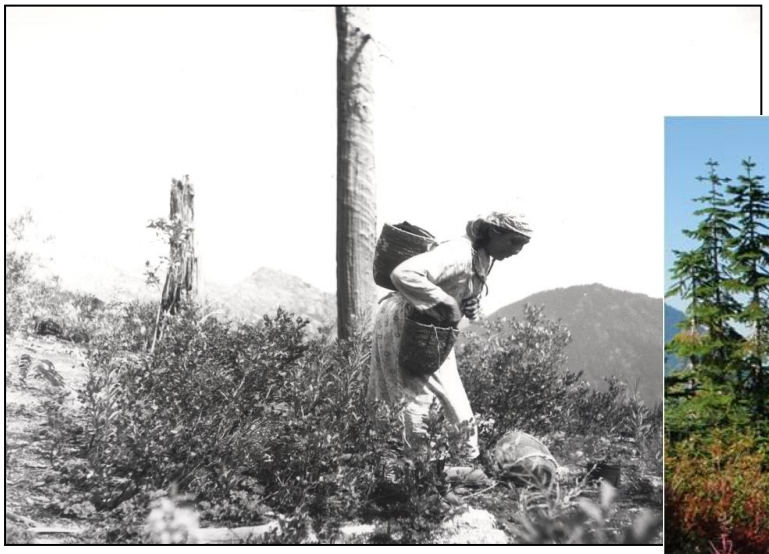
THE TULALIP TRIBES

Distribution and Recreational Harvest of Mountain Huckleberry "sweda?x̌" in the Mount Baker-Snoqualmie National Forest



A cooperative tribal-federal pilot effort toward the long-term sustainability of mountain huckleberries on national forest lands Libby Halpin Nelson, Editor, August 2015

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Cover: (left) Berry Picker at Stevens Pass; Source: Seattle Times, 1946; (right) Daniel Gene Zackuse, Jr., Summer 2012, Skykomish River watershed; Source: Libby Halpin Nelson.

Dedication

Henry “Hank” Delano Gobin
Kwi Tlum Kadim (May 29, 1941 to April 25, 2013)

This report is humbly dedicated to the late Hank *Kwi Tlum Kadim* Gobin,
who worked tirelessly to ensure that the Tulalip people were able to continue their
rich cultural traditions in the mountains according to customary teachings.
As Manager of Tulalip’s Cultural Resources Department, Hank Gobin was a relentless advocate for Tulalip’s reserved treaty rights on public lands. He served as a leader in collaborative efforts between the Tulalip Tribes and Mt. Baker-Snoqualmie National Forest and helped to build understanding between Tribal and Forest Service staff regarding the cultural and spiritual importance of mountain resources
like "**sʷəda?x̌** "(Mountain Huckleberry)
to the Tulalip people.
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Editor Acknowledgements

The Editor wishes to acknowledge the many people who both inspired and contributed directly to this work, including, from the Tulalip Tribes: the late Hank Kwi Tlum Kadim Gobin, Inez Bill, Russell Moses, Richard Young, Jason Gobin, Tessa Campbell, Patti Gobin, Michelle Totman, Val Streeter, Daryl Williams, Kurt Nelson, Julia Gold, Darla Boyer, Molly Alves, Michelle Balagot, and Michelle Myles. We also wish to thank staff from the U.S. Forest Service, Mt. Baker-Snoqualmie National Forest: Barb Busse, Phyllis Reed, Joe Neal and Laura Potash; members of the Tribal Advisory Committee for this project: Warren KingGeorge, Betty Swanaset, and all members of the joint tribal-federal Cedar-Huckleberry Committee. Finally, we wish to acknowledge the U.S. Environmental Protection Agency for a generous grant, through the Tribal General Assistance Program (GAP) in FY 2011 that made this research possible.

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Foreword

By Inez Bill
Tulalip Tribes Rediscovery Program Coordinator

I've been taught that everything we do begins with a prayer.

Our teachings tell us that before we harvest a plant, we say a prayer to show our gratitude for what the plant provides us, and to let it know how we will use it. In that way, we are honoring its spirit.

Our ancestors had a strong connection to our natural world. We see ourselves not as separate from or over our environment, but as equals with the plants and animals and all of nature. The environment provides for all of our needs; that is how our ancestors survived.

All things in our environment are a gift -- foods to nourish our bodies, medicine to heal us, and a spiritual connection that brings us into our values and teachings. Our teachings tell us not to take more than we need, not to waste anything, and to share our harvests with others in a generous and kind way. This will allow these gifts to nourish us and be our medicine.

Our people were never arrogant; they were humble and respectful. If the animals, plants, minerals, waters and all that is in our natural environment are to remain for us, we must show them respect and treat them in the right way.

Our native foods not only nourish our bodies, they also feed our spirit.

Huckleberry is a food and medicine to our people. Our ancestors visited certain areas for gathering berries. They knew where the berries were growing, and what companion plants might be growing there too and how to use them. The knowledge of plant uses was at times handed down through generations, or a spiritual communication could be received to help the person that was in need. Our people took care of our harvest areas, never overharvesting any one area. They had choices of where to go and would rotate among them, leaving some areas alone. Sometimes families had certain harvesting areas they would go to; these areas would be known and respected by others in the community. Other times, saltwater people might trade for berries from people living farther upriver and in the mountains.

Today we continue to take care of our harvest areas so that we can go back to that same area and gather again. After we harvest, we want it to look like we weren't ever there. If we are able to gather a little extra, we share with our elders and others who cannot harvest for themselves. It's also very important to be able to serve our traditional foods at our gatherings -- it is like "rolling out the red carpet" for our guests. By sharing our native foods, we are following our teachings, and showing that we are rich in our culture.

The foods of our people, like the berries and nettles and many others, are proving to be above and beyond today's "superfoods". They are extremely rich in vitamins and nutrients. At a time when diabetes is epidemic on our Reservation, we know that huckleberries serve as one food that our people can safely eat without elevating their blood sugar level. Thinking back --- our people, our ancestors, were on the right track. They had the foods that took care of them, and provided for all of their needs.

We can't always go back to the way it was, but if we did, even a little bit, we would be healthier. There are certain things we can do to make changes in the food we eat. But what's equally important is that we continue to carry forward these teachings and values of respect, and of taking care of our environment. As an example, think about going to the market to buy produce, like a head of lettuce. We don't say a prayer to that head of lettuce before we buy it. We don't think about that, or give thanks. That is how we forget our teachings. But by gathering our Native foods, we are reminded of the teachings, and to stay connected to our environment. We need to remember and share these teachings and values.

Huckleberries and all the plant foods and medicines were so important to us that our people included them in our Treaty! These were resources our ancestors secured for us so that we would be able to continue our way of life. We need to fight, just like they did, for the things our people use and need -- fight for the things our ancestors laid out for us in the treaty.

Approximately 18 years ago, I was preparing for a memorial ceremony and had the opportunity to go to Mount Adams to pick huckleberries. I was alarmed to see for myself that this area that was the gathering area of the Yakama Nation for generations, was desecrated. The damage was very evident. Without having to leave my vehicle, you could see plants that were destroyed to create harvest trails. There were tribal members there trying to harvest berries to put away for the year. We were told by them that there were commercial harvesters getting coolers full of berries to sell to restaurants so they could serve huckleberry pancakes or pies. I was very disturbed by this and want to be sure this won't happen here in our area on the Mt. Baker-Snoqualmie National Forest.

My late husband, Henry Gobin, always used to say, "To have a healthy people, you need a healthy environment". We see where salmon populations have declined to a critical level. Henry and I thought a lot about our winter ceremonies; we did not want to see a time where we would go to a gathering and not have any of our Native foods at the table because they were no longer available. Today, it is not only important that we continue the struggle to uphold our treaty rights, but we need to campaign for the health of our resources and access to our mountain areas. I hope this report will support our work to continue the lifeways of our people.

Preface

*In November of 2007, the Tulalip Tribes signed the first negotiated tribal government-to-government agreement with the U.S. Forest Service on the Mt. Baker-Snoqualmie National Forest (MBS). This agreement was initiated by Tulalip to address concerns over conservation and access to natural resources and culturally-important places within the National Forest. One resource of concern to tribal members is the Mountain Huckleberry, or, in the Lushootseed native language, "*sʷəda?x̌*".*

*For thousands of years "*sʷəda?x̌*" has served as an important food, medicine and trade good to the tribal Coast Salish peoples of this region, including Tulalip's ancestors. Annual gathering and processing of large quantities of mountain huckleberries was an integral part of the seasonal round of food gathering activities as well as their social, cultural, and spiritual lives. In 1855, with the signing of the Treaty of Pt. Elliott, predecessors of the Tulalip Tribes -- the Skykomish, Snoqualmie, Snohomish and other allied bands ceded thousands of acres of land in what is now a national forest – the Mt. Baker-Snoqualmie. Their ancestors, some of whom lived along the western slopes and mountain valleys of the Cascade Mountains, were relocated, along with other native peoples along the lower rivers and coasts, to a small saltwater reservation on Puget Sound. This area, that became the "Tulalip Reservation", was at quite a distance from the mountain territories and many of the higher elevation hunting and berrying grounds.*

When treaties were being negotiated, tribal leaders insisted they retain their rights to hunt, fish and gather plants and other natural resources in their traditional places, including their mountain territories. These are considered tribal "reserved rights" that guarantee signatory Tribes to the Pt. Elliott Treaty continued access to and use of these lands and resources outside of the reservation. They are not rights granted by treaty, rather they are rights Tribes have always possessed, and deliberately retained for their people through the Treaty process.

While patterns of use and access changed significantly with the signing of treaties, movement to reservations, and the conversion of many of these former Indian held lands to privately held parcels, gathering of huckleberries and other mountain plants and natural resources continued, and today remains an important cultural practice to Tulalip members and to those of other Coast Salish Tribes. Public lands like the Mt. Baker-Snoqualmie National Forest (MBS) play an important role in providing these treaty-reserved traditional foods and medicines.

Maintaining an adequate supply of and access to plants, like mountain huckleberry, on the Mt. Baker-Snoqualmie National Forest is critical to Tulalip and other area tribes. Tribal members worry that a growing regional population will continue to increase demand on huckleberries, and potentially other mountain plants. They have observed how many of the berry patches that they use currently are becoming overgrown by conifers, and that fewer new areas are available to replace their previous patches. Tribal members are also concerned about potential road closures or land status changes that might reduce access, a changing climate that may not favor mountain huckleberries, and the lack of good baseline information on the status of huckleberry habitat and use on the National Forest and a management plan to ensure their sustainability.

Tulalip and other area tribes with reserved treaty rights to gather plants on these open and unclaimed lands have a strong interest and significant stake in the future management of these lands and resources. We have worked steadily over the last several years with federal agencies, such as the U.S.

Forest Service, encouraging a greater focus on non-timber plant resources, like mountain huckleberry. We have also promoted managing for an array of forest stand ages and habitat types to encourage a greater diversity of plant and wildlife species that more closely resemble the mosaic-like pattern of plant and animal communities pre-dating pioneer settlement in the mid-1800s.

We have worked with other Tribes in the region on issues related to treaty gathering on public lands. In 2011, Tulalip coordinated and hosted a 3-day symposium on tribal plant gathering on public lands: "Sustaining Our Culture: Management and Access to Traditional Plants on Public Lands". We invited other Tribes using MBS forest lands to Tulalip to hear about and provide their thoughts and suggestions on the development of this baseline huckleberry study on the MBS. The "Distribution and Recreational Harvest of Mountain Huckleberry "sʷəda?x̌" in the Mt. Baker-Snoqualmie National Forest" takes advantage of Tulalip's cooperative relationship with the U.S. Forest Service, the combined tribal and Forest Service resources and expertise, contributions from other area Tribes, regional experts. Our work together produce this document reflects our mutual desire to ensure a diverse and resilient landscape, where culturally important species like mountain huckleberry may be sustained and indeed, thrive.

In 2008, Tulalip formed the "Cedar-Huckleberry Committee", a joint task force of traditional teachers and technical staff from Tulalip and staff from the Mt. Baker-Snoqualmie National Forest. The purpose of the Committee was to promote dialog between the Tribes and the Forest Service about mountain plants and plant gathering and their place in Tulalip culture, and to voice their concerns about the health of plants growing in their ancestral territories. The Committee published a final agenda for action that pointed to the need for better information on the distribution and status of mountain huckleberry and of current huckleberry harvests on the forest. This collaborative Tribal-Forest Service study of huckleberry habitat and recreational harvest on the MBS was undertaken in response to this recommendation.

As ancient stewards of the mountain areas and natural resources of the Coast Salish Sea ecosystem, tribes bring with them thousands of years of knowledge, practice, and relationship with the environment that has been handed down from generation to generation. Although tribal engagement in the future management of their mountain homelands and treaty-reserved resources is a matter of good governance, it also offers a vast source of practical experience and knowledge for the benefit of all people.

Tribes recognize that over the last one-hundred and fifty years, huckleberries have come to be important to non-tribal residents who appreciate huckleberry both as a food, and as an outdoor experience and tradition. These harvesters have many of the same concerns about the sustainability of huckleberry on public lands. It is our hope that by working together with federal land managers and by undertaking some of the needed studies to assess the status of huckleberry and their harvest on the MBS, we can help to ensure the health and sustainability of mountain huckleberry for all who value it for many generations to come.

Libby Halpin Nelson, Editor
August 7, 2015

Contributors

Inez Bill, Rediscovery Program Coordinator
Tulalip Tribes Natural and Cultural Resources Department

For six years, Inez Bill has been teaching tribal youth how to harvest and process plants in traditional tribal ways. Through teaching children the old ways of honoring, harvesting and using plants for food and medicine, the plants in turn will nourish the spirits and bodies of the Tulalip people for generations down the road. "We consider the medicinal plants as gifts from the spirit," said Bill, Coordinator for the Tribes' Rediscovery Program. . "We want to see our people harvesting the plants and herbs that our people have used historically".

"A lot of things have come to me now that I'm older, on how to teach our people," syas Bill. "People used to be taught by their aunts, uncles, and grandparents. Today, the Hibulb Cultural Center is an additional resource that our tribal membership can turn to for teachings. As Program Coordinator, Inez passes on the knowledge to tribal members in the Rediscovery Program. "I teach the youth not to harvest the whole plant, to make it like we were never here, and to thank the plant," she said. "There's respect in every aspect of our way of life."

Inez Bill's upbringing was steeped in tribal spiritual traditions. She remembers tramping through the woods as a child, scanning the ground for salmonberry and thimbleberry sprouts. It concerns her that some traditional foods have fallen out of use. "As kids, we'd eat sprouts and stay out of the house all day," she says. "I see moving toward a more traditional diet as a way of remembering. It's going back and remembering these foods, and, if we can, making them more available to our people."

Joyce LeCompte-Mastenbrook, PhD Candidate
University of Washington, Department of Anthropology

Joyce LeCompte-Mastenbrook's dissertation research is examining the connections between traditional foods revitalization in Coast Salish territory and the scientific and political aspects of management of public lands in the Cascades of Washington and British Columbia. She has particular interest, experience and expertise in mountain huckleberry, from both a biological and socio-cultural perspective. To better understand the connections between traditional foods and public lands management, LeCompte-Mastenbrook is focusing on the changing connections and interactions with the land in several places and communities throughout the Cascades. This work traces both the creation and maintenance of a colonial landscape and new collaborative relationships between Coast Salish people, land managers, forest and wildlife ecologists, archaeologists, animals, plants, and the landscape itself.

Robin D. Lesher, Ecological Consultant
Research Associate at the Burke Museum, University of Washington

Dr. Robin Lesher is currently an ecological consultant, and a Research Associate at the Burke Museum, University of Washington, where she is curating a herbarium collection of cryptogams from the national forests of northwestern Washington. Her research interests are species habitat modeling and distribution relative to environmental gradients; describing, mapping and monitoring vegetation; biodiversity, ecology and distribution of bryophytes, lichens and vascular plant species in northwestern Washington; subalpine and alpine vegetation; succession, growth and development of plant associations; fire history; conservation biology and restoration.

Lesher was Ecologist with the U.S. Forest Service from 1984 to 2011. Her responsibilities included an ecological inventory and classification of potential vegetation as well as applied research in the field of vegetation and landscape ecology on the Mt. Baker-Snoqualmie and Olympic National Forests. Lesher worked with J.A. Henderson and C. Ringo to develop species habitat models and maps for various species considered rare, or of cultural or economic interest. She has a B.S. and M.S. in Biology-Plant Ecology from Western Washington University, and a Ph.D. in Ecosystem Science from the University of Washington, College of Forest Resources.

Libby Halpin Nelson, Environmental Policy Analyst
Treaty Rights Office, Tulalip Tribes Natural Resources Department

Libby Halpin Nelson is a Senior Environmental Policy Analyst with the Tulalip Tribes, where she has been since 1990. She has worked on a wide range of environmental and tribal governance issues, both domestic and international. Libby was instrumental in the development of Tulalip's Government-to-Government Memorandum of Agreement with the U.S. Forest Service and continues to oversee its implementation to sustain the resources and places of importance to Tulalip on their ancestral territories and treaty-protected use areas. She is currently a project manager for a co-stewardship and huckleberry enhancement project with the Forest Service in the Skykomish Ranger District. Libby served as the coordinator for two regional and national conferences: "Sustaining Our Culture: Management and Access to Traditional Plants on Public Lands", as well as a national workshop for tribes on NEPA and development of tribal environmental policy acts. Prior to her work at Tulalip, Libby served as Manager of the Environmental Division for the Confederated Salish and Kootenai Tribes in Montana, and as a consultant to the World Resources Institute in Washington, D.C. to analyze impacts of deforestation to indigenous groups. Libby began her career in natural resources working with tribes in Alaska on subsistence policy in the 1980s.

Jan A. Henderson, Ecologist

Dr. Jan Henderson was Area Ecologist with the U.S. Forest Service, from 1979 to 2010, and is now retired. His responsibilities included applied research in the field of vegetation and landscape ecology on the Olympic and Mt. Baker-Snoqualmie National Forests in Washington, and potential vegetation modeling and mapping for Washington and Oregon. Prior to that he was Assistant Professor of forest ecology and silviculture at Utah State University from 1972-1979. He has numerous publications and presentations in the areas of vegetation classification, ecological succession, fire and climatic history and use of Geographic Information Systems (GIS) in forest management. He has a B.S. in Forest Management from Washington State University, an M.S. in Forest Ecology from Oregon State University and a Ph.D. in Plant Ecology from Oregon State University.

David Kendrick, Vegetation Program Manager, United States Forest Service, Mt. Baker-Snoqualmie National Forest

Dave is a forester and has served for the past eight years as the Forest Vegetation Program Manager for the Mt. Baker-Snoqualmie National Forest in Everett, Washington. His work includes managing the use of forest products such as berries, mushrooms, timber, and firewood. Dave has a Bachelor of Science in Forestry from the University of Missouri and a Master of Forestry in Forest Engineering from Oregon State University.

Chris Ringo, GIS Programmer/Analyst
Dept. of Crop and Soil Science, Oregon State University

Chris began his career as a computational scientist with Complex Systems Research Center at the University of New Hampshire, a research group involved in quantifying rates of global deforestation and the role of the oceans in the global carbon cycle. In 1990, he left academia for his first GIS position with the New Hampshire Department of Environmental Services. After more than a decade as a GIS programmer-analyst, cartographer, and manager for the Washington Department of Fish and Wildlife, Chris was hired by Jan Henderson and Robin Lesher of the Forest Service to provide GIS support for 6 years on the Potential Natural Vegetation Project, to map potential vegetation of Washington and Oregon, environmental gradients and support modeling and habitat mapping for species of interest. Chris is currently a Faculty Research Assistant with the Department of Crop and Soil Science at the Oregon State University in Corvallis, Oregon, where he is working on several regional-scale spatial data and analysis projects in collaboration with the Forest Service, the Natural Resources Conservation Service, and The Nature Conservancy.

Introduction and Project Overview

sʷəda?x̌, or Mountain Huckleberries (*Vaccinium membranaceum* and other *Vaccinium* species) are valued by western Washington Tribes as a subsistence, ceremonial and cultural resource. The archaeological record shows a very long relationship between native peoples and the western Cascade Mountains, dating back at least 9,000 years. Specific discoveries of mountain huckleberry drying trenches have been found dating back 2,500 years or more. Tribes know, and the ethnographic record confirms, that before European settlement their ancestors set fire to huckleberry habitat and used other means to create or maintain the open conditions that favor huckleberry growth. Throughout the plant's range, Native people used fire in a variety of site-specific ways to prevent conifer encroachment into existing huckleberry meadows and to create new ones.

In 1855, The Tulalip Tribes, as well as other Point Elliot Tribes of western Washington, entered into a treaty with the United States that reserved tribal hunting, fishing and gathering rights on off-reservation lands, which include the lands in the Mt. Baker-Snoqualmie National Forest. The Forest Service recognizes these tribal rights to continue to practice their treaty-reserved rights on NFS lands.

Non-tribal users also rely on huckleberries as a source of subsistence, recreation and as an outdoor experience. In addition, wildlife -- primarily bears, along with elk, deer, coyotes, chipmunks, ground squirrels, bird and insect species -- depend on the shrubs' leaves and berries for critical forage.

A common perception among tribal people today is that many of their formerly productive harvest areas are now degraded or have disappeared entirely. In the U.S., the majority of mountain huckleberry habitat occurs on public lands managed by the U.S. Forest Service (USFS). It is generally acknowledged that management practices on public lands over the course of the past century have resulted in a declining area of suitable huckleberry habitat and productivity. Huckleberries decline as the tree canopy becomes denser, and increase after canopy reduction. Over the past several decades, a changing fire regime on national forests, resulting from prohibition of traditional Native American burning in the late 1800s and early 1900s, and more generalized fire suppression policies of the early and mid-century contributed to a decrease in meadow habitats on national forests across the west. More recently, and in the Pacific Northwest specifically, decreased logging and the designation of management units as "Late Successional Reserves" under the Northwest Forest Plan of 1994, has also contributed to huckleberry habitat decline, with the decrease in logging of upper elevations potentially the biggest factor on the MBS today.

In recent years, The USFS has been working closely with the Tulalip Tribes to address our needs and concerns regarding resources on national forest lands. Maintaining off-reservation access to and harvest of mountain huckleberries, and being able to retain and in some cases revitalize these cultural practices, is critical to treaty tribes like Tulalip, as well as other western Washington tribes. Tulalip's reservation land base, as well as those of other tribal reservations in western Washington, does not support all of the foods, medicines, materials and certain physical landscapes necessary to sustain tribal culture; historically, tribal people sought these resources across a large and varied landscape.

In light of the increasing demand for huckleberries, potential climate change impacts, projected regional population growth, and potential road closures, Tribes are increasingly concerned about their ability to gather huckleberries and other traditional foods and medicines now and their sustainability for future generations. This study grew out of that concern.

Purpose and Structure of this Report

In an effort to address these tribal concerns about treaty gathering of mountain huckleberries, Tulalip and the U.S. Forest Service worked cooperatively to develop this study. We agreed that critical baseline information was needed to serve as "building blocks" for a plan to manage and sustain huckleberry habitat on the Mt. Baker-Snoqualmie National Forest. This included information on the current status and distribution of huckleberry habitat, as well as the current mountain huckleberry harvesting levels by the public. While it is known that several huckleberry species are harvested on the MBS, we chose to focus on Big Huckleberry (*Vaccinium membranaceum* Dougl.), since it appears to be most commonly targeted by harvesters and its habitat is also largely representative of these other mountain huckleberry species.

To collect this baseline technical information for mountain huckleberry, we contracted with regional experts on huckleberry in the western Cascades specifically to:

- Develop a habitat model and map for big huckleberry that shows the known occurrence and potential habitat of big huckleberry for the Mt. Baker-Snoqualmie National Forest.

- Develop a research plan and conduct an exploratory study to assess current recreational mountain huckleberry harvesting levels, practices and harvester knowledge on the Mt. Baker-Snoqualmie National Forest.

Contributors to this report have collaborated in developing a series of key findings and recommendations for the future management and sustainability of big huckleberry and huckleberry gathering into the future. The results are contained in this three-part report.

The Tulalip Tribes are supporting these specialized studies of habitat and harvest to assist in providing some of the information needed to initiate huckleberry planning on the forest, and other higher elevation species of ecological, cultural and recreational importance. Information presented in this report will serve as baseline information on current early successional mountain habitat type, and will enable monitoring of forest succession, management actions, effects of climate change, and other pressures on the resource. It will also provide information about the recreational harvest of huckleberries on the MBS, and serve as an evaluation of various techniques useful in understanding the harvest and demand for this berry on the MBS. Results from this work should help to evaluate potential impacts of road closures proposed on USFS lands to ensure access to important cultural and habitat areas, and enable evaluation of other USFS proposals and actions to the degree that they may impact these important plant and treaty resources.

Part A: Distribution of Big Huckleberry in the Mt. Baker-Snoqualmie National Forest

Known Occurrence and Potential Habitat Map for Big Huckleberry (Vaccinium membranaceum Dougl.*) on the Mt. Baker-Snoqualmie National Forest (Robin Lesher, Jan Henderson and Chris Ringo)*

Executive Summary

Big huckleberry is widespread on the Mt. Baker-Snoqualmie National Forest. The species was documented on 1,287 U.S. Forest Service (USFS) ecology plots, about one-third of the total plots. Big huckleberry was most frequent and abundant near the crest and in rain-shadow areas. It does occur in the higher precipitation areas as well where it is typically restricted to warmer or drier microsites. The potential habitat map shows this distribution pattern as well.

Big huckleberry is primarily a species of forested habitats. It is considered an early seral species as it is found to be most abundant in open conditions following disturbance on forest sites, such as logging or fire. It also appears to require full sun or partial shade to flower and fruit abundantly.

A potential habitat map was developed using data from 3,148 USFS) ecology plots on the Mt. Baker-Snoqualmie National Forest (MBS) (Figures A-2, A-3, A-2.1-A-2.6). It shows the distribution of four classes (High, Moderate, Low and Not) of potential habitat for *Vaccinium membranaceum* (VAME, big huckleberry, mountain huckleberry, thin-leaved huckleberry). The High habitat class represents much of the potential habitat for big huckleberry on the MBS. The map of the four habitat classes is shown in figures A-3, A-2.1-A-2.6, where the High habitat class is shaded blue. This map is compared to USFS maps of Land Use Allocation (LUA), stand age less than 80 years and roads (Figures A-3.1-A-3.6).

The area mapped as High Likelihood Habitat covers 508,636 acres or 29.2% of the National Forest, with 95% of this habitat class occurring in reserved lands (such as Wilderness, Administratively Withdrawn or Late-Successional Reserves) (Table A-1, Figures A-3.1-A-3.6). The area of High Likelihood habitat in the unreserved "Matrix" lands represents only 22,000 acres, with the highest amount on the Snoqualmie Ranger District, followed by the Mt. Baker District. Matrix is the land use allocation that is available for timber harvest and has the least constraints for management under direction of the forest plan.

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Introduction and Background

Big huckleberry (*Vaccinium membranaceum*) is a species of the Pacific Northwest and is commonly found in the Cascade and Olympic Mountains. It is also known as thin-leaved huckleberry or mountain huckleberry, or by its abbreviation "VAME". It ranges from southern British Columbia south through the Cascades of Washington and Oregon into northern California, and east to the northern Rocky Mountains of Idaho and Montana (Hitchcock and Cronquist 1973).

In Washington and northwestern Oregon, it is a widespread in the dry part of the maritime regions and the wet part of the dry interior regions at mid-to upper elevations. Big huckleberry is most common on volcanic soils in the Cascade Mountains from just north of Mt Rainier and south into northern Oregon. It is shade intolerant and reproduces by seed, or vegetatively by layering, spreading from the root crown and by sprouting from roots. By being such a prolific vegetative reproducer, it can persist in areas where it may be difficult or unlikely to reproduce by seed. However, this species is not rhizomatous as has been previously reported in the literature.

The North Cascades of Washington, which is the study area of this project, represents the cold, wet end of the range of big huckleberry. As the environment gets colder or wetter, this species tends to occur more commonly on southerly aspects and drier topographic positions. Big huckleberry is found at middle to upper elevations, in the Pacific Silver Fir, Mountain Hemlock, Subalpine Fir and Subalpine Parkland vegetation zones, and occupies drier sites than the other huckleberry species in northwestern Washington (Henderson et al. 1992). It is most common in the area described as the Mountain Hemlock/Big Huckleberry-Menziesia-White Rhododendron-Beargrass Plant Association Group (PAG) and the Pacific Silver Fir/Big Huckleberry-White Rhododendron-Beargrass-Alaska Huckleberry PAG (Henderson and Lesher 2012).

Big huckleberry is primarily a species of forested habitats and can be found in many places where it does not readily flower or fruit. These conditions are usually related to the density of the tree layers, as big huckleberry appears to require full sun or partial shade to flower and fruit abundantly. Big huckleberry is most abundant in open conditions following disturbance on forest sites, and thus is considered an early seral species. While huckleberry plants do not readily burn, the mature forests where they typically occur can burn under the right conditions of moisture and wind.

Big huckleberry can also occur in some specialized non-forest sites. These can range from dry microsites in primarily wet environments, such as along the edges of wet meadows, to very dry sites at lower elevations. While these sites are open enough for it to flower, it is usually not common there and often does not flower and fruit successfully.

As a species primarily of forested habitats it can persist through a long period of forest domination, perhaps 200-300 years. It does not usually flower in this situation and may eventually die out if the shade persists too long or is too deep. However, the ability to survive such long periods allows the species to resprout and regrow following forest fire, rather than relying solely on seed reproduction and recolonization.

It has thus adapted to areas with a fairly frequent (every 100-300 years) pattern of wildfires—that is it tends to occur in the drier and more fire prone habitats at upper elevations in the study area. Once the overstory of trees is killed by fire (or by logging) the surviving roots or root crowns can usually, and often vigorously, resprout. Once it starts to regrow, it can spread from the original sprout in expanding circles of newer regeneration, forming distinctive clones. As the outer stems have a

competitive advantage due to more free space, they are more vigorous but may grow outward as much as upward, making them susceptible to layering (i.e. rooting from the stem). Roots extending from the main or original root crown may also send up new vegetative stems.

As big huckleberry typically reproduces vegetatively, it tends to grow in clumps. This pattern is easily seen in communities with a dense covering of big huckleberry. Each clone, or group of stems all originating from the same root stock, may be recognized by its clumped structure. Often such a clone will show differences in leaf or fruit color, phenology or even color or flavor of the fruit. Plants growing near conifer trees appear to have an advantage as they are often more vigorous and the fruits may even be larger or more plentiful. When cut, burned or browsed it appears to have a good ability to resprout or regrow.

Big Huckleberry, like most other species, is sensitive to length of growing season for fruit maturation. It has been noted that years with heavy or late lying snow pack may delay flowering. This could be a problem for seed and fruit production, especially if the species' pollinators (bumblebees) are not present at the time of flowering. Similarly, if the fall is early, the fruit may not have time to fully develop. Such phenological effects on flowering and fruiting may not affect the entire population the same way, as some plants at the dry or warm fringes of the range may find such a season particularly good for them. In addition to relying on bees for pollination, seed dissemination occurs by birds, bears and other animals that eat the fruit and disperse the seeds.

This species has evolved in and has adapted to changes in climate. Climate is currently changing and has always been changing. Probably all Pacific Northwest plant species have a genetic makeup adapted to major climate changes, like those that occurred in just the last few million years (the Pleistocene epoch).

During the last 1000 years the study area has experienced a wide range in climates. It started with a warm and relatively dry climate (the medieval warm period). Then there was a period of dry and cold, then wetter and colder and then a warmer climate. The cold period from about 1300 to about 1800 is called the "Little Ice Age" (LIA).

Since the coldest part of the LIA, between the years 1500 to 1700, climate has been warming and precipitation patterns have also changed. During the cold and wet part of the LIA big huckleberry was probably much less abundant in this area and almost certainly there were few years in which it could complete its flowering and fruiting cycle. It is likely that during the current warming phase of the long-term climate cycle, this species has expanded its range in our area, becoming much more abundant than in previous centuries.

Big huckleberry is prized for its abundant and flavorful fruit, and is an important cultural and food species for tribal cultures of the Pacific Northwest. It is also valued by recreational pickers and commercial harvesters, and there has been increased interest in this species in recent years. Fruit production is higher in early seral communities, and in open or partially open forests. With a decline in timber harvest and wildfires in upper elevation areas, suitable habitat conditions for fruiting has declined, and there is concern for sustainable fruit production to meet tribal and other demands.

A collaborative project between the Tulalip Tribes and the Mt. Baker-Snoqualmie National Forest was funded by the U.S. Environmental Protection Agency to provide and develop critical baseline information needed for the development of a plan to manage and sustain big huckleberry habitat.

Our part of the project was to map the known distribution and potential habitat of big huckleberry for the land area of the Mt. Baker-Snoqualmie National Forest.

Potential habitat is defined as those areas where the environmental conditions exist that are comparable to known sites of occurrence for big huckleberry. However, big huckleberry may not actually occur in all areas mapped as potential habitat because of microsite or forest overstory conditions. Potential habitat represents sites where it is possible for big huckleberry to occur, given appropriate stand conditions.

Baseline information of the spatial and ecological distribution of big huckleberry is needed for the development of a plan to manage this important resource for sustainable production. Species habitat models have emerged as an important tool to address the ecology and spatial distribution of species and to support resource management and conservation biology. Understanding the ecology of a species, and its distribution across the landscape is the basis for addressing questions of habitat requirements, amount and distribution of potential habitat, and management needs. The information presented here on big huckleberry distribution, abundance, and modeled potential habitat can be used to identify potential areas for harvest and stand treatments to enhance huckleberry growth and fruit production, and to help address questions regarding sustainable harvest and management of this plant resource.

Objectives

Our objectives were to provide a map showing known occurrences of big huckleberry on the Mt. Baker-Snoqualmie National Forest (MBS); produce and validate a map of potential habitat for big huckleberry for the MBS, and provide additional GIS layers such as stand year of origin, land allocation and roads to enhance the potential habitat map and subsequent interpretations. The purpose of this project is to provide baseline information and develop new information that can be used in developing a plan to manage and sustain big huckleberry habitat on the MBS.

Study Area

The study area encompasses the greater Mt. Baker-Snoqualmie National Forest, an area of approximately 1.8 million acres (Figure A-1). The climate varies from wet maritime along the western front of the North Cascades, to relatively dry and somewhat continental in the rain-shadow areas of Mt. Rainier and Glacier Peak, and near the Cascade crest. Total annual precipitation (averaged by two acre pixel) varies from a minimum of 39.8 inches to 207.3 inches with a mean of 101.8 inches. The range in mean annual temperature is from 19.1^{o} F to 53.2^{o} F with a mean of 40.0^{o} F (Henderson et al., 2011a). The lowest elevation is 275 feet and the highest elevation is on Mt. Baker at 10,785 feet. The vegetation is dominated by coniferous forests primarily in the Western Hemlock and Pacific Silver Fir Zones (Henderson et al. 1992).

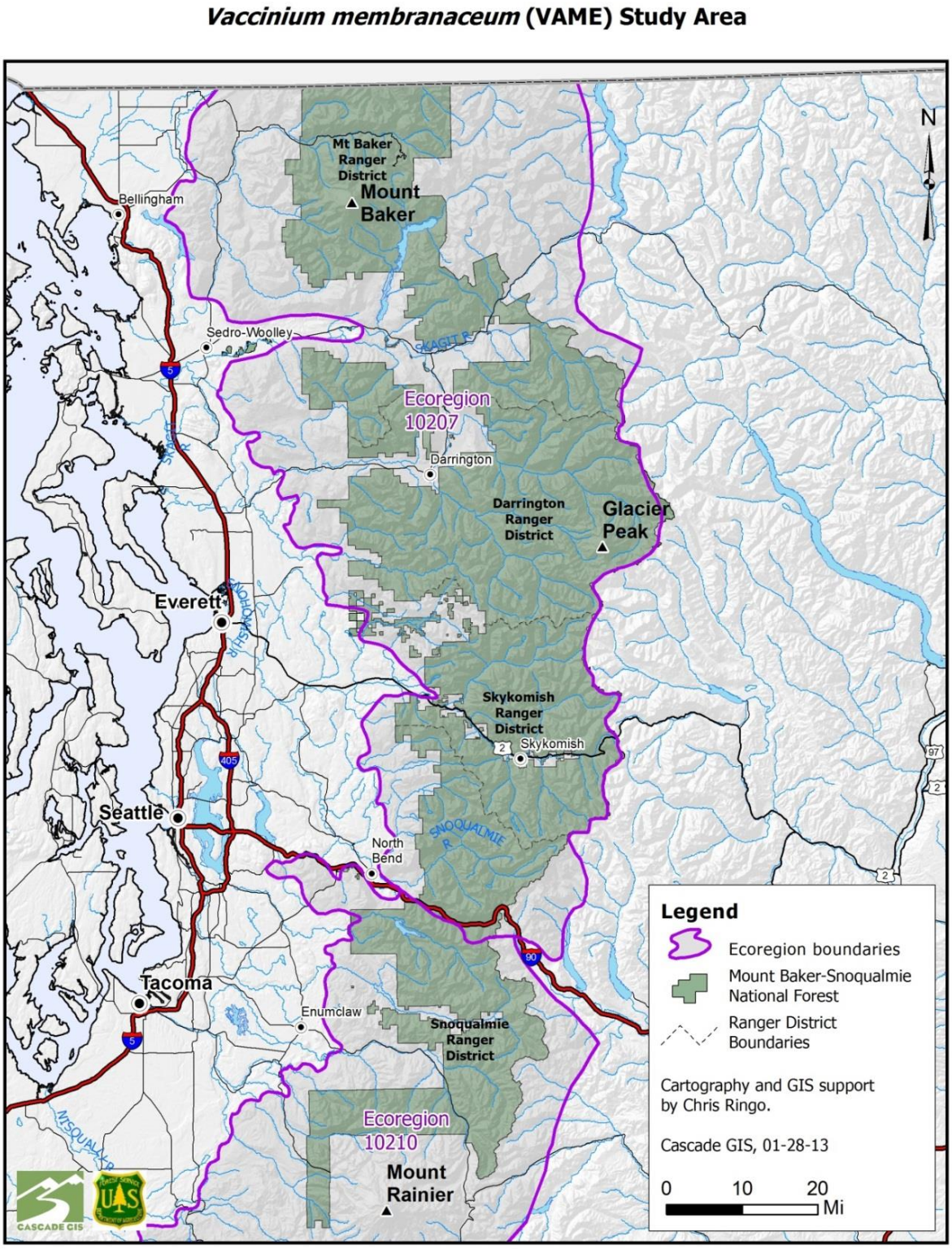

Figure A-1. Big Huckleberry distribution and habitat model study area on the Mt. Baker-Snoqualmie National Forest, Washington.

Known Occurrence of Big Huckleberry on the Mt. Baker-Snoqualmie National Forest

This project used U.S. Forest Service (USFS) Ecology Program plot data to map the known occurrence of big huckleberry on the Mt. Baker-Snoqualmie National Forest, and for analysis and development of a potential habitat model and map for big huckleberry. The Ecology plot data were collected from 1979-2011 on the Mt. Baker-Snoqualmie National Forest as part of the USFS Pacific Northwest Region Ecology Program to inventory and classify potential natural vegetation for national forest lands in Oregon and Washington (Henderson et al. 1989, Henderson et al. 1992, Henderson et al. 2011b). Potential plot locations were located on a systematic grid using the center of each section (square mile) of land as a target point. This assured that sample plots would be distributed evenly across the Forest and be located without bias by the field crews (Henderson et al. 1992).

Big huckleberry is widely distributed across the Mt. Baker-Snoqualmie National Forest. The known occurrence of big huckleberry is shown in Figure A-2, and displayed as two abundance classes (plots where big huckleberry cover was $\geq$ 10%, and plots where big huckleberry was present and less than 10% cover). Big huckleberry was present on 33% of ecology plots (1,287 of 3,881 plots) on the Mt. Baker-Snoqualmie National Forest. There were 428 plots where abundance of big huckleberry was $\geq$ 10% cover, representing 33% of ecology plots where big huckleberry occurred. District scale maps are found in Appendix 2 (Figures A-2.1-A-2.6) that display plot locations by big huckleberry abundance or not present.

Potential Habitat Model and Map for Big Huckleberry

Background and Model Development

The species habitat model is an application in the USFS Potential Natural Vegetation (PNV) Model developed by Jan Henderson (Henderson et al. 2011a). The USFS species habitat model developed by Lesher and Henderson was documented in the doctoral dissertation by Lesher (2005). We have used this approach to successfully model and map potential habitat for over a dozen rare species for the Survey and Manage Program under the Northwest Forest Plan. We also used this approach to develop a map of potential habitat for an economically important forest product – salal, for the Olympic National Forest (Lesher et al., 2008), and previously for big huckleberry as a preliminary model.

This modeling approach is an environmental gradient model. A basic assumption of this model is that the frequency of occurrence and abundance of a species along an environmental gradient resembles a bell-shaped distribution. That is, there is a "zone of the optimum" or "ecological optimum" where environmental conditions are most favorable for the species (i.e., the top of the bell-shaped curve) and where the species achieves its greatest abundance or frequency (Figure A-1.1). Also, the two tails at the edges of the distribution curve are places along the gradient where the environment is less favorable, and the species becomes more limited in distribution until it is eventually absent. At the edge of the species' range, or near the limits of its tolerance for a particular environmental factor, there are compensating factors that may allow the organism to survive in a less than optimal environment, as it becomes more and more restricted to suitable microsites.

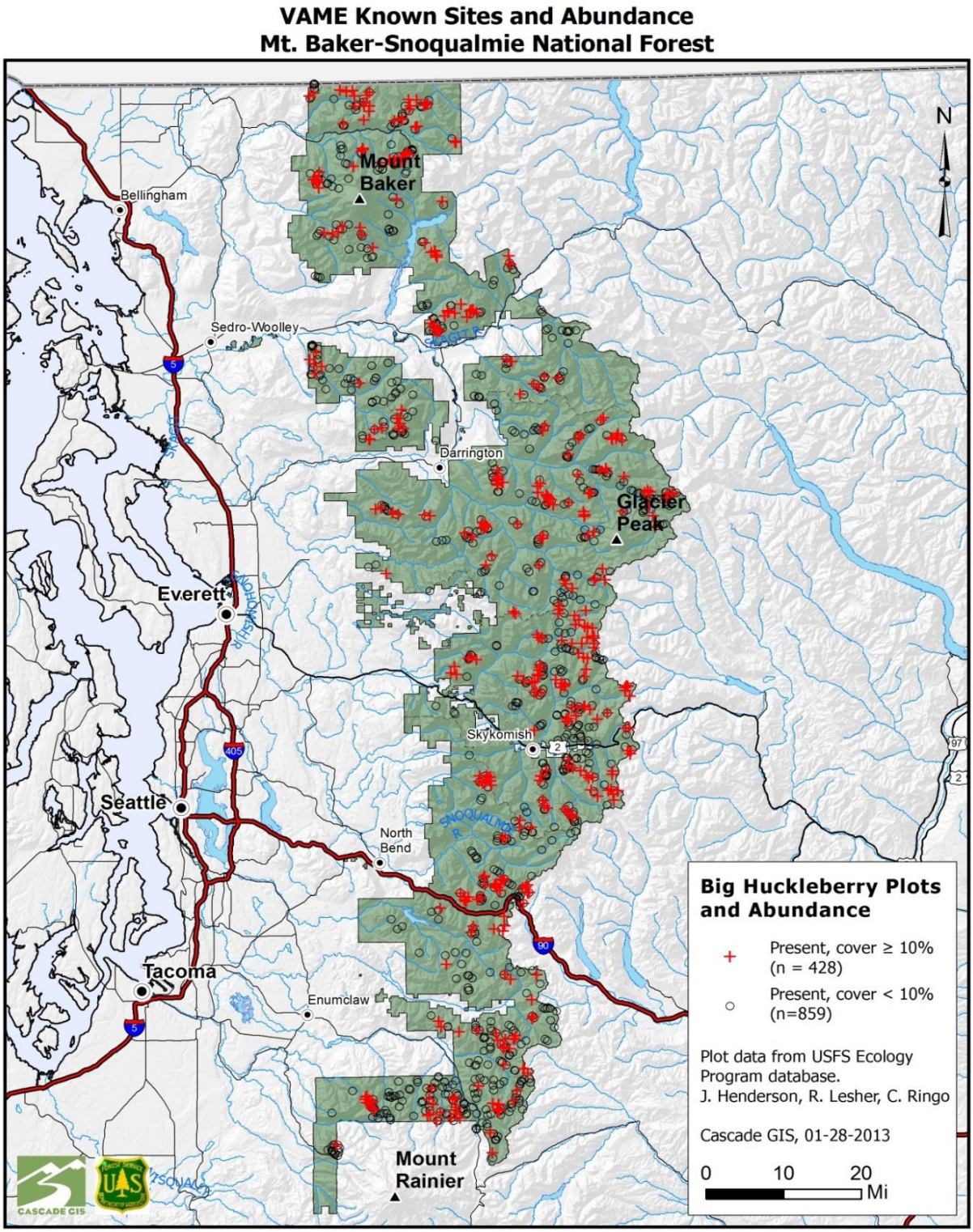

Figure A-2. Known distribution of big huckleberry by abundance classes for the Mt. Baker-Snoqualmie National Forest based on USFS Ecology plot data.

The USFS Ecology Program plot data were used to develop a model and map of potential habitat for big huckleberry. (See Appendix 1 for more detailed methodology). The plots were divided into two sets: model building (calibration) and model validation (Table A-1.1). We used known locations of big huckleberry and mathematical associations with environmental variables to predict places on the landscape where the most similar environmental conditions occur compared to where big huckleberry is known to occur. The environmental variables used in the habitat model generally represent direct quantitative gradients of various aspects of temperature and moisture at different spatial scales. Each variable was evaluated to determine its predictive capability in describing and mapping potential habitat for big huckleberry.

The PNV model stratifies the landscape of Washington and Oregon into areas of similar environments and vegetation called PNV Ecoregions (ER). The species habitat model application runs a separate model algorithm for each Ecoregion. Two Ecoregions encompass the Mt. Baker-Snoqualmie National Forest (ER 10207 north of I-90; ER 10210 south of I-90) (Figure A-1).

The habitat model calculates a habitat value for each 90-meter pixel (about two acres) in the study area. The model output is a potential habitat map that displays four potential habitat classes: High Likelihood, Moderate Likelihood, Low Likelihood and Not Likely Habitat. The habitat classes are defined by a frequency distribution of the big huckleberry calibration plots with cover of VAME $\geq$10%, where 68% of the plots occur in High Likelihood Habitat, 27% of the plots occur in Moderate Likelihood Habitat, 5% of the plots occur in Low Likelihood Habitat, and no plots occur in Not Likely Habitat. The best model was defined as the one that minimized the area mapped as High Likelihood, and maximized the area mapped as Not Likely Habitat, and still met the above plot distribution criteria. The variables used in the model presented here are Elevation, Elevation plus Cold Air Drainage effect, Mean Annual Temperature, Temperature Lapse Rate, Precipitation at Sea Level and Plant Association Group (Table A-1.2).

Model Validation

The final step was model validation. One-third of the original set of plots was reserved from the analysis and model building and used to test or "validate" the final model. The validation plots were used to assess the accuracy of the final habitat model and to determine if there was bias in the plots used to build the model.

The validation plots were randomly selected from the original database of ecology plots. These plots were used to test the final model for any bias in the calibration plot set used to build the model, and to test if the frequency and abundance of big huckleberry differed by habitat classes. We used chi-square tests to compare the frequency of validation plots by big huckleberry abundance class for each modeled habitat class to the frequency distribution of the calibration plots by habitat class (Table A-1.4). There were 875 validation plots: 132 plots with VAME $\geq$10% cover and 272 plots with VAME <10% cover (Table A-1.4). The distribution of validation plots among the four habitat classes was not significantly different from the distribution of calibration plots used to build the model, as confirmed by chi-square tests for the two abundance classes where VAME was present ($\geq$10% cover and < 10% cover). However, there was a significant difference between the calibration and validation plots in the frequency of plots by habitat class for the plots where VAME was Not Present.

We then tested how well the mapped habitat classes predicted abundance of big huckleberry. For this test we combined the two plot sets (calibration and validation) for the two VAME abundance classes, since it was determined they were from the same population. A chi-square test performed on

the combined plot sets confirmed there was a significant difference (P <0.001) in plot frequencies by habitat classes for plots where VAME cover was ≥10% and < 10% cover, and we concluded that abundance of big huckleberry was not independent of the modeled habitat classes (Tables A-1.4, A-1.5).

Map of Potential Habitat for Big Huckleberry on the Mt. Baker-Snoqualmie NF

Potential habitat is the area that has comparable environmental conditions to sites where big huckleberry is known to occur. The output of the habitat model is a map that predicts the distribution of potential habitat for big huckleberry on the Mt. Baker-Snoqualmie National Forest at a 90-meter pixel (2 acre) resolution (Figure A-3). The map displays four potential habitat classes (High, Moderate, Low and Not Likely) based on likelihood of occurrence of big huckleberry with cover greater than or equal to 10%.

The habitat map displays modeled potential habitat for big huckleberry. Potential means how capable the land is of supporting big huckleberry, but says nothing about the current condition of the vegetation. Model validation confirmed the habitat model was very successful at predicting big huckleberry abundance based on the two abundance classes when VAME was present (Tables A-1.4, A-1.5; Appendix 2 Figures A-2.1-A-2.6). For the plots where huckleberry was ≥10% cover, 68% (calibration plots) and 69% (validation plots) occurred in the area mapped as High Likelihood Habitat (Table A-1.5). In addition, for plots with big huckleberry < 10% cover, 39% (calibration plots) and 43% (validation plots) occurred in the area mapped as High Likelihood Habitat. However, for plots with big huckleberry Not Present, only 5% (calibration plots) and 9% (validation plots) occurred in the High Likelihood Habitat class.

The area mapped as High Likelihood Habitat has the greatest potential for big huckleberry occurrence and abundance, given suitable stand conditions. The final model mapped 29.2% of the MBS as High Likelihood Habitat (508,636 acres), 30.7% of the area as Moderate Likelihood Habitat, 11.9% as Low Likelihood Habitat and 28.2% as Not Likely Habitat (Table A-1).

Land Use Allocations are designated in the Northwest Forest Plan (1994) and Mt. Baker-Snoqualmie Forest Plan (1990) (Figure A-4). These allocations represent areas with different objectives and guidelines for management, and thus various constraints or opportunities. The vast majority (95%) of High Likelihood Habitat occurs in reserved lands (Wilderness, Late-Successional Reserve, Administratively Withdrawn) with about 22,000 acres occurring in Matrix where timber harvest is allowed and the opportunities for management are less constrained (Table A-1).

Table A-1. Acres of big huckleberry potential habitat by modeled habitat class and land allocation, Mt. Baker-Snoqualmie National Forest.

	Acres by Modeled Potential Habitat Class				
Land Allocation	**Not Likely**	**Low**	**Moderate**	**High**	**Total Acres**
Adaptive Management Area (AMA)	12,287	2,144	4,870	1,867	21,168
Administratively Withdrawn (AW)	21,886	9,460	28,993	32,935	93,274
Late-Successional Reserve (LSR and	194,700	74,836	188,983	163,119	621,639
Matrix (includes Riparian Reserves)	101,714	14,576	32,302	21,922	170,513
Other (not classified)	5,916	968	2,625	3,613	13,121
Wilderness / Congressionally	154,421	104,528	276,148	285,180	820,278
Grand Total	490,924	206,512	533,921	508,636	1,739,992
Area of Mt. Baker-Snoqualmie NF (%)	**28.2 %**	**11.9 %**	**30.7%**	**29.2%**	

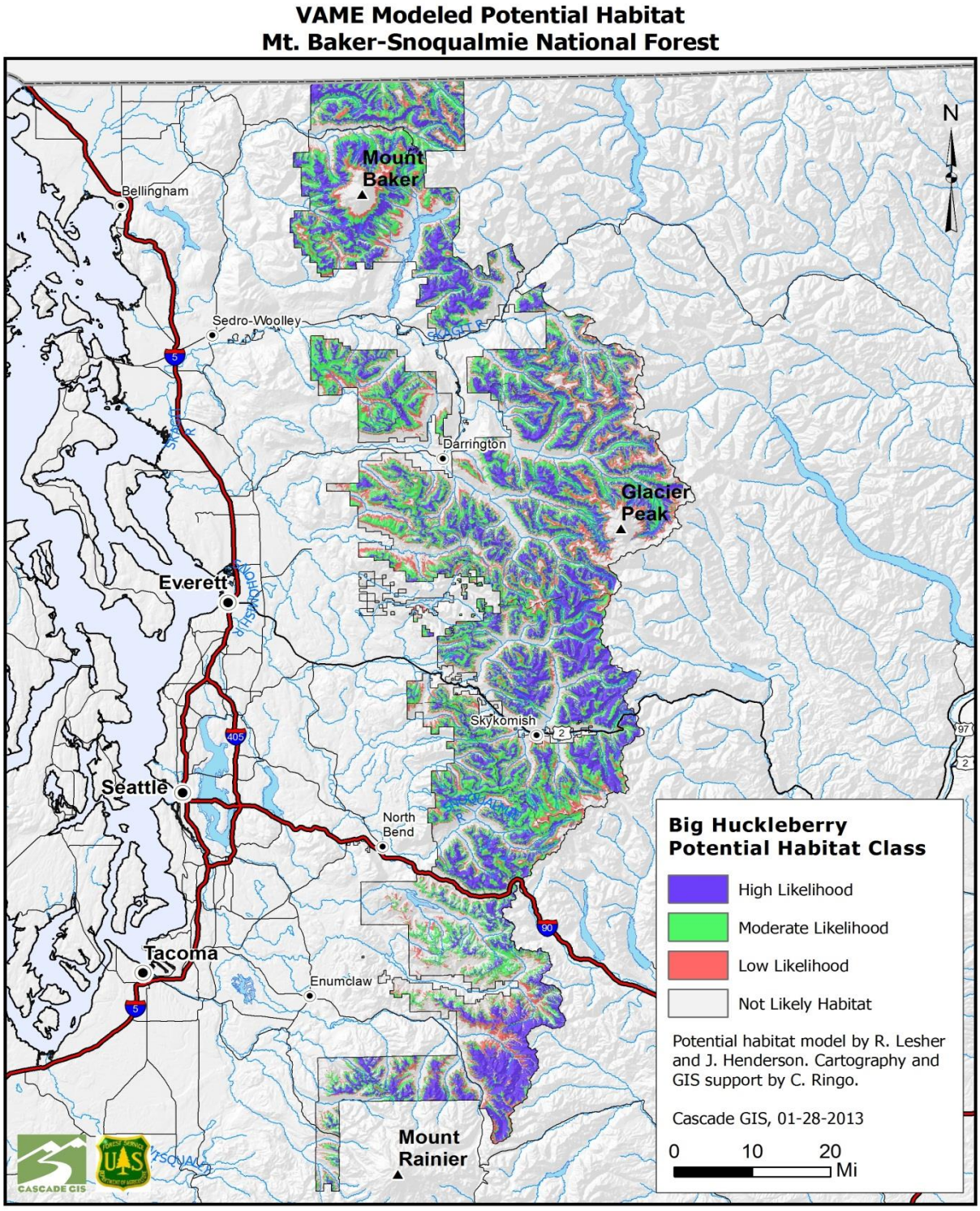

Figure A-3. Modeled potential habitat for big huckleberry by four habitat classes.

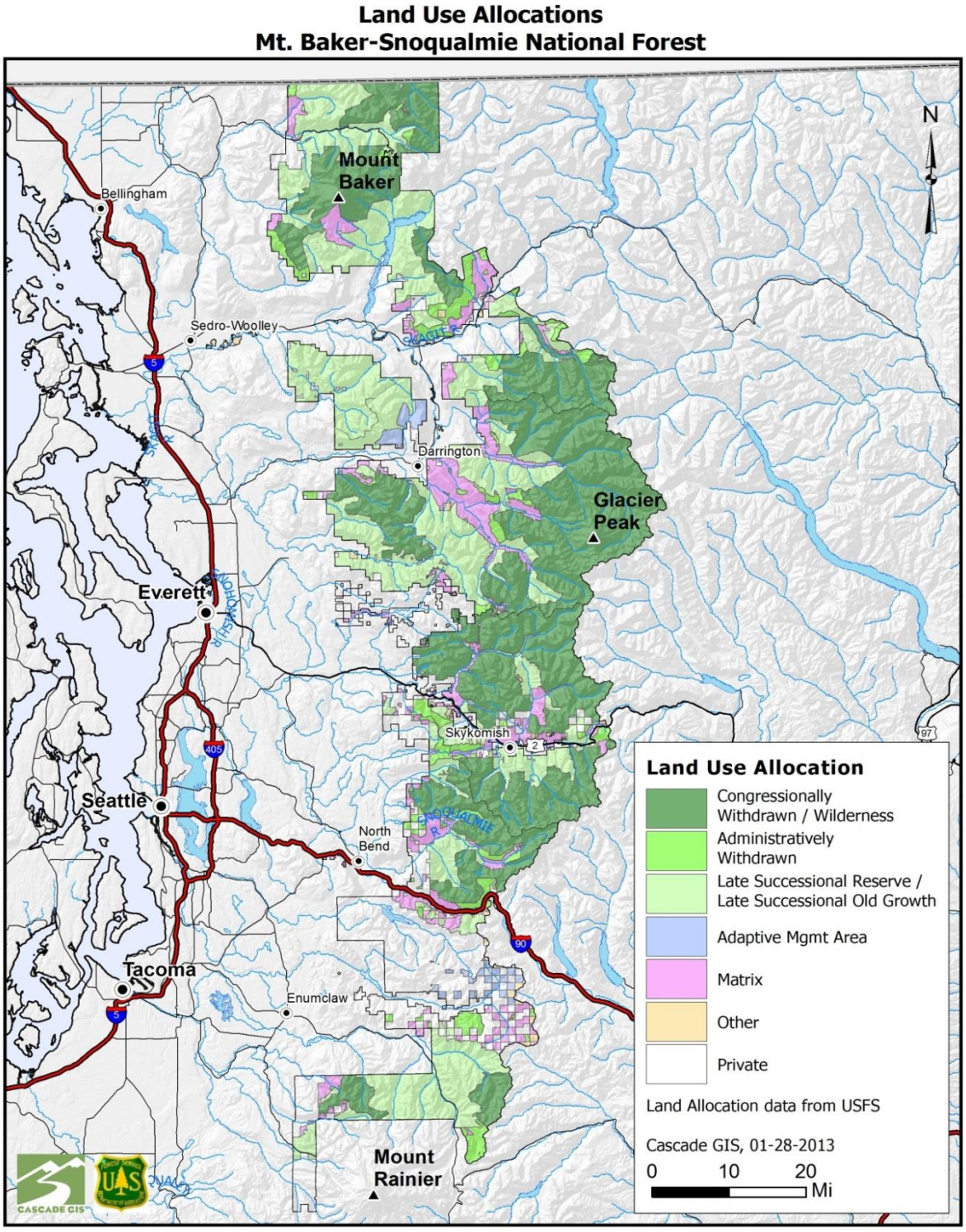

Figure A-4. Map of Forest Plan land use allocations, Mt. Baker-Snoqualmie National Forest.

Amount and Distribution of Potential Habitat for Big Huckleberry

Maps and summary tables of the distribution of potential habitat by land allocation and stand year of origin were developed for each ranger district on the Mt. Baker-Snoqualmie National Forest (Appendix 3). Summary tables for each ranger district display acres by modeled habitat class, land use allocation and six age classes based on stand year of origin data (Tables A-3.1-A-3.4). The district scale maps provide greater map resolution than the overview maps given in figures A-1-A-4, and display HIGH likelihood habitat relative to the merged land allocations units, stand ages less than 80 years, and road access (Figures A-3.1-A-3.6).

These maps can be evaluated to identify potential areas for big huckleberry growth and management. No stand treatments may occur in Wilderness, and are limited in the Administratively Withdrawn (AW) areas as well; thinning treatments may occur in Late-Successional Reserves (LSR) if stands are less than 80 years of age and there are neutral or beneficial effects for old-growth associated species. Treatments in the Finney and Snoqualmie Pass Adaptive Management Areas (AMAs) are guided by their respective AMA plans; whereas Matrix is the land area that is available for stand treatments and has the least constraints on management opportunities (USDA 1990; USDA and USDI 1994).

The distribution of the High Likelihood Habitat class by land allocation and ranger district is shown in Figure A-5. Most of the area mapped as High Likelihood Habitat for big huckleberry occurred in reserved land use allocations (Figure A-5). Only four percent of the HIGH habitat class occurs in Matrix. The Snoqualmie District has the greatest proportion of High Likelihood habitat in Matrix, followed by Mt. Baker, Skykomish, and Darrington. When this is further refined by stands younger than 80 years, there are 5,818 acres on the Forest in HIGH habitat class in Matrix and less than 80 years of age. Again the Snoqualmie RD has the greatest proportion, followed by Skykomish, Mt. Baker and Darrington. Refer to Appendix 3 for maps showing the landscape context and road access.

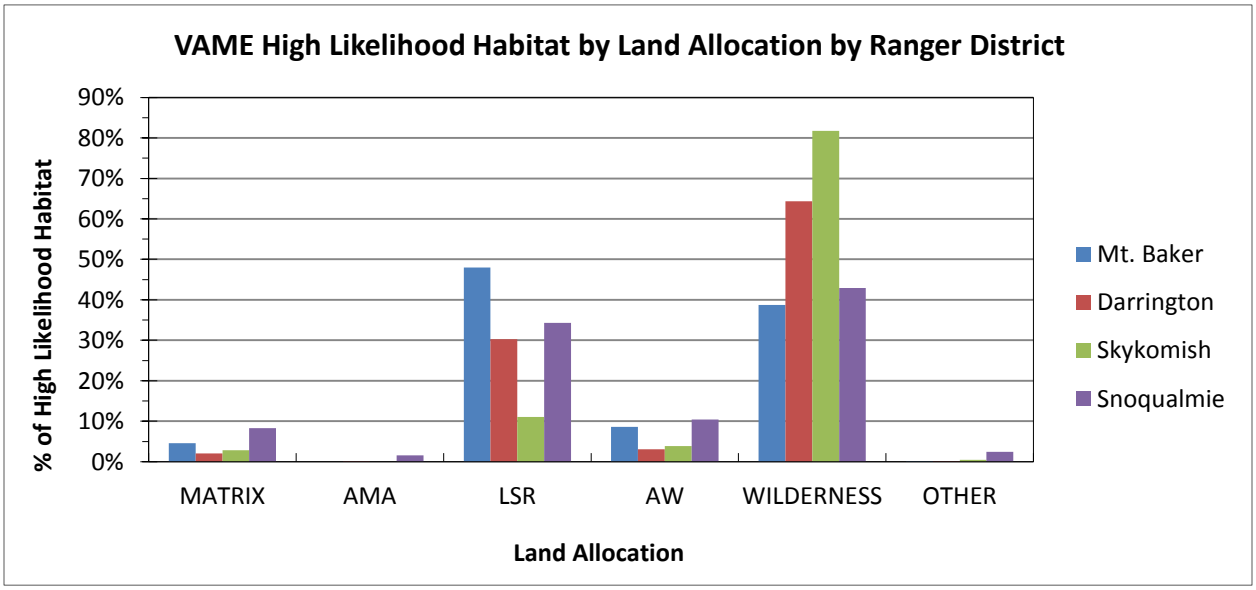

Figure A-5. Percent of Big Huckleberry High Likelihood Habitat by Land Allocation and Ranger District (where AMA is Adaptive Management Area, LSR is Late Successional Reserve, AW is Administratively Withdrawn, Other is not classified, and Matrix is available for timber harvest).

Interpreting and Understanding the Maps of Potential Habitat

The map of the four potential habitat classes (Figure A-3) represents the output of the USFS species habitat model (Lesher 2005). These four habitat classes are High, Moderate, Low and Not. They are defined by the proportion of ecology plots with big huckleberry (VAME) cover ≥ 10%, and are identified on the land by these modeled environmental variables – elevation, cold air drainage effect, mean annual temperature, temperature lapse rate, precipitation at sea level and Plant Association Group (Appendix 1).

This map was developed only for the two PNV Ecoregions (Figure A-1) that encompass the Mt. Baker-Snoqualmie NF. These ecoregions are defined based on broad environmental similarities, as well as similarities in the pattern of vegetation. Over a wider range than these two ecoregions, the variables of precipitation at sea level, temperature at sea level and fog effect are believed to be more important variables at describing the range of big huckleberry across the entire Pacific Northwest.

The **HIGH LIKELIHOOD** Potential Habitat Class is not uniform from one place to another, nor is it uniform with regard to the occurrence or abundance of big huckleberry. There are areas that are mapped as HIGH habitat class that are very suitable and some areas that are not suitable at all, because the complex topography and site conditions creates a mosaic of habitats at a finer resolution than the scale of the mapping unit. This map is represented in areas (pixels) that are two acres (90m x 90m) in size. During the collection of the field data used to make this map, sometimes more than one plot was put into a single pixel (plot size was typically 0.1 to 0.2 acres). These plots seldom represented the same vegetation or the same environment. The variability of the landform, of aspect and elevation and shape of slope cause the patterns of vegetation to be much more variable than are depicted by either the habitat model output or the potential vegetation zones or Plant Association Groups that were used as inputs.

Even in the area mapped as High Likelihood Habitat, not all areas will currently support big huckleberry. Big huckleberry may not be present due to variation in site conditions that occur at a scale smaller than the mapping unit, or due to variables that are not available in GIS [such as soil conditions (rocky, cliffs, or lack of soil)], or due to moisture conditions at a microsite level that are too wet or too dry. It is also possible that stand conditions may not be suitable for big huckleberry growth, such as dense forest stands that would inhibit development of big huckleberry. Site visits will be necessary to verify suitable habitat, big huckleberry occurrence and abundance, or the potential for stand treatments.

This High potential habitat class does not say anything about the current condition of the vegetation or the landscape. A particular area could be in old-growth forest (poor habitat for VAME) or could have recently burned or have been logged (good habitat conditions for VAME). It simply represents the "potential" for VAME to grow there and thus the potential for big huckleberry growth.

Within the area (Blue on the map) mapped as **HIGH**, 15% of the total ecology plots used for model building and validation had no VAME, and another 46% had low amounts of VAME (< 10% cover). A total of 85% of all the plots in this habitat class had some big huckleberry present (Table A-2).

The **MODERATE LIKELIHOOD** Potential Habitat Class for VAME on the Mt Baker Snoqualmie NF represents areas where VAME is likely to occur but less often and with lower average cover than the HIGH class. This class was mapped using the same variables and for the same area as the other classes, and the same caveats about variability in stand structure and environment apply.

Within the area (Green on the map) mapped as MODERATE, 52% of the total ecology plots had no VAME, and another 36% had low amounts of VAME. Thus 48% of all the ecology plots in this habitat class had some VAME present.

The **LOW LIKELIHOOD** Potential Habitat Class for VAME on the Mt Baker Snoqualmie NF represents areas where VAME is unlikely to occur and less often and with lower average cover than the MODERATE class. This class was mapped using the same variables and for the same area as the other classes, and the same caveats about variability in stand structure and environment apply.

Within the area (Red on the map) mapped as LOW, 77% of the ecology plots had no VAME, and another 18% had low amounts of VAME. Only 23% of all the ecology plots in this habitat class had any VAME present.

The **NOT LIKELY** Potential Habitat Class for VAME on the Mt Baker Snoqualmie NF represents areas where VAME is very unlikely to occur and less often and with lower average cover than even the LOW class. This class was mapped using the same variables and for the same area as the other classes, and the same caveats about variability in stand structure and environment apply.

Within the area (white or light gray on the map) mapped as NOT, 91% of the ecology plots had no VAME, and another 9% had low amounts of VAME. Only 9% of all the ecology plots in this habitat class had any VAME present at all, and there were zero plots with greater than 10% cover of VAME present.

Table A-2. Percent frequency by Habitat Class for Big Huckleberry Abundance Classes for the combined Calibration and Validation Plot Sets.

	Plot Frequency				% Frequency by Habitat Class		
	VAME Abundance Class			Grand Total All Plots (n=3148)	VAME Abundance Class		
VAME Model Potential Habitat Class	Absent	<10% cover	≥10% cover		Absent	<10% cover	≥10% cover
Not Likely	947	96	0	1043	90.8%	9.2%	0.0%
Low Likelihood	309	71	22	402	76.9%	17.7%	5.5%
Moderate Likelihood	492	345	114	951	51.7%	36.3%	12.0%
High Likelihood	113	347	292	752	15.0%	46.1%	38.8%

Additional Data Layers and Sources of Information

Other maps and data layers included in the final report are stand year of origin, forest plan land allocations, MBS roads layer, and base data layers.

1. Stand Year of Origin. The stand year of origin is derived from the USFS Ecology Program **draft** fire history layer, and Mt. Baker-Snoqualmie National Forest historic fire records and stand treatment records. The stand year of origin is classed into six age classes: < 40 years (1973-2012), 40-80 years (1933-1972), 81-162 years (1851-1932); 162-361 years (1651-1850); 362-703 (1309-1650), >703 years (1000-1308). These breaks represent age classes significant in forest development or stand management opportunities (<80 years) or encompass the large historic fires in this area (1701, 1508, 1308). See Appendix 4 for district scale maps (Figures A-4.1-A-4.6).

2. Land Management Allocation. The land management allocation layer is corporate data acquired from the U.S. Forest Service (found in the *LandMgmtPlanPolygon* feature class in the *ManagementDirection* geodatabase). This layer contains polygon data which depicts merged land allocations created from the Management Areas (MAs) of the Forest Plan (MBS Land and Resource Management Plan) and the land allocations from the Northwest Forest Plan (NWFP). For this project, we grouped these merged land allocations into broader mapping units using the metadata associated with this polygon corporate data, along with the standards and guidelines in the Northwest Forest Plan (1994) and the Mt. Baker-Snoqualmie Land and Resource Management Plan (1990). These broader categories represent different constraints or management opportunities. The mapping units for this purpose are Wilderness/CW (Congressionally Withdrawn); Administratively Withdrawn (AW); Late-Successional Reserve (LSR) (includes Late Successional Old Growth [LSOG] outside of LSR); Adaptive Management Area (AMA); Matrix ("Available" as allocated in the MBS Forest Plan with riparian reserves overlapping); Other (non-classified forest lands that were acquired after completion of the Forest plan); Water (Baker Lake), and Private. Acres were calculated for the different mapping units. These various land allocations indicate different management opportunities or constraints as they relate to areas of potential habitat for big huckleberry. Refer to the standards and guidelines in the Northwest Forest Plan (USDA and USDI 1994) and Mt. Baker-Snoqualmie Land and Resource Management Plan (USDA 1990) for specific details regarding management direction.

3. Roads. The roads layer was acquired from the U.S. Forest Service. This layer classifies the roads into various categories based on road quality and maintenance level, and can be used to evaluate access to potential habitat sites.

4. Base Layers. This category includes data that provide a geographic context for the maps, including major rivers and streams, cities/towns, volcanic peaks, national forest boundary, and shaded relief.

The information presented in the introduction and background section represent knowledge and expertise developed by the authors while conducting the ecological inventory of the Mt. Baker-Snoqualmie and Olympic National Forests and was adapted from numerous USFS white papers, talks, presentations and classes given by J Henderson between 1979 and 2011.

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Part A
APPENDICES

Appendix 1.

Habitat Model Development and Methods

There were four main steps in the development and validation of the big huckleberry habitat model using the methodology developed by Lesher and Henderson (Lesher 2005, Lesher et al. 2008).

- Assemble plot datasets for model building and validation
- Analysis of environmental variables and plot data for the habitat model
- Build and calibrate habitat model for the two PNV ecoregions on the MBS
- Model Validation

1. Assemble datasets for model building and validation

Ecology plot data (3,881 plots) were split into two data sets for model building and model validation. A random number generator was used to select 70% of ecology plots to build the model (calibration plots), and 30% of ecology plots to validate the final habitat model (validation plots). Plots in each set were then screened to determine if they could be used in the modeling process. Plots were excluded from the analysis if they represented disturbed or very early seral conditions, or occurred in specialized or unique habitats or atypical edaphic conditions at a scale finer than the resolution of the model or available GIS data. In addition, plots where big huckleberry was absent were evaluated in an attempt to determine if absence could be due to dense stand conditions or unsuitable site (i.e. environmental) conditions. If big huckleberry was absent, and it appeared that stand conditions were not restricting its occurrence, but rather the environment was not suitable for big huckleberry, then the plot was placed in the "Not Present" class. However, since big huckleberry is sensitive to light conditions, and if the stand conditions were such that they appeared to preclude the presence of big huckleberry (i.e. dense canopy or disturbance), or if a determination could not be made, then that plot was excluded from the analysis. A total of 733 plots were thus removed from the dataset: 444 from the model building (calibration) set, 289 from the validation set. Table A-1.1 shows the number of plots by big huckleberry abundance class for each plot set.

The calibration set was used for analysis and model building. The validation set was set aside and used to validate the final habitat model. These two data sets were then divided into three classes based on abundance of big huckleberry: 1) VAME $\geq$10% cover; 2) VAME present and <10% cover; and 3) VAME not present (Table A-1.1). Plot subsets where abundance of big huckleberry was greater than or equal to 10 percent cover (296 calibration plots; 132 validation plots) were the primary plots used to build and validate the final model.

Table A-1.1. Big huckleberry abundance class definitions and number of model building (calibration) plots and validation plots.

Big Huckleberry (VAME) Abundance Class	Model Building Plots	Validation Plots	Total Plots by Abundance Class
VAME $\geq$10% cover	296	132	428
VAME present and <10% cover	587	272	859
VAME Not Present	1,390	471	1,861
Grand Total	2,273	875	3,148

2. Analysis of environmental variables and plot data for habitat model

PNV model environmental variables and plot data were analyzed to identify predictive variables for modeling big huckleberry habitat within the study area. Fourteen environmental variables plus Plant Association Group were evaluated (Table A-1.2). Frequency distributions for big huckleberry were compared with frequency distributions for the landscape for each variable. A GIS point cover of the model building plots was intersected with the different environmental grids in the PNV Model to get values for each variable at each plot location. Also, the PNV model provides values for each variable for each pixel within the study area, which were used to calculate frequency distributions for each environmental variable for the study area landscape. This distribution represents the total study area population (N) for each model variable. For each environmental variable, data were grouped into classes and frequency distributions were calculated and graphed for big huckleberry and the study area landscape (i.e., ecoregion).

Frequency distributions of big huckleberry were then compared to the study area landscape. To do this we calculated ratios of actual values (relative frequency of VAME plots) to the expected values (relative frequency for the study area) for each class within each variable. This analysis was done for each variable in each of the two ecoregions on the MBS.

The ratios of relative frequency that compared big huckleberry to the landscape were used to identify predictive variables for modeling big huckleberry habitat. If the distribution for big huckleberry for a given variable is not different from the landscape distribution, then that variable is likely not predictive in modeling big huckleberry habitat. However, if the frequency distributions are different for big huckleberry and the landscape, then that variable may be a good predictor for big huckleberry habitat. Higher ratio values indicated a higher relative frequency for big huckleberry abundance at a particular segment of the environmental gradient.

3. Build model equations for the two ecoregions on the Mt. Baker-Snoqualmie N.F.

Analysis of environmental variables for VAME plots and the study area landscape (ecoregion) were the basis for developing mathematical functions to describe and model potential habitat where big huckleberry cover was 10% or greater. For this model, we used the ratio of VAME $\geq$ 10% cover compared to the ecoregion landscape. The ratio for each segment of each environmental gradient provided the input data to curve-fitting routines. Curve-fitting routines were used to calculate model coefficients for each environmental variable.

The distribution of big huckleberry frequency along an environmental gradient is modeled as a bell-shaped distribution calculated by the Lorentzian function. An example is shown (Figure A-1.1) for the model variable "Elevation plus the Cold Air Drainage Effect" for Ecoregion 10207. We used a Lorentzian function to approximate a Gaussian (bell-shaped) distribution as the coefficients are more intuitive to calibrate and the function is less complex for GIS programming. The equation for the Lorentzian function is:

$$y = a + b / (1 + ((x-c)/d)^2)$$

The "x" axis represents the environmental gradient; the "y" axis is a measure of frequency of big huckleberry occurrence (Figure A-1.1). The function is defined as: "a" is the y intercept; the "b" coefficient minus the "a" coefficient represents the amplitude of the curve, or the weight of the variable; "c" is the value on the x axis where y is maximum (the midpoint of the distribution along the environmental gradient); and "d" is the spread or breadth of the curve; "x" is the value at each pixel for the environmental gradient. The result of this equation, "y", is the "habitat value" calculated by the model for each 90-meter pixel in the study area.

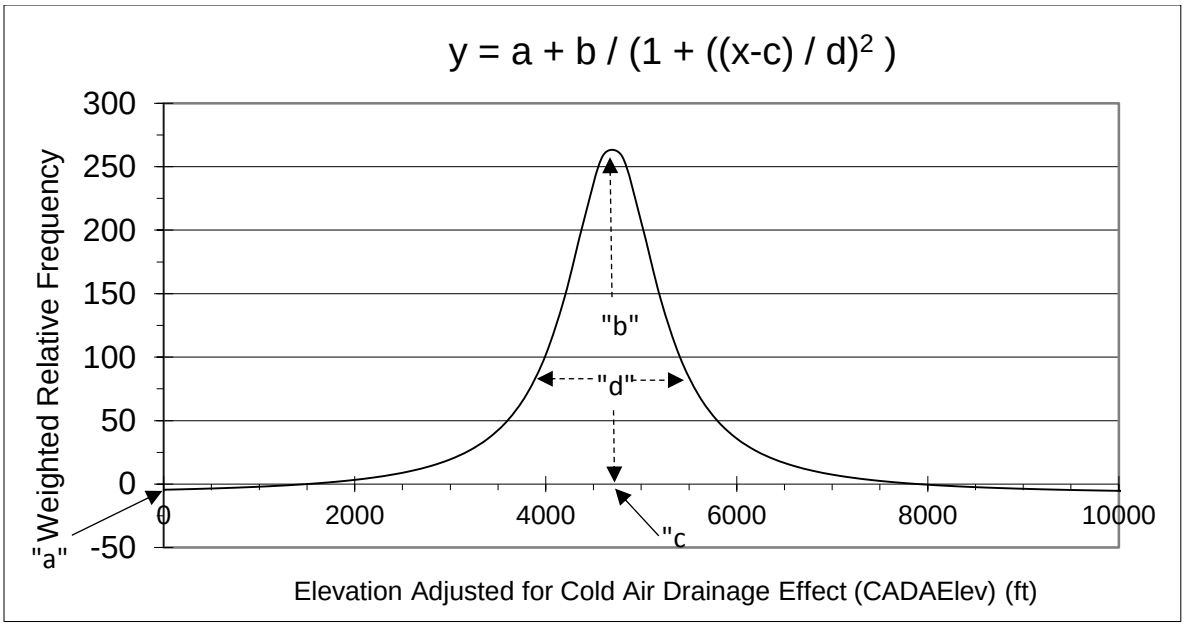

Figure A-1.1. Example of the Lorentzian function for the model variable and environmental gradient "Elevation Plus Cold Air Drainage Effect (CADAElev)" for Ecoregion 10207.

The environmental variables used in the model are continuous variables that represent direct environmental gradients. One additional variable – Plant Association Group, was used in the habitat model. Plant Association Group (PAG) is a discrete vegetation variable that is an integration of a complex of environmental variables. The model applies PAG as a weighting factor that modifies the result of the Lorentzian functions. PAG weights are scaled by frequency of VAME occurrence.

The species habitat model calculates a habitat value for each 90-meter pixel in the study area. The model solves a polynomial equation for the environmental variables (Lorentzian functions), then applies a PAG weight, and returns a habitat value for each pixel. Habitat values are then assigned through a conditional statement to one of four potential habitat classes: High Likelihood, Moderate Likelihood, Low Likelihood and Not Likely Habitat.

The habitat classes are defined by a frequency distribution of the big huckleberry plots used to build the model. The habitat classes are based on one, two and three standard deviations (s.d.) of a normal distribution, and are defined by the frequency distribution of the "VAME $\geq$ 10%" plots (n=296) where by definition: 68% of these VAME plots occurred in the High Likelihood class (1 standard deviation [s.d.]), 27% of these plots occur in the Moderate Likelihood class (2 s.d.), 5% of these plots

Table A-1.2. Environmental variables in the PNV Model evaluated for the big huckleberry habitat model.

Environmental Variable	Spatial Scale	Description
Precipitation at Sea Level (PSL)	Broad	Precipitation regime with the effect of elevation removed represents regional, orographic pattern of total annual precipitation.
Mean Annual Temperature at Sea Level (MATSL)	Broad	Temperature regime with the effect of elevation removed represents regional, orographic pattern of mean annual temperature.
Fog Effect	Broad	Contribution to precipitation from condensation of fog on tree crowns and interception losses through evapotranspiration. Scaled in relative values from -0.3 to 2.0, where 1.0 represents an additional 20 inches of PSL.
Adjusted Precipitation at Sea Level	Broad	Precipitation at Sea Level plus Fog Effect
Total Annual Precipitation	Intermediate	A function of Precipitation at Sea Level and elevation, where there is about a 15% increase in precipitation with every 1000 ft. (305 m) increase in elevation. Values calibrated to weather station data.
Temperature Lapse Rate	Broad	The rate of change in mean annual temperature with elevation. Values range from less than 2.2 deg F per 1000 ft (1.2 deg C per 305 m) elevation along the northwest Washington coast to 3.7 deg F per 1000 ft (2.1 deg C per 305 m) on the east side of the Cascades. Interpreted here as a measure of continentality.
Cold Air Drainage Effect (CAD)	Intermediate	Interpretation of the effective movement of cold air across a landscape due to the differential gravitational movement of heavy cold air compared to lighter warmer air. Calculated in PNV model using complex functions of mean annual temperature, temperature lapse rate, elevation, aspect and topography. CAD expressed in feet of elevation effect on vegetation.
Mean Annual Temperature (MAT)	Intermediate	Calculated from mean annual temperature at sea level, lapse rate and elevation, and includes the effects of CAD. Values calibrated to weather station data.
Elevation	Intermediate	Elevation data derived from Digital Elevation Model
Elevation Plus Cold Air Drainage Effect (CADAElev)	Intermediate	Elevation with the added effect of cold air drainage; expressed in units of elevation and representing the effective elevation for each pixel.
Aspect	Fine	Angle in degrees of downward facing slope relative to true north, derived from Digital Elevation Model
Topographic Moisture	Fine	Relative value representing wetness or dryness of a site relative to the gravitational redistribution of water through the landscape. Calculated in the PNV model as function of slope position, steepness of slope and slope shape (convex, concave).
Site Moisture	Fine	Topographic moisture modified by Soil Moisture value.
Shortwave Radiation	Intermediate	Represents maximum potential direct solar radiation expressed in mean daily shortwave solar radiation in $kJ/m^2/day$. Calculated by averaging solar radiation input for 4 days (spring and fall equinox, winter and summer solstice). Shortwave Radiation at a site is a function of latitude, aspect, slope, and landscape context.
Plant Association Group (PAG)	Fine	Potential vegetation communities mapped at a scale intermediate to vegetation zone and plant association. PAG is an output of the PNV model and is a function of vegetation zone, adjusted PSL, elevation, aspect, and topographic moisture. PAG is a discrete variable in the habitat model.

occur in the Low Likelihood class (3 s.d.), and no plots occur in the Not Likely class (4 s.d.). The final output of the big huckleberry habitat model is a grid-based map of four habitat classes at a 90 x 90 meter pixel resolution.

Iterative habitat models were run to calibrate the coefficients and achieve the best fit of modeled habitat distribution with the plot data. Conversion of the mathematical function to a spatial context required some calibration of the equation coefficients to get the best fit of the output habitat model grid to the VAME $\geq$ 10% plots. Criteria used for selecting the best model were minimizing the area that was mapped as High Likelihood Habitat, and maximizing the area mapped as Not Likely Habitat.

Development of the model was an iterative process. The variables used in the final model are elevation, elevation adjusted for cold air drainage effect, mean annual temperature, lapse rate, precipitation at sea level and plant association group (Table A-1.2). We selected the best model as the one that minimized the area mapped as High Likelihood Habitat, maximized the area mapped as Not Likely Habitat, and minimized the combined area mapped as High Likelihood and Moderate Likelihood Habitat.

There are two algorithms used in the current model, one for each ecoregion, as shown below. The model equations are complex polynomials where the Lorentzian functions for each environmental variable are added together, and then modified by PAG weight (Table A-1.3). A habitat value for big huckleberry was calculated for each pixel in the study area using the following equations.

Ecoregion 10207

Big Huckleberry Habitat value = $\mathbf{(-8.46 + 275.16 / (1.0 + ((CADAElev - (5409 - 11.184 * PSL)) / 570.61)^2)) + (-14.16 + 284.624 / (1.0 + ((MAT - 38.5) / 2.2)^2)) * PAG\ Weight}$

Ecoregion 10210

Big Huckleberry Habitat value = $\mathbf{[(-8.55 + 161.79 / (1.0 + ((Elevation - 5000) / 840)^2)) + (-54.9 + 191.97 / (1.0 + ((MAT - 36.133) / 4.317)^2)) + (9.51 + 54.81 / (1.0 + ((Lapse\ Rate - 3.229) / 0.025)^2))] * PAG\ Weight}$

The equation components [CADAElev (elevation adjusted for cold air drainage effect), MAT (mean annual temperature, Elevation, Lapse Rate (Temperature Lapse Rate), PSL (Precipitation at Sea Level)] are the values for each of these environmental variables at each pixel; PAG weight is determined for each pixel by comparing the PAG value in the PAG grid and then using the value from the PAG Weight Lookup table (Table A-1.3).

Table A-1.3. Plant Association Group (PAG) Weight values.

PAG	PAG Name	ER 10207	ER 10210
1901	WH/ARNE-XETE-VAME-HODI	0.3	0.3
1903	WH/GASH-BENE-RUPE-PAMY-RHMA	0.2	0.4
2202	PSF/GASH-BENE-ACTR-RHMA-dry VAAL	0.5	1.2
2204	PSF/VAME-RHAL-XETE-VAAL	2.0	2.0
2207	PSF/VAAL-MADI2-POMU-CLUN	0.3	
2302	MH/VASC-VAME-LUHI-XETE		1.0
2304	MH/VAME-RHAL-XETE	2.0	1.8
2305	MH/VAAL-CLUN-RUPE	1.0	1.0
2306	MH/OPHO-VAAL-CABI	0.7	
2371	MH/Non-forest Dry	0.1	
2391	MH/Non-forest Wet	0.1	
2504	SAF/VAME-LULA	0.1	
2505	SAF/ARLA-POPU-RHAL-XETE		1.0
3201	Dry Continental Parkland	0.3	0.3
3205	Moist, Maritime Parkland	0.2	0.3

4. Model Validation

Model validation was the final step in the species habitat model process. Once the model was calibrated and finalized, it was validated by an independent set of plots. The validation plots were randomly selected from the ecology database and screened for use as described earlier, and imported into GIS to create a point cover. The validation plot point cover was intersected with the big huckleberry habitat model grid. The number of plots in each big huckleberry abundance class was tallied by habitat class, and used to measure the accuracy of the model in predicting big huckleberry presence or relative abundance.

Table A-1.4. Calibration and Validation plot counts by big huckleberry (VAME) abundance class and modeled potential habitat classes.

	Calibration Plot Set				Validation Plot Set				Grand Total All Plots
	VAME Abundance Class			Calibration Plot Total	VAME Abundance Class			Validation Plot Total	
VAME Model Habitat Class	Absent	<10% cover	≥10% cover		Absent	<10% cover	≥10% cover		
Not Likely	701	68	0	769	246	28	0	274	1043
Low Likelihood	233	51	15	299	76	20	7	103	402
Moderate Likelihood	386	239	80	705	106	106	34	246	951
High Likelihood	70	229	201	500	43	118	91	252	752
Grand Total	1390	587	296	2273	471	272	132	875	3148

Table A-1.5. Percent frequency by Calibration and Validation Plot set and big huckleberry (VAME) abundance class for modeled potential habitat classes.

	Calibration Plot Set				Validation Plot Set				Grand Total All Plots
	VAME Abundance Class			Calibration Plot Total	VAME Abundance Class			Validation Plot Total	
VAME Model Habitat Class	Absent	<10% cover	≥10% cover		Absent	<10% cover	≥10% cover		
Not Likely	50%	12%	0%	769	52%	10%	0%	274	1043
Low Likelihood	17%	9%	5%	299	16%	7%	5%	103	402
Moderate Likelihood	28%	41%	27%	705	23%	39%	26%	246	951
High Likelihood	5%	39%	68%	500	9%	43%	69%	252	752
Grand Total	1390	587	296	2273	471	272	132	875	3148

Appendix 2.

Maps of big huckleberry known occurrence and modeled potential habitat by Ranger District

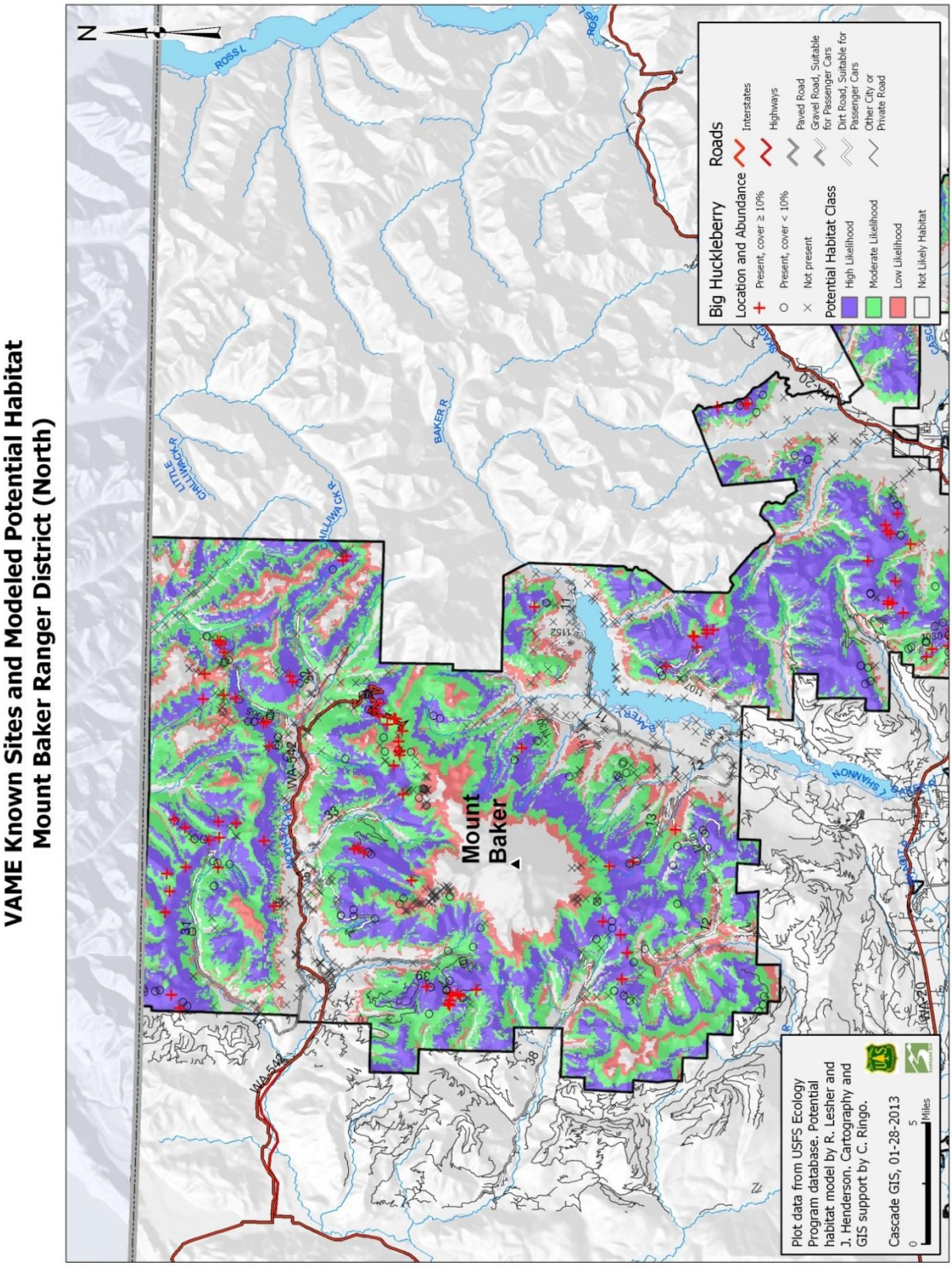

Figure A-2.1. Map of big huckleberry known occurrence and modeled potential habitat, Mt. Baker Ranger District (north).

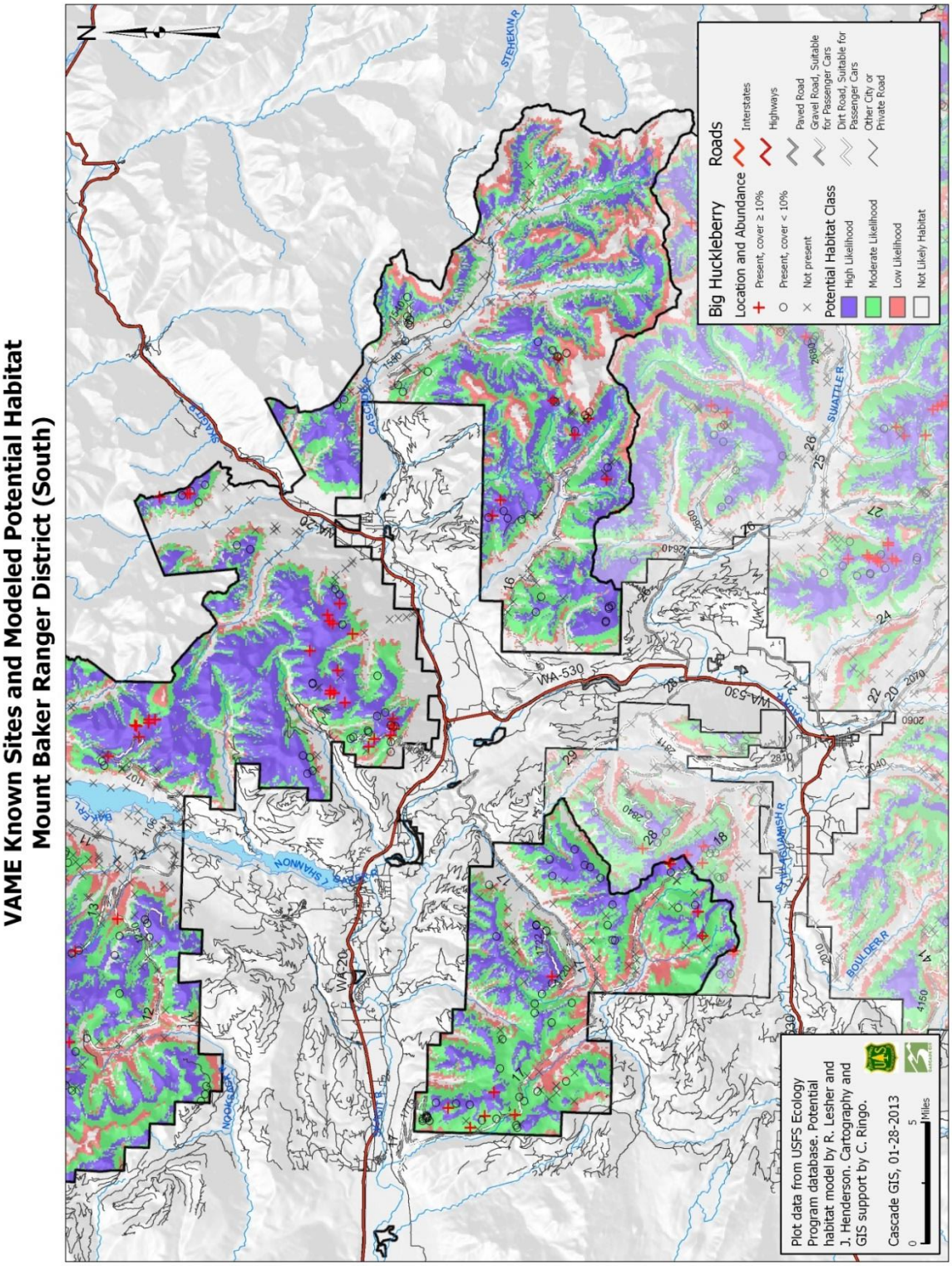

Figure A-2.2. Map of big huckleberry known occurrence and modeled potential habitat, Mt. Baker Ranger District (south).

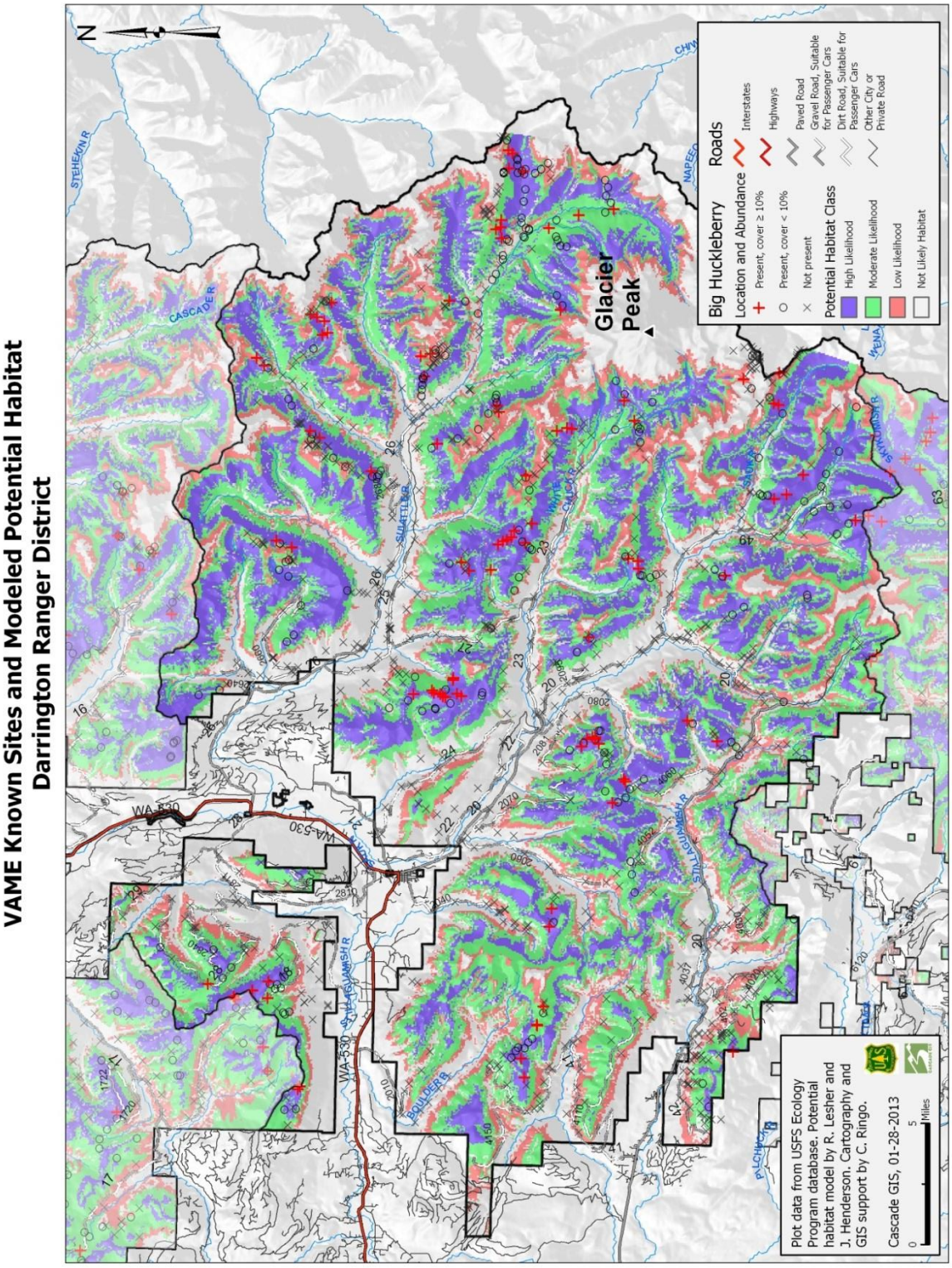

Figure A-2.3. Map of big huckleberry known occurrence and modeled potential habitat, Darrington Ranger District.

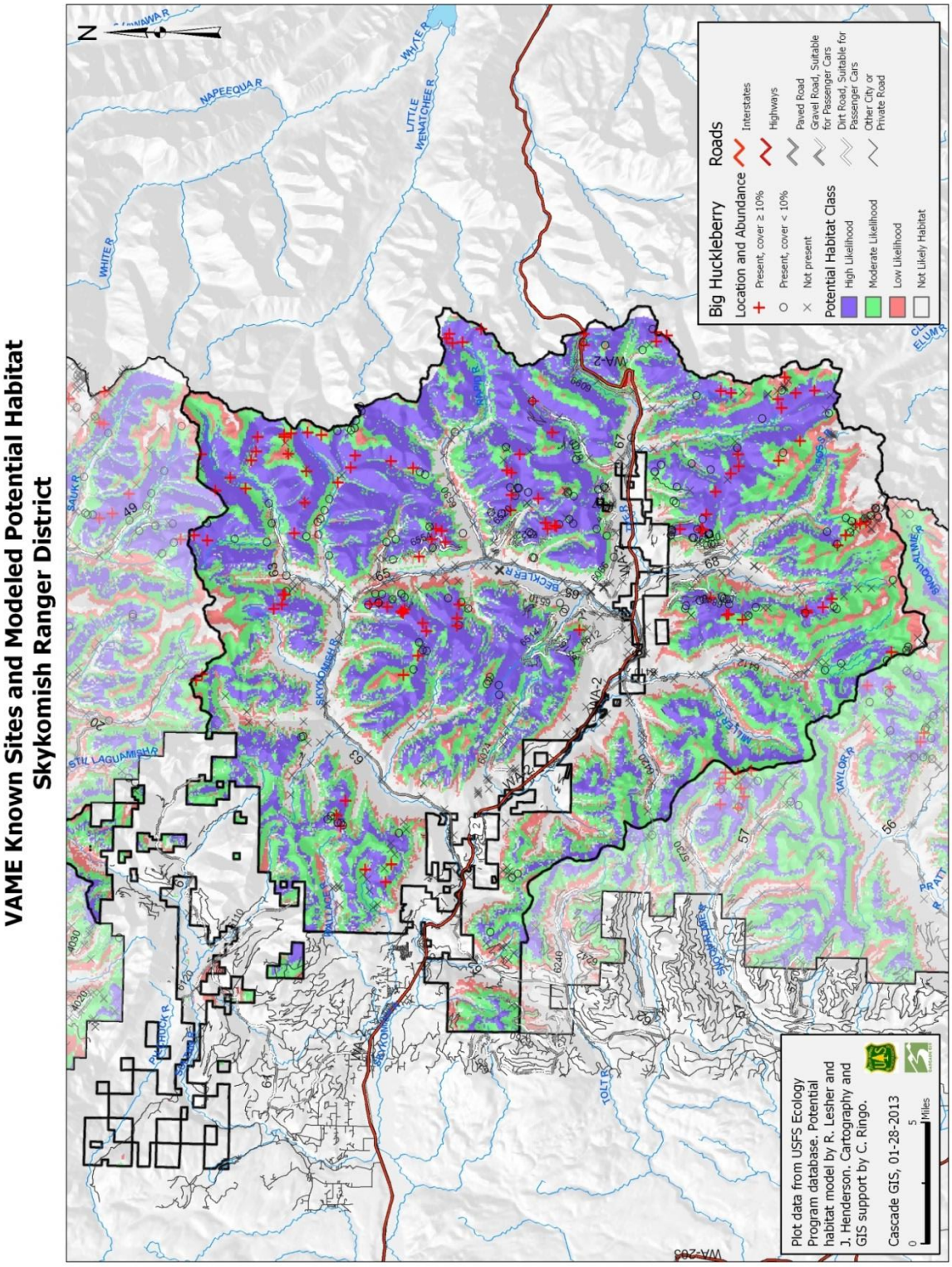

Figure A-2.4. Map of big huckleberry known occurrence and modeled potential habitat, Skykomish Ranger District.

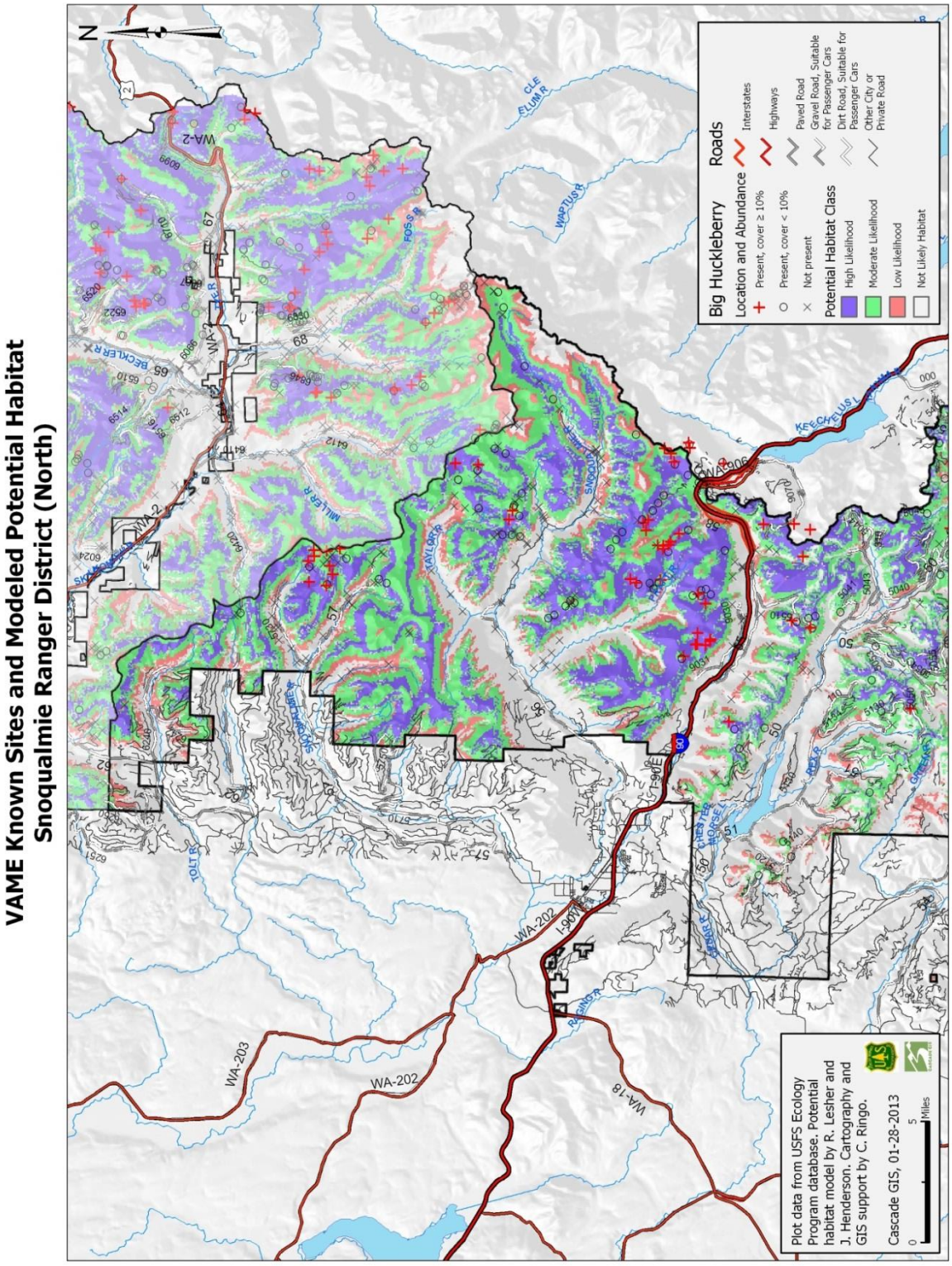

Figure A-2.5. Map of big huckleberry known occurrence and modeled potential habitat, Snoqualmie Ranger District (north).

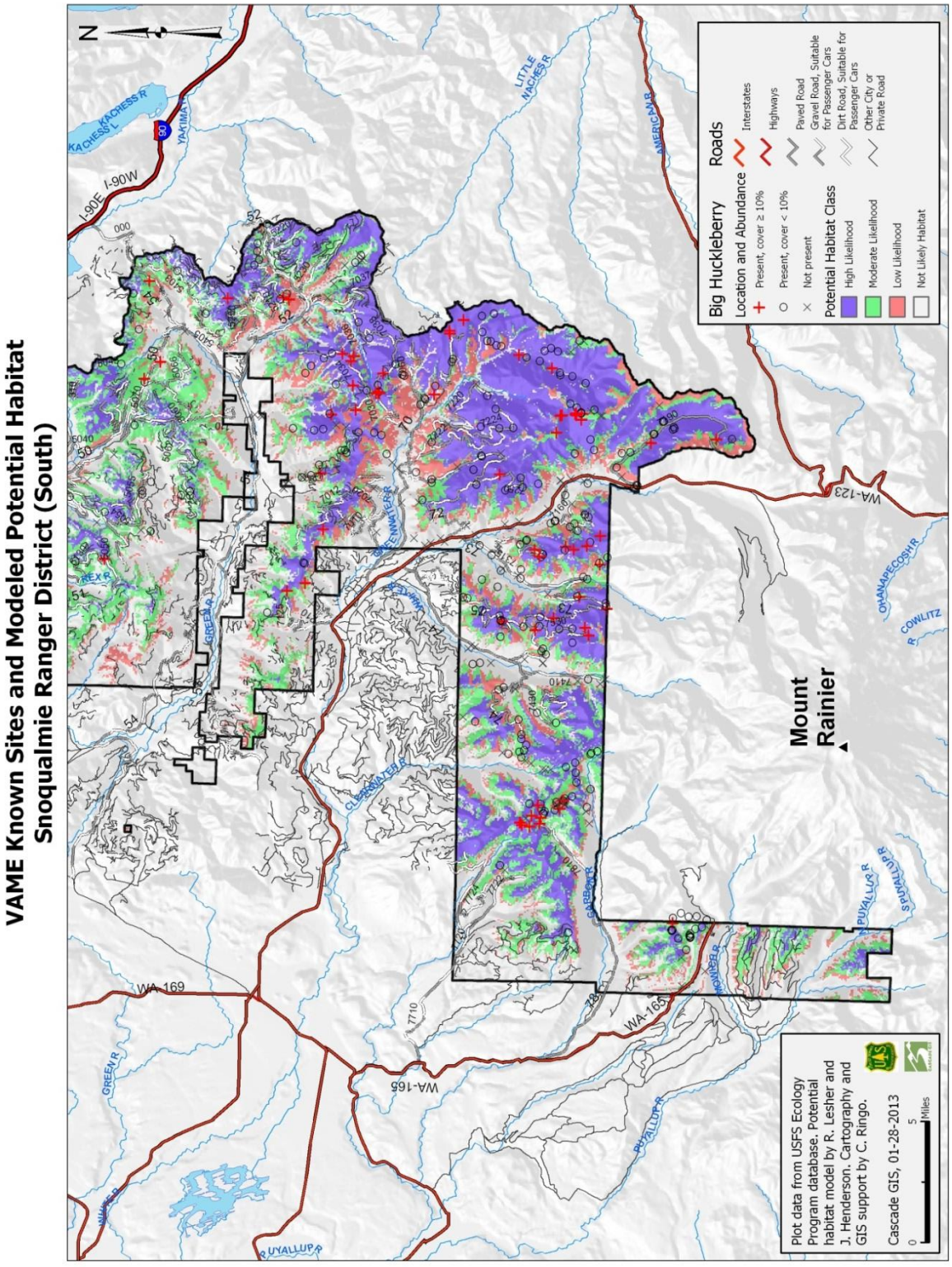

Figure A-2.6. Map of big huckleberry known occurrence and modeled potential habitat, Snoqualmie Ranger District (south).

Appendix 3.

Ranger District Summary Tables and Maps of Acres by Habitat Class, Stand, Age Class, and Land Allocation

Mt. Baker Ranger District

Darrington Ranger District

Skykomish Ranger District

Snoqualmie Ranger District

Table A-3.1. Summary of acres for Big Huckleberry Habitat Classes by Stand Age and Land Allocation, Mt. Baker Ranger District.

Summary of Acres

Habitat Class / Age Class	MATRIX	AMA	LSR	AW	WILDERNESS	OTHER	Grand Total
Mt Baker RD	**36,019**		**256,636**	**34,369**	**198,339**	**2,227**	**527,590**
Not Likely	**17,201**		**63,969**	**7,751**	**44,407**	**1,682**	**135,009**
1000 - 1308	634		12,381	255	7,435	38	20,743
1309 - 1650	485		11,164	511	3,307	14	15,481
1651 - 1850	7,167		6,485	5,162	2,929	1,527	23,270
1851 - 1932	1,999		13,622	698	1,133	12	17,464
1933 - 1972	2,864		11,035	58	1,094		15,052
1973 - 2012	2,474		6,417	8	382	70	9,352
unknown or non-forest	1,577		2,864	1,058	28,128	20	33,647
Low Likelihood	**2,889**		**26,613**	**3,082**	**28,618**	**66**	**61,268**
1000 - 1308	149		6,968	82	2,219		9,418
1309 - 1650	129		3,854	406	837		5,226
1651 - 1850	334		2,720	853	1,151	34	5,091
1851 - 1932	86		1,969	101	471		2,627
1933 - 1972	873		5,741	22	82		6,719
1973 - 2012	374		3,011		54	32	3,472
unknown or non-forest	943		2,349	1,617	23,805		28,715
Moderate Likelihood	**8,947**		**92,835**	**10,438**	**66,144**	**266**	**178,630**
1000 - 1308	1,495		34,033	1,364	19,910		56,802
1309 - 1650	412		18,528	913	6,515		26,369
1651 - 1850	833		8,137	3,440	3,564	193	16,167
1851 - 1932	229		3,914	360	1,839		6,342
1933 - 1972	2,356		11,621	197	575		14,749
1973 - 2012	1,177		8,847	68	145	72	10,309
unknown or non-forest	2,446		7,755	4,096	33,595		47,891
High Likelihood	**6,982**		**73,219**	**13,099**	**59,170**	**213**	**152,683**
1000 - 1308	3,546		31,869	4,198	23,248		62,861
1309 - 1650	157		18,164	1,943	11,896		32,161
1651 - 1850	734		6,586	4,657	5,003	211	17,191
1851 - 1932	354		2,251	664	2,738		6,007
1933 - 1972	521		4,061	207	837		5,626
1973 - 2012	557		4,828	459	338	2	6,184
unknown or non-forest	1,112		5,459	972	15,111		22,654

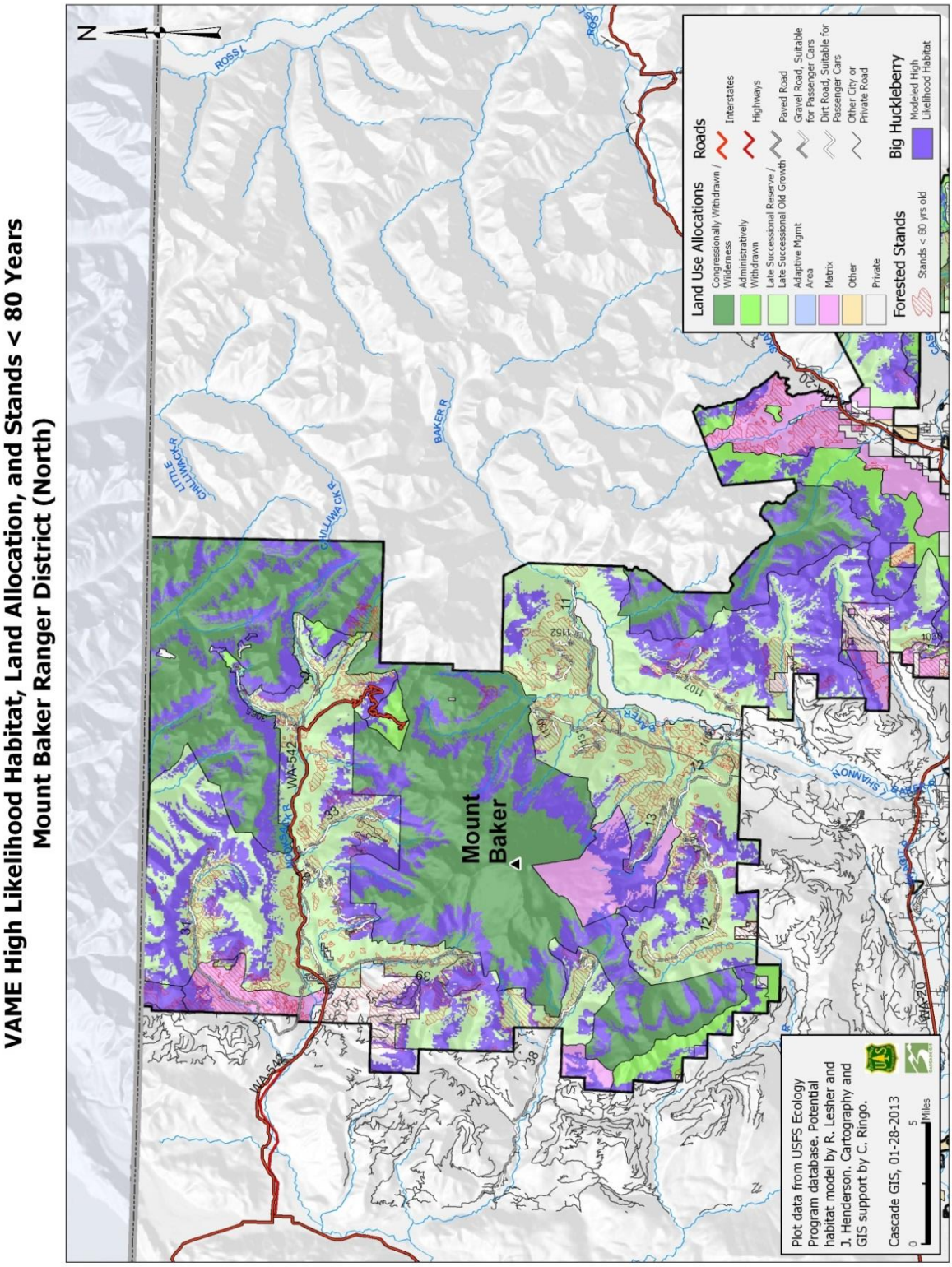

Figure A-3.1. Map of big huckleberry High Likelihood Habitat, Land Allocation and Stands <80 years of age, Mt. Baker Ranger District (north).

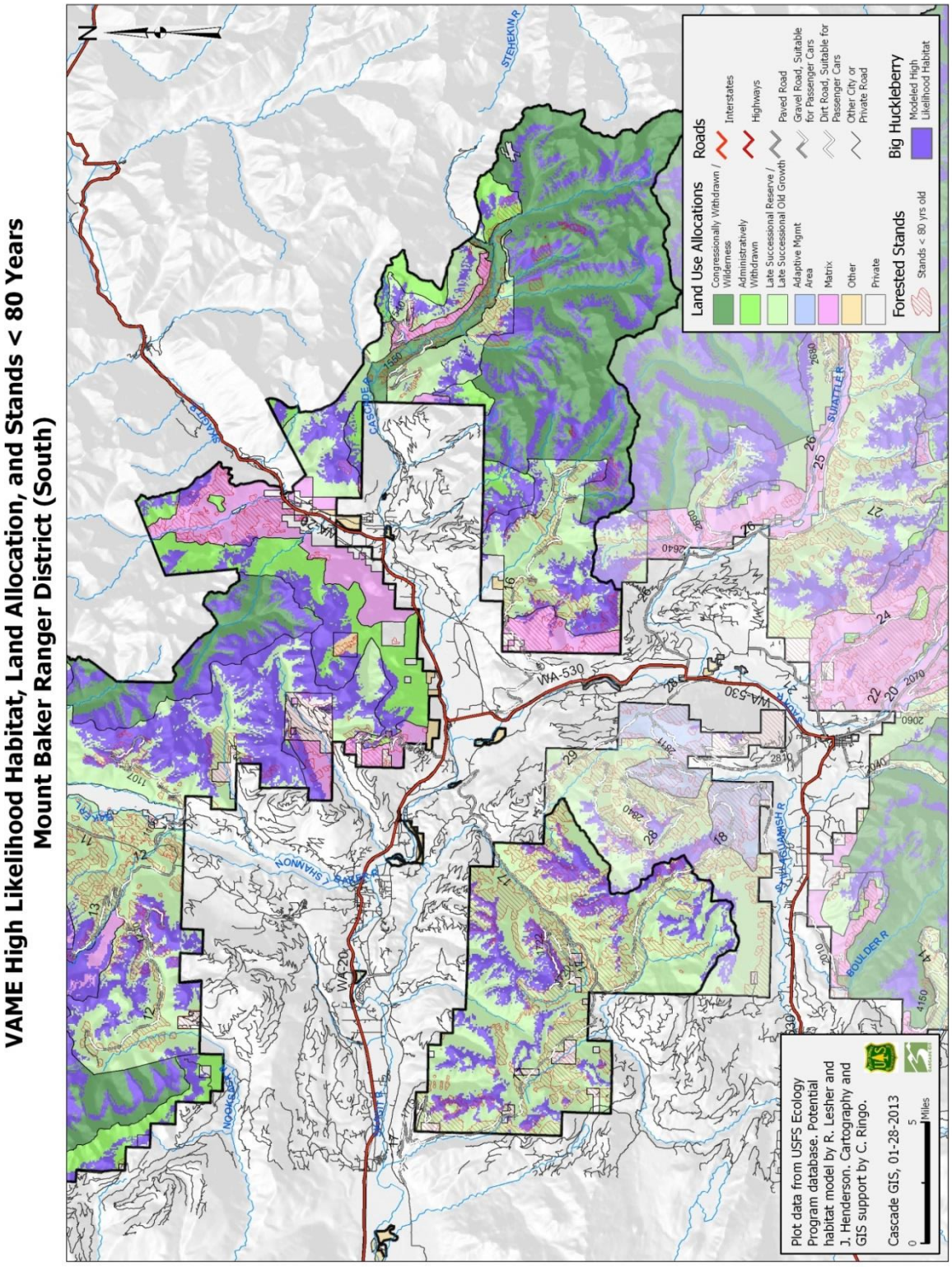

Figure A-3.2. Map of big huckleberry High Likelihood Habitat, Land Allocation and Stands <80 years of age, Mt. Baker Ranger District (south).

Table A-3.2. Summary of acres for Big Huckleberry Habitat Classes by Stand Age and Land Allocation, Darrington Ranger District.

Summary of Acres

Habitat Class / Age Class	MATRIX	AMA	LSR	AW	WILDERNESS	OTHER	Grand Total
Darrington RD	**53,684**	**10,392**	**185,322**	**11,562**	**289,988**	**2,277**	**553,226**
Not Likely	38,652	7,809	63,724	3,408	65,651	1,396	180,640
1000 - 1308	2,866	2	16,652	235	15,489	191	35,436
1309 - 1650	2,832	304	9,466	241	2,090	145	15,079
1651 - 1850	12,456	1,177	12,367	1,440	9,828	326	37,594
1851 - 1932	5,950	1,619	2,814	219	1,388	28	12,019
1933 - 1972	8,690	3,194	13,962	1,102	557	630	28,136
1973 - 2012	4,442	1,468	7,773	74	101	46	13,904
unknown or non-forest	1,416	44	690	95	36,198	30	38,473
Low Likelihood	**4,822**	**1,133**	**24,718**	**863**	**45,087**	**251**	**76,874**
1000 - 1308	593	10	8,050	80	7,067	4	15,805
1309 - 1650	525	6	3,615	56	1,265	34	5,502
1651 - 1850	1,066	133	2,492	235	3,912	12	7,851
1851 - 1932	161	107	714	2	672	4	1,660
1933 - 1972	1,748	670	5,671	239	280	145	8,752
1973 - 2012	688	207	3,148		30	46	4,120
unknown or non-forest	40		1,028	249	31,861	6	33,185
Moderate Likelihood	**7,557**	**1,243**	**56,877**	**3,188**	**94,177**	**447**	**163,489**
1000 - 1308	945	62	24,306	768	31,175	60	57,317
1309 - 1650	1,010	84	7,642	64	8,058	8	16,867
1651 - 1850	1,782	54	7,179	1,187	17,082	2	27,287
1851 - 1932	284	181	1,124		2,211	66	3,866
1933 - 1972	2,305	282	4,950	66	505	72	8,181
1973 - 2012	1,141	579	6,041	6	135	137	8,038
unknown or non-forest	91		5,634	1,096	35,011	101	41,933
High Likelihood	**2,653**	**207**	**40,004**	**4,104**	**85,073**	**183**	**132,223**
1000 - 1308	272	52	20,922	1,330	36,270	91	58,937
1309 - 1650	575	20	5,856	278	8,780		15,509
1651 - 1850	742		5,644	1,981	21,536		29,904
1851 - 1932	93	4	1,199		3,778	22	5,095
1933 - 1972	469	80	1,078	68	636		2,331
1973 - 2012	485	50	2,132	68	243	28	3,007
unknown or non-forest	18		3,172	378	13,829	42	17,440

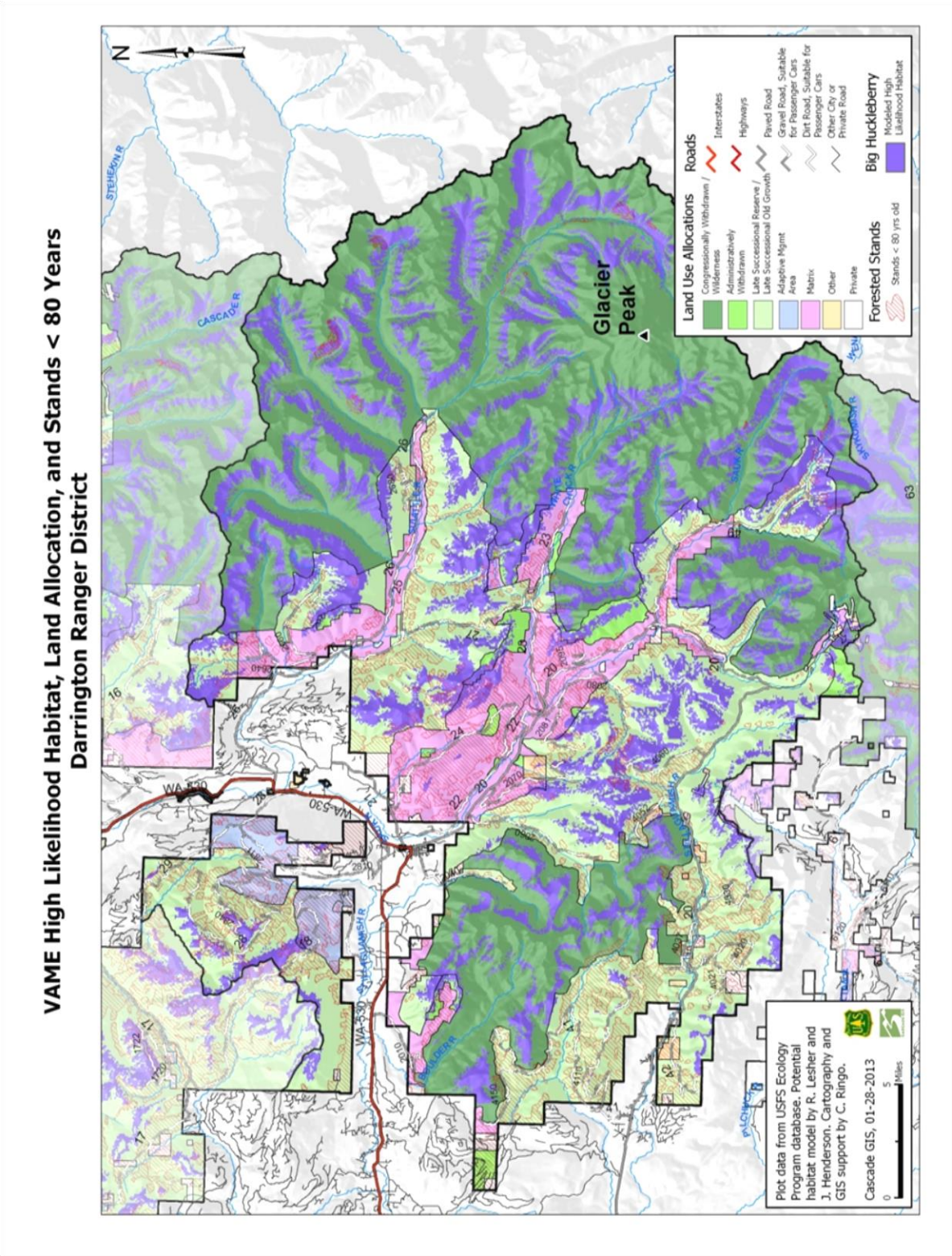

Figure A-3.3. Map of big huckleberry High Likelihood Habitat, Land Allocation and Stands <80 years of age, Darrington Ranger District.

Table A-3.3. Summary of acres for Big Huckleberry Habitat Classes by Stand Age and Land Allocation, Skykomish Ranger District.

Summary of Acres

Habitat Class / Age Class	MATRIX	AMA	LSR	AW	WILDERNESS	OTHER	Grand Total
Skykomish RD	**32,831**		**52,475**	**12,319**	**227,273**	**4,216**	**329,114**
Not Likely	**22,000**		**19,283**	**2,279**	**33,426**	**2,046**	**79,034**
1000 - 1308	1,096		4,423	1,183	9,547	111	16,360
1309 - 1650	1,090		1,032	328	3,581	24	6,055
1651 - 1850	3,321		3,858	89	6,813	225	14,306
1851 - 1932	6,143		3,681	18	2,607	855	13,304
1933 - 1972	8,563		3,735	477	3,971	710	17,456
1973 - 2012	1,299		1,668	28	473	101	3,568
unknown or non-forest	487		885	157	6,435	20	7,984
Low Likelihood	**1,895**		**5,809**	**1,078**	**21,160**	**610**	**30,551**
1000 - 1308	386		2,239	583	4,081	20	7,310
1309 - 1650	129		499	121	1,408	30	2,187
1651 - 1850	308		845	54	2,673	76	3,957
1851 - 1932	91		390	4	503	72	1,060
1933 - 1972	471		1,114	68	1,173	386	3,212
1973 - 2012	243		614	36	197	24	1,114
unknown or non-forest	268		109	211	11,124		11,711
Moderate Likelihood	**5,628**		**14,618**	**4,490**	**78,207**	**1,008**	**103,951**
1000 - 1308	734		4,938	1,412	19,550	44	26,679
1309 - 1650	877		2,697	873	5,325	48	9,820
1651 - 1850	797		1,406	105	10,052	139	12,498
1851 - 1932	475		943	74	2,094	161	3,748
1933 - 1972	718		1,829	95	1,877	344	4,862
1973 - 2012	1,100		1,724	50	352	209	3,436
unknown or non-forest	927		1,080	1,881	38,958	62	42,908
High Likelihood	**3,307**		**12,765**	**4,472**	**94,481**	**553**	**115,578**
1000 - 1308	247		4,429	841	36,858	54	42,430
1309 - 1650	654		2,786	1,261	12,544		17,245
1651 - 1850	376		1,324	551	17,494	115	19,860
1851 - 1932	521		1,094	823	5,359	117	7,913
1933 - 1972	268		867	34	2,816	54	4,039
1973 - 2012	911		1 ,597	270	332	91	3,200
unknown or non-forest	330		668	692	19,078	123	20,890

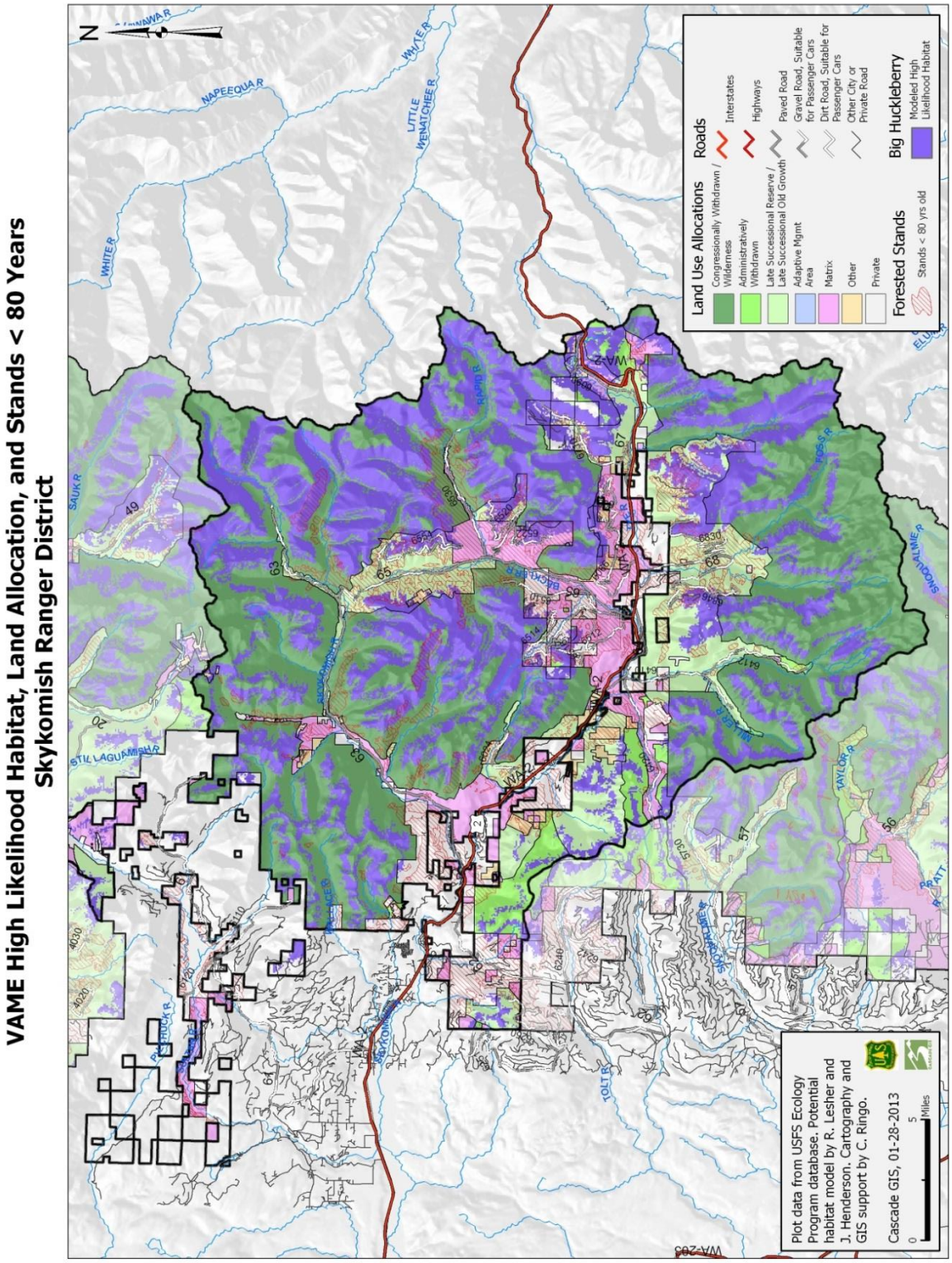

Figure A-3.4. Map of big huckleberry High Likelihood Habitat, Land Allocation and Stands <80 years of age, Skykomish Ranger District.

Table A-3.4. Summary of acres for Big Huckleberry Habitat Classes by Stand Age and Land Allocation, Snoqualmie Ranger District.

Summary of Acres

Habitat Class / Age Class	MATRIX	AMA	LSR	AW	WILDERNESS	OTHER	Grand Total
Snoqualmie RD	**47,978**	**10,770**	**127,205**	**35,023**	**104,665**	**4,401**	**330,042**
Not Likely	**23,861**	**4,478**	**47,724**	**8,449**	**10,935**	**793**	**96,239**
1000 - 1308	2,058	64	5,912	1,424	3,633		13,091
1309 - 1650	3,190		5,813	1,211	2,603		12,818
1651 - 1850	2,917	1,804	8,756	1,297	1,698	60	16,533
1851 - 1932	3,178	960	2,062	2,693	101	91	9,084
1933 - 1972	8,893	845	14,769	1,356	109	551	26,522
1973 - 2012	2,611	662	8,145	101	133	50	11,701
unknown or non-forest	1,014	143	2,267	366	2,659	40	6,489
Low Likelihood	**4,971**	**1,012**	**17,696**	**4,437**	**9,664**	**40**	**37,819**
1000 - 1308	760	4	2,541	791	3,027		7,123
1309 - 1650	437		1,674	314	563		2,987
1651 - 1850	414	332	4,200	394	955	16	6,312
1851 - 1932	1,133	302	1,495	951	38	6	3,925
1933 - 1972	1,489	183	3,287	241	62	18	5,280
1973 - 2012	686	173	4,031	36	26		4,952
unknown or non-forest	52	18	469	1,710	4,991		7,240
Moderate Likelihood	**10,168**	**3,621**	**24,654**	**10,876**	**37,620**	**905**	**87,845**
1000 - 1308	2,016	2	6,344	2,589	12,536		23,487
1309 - 1650	831		3,180	1,847	3,037		8,895
1651 - 1850	1,615	1,362	5,238	1,712	1,728	179	11,834
1851 - 1932	1,243	563	1,149	1,342	292	22	4,610
1933 - 1972	2,016	607	3,778	284	551	493	7,728
1973 - 2012	2,189	1,010	3,470	36	173	183	7,061
unknown or non-forest	259	76	1,495	3,068	19,303	28	24,229
High Likelihood	**8,978**	**1,660**	**37,131**	**11,261**	**46,447**	**2,663**	**108,139**
1000 - 1308	1,112		4,584	2,452	17,211		25,360
1309 - 1650	565		4,013	1,684	6,841		13,103
1651 - 1850	1,833	1,050	11,681	1,322	11,434	410	27,729
1851 - 1932	2,762	131	4,218	2,587	2,551	199	12,447
1933 - 1972	905	157	4,399	469	1,263	1,670	8,863
1973 - 2012	1,702	318	6,039	97	402	262	8,819
unknown or non-forest	99	4	2,197	2,651	6,745	123	11,818

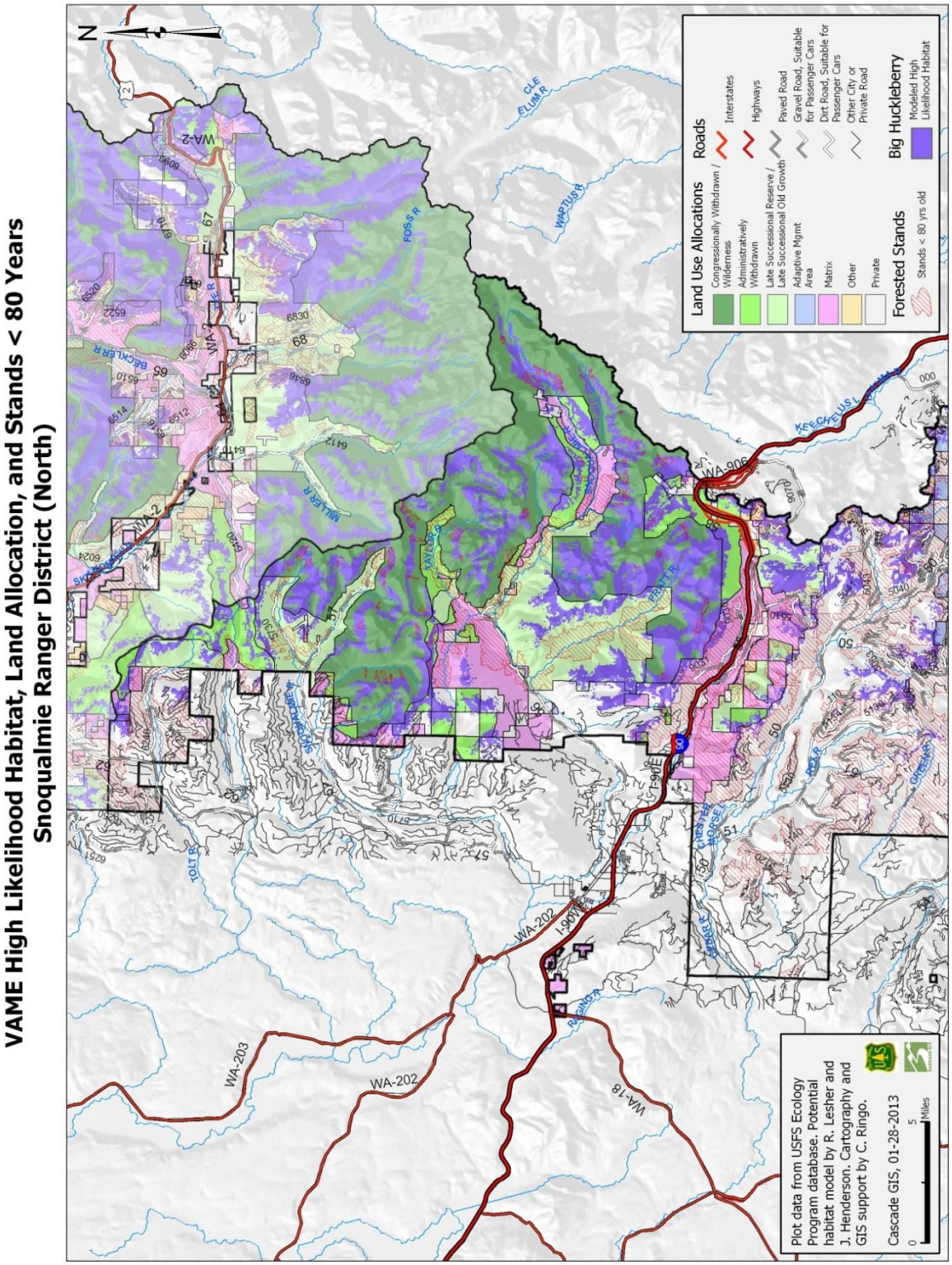

Figure A-3.5. Map of big huckleberry High Likelihood Habitat, Land Allocation and Stands <80 years of age, Snoqualmie Ranger District (north).

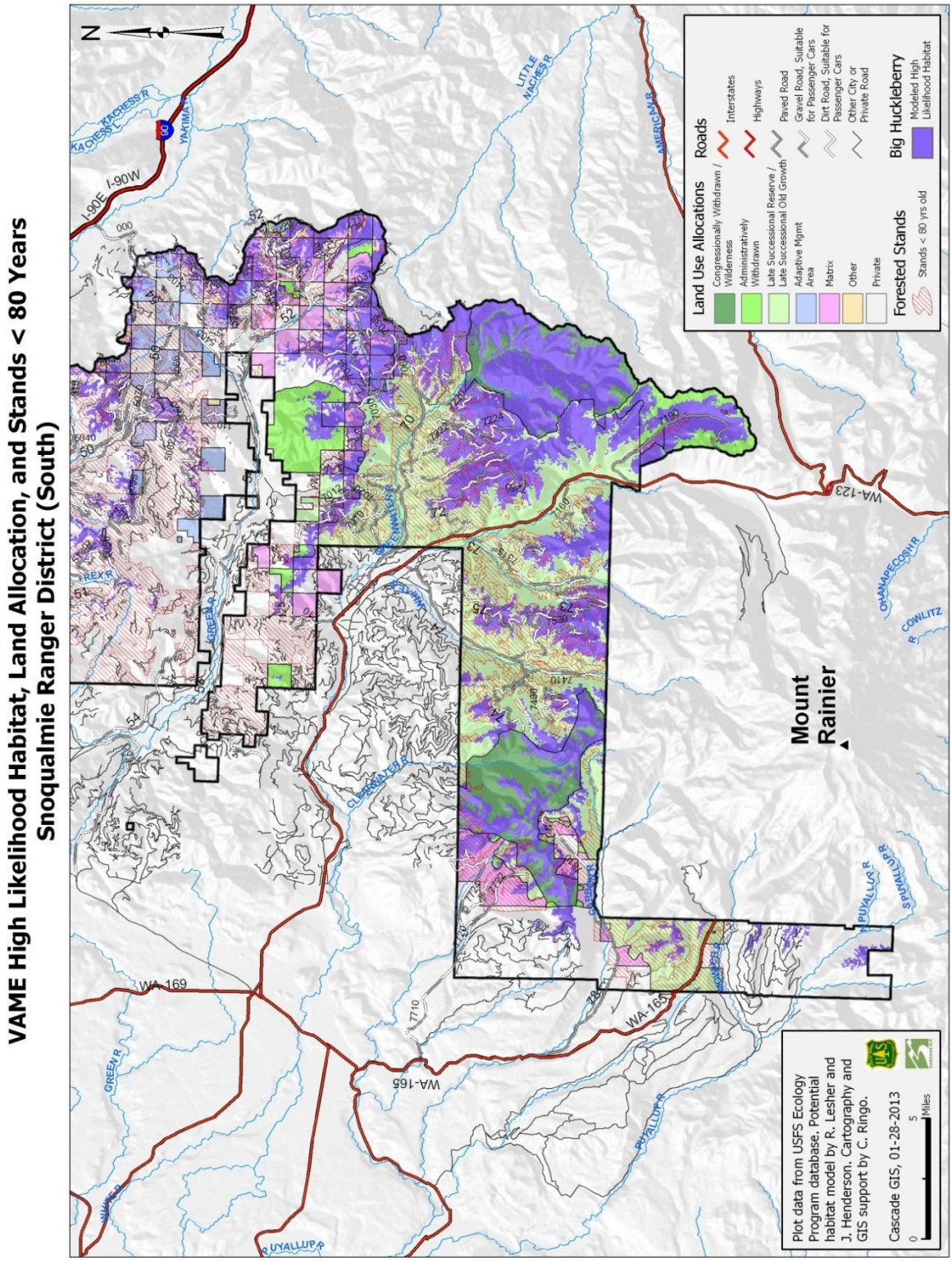

Figure A-3.6. Map of big huckleberry High Likelihood Habitat, Land Allocation and Stands <80 years of age, Snoqualmie Ranger District (south).

Appendix 4.

Stand Year of Origin Age Class Maps by Ranger District

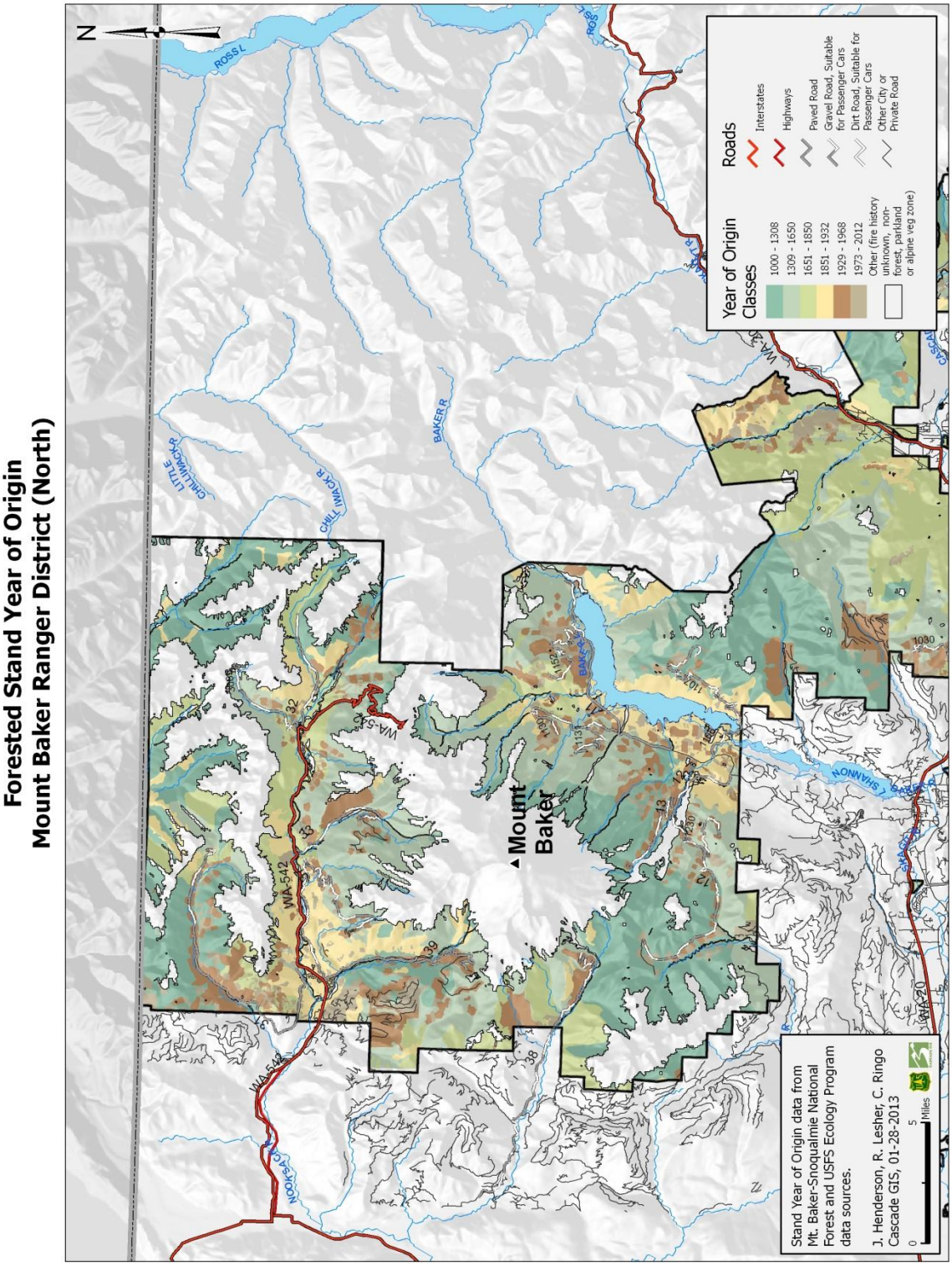

Figure A-4.1. Map of Stand Year of Origin Age Classes, Mt. Baker Ranger District (north).

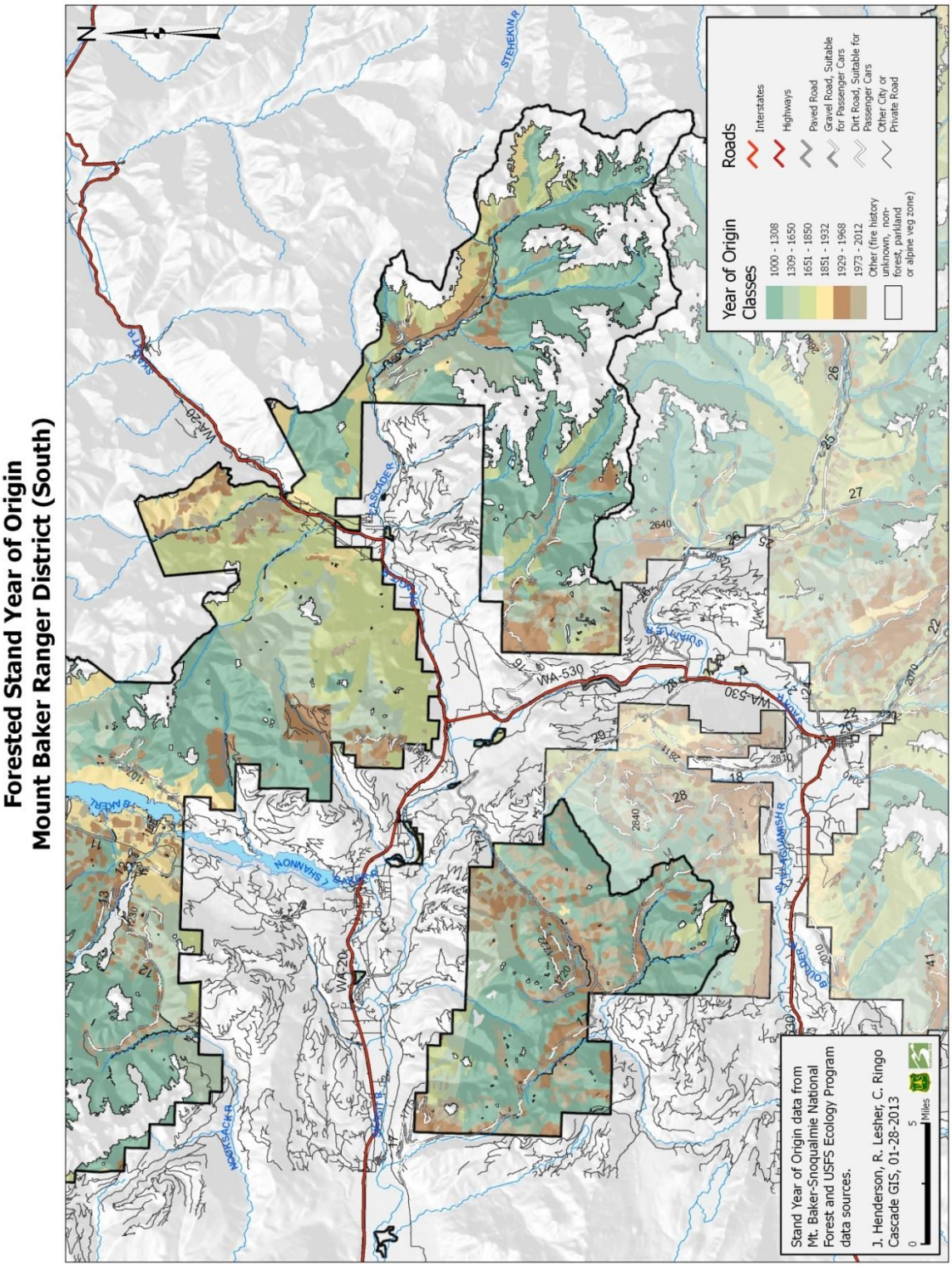

Figure A-4.2. Map of Stand Year of Origin Age Classes, Mt. Baker Ranger District (south).

Forested Stand Year of Origin
Darrington Ranger District

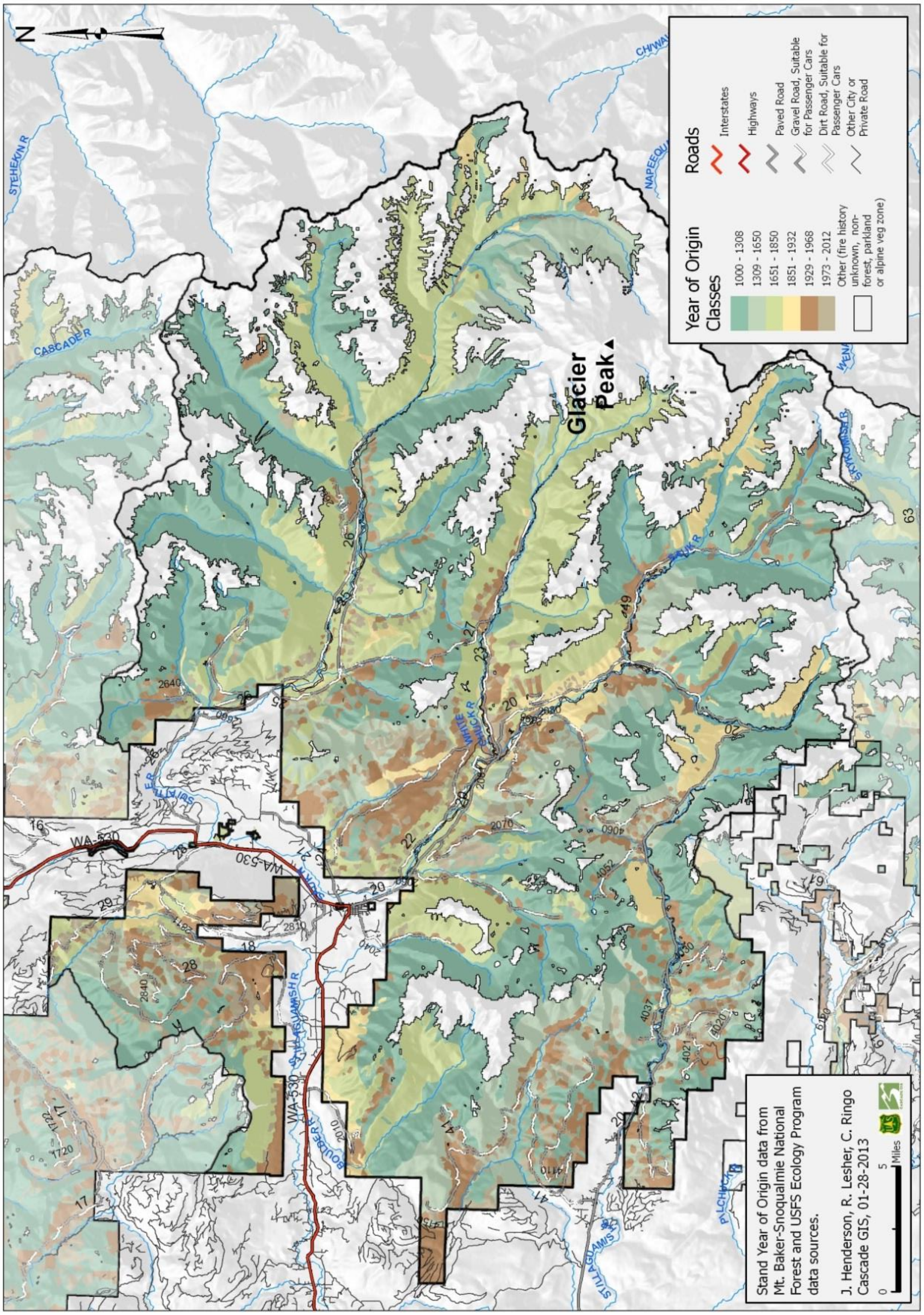

Figure A-4.3. Map of Stand Year of Origin Age Classes, Darrington Ranger District.

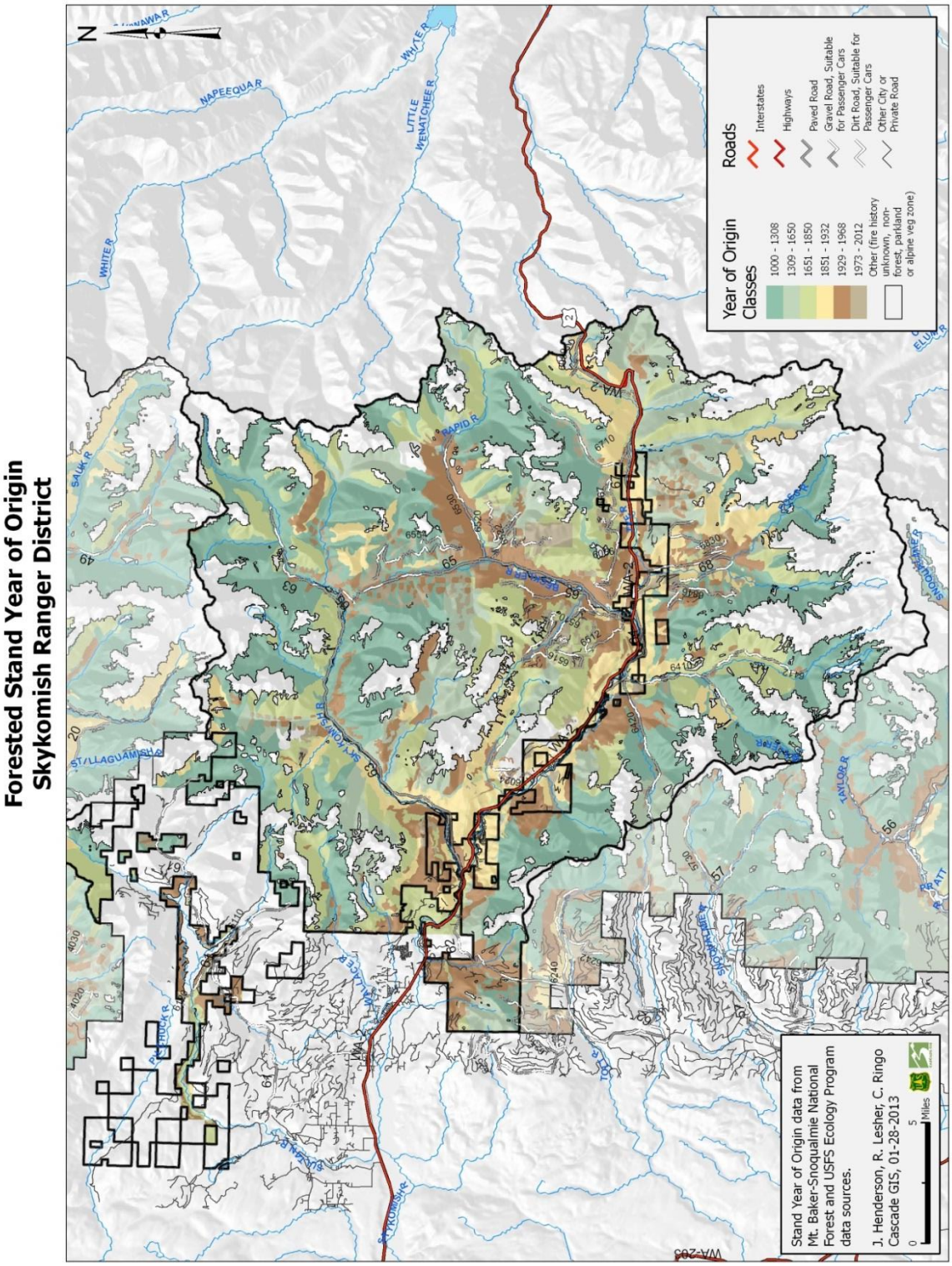

Figure A-4.4. Map of Stand Year of Origin Age Classes, Skykomish Ranger District.

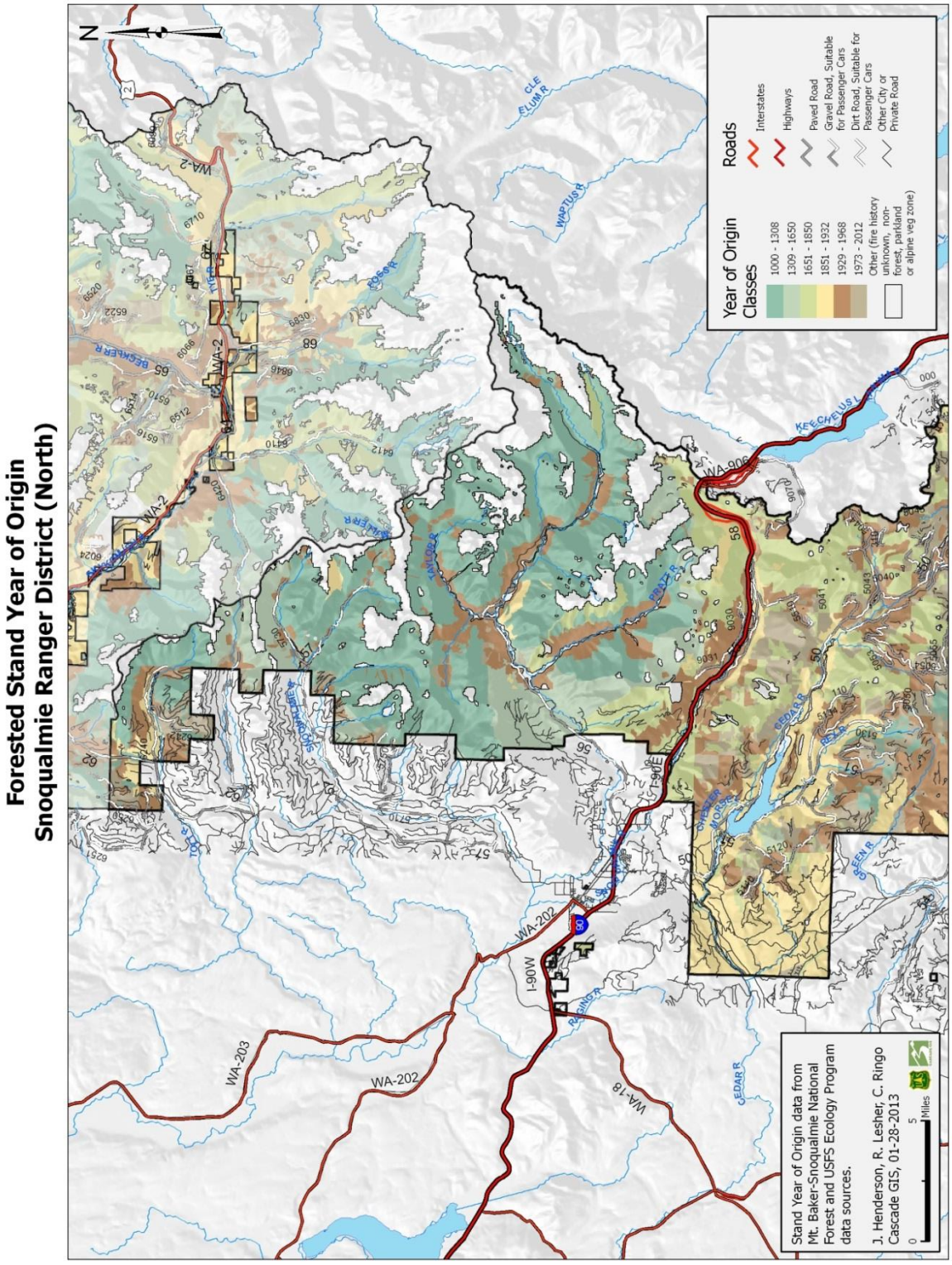

Figure A-4.5. Map of Stand Year of Origin Age Classes, Snoqualmie Ranger District (north).

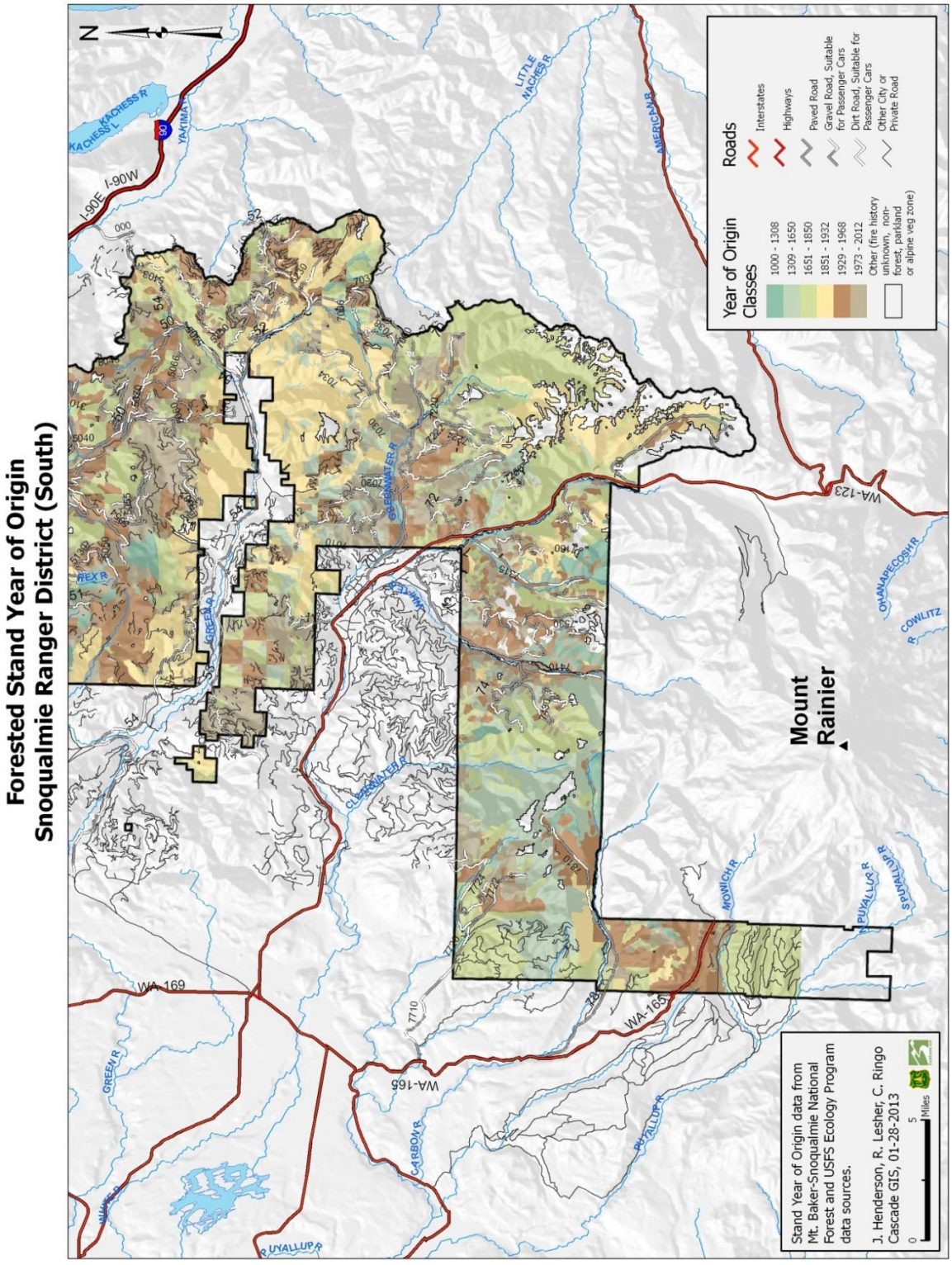

Figure A-4.6. Map of Stand Year of Origin Age Classes, Snoqualmie Ranger District (south).

Part B: Contemporary Recreational Harvest of Mountain Huckleberry

Mt. Baker-Snoqualmie National Forest Big Huckleberry Harvester Study
(Joyce LeCompte-Mastenbrook)

Acknowledgments

We wish to thank the harvesters who participated in this study, and Tulalip Natural Resources and Mt. Baker-Snoqualmie National Forest staff for their advice and support in the implementation of this project. Thanks also to the Washington Trails Association for promoting the study. A special thank you to the late Hank Gobin and Jason Gobin from the Tulalip Tribes, and to Warren and Elizabeth KingGeorge for their advice and insights in the development of the study, and to Professor Stevan Harrell at the University of Washington for his advice and feedback at every stage of the project.

Abstract

This report summarizes the results of an exploratory study conducted in 2012, designed to assess the recreational harvest of Big Huckleberry (*Vaccinium membranaceum*) on the Mt. Baker-Snoqualmie National Forest (MBS). It is not intended to represent or report on tribal treaty harvest. The results of the study were developed from a comprehensive analysis of 225 valid surveys, 24 semi-structured interviews, and during the big huckleberry-harvesting season, participant-observation activities at key berry harvesting sites across the Forest. The study found that for recreational harvesters, picking big huckleberry is a highly valued practice amongst a diversity of populations and plays an important role in their physical, emotional and social wellbeing. Those for whom the practice appears to play a more central role in their lives (i.e., people who typically harvest larger quantities of berries which they preserve for later use, and those who travel to the MBS Forest for the explicit purpose of harvesting big huckleberry) are more likely to be long-term harvesters with more than 15 years of experience harvesting on the Forest, and those who live in rural areas. These harvesters in turn are more likely to be over the age of 50. Long-term harvesters in particular have substantial local knowledge about huckleberry ecology and changes in huckleberry production over time. A key observation amongst these harvesters is the effect of conifer encroachment on formerly productive meadows. Road closures and permit requirements to harvest for personal use were key concerns amongst harvesters about decision-making and policy on the Forest. It is recommended that further harvest studies be conducted in order to assess harvest by groups that may not have responded to or been targeted by this type of recreational survey, including tribal treaty harvesters on the MBS.

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Figures and Tables

Introduction

This report summarizes the results of an exploratory recreational harvest study conducted in 2012 that examined the practices, values and knowledge of people who harvest big huckleberry (*Vaccinium membranaceum*) on the Mt. Baker-Snoqualmie National Forest (MBS). Due to budget and time constraints, this study did not include any evaluation of the non-recreational treaty harvest by tribal members on the MBS.

Big Huckleberry, also known as mountain, black, or thin-leaf huckleberry, is a middle elevation, montane understory shrub that grows in the Pacific Northwest.[1] Under favorable growing conditions, the plants can produce up to 100 gallons per acre of highly palatable and nutritious berries in a growing season.[2] Throughout their range, the people who harvest these fruits enjoy them for their flavor and nutritional values. Big huckleberries are also valued for subsistence, cultural, and economic reasons. Native Americans throughout the coastal and inland northwest have a long-term relationship with big huckleberries –or "ʂwəda?x̌" as it is known in the Coast Salish Lushootseed language. More recent settlers to the region also attach both material and symbolic values to the berries themselves, as well as to the places where they grow and to the very act of harvesting them.[3]

Big huckleberry tends to fruit most productively in relatively open conditions, such as mesic meadows and forest edges.[4] These conditions are most typically met through some form of disturbance – most notably natural and anthropogenic fire, and, more recently, clearcut logging. Management practices and forest policies that suppress forest disturbance thus have the potential to negatively affect huckleberry fruit production. In the US, the majority of huckleberry habitat open to harvesting occurs on public lands managed by the US Forest Service (USFS), where it is acknowledged that management practices over the course of the past century – particularly fire suppression - have resulted in declining berry productivity.[5]

This study was conducted on the Mt. Baker-Snoqualmie National Forest (MBS), which falls within the purview of lands that must be managed in accord with the goals and direction of the Northwest Forest Plan.[6] The MBS is also within close proximity to the most populous and rapidly growing area in Washington State – the Puget Sound metropolitan region. These two factors mean that Forest policy and practice tends to be oriented primarily towards recreational (as opposed to economic) human use, and to biodiversity conservation related goals. About 48% of the Forest is designated as wilderness area, where no motorized access is allowed, and a very "hands off" management style is outlined, such that "natural processes" and the wilderness character of the area is preserved. While logging has historically been a primary source of revenue, it is only permitted currently on about 5% of the MBS (94,434 acres out of a total MBS

[1] Franklin & Dyrness (1988), Hitchcock & Cronquist (1996)
[2] Minore, Smart, & Dubrasich (1979), Norton (1999)
[3] Carroll *et.al* (2003), Richards and Alexander (2006)
[4] Anzinger (2002), Franklin & Dyrness (1988), Henderson & Lesher (1992)
[5] Mack & McClure (2001), Main-Johnson (1999) A. H. Smith (2006), Turner (1999)
[6] The Northwest Forest Plan was developed in 1994 to protect the old growth forest habitat of two federally listed endangered species (spotted owl and marbled murellet). In addition to other set-asides, the Plan allows for timber harvest on about 8% of the ~24 million acres of federal land that it covers (NWFP ROD 1994)

acreage of 1,724,229) lands designated as "matrix" lands (excluding riparian reserves which must be maintained in a manner that supports the ecology and functions of the adjacent waterbody.) This minimal disturbance designation on the vast majority of the forest allows for conifer encroachment and thus also negatively impacts huckleberry habitat, while road closures and expansion of wilderness areas have the potential to negatively impact access to huckleberry gathering areas.

The 2005 MBS National Visitor Use Monitoring Report (NVUM) suggests that 12.4% of the Forest's users, or 170,128 ± 11%[7] spent an average of 1.2 hours gathering special forest products (SFP's)[8] on the MBS. Of these NVUM survey respondents, 17,013 ± 11% indicated that harvesting forest products was their primary forest use activity. While it is not possible to discern from NVUM statistics the subset of recreational big huckleberry harvesters included in these numbers, these figures do indicate that the recreational harvest and collection of special forest products *is* an important activity for a substantial number of MBS users.

While there is a general understanding that people value big huckleberry and a general consensus around loss of big huckleberry habitat and access amongst land management agencies and forest users, very few studies have been conducted that provide insight into who harvests big huckleberry recreationally and why they value this practice.[9] No studies pertaining to big huckleberry harvesting have ever been conducted on the MBS. Understanding the specific levels of harvesting on the Forest, as well as harvester demographics is an important first step towards implementing policies that are both ecologically sustainable and socially just. In addition to their role as potential "stakeholders," recreational harvesters have the potential to offer considerable insight into huckleberry ecology and productivity on the MBS.[10]

This exploratory study of big huckleberry recreational harvesting was conducted to begin to fill key knowledge gaps in our understanding of recreational huckleberry harvesting levels, practices, knowledge and values related to big huckleberry and big huckleberry habitat on the MBS. To this end, the project sought to address the following key questions:

1) What is the scope and extent of recreational huckleberry harvesting that currently occurs on the Mt. Baker-Snoqualmie National Forest?
2) What are the social, economic and cultural roles that recreational huckleberry harvesting plays in the lives of people who harvest the berries? (i.e., how do people value big huckleberry?)

[7] Visitor Use Report (2005). Calculated from table 2. Annual visit estimates (p. 9), and table 13. Activity participation (p. 21). These figures are estimated at a 90% confidence interval.
[8] The USFS defines special forest products as "Products collected from National Forest System lands for commercial, personal, tribal, educational, or scientific purposes, including without limitation: bark, berries, boughs, bryophytes, bulbs, burls, Christmas trees, cones, ferns, firewood, forbs, fungi (including mushrooms), grasses, mosses, nuts, pine straw, roots, sedges, seeds, transplants, tree sap, wildlflowers, fence material, mine props, posts and poles, shingle and shake bolts, and rails" (USDA Forest Service 2008**).**
[9] Carroll *et al* (2002), Carroll *et al* (2003), Forney (2012), Hansis (1998), Keefer (2007)
[10] Charnley *et al* (2008), Emery (2001), Jones & Lynch (2002), Jones *et al* (2005), Lynch *et al* (2004)

3) What do big huckleberry recreational harvesters observe and know that may contribute to the sustainable management of huckleberries and their habitats?
4) What are the social, economic, and ecological impacts of recreational harvesting on the Forest?
5) What do recreational harvesters understand about policies regulating the harvest and management of huckleberries and how do they feel about them?

The main body of the remainder of this report focuses on the study's key findings. These findings are drawn from the study survey, qualitative interviews, and participant-observation in the field during the recreational huckleberry harvesting season. Readers are also encouraged to examine "Appendix 1," which summarizes in greater detail the results of the survey. In particular, this section discusses some of the variation in recreational harvester demographics and practices across the districts that comprise the MBS Forest.

Methods

This study employed both quantitative and qualitative ethnographic methods to address the research questions described above. To this end, the study was comprised of three components – a survey that was available in both on-line and paper formats, in-depth interviews conducted with 24 harvesters, and participant-observation at key berry harvesting sites across the Forest during the big huckleberry harvesting season. Triangulating between these three forms of data during analysis helps to build on the strengths and address the weaknesses inherent in each of these three methods when used alone. Copies of the study flier, survey, and interview instrument are included in the appendices to this report.

The study was promoted in the following ways:

- Laminated study fliers (see Appendix 2) were posted at the trailheads to key berry picking sites across the Forest, and were also posted on community bulletin boards (grocery stores, gas stations, visitor centers, post offices, etc.) in the vicinity of harvesting sites.
- Study fliers and self-addressed, stamped paper copies of the survey were provided at ranger stations across the Forest. Several MBS

Figure B- 1: Study announcement on Washington Trails Association website

staff alerted potential participants to the study in the field and at ranger stations.

- The study was actively promoted by the Washington Trails Association on their website and Facebook page. The Washington Native Plant Society also promoted the study through their listserv (Figure B-1).

- The study was informally promoted through conversations on the online forum "Northwest Hikers.net"

Survey: The survey consisted of a series of questions related to recreational harvester practices, other activities harvesters engage in on the Forest, and barriers to harvesting, and took about 10 minutes to complete (see Appendix 2). The study was available online from mid-July through November 2012, and was administered using the University of Washington's WebQ program. Self-addressed, stamped paper copies of the survey were available at Ranger Stations across the district.

A total of 241 individuals completed the recreational harvester survey. The majority of respondents (n = 228) completed the survey online, with the remainder sending in paper copies that were manually entered into an Excel database as they were received. These results were then exported to an SPSS statistical program for further analysis. Of the initial 241 respondents, 16 were excluded from this analysis because they answered either "no" or "not sure" to the first survey question, "have you ever picked or harvested big huckleberry on the Mt. Baker-Snoqualmie National Forest?" This left a total of 225 valid survey responses. Significance of correlations was assessed using chi-square at the 95-percent confidence level.

Semi-structured interviews: Interviewees were selected from a pool of recreational harvesters who indicated their interest in being interviewed (n=57), and to a small extent by "snowball sampling" harvesters recommended by other interviewees. Twenty interviewees were selected to represent a roughly even number of harvesters from each Ranger District. Within each District, an effort was made to ensure a roughly even distribution of harvesters who live in urban or peri-urban environments, and those who live in more rural areas. Although an effort was made to select harvesters with a range of ages, the study was somewhat biased towards selecting harvesters with more than 15 years' experience harvesting on the Forest, so interviewees tended to be, but were not always, older than 50 years of age. Out of respect for their privacy, pseudonyms are used in place of the harvesters' actual names. These are signaled with parentheses the first time a harvester's pseudonym is used in the text.

The interview instrument consisted of a series of open-ended questions related to harvester practices and values, and observations and perceptions regarding huckleberry ecology, harvesting, stewardship, and policy (see Appendix 3). Interviews were audio recorded, transcribed, and coded by subject using Tams Analyzer. Each subject code was then evaluated for common patterns across the interviews.

Participant-observation was carried out at popular recreational harvesting sites across the Forest throughout the season. This was an opportunity to observe harvester activity and speak with harvesters about their experiences out in the field. Berry harvesting is widely dispersed across the Forest, making it difficult at times to know when and where harvesters might be encountered. Nevertheless roughly 50 harvesters were observed in the field, and about half of them were engaged in informal conversations. These discussions and observations provided valuable insights for the study, and were recorded in field-notes, which were written up each evening after a participant-observation event.

Study Limitations

This exploratory study of big huckleberry harvesting on the MBS Forest can be considered valid for that proportion of the harvesting population that outreach materials accessed, who were also amenable to participating in the study. Because the participants in this study were a "self-selected," rather than random sample, the study results cannot be considered scientific in the strictest sense. However, due to the exploratory nature of this study combined with the highly disbursed and time-sensitive nature of big huckleberry harvesting, random sampling of huckleberry harvesters was not a realistic strategy.

In future studies of berry harvesting in particular, or special forests products harvesting in general, more effort should be made to reach out to, and better represent the perspectives of harvesters of non-majority racial and ethnic identities. In particular, an effort should be made to work closely with native American tribes, including tribal elders and cultural departments to develop a study to characterize treaty harvest of huckleberries. Similar efforts should be made with minority populations for whom it is known that big huckleberry gathering is an important practice in their communities, including those groups for whom English is not their first language.

It should also be noted that the study finding of low levels of commercial harvest on the MBS Forest might not accurately reflect the actual levels of commercial harvesting that takes place. While none of the study participants indicated that they have observed large scale commercial harvesting on the Forest, it is possible that it does occur in areas not typically frequented by those who participated in this study. Furthermore, while three of the survey participants did volunteer that they do rarely sell their big huckleberries, it is possible that those who do this are less likely to participate in this type of study than those who do not.

Study Results

I: Overview of Harvester Demographics and Harvesting Levels

To provide a general sense of who is out on the MBS Forest picking big huckleberry and the quantity of berries they typically harvest, this section briefly reviews the results of questions included in the survey that are related to harvester demographics and the quantity of berries typically harvested in a given year. The survey included five basic demographic questions regarding place of residence, age, income, education, and race, and/or ethnicity. In addition, the

gender ratio of a subset of harvesters was calculated from those survey respondents who left their names for a follow-up interview. There are correlations between harvester demographics, harvesting levels and what harvesters use their berries for that provide further insight into the economic importance of big huckleberry harvesting to survey participants. These are discussed in greater detail at the end of this section.

II: Harvester demographics

The survey results indicate that huckleberry picking is an important activity for a diverse group of MBS Forest users. In terms of place of residence, about ¾ of the harvesters who responded to the survey live in urban or peri-urban areas, while ¼ live in rural areas. The age range of survey participants spanned from the most elderly survey respondent who was 80 years old, to the youngest, who was 20 years old. Just over half (53%) of the people who participated indicated that they were over 50 years of age. With regard to harvester income, ¾ of the survey respondents indicated that they considered themselves to be middle income, with a roughly equal proportion of respondents indicating that they were either low or high income. About ¾ of the survey participants indicated that their highest level of education attained was at least a bachelor's degree. Just over half of the respondents who left their names for a follow-up interview were male. 89% of the survey respondents indicated that their self-identified as white, while the remaining 11% of survey respondents indicated their race or ethnicity as African-American (1%), Asian (3%), Native American (1%), more than one race or ethnicity (2%), non-white Hispanic (2%), or "other" (3%). Demographic results are discussed in greater detail in Appendix 1 of this report.

It should be noted that while the proportion of harvesters who do not identify as white is small in relation to those who *do* identify as white, 11% is a substantially larger proportion of non-white Forest users than those who participated in the 2005 National Visitor Use Monitoring Survey mentioned above, where only 5% of Forest users self-identified as belonging to a race or ethnicity other than white. Although further research would be necessary to confirm it, this difference between our survey and the 2005 NVUM indicates that big huckleberry harvesting may be an activity that is proportionally more important to this group of Forest users than to the overall proportion of MBS Forest users who self-identify as being white. This finding reiterates the importance of a concerted outreach effort to the racially and ethnically diverse groups of Forest users who engage in big huckleberry harvesting should there be future studies of this activity on the MBS, and when it comes to decision-making processes concerning big huckleberry and other special forest products on the MBS Forest.

III: Harvesting levels

Precisely 2/3 of harvesters who participated in the survey indicated that they typically pick less than one gallon of big huckleberry in a given year. Of the remaining 1/3 of harvesters, 32% of the total say they harvest from one to five gallons, and a very small proportion (3% of the total) indicated that they harvest from 6 to 10 gallons of big huckleberry in a given year. It is likely that in at least some cases, survey respondents under-reported the quantities of big huckleberry that they are harvesting. However, in-person interviews with harvesters, as well as survey comments indicate that this was probably rare, as it was not uncommon for participants to remark that, given the time-consuming nature of big huckleberry harvesting, and the very small amounts they typically do harvest, they were surprised that the lowest level choice provided on the survey was 1 gallon of berries or less.

The survey results indicate that people who are more likely to harvest more than one gallon of berries in a typical season are those over the age of 50, those who live in rural areas, those who indicated their race or ethnicity as other than white, and those whose level of education is less than a bachelor's degree. Harvesters who indicated on other questions in the survey that they had been harvesting berries on the MBS for more than 15 years, and those who got started picking berries as a family tradition are also more likely to harvest more than one gallon of big huckleberry in a typical year. Not surprisingly, these harvesters, along with those who say they started picking big huckleberry through an interest in wild foods harvesting, are most likely to at least some of the time make a trip to the MBS for which the primary purpose is harvesting big huckleberry.

Uses of Big Huckleberry

In addition to the quantity of big huckleberries they harvest, participants were also asked how they typically use their berries. Not surprisingly, the survey participants clearly show that eating fresh huckleberries is very common and culturally important to harvesters. On the other end of the spectrum, bartering, trading, or selling huckleberries is not. However, there are a substantial number of harvesters who at least sometimes preserve their berries for later use, serve them on special occasions, and give them as gifts. Table B-1, below, summarizes the types of harvesters who are more likely to engage in these activities than the "average" harvester. These results indicate that the same groups of people who are more likely to pick more than one gallon of berries in a typical season or to visit the MBS primarily for a berry-picking excursion are also the ones who are more likely to engage in at least some of these practices.

Table B-1: Pct. harvester more likely to preserve, serve on special occasions, or gift big huckleberry, as compared to study mean

Percent harvesters more likely to preserve, serve on special occasions, or gift big huckleberry, as compared to study mean			
	Preserve	Special	Gift
STUDY MEAN (sometimes-always)	**71%**	**55%**	**37%**
Rural	89%	n.a.	n.a.
Education < Bachelor's	81%	n.a.	n.a.
Harvest experience > 15 yr	82%	77%	n.a.
Harvest > 1gal	96%	87%	62%
Harvest primary (sometimes-always)	92%	87%	57%
Beg. Family tradition	91%	83%	48%
Beg. Wild foods harvesting	77%	86%	56%
Race/ethnicity other than white**	89%	78%	56%

To summarize, the quantity of big huckleberries that a person typically harvests in a given year, whether they visit the MBS for the primary purpose of picking big huckleberry, and whether they are more likely to preserve, serve on special occasions, or gift their berries are all indicators of

the social, cultural, and/or economic importance of big huckleberry in the lives of berry harvesters. Based upon these indicators, the survey results suggest that if a big huckleberry harvester is over the age of 50, has been harvesting berries for 15 years or more, lives in a rural area, has a level of education that is less than a bachelor's degree, identifies as being of a race/ethnicity other than white, or got started picking big huckleberries as a family tradition, then big huckleberry harvesting is more likely to be an activity that is very important to them. It should also be noted that these practices are as or more important to a harvester's social and cultural identity, gift economy, or general sense of well-being as they are to their household's overall food budget. Indeed, harvester income is not correlated with any of these indicators of importance, and it was not uncommon for harvesters who were interviewed to remark that while the berries are very important to them, financial need is not what motivates them to harvest big huckleberries.

I: Understanding the Importance of Big Huckleberry to Recreational Harvesters

This section draws primarily on semi-structured interviews to gather a more nuanced understanding of what it is that people value about big huckleberry harvesting. While the people who gather big huckleberry on the MBS are demographically diverse, there is a shared sense among them that not only are the berries themselves highly valued, but that the actual practice of harvesting berries is profoundly meaningful. Big huckleberry is a flavorful, nutrient dense food that is high in antioxidants and essentially free for the taking, and these use values are of course important to harvesters. But a focus only on this captures just one facet of the affection and sense of attachment that people feel for this plant, and for the places where it grows. Rather, when a harvester travels to the MBS to pick big huckleberry, the excursion may also affirm their identity, their sense of place and of time, and strengthen their sense of connection to the Forest.

"Paula" is a long-time resident of the Darrington area with deep connections to the MBS Forest. In addition to working in the forest products industry for decades, she has extensive knowledge of the uses of wild plants in her area. This knowledge stems from her family history, as well as her close work with members of the Sauk-Suiattle Tribe. The nutrient density and healing properties of big huckleberry and other wild harvested foods was a point she emphasized several times during her interview, but as made clear in her statement below, these values are deeply intertwined with a strong sense of her personal and familial identity:

> *You need all these vital nutrients that you get from the wild plants, that you're not getting from the food [grown] on depleted soils that you buy in the grocery store…You know I wasn't even walking when my parents had me up picking berries. And my Grandmother would take me out and we would gather miners' lettuce, and [go] mushroom picking, and we were always out getting fish. My family always hunted, we always had wild meat in the freezer. That way is just something that I've done all my life, that's just part of who I am, is to go out and gather the berries, to feed my family. Basically to put food on the table. And it's to give them good quality, nutritious food.*

Similarly, "Scott" is a former University of Washington administrative employee who has been harvesting big huckleberry on Tonga Ridge since the early 1960's. Prior to what he described as increasing stress levels dealing with the traffic on highway two, and later, a move to Gig Harbor, for decades, Scott typically visited Tonga Ridge every week during big huckleberry season to harvest. Like Paula, Scott values the berries for their nutrient density, and flavor is of primary importance to him as well. But he also emphasizes the specialness of spending time in huckleberry habitat at this time of year:

> *Number one is the flavor, okay? Number two is just being in the woods at that time of year. It's magical, completely magical. Nothing like the rest of the year. And uh… of course, the anthocyanins, I mean, you have the antioxidants. There's nothin' like huckleberries for that. Those are the main reasons. Just to be there, and the flavor, and to have that flavor year round. [Cultivated] blueberries don't compare.*

Scott's comment that berry season is a magical time of year echoes the sense expressed repeatedly by harvesters that it is an important annual ritual that keeps them attuned to the seasonal cycles of nature. This was important to harvesters who dwell in both rural and urban areas. Rural dwellers most commonly described the connections between being in touch with the seasons and personal self-reliance and community identity. Harvesters living in urban areas often spoke about the importance of maintaining or cultivating their knowledge of plant gathering and the rhythms of the seasons as a kind of antidote to what they perceive as an increasingly homogeneous, industrialized food system.

"Susan" is also a long-time Darrington resident who has been instrumental in organizing volunteers to help maintain Forest Service roads. She describes the significance of berry harvesting in terms of self-reliance in her community in this way:

> *And the people here. We're very, we're self-reliant and we're very tied, I think, to the land … We talk about the weather by what White Horse Mountain is doing. You know, first snow, last snow, "did you see White Horse last night with the sunset?" I mean, that's the topic of conversation. […] And the huckleberries [are part of the conversation, too], you know? It's like, it's the morel season, it's the chanterelle season, and it's time to get the blackberries. It is definitely a cultural thing. I just went to a contra dance last night. The early spring contra dances you'll always see wild salads at the potluck… Our local population, you know, it's part of our culture. Some of us just don't want to eat domestic plants all the time.*

Though he no longer lives there, "Eric" was raised in Skykomish and continues to maintain strong connections to the MBS Forest and to the people who live in the area. Throughout the interview, Eric described how picking big huckleberry and other seasonally available plants were part of a way of life for his family and community when he was growing up. Like other rural harvesters that were interviewed, Eric described how he has at times harvested big huckleberry not only for himself, but also for elderly neighbors who are no longer physically able to harvest these berries themselves:

> *I used to just give mine away. Like I said, I've got those friends of mine that are elderly, and they can't get out anymore. So I give 'em the berries or I'll give 'em mushrooms or*

whatever. I don't ever swap, I don't sell berries or nothing like that. I'll just say, "here are some berries, maybe do me a favor later or something," but I don't expect nothing in return.

"Steve" is a resident of Redmond who grew up in Alaska and moved to Washington State to attend the University of Washington. He works in the IT industry and is an avid hiker and wild foods harvester. During the interview, Steve made clear that harvesting wild foods is a practice that serves as an antidote to the contemporary food system, and connects him to his experiences in Alaska, as well as to what he and other harvesters described as a deep time, almost instinctual human connection to gathering food:

…It's about 1,000 times more satisfying than going down to the store and buying them [berries]. You kind of connect with the earth and you're assuming they didn't go through a bunch of middle-men and what not to get to you. […] I would say that… here and there you go down and buy stuff that comes in a plastic wrapper or it came from… maybe not Mexico or New Zealand, but at least, somebody who you don't know picked it, and they put it on a truck… maybe it was as close as where I would go and pick the berries, but still, this thing was growing, and I picked it… like someone would have 40,000 years ago.

As alluded to in Steve's comment, for berry harvesters who come from other places where berry picking in particular, or wild foods foraging more generally, is a part of their culture, harvesting berries is a way for them to continue that practice and in some ways connect to the places and people they've come from. These people as well as harvesters who have lifelong or intergenerational ties to the MBS Forest frequently indicated that it was important to them to pass on this tradition by taking the younger generation out berry picking. "Tim," who works as a wildlife biologist for one of the local tribes, described the intergenerational importance of big huckleberry gathering to his family:

[I started picking huckleberries with] my Mother. We have a cabin just down the road from Corral Pass. Family camp. My great-grandfather built it in the '40's. We've been there … since the early 1900's. I used to go up there [Corral Pass] as a kid and used to pick huckleberries, so… It just kinda goes down the line. My kids are growing up with us going and picking huckleberries [there too] and, you know, I would like them to have their kids go up and pick huckleberries. … I think it's valuable for, not only Native American culture, but just people in general. You know, me teaching my kids how to go up and pick huckleberries and do that sort of stuff, too. I think that's important for my kids as well.

Like Paula and Susan, Eric - the harvester from the Skykomish area mentioned above - described the importance of maintaining connections to seasonal harvesting cycles. Like Tim, Eric also learned these things from a parent and also emphasized the importance of continuing these intergenerational practices:

My Dad used to take me out and we'd get berries, so that kinda just carried on through me. You know, we'd always do some canning, make jam or whatever, or make pies and stuff, and as long as I can remember, he used to haul me out, and we'd pick 'em since I was - since I can remember. It's kinda a seasonal thing you do. You do the mushrooms in

the spring, you do the blackberries in mid-May, June; the huckleberries in the fall, and mushrooms too for that, so it's kind of just a big cycle. So, we'd do that pretty much continuously here. And I think it's important, really. It's good to see people out there takin' their kid. If I see a family out there, and they're pickin' berries with their kids, then I can relate to 'em. It's good to see that, cause I used to do that. It's good to get them involved. Something that maybe in the future, they'll be able to do that. Or something they might wanna do… they think, "well, yeah. I used to do that when I was a kid." That's how I got to do all the stuff I got to do. Hiking and all that, is because I did it when I was a kid, and I enjoyed it, and it instills it in you.

"Minna" is a Swedish immigrant who typically gathers both big huckleberry and Cascade blueberry on Mt. Baker. She described how the practice of gathering blueberries provides a sense of connection to her childhood, and is integral to her sense of identity as a Swedish person. Minna also spoke of how this practice may be going by the wayside in Sweden:

I think it's a little bit of a connection with my childhood and my mother. I mean, I would love for her to come over [from Sweden] and do it. I mean, maybe she's too old, but I think still she would enjoy it, so a lot of that [her reasons for berry harvesting] is keeping those [traditions] alive. And unfortunately, my sisters and their kids are not doing it. I do not have children, so it feels sort of like a dying tradition. So a lot of it is just…I don't know. It connects us to nature and to history, and something that has good flavor.

The cultural significance that Minna feels for these berries was reiterated when she was asked whether she ever exchanges or sells them:

Oh, god no. Not happening. I've been thinking when I picked blueberries last time, I was gonna have it as a dessert, for like a dinner party, and the people that were there, I just couldn't, because I know they wouldn't appreciate it. There are peoples I might have it as a dessert for dinner party, but it would be dependent on the people. Cause if I don't feel like they appreciate it, they're not gonna get my hard labored blueberries. […] I'm more likely to share the berries with a Swede than an American. […] I mean, I can't imagine a Swede who didn't grow up and pick blueberries nearby growing up, and at least understand, but a lot of Americans, I feel…why pick it when they can buy it in the store? And they think, "those are much bigger, so they're better," and it's like, "no!"

Many harvesters, both long-term and those who are newer to big huckleberry harvesting, also spoke of the practice as a deeply meaningful way to connect to what it means to live in this place – expressing in different ways a similar sentiment that when they harvest and consume these berries, the places where they grow literally become a part of them. Harvesters frequently spoke of how picking huckleberries causes them to slow down and look around when they are out in nature, and that when they use the berries later, their smell and taste brings them back to that place for a moment. One harvester wrote in the survey that "it's almost a spiritual thing, and quite hard to explain." Another harvester who participated in an interview similarly described how she enjoys hiking and seeing views, but that there is something about slowing down and looking closely at the berries that allows her to really see the place where she is harvesting. Interview participants frequently described how the places where they harvest are beautiful to them – even old clearcuts – both because of the views they often afford and the beauty of the

landscapes themselves. Harvesters also spoke about how the berries are iconic of the Pacific Northwest in general. "Mary," a long-time big huckleberry harvester and resident of the Greenwater area, who is married to a Puyallup tribal member, described berry gathering areas are important both to wildlife, and because of their deep-time significance to Native communities:

> *I think a lot of [these gathering areas] used to be, well they're traditional berry harvesting areas. Many of 'em. And there's just a special feel about 'em. … There's just something about walking in an area like that that, you know, you just can't get somewhere else. I like goin' out there and seeing that it's a traditional area that's been used for generations. You know, that's very unique and very special. So, I hate to see that kind of go by the wayside. A lot of 'em…also have good wildlife-they're wildlife corridors. Huckleberry Mountain's a classic wildlife corridor. I see cougar all the time when I'm up there, I see martin, I see bobcat, I've had 'em follow me.*

II: Recreational harvester knowledge about big huckleberries and their habitats

The harvesters who were interviewed that have been picking big huckleberry on the MBS for long periods of time (15 years or more), not surprisingly also tend to be the people who carry considerable local knowledge about changes over time to big huckleberry production, and the local ecology and history of berry habitats. As mentioned in the demographic section above, long-term harvesters more often than not tend to be over the age of 50 and to live in rural areas.

Some of these harvesters keep diligent records of each year's harvest, noting where and when they harvested, when the berries ripened, and their relative abundance. The time it takes to pick a certain amount of berries is also a common metric for assessing berry productivity in a given year. Many of the long-term harvesters interviewed, as well as those that left comments on the survey, have observed that, in general, the past several years have been rather poor in terms of berry production. Some harvesters characterized this as a long-term trend, while others characterized a few years of poor berry production as a cyclical event. Still others theorized that recent declines in berry productivity could be attributed to a combination of both long-term trends and cyclical weather patterns. Common themes and observations regarding long-term declines in big huckleberry production centered on the effects of conifer encroachment, plant-pollinator interactions, and climate change.

Experienced harvesters are well aware that big huckleberry does not produce well in shade, and many harvesters with a strong understanding of the histories of their gathering areas similar to Mary's are aware that Native Americans used to burn big huckleberry meadows to keep them productive. Without fail, those who considered declining big huckleberry production to be a long-term trend primarily attribute this change to conifers encroaching into formerly productive meadows. Harvesters frequently attributed this to a lack of forest disturbance, either in terms of fire or clear-cut logging, or in some cases, to post-harvest re-vegetation practices that have occurred in the past. For instance, Mary described how, while working on tree planting crews on the Enumclaw Ranger District in the 1970's, trees would be planted every 10 or so feet apart

after a harvest. The trees, while growing slowly at these higher elevations, are now filling in so densely that nothing will grow in the understory.

Some harvesters also noted that over the past decade or so, they have observed that the rate of conifer encroachment is increasing in these upper elevation habitats. They attributed this to a warmer, wetter weather pattern more conducive to tree seedling germination because the snows melt out earlier. Paula, one of the Darrington area harvesters interviewed for the study, also suggested that this earlier snowmelt leaves exposed big huckleberry bushes more vulnerable to late spring cold snaps, which in turn can effect fruit production and potentially the overall health of the plants. It was not uncommon for harvesters concerned with conifer encroachment to also indicate that the lack of forest disturbance was contributing to declines in the abundance of other species, including in particular bears, ungulates, and certain types of birds.

Although it is not a unanimous sentiment amongst every harvester who participated in this study, it was quite common for those concerned with the relationship between conifer encroachment and declines in big huckleberry production to advocate for some form of disturbance in areas that are important to berry harvesters and to wildlife. For instance, Scott, the long-term harvester who is so familiar with Tonga Ridge, put it this way:

> *You know, I was cursing every day when Reagan was selling all the trees to the Japanese because in the 60's you'd go up on top of the mountain and you'd see a few patches of logging. By the late 80's you'd go up in the mountains and you'd see a few patches of trees. But, I mean, today, I would say, you know, if you can promote huckleberry habitat by selectively logging, do it.*

On the other hand, Tim, the tribal wildlife biologist, suggested that prescribed burning might be a more ecologically beneficial form of disturbance than selective logging:

> *I would think that burning these habitats every so often would increase a lot of things. Understory species, biodiversity, better berries, it produces bigger, fatter, elk and deer, which in turn feed the bears and cougars, which in turn feed the scavengers, which in turn, you know, so it just kind of goes down the… the chain. So… in my personal opinion I would say that burning would be better than scarifying the earth, [which] promotes weed species to come in and what not. If you burn and drop everything that's there, those nutrients and then the seeds that are there are gonna be the ones that grow, not the stuff that comes in on the [machinery].*

A few harvesters also wondered whether removing senescent, or aging branches would result in increased berry production by stimulating new growth. This observation is similar to one made about ecological relations between elk behavior and big huckleberry productivity in conversations with Muckleshoot tribal member Warren King-George. Warren has observed that in big huckleberry habitat where elk are prevalent, the elk tend to break the branches while also leaving their scat, both of which may have a positive effect on big huckleberry production.

On both the surveys and in interviews, a substantial number of harvesters concerned with declining huckleberry production also theorized about the possibility that plant-pollinator relationships may be changing. Although few of the study participants were completely

confident in their knowledge of which insects actually pollinate big huckleberry, harvesters most commonly expressed concern over whether there might be an overall decline in big huckleberry pollinators. Part of this concern is likely linked to the attention that honeybee colony collapse disorder has received in the media over the past several years. Others wondered about plant-pollinator interactions and climate change. In her discussion regarding the increased vulnerability of huckleberry bushes with earlier snowmelts to late season cold snaps, Paula also suggested that this phenomenon could also have an effect on plant-pollinator interactions. This observation was echoed by a number of harvesters during interviews, who theorized that pollinators might not be active if the plants are blooming when it is colder than usual.

Mary, who wonders whether pollinators are declining, theorized that if this is in fact the case, it might be related to pesticide use, or perhaps increased competition from European honeybees that are brought to the mountains for summer nectar foraging:

> *You used to hear a really loud hum in years past. And I noticed a decline when they … first did the gypsy moth. They flew over this whole area up here [highway 410]. And they sprayed. And they said it was only supposed to hurt the gypsy moth. And, the next year, we had absolutely, I mean, I have a house with flowers everywhere, and a big meadow next door, and it has wildflowers growing in it. The next year, we absolutely had no butterflies. I didn't see one butterfly. It killed…I don't know how many larvae. […] I didn't have any of the hummingbird moths, and the nighttime pollinators, the moth pollinators, I didn't have any of those. And I went out looking for them all summer long, and I didn't…the number of bees was down easily by over half. I could sit on my back deck, and listen to this, just this loud hum of insects and pollinators. It was barely audible. So, it was just this huge, huge decrease then. And, since then, … if I go out and really look in all of my flowerbeds, I might see 4 bees. […] I also wonder about the interaction between a lot of the - like [a local honey company] comes up and puts hives everywhere. I don't know if there's a competition there? Because they put a lot of hives out, and they put 'em all over the place in areas that have been timber harvested, like for fireweed honey. And that's typically your blueberry bushes as well, your huckleberry bushes, so I don't know what kinda impact that's had on the bees and the native stuff. I would think there's a competition there, but I'm not sure.*

Although he says he has not observed changes in huckleberry productivity that can specifically be attributed to climate change, Scott suggested that with current climate forecast models, big huckleberry plants may be lost altogether, or where it is possible, that they might "migrate" to higher elevations. Scott also theorized that subspecies of big huckleberry that are better adapted to a warmer, wetter climate might become more prevalent:

> *The climate models forecast that in this part of the world there's gonna be more rain and less snow. … If there's very little snow pack at 4000 ft. we might lose those huckleberries. [Or] they could evolve. I know there are what seem to be subspecies … in places like the White River. They don't look anything like the ones on Tonga Ridge … but the berries are in flavor…very similar. But that's a drier climate, not a wetter climate. So, this is a question for posterity…are there any other subspecies habituated to a wetter climate? … Maybe what we'll see is, the places that are now covered with those ankle-high, bright red leaved, glorious, but not as tasty huckleberries [Cascade blueberry - Vaccinium*

deliciosum]… maybe they will be the future home of this huckleberry. But this huckleberry is so much superior to the others that it's really worth keeping. I mean, speaking absolutely selfishly as a human, right? Mom [Mother Nature] has her own plans […] But where else can you find such a succulent monster that is so heavenly?

Although they did not necessarily use these terms when describing their observations, harvesters who understood low berry productivity as a cyclical phenomenon commonly associated differences in berry production from year to year with *el Niño/la Niña* southern oscillation events, and longer periods of "poor" berry years with the inter-decadal Pacific oscillation – the pattern of our local climate to shift between relatively cooler and relatively warmer periods approximately every 20 years. These theories were coupled with harvester observations about what big huckleberry "needs" in order to produce well:

- A reasonable snow pack that melts out early enough for the berries to mature, and at the same time provides sufficient moisture in the summer is critical to big huckleberry fruit production.
- Big huckleberry is susceptible to extreme cold, particularly when the plants are flowering and setting fruit. Therefore, plants growing in more exposed environments may be more susceptible to late season frosts.
- The berries simply dry up on more exposed sites in situations of excessive heat, particularly when combined with an extended period of drought.

These kinds of observations led harvesters to conclude that while "ideal" big huckleberry habitat will vary depending on the weather in a given year, in general the most *reliably productive* berry patches receive adequate sunlight and moisture during the growing season, while at the same time being protected from extreme weather events.

In sum, big huckleberry harvesters, particularly those with experience observing the places where they gather over long periods of time, have accumulated considerable knowledge of the ecological and climactic relationships that contribute to, or detract from, the productivity of this highly valued berry. Harvester observations and attitudes regarding the effects of conifer encroachment on big huckleberry harvesting areas suggest that they share tribal concerns about this phenomena, and are for the most part likely to be supportive of any efforts on the part of the MBS and of tribes to restore or enhance gathering areas. Harvesters' observations and theories regarding the dynamics of plant-pollinator interactions suggest the need for further analysis regarding the impacts of climate and possibly pesticide use on pollinator abundance, as well as possible competition from non-native pollinators. Their observations regarding microclimate and variability of big huckleberry production over time and space, the effects of long-term climate change, as well as shorter-term climate cycles, suggests that it will be important to consider these types of factors when identifying and prioritizing sites on the MBS Forest for future big huckleberry enhancement and restoration.

III: Social, ecological, and economic effects of big huckleberry recreational harvesting

This section of the report reviews the results of survey and interview questions related to harvester observations and practices related to the social, ecological and economic effects of big huckleberry harvesting on the MBS Forest. In general, harvesters tended to view big huckleberry harvesting as ecologically benign, since taking the fruit of a plant is "what that plant 'wants' you to do." Harvesters also tended to view their interactions with other harvesters and MBS Forest users in positive terms. None of the harvesters who were interviewed for this study shared that they had experienced any conflicts over big huckleberry harvesting on the MBS, or that they had definitely observed large-scale illicit commercial harvesting of big huckleberry. However, some of the interviewees and survey participants did describe experiencing conflicts over big huckleberry harvesting in other areas, such as the Gifford-Pinchot National Forest, where commercial harvesting is allowed.

In general, while big huckleberry harvesters did not feel that there was much that they could personally do to improve berry habitat and fruit production, many mentioned that they do participate in other kinds of stewardship activities on the Forest, including ecological monitoring, road and trail maintenance, invasive species removal, fire lookout maintenance, and environmental education. Harvesters also described certain practices that they felt would reduce any impacts their harvesting might have on the plants and other species. These included taking care not to trample the bushes or break their branches, and also moving around so as not to take all the fruit from a single bush or particular area in order to leave fruit for other species that also depend on the berries. A few harvesters also mentioned the use of huckleberry rakes with some level of ambivalence. Some of the harvesters who have observed a decline in big huckleberry production in the areas that they gather mentioned that they have also observed harvesters raking the bushes in these areas. They wondered if these phenomena were related, suggesting that perhaps the raking activity damages the buds that will become next year's berries. Other harvesters who have tried using huckleberry rakes were ambivalent about them not because of their ecological effects, but because they had found that removing the copious amounts of twigs and leaves that come along with the berries when one uses a rake is just as time-consuming as harvesting by hand.

While a small proportion of harvesters did indicate in the survey that "other pickers" and feeling unsafe were barriers to harvesting, these impressions seem to be very rare on the MBS. Harvesters tended to describe their interactions with other harvesters in positive terms. In areas that harvesters drive to, people will stop on the road and ask how the berries are. Eric, the harvester from Skykomish, suggested that there is a general sense of camaraderie amongst big huckleberry harvesters:

> *People have always been nice when you're out there picking … there's a camaraderie there. I've never really had, "Oh, you're pickin' on my bush! Don't come over here!" Or nothing like that.*

Rather than experiencing conflict, several harvesters remarked that they were surprised at how few people they encounter are even aware of the big huckleberry that is all around them when they are out on a hike. One harvester described it this way:

> *And with a lot of hikers who come by, they have no idea what I'm doing. They don't see them. It's really interesting. I'm picking them and they're a little bit under the leaf, kind of. And they don't realize what it is and they've never had them. It's kind of amazing to me how many people around here don't know what huckleberries are. They're taking a hike and they don't think about it. I mean maybe some are new to the area? But I think some of them are not.*

Minna, the harvester who is originally from Sweden, describes a similar experience, elaborating with some surprise that some people actually are fearful of eating berries in the wild:

> *I remember I had a friend who had hiked up to Spray Park, sort of ...September, and I had asked her [how] were the blueberries out here and she said she didn't know, cause she didn't look at the ground when she was hiking. Which, to me is like oh, my god, you can't be so focused on the destination; you need to see what's on the ground! […] If anything people are questioning what I'm doing, and if I'm not scared that I'm gonna die… Once when I was hiking Snow Lake up in Snoqualmie, and I was picking blueberries, it was one of those hike, pick blueberries, where you have enough for a couple of oatmeal breakfasts. A lot of people asked me what I was doing. Asking how I knew it was blueberries, if it was safe. They wouldn't try it. I gave it to them and they wouldn't try it!*

In general, harvesters do seem to feel that berry harvesting is a safe and healthy activity that carries no greater risk than a typical hike, so long as one remembers that, "bears have right of way in the berry patch." As one harvester put it, "I've never had an argument over picking… I'd be more worried with a bear… having an argument with a bear [more] than another person." However, while only 5% of survey participants overall mentioned "feeling unsafe" as sometimes being a barrier to harvesting, 10% of survey participants who identified with a racial/ethnic category other than white mentioned that feeling unsafe was sometimes a barrier to harvesting. Furthermore, some harvesters did express in interviews concern that there is the *potential* for an increase in frequency of harvester conflict in the future. With conifer encroachment and increasingly limited access to the remaining productive berry harvesting sites, these harvesters expressed concern about the social and ecological effects of concentrating berry harvesters into increasingly limited areas on the Forest. It should also be noted that, while not explicitly associated with the research for this study, the author has upon numerous occasions over the past eight years heard anecdotal stories of conflicts over big huckleberry harvesting in the Stampede Pass area.

The practice of harvesting big huckleberries to sell them to others does appear to occur on a very small and limited scale on the MBS Forest. Three harvesters who responded to the survey indicated that they have "rarely" sold their berries (these three harvesters all self-identified as white, male, and low-income). A few interviewees who live in rural areas indicated that they knew of elderly neighbors who, for a little extra money, might pick and sell their harvested berries to neighbors. No study participants indicated that they had definitely observed any kind

of larger scale commercial huckleberry harvesting on the MBS, noting that, having observed other kinds of commercial harvesting on the Forest (floral greens, fiddlehead ferns) they are familiar enough with these types of activities to recognize them when they are taking place. Tim, the tribal wildlife biologist, does helicopter monitoring of elk in the Green River watershed during huckleberry season, and has observed what may be commercial huckleberry gathering camps in this area:

> *I've seen vans out there before. I've never seen a group of people with rakes. I haven't seen that yet [but] I know it happens. I know it goes on. I haven't seen that myself, but, you know, I've been flying in the helicopter, capturing stuff, and you see a van down there and, you know, some people kinda movin' through and it's like, what are they… what are they doing'? … I'd probably say the Government Meadows area. Yeah. Up towards… Pyramid Creek, Windy Gap…*

Study participants tended to be ambivalent about large scale commercial harvesting as a matter of principle. The most common theme regarding commercial harvest stems from study participants' experiences in places where commercial big huckleberry harvesting does take place (e.g., Montana, Idaho, and on the Gifford Pinchot National Forest). In this regard, harvesters expressed concern about potential conflicts between user groups and the ecological effects of commercial harvest. While a few study participants feel that commercial harvesting is fine so long as commercial harvesters "respect" the berries, their habitats, and other MBS Forest users, the majority seem to feel strongly that what makes big huckleberry harvesting special is that it is an activity that takes place, at least for them, outside of the money economy. These participants tend to feel that under no circumstances should commercial harvesting of the berries be allowed on the MBS Forest.

IV. Recreational harvester perceptions of MBS policy and planning

In general, the harvesters who participated in this study tend to feel that big huckleberry harvesting is not a high priority of the MBS. Indeed, it was not unusual for harvesters who were interviewed to share the sentiment of one participant, who stated that big huckleberry is "not even on the radar" of MBS Forest Service staff. This they often attributed to the many issues that the Forest has to deal with in a time of shrinking budgets and minimal staffing. However, in addition to addressing the issue of conifer encroachment into meadows and declining big huckleberry productivity, harvesters most commonly mentioned permitting and road access to gathering sites as two areas where Forest planning and policy has the potential to effect the quality of, and capacity for, big huckleberry gathering on the MBS. Of these, road access to big huckleberry gathering areas was by far the issue that harvesters most frequently mentioned.

Several interviewees also expressed a sense of frustration or bewilderment about Forest planning processes and policies related to access and gathering of big huckleberry. These individuals were either unsure about how the Forest notifies the public when it comes to decision-making on the Forest, or felt that even when they had been involved in the planning process, that their involvement had not really made a difference. Harvesters also mentioned the difficulty they have in finding information regarding anything related to berry harvesting on the MBS website, including information about harvest regulations, and planning decisions that might affect harvesting.

Road Access

The harvester survey asked a series of questions about the kinds of barriers to big huckleberry harvesting that the study participants had experienced. After "poor berry year" (72%), and "lack of time," (68%), "road closures" (33%) was the third most commonly cited barrier to harvesting. At 47% for harvesters who live in rural areas, and 43% for those who have been harvesting big huckleberry on the MBS Forest for 15 years, these harvesters tend to experience this barrier much more often than the study mean. As previously mentioned, these groups are also amongst those harvesters for whom big huckleberry harvesting is more likely to be a highly important aspect of their lives, and who at least sometimes make a trip to the Forest for the express purpose of picking big huckleberry. These harvesters typically choose harvest sites that take an hour or less to reach from the place where they park their cars. They also tend to be over the age of 50. The importance of road access for these individuals is reflected in a statement made by Mary, who lives in the Greenwater area, and is herself over the age of 50:

> *I mean, the small blackberries, we still get those, but the huckleberries, it's just, you know… two things, I think a lot of the people got older… The roads got harder… You can't just find somewhere and pull up and pick along the road anymore. You've gotta really hoof it. So those of us who do go out, we try to get some for us and some for our older friends as well. Even I'm getting to the point where, I can't get the nice big berries. I can go up to Cumberland Pass, but it's not the big berries up there. You have to get a little higher up than that.*

"Bruce" is the pastor of a church in Darrington, and along with his wife "Helen," makes annual excursions to Segelson Ridge for the express purpose of gathering big huckleberry. They too are over the age of 50 and in their interview described the importance of being able to drive to their favorite gathering site:

> *Bruce: We like Segelson because you can drive, park your car, get out, and start pickin'. You don't have to hike in a half a mile to find them [big huckleberry].*
>
> *Helen: See, we appreciated that. That was… you know, besides the beauty of the spot up there. But it was… once you got up there you felt safe and it was nice. And… familiarity. Being familiar with that spot and we know what it's like. It's easy to go back to the same place because you've been there. We've never gone past where we sit and park. […] And it's funny because we, each time we go it's always available. That little area, it's like people have their favorite spots and … we've got ours. 'Cause you [just] get out of the car, and you walk across the road and you start pickin'. And that is the view spot. But I guess because that's where we found it and it's like going home each time, you know, and knowing that we just have to get out of the car and they're right there and even the same little logs that you can, you know you've walked on before…*
>
> *Bruce: And then you can sit down and start pickin'.*
>
> *Helen: And I just fill my bucket.*

In addition to road access to gathering sites for older harvesters, several harvesters also discussed the importance of road access to these areas for families with younger children. Another harvester from the Darrington area whose career is in the timber industry described the effects of a recent decommissioning in that area:

> *And this one in particular… one of the last times I went in there before I heard about the decommissioning, I was struck by the number of kids that were going in to fish. There's fish, they're stocked… I actually met one of the guys that stocks 'em. It's a big deal. So how do you get kids in the woods? And how do you give 'em the opportunities that I had as a Boy Scout, you know, to enjoy some of this area and then to grow up and actually care about it? And maybe even go in and make your career in it? You gotta have access. […] You know, when you've got the President talking about America's Great Outdoors and all this wonderful stuff - and I've got a whole folder full of wonderful quotes - but if you can't get there, if you can't provide it, it's all hot air.*

Permitting for Recreational Use

The harvest regulations on the MBS Forest officially requires recreational harvesters to obtain a permit to gather big huckleberry on the Forest if a harvester's intent is to gather more berries than what is considered to be "incidental use" The MBS does not permit or allow the commercial harvest of big huckleberry on the Forest. However, most of the harvesters who participated in the survey and in interviews claimed to be unaware of any regulations restricting the amount of berries that one is allowed to harvest from the Forest. They also seemed to be under the impression that the quantities of berries they are harvesting are less than the amount for which any sort of permit would be required. Harvesters expressed that if this is not the case, the Forest could do a better job informing harvesters about what the rules are. In addition to information on the website, harvesters suggested that it would be helpful to have these rules posted on trailhead signs. However, many harvesters felt highly ambivalent about the Forest requiring any kind of permit to harvest berries for personal use. A few harvesters objected to *any* permitting as a matter of principle – stating that this would be antithetical to the ideal of *public* lands. Others did not object to permitting *per se,* but felt that permits to harvest big huckleberry or other types of special forest products should only be required if issuing them serves a well thought out and clearly articulated objective. A few of the harvesters who participated in the study, both in comments left on the survey and in interviews, expressed concern that the results of this study would lead to increased regulation of big huckleberry harvesting on the part of the MBS Forest, and would perhaps lead to charging a fee for permits. For instance, Eric, the harvester from the Skykomish area, described how he and a friend had discussed this concern when talking about the study before he made the decision to participate:

> *So, yeah, even when I filled out the survey, I always thought that the Forest Service was gonna end up tryin' to get you to buy a permit to pick berries, or to buy a permit to pick mushrooms, just to make money. […] That's everybody's fear, is it might develop to be. And you'd think well, they can never charge you to go hiking on the trails, cause it's a*

public thing. Well, you gotta buy a trail pass now. Ya know, that's kinda just part of society's thinking is sure maybe not now, but maybe in the future, they will. To generate funds, because we'll have to lay off this many people. Cutbacks … So they have to go and get funds some other way.

Conclusions

Through a harvester survey, in-depth interviews with 24 big huckleberry recreational harvesters, and participant-observation at harvesting locations across the Forest, this study shows that big huckleberry, as well as Cascade blueberry (*Vaccinium deliciosum*) harvesting is an activity that is highly important to a diversity of Forest users. Big huckleberry is a flavorful, nutrient dense food, and this is of course important to harvesters. However, what is equally significant about the practice is the way that harvesting big huckleberry may affirm a harvester's identity, their sense of place and of time, and also strengthen their sense of connection to the Forest.

Recreational berry harvesting is a culturally, socially, and economically important activity to a diversity of MBS Forest users. For particular user groups, berry harvesting plays a more central role in their lives, including long-time harvesters, those who live in rural areas, harvesters who self-identify as belonging to a race/ethnicity other than white, and harvesters who got their start picking berries as a family tradition or due to an interest in wild foods harvesting. These harvesters are more likely than the "average" harvester to make trips to the Forest for the primary purpose of picking berries. They are also more likely to pick greater quantities of berries, and these berries are more likely to play a role in their household and gift economies.

The study also found that long-time recreational harvesters (those who have been picking berries on the Forest for 15 years or more) carry important insights regarding huckleberry ecology, environmental change on the Forest, and the effects of climate and weather on huckleberry production. Long-term harvesters also tend to be over the age of fifty, to live in rural areas, and to be more likely than the average of survey respondent to indicate that road closures are at least sometimes a barrier to their ability to harvest berries.

Although the sample size is small, this study also suggests that big huckleberry harvesting is an important way that people who self-identify with a race/ethnicity other than white connect with the Forest. This group is twice as likely as harvesters who self-identify as white to say that feeling unsafe is sometimes a barrier to their berry harvesting.

Over the past several years, the USFS and other land management agencies have increasingly come to recognize how important it is that the lands they are entrusted to steward remain relevant to American youth, and to a US population whose demographic is rapidly changing. This includes an aging population and proportionally larger numbers of the population who self-identify with a race or ethnicity other than white. The importance of big huckleberry gathering as an intergenerational practice, and the value placed on gathering big huckleberry harvesting by individuals across the demographic spectrum, suggests that it is just the type of activity that may help to ensure that the MBS remains relevant to Forest users over the long-term.

Furthermore, their substantive local knowledge of big huckleberry habitat, and a general tendency of long-term recreational harvesters to engage in different types of stewardship activities on the Forest, suggests that these individuals may bring under-appreciated strengths to the challenge of ensuring the long-term sustainability of big huckleberry, and the places where it grows. Many of these harvesters would be likely to participate in, or at least support, projects that enhance big huckleberry production in important gathering areas. And should the Forest ever decide to initiate them, given their considerable local knowledge, long-term harvesters in particular would be a great asset to "citizen-science" big huckleberry monitoring projects that could in turn help us to better understand big huckleberry ecology and to better plan for their future in the context of a rapidly changing climate.

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Part B

APPENDICES

Appendix 1. Survey results

A total of 241 individuals completed the harvester survey. The majority of respondents (n = 228) completed the survey online, with the remainder sending in paper copies that were manually entered into an Excel database as they were received. These results were then exported to an SPSS statistical program for further analysis. Of the initial 241 respondents, 16 were excluded from this analysis because they answered either "no" or "not sure" to the first survey question, "have you ever picked or harvested big huckleberry on the Mt. Baker-Snoqualmie National Forest?" This left a total of 225 valid survey responses. Significance was evaluated using a 95% confidence level.

Harvester Demographics

The survey included five demographic questions regarding place of residence, age, income, education, and race and/or ethnicity. In addition, the gender ratio of a subset of harvesters was calculated from those survey respondents who left their names for a follow-up interview. This section provides a brief summary of Forest-wide demographic data for valid survey responses to the demographic questions. Relevant correlations between demographic results and other components of the survey are discussed in greater detail in the sections that follow this demographic overview. Note that because survey percentages were rounded, in some cases the reported total results may equal 101%.

Place of residence: Of the 216 survey participants who responded to this question, 50% fell within the "urban" category, 27% fell into the "rural" category, and 22% were peri-urban. All respondents with the exception of the three Canadian participants were from Washington State. Of these, most reside in Western Washington.

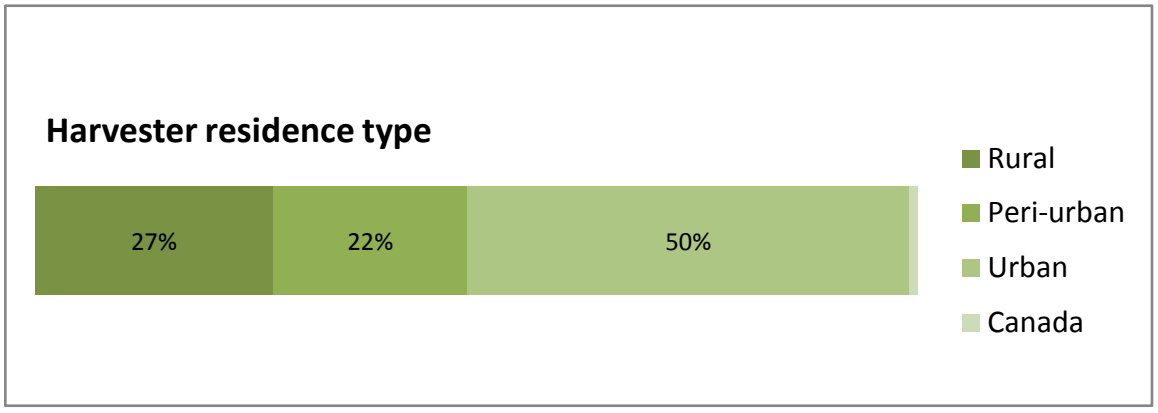

Figure B-1.1: Harvester residence type

Figures B-1.2 & B-1.3 are visual representations of the relationship between the zip code respondents provided as that of their primary residence, and the district that a harvester said they typically harvested within. Although there is variation, particularly when it comes to urban areas, the maps indicate a general pattern in that people typically harvest on the district that is closest to where they live. Correlations between harvest districts, harvester demographics and harvester practices are discussed in greater detail in the section on primary harvest district, below.

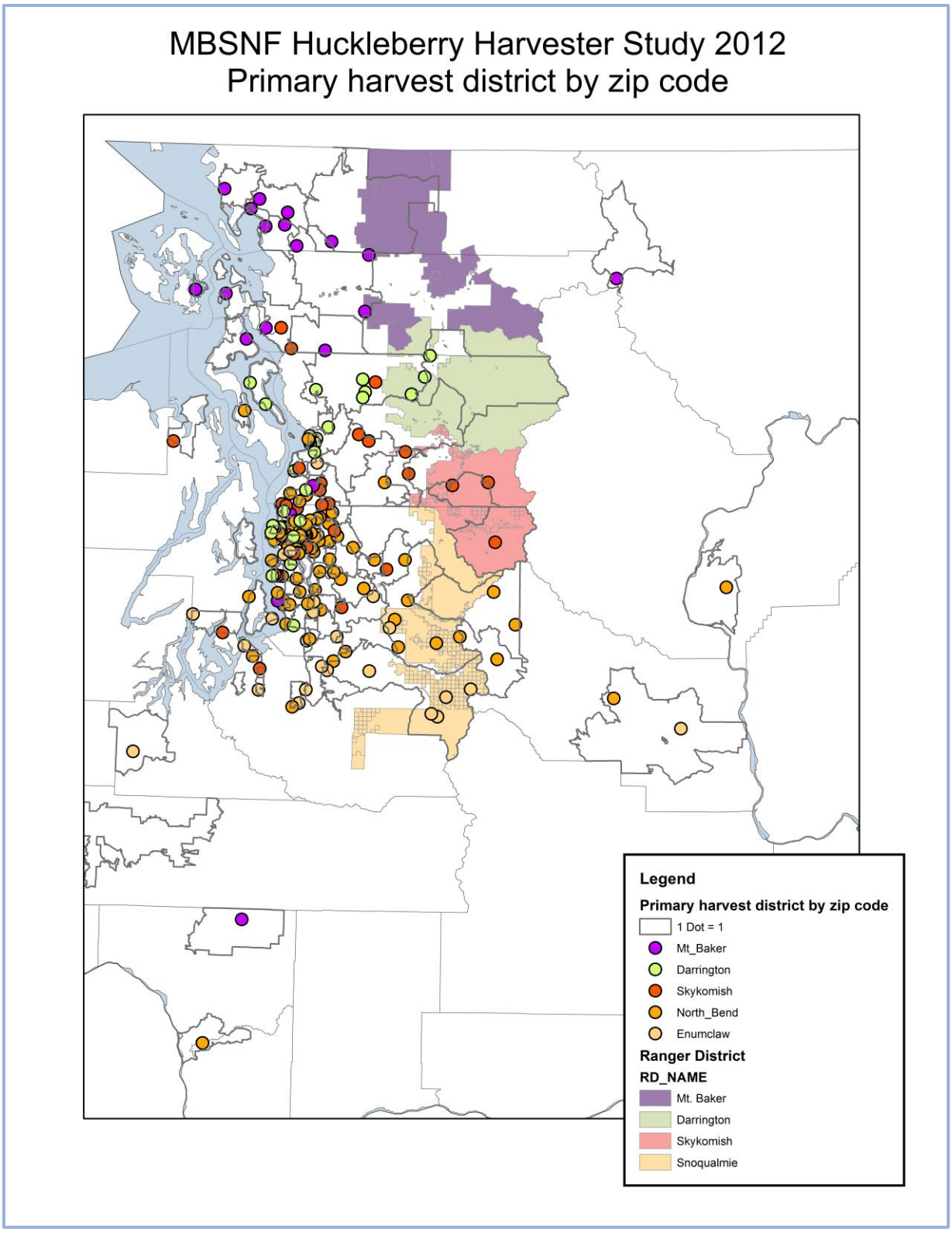

Figure B-1.2: MBS 2012 harvester study; primary harvest district by zip code

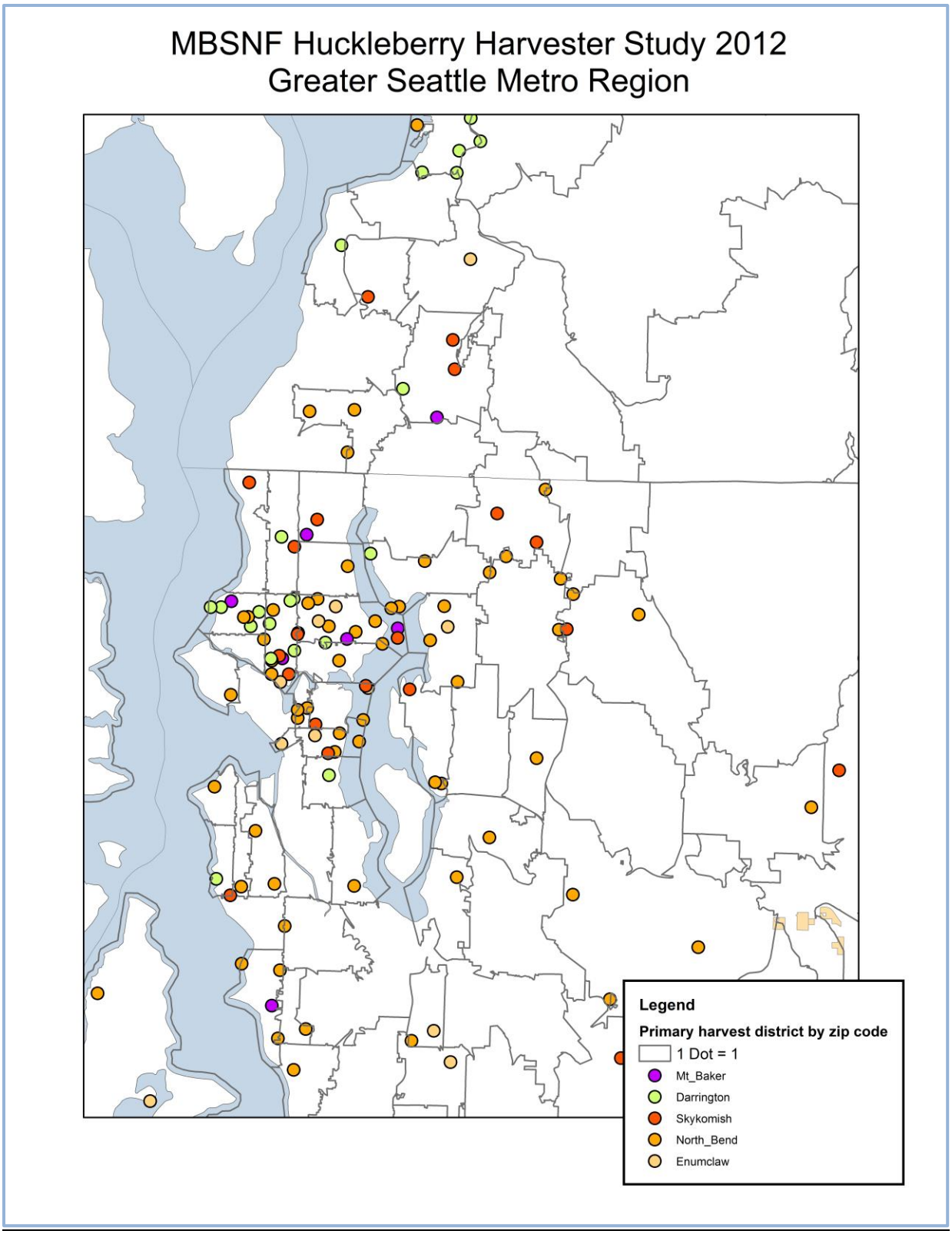

Figure B-1.3: MBS big huckleberry harvester study - primary harvest district by zip code, Seattle Metro Area

Age: Harvester reported age (n = 217) indicates a slight bi-modal distribution, with just over half of all survey respondents falling within the 30 – 39 year-old and 50-59 year-old age ranges. 53% of survey respondents indicated that they were 50 years of age or older. The most elderly survey respondent was 80 years old, while the youngest was 20 years old. Just 5% of survey respondents fell within the 20 – 29 year age range.

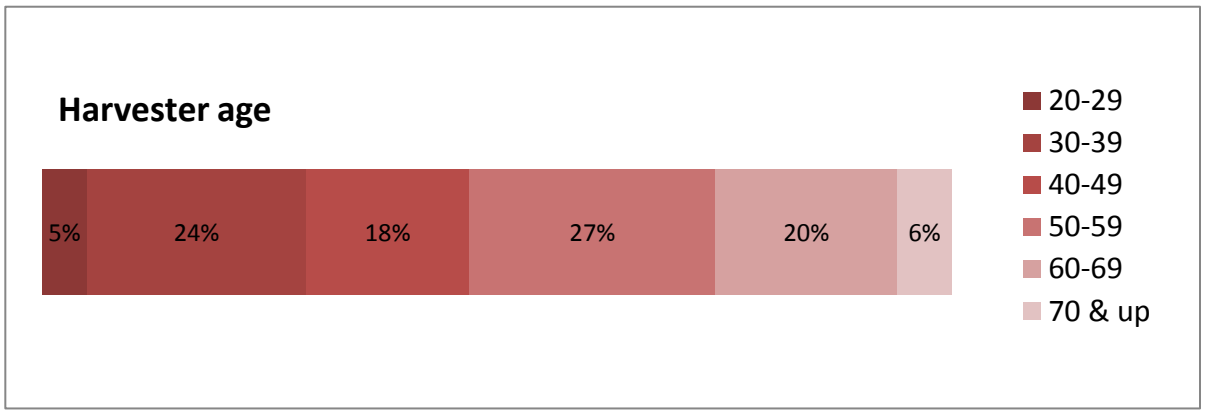

Figure B-1.4: Harvester age

Income: The survey asked participants if they considered themselves to be low, middle or high income. 214 respondents answered this question, of which 75% indicated that they considered themselves to be middle income, while a roughly even percent of the remainder indicated that they considered themselves to be low (14%) or high (12%) income.

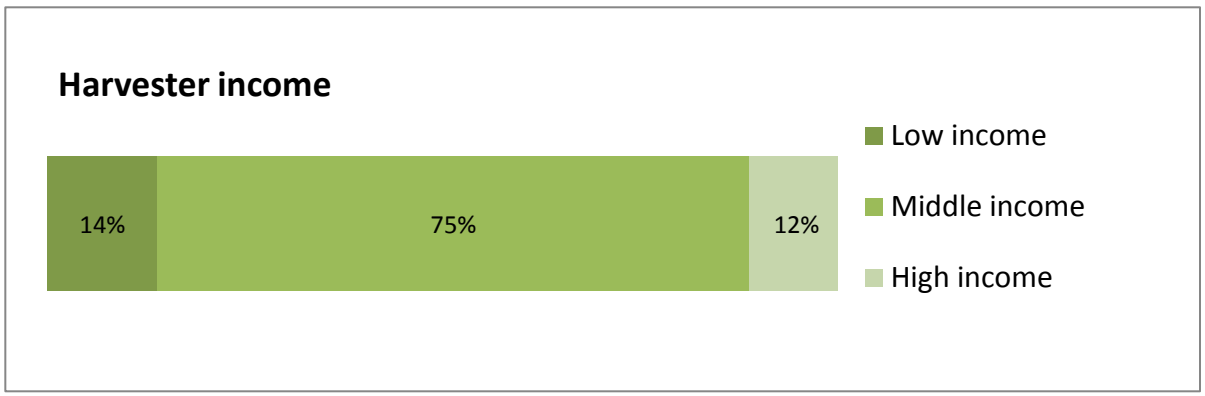

Figure B-1.5: Harvester income

Education: 28% of survey participants who answered this question (n = 217) indicated that their highest level of education was either high school or GED (16%), or that they had earned an Associate's degree (12%). 36% of the survey respondents indicated that a Bachelor's degree was their highest level of education, with an equal percentage reporting that their highest levels of

education were either a master's or professional (24%) or doctoral degree (12%). It should be noted that in follow-up interviews, it was found that there was a tendency amongst some survey respondents to over-report their levels of education.

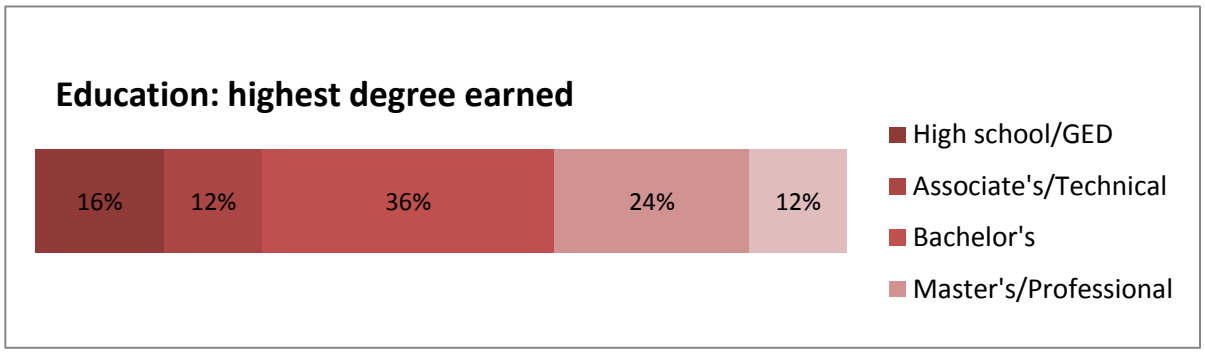

Figure B-1.6: Education - highest degree earned

Gender: Gender results are based on the first names of the sub-set of respondents who left contact information for follow-up interviews, as the survey itself did not include a question about the respondents' gender. This resulted in a total of 57 valid responses. Of these, 54% were male and 46% were female.

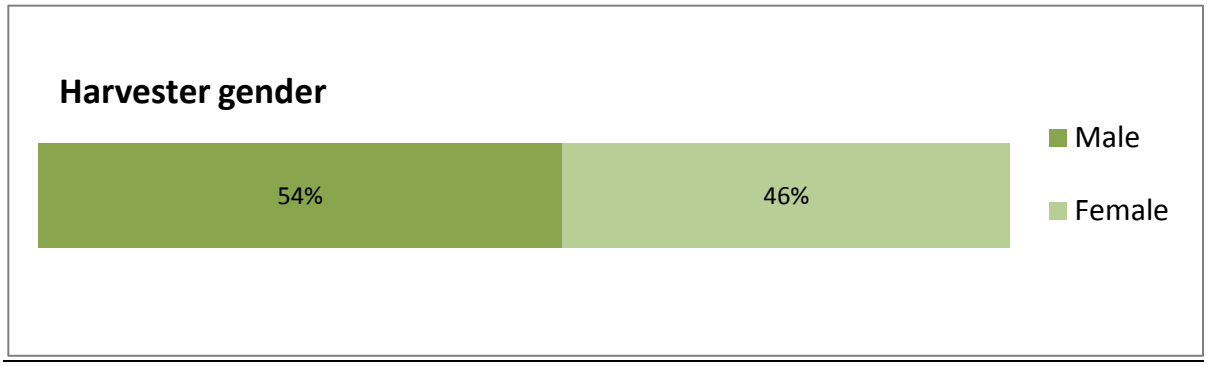

Figure B-1.7: Harvester gender

Harvester race and/or ethnicity: 89% of the survey respondents who answered this question (n=194) indicated that they self-identified as "white," while the remaining 11% of respondents (n=21) indicated their race or ethnicity as African-American (1%), Asian (3%), Native American (1%), more than one race or ethnicity (2%), non-white Hispanic (2%), or "other" (3%). For the purposes of further analysis, these results were collapsed into two categories - "white" and "non-white."

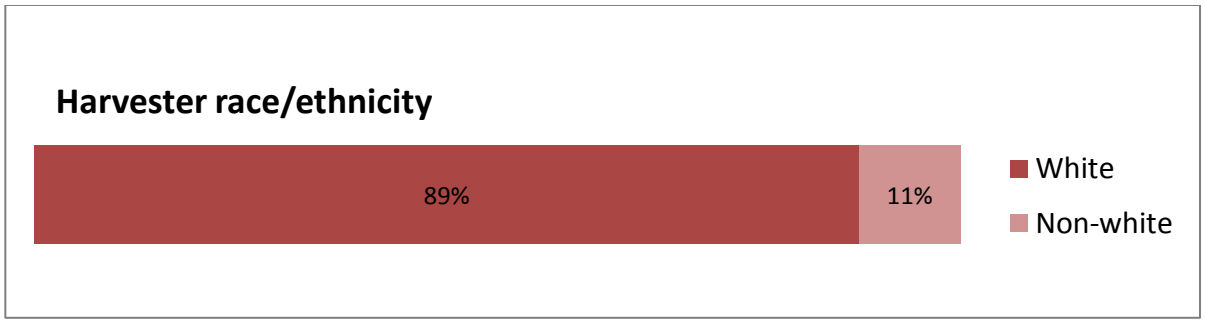

Figure B-1.8: Harvester race/ethnicity

Harvester Practices

The survey asked five general questions related to harvesting practices on the Forest. These questions and their results are described in this section.

Question: *For how many years have you been picking or harvesting big huckleberry on the Mt. Baker-Snoqualmie National Forest?*

Of the 218 harvesters who responded to this question, 10% indicated that they had been harvesting on the Forest for less than 2 years, 30% for 2 to 5 years, 17% for 6 to 10 years, 7% for 11 to 15 years, and 37% for more than 15 years on the MBS.

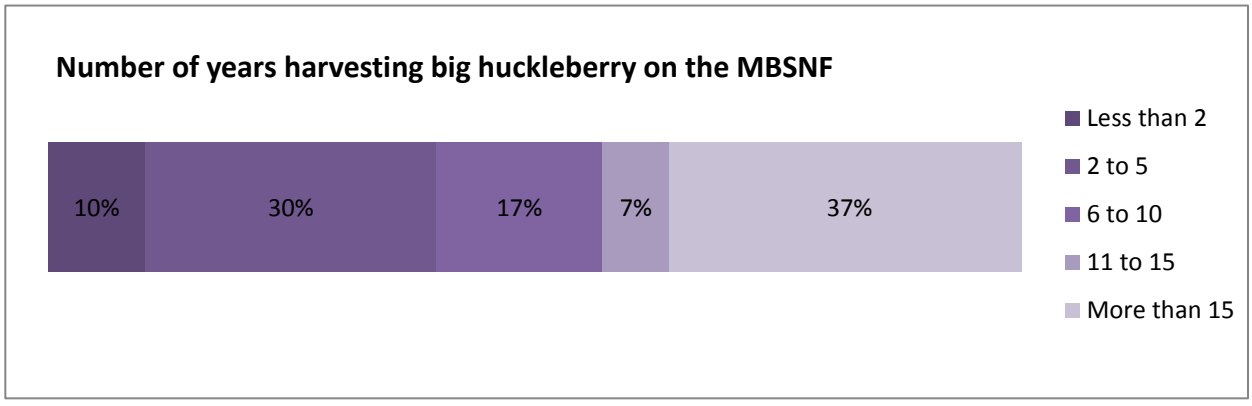

Figure B-1.9: Number of years harvesting big huckleberry on the MBSNF

Relationships between harvester demographics and years of experience harvesting on the MBS:

- Respondents who reported that they have been harvesting on the Forest for longer periods of time tend to be older, but those who have been harvesting on the Forest for shorter periods of time are not necessarily younger. 76% of respondents who stated that they have been harvesting on the Forest for more than 15 years are over the age of 50, while 58% of those reporting that they have been harvesting on the Forest 5 years or less are

also over the age of 50. This distribution may reflect a trend observed by study interviewees, who indicated both the presence of an aging, more experienced population of harvesters (thus suggesting a potential decline in harvesting levels on the Forest), as well as an emergent group of people with an interest in harvesting wild foods (thus suggesting a potential rise in harvesting levels on the Forest).

- Harvesters who have been picking big huckleberries on the Forest for more than 15 years are more likely to reside in rural areas than those who have been harvesting on the Forest for less than 15 years.
- Harvesters who have been picking big huckleberries on the Forest for less than 15 years are more likely to live in urban areas than those who have been harvesting on the Forest for more than 15 years.

Question: *How did you get started picking big huckleberries?*

224 harvesters responded to this question. 33% indicated that big huckleberry harvesting is a family tradition, 16% reported that it was because of an interest in wild foods harvesting, while the majority, 43%, responded that they got started through other outdoor experiences. Another 8% responded in the "other" category. Most of these respondents seem to have misunderstood the question, and responded with write-in answers indicating that they thought the question was asking them *why* they picked big huckleberry (i.e., because they taste good).

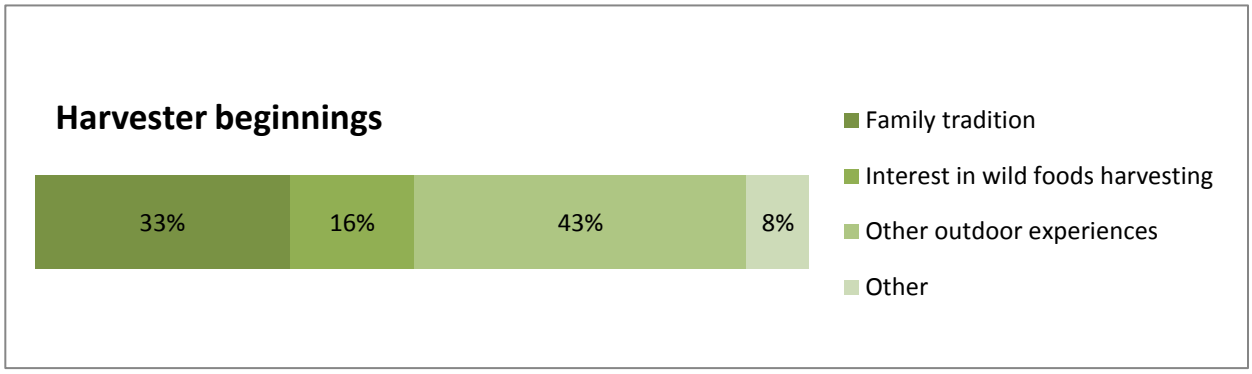

Figure B-1.10: Harvester beginnings

Relationships between harvester demographics and harvester beginnings on the MBS

- Harvesters who were most likely to respond that "family tradition" was how they got started harvesting big huckleberry included people over the age of 50, and those who reported being middle income.
- Harvesters most likely to respond that they started picking big huckleberry through an interest in wild foods harvesting included harvesters under the age of 50, those who identified as low-income, those who reported their highest level of education as being

less than a bachelor's degree, and males.

- *Both* low and high-income harvesters were more likely to report that they started picking big huckleberry through other outdoor experiences than middle-income harvesters.

Question: *In gallons, about how many big huckleberries do you pick or harvest on the Mt. Baker-Snoqualmie National Forest in a typical year?*

The number of berries a harvest typically picks is one measure of the importance of big huckleberry to the people who harvest them. Of the 224 survey participants who responded to this question, 65% said they harvest less than 1 gallon per year, 32% harvest 1 to 5 gallons per year, 3% indicated that they harvest 6 to 10 gallons of berries per year, and 1% said they harvest more than 10 gallons per year.

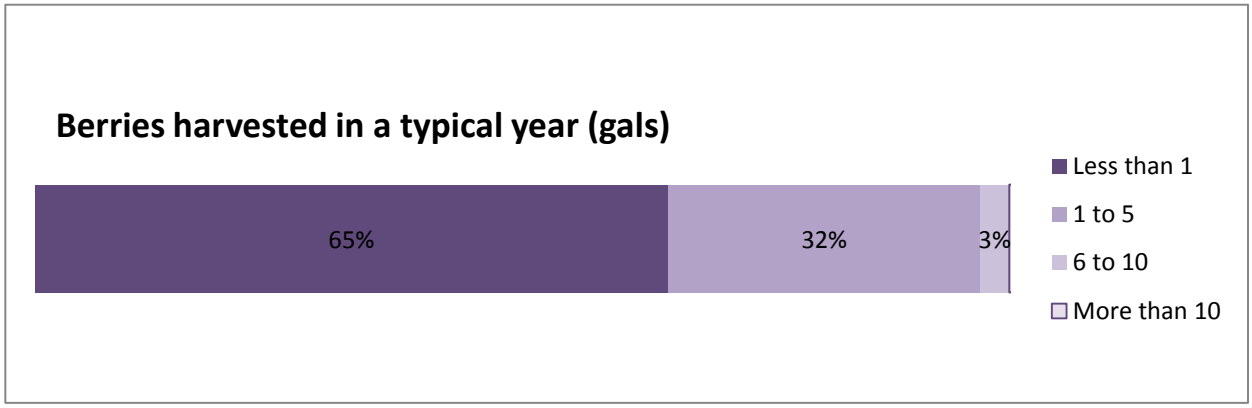

Figure B-1.11: Berries harvested in a typical year (gallons)

There are several statistically significant correlations between harvester demographics and other practices, and those who say they typically pick more than one gallon in a season, suggesting that for these groups of harvesters, berry picking may play a more central role in their lives than it does for other harvesters.

- Harvesters over the age of 50 are more likely to pick more than one gallon per season than those under the age of 50 (57% versus 43%).

- Number of years harvesting on the forest is positively correlated with the number of berries a harvester typically picks (Fig. A-12).

- Harvesters who live in rural areas are more likely to pick more than one gallon of berries in a typical season than their peri-urban and urban counterparts (rural = 52%, peri-urban = 35%, urban = 27%).

- Harvesters who indicated that their race or ethnicity was other than white were more

likely to harvest more than one gallon of berries in a typical season than those who identified as white (52% v. 36%).

- Berry harvesters whose level of education is less than a bachelor's degree were more likely to pick more than one gallon of berries than those harvesters with a bachelor's degree or higher (< bachelor's degree = 41%, bachelor's degree, 33%, > bachelor's degree 26%).

- Harvesters who indicated that they got their start picking berries as a family tradition are also more likely to say they typically harvest more than one gallon of berries in a year than those who got their start through an interest in wild foods harvesting or through other outdoor experiences (53% for family tradition, versus 16% for wild foods and 31% for other outdoor experiences).

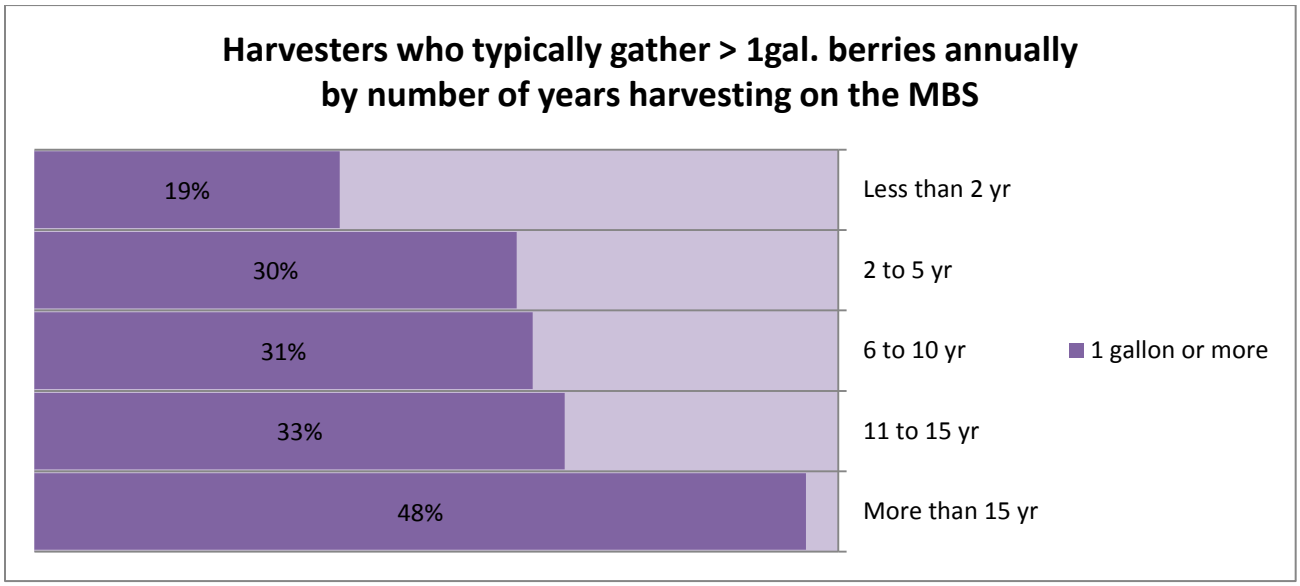

Figure B-1.12: Harvesters who typically gather > 1gal. berries annually by number of years harvesting on the MBS

Question: *Is big huckleberry picking your primary focus when you travel to the Mt. Baker-Snoqualmie National Forest and harvest?*

This question is considered a proxy for the importance of these berries to harvesters. On a 5-point scale ranging from "never" to "always," 27% of survey participants responded that berry picking never was their primary focus, 21% indicated that berry picking rarely was, 40% responded that berry picking sometimes was, 8% responded that berry picking usually was, and 4% answered that harvesting big huckleberry was always their primary focus when they visited the Forest to pick berries.

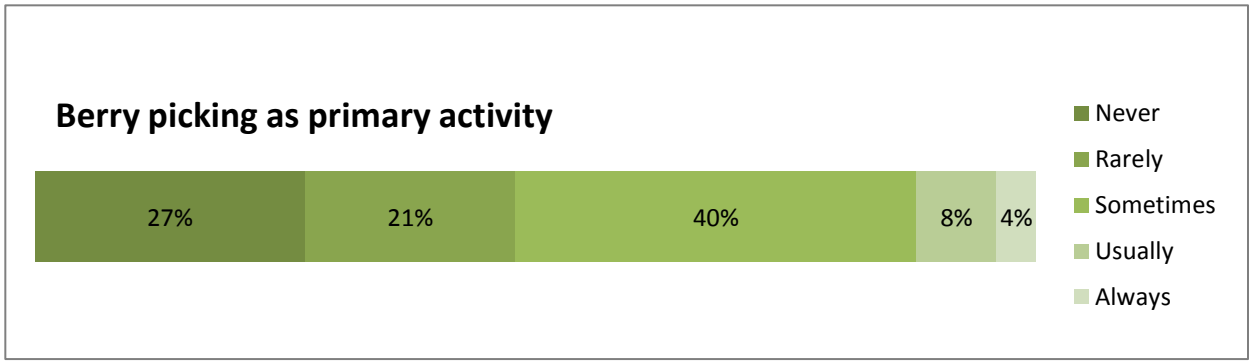

Figure B-1.13: Berry picking as primary activity

To assess correlations between this question and demographic variables as well as those related to general harvester practices, the Likert scale was collapsed into a binary category of "never" and "rarely" responses (48%), and "sometimes" to "always" responses (52%). Level of education, race/ethnicity, harvester residence, years harvesting on the Forest, gallons of berries typically harvested, and harvester beginnings all had statistically significant correlations with this question, while age, income, and gender did not.

- Harvesters who are more likely than the average of 52% to say that berry picking is "sometimes – always" their primary activity include:
    - Harvesters whose level of education is less than a bachelor's degree (59%)
    - Harvesters who live in rural areas (61%)
    - Harvesters who responded that their race/ethnicity is other than white (76%)
    - Harvesters who have been picking berries on the Forest for more than 15 years (60%)
    - Harvesters who got their start picking huckleberries because it is a family tradition (77%) *as well as* those with an interest in wild foods harvesting (66%).
- Not surprisingly, quantity of berries harvested and berry picking being the primary purpose of a visit to the MBS are correlated. 80% of harvesters who answered that they sometimes – always go to the Forest with the primary intention of picking berries also indicated that they typically harvest more than 1 gallon of berries in a given harvest season.

Harvester Practices by District

Question: *Which of the following towns is closest to where you harvested, or will harvest most of the big huckleberry that you have picked or will pick on the Mt. Baker-Snoqualmie National Forest in 2012?*

14% of survey respondents answered that they typically harvest on the Mt. Baker Ranger District, 17% of harvesters responded that they usually harvest on the Darrington District, 17% indicated that they typically harvest on the Skykomish District, 40% responded that they harvest on the North Bend side of the Snoqualmie District, while 12% of harvesters indicated that they harvest on the Enumclaw side of the Snoqualmie Ranger District.

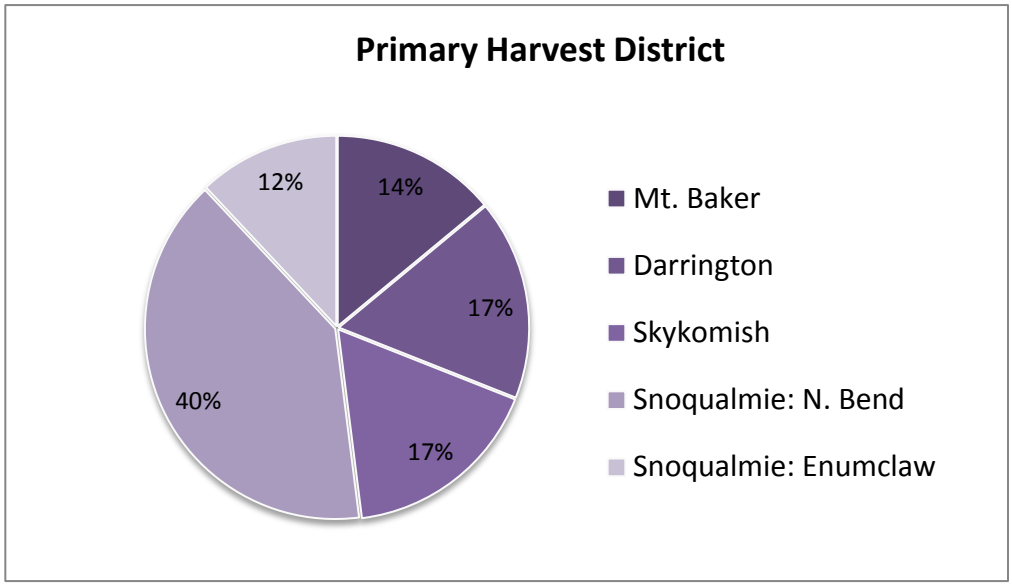

Figure B-1.14: Primary harvest district

There were significant differences between districts regarding how harvesters got started picking big huckleberry, and whether big huckleberry harvesting was ever their primary activity when they go to the Forest to harvest berries. There were also significant demographic differences with respect to income, age, and primary residence. While differences between districts in terms of gallons typically harvested in a given year, number of years' experience harvesting berries, level of education, race/ethnicity, or gender were not statistically significant between districts overall, there are some important differences in these categories that will be noted below.

Mt. Baker District

- The Mt. Baker District has a greater proportion than the overall mean of harvesters who indicated that family tradition was how they got started picking big huckleberries (46%

as compared to the 37% Forest average).

- This district also had the highest overall percentage of harvesters who indicated that they were low income (22% versus the mean of 14%), and fewer harvesters who indicated that they were middle or high income.

- The Mt. Baker District also had the highest proportion of rural harvesters (52% compared to the overall mean for the Forest of 30%), slightly more than the mean of peri-urban harvesters (26% versus 22%), and substantially fewer urban harvesters (22% versus 48%).

- Mt. Baker also had the highest proportion of harvesters who indicated that their race/ethnicity was other than white (20% compared to the Forest mean of 11%).

- This District also had a higher than average proportion of harvesters over the age of 50 (63% versus 53%).

Darrington District

- The Darrington District has a very high proportion of harvesters who indicated that they got started picking big huckleberry through other outdoor experiences (65% as compared to the mean of 47%).

- This District also had a high proportion of urban harvesters (56% v. 48%).

- People who harvest big huckleberry on the Darrington Ranger District were also most likely to indicate that picking big huckleberry was *not* their primary activity when they go to the Forest and harvest berries (58% versus the overall mean of 27%).

- No harvesters who said they typically pick berries on the Darrington Ranger District indicated that they were high income, while the largest proportion for the Forest overall indicated that they were middle income (84% versus a Forest average of 75%).

- Slightly more than the mean indicated that they were low income (16% versus 14%).

Skykomish District

- Harvesters on the Skykomish District were most likely to indicate that they typically harvest more than one gallon of big huckleberry in a given year (44% compared to 36% for the Forest overall).

- This District also had the highest proportion of harvesters who indicated that picking big huckleberry was "sometimes – always" their primary reason for going to the Forest when they pick big huckleberry (82% v. 73%).

- Like the Mt. Baker District, the Skykomish District has a high proportion of rural harvesters (41%), and harvesters that got started picking big huckleberry because it is a family tradition (53%).

- Skykomish has the highest proportion on the Forest of harvesters over the age of 50 (74% versus 53%).

- This district has a higher than average proportion of harvesters who have been picking big huckleberry for more than 15 years (41% versus 36%).

- Skykomish has both a higher than the mean proportion of low-income (16% versus 14%) and high-income (19% versus 11%) of harvesters.

Snoqualmie - North Bend

- North Bend has the highest percentage of urban harvesters (58% compared to the Forest mean of 48%).

- The harvesters on this portion of the Snoqualmie Ranger District have the highest proportion that indicated they had been harvesting on the Forest for less than 15 years (73% v. 64% for the Forest overall).

- This group of harvesters also has the highest proportion of harvesters on the Forest who are under the age of 50 (62% v. 47%).

- North Bend also has the highest proportion of harvesters who self-identified as white (94% versus 89% for the Forest overall).

- This part of the Forest also has the highest proportion of harvesters who indicated that they got started picking big huckleberry through an interest in wild foods harvesting (20% as compared to the Forest mean of 16%).

- A higher than average proportion also indicated that they started picking huckleberries through other outdoor experiences (53% v. 47%).

- North Bend harvesters are also more likely than the mean to say that picking big huckleberry is sometimes to always the exclusive reason for a visit to the Forest (80% versus 73%).

- They are also slightly more likely than the average to say they harvest more than one gallon of big huckleberry in a typical harvest season (39% v. 36%).

Snoqualmie – Enumclaw

- Enumclaw has the highest percentage of harvesters who have been picking big

huckleberry on the Forest for more than 15 years (50% compared to the Forest mean of 36%).

- A high proportion of harvesters on this part of the Snoqualmie Ranger District are also over the age of 50 (63% v. 53%).

- The highest percentage of harvesters who say they got started picking big huckleberry because it is a family tradition typically harvest on this part of the Forest (59% compared to 37% for the Forest overall).

- A higher than average percentage of Enumclaw harvesters also indicated that picking big huckleberry is sometimes to always a primary reason for a visit to the Forest (79% v. 73%).

- This group of harvesters was also *least* likely to indicate that they typically harvest more than one gallon of big huckleberry in a typical season (25% v. 36%).

- Enumclaw has the highest percentage of peri-urban harvesters (33% v. 22%), the lowest percentage of harvesters who indicated that they were low income (4% v. 14%), and a higher proportion of high-income harvesters (17% v. 11%).

Harvester Use of Big Huckleberries

Survey participants responded to a series of questions regarding how they use the big huckleberry that they harvest on the Forest, using a 1 – 5 scale, where 1 is *never* and 5 is *always.* Harvester use is one measure of the social, cultural, and economic *importance* of big huckleberry harvesting in people's lives. Survey responses clearly show that eating fresh huckleberries is culturally important to a wide range of harvesters. On the other end of the spectrum, bartering, trading, or selling big huckleberries are not. Figure B-1.15 shows the results for each question.

On the 1 – 5 scale, the average responses for each question about harvester use of their berries were as follows:

Use	Average response
Eat fresh	4.50 (*usually-always*)
Preserve for later use	3.36 (*sometimes*)
Serve on special occasions	3.06 (*sometimes*)
Give as gifts	2.13 *(rarely*)
Barter or trade	1.15 (*never*)
Sell	1.01 (*never*)

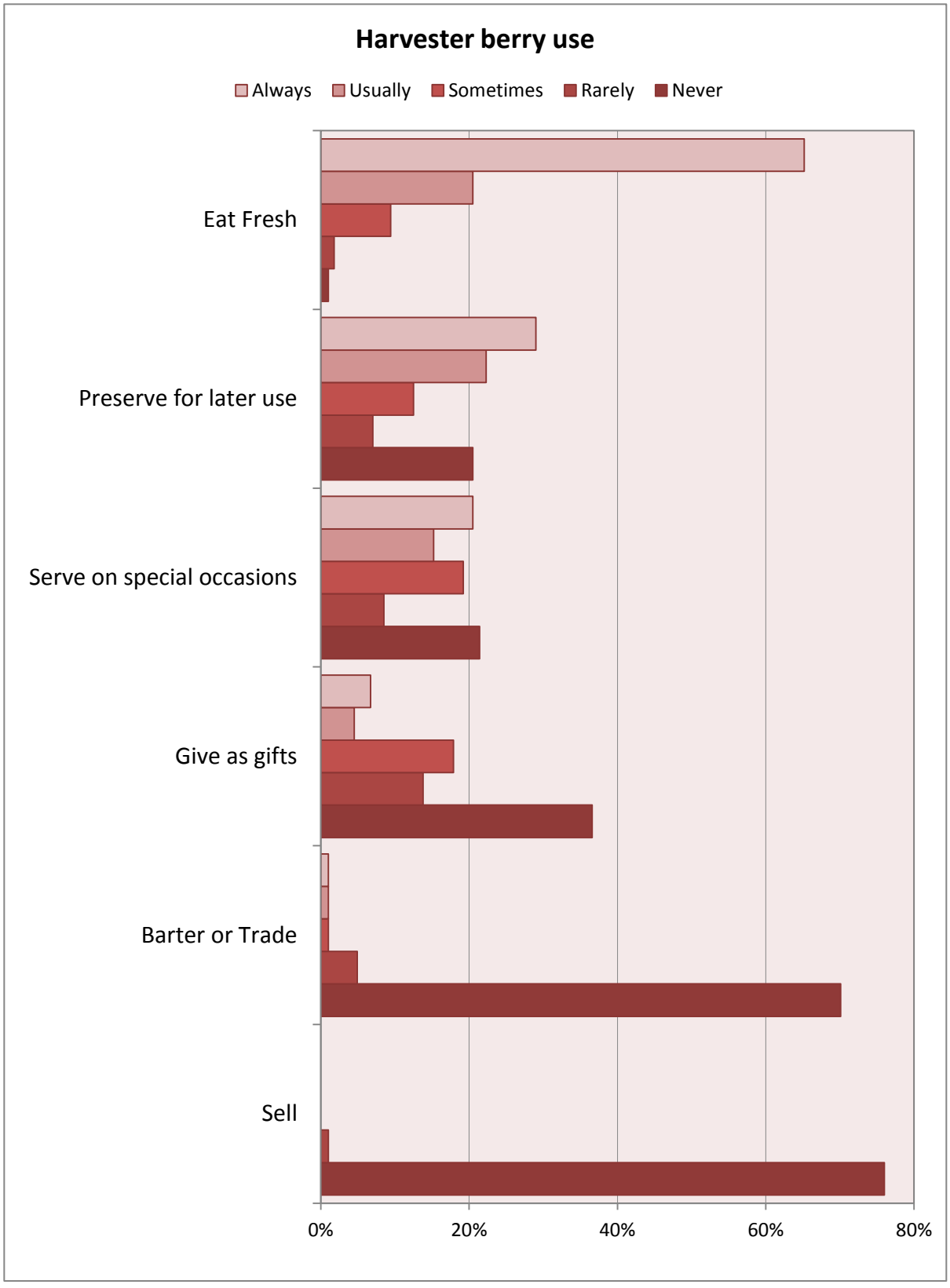

Figure B-1.15: Harvester berry use

There were statistically significant variations within three categories of berry use – "preserve for later use," "serve on special occasions," "and give as gifts." These were evaluated for correlations between observed variations and harvester demographics and practices by collapsing the five-point scale to a binary scale (*never-rarely* and *sometimes-always*). Table B-1.1 summarizes harvesters who are *more likely than the average survey respondent* to preserve, serve on special occasions, or gift big huckleberry. Though *not statistically significant* due to small sample size, the demographic "race/ethnicity other than white" is included.

Table B-1.1: Pct. harvesters based on demographics and harvester practices, who are more likely to preserve, serve on special occasions, or gift big huckleberry than the study mean

Percent of harvesters based on demographics and harvester practices, who are more likely to preserve, serve on special occasions, or gift big huckleberry, as compared to study mean

	Preserve	Special	Gift
STUDY MEAN (sometimes-always)	**71%**	**55%**	**37%**
Rural	89%		
Education < Bachelor's	81%		
Harvest experience > 15 yr	82%	77%	
Harvest > 1gal	96%	87%	62%
Harvest primary (sometimes-always)	92%	87%	57%
Beg. Family tradition	91%	83%	48%
Beg. Wild foods harvesting	77%	86%	56%
Race/ethnicity other than white**	89%	78%	56%

These results provide a more nuanced insight into the cultural, social, and economic importance of berry harvesting in people's lives.

- Preserving huckleberries for later use is interpreted here as something that is important in the context of a harvester's household economy. Doing so is more important than it is for the "average" harvester for the following groups:
    - Rural berry harvesters
    - Those who have been harvesting berries on the MBS for more than fifteen years

- Those whose level of education is less than a bachelor's degree
- Harvesters who got started picking berries because it is a family tradition
- Harvesters who got started picking berries though an interest in wild foods harvesting
- Harvesters whose race/ethnicity is other than white.
- Harvesters who typically pick more than one gallon of berries in a given year.
- Harvesters for whom berry picking is at least some of the time a primary reason for an excursion to the MBS.

As discussed in the harvester demographics and practices sections above, these categories overlap. Rural berry harvesters, those with more than 15 years' experience harvesting on the Forest, harvesters who started picking berries as part of a family tradition or due to an interest in wild foods harvesting, and those whose race/ethnicity is other than white, are *also* the harvesters who were most likely to at least sometimes go to the Forest with the primary intention of picking berries, *and* were most likely to pick more than one gallon of berries in a season (with the exception of the wild foods harvesters).

This overlap reinforces the idea that for people who tend to harvest more than one gallon of berries in a year, or who do go to the MBS with the primary intention of picking berries, huckleberry harvesting is an important activity in terms of their household economies.

These results hold true for the spectrum of harvesters from low to high income, suggesting that the importance of berries in harvesters' household economies is not necessarily dependent upon a harvester's income.

- Serving berries on special occasions is interpreted here as an expression of the symbolic value that a harvester assigns to the berries. The following groups are more likely than the average harvester to serve their berries on a special occasion:
  - Harvesters who have been picking berries on the MBS for more than 15 years
  - Harvesters who got started picking berries because it is a family tradition
  - Harvesters who got started picking berries due to an interest in wild foods harvesting
  - Harvesters whose race/ethnicity is other than white

    - Harvesters who typically pick more than one gallon of berries in a given year
    - Harvesters for whom berry picking is at least some of the time a primary reason for an excursion to the MBS.

- Giving berries as gifts can be interpreted as a measure of the importance of berries to harvesters in the context of a gift economy. Gift economies can be understood as a form of "exchange" in which the gift giver is communicating to the recipient that he or she values the relationship they have with that person and would like for it to continue. The following groups are more likely than the average to give their berries as gifts:
    - Harvesters who got started picking berries because it is a family tradition
    - Harvesters who got started picking berries due to an interest in wild foods harvesting
    - Harvesters whose race/ethnicity is other than white
    - Harvesters who typically pick more than one gallon of berries in a given year
    - Harvesters for whom berry picking is at least some of the time a primary reason for an excursion to the MBS.

Other Harvester Activities

Survey participants were asked to respond to a series of questions regarding other activities that they engage in on the Forest during their berry picking excursions using a 1 – 5 scale, where 1 is *never* and 5 is *always.* Figure B-1.16 shows the results for each activity.

On the 1 – 5 scale, the average responses for each question about harvester use of their berries were as follows:

Activity	Average response
Hunting & fishing	1.66 (*rarely*)
Cultural or spiritual activities	1.79 (*rarely*)
Artistic activities	1.84 (*rarely*)
Gathering other plants & fungi	1.93 (*rarely*)
Nature study	2.73 (*sometimes*)
Camping	2.99 (*sometimes*)
Spending time with friends or family	3.94 (*usually*)
Hiking	4.36 (*usually*)

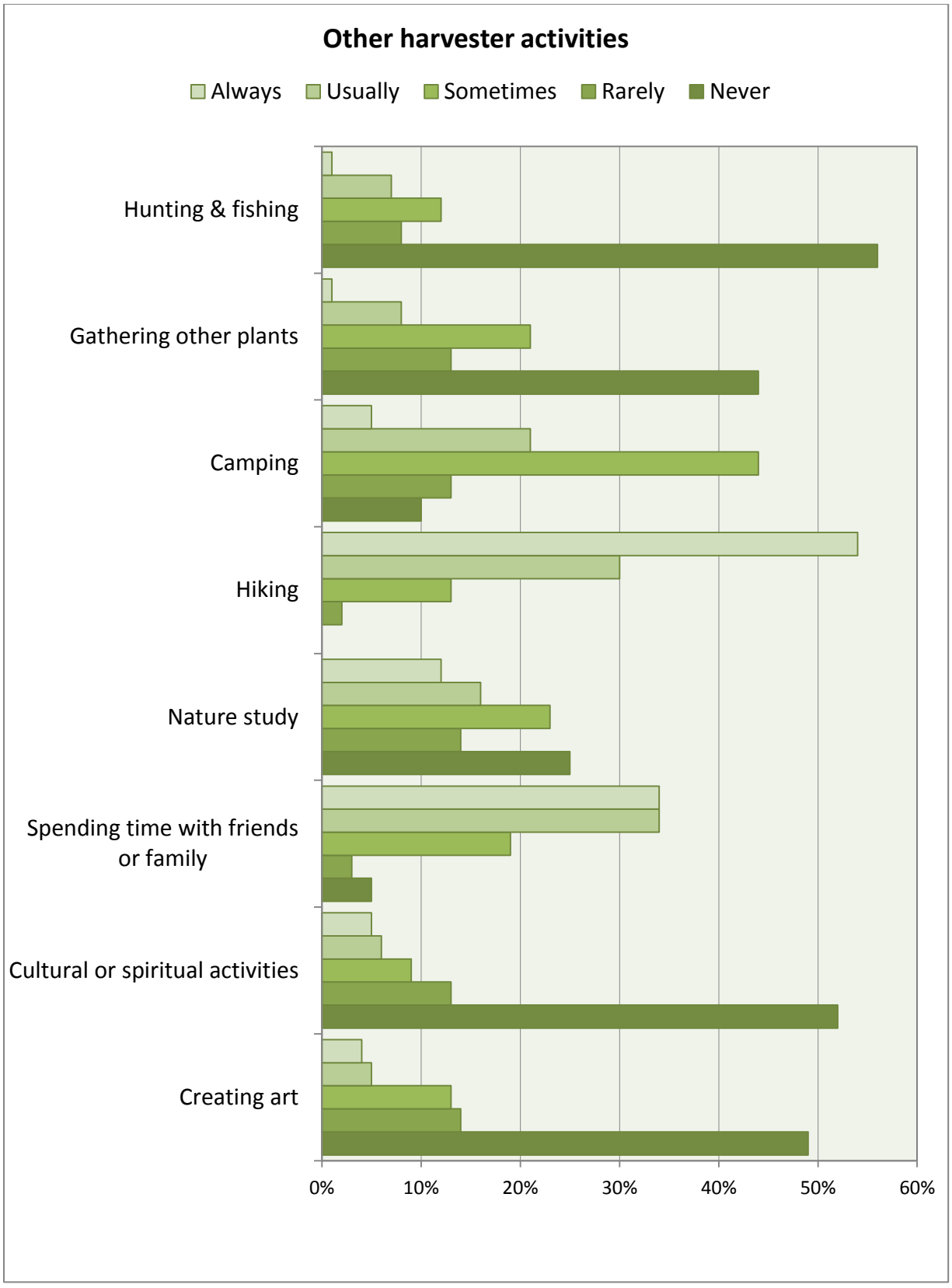

Figure B-1.16: Other harvester activities

Five types of "other activities" had statistically significant variations related to harvester demographics and practices. These included hunting & fishing, gathering other plants & fungi, studying nature, engaging in cultural or spiritual activities, and creating art. These were evaluated for correlations between observed variations and harvester demographics and practices by collapsing the five-point scale to a binary scale (*never-rarely* and *sometimes-always*). Table B-1.2 summarizes harvesters who are *more likely than the average survey respondent* to participate in these activities, with the exception of harvesters who got their start picking berries through other outdoor experiences. With this group, there is a statistically significant trend in that they are *less likely* than the average harvester to hunt or fish, gather other plants or fungi, or engage in the study of nature during a berry picking event.

Table B-1.2: Pct. of harvesters by demographic and harvester practices who are more likely participate in other activities on the MBS, as compared to study mean

Percent of harvesters by demographic and harvester practices who are more likely to participate in other activities on the MBS, as compared to study mean

	Hunt/fish	Gather Plant/fungi	Nature study	Cult/spir	Art
STUDY MEAN (*sometimes-always)*	**23%**	**34%**	**57%**	**27%**	**27%**
Low income					52%
Ed < bac	38%	48%	63%		
Race/ethnicity other than white		53%	78%		
Age > 50 yr			67%		
Exp > 15 yr	30%				
Res Rural	35%	50%	70%		
Wild foods		56%	74%	36%	
Other outdoor experiences	17%*	21%*	48%*		
Harvest primary		45%	66%	30%	
Harvest > 1 gal	31%	44%	67%	31%	

* *Negative correlation*

- These results indicate that for those harvesters for whom big huckleberry plays a more central role in their lives economically, socially, and culturally, the Forest is also important for a suite of other activities that they also engage in while out picking berries.

- Harvesters who have been picking berries on the MBS for fifteen years or more and those who typically pick more than one gallon of berries in a given season are more likely to hunt or fish during a berry-picking event.

- Harvesters whose level of education is less than a bachelor's degree and those who live in rural areas are more likely than the average harvester to hunt & fish, gather other plants & fungi, and study nature during a berry picking event.

- Harvesters who identify with a race/ethnicity other than white are more likely to gather other plants or fungi and study nature during a berry-picking event.

- Harvesters over the age of fifty are more likely to engage in nature study during a berry-picking event.

- Harvesters who got their start picking berries through an interest in wild foods harvesting, those for whom berry picking is at least sometimes the primary motivation for a visit to the Forest, and those who typically pick more than one gallon of berries in a given season are all more likely than the average harvester to gather other plants or fungi, study nature, or engage in cultural or spiritual activities during a berry-picking event.

- Conversely, harvesters who got their start picking berries through other outdoor experiences are *less likely* than the average harvester to hunt or fish, gather other plants or fungi, or study nature during a berry-picking event.

- Nature study may be a good proxy for harvester knowledge regarding changes in huckleberry production, and the ecology of huckleberry habitats. The following groups were more likely than the average harvester to say they engaged in nature study during a berry-picking event:

    - Harvesters whose level of education is less than a bachelor's degree

    - Harvesters who identified their race/ethnicity as other than white

    - Harvesters over the age of fifty

    - Harvesters who live in rural areas

    - Harvesters who got their start picking berries through an interest in wild foods harvesting

    - Harvesters who at least sometimes travel to the MBS for the primary purpose of picking berries

- Harvesters who typically pick more than one gallon of berries in a season.

Barriers to Harvesting

Survey participants were asked to respond to a series of questions regarding barriers to harvesting that they experience using a 1 – 5 scale, where 1 is *never* and 5 is *always.* Figure B-1.17 shows the results for each barrier.

On the 1 – 5 scale, the average for each barrier was as follows:

Barrier	Average response
Personal disability	1.16 (*never*)
Personal safety	1.17 (*never*)
Harvest regulations	1.20 (*never*)
Other pickers	1.61 (*rarely*)
Transportation costs	1.70 (*rarely*)
Concern that berries were picked over	1.82 (*rarely*)
Did not know where to pick berries	1.92 (*rarely*)
Road closures	1.94 (*rarely*)
Lack of time	2.74 (*sometimes*)
Poor berry year	2.75 (*sometimes*)

Five types of barriers to harvesting had statistically significant variations related to harvester demographics and practices. These included "lack of time" (time), "poor berry year" (bad year), "felt unsafe" (safety), "did not know where to pick berries" (knowledge), and "road closures" (roads). These were evaluated for correlations between observed variations and harvester demographics and practices by collapsing the five-point scale to a binary scale (*never-rarely* and *sometimes-always*).

Table B-1.3 summarizes harvesters who are *more* likely than the average survey respondent to experience at least one of these barriers to harvesting at least some of the time, with the exception of harvester knowledge, where harvesters with more than 15 years' experience on the MBS, and those who typically harvest more than one gallon in a given year were *less* likely than the average harvester to say that lack of knowledge was a barrier to their harvesting.

Table B-1.3: Pct. of harvesters by demographic and harvester practices who experience greater barriers to harvesting on the MBS than the study mean

Percent of harvesters by demographic and harvester practices who experience greater barriers to harvesting on the Forest than the study mean

	Time	Bad year	Safety	Knowledge	Roads
STUDY MEAN (*sometimes-always*)	**68%**	**72%**	**5%**	**32%**	**33%**
Res Rural		84%			47%
Ed bac	71%				
Ed > bac	80%				
Exp > 15 yr	75%	85%		23%*	43%
Race/ethnicity other than white			10%		
Family tradition		83%			41%
Wild foods					42%
Harvest primary	75%	80%			42%
Harvest > 1 gal		79%		23%*	

**Negative correlation*

- "Road closures" was the second most commonly cited barrier to harvesting. This barrier is experienced more often experienced by harvesters who live in rural areas, who have been harvesting on the Forest for 15 or more years, by those who got their start harvesting due to an interest in wild foods harvesting or as a family tradition, and those who at least sometimes go to the Forest for the primary purpose of picking berries.

- "Poor berry year" can be considered a proxy for harvester knowledge, assuming that a harvester must "know" that it is a poor berry year before it can be a barrier to harvesting. Harvesters who were more likely to know that is was a poor berry year include those for whom berry picking appears to be a more central activity in their lives, including long-time harvesters, people who live in rural areas, and those who got their start picking berries because it is a family tradition.

- The linkage between harvester knowledge and certain harvester demographics and practices is also reflected in the fact that harvesters with 15 years or more experience picking berries on the MBS, and those who typically harvest more than one gallon of berries in a given year were *less* likely to indicate that not knowing where to pick berries is a barrier to their harvesting activities.

- Harvesters who indicated that their race/ethnicity is other than white were twice as likely to indicate that "feeling unsafe" was sometimes a barrier to harvesting berries on the MBS.

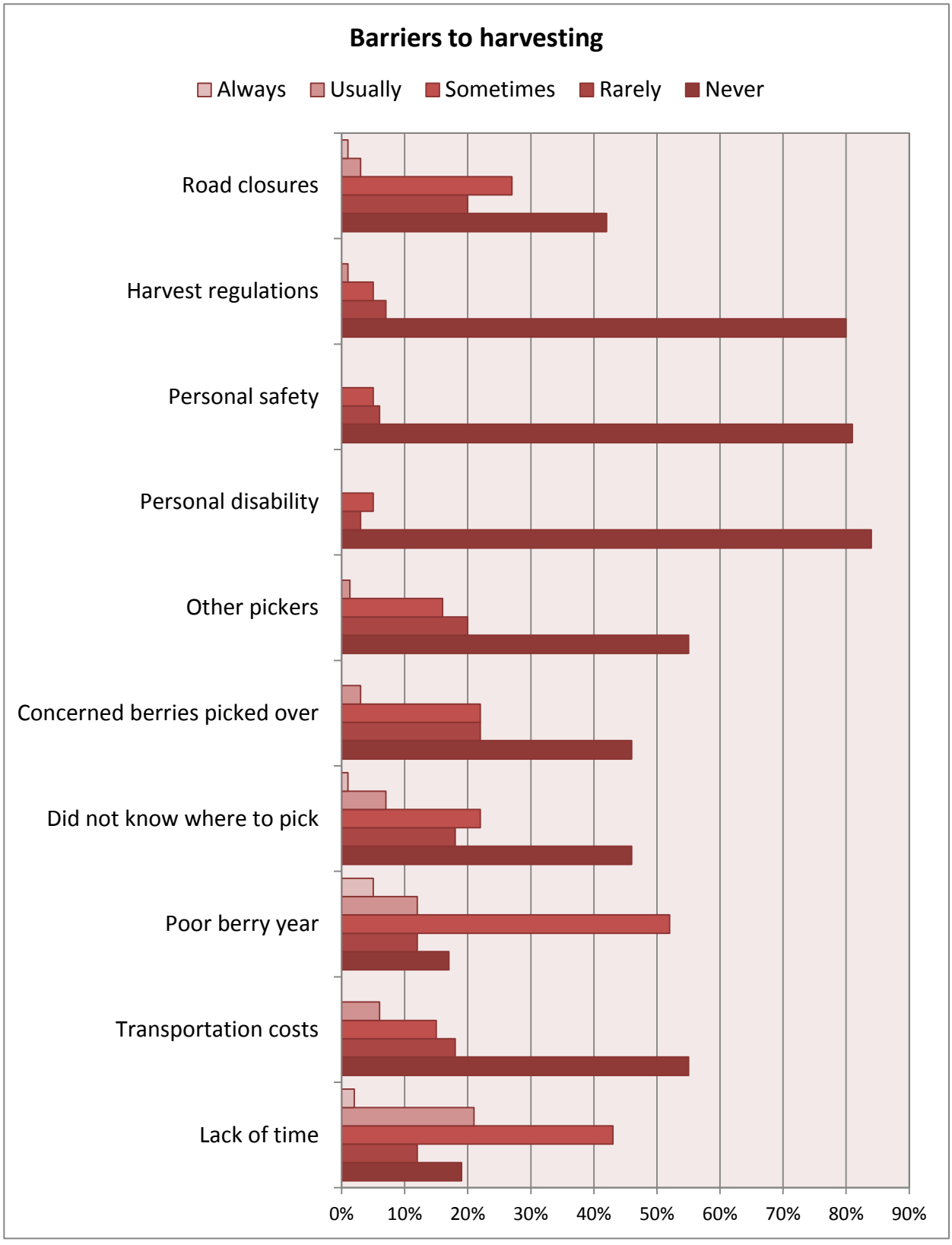

Figure B-1.17: Barriers to harvesting

Appendix 2. Study Recruitment Flier

Mt. Baker-Snoqualmie Forest

Big Huckleberry* Study 2012

Do you pick or harvest big huckleberry on the Mt. Baker-Snoqualmie National Forest?

We'd like to hear from you!

What is this study about? The big huckleberry harvester study is examining big huckleberry harvesting practices, abundance and accessibility on the Mt. Baker-Snoqualmie National Forest, and we need your help. Your voluntary participation will help us to understand the social, economic, and cultural significance of big huckleberry to the people who pick and harvest them, as well as barriers to harvesting on the Mt. Baker-Snoqualmie Forest.

Why is this study important? Big huckleberry harvesters have expressed concern about potential loss of habitat, effects of road closures on access, and growing interest in big huckleberry harvesting. This study will help us to better understand current levels of harvesting on the Mt. Baker-Snoqualmie Forest, and the importance of big huckleberry to the people who harvest them.

Who should participate? Anyone who picks or harvests big huckleberry on the Mt. Baker-Snoqualmie Forest, and is over the age of 18, and would like to share their perspectives is invited to volunteer.

How can I participate? You can participate in this study by:

- **Taking a 10-minute online survey: http://tinyurl.com/huckleberrysurvey**
- **Participating in an interview about your big huckleberry harvesting experiences on the Mt. Baker-Snoqualmie Forest.**

How will information gathered in this study be used? Over the next decade, the Mt. Baker Snoqualmie Forest will be developing management plans that have the potential to affect abundance of, and access to, big huckleberry gathering areas. We hope that the study results will help to ensure that big huckleberry harvester values and concerns are taken into account in planning and decision-making processes.

Who is conducting the study? This study is a collaborative effort between the Mt. Baker-Snoqualmie Forest and the Tulalip Tribes. Joyce LeCompte-Mastenbrook, Environmental Anthropologist, University of Washington, has been contracted to conduct the study.

To participate in this study, or for more information, contact:
Joyce Mastenbrook at jklm@uw.edu or 888.224.9439

*** Big huckleberry (*Vaccinium membranaceum*), also known as mountain, black, or thin-leaf huckleberry occurs on the Mt. Baker-Snoqualmie Forest from 2,500 to 6,000 feet in elevation. Big huckleberry matures in late summer.**

Figure B-2.1: Study flier

Appendix 3. Harvester Survey

Mt. Baker-Snoqualmie National Forest
Big Huckleberry* Study 2012

Do you pick or harvest big huckleberry on the Mt. Baker-Snoqualmie National Forest?

Please take a few minutes to fill out this confidential survey!

What is this survey about? This survey is about big huckleberry picking & harvesting practices, and abundance & accessibility on the Mt. Baker-Snoqualmie National Forest, and we need your input. Your voluntary participation will help us to understand the social, economic, and cultural significance of big huckleberry to the people who pick and harvest them, as well as barriers to picking & harvesting on the Mt. Baker-Snoqualmie National Forest.

Who should participate? Anyone who picks or harvests big huckleberry on the Mt. Baker-Snoqualmie National Forest and is over the age of 18.

How will the information gathered be used? Over the next decade, the Mt. Baker Snoqualmie Forest will be developing management plans that have the potential to affect abundance of, and access to, big huckleberry gathering areas. We would like to help ensure that harvester values and concerns are taken into account in planning and decision-making processes.

Who is conducting the study? This study is a collaborative effort between the Mt. Baker-Snoqualmie Forest and the Tulalip Tribes. Joyce LeCompte-Mastenbrook, environmental anthropologist, has been contracted to conduct the study.

For more information contact Joyce Mastenbrook at jklm@uw.edu or 888.224.9439

This survey is available online at: http://tinyurl.com/huckleberrysurvey

***Big huckleberry (*Vaccinium membranaceum*), also known as mountain, black, or thin-leaf huckleberry occurs on the Forest from 2,500 to 6,000 feet in elevation. Big huckleberry matures in late summer to early autumn, and typically has shiny, blue-black fruit.**

! Huckleberry Harvester Study
c/o Joyce LeCompte-Mastenbrook
UW Department of Anthropology
Box 353100
Seattle, WA 98195-3100

Big Huckleberry Study

c/o Joyce LeCompte-Mastenbrook

UW Department of Anthropology

Introduction. People harvest many kinds of wild berries in Washington State, from the coast to the high mountains. **In this survey, we are interested in your experiences with big huckleberry,** the shiny blue-black fruit that occurs in the mountains at middle to high elevations. Please answer the following questions by placing an "X" or checking the box most appropriate to your situation. *You are free to decline to answer any of the questions.* **Your participation in this study is important. Thank you for taking the time to fill out this survey!**

1) Have you **ever** picked or harvested big huckleberry on the Mt. Baker-Snoqualmie National Forest? (Choose one)

Yes	No	Not sure

If "no" or "not sure" to question 1, please skip to question 4.

2) If yes, for **how many years** have you been picking or harvesting big huckleberry on the Mt. Baker-Snoqualmie National Forest? (Choose one)

Number of years	Less than 2	2 to 5	6 to 10	11 to 15	More than 15	Not sure

3) In gallons, about how many big huckleberries do you pick or harvest on the Mt. Baker-Snoqualmie National Forest in a **typical year**? (Choose one)

Number of gallons	Less than 1	1 to 5	6 to 10	More than 10	Not sure

4) How did you get started picking big huckleberries? (Choose one)

	Family tradition	Economic opportunity	Interest in wild foods harvesting	Through other outdoor experiences
Other (please describe)				

5) Have you picked or harvested, or do you plan to pick or harvest big huckleberry on the Mt. Baker-Snoqualmie National Forest **in 2012?** (Choose one. If "no," or "not sure," skip to question 8.)

Yes	No	Not sure

6) **In gallons**, about how many big huckleberries have you personally picked or harvested so far on the Mt. Baker Snoqualmie National Forest **in 2012?** (Choose one)

Number of gallons	None	Less than 1	1 to 5	6 to 10	More than 10	Not sure

7) **In gallons,** About how many big huckleberries **in total** do you personally **plan to** pick or harvest **in 2012?** (Choose one)

Number of gallons	None	Less than 1	1 to 5	6 to 10	More than 10	Not sure

8) How do you typically use the big huckleberries that you pick or harvest from the Mt. Baker-Snoqualmie National Forest? (Please mark the appropriate box for each use)

	Never	Rarely	Some-times	Usually	Always
Eat fresh					
Preserve for later use (freeze, can, dry)					
Serve on special occasions					
Give away as gifts					
Barter or trade					
Sell					
Other (please describe below)					

9) Is big huckleberry picking your **primary focus** when you travel to the Mt. Baker Snoqualmie National Forest and harvest? (Choose one)

Never	Rarely	Some-times	Usually	Always

10) What other activities have you engaged in, or do you plan to engage in, **during** your big huckleberry picking excursions on the Mt. Baker-Snoqualmie National Forest in 2012? (Please mark the appropriate box for each activity)

	Never	Rarely	Some-times	Usually	Always
Hunting & fishing					
Gathering other plants or fungi					
Camping					
Hiking					
Nature study					
Spending time with friends or family					
Cultural and/or spiritual activities					
Artistic activities					
Other (please describe below)					

11) Which of the following towns is closest to where you harvested, or will harvest **most of** the big huckleberry that you have picked or will pick on the Mt. Baker-Snoqualmie National Forest in 2012? (Choose one)

Nearest town	Enumclaw	North Bend	Darring-ton	Sky-komish	Sedro-Wooley	Not sure
Other (please describe)						

12) How many hours did it take you, or do you expect it to take you, to travel from your home to the berry patch where you picked or will pick big huckleberry on the Mt. Baker-Snoqualmie Forest in 2012? Please provide your "one way" travel time. (Choose one)

Number of Hours	Less than 2	2 to 4	More than 4

13) Have any of the following barriers **ever prevented you** from harvesting or picking big huckleberry on the Mt. Baker-Snoqualmie National Forest? (Please mark the appropriate boxes for each barrier)

	Never	Rarely	Some-times	Usually	Always
Lack of time					
Transportation costs					
Poor berry year					
Did not know where to pick berries					
Concern that berries are picked over					
Other pickers					
Personal disability					
Felt unsafe					
Worried about regulations					
Road conditions					
Other (please describe)					

Demographic information (All responses are optional and confidential).

14) What is your zip code?_____

15) In what year were you born?_____

16) Do you consider yourself to be low, middle or high income?_____

17) What is the highest level of education you have completed?_____

18) With which racial &/or ethnic groups do you identify?_____

19) Is there anything you'd like to add that we haven't yet asked?_____

Your participation in this survey is important! Thank you for taking the time to respond.

Optional: To better understand the perspectives of harvesters, we are also conducting in-depth interviews, which take about one hour. If you are interested in participating in a confidential interview about your big huckleberry harvesting experiences on the Mt. Baker-Snoqualmie National Forest, please provide your name & contact information below, or contact the principal investigator, Joyce LeCompte-Mastenbrook at jklm@uw.edu or 888.224.9439

Name_____

Email &/or phone number_____

Appendix 4. Harvester interview protocol

I. Introduction

My name is _____and I am working on a project to better understand the social, economic, and cultural importance of big huckleberry harvesting on the Mt. Baker-Snoqualmie Forest to the people who pick and harvest them, as well as barriers to harvesting them on the Forest.

Big huckleberry harvesters have expressed concern about potential loss of habitat, effects of road closures on access, and growing interest in big huckleberry harvesting. This study will help us to better understand current levels of harvesting on the Mt. Baker-Snoqualmie Forest, and the importance of big huckleberry to the people who harvest them.

Over the next decade, the Mt. Baker Snoqualmie Forest will be developing management plans that have the potential to affect abundance of, and access to, big huckleberry gathering areas. We hope that the study results will help to ensure that big huckleberry harvester values and concerns are taken into account in planning and decision-making processes.

With your permission, I would like to interview you about your perspectives on big huckleberry harvesting on the Forest. The interview will take about 60 minutes, and with your consent, I would like to record the interview. Your participation in this interview is voluntary, and you may choose to stop the interview at any time. You are also free to decline to answer any questions or parts of questions that I ask you.

Before we begin, I'd like to give you a copy of my statement of consent, which explains the voluntary nature of the interview, how I intend to use the information, and how I will protect your confidentiality. Please take a moment to look this over and let me know if you have any questions or concerns.

[Begin interview, ask to begin audio recording]

II. I'd like to begin by asking you some general questions about the importance of big huckleberry harvesting on the Mt. Baker-Snoqualmie Forest to you, your family, and your community.

- Do you gather big huckleberry on the Mt. Baker-Snoqualmie Forest?

  [if no, continue here… if yes, skip to next section…]

- Have you previously been involved in plant gathering? [If yes, ask for more information, including why this person no longer gathers big huckleberry. If no, ask for more information as to why this person does not gather big huckleberry, including whether or not they have a desire to do so].

- Do you know of anyone in your family or community who does gather big huckleberry? [If yes, gather information about who/what/where/how]

- Can you recommend anyone else who is involved in big huckleberry gathering that I should contact?

- [If no to these two questions] Can you provide any insights as to why people might not be gathering big huckleberry?

- Do you see any benefits to encouraging people to get involved in big huckleberry gathering? What kinds of plants do you gather? [prompt with list]

[If yes, pick up here]

- How long have you been gathering big huckleberry? [Ask if they have been gathering on the Mt. Baker-Snoqualmie Forest for this entire time, or if they have gathered in other places as well].

- How did you get started gathering?

- How did you learn to identify and collect them?

- How much time do you spend gathering big huckleberry in a typical season?

- Has your gathering activity changed over time?

- Do you use any special tools to aid your gathering (i.e., basket, rake)?

- When you gather big huckleberry, do you typically gather by yourself or with other people?

- Have you been involved in teaching other people how to find, identify, gather or use big huckleberry?

- Do you gather any other plants, plant parts or fungi in addition to big huckleberry?

- [if yes], what other types of plants and fungi do you harvest? [ask about quantities of and uses for other items]

- When out gathering berries, do you engage in other activities too?
- Do you participate with any groups or formal organizations that promote plant gathering and/or share information about plants, plant gathering and/or processing?
- In gallons, how much big huckleberry do you typically gather in a given year?
- How do you use the berries that you collect? Do you process them in any way?
    - [If processed] Is this something that you do by yourself, or do you work with others?
- Do you ever donate your berries, give them as gifts, exchange or sell them?
    - [If donate or give] Where or to whom do you donate them? Is this something that you do by yourself, or do you work with others?
    - [If barter/exchange] Please describe the transaction. Do you have any way to place a value on the exchange?
    - [If sell] What kind of market or venue do you use to sell your berries? How much money do you make by selling them?
- What are the main reasons that big huckleberry gathering is important to you?
- Have you ever had difficulty obtaining enough big huckleberry to meet your needs? [If yes, what were the circumstances: i.e., personal/social/ecological]
- If you were not able to gather big huckleberry, how would you or your family or your community be affected? What alternatives, if any, would you seek?
- Have you ever purchased big huckleberry, or any products made with big huckleberry? [If yes, where, when and from whom purchased]

III. <u>Next I'd like to ask you some specific questions about the places where you gather big huckleberry.</u>

- What kinds of places to you gather big huckleberry from? [i.e., open meadows, forests… what are the habitats like]
- How far do you have to travel to get to your berry picking sites? (approximate miles and time)

- How do you get to the places where you gather?
- Can you provide general locations where you gather big huckleberry? (I will use this information for analytic purposes only; any information will be generalized so that specific locations will not be disclosed)
- How did you find out about the areas where you gather?
- Why do you gather big huckleberry in the locations that you choose?
- Do you tend to go to the same places to harvest big huckleberry each year, or do the locations where you harvest change from year to year?
- Are the places where you gather big huckleberry important to you for any other reasons besides plant gathering?
- Have you observed any changes over time to the areas where you gather big huckleberry?
- Have you observed any changes over time to the quality or quantity of the big huckleberry that you harvest?
- Are you aware of any stewardship or restoration activities occurring in the places where you gather your berries?
- Do you ever encounter any barriers to gathering? [If yes, please describe specific situations]
- Do you know if other people also gather big huckleberry in the same areas that you do? [if yes, prompt for details].
- Have there been any tensions or conflicts over picking in these areas? [If yes, with whom and why? What were/are the conflicts and what steps – if any – were taken to avoid or resolve them?]
- Do you feel that big huckleberry gathering is risky or dangerous? [If yes, how so?]
- Are you concerned with possible health risks associated with big huckleberry gathering? [If yes, how so? What measures do you take in order to reduce these risks?]

IV. Next I'd like to ask you some specific questions about the berries themselves.

- In a given year, do you notice differences in the quality or quantity of big huckleberry in the places where you harvest (for instance, do you notice differences in the size, flavor, or quantities of berries on bushes from one patch to another)?
- [if yes], what kinds of differences have you noticed? What do you think causes these differences?
- Have you observed differences in huckleberry fruit production from year to year?
- [If yes], what kinds of differences do you notice? What do you think causes these differences?
- Do you know if gathering big huckleberries has any impact on the plants, or habitats, or other organisms that share the habitat?
- Do you do anything to improve the quality or promote the health of the berry plants or their habitats, or to ensure a future berry supply?

V. Now I'd like to ask you a few questions about the kinds of planning and policies related to plant gathering.

- Are you aware of any restrictions or regulations related to big huckleberry gathering on the Mt. Baker-Snoqualmie Forest? [If yes, do you know if these policies are enforced? Are you concerned about how these policies impact you?]
- Do you think that your needs and values as a big huckleberry gatherer are being addressed by current planning efforts and policies on the Mt. Baker-Snoqualmie Forest? If so, how? If not, please describe your concerns and explain how your needs might be better addressed.
- Have you observed any changes in attitudes held by public land managers about plant gathering?

VI. We're almost finished with the interview. Because I am also interested in seeing if there are any social patterns associated with traditional plant gathering, I am asking people to share some basic information about themselves to the degree they're comfortable.

- What town do you live in, or is closest to your home?

- How long have you lived there?
- Do you rent or own your home?
- How many people live in your household?
- Do you consider yourself to be low, middle or high income?
- What is your occupation?
- What is the highest level of education that you've completed?
    - ☐ High school
    - ☐ Two-year college degree
    - ☐ Four-year college degree
    - ☐ Professional degree
    - ☐ Master's degree
    - ☐ PhD
- What year were you born?
- Where were you born?
- Which racial and/or ethnic groups do you identify as?

VII. <u>I have just a few final wrap-up questions to ask.</u>

- Is there anyone else who is involved with big huckleberry gathering that I should contact? [If yes, ask for specific contact info].
- Would you like me to follow up with you regarding the results of this study?
- Would you be willing to allow me to accompany you sometime when you go out big huckleberry gathering? If so, what is the best way for me to follow up with you to arrange this opportunity?
- Is there anything that you'd like to add that we haven't had a chance to discuss yet?

<u>That's all the questions I have! Thank you very much for sharing your time and insight.</u>

Part C: Key Findings and Recommendations

Key Findings and Recommendations

The purpose of this project is to provide baseline information that can be used in evaluating how best to manage and sustain big huckleberry habitat and harvest on the MBS. Summarized below are highlights of what we have learned and recommendations going forward:

Big Huckleberry Abundance and Distribution on the Mt. Baker-Snoqualmie National Forest

- **Big huckleberry is widespread on the Mt. Baker-Snoqualmie National Forest.** This geographic area represents the cold, wet edge of the range of big huckleberry. The species was documented on 1,287 USFS ecology plots, or about one-third of the total plots. Big huckleberry was most frequent and abundant near the crest at middle to upper elevations and in rain-shadow areas. Big huckleberry occupies drier sites than the other huckleberry species in this area.

- **Big huckleberry is primarily a species of forest sites, however is most abundant in open conditions following disturbance to forests, such as logging or fire**. It also appears to require full sun or partial shade to flower and fruit abundantly.

- **The area modeled and mapped as "High Likelihood" potential habitat for big huckleberry covers approximately one-third of the National Forest.** It is important to note that "high likelihood" refers to the *potential* for the site to support big huckleberry (not actual presence); this mapping unit (habitat class) has the greatest potential for big huckleberry occurrence and abundance given suitable stand conditions.

- **Big Huckleberry was present in 85% of the ecology plots occurring in areas mapped as "High Likelihood" habitat (hereafter referred to as simply "HIGH").**

- **An area mapped as "HIGH" habitat is not the same as a "good huckleberry harvesting patch"**; rather, it is a relative indicator of the potential for finding big huckleberry there, which is greater than other sites on the Forest. While validation of the model did show presence of big huckleberry in 85% of the ecology plots, it also showed that on over 60% of the test plots in this "High Likelihood Habitat", there was <10% Big Huckleberry cover.

- **Where it occurs, big huckleberry abundance at these "High" sites is predicted to vary greatly,** ranging from scattered plants, to denser coverage or abundance. As mentioned, berry productivity (or actual berries available) is not being modeled here, and

regardless, is highly variable from site to site, and year to year. This model was successful in defining and mapping potential habitat for big huckleberry and the distribution across the MBS.

By District, high likelihood habitat ranges from 24-35% of total acres on each Ranger district (RD) - Skykomish and Snoqualmie RDs have the highest percentage of high habitat followed by Mt. Baker and Darrington. However, the acres of high likelihood habitat in the "Matrix" land allocation is considerably less and ranges from 2-8% of total acres by district –Snoqualmie RD is highest at 8%, followed by Mt. Baker (4.6%), Skykomish (2.9%) and Darrington at 2%.

Big Huckleberry Management and Access

- Within the 1.7 million acre Mt. Baker-Snoqualmie National Forest, approximately one third of the MBS (508,636 acres) is shown by the model to be "High Likelihood" habitat for big huckleberry. **95% of the HIGH habitat class occurs on reserved lands** (i.e., Wilderness, Administratively Withdrawn or Late-Successional Reserves), where there are either recreational harvest restrictions, or constraints to managing these lands to enhance huckleberry growth and fruit production.

- **Approximately 60% of the HIGH big huckleberry habitat occurs within designated Wilderness.** USFS regulations currently prohibit motorized access on these lands and, in the MBS wilderness designated areas, do not currently allow for permitting of recreational huckleberry harvest.

- **HIGH potential habitat in the unreserved "Matrix" lands represents only 22,000 acres.** These are areas where management "treatments" to maintain, enhance, or restore big huckleberry may be most feasible, as allowed by forest plan directives. The **Snoqualmie Ranger District has the greatest proportion of HIGH habitat in Matrix,** followed by Mt. Baker, Skykomish, and Darrington.

- While big huckleberry occurs throughout the age range of forests from very young stands to very old forests, and potentially even in high abundance in older stands, observations show that it does not fruit well in these more mature, shaded habitats. When the extent of High Likelihood habitat is further refined by looking to younger aged stands where big huckleberry is expected to be most productive for fruiting, **there are only 5,817 acres in the HIGH habitat class in Matrix, in stands less than 80 years of age**. Again, the Snoqualmie Ranger District has the greatest amount of this habitat.

- **A spatial analysis of the current MBS road system with the HIGH habitat shows that approximately 68,000 acres (3.9% of the MBS) are located within ¼ mile of a passable road, and 115,000 acres within a ½ mile (6.6% of the MBS).** Most of this

acreage occurs in the Snoqualmie Ranger District, followed by the Mt. Baker. Smaller acreages of road-accessible HIGH habitat are present in the Skykomish and Darrington Districts. This relatively limited acreage on the forest has implications not only for access to harvesters, but also access for any potential huckleberry management activities that would require road access for transport of needed equipment, or other access-dependent factors. (see Part C: Appendix 1, Figures C-1.1 through A-1.5 and Table C-1.1)

- **Overlap in areas of high huckleberry potential, lands designated "Matrix", road proximity and forest stands less than 80 years in age, represent areas where we believe management and enhancement is *currently* most plausible and most likely to be effective. There are only a handful of such sites, with most occurring in the Snoqualmie Ranger District.** (see Part C: Appendix 1, Figures C-1.7 through C-1.11)

- **Other areas of overlapping high huckleberry potential, road proximity and forest stands less than 80 years in age also occur in current "Adaptive Management Areas" and even some "Late Successional Reserves" (LSR).** These sites again represent areas with high potential for huckleberry management, but may require special justification or a future change in land management designation. While LSR's are designated to be managed for late succession, it should be noted that portions of some of these areas are at high elevations and currently represent "high" huckleberry potential areas. They are highlighted here so that they might be given special consideration for their potential value as accessible huckleberry management areas in current and in future planning efforts on the MBS (see Part C: Appendix 1, Figures C-1.7 through C-1.11).

- Further analysis to identify areas that *may* be plausible with future revisions to land use plans that provide the management direction on the MBS, such as the regional "Northwest Forest Plan" and/or the local Mt. Baker-Snoqualmie National Forest Land and Resource Management Plan" as shown by an overlap of **lands designated as "Late Successional Reserve", road proximity and forest stands less than 80 years in age, represent**

Recreational Harvest on the MBS

and Recreational Harvester Knowledge

- **Recreational huckleberry harvesting is undertaken by a diverse group of MBS Forest users**, and is reported by recreational harvesters to be an important way in which they make connections with the Forest.

- **One-third of the recreational harvesters who completed the survey said they pick more than one gallon** of berries in a typical season.

- **The profile that emerges for recreational harvesters who are more likely to harvest larger quantities of berries, preserve them for later use, and/or travel to the MBS Forest for the explicit purpose of harvesting big huckleberry is this: they are more likely to be longer-term harvesters (>15 years on the MBS), rural area residents, and over the age of 50.**

- Throughout the plants' range, two of the most commonly noted **factors affecting abundance and access include: conifer encroachment into formerly productive meadows, and loss of access to productive meadows due to road closures.**

- While no study participants stated that they had experienced resource related conflicts on the MBS Forest, some **harvesters did express in interviews concern that there is the potential for an increase in frequency of harvester conflict in the future**. With conifer encroachment and increasingly limited access to the remaining productive berry harvesting sites, these harvesters expressed concern about the social and ecological effects of concentrating berry harvesters into increasingly limited areas on the Forest. It should also be noted that, while not explicitly associated with the research for this study, the author of this study has upon numerous occasions over the past eight years heard anecdotal stories of conflicts over big huckleberry harvesting in the Stampede Pass area.

- There is some evidence that points to a **small "commercial" harvest on the Forest, but on a limited scale**. Commercial harvest of berries is currently prohibited on the MBS, unlike for the Gifford-Pinchot NF, south of the MBS. Since regulations do not permit commercial harvest on the MBS, it is unlikely to be well reported or captured at all through voluntary surveys such as the one used for this study. As such, we are unable to say definitively whether commercial harvest of huckleberries is currently a problem or not on the MBS. Study participants with experience harvesting on the Gifford-Pinchot and other national forests where commercial harvesting takes place were adamant that they do not want to see commercial harvesting on the MBS.

- Harvesters observed that **big huckleberry tends to fruit best in relatively open conditions, such as in moderately moist meadows and forest edges. They were also aware that** these conditions are most typically met through some form of disturbance – most notably natural and anthropogenic fire, and, more recently, clearcut logging.

- Many **long-term harvesters observed that the past several years have been "poor"** in terms of berry production. Some characterized this as a long-term trend, attributed to conifer encroachment, lack of disturbance by logging or fire, and/or climate change; others characterized it as a cyclical event tied to regional weather patterns, or as due to a combination of these factors.

- **Harvesters cited road closures as a primary barrier to huckleberry harvesting on the MBS Forest.** While many harvesters do recognize conifer encroachment as

impacting berry habitats, a greater number expressed concern about the impacts of road closures on access to harvesting sites.

- **Harvesters tended to believe that berry harvesting was "not even on the radar" of the MBS staff**. This, they attributed, to the many issues that the Forest has to manage in a time of shrinking budgets and minimal staffing.

- **Most harvesters seemed to be unaware of any regulations restricting the amount of berries** that one is allowed to harvest from the Forest, or permitting requirements.

- **This research study likely under-represents those harvesters who are less likely to fill out survey forms** for a number of possible reasons, including ethnic minorities**.** Follow up studies regarding big huckleberry harvesting on the MBS Forest should make explicit effort to reach out to these populations. Doing so will help us to better understand the diversity of big huckleberry harvester practices, knowledge and values on the MBS.

What We Still <u>Don't</u> Know

- **Actual huckleberry availability and quantity on forest lands**: While we now have a map of "potential habitat" on the MBS, we don't know the actual "supply" of berries (i.e. their actual productivity) on the MBS. Estimating the supply is complicated by the variability found across different habitat types and individual plants, as well as the year to year fluctuation of huckleberry production.

- **Potential habitat for other species of Mountain Huckleberries:** The big huckleberry habitat model does not address other species of huckleberry that are present in the MBS, such as Cascade Huckleberry (*V. deliciosum*), Alaska Huckleberry (*V. alaskaense*), Oval-leaf Huckleberry (*V. ovalifolium*) or Red Huckleberry (*V. parvifolium*). Each huckleberry species is unique in its distribution and habitat requirements, although various species may co-occur in some areas.

- **Quantity of Big Huckleberry Harvested from the Forest:** While this study provides insight into the knowledge, practices, and values of a segment of huckleberry harvesters on the MBS, it does not provide an estimate of the quantities of berries that are harvested on the Forest in a given year, or the extent to which a perceived lack of availability of berries is a barrier to the potential harvest of big huckleberry. Also, while this study does not point to a large commercial harvest of huckleberries currently, this type of harvest is not legal and is unlikely to be well captured in a volunteer survey of recreational harvesters, and should be monitored.

- **Tribal Treaty Harvest:** This study did not attempt to target or characterize harvest by treaty tribes with reserved gathering rights on the MBS; rather it focused only on recreational huckleberry harvest and use by the public. A concerted effort would be required to characterize the treaty harvest by tribes, including tribal depth of experience and unique cultural traditions, knowledge and current treaty harvest patterns, needs and tribal regulations or policies. This information would shed further light on the overall demand for and harvest of big huckleberry on the MBS, and allow for an analysis of whether the current supply is able to meet both treaty harvest and recreational harvest demand.

- **Climate-related impacts and their variability across the forest and range of Big Huckleberry, both in the short and long-term.**

Recommendations

- Big Huckleberry requires disturbance to be sustained on the landscape. Without disturbance, it will likely be shaded out by encroaching conifers and fruit production will decline. **Consider various management options such as thinning, pruning, regeneration harvest, and prescribed burning to sustain and enhance Big Huckleberry habitat and fruit production on the MBS.**

- Areas where management and enhancement for big huckleberry are currently feasible and most likely to be effective are where there is overlap between high likelihood potential habitat, lands designated as "Matrix", road proximity and forest stand age less than 80 years old. Other such sites on lands currently designated as "Adaptive Management Areas" or "Late Successional Reserves" also represent areas having high potential for future huckleberry management. **Site visits to these areas are recommended to verify the presence of big huckleberry, and to determine appropriate management actions to enhance big huckleberry vigor and fruit production, as well as options for maintaining road access.**

- **USFS should scrutinize future forest plans and proposals that will add any remaining high potential habitat areas to a designation that will not permit active huckleberry management.** In future revisions to the "Northwest Forest Plan" and the "Land and Resource Management Plan" for the MBS, for example, the Forest Service should consider those areas identified in this report that may currently be designated as Late Successional Reserve or other category that represent key areas where huckleberry enhancement is considered to be most plausible and worthwhile, to ensure that management for these important resources is weighed.

- The huckleberry harvester study provides a model for characterizing recreational use and harvest of special forest products on the MBS. **The Forest should undertake similar studies for any management decisions made on the MBS Forest that may affect access to, or abundance of, special forest products of importance to the public and/or treaty tribes.**

- The study under-represents those recreational harvesters who are less likely to fill out survey forms for a number of reasons, including ethnic minorities and/or non-English speakers. **Future studies should make a concerted effort to reach out to under-represented populations. This will help the Forest Service to better understand the diversity of harvesters and their use and knowledge of huckleberries on the MBS.**

- While we have learned something about non-tribal recreational harvest of huckleberries on the MBS Forest, we have not, through this study, characterized Tribal Treaty Harvest. At least ten different federally-recognized treaty Tribes (Lummi, Nooksack, Upper Skagit, Sauk-Suiattle, Swinomish, Stillaguamish, Tulalip, Muckleshoot, Nisqually, Puyallup) have reserved gathering rights on the MBS. As a result, federal policies addressing treaty rights' harvest are necessarily different than for the general public. **Tribes may wish to undertake work within their tribal communities to get a better understanding of their current and anticipated huckleberry harvest needs,** and whether tribes are finding access to an adequate supply of huckleberries as provided for under the 1855 Treaties of Point Elliott and Medicine Creek. Feeding the results of this kind of evaluation into future Forest Service planning efforts could help to support continued access and supply of this important treaty resource.

- **Continue to ban permits for commercial harvest of mountain huckleberry on the MBS**, and monitor huckleberry harvest to track any non-permitted commercial use of huckleberries on the MBS in the future. Tribes have repeatedly stated concerns to the USFS about their ability to access (including elders access) and harvest enough huckleberries for their needs, and those of future generations; in addition, as reported in this study, recreational harvesters do not support commercial permits on the MBS.

- **To monitor actual quantities of huckleberries coming off the forest from recreational harvest, the Forest Service should consider development of a reasonable permitting program** (reasonable in the sense that acquiring a permit should not impose too much of a burden on permittees.) Based on the recreational harvest study, we believe that most people will cooperate if 1) they understand why it is important for berry management, 2) permits are very easy to get, and 3) rules about the need for a permit are clear and consistent across the Forest. To get a good understanding of quantities harvested recreationally, it will probably take three to five years to identify patterns in the data.

- Very few areas remain on the MBS where Forest Service roads currently provide access to high potential big huckleberry habitat where recreational harvest (as opposed to just

incidental use) is allowed. **In considering the roads network and any future road closures, the USFS should prioritize maintaining roads that provide access to higher elevations, and particularly to areas identified as "High Potential Habitat" for big huckleberry.**

- **Collaborate with other land managers to share information about management strategies and the effectiveness of various huckleberry enhancement techniques; also share accumulated knowledge about the effects of climate change on viable huckleberry habitat within and between land ownerships.**

- It is hard to predict how climate change projections for the Pacific Northwest will affect big huckleberry, as well as various management treatments, as some conditions may benefit the species, while others may not. Predictions for warmer, wetter winters may favor big huckleberry, as could increases in atmospheric carbon and the extent and frequency of wildfire. A diminished and earlier melting snowpack however, could affect big huckleberry negatively. **Monitoring known areas of big huckleberry habitat and species occurrence, as well as treatment areas, will be important in evaluating trends in habitat, huckleberry growth, plant vigor and fruit production in response to treatment, and potential correlations with climate change, disturbance regimes and stand development.**

Part C:
Appendix 1

Analysis of roads and proximity and access to areas of High Huckleberry Habitat Potential

Figures and Tables

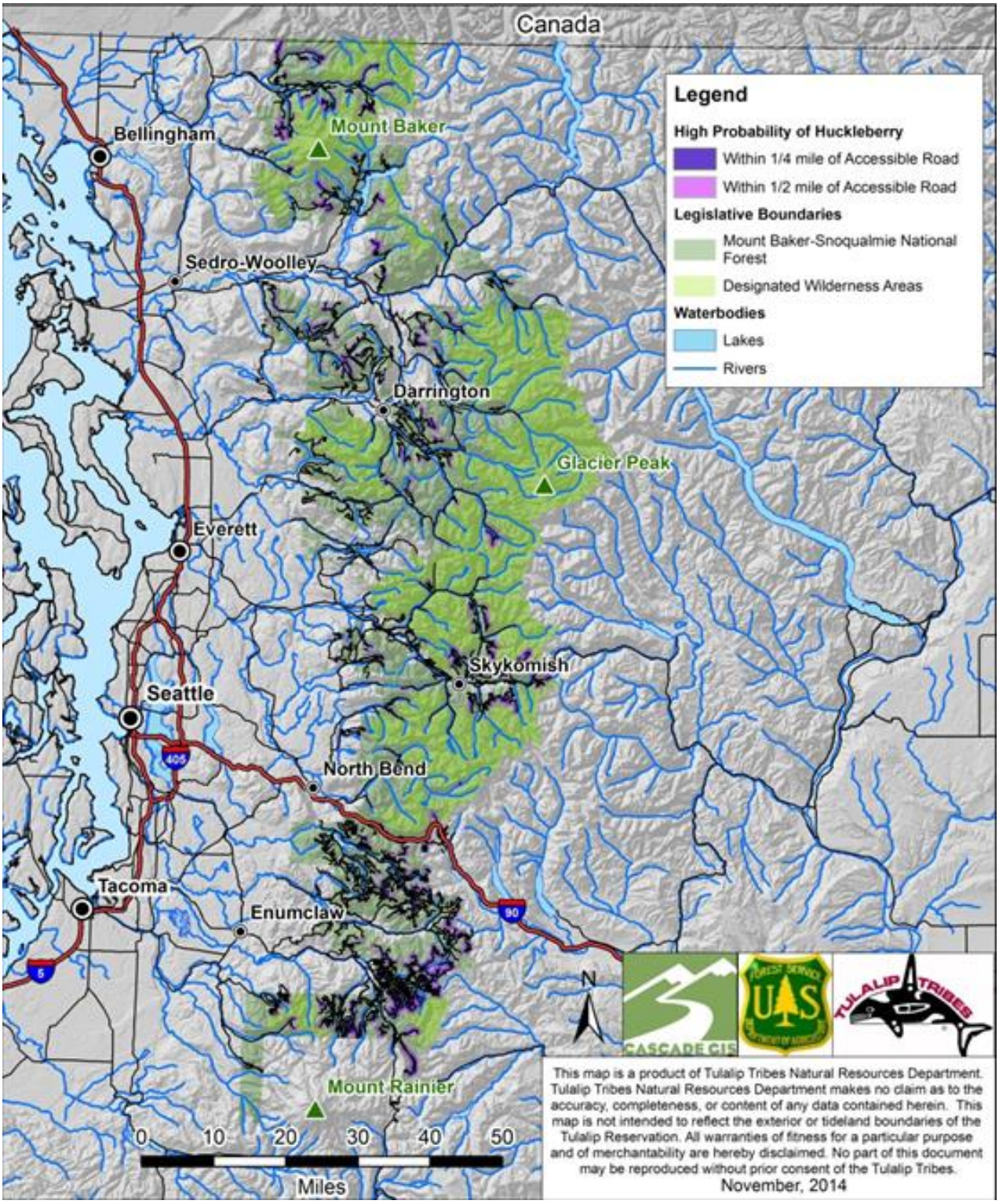

Figure C-1.1. Areas of Road-Accessible "High Huckleberry Habitat Potential" in the Mount Baker-Snoqualmie National Forest.

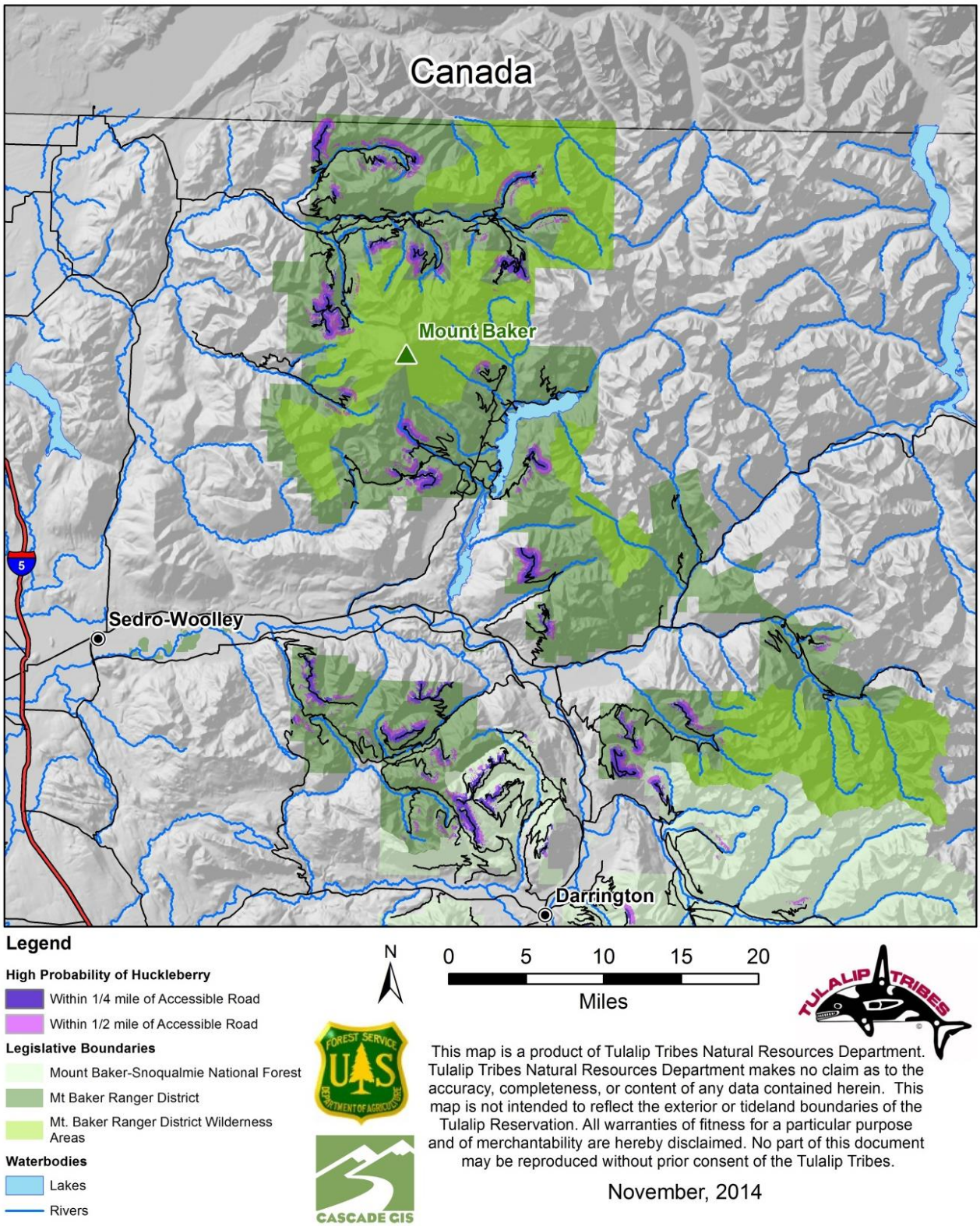

Figure C-1.2. Areas of Road-Accessible "High Huckleberry Habitat Potential" in the Mount Baker Ranger District.

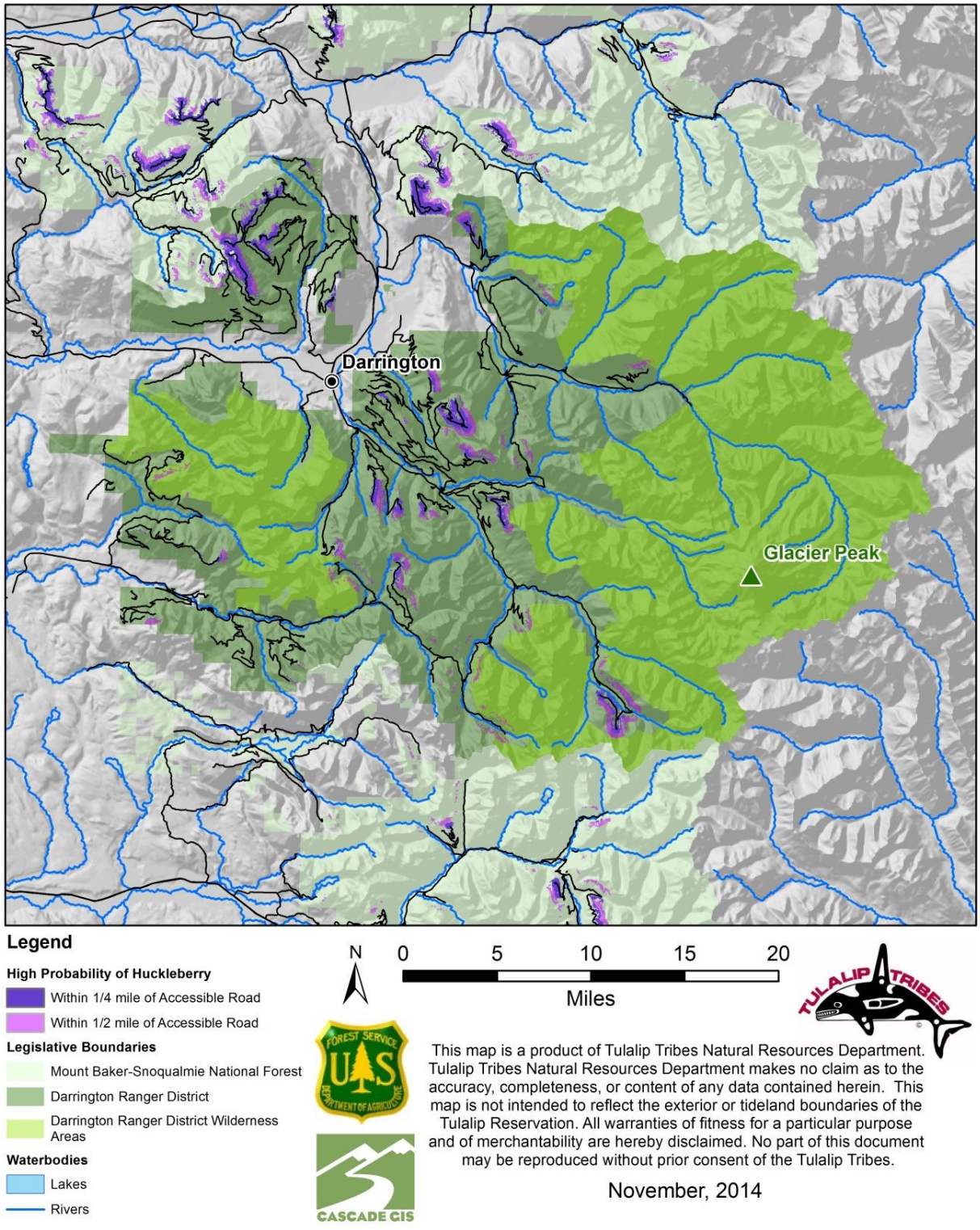

Figure C-1.3. Areas of Road-Accessible "High Huckleberry Habitat Potential" in the Darrington Ranger District.

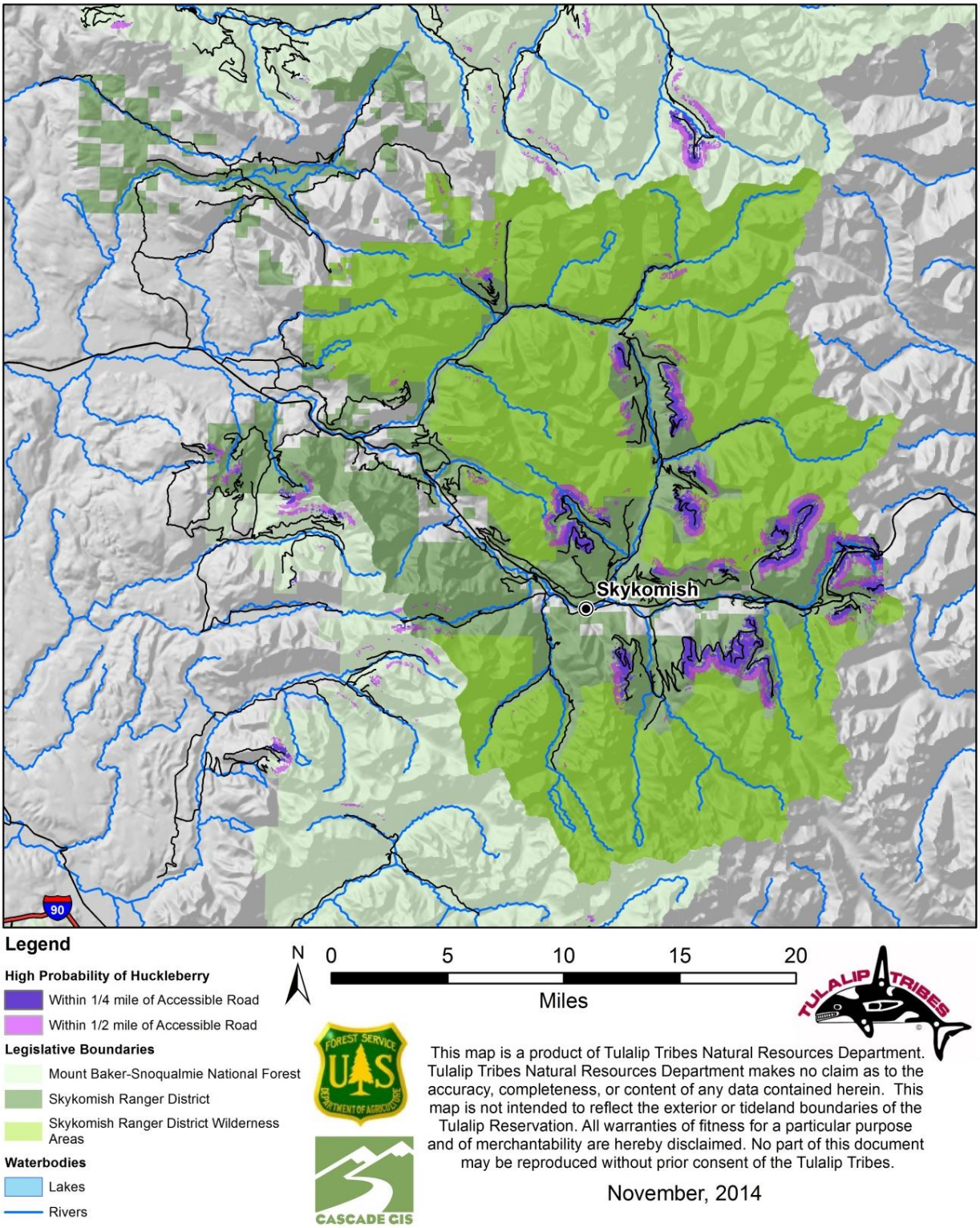

Figure C-1.4. Areas of Road-Accessible "High Huckleberry Habitat Potential" in the Skykomish Ranger District.

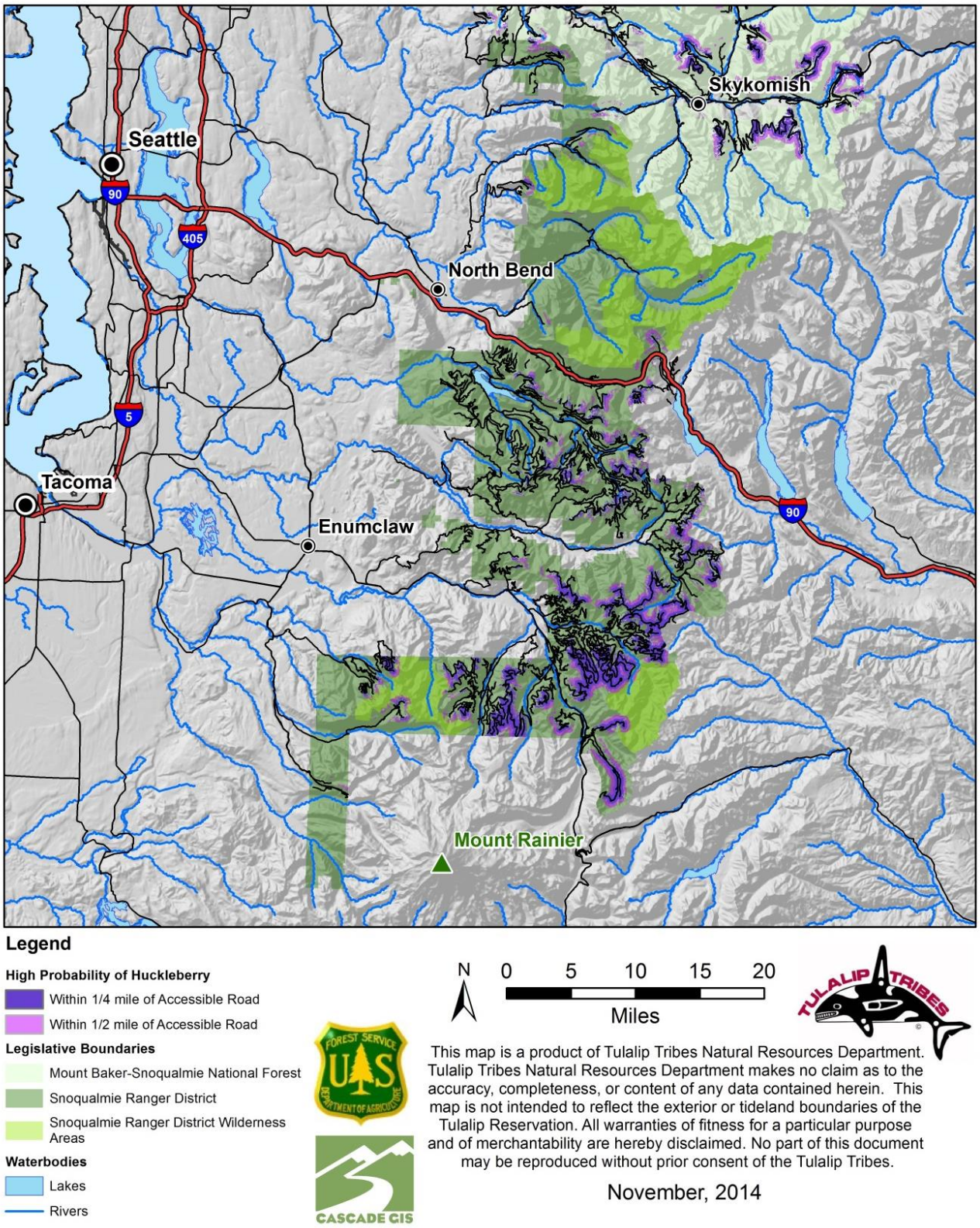

Figure C-1.5. Areas of Road-Accessible "High Huckleberry Habitat Potential" in the Snoqualmie Ranger District.

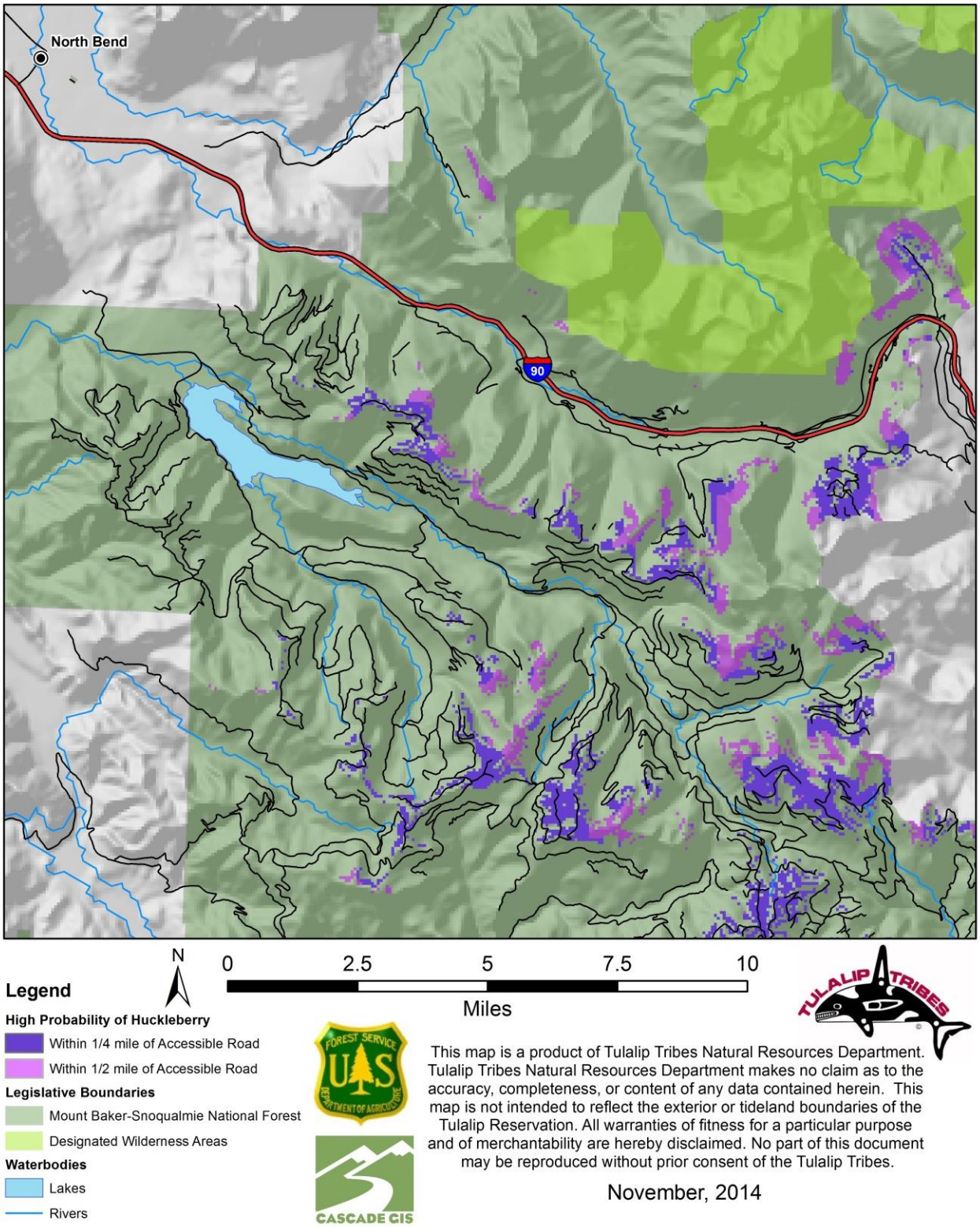

Figure C-1.6. Close Up of Areas of Road-Accessible "High Huckleberry Habitat Potential" in a portion of the Snoqualmie Ranger District.

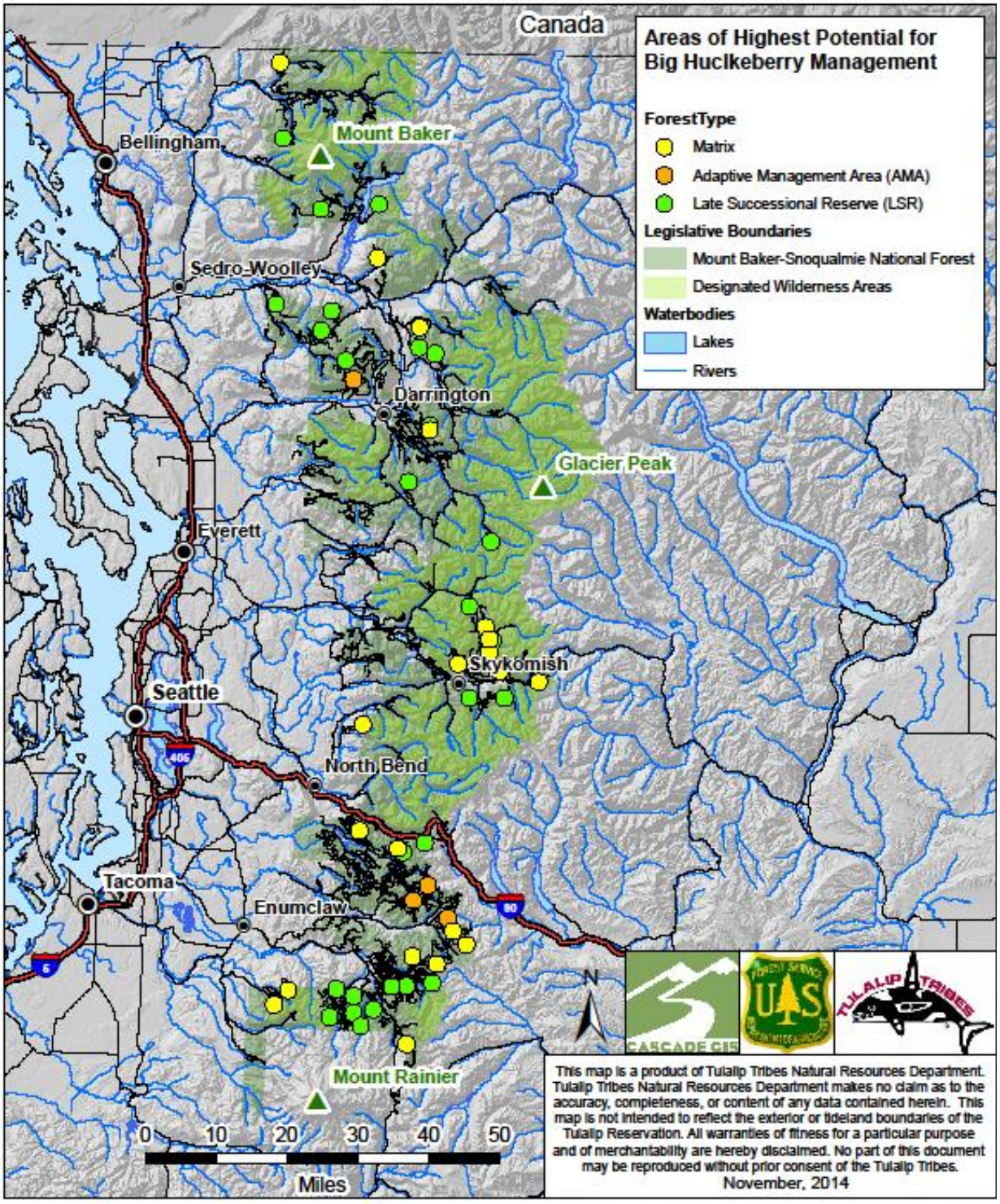

Figure C-1.7. High Potential Areas for Huckleberry management and Enhancement: as shown by Areas of Road-Accessible "High Huckleberry Habitat Potential", in Age Stand <80years old and in Matrix, Adaptive Management Areas, and Late Successional Reserve Land designations in the Snoqualmie Ranger District

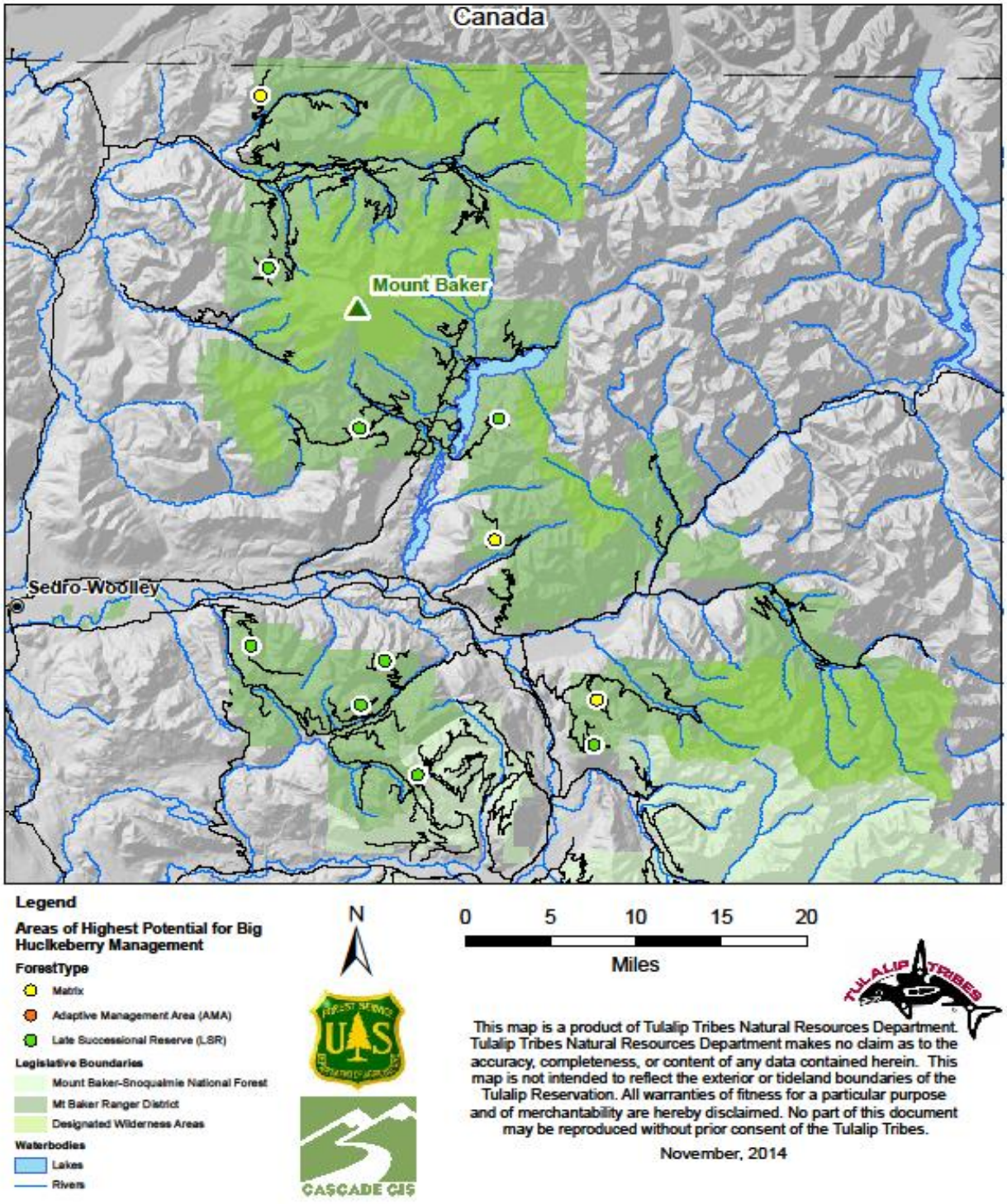

Figure C-1.8. Mt. Baker District High Potential Areas for Huckleberry Management and Enhancement: as shown by Areas of Road-Accessible "High Huckleberry Habitat Potential", in Age Stand <80years old and in Matrix, Adaptive Management Areas, and Late Successional Reserve Land designations

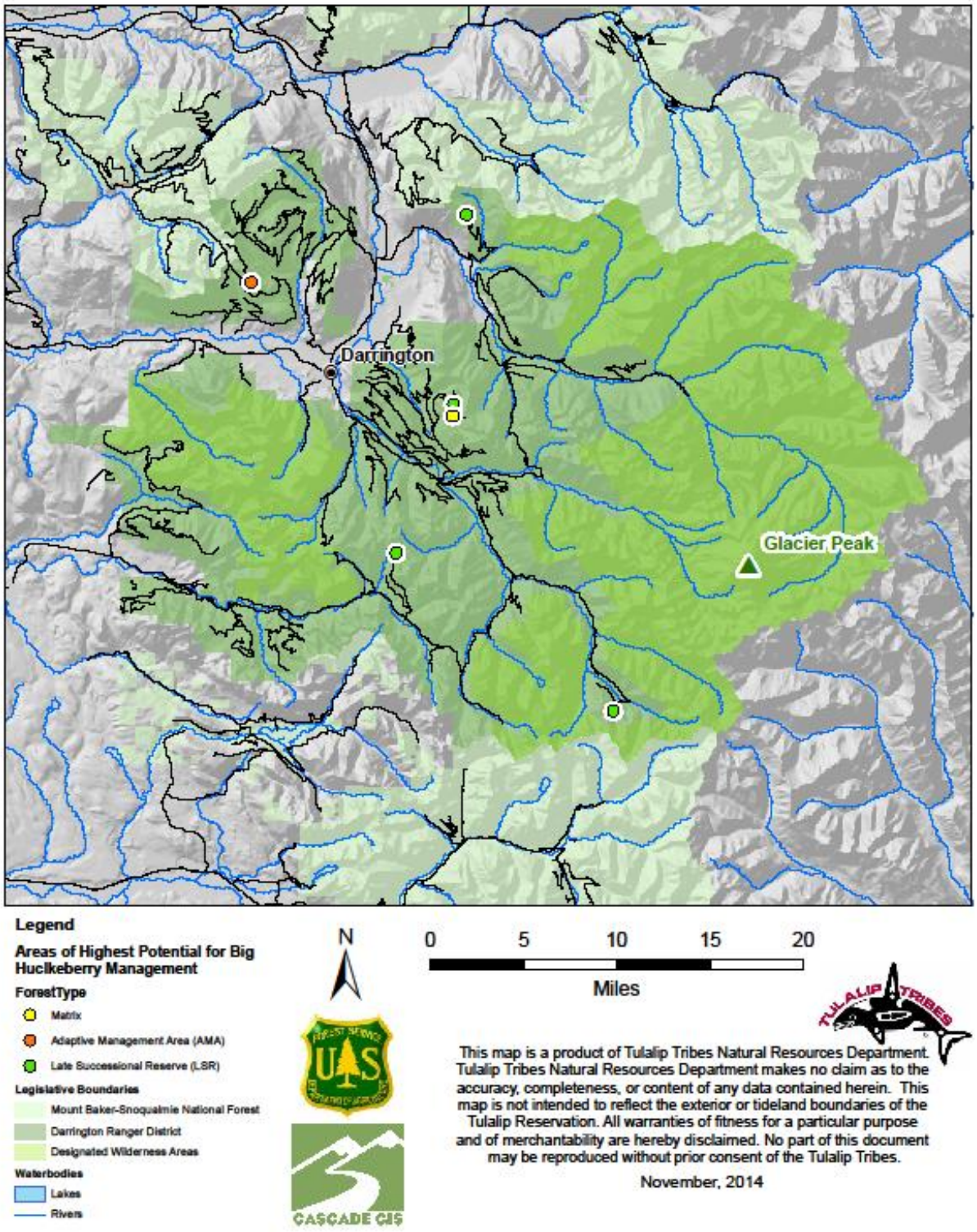

Figure C-1.9. Darrington District High Potential Areas for Huckleberry Management and Enhancement: as shown by Areas of Road-Accessible "High Huckleberry Habitat Potential", in Age Stand <80years old and in Matrix, Adaptive Management Areas, and Late Successional Reserve Land designations.

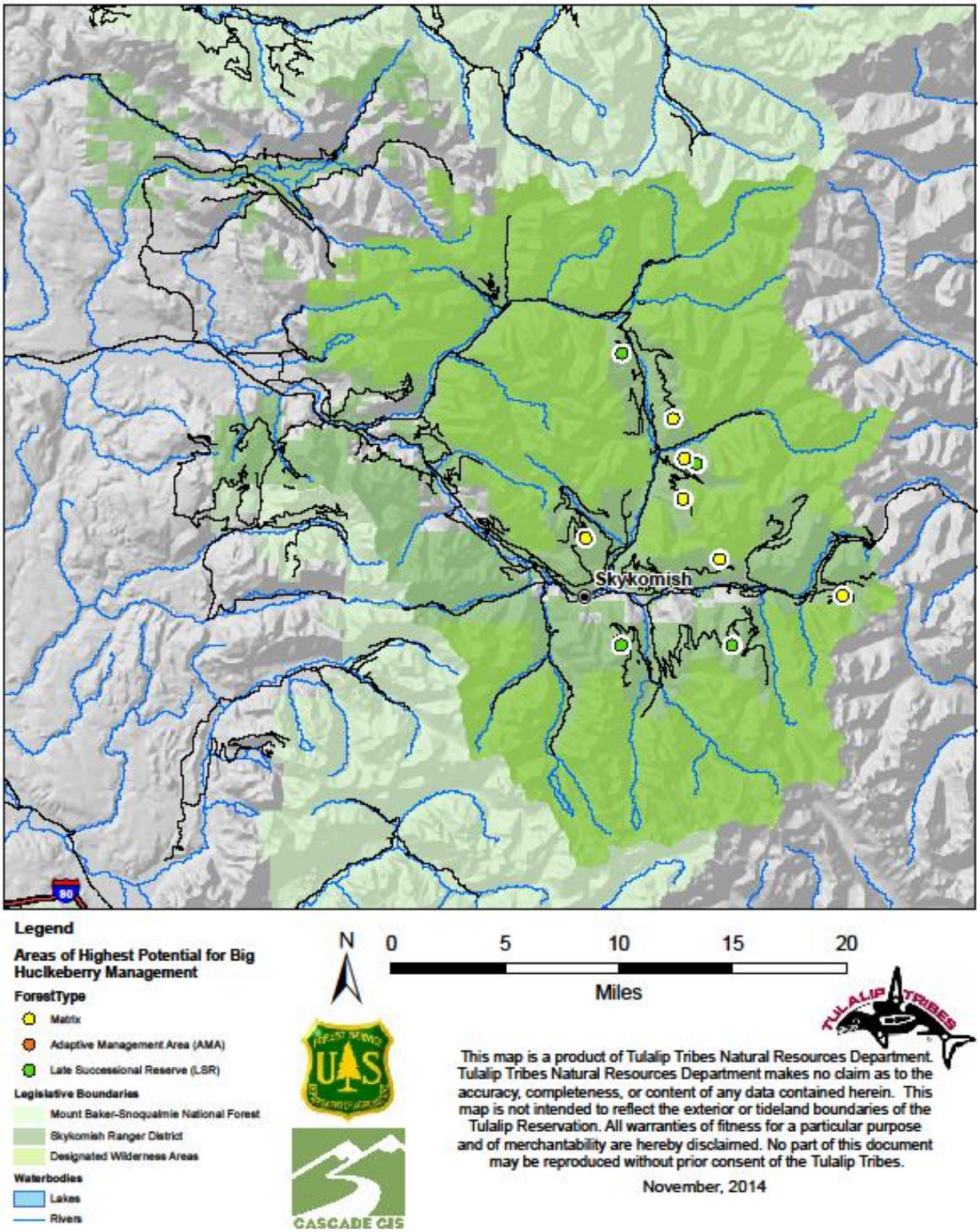

Figure C-1.10. Skykomish District High Potential Areas for Huckleberry Management and Enhancement: as shown by Areas of Road-Accessible "High Huckleberry Habitat Potential", in Age Stand <80years old and in Matrix, Adaptive Management Areas, and Late Successional Reserve Land designations.

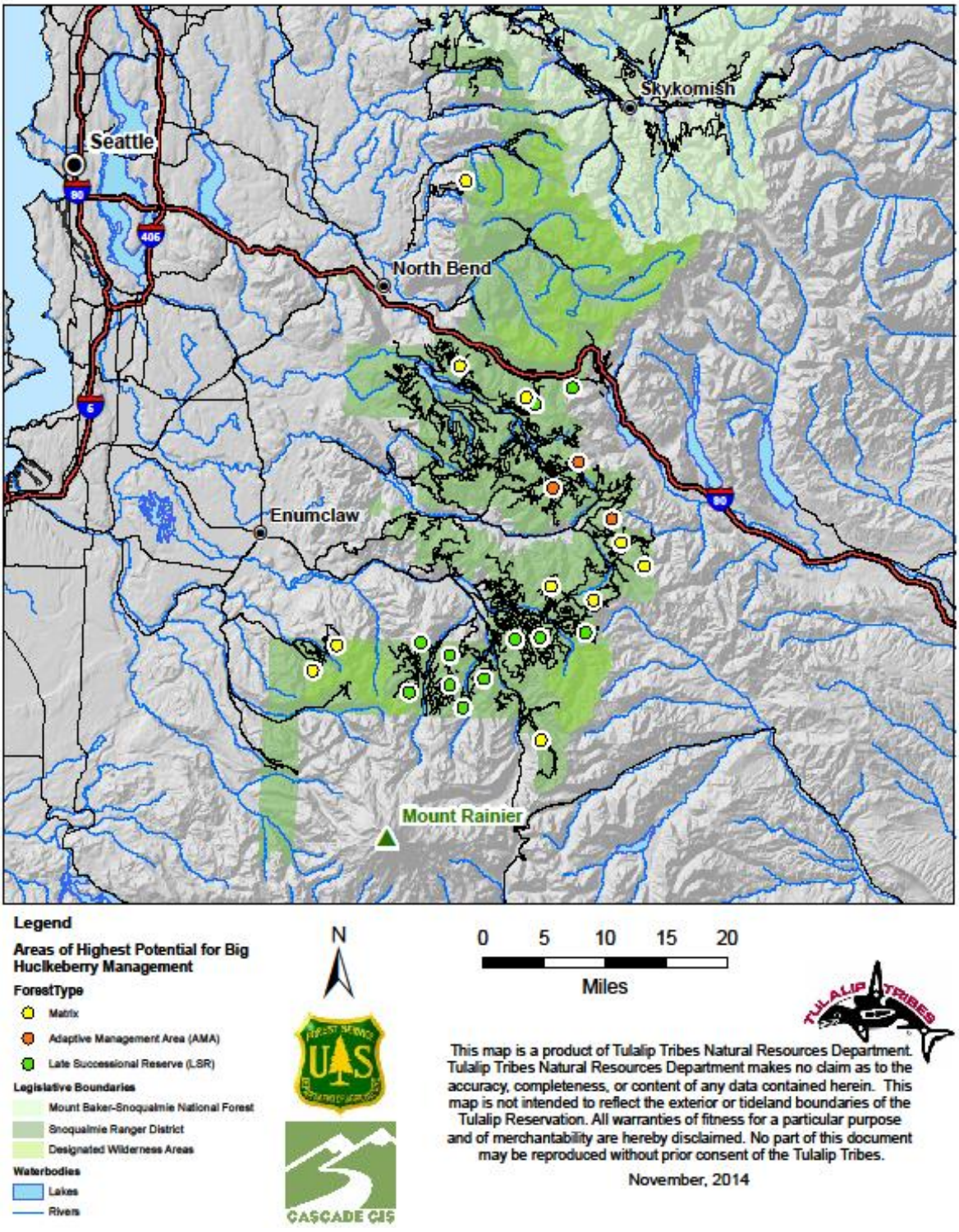

Figure C-1.11. Snoqualmie District High Potential Areas for Huckleberry Management and Enhancement: as shown by Areas of Road-Accessible "High Huckleberry Habitat Potential", in Age Stand <80years old and in Matrix, Adaptive Management Areas, and Late Successional Reserve Land designations.

Table C-1.1. High Huckleberry Habitat Potential Area within ¼ mile of open road.

Ranger District	Acres
Mt. Baker	15,168
Darrington	6,097
Skykomish	9,131
Snoqualmie	37,547
Total Forest Wide	67,943

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Table C-1.2. High Huckleberry Habitat Potential Area within ½ mile of open road.

Ranger District	Acres
Mt. Baker	29,917
Darrington	12,752
Skykomish	17,666
Snoqualmie	54,917
Total Forest Wide	115,252

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