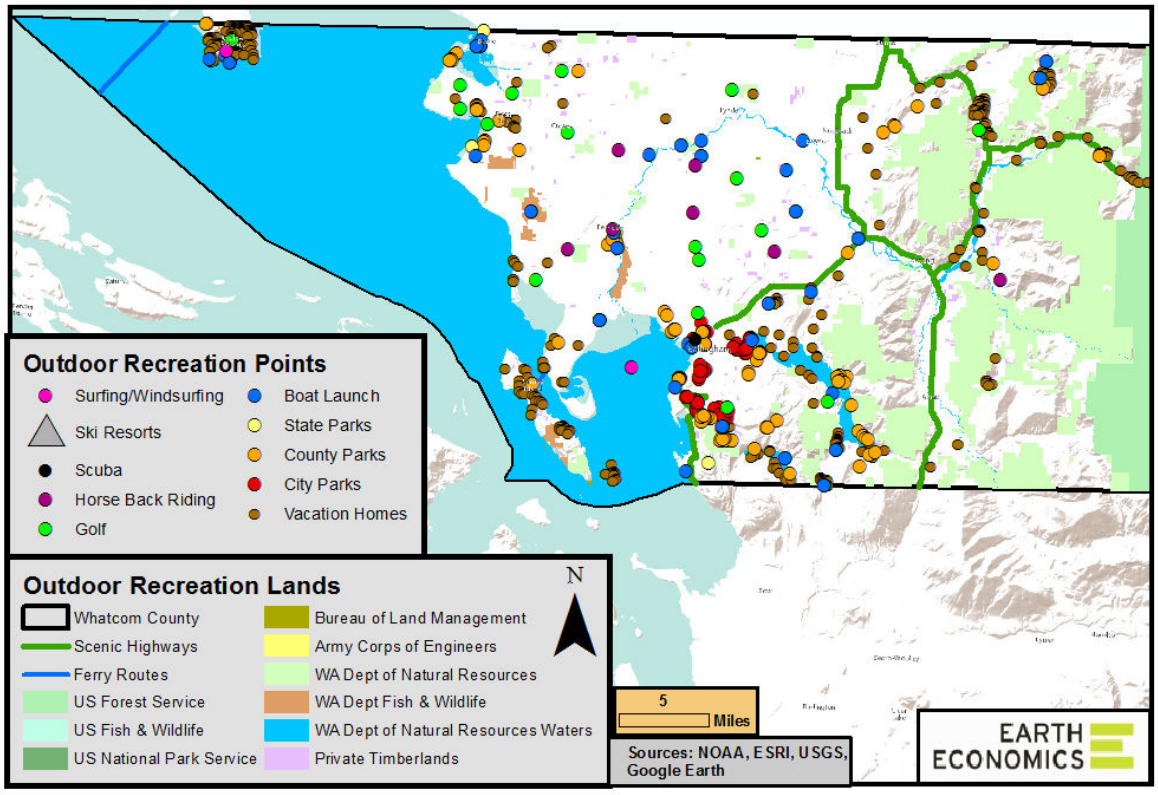
Figure 1. Schematic on Data Components and Methodology



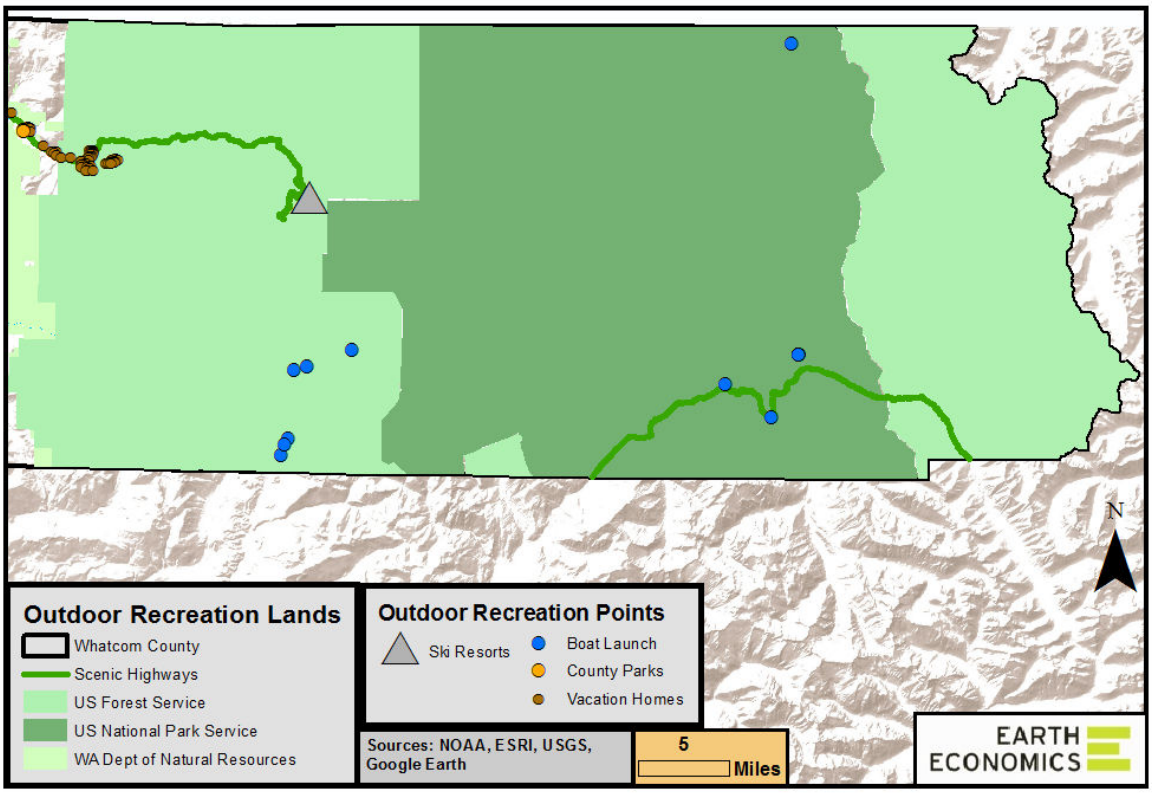
Recreation Land Type Identification

The first step in the analysis involved identification of recreational lands in Whatcom County. These lands included federal and state managed lands, public waters, county, city and port lands (referred to as "local"), public lands used for special events, and some private lands. Data was only available for certain types of private lands such as golf courses and horseback riding facilities. For some types of land, primary data was not available; thus, this analysis offers a baseline for consumer recreation expenditures as it is not completely exhaustive of all recreation lands. The distribution and relative size of the recreational lands included in this study can be seen in Figure 2 below. For the purposes of visualization, some lands are exhibited as areas and others as points.

Figure 2. Recreational Lands and Activities in Whatcom County



Map 1: Western Whatcom County



Map 2: Eastern Whatcom County

Recreation Activities: Participant Type and Expenditure Profile Identification

Next, four participant types were identified for this analysis: day local participants, overnight local participants, day non-local visitors, and overnight non-local visitors. In our analysis, we calculated total participant days, which refers to a single visit to a recreational land or a one-time engagement by one individual in a recreational activity.

Each participation day involves different types of expenditures depending on the location and the activities involved. These expenditures include any purchases made to enable a recreation experience, such as gasoline, food, lodging, and equipment. Most of these purchases are made within Whatcom County. Expenditure profiles were therefore created for a typical recreational outing in each land type, along with an additional set of 40 specific recreational activities. This set of activities can be found in Appendix B.

Expenditures on equipment were calculated based on U.S. Census consumer data and data available from previous research as outlined in Appendix A and C. These studies use consumer surveys and economic research to quantify average spending for different recreation activities. Adjustments were made for activities that have a different participation rate in Washington than in the rest of the U.S. (e.g. snowmobiling). Appendix A includes additional information on how participation data was calculated using Geographic Information Systems (GIS).

Economic Contribution and Impact Analysis

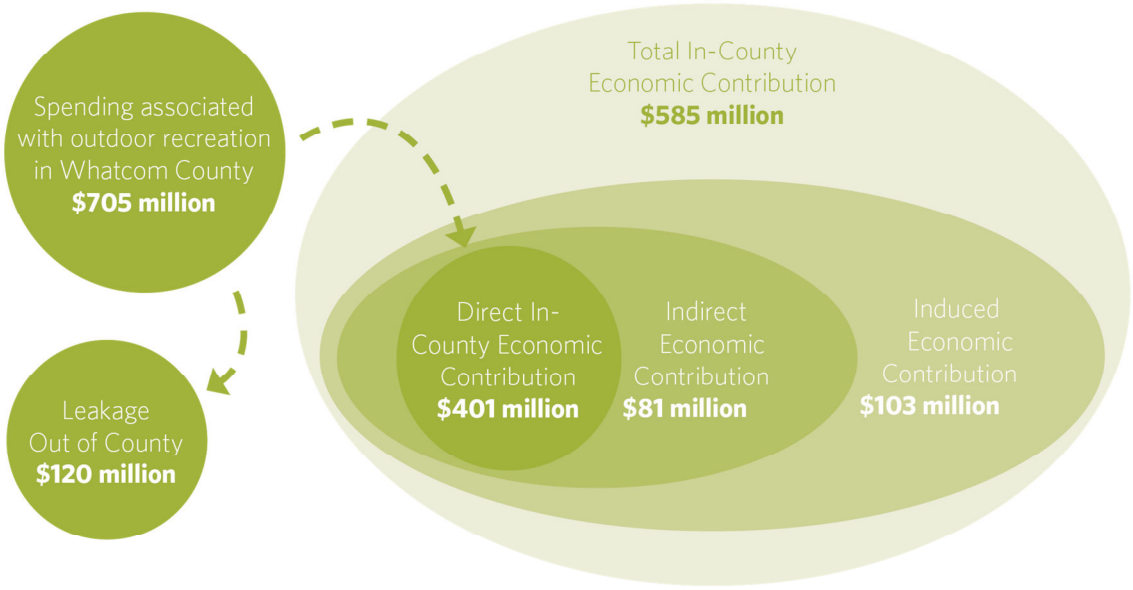
The economic contribution analysis identified the portion of expenditures that stays in Whatcom County and that trickles through the economy to supply goods and services, generate jobs and income, stimulate producers, and generate tax revenue. All of these economic activities are different types of contributions. Contributions are also calculated by the economic sector in which they occur (e.g. hotels, food and beverage places, etc.).

> *"Tourism throughout Whatcom County generates nearly $600 million in visitor spending each year. Our world-class recreation provides a crucial component of the experience which helps draw visitors initially, and keeps them coming back."*
>
> *~ Loni Rahm*
> *President & CEO*
> *Bellingham Whatcom Tourism*

The analysis for calculating economic contribution and economic impact was completed using IMPLAN (IMpact Analysis for PLANning), which is widely used in recreational economic analyses. This tool uses local data on economic and industry relationships to predict revenue flows to existing businesses (direct contributions), effects on related industries from which purchases are made (indirect contributions), and effects from expenditures made through the affected household incomes and salaries (induced contributions). In other words, the economic contribution analysis estimates the portion of expenditures that register as sales retained in the county (direct contributions), as well as intermediate sales made from industry-to-industry purchases within the supply chain (indirect contributions). In addition, the contribution analysis includes purchases made with the salaries and wages of those employed in the supply chain (induced contribution). All economic activity triggered by the initial expenditures is captured by region-specific economic IMPLAN models (See Appendix D for IMPLAN model details). Local economic models were derived using data from the U.S. Bureau of Labor Statistics (BLS), the U.S. Bureau of Economic Analysis (BEA), and the U.S. Census Bureau.

Based on our expenditure analysis, we estimate that residents and visitors to Whatcom County spend approximately $705 million per year on outdoor recreation trips and equipment. This estimate is based on spending across all the recreational lands included in this report. Figure 3 illustrates the relationship between expenditures and economic contribution.

Figure 3. The Relationship between Expenditures and Economic Contribution



In total, there were 14 million participant days per year in outdoor recreation. Whatcom County residents average 71.8 participant days per year, far above the state average of 59 for all residents and visitors to the state. This indicates that Whatcom's recreation economy is especially strong within Washington State.

Total expenditures in Whatcom County were highest for recreation in or on public waters, which included motorized and non-motorized boating, fishing, swimming, kite boarding, inner tubing/floating, and scuba diving in most marine and freshwaters. Water recreation includes a number of activities with high trip and equipment expenditures, especially motorized boating. Approximately $132 million dollars are spent each year in recreational activities in Bellingham Bay, the Nooksack River and other bodies of water around the County.

"Whatcom County provides easy access to some of the best cruising waters in the world, the Port continues to have strong demand for marina slips, and the marine trades businesses, which support recreational boaters, are thriving."

~Rob Fix
Executive Director
Port of Bellingham

Economic Contribution Analysis for Recreational Lands in Whatcom County

According to calculations made based on the IMPLAN model, after leakages are accounted for, total outdoor recreation-related expenditures generate $401 million in direct in-county sales (i.e. direct contribution), $81 million in supply chain activity to create outdoor recreation goods and services (i.e. indirect contribution), and $103 million is added output effect generated by

household wages (induced contribution). Thus, total economic contributions to Whatcom County amount to $585 million (Table 1).

Table 1. Economic Contributions from All Recreational Lands in Whatcom County

Category	Total Output
Direct	$400,815,676
Indirect	$80,770,123
Induced	$103,168,654
Total	**$584,754,453**

The top eight economic sectors receiving contributions resulting from outdoor recreation in Whatcom County are shown in Table 2. Together, they receive half the total contributions generated by the outdoor recreation economy. Food and beverage providers are the largest beneficiaries of outdoor recreation expenditures. Hotels and motels follow, then retail sales, due largely to the fact that equipment expenditures are included in this figure. Sales within the category of "Other amusement and recreation industries" include access and entrance fees by private agencies, equipment rentals, or guided tours. Petroleum refineries make the top industries due to the large portion of gasoline sales reaching the petroleum industry.

Table 2. Total Output By Top Industry (top 8 in Whatcom County)

Industry	Total Output
Food services and drinking places	$87,218,421
Hotels and motels, including casino hotels	$52,577,865
Retail Stores - Sporting goods, etc.	$49,779,614
Other amusement and recreation industries	$49,254,782
Petroleum refineries	$37,623,072
Wholesale trade businesses	$28,986,964
Retail Stores – Miscellaneous	$22,211,476
Retail Stores - Gasoline stations	$21,431,856

Outdoor recreation spending leads to contributions to the local and state tax base. Table 3 shows general categories of state and local taxes that receive revenue from the observed expenditures. Taxes on production and imports represent the largest source of tax revenue. These taxes are comprised of business property taxes, sales and other excise taxes. Goods such as gasoline have especially high excise taxes. Household taxes are comprised of fees and fines paid to local and state governments for motor vehicle licenses, property taxes, and fishing and hunting licenses. Employee compensation refers to taxes paid by employers and employees into Washington State's benefit trust fund and workers compensation system. Corporation taxes refer to taxes on net dividends. Total tax contributions are estimated at about $62.7 million.

Table 3. Local and State Tax Impact Contribution of Recreation

Category	Total
Tax on Production and Imports	$61,632,673
Households	$718,277
Employee Compensation	$321,016
Corporations	$40,276
Proprietor Income	$0
Total	**$62,712,242**

Finally, 6,502 jobs are supported in Whatcom County as a result of expenditures related to outdoor recreation. The table below identifies the sectors where most of this employment occurs.

Table 4. Top 5 Industries Supported by Consumer Recreation Spending

Industry	Employment
Food services and drinking places	1,350
Retail Stores - Sporting goods, etc…	1,038
Other amusement and recreation industries	1,006
Retail Stores - Miscellaneous	421
Hotels and motels, including casino hotels	415

"I've been a Whatcom County resident on and off my entire life and my husband and I have raised our five children here. As a family we take advantage of the amazing outdoor opportunities in Whatcom County in many different ways. We enjoy boating on Lake Whatcom, trail running, golfing, skiing and my son and I are both avid marathoners who participate in many races each year in the area.
Additionally, VSH CPAs, where I am a partner, has participated in the annual Bellingham Traverse for the past four years, helping to build camaraderie and common interest amongst our staff."

~Kathy Herndon
Partner
VSH CPAs

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Chapter 2: The Recreation Business Economy in Whatcom County

Chapter 1 focused on estimating the contribution of consumer expenditures on Whatcom County; this section focuses specifically on recreation-related businesses themselves. These analyses are complementary – both demonstrate the importance of outdoor recreation opportunities to Whatcom County's economy.

> *"Recreation is critical to Bellingham and Whatcom County. Recreational opportunities not only highlight our beautiful region, they help create jobs, attract talented professionals and build our reputation as a healthy place to live, work and play."*
>
> *~Kelli Linville*
> *Mayor*
> *City of Bellingham*

According to ReferenceUSA, there are currently 279 recreation-related businesses in Whatcom County. These businesses cover a broad range of products and services, including outdoor equipment retail outlets, boat building companies, gear manufacturers, campgrounds and other recreation-related enterprises. Businesses were drawn to the area by the recreational opportunities available in Whatcom County, and they directly support both residents and visitors in their enjoyment of the area's activities. They also contribute significantly to the local economy. In 2014, these businesses generated total revenues of $508 million. Recreation-related businesses make substantial contributions to Whatcom County's thriving economy through their operations, links to suppliers, and wages paid to employees.

Methodology

In this part of the analysis, all data was collected using the ReferenceUSA database. First, businesses were selected for inclusion in the analysis based on the following criteria:

- Is the business located in Whatcom County, and is revenue data available?
- Does this business facilitate or support outdoor recreation (directly or indirectly) for Whatcom County residents and visitors? Some types of businesses that met this criteria included:
    - The manufacture, distribution, and sale of recreation related equipment
    - Guide, transportation, tour, and rental services
    - Private recreation sites such as golf clubs and campsites
    - Outdoor-related publishing (guidebooks and magazines)
    - Equipment retail and repair shops

- Indoor recreation businesses such as health clubs were excluded from the analysis.

After the business list was finalized, each business was mapped to 1 of 440 IMPLAN industries based on its North American Industry Classification System (NAICS) code. Annual revenues were then summed by IMPLAN sector. The top IMPLAN industries by annual sales, as seen in Table 5, were identified so that they could then be entered into a Whatcom County input-output model. Final results were then calculated for total output, value added, tax contribution and employment.

Table 5. Top Whatcom Recreation Industries Grouped By IMPLAN Sector

Sector	Example	Total Sales (2013)
Retail - Motor vehicle and parts	Boat Dealer	$138,139,000
Wholesale trade	Gear Wholesaler	$85,899,000
Boat building	Boat Manufacturing	$73,083,000
Retail - Sporting goods, etc…	Bike Shop	$72,652,000
Other amusement and recreation industries	Marina, Golf Course	$47,773,004
Retail - Clothing and clothing accessories	Outdoor Shoe Store	$14,537,000
Other accommodations	RV Resort	$12,834,000
Motorcycle, bicycle, and parts manufacturing	Bike Builder	$8,485,000

Business Contribution Analysis

Our calculations based on the IMPLAN model revealed that Whatcom County recreation businesses support 3,728 jobs while adding over $217.3 million (Value Added) to the county's GDP. These businesses generate $266.9 million in direct output effects. This spending, in turn, results in $58.8 million in indirect effects through supply chain purchases and $63.5 million in additional spending due to labor wages (induced effects). In total, economic contributions generated from outdoor recreation businesses in Whatcom County had an impact of $389 million in 2014. Table 6 displays detailed results for these effects.

Table 6. Total Contribution of Whatcom Recreation Businesses

Impact Type	Employment	Value Added	Output
Direct Effect	2,824	$139,171,162	$266,869,644
Indirect Effect	427	$36,872,838	$58,757,809
Induced Effect	477	$41,249,048	$63,549,040
Total Effect	**3,728**	**$217,293,048**	**$389,176,493**

As expected, the top industries in Total Value Added (Table **7**) include some of the same industries with the highest total sales. Gear manufacturers, boat dealers and boat builders are all heavily represented in the top industries for highest total sales and top value added. Sporting goods retail outlets, campsites and golf courses are also large contributors. However, some industries with no direct contribution also appeared in the top 10 due to the high indirect and induced value they added. These are primarily real estate related industries, which may have high indirect and induced value added through the rental of retail space and home rentals to workers in the region. Advertising and related services are also in the top ten, demonstrating the use of advertising businesses by the recreation industry.

"We moved our company in January of 2013 to Bellingham primarily due to the amazing, year round mountain biking we have here in Whatcom County and the fact that we are so close to BC with all the exposure it would bring to our brand. There is so much potential to grow the biking industry here, which is a huge benefit not only to the local bike brands and stores, but the hotels, restaurants and other retail as well."

~Vin Quenneville
Director of Sales
Canfield Brothers

Table 7: Top Industries by Value Added

Top Industries By Value Added	Direct	Indirect	Induced	Total
Other amusement and recreation industries	$29,645,986	$27,138	$120,933	$29,794,057
Retail Stores - Sporting goods, etc…	$21,909,287	$96,300	$190,754	$22,196,341
Retail Stores - Motor vehicle and parts	$19,213,627	$383,576	$734,528	$20,331,732
Boat building	$19,193,831	$36,574	$3,390	$19,233,795
Wholesale trade businesses	$10,297,863	$2,332,153	$1,786,886	$14,416,903
Real estate establishments	$0	$5,798,348	$3,654,045	$9,452,393
Imputed rental activity for owner-occupied dwellings	$0	$0	$7,286,749	$7,286,749
Other accommodations	$6,736,875	$751	$698	$6,738,324
Retail Stores - Clothing and clothing accessories	$4,424,036	$160,660	$427,380	$5,012,077
Advertising and related services	$3,161,750	$1,455,015	$163,939	$4,780,704

Other amusement and recreation (which includes places like golf courses, marinas, and stables) contributes the most jobs. Retail stores and boat builders are also large supporters of jobs.

Table 8 lists the top 10 sectors by employment supported by Whatcom County recreation businesses.

Table 8. Employment due to Whatcom County Recreation Businesses

IMPLAN Sector	Employment
Other amusement and recreation industries	952
Retail stores - Sporting goods, hobby, book and music	610
Retail stores - Motor vehicle and parts	280
Boat building	244
Other private educational services	137
Other accommodations	129
Retail stores - Clothing and clothing accessories	102
Wholesale trade businesses	92
Food services and drinking places	90
Scenic and sightseeing transportation and support activities for transportation	76

In addition to providing jobs, Whatcom County recreation businesses contribute to the local and state tax base. The state and local governments help make Whatcom County an attractive place to live, work, and recreate. This positive economic climate in turn attracts businesses that support further development through tax payments. Tax contributions are detailed in Table 9.

Table 9: Tax Contribution of Whatcom County Recreation Businesses

Tax Category	State and Local Total
Tax on Production and Inputs	$ 33,459,848
Households	$ 438,923
Employee Compensation	$ 207,935
Corporations	$ 21,775
Total	**$ 34,128,481**

"Whatcom County is unlike any other area of the United States. McNett maintains its Headquarters in Bellingham (and has for over 30 years) because we choose to create opportunities for our team that enrich both their professional and their personal lives and Whatcom County provides one of the best play grounds in the world!"

~Duane and Nancy McNett
Owners
McNett Corporation

Whatcom County's natural capital and diverse recreational opportunities make the county a wonderful place to live, work and visit. These assets have allowed a diverse group of businesses to thrive in the county, facilitating access and enjoyment of the local environment. These businesses form a hub of regional economic activity, provide jobs to thousands of people and contribute to the local tax base. The results of this analysis demonstrate the importance of local recreation businesses to Whatcom County's economy, and reinforce the importance of a healthy natural environment to the businesses that depend on recreation activity.

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Chapter 3: Ecosystem Services in Recreational Lands

Thus far, we have identified the value of recreation-related expenditures and the economic contribution of recreation-related businesses to the Whatcom County economy. In this final chapter, we identify the additional benefits that recreational lands provide through ecosystem services. These services are often overlooked by traditional economic analysis; however, their value should not be underestimated. Not only does outdoor recreation provide benefits to the county above and beyond expenditures and business revenue, but there are also additional ecosystem services provided by Whatcom County. We conclude our report with an examination of outdoor recreation as an ecosystem service and identify the value of three additional services: aesthetic information, habitat and nursery, and water quality.

Introduction to Ecosystem Services

In addition to the monetary flows associated with outdoor recreation in Whatcom County's economy, there are a number of other benefits which are not accounted for within traditional economic indicators. These benefits are important to people's well-being and to their economic and behavioral decisions. For example, people may value recreation above and beyond what they actually pay for it. Outdoor recreation also keeps people healthy and enhances general well-being. These benefits are made possible by access to Washington's natural spaces. In this light, outdoor recreation can be thought of as a service provided by ecosystems, or an "ecosystem service."

> *"Whatcom County's abundant natural beauty is a huge draw for outdoor recreation enthusiasts. This study draws the positive correlation between our scenic landscape and its impact on local business and our overall economy."*
>
> *~Jack Louws*
> *County Executive*
> *Whatcom County*

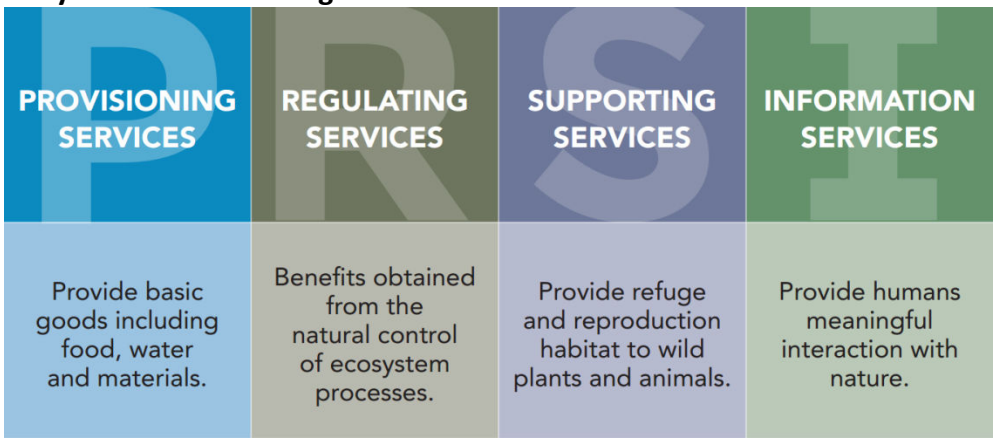
Ecosystem services are defined as the benefits people derive from nature free of charge. Trees, water, and animals provide goods and services such as breathable air, drinkable water, nourishing food, flood risk reduction, waste treatment, and stable atmospheric conditions. These are all examples of ecosystem services.

Earth Economics uses a framework of 21 ecosystem services adapted from the taxonomy laid out in de Groot et al (Table 15).[1] These 21 ecosystem services are further organized into four broad categories: provisioning services, regulating services, supporting services and information

[1] de Groot, R.S., Wilson, M.A., Boumans, R.M.J., 2002. A typology for the classification, description, and valuation of ecosystem functions, goods, and services. Ecological Economics 41, 393-408.

services. The figure below provides definitions of each ecosystem services category, and comprehensive definitions of all 21 ecosystem services can be found in Appendix E.

Figure 4. Ecosystem Services Categories



Recreation as an Ecosystem Service

Recreational opportunities in the outdoors are in the Information Services category. Thanks to natural spaces, recreational activities such as hiking, camping, fishing, hunting and wildlife viewing can take place. Without healthy ecosystems, many recreational activities simply would not exist or would not hold the same value.

In previous chapters, we demonstrated how recreational activities stimulate the economy with millions of dollars in recreation-related expenditures. In this chapter, we examine the additional benefits that outdoor recreation provides. These benefits are, primarily, the increase in general quality of life that people experience through outdoor recreation and the satisfaction people obtain from engaging in these activities over and above the expenditures they incur. These are referred to as "economic benefits" since they affect people's well-being, and their value can be translated into market value approximations.

Though it is difficult to value non-market benefits, economists have developed many methods to estimate them. The value held by the consumer of recreation above what they may have to pay for it is what economists refer to as "consumer surplus". Another way economists describe this concept is as the difference between the maximum price consumers would be willing to pay and what they actually pay. This difference is a gain for the consumer since they pay less than the value they place on that benefit. For example, a Whatcom County resident may be willing to pay $50 to go hiking for one day at Larrabee State Park. If the actual cost of the hiking trip is only $20, then the hiker gains a net economic benefit (consumer surplus) of $30 per day. This value frequently goes unaccounted for by traditional economic analysis, but is addressed in this report.

Additional Ecosystem Services

Recreation is not the only service provided by an ecosystem. This analysis also addresses the valuation of three additional ecosystem services: aesthetic information, habitat and nursery, and water quality. These services can be found in many natural recreational lands, and they are closely related to the recreational experience. The three services included in our study are described as follows:

Aesthetic Information (Information Services)

Aesthetic Information is defined as enjoying the sights, sounds, smells, and presence of nature. This ecosystem service is often valued through property sales, and hence reflects the added value to those who live close to outdoor recreational areas. Properties located on the edge of a pristine lake are often more expensive than non-lakeside properties in the same area. One-half of the respondents to a National Association of Realtors survey reported they would pay 10% more for a house located near a park or open space, while the actual premium paid for homes directly adjacent to parks is 16% higher.[2]

Habitat and Nursery (Supporting Services)

Recreational activities such as wildlife viewing or hunting would not exist without the ecosystem service of habitat and nursery. Ecosystems provide safe havens for species essential to the maintenance and appeal of recreation areas. Degraded habitats can negatively affect recreation experiences and park attendance. Habitat can be thought of as providing production value, which can be similarly valued to factors of production for a business or industry.

Water Quality (Regulating Services)

Water quality enhances recreation by providing clean water. No one wants to swim in coliform bacteria or red tides. Beach closures prohibit some recreational activities completely and can negatively affect an area's reputation in the long term. Some ecosystems and species, like shellfish, are able to provide clean water by removing pollutants and sediment from water or, in the case of forests, by keeping sediment out of water in the first place. Natural lands filter and control the flow of water in lieu of built infrastructure like water purification facilities, levies and storm water systems. Estimating the cost of replacing these functions with built infrastructure, or determining replacement value, is one way to value water quality within an ecosystem.

[2] Tassel, Sandra "Making the Most of Our Money: Recommendations for State Conservation Programs" Look at the Land, Inc., Nature Conservancy, and The Trust for Public Land.

Methodology

> *"The intrinsic value of the County's natural environment and abundance of open space lands contribute greatly to the quality of life and healthy active lifestyles of its residents."*
>
> *~ Michael McFarlane*
> *Director*
> *Whatcom County Parks & Recreation*

In Whatcom County, there are an abundance of opportunities for additional recreational benefits, and the county is also rich in the three above mentioned ecosystem services. For our analysis, we used benefit transfer methodology (BTM) to estimate the ecosystem service values highlighted above for Whatcom County. BTM estimates the economic benefit of ecosystem services by applying derived values from previously published valuation studies to a new, sufficiently similar, study area. These published studies utilize a variety of primary valuation techniques. Some methods, like Contingent Valuation or Travel Cost, measure the benefits consumers derive above and beyond what they would normally pay, while other methods value ecosystem services through market data. Table 100 provides a full list of primary valuation methods that were used in the transfer.

Table 10. Primary Valuation Methods

Valuation Method	Description
Market Approaches	
Market Price	Valuations are directly obtained from what people are willing to pay for the service or good on a private market.
Replacement Cost	Cost of replacing ecosystem services with man-made systems.
Avoided Cost	Value of costs avoided or mitigated by ecosystem services that would have been incurred in the absence of those services.
Production Approaches	Service values are assigned from the impacts of those services on economic outputs.
Revealed Preference Approaches	
Travel Cost	Based on the cost of travel required to consume or enjoy ecosystem services. Travel costs can reflect the implied value of the service.
Hedonic Pricing	The value of a service is implied by what people will be willing to pay for the service through purchases in related markets.
Stated Preference Approaches	
Contingent Valuation	Value for service demand elicited by posing hypothetical scenarios that involve some valuation of land use alternatives.

A benefit transfer methodology includes the following steps:

1. Calculate the number of acres of each land cover type using GIS data
2. Identify ecosystem services present on each land cover type
3. Determine which ecosystem services can be valued using peer-reviewed studies on similar ecosystems
4. Calculate the per acre value of each land cover type by summing across all ecosystem services valued for that land cover type
5. Calculate the total value for each land cover type by multiplying the per acre value for each land cover type by the number of acres

Economic service values for recreational activities were derived from a recreation value database developed by Randall Rosenberger of Oregon State University.[3] The ecosystem service values of aesthetic information, habitat and water quality were estimated using Earth Economics' Ecosystem Valuation Toolkit (EVT). EVT is maintained by Earth Economics and is a comprehensive database of published, peer-reviewed primary valuation studies.

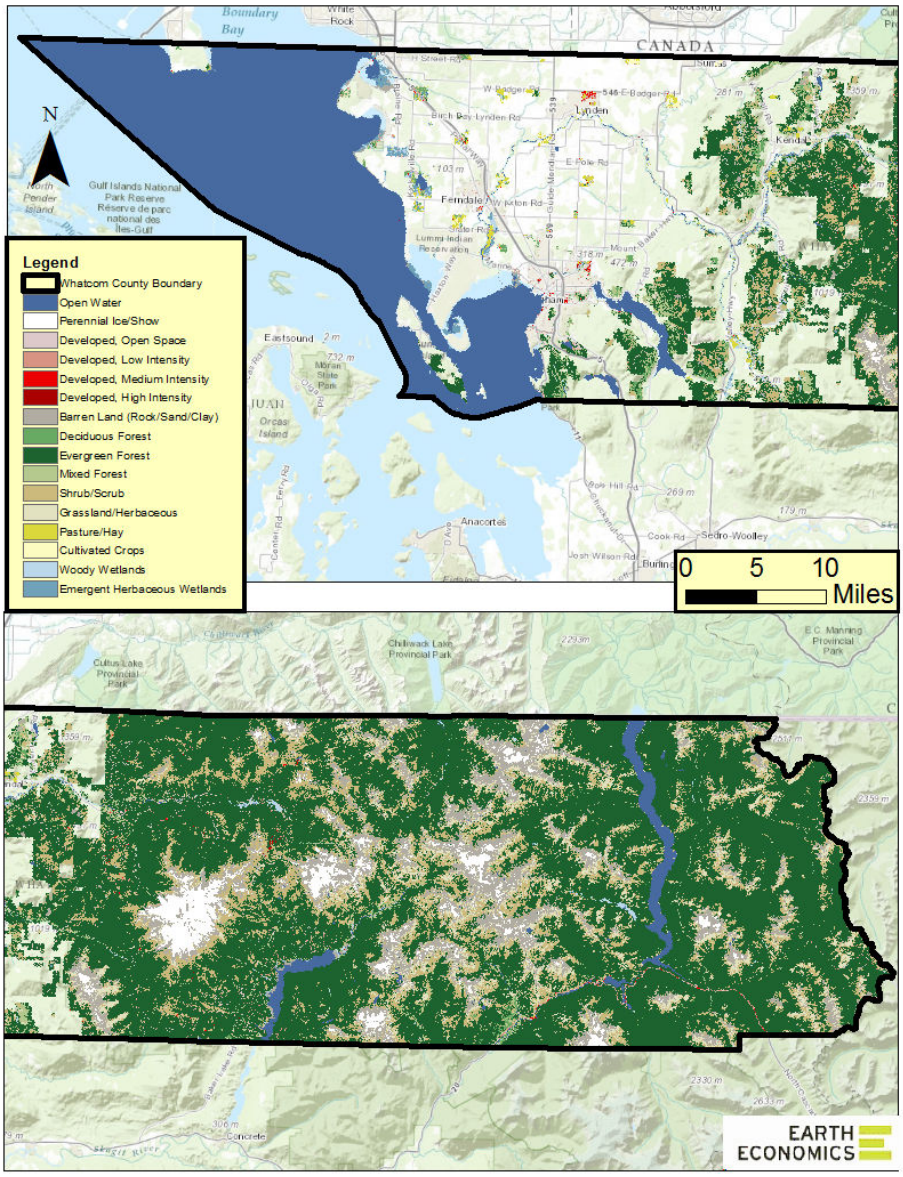
Geographic Information Systems (GIS) was used to determine the number of acres of National Land Cover Dataset (NLCD) land and water cover types in Whatcom County (Table 11). Figure 5 maps the land cover types on recreational lands in Whatcom County. Private lands were not included in this analysis due to limited data availability within this category.

Table 11. Area of land cover classes valued on recreational land types

Land Cover	Acres
Forests	389,568
Marine and Estuary	202,989
Grasslands	124,607
Rivers and Lakes	12,698
Wetlands	12,514
Cultivated Lands	4,195
Developed, Open Space	6,361
Beaches	1,716
Total	754,648

[3] Database is publicly available on-line.

Figure 5. Land Cover of Recreational Lands in Whatcom County



The greatest limitation of this analysis is a lack of primary valuation studies for Whatcom County that represent the identified ecosystem services. Some land cover-ecosystem service combinations lack published primary data. As a result, not every ecosystem service on each land cover type was able to be valued. Exclusion from this analysis does not necessarily mean that the ecosystem does not produce a given service, or that this service is not valuable. Rather, it merely indicates a lack of primary data that would allow for valuation of the service. Appendix F contains a full list of services that were unable to be valued in this analysis.

Results

Recreation as an ecosystem service across all land cover types in Whatcom County results in a total value of $900 million per year. Furthermore, all ecosystem services that are specifically related to recreation are valued between $5 billion and $9 billion per year. Together, recreation and related services total $6 billion to $10 billion annually in non-market benefits.

Table 12 shows the average consumer surplus, participation days and total consumer surplus per year for activities occurring in Whatcom County. As previously described, consumer surplus indicates the benefit consumers receive beyond what they are required to pay. BTM reveals that the consumer surplus varies widely across recreation activity types, yet the total annual economic benefit of recreation as an ecosystem service still yields $918 million dollars.

Table 12. Consumer Surplus of Recreational Activities in Whatcom County

		Participation Days	Average Consumer Surplus per Day (2014 USD)	Consumer Surplus per Year (2014 USD)
Sightseeing and Nature Activities	Sightseeing	1,103,785	39	42,663,583
	Visiting nature interpretive center	324,510	20	6,445,008
	Wildlife viewing/photographing/watching	4,077,843	38	154,929,443
	Gathering/collecting things in nature setting	559,017	47	26,004,602
	Total	6,065,156		230,042,635
Fishing or Shellfishing	Total	778,697	66	51,652,920
Water-Related Activities	Swimming in natural waters	788,059	38	29,846,061
	Swimming (outdoor pools)	399,548	-	-
	Kiteboarding, etc…	41,424	50	2,084,409
	Inner tubing or floating	377,474	50	18,994,095
	Scuba diving	32,396	70	2,256,864
	Total	1,638,901		53,181,429
Boating	Motorized	570,100	26	14,813,636
	Non-motorized	167,462	42	6,991,830
	Rafting	9,895	35	342,324
	Total	747,457		22,147,790
Snow and Ice Activities	Snowshoeing	40,800	20	813,887
	Snowboarding	91,876	55	5,058,531
	Skiing	120,329	19	2,281,360
	XC Skiing	58,231	20	1,161,611
	ATV snow/ice	41,287	39	1,595,852
	Total	352,522		10,911,241

Hiking, Climbing, Mountaineering	Hiking	1,403,161	65	91,360,749
	Climbing/Mountaineering	140,059	42	5,913,174
	Total	1,543,220		97,273,923
Bicycle Riding	Total	1,994,240	37	73,733,679
Horseback Riding	Total	373,942	24	8,885,942
Off-Roading for Recreation	Total	598,614	31	18,791,730
Camping	Total	813,315	44	35,426,001
Hunting & Shooting	Total	518,005	95	49,438,078
Ball Sports	Volleyball outdoor	123,617	-	-
	Basketball outdoor	193,951	-	-
	Tennis outdoors	236,897	-	-
	Field Sports	234,446	-	-
	Soccer outdoors	270,892	-	-
	Baseball	115,092	-	-
	Softball	166,244	-	-
	Football	145,235	-	-
	Frisbee	358,063	-	-
	Skateboarding	61,809	-	-
	Total	1,906,246		-
Golf	Total	297,321	-	-
Other Recreation	Playground Use	1,803,242	5	9,791,605
	Running/Jogging/Trail running	4,485,962	5	22,348,486
	Picknicking, BBQing, Cooking Out	1,454,328	23	34,054,357
	Walking	10,571,092	19	200,519,140
	Total	18,314,624		266,713,588
GRAND TOTAL		35,942,260		918,198,955

Average consumer surplus per day ranges from $5 to $95 for various recreational activities. Activities with low consumer surplus, such as running or playground use, tend to be inexpensive to partake in. High consumer surplus tends to occur with more expensive activities. For example, hunting and scuba diving have the two highest associated consumer surplus estimates, and they are also among the more costly outdoor activities available in Whatcom County.

Some activities, such as basketball and field sports, are not associated with a consumer surplus value in this analysis. These activities were excluded for two reasons. First, the benefits people derive from these activities do not stem from ecosystems—rather, they are performed on very developed areas. As such, it is not appropriate to value them as ecosystem services. Second, some activities are also associated with high damage to ecosystems, which would also be

inappropriate to value as an ecosystem service. For example, swimming in outdoor pools is excluded because it is not a benefit derived from nature.

Additional Ecosystem Services Value

As mentioned previously, we include the valuation of three additional ecosystem services that support recreation: aesthetic information, habitat and nursery, and water quality. These services are closely linked with recreation and dramatically affect the recreational experience.

Table 13 shows the total economic value of the three additional services included on each land cover type per land class. The economic value of ecosystem services related to recreation total between $5 billion and $9 billion per year across all lands in Whatcom County

> *"Wild Whatcom fosters lifelong connections to nature and community through outdoor exploration and service. Having a wonderful array of natural places to explore with kids locally is a vital part of developing a sense of place and environmental stewardship."*
>
> *~Emily Highleyman*
> *Executive Director*
> *Wild Whatcom*

Table 13. Combined ecosystem service value of NLCD classes on federal lands

Land Cover	Acres	Total Low ($/year)	Total High ($/year)
Developed, Open Space	6,361	3,052,294	19,055,339
Forests	389,568	2,442,846,838	4,794,800,281
Grasslands	124,607	992,839,162	1,577,860,682
Cultivated Lands	4,195	11,362,626	23,337,059
Wetlands	12,514	10,011,601	311,931,492
Rivers and Lakes	12,698	3,253,453	7,292,409
Marine and Estuary	202,989	1,867,647,982	2,230,596,572
Beaches	1,716	429,898	1,135,277
Total	**754,649**	**5,331,443,853**	**8,966,009,110**

Conclusion

This study had two primary objectives:

1) To identify the impact of outdoor recreation-related expenditures and businesses through an economic contribution analysis.
2) To describe the additional benefits of recreational lands in Whatcom County through an ecosystem services valuation.

Three analyses were undertaken to reach these goals: an analysis of outdoor recreation expenditures in Whatcom County, identification of the recreation-specific business contributions, and a valuation of the ecosystem services related to recreation.

The value of consumer outdoor recreation spending should not be underestimated. In fact, the amount of consumer spending on outdoor recreation clearly demonstrates the importance of continued investment in recreational lands. As this report has shown, annual consumer outdoor recreation spending in Whatcom County totals $705 million. Total economic contributions to the Whatcom County economy amount to $585 million every year. These expenditures and their impacts support 6,502 jobs in a variety of industries including the hospitality and restaurant industries. Not only is recreation an important part of why people choose to live in Whatcom County, it is also a foundation of the local economy.

Additionally, Whatcom's recreation industries (such a gear manufacturers and boat builders), including their suppliers and related economic activities (total direct, indirect and induced effects), have a significant impact on the local economy. These industries account for over $389 million in business output and support 3,728 recreation business jobs.

In addition to the monetary contribution of outdoor recreation, the benefits not traditionally accounted for within economic analysis also provide significant value. The combined total estimated value of nonmarket benefits such as aesthetic value, water quality, and habitat and nursery is between $6 billion and $10 billion a year.

There is much more to the story of outdoor recreation and its importance to the Whatcom County economy than this report reveals. Outdoor recreation provides opportunities for physical exercise, keeping local communities and visitors healthy. Outdoor recreation markets move income from urban to rural areas. Outdoor recreation draws employers who provide sustainable jobs. With these evident benefits taken into account, recreation is likely one of the largest investments in Whatcom County. Understanding the value of Whatcom's recreational assets is essential to providing an accurate economic analysis of Whatcom's economy.

Appendix A: GIS-based Allocation Model and Expenditure Methodology

Data sources included existing studies on recreation, data recorded by destination sites, local surveys on recreation behavior, licenses and permits issued for specific activities, and, when necessary, modeling of location-specific trends. Geographic Information Systems (GIS) methods assisted in allocating expenditure results to specific locations. All expenditure estimates were based on data of various vintages and have been converted to 2014 dollars using the Bureau of Labor Statistics' Consumer Price Index. Similarly, yearly participant data was derived from estimates from various years and adjusted to Whatcom County's current population.

Many public land managers also provided GIS polygon or parcel data for their jurisdiction. When these were not available, destinations were geocoded from Google Earth search results (e.g. "horseback riding") or local data sources (e.g. mountain bike trails). In these cases, we utilized a GIS-based allocation model to calculate attendance probabilities given the destination's proximity to populated areas. It should be noted that some double counting may have occurred with public water accessed through public land types, as water recreation was estimated as a separate category and could not always be differentiated from certain land types (e.g. county parks).

All visitation data was converted to "participant days" as the common unit of analysis. A participant day denotes one person's presence in a recreational area during the course of a 24-hour period. Overnight participants are counted as those who sleep onsite or near the site as a result of their visitation. When participation was estimated from specific activities for which there was no primary data or local study, the Washington's Statewide Comprehensive Outdoor Recreation Plan (SCORP, 2013) survey of Washington adults was used. The survey estimates participation rates (i.e. percent of residents participating in a recreational activity) as well as participation frequency (i.e. average numbers of days per year a resident recreates in a given activity). The product of these two variables and the adult population of the State yields the total number of participation days for any activity. The SCORP survey does not allocate participation to recreation destinations. Thus, triangulation of attendance data, participation days, and GIS datasets was necessary to generate site-specific visitation data when this methodology was necessary.

Common concerns with participation data are the double counting of park visitors, the ability to estimate visitation at facilities with little or no access control, and differences in methods for estimation used by various facilities. The primary limitation of expenditure data is often the lack of specific data for particular facilities or facility types. The values presented here can be

interpreted as best approximations given the data available. Most public agencies applied some kind of control for double counting in their collection of primary data.

Where participation data had site-specific resolution and where sites were wholly contained within the boundary of Whatcom County, we were able to assign participation days and economic expenditures to the specific site. However, when this was not the case, we allocated participation data between "competing" areas based on ratios derived from population or land area. Both of these methods require assumptions that do not take into account irregular distribution of activities and visitation within each site, let alone routes taken to such sites. Some entrance points may be more popular than others, and may, as a result, affect economic activity near these areas. For visitation figures derived from the SCORP survey (e.g. swimming) and for data sources that did not break out visitation by site, (e.g. Washington Department of Natural Resources and Washington State Department of Fish and Wildlife) we employed a GIS tool called the "Huff Model" adapted for ESRI ArcMap 10.2 (GIS software) to model distribution based on population density and the distance of population centers (census tracts) to sites of interest. Where point datasets did not exist (e.g. surfing and SCUBA sites), we geocoded site locations from address lists. We were then able to use boundary shapefiles to divide these points and sum their respective weighted visitation probabilities.

Appendix B: Recreational Activities

Below is a list of the 40 recreational activities used in this study.

1. Sightseeing
2. Visiting nature interpretive center
3. Wildlife viewing/photographing/watching
4. Gathering/collecting things in nature setting
5. Fishing or shellfishing
6. Swimming in natural waters
7. Swimming (outdoor pools)
8. Kiteboarding, etc…
9. Inner tubing or floating
10. Scuba diving
11. Motorized
12. Non-motorized
13. Rafting
14. Snowshoeing
15. Snowboarding
16. Skiing
17. XC Skiing
18. ATV snow/ice
19. Hiking
20. Climbing/Mountaineering
21. Camping
22. Bicycle Riding
23. Horseback riding
24. Off-roading for recreation
25. Hunting & shooting
26. Volleyball outdoor
27. Basketball outdoor
28. Tennis outdoors
29. Field sports
30. Soccer outdoors
31. Baseball
32. Softball
33. Football
34. Frisbee
35. Skateboarding
36. Golf
37. Playground use
38. Running/jogging/trailrunning
39. Picknicking, BBQing, cooking outdoors
40. Walking

Appendix C: Expenditure Profiles

A separate methodology was used to estimate expenditures attributable to popular outdoor recreational activities in Whatcom County. These expenditures were calculated based on participant days derived from the 3000-person survey conducted by Responsive Management to develop the Statewide Comprehensive Outdoor Recreation Plan (SCORP 2013). The results used a regional proportionate sample of respondents from 10 different multi-county regions across Washington State. Expenditure profiles were created for each activity based on literature searches, U.S. Census data, and communication with activity associations. The activities were chosen based on their popularity among adults in Whatcom County, their existence within at least one of the recreational lands studied, and their potential economic contribution. From a total of 300 activities studied in SCORP, only 40 activities were selected and organized into 14 general categories.

Calculation of expenditures was based on: a) participation rate b) participation frequency, and c) average activity expenditure rates. Trip expenditures were calculated by total number of participant days and equipment expenditures were calculated based on participation rates. Total expenditures derived through the activity analysis methodology resulted in about $41.6 billion in annual expenditures.

The SCORP survey provides important insights into the relative popularity of various activities. For example, there are 357 million participant days attributed to walking for outdoor recreation and 151 million to jogging or running in outdoor settings. These activities have relatively low expenditures per trip, but given their high frequency, they amount to high total expenditures (a combined amount of $2.7 billion). In contrast, other activities, such as windsurfing, only have about 740,000 participant days per year, but contribute as much as $170 million in expenditures per year. In part, some of these high expenditures emerge from equipment needed for activities or high cost of trips to the site of the activity.

Expenditures per trip were borrowed from existing studies and surveys. This data has been generated from both management agencies and activity-specific interest groups. From these figures, activity-based expenditure profiles were created to divide a typical recreation day's expenditures into expense categories (e.g. gasoline and food, see Appendix D). Since individuals can engage in many activities in a single day or trip and thus result in "double counting", some activities were eliminated, consolidated, or adjusted.

Expenditures on equipment were calculated based on U.S. Census consumer data and data available from previous research. Equipment expenditures were based on participant numbers for a set of activities selected from Washington's Statewide Comprehensive Outdoor Recreation Plan (SCORP, 2013) survey. Participant numbers refer to whether an individual engaged in an

activity regardless of the frequency in which they did it. Equipment is assumed to be needed in the same amounts whether the participant did the activity once per year or 100 times per year. Equipment expenditures per participant were obtained or extrapolated for each activity based on U.S. Census Data of yearly sales for specific equipment that could be associated with the activity, expert consultation, and use of results from other studies on a given recreational activity or destination.

Appendix D: IMPLAN model

Methodology Summary

Completing an Input-Output Analysis in IMPLAN is a multi-step process. Total participant days and expenditures were calculated for activities and equipment categories. For each category, we allocate expenditures into industry sectors based on survey data. Industries from supporting materials were mapped to specific IMPLAN sectors. The IMPLAN model calculated the direct, indirect, and induced contributions of these activities. Models were built for both total outdoor recreation expenditures and outdoor recreation on public lands at the county and state level. In this Appendix, additional details are provided on the assumptions for each step in this process.

Expenditure Profiles & Industry Allocation

Expenditures were modeled in Whatcom County in 26 different categories. These included expenditures resulting from recreation on federal, state, local, and private lands; water-based activity spending; and expenditures at events and on equipment. Each of these categories involves different average trip lengths, equipment requirements, and average distance to site. For example, the average participant day at a national park would have different purchases than the average participant day at a Fish & Wildlife recreation area, due to average length of stays and activities available. To account for this, different expenditure profiles were adopted for each activity or land cover category. These expenditure profiles were calculated based on a literature review. These profiles are typically calculated using survey data from actual activity-participants.

IMPLAN Sector Mapping

After selecting expenditure profiles for each activity category, the next step was to map the spending categories to IMPLAN industry sectors. IMPLAN V3.1, which was used in this study, includes 440 industry sectors based on the Bureau of Economic Analysis' latest Benchmark Input-Output Study. North American Industry Classification System (NAICS) codes were also used. These codes are 2-6 digit codes created by the U.S. Office of Management and Budget, with increasing specificity for longer codes. Using NAICS codes, research methodology descriptions in the source data, and previous IMPLAN studies, all spending categories in the expenditure profiles were mapped to one of the 440 IMPLAN sectors. In the end, all sectors were mapped to 1 of 18 IMPLAN categories. For example, the expenditure “Eat/Beverage in Premise” for Federal Lands (Source: Longwoods 2000) was mapped to IMPLAN Sector “413 Food services and drinking places,” called "food and beverage services" in this report, based on its description. **Table 14** is the list of all sectors that were utilized in this analysis.

Table 14. IMPLAN Sector List

IMPLAN Sector	Description
328	Retail - Sporting goods, hobby, book and music
320	Retail - Motor vehicle and parts
326	Retail - Gasoline stations
413	Food and beverage services
324	Retail - Food and beverage
410	Other amusement and recreation industries
330	Retail – Miscellaneous
411	Hotels and motels, including casino hotels
322	Retail - Electronics and appliances
432	Other state and local government enterprises
418	Personal and household goods repair and maintenance
363	General and consumer goods rental except video tapes and discs
429	Other Federal Government enterprises
336	Transit and ground passenger transportation
412	Other accommodations
338	Scenic and sightseeing transportation and support activities for transportation
70	Soft drink and ice manufacturing
61	Seafood product preparation and packaging

IMPLAN Model Construction

In order to construct the county models, expenditures were summed across all activities by IMPLAN sector. This resulted in sector-based subtotals within each county and for the entire state. Totals were calculated for all expenditures, public lands, and private lands. IMPLAN sector expenditure sub-totals were entered into IMPLAN for each county model as well as the state.

Retail purchases generally involve consumers purchasing goods from outlets that did not produce the product. Consumers will pay an amount above the original producer price due to transportation fees, wholesaler fees, and the retailer's markup. However, IMPLAN prices are in terms of producer prices. When entering retail or wholesale spending categories (such as purchases at a grocery or sporting goods store), IMPLAN provides the option of whether the amount represents total value or marginal value. This study utilized expenditure profiles that indicate the total value spent at retail outlets. IMPLAN will also take that total value spent and apply wholesale, trade, and transport margins to appropriately capture the amount of the retail purchase that stays with the retail outlet. This ensures that consumer expenditure at the retail outlet is properly allocated amongst the supply chain participants. If the option to not apply

margins was selected, IMPLAN would allocate 100% of the retail purchase to the retail outlet as opposed to its suppliers.

IMPLAN modeling also requires the selection of the appropriate Local Purchase Percentage (LPP). The LPP is used to determine what percentage of sales is applied to the county and state multipliers. The default LPP is 100%. However, not all industries are available in every county, and trips taken to one county (or the state) may involve purchases outside of that region. For this reason, we utilize the Social Accounts Multiplier (SAM) Model Value provided by IMPLAN. This value models the region's ability to meet local demand with local supply of a good, service, or commodity. We used LPPs of 100% for IMPLAN sectors hotels and motels (including casino hotels), other accommodations, and other amusement and recreation industries, as the methodology of allocating visitor days estimated that trips to a region were using such services locally.

For gasoline, the analysis captures the fact that Washington does a significant amount of refining. To do the refining, expenditures on gasoline were entered into IMPLAN as a Commodity Change for industry 3115 Refined Petroleum Products. IMPLAN then allocated these expenditures across the relevant supply chain industries including Refineries, Wholesale Distribution and Gasoline Stations. The allocation to gasoline stations was given a Local Purchase Percentage of 100%. This was more accurate than allocating all gasoline expenditures to Retail Gasoline stations because this does not distinguish gasoline from other gas station purchases. With all expenditures and assumptions properly entered into IMPLAN, the model was run separately for each region and group of activities.

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Appendix E: Ecosystem Services Definitions

Below is a table defining all 21 of the Ecosystem Services used by Earth Economics. Our classification is based off de Groot et al. (2002).[4]

Table 15. Definition of Ecosystem Goods and Services

Good/Service	Economic Benefit to People
Provisioning Services	
Food	Producing crops, fish, game, and fruits
Medicinal Resources	Providing traditional medicines, pharmaceuticals, and assay organisms
Ornamental Resources	Providing resources for clothing, jewelry, handicraft, worship and decoration
Energy and Raw Materials	Providing fuel, fiber, fertilizer, minerals, and energy
Water Supply	Provisioning of surface and ground water for drinking water, irrigation and industrial use
Regulating Services	
Biological Control	Providing pest and disease control
Climate Stability	Supporting a stable climate at global and local levels through carbon sequestration and other processes
Air Quality	Providing clean, breathable air
Moderation of Extreme Events	Preventing and mitigating natural hazards such as floods, hurricanes, fires, and droughts
Pollination	Pollination of wild and domestic plant species
Soil Formation	Creating soils for agricultural and ecosystems integrity; maintenance of soil fertility
Soil Retention	Retaining arable land, slope stability and coastal integrity
Waste Treatment	Improving soil, water, and air quality by decomposing human and animal waste, and removing pollutants
Water Regulation	Providing natural irrigation, drainage, ground water recharge, river flows, and navigation
Supporting Services	
Habitat and Nursery	Maintaining genetic and biological diversity, the basis for most other ecosystem functions; promoting growth of commercially harvested species
Genetic Resources	Improving crop and livestock resistance to pathogens and pests
Information Services	
Aesthetic Information	Enjoying and appreciating the presence, scenery, sounds, and smells of nature
Cultural and Artistic Inspiration	Using nature as motifs in art, film, folklore, books, cultural symbols, architecture, and media
Recreation and Tourism	Experiencing natural ecosystems and enjoying outdoor activities
Science and Education	Using natural systems for education and scientific research
Spiritual and Historical	Using nature for religious and spiritual purposes

[4] de Groot, R.S., Wilson, M.A., Boumans, R.M.J., 2002. A typology for the classification, description, and valuation of ecosystem functions, goods, and services. Ecological Economics 41, 393-408.

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Appendix F: Gap Analysis

The table below describes the ecosystem service/land cover combinations that were valued in the ecosystem service value analysis.

Table 16. Gap Analysis for the Ecosystem Service Valuation

National Land Cover Database (NLCD) Code and Name	Aesthetic Information	Wildlife Habitat	Water Quality
11 Open Water	X	X	X
12 Perennial Snow/Ice			
21 Developed, Open Space	X		X
22 Developed, Low Intensity			
23 Developed, Medium Intensity			
24 Developed, High Intensity			
31 Barren Land	X		
41 Deciduous Forest	X	X	X
42 Evergreen Forest	X	X	X
43 Mixed Forest	X	X	X
52 Shrub/Scrub			
71 Grassland/Herbaceous	X	X	X
81 Pasture/Hay	X	X	X
82 Cultivated Crops	X	X	
90 Woody Wetlands	X	X	X
95 Emergent Herbaceous Wetlands	X	X	X

Key

Ecosystem service present on land cover type and valued in this analysis	X
Ecosystem service present on land cover type	
Ecosystem service not present on land cover type	

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