The Values of Place: Recreation and Cultural Ecosystem Services in Puget Sound

Report to the Puget Sound Institute

Authors (listed alphabetically):
Kai Chan
Mollie Chapman
Cheryl Chen
Noah Enelow
Taylor Hesselgrave
Sarah Klain

September 21, 2015

EXECUTIVE SUMMARY

This report details research to understand recreational and other cultural values associated with Puget Sound ecosystems. It includes four components: Chapter 1, a characterization of coastal recreation and associated expenditures among residents of the region, including an analysis of how these values vary across space; Chapter 2, an analysis of sense of place and aesthetic values associated with the region; Chapter 3, an experimental analysis of willingness to pay for environmental protection through agricultural riparian buffers; and Chapter 4, analysis of interviews with farmers regarding attitudes towards riparian buffers in Snohomish County.

The first component (Ch.1) details the financial impact of direct expenditures (e.g., hotel stays, dining, shopping). This study estimated the total number of recreational trips and direct trip expenditures per year among residents of the Puget Sound region. Survey respondents took an average of 2.65 trips with recreation as the primary purpose in the last year, which corresponds to 8.8 million trips per year among the study population. With respondents spending an average of $53.74 per trip, we estimated that the study population's total annual coastal visitation trip expenditures were approximately $474.8 million. Approximately 65.1% of survey respondents visited Puget Sound in the last 12 months, for an average of 5.38 trips with the primary purposes of recreation, leisure/tourism, visiting family/friends, work or other. Of those who had made visits, the majority (63.3%) has been visiting the Puget Sound from more than ten years to all of their lives. Coastal trips in Island County and King County were most popular among respondents, constituting approximately 21.4% and 20.4% respectively of total coastal trips. The top five most popular recreational activities among survey respondents over the last 12 months were beach going (64.7%), scenic enjoyment (61.9%), hiking (43%), wildlife viewing (37.6%), and photography (31%).

Our spatial analysis revealed that much of the region features memorable recreational experiences for some people, with especially popular or evocative areas along the northern edge of the Olympic Peninsula near Port Angeles, in the Hood Canal area west of Bremerton, and in the San Juan Islands area near Friday Harbor. The report's spatial data sets and maps display the extent and intensity of use for both coastal recreation overall, and for the top ten most popular coastal recreation activities.

The health of Puget Sound's coast is linked to the environmental quality of the region's rivers and lands. Riparian buffers can improve fish habitat and water quality, but many land-owners face trade-offs when considering the creation of riparian buffers (e.g., removing land from agricultural production can reduce farm productivity). Results of our choice experiment survey (Ch.3) in this report indicate that residents of Puget Sound demonstrate positive and significant willingness to pay (WTP) for riparian restoration, with incremental WTP decreasing at higher levels of riparian habitat quality. Survey respondents were indifferent to low to moderate levels of farmland conversion (4% to 8%) but indicated significant preference against high levels of conversion (16%). Respondents from higher-income groups and people who recreate outdoors more frequently have higher WTP for riparian restoration and farmland conversion.

To better understand perceptions of riparian buffers, this report includes an assessment of famers' attitudes towards riparian buffers in Snohomish County (Ch.4). Semi-structured interviews with full time, part time and hobby farmers examined aesthetic values, connection to place, and motivations and barriers to enrolling in voluntary riparian buffer programs. The following factors motivated farmers to create riparian buffers: possibilities for land improvement; a sense of stewardship; and the availability of technical, labor and financial assistance. Farmers want flexibility in buffer locations and width, tailored to the locally specific characteristics of their land. Flexibly structured incentive programs are more likely to induce rural landowners and farmers to create and expand riparian buffers.

This report establishes an economic and spatial baseline of coastal recreation patterns; it documents the strong connections that Puget Sound residents have to their coastal ecosystems and their willingness to pay to protect these environments. Our study suggests that recreation and restoration are complementary. The results of our recreational survey indicate that recreation plays a significant role in the lives of hundreds of thousands of Puget Sound residents; our riparian buffer choice experiment results indicate that people who recreate frequently are willing to pay for restoration. The economic, cultural and social values of Puget Sound highlighted in this report can inform coastal resource management and riparian restoration efforts.

TABLE OF CONTENTS

EXECUTIVE SUMMARY i

INTRODUCTION 1

1. THE VALUES OF COASTAL RECREATION 3

1.1. Introduction to Coastal Recreation 3

1.2. Establishing a Coastal Recreation Economic Baseline 8

1.3. Establishing a Coastal Recreation Spatial Baseline 22

1.4. The Spatial Clustering of Recreational Behavior: Exploratory Data Analysis 25

1.5. Coastal Recreation Study Conclusion 32

Chapter References 32

2. TOWARDS A PUGET SOUND SENSE OF PLACE: EXPLORATORY ANALYSIS 33

2.1. Introduction 33

2.2. Methods 33

2.3. Results and Conclusion 33

3. THE VALUES OF RIPARIAN BUFFERS: A STUDY OF TRADEOFFS 35

3.1. Introduction 35

3.2. Methods 36

3.3. Results 40

3.4. Discussion and Conclusions 47

3.5. Conclusions 49

Chapter References 49

4. PLACE BASED STUDY: AESTHETICS, SENSE OF PLACE AND LANDOWNER ATTITUDES TOWARDS RIPARIAN BUFFERS IN SNOHOMISH COUNTY 52

4.1. Introduction 52

4.2. Methods 53

4.3. Results 55

4.4. Discussion 67

4.5. Conclusion 67

Chapter References 68

5. CONCLUSION 70

Acknowledgements 72

Appendix A. Coastal Recreation Survey Questions 73

Appendix B. Coastal Recreation Map Products 77

Appendix C. Riparian Buffer Choice Experiment: Choice Sets and Preamble 103

Appendix D. Methods on Selection of Number of Spatial Clusters 108

The Puget Sound Institute

Over the last several years the Puget Sound Partnership (PSP) in collaboration with the University of Washington Puget Sound Institute (PSI) has been engaged in a concerted effort to incorporate the human dimension in its ecosystem recovery strategies and implementation. This study is a part of a larger initiative by the University of Washington Puget Sound Institute (PSI) consisting of research projects from social science investigators at academic and research institutes, government agencies and other professional consultancies to conduct research on Puget Sound ecosystem service values, specifically marine based recreation (boating, wildlife viewing, fishing, and swimming), aesthetics and proximity to shorelines, and a Puget Sound sense of place.

Point 97

Point 97 is a high-tech spin-off of Ecotrust, delivering impact technology solutions and engagement strategies for coastal and marine planning in regions around the world. Working to improve marine and coastal management practices, Point 97 helps partners and clients strengthen coastal communities and ocean ecosystems, bridge different ocean user perspectives and implement management decisions in an inclusive and transparent way. Learn more at pointnineseven.com

Ecotrust

For more than 20 years, Ecotrust has converted $80 million in grants into more than $500 million in capital for local people, businesses, and organizations from Alaska to California. Ecotrust's Marine Consulting Initiative builds tools that help people make better decisions about the ocean. Our tools help visualize and map marine ecosystems and uses, bridge differing perspectives, and implement management decisions in a more inclusive and transparent way. The marine planning tools are part of Ecotrust's 20-year history of doing innovative things with knowledge, technology, and capital to create enhanced conservation and economic development for coastal communities on a global scale. Learn more at http://www.ecotrust.org.

IRES

The Institute for Resources, Environment and Sustainability at the University of British Columbia is a problem and solution-focused interdisciplinary research institute and graduate program. The mission of IRES is to foster sustainable futures through integrated research and learning about the linkages between human and natural systems, and to support decision making from local to global scales. This is achieved through collaborations involving students, faculty and partners outside of academia in a manner that recognizes a diversity of skills, intellectual histories and methodological approaches.

CHANS Lab

The mission of the Connecting Human and Natural Systems (CHANS) lab is to conduct cutting-edge analysis and modeling of social-ecological systems, for both fundamental insight and application to real-world practice and transformation--to enable the just treatment of current and future people and the natural world.

For questions or comments, please contact Noah Enelow, Economist, at Ecotrust,
721 NW 9th Avenue, Suite 200
Portland, OR 97209; nenelow@ecotrust.org ; 503-467-0752

LIST OF TABLES

Table 1. Number of survey respondents and 2010 population data 4
Table 2. Survey wave information 6
Table 3. Survey length and completion 6
Table 4. Demographics of survey and study populations 6
Table 5. Puget Sound coastal visitation summary statistics 8
Table 6. How long respondents have been visiting the Puget Sound 8
Table 7. Distribution of coastal trips reported in the last 12 months 9
Table 8. Mode of transportation on last trip 10
Table 9. Where respondents live and distance from Puget Sound waters 11
Table 10. Most valued resources in the Puget Sound 12
Table 11. Activity participation in each activity in the last 12 months 14
Table 12. Participation in each activity for the last trip 15
Table 13. Primary recreational activity for the last trip 16
Table 14. Average trip expenditures per person by item across all respondents, last trip 18
Table 15. Average expenditures per item per person across respondents reporting expenditures for a certain item, last trip 19
Table 16. Estimated number of trips and direct expenditures 21
Table 17. Number of markers placed for all activities in mapping survey 23
Table 18. Number of markers placed for primary activities in mapping survey 24
Table 19. Spatial Outliers by Use Type 25
Table 20. Summary of Cluster Demographics 27
Table 21. Primary Activities Listed as Top Three Most Popular By Cluster 27
Table 22. Brief List of Attributes and Levels 38
Table 23. Variables in Choice Experiment Analysis 40
Table 24. Model Results 42
Table 25. Likelihood Ratio (LR) Test of Models 43
Table 26. Marginal Willingness To Pay (MWTP) for Choice Experiment Variables 44
Table 27. Age Breakdown of Interview Participants 59
Table 28. Cluster Analysis: Demographic Summary by Cluster 102
Table 29. Attribute Images 105
Table 30. Descriptions of Attribute Levels 106

LIST OF FIGURES

Figure 1. Puget Sound Study Region 5
Figure 2. Length of time respondents have been visiting Puget Sound 9
Figure 3. Distribution of recreational trips by county, last 12 months 10
Figure 4. Location of respondents' residences 11
Figure 5. Distance from respondents' homes to Puget Sound waters 12
Figure 6. Most valued resources of Puget Sound 13
Figure 7. Activity participation rates, last year and last trip 17
Figure 8. Average expenditure per trip for coastal visitation 20
Figure 9. Estimated number of trips and direct expenditures 21
Figure 10. Screenshot of coastal recreation survey: Map interface 22
Figure 11. Spatial Clusters of Recreational Activity 28
Figure 12. Average Recreational Expenditure by Cluster 29
Figure 13. Reported Quality of Coastal Recreation Trip 30
Figure 14. Average Reported Quality of Visit by Site Cluster 31
Figure 15. Interview excerpts demonstrating affective qualities tied to Puget Sound sense of place 34
Figure 16. Distribution of Marginal Willingness to Pay (MWTP) for Individual Levels of Riparian Environmental Quality and Farmland Conversion (Model 3) 45
Figure 17. Mean survey respondent assignment of relative importance of riparian ecosystem components with standard deviations 46
Figure 18. Frequency of relative value weighting across environmental conditions 46
Figure 19. Farm Values and Income in Puget Sound Counties and Washington State, 2012 (Source: Based on USDA Census Publications, County and Statewide Profiles) 56
Figure 20. Change in Value of Sales in WA State counties, 2007 to 2012 56
Figure 21. Distribution of Property Sizes of Interview Participants. 57
Figure 22. Distribution of Property Sizes of Farms in Snohomish County 57
Figure 23. Number of different types of farmers in Snohomish County and interview sample. 58
Figure 24. Average property sizes of different types of farmers in interview sample and Snohomish County CREP contract holders. 58
Figure 24. Intensity of Use Map - All Activities Combined 78
Figure 25. Intensity of Use Map - Scenic Enjoyment/Sightseeing 79
Figure 26. Intensity of Use Map - Beach Going 80
Figure 27. Intensity of Use Map - Hiking 81
Figure 28. Intensity of Use Map - Wildlife Viewing 82
Figure 29. Intensity of Use Map - Photography 83
Figure 30. Intensity of Use Map - Sitting in Your Car Watching the Scene 84
Figure 31. Intensity of Use Map - Camping 85
Figure 32. Intensity of Use Map - Tidepooling 86

Figure 33. Intensity of Use Map - Fishing from Shore/Boat 87
Figure 34. Intensity of Use Map - Collection of Nonliving Resources/Beachcombing 88
Figure 35. Intensity of Use Map - Power Boating/Jet Skiing 89
Figure 36. Primary Activity Map - All Activities Combined 90
Figure 37. Primary Activity Map - Sightseeing/Scenic Enjoyment 91
Figure 38. Primary Activity Map - Beachgoing 92
Figure 39. Primary Activity Map - Hiking 93
Figure 40. Primary Activity Map - Camping 94
Figure 41. Primary Activity Maps - Fishing from Shore/Boat 95
Figure 42. Photography 96
Figure 43. Primary Activity Map - Wildlife Viewing 97
Figure 44. Primary Activity Map - Kayaking/Canoeing/Rowing 98
Figure 45. Primary Activity Map - Power Boating/Jet Skiing 99
Figure 46. Primary Activity Map - Collecting/Picking/Harvesting Sea Life from Shore 100
Figure 47. Primary Activity Map - Sitting in your Car Watching the Scene 101
Figure 48. Choice Experiment Preamble 103
Figure 49. Choice Experiment Question Example 104
Figure 50. Relative Weighting of Riparian Environment Characteristics 107
Figure 51. Sum of standard deviations across clusters 108
Figure 52. Sum of standard deviations within clusters 109

INTRODUCTION

Coastal recreation, tourism, and ethical or existence values are among the most important ecosystem service (ES) benefits identified by Puget Sound stakeholders (Iceland et al, 2008). The ecosystem services (ES) concept has become the leading framework to understand and communicate the human dimensions of environmental change. This report focuses on economic, social and cultural values inextricably linked to ES benefits in the context of ongoing efforts to restore and protect the Sound.

One of the Puget Sound Partnership's key goals is that the "quality of human life is sustained by a functioning Puget Sound ecosystem" (PSP, 2008). In pursuit of this goal, Puget Sound residents and stakeholders seek to preserve and enhance Puget Sound's unique place-based characteristics, including recreational opportunities and aesthetic values. Decisions on how to manage the region's environmental and natural resources, however, require difficult and complex trade-offs between competing ecological goods and diverse cultural values linked to ecosystems. This report helps to inform environmental management decisions by developing a greater understanding of how Puget Sound residents and land-owners may negotiate such trade-offs. We examine three contexts: coastal recreation (Chapter 1), outdoor recreation in general (Chapter 2) and riparian buffers on agricultural lands (Chapters 3 and 4).

We used an interdisciplinary approach, drawing methods from economics, geography, and anthropology, to develop a rich set of quantitative and qualitative analyses and data sets on particular ES values in Puget Sound. Using quantitative approaches, Chapter 1 uses a survey and Chapter 3 employs a choice experiment. Chapters 2 and 4 use qualitative interview methods. These diverse methods allow for a broader perspective representative of Puget Sound residents via the quantitative survey and choice experiment as well as an in-depth understanding of the particular perspectives of interviewees.

Our analyses focus on coastal recreation as well as land management practices that influence both riparian habitat and downstream water quality – specifically riparian buffers. Both Chapter 1, The Values of Coastal Recreation and Chapter 3, The Values of Riparian Buffers: A study of trade-offs, used web-based surveys to achieve a demographically representative sample of residents of the counties within Puget Sound. Chapter 1 estimates total annual visitation trip expenditures among coastal recreators, which is an important part of the total economic value of coastal recreation. This chapter and associated appendices provide spatial data sets and maps displaying the extent and use intensity of coastal recreation overall, as well as the ten most popular coastal recreation activities. It provides an economic and spatial overview of current coastal recreation patterns in the region. This baseline recreational data can inform spatial planning processes by providing inputs to future scenario analyses and decision support tools.

Chapter 2, Towards a Puget Sound Sense of Place is an exploratory qualitative analysis of sense of place and aesthetic values associated with the region's seascapes and landscapes. One prominent theme arising from these semi-structured interviews of professionals who work in natural resource conservation and management is concern that some outdoor places are "loved to death" and need additional management effort to reduce human impacts. Interviewees also expressed, at times, profound appreciation for the region's natural beauty and the therapeutic qualities of outdoor recreational time. This chapter explores the extent to which a regional, watershed or community-based sense of place resonated with interviewees.

The final two chapters focus on riparian buffers on agricultural land from two perspectives: the public, via a choice experiment, and farmers, via interviews. Riparian buffers are created to improve fish habitat and water quality. Land-owners, however, often confront trade-offs when considering the planting of riparian buffers (e.g., removing

land from agricultural production can reduce farm productivity). Chapter 3 employs a choice experiment to estimate the public's willingness to pay (WTP) for riparian habitat restoration while acknowledging that buffers can take agricultural lands out of production. Results of our choice experiment survey indicate that residents of Puget Sound demonstrate positive and significant willingness to pay (WTP) for riparian restoration, with incremental WTP decreasing at higher levels of riparian habitat quality. Survey respondents were indifferent to low to moderate levels of farmland conversion (4% to 8%) but indicated significant preference against high levels of conversion (16%). Respondents from higher-income groups and people who recreate outdoors more frequently have higher WTP for riparian restoration and farmland conversion.

Chapter 4, Place-Based Study: Aesthetics, Sense of Place and Landowner Attitudes towards Riparian Buffers in Snohomish County, expands the discussion of riparian buffers to include an analysis of farmers' attitudes towards riparian buffers in Snohomish County. It includes recommendations on how to improve programs that incentivize the creation of riparian buffers with a special focus on the Conservation Reserve Enhancement Program (CREP). Here we take an approach of looking at 'what works' by examining the motivations, values around farming and land management of landowners who have installed riparian buffers. This assessment allows us to better understand perceptions of challenges and incentives associated with riparian buffers, from the farmer's perspective. Semi-structured interviews with full time, part time and hobby farmers were conducted to assess famers' attitudes and opinions regarding the challenges and incentives in creating and expanding riparian buffers in Snohomish County. These interviews examined aesthetic values, connection to place as well as motivations and barriers to enrolling in programs to create riparian buffers on agricultural land. The interviews elicited a wide variety of values and motivations for riparian buffers as well as barriers to participation. The following motivated farmers to create riparian buffers: the ability to improve their land via stream bed stabilization or solve drainage issues; a sense of stewardship or concern for the environment; and technical, labor and financial assistance offered by riparian buffer programs. Farmers want flexibility in buffer locations and width, tailored to the locally specific characteristics of their land. A variety of program rules, structures and incentives is likely to best incentivize rural landowners and farmers to create and expand riparian buffers.

The regional survey work and the in-depth place-based study are intended to inform Puget Sound Institute's ongoing restoration work, the public marketing and communication of restoration campaigns and the development of projects focused on environmental attributes that residents treasure most. This report identifies how different types of values motivate or impede changes in environmental management.

References

Iceland, C., Hanson, C., and Lewis, C. 2008. *Identifying Important Ecosystem Goods and Services in Puget Sound*. Washington, DC: World Resources Institute and Meridian Institute.

PSP, 2008. Puget Sound Action Agenda. Puget Sound Partnership, Olympia, WA.

1. THE VALUES OF COASTAL RECREATION

1.1. Introduction to Coastal Recreation

The Puget Sound region of Washington, which spans approximately 100 miles from Deception Pass in the north to Olympia in the south, is well known for its unique beauty and abundant coastal recreation opportunities. These recreation opportunities provide significant economic and social benefits to both visitors and resident coastal communities, such as the economic contribution from direct expenditures (e.g., hotel stays, dining, shopping) and non-market benefits such as enhanced human health and well-being (e.g., from outdoor exercise and aesthetic appreciation of land and seascapes). To better understand changes in coastal recreation use patterns and its associated benefits over time, it is necessary to establish a baseline of how many people use the coast, what they do, the economic contributions of these different types of uses, and the site/environmental attributes that drive coastal recreation patterns—especially in a geospatial context.

We conducted a region-wide survey to establish a broad understanding of spatial patterns of use, trip-related economic values, and site attribute preferences of coastal recreation across the entire Puget Sound region. Our survey elicited monetary trip expenditures and gathered a broad spatial data set of recreational activities in the Puget Sound. It should be emphasized that the trip expenditures estimated in this report are but a portion of the overall economic value of coastal recreation. Trip expenditures are indicators of minimum willingness to pay for coastal recreation. There are secondary economic effects of coastal recreation such as the contribution of coastal recreation to industries such as the local tourism economy (e.g., jobs and wages). Furthermore, there are a plethora of non-market values of environmental attributes and ecosystem goods and services that contribute to recreation sites' total economic value (TEV). Additional valuation methods to investigate the full economic value of coastal recreation, such as hedonic analysis of property prices, input-output analysis of recreation spending, along with identification and explanation of the social and cultural values associated with coastal environments, are important to understand and account for in future research efforts.

1.1.1. Coastal Recreation Survey Methods

A customized, web-based survey instrument, which utilizes Point 97's Viewpoint survey and mapping technology, was used to collect spatially explicit data on coastal recreation. This survey utilized a standing internet panel hosted by Knowledge Networks (KN) designed to be demographically representative based on 2010 U.S. Census statistics. Knowledge Networks is a leader in deploying custom online surveys for various academic, governmental, and commercial applications. Point 97 employed KN because the company specializes in probability sampling and providing survey data that aims to be proportionally representative through a peer-reviewed data collection methodology that reaches across the U.S. population, including many difficult-to-survey populations such as cell phone–only households, non-internet connected households, African Americans, Latinos, and young adults. It should be emphasized that respondents could not self-select for this survey and all respondents were sampled through Knowledge Network's methods.

Utilizing KN's services, Point 97 designed this coastal recreation study to collect spatially explicit data on coastal recreation use patterns, characteristics, and associated trip expenditures. This would have been difficult to achieve using traditional mail or intercept survey methods. The advantage of deploying Point 97's survey tool in combination with KN's services was that all data collected constituted a weighted sample (based on U.S. Census data of household characteristics and county of residence) of the larger study population. The sample is demographically representative of the study population after applying the weights.

The Puget Sound region coastal recreation survey was launched in April of 2014 after extensive testing to ensure the mapping component of the survey tool would capture high-quality spatial data at the appropriate scale and in a user-friendly manner. In an effort to capture seasonal variations in coastal use, we collected data on each respondent's most recent coastal trip, and deployed the survey in two survey "waves" over a six-month period.

Data collection was completed in October 2014, and the data were then subsequently analyzed and synthesized. In the survey, respondents were asked to recount details of their coastal visits over the previous 12 months and of their last trip, including information about the number of trips taken, participation in recreational activities, the location of activities, and expenditures made. This section describes the survey and analysis methods, and the results are presented in the following section. The survey questions regarding coastal visitation and recreation use can be found in Appendix A.

Our study population (the "sample frame" from Knowledge Network's standing internet panel) was defined as the total resident population over the age of 18 years of Washington counties within our study area (see Figure 1). We chose this study population to explore where and how Puget Sound residents recreated in their coastal region, and to provide a baseline estimate of their value of coastal recreation via trip expenditures. We differentiate this from coastal tourism which is often defined as involving overnight stays from visitors from outside the region. However, establishing a clear distinction between the two categories is somewhat difficult as they undoubtedly overlap. Furthermore, the value of coastal real estate also may overlap with the value of coastal recreation in the case of coastal residents who may often recreate on the coast but do not incur any trip expenditures. Indeed, the value of this type of coastal use is captured in coastal real estate values where the individual resides. Thus, we would like to emphasize that the economic data presented in this report are but a reflection of direct trip expenditures and estimating the full value of coastal recreation would require further study.

These counties below were chosen as our study population as they are counties within the defined Puget Sound:

- Whatcom
- San Juan
- Skagit
- Island
- Clallam
- Snohomish
- Jefferson
- Kitsap
- Mason
- King
- Pierce
- Thurston

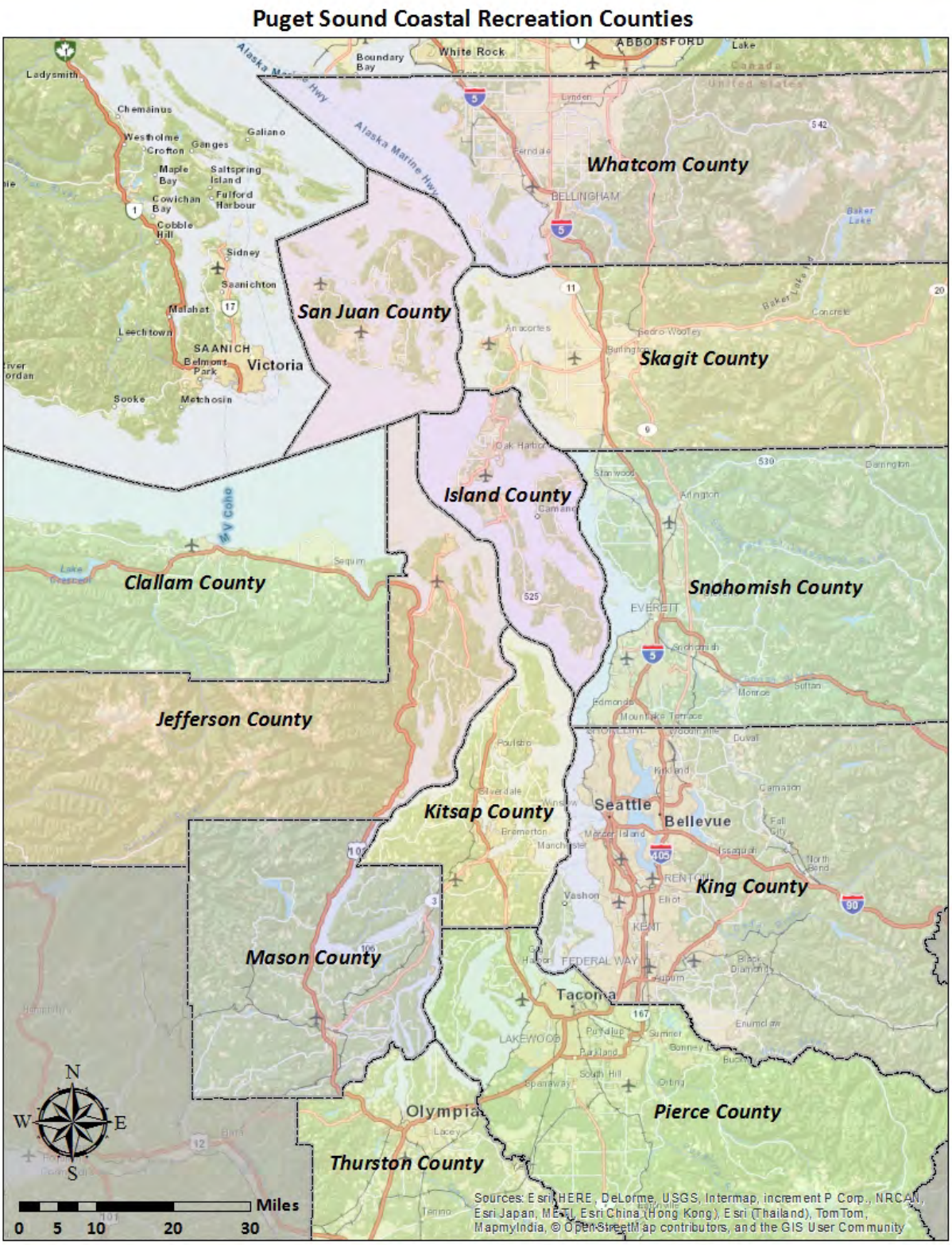
Table 1 displays the study population (3.3 million), the total population of the study area (4.3 million), and the population of the state of Washington (6.7 million).

Table 1. Number of survey respondents and 2010 population data

Area	Population
Study population (>18 yrs)	3,339,610
Study area total population	4,316,357
Washington state population	6,724,540

Source: Current study and 2010 US Census Bureau

Figure 1. Puget Sound Study Region



Survey data were collected over two successive waves distributed over a six-month period to capture the seasonal variation in coastal use patterns. Table 2 displays the months over which each wave was conducted and

the respective number of respondents; overall, the survey was completed by 3,234 respondents. Table 3 displays the median survey length, 15 minutes, and the total number of respondents that completed the mapping portion of the survey (2,206 which is approximately 68.2% of total respondents).

Table 2. Survey wave information

Survey wave	Wave dates	Respondents	%
Wave 1	April 2014	1,615	50%
Wave 2	September 2014	1,619	50%
TOTAL		**3,234**	**100%**

Source: Current study

Table 3. Survey length and completion

Total number of respondents	3,234
Median survey length (min)	15
Number of respondents who completed the mapping portion	2,206

Source: Current study

We incorporated verbatim the US Census Bureau demographic survey questions into our survey. We then compared our findings to US Census demographic findings as an indication of how representative our survey sample is of the sample frame, see Table 4. Our survey aimed to be representative of the study area population, and while our sample was relatively well matched with 2010 Census findings, there are two exceptions: 1) females are overrepresented; and, 2) white, non-Hispanics are overrepresented (and other categories correspondingly underrepresented).

Table 4. Demographics of survey and study populations

Demographics	Study area population	Survey respondents
Male	49.8%	42.2%
Female	50.2%	57.8%
White, non-Hispanic	70.5%	83.3%
Black, non-Hispanic	4.7%	1.5%
Other, non-Hispanic	11.8%	8.6%
Hispanic	8.7%	3.8%
2+ Races, non-Hispanic	4.3%	2.9%

Source: Current study and 2010 US Census data

1.1.2. Coastal Recreation Baseline Estimation Analysis Methods

To analyze the survey data, Knowledge Networks provided a post-stratification survey-weighting methodology to more closely align our survey sample representation with the study population's demographics. Once the survey was complete, Knowledge Networks applied data weights informed by demographic and county of residence data to adjust each respondent's contribution to overall survey results. A data weight is effectively a multiplier that adjusts a given respondent's contribution to compensate for planned and unexpected mismatch between the survey sample and the study area population. The aim of post-stratification survey-weighting is to adjust the weight given to individual sample data based on demographic characteristics so as to better reflect the population they are intended to represent.[1]

Once all respondents completed the survey, Knowledge Networks provided the post-stratification survey weights, and Point 97 used the statistical software R to apply the weights and analyze the data, determining the weighted means as well as confidence intervals[2] as presented in the results below.

To analyze data gathered regarding trip expenditures respondents made on their last trip, we took the following steps to ensure we utilized the best data possible to convey results:

- Respondents who visited the coast but did not indicate they had purchased an item were given a zero value expenditure for that item.
- If respondents indicated that they purchased an item but did not provide a cost or answer for how many people the expenditure was made for, the entire cost-per-person estimate was assumed to be invalid and was removed from the sample.
- We provide two tables to present analysis results on trip expenditures:
    - The first table (Table 14) displays the average per-person expenditures made by respondents on their last trip. These expenditures are averaged across all respondents who indicated any expenditures, providing an average total trip expenditure estimate which can be scaled up to the larger study population.
    - The second table (Table 15) presents cost-per-person, averaged only across respondents who indicated expenditure for a given item. These values are not weighted and cannot be extrapolated to the greater study area population but provide information as to how much people on average are spending on expenditure items.

In addition to survey questions, respondents were asked to map the location where they conducted specific coastal recreation activities on their last trip. Details on this component of the survey and results are discussed in section 1.4.

[1] More details about Knowledge Network's post-stratification survey-weighting methods can be found on the KN website: http://www.knowledgenetworks.com/accuracy/summer2007/disogra.html

[2] Confidence intervals (CI) are statistical measures of variability, which indicate the range of values in which the true value is likely to be given a specified probability, in this report confidence intervals are reported at 95% probability.

1.2. Establishing a Coastal Recreation Economic Baseline

1.2.1. Trips and Activities

Table 5 displays the percentage of survey respondents who visited the coast of the Puget Sound region in the last twelve months, the average number of trips made annually over all respondents, and the average number of trips by most common primary reason across respondents. Overall, 65.1% of respondents visited Puget Sound over the last twelve months. Across all respondents, that is including those who had not visited Puget Sound at all in the last twelve months, the average number of trips per year was 5.38. The primary reason for respondents' most recent trip to the coast was for recreation (46.2%), for which respondents made 2.65 trips per year on average. Leisure/Tourism was the second most popular purpose for a trip to the Puget Sound (1.21 trips per year on average) followed by trips to visit friends and family (0.85 trips per year on average).

Table 5. Puget Sound coastal visitation summary statistics

			95% Confidence Interval	
		Average	Low	High
Last 12 months	Respondents who visited the Puget Sound	65.1%	63.4%	66.7%
	Average # of trips over all respondents	5.38	4.61	6.15
Average # of trips by primary purpose	Primary purpose: Recreation	2.65	2.33	2.96
	Primary purpose: Leisure/Tourism	1.21	1.04	1.38
	Primary purpose: Visiting family/friends	0.85	0.58	1.11
	Primary purpose: Work	0.43	0.20	0.66
	Primary purpose: Other	0.25	0.00	0.49

Source: Current study

Table 6 and Figure 2 display the distribution of respondents according to how long they have been visiting Puget Sound area. The majority of respondents (63.3%) have been visiting Puget Sound from more than ten years to all of their lives. In contrast, "newcomers", those who have only started visiting Puget Sound in the last year, were the minority of visitors to the region in the last 12 months, constituting only 9.2% of total respondents.

Table 6. How long respondents have been visiting the Puget Sound

	Average % of total sample	95% Confidence Interval	
		Low	High
Just the last year	9.2%	8.0%	10.4%
One to three years	11.1%	9.8%	12.4%
About four to ten years	16.4%	14.8%	17.9%
More than ten years	31.1%	29.2%	33.0%
All my life	32.2%	30.3%	34.2%

Source: Current study

Figure 2. Length of time respondents have been visiting Puget Sound

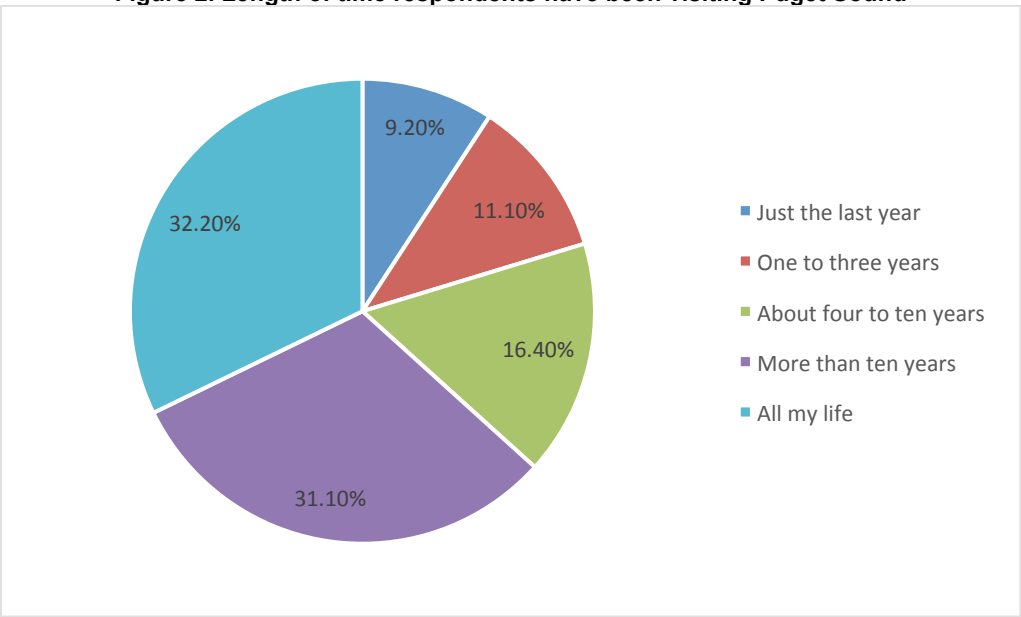


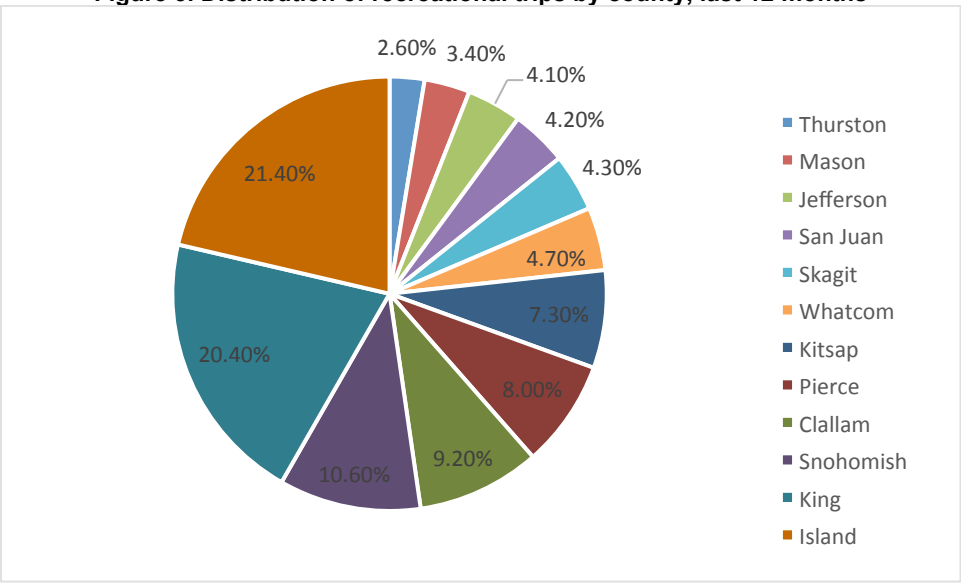
Table 7 and Figure 3 display the distribution of coastal trips reported by survey respondents over the last 12 months, including confidence intervals of the means. Coastal trips in Island County and King County were most popular among respondents, constituting approximately 21.4% and 20.4% respectively of total coastal trips. The counties of Snohomish and Clallam followed closely to each other at 10.6% and 9.2% of total reported visits, respectively. Thurston County had the fewest coastal visitors, at approximately 2.6% of survey respondents.

Table 7. Distribution of coastal trips reported in the last 12 months

County	Average % of total sample	95% Confidence Interval	
		Low	High
Whatcom	4.7%	1.6%	7.9%
San Juan	4.2%	3.6%	4.8%
Skagit	4.3%	3.1%	5.4%
Island	21.4%	10.0%	32.7%
Clallam	9.2%	4.8%	13.6%
Snohomish	10.6%	4.4%	16.8%
Jefferson	4.1%	3.1%	5.0%
Kitsap	7.3%	5.6%	9.1%
Mason	3.4%	2.4%	4.3%
King	20.4%	13.6%	27.2%
Pierce	8.0%	5.4%	10.7%
Thurston	2.6%	2.0%	3.1%

Source: Current study

Figure 3. Distribution of recreational trips by county, last 12 months



The average number of nights spent per recreational trip to the Puget Sound was 1.3 nights across respondents. Approximately 96.4% of respondents began their trip to the Puget Sound from their homes. Driving a personal vehicle (83.5% of respondents) or carpooling with another driver (6.7%) were the most popular modes of transportation to the Puget Sound for recreational trips (see Table 8). Those who drove reported an average of 2.5 passengers (including themselves) on their last trip.

Table 9, Figure 4, and Figure 5 display the distance between where respondents live and Puget Sound waters.[3] The majority of Puget Sound recreators live in suburban areas (48.5%) and urban areas (26.3%). Over one third of respondents (36.5%) lived one to five miles away from where they reported recreating.

Table 8. Mode of transportation on last trip

Mode	Average % of respondents	95% Confidence Interval	
		Low	High
Drove personal vehicle	83.5%	81.9%	85.0%
Carpooled with someone else	6.7%	5.7%	7.7%
Bus	2.3%	1.7%	3.0%
Ferry (no vehicle)	2.1%	1.5%	2.7%
Walking	1.9%	1.3%	2.4%
Other	1.5%	1.0%	2.0%
Bicycle	1.0%	0.6%	1.4%
Drove rented vehicle	0.7%	0.4%	1.1%
Train	0.4%	0.2%	0.7%

Source: Current study

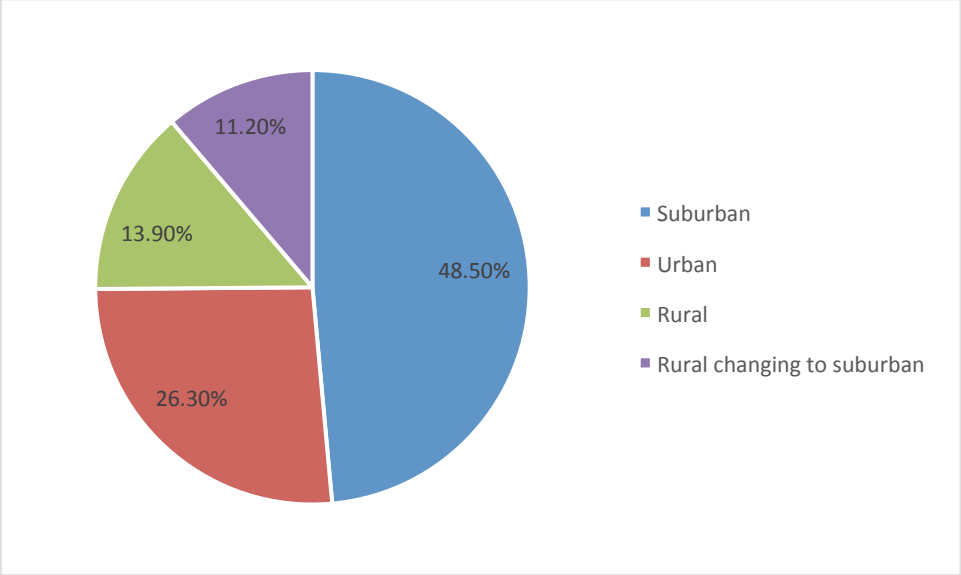
[3] Defined as a river, lake, bay, creek, or stream.

Table 9. Where respondents live and distance from Puget Sound waters[4]

		Average % of respondents	95% Confidence Interval	
			Low	High
Area	Suburban	48.5%	46.5%	50.6%
	Urban	26.3%	24.5%	28.2%
	Rural	13.9%	12.4%	15.3%
	Rural changing to suburban	11.2%	9.9%	12.6%
Distance	One block or less	10.9%	9.6%	12.2%
	Several blocks	13.5%	12.0%	14.9%
	Less than one mile	20.0%	18.4%	21.7%
	1 to 5 miles	36.3%	34.3%	38.3%
	6 to 15 miles	12.4%	11.1%	13.8%
	16 to 30 miles	4.7%	3.9%	5.6%
	More than 30 miles	2.1%	1.5%	2.7%

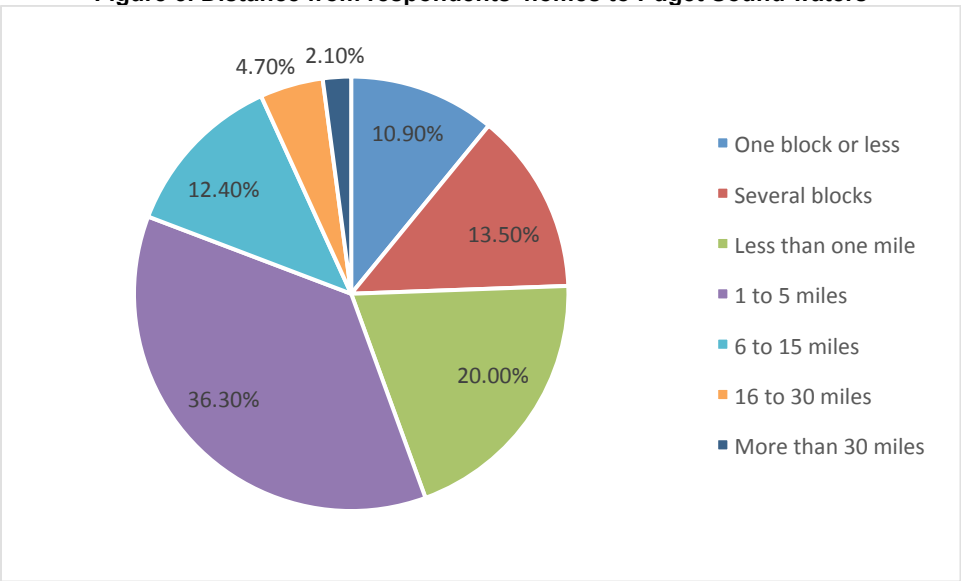
Source: Current study

Figure 4. Location of respondents' residences



[4] Defined as a river, lake, bay, creek, or stream.

Figure 5. Distance from respondents' homes to Puget Sound waters



Respondents were asked to choose the top two aspects of Puget Sound region's natural resources they value most, from a pre-set list. Table 10 and Figure 6 display the results. The largest single group of respondents selected the all-encompassing answer, “Everything is beautiful/The scenery” (41.4 percent).[5]

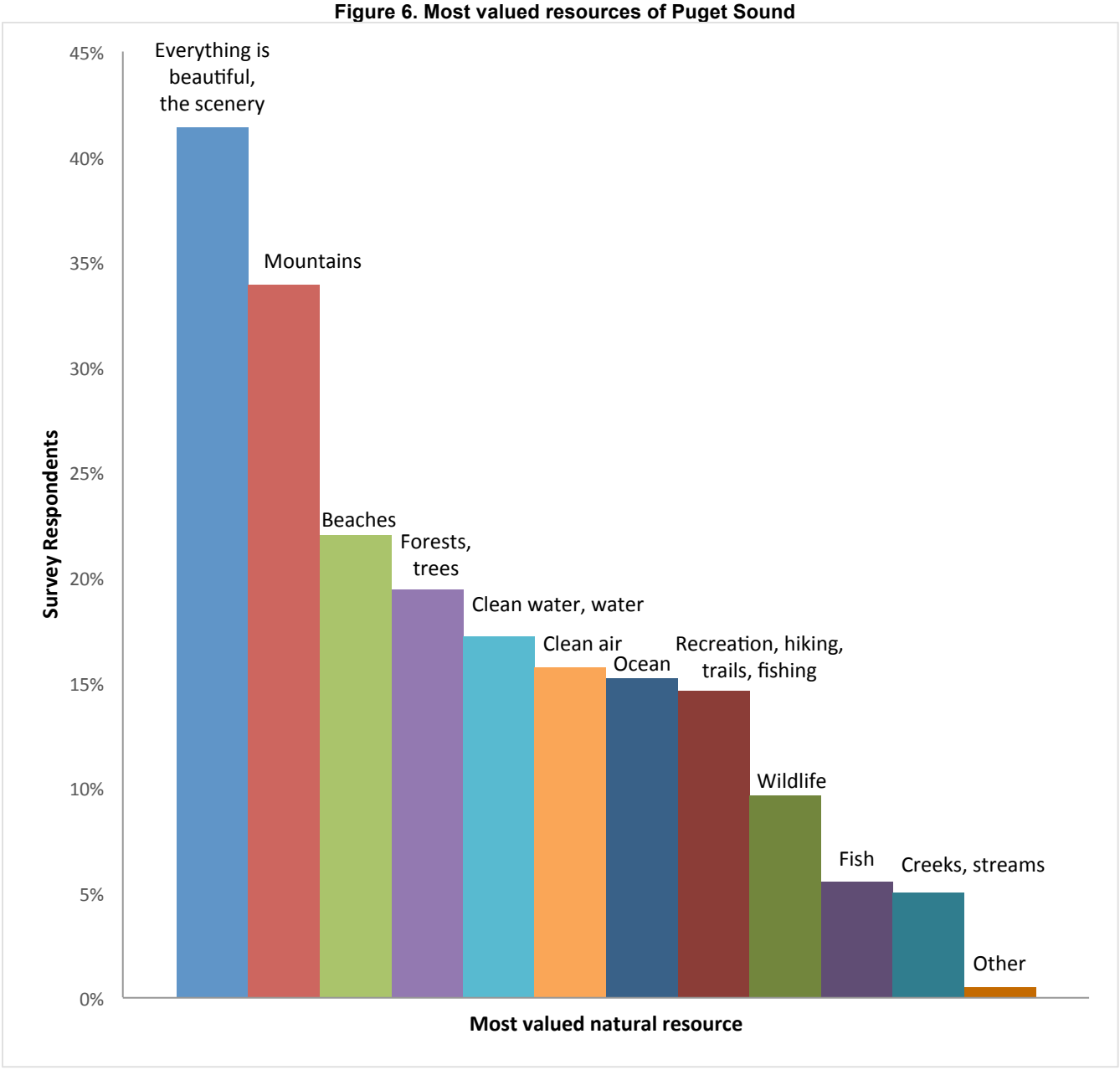
Table 10. Most valued resources in the Puget Sound

Resources	Average % of respondents	95% Confidence Interval	
		Low	High
Everything is beautiful/The scenery	41.4%	39.3%	43.4%
Mountains	33.9%	31.9%	35.9%
Beaches	22.0%	20.2%	23.7%
Forests/Trees	19.4%	17.8%	21.1%
Clean water/Water	17.2%	15.6%	18.7%
Clean air	15.7%	14.1%	17.2%
Ocean	15.2%	13.7%	16.7%
Recreation/hiking trails/fishing	14.6%	13.1%	16.1%
Wildlife	9.6%	8.4%	10.8%
Fish	5.5%	4.5%	6.4%
Creeks/Streams	5.0%	4.1%	5.9%
Other	0.5%	0.2%	0.8%

Source: Current study

[5] The total percentages in Table 10 add up to more than 100%, since respondents were allowed to select more than one answer.

Figure 6. Most valued resources of Puget Sound



isiting with friends and family.

Table 11 displays the activity participation rates of survey respondents over the last 12 months. Respondents made multiple selections. The top five most popular activities among survey respondents over the last 12 months were beach going (64.7%), scenic enjoyment (61.9%), hiking (43%), wildlife viewing (37.6%), and photography (31%). The confidence intervals for each of these participation rates are also displayed in Table 11. Approximately 4.5% of survey respondents indicated that they also participated in "other" activities. The most popular activities people indicated as "other" activities were golfing, picnicking, and visiting with friends and family.

Table 11. Activity participation in each activity in the last 12 months

Activity	Average % of total sample	95% Confidence Interval	
		Low	High
Beach going, sitting, walking, jogging running, dog walking, kite flying, etc.	64.7%	62.7%	66.7%
Sightseeing/Scenic enjoyment	61.9%	59.9%	63.9%
Hiking	43.0%	40.9%	45.1%
Wildlife viewing (e.g. watching whales, birds, seals, and/or other marine life)	37.6%	35.6%	39.6%
Photography	31.0%	29.1%	32.9%
Sitting in your car watching the scene	22.9%	21.2%	24.7%
Camping	22.8%	21.1%	24.6%
Tide pooling	15.8%	14.3%	17.3%
Fishing from shore/boat (e.g. hook and line, crabbing, spearfishing, etc.)	13.6%	12.2%	15.1%
Kayaking/Canoeing/Rowing in the ocean or estuary/slough	10.6%	9.3%	11.8%
Biking	10.5%	9.2%	11.7%
Swimming in the ocean	9.3%	8.1%	10.5%
Power boating/jet skis	9.3%	8.1%	10.5%
Collecting/picking/harvesting sea life from shore (clamming, seaweed, mussels, etc.)	8.9%	7.7%	10.0%
Collection of non-living resources/beachcombing (agates, beach glass, driftwood)	8.6%	7.5%	9.8%
Sail boating	2.7%	2.0%	3.4%
Surfing, board, boogie, paddleboard	1.9%	1.4%	2.5%
SCUBA diving, from shore, from boat	1.7%	1.1%	2.2%
Horseback riding	1.6%	1.1%	2.1%
Windsurfing/Kite boarding	1.2%	0.8%	1.7%
Free diving/snorkeling (from shore, from boat)	1.1%	0.7%	1.5%
Hang gliding/parasailing	1.1%	0.7%	1.5%
Skim boarding	0.6%	0.3%	0.9%
Other	4.5%	3.7%	5.4%

Source: Current study

When asked specifically about the multiple coastal activities conducted on their most recent "last" trip, participant activity rates differed slightly, see Table 12. The top five activities respondents participated in on their last trip were scenic enjoyment (51.6%), beach going (50.9%), hiking (30.9%), wildlife viewing (28.3%), and photography (25.2%). The most popular activities people indicated as "other" activities were golfing, picnicking, and shopping or specific events. Table 12 also displays the confidence intervals for each activity participation rate.

Table 12. Participation in each activity for the last trip

Activity	Average % of total sample	95% Confidence Interval	
		Low	High
Sightseeing/Scenic enjoyment	51.6%	49.5%	53.6%
Beach going, sitting, walking, jogging running, dog walking, kite flying, etc.	50.9%	48.8%	53.0%
Hiking	30.9%	29.0%	32.9%
Wildlife viewing (e.g. watching whales, birds, seals, and/or other marine life)	28.3%	26.5%	30.2%
Photography	25.2%	23.4%	27.0%
Sitting in your car watching the scene	15.1%	13.6%	16.6%
Camping	11.9%	10.6%	13.3%
Tide pooling	8.2%	7.1%	9.4%
Fishing from shore/boat (e.g. hook and line, crabbing, spearfishing, etc.)	7.4%	6.3%	8.5%
Collection of non-living resources/beachcombing (agates, beach glass, driftwood)	6.1%	5.1%	7.1%
Power boating/jet skis	4.6%	3.7%	5.4%
Kayaking/Canoeing/Rowing in the ocean or estuary/slough	4.3%	3.4%	5.1%
Collecting/picking/harvesting sea life from shore (clamming, seaweed, mussels, etc.)	4.1%	3.3%	5.0%
Swimming in the ocean	4.1%	3.2%	4.9%
Biking	3.9%	3.1%	4.7%
Surfing, board, boogie, paddleboard	1.3%	0.8%	1.7%
Sail boating	1.0%	0.6%	1.4%
SCUBA diving, from shore, from boat	0.9%	0.5%	1.3%
Free diving/snorkeling (from shore, from boat)	0.7%	0.3%	1.0%
Windsurfing/Kite boarding	0.5%	0.2%	0.8%
Horseback riding	0.3%	0.1%	0.6%
Skim boarding	0.3%	0.1%	0.6%
Hang gliding/parasailing	0.1%	0.0%	0.2%
Other	4.5%	3.6%	5.4%

Source: Current study

After noting all coastal activities conducted on their most recent "last" trip, participants were asked to choose which activity they considered their primary activity (Table 13). The top five activities respondents participated in on their last trip were scenic enjoyment (26.8%), beach going (26.3%), hiking (10.9%), camping (7.9%), and fishing from shore or a boat (5.2%). The most popular activities people indicated as "other" activities were specific events like a boat race, outdoor festivals, weddings, etc. Table 13 also displays the confidence intervals for each activity participation rate.

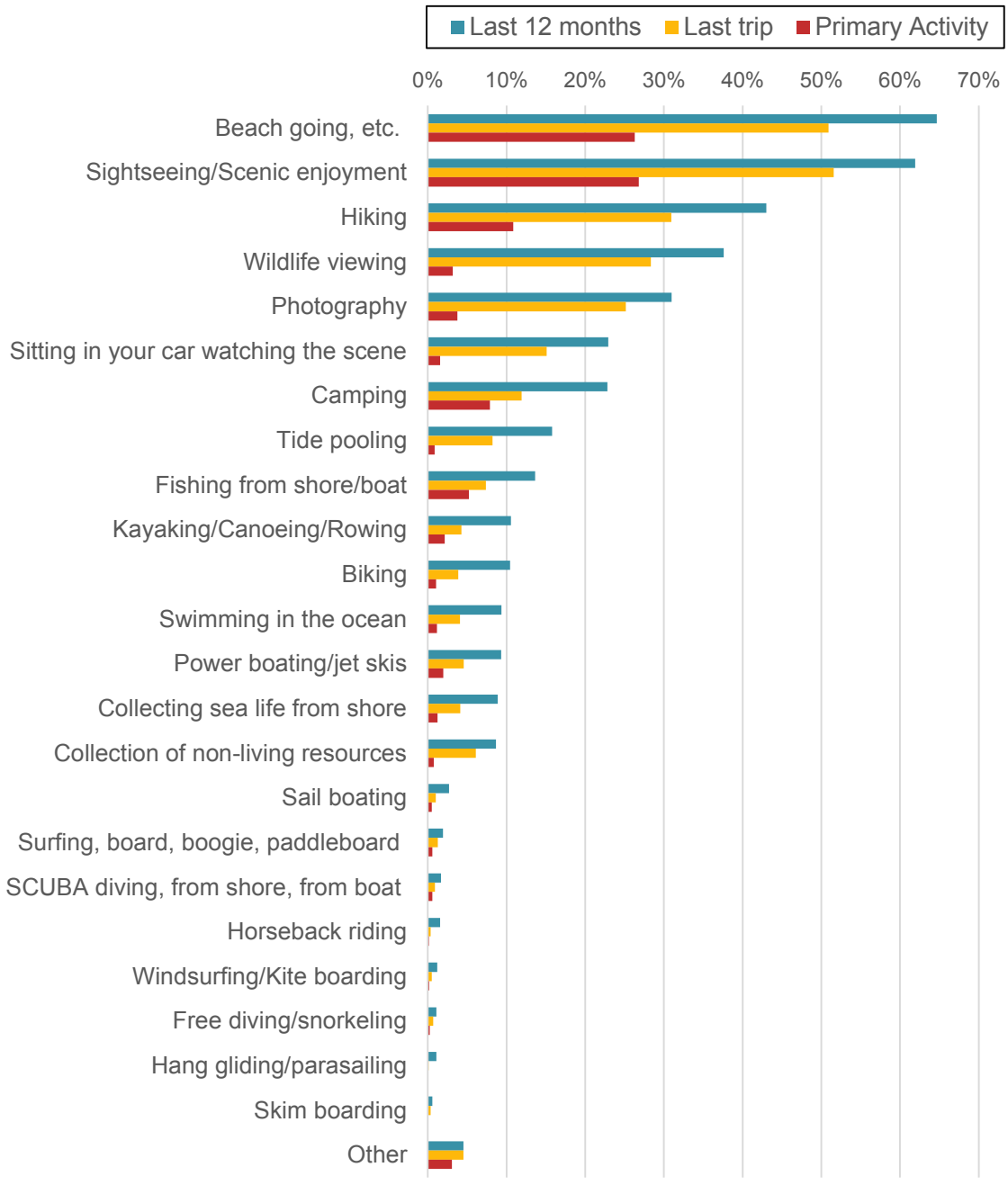
Table 13. Primary recreational activity for the last trip

Activity	Average % of total sample	95% Confidence Interval	
		Low	High
Sightseeing/Scenic enjoyment	26.8%	25.0%	28.6%
Beach going, sitting, walking, jogging running, dog walking, kite flying, etc.	26.3%	24.5%	28.1%
Hiking	10.9%	9.6%	12.2%
Camping	7.9%	6.8%	9.0%
Fishing from shore/boat (e.g. hook and line, crabbing, spearfishing, etc.)	5.2%	4.3%	6.1%
Photography	3.7%	3.0%	4.5%
Wildlife viewing (e.g. watching whales, birds, seals, and/or other marine life)	3.2%	2.4%	3.9%
Kayaking/Canoeing/Rowing in the ocean or estuary/slough	2.2%	1.6%	2.8%
Power boating/jet skis	2.0%	1.4%	2.5%
Sitting in your car watching the scene	1.5%	1.0%	2.1%
Collecting/picking/harvesting sea life from shore (clamming, seaweed, mussels, etc.)	1.2%	0.8%	1.7%
Swimming in the ocean	1.2%	0.7%	1.6%
Biking	1.0%	0.6%	1.5%
Tide pooling	0.9%	0.5%	1.3%
Collection of non-living resources/beachcombing (agates, beach glass, driftwood)	0.7%	0.4%	1.1%
SCUBA diving, from shore, from boat	0.6%	0.3%	0.9%
Surfing, board, boogie, paddleboard	0.6%	0.2%	0.9%
Sail boating	0.5%	0.2%	0.8%
Free diving/snorkeling (from shore, from boat)	0.2%	0.0%	0.4%
Windsurfing/Kite boarding	0.2%	0.0%	0.3%
Horseback riding	0.1%	0.0%	0.3%
Hang gliding/parasailing	0.1%	0.0%	0.2%
Skim boarding	0.0%	0.0%	0.1%
Other	3.1%	2.3%	3.8%

Source: Current study

J. Ashworth

Figure 7. Activity participation rates, last year and last trip



Source: Current study

1.2.2. Trip Expenditures

Table 14 displays the average expenditures made for each item across all respondents on their last trip. It is important to note that these averages include respondents who took a trip but did not make expenditures in this category and do not include respondents who did not report a trip over the last twelve months. Averaged across all respondents who took a trip, the highest expense was food and beverage purchases at a restaurant or bar at approximately $11.53. These were also the second most prevalent type of expenditures made, with 43.2% of (trip-taking) respondents reporting such expenditures. The most prevalent type of expenditures made were car fuel expenditures (56.6% of respondents reporting, an average of $10.24 across all respondents). The third largest average expenditure per respondent was lodging, at approximately $8.15 per trip, though only 14.7% of respondents reported expenditures in this category. Some expenditure categories, however, were used by very small percentages of respondents; for instance, only 0.8% of respondents rented boats and 0.5% of respondents took airline flights. Across the sample, the weighted average total trip expenditure is approximately $53.74 per person, per trip.

Table 14. Average trip expenditures per person by item across all respondents, last trip[6]

	Across all respondents			
	Average expenditures ($)	**95% Confidence Interval**		**% of observations**
Category		**Low**	**High**	
Food and beverages at a restaurant or bar	$11.53	$10.59	$12.48	43.2%
Car fuel	$10.24	$9.41	$11.07	56.6%
Lodging/Campsite Fee	$8.15	$6.83	$9.47	14.7%
Food and beverages from a store	$6.72	$6.13	$7.30	42.6%
Shopping and souvenirs	$3.45	$2.86	$4.05	14.9%
Bus/Ferry/Train ticket	$3.15	$2.72	$3.58	20.2%
Sundries	$2.25	$0.50	$4.00	6.6%
Boat fuel	$1.87	$0.96	$2.78	4.3%
Airline flight	$1.44	$0.55	$2.32	0.5%
Parking	$1.33	$0.92	$1.75	13.3%
Boat rental	$0.95	$0.00	$2.65	0.8%
Park entrance, museum, aquarium, or other entrance fee	$0.94	$0.73	$1.15	10.0%
Equipment rental	$0.72	$0.41	$1.03	2.6%
Car rental	$0.66	$0.30	$1.02	1.2%
Charter fee, whale watching, etc.	$0.51	$0.22	$0.81	1.1%
Other	$0.46	$0.18	$0.74	1.8%
Lessons, clinics, camps	$0.44	$0.08	$0.80	1.0%
Boat ramp fees	$0.41	$0.16	$0.65	2.0%
One day fishing license fee	$0.28	$0.17	$0.38	1.6%
Dive equipment rental and airfills	$0.26	$0.00	$0.54	0.4%
Bait and tackle	$0.26	$0.17	$0.34	3.4%
Total trip expenditures per person	**$53.74**	**$49.93**	**$57.55**	

Source: Current study

[6] Outlier expenditure observations fifteen standard deviations away from the mean for each expenditure category were removed from the dataset prior to averaging.

Table 15 displays the average expenditure for each item across only respondents who indicated expenses for that item. In other words, among all respondents who spent money on airline flights, which was only 0.2% of trip-taking respondents, the average expenditure amount was approximately $303.70 per person per trip. This was followed by expenditures on boat rental ($217.90) and on lessons, clinics, and camps ($100.11). Average expenditures (given an expenditure) in more popular expenditure categories were as follows: car fuel at $17.67, food and beverages from a restaurant or bar at $27.02, and food and beverages from a store at $14.92 per person per last trip.

Since not every respondent spent money on every item, it is important to note explicitly that the average expenditures per item presented in Table 15 should not be added together. Further, because many of the sample sizes used to estimate the average expenditures presented in Table 15 were small, respondent data for these expenditures were not weighted; thus, the amounts are not suitable for extrapolation to the population of the entire study area.

Table 15. Average expenditures per item per person across respondents reporting expenditures for a certain item, last trip[7]

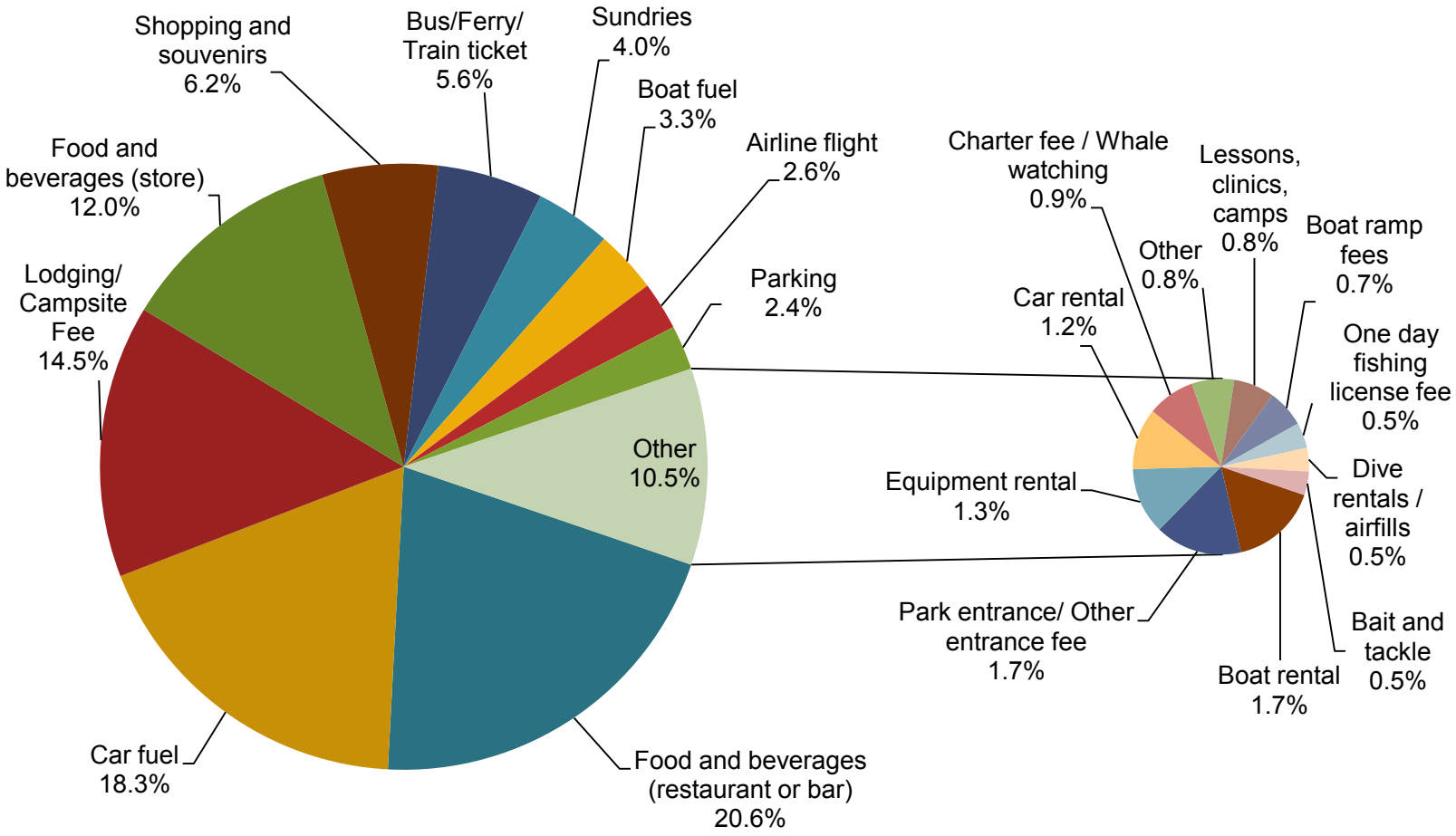
Category	Average expenditures ($)	95% Confidence Interval		# of Observations
		Low	High	
Airline flight	$303.70	$202.09	$405.31	5
Boat rental	$217.90	$0.00	$552.34	15
Lessons, clinics, camps	$100.11	$16.80	$183.43	11
Car rental	$73.03	$40.74	$105.32	17
Lodging/Campsite Fee	$67.47	$59.51	$75.43	336
Charter fee, whale watching, etc.	$62.22	$44.83	$79.61	28
Dive equipment rental and airfills	$50.13	$0.00	$106.71	8
Boat fuel	$37.45	$23.86	$51.04	99
Other	$36.90	$23.45	$50.36	39
Equipment rental	$29.73	$21.11	$38.36	47
Food and beverages at a restaurant or bar	$27.02	$25.37	$28.68	1044
Shopping and souvenirs	$26.23	$23.22	$29.24	333
One day fishing license fee	$18.06	$15.21	$20.90	35
Car fuel	$17.67	$16.48	$18.85	1285
Sundries	$15.75	$2.01	$29.50	142
Bus/Ferry/Train ticket	$15.46	$13.98	$16.94	477
Food and beverages from a store	$14.92	$13.85	$15.99	955
Boat ramp fees	$10.97	$3.70	$18.24	30
Bait and tackle	$9.60	$7.18	$12.02	67
Park entrance, museum, aquarium, or other entrance fee	$8.75	$7.49	$10.02	226
Parking	$6.65	$5.24	$8.06	277

Source: Current study

[7] Outlier expenditure observations fifteen standard deviations away from the mean for each expenditure category were removed from the dataset prior to averaging. Fifteen standard deviations was chosen because it removed the extreme outliers while maintaining the vast majority of data points.

Figure 8 below displays the relative average expenditures made per person per trip for all items as displayed in Table 14 above. Nearly 90% of the average trip expenditures per person were made in the following ten categories: food and beverages (restaurant or bar), car fuel, lodging/campsite fee, food and beverages (store), shopping and souvenirs, bus/ferry/ train ticket, sundries, boat fuel, airline flight, and parking.

Figure 8. Average expenditure per trip for coastal visitation



Source: Current study

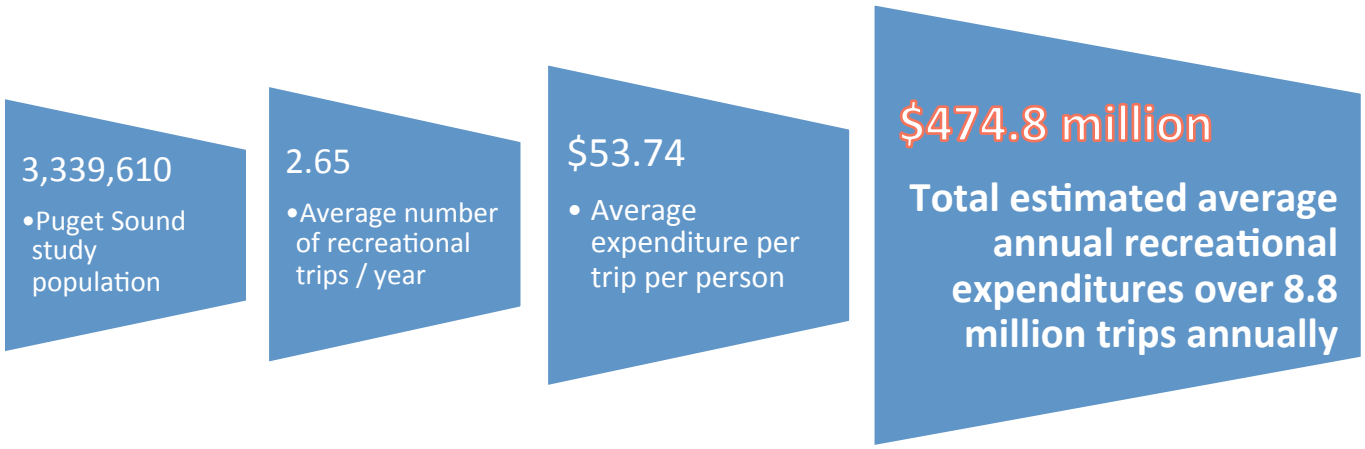
Table 16 and Figure 9 display the estimated total number of trips and direct expenditures per year among the study population. Given that survey respondents took an average of 2.65 coastal recreational trips per year (average across all survey respondents), we estimated a total of 8.8 million trips per year among the study population to the Puget Sound. As respondents who took a trip spent an average of $53.74 per trip per person, we estimated that the study population's total annual coastal visitation trip expenditures were approximately $474.8 million (8.8 million trips x $53.74 per trip) in the Puget Sound region. Our estimate of total average annual recreational expenditures for this region falls into a 95% confidence interval of $388.9 to $568.7 million.

Table 16. Estimated number of trips and direct expenditures

		95% Confidence Interval	
		Low	High
Study population (>18 yrs)	3,339,610	3,339,610	3,339,610
Average # of recreational trips/year	2.65	2.33	2.96
Estimated number of trips for total study population	8,835,602	7,789,751	9,881,453
Average expenditure/trip	$53.74	$49.93	$57.55
Total estimated average annual recreational expenditures (millions $)	**$474.8**	**$388.9**	**$568.7**

Source: Current study

Figure 9. Estimated number of trips and direct expenditures

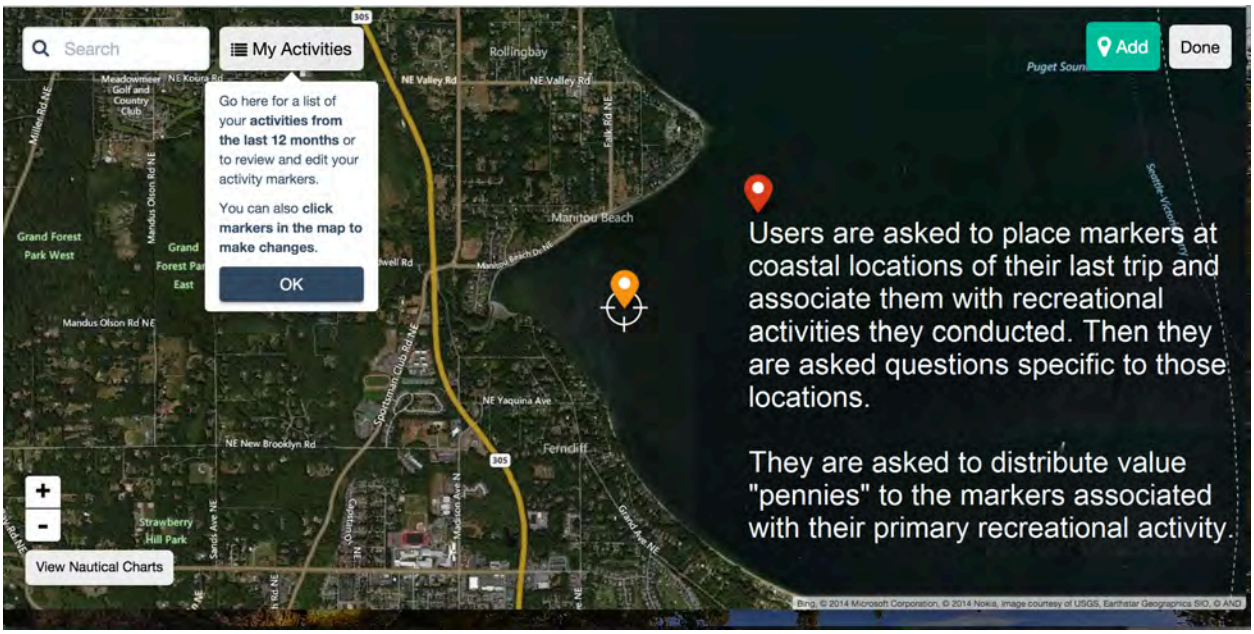


Source: Current study

1.3. Establishing a Coastal Recreation Spatial Baseline

In addition to survey questions, respondents were asked to map the location of where they conducted specific coastal recreation activities on their last trip. To map locations, Point 97 developed a sophisticated mapping tool utilizing its Viewpoint survey technology together with Google Maps (displayed in the screenshots below). The mapping tool was designed to be user-friendly and easily navigable. It required each respondent to zoom to a particular spatial scale in order to ensure that accurate and quality data were collected.

Figure 10. Screenshot of coastal recreation survey: Map interface



Source: Point 97

As noted above the data were collected in two waves to capture seasonal variations in coastal recreation use patterns. The spatial data are a combined set across both survey waves. The survey respondents provided information by placing a point or marker on a map and then indicated which activity or activities they conducted at each specific location on their last trip.

Appendix B of this report contains two sets of map products derived from the spatial data collected. The first set of maps depicts spatial patterns of use (distribution and intensity of use) quantified by the number of trips to recreation locations. The second set of maps depicts the economic value of trip expenditures associated with each recreation location. These economic value maps were develop using only the locations where respondents conducted their last trip's primary recreation activity. We associated value to each respondent's primary activity location by distributing each respondent's trip expenditures across these locations. To inform how trip expenditure values were distributed across primary activity locations we asked each respondent to distribute 100 pennies across their primary activity locations based on the importance of that location to their primary coastal recreation activity.

For each of these two map sets we created region-wide maps for all coastal recreation activities combined and for each of the top ten selected coastal recreation activities. Table 17 indicates the number of makers placed per activity per survey wave for all activities; Table 18 indicates the number of markers placed per primary activities only per survey wave.

To represent these data spatially, Point 97 utilized a kernel density analysis in ArcGIS. The kernel analysis is a nonparametric statistical method for estimating probability densities from a set of point data.

Conceptually, a smooth raster surface is fitted over each point. The surface value is highest at the location of the point and diminishes with increasing distance (i.e., search radius), eventually reaching zero. Based on previous experience conducting a similar analysis in Oregon and after conducting several tests, the kernel density analysis on all activities was given a radius of one mile.

Weights given to the markers placed by individual respondents were also used and incorporated into the kernel density analysis. As discussed above, these weights were created by Knowledge Networks to align respondent demographics with study population demographics. The resulting dataset is a smooth raster surface depicting the intensity use or density of an activity.

Table 17. Number of markers placed for all activities in mapping survey

	Number of activity markers placed		
Activity name	**Wave 1**	**Wave 2**	**TOTAL**
Sightseeing/Scenic enjoyment	670	697	**1,367**
Beach going (sitting, walking, jogging/running, dog walking, kite flying, etc.)	543	576	**1,119**
Photography	282	321	**603**
Hiking	302	300	**602**
Wildlife viewing	291	268	**559**
Sitting in your car watching the scene	139	152	**291**
Camping	87	124	**211**
Tide pooling	87	91	**178**
Fishing from shore/boat (e.g. hook and line, crabbing, spearfishing, etc.)	64	89	**153**
Kayaking / Canoeing	40	68	**108**
Collecting/picking/harvesting sea life from shore (clamming, seaweed, mussels, etc.)	55	49	**104**
Collection of non-living resources	59	40	**99**
Power boating	33	64	**97**
Other	58	36	**94**
Biking	43	36	**79**
Swimming in the ocean	15	46	**61**
Sail boating	8	20	**28**
Surfing (board, boogie, paddleboard)	3	9	**12**
SCUBA diving (from shore, from boat)	10	2	**12**
Skim boarding	1	5	**6**
Windsurfing/Kite boarding	2	3	**5**
Horseback riding	3	1	**4**
Free diving / snorkeling	3	1	**4**
Hang gliding / parasailing	0	2	**2**
Total	**2,798**	**3,000**	**5,798**

Table 18. Number of markers placed for primary activities in mapping survey

	Number of activity markers placed		
Activity name	**Wave 1**	**Wave 2**	**TOTAL**
Sightseeing/Scenic enjoyment	355	384	**739**
Beach going (sitting, walking, jogging/running, dog walking, kite flying, etc.)	311	313	**624**
Hiking	151	120	**271**
Camping	63	97	**160**
Fishing from shore/boat (e.g. hook and line, crabbing, spearfishing, etc.)	42	63	**105**
Wildlife viewing	52	38	**90**
Photography	49	40	**89**
Kayaking / Canoeing	24	43	**67**
Other	38	28	**66**
Power boating	22	38	**60**
Biking	24	14	**38**
Sitting in your car watching the scene	15	20	**35**
Collecting/picking/harvesting sea life from shore (clamming, seaweed, mussels, etc.)	15	19	**34**
Tide pooling	8	16	**24**
Sail boating	5	18	**23**
Swimming in the ocean	4	14	**18**
Collection of non-living resources	13	4	**17**
SCUBA diving (from shore, from boat)	9	1	**10**
Surfing (board, boogie, paddleboard)	2	5	**7**
Horseback riding	0	2	**2**
Windsurfing/Kite boarding	2	0	**2**
Free diving / snorkeling	0	2	**2**
Hang gliding / parasailing	0	1	**1**
Skim boarding	0	1	**1**
	1,204	**1,281**	**2,485**

1.4. The Spatial Clustering of Recreational Behavior: Exploratory Data Analysis

In addition to estimating spatial patterns of recreational use, trip expenditures, and reasons for visiting and appreciating Puget Sound, we also sought to characterize patterns of recreational clustering through Exploratory Spatial Data Analysis (ESDA). ESDA is effective and important to assist discovering data patterns so that possible relationships can be identified and reasonable hypotheses established (Anselin, 1996). ESDA helps us explore questions such as: To what extent do recreational users of similar types cluster together at specific sites or sub-regions of Puget Sound? Do recreators of similar types, whether by activity or demographic categories such as age, income, ethnicity, gender, or educational attainment, tend to visit the same areas? How do these clusters of recreational activity differ from each other?

1.4.1. Methods

We employed a spatial clustering algorithm to define sites for our analysis preceded by variable filtering of observations by the stated use type. A cluster of activity is considered a location where a number of users have identified priority activities in close proximity to each other. Our approach assumes that users in a given site experience (and value) a similar set of site attributes.

Prior to executing the clustering algorithm, we removed observations that were spatially separated from other recreational use locations to ensure that output clusters were tightly grouped. Following Hartigan (1975), we filtered these outliers by quantifying the spatial separation among point incidents by identifying the distance to the closest neighbor of the same use type and subsequently filtering any points with a minimum distance to the closest neighbor of greater than two standard deviations specific to the respective use type. We aggregated all in-water users (swimming, surfing, etc.) to a single use type. Table 19 below shows the frequency, average distance and standard deviation as well as the total number filtered for each use type. Out of the 2,485 primary activity points, we removed 30 spatial outliers.

Table 19. Spatial Outliers by Use Type

Use type	Frequency	Average Nearest Neighbor	SD	> 2 SD	# Filtered
Beach going	692	712	1112	2936	13
Scenic enjoyment	864	713	1105	2923	10
Camping	160	887	1205	3297	0
In water user	27	1135	1131	3397	0
Biking and Hiking	311	1029	1388	3805	3
Boating	150	1309	1554	4417	0
Fishing	139	1398	1612	4622	1
Photography	89	821	1022	2865	2
Tide pooling	41	805	1116	3037	0
Diving	12	1282	2037	5356	1
Total filtered					**30**

Source: Current study

Once spatial outliers were removed we used a clustering algorithm available through the ArcGIS 10.x grouping tool. We specified Cartesian coordinates to define feature characteristics. By doing so we could employ a K-means cluster algorithm (see Jain, 2009 for an overview of the K-means algorithm). The goal of the K-Means algorithm is to partition features so that the differences among the features in a group (defined by their x-y coordinates), over all groups, are minimized. Because the algorithm is NP-hard, a greedy heuristic is employed to group features.

The clustering algorithm requires the selection of a specified number of groups which assumes prior knowledge about the distribution of observations. Absent such knowledge we attempt to identify the optimal number of clusters across the study area. To do so we attempted to minimize both the number of groups as well as the dispersion across any given site. This required executing a series of cluster solutions with a variable number of discrete clusters. Each solution was analyzed in terms of spatial dispersion of site attributes within each cluster and across all clusters defined by the sum of the standard deviations of distance between the feature (location of attribute) and the stated use location. Site attributes included distance measures to the nearest:

- Kelp bed
- Mammal haulout location
- Rocky beach
- Sandy beach
- Bird nest
- Camping site
- Drinking water availability
- Marina
- Parking fee

We plotted the summed standard deviation of all attributes within each cluster and the summed mean standard deviation for any given cluster across all clusters to determine the optimal number of clusters (see Appendix D). The optimum solution yielded 50 distinct clusters with an average number of 49.1 users. The minimum number of individuals for any given cluster was 3 and the maximum was 197. Once our sites were defined we summarized the mean value of all explanatory variables across all individuals in a given site.

1.4.2. Results of Cluster Analysis

The results of our clustering analysis are displayed in Figure 11 below. We derived a map of 50 overlapping but largely distinct clusters with varying numbers of activity points. The minimum number of primary activity points in a single cluster was contained in cluster #29, a small cluster in the Point Roberts area of northern Puget Sound, which contained only 3 activity points. The maximum number of activity points was contained in cluster #17, a large cluster that included the central city of Seattle, and contained 197 primary activity points.

Survey respondent demographics differed across clusters in terms of age, income, education, gender, ethnicity/race, employment status, and retirement status. Table 20 below provides (unweighted) averages, minimums and maximums across all clusters for key demographic variables. For instance, the gender breakdown on average across clusters was 57% female (and 43% male). The average household income across clusters was $87,301; the minimum was $39,500 and the maximum was $109,833. On average, 16% of all recreators by cluster were nonwhite (black, Hispanic, Asian or 2+ races); however, this average masks variation across clusters that ranges from 0% nonwhite (100% white) users, to 40% nonwhite (60% white) users. Likewise, the percentage of recreators by cluster who were retired ranged from 3% to 58%. Average expenditure per user by cluster ranged from $24 to $638. A full demographic summary of each cluster is given in Table 28, Appendix B.

Table 20. Summary of Cluster Demographics

	Average	Min	Max
% Female	57%	27%	100%
Average Age	51	44	63
Average Household Income	$87,301	$39,500	$109,833
% College Grad	60%	23%	100%
% Nonwhite	16%	0%	40%
% Employed/Self-Employed	62%	29%	80%
% Retired	25%	3%	58%
Average Expenditure	$149	$24	$638

Source: Current Study

In contrast to the variable demographics, activity choice followed similar patterns across clusters; the most popular primary activities across the clusters were largely the same. Table 21 below lists the most popular primary activities across clusters, ranked by the number of clusters for which that activity was either first, second or third most popular. Sightseeing/Scenic enjoyment was the first, second, or third most popular primary activity in 48 clusters. Beach going was first, second, or third most popular in 44 clusters. The grand total of first, second, or third ranked activities was 196, reflecting 46 ties within clusters for first, second, or third most popular activity. Only five activities ranked first, second or third most popular as primary activities in 10 or more clusters (hiking, camping and fishing in addition to the two mentioned above).

Table 21. Primary Activities Listed as Top Three Most Popular By Cluster

Activity	# Clusters
Sightseeing/Scenic enjoyment	48
Beach going (sitting, walking, jogging/running, dog walking, kite flying, etc.)	44
Hiking	36
Camping	20
Fishing from shore/boat (e.g. hook and line, crabbing, spearfishing, etc.)	12
Wildlife viewing	7
Kayaking / Canoeing	6
Power boating	6
Collecting/picking/harvesting sea life from shore (clamming, seaweed, mussels, etc.)	3
Other	3
Photography	3
Sail boating	3
Swimming in the ocean	2
Biking	1
Free diving / snorkeling	1
Surfing (board, boogie, paddleboard)	1
Grand Count	**196**

Source: Current study

Figure 11. Spatial Clusters of Recreational Activity

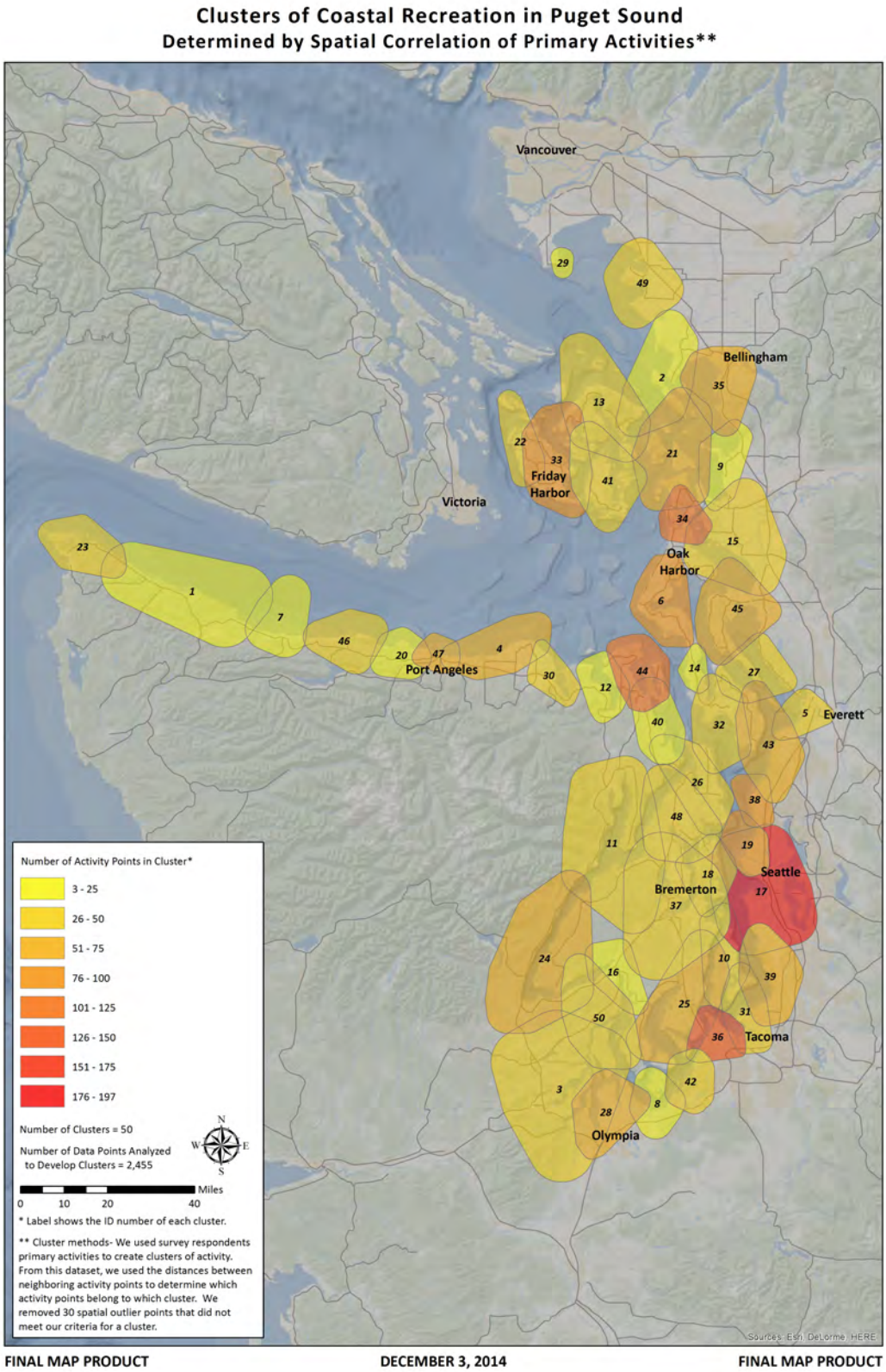


Figure 12 below summarizes average coastal recreational expenditure by cluster. The highest average expenditure by cluster was associated with cluster #22, an area near San Juan Island, for which power boating was one of the most popular activities. The map highlights that average coastal recreation expenditures tend to be relatively low near many cities, including Olympia, Tacoma, Seattle, and Everett. This map suggests a positive correlation between distance from urban centers and average coastal recreation trip expenditure, which could be tested in future research.

Figure 12. Average Recreational Expenditure by Cluster

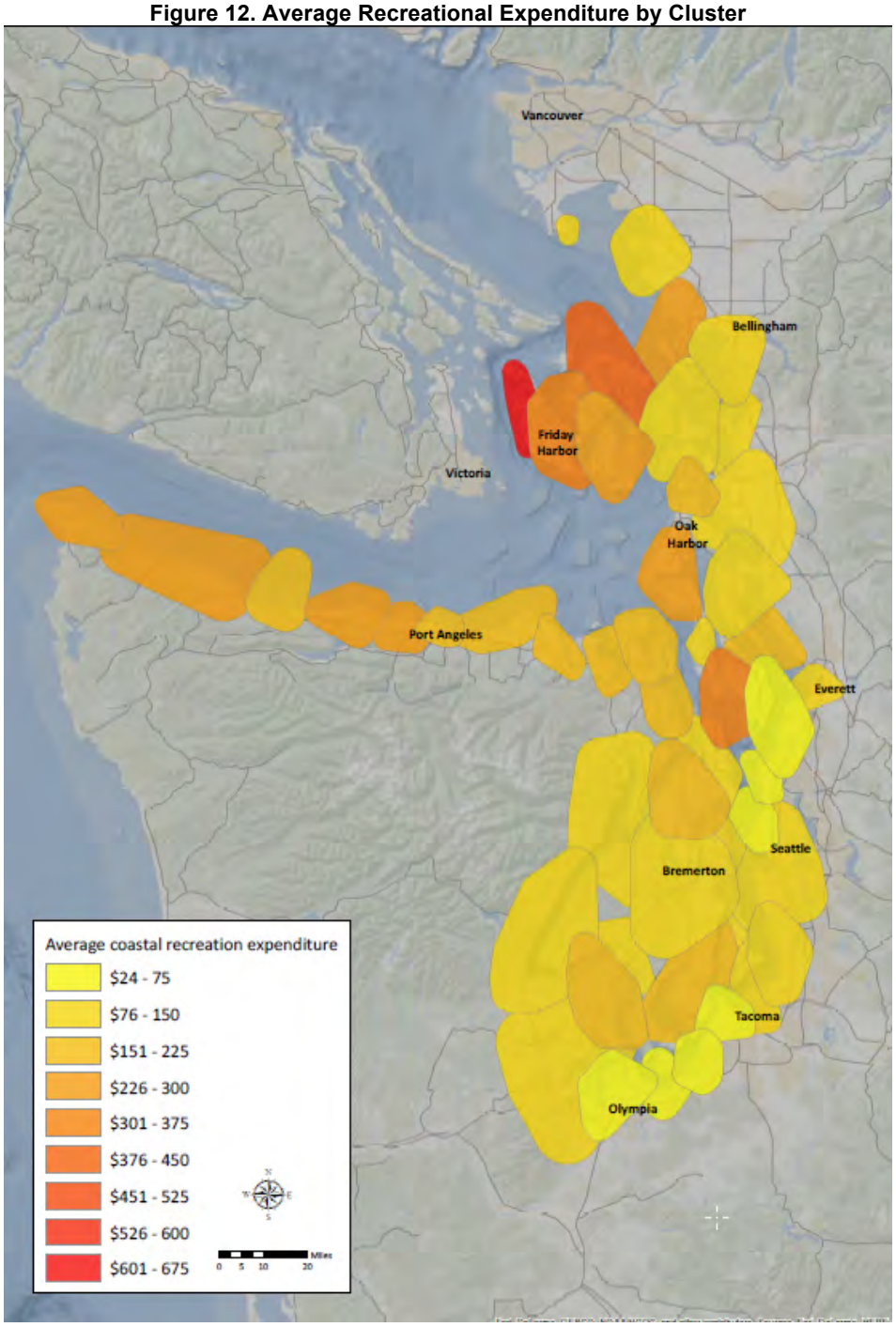
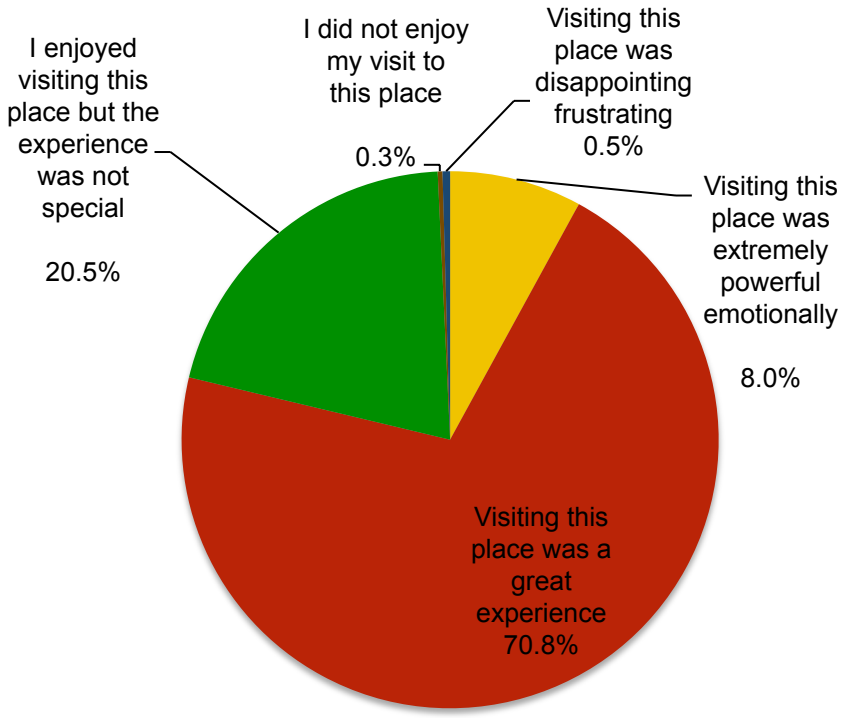


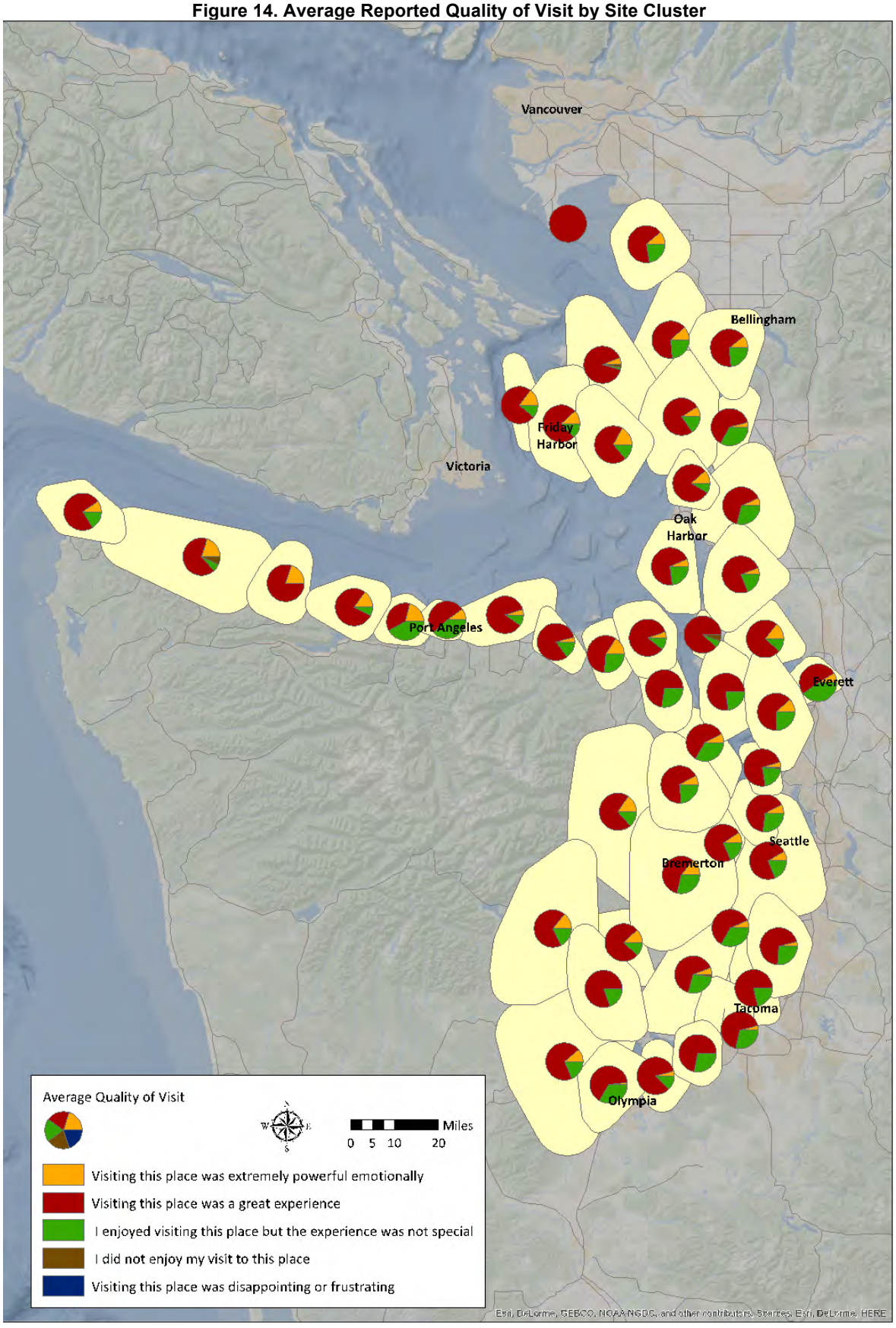
Figure 13 summarizes the reported quality of coastal recreation trips. Out of the 2,455 locations mapped in clusters, survey respondents assigned a quality rating to 2,436 (99.1%). The majority of respondents considered their visit to be a “great experience” (70.8%); a minority considered the experience “enjoy(able)… but not special” (20.5%), and a smaller minority considered the experience “extremely powerful emotionally” (8.0%). Less than 1% of respondents either did not enjoy the visit, or considered it disappointing or frustrating.

Figure 13. Reported Quality of Coastal Recreation Trip



The map in Figure 14 below shows the spatial distribution of the reported quality of experiences at various clustered sites. This map suggests a small, positive correlation between trips to places described as “extremely powerful emotionally” and distance from urban centers. For instance, the sites located along the northern edge of the Olympic Peninsula near Port Angeles, in the Hood Canal area west of Bremerton, and in the San Juan Islands area near Friday Harbor, appear to have larger proportions of responses described as “extremely powerful emotionally” (coded in yellow). In future research, regressions could be used to test if there is a positive correlation between distance to urban center and reported trip quality.

Figure 14. Average Reported Quality of Visit by Site Cluster



The map in Figure 14 above appears to reflect how places frequently, easily and inexpensively visited tend to be characterized as “great experience” or “enjoyable but not special.” Places that are potentially less frequently visited, and more expensive to access, may be more often considered “extremely emotionally powerful.” This tendency may be partially explained based on people’s tendency to remember emotionally charged unusual events more than ordinary events. It is possible that people make fewer long distance than short distance trips and the novelty of a place farther from home contributes to the likelihood of the site being both memorable to include in the survey and considered “extremely powerful emotionally.” Additionally, people may be more selective about the destinations that necessitate a longer trip with a tendency to take longer trips to places that they expect to be exceptional.

1.5. Coastal Recreation Study Conclusion

Washington’s Puget Sound is an iconic region for coastal recreation. It is possible to provide recreational opportunities for all of Puget Sound’s residents in ways that also protect and conserve marine resources and biodiversity. In order to do so it is important to not only understand the economic dimension of coastal recreation but also how spatial use patterns and economic values rely upon and impact the status and health of marine resources and ecosystem services.

This chapter has established a spatial and economic baseline of coastal recreational use in the Puget Sound region. Based on our weighted survey sample from Knowledge Networks, we have identified the characteristics of Puget Sound coastal recreational users, including the location of their most recent recreational trips, the chosen activities undertaken on those trips, their length of time visiting Puget Sound, the number of trips they have taken in the past year, and the resources of Puget Sound they value the most. We have also analyzed the expenditures that coastal recreational users have made on their most recent Puget Sound recreational trip, broken down by major expenditure category. We extrapolated those expenditures to arrive at an estimate of last year’s total annual spending on coastal recreation in Puget Sound. In Appendix B we provide a series of maps indicating intensity of use and primary activities, broken down by the top ten recreational activities undertaken by Puget Sound coastal recreational users. Finally, we provided an exploratory spatial data analysis (ESDA) based on the K-means clustering algorithm, to identify patterns of spatial clustering of recreational activity. We find noticeable differences in demographics, trip expenditures, and reported site quality across clustered sites. These systematic differences across clusters can be explored by further statistical analysis.

In this analysis, we do not estimate non-market economic values; we acknowledge that trip expenditures are but a portion of the overall economic value of coastal recreation, which includes broader effects on human health and well-being. We also do not estimate the secondary economic effects of coastal recreation such as additional jobs created, wages and income earned by local industries such as tourism, as indirect and induced effects of initial trip expenditures. Additional valuation methods to investigate the full economic value of coastal recreation and their associated social and cultural value to the health of local economies and people are important to understand and account for in future research efforts.

Chapter References

Anselin, L., 1996, The Moran scatterplot as an ESDA tool to assess local instability in spatial association, in Fisher, M., Scholten, H., and Unwin, D (Eds.) *Spatial Analytical Perspectives on GIS*, pp. 111-125, London: Taylor & Francis.

Hartigan, J.A., 1975*, Cluster Algorithms*. New York: John Wiley & Sons.

Jain, A. K. 2010. Data Clustering: 50 years beyond K-Means. *Pattern Recognition Letters*. 31, pp 651-666.

2. TOWARDS A PUGET SOUND SENSE OF PLACE: EXPLORATORY ANALYSIS

2.1. Introduction

The study of human well-being and the environment is inherently interdisciplinary due to people's material and non-material dependence upon ecosystems. Non-material links between people and ecosystems, also referred to as "intangibles", such as cultural identity and spiritual values, can be closely associated with material elements of ecosystems (e.g., fisheries, forests). This chapter focuses on such intangibles, including sense of place and aesthetic values attached to Puget Sound.

2.2. Methods

Four exploratory qualitative semi-structured interviews were conducted in Snohomish County, which included prompts on aesthetics, recreation, favorite places and place identity as related to the outdoors. Interviewees identified and characterized favorite activities and qualities that they associate with ecosystems in Puget Sound. Interviewees included a fisheries biologist for a tribe, restoration ecologist, river system research director and shellfish protection program coordinator.

Given the small and relatively homogenous sample size (four males with professions closely tied to river and coastal ecosystems), no general conclusions are drawn, but interview excerpts illustrate affective dimensions associated with a sense of place and prominent aesthetic qualities associated with Puget Sound.

2.3. Results and Conclusion

When asked about recreational experiences, interviewees mentioned activities that ranked highly in the mapping survey, including sightseeing/scenic enjoyment and hiking as shown in Figure 15.

When discussing state parks and some protected areas, half the interviewees raised the issue of visitors who "love the area to death." Interviewees noted a need to manage crowds to better protect public areas from trampling and over-use.

A related concern emerged from the interviews related to perception of a growing disconnection between people and natural resources as the economy in Puget Sound has transitioned from its historic natural resource-based economy, particularly logging and fishing, to a technology and service based economy. An interviewee said this economic transition:

> *"detaches people from what made this place great and I think we're in danger of trampling it if we don't take a closer look and maybe make some economic sacrifices to preserve a lot of the natural beauty that drew people here in the first place…. I think that it might remove people from a reason to care about a lot of these resources that some of us really think are important."*

There was no consensus on the extent to which a Puget Sound-scaled sense of place resonated with interviewees. A "Puget Sound sense of place" made sense to three of the interviewees while one associated a place-based identity with his watershed rather than the Sound.

Figure 15. Interview excerpts demonstrating affective qualities tied to Puget Sound sense of place

3. THE VALUES OF RIPARIAN BUFFERS: A STUDY OF TRADEOFFS

3.1. Introduction

In the effort to protect and restore Puget Sound's environment, planners and policymakers must frequently negotiate conflicts between alternative land uses, including farmland, residential or commercial development, and habitat for fish and wildlife. The ongoing controversy over riparian buffers on farmland provides a prime opportunity for studying these conflicts and exploring potential solutions.

To shed light on this problem, we sought to understand the public's willingness to pay for farmland conversion to riparian buffers, and the tradeoffs that the public is willing to make between the total acreage of farmland converted to riparian buffers and the ecological quality of those buffers, through a stated preference, choice experiment (CE) study. The issue of riparian buffers is of high political and social significance in the Puget Sound region. The topic of setting riparian buffer regulations, and providing farmers with incentives to adopt buffers of various widths, has been rife with controversy (see Breslow 2011 for a substantial review of the issues). On one side of the debate, many farmers have argued that requirements for riparian buffers would represent a loss of property rights and an intrusion into their land-use practices that does not have the beneficial effects claimed. On another side of the debate, Native tribes have asserted that the lack of appropriate riparian buffers endangers salmon habitat, thus violating the tribes' rights to fish in all usual and customary locations, as enshrined in treaty (Northwest Indian Fisheries Commission 2011). Environmental organizations, a third group, assert the importance of riparian buffers for biodiversity, water quality, and other ecosystem benefits. Farmland and riparian buffers can be understood as two distinct land-use types, each of which provides a suite of ecosystem services, and which are currently in conflict in the Puget Sound region.

Ecological evidence indicates that riparian zones, the areas in close proximity to creeks and streams, are an important element of natural infrastructure, mitigating the impacts of agriculture and commercial development on the health of watersheds. Riparian buffers between agricultural fields and fish-bearing streams reduce the velocity of surface water runoff, trap sediment, reduce streambank erosion, and absorb key pollutants such as nitrogen, phosphorus, hydrocarbons, PCBs, and pesticides (Desbonnet *et al* 1994; Tiner *et al* 2003; Stoffyn-Egli and Duinker 2010).

Riparian zones are some of the most biodiverse areas on earth, providing habitat and refugia for a wide variety of plant, bird, amphibian, mammal and invertebrate species. Vegetated riparian zones help maintain relatively low temperatures of creeks and streams, necessary for many indigenous fish species. Ecological research specific to the Puget Sound region demonstrates that regional riparian restoration will increase the probability that anadromous fish, such as salmon, will return to more of the area's watersheds, thereby providing a key element of the restoration of the Puget Sound ecosystem (e.g. Lawrence *et al.* 2014). However, salmon populations are impacted by multiple factors, which include invasive non-native species, real estate development, and climate change; the independent, causal effects of riparian buffer restoration on fish populations can thus be difficult to distinguish. Further, the appropriate policy tools to implement buffers sufficient for salmon restoration are not clear, since many farms in the Puget Sound region are located along streambanks and use the riparian zone for cultivation.

Recent evidence suggests that buffers must be relatively continuous to reduce stream temperatures sufficiently to promote salmon habitat restoration (Stoffyn-Egli and Duinker 2010). Thus, voluntary compensation programs require relatively high adoption rates by farmers along the same waterways. It is not clear whether a program or policy sufficiently rigorous to restore fully the riparian zone for salmon habitat can be made acceptable to a sufficient number of farmers. To determine the optimal riparian restoration policy, we would need to answer three questions: first, how much riparian restoration, in which locations is needed to recover salmon populations to approximately historic conditions? Second, what combination of incentives and regulations is most likely to induce farmers to restore the requisite number of acres in the most desirable locations? And third, what is the public's willingness to pay for such incentives and regulations?

To date, a major focus of contestation over riparian policies has been minimum buffer widths. Setting uniform regulations on riparian buffer width is difficult, in part because the width of the riparian zone

necessary to protect key ecosystem functions differs based on the characteristics of the landscape. Soil type, depth of water table, land use type, runoff path, slope, and type and density of vegetation all affect the capacity of the buffer to absorb pollutants (Tiner 2003). For instance, a shallower water table allows buffers to remove nitrates more effectively; a sandier soil type induces greater sediment removal for a given buffer width. Though the impact of buffer width on the efficacy of pollution and sediment sequestration has been shown to be quite variable, ecologists have developed some rules of thumb as guides to policy. For instance, a buffer width of 30m is generally considered adequate to maintain water quality and control pollution outflows (Stoffyn-Egli and Duinker 2010). Yet it remains difficult to predict the impact of buffer width on desirable ecological outcomes pertaining to fish and wildlife habitat.

Existing evidence indicates that, in general, the effectiveness of riparian buffers in pollution removal is subject to diminishing returns in the width of the buffer (Desbonnet *et al* 1994). However, wide buffers are important in securing adequate habitat for wildlife. For instance, while buffers of less than 15m in width have been shown to provide adequate resting and feeding habitat for birds and other small wildlife, to provide habitat corridor for most riparian-obligate mammals (e.g., mink, otter, or beaver), a buffer of at least 50 meters is necessary. The impact of buffer width on fish habitat is subject to a great deal of uncertainty; in particular, very little is known about the impact of buffer width on the probability of salmon population recovery. Further, the science of riparian buffers is the subject of intense political contestation; Breslow (2011) offers an in-depth discussion of the debate between farmers, environmentalists, and tribal representatives about what constitutes “best available science”.

To date, there has been no research in the Puget Sound region that measures the public’s attitudes and willingness to pay for riparian restoration. Previous work, such as Breslow (2011), has focused on the major stakeholder groups currently contesting the issue: farmers, tribes, and environmental groups. However, the broader public and the numerous interest groups that comprise it are also stakeholders in the issue of riparian restoration. Riparian restoration programs are costly, and often require compensation to affected parties, including farmers whose land must be taken out of cultivation in order to implement buffers of sufficient width. Measuring public preferences for riparian restoration, public attitudes towards the tradeoff between such restoration and farmland loss, and public willingness to pay to compensate farmers for lost income as well as restoration costs, is essential to assessing the feasibility of publicly funded riparian restoration programs. This study represents the first step in that direction by developing a choice experiment (CE) study on public willingness to pay additional taxes for riparian restoration in the face of farmland loss.

Relatively few CE studies to date address the question of riparian buffers, and none from a broad public perspective. Rolfe *et al* (2006) use a CE methodology to measure Central Queensland (Australia) landowners’ willingness to accept (WTA) for adjustments in the attributes of riparian buffering programs, including buffer strip width and minimum biomass planting level. Their results indicate that landowners on average are willing to accept $3.70 per additional meter of buffer width and $7.91 per additional 1% of minimum biomass plantings. However, non-landowners’ willingness to pay (WTP) to compensate landowners for the installation of buffers had not been measured until this study. Our study, therefore, represents an innovative use of CE methodology to address an issue of high political and social importance.

3.2. Methods

In order to measure subjective tradeoffs between farmland conversion, riparian restoration, and annual taxation, we designed a stated preference choice experiment (CE) that measures public willingness to pay (WTP) for riparian restoration on converted farmland. To develop this experiment, we investigated the ecological benefits of riparian buffers, and estimated the cost of converting farmland to riparian habitat in Puget Sound.

3.2.1. Choice Experiment Design

Choice experiments are stated-preference methods of environmental valuation that measure the marginal values of attributes of environmental assets (Hanley, Wright and Adamowicz 1998). A choice experiment is a survey that presents a sequence of sets of hypothetical choice alternatives comprised of varying levels of specific environmental attributes at varying prices. The survey asks respondents to choose their

most preferred alternative from the set, which usually comprises two or three alternatives. Results of choice experiments yield estimates of respondents' WTP for each attribute. Choice experiments allow the researcher to manipulate the levels of the attributes of interest systematically, thereby avoiding collinearity and low variability issues that often plague revealed preference (RP) approaches such as travel-cost models (Naidoo and Adamowicz 2005).

We developed our choice experiment through a pre-test, which was administered to 53 individuals. The research team recruited pre-test participants through our networks of professional contacts, extended family, friends, and former college and graduate school classmates, through Outlook contacts lists, professional networking website LinkedIn, and various social media websites including Facebook. The pre-test included three of the major attributes associated with riparian restoration separately: water quality, vegetative cover, and wildlife habitat, as well as farmland conversion, and an annual per-household tax as the price variable. However, pre-test respondents refused to answer the questions that did not conform to their perceptions of realistic attribute combinations, e.g. low water quality and high abundance/diversity of wildlife.

For the final experiment, we combined the three riparian attributes into a single composite attribute, with the understanding that riparian restoration will improve all three attributes simultaneously: it will improve water quality, increase vegetative cover, and provide superior wildlife habitat. The results of this choice experiment, then, will provide estimates of the public's WTP for riparian restoration as a whole, as compared to their willingness to pay/accept (WTP/WTA) for conversion (and hence loss) of farmland. In the preamble to the choice experiment, we explained that we were interested in "protecting and restoring habitat in riparian areas." We defined "environmental quality" as an attribute of each choice alternative, and defined a series of levels ranging from "Very Poor" to "Very Good". We depicted each level of this attribute on the choice question with a photograph and accompanying verbal description. The description of each level of environmental quality included a series of component attributes that included water clarity, safety for swimming, possibility of fishing, degree of vegetative cover on the streambank, and frequency of visibility of birds and other wildlife. A complete description of the attributes and levels of each attribute is provided in Table 30.

Our final experiment thus made use of three attributes: the environmental quality of riparian buffers, the quantity of farmland converted to buffers, and annual taxation over a 10-year period. All attributes are generic and allowed to vary across alternatives. We did not use buffer width as a variable, since the relationship between the quality of the buffer and its width is complex and not easily represented in an attribute-based experimental design.

Each choice question consisted of three choice alternatives based on three attributes. Each attribute was given five levels. A brief table listing the attributes and levels is provided below in Table 22. The lowest level of each attribute (Very Poor, 0% conversion, and no tax) was provided in each choice set as a common base alternative; the other four levels were allowed to vary across the other two alternatives according to basic experimental design. In other words, every choice question contained a common base alternative composed of the lowest level of each attribute; the other two alternatives consisted of varying combinations of the other four levels of the attributes according to the experimental design. Though the quality of the riparian environment in Puget Sound agricultural regions is not uniformly "Very Poor," we chose the lowest level of each attribute as the common base alterative in order to focus on the public's WTP for improvements in the riparian environment exclusively. For the purposes of this study, we were not interested in the public's willingness to accept (WTA) compensation for degrading the riparian environment further.

In the survey instrument we used to administer the choice experiment, each level of each attribute was provided with an image to represent it, and a verbal description of the attribute that survey respondents could access to explain it via a hover-over button. This descriptive material was essential in clarifying the primary components of the "Environmental Quality" variable, which included water clarity, safety for swimming, suitability for fishing, vegetative cover, and wildlife abundance and diversity as described above. The experiment was introduced with a preamble explaining the purpose of the experiment, and an example question. Screen shots of the preamble, one of the choice questions, and the complete description of attributes and levels are given in Appendix C.

Table 22. Brief List of Attributes and Levels

Attribute	Level 1	2	3	4	5
Riparian Environmental Quality	Very Poor	Poor	Fair	Good	Very Good
Farmland Loss	0%	2%	4%	8%	16%
Annual Taxation (10 Years)	None	$10.00	$20.00	$40.00	$80.00

Source: Current Study

The choice experiment was conducted during Wave 2 of our Puget Sound recreational survey (see Chapter 1 of this report). A total of 441 survey respondents received Block 1; 406 respondents received Block 2. Of the respondents who were given Block 1, 153 did not fill out the survey at all, and 3 gave partial responses (only answered some, not all, of the questions). Of the respondents who were given Block 2, 121 did not fill out the choice experiment at all, and 4 gave partial responses. We used the remaining 566 respondents with complete responses, of which 285 were from Block 1 and 281 were from Block 2, to analyze the choice experiment.

We used an orthogonal, main-effects, blocked survey design with two blocks of eight questions each. The orthogonal design was implemented using the rotation method, one of the two standard methods provided in the support.CEs package in R (Aizaki 2014). Main effects designs for linear models typically account for 70 to 90 percent of the explained variance of respondents' choices (Louviere *et al.* 2000).

We estimated respondents' preferences for our choice attributes using conditional logistic regression. Conditional logistic (or conditional logit) is a standard empirical model used in the analysis of choice behavior. A conditional logistic regression maximizes the log likelihood function on a series of observed choices, conditional on the levels of the attributes of the choice alternatives (McFadden 1973). It returns a series of coefficients which provide estimates of the effect of each variable on the likelihood (specifically, log odds) that the respondent will select a particular choice alternative. We applied the sample weights from the Knowledge Networks panel to our data in running the conditional logit model; hence we can consider the results representative of the population as a whole.

3.2.2. Farmland Loss and Taxation

In order to assure CE attribute levels were plausible scenarios, we linked farmland loss to annual, state-level taxation using an informal, back-of-envelope calculation based on data from the Conservation Reserve Enhancement Program (CREP) in Washington State, the US Census (2012) and the US Department of Agriculture (USDA), and a few heuristic assumptions explained below. Out of the 15 million acres of farmland in the state, 600,000 are in Puget Sound (4% of state total). The CREP program allots funding for a maximum of 100,000 acres of farmland converted to riparian buffer in Washington State. If all of these acres were converted within the Puget Sound region, a maximum of 16.67% of the region's farmland would be converted to riparian buffers. We thus vary the farmland loss attribute between 2% and 16% of total farmland lost in the Puget Sound region, to approximate the range of plausible levels of farmland conversion. [8]

CREP payments to farmers range from a minimum of $186/acre to a maximum of $566/acre (Skagit Conservation District 2014). CREP payments may be made for as few as 10 and as many as 15 years. Thus, the total cost of the CREP program ranges from a minimum of $186 million to a maximum of $849 million. The population of Washington State is 6.9 million, of which 3.5 million live in Puget Sound (US Census 2012). The per-capita cost of CREP, across all Washington State residents, ranges from $26.97 - $123.10 / person. We assume a (conservative) ten-year period over which taxes would be levied. The annual cost per person over ten years to fund the entire CREP program is thus $2.70 - $12.31, and per household it is $6.80 - $31.02, given the State of Washington average household size of 2.52 members (US Census 2012). If all of the revenues and costs of the program are restricted to the Puget Sound region, then the range of annual taxes is $13.39 - $61.13. We chose a range of levels for the annual

[8] For the logit model estimation, these levels were coded as 0 through 4.

taxation attribute with a lower bound below the minimum cost of the CREP program, and an upper bound above the maximum possible cost. These levels were $10, $20, $40, and $80 / year.

3.2.3. Key Hypotheses

We hypothesized that people with different relationships to the Puget Sound environment would value riparian restoration differently. Specifically, we hypothesized that (1) people who take recreational trips to Puget Sound more frequently, and (2) people whose chosen recreational activities that are most strongly affected by upstream riparian restoration, will value riparian quality more highly than people who take fewer recreational trips, and whose activities are relatively less affected by upstream riparian restoration. Our hypothesis follows the work of Berninger *et al.* (2010), who find varying preferences for forest management alternatives among six separate interest groups in three regions spanning two countries (Canada and Finland). The interest groups surveyed by Berninger *et al.* (2010) were environmentalists, forestry professionals, forest owners, multiple users (e.g., hunters, berry pickers, and hikers), and two indigenous groups, Metis and Innu.

We tested our two hypotheses through including variables that captured the recreational behavior or survey respondents. Our first hypothesis holds that people who recreate more frequently in Puget Sound are more likely to support riparian restoration. We test this hypothesis by including a variable for the number of trips taken by the respondent whose primary purpose was outdoor recreation. Our second hypothesis holds that people whose choice of recreational activities are more closely tied to the condition of riparian zones will, on average, have higher WTP for riparian restoration. To test this hypothesis, we include a binary (dummy) variable that takes the value of 1 for respondents who had reported engaging in downstream, coastal recreational activities that would be especially strongly affected by the presence of riparian buffers upstream. These activity groups included all in-water activities, all fishing and collecting of living resources, and all scenic and wildlife viewing activities. The complete list is: camping, photography, sightseeing, wildlife viewing, tidepooling, fishing, collection/picking/harvesting of sea life, skim boarding, surfing, swimming, windsurfing/kite boarding, freediving/snorkeling, kayaking/canoeing, and SCUBA diving. Since most of these activities were pursued by relatively few respondents, we created a single binary dummy variable that takes the value of 1 if the respondent had pursued any of them as her/his primary activity during her/his last recreational trip to the Puget Sound region. The variable takes the value of 0 if the respondent had not pursued any of the activities in question.

In all of our choice sets, we include a variable that represents the common base option of no taxation, no farmland conversion, and very poor riparian quality. We hypothesize that certain groups within the population are more likely to choose this alternative, and certain groups are less likely to choose it. To test this hypothesis, we create interaction variables by multiplying the Base variable by several demographic and behavioral indicator variables. These coefficients on these interaction variables will allow us to detect whether, for example, higher-income survey respondents are more or less likely to prefer the Base option of no taxation, conversion, or riparian restoration.

We include four interaction terms by the method given above. First, we multiply the Base variable with the activity dummy discussed in the previous paragraph. We hypothesize that participants in downstream recreational activities are less likely to choose the Base alternative. Second, we multiply the Base variable by a variable measuring the number of recreational trips to Puget Sound region the survey respondent had taken over the last 12 months. We hypothesize that more frequent Puget Sound recreators are less likely to choose the common Base option. Third and fourth, we include interactions between the common base variable and the income and education variables from our dataset. We hypothesize that higher income, and more highly educated survey respondents, are less likely to choose the common Base alternative.

Finally, we test the hypothesis that public preferences for riparian quality exhibit nonlinearities. We test this hypothesis by comparing three regression models. Our first ‘linear’ model presents coefficients and WTP estimates on the riparian quality and farmland conversion variables without transforming them (calibrating a single estimate for each incremental ‘point’ of riparian quality from 0 = very poor to 5 = very good). Our second ‘log’ model takes the natural log of the riparian quality variable. Our third ‘levels separated’ model treats separately each level of riparian quality and each independent level of farmland

conversion, and calculates MWTP for each level separately. For example, a MWTP for riparian quality 4 (good) that was less than twice the MWTP for riparian quality 2 (poor) would be some evidence for non-linearity. Our list of variables is summarized in **Table 23** below.

Table 23. Variables in Choice Experiment Analysis

Variable Name	Description
Riparian_Quality	The quality of the riparian environment on a five-point scale ranging from "Very Poor" (0) to "Very Good" (5)
lnqual	The natural log of the riparian quality scale
Farm_Conversion	The percentage of total farmland in Puget Sound converted to restored riparian habitat, ranging from zero to 16%
Annual_10Yr_Tax	The annual tax required to be paid by the respondent for ten years in exchange for the riparian conversion program, ranging from zero to $80/yr
Base	A dummy variable representing the common base option, present in all choice sets, of Very Poor riparian quality, zero farmland conversion, and zero tax
Income	The respondents' income on a 19-point scale ranging from "less than $5,000" to "more than $175,000"
Education	The respondents' education level on a 14-point scale ranging from "No formal education" to "Professional or doctoral degree"
Numrectrips	The respondents' reported number of trips to the Puget Sound region during the last 12 months specifically for the purposes of outdoor recreation
ActivityDummy	Dummy Variable which takes the value of 1 if the respondent engaged in any of the following activities: camping, photography, sightseeing, wildlife viewing, tidepooling, fishing, collecting sea life, skim boarding, surfing, swimming, windsurfing/kiteboarding, freediving/snorkeling, kayaking/canoeing, SCUBA diving

Source: Current study

3.2.4. Direct Question on Relative Importance of Riparian Environmental Characteristics

At the end of the choice experiment survey we included an exploratory question asking respondents more directly than in the choice experiment about their personal preferences regarding the relative importance of principal observable environmental attributes that comprise riparian zones (see Appendix A.)Respondents were asked to distribute 100 “pennies” of importance across water clarity, safety for swimming, suitability for fishing, streambank vegetation, and presence of birds and other wildlife. Responses to this question identify the most salient features of river ecosystems to residents of Puget Sound.

3.3. Results

3.3.1. Choice Experiment Results

Table 24 below presents the results of the conditional logistic regression on choice alternatives.[9] The results for models 1 and 2 indicate that a higher level of riparian quality presented in a choice alternative increases the probability (log odds) that survey respondents will choose that alternative; the coefficients on the riparian quality variables are positive and statistically significant. The first two models also indicate that—all else equal—the public is averse to converting higher levels of farmland to other uses. Higher levels of farmland conversion are associated with lower probabilities of choosing a given alternative; the coefficients on farmland conversion are negative and statistically significant.

The third model confirms the findings of the first two with respect to riparian quality: the coefficients on Good and Very Good riparian quality are statistically significant and of positive sign, meaning that a riparian quality level of Good or Very Good will increase the probability that a survey respondent will choose that alternative. The third model refines the findings with respect to farmland conversion: it demonstrates that the public is highly averse to relatively high levels of farmland conversion, but tolerant

[9] These results do not indicate willingness to pay (WTP); see **Table 26** for WTP values.

of moderate levels of conversion. Whereas the inclusion of the highest level of farmland conversion (16%) in a choice alternative significantly decreases the odds of a respondent choosing that alternative, the inclusion of the second and third highest levels of conversion in an alternative do not affect that respondent's choice significantly. Empirically, the coefficients on the third and second highest levels of farmland conversion (4% and 8%) are not statistically different from zero; the coefficient on the highest level of farmland conversion (16%) is statistically significant and negative.

Finally, all three models indicate aversion to taxation; all else equal, including a higher level of taxation in a given alternative decreases the probability that a survey respondent will choose that alternative. The coefficient on the taxation variable is statistically significant, and negative as expected, in all three models.

The coefficient on the Base variable in the first two models is statistically significant and positive, suggesting a baseline preference for the stylized "status quo" scenario featuring no farmland conversion, very poor riparian quality, and no taxation. This baseline preference applies only when all else is equal: that is, it is consistent with a willingness to pay for riparian quality but indicates that if a respondent were faced with two scenarios that seemed to offer little net advantage, s/he might be likely to default to the "status quo" scenario. This result is consistent with the findings of status quo bias prevalent in the choice experiment literature (e.g. Adamowicz *et al* 1998). However, this bias is not uniform. Higher income, and a larger number of recreation trips, are both associated with statistically significant preference against the common base option. Higher education, and participation in downstream recreational activities, are also associated with preferences against the common base, but the relationship is not statistically significant. Since all of the dummy variables in Model 3 are evaluated relative to the common base, its dummy variable is not included in that model.

Of the three models, Model 3 performs the best, followed by Model 2 and then Model 1. We use two measures of goodness-of-fit, adjusted rho-squared and the Akaike information criterion (AIC). Higher adjusted rho-squared, and lower AIC, entail superior goodness-of-fit. Adjusted rho-squared is lowest in Model 1 and highest in Model 3; AIC is largest in Model 1 and smallest in Model 3.

Table 24. Model Results[10]

	Model 1		Model 2		Model 3	
Variable	**Coefficient**	**Z**	**Coefficient**	**z**	**Coefficient**	**Z**
Riparian_Quality	0.718423	29.878***				
Log Riparian_Quality			2.434183	30.119***		
Farm_Conversion	-1.19074	-2.999**	-1.21766	-3.054**		
Riparian_Quality_Poor					-0.60398	-1.471
Riparian_Quality_Fair					0.507229	1.238
Riparian_Quality_Good					1.2908	3.146**
Riparian_Quality_Very Good					1.615394	3.934***
Farm_Conversion_4%					-0.09203	-1.493
Farm_Conversion_8%					0.007592	0.109
Farm_Conversion_16%					-0.16638	-2.881**
Annual_10Yr_Tax	-0.01307	-14.667***	-0.01321	-14.741**	-0.01317	-14.662***
Base	1.049225	2.545*	2.175606	5.199***		
Base*Income	-0.05538	-3.555***	-0.05553	-3.565***	-0.05562	-3.57***
Base*Education	-0.0613	-1.629	-0.06041	-1.608	-0.05995	-1.596
Base*Activitydummy	-0.18154	-1.48	-0.18179	-1.483	-0.18196	-1.484
Base*Numrectrips	-0.04054	-2.647**	-0.04054	-2.643**	-0.04055	-2.642**
R-squared[11]	0.312781		0.318193		0.320427	
Adjusted R-squared	0.311181		0.316593		0.318027	
Akaike information criterion (AIC)	6887.89		6833.774		6819.438	
Bayesian information criterion (BIC)	6939.274		6885.158		6896.515	
Log likelihood at convergence	-3435.95		-3408.89		-3397.72	

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: Current study.

Table 25 below reports the results of a likelihood-ratio (LR) test comparing the three models, under the null hypothesis that all the models are the same. The test compares the null model, Model 1, to the two alternative models, Models 2 and 3. The test statistic is a Chi-squared with the number of degrees of freedom being the number of additional parameters from Model 1. The results of the test are that Models 2 and 3 are each statistically significantly different from Model 1, confirming the results of comparing the adjusted rho-squared and AIC. Model 3 is the best fit of all three models, judging by its largest (smallest negative) log-likelihood ratio. Taking into account the larger number of parameters, the Chi-squared test indicates that Model 3 is a significantly better fit than Model 1. Model 2 is a better fit than Model 1.[12]

[10] Throughout this table, a positive coefficient indicates that a higher likelihood (log odds ratio) that a respondent would choose an alternative featuring the variable in question (or a higher level of the variable). Z represents the test statistic associated with the coefficient, which would be normally distributed under the null model (mean 0, standard deviation 1), and asterisks indicate significance level for that statistic.

[11] R-squared and adjusted R-squared follow McFadden (1973). Higher rho-squared, higher adjusted rho-squared, lower AIC, and higher (less negative) log-likelihood all entail superior goodness-of-fit.

[12] A second, two-way LR test (not shown) confirmed that Model 3 is a statistically significantly better fit than Model 2.

Table 25. Likelihood Ratio (LR) Test of Models

Model	LogLik	Df	Chisq
1	-3435.9		
2	-3408.9	0	54.12***
3	-3397.7	4	22.34***

Source: Current study.

Table 26 below presents the estimates of marginal willingness to pay (MWTP) for each environmental attribute variable, for each model. The estimates, given in the first column of figures in the table to the right of the variable name, indicate that the public exhibits positive MWTP for increases in riparian quality, and negative MWTP for farmland conversion. The second and third columns of the table present a 95% confidence interval for the estimate based on Krinsky-Robb (1986) parameter simulations.

From **Table 25** above, we can see that Model 3 performs the best of all our models; we report the results of this model first. In Model 3, the respondent public reveals higher WTP for higher riparian quality, but WTP appears to increase in quality at a decreasing rate. In other words, the relative MWTP for Very Good in comparison to Good riparian quality ($122.65 – $98.01 = $24.64) is less than the relative MWTP for Good in comparison to Fair riparian quality ($98.01 – $38.51 = $59.50), holding farmland conversion constant. Further, the public reveals negative and statistically significant MWTP for the highest level (16%) of farmland conversion (-$12.63), but statistically insignificant MWTP for farmland conversion of 4% or 8%, holding riparian quality constant. In other words, at any given level of riparian quality, the public's preferences for farmland conversion appear to turn significantly negative once the level of conversion passes 8%. (The structure of the variables did not allow us to compare 2% and 4% farmland conversion.)

In Model 1, MWTP for each additional level of riparian quality is $54.99 per year; this is the public's annual WTP to improve riparian quality by one level (from Poor to Fair, for example), for any given level of farmland conversion. MWTP for farmland conversion is negative $91.14; the public reveals a reduced WTP of $91.14 for each doubling of farmland conversion - from 4% to 8% of acres, for example – at any given level of riparian quality. In general, the public appears to prefer higher riparian quality at each level of farmland conversion, but prefers not to convert additional farmland at each level of riparian quality. Converting farmland to riparian buffers without a corresponding improvement in riparian habitat quality would thus be an undesirable outcome, according to the results of this survey. In Model 2, the public displays MWTP of $184.21 for each additional one-point increase in the natural log of the riparian quality score. Raising the level of riparian quality from Very Poor (scored 1) to Good (scored 3) would approximate a one-point increase in the natural log of quality (ln 3 – ln 1 = 1.09).

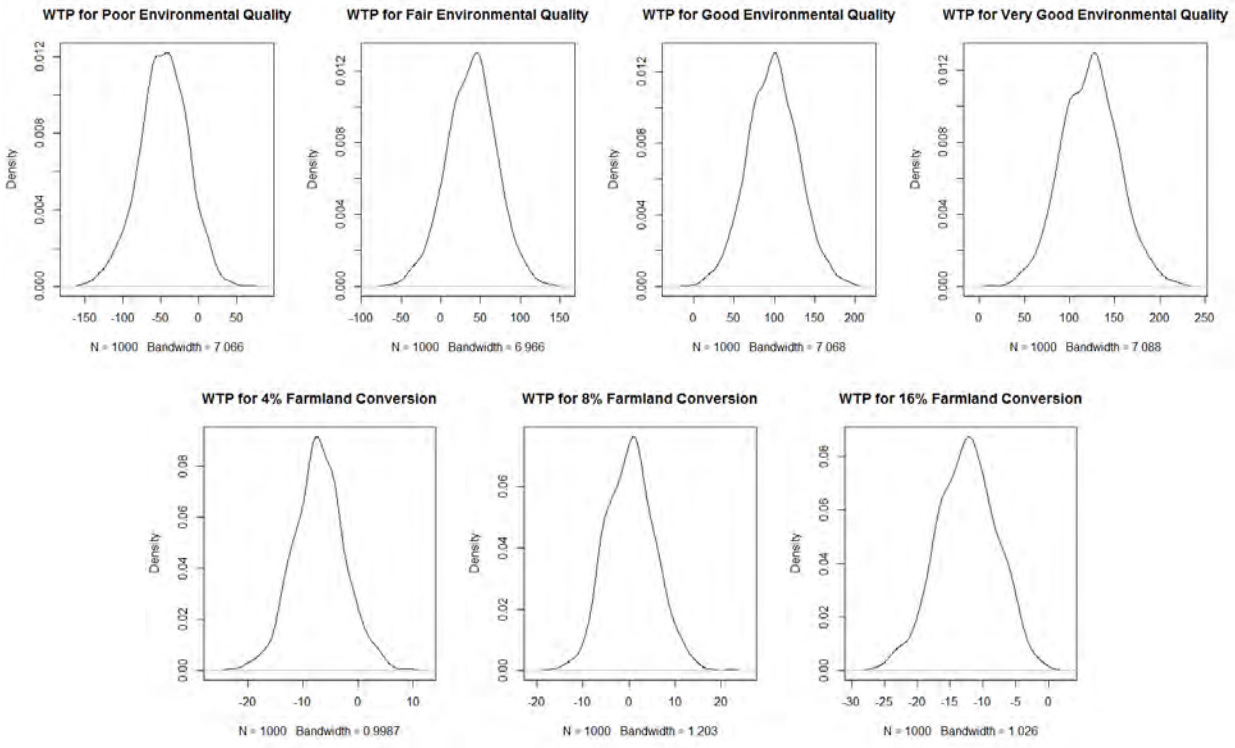
Though Models 1 and 2 suggest a general negative WTP for farmland conversion, Model 3 suggests that this effect is driven by a strong preference against high relative levels of conversion (16%), and indifference to lower levels of conversion, for given levels of riparian quality.

Table 26. Marginal Willingness To Pay (MWTP) for Choice Experiment Variables

	Model 1		
Variable	**MWTP**	**2.50%**	**97.50%**
Riparian_Quality	54.99	48.26	63.59
Farm_Conversion	-91.14	-149.07	-30.39
	Model 2		
Variable	**MWTP**	**2.50%**	**97.50%**
Log(Riparian_Quality)	184.21	162.12	211.92
Farm_Conversion	-92.15	-157.95	-30.11
	Model 3		
Variable	**MWTP**	**2.50%**	**97.50%**
Riparian_Quality_Poor	-45.86	-110.40	13.83
Riparian_Quality_Fair	38.51	-25.77	94.59
Riparian_Quality_Good	98.01	34.45	154.66
Riparian_Quality_Very Good	122.65	60.25	183.52
Farm_Conversion_4%	-6.99	-16.65	2.67
Farm_Conversion_8%	0.58	-9.28	10.98
Farm_Conversion_16%	-12.63	-21.49	-3.88

Figure 16 below provides kernel density estimations of the distribution of marginal willingness to pay (MWTP) for individual levels of riparian environmental quality and farmland conversion. Distributions are derived via Krinsky-Robb (1986) simulations, which are based on an assumption of multivariate normal distribution of parameters; a sample size of N=1000 replications is used. The first four graphs reveal comparable ranges of MWTP across riparian quality variables, with dramatically different means. The last three graphs, likewise, reveal comparable ranges of MWTP across farmland conversion variables, with different means, reflecting the multivariate normal distribution assumption inherent in the method.

Figure 16. Distribution of Marginal Willingness to Pay (MWTP) for Individual Levels of Riparian Environmental Quality and Farmland Conversion (Model 3)



3.3.2. Relative Weighting of Riparian Ecosystem Components Results

Figure 17 and **Figure 18** display results from directly asking respondents to weight the relative importance of riparian ecosystem characteristics. Mean *presence of birds and other wildlife* as well as *water clarity* ranked the highest. The standard deviation associated with *presence of birds and other wildlife* was largest, demonstrating the variation in prominence of that feature when people think about what they value most in association with rivers given the options that the survey provided.

Figure 17. Mean survey respondent assignment of relative importance of riparian ecosystem components with standard deviations

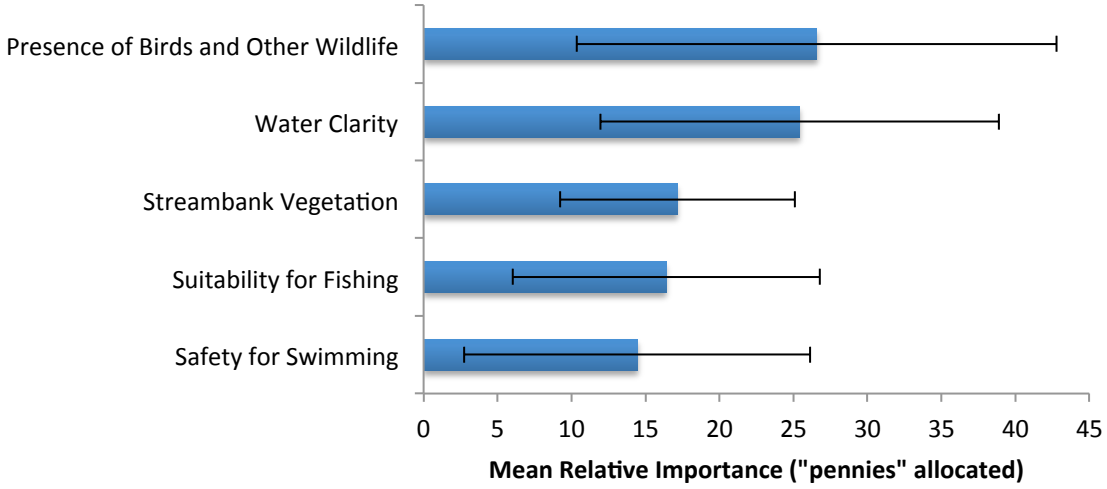
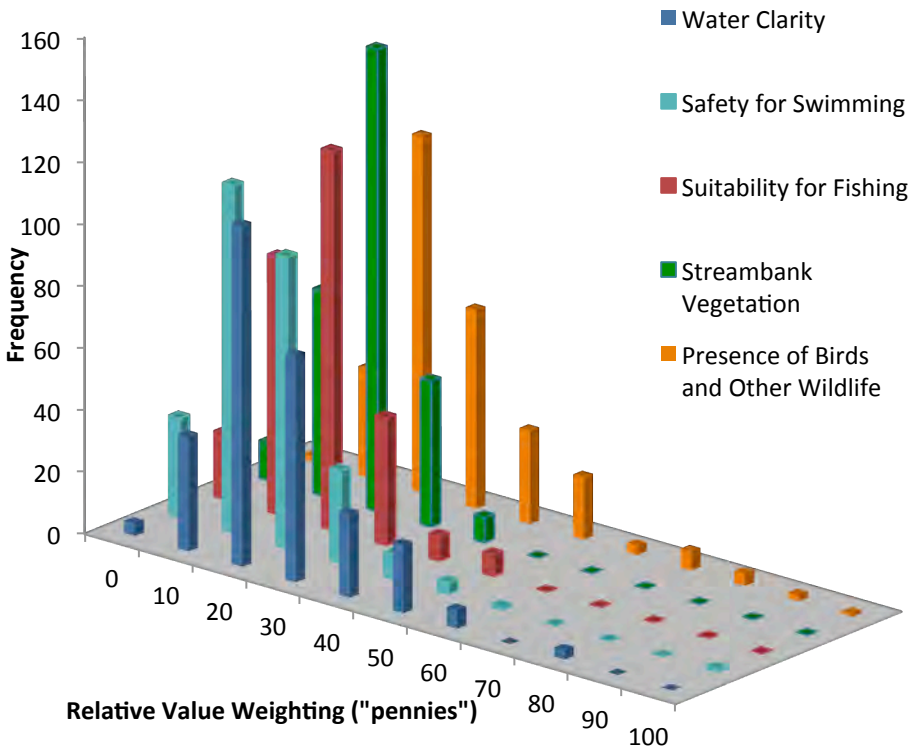


Figure 18. Frequency of relative value weighting across environmental conditions



3.4. Discussion and Conclusions

3.4.1. Review of Results

Three major results emerge from our analysis:

1. The recreating public, measured by our representative survey sample, has indicated positive and significant willingness to pay for riparian restoration, with incremental WTP decreasing at higher levels of riparian habitat quality.
2. The recreating public has indicated indifference to low to moderate levels of farmland conversion (4% to 8%) but a significant preference against high levels of conversion (16%).
3. Members of higher-income groups and more frequent recreators have indicated higher WTP for riparian restoration and farmland conversion

The next three paragraphs discuss the above three results briefly.

First and most importantly, the public has stated positive and significant willingness to pay (WTP) for riparian restoration projects on converted farmland. In our results, higher levels of riparian habitat quality were associated with higher levels of WTP. However, though the public's preferences for riparian restoration appear to favor higher levels of riparian quality over lower levels, the intensity of this relative preference weakens at higher levels of quality.

Second, the public appears to be indifferent to low to moderate levels of farmland conversion in Puget Sound region (up to 8%), but has stated its preference against higher levels of farmland conversion (16%). These results suggest a variety of possible interpretations: on the surface, the results suggest that the public desires to preserve farmland, whether for aesthetic, heritage, or food security reasons. Further research may inquire about public attitudes towards farmland in more depth. The above results may also be an artifact of the relative differences between the proposed levels of conversion; the numeric difference between 8% and 16% is more dramatic than the differences between the lower levels of conversion. There may also be a cognitive bias against the highest possible level of change, whatever that change might be simply because it is the highest. Consequently, the question remains: would the public's relative preferences for farmland conversion change if an additional, higher level of 24% conversion were added? Finally, the public may also be subject to a threshold "extra digit" effect at 10% conversion; further research might test for a structural break in WTP between 9% and 11%.

Third, members of higher-income groups and more frequent participants in recreational activities have indicated higher WTP for riparian restoration and farmland conversion, relative to other respondents. This result is demonstrated by significant preferences of these groups against the common base choice alternative of Very Poor riparian quality, zero farmland conversion and zero taxation. Participants in recreational activities that occur downstream from riparian areas also suggest higher WTP for riparian restoration, as do more educated groups; however, the latter two results are not statistically significant. These results suggest that people's relationships to the Puget Sound environment affect their preferences for restoration of that environment.

The results from the direct question on assigning relative value to characteristics of riparian ecosystems show that, on average, the public values the presence of wildlife and water quality above stream bank vegetation, suitability for fishing and safety for swimming. These highly visible features--wildlife and water clarity—are salient and desirable features of rivers. This result suggests that communication materials associated with future restoration projects might garner public support by emphasizing wildlife and water quality among *multiple* benefits associated with restoration.

These results are promising for scientists, advocates, and policymakers seeking to restore riparian farmland for salmon habitat, water quality, biodiversity, wildlife corridors, or any other purpose. They suggest that there is public appetite for riparian restoration funded by taxation, which may be able to counteract a portion of the losses of riparian habitat due to logging, farming, real estate development and other environmental stressors.

3.4.2. Further Work

The stylized choice situations constructed for our experiment asked respondents to evaluate a series of combinations of riparian environmental quality and farmland conversion relative to a presumed baseline of very low riparian quality and zero farmland conversion. The reality is more complex. Riparian areas bordering farmland in Puget Sound exhibit differing levels of quality based on differences in farming practices and differential adoption of riparian buffer programs such as CREP. Further work in this area might collect additional data to set a more accurate baseline of the condition of riparian zones in Puget Sound.

The choice experiment described and analyzed above in sections 3.1 and 3.2 limited itself to a narrow range of attributes to represent alternative hypothetical projects for riparian restoration on converted farmland (as is necessary for choice experiments). However, additional attributes could add nuance to the results. For instance, public access to some portion of the riparian buffers may be possible without disrupting farmland or invading the privacy of farm households. If such access is granted, perhaps in exchange for admission fees, an expansion of riparian recreation in the form of swimming, fishing and wildlife viewing, as well as tribes' subsistence and ceremonial fishing and harvesting, may be possible. Further studies may attempt to include river access as a variable influencing the public's willingness to pay for riparian restoration. Further studies may also include estimates of net job loss associated with farmland conversion and riparian restoration.

Further stated preference studies on this topic may also explore two-way interactions between farmland conversion and riparian quality. Greater attention to experimental design may make possible further disaggregation of environmental quality attributes. For instance, a more nuanced experimental design may take into account interactions between the component attributes of buffers, such as associating specific ranges of water quality outcomes and wildlife presence and abundance with specific buffer widths, as suggested in Stoffyn-Egli and Duinker (2010). For instance, Stithou *et al* (2012) employ an experimental design with restrictions on attribute-level combinations, in estimating public preferences for ecological improvements in the Boyne River catchment in Ireland.

Further choice experiment studies on riparian buffers may also test for additional properties of public preferences documented in the valuation literature. For instance, choice experiments on wetlands have documented loss aversion as a characteristic of choice behavior over environmental outcomes (Hoehn *et al* 2004). Our choice experiment did not incorporate loss aversion, since it did not specify any outcomes that represented either losses of riparian quality, or increases in available farmland, in comparison to the common base option. Our experiments evaluated gains in riparian buffer quality and converted farmland against alternative taxation levels, relative to a common base alternative at the lowest level of each attribute. Developing a more accurate picture of the status quo, and evaluating outcomes over both gains and losses from that baseline, would represent a refinement of this study.

Given that the riparian areas described in this choice experiment are not frequently used for recreation, our study appears to measure the public's preferences for environmental outcomes independently of their access to direct enjoyment of these outcomes. Ecosystem service theory (e.g. Sagoff 1998) distinguishes between *consumer preferences*, which reflect individuals' subjective valuation of the direct enjoyment provided by ecosystem goods and services, and *citizen preferences*, which reflect individuals' perceptions of the value that society as a whole ought to place on these goods and services. Since our survey respondents do not recreate within riparian zones, our choice experiment appears to be measuring citizen preferences, as distinct from consumer preferences. However, the finding that more frequent recreational users have higher WTP for riparian quality suggests that our survey respondents may be evaluating, whether consciously or not, the downstream implications of varying levels of riparian quality. More frequent recreational users may also exhibit stronger pro-environmental values, leading to greater WTP for restoration. Citizen and consumer preferences may be intertwined in the case of recreational users' preferences over environmental outcomes, since for recreators the environment is both a public resource and a consumption good. Further work on this issue could combine choice experiments with direct questions to elicit respondents' values, attitudes and motivations; such work could also engage

respondents in group deliberation, informed by scientific research results, to elicit citizen preferences that may remain obscure in market-like settings.

We suggest that further work on this topic conduct additional research on the most salient attributes of riparian buffers from the perspective of recreation, aesthetics and sense of place. Importantly, these attributes must be relatively uncorrelated with one another. The foundation of choice experiment methodology is Lancaster's theory of consumption based on attributes; however, this theory appears to be limited in its applicability to public enjoyment of landscapes. For instance, in our choice experiment pre-test, survey respondents refused to answer choice questions containing combinations of attributes that seemed unrealistic, such as highly polluted water combined with thriving wildlife habitat. The outcome of our pre-test suggests that survey respondents may experience difficulty in disaggregating the attributes of a landscape and valuing each attribute separately from the others. Ecological attributes of landscapes are often correlated; restoration efforts necessarily aim to restore whole ecosystems, rather than simply increase the levels of the most desirable ecosystem attributes. Further, the Lancaster theory is of limited applicability in ecosystem service valuation, since individual ecosystem attributes do not map easily to single services: each attribute of an ecosystem or landscape contributes to multiple services, and each service is "produced" or derived from multiple interacting attributes. Multi-attribute choice experiments on environmental topics, to produce meaningful results, should be careful to include attributes that can be varied independently of one another.

3.5. Conclusions

Our study suggests that in general, the public is willing to pay to restore riparian areas. The results of all three of our models indicate that the public is willing to pay additional taxes for higher quality riparian environments. However, the results of Models 2 and 3 indicate that the public's willingness to pay for additional increases in quality declines as the level of quality increases. The results of Model 3 indicate that the public is indifferent to farmland conversion up to 8% of acreage, but prefers not to convert farmland up to 16%. More frequent participants in coastal recreational activities are more likely to be willing to pay to restore riparian areas. Individuals from higher-income households are also more likely to be willing to pay for riparian restoration.

We do not yet know whether these payments will be sufficient to undertake the scale and scope of restoration necessary to achieve the key objective of restoring historic salmon runs. Riparian restoration depends on length and continuity of riparian buffers, not just buffer width: successful restoration of fish and wildlife habitat requires long, continuous buffers, not just wide ones (Stoffyn-Egli and Duinker 2010). With disaggregated landownership and farmer reluctance to adopt buffers, setting wide minimum buffers may lead to a sacrifice of buffer length by reducing the percentage of farmers willing to participate (Smith 2013). A policy of widening the minimum buffer strip may lead to a fall in the rate of adoption of CREP or other voluntary buffer programs – thereby reducing the effectiveness of the remaining buffers. The next chapter will discuss farmers' attitudes towards riparian buffers; understanding farmers' attitudes and willingness to install riparian buffers can provide important guidance towards the design of effective riparian restoration policies.

Chapter References

Adamowicz, Wiktor, Peter Boxall, Michael Williams, and Jordan Louviere (1998): "Stated Preference Approaches for Measuring Passive Use Values: Choice Experiments and Contingent Valuation." *American Journal of Agricultural Economics*, 80:1, 64-75.

Aizaki, Hideo (2014): "Package 'support.CEs'".
URL: http://cran.r-project.org/web/packages/support.CEs/support.CEs.pdf

American Farmland Trust (2012): "Puget Sound Farmland Protection Report." URL:
http://www.farmland.org/programs/states/wa/Puget-Sound-Farmland-Protection-Report.asp

Berninger, Kati, Wiktor Adamowicz, Daniel Kneeshaw, and Christian Messier (2010): "Sustainable Forest Management Preferences of Interest Groups in Three Regions with Different Levels of Industrial Forestry: An Exploratory Attribute-Based Choice Experiment." *Environmental Management*, 46: 117-133.

Daily, Gretchen (2007). *Nature's Services: Societal Dependence on Natural Ecosystems*. Washington, DC: Island Press.

Desbonnet, Alan, Virginia Lee, Pamela Pogue, David Reis, James Boyd, Jeffrey Willis, and Mark Imperial (1995): "Development of Coastal Vegetated Buffer Programs." Coastal Management, Volume 23, pp. 91-109.

Hanley, Nick, Robert E. Wright and Wiktor Adamowicz (1998): "Using Choice Experiments to Value the Environment: Design Issues, Current Experience and Future Prospects." *Environmental and Resource Economics,* 11 (3-4): 413-428.

Krinsky, I. and Robb. A. L. (1986) "On Approximating the Statistical Properties of Elasticities." *The Review of Economics and Statistics,* 68, 715–719.Lawrence, David J., Ben Stewart-Koster, Julian D. Olden, Aaron S. Ruesch, Christian E. Torgersen, Joshua J. Lawler, Don P. Butcher, and Julia K. Crown (2014): "The interactive effects of climate change, riparian management, and a nonnative predator on stream-rearing salmon." *Ecological Applications,* 24(4), 895-912.

Louviere, Jordan, David Hensher, and Joffre D. Swait (2000): *Stated Choice Methods: Analysis and Application.* Cambridge: Cambridge University Press.

McFadden, Daniel (1973): "Conditional logit analysis of qualitative choice behavior." URL: http://eml.berkeley.edu/reprints/mcfadden/zarembka.pdf

Naidoo, Robin and Wiktor Adamowicz (2005): "Biodiversity and nature-based tourism at forest reserves in Uganda." *Environment and Development Economics,* 10: 159-178.

Northwest Indian Fisheries Commission (2011): "Treaty Rights At Risk: Ongoing Habitat Loss, the Decline of the Salmon Resource, and Recommendations for Change." Olympia, WA: Northwest Indian Fisheries Commission.

Puget Sound Partnership (2014): "Puget Sound Facts." URL: http://www.psparchives.com/puget_sound/psfacts.htm

Rolfe, John, Khorshed Alam, Jill Windle and Stuart Whitten (2004): "Designing the Choice Modeling Survey Instrument for Establishing Riparian Buffers in the Fitzroy Basin." Emerald, Australia: Central Queensland University.

Rolfe, John, Jill Windle, Andrew Reeson and Stuart Whitten (2006): "Assessing the incentives needed to improve riparian management in grazing systems: Comparing experimental auctions and choice modelling approaches." Sydney, Australia: 50th Annual Conference of Australian Agricultural and Resource Economics.

Sagoff, Mark (1998): "Aggregation and deliberation in valuing environmental public goods: A look beyond contingent pricing." *Ecological Economics* 24, 213-230.

Skagit Conservation District (2014): "Conservation Reserve Enhancement Program: CREP." URL: http://www.skagitcd.org/crep

Smith, Carol (2013): "2013 Implementation and Effectiveness Monitoring Results for the Washington Conservation Reserve Enhancement Program (CREP): Buffer Performance and Buffer Width Analysis." Washington State Conservation Commission.

State of Washington (2014): "Conservation Reserve Enhancement Program (CREP)." URL: http://scc.wa.gov/crep/

Stithou, Mavra, Stephen Hynes, Nick Hanley, and Danny Campbell (2012): "Estimating the Value of Achieving 'Good Ecological Status' in the Boyne River Catchment in Ireland Using Choice Experiments." *Economic and Social Review,* 43:3, 397-422.

Stoffyn-Egli, Patricia, and Peter N. Duinker (2013), "An Ecological Approach to Riparian-Buffer Definition, and Implications for Timber Harvests in Nova Scotia, Canada." Journal of Sustainable Development, Vol. 6, No. 12, 111-134.

US Census Bureau (2014): “QuickFacts: Washington.” URL: http://quickfacts.census.gov/qfd/states/53000.html

USDA (2014): “Web Soil Survey.” URL: http://websoilsurvey.nrcs.usda.gov/app/

USDA (1998) “State of Washington Conservation Reserve Enhancement Program (CREP): Fact Sheet.” URL:https://www.fsa.usda.gov/FSA/newsReleases?area=newsroom&subject=landing&topic=pfs&newstype=prfactsheet&type=detail&item=pf_19981001_consv_en_wash.html

USDA Farm Service Agency (2014): “Conservation Reserve Enhancement Program.” URL: https://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=cep

4. PLACE BASED STUDY: AESTHETICS, SENSE OF PLACE AND LANDOWNER ATTITUDES TOWARDS RIPARIAN BUFFERS IN SNOHOMISH COUNTY

4.1. Introduction

Riparian buffers—vegetation strips along streams and waterways—are key for both salmon recovery efforts and watershed restoration in the Puget Sound region. Increasing the miles of stream with riparian buffers, however, involves the cooperation of private landowners, who are sometimes reluctant to 'give up' productive land. In this place-based study we sought to understand the importance of key cultural ecosystem services (CES), defined as ecosystems' contributions to non-material benefits that arise from human–ecosystem relationships (Chan et al., 2012), and cultural values related to land use in the context of a locally and regionally salient land management issue—riparian buffers on agricultural land. For this research, we established a relationship with the Snohomish Conservation District (SCD) with whom we identified the issue of riparian buffers on private agricultural lands as a focus. Discussions with PSI staff confirmed the issue to be of regional importance as well. This study involved in-depth interviews with landowners in Snohomish County to understand their values, including sense of place and aesthetics.

A variety of programs exist in the Puget Sound to support and incentivize the creation of riparian buffers on private land. The federally funded Conservation Reserve Enhancement Program (CREP) offers compensation for the creation of riparian buffers on agricultural lands. Most programs offer some form of cost sharing for the expense of installing riparian buffers. The CREP program pays for the expense of installation as well as a yearly payment based on the width and length of eligible land put into riparian buffers. While current program structure is somewhat flexible, generally buffers must be a minimum of 35 feet on each side of salmon bearing streams to qualify. Current policy debates surround proposals to increase minimum buffer widths required for CREP participation up to 100 feet. In light of these potential changes, this study seeks to better understand the values and motivations of landowners who participate in the CREP program or other riparian buffer programs. It seeks to inform how participation could be increased and how policy changes could impact participation.

Previous work on this issue includes an ethnographic study in neighboring Skagit County. Breslow (2011) highlighted several important dimensions of the conflict between farmers and farm advocates, Native Americans and advocates of restoration. Differences in ideas about place, aesthetics, nature and science played a role in the conflict between farmland preservation and salmon restoration. This study builds on Breslow's work, but takes a different approach. Rather than a detailed analysis of the conflict, this work takes the approach of 'looking for the bright spots' (Heath & Heath, 2010). What motivated participants to enroll in CREP or work with SCD on another riparian buffer project, despite potential conflicts and barriers?

By examining riparian buffers on agricultural land through an ecosystem services lens we can better clarify the different benefits and costs to different groups of increasing riparian buffers. Ecosystem services (ES) can be described "as the provision of direct and indirect benefits to people from ecosystems" (Chan, Satterfield, & Goldstein, 2012).

For example, increasing acres of riparian buffers on agricultural lands in Snohomish County (a management or policy action) likely would enhance ES such as water filtration and flow regulation; these benefits to downstream residents are valued by many in Puget Sound. Riparian buffers may help with stream bed stabilization which may be a benefit valued by residents or visitors to Puget Sound for aesthetic reasons and/or valued by farmers for protection of their fields. All of these benefits will likely contribute to habitat for birds and riparian species as well as salmon populations. Riparian buffers are considered one of many important factors in maintaining healthy salmon populations. Many different groups in Puget Sound value salmon, both a provisioning service as well as a CES. However, there is a trade-off between the ES generated by riparian buffers on agricultural lands and the use of those lands for agricultural purposes. When riparian buffers are created, that land is lost for the ES of agricultural production. When program rules restrict private property owners options for control and management of that land, there are psychological and governance oriented losses.

These benefits can be described qualitatively, in common categories such as provisioning or regulating; some can be estimated or quantified in biophysical terms. For some ES, aspects of their value or benefit can be estimated using monetary measures. Chapter 1, *The Values of Coastal Recreation* and Chapter 3, *The Values of Riparian Buffers: A study of trade-offs* estimate aspects of the value of different ES in Puget Sound using monetary measures.

A variety of policy mechanisms exist to protect or enhance ES. One of these is Payment for Ecosystem Services (PES). PES programs are a type of market based conservation program that involve a transaction between an ecosystem service "supplier" and "beneficiary." The CREP program in Snohomish County is one of a suite of funding programs supporting conservation on private agricultural lands that can be considered a PES program. In this case, government represents the "beneficiaries" (people who care about salmon, water quality in the Puget Sound and tributaries and riparian habitat) and farmers act as the "suppliers" of a suite of ES (including water filtration, stream bed stabilization, riparian habitat, stream temperature stabilization) supported by the management change of riparian buffers. These ES help to create good habitat for salmon and thus support salmon populations. Salmon are a key provisioning and cultural ES in Puget Sound. Valued for tribal, commercial and recreational fishing, these species also play critical roles in the cultural traditions of tribes in the region (Northwest Indian Fisheries Commission, 2014).

This study sought to better understand the motivations of rural landowners to participate in riparian buffer programs. Special attention was given to the perspectives as well as aesthetic and cultural values of landowners about the importance and meaning of 'nature' and 'place.' We looked to understand landowners' values and moral logics around land management and how these influenced their decision to participate in a riparian buffer program. Finally, barriers to participation as well as suggestions for improvement were included. Thus, the following research questions were examined:

4.1.1. Research Questions

Our principal research questions are as follows:

1. What are the aesthetic values that farmers hold in relation to their property or other farms?
2. What is the nature of landowners' connection to place? Is a 'Puget Sound sense of place' resonant with them? What scale of place do they feel connected to?
3. What goals and values do farmers have for their own farm?
4. What motivated landowners to participate in a program to create a riparian buffer on their property?
5. What barriers, costs or challenges did participants find in participating in riparian buffer programs?
6. What are their suggestions for improvement?

An understanding of farmers' perspectives on riparian buffer programs as well as their values around aesthetics, land management and farming can help to design more effective programs. In addition, understanding how CES and cultural values play out in this context provides a richer and more policy relevant understanding of these values. Farmers and other rural landowners may be motivated to install riparian buffers on their land for many different reasons, including a desire to experience CES on their own land (e.g. via bird and fish habitat or aesthetic benefits of additional plantings and trees) or based on their cultural and moral value orientations (e.g., a sense of stewardship or a desire to do their part).

This chapter contributes to our research question: To what extent do stakeholders' perceptions of CES and value orientations help explain their attitudes toward environmental management, including ecological restoration? Whereas the previous chapter focused on public views around riparian buffers and farmland loss, this chapter focuses on the perspectives of farmers and other rural landowners.

4.2. Methods

Interviews were conducted with 22 property owners or managers who had worked with or considered working with SCD on conservation projects on their property. All but one interviewee had implemented a

riparian buffer on their property or were planning on doing so. Of the individuals interviewed, 7 were participants in the CREP program (6 projects as one couple was interviewed separately) and 3 were planning or considering enrolling in CREP. Two interviews were conducted with individuals who managed a property owned by a church. All others were both owners and managers of their own land. Participants came from communities in or around Arlington, Everett, Stanwood, Lake Stevens, Monroe, or Snohomish. They had lived in Puget Sound between 3 years to 72 years. Most had animals on their land, usually horses or cows.

Interview participants were recruited with the help of SCD via their existing relationships and contacts. While sampling was not representative, efforts were made to reach a diverse group of respondents within SCD's network, including age, gender and farm size. The sample included both CREP enrollees as well as landowners who had implemented a riparian buffer via another program or voluntarily. The sample was limited by the number of potential participants in SCD's network (there are only 29 CREP enrollees in Snohomish County) and those that were willing to participate. While initially full or part time farmers were targeted, not enough participants could be found so the sample was later expanded to include hobby farmers as well as other types of rural landowners such as those with horses, animals for training purposes, or nurseries. Individuals who managed church properties were also interviewed.

The interview protocols were developed in consultation with the research team, PSI and SCD staff, as well as a literature review. Interviews were conducted in two phases. A first round of in-depth interviews was conducted in November and December 2013 including interviews of 5 landowners that work with SCD. This first phase involved questions about sense of place, recreation and aesthetics as well as conservation related land management changes. Based on the results from this first round, the interview protocol for the second round was narrowed to allow for more in-depth discussion of the key themes identified in the first round of interviews. In the second round 17 participants were interviewed between October and December 2014.This second round of interviews focused on three key areas: a) values related to farms and farming, including sense of place and aesthetics as well as land management paradigms; b) experiences with riparian buffer programs, including motivations, benefits and costs to participation; and c) participant's suggestions for improvement of riparian buffer programs. Interviews lasted between 1/2 and 2 hours and were conducted by the researcher in participants' homes, workplaces or cafes with the exception of 2 interviews conducted by phone. Two couples were interviewed, one together and one separately; there were then 21 total interviews and 20 discrete properties included in the study.

Analysis of interviews was as follows: Interviews were transcribed by the research team and assistants. The lead researcher for this qualitative study (M. Chapman) coded the transcripts with NVivo for Mac qualitative data management software. Ten interviews were selected for coding based on type of landowner (full and part time farmers were prioritized as there were fewer in the sample compared to hobby farmers) and to achieve a breadth of perspectives. Field notes, which included summaries of key points from the interviews, were used to analyze major points of the remaining interviews. Additional

sources of data included webpages of interview participants' businesses, videos and newsletters produced by the SCD, and publically available demographic data.

4.3. Results

The interviews showed a rich variety of values, motivations and concerns among rural landowners and farmers. Importantly, very few respondents relied on farming as their primary income. Most have a mixture of on and off farm income generation.

Many landowners with small parcels that grow food for personal consumption or as a hobby or those with small scale horse pastures can be engaged to work with SCD or other NGOs to implement riparian buffers. Assistance in the form of planning, labor and trees/plants is important for this group. However, given their small size, they require flexibility in implementing projects that fit with the way the want to use their land. Projects that allow them to improve their land at the same time (e.g., reduce stream bank erosion, improve drainage, or control invasive plants) are especially attractive.

Landowners with larger holdings who use their property for financial and productive purposes may require additional incentives. For these landowners, incentives in the form of these other projects to improve their land are often the most important motivators, e.g., stabilization of stream beds, measures to improve drainage, compost installation. Allowing flexibility in the locations of buffers and their widths also increases likelihood of participation. Most farmers desire a collaborative relationship that allows for a customized solution.

The following sections seek to give a sense of the most important themes as well as the breadth of ideas elicited in interviews. The first part describes the types of farmers and rural landowners interviewed and compares this to statistics on farmers in Washington State and Snohomish County. As the sampling focused on those landowners who had worked with SCD and installed buffers, it is important to understand the sample and consequently, what can and cannot be generalized from the study. The second section describes the aesthetic values that farmers have regarding their own farm and other farms in their community. The third part describes connection to place, especially local versus Puget Sound wide connections. The fourth section gives an overview of values and goals that farmers have for their land. Finally, motivations and barriers to participation in riparian buffer programs as well as respondents' suggestions for improvement are described in sections five to seven, respectively.

4.3.1. Types of farms and farmers interviewed

Importantly, very few respondents relied on farming as their primary income. Most have on and off farm income. This is likely a result of two factors. First, relative to Washington State as a whole, farming in Snohomish County is dominated by small farms with low sales volumes and operators whose primary occupation is not farming. Farms in Snohomish county have lower sales—a per farm average of $97,000 in Snohomish compared to $244,859 in Washington state as a whole (USDA, 2012 Washington; USDA, 2012 Snohomish County). The average net cash income from a farm in Snohomish County is $4,244. Of the 1,438 farms in Snohomish County, 589 have sales of less than $1000 annually. A further 536 had sales of $1000 to $10,000 annually (USDA, 2012 Snohomish County). The average size farm in Washington state at 396 acres is substantially larger than in Snohomish County where the average is 49 acres (USDA, 2012 Washington; USDA, 2012 Snohomish County). Even within Puget Sound, Snohomish County has relatively smaller incomes and farm values, particularity compared to Whatcom and Skagit Counties. It is most similar in this regard to King and Pierce Counties (see Figure 19).

The high cost of land in Puget Sound compared to Eastern Washington, access to alternative markets (such as direct to consumer sales, value added products, etc.) and availability of off farm labor markets are possible reasons why Snohomish County farms are more often smaller and have lower sales volumes than statewide. Figure 20 shows that growth in sales of agricultural products in Washington has been dominated by counties in the eastern and southern part of the state, with slower or decreasing growth in the counties around Puget Sound.

County/ State	Number of Farms	Market Value of Products Sold (Average per Farm)	Farm Income (Average Net Cash per Operation)
Whatcom	1,483	209,937	30,306
Skagit	1,074	253,515	26,008
Mason	,377	108,247	20,790
Thurston	1,336	91,634	11,638
Pierce	1,478	61,524	5,998
King	1,837	65,732	4,806
Snohomish	**1,438**	**97,000**	**4,244**
Jefferson	221	34,648	-1,114
San Juan	274	15,492	-1,785
Island	377	30,416	-3,404
Clallam	536	19,865	-6,003
Kitsap	706	7,513	-6,799
Washington State	37,249	244,859	47,047

Figure 19. Farm Values and Income in Puget Sound Counties and Washington State, 2012 (Source: Based on USDA Census Publications, County and Statewide Profiles)

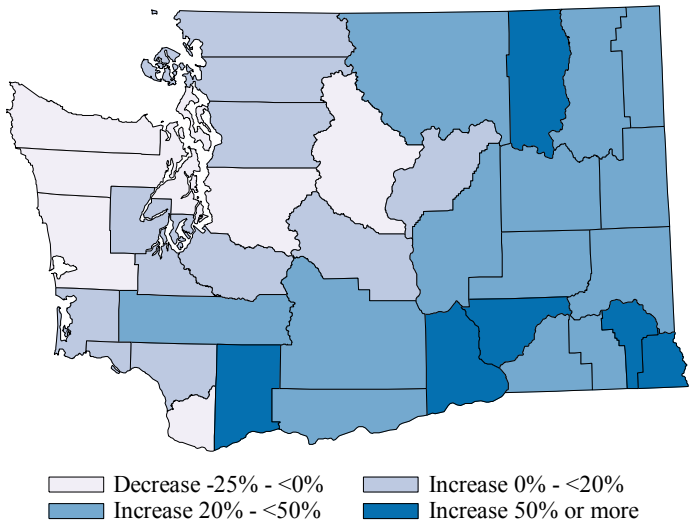


Figure 20. Change in Value of Sales in WA State counties, 2007 to 2012
(Source: copied from USDA, 2012 Washington)

The sample interviewed shows a similar distribution to the size of farm properties in Snohomish County, with the majority of farms in the categories 1 to 9 acres and 10 to 49 acre sizes and smaller numbers of larger farms. The charts below show the size distribution of properties of the interview sample as well as of Snohomish County.

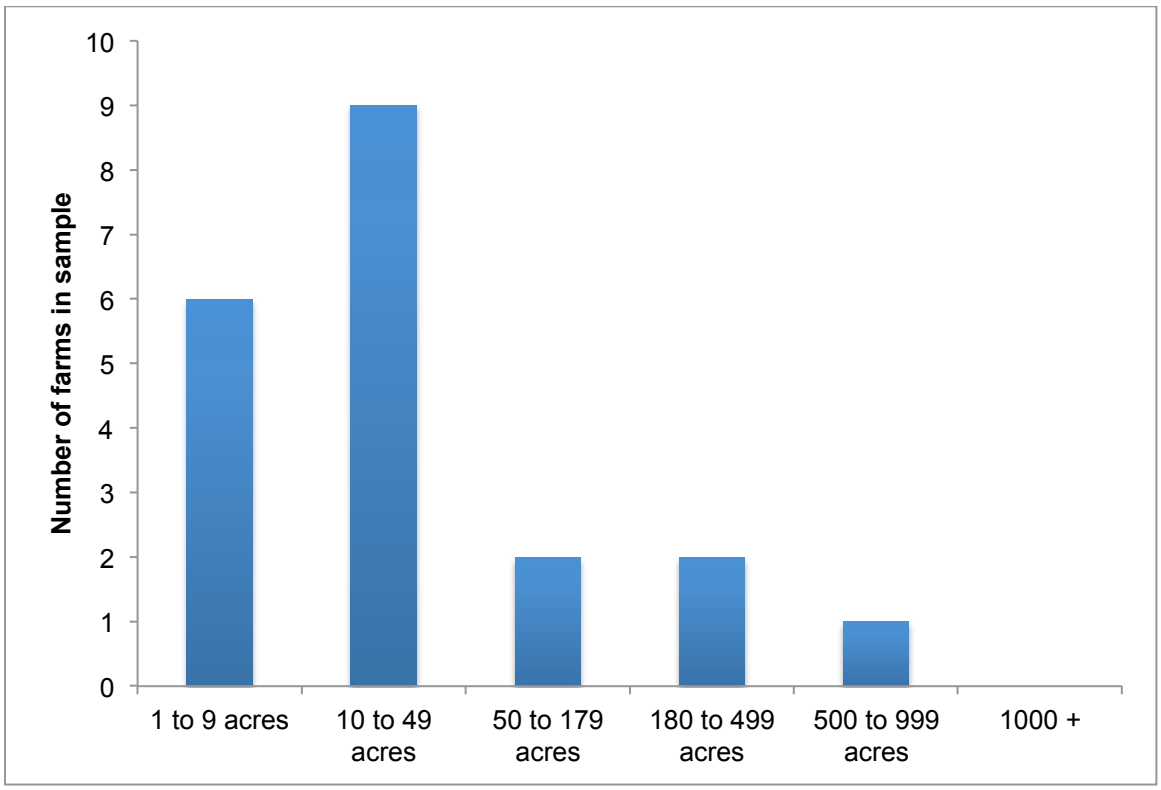


Figure 21. Distribution of Property Sizes of Interview Participants.
Source: Current study; Categories selected for comparison with data from Snohomish County below (number of farms is by property not respondent as two couples were interviewed; two of the farms included are properties owned by churches)

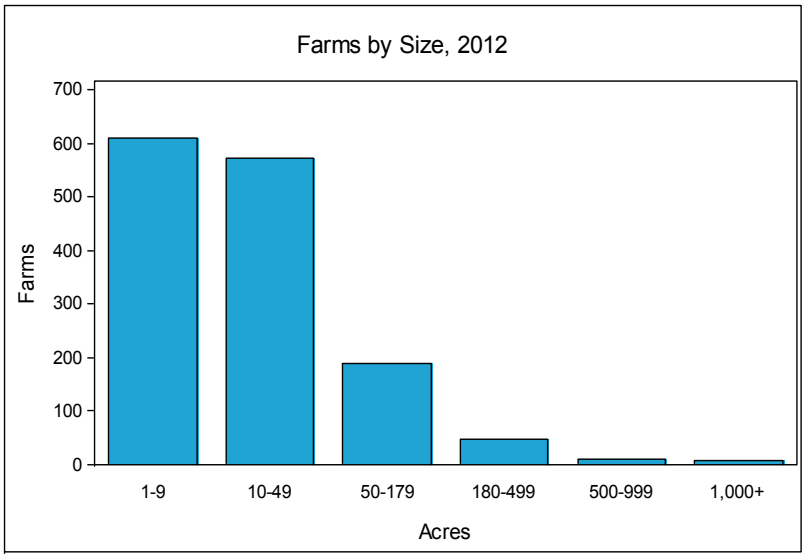


Figure 22. Distribution of Property Sizes of Farms in Snohomish County
Source: copied from USDA, 2012 Snohomish

Second, it appears that hobby farmers were more likely than full time farmers to agree to participate in the study. Only 3 participants obtained the majority of their income from productive activities on their land, representing 15% of the sample. This is a smaller percentage than in Snohomish County where 36% of primary operators have farming as their primary occupation (USDA, 2012 Snohomish County).

However, none of the CREP contract holders interviewed were hobby farmers (see definitions in figure below). Thus of the sample interviewed, CREP participants were full or part time farmers while those who had implemented non-CREP buffers were mostly hobby farmers.

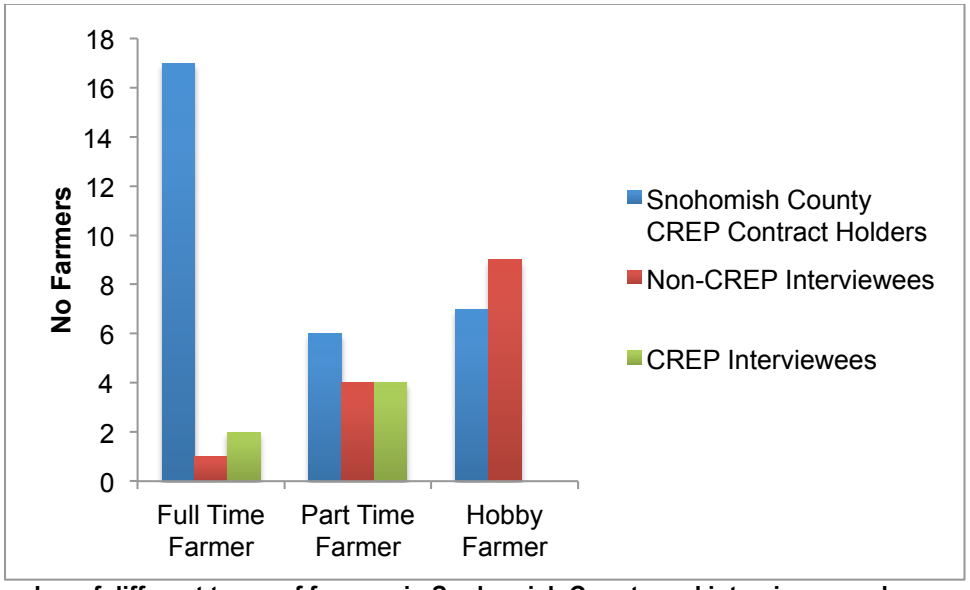


Figure 23. Number of different types of farmers in Snohomish County and interview sample.
Source: Data from Current study sample and Snohomish Conservation District. Full Time Farmers are those who obtain a majority of their income from productive activities on their land; Part Time Farmers are farms operated as a business but supported by off farm income; Hobby Farmers produce only for friends of family or have horses or other animals for personal use. Churches interviewed were excluded from this data.

The average sizes of interviewees properties are shown below. CREP interviewees had larger than average property sizes compared to all CREP contract holders in Snohomish County.

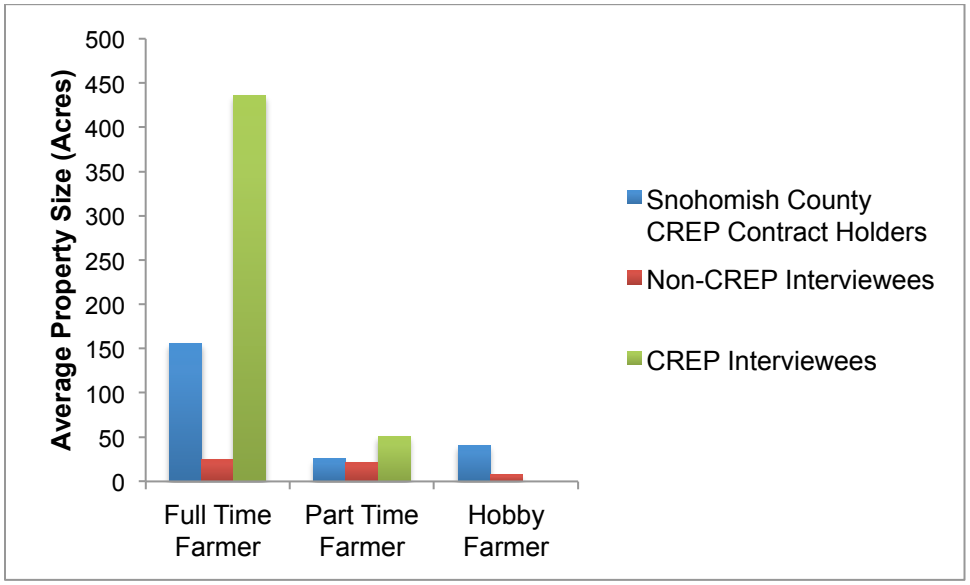


Figure 24. Average property sizes of different types of farmers in interview sample and Snohomish County CREP contract holders.
Source: Data from Current study sample and Snohomish Conservation District. Full Time Farmers are those who obtain a majority of their income from productive activities on their land; Part Time Farmers are farms operated as a business but supported by off farm income; Hobby Farmers produce only for friends of family or have horses or other animals for personal use. Churches interviewed were excluded from this data.

Age and gender breakdowns were not substantially different than statewide statistics (USDA, 2012 Washington). Participants included 9 women and 13 men.

Table 27. Age Breakdown of Interview Participants
Source: Current Study

Age Range	Number of Participants
30 to 39	2
40 to 49	8
50 to 59	5
60 or more	7

Participants in the sample had managed or farmed their land from between 1 year to over 30 years. A few had spent their whole lives on a farm while others were brand new to farming. The statewide average for time farming is 26.4 for those whose primary occupation is farming and 20.3 for those with another primary occupation.

4.3.2. Most farmers prefer a clean, well-cared for aesthetic

Installing a riparian buffer sometimes involves converting crop or pasture land into plantings of trees and shrubs. This can do two things: it can make the land look less neat and orderly and it obscures views of the waterway and in cases pastures on the other side of the waterway. Many farmers prefer a 'clean and neat' aesthetic versus a 'wild and natural' one. This is also partly practical. Machines do better with straight edges. Visibility of animals is important for easy monitoring. Depending on how they are installed, riparian buffers can help to straighten out a field by varying their width along the river and creating a straight edge on the field side.

Some hobby farmers or other types or rural landowners however preferred to 'let nature do its thing.' Some also valued the addition of plants and trees on their property and considered it an improvement. In some cases installing a buffer involved removing blackberry plants, which are considered a nuisance by many landowners.

While there were some differences in aesthetic ideals for farms as described above, there was much agreement on what a poorly managed farm looked like: muddy, poorly treated animals and disorganized. Some farmers expressed frustration at a poorly run farm that was visible from the highway, giving farmers in the region a bad rap.

> *"There's a particular farm . . . that's nasty and disgusting. And thousands of people see that farm down there and it's just a mud pit that animals are . . . sickly looking. And what this does is it kind of gives you that picture of the farm you know and it's just kind of, it gives a negative, a real negative impact on what farmers really are and what they do"*

Another theme is the different ideas that farmers and urban environmentalists have about the rural landscape. One farmer questioned the motivations of urban environmentalists. This farmer was frustrated with government regulations that seemed to be increasingly difficult to comply with and suggests below that urban environmentalists are more concerned with remaking the landscape into a park like recreational setting then their stated goals of salmon habitat restoration.

> *"Well, I mean this is the big question, you know. It just never stops. You know it's, take this now . . . is it just, and I don't think it has anything to do with the fish, I don't know, like I said I think they want, Seattle wants this to be their park. They can't have it both ways. They want to come out here and dictate to us . . . what we can do, they don't want smells . . . they want it to just look pretty, they wanna be able to see the cattle out in the*

field but they don't want no manure… you know, they can't have it both ways….they're gonna have to start living in the real world."

In the above quote the farmer also suggests that urbanites have an idealized version of agriculture, in this case preferring the view of cows without the smell of manure.

In sum, landowners varied in their aesthetic preferences, with some preferring more wild and others a more clean and organized look. However, in general landowners seek to take care of their land and improve it, though they may have different definitions of 'improve.'

4.3.3. Local community connection is more important than a 'Puget Sound sense of place' for many rural residents

Discussions about community and place connection elicited several different types of responses, ranging from place connections specific to the respondent's own land, to their community and for some to the Puget Sound as a whole. In general connections were stronger a community or town level than at the Puget Sound level.

For most rural residents community and connection is local, not Puget Sound wide. Many respondents associate most strongly with their local community, especially the relationships they have. When asked about connection to a local community or to the Puget Sound, one respondent said 'To me it's more about people,' a sentiment that several others expressed. Another pointed out that farmers often do not leave their community very often to have the experiences they would need to develop a connection to Puget Sound.

"Farmers are attached to the land and they seldom leave and they don't have time to go play in water."

A few landowners, however, did feel a sense of connection to Puget Sound. For example the following quote mentions the connection via water flowing from this farmers land to the ocean as well as the wildlife the sound supports.

"Even though I drive through my little community . . . every day, I just feel this big connection to the Puget Sound, cause . . . we are right here, and our water goes into the Puget Sound, and so . . . I feel really connected to it and all the wildlife and the whales and all that sea life."

Some landowners expressed a sense or responsibility towards protecting Puget Sound, despite not feeling a personal connection to it:

"I don't think a great deal of Puget Sound, but I think that we should all think enough to protect it"

Connections with their own land are also important, such as those developed through years of working on and observing their land.

"This is a home. . . This is where somebody lives and somebody has taken ownership of the land and responsibility for it. And they maintain that land . . . you look around, and you won't see any Scotch Thistles, that's not because I use chemicals on them, that's because I went around with a shovel and a cultivating fork and I dug every single one of them up that I could find, every spring. That's why they are not here."

Efforts to inspire action based on a Puget Sound sense of place may be difficult in rural communities. Locally focused action perhaps with connections to regional programs and goals, may be more effective.

A “Puget Sound Sense of Place” may not resonate as well as more locally specific place connections for some groups.

One respondent, a manager of church owned land, explained the connection between fishing, a healthy ecosystem and community. Healthy ecosystems are needed to support an abundance of salmon and crabs. As these species are caught in a short period of time, catching these species brings together many people from the community—a ‘holiday’ as the respondent says. Thus fishing and crabbing are experiences that connect people to both to the environment and their communities.

> *“Interviewer: Is it different to catch a salmon than say a trout?*
>
> *Respondent: Yea, they're bigger and they fight more and there's more meat and more to eat. And they're not as ubiquitous. You can catch trout any old time and they're not quite as tasty in my opinion. But salmon are kinda special and there's the salmon run so it creates a whole community dynamic around here too where on Facebook and people at church or at work, either catch a salmon or get one from someone who's caught and is giving them away. It's just kinda of a community conversation at that point, a shared experience, like a holiday almost.*
>
> *. . . Crabbing is a little bit like that. The season's relatively short and a lot of people like to crab. So you go down to the sub water part down the road and it'll be crabbing season and it's kind of like the opening day of salmon season, it's just a ridiculous amount of people out there just doing stuff. But it creates a community experience, shared experience that's really valuable. But if we trash the environment, we didn't have that, there where are people going to have the relation to the environment as well as one another, where it's kind of one and the same at that point. Where nature is actually creating the context for people to actually get together.”*

4.3.4. Participants expressed a wide variety of values and goals for their land or farm, especially the satisfaction of taking care of or working on their land

The majority of farmers interviewed in Snohomish County rely on other sources of income. Often one or more family members has an off farm job. These jobs are frequently their primary sources of income while farming is more about the experience, lifestyle, or hobby than income, as many respondents explained. Some people support their farm with their off farm job. The importance of making a farm profitable or at least not losing money varied across participants. Profitability was rarely the first thing mentioned when asked about their goals for their farm. As one farmer explains below, farming is not lucrative and those who farm do so because they want to.

> *“Well the land you need, the cost of the land and everything, you just can’t afford, you can’t justify it, other than just a hobby. You know, that you wanna do it. You might make a little bit of money, but just like with [a couple that farms], they both work. You know, the farm supplements it a little bit, they make enough to justify doing it, but as far as to make a living off of it, they couldn’t. They couldn’t survive off of it, especially by the time you pay all the taxes”*

Goals and values mentioned by farmers include: caring for animals, contributing to one’s community, preserving a farm or farming for future generations, farming as a way to connect with family or continue family traditions, personal and non-personal histories of the land, rural lifestyles, self-sufficiency, leaving the land better than one found it and sustainability.

Many farmers talked about the satisfaction of what they did. In the following quote, a part time farmer describes several motivations and values about their farm, including privacy, being on the river, and feeling like their property was 'heaven.' One farmer explained how despite the work being hard and taking a toll on his family, even the unglamorous work of scraping the feeders is exactly what he wants to be doing.

> *"But we had the farm, 'cause it was so private, and we loved what we did and we were on the river, and . . . you feel like you've died and gone to heaven, cause you have this big piece of property and it's, you get up every morning, it's a lot of work, it's a lot of work it really takes a big toll on a family, but it's worth it . . . I have no regrets, I remember my brother used to come and I'd be out scraping the feeders, and he looked at me and he goes what would you, 'if you weren't scraping the feeders what would you be doing?' and I'm thinking, scraping the feeder. I can't imagine anything else that I'd rather be doing."*

Caring for the land, acting as a steward, or improving it were often mentioned. The hobby farmer below describes being connected to their land, feeling home there. This individual also describes the importance of learning about their land and taking responsibility for not only improving the land but also figuring out how to do that. Also in the quote is a philosophy of relating to nature, i.e., not 'letting it go' but being part of it and actively managing it.

> *"My philosophy is that when I am gone, I want to leave it better than when I found it. But what is better? That's the responsibility that I have to figure out what is better. Just to walk away from it, let the blackberries take over everything and just let it go back to nature, I don't feel that's an improvement. We are part of the environment here also, I am part of Nature, I live here. This is where my home is. So the thing that I see is we all need to live here but we all need to be able to be able to figure out how to do it. "*

4.3.5. Motivation to participate in buffer programs depended on type of landowner

Participants who had installed buffers often had become involved with SCD because of some land management issue such as concern about stream bank erosion or drainage issues. Later some became motivated as well by the chance to improve their land and protect water quality.

While a variety of different types of landowners were interviewed, two general types of landowners can be conceived of for the purposes of thinking about riparian buffer programs: 1) full or part time farmers and 2) hobby farmers or other types of rural landowners (e.g., nurseries, animal training facilities, or horse boarding stables).

The first group, full or part time farmers, may require incentives to participate. Often technical, labor and material contributions that allow for the simultaneous creation of buffers alongside changes desired by the landowner can offer win-wins or at least compromises, e.g., stabilization of stream beds, measures to improve drainage, compost installation, etc. For these landowners, incentives in the form of these other projects to improve the productive capacity or function of the land are often the most important motivators.

Financial incentives were never the sole motivator, but for some farmers, such incentives played a role in choosing to sign up, especially if productive land was converted for part of the riparian buffer. The following quote explains how for one full time farmer, the income from the CREP program was helpful for the farm. In this case a small amount of productive land and a larger amount of land that was not being used was enrolled in CREP:

> *"We thought that would be a nice income too . . . you know to supplement [the] farm and . . . [in] comparison to what [the] land . . . could be utilized for . . ."*

Allowing flexibility in location and width of buffers can increase likelihood of participation. Given that agricultural lands are far from homogeneous, some fields or pastures are more critical to farming operations than others. Most farmers desire a collaborative relationship that allows for customized solutions. SCD helps farmers by listening to their situation and then applying their knowledge of the various grants, programs, and support available for projects including riparian buffers. In this way they play an important role. However, they are limited by the existing program structures and rules.

The following quote from a full time farmer describes how three factors were important in signing up for CREP: 1) being able to enroll lots of unutilized land and only give up a small amount of productive land; 2) to slow down erosion of the river bank; and 3) to be a good steward of the land and create habitat.

> *"The primary motivation was the fact that there was a lot of land on the river side that was unutilized that could be a part of the program, even though we knew we had to take land that was production land . . . It was worth giving up a little bit of that to make this project work, in conjunction with . . . [to] slow down some of the erosion process that the floods would do . . . I wanted it [the farm] to be a successful . . . [and] to be a good steward of the land, and felt doing the CREP project was doing that too because it created some more habitat for certain wildlife, you know, whether it's the eagles or coyotes"*

The second group, landowners with smaller parcels for family scale production, hobby farms, or horse pastures can be engaged to work with SCD or NGOs on projects to improve water quality and salmon habitat. However, given their small size, they require flexibility in implementing projects. These landowners often are not using their property for primarily income generation so they may be more willing to 'give up' land for buffers, provided it does not impinge too much on their other activities. Most of the hobby farmers interviewed had implemented a non-CREP riparian buffer, i.e., they received assistance in the form of labor, trees or technical help, but no annual rental payments. The assistance in the form of plants and labor were important for many hobby farmers. Some explained that they wanted to put in a buffer but did not have the means to do so without assistance for labor and plants. For example:

> *"we wouldn't have been able to do all the hard work to plant it and to do as much maintenance"*

In the following quote, a hobby farmer explains several of the important motivating factors in putting in a riparian buffer. As with many other landowners, initially, they were concerned about their creek moving and eroding the beds. Since they valued the current position of the creek on their property they were concerned about this change. They also mention at the beginning concern about the impacts of stream bank erosion on salmon. They were able to work with SCD to modify the initial plan of planting 50 feet on each side of the river to only 25 feet. This flexibility to adjust a project to fit with a landowners needs was important for many respondents. Finally, they felt good about the project because they consider themselves environmental stewards.

> *"We saw the erosion that was going on. Over the space of a number of years we lost huge swathes of our creek side and we knew that A) that was damaging the salmon B) we were going to have a vastly different creek from that we had when we started, that [creek that] we liked. So we contacted initially Surface Water Management and then after them the Conservation District. They came out and they offered us support to plant up to fifty feet, which was too far for us, on either side of the creek. And all we had to do was say yes because they would bring in the plants, they would do the plantings. Since my wife and I tend to be oriented towards being environmentally stewards approach to just using the land, this felt pretty good. They offered a lot of help in designing the layout, what plants would be appropriate for a river area that was a wetland and for our climate.*

Lots of native plants. So we were encouraged by their willingness to both provide materials and provide the labor."

The above quote reflects many common themes for hobby farmers such as concerns about erosion as well as a desire to be environmental stewards. This couple was happy that SCD offered technical assistance ('help in designing the layout') and project management ('all we had to do was say yes'). While some hobby farmers shared a desire to 'just say yes' and let the district manage the project, others wanted to play a more active role in the project and have more control.

As with full and part time farmers, flexibility to make the project work with their own land and goals was important for hobby farmers:

"the Conservation District was really excellent at telling us 'Here's what would be ideal, what can you deal with?' And it was a great negotiation."

The managers of church properties mentioned a few additional motivations that were important to them as institutions and community organizations. Below, the respondent explains how community relations, a Christian stewardship ethic as well as opportunities for outdoor education were all benefits of creating a riparian buffer.

"cause we're an entity, we're an organization, and a religious organization at that so, there's expectation that we ought to do more than the average. That's not always something that's been self evident to Christian organizations. . . . it's something that is slowly dawning on us, that we really do have an obligation as a statement of faith to take care of the environment God created and wants us to take care of. So . . . we should do this as a matter of our whole mission, as well as community relations and outdoor education. The outdoor education piece is like a nice collateral benefit. We say if we're doing all this why don't we build some curriculum around it. Cause we have schools coming here doing outdoor education already and so why don't we incorporate some classes having to do with human impact on the water or how to improve water quality."

In sum, many different factors were important for motivating participation and usually several factors combined to make the project attractive.

4.3.6. Barriers include loss of land, loss of control, regulatory restrictions, and differences in local versus scientific knowledge

Two key issues found by Breslow (2011) in Skagit county were also present in this work in Snohomish: 1) consideration of responsibility and fairness in terms of salmon restoration; and 2) differences in views and concepts of nature between environmentalists and farmers. However, the way participants in this study talked about these themes was different than in Breslow's work. In the Snohomish sample, respondents were more likely to blame urban areas and new residential developments for impacts to water quality than to blame tribal fishing (though that topic came up occasionally).

Some farmers are frustrated and feel they are not being fairly treated compared to other sectors in the region, especially residential areas.

"The people that live in the hills and all these fancy houses and everything, they're beating us down, we're the last ones before the river. So we're doing all the polluting. But it's also coming from upstream."

Many landowners and farmers, given how they live and work on their land daily, have substantial local ecological knowledge about the history and seasonal cycles on their land. While scientific knowledge

offers generalizable results, farmers and landowners knowledge offers specific understanding of processes on their own land. Below, a hobby farmer discusses the riparian buffer installation. They suggest that the people putting in the buffer ignored the farmers' suggestions and local knowledge.

> *"I mentioned a couple things to them when they were doing it and they just kind of nodded their head went back to their book. This is how the book says to do it. Um and I wasn't offended by that, I was thinking ok we are searching for knowledge, where's the knowledge? These folks have studied this a lot, they have put a lot of years of study into this they know a lot but maybe because I live here I know more specific information. And I think the specific information is really important. It needs to be embraced a little bit stronger."*

Considering this knowledge along with expertise from restoration ecologists could be helpful. For example, landowners may be able to explain which areas have flooded in recent years or what parts of the creek receive more sun or shade. In other cases, landowners may misinterpret their observations, such as not differentiating between salmon runs and which runs are endangered. Some focused more on the filtering function of buffers and questioned the purpose of wider wooded buffers.

Most important may be listening to and considering landowners' local knowledge. Farmers and landowners generally have an experientially based understanding of the land management practices that can increase productivity and they have often observed how such practices impact both crops and domesticated animals as well as wild plants and other wildlife on their land. For example:

> *"Unless you really go out here and live it, you . . . [are] never gonna understand it"*

In the below quote, a farmer expresses frustration at fish biologists not explaining why farmers would need to make changes.

> *"there was a bunch of people called fish biologists that . . . acquired the ability of being smarter than everybody else when the fish were listed. And . . . we'd sit out there as farmers and say why do we need to do this? And 'Because I said so, I'm a fish biologist.' You know it's been like a little kid that's got a dad or a mom that doesn't teach them anything except well I said so, so that's why you do it, and I'm bigger than you."*

A critical issue for many farmers is the loss of productive land. One farmer pointed out that this loss would be ongoing and thus, if substantial, compensation would also need to be ongoing to balance out the loss.

> *"There would have to be some kind of, definitely some sort of compensation. . . but it would have to be a long term thing because when my son, or when the next generation comes in, they're gonna be going 'well we had 10 acres over here and my dad when he was farming, they used to pay him, how come you're not gonna pay me?'. . . .So it's gotta be . . . a real long term thing because really you're losing all that land, and in the farming industry that's all you got"*

Another key point is loss of control over the land. One respondent with an off-farm job explained that control of their land was more important than financial assistance.

> *"The financial assistance is good but not necessary. . . I'm a working guy. I have a paycheck, I don't mind spending my money on the place so. But the big thing is don't give me restrictions that I can't live with. That's what the government does that is the hardest thing to deal with. They make restrictions that you can't live with. So they need to be more sensitive to that."*

The cost of complying with regulations was another issue that often came up. Below a farmer explains how regulations can change the types of farms that can remain in business.

> *"We need to do things different, but even the regulations to do things different, it's getting to the problem where only the rich farmers can afford to comply with all the rules and regulation . . . it's happened just like it did with the oil companies and the little ma and pa stores who are out of business, because, you know, big business has taken over, because the little ones can't afford to comply with the regulations, and it's gonna be the same way with farming."*

Restrictions in the CREP program were also an important barrier, specifically concerns about restrictions for selling the land and the 'no touch' requirement. Many respondents were interested in the idea of working buffers, which are riparian buffers that function as a buffer while providing other ES, such as a place for growing mushrooms, fruit trees, berries or materials for basket weaving, and/or a nature trail.

4.3.7. Suggestions for improvement

For many farmers, flexibility and individualized plans are important and they suggested that more farmers would be interested in programs that fit with individual farms.

> *"When you talk about buffers, you know, they talk about water quality, a lot of it is timing, when you're putting cattle out on the fields, and you know there's just so much more to it to work, you know, one size fits all program is just not, not enough feasible for every body."*

Another suggested more contact with knowledgeable and receptive outreach or extension agents. Below, a respondent explains that not only do farmers want advice but also someone who will listen to them.

> *"They should put their resources into knowledgeable people who can assess and advise. And who will listen. . . . Get a knowledgeable person who is well educated in this area and who's got experience in this area, get them to assess what's going on, talk with the people live there and you know if you get the people who live there interested they'll start really watching."*

Building relationships was also suggested as important. One farmer suggested that to get more farmers on board with riparian buffers an organization would have to come out and spend the time and effort to really build a relationship with a popular farmer in the region by offering him or her lots of help.

> *"I would probably find the most popular farmer in the valley, and just schmooze him, just kiss his ass the whole time, 'we're gonna come out, we're gonna do this for ya, we're gonna do that for ya, you know we're gonna go through,' and once you kind of re-establish that relationship he's gonna talk, and that's gonna spread."*

Some people also mentioned frustration at the slow speed of the process and the high turn over rate among the groups they worked with.

One respondent expressed that the selection of where to plant which trees or shrubs needed improvement to increase the survival rate of the plantings.

> *"I wanted to make them [the planting crew] all t-shirts that say "look up" because they would plant a western red cedar two feet from the base of a hundred foot Sitka spruce."*

4.4. Discussion

4.4.1. Designing Effective Riparian Buffer Programs

Width and length as well as continuity of riparian buffers are important for the many functions they provide for salmon and ecosystem health. Smaller grassy buffers help to filter agricultural runoff whereas wider buffers including shrubs and trees can help to stabilized stream beds, provide woody debris (important for fish habitat), and critically shade streams. Shading is the most important function for salmon as it lowers water temperature. Downstream these factors can contribute to a healthier marine ecosystem and more productive fishing grounds (Stoffyn-Egli and Duinker, 2010; Desbonnet et al., 1994).

Recent pressure from tribal governments concerned about salmon populations has led some groups to recommend increasing the required buffer width to a 100 feet minimum. The Northwest Indian Fisheries Commission (Treaty Rights at Risk, July 2011) called for greater leadership and action to protect endangered salmon populations, including a recommendation to increase minimum riparian buffer widths from 35 to 100 feet in federally supported grant programs on agricultural lands (p. 26). In December 2013 the Washington State Conservation Commission produced a report analyzing Conservation Reserve Enhancement Program CREP's effectiveness (Smith, 2013). This report stated that 80% of all CREP forested buffers are already 100 feet or greater, with an average width of 142 feet. The report argued that the proposed rule change would ultimately lead to reduced riparian buffers enrolled in the program as less land would be eligible. Allowing 35 foot buffers means that farms can create more continuous buffers through areas where 100 foot buffers are not acceptable to the landowner, due to, for example, the presence of buildings or critical crop or pasture land. This issue highlights a key challenge for conservation programs that work on agricultural lands—how to create programs that are both effective at achieving conservation goals but also acceptable to farmers.

Continuity of buffers is also important (Stoffyn-Egli and Duinker, 2010; Desbonnet et al., 1994). An important area of future research is the extent to which targeted efforts focused on particular creeks or watersheds can be more effective socially as well as ecologically. This work has highlighted the importance of personal relationships and connections as well as community involvement. Can such locally situated responses be harnessed to increase landowner enrollment?

One respondent recommended greater focus on recognition for landowners' efforts. Honoring and promoting the contribution of landowners who go 'above and beyond' by enrolling in riparian buffer programs should be studied as a potential strategy for increasing participation. However, cooperation might also be hindered by a desire for independence on the part of rural landowners. Such efforts should consider language used—aesthetic and cultural values of ecologists and environmentalists may clash with rural worldviews.

An important strategic question remains: should resources be focused on many small landowners to create flexible and widespread buffers or concentrated on larger projects with large landowners? Landowners with smaller parcels have several advantages. They may be more likely to get involved, require less or no compensation for loss of productive land and can become advocates and allies. However, many may not have enough land to allow for wider 100 foot or more buffers. Answering this question will require an understanding of what approach is ecologically most effective as well as what might be most realistic to implement. Ultimately, a combination of programs for large and small landowners may be the best approach. This research has highlighted a variety of different motivations and values of landowners enrolled in riparian buffer programs. Further research is needed to identify more clearly how these motivations differ between hobby farmers and full or part time farmers.

4.5. Conclusion

The results of this research show that increasing the number of landowners enrolled in riparian buffer programs is best achieved by a suite of programs with different types of structures, rules and incentives. Such an array of programs would allow for a broader and ultimately larger group of landowners to be reached. Each landowners' particular situation is unique. People and programs that are able to work with individual landowners to develop a package of projects, commitments and incentives are generally met

with greater interest and enthusiasm from landowners. While wider buffers are ecologically preferable, limiting policy mechanisms to one set of standards with stringent requirements and wider buffer requirements is unlikely to increase enrollment. To the contrary, it is most likely to exclude landowners who are not able or willing to meet these requirements. Providing additional incentives for wider buffers while encouraging and supporting a variety of programs that support creation of narrow buffers, hedge rows, or other projects to improve salmon habitat (woody debris projects for example) is likely to bring in a greater number of landowners.

Finally, and most importantly, this work shows that participation in riparian buffer programs is motivated by a wide variety of values, but rarely is economic gain foremost among them. Financial incentives are important, and may be critical for some participants especially if productive land is converted to a riparian zone. Also, cost sharing to pay for planting and labor is key. However, no one enrolls only for the money. Presenting participation in buffer programs as a form of stewardship and a way to give back to the community can make participation more attractive. Ultimately a combination of factors is likely to motivate more landowners to improve riparian habitat on their properties, including the opportunity to improve the land (e.g., via stream stabilization or improved drainage), values like community and stewardship, technical assistance, relationships with people and organizations, and financial assistance.

> *"Puget Sound and it's health is integral to the health of the whole region. And it's kind of the gem of Washington State. It's also one of the most gorgeous and amazingly biodiverse areas in the lower 48 and I think it's criminal for us to behave and live in such a way that we end up sterilizing the sound. We all have to work together at some level."*
>
> -Manager of a church property with a riparian buffer

Chapter References

Breslow, S. J. 2011, January 3. *Salmon Habitat Restoration, Farmland Preservation and Environmental Drama in the Skagit River Valley*. (E. S. Hunn). University of Washington.

Chan, K. M. A., T. A. Satterfield, & J. Goldstein, 2012. Rethinking ecosystem services to better address and navigate cultural values. *Ecological Economics*, *74*(0), 8–18. doi:10.1016/j.ecolecon.2011.11.011

Desbonnet, Alan, Virginia Lee, Pamela Pogue, David Reis, James Boyd, Jeffrey Willis, and Mark Imperial. 1995. Development of Coastal Vegetated Buffer Programs. Coastal Management, Volume 23, pp. 91-109.

Heath, C., & D. Heath, 2010. *Switch*. Crown Business.

Northwest Indian Fisheries Commission. 2011. *Treaty Rights At Risk* (pp. 1–35). Olympia, WA: Treaty Indian Tribes in Western Washington.

Northwest Indian Fisheries Commission. 2014. Annual Report 2014: Tribal Natural Resources Management. *Nwifc.org*. Olympia, WA. Retrieved December 29, 2014, from http://nwifc.org/w/wp-content/uploads/downloads/2014/01/annual-report-14-final.pdf

Smith, C. 2013. *2013 Implementation and Effectiveness Monitoring Results for the Washington Conservation Reserve Enhancement Program (CREP),* pp. 1–38. Washington State Conservation Commission.

Stoffyn-Egli, Patricia, and Peter N. Duinker, 2013. An Ecological Approach to Riparian-Buffer Definition, and Implications for Timber Harvests in Nova Scotia, Canada. Journal of Sustainable Development, Vol. 6, No. 12, 111-134.

US Department of Agriculture (USDA). 2012 Census of Agriculture: Washington Highlights. US Dept of Agriculture.

US Department of Agriculture (USDA). 2012 Census of Agriculture County Profile: Snohomish County Washington. US Dept of Agriculture.

5. CONCLUSION

Securing a healthy, prosperous future for Puget Sound will require careful attention to the relationships between ecological resources and human populations. As Puget Sound's economy transitions from one based primarily on resource extraction and farming to one based on technology and tourism, greater attention must be paid not only to the diversity of uses of the landscape – recreation, farming, subsistence fishing and harvesting, for examples – but also the diversity of meanings: the multiple values of place. This report takes a step towards systematically describing, measuring, and documenting these values.

Outdoor recreation is an important source of value for many thousands of Puget Sound residents. Chapter 1, The Values of Coastal Recreation, provided an economic and spatial baseline documenting the significance of recreational activities, the direct impact of recreational spending, and the spatial patterns of recreational activity in the coastal Puget Sound region. We used GIS analysis to map the location of different recreational activities, and identify the patterns of clustering around landscape attributes that characterizes coastal recreation in Puget Sound.

Sense of place also provides Puget Sound residents with a source of non-economic value and meaning that cannot be fully captured through measurement of expenditures or mapping of activities. Chapter 2 offered some notes towards capturing an evolving regional sense of place in Puget Sound through an exploratory sample of semi-structured interviews. Interviewees noted that the economic transition underway in Puget Sound detaches people from place, opening up dangers of environmental degradation. The crowdedness of public recreational areas was also mentioned, raising the possibility that the region may be "loved to death" from overuse.

Our report also highlighted the tradeoffs between different values of a single place. The issue of riparian buffers was explored as an apt example of such a tradeoff. Restoring riparian biodiversity, which could increase the likelihood of restoring historic salmon runs, requires conversion of farmland to habitat in the form of riparian buffers. Riparian buffers—vegetation strips along streams and waterways—are key for both salmon recovery efforts and watershed restoration in the Puget Sound region. However, such conversion requires farmers to give up portions of their land, and raises questions of the relative importance of ecological restoration and farmland preservation.

We examined the question of riparian buffers from two separate angles: the Puget Sound recreating public, through our recreational survey, and farmers themselves, through semi-structured interviews. Chapter 3, The Values of Riparian Buffers, examines the issue from the public's perspective via a choice experiment. We found that the recreating public is willing to pay for riparian restoration on converted farmland, though its incremental willingness to pay decreases at higher levels of riparian habitat quality. The recreating public is also indifferent to low to moderate levels of farmland conversion, though they have a strong preference against relatively high (16%) levels of conversion. These results suggest that moderately sized riparian buffer programs are likely to be acceptable or even desirable to the public.

Chapter 3, Place-Based Study, examines the issue of riparian buffers from the farmers' perspective, via semi-structured interviews with farmers of various types in Snohomish County. Our study sought to better understand the motivations of rural landowners to participate in riparian buffer programs. Special attention was given to the perspectives as well as aesthetic and cultural values of landowners about the importance and meaning of 'nature' and 'place.' Our study found a diversity of attitudes towards riparian buffers, with some common themes emerging. Allowing flexibility in location and width of buffers, to account for the heterogeneity of farm plots, can increase likelihood of participation. Most farmers desire a collaborative relationship that allows for customized solutions. One-size-fits-all programs were seen as threats to farmers' autonomy. Financial incentives, though never the sole motivator, played a role for

some farmers in choosing to enroll in riparian buffer programs, especially if productive land was converted to buffer. A sense of land stewardship was also an important motivator, encompassing both pragmatic concerns for streambank erosion and spiritual values of protecting creation.

We envision this report as a step in the process of developing a body of robust, interdisciplinary regional social science focused on Puget Sound. We encourage further work to take place in a number of areas, of which we mention three in particular. First, we encourage additional exploration of a Puget Sound sense of place. Some, but not all, of our interviewees expressed a sense of place that encompasses the region; others focused primarily on their specific community or watershed. The nature of a regional sense of place, and its relationship to more local senses of place, can be explored further. Second, we encourage additional analysis of the public's willingness to pay for ecological restoration programs of different types, including further inquiry on riparian buffers. In particular, we encourage the exploration of public willingness to pay for "working buffers" – riparian zones with public or community access for fishing, hunting, swimming, birdwatching, or other forms of recreation or subsistence activity. Third, we encourage further inquiry into the relationship between local knowledge, ecosystem science and policy formation and implementation. From our interviews with farmers around attitudes towards riparian restoration, we concluded that respect for local knowledge, and flexibility in the implementation of policies to account for local context, was an important factor in determining whether farmers' attitudes towards riparian buffers were positive or negative. We imagine this dynamic may hold true for other Puget Sound environmental policy issues as well. Ultimately research on the human and cultural dimensions of ecological restoration in the Puget Sound will require studies that not only cross disciplines but examine the relationships between local and regional scales.

Acknowledgements

We thank the employees of the Snohomish Conservation District for helping us to identify the unresolved issue of riparian buffers and connecting us to farmers involved in buffer creation and expansion. A total of 26 interviewees from Puget Sound generously donated their time to us. Kelly Biedenweg and Tessa Francis from the Puget Sound Institute provided useful feedback throughout our project. We are grateful for Terre Satterfield's guidance regarding the qualitative analysis components. We thank Justin Ashworth for sharing his coastal recreation photographs and permitting us to use them. We thank Kristen Sheeran of Climate Solutions (formerly Ecotrust) for supporting the early stages of this work.

Appendix A. Coastal Recreation Survey Questions

The following is an exact copy of the survey text regarding coastal recreation questions.

Welcome! We are conducting a survey of recreation activities in the coastal areas of the Puget Sound region. This survey is being conducted to help inform planning and management of the Puget Sound. We want to hear from you even if you have not visited the Puget Sound coastal area recently.

Q1. Have you been to the coastal areas of the Puget Sound region (yellow area) for **primarily recreation purposes** at least once in the last 12 months?

For the purposes of this survey, recreation includes activities such as beach going, wildlife viewing, scenic enjoyment, kayaking, fishing, clamming, etc.

The following questions are about your trips to Puget Sound coastal areas during the last 12 months. A trip is defined as an **intentional trip** to Puget Sound coastal areas **separate from your daily routine**. For coastal residents, daily routine activities could include daily dog walks on the beach or driving along the cost to get to work/the store. For this survey we are inquiring about your **intentional trips** (e.g. day/weekend trips, vacations, etc.) to the coast that are separate from your daily routine.

Q2a. Please estimate how many trips you have made to Puget Sound coastal areas (see yellow area) in the last 12 months. Again, a trip is defined as an **intentional trip** outside of daily routine. Your best estimate is fine.

Q2b. You previously responded that you made **[INSERT RESPONSE FROM Q2a]** trip(s) to Puget Sound coastal areas in the last 12 months. Please indicate how many trips were made for the following primary purposes. The primary purpose is what primarily motivated you to take the trip(s) outside of your daily routine.

- Outdoor Recreation
- Leisure/Tourism
- Visiting Family/Friends
- Work Travel
- Other

Info popup for Outdoor Recreation:
Outdoor Recreation includes activities such as beach going, sightseeing/scenic enjoyment, hiking, biking, walking, kayaking, boating/sailing, camping, photography, swimming, clamming, fishing, etc.

Info popup for Leisure/Tourism:
Leisure and Tourism includes activities such as dining, shopping, golf, attending festivals/events, eating at a restaurant, etc.

Q3. We are interested in knowing what types of outdoor recreation activities you do when you go to the coastal areas of the Puget Sound region. Which of the following activities have you participated in **during the last 12 months** in the Puget Sound?

- Beach going (sitting, walking, jogging/running, dog walking, kite flying, etc.)
- Hiking
- Biking
- Camping
- Photography
- Sightseeing/Scenic enjoyment
- Sitting in your car watching the scene
- Collection of non-living resources/beachcombing (agates, beach glass, driftwood)
- Wildlife viewing (e.g. watching whales, birds, seals, and/or other marine life)
- Horseback riding
- Tide pooling
- Fishing from shore/boat (e.g. hook and line, crabbing, spearfishing, etc.)
- Collecting/picking/harvesting sea life from shore (clamming, seaweed, mussels, etc.)
- Hang gliding/parasailing
- Skim boarding
- Surfing (board, boogie, paddleboard)
- Swimming in the ocean
- Windsurfing/Kite boarding
- Free diving/snorkeling (from shore, from boat)
- Kayaking/Canoeing/Rowing in the ocean or estuary/slough
- Power boating/Jet skis
- Sail boating
- SCUBA diving (from shore, from boat)
- Other, please list:

Q4. For how long have you been visiting the coastal areas of Puget Sound and enjoying one or more of the activities you identified?

- Just the last year
- One to three years
- About four to ten years
- More than ten years
- All my life

Q5. Below is a map of the coastal counties within the Puget Sound region. You previously responded that you took **[INSERT RESPONSE FROM Q2b – Outdoor Recreation]** trip(s) to the Puget Sound region for outdoor recreation in the last 12 months. Please indicate **the number of trips in which you went to**

each of these coastal counties for outdoor recreation in the last 12 months on the map below.

If you did not take a trip to a particular coastal county, please choose 'zero'. Your best estimate is fine.

Now we'd like you to think about your **last trip** to the coastal areas of Puget Sound (see yellow area in map) that was **primarily for outdoor recreation purposes** . A trip is defined as an **intentional trip separate from your daily routine**. For coastal residents, daily routine activities could include daily dog walks on the beach or driving along the cost to get to work/store. An **intentional trip** (e.g. day/weekend trips, vacations, etc.) is separate from your daily routine.

Based on this, we'd like you to answer the following questions about your **last trip** to the coastal areas of Puget Sound that was **primarily for outdoor recreation purposes** .

Q6. When was the date of your **last trip** to the coastal areas of Puget Sound that was **primarily for outdoor recreation purposes?** Your best estimate is fine.

Q7. How many nights did you spend at the coast during your **last trip** to the coastal areas of Puget Sound that was **primarily for outdoor recreation purposes?**

Q8a. On your **last trip** to the coastal areas of Puget Sound that was **primarily for outdoor recreation purposes** did you start your trip from your home?

Q8b. If you did not start your last trip from home, what city and state did you start your trip from?

Q9a. What was the primary mode of transportation you used to get to the coastal area of Puget Sound on your **last trip**?

- Bus
- Bike
- Walking
- Drove personal vehicle
- Drove a rented vehicle
- Rode with someone else – carpooled
- Ferry (without a personal vehicle)
- Train
- Other, please specify:

Q9b. How would you describe the car that you used to get to the coast of Puget Sound on your **last trip**?

- Compact car, small sedan, or hybrid
- Medium sedan
- Large sedan/Wagon
- SUV, Pickup truck, or Mini-van
- Other, please specify:

Q9c. How many passengers (including yourself) were in the vehicle with you on your **last trip**?

Q9d. How many of those passengers were your children/dependents?

Q10. Approximately how many people (including yourself) went on your of your **last trip** to the coastal areas of Puget Sound that was **primarily for outdoor recreation purposes?**

Q11. During your **last trip** to the coastal areas of Puget Sound, what outdoor recreation activities did you participate in? Select all that apply.

- Beach going (sitting, walking, jogging/running, dog walking, kite flying, etc.)
- Hiking
- Biking
- Camping
- Photography
- Sightseeing/Scenic enjoyment
- Sitting in your car watching the scene
- Collection of non-living resources/beachcombing (agates, beach glass, driftwood)
- Wildlife viewing (e.g. watching whales, birds, seals, and/or other marine life)
- Horseback riding
- Tide pooling
- Fishing from shore/boat (e.g. hook and line, crabbing, spearfishing, etc.)
- Collecting/picking/harvesting sea life from shore (clamming, seaweed, mussels, etc.)
- Hang gliding/parasailing
- Skim boarding
- Surfing (board, boogie, paddleboard)
- Swimming in the ocean
- Windsurfing/Kite boarding
- Free diving/snorkeling (from shore, from boat)
- Kayaking/Canoeing/Rowing in the ocean or estuary/slough
- Power boating/Jet skis
- Sail boating
- SCUBA diving (from shore, from boat)
- Other, please list:

Q12. Of the outdoor recreation activities you just selected, what was your primary activity during your **last trip** to the coastal areas of Puget Sound?

Q13. Mapping of Coastal Recreation activity locations
In the mapping component the respondent will be presented with a navigable map of the coast (e.g., Bing maps) and will be asked:

1) Navigate the map or use search function to zoom to the areas which they conducted outdoor recreation activities on their last trip.
    a. The user can utilize a search function (similar to google maps) to zoom to specific areas
    b. The user can zoom in and out and move the map around to navigate the map to specific areas
    c. If the use zooms out to far and attempts to drop an activity marker they will be prompted to zoom further in.
2) For each activity marker placed the user will be asked to associate one or more activity with the activity marker they place on the map
3) For each activity marker placed the user will also be asked:
    a. How many hours did you spend at this site on this trip?;
    b. Why they chose to recreate at this particular place:
        i. Please indicate why you chose to recreate at this particular site: Respondents may select more than one. List will be presented in randomized order.
            1. The water is clean, clear and/or good to swim in
            2. The site has good facilities/amenities/access (e.g. parking, bathrooms, picnic tables, marina, camping, trails, etc.)
            3. The site is beautiful or has striking natural features
            4. The site is perfect for my particular activity (e.g. surf break, fishing area, dive site, etc.)
            5. Wildlife is abundant and diverse
            6. It's close to home/work/where I'm staying
            7. The site is large and offers room for exploration
            8. The site is secluded, away from crowds, and offers privacy
            9. This is where my friends or family have always gone
            10. I have lots of memories from this place
            11. This is a spiritual/inspiring place for me
            12. There are specific natural resources I like to collect here
            13. It is a place I can learn about, teach, or research the natural environment
            14. I feel healthier after going to this place
            15. Other <fill in>
    c. Which description best matches how you experienced this place you visited on this trip?
        1. Visiting this place was extremely powerful emotionally, e.g., deeply restorative or inspiring
        2. Visiting this place was a great experience, e.g., refreshing, a chance to recharge and relax
        3. I enjoyed visiting this place, but the experience was not special.
        4. I did not enjoy my visit to this place.
        5. Visiting this place was disappointing and/or frustrating
    a. Please explain why you described your experience at this place in this way.
    b. Imagine this place you visited on this trip was ruined in your estimation for some reason. Would such an outcome be:
        1. Extremely upsetting—the place is irreplaceable and/or I have a special connection* to it
        2. Upsetting—it's a great place, but there are a few others I could potentially go to instead
        3. Mildly Upsetting--It wouldn't bother me that much, there are some good alternatives
        4. Nothing to worry about, there are lots of places that are just as good
        5. For the best, the place is not worth visiting.
4) Once all activity markers have been placed the activity markers for the primary activity indicated in the previous portion of the survey will be presented
    a. Users will be prompted to distribute 100 pennies across this primary activity to indicate the relative value of each location to their use of this activity
    b. This distribution of value will then be subsequently used with the trip expenditure data collected further in the survey to estimate the value of coastal and ocean recreation areas.

Q14a. During your **last trip** to the coastal areas of Puget Sound that was **primarily for outdoor recreation purposes** , please indicate if your party spent money on the following items:

- Parking
- Car fuel
- Airline flight
- Bus/Ferry/Train ticket
- Food and beverages from a store
- Food and beverages at a restaurant or bar
- Shopping and souvenirs (t-shirts, posters, gifts, etc.)
- Sundries (sunscreen, surf wax, motion sickness pills, batteries, camera data cards, etc.)
- Car rental
- Dive equipment rental and airfills
- Equipment rental (Surfboard, bike, kayak, stand up paddle, etc.)
- Lodging/Campsite Fee (if you stayed overnight)
- Charter fee (whale watching, etc.)
- Park entrance, museum, aquarium, or other entrance fee
- Lessons, clinics, camps
- One-day fishing license fee
- Bait and tackle
- Boat fuel
- Boat rental
- Boat ramp fees
- Other, please list

Q14b. During your **last trip** to the coastal areas of Puget Sound that was **primarily for outdoor recreation purposes** , please estimate how much **your party** spent on the above items and the number of people it covered.

Q15. Choice Experiment Module

Q16. Overall, how would you rate the health and condition of the waters in and around Puget Sound? These include rivers, creeks, and streams that flow into Puget Sound along with the salt water, the shoreline, beaches, and bays? Please use a scale of 1 to 7, where one is “very poor condition” and seven is “excellent condition”

Q17. What are the top two things about Puget Sound region's natural resources that you value the most?

- Mountains
- Creeks/streams
- Forests/trees
- Clean water/water
- Beaches
- Recreation/hiking trails/fishing
- Everything is beautiful/the scenery
- Clean air
- Wildlife
- Fish
- Ocean
- Other

Q18. How would you describe the area in which you live? Would you say:

- Urban
- Suburban
- Rural changing to suburban
- Rural

Q19. How close do you live to one of Puget Sound’s waters: such as a river, lake, bay, creek, or stream? Would you say:

- One block or less
- Several blocks
- Less than one mile
- 1 to 5 miles
- 6 to 15 miles
- 16 to 30 miles
- More than 30 miles

Thank you so much for participating in our survey. We appreciate your help and input!

Appendix B. Coastal Recreation Map Products

This appendix presents Puget Sound coastal recreation "heat" maps created by the activity markers placed by the respondents of our recreational survey. As described in section 0, survey respondents provided information by placing a point marker on a map and then indicated which activity or activities they conducted at each specific location on their last trip. The spatial data are a combined set across both survey waves accounting for seasonal variations in coastal recreation. Table 17 and Table 18 above indicate the number of makers placed per activity per survey wave for all activities.

This appendix contains twenty two maps depicting the spatial patterns of use (distribution and intensity of use) across the region for coastal recreation overall and for the top ten select coastal recreation activities and the top ten select *primary* coastal recreation (ranked by number of activity markers placed).

Intensity of Use Maps:

Regional map and top ten coastal recreational activities, created using all activity point markers[13]:

1. All activities combined
2. Scenic enjoyment/sightseeing
3. Beach going (sitting, walking, running, dog walking, kite flying, etc.)
4. Hiking
5. Wildlife viewing (e.g. watching whales, birds, seals, and/or other marine life)
6. Photography
7. Sitting in your car watching the scene
8. Camping
9. Tide pooling
10. Fishing from shore/boat (e.g. hook and line, crabbing, spearfishing, etc.)
11. Collection of nonliving resources/beachcombing (tie)
12. Power boating / jet skis (tie)

Primary Activity Maps:

Top ten coastal recreational activities, creating using only primary activity point markers[14]:

1. All activities combined
2. Scenic enjoyment/sightseeing
3. Beach going (sitting, walking, running, dog walking, kite flying, etc.)
4. Hiking
5. Camping
6. Fishing from shore/boat (e.g. hook and line, crabbing, spearfishing, etc.)
7. Photography
8. Wildlife viewing (e.g. watching whales, birds, seals, and/or other marine life)
9. Kayaking/Canoeing/Rowing in the ocean or estuary/slough
10. Power boating / jet skis
11. Collecting/Picking/Harvesting Sea Life from Shore (tie)
12. Sitting in your car watching the scene (tie)

[13] In order of number of activity markers placed, see Table 17.
[14] In order of number of activity markers placed, see Table 18.

Figure 25. Intensity of Use Map - All Activities Combined

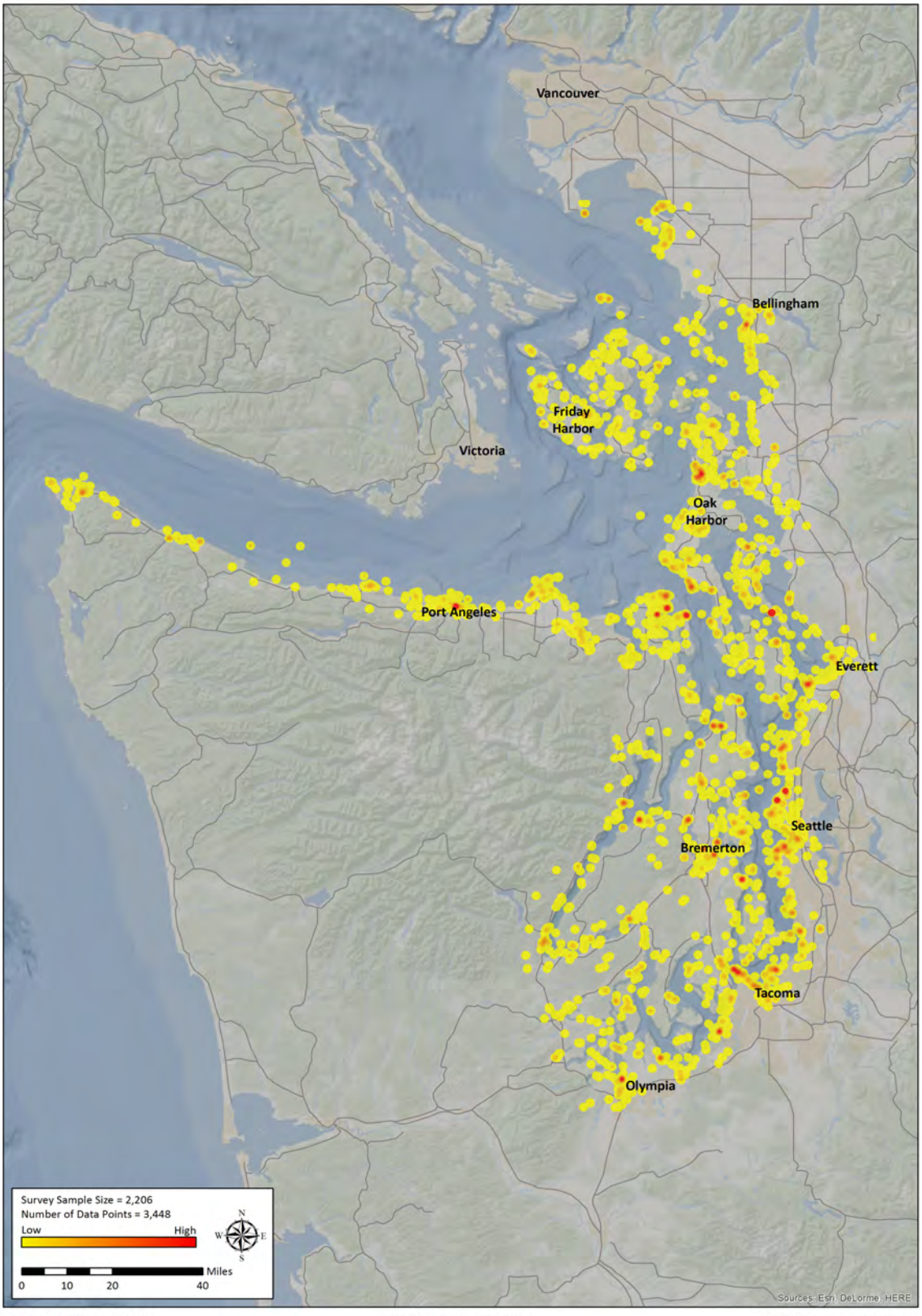
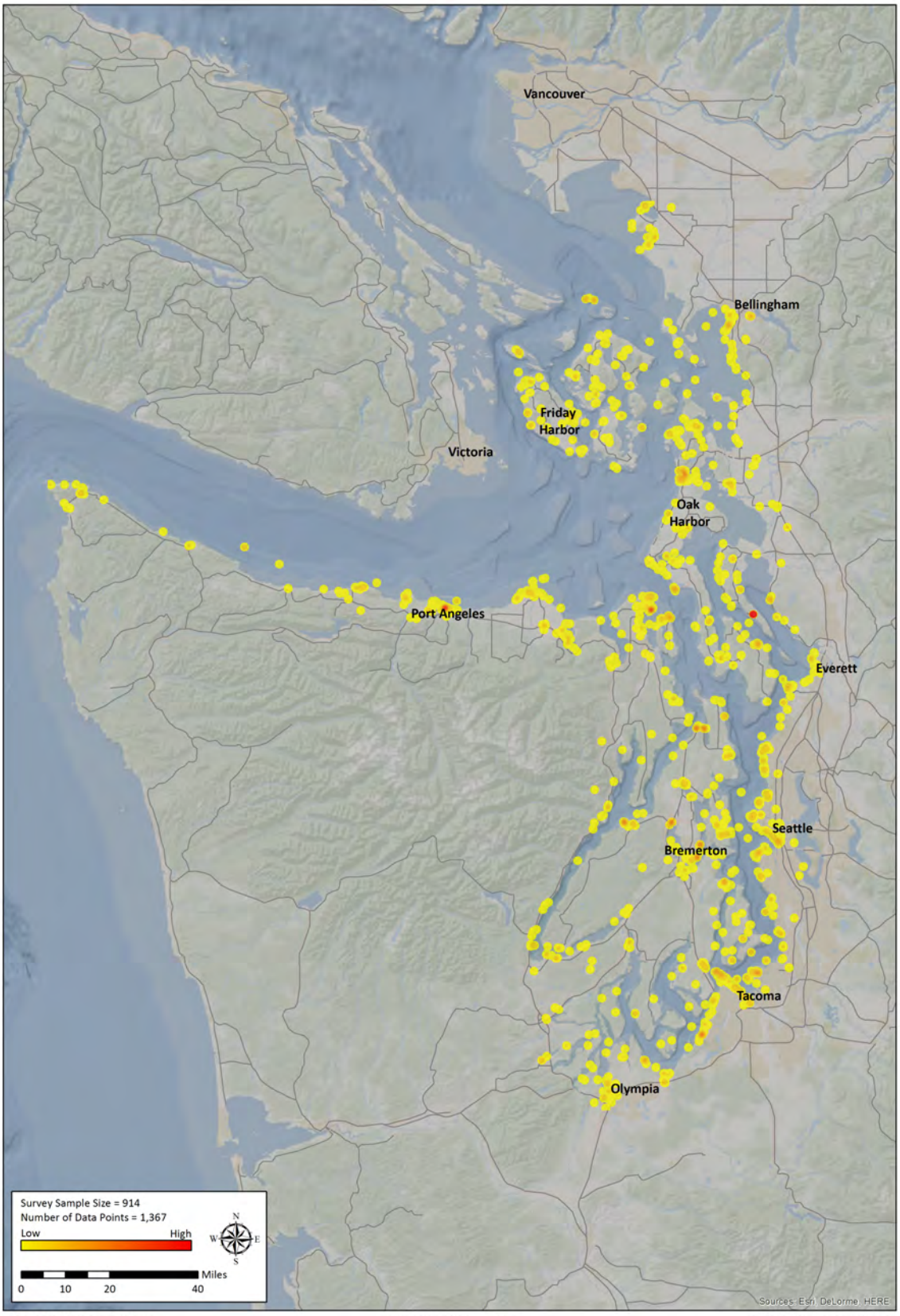
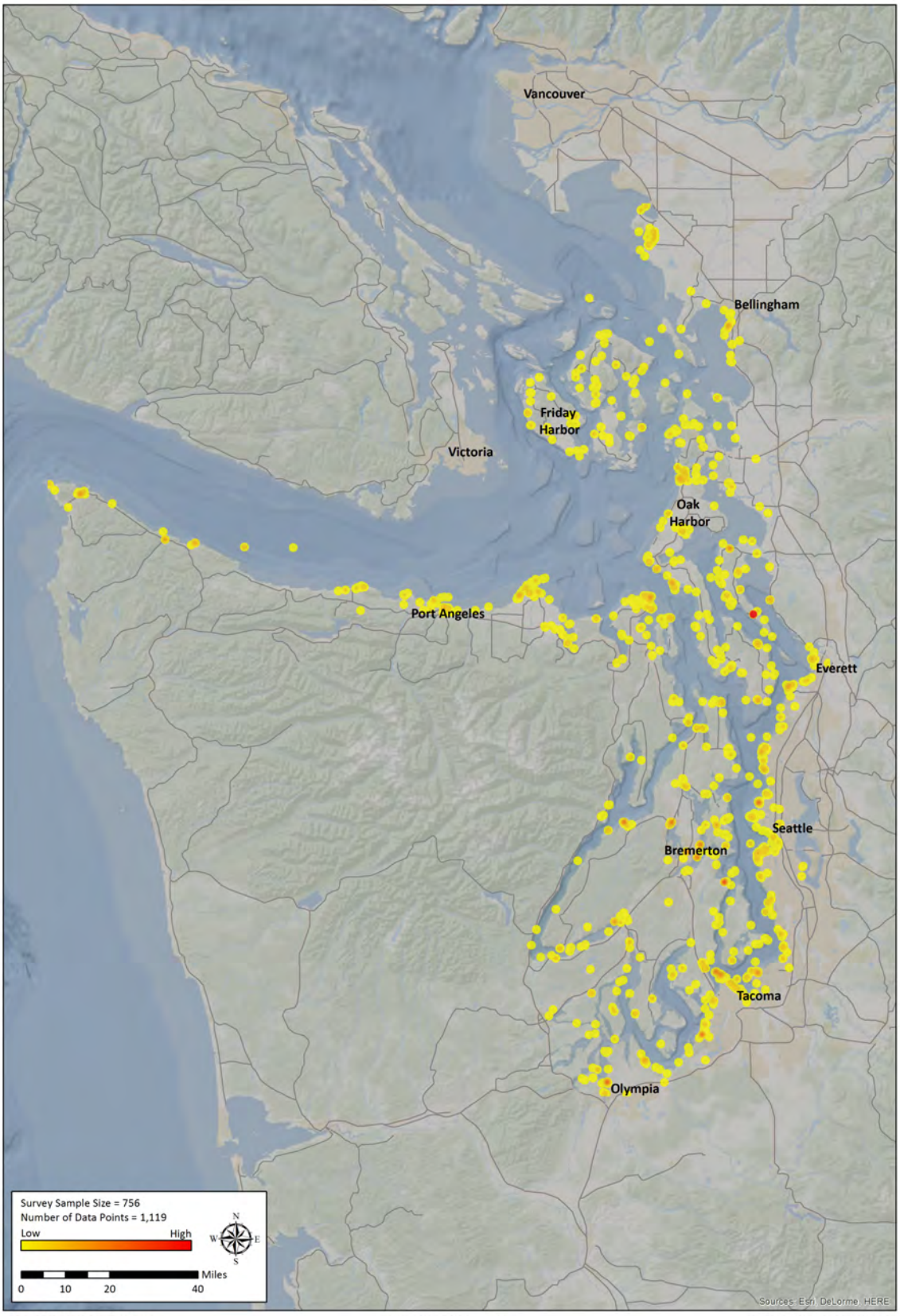


Figure 26. Intensity of Use Map - Scenic Enjoyment/Sightseeing



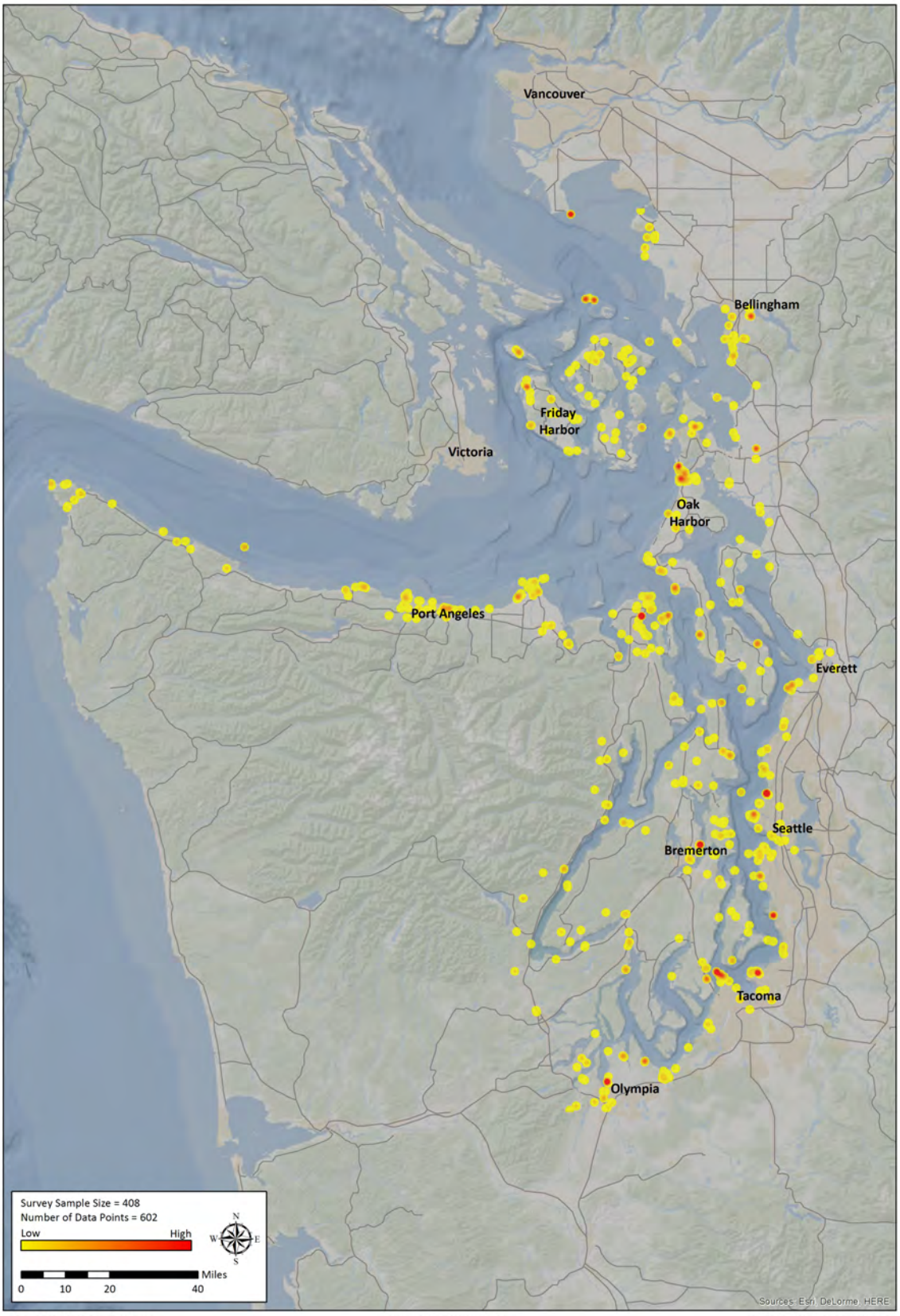
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 27. Intensity of Use Map - Beach Going



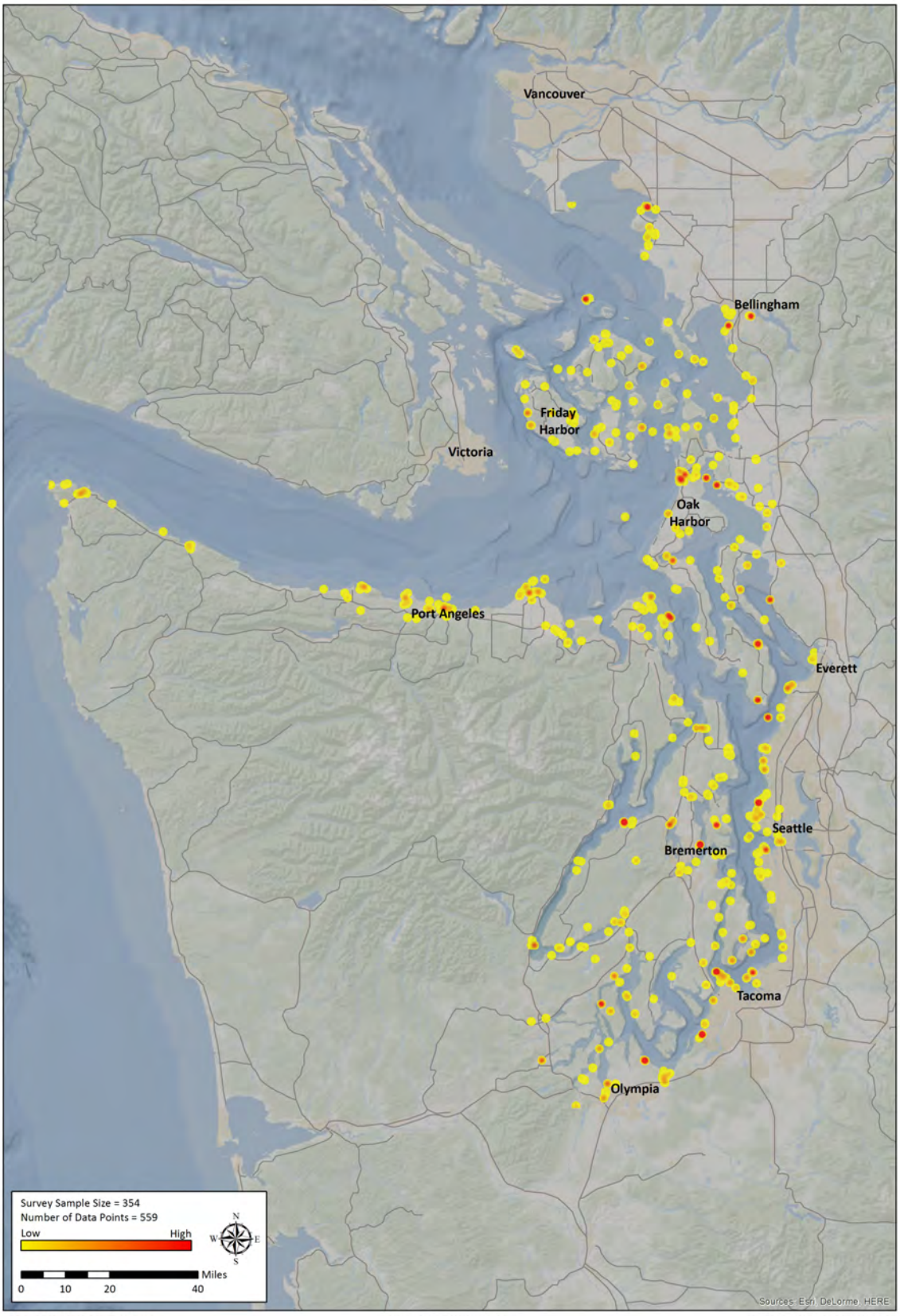
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 28. Intensity of Use Map - Hiking



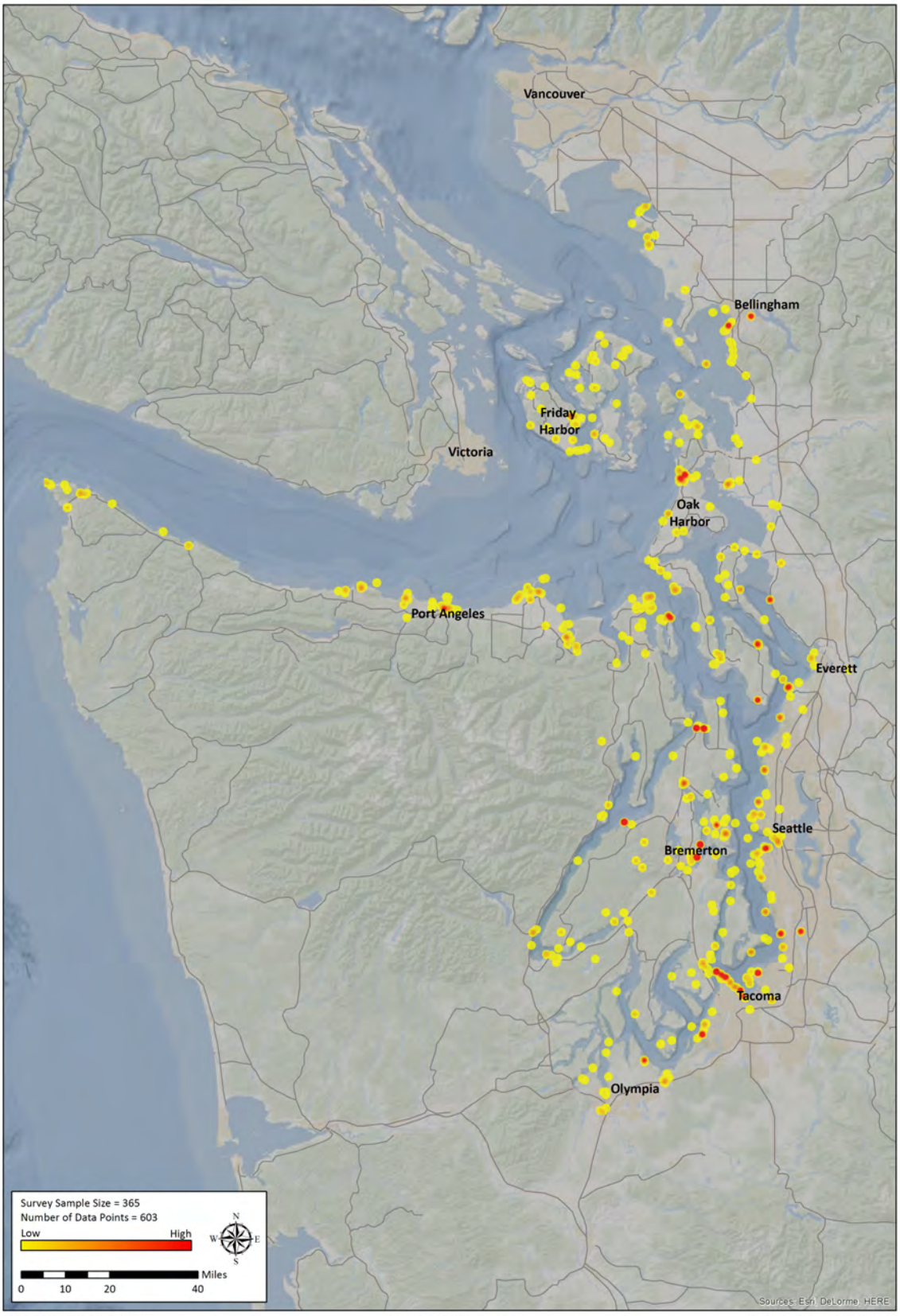
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 29. Intensity of Use Map - Wildlife Viewing



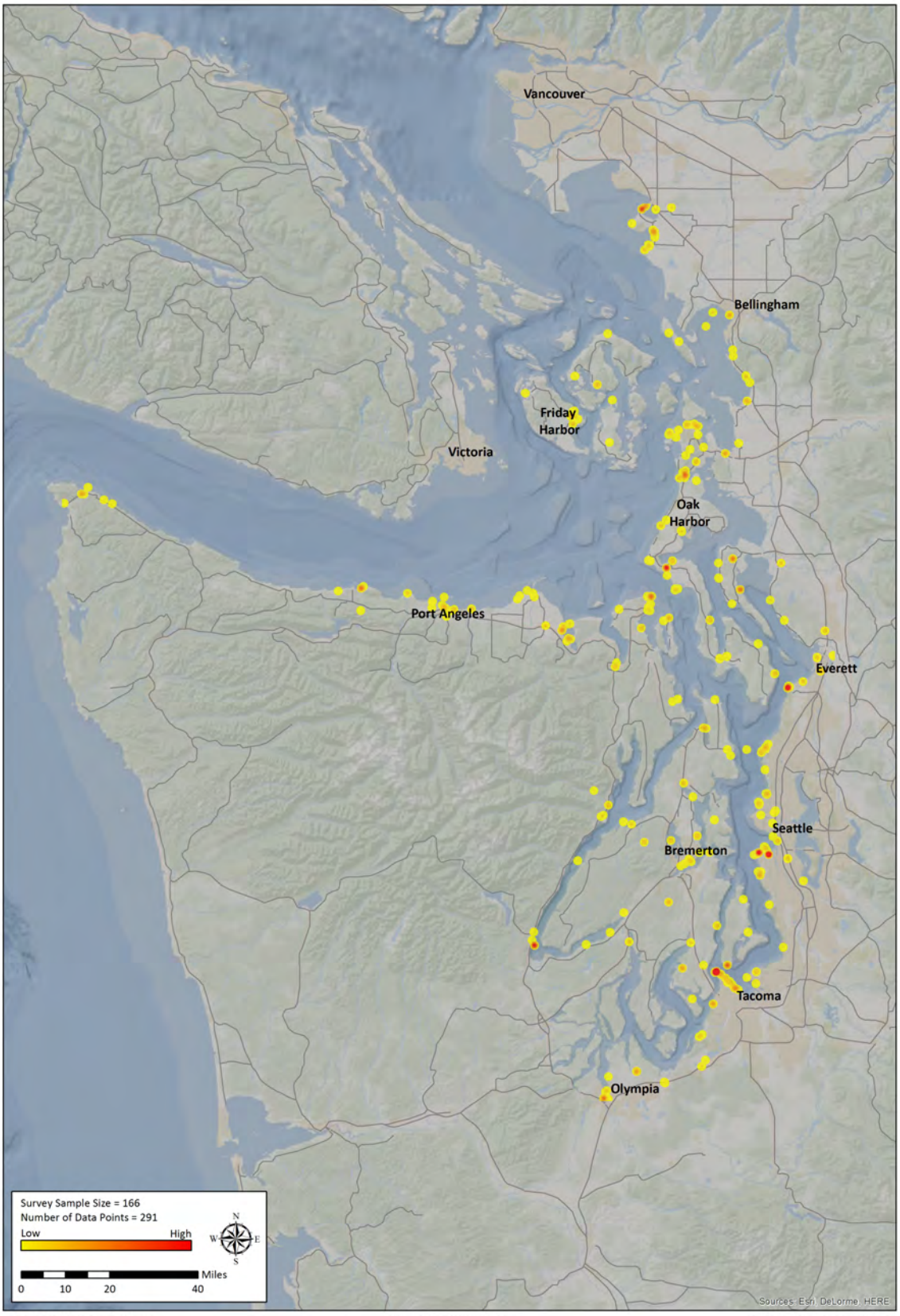
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 30. Intensity of Use Map - Photography



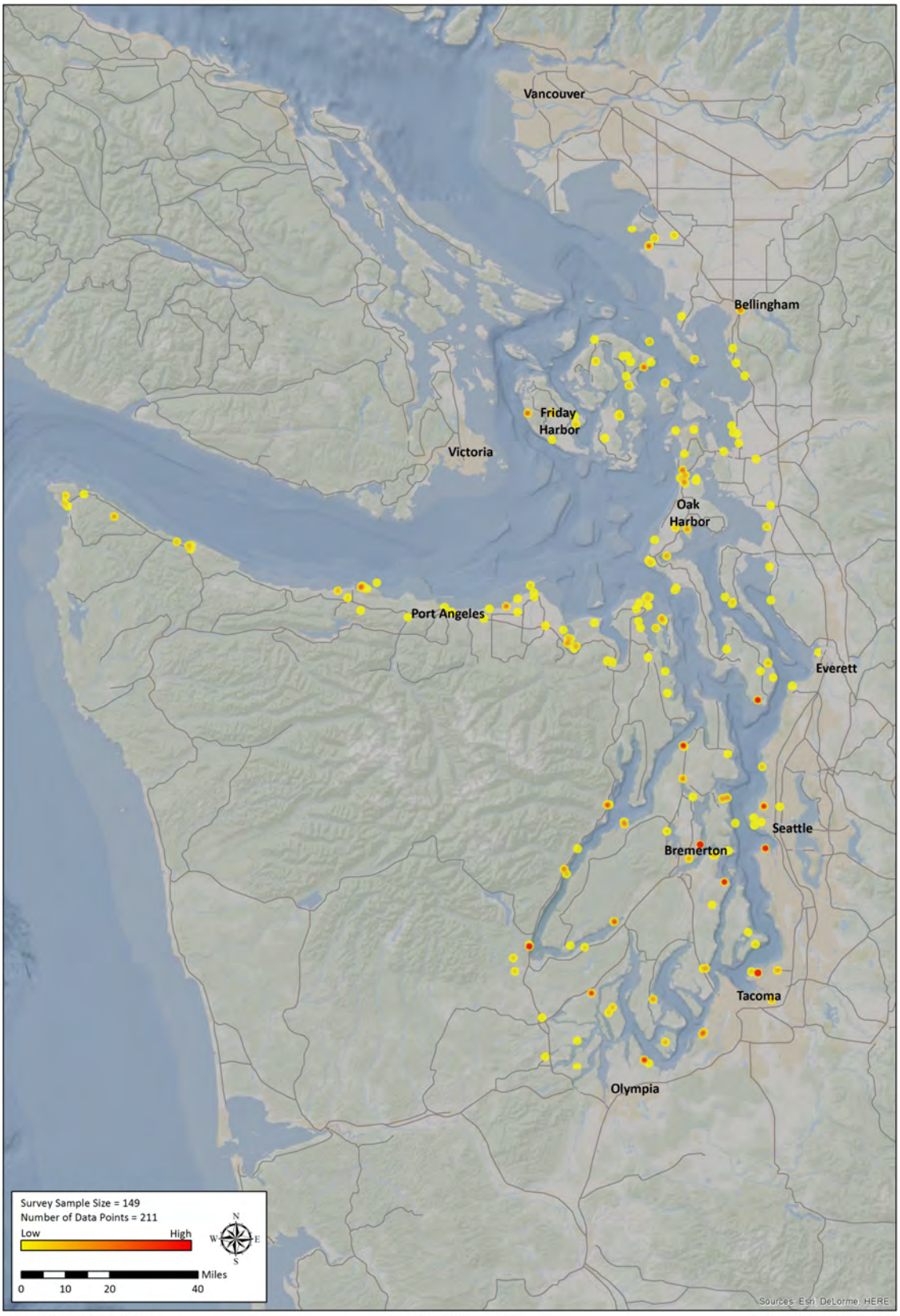
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 31. Intensity of Use Map - Sitting in Your Car Watching the Scene



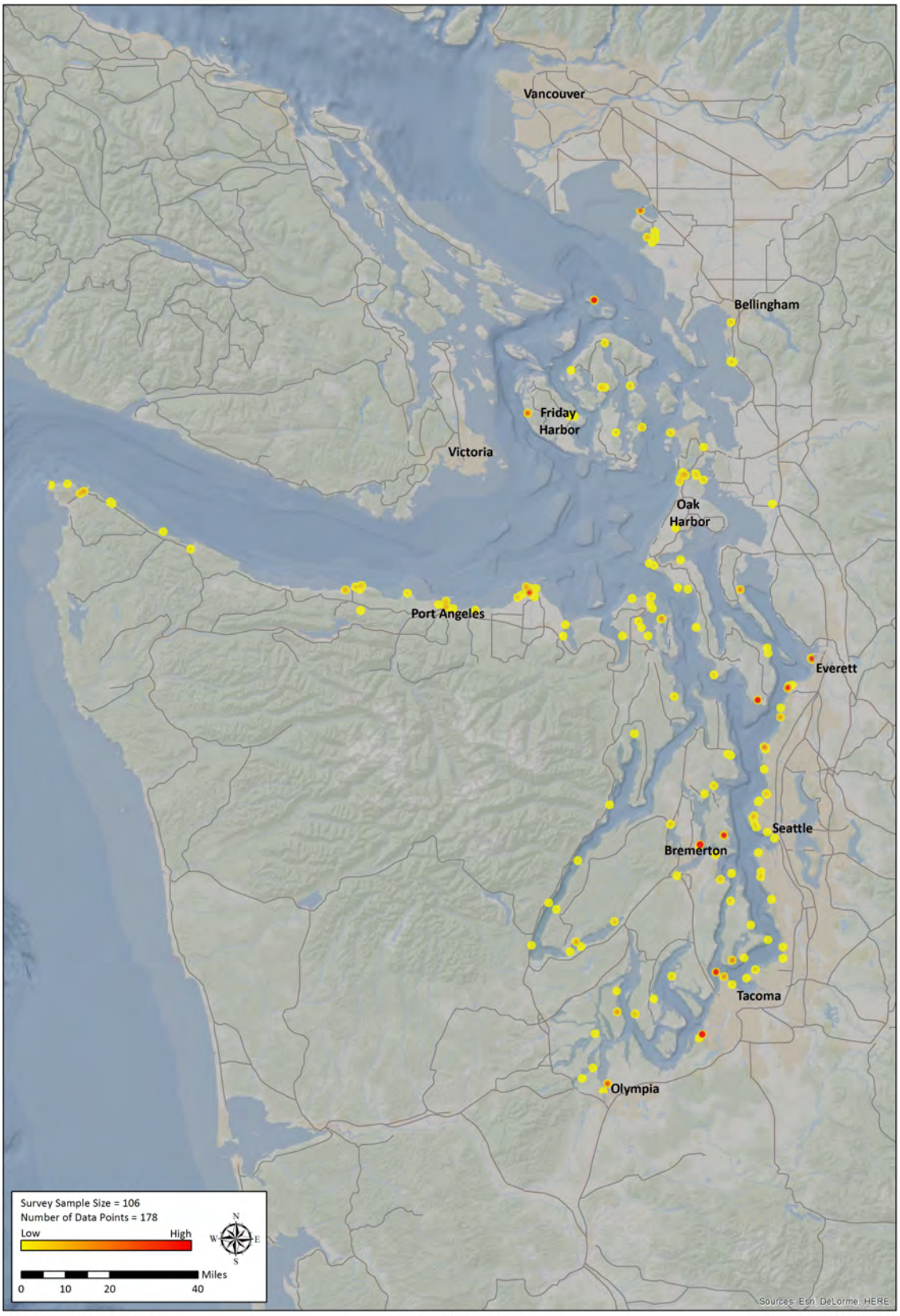
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 32. Intensity of Use Map - Camping



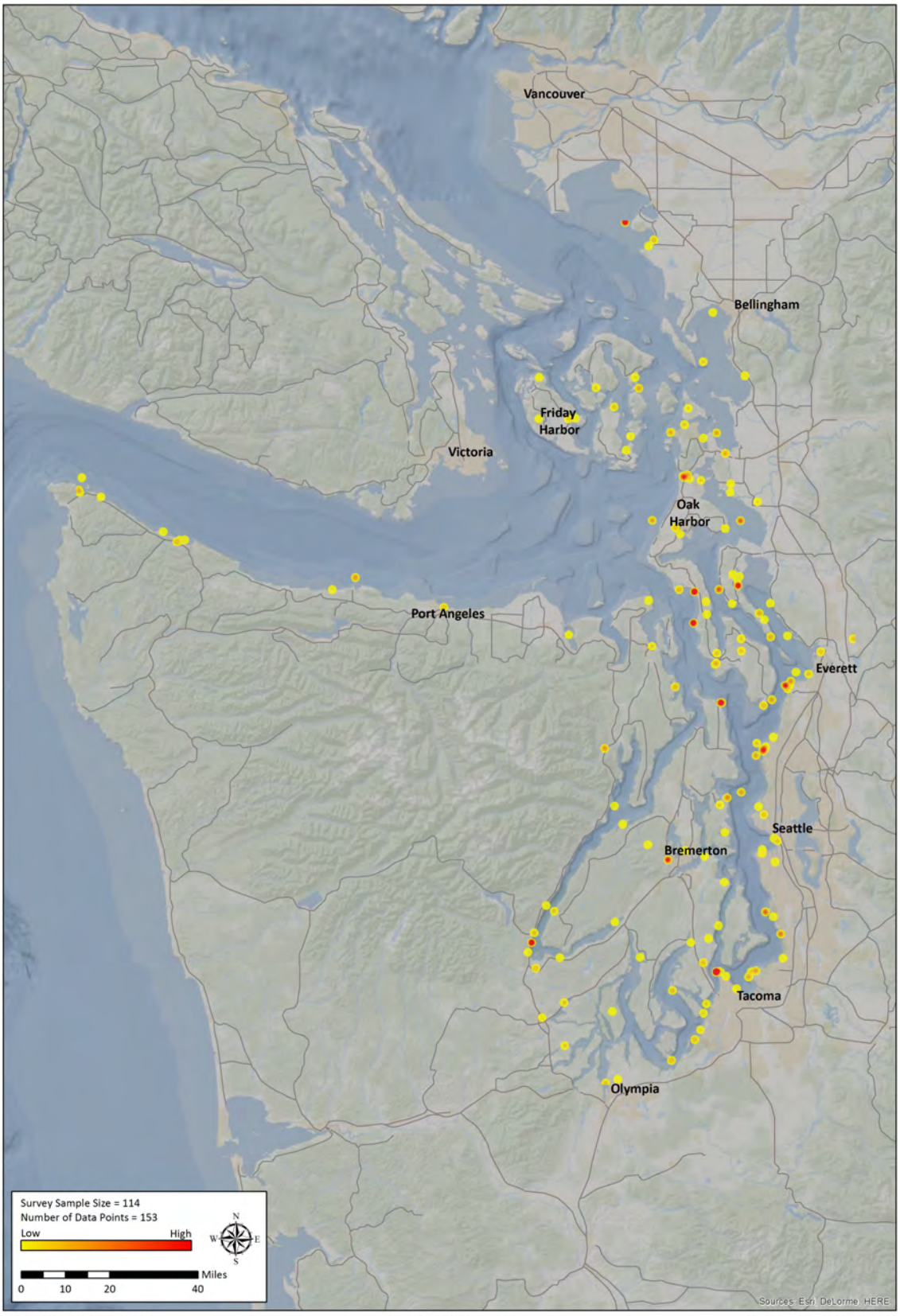
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 33. Intensity of Use Map - Tidepooling



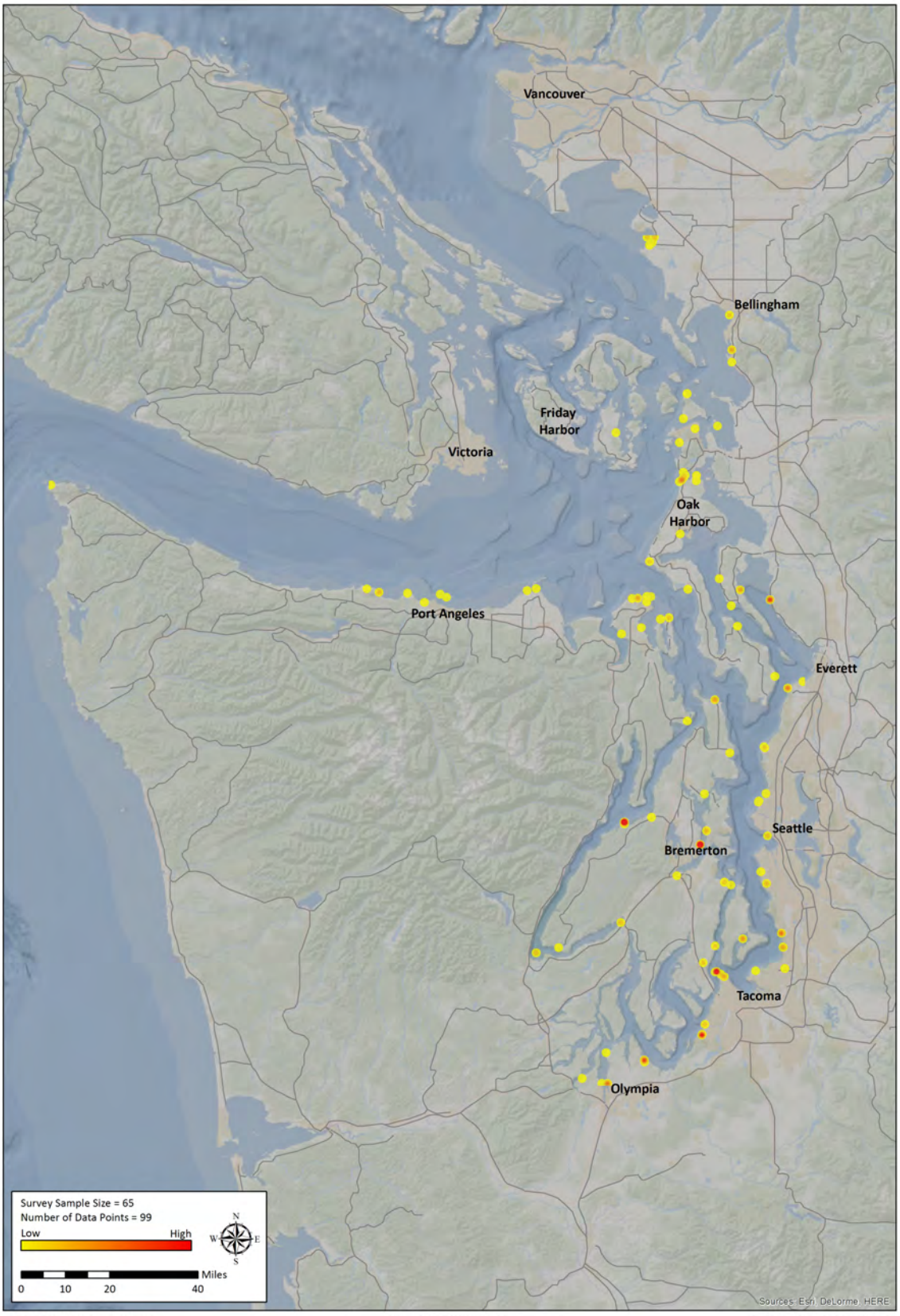
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 34. Intensity of Use Map - Fishing from Shore/Boat



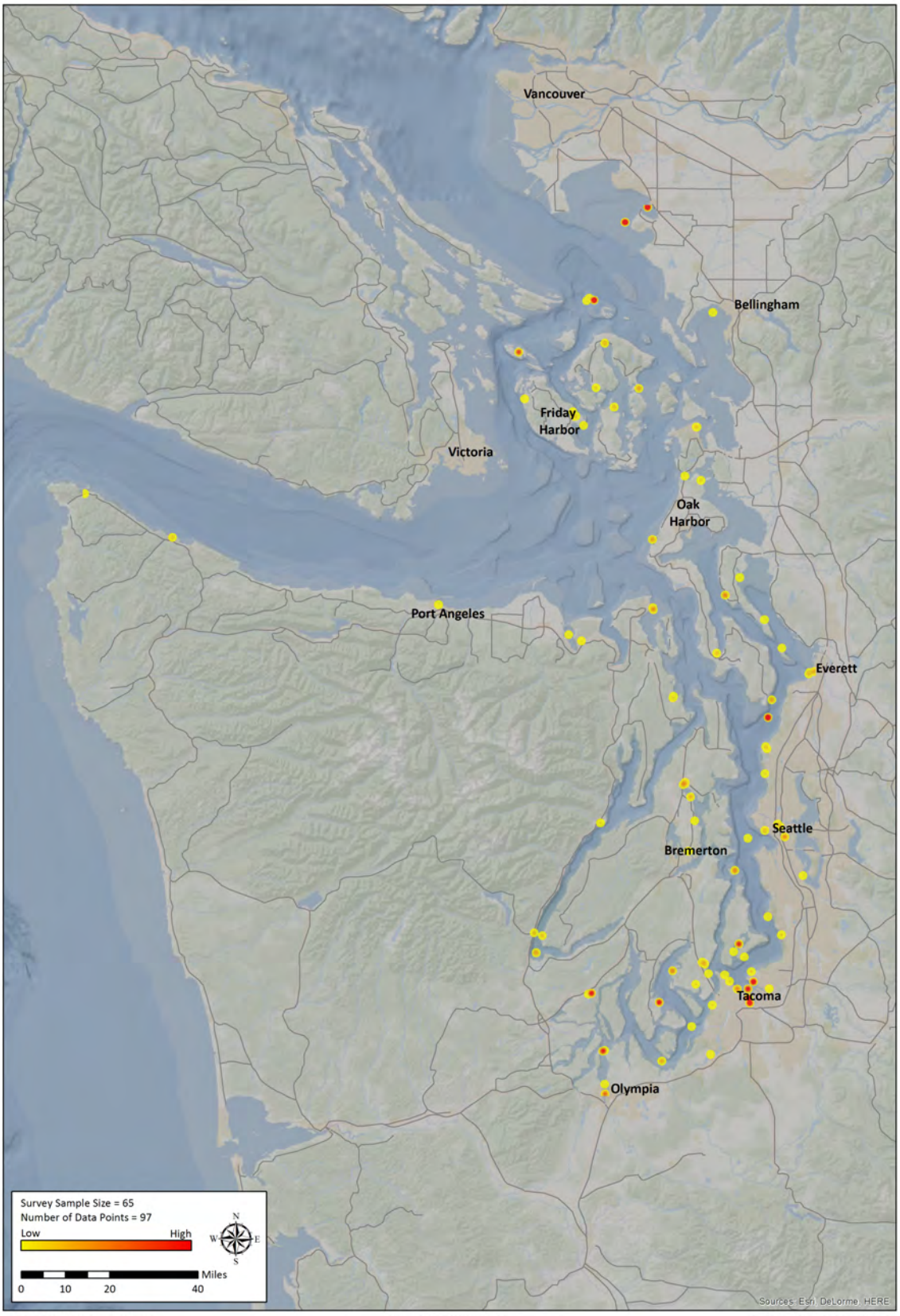
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 35. Intensity of Use Map - Collection of Nonliving Resources/Beachcombing



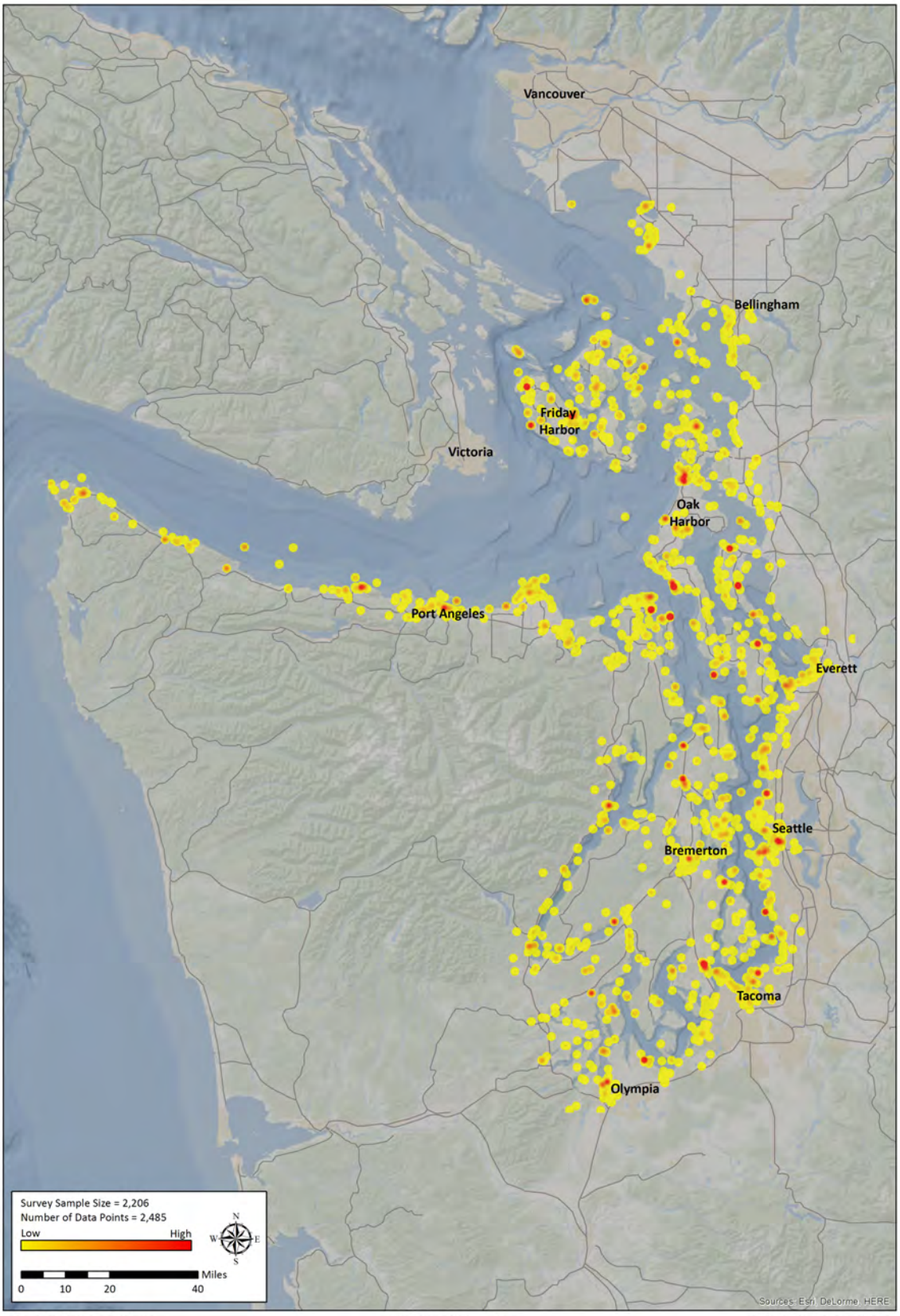
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 36. Intensity of Use Map - Power Boating/Jet Skiing



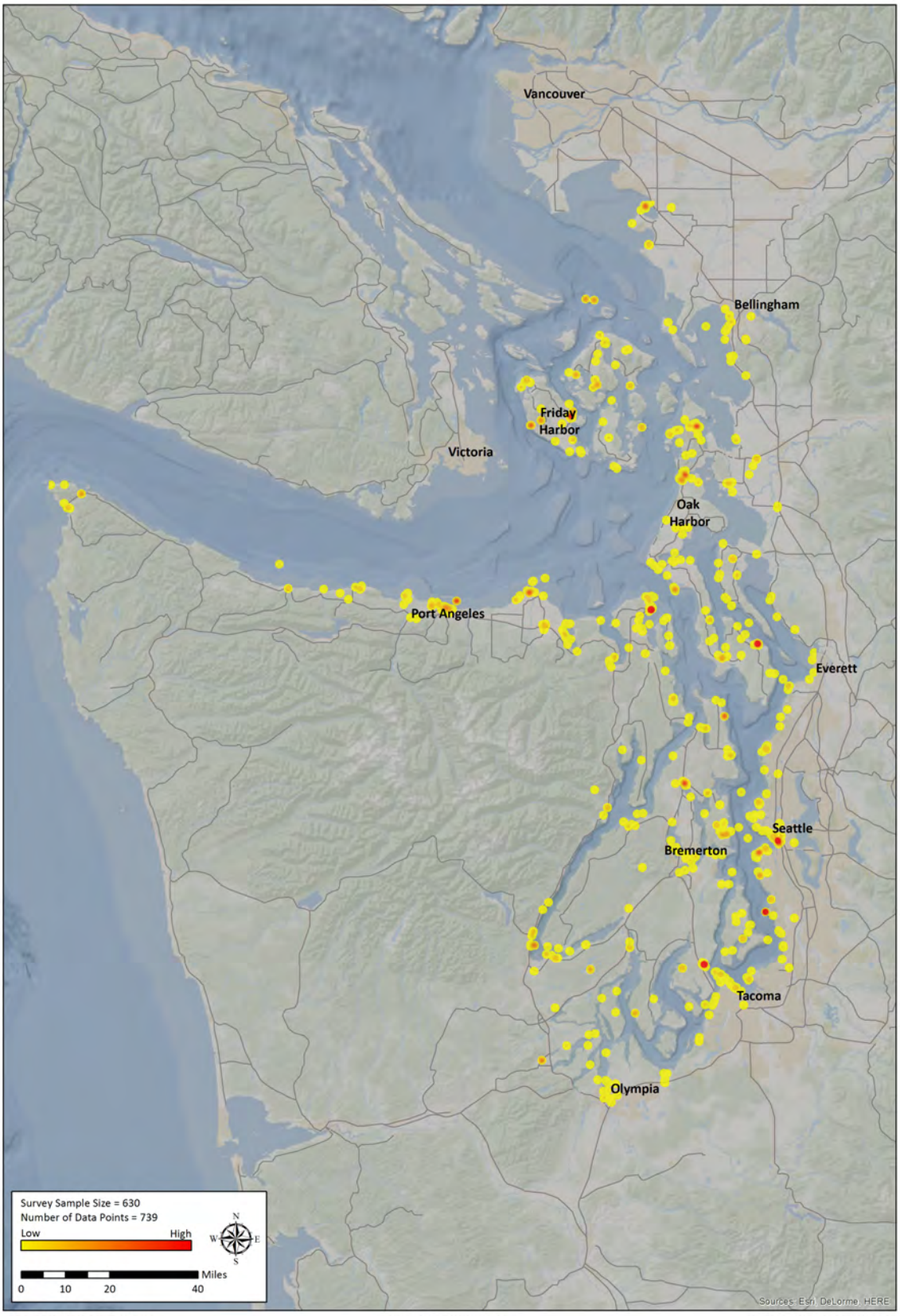
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 37. Primary Activity Map - All Activities Combined



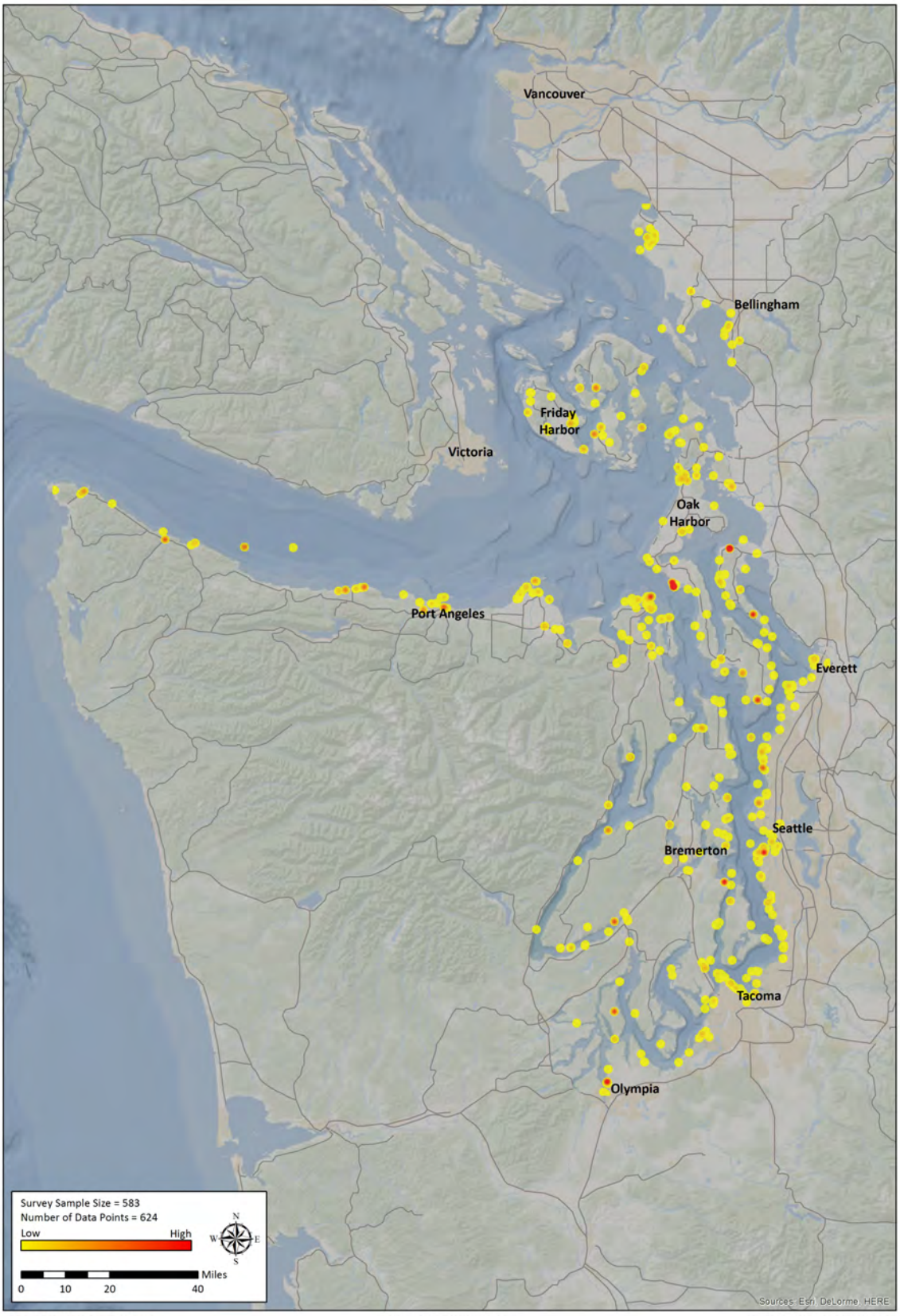
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 38. Primary Activity Map - Sightseeing/Scenic Enjoyment



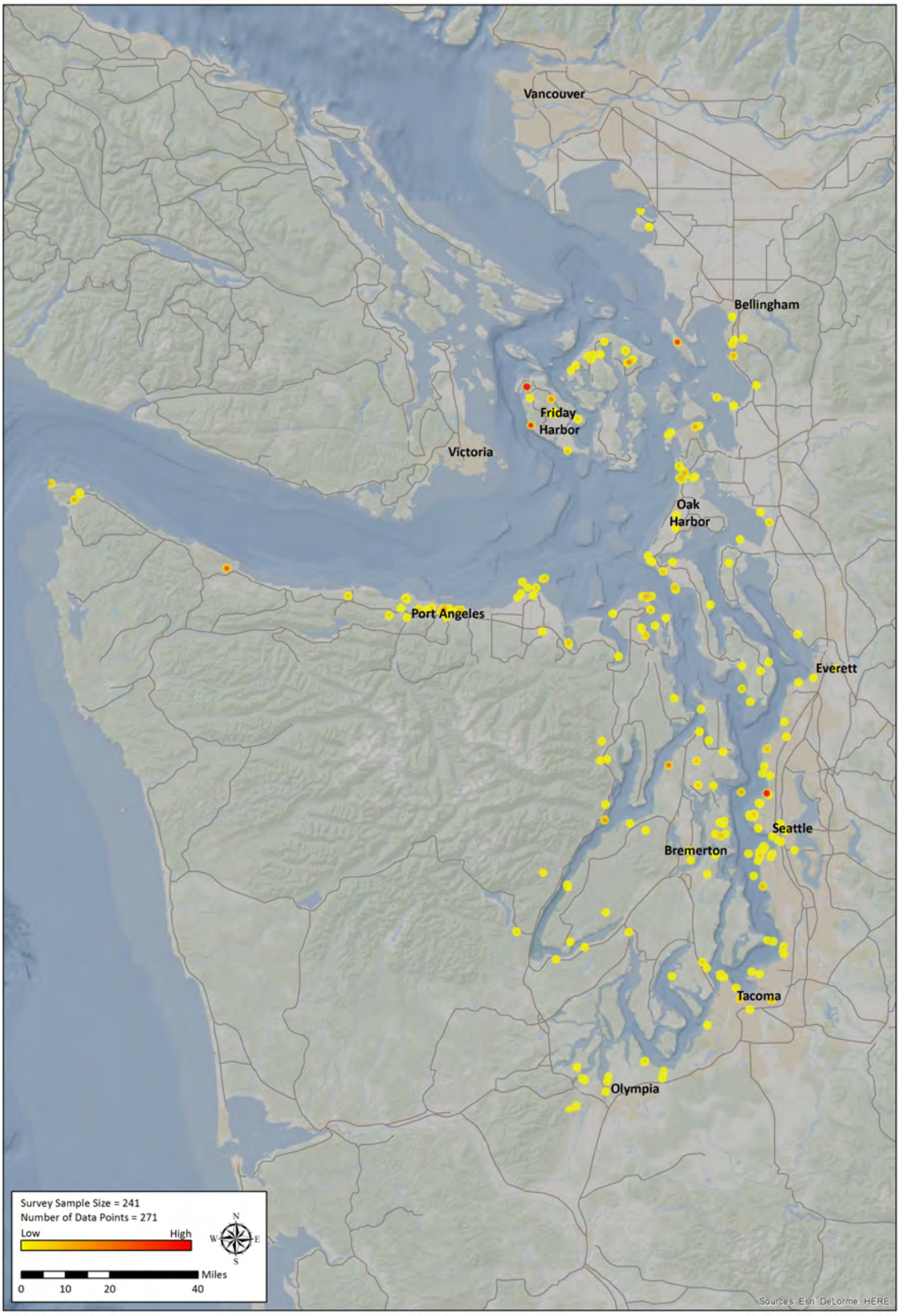
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 39. Primary Activity Map - Beachgoing



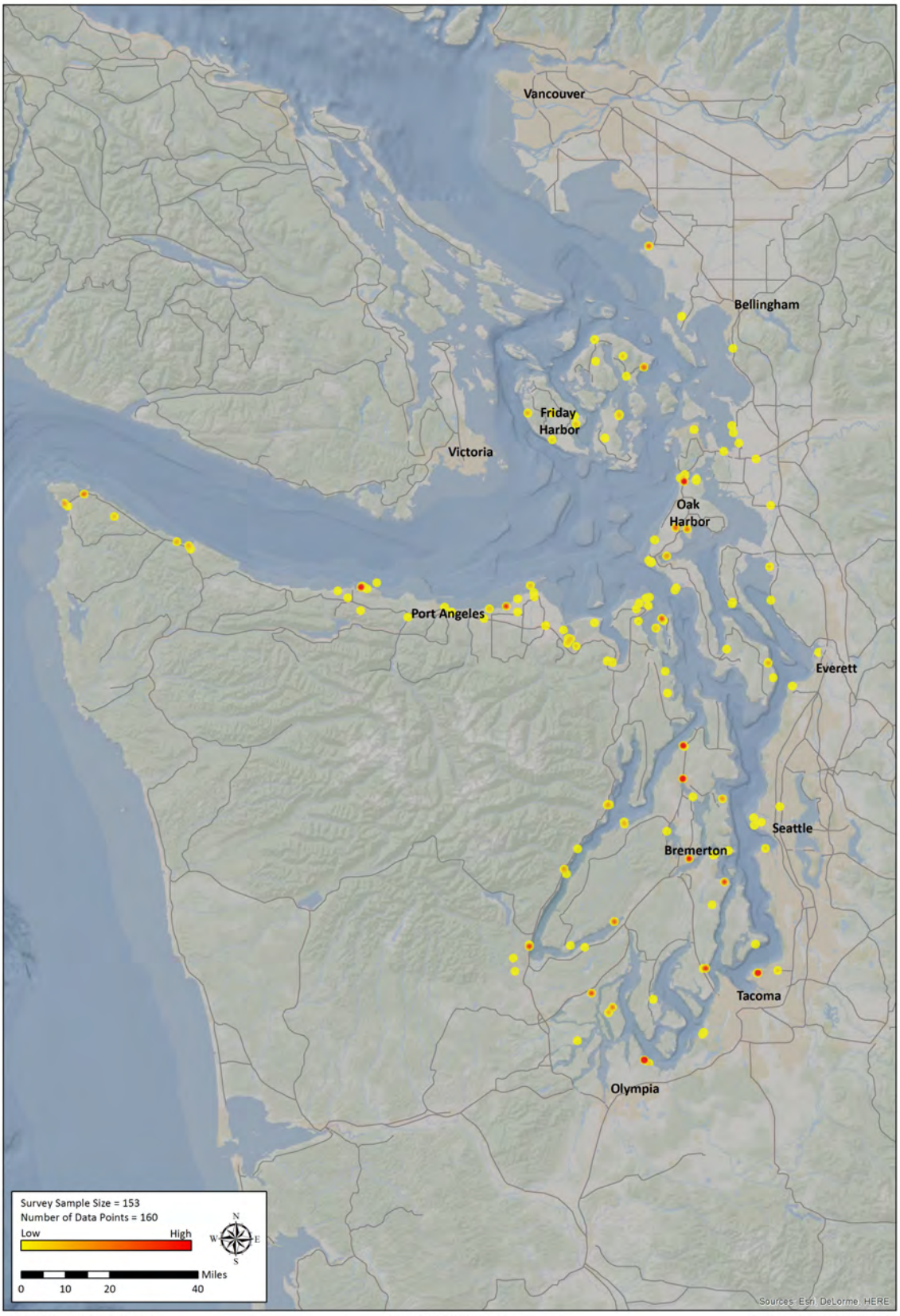
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 40. Primary Activity Map - Hiking



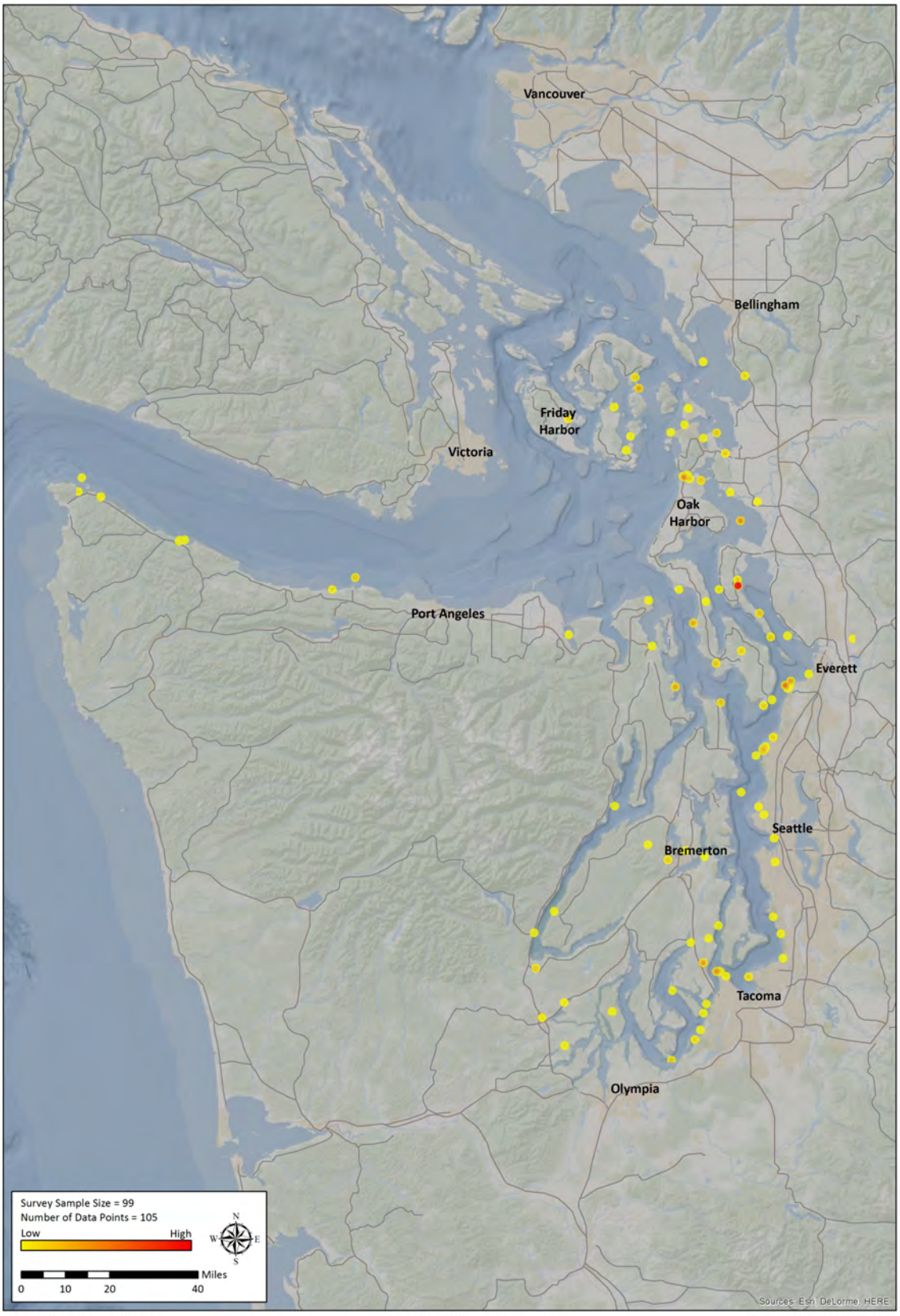
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 41. Primary Activity Map - Camping



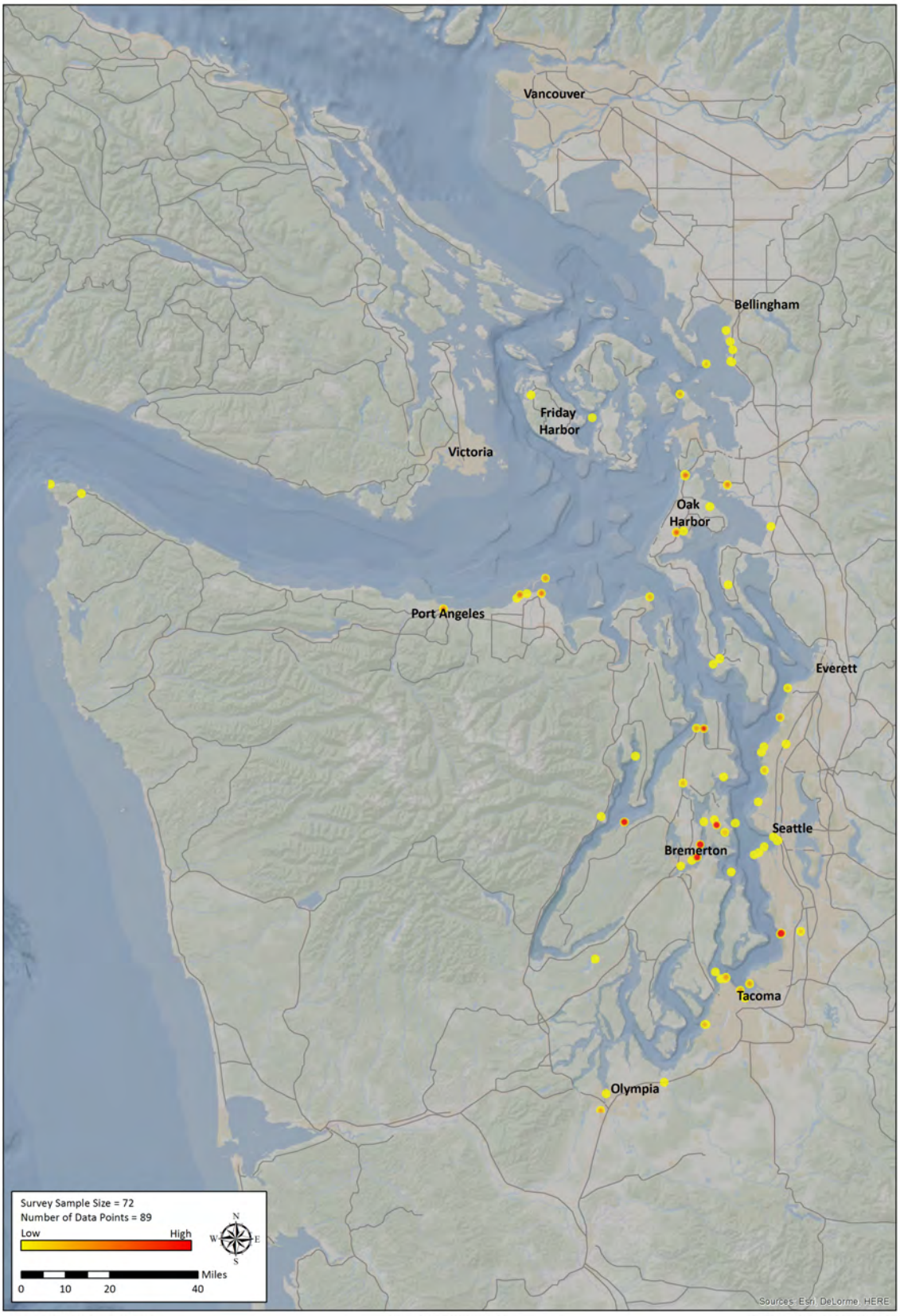
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 42. Primary Activity Maps - Fishing from Shore/Boat



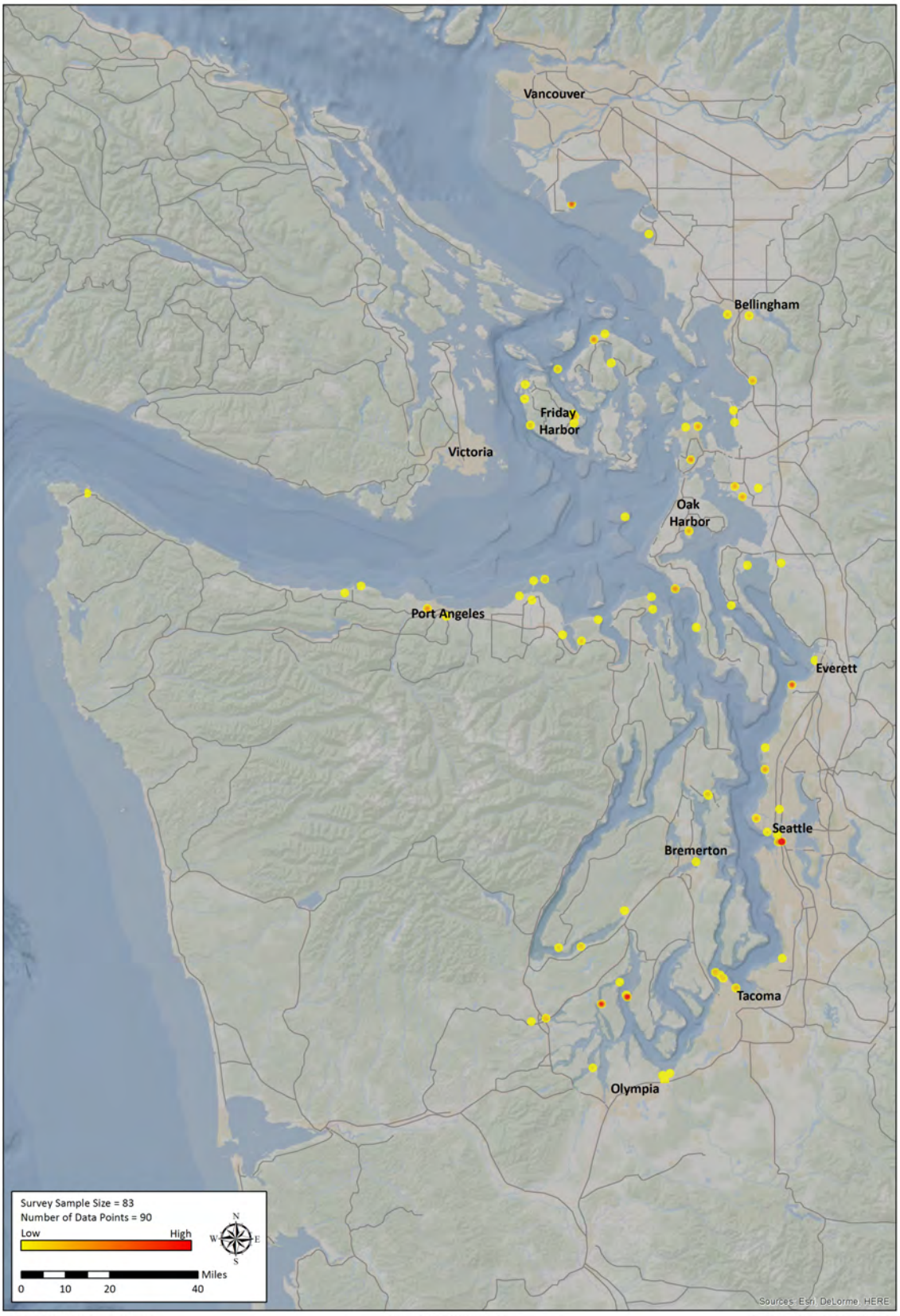
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 43. Photography



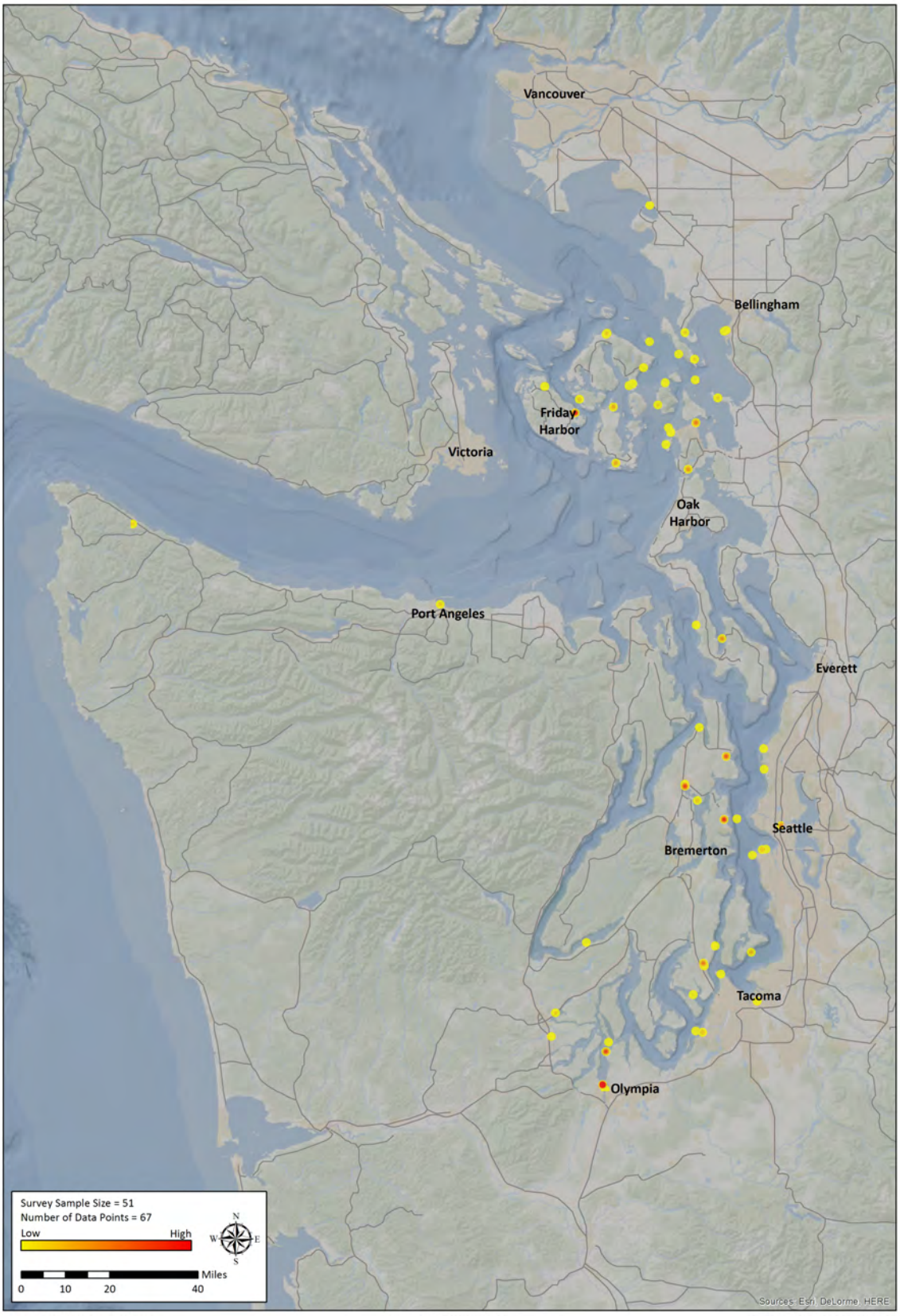
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 44. Primary Activity Map - Wildlife Viewing



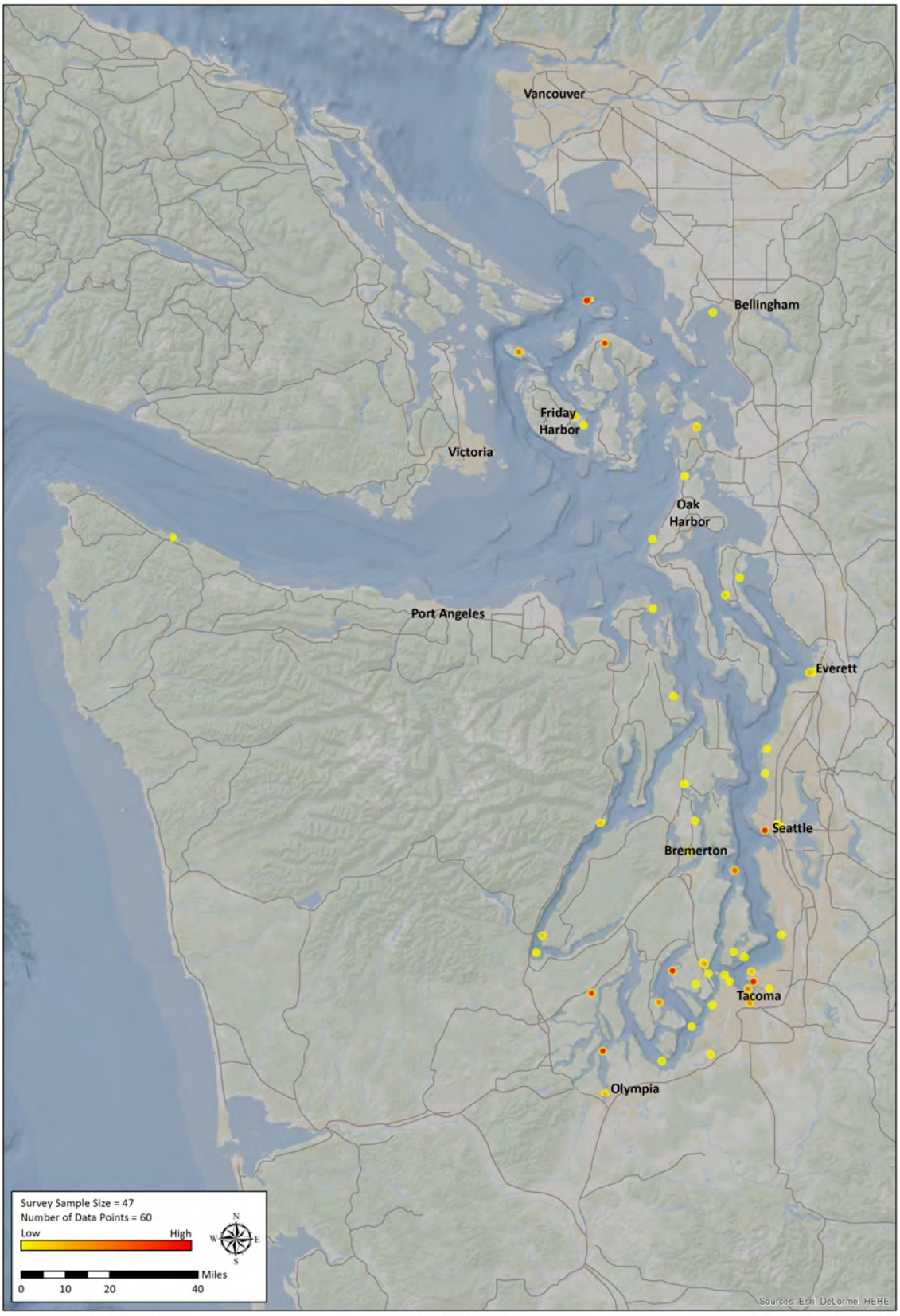
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 45. Primary Activity Map - Kayaking/Canoeing/Rowing



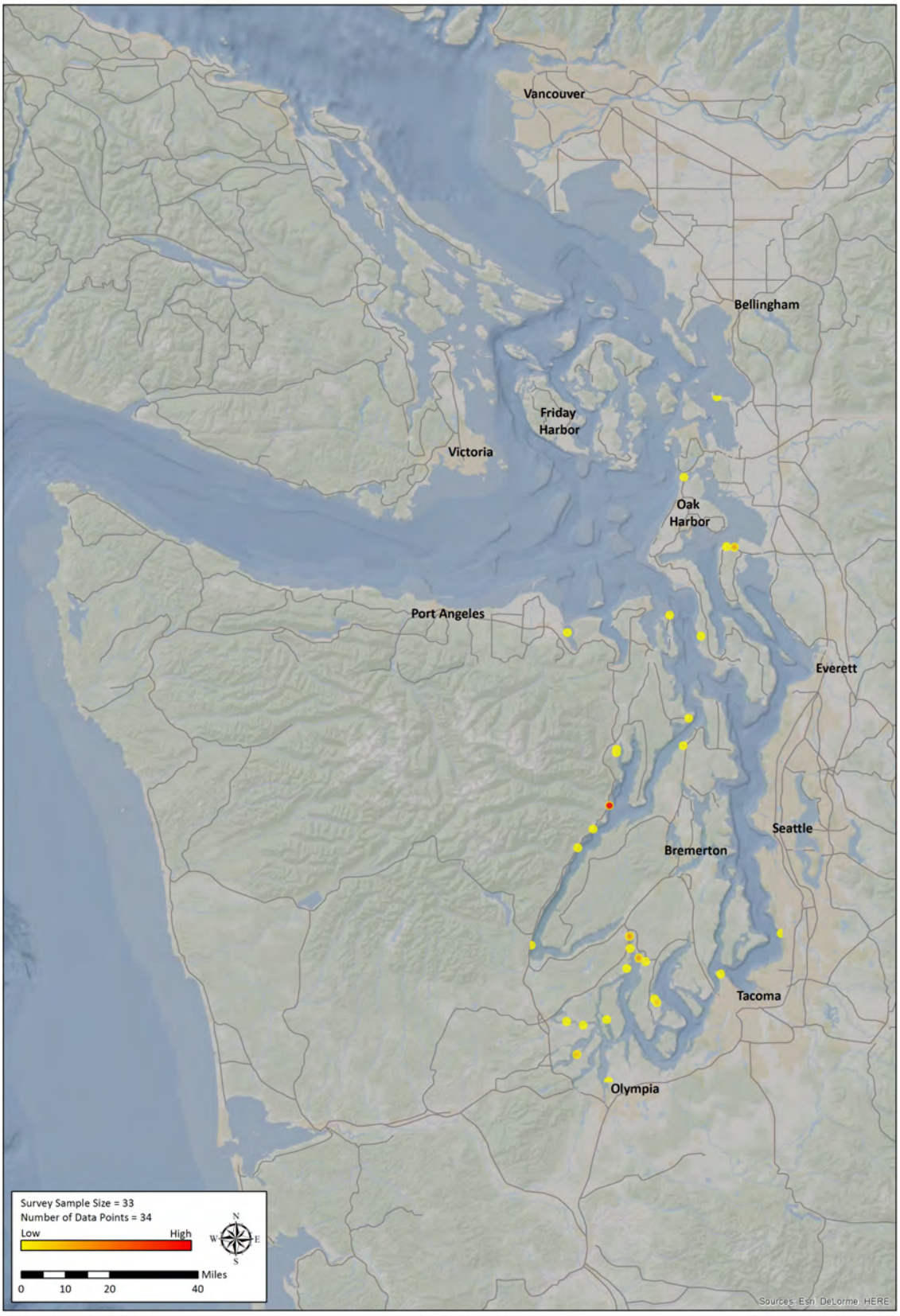
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 46. Primary Activity Map - Power Boating/Jet Skiing



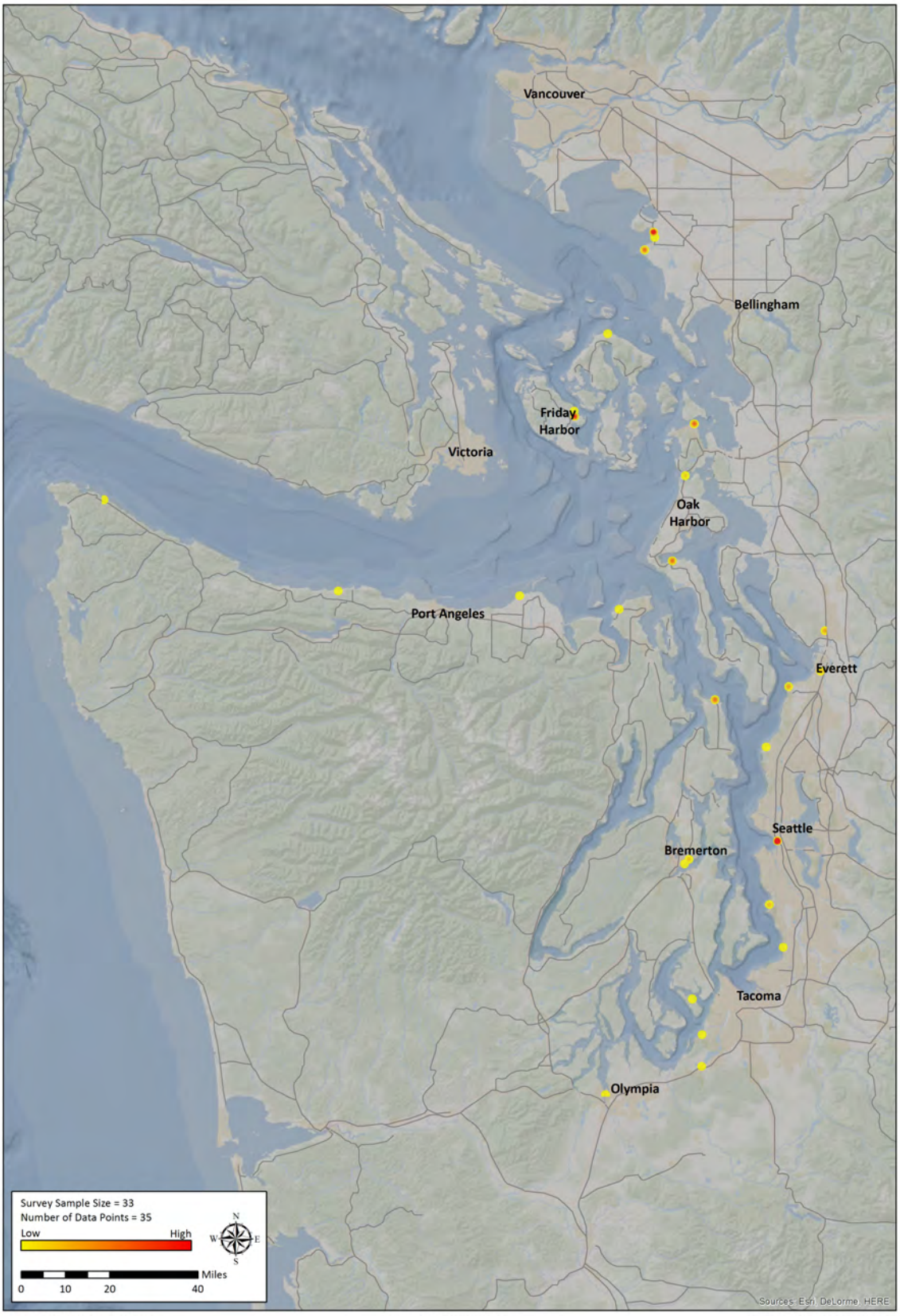
FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 47. Primary Activity Map - Collecting/Picking/Harvesting Sea Life from Shore



FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Figure 48. Primary Activity Map - Sitting in your Car Watching the Scene



FINAL MAP PRODUCT DECEMBER 3, 2014 FINAL MAP PRODUCT

Table 28. Cluster Analysis: Demographic Summary by Cluster

Cluster #	# Users	% Female	Average Age of User	Average Household Income	% College Graduate	% Non-White	% Employed or Self-Employed	% Retired	Average User Expenditure on Last Trip
1	15	40%	48	$81,833	67%	7%	53%	27%	$257
2	17	59%	49	$71,838	59%	24%	59%	35%	$257
3	28	57%	53	$97,500	61%	18%	61%	21%	$125
4	62	48%	53	$85,625	61%	8%	71%	18%	$182
5	35	60%	44	$77,571	49%	23%	71%	3%	$83
6	78	53%	51	$88,557	55%	23%	55%	29%	$233
7	5	40%	47	$39,500	60%	40%	80%	20%	$191
8	24	42%	57	$93,541	67%	8%	58%	38%	$24
9	24	63%	63	$84,687	63%	0%	29%	58%	$83
10	30	57%	50	$79,333	63%	27%	80%	13%	$90
11	45	44%	51	$91,250	64%	24%	62%	29%	$120
12	19	63%	57	$103,815	63%	11%	58%	37%	$188
13	48	52%	50	$103,177	65%	8%	67%	27%	$435
14	17	59%	55	$107,647	71%	0%	47%	35%	$124
15	46	70%	59	$93,070	72%	0%	52%	41%	$96
16	25	60%	52	$92,100	72%	12%	60%	28%	$119
17	197	56%	46	$84,270	66%	22%	70%	16%	$94
18	55	55%	45	$94,772	60%	24%	67%	16%	$110
19	78	72%	46	$87,323	65%	14%	68%	14%	$54
20	19	37%	52	$99,868	58%	11%	68%	26%	$299
21	66	44%	57	$82,196	67%	6%	50%	39%	$143
22	27	59%	50	$101,111	78%	19%	67%	26%	$638
23	33	48%	48	$98,143	61%	15%	73%	18%	$248
24	57	65%	54	$96,864	54%	14%	60%	32%	$127
25	52	56%	53	$98,052	67%	10%	62%	29%	$213
26	39	72%	52	$80,737	49%	13%	51%	31%	$106
27	35	57%	52	$93,714	63%	17%	63%	31%	$160
28	63	54%	49	$88,174	56%	13%	63%	21%	$65
29	3	100%	50	$78,333	100%	0%	67%	33%	$138
30	47	62%	54	$83,537	51%	13%	64%	28%	$183
31	44	59%	50	$79,318	59%	16%	52%	23%	$83
32	39	56%	56	$93,397	54%	26%	51%	33%	$312
33	76	57%	49	$99,802	76%	24%	72%	20%	$374
34	105	57%	50	$96,250	65%	12%	65%	20%	$162
35	56	66%	52	$62,745	57%	20%	41%	34%	$101
36	129	58%	49	$77,839	51%	13%	57%	19%	$50
37	43	60%	47	$78,255	42%	26%	65%	12%	$89
38	82	59%	51	$78,246	61%	15%	66%	24%	$60
39	73	51%	49	$89,246	63%	18%	66%	22%	$75
40	11	27%	62	$88,863	64%	0%	45%	55%	$157
41	30	67%	49	$109,833	60%	10%	73%	17%	$231
42	35	66%	49	$67,428	43%	26%	46%	37%	$28
43	72	64%	48	$80,937	54%	13%	64%	18%	$62
44	111	59%	53	$87,398	65%	11%	51%	32%	$195
45	54	59%	52	$88,819	56%	26%	61%	22%	$143
46	28	50%	57	$72,812	50%	7%	54%	32%	$245
47	61	59%	51	$93,565	57%	26%	66%	23%	$200
48	40	45%	55	$95,218	50%	18%	73%	18%	$165
49	46	57%	55	$74,673	52%	28%	65%	26%	$115
50	31	48%	49	$84,274	23%	10%	61%	35%	$159
Totals	**2455**	**57%**	**51**	**$87,301**	**60%**	**16%**	**62%**	**25%**	**$149**

Appendix C. Riparian Buffer Choice Experiment: Choice Sets and Preamble

Figure 49. Choice Experiment Preamble

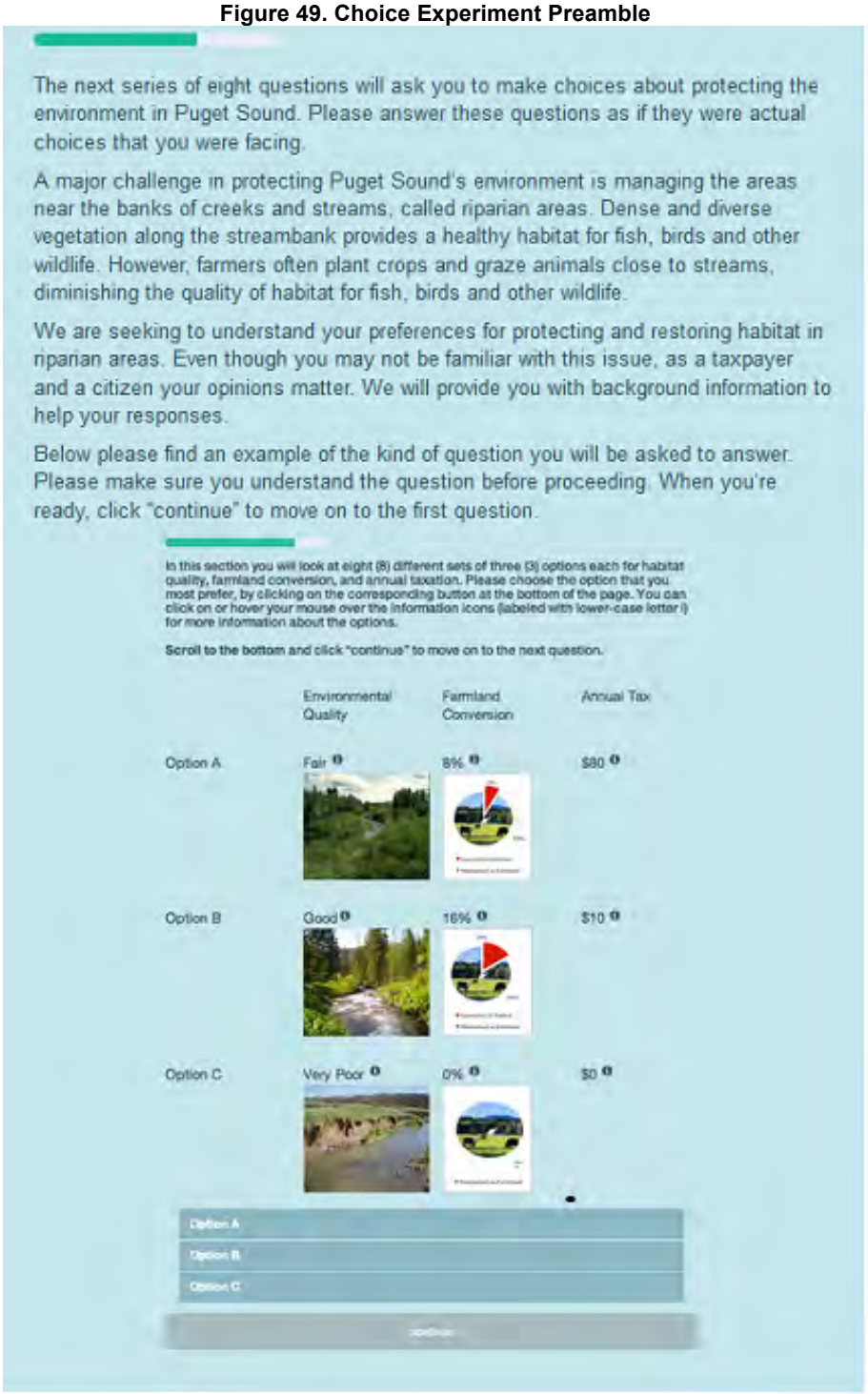


Figure 50. Choice Experiment Question Example

Table 29. Attribute Images

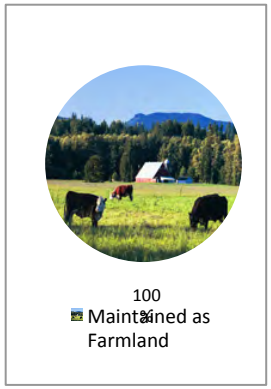
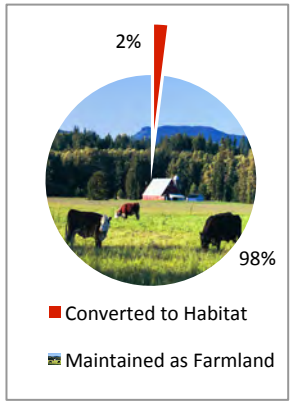
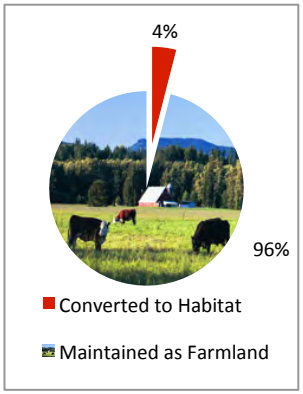
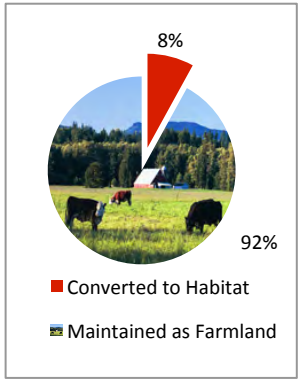
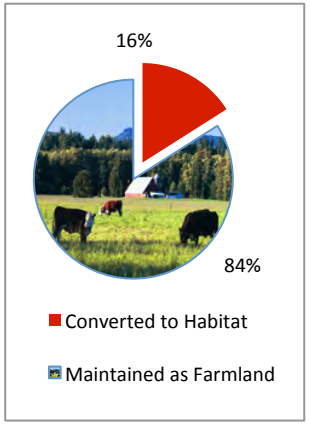
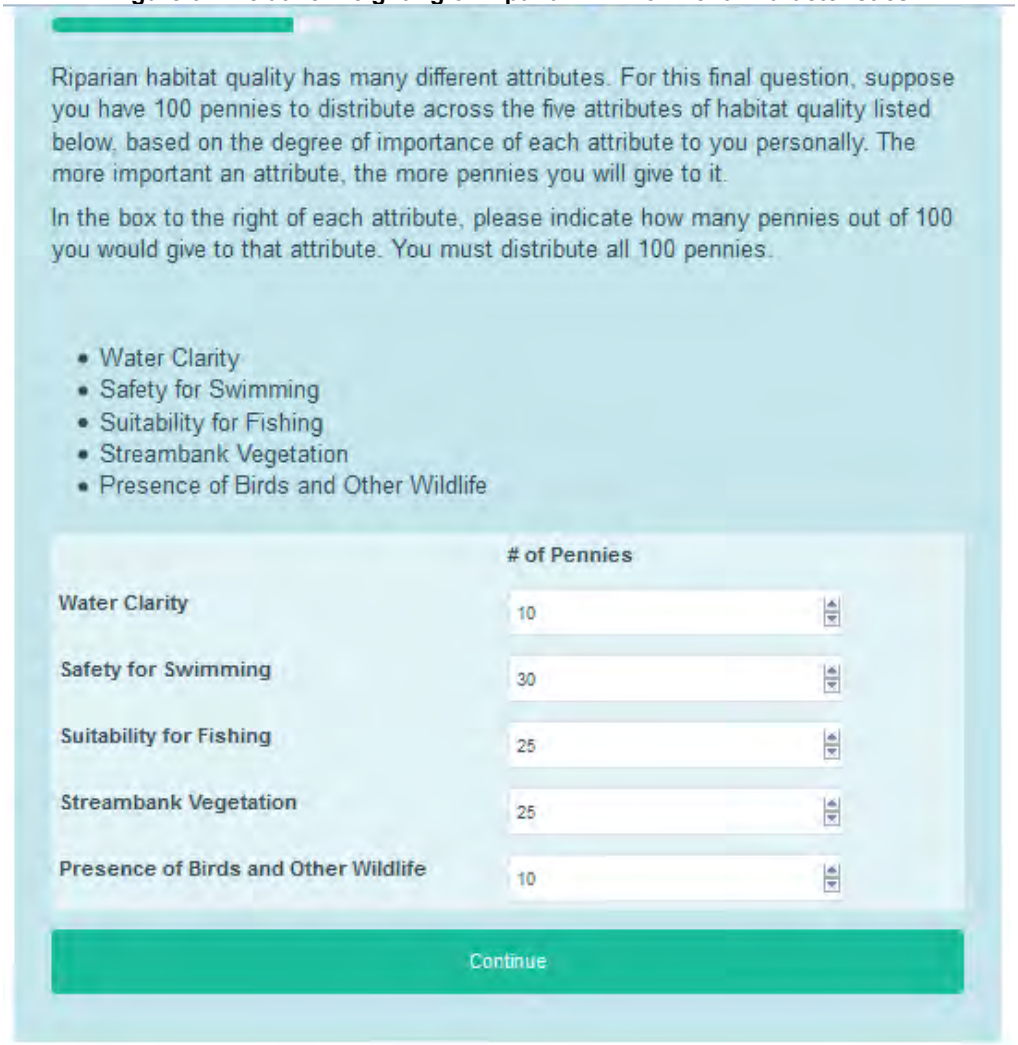
	Very Poor	Poor	Fair	Good	Very Good
Environmental Quality Image					
Image Sources – Environmental Quality	Center for Watershed Studies: http://www.cws.bse.vt.edu/ http://www.cws.bse.vt.edu/images/sized/images/uploads/SWR_Stroubles_high_banks_and_sediment_loss_640x480-320x220.jpg	Washington State Department of Ecology: http://www.ecy.wa.gov/programs/wq/nonpoint/agriculture/agwqrisks.html	Association for Temperate Agroforestry: http://www.aftaweb.org/about/what-is-agroforestry/riparian-buffers.html	Source: Montana Watercourse: http://mtwatercourse.org/media/photos/RiparianArea01.JPG	Source: Ecology Global Network: http://www.ecology.com/2011/09/07/watershed-more-than-an-event/
Farmland Conversion					
Images Source – Farmland Conversion	Source: http://smartpreservation.net/snohomish-county-washington/				

Table 30. Descriptions of Attribute Levels

Attribute Name	Attribute Description	Level 1	Level 2	Level 3	Level 4	Level 5
Environmental Quality - Level Names		**Very Poor**	**Poor**	**Fair**	**Good**	**Very Good**
Environmental Quality - Descriptions	This attribute refers to the overall quality of the riparian area, including water quality, vegetative cover and wildlife habitat.	• Cloudy water; stream bottom is not visible • River unsafe for swimming • Fishing not possible • Streambank is eroding; some grasses along the water's edge • No birds or other wildlife	• Somewhat cloudy water; stream bottom occasionally visible. • Water safe for swimming 1/4 of the time • Fishing possible 1/4 of the time • Streambank covered in grass with a few shrubs; no trees • Birds sometimes visible	• Stream bottom visible about 1/2 the time • Water safe for swimming 1/2 of the time • Fishing possible 1/2 of the time • Streambank covered in native shrubs with grasses near water's edge; sparse tree cover • Birds regularly visible	• Water is fairly clear; stream bottom is usually visible • Water safe for swimming 3/4 of the time • Fishing possible about 3/4 of the time • Streambank covered in abundant native shrubs with intermittent tree cover • Birds regularly visible • Other wildlife (frogs, turtles, and beaver) sometimes visible	• Water always clear; stream bottom always visible • Water always safe for swimming • Fishing always possible • Streambank densely covered in abundant and diverse trees and shrubs • Birds regularly visible • Other wildlife (frogs, turtles, and beaver) regularly visible • Large mammals (elk) sometimes visible
Conversion of Farmland to Natural Habitat - Level Names		**0%**	**2%**	**4%**	**8%**	**16%**
Conversion of Farmland to Natural Habitat - Descriptions	This attribute refers to the percentage of total farmland in the counties bordering Puget Sound that will be converted to riparian habitat, and no longer cultivated.	No farmland in the counties bordering Puget Sound has been converted to riparian habitat.	2% of the total farmland acreage in the counties bordering Puget Sound has been converted to riparian habitat, about 12,000 acres.	4% of the total farmland acreage in the counties bordering Puget Sound has been converted to riparian habitat, about 24,000 acres.	8% of the total farmland acreage in the counties bordering Puget Sound has been converted to riparian habitat, about 48,000 acres.	16% of the total farmland acreage in the counties bordering Puget Sound has been converted to riparian habitat, about 96,000 acres.
Annual Tax Per Household - Level Names		**$0.00**	**$10.00**	**$20.00**	**$40.00**	**$80.00**
Annual Tax Per Household - Description	This attribute refers to the annual tax that all households in Washington State will be required to pay, every year for 10 years, to finance farmland conversion and riparian habitat restoration.	Households are not required to pay an annual tax.	Households are required to pay an annual tax of $5.00 per year for 10 years.	Households are required to pay an annual tax of $10.00 per year for 10 years.	Households are required to pay an annual tax of $20.00 per year for 10 years.	Households are required to pay an annual tax of $40.00 per year for 10 years.

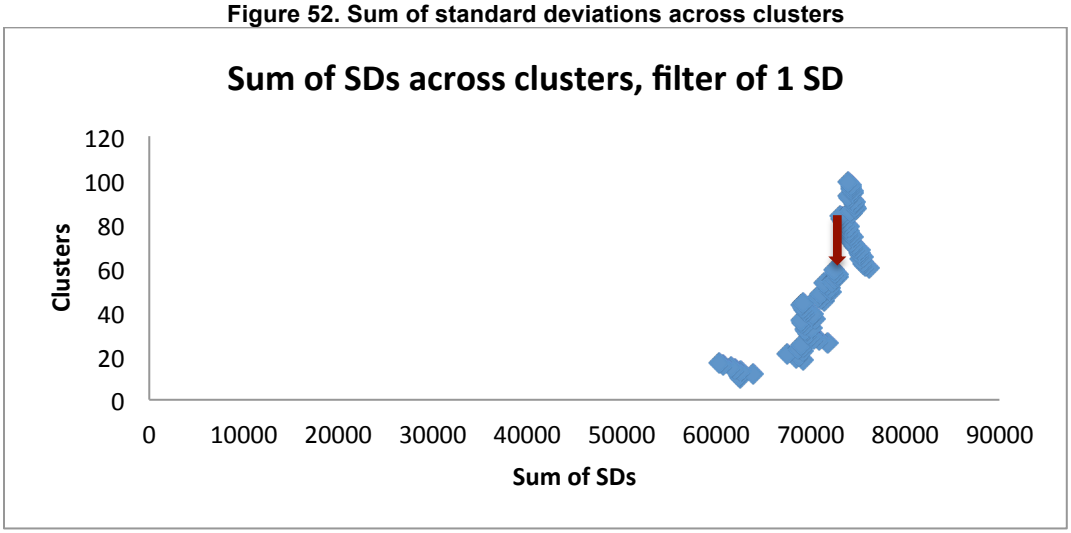
Figure 51. Relative Weighting of Riparian Environment Characteristics



Appendix D. Methods on Selection of Number of Spatial Clusters

We mapped the coastal recreation activity data in 50 clusters. We chose 50 as a suitable number of clusters based on the objectives of minimizing the distance between each recreational activity location within a cluster, and maximizing the distance between each cluster. To select an appropriate number of clusters, we plotted the standard deviation of the distance from a recreation activity point to each of a pre-defined set of site attributes, both across and within clusters. The red arrows indicate the sum of the SD across and within 50 spatial clusters. We plotted the sum of the standard deviations (SD) associated with different numbers of clusters with filters of 1 standard deviation SD and 2 SDs. We selected 50 spatial clusters using professional judgment, since 50 spatial clusters reasonably minimizes the distance between points in a cluster and maximizes the distance between clusters.

Figure 52. Sum of standard deviations across clusters



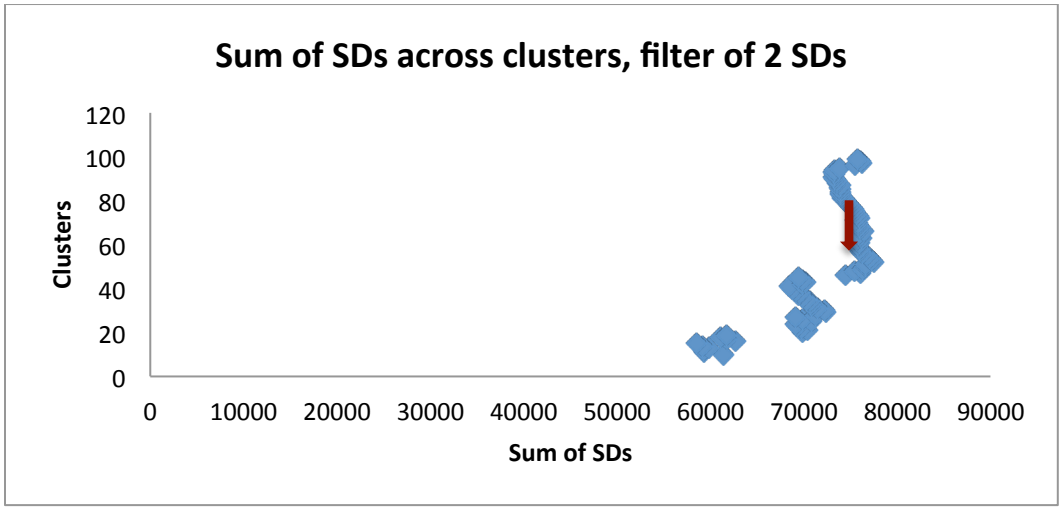


Figure 53. Sum of standard deviations within clusters