

The Shades of Participation: Assessing the Barriers to Community Participation in Land-Use Decision-Making Processes That Address Environmental Injustices for Low-Income Communities of Color

By
Jasmine King

MPP Essay

Submitted to
Oregon State University

In partial fulfillment of
the requirements for the
degree of

Master of Public Policy

Presented November 23, 2020
Commencement June 12, 2021

Master of Public Policy essay of Jasmine King presented on November 23, 2020

APPROVED:

Lori A. Cramer, representing Sociology

Lisa Gaines, representing Natural Resources

Ana Spalding, representing Marine and Coastal Policy

Lorenzo Ciannelli, representing Earth, Ocean and Atmospheric Sciences

Jasmine King, Author

Table of Contents

Table of Contents	3
Abstract	6
Notes & Acknowledgements	7
Land Acknowledgement	7
Whose land?	9
Acknowledgements	10
Format of this Document	11
Chapter 1 MPP Essay	12
Introduction	12
Literature Review	17
<i>What is Environmental Justice?</i>	18
<i>Roots of the EJ Movement</i>	19
<i>History of the EJ Movement to Now</i>	20
<i>Relation to Other Movements and Structural Inequalities</i>	21
<i>What is Land Use?</i>	22
<i>Inequitable Zoning</i>	23
<i>Importance of Race</i>	25
<i>Potential of Land Use Planning to Improve EJ Outcomes</i>	26
<i>What is the Policy Process like?</i>	27
<i>Environmental Justice & Land Use Policy</i>	29
<i>Oregon Land Use Goal 1 (1975)</i>	29
<i>EO 12898 (1994)</i>	29
<i>Environmental Justice Task Force (2008)</i>	30
<i>2035 Comprehensive Plan: City of Portland Community Involvement Goal</i>	31
<i>Community Based Environmental Protection: CBPR</i>	32
EJ in Oregon	33
Theoretical Frameworks	34
Principles of EJ	34
Critical Race Theory	35
Social Construction & Policy Design	36
Research Questions	38
Methodology	39

Results and Discussion	44
How Do Organizations Address Environmental Justice in Their Work?	46
Elevating Community Voices	46
Collaboration with Local Communities	47
Changing the Narrative	48
Coalitions with Other Organizations	49
Building Community Capacity & Health	49
Dynamics of Participation	52
Barriers to Participation	54
Language	54
Who's in the Room?	55
Relationship Building	56
Class & Cultural Differences	57
Distrust in the Process	58
Logistical Barriers	59
Policies and the Principle of Participation	60
The Role of Local Organizations	64
Community Participation Processes Through the Lens of the Principles of EJ, Critical Race Theory and the Social Construction and Policy Design Framework	66
Principles of EJ	67
Critical Race Theory	70
Social Construction and Policy Design	72
Appendix I. Interview Protocol	80
Appendix II. References	82
Chapter 2: NRT Project	88
<i>Land Acknowledgement</i>	91
Introduction	92
<i>Motivation</i>	95
Approach	96
Literature Review	98
How Does Policy and Land Use Shape Vulnerability?	98
What is Socio-economic Vulnerability?	99
Research Questions	102

Methods	102
Study Sites	102
Methodology	104
How Policy & Land Use Shape the Natural Landscape	104
Characterizing Socio-economic Vulnerability on the Oregon Coast	105
Whole-system Vulnerability: How Socio-economic and Physical Vulnerability Interact	112
Results	113
<i>Policy & Land Use (Table S1)</i>	113
<i>Policies & Practices on the Oregon Coast: How and why is policy relevant in shaping the natural landscape and the human communities that reside in it? (Table 2)</i>	113
<i>Alsea Land-Use History (Table 2)</i>	118
<i>Coquille Land-Use History (Table 2)</i>	119
<i>Nehalem Land-Use History (Table 2)</i>	120
<i>Evolution of Environmental and Land-Use Oregon Policy Priorities Over Time</i>	121
<i>Priorities of Oregon Environmental, Land Use, and Coastal Policies</i>	122
<i>Changes in Policy Priorities Over Time</i>	122
<i>Effects of Priorities on Community Livelihoods</i>	123
<i>Incorporating Vulnerability into Environmental, Land Use and Coastal Policy</i>	123
Socio-economic Vulnerability	124
Whole-system Vulnerability: The Interaction Between Socio-economic and Physical Systems	130
<i>Impacts of the Social System on Physical Vulnerability: Natural and Human-influenced Sediment Supply on Salt Marsh Morphology</i>	131
<i>Impacts of the Physical System on Socio-economic Vulnerability</i>	136
Conclusion	139
Socio-hydrogeomorphological vulnerability of the Oregon Coast	139
Limitations & Future Directions	141
Appendix I. References	144
Appendix II. Tables	150
<i>Table 1. List of and descriptions for U.S. Census Bureau ACS variables used for the social vulnerability analysis (U.S. Census Bureau 2019).</i>	150
<i>Table S1. Decadal Land Use & Policy History of Statewide, Federal and Local Oregon coastal, forest and environmental management.</i>	152
Appendix III. Figures	192

Abstract

Environmental injustices, defined as inequitable access to fair, safe, and healthy environmental outcomes, are often rooted in issues of land management, policy decision making, and sovereignty. This results from a series of processes, including loss of land ownership, exclusionary and discriminatory zoning, and structural barriers to participation. Black, Indigenous, Communities of color have experienced tremendous downward shifts in land ownership that create limitations for their capacity to participate in decision-making processes. Additionally, land use policies such as zoning have played a central role in disproportionately distributing harmful and toxic industries and waste sites in low-income, communities of color. Once environmental hazards are placed in these communities, it becomes increasingly difficult to express discontent due to numerous structural barriers. **This research contributes to our understanding of what barriers exist to expressing discontent and other avenues of participation in land use decision-making processes.** While government agencies such as the Environmental Protection Agency (EPA) recognize environmental justices and the disproportional placement of unwanted facilities in communities of color, there have been few deliberate and substantive attempts to rectify injustices through policy implementation. The EPA has inspired states, organizations and communities to adopt community based environmental participation (CBEP) practices intended to increase participation as it pertains to environmental issues, but seldom specifically directed at low-income communities of color. Applying the Social Construction framework, Critical Race Theory and Principles of Environmental Justice lenses, an analysis is conducted to assess if CBEP practices adopted by Oregon agencies effectively involve low-income communities of color. Specifically, this research examines how policies related to community participation in decision making have changed in Portland, as well as the impact participation has on policy implementation for environmental outcomes. Utilizing semi-structured interviews with representatives of key organizations in Portland, Oregon with the specific mission of environmental justice CBEP practices were assessed for their effectiveness within the local community. Results suggest that CBEP practices and community participation efforts implemented by the state partially address the needs of low-income BIPOC communities. Participants indicate efforts to include low-income BIPOC voices have increased, yet meaningful participation is minimal due to a lack of structural support for community members at the decision-making level.

Key words: environmental justice, community participation, community based environmental protection, EJ Principles, Social Construction, Critical Race Theory, Oregon, policy

Notes & Acknowledgements

As a person holding multiple marginalized identities throughout my life and my work, my positionality is greatly informed by identity politics and the study of Black feminism. By identity politics, I draw from the work of the Combahee River Collective (<https://www.blackpast.org/african-american-history/combahee-river-collective-statement-1977/>) who describe it as a politic that aims to improve the material conditions of Black women and feminine people globally. The work of Black feminism asserts that only through liberating Black women and femmes from their violent material conditions may all other people become free. Thus, this work is not possible without a critical analysis of capitalism. Underscoring these politics is the idea that social constructions shape the very material conditions that people live under. And, it is this through this lens that both my own work and that of the larger Environmental Justice movement have been founded upon.

Land Acknowledgement

This research study centers the experiences of staff members and low-income Black, Indigenous and the people of color of the Portland Metro, the metropolitan region of what is now commonly referred to as Portland, Oregon. "The Portland Metro area rests on traditional village sites of the Multnomah, Wasco, Cowlitz, Kathlamet, Clackamas, Bands of Chinook, Tualatin, Kalapuya, Molalla, and many other tribes who made their homes along the Columbia River creating communities and summer encampments to harvest and use the plentiful natural resources of the area" (Portland Indian Leaders Roundtable, 2018).

More information here: <https://www.up.edu/activities/files/leading-with-tradition.pdf>

The original peoples of this land were forcibly removed by European settlers through disease, violence and assimilation via federal Boarding Schools that separated Native people from their culture and communities. Their descendents were relocated to major cities and other regions throughout the State of Oregon and U.S. against their will.

This legacy of the colonialism that perspired the elimination, assimilation and termination of Native peoples in the Portland Metro is very much alive today where Native people remain disproportionately represented amongst the poor, homeless, unemployed and those facing incredible health disparities. Despite tremendous need, Native communities seldom receive adequate resources and support from the Portland local government. We cannot move forward towards justice without first recognizing this history, of both past and present.

This acknowledgement serves not only to recall this history, but to also identify the ways in which it plays out in the present. We must interrogate how current policies and the management of this land perpetuate this history. May we take this opportunity to thank the original caretakers

of this land, and honor their legacy by working to ensure the self-determination of all Native and oppressed peoples.

Whose land?

By Jasmine King

I remember singing the lyrics “this land is your land, this land is my land. from California to the New York island” while I was in elementary school. The song is called “This Is Your Land” by Woody Guthrie. What did Guthrie mean by those words? Whose land is it? And, what *IS* the land? I didn’t carry the weight of these words back then. the land simply meant something I walked upon. Not until I aged into adulthood did I realize the sacrifices made for this very land.

I always grew up listening to my granddad talking about working on the farm. my family still owns that farm in Oklahoma, and my mom used to go out there in the summers. I still haven’t been, but I dream of being able to pass down land to my children.

My parents don’t live this reality. they’ve fought their whole lives just to scrape by. I want better for us. I want us to have a deep, rich relationship with the ground that carries us through each day. The ground that feeds and nurtures; that holds our histories; that provides the very foundation of our being.

But what does it mean to be in relationship with the land? how do we communicate? What do we give and take? And how much? What is our responsibility? How do we honor this relationship? What does the land mean to me? To you? To generations past and those to come?

Many of us in the United States don’t know or even care to know the answers to these questions. we go our entire lives with an invisible wall between ourselves and the earth that carries us. we believe we are separate. and, we accept the loss and emptiness that can’t be named. We fill our lack with exploited treasures created by the breaking and cracking of our beloved land. We don’t know her. Not enough.

They haven’t wanted us to.

Who is “they”? Those with power. In the context of the United States of America and other colonized countries, white settlers have dominated the land. Because land is power, and those with land have power. The land is the basis of our very lives. Every resource we need is tied to the land. We all need it. So, then what happens when only some have access to it? Or when only some have access to the land which is healthy and nurturing?

The land holds a multitude of meanings. The land is sacred. The land is the foundation. The land is food. The land is sustenance. The land is life. The land is safe. The land is home. The land is power. The land is powerful. The land is my relative. And I am a relative to the land.

The land is immensely political. Wars have been fought over land since the beginning of time. It’s not just where we live. It dictates every aspect of how we live, and if we will live. Whether or not you have access to good, healthy, safe land is the difference between life and death. This is the story of my people.

My ancestors were taken from their land - their life - and forced to work stolen land. They walked miles, picked and plucked beneath the sun, and grew life out of a landscape of death. They toiled American soil for centuries only to lose access to over 80% of what they owned. And still, what they owned was stolen land. Made possible by the genocide of Indigenous peoples.

Whose land do we stand upon?

Acknowledgements

To my committee chair, Lori Cramer, I am incredibly grateful for your wisdom, cheerful support, and necessary guidance throughout this research and writing process. Thank you for your listening ear and encouragement during these past couple of years, and necessary advice amongst this evolving and ambitious project and year. I'd also like to extend my utmost appreciation to my committee members, Ana Spalding and Lisa Gaines, and Minor Professor, Lorenzo Ciannelli for your valuable feedback and perspectives. Thank you to the SPP faculty and staff for all of your words of inspiration and validation, and for the opportunity to do this work. And, thank you to Rorie Solberg for being a great professor to work with during my last term here at OSU.

Thanks to my experiences working with OPAL (OSU Policy Analysis Laboratory) and as a Graduate Fellow for the NSF-NRT project, I have gained invaluable experiences and skills that will undoubtedly prepare me well for my next chapter. I am immensely appreciative of the OPAL and NRT leadership for providing me with the opportunities to further my research competencies. And to my NRT research team, thank you for being the best interdisciplinary team I've ever been a part of. I learned so much from you all, and I will always cherish the time we spent together.

To our MPP cohort, you all made living in small-town Oregon a little brighter, and brought so much laughter to my life. And, I cannot express enough gratitude for the transformational experiences I've had through the relationships I built with members of the Coalition of Graduate Employees and the Women of Color Caucus. Thank you for being a space I didn't know how much I needed, and for being my community as I built my home away from home.

And, to all of the friends that I met here at OSU, as well as those back home and afar, I could not have done this without your endless strength and support. I deeply appreciate the way you all have held space for my emotions, rambles and uncertainty; for sending me words of affirmation, food or material support; and for reminding me who I am and why I'm here. To my family, thank you for always believing in me and for recognizing my accomplishments. Your words and love never go unnoticed, and have been my reason for carrying on. This accomplishment is as much all of yours as it is mine.

Lastly, I want to express my utmost gratitude to the participants in this study that made this work possible. I cherish the time spent speaking with you all and learning about the incredible work you do. Thank you for your devotion to environmental justice and for sharing your valuable insights.

Format of this Document

This document is structured under the OSU manuscript document format. Chapter One is structured as a standalone manuscript and reflects original work by the author, and is a traditional Masters or Public Policy Essay. Chapter 2 expands directly on community vulnerability in relation to coastal communities on the Oregon coast examined in a 2019/2020 transdisciplinary group project through the NRT: Risk and Uncertainty quantification in marine sciences housed at Oregon State University. The chapter seeks to explore elements of social and economic vulnerability relevant to physical vulnerability and flooding within the historical and policy context of the Oregon coast.

Results from both manuscripts contribute to a growing body of research that examines factors of vulnerability in both rural and urban communities in the face of policy, social, economic and environmental changes. The examination of these factors is essential to anticipate the ability of a given area to absorb and adapt to change.

Chapter 1 MPP Essay

Introduction

The participation of the public within the United States (US), decision-making processes is often limited to actions such as voting, phoning elected officials, participating in city council meetings and rare opportunities for public comment (1000 Friends of Oregon 2015). Although elected officials are expected to work in the interests of those they represent, they are rarely able to satisfy the interests of all of their constituents. It is too often the case that decision-makers conflict with the very needs of their people (Beretta 2012). While the general public experience challenges with participating in decision making regarding environmental issues (1000 Friends of Oregon 2015), this reality is magnified amongst the People of the Global Majority or Black, Indigenous and People of Color (Bullard and Johnson 2002). With such few opportunities to hold meaningful political and decision-making power, the People of the Global Majority or Black, Indigenous and People of Color (BIPOC) in the U.S. seldom see their interests and needs met by the government (Feagin 2013, Richter 2017). Rather than being a tool for the enforcement of environmental protections for all communities and a means for communities to self-determine their lives, public policy has exacerbated environmental injustices amongst communities that are disenfranchised economically, socially and politically (e.g., the BIPOC). This study aims to explore the circumstances that have led to environmental injustices within public policy, and how these circumstances affect the dynamics of participation amongst BIPOC communities in Portland, Oregon. In the following paragraphs, a brief overview of environmental justice, environmental justice policies that pertain to the geography of Portland, and the connection between environmental justice and land use will be further explored.

The main tenet of environmental justice (EJ), the primary response to environmental injustices, and environmental racism is that certain groups face disproportionate environmental outcomes. A lack of access to clean air, clean water and green spaces typically falls on low-income, Indigenous, Black and People of Color communities, and other groups that are disproportionately affected include elderly populations and those that are disabled (Day 2010; Jampel 2018). EJ seeks to rectify these disproportionate outcomes by removing the barriers to healthy environmental outcomes as well as removing the very harms that cause environmental injustices such as industrial pollutants (Taylor 2014; U.S. General Accounting Office 1983).

Importantly, EJ is not to be confused with environmental equity, which is ensuring all groups have equal access to both positive and negative environmental outcomes. In contrast to environmental equity, EJ desires to remove the possibility of *human-caused* negative environmental outcomes in entirety, such as outcomes of harmful pollution in the air, water and land; limited access to healthy and safe housing, neighborhoods, and workplaces; and inequitable transportation (Energy Justice Network). Distinct from seeking to remove the possibility of purely environmental disturbances that occur without the influence of human society, such as fires started by lightning or hurricanes, EJ focuses on addressing the human dimension of environmental issues.

As we exist today, it is becoming increasingly difficult to disentangle human-caused and naturally occurring environmental outcomes. Still, the focus of EJ is to ask: How can we ensure that the structure of our society is not exacerbating these environmental harms, and how can we ensure we are not causing environmental harms where there are none? The answer to these questions typically involves a restructuring of the society as a whole. This remains an area of

contention amongst EJ activists, where most EJ work occurs within our current system via policy change, while others seek to work outside of the system and policy arena (Pulido 2016).

Critical to the environmental justice movement are the Principles of Environmental Justice, conceived in 1991, including 17 principles designed to “re-establish our spiritual interdependence to the sacredness of our Mother Earth” and ensure environmental justice, amongst other aspirations, as these principles act as a defining document for international environmental justice efforts (Delegates to the First National People of Color Environmental Leadership Summit 1991). These 17 principles are included below.

Table 1. Principles of Environmental Justice (EJ)

1) Environmental Justice affirms the sacredness of Mother Earth, ecological unity and the interdependence of all species, and the right to be free from ecological destruction	10) Environmental Justice considers governmental acts of environmental injustice a violation of international law, the Universal Declaration On Human Rights, and the United Nations Convention on Genocide.
2) Environmental Justice demands that public policy be based on mutual respect and justice for all peoples, free from any form of discrimination or bias.	11) Environmental Justice must recognize a special legal and natural relationship of Native Peoples to the U.S. government through treaties, agreements, compacts, and covenants affirming sovereignty and self-determination.
3) Environmental Justice mandates the right to ethical, balanced and responsible uses of land and renewable resources in the interest of a sustainable planet for humans and other living things.	12) Environmental Justice affirms the need for urban and rural ecological policies to clean up and rebuild our cities and rural areas in balance with nature, honoring the cultural integrity of all our communities, and provided fair access for all to the full range of resources.
4) Environmental Justice calls for universal protection from nuclear testing, extraction, production and disposal of toxic/hazardous wastes and poisons and nuclear testing that threaten the fundamental right to clean air, land, water, and food.	13) Environmental Justice calls for the strict enforcement of principles of informed consent, and a halt to the testing of experimental reproductive and medical procedures and vaccinations on people of color.
5) Environmental Justice affirms the fundamental right to political, economic, cultural and environmental self determination of all peoples.	14) Environmental Justice opposes the destructive operations of multinational corporations.
6) Environmental Justice demands the cessation of the production of all toxins, hazardous wastes, and radioactive materials, and that all past and current producers be held strictly accountable to the people for detoxification and the containment at the point of production.	15) Environmental Justice opposes military occupation, repression and exploitation of lands, peoples and cultures, and other life forms.
7) Environmental Justice demands the right to participate as equal partners at every level of decision making, including needs assessment, planning, implementation, enforcement and evaluation.	16) Environmental Justice calls for the education of present and future generations which emphasizes social and environmental issues, based on our experience and an appreciation of our diverse cultural perspectives.
8) Environmental Justice affirms the right of all workers to a safe and healthy work environment without being forced to choose between an unsafe livelihood and unemployment. It also affirms the right of those who work at home to be free from environmental hazards.	17) Environmental Justice requires that we, as individuals, make personal and consumer choices to consume as little of Mother Earth's resources and to produce as little waste as possible; and make the conscious decision to challenge and reprioritize our lifestyles to ensure the health of the natural world for present and future generations.
9) Environmental Justice protects the right of victims of environmental injustice to receive full compensation and reparations for damages as well as quality health care.	

In the 1990s, President Clinton signed an Executive Order (EO) to address environmental inequity amongst minority and low-income populations by calling on all Federal agencies to include EJ as part of their mission. E.O. 12898 sought out to bring environmental justice to the attention of federal agencies, in hopes that they would incorporate various initiatives and programs to identify and address environmental injustices. Yet, implementers of the policy have argued that Executive Orders lack policy “teeth”, meaning there are few tangible ways of ensuring the outcomes described by the order (Buckhoy 2015; Liang 2018). States are free to develop their own environmental justice policies and means of measuring outcomes and impacts, thereby leading to differential interpretation and implementation of the policies. Furthermore, without legislative authority, programs and policies that seek to address environmental injustices often receive little to no dedicated funding to ensure adequate outcomes.

It is important to understand that issues of environmental justices are multidimensional and span various policy realms such as land use regulation, environmental policy, transportation policy, and housing policy. In this study land use regulation and environmental policy are of particular focus. Environmental injustices occur at the intersections of these policy realms, such as through the zoning of an incinerator or a freeway expansion near a residential neighborhood composed of mostly low-income BIPOC people. These zoning and transportation policies and processes are tied to the system of capitalism in the U.S. Being that capitalism is centered on deregulation, profit and high rates of production and consumption, it relies on the extraction of resources at extreme rates and views the land as something to use (Pulido 2016).

More directly, capitalism profits from extracting natural resources such as oil, natural gas, and fossil fuels from the land. These production processes culminate in high concentrations of toxic waste and pollution. Such negative externalities work together with racialized and class-

based structural forces to concentrate toxic waste and pollution in vulnerable communities. While EJ efforts work to challenge these outcomes outside of state structures, working to dismantle and restructure the very economic system, this study focuses on the processes that occur within state structures such as policy making, where these EJ injustices are sought to be rectified through a variety of policy realms and mechanisms via land use, environment and economics. Over time, policies have evolved to include public participation within the structure of decision making to rectify environmental harm. As I will discuss in the review of literature that follows, these policies have worked minimally to benefit disenfranchised communities in their pursuit of environmental justice, which ultimately raises questions of the efficacy of such policies in achieving this end.

Literature Review

The research questions in this study are centered on the differential experiences of low-income BIPOC communities in the decision-making process. These questions were developed out of in-depth research on the relationship between land use and environmental justice. Throughout such research, policies pertaining to both environmental justice and land use illuminated experiences of community members as they navigated the decisions that affected their daily lives. To clarify the particular experiences of frontline communities¹, the research questions in this study arose. The following literature review will further illuminate the links between the EJ movement, land use, and community participation processes that have ultimately culminated in this study.

¹ Communities that bear the brunt of the effects of climate change and environmental harms.

What is Environmental Justice?

Environmental justice (EJ) is the direct response to environmental racism, or the disproportionate impact of environmental hazards on the People of the Global Majority, otherwise referred to as Black, Indigenous and People of Color (BIPOC) in the U.S. (Energy Justice Network). Often, poor people also experience disproportionate siting of environmental harms, and it is worth noting that the People of the Global Majority comprise a large proportion of the poor (Macartney et al. 2013). In the era of increased recognition and acknowledgement of climate change, these communities are also often referred to as frontline communities, as they bear the brunt of the effects of climate change. Environmental hazards include anything that present indirect or direct harms to communities across both space and time, and many of these are expected to be compounded by climate change (Grineski et al. 2011; Shultz et al. 2020). Common environmental injustices, or harms, are toxic waste facilities, air pollution, water pollution and poisoning, and degradation of the land. The EPA recognizes environmental hazards and categories such as Superfund sites, Brownfield sites and other environmental clean-up sites, in response to the passing of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 1980 (VonVille 2020), although funding support for these projects is not always consistent. A lack of consistent funding is often described as a failure of environmental policy to address environmental injustices (Pulido et al. 2016). Tools such as EJSCREEN developed by the EPA (<https://ejscreen.epa.gov/mapper/>) or Energy Justice Network's mapping project (<http://www.energyjustice.net/map>), along with numerous research studies elucidate the connection between the siting of toxic facilities and the community's demographics (Clark et al. 2014; Miranda et al. 2011; U.S. General Accounting Office 1983).

Importantly in this study, environmental racism and injustices are situated within the framework of U.S. racial capitalism, white supremacy and imperialism that constitute the very fabric of the U.S (Pulido 2017). Therefore, environmental injustices are not isolated from the systems of oppression that the People of the Global Majority face daily while living in the U.S. It is critical then to identify multiple policy arenas in which environmental injustices are made possible. This work will focus specifically on environmental justice and land use legislation both federally and in the State of Oregon. Before getting into the policy landscape, it will be worth providing context by briefly outlining the history of the environmental justice movement, recent evolutions, and the movement's ties to land use regulation. I will then outline some of the literature describing participation processes for low-income BIPOC communities and how they fit into the larger policy landscape.

Roots of the EJ Movement

Many cite the emergence of the Environmental Justice movement in the late 1970s and early 1980s when news media covered toxic waste dumping in the summer of 1978 in the Love Canal in New York while others identify the emergence following the first class-action lawsuit following a toxic waste siting in a Black neighborhood in Houston, TX in 1979, claiming the citing violated their civil rights (Melosi 2000). The EPA identifies the Environmental Justice movement taking off in the late 1960s during the major wave of the Civil Rights Movement, where Memphis garbage workers took action for fair pay and better working conditions, in what was known as the Memphis Sanitation strike in February of 1968 (U.S. EPA 2014). The event most widely recognized as the catalyst of the EJ movement occurred in Warren County, North Carolina in 1982 where Black people organized a non-violent sit-in to protest against a polychlorinated biphenyl (PCB) landfill that resulted in arrests of 500 environmental and civil

rights activists (U.S. EPA 2014). This action spurred a study by the General Accounting Office that verified the disproportionate siting of toxic facilities in communities with a significant Black population (U.S. General Accounting Office 1983). Throughout the 1980s and subsequent decades more studies came out that identified statistical relationships between race, class and environmental hazards (Angel 1991; Keating 2002; Taylor 2014; U.S. General Accounting Office 1983) and a series of groups began to form such as the Indigenous Environmental Network and Southwest Network for Environmental and Economic Justice (SNEEJ). The EPA formed the Environmental Equity Workgroup in July of 1990 and in October of the following year, the First National People of Color Environmental Leadership Summit convened and created and adopted the 17 Principles of Environmental Justice (Energy Justice Network). This document remains a central guiding document for environmental justice activists and organizations, and serves as a guide for the EJ analysis of this study. Still, the Environmental Justice Movement continues to evolve and shift to meet the current political moment.

History of the EJ Movement to Now

In her study on the *Rise of the Environmental Justice Paradigm*, Taylor (2012) identifies the Environmental Justice Movement (EJM) as the latest in a series of environmental mobilizations that employ the injustice frame. The EJM makes the injustice frame explicit (a master frame) and examines the human-human and human-nature relations through the lens of race, class, and gender and the simultaneity of oppression. Framing is “the process by which individuals and groups identify, interpret, and express social and political grievances”, and master frames help activists make causal attributions (Taylor 2012:511). The EJM is a transformative frame in that it seeks sweeping changes in social structure and the ideological foundations that form it, much in contrast to its predecessor that mostly sought reform, the

mainstream Environmentalism movement. Paying closer attention to the human dimension of the environment, the EJM examines how discrimination results in humans harming each other, how BIPOC communities bear the brunt of discrimination, and how discriminatory practices hasten the degradation of environments (Taylor 2012). The simultaneity of oppression, the notion that discrimination can arise from multiple sources and it can be interlocking and inseparable, is also central to the work of Jampel (2018) in their analysis of the intersections of disability, racial and environmental justice.

Relation to Other Movements and Structural Inequalities

Jampel (2018) critically calls for a multi-lens analysis that is central to intersectional work. Scholars are well aware of the ways in which race and class inform environmental outcomes, but little attention is paid to disability. Jampel's (2018) work is invaluable to the environmental justice movement by addressing ableism within the EJ movement where environmental health research is often based on a fear of disability. Without this critical lens, we may also lack the consideration of how environmental injustices can perpetuate ableism and disproportionately burden disabled people. Jampel (2018) also argues that a more complete explanation of EJ issues is made possible by accounting for disability justice. Similarly, Pellow (2016) draws parallels between the Black Lives Matter and Environmental Justice Movement, where "various social categories of difference work to place particular bodies at risk of exclusion, marginalization, erasure, discrimination, violence, and othering", a process that exists in both policing and environmental management (Pellow 2016:225).

As both Jampel (2018) and Pellow (2016) assert the importance of examining EJ issues with an intersectional approach, Pulido (2017) takes this further by emphasizing that these

layered systems of oppression are a function of the very system itself. In other words, environmental racism and the systems of oppression that accompany it is a form of state-sanctioned violence meant to make racial capitalism possible (Pulido 2017:529). Racial capitalism, coined by Cedric Robinson in *Black Marxism*, is the idea that racism is a “structuring logic of capitalism” (Pulido 2017:526). The dispossession of land and the failure of environmental enforcement amongst low-income BIPOC communities are made possible by a process of racialization for the purpose of benefiting the free market. Focusing on the politics of land is key to conceptualizing environmental injustices, and thus a thorough review of this connection and the political landscape of land-use policy will be reviewed in the following sections.

What is Land Use?

At its core, land use describes the relationship between people and their environment. Although conducted differently across various social, cultural, political and economic contexts, people have always designated different areas of land for various purposes. Prior to European colonization in the United States, land use planning did not involve the level of environmental extraction and pollution that it does today (Greenberg and Greenberg 2013). Specifically, in Oregon, much of land use planning involved the extraction of timber and shaping the land for agriculture use (Department of Land Conservation and Development 2020). Not until the late 1960s and 1970s did the state begin to identify land use planning something of concern with rapidly increasing populations. Contrary to Indigenous land management, the state initiated and controlled much of these processes and were primary decision makers for how the land would be used. Over time, as Indigenous populations were relocated and decreased substantially due to settler violence, they became less involved in the management of their traditional lands, a

process referred to as appropriation (Pulido 2017). This lack of involvement and participation in land use management drives much of the environmental justice movement, which Pulido (2017) describes as a process that is deeply racialized where land ownership and decision-making power was reserved for whites (Pulido 2017:528). This phenomenon is not exclusive to the United States, as a larger shift in land governance has occurred throughout time on a global scale, especially with the rise in globalization and global capitalism (Sikor et al. 2013).

Sikor et al. (2013) identify significant trends in land governance, or the “systems of rule at all levels of human activity” related to land use, that shift from territorial to flow (Sikor et al. 2013). This shift is characterized by greater attention to resources or goods as they “flow” through the environment. They argue that not only is this shift occurring at greater rates globally, but it is also resulting in increased inequality and injustice due to greater competition. This is much due to the revalorization of land, in which lands are given new values. Sikor et al. (2013) identify “land grabbing”, or dispossession, as a consequence of changing global land governance as well as increased carbon emissions, exclusion in trade, and the marginalization of ethnic minorities due to monetization and individualization within the culture.

Inequitable Zoning

Environmental injustices amongst low-income, communities of color are often a byproduct of the processes such as the loss of land ownership, exclusionary and discriminatory zoning, and structural barriers to participation in decision making that have resulted from the change in global land governance (Pulido 2017, Sikor et al. 2013, Taylor 2014). Where global land governance has shifted from Indigenous models and definitions of land use and ownership in which many Native communities consider the land to be a relative (Brady 1999), the dominant culture of today enforced by settlers perceives land as a commodity (Mrozowski 1999). The

#LandBack movement, an endeavor to restore stolen territory to Indigenous nations, seeks to rectify the injustices caused by this shift in relationship to land (Lakota People's Law Project 2020). Ultimately, scholars of environmental justice identify land use policies and management as central to the processes that drive environmental injustices (Arnold 2000, Maantay 2001, National Academy of Public Administration 2003, Salkin 2006). A model centered on land use planning and regulation identifies patterns in inequitable distribution of zoning in addition to environmental pollutants themselves (Arnold 2000).

At the core of land use regulation is zoning, where “zoning codes burden low-income communities of color with intensive use designations” (Arnold 2000:11). Similarly, Mantaay (2001) identifies zoning as a significant land use regulatory tool for determining land uses, and finds that zoning has been utilized to concentrate environmental hazards in certain areas of the city. The U.S. Government has acknowledged this history and launched studies throughout federal organizations to address that, “for many years, federal policies reinforced local practices that limited housing for African-Americans to less desirable areas adjacent to polluting facilities”, and zoning was regularly brought into this mix by dictating land uses (National Academy of Public Administration 2003:27). Of particular importance is zoning determines where pollutants and toxins can be sited legally, and these sites are distributed disproportionately amongst communities of color (National Academy of Public Administration 2003). Additionally, the report found that enforcing environmental laws related to issues of environmental injustices were much slower and stagnated for non-white communities, suggesting a lower priority for addressing issues in minority communities. As Salkin (2006) explains, this is exemplified by “choosing sites for locally unwanted land uses (geographic equity); the process for deciding where to site these unwanted land uses, including the location and timing of public hearings

(procedural equity); and sociological factors, including which groups hold the political power inherent in land use decisions (social equity)” (Salkin 2006:3). As discussed in the following paragraphs, racism permeates each component of the zoning process.

Importance of Race

In Taylor's (2014) *Toxic Communities*, race was found repeatedly as a determining factor for hazardous and toxic waste siting. While racial discrimination appears to be a common thread amongst EJ claims, there are important structural components that shape this reality (Benz 2019, Pulido 2017, Taylor 2014). Taylor (2014) discusses zoning as a means for creating and influencing segregated neighborhoods, which ultimately make concentrating noxious land uses amongst certain communities more possible. Taylor (2014) outlines the history of zoning, arguing that although racial zoning laws have been “struck down”, prejudice and bias still exist within the structures and institutions that shape housing and land use. Taylor (2014) highlights colonialism as commonly presented as a thesis most relevant to the EJ movement. These are critical findings central to the work of Pulido (2017) who highlights the link between environmental racism and racial capitalism, a foundational framework of U.S. society. Similar to Pulido's (2017) work on racial capitalism, Taylor (2014) identifies market dynamics as a common claim of environmental injustice as it describes the reality of residential movement and migration. Additionally, environmental protections are presented within the context of legality, regulation, and administration where the burden of proof is placed on victims (Benz 2019; Bullard and Lewis 1996; Pulido et al. 2016; Taylor 2014). As scholars like Taylor (2014) document how EJ issues are attributed to manipulation, blackmail and enticement within the siting process, it becomes clear that racism and racial capitalism is embedded within the very structure of land use regulation.

In regards to the land use practice of zoning, Wilson et al. (2008) refer to the processes of exclusionary practices within neighborhoods that concentrate resources in some areas and create special districts that serve personal gains, as exclusionary zoning. Exclusionary zoning processes that segregate social groups impact community development and create disparities that ultimately result in adverse health impacts and environmental justice issues (Taylor 2014; Wilson et al. 2008). Wilson et al. (2008) highlight a key shift in urban planning and public health decision-making. Where the two processes acted in a collaborative manner in the pursuit of sanitation goals, urban planning is now more focused on economic and material interests in service of neoliberalism (Pulido 2017; Wilson et al. 2008). Despite the history of land use planning in service of profits over the health and well-being of communities, some scholars in the EJ field suggest utilizing the land use arena to rectify environmental harms. While there remains disagreement amongst environmental justice scholars, it is recognized that the policy arena is one of significance in the movement, as it contains the possibility for public participation in shaping the land use decisions that impact their daily lives.

Potential of Land Use Planning to Improve EJ Outcomes

Salkin (2006) and Arnold (2000) both propose that, although land use planning has perpetuated negative environmental justice concerns on communities, it can also be an avenue for addressing issues of environmental justice. Arnold (2000) argues that utilizing land use regulation and planning is a necessary and proactive solution. Specifically, Salkin (2006) identifies the relevancy of local government and the role local decision-making and regulatory processes play in the future of land use. Local government officials have been the primary decision makers regarding what can go where. Often, the interests of those in governmental positions have contrasted with the interests of the public, especially those residing in zones with

a higher presence of noxious land uses (Greenberg and Greenberg 2013; Pulido 2017; Taylor 2014). As land use planning is entering the foreground of the EJ movement, there is increasing potential for concerns of environmental justice to be incorporated into comprehensive plans. Salkin (2006) points to the value of citizen participation as plans are being developed. Simply including singular opportunities for public comment is not nearly enough to adequately address concerns. Rather, Salkin highlights promising examples in which public comment was broadened to include diverse perspectives, as well as requiring land use planning entities to attain participation at the highest possible level (Salkin 2006). While these promising examples bring hope to the prospect of meaningful participation, much of the participation processes and policy process as a whole remains inaccessible and exclusionary towards low-income BIPOC communities. The following sections will elaborate on the land use and environmental justice policy process, and avenues for participation defined by the literature.

What is the Policy Process like?

While there remains no singular definition for the discipline and field of public policy, it can be broadly conceptualized as the actions that a government does or does not do. Public policy as it is named affects all of the public living within a governmental jurisdiction, as well as those affected socially, economically and politically by said government jurisdiction. The term policy has etymological origins in the concept of policing, in which “law and order” are enforced upon various entities of the public (Wedel et al. 2005). Beyond the simple definitions of the term, it is important to consider the context in which public policy exists and evolves. In the United States, all public policies are traced back to the conception of a country founded on white supremacy, genocide, slavery and racial capitalism (Pulido 2017; Wedel et al. 2005). Therefore, the motivations behind policies, language, purpose and level of participation are all rooted in

such a context. Because of the hierarchical structure of public policy in the U.S., the political power behind decision making is concentrated in the hands of elected officials who are mostly white, male and of the ruling class. For much of the history of the U.S., the People of the Global Majority, women and low-income people have been excluded by design from decision-making processes due to a lack of political power (Salkin 2006).

In the State of Oregon, which originated as a “whites-only” state, this is a particularly salient reality for many of the low-income communities of color that reside in the state (Brooks 2005). Often, if opportunities for participation do arise, they are completely inaccessible to these communities (Minkler et al. 2008, Minkler et al. 2010). Typically, the general public participates via processes such as public forum, calling their representatives or submitting emails to legislators. Critically, as discussed below, participation is multifaceted. According to the Principles of Environmental Justice, meaningful participation occurs only if all forms of participation are satisfied (Delegates to the First National People of Color Environmental Leadership Summit 1991). As we know it both historically and presently, the participation processes available to the general public include only some forms of participation, and even these processes are not available for all (Minkler et al. 2008, Minkler et al. 2010, Salkin 2006). The context, dynamics and politics of the policies to address land-use and environmental justice outcomes will become apparent throughout further discussion. Ultimately, this analysis seeks to understand the varying degree of accessibility amongst different groups to self-determine their environmental outcomes, and the role of policy in shaping this reality. Below, I begin to construct the policy context of Environmental Justice legislation and community participation in the U.S., the State of Oregon and within the metropolitan area of Portland, Oregon.

Environmental Justice & Land Use Policy

Oregon Land Use Goal 1 (1975)

In the 1970s, Governor Tom McCall signed Senate Bill 100 into law in Oregon, requiring all cities to develop local comprehensive plans in support of the Statewide Planning Goals (Department of Land Conservation and Development 1973). Included in the first 14 goals was the Department of Land Conservation and Development's (DLCD) Goal 1, the goal of citizen involvement. This goal was initially developed to include citizens throughout the entirety of the planning process, and included six different components. First, the goal set the intention of creating a citizen involvement committee of a cross-section of affected citizens. Second, communication was to be both effective and done so in a two-way manner between citizens and decision makers. Third, citizens were to be involved in all phases of the planning process, although there is no clear guideline for this component. Fourth, all technical information shared with citizens is to be understandable and available. Fifth, feedback mechanisms must be in place so that citizens can receive responses from policymakers. And lastly, there must be financial support allocated to the citizen involvement program (Oregon's Statewide Planning Goals & Guidelines GOAL 1: CITIZEN INVOLVEMENT). Unfortunately, it is often the case that funding for such programs runs out throughout shifts in the market (Benz 2019). Succeeding the Oregon Land Use Goal 1 by about 20 years, E.O. 12898 was signed into law in 1994 by President Bill Clinton.

EO 12898 (1994)

The purpose of Executive Order 12898 was to focus federal attention on the environmental and human health effects of federal actions on minority and low-income

populations with the goal of achieving environmental protection for all communities. Specifically, it directs federal agencies to identify and address the disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations, and develop a strategy for implementing environmental justice (EPA 2013). Despite its intentions and significant success as a policy effort, E.O. 12898 lacks the legislative authority necessary for adequate environmental protection enforcement amongst frontline communities (Buckhoy 2015; Liang 2018). Following this Federal acknowledgement of Environmental Justice in 2008, Oregon created the Environmental Justice Task Force.

Environmental Justice Task Force (2008)

The Environmental Justice Task Force created in 2008 included a 12 person task force appointed by the Governor with “special interest in and knowledge of environmental justice” (State of Oregon Environmental Justice Task Force 2016). This task force advises the Governor on environmental justice issues; advise natural resource agencies on environmental justice issues, including community concerns and public participation processes; identify, in cooperation with natural resource agencies, minority and low-income communities that may be affected by environmental decisions made by the agencies; meet with traditionally underrepresented communities and make recommendations to the Governor regarding concerns raised by these communities; and define environmental justice issues in the state (State of Oregon Environmental Justice Task Force 2016). Outside of government reports, there have been minimal analyses of the effectiveness of the EJ Task Force since 2008. While the EJ Task Force has attempted a collaborative effort between state entities, natural resource agencies and community members, its goals of citizen engagement are not as fleshed out as Portland’s

Community Involvement Goal. It is also important to consider the Community Involvement Goal within Portland's 2035 Comprehensive Plan to better understand the local policy background in which community members are able to participate, which may differ quite considerably from opportunities provided via the EJ Task Force at the state level.

2035 Comprehensive Plan: City of Portland Community Involvement Goal

In an effort to improve upon the City of Portland Comprehensive Plan, the 2035 plan adopted and edited in 2020 included new goals on community involvement. These seven goals included community involvement as a partnership (2.A), social justice and equity (2.B), value community wisdom and participation (2.C), transparency and accountability (2.D), meaningful participation (2.E), accessible and effective participation (2.F), and strong civic infrastructure (2.G). It also outlines specific policies needed to achieve these goals such as community members as partners in decision making, the need for Environmental Justice, and eliminating burdens ("mitigate/minimize where it can't be eliminated"), amongst numerous others (City of Portland 2020). While the 2035 Comprehensive Plan community involvement goals seem to be more thoroughly constructed than that of Oregon's Land Use Goal 1 signed into law in the 1970s, questions arise of its effectiveness. Critical to the guiding themes of this research is the question of whether policies drafted and signed by state entities can successfully integrate the Principles of EJ. In other words, beyond simply stating the aspirations of meaningful participation amongst frontline communities, what does this entail in action? An emerging strategy in EJ work and improving participation processes is Community-Based Participatory Research. Its tenets and a brief history of several studies is described below.

Community Based Environmental Protection: CBPR

Community-based Participatory Research (CBPR) is a collaborative approach between community members and decision makers. The goal of CBPR is not only to increase and improve participation amongst communities, but also to improve the very conditions of their lives (Minkler et al. 2008, Minkler et al. 2010; Petersen et al. 2006). By engaging in CBPR, community members can inform, conduct and evaluate the data collection that occurs within their communities. In EJ research, community members commonly collect data on air quality via personal air quality sensors. By giving community members sensors, they can more accurately collect data where they live in contrast to randomly placed sensors that may be far away from their residence. Furthermore, upon data collection, community members lived experiences are often also received as testimony to accompany the data. In other cases, community members also participate in decision-making processes themselves and draft policies that improve environmental enforcement (Minkler et al. 2008, Minkler et al. 2010; Petersen et al. 2006). CBPR is a promising participation strategy for low-income communities of color, but it may not constitute meaningful participation for all communities. There are likely unknown opportunities of meaningful participation that have yet to be documented and analyzed within academia. Therefore, it is the hope that beyond this review of the literature of the EJ movement, land use and its connection to EJ work, the policy process and some arenas for public participation to address EJ issues, the firsthand accounts of staff members at local organizations will provide a greater depth to understanding the dynamics of participation in EJ and land use decision making. In order to meaningfully analyze this limited study of participatory experiences amongst low-income BIPOC communities in Portland, a multidimensional theoretical frame of analysis will be utilized by including the vantage points of the Principles of EJ, Critical Race Theory and the

Social Construction and Policy Design Framework. What follows is a description and methodology for employing this approach.

EJ in Oregon

In 2014, the City of Portland updated its Community Involvement goal in its Comprehensive Plan to include a more meaningful effort to include the community in land-use decision-making processes, and specifically addressed communities of color. Oregon's land use planning program has included a similar goal since its inception back in the 1960s, noted as Goal 1: Public participation. 1000 Friends of Oregon, an organization in Portland committed to ensuring access to healthy natural environments for Oregonians, has conducted assessments of Oregon's Goal 1. Their findings suggest that little has changed to ensure greater and more meaningful participation in the decision-making process. Importantly, they have found that Citizen Involvement Programs (CIP) have rarely been updated, metrics for evaluating these programs have not been developed, local governments are seldom willing to incorporate public participation, Oregonians are uninformed about the land use program, Committees for Citizen Involvement are largely comprised of a jurisdiction's planning commission, and Goal 1 is lacking in specificity and the teeth required for meaningful participation (1000 Friends of Oregon 2015). In greater specificity, they determine that present methods for participation are insufficient, such as public hearings, and the funding necessary for adequate participation is generally nonexistent for these efforts. These findings are particularly central to this study as it illuminates the challenge of not only bettering participation for vulnerable and low-income communities of color, but also for the broader Oregonian population. If these barriers exist for the entirety of Oregon, what further barriers may be present for marginalized, and often, most affected communities? Furthermore, these findings suggest policy has been vague and

insufficient in addressing public concerns and input. This begs the question of whether or not it is possible to pass and implement a policy that specifically addresses the unique needs of low-income, communities of color if it cannot even do so for its broader, more privileged residents. If present efforts for this change are in existence, what does this process look like, and what is hindering it? If present policy efforts are insufficient in ensuring meaningful participation for Oregonians as a whole, and specifically low-income, communities of color, what might meaningful legislation look like? This study attempts to understand where policy and implementation may still be lacking, and how community-representing organizations define meaningful participation, current efforts to executing such, and potential solutions for reducing the barriers to meaningful participation.

Theoretical Frameworks

Principles of EJ

Foundational to the Environmental Justice Movement (EJM) that has taken shape and evolved out of the Civil Rights Movement, are the 17 Principles of Environmental Justice (see Table 1 above). In October of 1991, the Principles of Environmental Justice were conceived and adopted by the Delegates to the First National People of Color Environmental Leadership Summit (Delegates to the First National People of Color Environmental Leadership Summit 1991). These principles operate as a significant document for the Environmental Justice Movement as a whole. These principles are international in scope, attentive to the vast cultures and relationships to the land, and rooted in anti-colonialism and anti-oppression. They seek to provide a framework for the movement to address issues of EJ, as well as make possible the self-determination of all people of color. Importantly, these principles emphasize the spiritual value

of land in contrast to that which views the land as a commodity. By adopting and implementing the Principles of EJ, it is believed that all people may be in right relationship with the land (Delegates to the First National People of Color Environmental Leadership Summit 1991). While this document is of considerable importance amongst people involved in the EJ movement, these principles are not policy nor are they embedded in the structure of the U.S. And, only in some contexts do these principles inform policy. The reasons for this will be further explored through the lenses of Critical Race Theory and the Social Construction and Policy Design framework, discussed in the following sections.

Critical Race Theory

Critical Race Theory is a theoretical framework in the social sciences that explores the relationship between society and culture and categorizations of race, power, and legal forces. With Critical Race Theory (CRT) arising out of the downfalls of the Civil Rights Movement (Delgado and Stefancic 1993), scholars explored new avenues for understanding the dynamics of race and racism. Upon realization of the limitations of the acts passed in the 1960s out of the Civil Rights Movement, scholars have identified structural, economic, political and cultural institutions that enhance the ruling class and further embolden a type of caste system. Scholars of CRT have also sought to elucidate the ways in which the law maintains the status quo of racial inequality rather than acting as a balm for oppressed racialized communities. In the EJ realm, Environmental Law only renders an act environmentally “unjust” or “racist” when intent can be proven, and very rarely is intent documented in such a way that racism is clearly displayed (Benz 2019). And, despite the laws such as the Clean Air Act and Clean Water Act, social institutions carry out the work of burdening racialized communities with environmental hazards (Bullard and Lewis 1996; Pulido et al. 2016; Pulido 2017; Richter 2017). Furthermore, despite the passages of

policies to address EJ such as EO12898 or the creation of state environmental quality departments, budgeting can easily move funds away from these initiatives (Benz 2019). Without adequate funding to staff agencies and implement policies, enforcement mechanisms begin to lose their power with the burden of proof largely falling on low-income communities of color. CRT also opens the opportunity to analyze how racism occurs in less visible ways such as through zoning, land use ordinances and siting histories. Critical Race Theory and the Social Construction and Policy Design framework work well together as a multidimensional lens of analysis by complementing themes of institutionalized social othering and the unequal distribution of benefits and risks amongst social groups. I will now explore Social Construction and Policy Design as a frame of analysis.

Social Construction & Policy Design

Social Construction and Policy Design (SCPD) is a policy process framework which argues that target populations are socially constructed by public policymakers in positive and negative terms and receive varying distributions of burdens and benefits as a result of these social constructions (Ingram et al. 2007). The Social Construction and Policy Design framework begs the question of the underlying social processes that result in the unequal distribution of benefits and burdens upon target groups. This framework identifies a policy that distributes benefits and barriers unequally to be considered degenerate. Therefore a policy that sets out to ensure clean air and water for all people that results in the concentration of clean air and water amongst only certain groups of the population, and unhealthy clean air and water amongst other groups would be determined as degenerate. The categorizations of target groups include advantaged, contender, dependent and deviant, and are determined by degrees of political power and level of deservingness (Ingram et al. 2007). As Ingram et al. (2007) explain, “The political

power of a target group refers to the extent of its political resources, such as whether it is large, united, easy to mobilize, wealthy, skilled, well positioned, focused on issues of concern to it, accustomed to voting and contacting public officials, and so on” (Schneider et al. 2014:109). The target groups that are recipients of greater burdens are typically deviants and dependents, while the advantaged and contender groups are typically recipients of social benefits.

As Liang (2017) describes in their examination of degenerative policy and environmental justice amongst Latino communities, policies may influence negative stereotypes against target groups that ultimately lead people to believe that group as less receiving of social services. Another example of this phenomenon is welfare, where recipients of welfare that are commonly Black or Latino are perceived as lazy or undeserving of government aid despite the economic hardships they face because of their race. Liang finds that there is a connection between the social construction of Latinos as deviant based on the “illegal immigrant stereotype” and disproportionate environmental burden placed upon them (Liang 2018).

This study aspires to contribute to the growing body of literature that employs an intersectional and multidimensional mode of analysis by integrating the themes within the Principles of EJ, CRT and SCPD. Furthermore, rather than general public participation dynamics, this study focuses on the particular barriers and dynamics faced by low-income communities of color in Portland. Portland is proportionally the whitest large city in the U.S. (Badger 2015) and environmental burdens are still concentrated amongst communities of color despite their small population (EPA 2018). These effects are also impacting low-income communities across all races, including white communities such as those in mobile homes. Therefore, this study focuses not only on the racial dimension of EJ issues in Portland, but also class.

Research Questions

The research questions for this study include the following: (1) How do low-income Black, Indigenous and people of color understand, engage with, and participate in land-use decision-making processes in Oregon, and what effects might participation have on environmental justice (EJ) outcomes? (2) What barriers exist for low-income, communities of color in this process, and how is successful community participation defined and measured? (3) What policies address engagement and participation in land-use decision-making processes, and how do they incorporate the EJ Principle of Participation? (4) What role do local organizations play in ensuring or improving community participation in decision making? Furthermore, the theoretical analysis conducted in this study aims to address questions of how community characteristics shape or inform EJ outcomes, what institutions and structures play a role in community participation, and how might community partnerships with environmental justice organizations mitigate barriers to participation. A review of the methodology for this research study follows.

Methodology

This study takes a two-pronged approach by including both primary and secondary data to address the research questions. First, the secondary data collected in this study included City of Portland, Federal and Oregon Statewide policy documents. These documents were selected as they specifically address issues of land use, public participation in decision making, and environmental justice. The purpose is to conceptualize the policy sphere in which people participate to provide adequate background context. Importantly, policy documents do not necessarily describe the intricacies of the day-to-day functions of civic processes. In general, these policy documents offer a blueprint of the intended dynamics of public participation, land use and environmental justice in Portland, Oregon and the broader U.S.

The language pertaining to environmental justice, land use, low-income communities of color, and community participation within these documents were coded and analyzed via a lens of the Principles of Environmental Justice, Critical Race Theory and the Social Construction and Policy Design policy process framework. Because this is a document analysis without the perspectives of those that conceived these documents, the language and terminology are interpreted literally. Beyond analyzing these documents to provide background context for the dynamics in which these communities participate, this analysis addressed the benefits or hindrances of such policies for low-income communities of color. This aspect of the document analysis is supported by in-depth interviews with staff members at organizations that work to address environmental justice in Portland, Oregon.

The sample of interview participants at organizations in Portland, Oregon were selected based on an internet search of organizations with the term environmental justice in their mission statement, values or components of their work. Upon recommendation of the Executive Directors

of these organizations, staff members at organizations were selected based on their expertise in community and public participation in decision-making processes pertaining to issues of land use and environmental justice. From this sample, additional participants were recommended by staff at various agencies via snowball sampling (Babbie 2013), and were also contacted to participate in the interviews.

While a more thorough exploration of the dynamics of and barriers to participation in decision making may have included community members themselves, staff members at organizations were selected due to their expertise in both the policy arena as well as their direct work with community members. It is also likely in many cases that staff members of these organizations reside within the very communities that they serve, and therefore share a common experience with community participants, lending them a unique understanding of the processes. Due to limited time and financial constraints, staff members at organizations were selected due to this unique position. With more resources available, future interviews may include both direct community member perspectives as well as those with legislative and decision-making power.

Ultimately, five participants agreed to be interviewed. These five interviews were transcribed and coded for main concepts, patterns, and themes (Babbie 2013). Broad initial themes and concepts were identified prior to the interviews that were drawn from the literature and this study's questions developed from previous literature. Additionally, interview questions were developed to answer specific research questions in this study, and responses that addressed these research questions were coded as such. Some of these themes in this study include advocacy and elevating community voices, capacity building, coalitions and partnerships. Upon initial transcription, the interviews were first organized by the various question responses according to the interview guide (see Appendix 1). In some cases, follow-up questions were

included in relation to the original questions, but these were not replicated across all interviews. Following the initial categorization, patterns were identified within the various interview questions and responses, resulting in the formation of emergent themes. For example, in the initial question inquiring about how organizations address issues of environmental justice, responses fell into categories such as community capacity building, technical support, coalitions and partnerships, advocacy and elevating community voices. Codes for the various themes were then developed following an initial review of each question response. Often, respondents provided responses to questions that explicitly mentioned these concepts, where an interviewee may have shared one directly from the environmental justice and community participation literature such as capacity building. At other times, responses were put into themes based on its similarity in terminology or concept. For example, one of the central themes that emerged from this study was advocacy and elevating community voices. Responses that explicitly included these words, along with similar responses such as “come to the table”, “going out for public comment” or “consulting the community” were coded as advocacy and elevating community voices. This process was repeated for each subsequent question. Working through the questions and responses, themes and codes were identified for each question, as well as broader themes and codes that connected across the various interview questions and research questions. Some of the research questions in this study are also further elucidated via a theoretical and policy analysis. The explanation of this process and its relation to answering the research questions follows.

This analysis is rooted in the theoretical frameworks of Critical Race Theory (Benz 2019, Pulido 2016, Delgado and Stefancic 1993), Social Construction and Policy Design (Buckhoy 2015, Ingram et al. 2007, Liang 2018), and the Principles of Environmental Justice (Delegates to

the First National People of Color Environmental Leadership Summit 1991). First, the Principle of Participation amongst the Principles of Environmental Justice provides a clear structure of what meaningful participation looks like amongst low-income communities of color. Although participants are not asked directly about each step included in the Principle of Participation, their responses will be screened for these components. The Principle of Participation includes five different components of participation. Responses that speak to the participation process will be coded according to its relevance to the various components. Ultimately, of particular interest is whether the experience of low-income BIPOC communities in the participation process is one that fulfills the Principle of Participation. If respondents share that communities participate at each of these levels, the participation process could be said to be meaningful for these communities. In the opposing case, participation could be said to be meaningless or hold little value in achieving desired environmental outcomes.

Furthermore, the policy process lens provided with the Social Construction and Policy Design framework offers an opportunity to identify patterns and themes amongst the responses that align with the concepts of target groups and degenerate policy. Responses that describe communities in line with concepts of deviance and disadvantage may be coded as target groups. And, if respondents describe policies favoring some groups over others, such policies may be described as degenerative. Lastly, Critical Race Theory offers a structural critique of public participation policies in Oregon that aim to address EJ issues amongst communities of color. It also provides a lens for analyzing organizational efforts to address EJ issues as being culturally relevant or not for affected communities.

While the literature describes numerous studies identifying various barriers to public participation in decision making, this study aspires to do so with the multidimensional analysis

of the Principles of EJ, CRT, and the SCF. Most notably, 1000 Friends of Oregon (2015) conducted a study on barriers to public participation in Portland, Oregon yet their analysis focused on the entire population whereas this study focuses specifically on the experiences of frontline communities, namely low-income BIPOC communities in Portland, Oregon. It is well-known that low-income communities of color lack access to participation processes, and it is my hope that the theoretical frameworks used here offer a more in-depth structural analysis of the powers at play. With the historical background on the EJ movement, land use decision-making and EJ in Oregon, and the primary and secondary data collected and analyzed via this multidimensional theoretical approach, this study aims to address not only what barriers low-income communities of colors face in participating, but also how the policy arena and structural forces impact these dynamics.

Results and Discussion

Out of the intended interview sample of fourteen, five interviews were conducted with six staff members (two staff members at one organization) at different organizations in Portland, Oregon. Of the five organizations, one was conducted with a member working for a city initiative, the Portland Clean Energy Fund (<https://portlandcleanenergyfund.org/about>) that has been both conceived and executed by Portland community members, and particularly those from frontline communities. This organization stood in contrast to the others in the sample in that the initiative is executed by the City of Portland, and therefore is influenced by both state and community forces. Some of the grassroots organizations in this sample also organized to pass the ballot measure that created the Portland Clean Energy Fund in 2018 (Portland Clean Energy Fund 2020). Besides this initiative, all other interviews were held with community-based organizations that operate out of the Portland Metropolitan Area and dedicate at least part of their work to resolving issues of environmental justice. While most of the sample was conceived based on prior internet research, one organization was contacted from a suggestion by a previous interviewee.

In many cases, staff members of these organizations also either lived in the communities they served or identified demographically and experientially with those they served. At times, it was difficult for interviewees to separate the personal from the professional, given the nature of environmental justice work. As described in the literature, many environmental justice organizations evolve out of grassroots organizing efforts where members of a community find themselves engaging in work that impacts the very place they call home (Cable and Benson 1993). It was clear that staff members were often invested in the work because of a personal history or connection. As one respondent expressed, “So, the organization from my own

perspective exists because we exist. We are working there and we create those... advocacy strategies to protect our community” (Interview 3). And, similar to the CBPR studies mentioned above (Minkler et al. 2008; Minkler et al. 2010), some staff members spoke of the importance of culture in protecting the environment. One respondent clarified this by explaining some of the background behind their position and their role in engaging the community on environmental concerns, going on to assert that, “as a community, we really care about the environment. It's like people telling me how to protect or care for the Mother Earth when that's part of my culture” (Interview 3). Further along in this analysis, the element of culture in community engagement programs will be explored with greater depth, signifying a vital prerequisite of meaningful participation.

Interviewees came from a variety of backgrounds both professionally and personally, and worked in a range of positions that were all in some way related to community participation, land use and environmental justice. While all interviewees had some experience related to these aspects of environmental justice and policy, it was clear that each of their experiences were rather unique. Some interviewees were new in their positions, with the shortest duration of experience being about a year, while others had been engaging in this field of work for many years, the longest working with their organization for over a decade. This multitude of experiences provided for some particularly insightful findings on the dynamics of community participation in decision-making processes. While there were expectations of a greater deal of diversity in some of the responses, it was illuminating to find that interviewees came to many similar conclusions regarding policy and participation dynamics. Before getting into the specifics, it will be worth exploring the numerous ways that these organizations address environmental justice in their work.

How Do Organizations Address Environmental Justice in Their Work?

Elevating Community Voices

Of the five respondents, all highlighted the importance of elevating community voices and creating more opportunities for community participation to address environmental injustices. At the heart of the work of these organizations is the recognition that despite being a difficult process, community input, particularly from frontline communities, is essential for environmental justice. As a staff member at Organization 3 shared, “we do not go to communities to try to protect communities without consulting the community... without engaging the community, which is really important” (Interview 3). They went on to describe working with different communities such as the Latino community and the Native communities along the Columbia River, highlighting that this is their land and working with them is the only way to properly protect it. All other respondents also mentioned that their work centered on voices that were typically left out of the decision-making process including low-income and BIPOC communities. One respondent shared that,

“I think the term is universal... universal targeting, where you kind of you target specific folks and it kind of... It works to expand to all people. I think that that shows in terms of our work on housing or working on green spaces where we were very intentional about getting equity language throughout the parks and nature bond. So it's like making sure that there's access for people of color, particularly Black and Indigenous folks, and with that, it just... it helps everyone” (Interview 1).

In line with the Principles of EJ and elements of cultural significance emphasized in Critical Race Theory, the necessity of community involvement becomes abundantly clear throughout these interviews.

Collaboration with Local Communities

Beyond simply going to communities to receive feedback on various projects and initiatives, some respondents also spoke of collaborating with communities that have already organized themselves around particular issues. Importantly, staff members at these organizations emphasize that in order for their work to be truly effective, it must be community-led. In response to a question on what is needed to address EJ, one respondent shared an anecdote of a community taking their power back and expressed that,

“You know sometimes it has to happen organic and you have to make room for that, and for somebody who's like, in the world of like we need to do community engagement... I'll never forget what one of my mentors once said... “a good leader knows when to step back to let the people lead the way.” ... As an organization that leads or you know we're supposed to help lead the people, we also have to step back to let the people lead the way, and you try to follow where this is all going” (Interview 4).

As this comment makes clear, EJ organizations in Portland recognize community-driven projects as critical arenas for community participation. Many community members are already determined to participate and create positive change in their neighborhoods. By collaborating with organizations, community members can receive tangible support and resources to bring their ideas to fruition.

Changing the Narrative

Much of the narrative around the environmental movement is white, middle-class, academic dominated. It is this narrative that leaves out low-income BIPOC communities, and often frames them as not caring about the environment or sustainability efforts (Whittaker et al. 2005). The responses of these staff members stands in direct contrast to this framing by illuminating the deep care that these communities have for the environment in which they live. It is not that these communities do not care about living in healthy spaces or that they have made choices that place them in these harmful positions, but rather low-income BIPOC communities have been stripped of the power to self-determine their livelihoods. An interviewee at the fifth organization expands upon this by stating,

“And I think the DLCD... it didn't think a lot about... “How would we want to envision... low-income people and people of color, and the state and tribal folks as having greater agency over the decision making?” and it just didn't... And so I think those oversights or, at worst racist... foundations for our land use planning have really handcuffed the agency from really robust participation processes” (Interview 5)

As I will highlight in a deeper discussion of Oregon and Portland-specific policies, as well as the overall barriers to community participation, there are critical structural forces that have disempowered communities from participating in the decision-making process. While this research is particularly focused on the element of community participation, interviewees expressed a multitude of approaches to addressing issues of environmental justice and these responses are worth a more thorough review.

Coalitions with Other Organizations

Coalitions and collaborative efforts are often crucial to EJ work, particularly when organizations are striving towards a particular policy outcome or fighting against industrial projects that may harm their communities (Cable and Benson 1993). All staff members that were interviewed in this sample highlighted the value of partnerships, recognizing that much of this work cannot be done alone. One respondent stated, “I think we do a lot of our work in partnership and collaboration and lots of coalitions. We tend to find that we're able to get more done” (Interview 1). Another declared,

“Yeah, we're constantly working with other organizations. I mean, this is a job that you... can't do it by yourself. You need, like I said, we work with the community. We go to these areas and communities are sometimes, or most of the time, they're already organized, you know. So that's when we... It becomes good for us to work with different organizations” (Interview 3).

Community organizations and community members themselves engage in a sort of back and forth engagement process in which organizations provide community members with tools, resources, and opportunities to build their capacity, while community members provide personal expertise and people power towards organizing efforts.

Building Community Capacity & Health

Capacity building is a recurring concept in EJ literature, where communities strengthen their advocacy efforts through leadership training, grassroots organizing and acquiring resources to directly address their needs. Staff members referred to components of EJ efforts like community advocacy and organizing that touched more on the policy process, but were also

focused on aspects of addressing these basic human needs of clean and safe environments, as evidenced in the following statement:

“There are specific goals that kind of tie us to environmental justice and it's making sure that there's adequate housing, and that's definitely connected just historically to folks of color, and then making sure that there's adequate transportation, because inherently, transportation is a... it's a human right. Being mobile is a human right. I think we deal with technical things, with making sure that it's a great system that everyone can use and then access to green spaces and parks. And I think that's just a... that goes into having that clean air, places where we can have recreation and clean water, kind of all of those things” (Interview 1).

Another respondent expressed a similar point by stating,

“We're protecting our community at the same time. I mean, we cannot think about protecting the environment without saying we're creating social justice at the other end... So when we are protecting the health and the safe of the river, we're protecting the health on the safe of the communities that live along the river” (Interview 3).

A common theme throughout responses in regards to addressing environmental justice was the critical need to ensure healthy spaces including clean air, clean water, access to green spaces, safe living spaces and infrastructure, equitable transportation and receiving direct financial resources to address their needs. Of great significance, several respondents mentioned the community-led ballot initiative, the Portland Clean Energy Fund (<https://portlandcleanenergyfund.org/about>), a program designed to directly benefit frontline communities most impacted by climate change and present environmental degradation. The program is funded by a tax on corporations, as they are recognized as the major contributors to

both climate change and environmental degradation that have led to the environmental injustices many low-income BIPOC Portlanders face. Being that the program was initiated by community members, it was spoken of with great reverence and with the hope of actually addressing the peoples' needs. Of all the policies mentioned during the interviews such as the Environmental Justice Task Force, Oregon's Land Use Planning Goal 1, and Portland's 2035 Comprehensive Plan Community Involvement Goals, the Portland Clean Energy Fund was the most highly esteemed in its potential to ensure equitable environments for all Portland communities.

Touching on some barriers to participation, most of the organizations identified ensuring access and sharing information as part of their EJ efforts. Whether they are working on the more technical aspects of environmental information or decision-making processes, or they are simply breaking down terminology for community members, information sharing was seen as a critical component to their work. One interviewee shared a personal experience with technical language and tied that to the work they do with their organization stating,

“It was so much for me. When this individual who I felt was very knowledgeable was tryna break down new terminology to me. And she was just like, *‘Trust me. Just go with it. You may not get it now. But by the end of the year, you will’*, and that to me is everything because terminology locks people out... If you can talk the talk, that's really who gets to participate, right. And, I think really it's about using accessible terminology, it's about being able to engage with people” (Interview 4).

It is commonplace for community members to be invited to meetings on land use and environmental projects with no technical expertise on the topic. In a similar vein, community members also generally lack a thorough understanding of the policy and decision-making process on the whole. And, this is where organizations that address EJ issues come in by

educating community members on these various components. Below, I further explore this barrier in greater detail by situating it within a multidimensional theoretical analysis of the structural and cultural components at play.

Dynamics of Participation

As a reminder of the Principle of Participation, one of the 17 Principles of EJ, meaningful participation occurs when community members are able to participate at all levels of the decision-making process including needs assessment, planning, implementation, enforcement and evaluation (Delegates to the First National People of Color Environmental Leadership Summit 1991). Another component of meaningful participation is that communities can self-determine their environmental outcomes. In other words, when people participate in the decision-making process, they are able to influence a decision in a way that meets their needs. Respondents were not explicitly asked if community members were able to participate in each of these five levels, but were rather asked more generally if communities participated at different or all levels of decision making. On occasion, some respondents expressed that community members do have opportunities to participate at each of these levels, although they did not explicitly mention the five listed in the Principle of Participation or whether it was occurring at the state level. For example, a staff member explained that,

“For instance, even developing the guiding principles we... that was developed by the nine person volunteer committee went out for public comment. We got hundreds of comments about, you know, whether it was on track or not, some modifications concerns. And then revise them and then in building the grant material as well. We provided an opportunity for community review of that and now it's released, and as part of the release there's both the application form, but also the scoring criteria so people can see kind of

how their project would be reviewed or scored. So we're trying to create like... transparency throughout the process of how decisions are made, and you know we have like in any public meeting... we have opportunity for public input in the public meetings at the beginning” (Interview 2).

In this instance, the staff member lays out opportunities for participation in a variety of ways, from the beginning of the process to the end. Because the program they were working on implementing was community-led, it is likely that community members crafted the program with the intention of including perspectives at different stages of the planning process. In another instance, a staff member described that in terms of being involved in all parts of the process, “the community will decide what to do” (Interview 3). In both cases, staff members were describing situations in which they were working between themselves as an organization and community members. Concerning the state level of decision making, a staff member at the third organization emphasized the need to get people engaged to call, sign petitions and go to court but expressed numerous barriers in doing so. Importantly, while opportunities to participate may exist at various levels of decision making, many respondents report barriers that deter low-income BIPOC communities in particular. Other respondents also referred to the lack of quality of the participation opportunities where communities were treated as a “checkbox” prior to making a decision. Rather than acquiring input from communities that may influence decisions, communities were often approached when decisions were already 95% made. Oftentimes, especially amongst Black communities in Portland, community members have participated in decision-making processes but were at the receiving end of broken promises by the City of Portland. As I will describe in the following section, themes of distrust and a lack of quality

participation opportunities, amongst numerous barriers characterize much of the dynamics of participation amongst many frontline communities.

Barriers to Participation

Language

Numerous barriers to low-income communities of color participating in the decision-making process were relevant to all levels of participation. One of the most common responses referred to the use of highly technical language as a barrier to engagement in that people do not feel that they can engage. A respondent at the first organization shared,

“The language is very technical, so it intimidates people... it's not like human centered” (Interview 1). Another staff member responded saying, “if you can talk the talk. That's really who gets to participate”, in reference to the high degree of academic language (Interview 4).

Similarly, language barriers were often highlighted, as respondents explained that important documentation and meeting formats were done without adequate translation. Along those lines, a staff member at the third organization expressed many of the community members' perspectives, saying,

“I don't speak the language or I have an accent... I don't know if they're going to understand what I'm going to say. And when you have to speak in front of a panel for... you forget your words, you know, you forget the words from your own language. Can you imagine people forgetting the words in the language... not native to them?” (Interview 3).

This respondent also went on to share that their organization was working with communities that are from certain countries that do not speak common languages such as Spanish, so translation can be even harder to come by. Even if the city government translates documents, meetings or information into commonly spoken languages, those that speak languages outside of those will be further excluded from the process. Without an explicit effort to include these languages for information sharing amongst minority communities, the community engagement practices implemented by state and city entities maintain the status quo, only being accessible to the dominant population. Not only do language barriers prevent communities from being able to understand what is being said, but they also perpetuate the feeling that they are unwelcome at the table. This barrier connects to other aspects of environmental justice work in that low-income communities and communities of color do not often see themselves in the work.

Who's in the Room?

When the only people that community residents see engaging at the decision-making table or advocate for issues in their communities are white, middle-class, and highly educated, many come to the conclusion that they don't belong in those spaces. A staff member at the second organization shared that, "in climate work much of the messaging around climate change has been focused on, you know, white, middle class and upper middle class people as like being, you know, the part of... part of the solution" (Interview 2). Although low-income communities and communities of color are often the most impacted by climate change and environmental degradation, it is unlikely that they will want to participate if they do not see their people there. Similarly, a staff member at the third organization expressed that,

"We don't believe that we belong here... We're disconnected. So you have to work, and work with communities to empower them because a lot of time... they don't feel like they

will be welcome there... These communities have never been invited to do that before. So I mean they go to these places and they're going to encounter way more white people than brown people... I'm just gonna say 'what am I doing here?'" (Interview 3).

Although there are city and statewide efforts to include greater participation of low-income communities and communities of color, multiple respondents shared that because there are so few of these communities in the room, they often feel excluded and tokenized.

Relationship Building

A staff member at another organization connected this reality to the concept of relationship building and highlighted relationship building as one of the most important components of their work. They explained that when people do not know others in the room, they will not feel comfortable saying anything. This gets at two layers of the issue, as not only are people deterred from entering the space to begin with, they also may not feel comfortable participating once they are there. As the staff at the fourth organization highlights,

"I don't care, you can have all the food in the world. You can have the nicest room, you can make it easy to get to. You can give people money, but if you don't have somebody facilitating or multiple people around that welcome you into the space and make you believe you deserve to be there... That's like, I don't know why anybody anywhere would want to participate, even if we brought it to them" (Interview 4).

With public participation being as it is described here, there are questions raised regarding how meaningful these processes really are for low-income communities and BIPOC communities. These engagement processes are a reflection of the citizen involvement policies created and implemented by Oregon and the City of Portland, and as these responses explicate, the very

design of such policies may be exclusionary to the low-income BIPOC communities they declare to serve.

Class & Cultural Differences

Relatedly, in addition to language barriers and a general unwelcoming air, decision-making and participation processes are typically conducted in a way that makes sense to white, upper and middle class academic culture (Jones and Okun 2001). Respondents have reported a lack of different ways to engage communities and lack of acknowledgement of disabilities and different styles of communication and learning within decision-making meetings. One respondent brought up the importance of recognizing that these communities come from different cultural backgrounds, and participation processes ought to be respectful of that. A staff member shared,

“I know this again, from work and training that I had to bring a class informed lens.

People who have access to academia and middle-class culture are more comfortable with the written word. People who come from oral-based traditions, they want to have conversations and relationships built. So a lot of my work is a lot of relationship building.

It’s about meeting people and just getting to know what they’re about” (Interview 4).

This reality of the written word being a primary means of communicating within decision-making processes has also been cited as a tenant of white supremacist culture (Jones and Okun 2001). While those writing policies and practices aimed at increasing community participation may not be intentionally designing in such a way that is explicitly white supremacist, the lack of intentionality behind providing diverse ways of communicating can lead to colorblind policies (Benz 2019).

Distrust in the Process

Another layer to this aspect of meaningful participation is the issue of distrust in the process for frontline communities. All respondents brought the historic landscape of politics and land use in Oregon being a factor in shaping the landscape of decision making and environmental justice in the state today. Oregon's history of being a majority white and "whites-only" state (Semuels 2016) has directly impacted the environmental conditions of those that are Black, Indigenous and People of Color. Staff members were well aware of this history and noted the ways in which communities of color, and particularly Black communities and Native communities, have been displaced from their homes in Portland. One respondent shared,

"I think here in the Portland Metro area, in particular communities of color, particularly Black communities, have a lot of distrust of [redacted] and other entities because of the, you know, the really long and... complicated, but messed up history. Basically of... of how that community has been treated time and time again" (Interview 1).

In some cases, this mistreatment has been embedded into policies such as through zoning, redlining and racially restrictive covenants that reinforced racial segregation. Even after the passage of the 1968 Fair Housing Act, the City of Portland continued to conduct exclusionary and inequitable land use planning practices that have displaced communities of color and low-income communities while also disproportionately bearing the weight of environmental concerns (City of Portland 2019). Some respondents continue to do work with and engage with these displaced communities, and many of these organizations highlight the need for a language of anti displacement in all land use and environmental policies.

Logistical Barriers

Other logistical barriers that prevented communities from being able to attend meetings included a lack of adequate childcare, the time of day of the meeting conflicting with other obligations, the location, and issues of transportation access, which are also barriers cited in much of the EJ literature (Minkler et al. 2010). One respondent spoke of an experience being asked to invite communities to participate on a decision concerning the use of a pesticide, and expressed a few barriers stating,

“We have a chance to talk to congress people in Salem earlier this year and they called me three, four days before we have the potential to do that. And they said we have a week to do that. ‘Can you get some people to go and speak to your local representative and Salem and give a testimonial?’ Because you... And it's like, you have to think about, well, first of all, is going to be a farm worker that needs to work because they can't escape work. And going to Salem and spending the whole day there” (Interview 3).

As this staff member expressed, along with several other respondents, it is common for participation opportunities to be presented to communities with a quick turn-around. In an extreme example, communities only get a few days, but even having only a few weeks to prepare testimony can prove to be a high barrier for engagement. Another aspect to this scenario that occurs often in this field of work is that decision-making opportunities occur during times when community members work. As this staff member shared, many low-income communities of color cannot afford to take off work to testify in front of decision-makers when they need to feed their families. And, this relates to the last issue of funding. While many corporations fund staff to come to the decision-making table, many community members are participating voluntarily. Without adequate funding to pay community members to participate, they simply cannot afford

to take time out of their day to testify and let their voices be heard. One respondent cited funding as the most critical barrier stating,

“You know, we see a pretty consistent and steady request from government entities to, you know, participate in this... you know, development of this decision or development of this program. And so I think they get it but we are strapped for cash to engage and they are strapped for cash too. And so I think there's a really important piece to note here about just how... You know, significant resources have been stripped out of federal funding, out of state funding for this essentially kind of civic participation and... And that's really, you know, hurting the ability of people that are closest to the problem to be able to craft the solutions” (Interview 5).

Another respondent shared similar thoughts that the City of Portland has not figured out how to compensate people for their time yet. While the intention to engage more people is there, an effort conducted without that class-informed lens to properly value people for their time will continue to miss the mark. Although Portland recently developed new citizen involvement goals that included components of social justice, valuing community participation and meaningful participation, without the resources backed behind these initiatives, they will be unable to lead to truly meaningful participation.

Policies and the Principle of Participation

Generally, staff members did not speak highly of policies to address community engagement including the State of Oregon’s Land Use Planning Goal 1 (Citizen Involvement), the City of Portland’s Comprehensive Plan Goals on Citizen Involvement, or the Oregon Environmental Justice Task Force (EJTF). Of the three policies in Oregon, the EJTF, created to protect minority and low-income populations from disproportionate environmental impacts, is

most in line with CBEP policies and practices due to its explicit environmental justice goals. More tangentially, the Oregon Land Use Planning Goal 1 and Portland's Citizen Involvement Goals attempt to create greater opportunities for community participation in decision making without such explicit environmental justice goals. Nearly all interviewees shared that policies passed by state and city officials have not been enough to address community participation and issues of environmental justice. As one staff member shared in response to being asked about their familiarity with policies that address community participation in decision making, they shared, "Yes, I'm aware of them. But... my take is that the tools we have have not been used nearly well enough" (Interview 2). Part of the reasoning behind these assertions is the funding component, where these initiatives passed to address EJ are not provided with adequate resources and funding to effectively implement their goals. Yet, when funding is provided, these initiatives are often the first to lose their resources with the arrival of budget cuts. Numerous respondents brought up the Environmental Justice Task Force and described it as "lacking teeth", meaning the measures for implementation are insufficient. From another perspective, one staff member highlighted that simply creating more committees to voice the needs of the community will not be enough to engage in legal battles with corporations and their lobbyists. While corporations have access to funds to back campaigns and legislators, frontline communities do not have access to that same level of influence. A respondent at the fifth organization summarized the situation by explaining that,

"Oregon is really, really far behind in not just engaging but centering you know, low income, people of color, tribal folks in environmental decision making. And I think the DLCD... You know, in the end, and it's... it's goals, you know, were set up in a time where... The priority was on protecting farm and forest land and ways of life for farmers

and timber owners and it didn't think a lot about, well, how do these goals, you know, really.... Take care of low-income people over time and and how, you know, how would we want to envision low-income people and people of color, and the state and tribal folks as having greater agency over the decision making? And it just didn't. And I think to some extent, you know, it was very exclusive and racist in... and not having that moral holistic view and coming out of, you know, a place that is an exclusive you know, whites-only kind of state. And so I think those oversights or, at worst, you know, racist foundations for our land use planning have really kind of handcuffed, the agency from really robust participation processes” (Interview 5).

This perspective was held across all respondents, most critically emphasizing that the very structure and design of the policies low-income BIPOC Portlanders depend on for community advocacy and participation do not provide meaningful outcomes. Despite this unfortunate reality for low-income and BIPOC communities in Portland, this staff member at the fifth organization highlighted improvements and new leadership at state agencies, and a real effort to reckon with the past and work towards a more robust process of participation. Outside of these efforts, other staff members were excited to share other initiatives and policies happening in Portland that they felt are working to effectively address environmental justice.

Some staff members brought up promising policies that their own organizations are or have been working on, or other policies outside of those analyzed in this study, that were taking place in Portland such as the Portland Clean Energy Fund (<https://portlandcleanenergyfund.org/about>), the Residential Infill Project (<https://www.portland.gov/bps/rip/about-residential-infill-project>), the first mobile-home zoning ordinance (<https://www.opb.org/news/article/portland-mobile-home-park-zoning-rule-change->

city-council/, and committees for regional planning with Metro (<https://www.oregonmetro.gov/regional-leadership/metro-advisory-committees>). A common thread amongst these initiatives is their community influence and opportunities for meaningful participation. Respondents shared anecdotes of community members directly shaping policies, being compensated for their participation efforts, and being a part of processes that are accessible to communities of color, immigrant communities, low-income and disabled communities. One staff member highlighted work being done on a committee outside of their organization in which they shared,

“We helped develop a charter that have policies about like if you want diverse community participation... One, you need to compensate them, and two, you need to make it accessible. Three, you need to make sure that they've been heard, so they don't need to come to the table over and over and over and over again... to make sure that you're listened to the first time” (Interview 4).

Most importantly, these staff members shared that outcomes were directly determined by community members themselves. A staff member at the fifth organization expressed a community-led outcome where,

“You know, we want to start providing some resources, but part of the model that we created was a peer to peer model where people were helping each other fix their homes and we were providing some of the technical expertise and resources that they did not have access to. And out of that came, you know, really robust repairs. But then this desire of like, well, we should be doing more, we should be helping other neighbors. So the program grew and eventually it grew to them saying, well, we need to... we're playing whack a mole here, we need to create some policies that really, you know, give us more

stability in these parks so that you know we can make investments in our homes. And that led to a community led effort to pass the state's first mobile home zoning ordinance" (Interview 5).

When asked in greater detail about the process, this respondent shared that the community members themselves drafted the policy with support of the organization. Despite the slow and challenging process, they referred to this kind of organizing work as "the only kind", emphasizing how essential it is to the efforts of EJ (Interview 5). Finally, this point really drives home the role of local, grassroots organizations in ensuring and improving community participation in decision making.

The Role of Local Organizations

By elevating community voices, translating materials, providing information and education, building community capacity, providing spaces for meetings, food and childcare, these organizations engage frontline communities in the decision-making process and get them excited to do so. Of most significance, organizations in Portland sought out to assist low-income BIPOC communities by uplifting community voices. As one respondent voiced,

"How can we bring our... technical expertise to working in these coalitions, but also at the same time, acknowledging that I think you know, we don't speak for a lot of communities, whether it's cultural or geographies or so on. So, you know, creating power and structures to help other people come to the table and have a voice" (Interview 1).

Importantly, these organizations engage in relationship building that empowers low-income BIPOC Portlanders to fight for their community and advocate for themselves. A respondent at one organization explained some of the dynamics of the work they do stating,

“So a lot of that engagement has to be intentional. A lot of one on one, with a lot more flexibility. I can't just expect people to like, ‘Hey, we're going to have a meeting, you know, we're going to talk about it at the meeting, you should come’... sometimes they're not going to come to the meeting. Sometimes they're not going to be sure they even want to come to the meeting. So a lot of one on one conversation sometimes have to happen, and to make sure that you're getting people's input or that people still support it if you do bring them to the larger meeting... What kind of ground, pre-ground do we need to cover together so that... That meeting's stakes is going to be... worth their time more.

Sometimes it's about just information sharing, emailing, calling people... Like if you just shoot them an email and ask them to comment... but a lot of times people are like, ‘Why should I? What's the value in that?’ And I'll be like, well if you can just tell me I'll capture your comments and I'll bring them back to the table” (Interview 4).

In addition to supporting efforts for advocacy, these organizations often also act as a bridge between community members and necessary resources. With the Portland Clean Energy Fund, a staff member explained in regards to the initiative that, “it's more addressing the investments in communities as we see them and have them now and addressing disparities that we are currently dealing with” (Interview 2). The organizational efforts identified in this study are non-exhaustive, and with a larger sample, it is likely that far more efforts may be realized. Based on these responses, the role of organizations in improving opportunities for community participation are rather extensive, and their efforts are invaluable towards achieving environmental justice.

Still, the weight of removing the barriers to participation cannot be placed solely on the backs of local organizations and community members that lack adequate funding. As this research has further expanded upon the work of local organizations such as 1000 Friends of

Oregon in their research on barriers to community participation, it is clear what needs to be done to ensure equitable access to engagement for all communities in Oregon. Before exploring opportunities for bettering the participation process for low-income BIPOC communities, a theoretical analysis will examine the ways in which community participation policies enacted by Portland and the State of Oregon attempt to effectively address the needs of these communities along with areas of improvement.

Community Participation Processes Through the Lens of the Principles of EJ, Critical Race Theory and the Social Construction and Policy Design Framework

Following the analysis of the interviews conducted with staff members at organizations in Portland, it is important to situate the responses more intentionally within theory. By offering this multi-pronged approach, the hope is that the information shared by those working on the ground can engage with broader structural themes of environmental justice, race and class. Revisiting some of the research questions and aspirations presented earlier, this theoretical analysis aims to address the institutions and structures that play a role in community participation, how community characteristics shape or inform EJ outcomes, and how community partnerships with environmental justice organizations can mitigate barriers to participation. This study focuses primarily on the aspect of community engagement in decision-making processes, yet some of the EJ literature points to concerns with a reliance on state processes for achieving positive environmental outcomes. Within the limited context of staff member perspectives of Portland organizations, the experiences shared may offer a glimpse into the systems and policies that perpetuate inequitable participation amongst low-income BIPOC communities. Beginning with the lens of the Principles of EJ, and particularly the Principle of Participation, these elements will be explored in the following sections.

Principles of EJ

With the emergence of the Environmental Justice Task Force in 2008 came some hope in the potential of improved environmental outcomes for frontline communities in Oregon.

Although the EJTF aspired to address issues of environmental justice by advising agencies and government entities on EJ issues, identifying affected communities, and meeting with affected communities, several respondents asserted that this policy alone is insufficient to address EJ issues in totality (Interview 2, Interview 3). The EJTF is founded on the EPA's definition of "meaningful involvement", stating,

- “1. Potentially affected community residents have an appropriate opportunity to participate in decisions that will affect their environment and/or health;
2. The potentially affected community can influence the agency's decision;
3. The decision-making body will consider the concerns of all participants before making a final decision; and
4. The decision makers seek out and facilitate the involvement of those stakeholders potentially affected by a decision, specifically those communities traditionally underrepresented in decision-making” (EJTF)

In contrast to the Principles of EJ, the EPA's definition of meaningful involvement does not explicitly name the opportunity to participate at all levels of decision making. Where the Principles of EJ assert that, “Environmental Justice demands the right to participate as equal partners at every level of decision making, including needs assessment, planning, implementation, enforcement and evaluation” (Principles of EJ), the EPA's definition of meaningful involvement is vague with regard to the different levels of participation. Although respondents expressed that Oregon's Land Use Planning Goals were created without frontline

communities in mind, Oregon’s Land Use Planning Goal 1: Citizen Involvement does refer to various phases of the planning process where,

“Citizens shall have the opportunity to be involved in the phases of the planning process as set forth and defined in the goals and guidelines for Land Use Planning, including Preparation of Plans and Implementation Measures, Plan Content, Plan Adoption, Minor Changes and Major Revisions in the Plan, and Implementation Measures” (State of Oregon).

Finally, while no participant explicitly referred to the City of Portland’s 2035 Comprehensive Plan Goals, there was an even greater effort to use language more in line with the Principles of EJ, where they express the goal’s intent to, “Expand opportunities for meaningful community engagement in planning and investment processes, from issue identification and project scoping through implementation, monitoring, evaluation, accountability, and enforcement” (City of Portland). While the language within these policies appears to be in line with the Principles of EJ, respondents in this sample expressed contrasting experiences.

Briefly discussed in the previous sections on participation processes, a few respondents shared in regards to Oregon’s Land Use Planning Goals that, “there is like a statewide standard and it's minimal” or that these goals were designed during a time when the needs of low-income BIPOC communities were not a priority (Interview 1, Interview 5). Other interviewees spoke of the EJTF, identifying the policy as ineffective and seldom used to its potential. While the City of Portland 2035 Comprehensive Plan was not explicitly mentioned by respondents, one expressed hope in the state’s renewed dedication to “not only their sort of... reckoning with that past and how it affects the current, but a desire to and really put their money where their mouth is... aggressively accelerate more robust participation centering equity in all that they do” (Interview

5). Importantly, these responses included no direct assertions that the Statewide Planning Goals, the EJTF or the 2035 Comprehensive Plan provided participation opportunities at all levels of decision making outlined in the Principles of EJ. Still, even if these opportunities did exist, all respondents reported numerous barriers to participation, which these policies hardly address. The Statewide Planning Goals assert the need for effective communication, yet do not mention barriers or how to make the process more accessible to marginalized communities. The EJTF highlights the need for transparency and increased access of materials in plain language, but many of the barriers mentioned by respondents are not included in the policy guidelines. Lastly, the 2035 Comprehensive Plan most explicitly and intentionally names several barriers to participation and efforts to address them such as land use literacy, transparency, culturally competent approaches, and accessibility in terms of time, location and language, but still fails to address all of the barriers named by the participants in this study. At this point, I will discuss these barriers below.

Respondents in this study identified a multitude of barriers to low-income BIPOC community participation in the participation processes including logistical barriers such as location, time-of-day, transportation, childcare, language, technical language, and receiving a short-notice for opportunities to participate. While some of these barriers were mentioned by the policies of interest in this study, they did not at all highlight barriers such as the lack of a sense of belonging in decision-making processes amongst low-income BIPOC folks or not feeling welcome. Other barriers mentioned by respondents included the aspect of relationship building, related to the other barriers just highlighted. Also of critical importance is the focus on the written word in decision-making processes, which is inaccessible to those that prefer to or need to communicate by other means. Lastly, the issue of trust came up repeatedly, and has hardly

been of consideration by government entities. Even when policies integrate language that speaks to including communities at all levels of planning and decision making, they will fail to provide opportunities for meaningful participation without a consideration of these barriers.

Critical Race Theory

Critical Race Theory (CRT) provides a framework of analysis that makes it possible to go beyond the surface of the dynamics of participation to elucidate and explore the very roots of these processes. By focusing on components of colorblind policymaking, structural determinism, and the intersections of race, culture and class, this aspect of analysis seeks to explore the why beneath the policies and the experiences of low-income BIPOC communities. A significant position in much of CRT work is the systems analysis that situates issues of race and class within the political, social and economic contexts in which they reside.

Portland, Oregon occupies territory in the State of Oregon, residing on the stolen land of Indigenous peoples that is commonly known as the United States of America. Upon this stolen land, Oregonians settled to create a whites-only state (Semuels 2016) centered on private property and capitalism. And, for the community of Oregonians to have the capacity to create the state that they did, racial capitalism was necessary. Racial capitalism, the idea that race is a critical tenet to the structure of capitalism, meant that European colonizers racialized groups such as Native and Black people in order to dominate them and acquire land (Pulido 2016). Thus, the land use history and environmental practices that both precede and exist within modern day rest upon this very structure. As some respondents shared, the Oregon Land Use Planning Goals were created during a time that prioritized the needs of white property owners (Interview 5). Considering the very foundation upon which they were created and implemented, the effects of this history can and do permeate the processes of community participation of today. In other

words, the structure of racial capitalism in which policies of participation were created, will ultimately lead to the subjugation of racialized groups in the decision-making process by exclusion.

Colorblind policymaking, described in some of the literature explored in previous sections, renders racial inequalities invisible. As long as the policies created fail to reckon with and make explicit the racial and economic exclusionary history in Oregon, they will be colorblind. While some may argue (Glazer 1987) that colorblind policymaking may be more fair and equal, it cannot address the specific necessities of low-income BIPOC communities (Bonilla-Silva & Dietrich 2011). As was explored in the previous discussion of the Principles of EJ, from the perspective of those interviewed for this study, the policies in this study do not incorporate any means of addressing barriers of trust, relationship-building and a sense of belonging amongst low-income BIPOC communities. While they intend to provide opportunities for all communities to participate, they will neglect to do so without an explicit naming of and dedication to addressing these culturally relevant elements of decision making.

The intersections of race, class and culture become evidently clear in responses of barriers to participation that speak to the structure to the engagement itself. As one respondent emphasized earlier, the utilization of the written word can exclude communities in which culturally relevant engagement looks more like oral communication or experiential engagement (Interview 4). While the 2035 Comprehensive Plan in Portland has mentioned this aspect of cultural relevance, it was not a pertinent topic amongst respondents likely due to its recent passage in 2020. Still, even with such a component included in policies of participation, it is unclear whether the entire structure of community participation in Portland will be able to adequately address the needs of low-income BIPOC communities. As long as communities of

color and low-income communities fail to see themselves reflected in the work of land use planning and decision making, engagement processes will remain culturally irrelevant.

Social Construction and Policy Design

Finally, the Social Construction and Policy Design (SCPD) framework attempts to identify elements of social constructions within the very design of policies themselves. This framework executes this by identifying socially-constructed target groups within a particular context that are relevant to a given policy or set of policies (Ingram et al. 2007). In this case, the policies of interest are Oregon Land Use Planning Goal 1, the EJTF, and the City of Portland 2035 Comprehensive Plan Community Involvement Goal. In some cases, analyses may identify socially constructed groups that fit within all four quadrants, including advantaged, contender, disadvantaged and deviant populations. For simplicity of this analysis, the socially constructed groups will fulfill the advantaged and deviant populations. The SCPD framework asserts that policies become degenerative when divergences occur with respect to the benefits and burdens placed upon different target groups (Ingram et al. 2007). Upon closer analysis, the policies within this study could be determined to be degenerative due to unequal benefits and burdens shared by low-income BIPOC communities in land use and EJ decision-making processes.

The target groups in this study include white, middle and upper class communities as advantaged, and low-income BIPOC communities as deviant. White, middle and upper class communities are identified as advantaged because they receive the greatest benefit from the community participation processes described in this study. Within the context of Portland, they receive these benefits due to the positive social constructions policymakers have made about this group. Considering the racial, economic and social history of Oregon (City of Portland 2019), it is evident that white, middle and upper class communities are seen as the most deserving of

positive environmental outcomes and opportunities for community engagement, where one respondent shared, “they go to these places and they’re going to encounter way more white people than brown people” (Interview 3). And, low-income BIPOC communities are deviant in that they receive the greatest burdens from the enactment of these community participation and EJ policies. A long history of racial capitalism, racist zoning and land use planning have designated low-income BIPOC communities as undeserving of positive environmental benefits and opportunities for participation in decision making processes. Being on the receiving end of numerous barriers to participate and self-determine healthy environmental outcomes for their community, these policies fail to explicitly and effectively address the needs of low-income BIPOC communities.

These policies may be denoted as degenerate given the differences in experiences amongst low-income BIPOC communities and white, middle and upper class communities. As respondents share that there are many white and higher income people participating in the decision-making process, they seldom see low-income and BIPOC communities. As one respondent expressed,

“In climate work much of the messaging around climate change has been focused on, you know, white middle class and upper middle class people as like being, you know... part of the solution. And so, I think one of the barriers is really working to make sure that our low income communities and communities of color understand the opportunity for change... We’re having to reframe the narrative of who climate action is for” (Interview 2).

These policies are also relics of a past of racist and exclusionary zoning that resulted in the displacement of low-income and communities of color, as well as segregated neighborhoods

(City of Portland 2019). Many of these segregated neighborhoods disproportionately reside in proximity to environmental hazards, are recipients of inequitable transportation, and lack access to healthy, green spaces. Respondents asserted a need for a language of displacement in policies that aim to address issues of EJ, where one staff member shared that through the Portland Clean Energy Fund, they are “trying to create more investment in parts of Portland that have been under invested in without leading to displacement and gentrification while doing that investment” (Interview 2), yet this language was not found in the policies of focus in this study. Outside of these policies, community-led initiatives and policies remain a beacon of hope in ensuring anti-displacement, effectively addressing the barriers of participation most important to low-income BIPOC communities, and provide opportunities for these communities to self-determine their environmental outcomes.

Conclusion

The goals of this study have been to better understand the dynamics of participation for low-income BIPOC communities in Portland, Oregon, identify barriers to participation, and analyze the initiatives and policies aimed at improving participation processes for their meaningfulness in achieving desired outcomes. To accomplish these goals, a multifaceted approach was taken that included a qualitative analysis of these participation processes via semi-structured interviews with staff members at organizations in Portland. In addition to the interviews, a multi-pronged theoretical analysis of Oregon and Portland policies was conducted using the Principles of EJ, Critical Race Theory and the Social Construction and Policy Design framework. An overview of these findings follows.

The current engagement mechanisms available to low-income BIPOC communities in Portland, Oregon remain entrenched in a racist and exclusionary history of land use planning that prioritized the needs of white property owners. Oregon's Land Use Planning Goal 1 that set out to prioritize community participation was not created with frontline communities in mind. By failing to include low-income BIPOC experiences into the policy design, the very structure of the participation process remains an obstacle to meaningful participation. Typical engagement processes include opportunities to engage via public comment, meetings with various stakeholders, emailing and sending letters. Despite these opportunities, those that are low-income, immigrants or refugees, have disabilities or other marginalized experiences face numerous barriers. These impediments to participation include both technical and social components. From a technical perspective, terminology is often too difficult to comprehend, there are significant language barriers, the time of day is inaccessible, transportation is inaccessible, there is a lack of childcare, and no funding available to compensate those that take

the time out of their days to participate. In addition to these technical aspects, decision-making opportunities are unwelcoming to frontline communities, there is a lack of relationship building within the process, a sense of disempowerment, and immense distrust in the overall process. Not only do these communities face tremendous challenges in simply expressing their voices, it is commonplace for this expression to not lead to an outcome that directly benefits them. As long as communities are unable to engage in a self-determination of their livelihoods and environments, any efforts to engage communities within the decision-making process will fall short of truly meaningful participation.

Staff members at local organizations in Portland, Oregon also explored ideas they had for ideal engagement processes for the communities that they serve. Many respondents suggested major improvements to the participation process by making it more accessible, providing compensation for participants, including a greater diversity of voices, making people feel welcome and an acknowledgement by government entities of the failure to center the needs of low-income communities, BIPOC communities and other historically marginalized communities within Portland, and Oregon as a whole. As one staff member expressed,

“Not only do those folk... those decision makers need to be more representative of communities of color in particular, but then also to, you know, create the resources necessary for communities to then directly redefine how we do everything from transportation to water to climate to toxics to land use” (Interview 5).

While organizations and the communities they work with have seen significant, yet marginal success in efforts to shape their environmental outcomes, many respondents shared perspectives suggesting the need to change many, if not all, components of the land use and environmental planning apparatus. As many environmental advocates and organizers continue to engage their

communities at the state level, there is a recognition that many of the injustices present within the participation process are there by design.

Within the confines of this interview sample, these results have attempted to expand upon the analysis of community participation processes conducted by 1000 Friends of Oregon (2015). Amongst the vantage points of sample respondents and in the context of Portland, because these policies have been designed in such a way that communities lack access to meaningful participation, it is clear that Oregon's Land Use Planning Goal 1, the EJ Task Force, and the City of Portland's 2035 Comprehensive Plan Citizen Involvement Goals do not adequately incorporate the Principle of Participation into the structure. As it is now, low-income BIPOC communities are able to contribute to the needs assessment, some of the planning and some evaluation mechanisms. From the perspectives of the respondents in this study, community members are seldom able to participate in the implementation and enforcement of the policies that affect their living spaces. Although all interviewees identified community participation as one of, if not the most important element to achieving environmental justice, other components were underscored. In response to questions of what is needed to address EJ in Oregon, some staff members also suggested the need for a strong environmental justice movement, greater education amongst communities, and letting communities lead the way.

As highlighted above, while this research was conducted within the particular landscape of Portland, assertions about the dynamics of community engagement amongst low-income BIPOC communities are rather limited. Being such a small metropolitan region in comparison to others across the United States, the capacity for communities to participate in decision-making processes is much higher and holds greater value. In smaller states and communities, it is much easier to connect with and reach representatives compared to those trying to do so in larger

communities. With that being said, the emphasis on the importance of community participation may hold more weight in Portland communities. It is important to recognize both within the literature and within the context of this study that community participation is key to addressing environmental injustices. As a staff member at the first organization responded, “it just seems so important that the people who live in that community are able to define the outcomes and what they want in their community” (Interview 1). This concept is central to not only the Principles of Environmental Justice, but also the Land Back movement’s effort to give Indigenous peoples autonomy over their ancestral lands, as well as the Black Lives Matter movement that is rooted in the effort to ensure safe communities for Black people.

While community participation is one aspect of EJ efforts, it was well worth exploring in Oregon given the explicit laws and policies targeted at ensuring community participation. Upon these findings, it is clear state entities can improve on avenues to fully include and integrate the Principles of Environmental Justice in policies pertaining to participation, especially for low-income BIPOC communities and those at the frontline of environmental harms. As this research focused specifically on the Principle of Participation, a more thorough analysis including all of the Principles of EJ would provide a greater depth to these findings. Additionally, this research would benefit from an exploration of not only the voices of staff members at local organizations, but also community members themselves and those working within state entities. By doing so, a more complete picture of the dynamics of participation amongst frontline communities may come into focus. Lastly, this research was limited to Portland, Oregon which is the whitest large city in the U.S. (Badger 2015). Conducting this study across different states, communities and jurisdictions may more thoroughly bring to light the true shades of participation amongst communities as they engage in decision-making processes regarding environmental justice. Yet,

this research brought to light a few of these shades, providing valuable insight on the ways low-income BIPOC communities participate, the barriers they face, and potential avenues to achieve their desired outcomes.

Appendix I. Interview Protocol

Research Question	Research Focus	Interview Questions
How do low-income Black, Indigenous and people of color understand, engage with, and participate in land-use decision-making processes in Oregon?	Dynamics of Participation	Can you describe the work you do for (organization name)? How long have you been working there? And, how long in your position(s)? What led you to your current role?
What role do local organizations play in ensuring or improving community participation in decision making?	Role of Organizations	How does your organization address issues of environmental justice? Do you partner with other organizations? How so? Is your organization involved with policy?
What policies address engagement and participation in land-use decision-making processes, and how do they incorporate the EJ Principle of Participation?	Effectiveness of Participation & EJ Policies	Are you familiar with any policies that address community participation in (environmental justice) decision making in Oregon?
What role do local organizations play in ensuring or improving community participation in decision making?	Role of Organizations, Community Characteristics	What are the characteristics of the communities that your organization serves?
What role do local organizations play in ensuring or improving community participation in decision making? What barriers exist for low-income, communities of color in this process? And, how is successful community participation defined and measured?	Role of Organizations	How do these communities typically engage in environmental justice decision making? (What do you mean by engagement?) Can you describe the experiences of low-income BIPOC, in particular? What are some barriers for low-income BIPOC communities' participation in decision making?
How is successful community participation defined and	Effectiveness of Community	How does your organization envision community participation in decision-

measured? What role do local organizations play in ensuring or improving community participation in decision making?	Participation for EJ Outcomes, Role of Organizations	making for low-income BIPOC communities? <i>Does your organization play a role in this?</i>
What effects might participation have on environmental justice (EJ) outcomes?	Effectiveness of Community Participation for EJ Outcomes	How important is community participation in addressing issues of environmental justice?
How is successful community participation defined and measured? What effects might participation have on environmental justice (EJ) outcomes?	Effectiveness of Community Participation for EJ Outcomes	What is needed to address environmental injustices in Oregon?
	Additional Info	Anything else you would like to share?

Appendix II. References

- 1000 Friends of Oregon. (2015). *Public Participation in Land Use Planning: Transforming Aspiration into Realization*. https://friends.org/sites/default/files/2019-04/Public%20Participation%20in%20Land%20Use%20Planning%202015_1.pdf
- Angel, B. (1991). *The Toxic Threat to Indian Lands*. Greenaction for Health and Environmental Justice.
- Anguiano, C., Milstein, T., De Larkin, I., Chen, Y.-W., & Sandoval, J. (2012). Connecting Community Voices: Using a Latino/a Critical Race Theory Lens on Environmental Justice Advocacy. *Journal of International and Intercultural Communication*, 5(2), 124–143.
- Arnold, C. A. (2000). *Land Use Regulation and Environmental Justice* (No. 89521826).
- Babbie, E. (2013). *The Practice of Social Research* (13th ed.). Cengage Learning.
- Badger, E. (2015). How the whitest city in America appears through the eyes of its black residents. *Washington Post*.
- Benz, T. A. (2019). Toxic Cities: Neoliberalism and Environmental Racism in Flint and Detroit Michigan. *Critical Sociology*, 45(1), 49–62. <https://doi.org/10.1177/0896920517708339>
- Beretta, I. (2012). Some Highlights on the Concept of Environmental Justice and its Use. *E-Cadernos CES*, 17. <https://doi.org/10.4000/eces.1135>
- Bonilla-Silva, E., & Dietrich, D. (2011). The Sweet Enchantment of Color-Blind Racism in Obamerica. *The Annals of the American Academy of Political and Social Science*, 634, 190–206. <https://www.jstor.org/stable/29779402>
- Brooks, C. A. (2005). Race, politics, and denial: Why Oregon forgot to ratify the Fourteenth Amendment. *Oregon Law Review*.
- Buckhoy, N. (2015). Environmental Justice for Whom?: A Social Construction Framework Analysis of Executive Order 12898. *Environmental Justice*, 8(5), 157–164. <https://doi.org/10.1089/env.2015.0014>
- Bullard, R. D., & Johnson, G. S. (2000). Environmentalism and Public Policy: Environmental Justice: Grassroots Activism and Its Impact on Public Policy Decision Making. *Journal of Social Issues*, 56(3), 555–578. <https://doi.org/https://doi.org/10.1111/0022-4537.00184>
- Bullard, R. D., & Lewis, J. (1996). *Environmental Justice & Communities of Color*. Sierra Club Books.

- Cable, S., & Benson, M. (1993). Acting Locally: Environmental Injustice and the Emergence of Grass-Roots Environmental Organizations. *Social Problems*, 40(4), 464–477. JSTOR. <https://doi.org/10.2307/3096862>
- 2035 Comprehensive Plan, City of Portland, (2020) (testimony of City of Portland).
- City of Portland. (2019). *Historical Context of Racist Planning*. City of Portland. <https://www.portland.gov/bps/history-racist-planning-portland>
- Clark, L. P., Millet, D. B., & Marshall, J. D. (2014). National Patterns in Environmental Injustice and Inequality: Outdoor NO₂ Air Pollution in the United States. *PLOS ONE*, 9(4), e94431. <https://doi.org/10.1371/journal.pone.0094431>
- Day, R. (2010). Environmental Justice and Older Age: Consideration of a Qualitative Neighbourhood-based Study: *Environment and Planning A*. <https://doi.org/10.1068/a43109>
- Delegates to the First National People of Color Environmental Leadership Summit. (1991). *The Principles of Environmental Justice (EJ)*. <https://www.nrdc.org/sites/default/files/ej-principles.pdf>
- Delgado, R., & Stefancic, J. (1993). Critical Race Theory: An Annotated Bibliography. *Virginia Law Review*, 79(2), 461–516. JSTOR. <https://doi.org/10.2307/1073418>
- Department of Land Conservation and Development. (2020). *Department of Land Conservation and Development : History of Land Use Planning : Oregon Planning : State of Oregon*. <https://www.oregon.gov/lcd/OP/Pages/History.aspx>
- Energy Justice Network. (n.d.). *Environmental Justice / Environmental Racism*. Environmental Justice / Environmental Racism. Retrieved October 2, 2020, from <http://www.ejnet.org/ej/>
- EPA. (2018). *EJSCREEN: Environmental Justice Screening and Mapping Tool*. United States Environmental Protection Agency.
- Feagin, J. (2013). *Systemic Racism: A Theory of Oppression*. Routledge.
- Glazer, N. (1987). *Affirmative Discrimination: Ethnic Inequality and Public Policy*. Harvard University Press.
- Greenberg, J. H., & Greenberg, G. (2013). Native American Narratives as Ecoethical Discourse in Land-Use Consultations. *Wicazo Sa Review*, 28(2), 30–59. JSTOR. <https://doi.org/10.5749/wicazosareview.28.2.0030>
- Grineski, S. E., Collins, T. W., Ford, P., Fitzgerald, R., Aldouri, R., Velázquez-Angulo, G., de Lourdes Romo Aguilar, M., & Lu, D. (2012). Climate change and environmental

- injustice in a bi-national context. *Applied Geography*, 33, 25–35.
<https://doi.org/10.1016/j.apgeog.2011.05.013>
- Ingram, H., Schneider, A. L., & DeLeon, P. (2007). *Social Construction and Policy Design* (pp. 93–126). Westview Press.
- Jampel, C. (2018). Intersections of disability justice, racial justice and environmental justice. *Environmental Sociology*, 4(1), 122–135.
<https://doi.org/10.1080/23251042.2018.1424497>
- Jones, K., & Okun, T. (2001). *The Characteristics of White Supremacy Culture*. Dismantling Racism: A Workbook for Social Change Groups.
<https://www.showingupforracialjustice.org/white-supremacy-culture-characteristics.html>
- Keating, M. H. (2002). *Air of Injustice: African Americans & Power Plant Pollution*. Clean Air Task Force.
- Lakota People's Law Project. (2020). #LandBack is Climate Justice.
<https://lakotalaw.org/news/2020-08-14/land-back-climate-justice>
- Liang, J. (2018). Latinos and Environmental Justice: Examining the Link between Degenerative Policy, Political Representation, and Environmental Policy Implementation. *Policy Studies Journal*, 46(1), 60–89. <https://doi.org/10.1111/psj.12240>
- Maantay, J. (2001). Zoning, equity, and public health. *American Journal of Public Health; Washington*, 91(7), 1033–1041.
<https://search.proquest.com/docview/215107208/abstract/D71239FB954D42FEPQ/1>
- Macartney, S., Bishaw, A., & Fontenot, K. (2013). *Poverty Rates for Selected Detailed Race and Hispanic Groups by State and Place: 2007–2011*. U.S. Census Bureau.
<https://www2.census.gov/library/publications/2013/acs/acsbr11-17.pdf>
- Melosi, M. V. (2000). Environmental Justice, Political Agenda Setting, and the Myths of History. *Journal of Policy History*, 12(1), 43–71. <https://doi.org/10.1353/jph.2000.0008>
- Minkler, M., Garcia, A. P., Williams, J., LoPresti, T., & Lilly, J. (2010). Sí Se Puede: Using Participatory Research to Promote Environmental Justice in a Latino Community in San Diego, California. *Journal of Urban Health*, 87(5), 796–812.
<https://doi.org/10.1007/s11524-010-9490-0>
- Minkler, M., Vásquez, V. B., Tajik, M., & Petersen, D. (2008). Promoting Environmental Justice Through Community-Based Participatory Research: The Role of Community and Partnership Capacity. *Health Education & Behavior*, 35(1), 119–137.
<https://doi.org/10.1177/1090198106287692>

- Miranda, M. L., Edwards, S. E., Keating, M. H., & Paul, C. J. (2011). Making the Environmental Justice Grade: The Relative Burden of Air Pollution Exposure in the United States. *International Journal of Environmental Research and Public Health*, 8(6), 1755–1771. <https://doi.org/10.3390/ijerph8061755>
- National Academy of Public Administration. (2003). *ADDRESSING COMMUNITY CONCERNS: HOW ENVIRONMENTAL JUSTICE RELATES TO LAND USE PLANNING AND ZONING*. <https://www.epa.gov/sites/production/files/2015-02/documents/napa-land-use-zoning-63003.pdf>
- Oregon's Statewide Planning Goals & Guidelines GOAL 1: CITIZEN INVOLVEMENT, OAR 660-015-0000(1) (1975).
- Pellow, D. N. (2016). TOWARD A CRITICAL ENVIRONMENTAL JUSTICE STUDIES Black Lives Matter as an Environmental Justice Challenge. *Du Bois Review*.
- Petersen, D., Minkler, M., Vásquez, V. B., & Baden, A. C. (2006). Community-Based Participatory Research as a Tool for Policy Change: A Case Study of the Southern California Environmental Justice Collaborative. *Review of Policy Research*, 23(2), 339–353.
- Portland Clean Energy Fund Coalition. (2020). *Portland Clean Energy Fund*. <https://portlandcleanenergyfund.org/about>
- Pulido, L. (2017). Geographies of race and ethnicity II: Environmental racism, racial capitalism and state-sanctioned violence. *Progress in Human Geography*, 41(4), 524–533. <https://doi.org/10.1177/0309132516646495>
- Pulido, L., Kohl, E., & Cotton, N.-M. (2016). State Regulation and Environmental Justice: The Need for Strategy Reassessment. *Capitalism Nature Socialism*, 27(2), 12–31. <https://doi.org/10.1080/10455752.2016.1146782>
- Richter, L. (2017). Constructing insignificance: critical race perspectives on institutional failure in environmental justice communities. *Environmental Sociology*, 4(1). <https://www-tandfonline-com.ezproxy.proxy.library.oregonstate.edu/doi/abs/10.1080/23251042.2017.1410988>
- Schneider, A. L., Ingram, H., & DeLeon, P. (2014). Democratic Policy Design: Social Construction of Target Populations. In *Theories of the Policy Process*. Avalon Publishing.
- Salkin, P. E. (2006). Intersection Between Environmental Justice and Land Use Planning. *Planning & Environmental Law; Chicago*, 58(5), 3–9. <http://search.proquest.com/docview/233312615/abstract/494D2F70A1674E8FPQ/1>

- Samuels, A. (2016, July 22). *The Racist History of Portland, the Whitest City in America*. The Atlantic. <https://www.theatlantic.com/business/archive/2016/07/racist-history-portland/492035/>
- Shultz, J. M., Sands, D. E., Kossin, J. P., & Galea, S. (2019). Double Environmental Injustice — Climate Change, Hurricane Dorian, and the Bahamas. *New England Journal of Medicine*. <https://doi.org/10.1056/NEJMp1912965>
- Sikor, T., Auld, G., Bebbington, A. J., Benjaminsen, T. A., Gentry, B. S., Hunsberger, C., Izac, A.-M., Margulis, M. E., Plieninger, T., Schroeder, H., & Upton, C. (2013). Global land governance: from territory to flow? *Current Opinion in Environmental Sustainability*, 5(5), 522–527. <https://doi.org/10.1016/j.cosust.2013.06.006>
- State of Oregon Environmental Justice Task Force. (2016). *STATE OF OREGON ENVIRONMENTAL JUSTICE TASK FORCE Environmental Justice: Best Practices for Oregon's Natural Resource Agencies*. https://www.oregon.gov/gov/policy/environment/environmental_justice/Documents/2016%20Oregon%20EJTF%20Handbook%20Final.pdf
- State of Oregon Environmental Justice Task Force. (2020). *State of Oregon: Environmental Justice Task Force - Environmental Justice Task Force*. https://www.oregon.gov/gov/policy/environment/environmental_justice/Pages/default.aspx
- Taylor, D. (2014). *Toxic Communities: Environmental Racism, Industrial Pollution, and Residential Mobility*. New York University Press. <http://ebookcentral.proquest.com/lib/osu/detail.action?docID=1685764>
- Taylor, D. E. (2000). The Rise of the Environmental Justice Paradigm. *American Behavioral Scientist*, 43(4), 508–580.
- US EPA, O. (2013, February 22). *Summary of Executive Order 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* [Overviews and Factsheets]. US EPA. <https://www.epa.gov/laws-regulations/summary-executive-order-12898-federal-actions-address-environmental-justice>
- U.S. General Accounting Office. (1983). *Siting of Hazardous Waste Landfills And Their Correlation With Racial And Economic Status Of Surrounding Communities*. U.S. General Accounting Office.
- VonVille, H. (2020). *Environmental Data: Superfund, Brownfields, & Other Environmental Clean-up Sites*. <https://hsls.libguides.com/Environmental-Data/Superfund-Brownfields>
- Wedel, J. R., Shore, C., Feldman, G., & Lathrop, S. (2005). *Toward an Anthropology of Public Policy*. <https://journals-sagepub-com.ezproxy.proxy.library.oregonstate.edu/doi/abs/10.1177/0002716205276734>

- Whittaker, M., Segura, G. M., & Bowler, S. (2005). Racial/Ethnic Group Attitudes Toward Environmental Protection in California: Is “Environmentalism” Still a White Phenomenon? *Political Research Quarterly*, 58(3), 435–447. <https://doi.org/10.1177/106591290505800306>
- Wilson, S., Hutson, M., & Mujahid, M. (2008). How Planning and Zoning Contribute to Inequitable Development, Neighborhood Health, and Environmental Injustice. *Environmental Justice*, 1(4), 211–216. <https://doi.org/10.1089/env.2008.0506>

Chapter 2: NRT Project

How Is Risk Distributed?: Assessing Socio-economic Vulnerability on the Oregon Coast

By: Jasmine King

Interdisciplinary Chapter

Submitted to

Oregon State University

This chapter was completed

in partial fulfillment of

The OSU-NRT program

in Risk and Uncertainty quantification

in marine science and policy

Presented November 23, 2020

Commencement June 13, 2020

Table of Contents

Chapter 2: NRT Project	88
<i>Land Acknowledgement</i>	91
Introduction	92
Motivation	95
Approach	96
Literature Review	98
<i>How Does Policy and Land Use Shape Vulnerability?</i>	98
<i>What is Socio-economic Vulnerability?</i>	99
Research Questions	102
Methods	102
Study Sites	102
Methodology	104
<i>How Policy & Land Use Shape the Natural Landscape</i>	104
<i>Characterizing Socio-economic Vulnerability on the Oregon Coast</i>	105
<i>Whole-system Vulnerability: How Socio-economic and Physical Vulnerability Interact</i>	112
Results	113
Policy & Land Use (Table S1)	113
<i>Policies & Practices on the Oregon Coast: How and why is policy relevant in shaping the natural landscape and the human communities that reside in it? (Table 2)</i>	113
<i>Alsea Land-Use History (Table 2)</i>	118
<i>Coquille Land-Use History (Table 2)</i>	119
<i>Nehalem Land-Use History (Table 2)</i>	120
<i>Evolution of Environmental and Land-Use Oregon Policy Priorities Over Time</i>	121
Priorities of Oregon Environmental, Land Use, and Coastal Policies	122
Changes in Policy Priorities Over Time	122
Effects of Priorities on Community Livelihoods	123
Incorporating Vulnerability into Environmental, Land Use and Coastal Policy	123
<i>Socio-economic Vulnerability</i>	124
<i>Whole-system Vulnerability: The Interaction Between Socio-economic and Physical Systems</i>	130
Impacts of the Social System on Physical Vulnerability: Natural and Human-influenced Sediment Supply on Salt Marsh Morphology	131

	90
<i>Impacts of the Physical System on Socio-economic Vulnerability</i>	136
Conclusion	139
<i>Socio-hydrogeomorphological Vulnerability of the Oregon Coast</i>	139
<i>Limitations & Future Directions</i>	141
Appendix I. References	144
Appendix II. Tables	150
<i>Table 1. List of and descriptions for U.S. Census Bureau ACS variables used for the social vulnerability analysis (U.S. Census Bureau 2019).</i>	150
<i>Table S1. Decadal Land Use & Policy History of Statewide, Federal and Local Oregon coastal, forest and environmental management.</i>	152
Appendix III. Figures	192

Land Acknowledgement

Our research predominantly took place at Oregon State University in Corvallis, OR, which is located within the traditional homelands of the Mary's River or Ampinefu Band of Kalapuya. Following the Willamette Valley Treaty of 1855 (Kalapuya etc. Treaty), Kalapuya people were forcibly removed to reservations in Western Oregon. Today, living descendants of these people are a part of the Confederated Tribes of Grand Ronde Community of Oregon (<https://www.grandronde.org>) and the Confederated Tribes of the Siletz Indians (<https://ctsi.nsn.us>).

Our research focuses on the Nehalem, Alsea, and Coquille Rivers and their estuaries.

Nehalem Bay and its watershed are located within the traditional homelands of the Nekalim (Nehalem) division of the Tillamook Tribe. In 1856, the Tillamook people were forcibly removed to the Siletz Reservation in Lincoln County. Today, the descendants of the Nekelim people are a part of the Confederated Tribes of Grand Ronde Community of Oregon (<https://www.grandronde.org>) and the Confederated Tribes of the Siletz Indians (<https://ctsi.nsn.us>). Some Nehalem are part of the unrecognized Clatsop Nehalem Confederated Tribes (<http://clatsop-nehalem.com/>).

Alsea Bay and its watershed are located within the traditional homelands of the Älsé (Alsea). As a result of disease and forcible displacement, the decimated Älsé took refuge with the Siletz Tribe by 1910. Today, living descendants of these people are a part of the Confederated Tribes of the Siletz Indians (<https://ctsi.nsn.us>).

The Coquille River flows through the traditional homelands of the Cow Creek Band of Umpqua Tribe of Indians. As a result of the Treaty of 1854, the Cow Creek Band of Umpqua Tribe of Indians became a landless tribe. Today, the Cow Creek Band of Umpqua Tribe of Indians is one of the nine federally recognized Indian Tribal Governments in the State of Oregon (<https://www.cowcreek-nsn.gov/>).

The Coquille River Estuary is located within the traditional homelands of the Miluk Coos. Following the Treaty of 1855, Coos people were forcibly removed to reservations in Western Oregon. Today, living descendants of these people are a part of the Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians (<https://ctclusi.org/>).

Introduction

The landscape of the Oregon coast and Oregon Coast Range is continually evolving throughout changes in global climate, environmental management, land-use practices, and human development over time. On the Oregon coast, these dynamics are reflected in estuaries (Thorne et al. 2018) and coastal watersheds (Wu et al. 2012), as well as in the variability of ecosystem services available for coastal human communities. Estuaries are important for a number of reasons including land stability, food sources, flood protection and carbon sequestration, which is becoming increasingly necessary with impending impacts of climate change (Thorne et al. 2018). Beyond the water source that the Oregon Coast Range provides through the coastal watersheds, it is also home to a flourishing forested region. Oregon in particular, has depended heavily on the Oregon Coast Range for timber harvest, fishing, agriculture and development, which is important not only socially, but also economically and politically (Boisjolie et al. 2017).

This chapter broadly considers how public policy aids in both understanding and addressing how we characterize vulnerability to environmental harm in Oregon. Because communities depend on these ecosystem goods and services, any change in them (through natural or anthropogenic drivers) puts at risk the sustainability of the community. In particular, public policy plays a role both as a driver of change and as a potential way to support communities. Thus, it is important to understand how we characterize vulnerability in Oregon. To do so, here I explore the following questions: *How do social and natural sources of sediment production change over time? How can vulnerability be defined in watersheds, estuaries, and Oregon coastal communities? And, how do the vulnerabilities in these individual systems sum to landscape-wide vulnerability?*

In this chapter, I emphasize the characterization of socio-economic vulnerability necessary for holistic environmental management, hazard adaptation and mitigation. Additionally, I focus on the relevance of policy and land use in shaping the natural landscape and the human communities that reside in it. Finally, conceptualizing the ways in which socio-economic and physical vulnerability interact with the policy and management landscape is a central goal to this chapter. Therefore, this work seeks to highlight the ways that human and ecological communities engage in a cyclical pattern of sustainable and unsustainable management, in which states of being can be categorized as either “vulnerable” or “resilient”. To do so, a vulnerability assessment is conducted on coastal communities in the Alsea, Coquille and Nehalem sites.

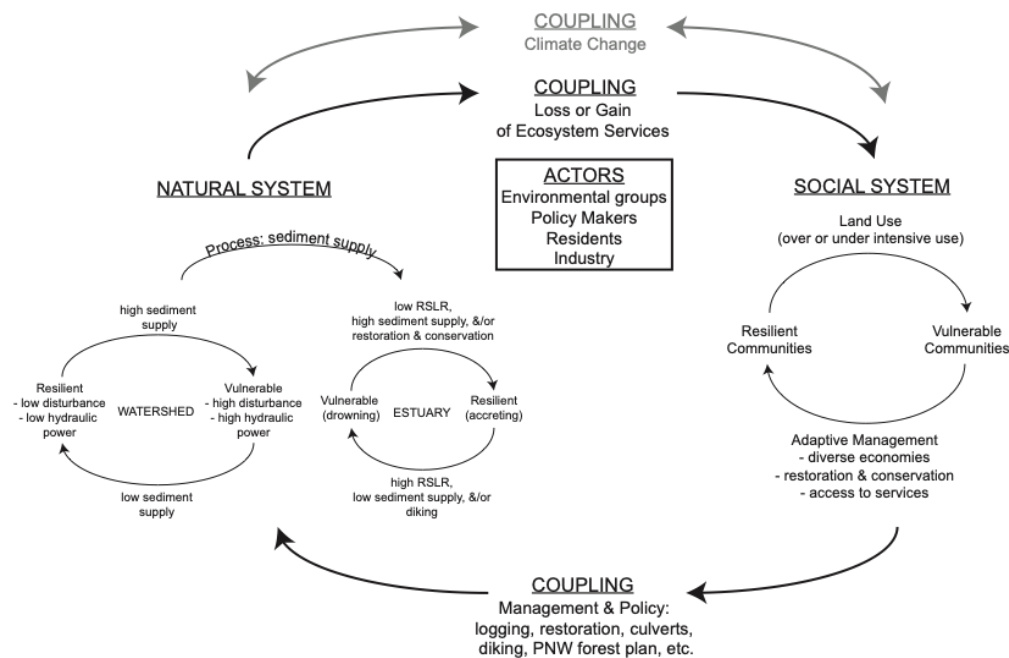


Figure 1. Feedbacks between the social and hydrogeomorphic systems.

Vulnerability assessments and/or indices provide an opportunity to determine a range of indicators that either drive vulnerability or create a buffer against it in the case of natural hazards. A community’s vulnerability to environmental hazards, and in this case flooding, can be

assessed and measured by utilizing a framework of exposure, sensitivity, and adaptive capacity (Ekstrom et al. 2015; Krishnan et al. 2019; Yin et al. 2012). Understanding the relationship between physical and socio-economic vulnerability is of considerable significance (see Figure 1 above). When socio-economic and physical vulnerability connect with a backdrop of land-use policy, it may become clear that environmental management has altered both human and ecological resilience amongst the landscape. It is expected that an increase in environmental and ecological legislation acts as a buffer against physical vulnerability, alongside socio-economic factors. Conversely, a time in which environmental legislation is sparse and land use is seldom regulated, it is expected that physical vulnerability will be high. How this relates to socio-economic vulnerability is important, yet our comprehension of these system interactions could be greatly improved. Therefore, characterizing vulnerability by using the exposure, sensitivity and adaptive capacity framework will aid in conceptualizing the relationships between physical and social vulnerability.

To elucidate these relationships, this research will be conducted through the lens of the coupled natural-human systems framework, which seeks to further current understandings of the dynamics of both human and natural systems, and how these systems might interact. Analysis of land-use practices, management, and policy changes throughout the last century along with analysis of geomorphic changes in coastal streams and estuaries can highlight the interconnectedness of vulnerability within natural and human systems. Oregon coastal and forest policies have significantly reforested and improved the physical landscape (Boisjolie et al. 2017), but identification of whole system vulnerability would best inform the policy and decision-making process. By illuminating the specific interactions between systems, along with further

developments in the assessment of individual system vulnerabilities, whole system vulnerability can be characterized.

Vulnerability assessments can be useful to bettering our understanding of who is most affected by what. In my Masters Essay, I seek to identify and understand why there are various communities in urban Oregon, such as low-income Black, Indigenous and People of Color communities, that have a greater susceptibility to environmental hazards such as poor air quality and poor water quality. Being able to characterize communities based on their vulnerability to environmental hazards is of great significance to environmental justice work, which claims that communities with a higher degree of socio-economic vulnerability, or a higher sensitivity and decreased adaptive capacity, are at a greater risk to environmental harms. For example, communities that are impoverished, are economically dependent on a particular industry, and lack the community infrastructure for mitigating hazards, are more vulnerable to poor air and water quality because they lack the capacity to move away from or lessen the hazard. A holistic characterization of socio-economic and physical vulnerability will be of great significance for environmental justice work, in an effort to improve both community and environmental resilience.

Motivation

Oregon coastal communities rely on ecosystem services provided by both coastal streams and salt marshes. This reliance increases both the vulnerability of coastal communities as climate and land-use change threaten the natural system, and the vulnerability of natural systems – especially salt marshes – through impactful land-use practices (see Figure 1 above). Indeed, the Oregon economy is intrinsically linked to the natural resources of the area. About half of the land in Oregon is forested, which has established Oregon as a leader in the logging and timber industry

that presently employs over 60,000 people (OFRI 2020). Historically, Oregon's timberland has been integral to war efforts, housing, schools and other settlements, and agriculture has played a major role in Oregon's local economy that has led to diking of wetland areas (Wright et al. 2006). Understanding both the hydrogeologic and social drivers of salt marsh morphology is critical to predicting the vulnerability of these systems under future scenarios of land-use and climate change.

Human impacts upstream likely influence salt marsh morphodynamics, as well (see Figure 1 above). Given the importance of fluvially supplied sediment, human land-use changes that have influenced sediment erosion and fluvial transport (log drives, splash damming, dams) likely have had a significant impact on salt marsh growth, as others have noted (e.g., Kirwan et al. 2011). Activities that destabilize the landscape, including logging and road construction, result in greater erosion and runoff, leading to increased sediment loads (Beschta 1978; Brown & Krygier 1971; Madej 2001, Miller 2010, Wright et al. 2006). Forest fire, both natural and as a result of human activities (increased fire source, shrubs, gas and electric machinery, and forest fuels), also leads to increased sediment erosion (Wondzell and King 2003). Additionally, human development and urban growth have undoubtedly influenced the landscape within the Oregon Coast Range as human communities have built housing, sawmills, agricultural sites, and docks along the water (Hennessey 2005, Wright et al. 2006).

Approach

The Nehalem, Alsea, and Coquille watersheds were selected as study locations to determine the relative importance of different drivers of socio-ecological vulnerability, as these systems span the Oregon coast and exhibit key differences in estuarine and watershed morphology, and land-use history. To connect changes with estuarine and watershed morphology with human land use practices, a sample of Oregon statewide forest and coastal policies, U.S. federal

environmental policies, and local policies were identified and characterized chronologically. Additionally, histories of land-use practices such as logging, splash damming, and diking have been characterized alongside policy histories to provide an in-depth picture of how land-use practices have changed over the last century. To describe the effects of both human and natural system changes on coastal communities, a vulnerability index is constructed using American Community Survey data for Census Tracts situated within the Alsea, Nehalem, and Coquille systems. Vulnerability of each system will be assessed by characterizing the physical vulnerability within the watersheds and estuaries, and the socio-economic vulnerability within the coastal communities of each system.

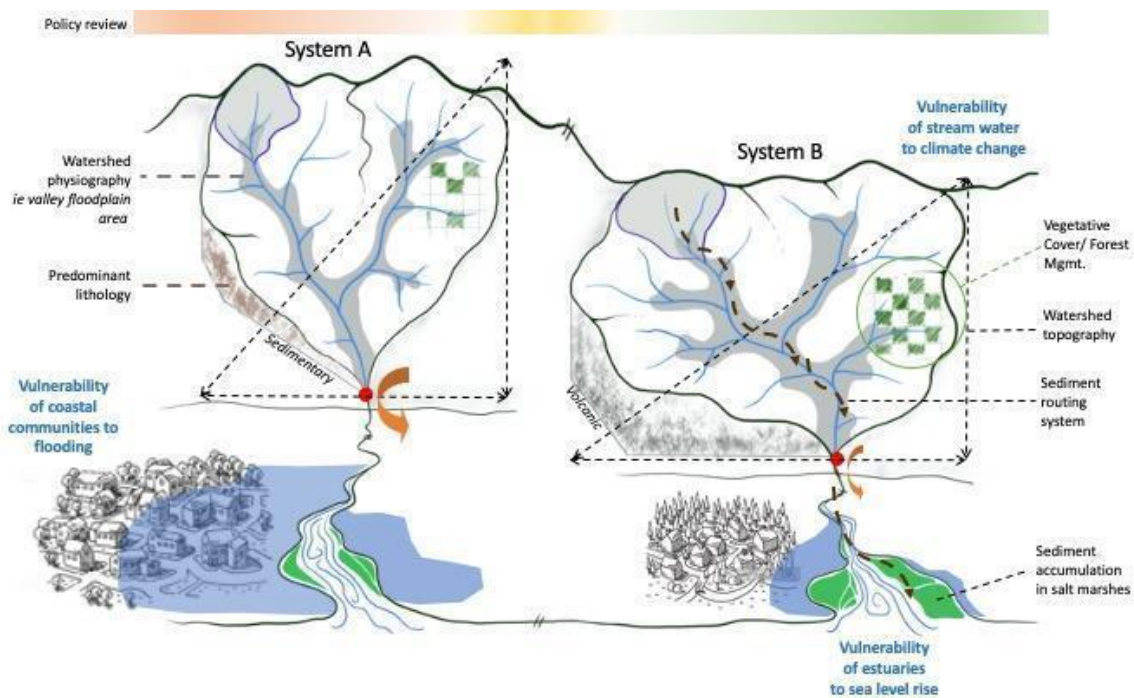


Figure 2. Conceptual diagram.

Literature Review

How Does Policy and Land Use Shape Vulnerability?

Public policy is that which executes the very fabric and function of U.S. society. In the field of public policy, it is often referred to as the actions that governments do and don't do. Policies are put in place to distribute resources, manage land, and implement various measures to regulate people and society. Depending on the way these policies are interpreted, this management of resources, land and people can either uphold or undermine the needs of the people. Policies are also informed by biases which can result in privileging some over others by affording varying amounts of resources and opportunities amongst different communities (Wedel et al. 2005). And critically, policy exists as an extension of the dominant culture. In terms of land management, policies in the U.S. enacted by European settlers were rather distinct from the Native people and original inhabitants of this land. The dominant culture of today, predicated by that of settlers, perceives land as a commodity (Mrozowski 1999). In contrast, many Native communities have viewed the land as a relative (Brady 1999). Recognizing these dispositions can help us better understand how policies play a role in community vulnerability, though the primary focus of this analysis will be the progression of policies throughout the period of European settlement to present day. The concepts in public policy that have been briefly explored here will be useful in further discussion of the relationship between policy and vulnerability.

In addition to the policy landscape of the Oregon Coast Range, the land use history is equally worth exploring as it relates to vulnerability on the Oregon coast. Land use is a broad concept that refers to the relationship between people and their environment. And, the management of this relationship can be referred to as land use policy. Because human

communities rely on the land for survival, land use practices and accompanying policies affect all aspects of human lives and non-human lives (Burby et al. 1999). As an illustration, a land use policy of interest is zoning, an act that designates what a portion of land may be used for or sets limits on how it may be used. In 1963, the Oregon State legislature created the Exclusive Farm Use (EFU) zone that designates what uses are allowed in that zone (Table 1). Because only certain uses are permitted in the EFU zone, this portion of land can no longer be used for other purposes such as residential housing. It also means that that portion of land is used for farm uses only, and will no longer be conserved as natural area. Each of these outcomes have impacts on human and non-human communities by limiting resources available for humans and the flora and fauna of the ecosystem. This example highlights one of the many ways in which land use plays a role in vulnerability. Thus, in addition to a broad policy review of environmental, coastal, forestry and land use policies pertaining to the landscape of the Oregon coast, a land use history of the region accompanies this review. The land use history and policy review are intended to be explored in conjunction with one another, as land use and policy occur in concert with one another. Vulnerability will be explored amongst this backdrop of land use and policy, and a review of socio-economic vulnerability in the literature follows.

What is Socio-economic Vulnerability?

In the risk and uncertainty literature, social vulnerability has been gaining more traction. Several studies describe social vulnerability as a component of whole system vulnerability. (Brooks 2003, Cutter 2003, Ekstrom et al. 2015) This study seeks to emulate this concept. Jepson and Colburn (2013) identify vulnerability as a combination of pre-existing social conditions prior to the occurrence of an event that influence how well a community can respond to the event (Jepson and Colburn 2013). Their definition is situated in relation to the concept of resilience,

where resilience speaks to the community's response, or their ability to recover from disturbance and absorb any impacts. Under the framework above, this concept would be captured under the concept of adaptive capacity. Capacity is a broad idea that is applied to a multitude of contexts, referring to how much something can contain, produce or withstand. Adaptive capacity specifically refers to the capacity to endure change. In a social context, adaptive capacity typically includes the social characteristics of a community that may lessen risk such as socio-economic status, housing characteristics, education, age, disability status, etc (Cinner et al. 2018, Cutter et al. 2003). Communities that are low-income and therefore have a low adaptive capacity, may be categorized as highly vulnerable. Adaptive capacity is one concept within social vulnerability that is useful, and many of the variables selected in this analysis can speak to this. Under the exposure, sensitivity, and adaptive capacity framework (Ekstrom et al. 2015), social vulnerability is also shaped by infrastructure such as hospitals, emergency response plans, or economic relief for residents (sensitivity), and how many people or resources may be at risk (exposure). Communities that lack such an infrastructure and have high population density in proximity to a hazard can be referred to as highly sensitive and greatly exposed.

Vulnerability in this study is broadly conceived as a concept referring to the quality of being significantly impacted by exposure to a given hazard, or a set of hazards. For human communities in coastal Oregon, these hazards might be a lessened availability of natural resources, landslides, erosion, and flooding. This study is particularly interested in flooding as it pertains to salt marsh and watershed vulnerability on the Oregon coast. Here, salt marshes and watersheds are hypothesized as vulnerable to forest, coastal, and broad environmental land use practices and policy changes, and this analysis is conducted through this lens. From the perspective of the human dimension, coastal community residents are hypothesized as vulnerable

to shifts in salt marsh and watershed resilience. Thus, highly vulnerable communities may be those that experience greater impacts from salt marsh and watershed shifts that result in flooding.

Some communities may come to experience greater impacts through a loss of property, resources, and economic stability. From a physical perspective, communities that are closer to a hazard will be categorized as more vulnerable. But, physical components are not the only influence on a community's vulnerability. Equally important are the socio-economic factors that sculpt the capacity of communities to become resilient in the face of a hazard or environmental disaster. In fact, socio-economic vulnerability as a concept challenges what we commonly refer to as "natural disasters". Because all human communities exist in society, their livelihoods are shaped by said society. A disaster is not purely a physical occurrence, but rather can be immensely compounded and molded by social factors (Marino 2015). For example, earthquakes can be disastrous to communities, but they are not always. Most often, earthquakes become disastrous when communities lack the social infrastructure to withstand such an occurrence (Marino 2015). In countries where earthquakes occur amongst a backdrop of limited resources, earthquakes can be deadly. But, in countries where resources are available so that buildings, roads and bridges are built especially to withstand major earthquakes, they may simply become a passing experience. This is all to say that social and economic factors shape the conditions of vulnerability in the face of environmental hazards (Marino 2015). Thus, these results will elucidate some of the factors that may construct socio-economic vulnerability amongst coastal communities in Oregon, particularly in regards to the adaptive capacity. In addition to exploring these factors, the policy and land use landscape in Oregon will be examined along with a discussion of the interplay between social and physical vulnerability.

Research Questions

As communities in coastal Oregon rely on ecosystem goods and services, they remain vulnerable to any change in these goods and services (driven by both natural or anthropogenic forces). Therefore, characterizing vulnerability is critical in Oregon. In an effort to do so, I explore the following questions:

1. What is the relevance of policy and land use in shaping the natural landscape and to the human communities that reside in it? (How do social and natural sources of sediment production change over time?)
2. How can socio-economic vulnerability to flooding be characterized on the Oregon coast? (How can vulnerability, especially related to coastal flooding, be defined in watersheds, estuaries, and Oregon coastal communities?)
 - a. How can this characterization of socio-economic vulnerability address holistic environmental management, hazard adaptation and mitigation?
3. How can the ways in which socio-economic and physical vulnerability interact be conceptualized? (How do the vulnerabilities in these individual systems sum to landscape-wide vulnerability?)
 - a. How does the socio-economic and physical vulnerability to flooding interact with the policy and management landscape on the Oregon coast?

Methods

Study Sites

The three systems of interest - Nehalem, Alsea, and Coquille - were selected for numerous reasons. Alsea Bay, Nehalem Bay and the Coquille River Estuary are all situated in coastal Oregon

communities. The Alsea site lies between Nehalem and Coos in midwestern Oregon. The towns adjacent to Alsea Bay include Waldport and Yachats and primarily base their economic activity on hospitality, retail and recreation. Alsea Bay and the Alsea watershed include much of the Siuslaw National Forest and privately owned land, and is logged extensively. Of all three sites, Lincoln county which encompasses Alsea Bay has the highest population density (46.98 people per sq. mi.) (Shroeder 2016). The historical land use and policy history review includes information spanning the entire Alsea watershed. The vulnerability analysis for the Alsea site focuses on three census tracts covering Waldport, Yachats and surrounding communities of Alsea Bay.

Nehalem Bay resides within the communities of Wheeler and Nehalem, settled in 1868, and is the northernmost site. Tillamook county has the lowest population density (22.90 people per sq. mi.) of the three sites and is home to the Tillamook State Forest, an expansive agricultural economy, tourism, and forestry (Shroeder 2016). The historical land use and policy history review includes information spanning the entirety of the Nehalem watershed and surrounding areas. The vulnerability analysis for the Nehalem site includes two census tracts covering Nehalem, Wheeler and Rockaway Beach.

The Coquille site resides within Coos county south of Coos Bay, and is adjacent to Bandon, Coquille and Myrtle Point. Coos county has the second highest population density of the three sites (39.50 people per sq. mi.) and is home to the Port of Coquille is a part of an expansive logging region (Shroeder 2016). The historical land use and policy history review includes information spanning the entirety of the Coquille watershed and surrounding areas. The vulnerability analysis for the Coquille site includes three census tracts covering Bandon, Coquille and Myrtle Point.

Methodology

How Policy & Land Use Shape the Natural Landscape

First, to address how social sources of sediment change over time and the role of policy and land use in shaping the natural landscape, I take a mostly qualitative approach in this component of the study, utilizing historical document analyses to characterize Oregon land use, environmental, coastal and forest policy relevant to the selected study sites using 15 historical documents from governmental, academic and professional sources. These documents were selected based on relevance to the problems of interest, relevance to the geographical regions, and timeframe. This policy review aims to characterize the political landscape of the Oregon Coast Range throughout the last century in an effort to provide adequate context for the social and physical changes occurring in the Alsea, Nehalem and Coquille watersheds and estuaries, specifically addressing the social sources of sediment in these sites. In contrast to an in depth policy analysis, I conduct this review by identifying relevant documents, policies of relevance within those documents, and organizing policies chronologically, by priority and by location. Once the policies of interest are organized, I identified general trends within the data in regards to how the policy landscape as a whole has changed over time, which kinds of policies have become more or less relevant, and policies of great significance to the vulnerability of the systems. With a background knowledge and literature review conducted along with our team's field expertise, these areas of significance were identified and included policies on forestry, logging, fires, development, coastal management, land use, general environmentalism and conservation, and others broadly pertaining to the physical changes occurring in the watersheds and estuaries on the Oregon Coast.

In addition to this policy review, I conducted a document analysis to underscore a general land use history on the Oregon coast over the last century. The purpose of this analysis was to

provide an additional layer of context to the policy review, as well as a more specific characterization of site specific dynamics. While the policy review provides a wide-reaching characterization of the political and land use management landscape on the Oregon coast, it seldom offers the specificity necessary to answer how social sources of sediment change over time within the specific study sites. Therefore, this historical review can make the social sources of sediment more evident. For example, although the policy review may have minimal information on diking or dredging around an estuary of interest, by analyzing historical documents of the land use history, we are able to identify how much area has been diked over time and in what periods of time. Thus, land-use practices that may affect sediment transport were documented chronologically, by type, and by specific site. This review of Oregon coastal land use history will lend itself to address questions about how land use affects both socio-economic and physical vulnerability.

Characterizing Socio-economic Vulnerability on the Oregon Coast

To answer question two of this study, we created a social vulnerability index, utilized and analyzed amongst selected census tracts in coastal Oregon that represent the three study sites of interest. Vulnerability in the human system will comprise a series of indicators that are related to the event of extreme flooding. Because sensitivity describes the social infrastructure in the face of environmental risk, sensitivity to flooding on the Oregon coast might be determined by indicators such as number and proximity of hospitals, road accessibility, and disaster preparedness plans and shelters. This analysis does not include these indicators, but it is worth noting how intimately connected indicators of sensitivity are to indicators of adaptive capacity. For instance, the success of an adequate disaster preparedness plan is directly tied to how many people have access to the plan i.e. How is this plan communicated to its residents? And, is the plan in languages spoken by all residents? These elements of accessibility are explored in this vulnerability index via the

following indicators: population with access to a phone and population that speaks limited english.

The indicators of adaptive capacity include:

Socio-economic status: employment, population employed in Agriculture, Forestry and Fishing², insurance³, SNAP⁴, education, poverty, income, unemployment

Housing characteristics & disability: under-18, 65 plus, single parent, disability status

Minority status & language: citizen⁵, non-citizen⁶, limited english speaking households, Black, Indigenous and POC population

Housing type & transportation: mobile home, group quarters, vehicle, access to phone⁷

Socio-economic vulnerability typically includes indicators for exposure, and in this study exposure will be characterized by *population*. Exposure sometimes includes physical components of vulnerability such as proximity to a floodplain or relative sea level rise, but these indicators are not included in this social vulnerability analysis. But outside of this index, socio-economic vulnerability will be compared to elements of physical vulnerability such as salt marsh vulnerability to sea level rise, hydrologic response to precipitation, and physiographic controls on flood magnitude in populated areas. A description of each of the variables used in this analysis is included below.

Table 1. List of and descriptions for U.S. Census Bureau ACS variables used for the social vulnerability analysis (U.S. Census Bureau 2019).

Variable	Description
65PLUS	Estimate of total population 65 years and older
AGFOREST	Estimate of civilian employed population 16 years and over in agriculture, forestry, fishing and hunting, and mining

² Indicator selected outside of the CDC's SVI

³ Indicator selected outside of the CDC's SVI

⁴ Indicator selected outside of the CDC's SVI

⁵ Indicator selected outside of the CDC's SVI

⁶ Indicator selected outside of the CDC's SVI

⁷ Indicator selected outside of the CDC's SVI

BIPOC	Estimate of total population – White population (Estimate of population that are Black, Indigenous & People of Color)
CITIZENSHIP	Total estimate of U.S. citizens, population born in the United States
DISABILITY	Estimate of Total Civilian Noninstitutionalized Population with a disability
EMPLOYED	Estimate of civilian employed population 16 years and over
GROUPQTRS (Group Quarters)	Estimated population living in group quarters. A group quarters is a place where people live or stay, in a group living arrangement, that is owned or managed by an entity or organization providing housing and/or services for the residents. Group quarters include such places as college residence halls, residential treatment centers, skilled nursing facilities, group homes, military barracks, correctional facilities, and workers' dormitories.
INCOME	Estimate of per capita income in the past 12 months (in 2018 inflation-adjusted dollars)
INSURED	Estimated population with health insurance. Health Insurance. This question measures the insured and uninsured by asking about coverage through an employer, direct purchase from an insurance company, Medicare, Medicaid or other government-assistance health plans, military health care, VA health care, Indian Health Service, or other types of health insurance or coverage plans. Plans that cover only one type of health care (such as dental plans) or plans that only cover a person in case of an accident or disability are not included.
LTDENG (Limited-English)	Estimate of population that speaks limited-English. The Bureau asks three questions to gather data on those speaking a language other than English at home, what that language is, and how well each person speaks English.
MOBILE HOME	Estimated population living in mobile homes (An HU may be a house, an apartment, a mobile home or trailer, a group of rooms, or a single room that is occupied (or, if vacant, intended for occupancy) as separate living quarters).
MUNIT (Multi-Unit Housing)	Estimate of multi-unit housing (Sum of housing units of 2 or greater per structure)
NO DIPLOMA	Estimated population that did not receive a HS diploma

NO PHONE	Estimate of occupied housing units with no access to telephone service
NO VEHICLE	Estimate of occupied housing units with no vehicle available
NON-CITIZEN	Estimate of population of non-U.S. citizens (persons born outside of the United States)
POVERTY	Estimate of income in the past 12 months below poverty level
SINGLE-PARENT	Estimate of total single parent households (Male householder, no wife + Female householder, no husband)
SNAP	Estimate of households receiving food stamps/SNAP
UNDER18	Estimated population under 18 years old
UNEMPLOYED	Estimated population of unemployed persons 16 years and older in the civilian labor force
UNINSURED	Estimated population without health insurance. Health Insurance. This question measures the insured and uninsured by asking about coverage through an employer, direct purchase from an insurance company, Medicare, Medicaid or other government-assistance health plans, military health care, VA health care, Indian Health Service, or other types of health insurance or coverage plans. Plans that cover only one type of health care (such as dental plans) or plans that only cover a person in case of an accident or disability are not included.

This vulnerability index aids in identifying the vulnerability of coastal communities to cultural and economic adversities that are driven by physical vulnerability, and policy and land use changes throughout time. To effectively and meaningfully quantitatively measure vulnerability, indices are commonly constructed in risk and uncertainty literature. This methodology is not without flaws, which I will get into further, but by constructing an index, variables can be selected and compared across geographical areas. Because this research seeks to elucidate the dynamics of vulnerability across socio-economic and physical systems, it is important to look at these relationships in various contexts. Vulnerability indices are also used within a multitude of disciplines, spanning public health, disaster management, social justice, and newly budding in the field of environmental justice, which is the topic of my first chapter. The identification of relevant variables, which speak to the accessibility of resources amongst given populations, along with the measurement of these variables engages us with what is worth paying attention to.

Indices can be useful mechanisms to quantitatively measure vulnerability across a multitude of systems and regions of interest. But, indices cannot always capture the true dynamics of vulnerability within and across systems. Without interrogation within communities of the variables that impact their lives both before and after disasters, selections of relevant variables can be rather subjective. Additionally, it is difficult to determine if some variables weigh more on a community's overall vulnerability without information from the community. Furthermore, vulnerability indices are composed of aggregated data, meaning individual experiences can get lost in the analysis. Making assertions based on the results of such analysis may benefit some members of the community while harming others. Although this methodology is limited in these

various respects, it is a straightforward means of assessing vulnerability that can be translated across systems. Thus, the methodological process is further explained below.

To assess and characterize the social vulnerability within the study sites, we computed a vulnerability index using a dataset of 162 census tracts across 22 variables (see Table 1 above) obtained from the 2018 American Community Survey (ACS) conducted by the U.S. Census Bureau. The ACS data was selected for the vulnerability analysis primarily due to the availability of an array of variables at the census tract level that were not available in the 2010 U.S. Census. Of the 22 variables (Table S1), 17 were selected based on the U.S. Center of Disease Control's (CDC) Social Vulnerability Index (SVI), and an additional five variables (Agforest, SNAP, Insured, Uninsured, Telephone Access, Citizenship, and Non Citizenship) were selected based on place-based relevance (Flanagan et al. 2011). Because of the importance of agriculture, forestry and fishing for Oregon coastal communities, the number of people employed in these fields was added as the "Agforest" variable, as it is generally understood that economies with greater diversity are more resilient. Another variable added that was not included in the CDC's SVI was the number of people on SNAP, which is a food assistance program. Additionally, two parameters for health insurance were added including number of people insured as well as number of people uninsured. A parameter for access to a telephone was also included in this analysis, as emergency information typically comes to our phones in the current society, those without access to a reliable phone may not be able to receive critical lifesaving information in a time of physical hazard. For each variable there is an estimated count of people satisfying the characteristics of the variable within each census tract along with an estimated Margin of Error (M.O.E.). In the ACS, the M.O.E. is computed using the two-sided 90% quantile of the Normal distribution (1.645). In addition, for each census tract unit an estimated total population is provided along with a M.O.E. estimate. In

general the response rates for the ACS were high (U.S. Census Bureau 2018, *American Community Survey Response Rates*) indicating that missingness was not a particularly large concern with the ACS data. Counts for some variables such as BIPOC (Black, Indigenous, People of Color), Non-Citizen, or Agforest are relatively small counts in many census tracts and correspondingly have high M.O.E. estimates. The increased uncertainty for some variables may be due to difficulty in contacting and surveying small, rural subpopulations which is a common issue across different surveys. To account for the difference in estimated total population size between different census tracts, we adjust each entry to be the estimated count per 100,000 using the estimated total population size of each census tract to allow comparisons to be fairly made between census tracts.

Following the CDC's SVI, we computed a sum-rank social vulnerability index to compare social vulnerability across census tracts. First, using the population-adjusted ACS data the percentile ranks of census tracts within each variable are calculated. Then the sum-rank of a census tract is calculated as the sum of the percentile ranks of that particular census tract across all the variables. The higher the percentile ranking of a census tract in a particular variable the more vulnerable that census tract is with respect to that variable. The sum-rank vulnerability index was chosen as the simplest method for capturing overall vulnerability of the census tracts as a combination of individual vulnerabilities. The interest in analysis is in both the sum-rank vulnerability and in the variability in vulnerability of census tracts in different variables. In some vulnerability indices, the individual percentile ranks are weighted and indices may take on models such as the Weighted Sum Model (Krishnan et al. 2019). However, given time and data constraints, the individual percentile ranks are weighted equally in the sum-rank calculation for each census tract.

In order to assess the uncertainty associated with the percentile ranks we perform a Monte Carlo simulation of the vulnerability index. We assume that each entry in the ACS dataset is drawn independently from a Normal distribution where the mean is the ACS population-adjusted per 100,000 estimated count and the standard deviation is the standard error obtained from the ACS population-adjusted M.O.E. estimate. We make a random draw for each entry of the ACS table to obtain a simulated ACS table which we repeated 10,000 times in order to dampen the Monte Carlo error. For each simulated ACS table, we then computed the sum-rank vulnerability index. We are interested in a subset of 8 census tracts in the Nehalem, Alsea, and Coquille estuaries so we compare the sum-ranks as well as percentile-ranks of individual variables between those 8 census tracts.

Whole-system Vulnerability: How Socio-economic and Physical Vulnerability Interact

This particular vulnerability assessment is integrated across the physical systems of interest. A broad overview of the ways in which socio-economic vulnerability and physical vulnerability interact will be analyzed further through the lens of a coupled natural-human systems approach. In this particular analysis, when considering the ways in which the land use and policy history of coastal Oregon engages with the vulnerability of the watersheds and salt marshes of coastal communities, we are able to identify what resources are impacting this relationship. First, to conceptualize general areas of vulnerability that intersect across physical and socio-economic systems, I identified policy and land use areas from the document analysis along with various components of vulnerability in the physical systems. Second, utilizing knowledge of specific land use practices that are expected to alter sedimentation, I compared the historical documentation of land use practices such as diking, logging, and road construction alongside temporal changes in sedimentation. Finally, with background information regarding potential physical hazards on the

Oregon coast, I explored temporal changes in the physical landscape alongside potentially relevant areas of socio-economic vulnerability such as housing and flooding patterns. Given the complex dynamic of natural-human systems, it is unlikely that strong conclusions can be made regarding the interactions of these vulnerabilities. Still, with the characterizations of changes in the physical and human systems on the Oregon coast, future directions worth exploring may be identified. An investigation of the findings obtained from the interdisciplinary document analysis, vulnerability index analysis, and examination of their interactions follows.

Results

This analysis begins with a policy and land use review of relevant environmental and land use policies on the Oregon coast. Beyond the general overview, site specific land use histories will be explored that will aid in exploring how social sources of sediment evolve temporally. Following this policy and land use analysis, results from the vulnerability analysis will be examined which will point to the general areas of socio-economic vulnerability that may interact with physical vulnerability. Lastly, these general areas of socio-economic vulnerability will be investigated in further detail, highlighting areas of interaction with elements of physical vulnerability.

Policy & Land Use (Table S1)

Policies & Practices on the Oregon Coast: How and why is policy relevant in shaping the natural landscape and the human communities that reside in it? (Table 2)

Late 19th and Early 20th Century

Obtained from the policy and land use document analysis I conducted, Statewide, Federal, and local policies affecting Oregon's coast, rivers, forests, and overall environmental and land uses

have made some substantial shifts since the arrival of European settlers. The 19th century on the Oregon coast was largely characterized by European settlement and the removal of Native Americans from the region by force or disease (Hennessey 2005, Meinke et al. 1999, Miller 2005, Johnson 1999). European settlers saw the Oregon Coast Range and coastal landscape as a highly productive region. Due to the hydrological landscape of the region, transportation of both people and resources took place on the rivers and streams, which would have tremendous impact on the ecological environment (Hennessey 2005, Meinke et al. 1999, Miller 2005, Johnson 1999). Other significant land uses and changes of the time included forest fires, railroads, road building, logging operations, and the construction of docks, seawalls and other various structures to develop the marine area. The late 19th century included significant novel policies for Oregon and the US that initiated widespread forest and land management (See Table 2 in Appendix).

Policies enacted to protect forests, lands and environmental resources increased in the first few decades of the 20th century (See Table 2 in Appendix). The policies were primarily focused on fire control as a result of sweeping forest fires in the 19th century which were commonly human caused. The 1910s saw increased development on the Oregon coast with the construction of various ports, the designation of beaches as state highway, and an increase in positions addressing issues of forestry in the state. With an increase in road construction, waterways were used less for transportation and trucks were used more in forestry operations. Trucks likely pushed logging operations slightly away from the edges of waters, but despite an increase in forestry laws, logging operations in coastal forests were increasing due to war activity and development (Miller 2005). Following these practices, the 1920s underwent another increase in forestry laws, calling for improved protection, tree nurseries, insect control and the formation of State forests.

Mid 20th Century

An influx in forestry laws and practices were initiated in the 1930s along with several reforestation programs following widespread forest fires. At this point, forestry laws were still mostly focused on insects and fire protection. The “Rules of Forest Practice” were developed with private, state and federal representatives in 1933. In the 1940s, Oregon forestry policy shifted towards a more rehabilitation focus, and many logging operations spent millions complying with forest fire laws. As forestry became more significant to Oregon’s economy, it became imperative to integrate more sustainable practices while maintaining the increasing timber industry. Thinning practices became more prevalent in the 1950s to produce lumber, to reduce the level of extraction and improve forestry economically. With fires being a continual issue in the forests, taxes were enacted for research, an emergency fire cost fund was created, and the Forest Closure Act was strengthened in 1954. Overall, state land management became a major program of the forestry department (Miller 2005).

In 1964, the National Wilderness Act created 9 million acres in wilderness areas. Oregon beaches were established as public during this time period, and therefore private entities could not own this land. Importantly, the late 1960s laid the groundwork for sweeping environmental protections that would take place in the 1970s with the passage of the National Environmental Protection Act in 1969. The 1970s is known as a period of significant environmental protections on both the state and federal level (See Table 2 in Appendix). In terms of land use, there was a decline in wood at river mouths between 1970 and 1985, and technological advancements were implemented to process state forestland data and categorize forest operations (Miller 2005).

Late 20th Century

The 1980s saw a slight decrease in timber harvest that picked up again in the 1990s. This may have been due to changes in the market where there were near widespread bankruptcies among timber companies as a result of the economic recession (Miller 2005). The “Forestry Program for Oregon” was updated in 1982, and Lincoln and Tillamook County approved of their comprehensive plans in this year. Resource study conducted during the 1970s and 1980s identified environmental impact statements and proposed land and resource management plans for all of Oregon’s 13 national forests (Miller 2005). The 1990s was another significant decade in terms of forest, coastal and environmental policy protections that included efforts to integrate land use and transportation planning, improve ecological habitat, and initiate new ecosystem approaches to resource management (See Table 2 in Appendix).

About ten significant forest and coastal management plans and laws continued efforts to address current and future resource management concerns on the Oregon coast in the 2000s to present. Oregon’s economy continues to remain dependent on logging and timber as an industry, but much of the intensive extractive practices such as railroad logging, splash damming, and log drives are in the past as greater efforts have taken place to address erosion to protect both human and natural habitat. The 2010s saw a major surge in environmental policies focused on climate change and in Oregon, forestry set goals to store carbon in forests and forest products, and reduce carbon emissions overall (Yost 2019). Oregon policies throughout the decades have seen immense changes, as shown below in Figure 3. Policies in the early 20th century were one often dimensional, focused primarily on protections from fire. Although a more holistic and comprehensive integrated approach is possible, Oregon policies addressing coastal and forest

resources on the Oregon coast have incorporated a variety of environmental issues regarding both human and natural vulnerabilities.

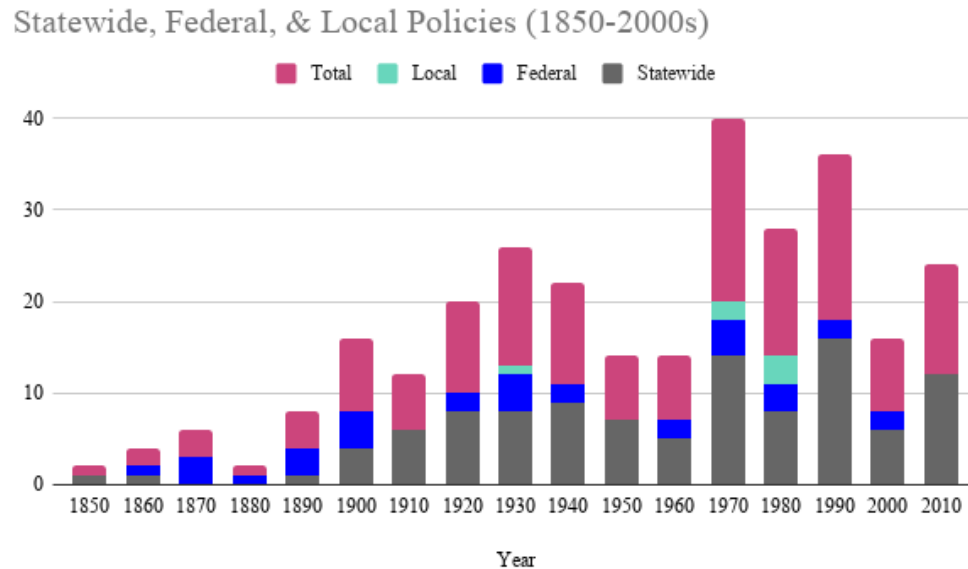


Figure 3. Count of Statewide (Oregon), Federal, and Local policy changes per decade. Rather than an exhaustive list of all environmental policy changes from 1850-present, these policy changes were selected based on relevance to coastal, forestry and environmental management in the Oregon Coast Range. As shown, the gray bars represent Statewide policies, the blue bars represent Federal policies, the teal bars represent Local policies, and the pink bars are a sum of the Statewide, Federal and Local policies per decade.

Policy & Land Ownership

While the overall trend of coastal and forest environmental policies has shown to be positive on the Oregon coast, these changes are not equal across the Nehalem, Alsea and Coquille sites. Currently, each site lies within a patchwork of private, state, federal, and tribal lands. The Alsea site is mostly covered by Federal lands due to its position in the Siuslaw National Forest, with the remaining lands being primarily private/industrial. The Coquille site is primarily within private/industrial lands with the remaining lands being Federal. The Nehalem site is primarily under the jurisdiction of private/industrial lands with the remaining majority under the jurisdiction

of the state. Different land ownership dictates what policies and practices are applicable. For example, states have jurisdiction over state lands only and therefore state agencies do not have agency over what occurs on National forestland. This is especially true considering Tribal land ownership, in which data for these areas are not accessible to others outside of the tribe. It becomes difficult to clearly conceptualize policy patterns when each site has all ownership types or ownership is spotty. While policies such as the Northwest Forest Plan in 1994 were identified as a major win for environmentalists, it does not concern all land ownership designations, and is therefore less important to the Nehalem site. Because each site's land ownership patterns diverge quite significantly, some of the differences in ecological changes may be attributed to the differences in land management (Campbell et al. 2004, Stanfield et al. 2000). Overall, statewide coastal, environmental and forestry policies have increased since the 1800s to address issues such as erosion, fishery health, fires, forest health, development and the economy, and have continued to increase after the major environmental policies of the 1970s, while Federal policies to address these issues have not risen as steadily.

Alsea Land-Use History (Table 2)

The Alsea watershed was largely impacted by various land use practices such as agriculture, road building, logging and dredging practices over the past century. The 1800s and early 1900s in the Alsea watershed were largely shaped by European settlement that involved increases in agriculture, road building, homesteading and shifts in land ownership away from the public domain. The waterways in the region were impacted by the construction of docks, seawalls, log drives, the processing of timber via sawmills constructed along the waterways, and the US Army Corps of Engineers shooting out channels down the Alsea River. Issues of land ownership also characterized the Alsea watersheds where many of the lands were converted to the Siuslaw

National Forest which transferred state ownership to the Federal government, and would have significant impacts regarding forest policies and practices throughout the century. Alsea was used continuously for agricultural purposes and log drives during the early 20th century, and land ownership transferred between families on the lower site of Alsea. As motorized trucks came into being, log drives and railroad logging would begin to slow as trucks could go deeper into the forest. The later half of the 20th century saw more private lumber companies that constituted an increased landowners class in the area such as Georgia-Pacific, an industrial timber company that acquired more lands, converting 110-120 year old second growth timber into plantations and clearing large portions of land. Agricultural usage of the tidal wetlands significantly waned by the 1970s where recreational housing became more prominent and replaced much of the previous agricultural usage. By the 1980s, logging near Alsea had become more prominent with an increase in logging roads and clearcuts (See Table 2 in Appendix II for more information).

Coquille Land-Use History (Table 2)

Similar to the Alsea, the Coquille watershed was largely characterized by logging, dredging, development and road construction but agriculture usage was less documented in this region. The later half of the 1800s and first decade of the 1900s continued to see log drives, splash dam usage, and channel maintenance on the Coquille River. Extensive logging also took place on the north, south and middle forks of the Coquille, and coal mining also occurred. In 1911, the Port of Coquille was formed after nearly half a million cubic yards of material was dredged by the USACE over a decade-long period, and would continue to fund the curing of bankside vegetation throughout the 1920s. The Port of Bandon was also formed during this time period and funding was also utilized for restoring and deepening the channels while many private landowners and private companies also cleared banks more inland of the Coquille for boats. In the early 1930s, the

land was shaped by local forest fires and Camp Remote, a Civilian Conservation Corps camp established in Camas Valley where men slashed timber for road construction and conservation work. Timber production and channel modification majorly influenced the Coquille watershed following the second World war due to an increase in demand for lumber. This increase in production was possible because of transportation improvements in the decades prior. The Coquille watershed is dominated by private lands where in the 1990s, approximately 61% of the lands of the Upper Middle Fork Coquille WAU were private. Many of these lands are agricultural, urban and forested, and about 44 percent of these lands have been harvested from the 1960s to the 1990s. Approximately 40% of the watershed is private industrial forest land. Federal, state, and county lands occupy about 30% of the watershed. The Bureau of Land Management (BLM) and U.S. Forest Service administer the largest of these public holdings. Another 30% of the basin is in smaller non-industrial private holdings (Benner 1991, Meinke et al. 1999, Miller 2010, Phelps 2011, Stanfield 2000).

Nehalem Land-Use History (Table 2)

The Nehalem watershed is characterized by many years of fires, logging, channel modification, agriculture and settlement. Logging was prevalent during the 19th century, and many of these operations were family owned, animals were used to carry logs, and logs were transported by streams and rivers. Before the 19th century came to a close, the USACE contracted with Noble and Saunders for extensive channel rehabilitation in the upper portion of the river, and by 1868, the towns of Nehalem and Wheeler were settled and land was cleared for agriculture. Extensive log drives occurred on the Nehalem River from 1901-1926 and more potential splash dams were believed to be on the North Fork of the Nehalem River. In 1911, the railroad connecting Portland with Tillamook County was completed, more railroad tracks were built in the town of Timber, and

with the completion of the Southern Pacific Railroad, logging began in earnest in this region while using small privately constructed logging railroads. Hatchery operations also occurred in the Nehalem watershed. From 1929-1940, two dams on the Nehalem River were removed and commercial fishing occurred in the mid 1930s on the Nehalem River. Many destructive fires occurred between 1933 (Tillamook Burn) and 1945 which led to delinquent tax payments on privately owned lands, and these lands were then deeded to the state for reforestation and are presently recognized as state forest lands in the watershed today. In 1996, the Upper Nehalem Watershed Council was formed, and in 1997, the Lower Nehalem Watershed Council formed. In the 2000s, several small dams still existed in the Wheeler Management Basin (Johnson 1999, Miller 2010, Oregon Department of Forestry 2005, Stanfield 2000).

With this review of the policy and land use influence on physical vulnerability, some questions worth pondering arise: What do Oregon environmental, land use, forestry and coastal policies prioritize? How have these priorities changed over time? How might these priorities affect peoples' lives? What components of vulnerability are addressed by these policies? Which components aren't addressed?

Evolution of Environmental and Land-Use Oregon Policy Priorities Over Time

Without getting into the fine details of each policy, this portion of the analysis will highlight the general priorities of these policies as ascertained by their brief descriptions. Information in the document analysis that was collected includes the name of the policy, the year it was created, passed and implemented, and a short description of what the policy was designed to do along with any background information that may have been provided. Thus, this analysis is centered on what can be determined from the brief descriptions available in the documentation, as that description will best depict the priorities of the policies.

Priorities of Oregon Environmental, Land Use, and Coastal Policies

As this discussion of the selected Oregon environmental, land use, coastal and forest policies has illuminated, major priorities include development of the land and economy, overall environmental concerns, forestry and fire prevention, coastal health and development, and transportation. Of these five general areas of the relevant policies of this study, the most prioritized policy areas were forestry and fire prevention (78 policies), and overall environmental concerns (50 policies). The priorities of policymaking in Oregon have evolved over the many decades of its existence. There is a clear shift from early European settlement to present day, and an even greater shift from the centuries of Indigenous sovereignty that precedes settlement, although this history is not included in the policy review. An exploration of this development of policy prioritization from the 1850s to present will follow.

Changes in Policy Priorities Over Time

In the mid 1800s, the policies reflected priorities primarily focused on development of the land and some roads, land ownership and protection of the land from major disturbances that result from forest fires. The basic needs of early settlers took precedent over the details of forest and coastal management. Throughout Oregon's history, the priorities of the policies changed to reflect the evolution of the developing society. Whereas earlier policies centered fewer needs such as fire prevention and ensuring viable land for housing and agriculture, policies passed a century later have expanded to address numerous needs related not only to broad issues such as resource availability, but also concerned with the quality of the land and relationships between resource management and ecological health. As the sheer number of policies grew throughout the 20th century, they also took a diversity of environmental concerns into consideration such as erosion, water quality, and the impacts of logging on the land.

Effects of Priorities on Community Livelihoods

While many of these policies primarily center environmental-related concerns, human communities are very well affected by these issues due to the dependence on natural resources. To survive, human communities rely on clean water, land for farming, various resources for shelter, and plants for medicine amongst others. Therefore, by prioritizing the protection of natural resources, human communities' lives are also protected. It is not always true though that what's best for the environment is best for humans. For example, communities living on the coast may experience negative outcomes due to erosion including losses in land, property, and even life. Conversely, erosion that results in sediment accretion within a local estuary may be positive for that ecosystem, as the sediment eroded from the land may prevent the salt marsh from drowning. In an opposite situation, there are times when policies to address environmental issues seldom integrate the diverse needs of the human communities that reside in the region. Finding the right balance in human and non-human community needs has remained a challenge in environmental and land management, and within the policies that seek to implement such goals.

Incorporating Vulnerability into Environmental, Land Use and Coastal Policy

Socio-economic vulnerability is commonly described using a set of variables that comprise various categorizations of vulnerability. In the risk and uncertainty literature, this begins with a broad categorization of issues concerning exposure, sensitivity, and adaptive capacity. Within these different areas, there are further categorizations. For example, the area of vulnerability that speaks to community characteristics might include categories such as housing characteristics, employment characteristics, and population demographics. While the policies of focus in this study are not explicitly focused on these aspects of communities, they can be

incredibly impactful towards shaping community vulnerability. Some of the ways in which environmental, coastal and forestry policies can impact community vulnerability will be discussed later.

Although seemingly distant in terms of policy priorities, the effect of land use and environmental management on human communities cannot be understated. The dynamics between areas of policy that pertain to environmental management and those that pertain to socio-economic vulnerability will be further explored. Before doing so, socio-economic vulnerability in the Alsea, Coquille and Nehalem communities will be examined. Vulnerability will be compared across the three study sites, and an identification and examination of relevant variables will be conducted.

Socio-economic Vulnerability

As examined in the methodology, variables that pertain to these components of social vulnerability have been selected for analysis, many of which were selected and analyzed by the CDC's Social Vulnerability Index (SVI). These results expand upon the CDC's SVI and are notably situated within the backdrop of coastal Oregon. To characterize the social vulnerability of coastal community residents in the Alsea, Coquille and Nehalem watersheds, we conducted a percentile-ranking of twenty-two variables for census tracts on the Oregon coast. Per the methods section, eight census tracts were selected from Coos (9, 10, 11), Lincoln (9515, 9516, 9517) and Tillamook (9601, 9602) counties to represent the coastal community residents directly adjacent to the Coquille, Alsea and Nehalem estuaries, respectively. In the percentile sum-ranks adjusted for population (Figure 1), Coquille ranked the highest overall followed by Alsea and then Nehalem. Therefore the Nehalem is denoted as the "least vulnerable" of the three sites while the Coquille site is denoted as the "most vulnerable" overall. We note in Figure 8, that Coos county, census tract 9 and Lincoln county, census tract 9515, were of lower percentile sum rank

than other census tracts within the Coquille and Alsea study sites, respectively. In addition, the violin plots in Figure 8 show the spread of the simulated percentile sum ranks for each of the census tracts within the study sites. With the exception of Tillamook county, census tract 9601, which has a lower true percentile sum-rank than might be expected from the simulated distribution of percentile sum-ranks, the true percentile sum-ranks for the selected census tracts are within the middle 50% of the simulated percentile sum-ranks. Therefore, our conclusions with respect to which study sites we denote as most or least vulnerable overall do not shift between the simulated datasets and the true dataset.

When looking at the ranking across individual variables, this distinction becomes much less clear and the uncertainty is much greater. Nehalem consistently ranks lower than both Alsea and Coquille across most variables while the highest ranking oscillates between Alsea and Coquille. For some variables, there is no clear distinction between the rankings across all selected census tracts, and some individual census tracts may rank high while other tracts within their site rank low. For a few variables, the census tracts in the Alsea site are all clearly ranked higher than the census tracts in the other sites, while in others the Coquille sites are all clearly ranked higher than the census tracts in the other sites.

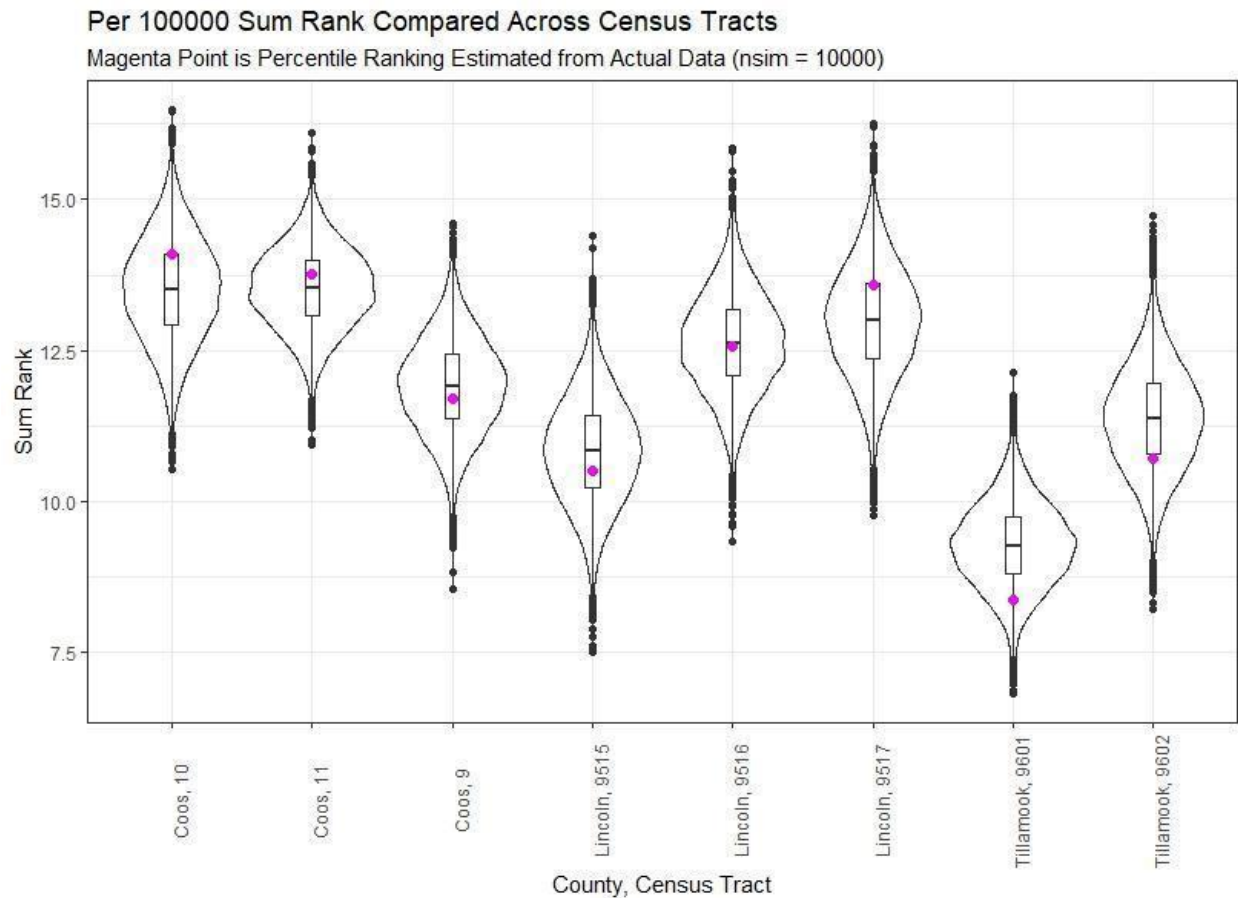


Figure 4. Simulated Per 100000 Sum-Rank Vulnerabilities Compared Across Census Tracts. Magenta Point is Percentile Ranking Estimated from Actual ACS Data. The violin plot displays both the histogram and boxplot of the simulated distribution of the percentile sum-ranks for each census tract within the three study sites.

Within each study site, the selected census tracts exhibited a relatively wide range of sum-rank vulnerability rankings between highest and lowest. In Figure 8, Coos county census tract 10 is ranked the highest overall, while Coos county census tract 9 actually ranks lower than some tracts in Lincoln county. This inconsistency between census tracts within the three sites is prevalent across almost all variables. Still, some variables clearly have a greater influence on the vulnerability for each of the three sites. In the population without access to a phone variable, all three census tracts in the Alsea site (Lincoln county tracts 9515, 9516, and 9517) are ranked higher than both Coquille (Coos county) and Nehalem (Tillamook county) (Figure S1- access to phone).

With most census tracts ranking highest in the Coquille site, its vulnerability was largely influenced by various variables impacting socio-economic status, household composition, access to insurance, diversity of economy, race, citizenship, and disability. In other variables, Coquille ranked lower in some census tracts than the Alsea site, and in fewer cases, ranked lower than the Nehalem site. At least one tract in the Nehalem site consistently ranked lowest across almost all variables. For the variables education, employment status, SNAP status, access to phone, and BIPOC population, both census tracts within the Nehalem site ranked the least vulnerable (Figures S2 (no diploma), S3 (employment), S4 (SNAP), S1 (access to phone), and S5 (BIPOC)). The Alsea site was ranked highest in vulnerability for all census tracts in terms of phone access and insurance status (Figures S1 (access to phone) and S6 (insurance)). The Coquille site was ranked highest in vulnerability for all census tracts in terms of population under 18 (Figure S7 - under 18).

For all other variables, the three sites had some census tracts ranked higher than some sites but not all. For example, for some variables, the Nehalem site actually had one census tract ranked higher than tracts in the Alsea and Coquille sites. It is also worth noting that the Nehalem site only has two census tracts while Alsea and Coquille have three census tracts. The census tracts representing the Nehalem site were simply much larger spatially than the Alsea and Coquille tracts, and therefore only two were selected to be focused on for analysis. But, with the Nehalem site consistently ranked lowest across most variables, this aspect likely has little effect.

All of the census tracts across the variables are very closely ranked in many instances. There were several variables that could be described as “moderately vulnerable” or “least vulnerable” as none of the census tracts across all three sites ranked above 0.75. Despite some economic, social and political differences in the various regions, the communities residing in the Alsea, Coquille and Nehalem sites are all relatively similar. This is particularly true for some

variables such as limited english speaking population and BIPOC population. Still, most of the variables contained census tracts that ranked above 0.75 and may be considered “highly vulnerable”.

Access to phone (Alsea 9515), no vehicle (Alsea 9516), poverty (Coquille 11, Alsea 9516), SNAP (Coquille 11, Alsea 9516), unemployed (Coquille 9), uninsured (Coquille 9 and 11; Alsea 9515, 9516, 9517), AgForest (Coquille 9 and 11; Alsea 9517), noncitizen (Coquille 10), disability (Coquille 9, 10, 11; Alsea 9515, 9516, 9517; Nehalem 9602), [reverse employment (Coquille 10 and 11; Alsea 9515, 9516, 9517)], group quarters (Coquille 9 and 10; Alsea 9517), income (Coquille 11), [reverse insured (Coquille 9; Lincoln 9517)] , mobile home (Coquille 11; Alsea 9515; Nehalem 9602), no diploma (Coquille 11), 65plus (Coquille 10, Alsea 9515, Nehalem 9601 and 9602).

These variables were primary drivers to a census tract’s overall vulnerability ranking. Notably, most of the variables added in addition to the CDC’s SVI had impacts on the vulnerability such as access to a phone, SNAP, insurance, and population working in Agriculture, Forestry and Fishing. A given census tracts’ vulnerability is determined by a substantial amount of factors, and without assigned weights, it becomes difficult to determine which variables have had the greatest impact. Still, the variables with “high vulnerability” helps us understand what is worth paying attention to.

The variables that had less of an influence on vulnerability included BIPOC population, citizenship, limited english, multi-unit housing, single parent households, and population under 18, where the census tracts ranked below 0.75 across all three sites (Figures S5 (BIPOC), S8 (citizenship), S9 (limited english), S10 (multi-unit), S11 (single parent), S7 (under 18)). These variables were more representative of a population’s “social” characteristics but are also related to socio-economic status and housing.

It is likely that some of these variables are related to and affected by other variables included in the analysis via correlation. For example, single-parent households are often households that experience lower incomes and poverty, and they may have SNAP or other government assistance. Therefore, while the variable single-parent households did not show up as “highly vulnerable” for the census tracts in this analysis, its effect on vulnerability may have been overshadowed by poverty or SNAP thus resulting in it being ranked lower. There are also some “paired” variables included such as citizenship and non-citizenship, employment and unemployment, and insured and uninsured. These variables likely undergo a similar effect as they are correlated with one another.

Importantly, variables signifying the social conditions affected by physical hazardous events on the Oregon coast were particularly relevant to the overall vulnerability of these communities. The AgForest variable, representing the population employed in Agriculture, Forestry and Fishing, ranked above the 90th percentile in the Coquille site, and above the 80th percentile in the Alsea site (Figure S12 - agforest). With a local population and economy highly dependent on the natural resources of the region, a major flooding event would have significant impacts on both the local community and Oregon as a whole. The disabled population and the population over 65 were also ranked very high across all three sites, often above the 75th percentile and sometimes ranked above the 90th percentile (Figures S13 (disability) and S14 (over 65)). Other factors affecting housing characteristics such as access to a phone and vehicle, mobile home and group quarters were also highly ranked across several sites. Numerous factors impacting socio-economic status were also significant to the vulnerability including income, insurance status, education, and poverty.

As these results explicate, some variables have a greater impact on the overall socio-economic vulnerability than others. This is demonstrated by the high ranking these variables received in the analysis. As these numbers suggest, employment in the Agriculture, Forestry and Fishing industries, disability, accessibility to a phone, accessibility to a vehicle, and residence in mobile homes and group quarters proved to be worth paying attention to. These findings elucidate areas of policymaking that may be further integrated into coastal, forest and environmental management in the face of impending environmental hazards like flooding.

Whole-system Vulnerability: The Interaction Between Socio-economic and Physical Systems

The potential avenues of interaction between social and natural systems is essentially infinite. As complex as human societies are, so are the linkages between humans and the environment. Not often are physical changes in the environment the result of one singular variable. As this study has shown, vulnerability in both the physical and social systems is multidimensional. Thus, the interactions between the vulnerabilities in these systems is as multifaceted, if not more. To conclude the analysis, this portion will explore some of the many intersections where physical and social vulnerability might meet beginning with a general conceptualization of components of socio-economic and physical vulnerability. This conceptualization will be followed by a discussion of social system impacts on the physical system, and finally physical system impacts on the social system.

First, to conceptualize general areas of vulnerability that intersect across physical and socio-economic systems, socio-economic vulnerability areas will be identified from the vulnerability analysis along with various components of vulnerability in the physical systems. As a review, the CDC's SVI categorizes vulnerability into areas of: socio-economic status, housing characteristics and disability, minority status and language, and housing type and transportation.

This analysis includes additional variables such as access to phone, SNAP status, citizenship, insurance and employment in agriculture, forestry and fishing. These additional variables are incorporated into the categorizations designated by the CDC. Of the 22 variables that comprise vulnerability in this analysis, 16 variables received rankings of “high” vulnerability, meaning they ranked above 0.75. These variables are included below:

Access to phone, no vehicle, SNAP, unemployed, uninsured, employed in AgForestFishing, noncitizen, disability, employed, group quarters, income, insured, mobile home, no diploma, population 65 and over

Each category of the CDC’s SVI is represented by these variables. Thus, areas of socio-economic status, housing characteristics and disability, minority status and language, and housing type and transportation are general domains of vulnerability that are relevant to the human system. Some of the general areas of physical vulnerability in regards to salt marshes on the Oregon coast, as ascertained by our transdisciplinary research team, include: relative sea level rise, salt marsh accretionary balance, change in salt marsh area over time, trapping efficiency and ponding, all describing whether salt marshes could be drowning or accreting. For coastal streams, vulnerability described overall “flashiness”, including indicators such as: streamflow regime characteristics that described watershed storage, temporal patterns of precipitation, and stream responses to precipitation. Each of these physical vulnerabilities describe a likelihood of the system undergoing significant flooding.

Impacts of the Social System on Physical Vulnerability: Natural and Human-influenced Sediment Supply on Salt Marsh Morphology

Utilizing knowledge of specific land use practices that are expected to alter sedimentation, the historical documentation of land use practices such as diking, logging, and road construction

are compared alongside temporal changes in sedimentation. General issues of land use explored in this analysis include logging, agriculture, diking, dredging, road construction, restoration, logging and sawmills, splash damming and log drives, dams and overall changes in development and land ownership. Due to the multiplicity of these different land uses, it is difficult to say which are the core culprits of vulnerability in the physical systems. Still, according to the literature and results of this analysis, expected primary drivers of physical vulnerability on salt marsh and coastal stream systems on the Oregon coast are logging industry land uses, road construction and development, and diking and dredging.

Both Nehalem and Coquille exhibited extreme lateral growth during the first half of the 20th century (King et al. 2020). It is likely that intense land use within Nehalem and Coquille resulted in greater sediment erosion and ultimately accumulation within the salt marshes, causing the observed expansion. Logging, road and railroad construction, log drives, and splash damming were all concentrated in these systems.

Nehalem salt marshes additionally experienced both lateral growth and mass accumulation from 1939 to 1953, though values were somewhat lower than the early half of the 20th century (King et al. 2020). Logging during this time increased to support the demands of WWII. Consequently forest road construction increased, large diesel trucks were used in logging operations, and splash damming was common (Miller 2005, Miller 2010). The Tillamook burns likely also caused sediment supply to increase. By 1945, the old growth timber was gone in the Nehalem watershed. After the destructive fires, rehabilitation began in the Tillamook Burn area through the 1970s (Johnson 1999).

From 1939 to 1952 was a period of net lateral erosion of salt marshes in Alsea bay (King et al. 2020). Though Alsea saw its own share of logging, efforts were often to support construction

of residences rather than as a major export. In the 1940s, the upper region of the wetland was used for residential homes and agriculture. And, towards the end of the 1940s, an attempt was made to blast a channel along the south side of the estuary near the city docks (Hennessey 2005).

Though 1939 to 1942 was a period of growth within Coquille, likely as a result of continued logging efforts and the Bandon fire in 1936, 1942 to 1954 saw net lateral erosion of the Coquille salt marshes, especially along the eastern bank of the river (King et al. 2020). No decrease in logging was evident during this time; however, up until 1948 the Army Corp of Engineers dredged the Coquille River to improve navigation (Benner et al. 1992). It is possible these efforts combined with increased wake due to boat travel may have resulted in erosion of the marsh edge.

The only period of time during which all three estuaries display similar morphological change is during the salt marsh expansion of the early 1950s to early 1970s as visible in the lateral change data (King et al. 2020). This period coincides with intensive logging and the wet phase of the Pacific Decadal Oscillation when coastal stream discharge was elevated (1944 to 1978; Wheatcroft et al. 2013). A storm event during the winter of 1964-65 caused large floods in all three systems. Large magnitude flows lasted for 8-11 days, and averaged 66, 44, and 30 mm/day in the SF Coquille, Alsea, and Nehalem rivers, respectively. The storm was particularly impactful in the Coquille and Alsea watersheds, in which the largest floods on record occurred. Additionally, during this flood the Coquille and Alsea there were 9 and 12 tide events, respectively, that exceeded mean higher high water, while Nehalem tides never exceeded mean higher high water (King et al. 2020).

In Alsea, the late 1940s to early 1970 saw increased logging by residents on private property, as well as increases in development via road construction and residential lots. During the 1950s, more private lumber companies constituted an increased landowners class in the area such

as Georgia-Pacific, an industrial timber company that acquired more lands, converting 110-120 year old second growth timber into plantations and clearing large portions of land (Hennessey 2005).

From 1974 to 1980 was a period of rapid salt marsh lateral growth in Nehalem, especially along the downstream edges of the large island (King et al. 2020). Although the 1970s is a period known for increased environmental protections, the logging industry continued in full force in the Nehalem watershed and across Oregon forests. Furthermore, it takes time for policies to be implemented which results in some lag between the time a policy is passed and when effects on the landscape begin to take place. Increased protections do not necessarily lead to a reduction in logging efforts, but rather places additional rules on logging practices so as to conduct logging operations in the most environmentally sound manner possible. In addition, this time period saw the lowest rates of mass accumulation on the salt marsh (King et al. 2020). It is possible that the shift to the dry phase of the Pacific Decadal Oscillation reduced flooding, resulting in less sediment transported onto the established salt marsh platform while still allowing for lateral growth.

From 1980 to 1994 was the only period of net lateral erosion in Nehalem Bay (King et al. 2020). The timber industry in the 1980s suffered greatly due to widespread recession in the US, and resulted in bankruptcies and significant reductions in operations until the state forester lowered the price of timber (Miller 2005). Further, though 1994 to 2018 in Nehalem Bay was a period of net lateral growth, rates were relatively neutral. A peak in mass accumulation is evident in the mid-90s, likely a result of the 500-year return interval flood that occurred in 1996, the largest flood event on record in this system.

With the exception of a net neutral period of lateral change from 1983 to 1991, 1972 to the present saw net erosion of Alsea Bay salt marshes. Mass accumulation rates were additionally

stagnant during this time (King et al. 2020). Agricultural usage of the tidal wetlands significantly waned by the 1970s as only 25% of the land became considered viable farming land. Recreational housing became more prominent and replaced much of the previous agricultural usage (Hennessey 2005). Prior to the 1970s, harvest levels of timber were regularly above 400,000 thousand board feet (mbf)s annually. Following the 1970s up until present, production has stayed below 400,000 (mbf)s per year, and has plateaued around 200,000 (mbf)s as of present. It is possible that federal ownership of much of the Alsea watershed has protected it from intensive logging practices via an expansion of wilderness areas (Miller 2005), but also resulted in relatively low suspended sediment concentrations above the natural values.

Though the century saw a steady downward trend in mass accumulation rates, net lateral growth of the Coquille salt marsh continued from 1967 into 1978, but 1978 to 1986 was a period of net erosion (King et al. 2020) possibly related to the decrease in logging operations as a result of the economic recession. Similar to the Alsea watershed, Coquille experienced a reduction in harvest levels by about half during this time period. With the exception of 1986 to 1994, which was a period of net lateral growth, the late 1990s to present has seen net erosion of the Coquille salt marshes (King et al. 2020). From the 1990s, harvest levels in Coos county have remained below 400,000 (mbf)s compared to 600,000 (mbf)s and above in previous decades. As of present, harvest remains below 300,000 (mbf)s annually. As in Nehalem, policy in this timeframe resulted in less intense land use and ultimately reduced downstream suspended sediment supply, likely due to an expanded Forestry Program for Oregon and the Stream Enhancement Initiative (Miller 2005). Generally, this analysis highlights the logging industry land uses, road construction and development, diking and dredging as expected social drivers of physical vulnerability on salt marsh and coastal stream systems on the Oregon coast.

Impacts of the Physical System on Socio-economic Vulnerability

Finally, with background information regarding potential physical hazards on the Oregon coast, temporal changes in the physical landscape will be explored alongside potentially relevant areas of socio-economic vulnerability such as housing and flooding patterns. In other words, I will explore various means in which salt marsh drowning might impact community vulnerability. Several domains of vulnerability will be explored such as socio-economic status, housing type and transportation, and housing characteristics and disability. Furthermore, vulnerability results from the social system will be compared with those of the physical system, drawn from the transdisciplinary report.

Of great importance in this study is the aspect of the economic value of forestry and the logging industry. The population that works in this industry is immensely affected by changes in forestry practices and policies. Many of the communities in this study have over 80% of their population employed in agriculture, forestry or fishing. The availability of work outside of these industries is limited, which means their local economy lacks diversity. A lack of diversity of the local economy can create conditions that increase vulnerability. Being too heavily reliant on one industry or group of industries to make income in the face of major changes in that industry can result in significant financial losses amongst both individual community members and the community as a whole. With the likelihood of continual major shifts in the vulnerability of coastal ecological systems such as the coastal rivers, estuaries and watersheds in which people work, income and availability of resources may become volatile. Across the three systems of this study, the communities residing in the Coquille system in Coos county are most vulnerable to shifts in the agriculture, forestry and fishing industries as they have the highest proportion of their population employed by these industries. Following Coos county is Lincoln county, with

Tillamook county as least vulnerable. A similar pattern occurs in the housing type and transportation variables discussed in the following paragraph.

Housing type and transportation also prove to be indicators of high vulnerability amongst coastal communities. In this study, housing as a component of vulnerability is indicated by population residing in mobile homes and population residing in group quarters. Mobile housing is denoted as a vulnerable housing type compared to permanent housing, likely due to the structural foundations of the homes. In the case of flooding on the Oregon coast, mobile homes likely lack the structural foundations necessary for enduring high volumes of water or resisting heavy debris. In terms of the population residing in group quarters, this variable may act as an indicator of high vulnerability in the face of an environmental hazard due to increased difficulty in moving more people to safety when necessary. It is also true that the more people residing in a place, the greater their exposure to a hazard. Across both the group quarters and mobile home variables, the census tracts in Coos county ranked the highest in terms of vulnerability, followed by those in Lincoln and Tillamook counties.

Finally, although certainly not the last of the variables shaping community vulnerability on the Oregon coast, housing characteristics and disability demonstrates a prominent area of vulnerability in this study. In terms of disabled population, Coos county ranked highest in this variable with Lincoln county in the middle, and Tillamook county ranking least vulnerable. With such a high disabled population, enduring a flooding hazard will prove to be much more difficult than with a minimal disabled population. And, the same could be said about communities with more single-parent households and those with higher populations under 18. Coos county ranked the highest in these variables, as well. And, Lincoln ranked just higher than Tillamook county which ranked the least of the three regions.

Overall, in terms of socio-economic vulnerability, Coos county was determined to be most vulnerable of the three study sites, Tillamook county the least vulnerable and Lincoln county ranked in between the two. The vulnerability of watersheds in our transdisciplinary report follows this pattern with the Coquille watershed being the most vulnerable, the Nehalem the least vulnerable of the three, and Alsea in the middle. Salt marsh vulnerability was not as clear cut as that of the social system, and deviated from the vulnerability results in the socio-economic and watershed systems. In most aspects, the Alsea salt marsh was determined as most vulnerable, but the Coquille and Nehalem salt marshes alternated in terms of least vulnerable across several factors. While it is difficult to make strong conclusions regarding the whole-system vulnerability, these results suggest that vulnerability does not always translate equally across social and physical systems. In some cases, higher vulnerability in one system may mean lower vulnerability in another. These patterns may become clearer with further explorations of the interactions between systems via continued transdisciplinary research.

Conclusion

As a review, this chapter emphasizes the characterization of socio-economic vulnerability, the relevance of policy in shaping the natural landscape and the human communities that reside in it, and conceptualizing the ways in which socio-economic and physical vulnerability interact with the policy and management landscape. The role of public policy and sociological study on this research has been useful particularly in addressing concerns of the human dimension that are seldom highlighted in the fields of hydrology and geomorphology. Where there have been gaps in our conceptualizations of hydrogeomorphic shifts on the Oregon coast, the land use and policy review can provide a social context to explore and attempt to explain some of these phenomena. And, in highlighting the importance of socio-economic factors in informing vulnerability, our characterization of whole-system vulnerability can be further developed. By engaging in a multidimensional, interdisciplinary analytical process, it is the hope of this study that the dynamics of socio-economic and physical vulnerability within the Oregon coastal landscape have been further elucidated. Beginning with socio-ecological connectivity of the Oregon Coast, the goals, results and implications of this chapter will be explored.

Socio-hydrogeomorphological Vulnerability of the Oregon Coast

Socio-economic vulnerability was characterized by a vulnerability index comprising 22 selected variables that address various areas of vulnerability. Of the three study sites, The Coquille watershed, including the Coquille estuary and residents of Coquille, Bandon and Myrtle Point, displayed the highest sum-rank of vulnerability. Of critical importance in informing this vulnerability were the following variables: poverty, SNAP, unemployment, uninsured population, population employed in Agriculture, Forestry and Fishing, non-citizen population,

disabled population, population residing in group quarters, income, population residing in mobile homes, education level, and age. Following behind the Coquille watershed in sum-rank vulnerability was the Alsea watershed. Nehalem remained the least vulnerable of the three study sites. In addition to the variables that were most pertinent to Coquille's high vulnerability ranking, accessibility to a phone and a vehicle played a significant role in informing Alsea's vulnerability ranking. Nehalem ranked lower than the Coquille and Alsea sites across these variables, resulting in a lower sum-rank of vulnerability. Variables of least importance included BIPOC population, citizenship, limited english, multi-unit housing, single parent households, and population under 18. These findings prompt further questions as to why these populations are highly vulnerable in terms of employment, housing, and socio-economic status? Compared to the metropolitan regions of Oregon, coastal communities are often more limited with regard to areas of occupation and resultantly find themselves significantly employed in the natural resources industries. While these industries remain critical to human survival, changes in the industry may affect these working residents more significantly. In the case of a major flooding event, not only are residents' physical homes at risk, but they may be out of work for some time. Housing also proved to be a significant area of vulnerability, which is particularly tied to land use via zoning and development policies. There is potential to address vulnerability of coastal communities by further integrating housing and socio-economic status into land use policymaking as a means of resilience in the face of environmental hazards.

The connection between natural vulnerability and social vulnerability is most clearly articulated through the human dependence on natural resources for economic and social well-being. Socially, the Coquille site is ranked highest for this variable and in terms of overall vulnerability. The Alsea site follows closely behind the Coquille, and Nehalem is ranked the lowest of the three. Both

policies and physical hazards that alter the ways in which humans interact with natural resources directly impact the populations that rely on these industries for their work. It is also clear that the Coquille site has experienced the highest degree of logging when looking at timber harvest data from the Oregon Department of Forestry. Just in 2018, 253,982 thousands of board feet were harvested in Coos county, compared to 179,825 thousands of board feet in Lincoln county, and 154,027 thousands of board feet in Tillamook county (ODF 2019; Figures S15-S17). Vulnerability is a relative measurement, and Coquille is more vulnerable compared to Alsea and Nehalem overall. But, Coquille may not be considered socially vulnerable when compared to populations with greater proportions of those that speak limited english or are of more marginalized identities. It is also critical to pay close attention to the ranking of each variable, as it tells us what is important to the vulnerability overall. Many socio-economic, housing, household demographics and cultural components were relevant to the vulnerability in this analysis, including the Agforest variable, which suggests that these variables are worth prioritizing when characterizing vulnerability on the Oregon coast.

Limitations & Future Directions

Our case-study research is wide-reaching and transdisciplinary, bringing many big datasets, analyses, and concepts together. By nature, there are opportunities for improvement, particularly if our case-study methods were to be scaled up to systematically assess socio-ecological vulnerability across coastal systems. Connections between human and natural systems would be further elucidated with more detailed analysis of each policy and land-use. The social vulnerability analysis would be greatly improved by accounting for correlations between variables, weighting variables as appropriate and backed by research, and cross-checking variables with community member perspectives. Conducting multiple types of analyses would improve

conclusions on community vulnerability. In both social and natural systems, our findings may be improved with a larger study extent, though a case-study of three sites was appropriate for the scope of the project.

Our case study of three coastal systems reveals important connections between social and natural systems. Through both spatial and temporal evaluations, we demonstrate: (1) the potential hydrological and land-use explanations for anomalies in sediment accumulation in downstream salt marshes, (2) the interactions between salt marsh dynamics and policy changes over the recent century, and (3) how vulnerability can be defined in individual natural and social systems and can be integrated to understand system-wide socio-ecological vulnerability. Our case study provides a framework by which resource managers may structure evaluations of socio-ecological vulnerability in dynamic and highly connected coastal environments.

While the first chapter focused on the dynamics of participation amongst communities that could be labeled as vulnerable, likely ranking high in terms of the variables included in this analysis, this chapter highlights some of the interactions between community vulnerability and natural system vulnerability. The relationship between policy and socio-economic vulnerability is seldom explored in the natural resource, risk and uncertainty literature. While much of the focus remains on physical vulnerability, socio-economic vulnerability in the face of environmental hazards is poorly understood. Not only can interconnectedness of socio-economic and physical vulnerability be further elucidated, but the context of policy as it pertains to vulnerability can be explored much more considerably. This analysis sought to discuss some of the more distant relationships between policy making and natural resource issues such as socio-economic status and flooding hazards. It begins to dive into questions like, what role do education level, income level and access to a phone or vehicle play in terms of the capacity to

endure a risk such as flooding? As long as natural resource policies center physical vulnerability without an integration of socio-economic vulnerability, human communities may suffer in terms of their ability to manage environmental disasters. In the reverse, policies that address issues of socio-economic vulnerability would also benefit from incorporating considerations of physical vulnerability. As coupled natural-human systems literature suggests, natural and human systems may exist in cycles of resilience and vulnerability, feeding back on factors within each system. When human communities are economically vulnerable, they may manage land in such a way that benefits the economy, while neglecting ecosystem needs. Vulnerability in physical systems that result in increased flashiness or erosion may subsequently impact human communities' capacity to work in fields of forestry due to increased risk. These relationships are often nuanced and complex, and this study attempts to simply bring some of these concerns to light.

Further directions in this research may include a more in-depth policy analysis of a particular policy or set of policies that consider not only the effects on the ecosystem but also on community members that work in natural resource industries by incorporating more stakeholder perspectives. Additionally, this research could be expanded by developing the vulnerability analysis to more accurately describe the different domains of vulnerability. And, by clarifying the relationship between physical and social vulnerability, whole-system management that improves resilience may become more possible. Ultimately, rather than conducting such studies separately, integrating across disciplines and amongst stakeholders may elucidate dynamics and relationships that are not apparent with one-dimensional research studies.

Appendix I. References

- Barbier, E., Hacker, S., & Kennedy, C. (2011). The value of estuarine and coastal ecosystem services. *Ecological Economics*, 81, 169–193.
- Benner, Patricia A., 1991. "Historical Reconstruction of the Coquille River and Surrounding Landscape." In: Near Coastal Waters National Pilot Project: The Coquille River, Oregon. "Action Plan for Oregon Coastal Watersheds, -Estuary and Ocean Waters, 1988-91." Prepared by the Oregon Department of Environmental Quality for the U.S. Environmental Protection Agency, Grant X-000382-1.
- Beschta, R. L. (1978). Long-term patterns of sediment production following road construction and logging in the Oregon Coast Range. *Water Resources Research*, 14(6), 1011–1016. <https://doi.org/10.1029/WR014i006p01011>
- Boisjolie, B. A., Santelmann, M. V., Flitcroft, R. L., & Duncan, S. L. (2017). Legal ecotones: A comparative analysis of riparian policy protection in the Oregon Coast Range, USA. *Journal of Environmental Management*, 197, 206–220. <https://doi.org/10.1016/j.jenvman.2017.03.075>
- Brady, J. (1999). "Land Is Itself a Sacred, Living Being": Native American Sacred Site Protection on Federal Public Lands Amidst the Shadows of Bear Lodge. *American Indian Law Review*, 24(1), 153. <https://digitalcommons.law.ou.edu/ailr/vol24/iss1/18>
- Brooks, N. (2003). Vulnerability, Risk and Adaptation: A Conceptual Framework. Tyndall Centre for Climate Change Research, Working Paper No, 38.
- Brown, G. W., & Krygier, J. T. (1971). Clear-cut logging and sediment production in the Oregon Coast Range. *Water Resources Research*, 7(5), 1189–1198.
- Burby, R. J., Deyle, R. E., Godschalk, D. R., & Olshansky, R. B. (2000). Creating Hazard Resilient Communities through Land-Use Planning. *Natural Hazards Review*, 1(2), 99–106. [https://doi.org/10.1061/\(ASCE\)1527-6988\(2000\)1:2\(99\)](https://doi.org/10.1061/(ASCE)1527-6988(2000)1:2(99))
- Campbell, S., Dunham, P., & Azuma, D. (2004). *Timber Resource Statistics for Oregon* (Resource Bulletin PNW-RB-242; p. 67). U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.
- Cinner, J. E., Adger, W. N., Allison, E. H., Barnes, M. L., Brown, K., Cohen, P. J., Gelcich, S., Hicks, C. C., Hughes, T. P., Lau, J., Marshall, N. A., & Morrison, T. H. (2018). Building adaptive capacity to climate change in tropical coastal communities. *Nature Climate Change*, 8(2), 117–123. <https://doi.org/10.1038/s41558-017-0065-x>
- Colburn, L. L., Jepson, M., Weng, C., Seara, T., Weiss, J., & Hare, J. A. (2016). Indicators of climate change and social vulnerability in fishing dependent communities along the

- Eastern and Gulf Coasts of the United States. *Marine Policy*, 74, 323–333.
<https://doi.org/10.1016/j.marpol.2016.04.030>
- Coos County Board of Commissioners, Coos County Planning Commission, Coos County Planning Department, & Coos County Council. (1985). *Coos County Comprehensive Plan*.
- Coquille Watershed Association. (n.d.). *Coquille Watershed Association*. History and Mission Statement. <https://www.coquillewatershed.org/about-us/mission-statement-and-objectives/>
- Cutter, Susan L, Boruff, Bryan J, & Shirley, W. Lynn. (2003). Social Vulnerability to Environmental Hazards. *Social Science Quarterly*, 84(2), 242–261.
<https://doi.org/10.1111/1540-6237.8402002>
- Donato, D. J., Fontaine, J. B., Campbell, J. L., Robinson, W. D., Kauffman, J. B., & Law, B. E. (2006). Post-Wildfire Logging Hinders Regeneration and Increases Fire Risk. *Scienceexpress Brevia*, 1–3.
- Ekstrom, J., Suatoni, L., Cooley, S. et al. Vulnerability and adaptation of US shellfisheries to ocean acidification. *Nature Clim Change* 5, 207–214 (2015).
<https://doi.org/10.1038/nclimate2508>
- Flanagan, Barry E.; Gregory, Edward W.; Hallisey, Elaine J.; Heitgerd, Janet L.; and Lewis, Brian (2011) "A Social Vulnerability Index for Disaster Management," *Journal of Homeland Security and Emergency Management*: Vol. 8: Iss. 1, Article 3. DOI: 10.2202/1547-7355.1792
- Garland, J. J. (2015, May). *The Oregon Forest Practice Act: 1972 to 1994*.
- Haney, D., Hawe, P., Hopkins, S., Frazier, E., Power, B., Conley, L., Tomczyk, T., Monthey, R., Koski, M., Maxwell, D., & Bergen, D. (1995). *South Fork Alsea Watershed Analysis* (p. 114). Bureau of Land Management.
- Hennessey, J. (2005). *A Historical Reconstruction and Land Use History of Six Tidal Wetlands in Oregon*. Oregon State University.
- Jepson, Michael and Lisa L. Colburn 2013. Development of Social Indicators of Fishing Community Vulnerability and Resilience in the U.S. Southeast and Northeast Regions. U.S. Dept. of Commerce., NOAA Technical Memorandum NMFS-F/SPO-129, 64 p.
- Johnson, J. (1999). *Nehalem River Watershed Assessment*. Portland State University.
- Kirwan, M. L., Murray, A. B., Donnelly, J. P., & Corbett, D. R. (2011). Rapid wetland expansion during European settlement and its implication for marsh survival under modern sediment delivery rates. *Geology*, 39(5), 507-510.

- Krishnan, P., Ananthan, P.S., Purvaja, R. et al. Framework for mapping the drivers of coastal vulnerability and spatial decision making for climate-change adaptation: A case study from Maharashtra, India. *Ambio* 48, 192–212 (2019). <https://doi.org/10.1007/s13280-018-1061-8>
- Lincoln County. (1982). *Lincoln County Estuary Management Plan*.
- Lower Nehalem Watershed Council. (n.d.). *Lower Nehalem Watershed Council*. <https://lnwc.nehalem.org/>
- Madej, M. A. (2001). Erosion and sediment delivery following removal of forest roads. *Earth Surface Processes and Landforms*, 26(2), 175–190. USGS Publications Warehouse. [https://doi.org/10.1002/1096-9837\(200102\)26:2<175::AID-ESP174>3.0.CO;2-N](https://doi.org/10.1002/1096-9837(200102)26:2<175::AID-ESP174>3.0.CO;2-N)
- Marino, E. (2015). *Fierce Climate, Sacred Ground: An Ethnography of Climate Change in Shishmaref, Alaska*. University of Alaska Press.
- Meinke, P., Espinosa, R., Snedaker, S., Kuck, T., Thornton, C., Horn, E., Carson, K., Basham, G., Mathweg, D., Scheleen, D., Adams, B., Gilster, B., Roberts, D., Wagnitz, R., & Ross, J. (1999). *Upper Middle Fork Coquille Watershed Analysis* (p. 204). Bureau of Land Management.
- Midcoast Watersheds Council. (n.d.). *Midcoast Watersheds Council*. <http://www.midcoastwatersheds.org/about-us>
- Miller, R. R. (2010). *Is the Past Present? Historical Splash-dam Mapping and Stream Disturbance Detection in the Oregon Coastal Province* [Masters of Science]. Oregon State University.
- Miller, R. W. (2005). *Forests, People and Oregon: A History of Forestry in Oregon*. Oregon Department of Forestry.
- Mrozowski, S. A. (1999). Colonization and the Commodification of Nature. *International Journal of Historical Archaeology*, 3(3), 153–166. <https://doi.org/10.1023/A:1021957902956>
- NOAA. (2020). *Coastal Zone Management Act*. Office For Coastal Management (National Oceanic and Atmospheric Administration).
- Oregon Department of Forestry. (2019, September 27). *Oregon Timber Harvest Data, 1962-2018*. Timber Harvest Data 1962-2018.
- Oregon Department of Forestry, & R2 Resource Consultants. (2005). *Upper Nehalem Watershed Analysis* (p. 360). Oregon Department of Forestry.

- Oregon Forest Resources Institute. (2019). Oregon Forest Facts 2019-20 Edition.
<https://oregonforests.org/node/172>
- Peck, E. K., Wheatcroft, R. A., & Brophy, L. S. (2020). Controls on sediment accretion and blue carbon burial in tidal saline wetlands: Insights from the Oregon coast, USA. *Journal of Geophysical Research: Biogeosciences*, 125(2), e2019JG005464.
- Phelps, J. D. (2011). *THE GEOMORPHIC LEGACY OF SPLASH DAMS IN THE SOUTHERN OREGON COAST RANGE* [Master of Science]. University of Oregon.
- Rhodes, J. J. (2007). *The Watershed Impacts Of Forest Treatments To Reduce Fuels And Modify Fire Behavior*. prepared for Pacific Rivers Council.
- Schroeder, Jonathan P. (2016). Historical Population Estimates for 2010 U.S. States, Counties and Metro/Micro Areas, 1790-2010. Retrieved from the Data Repository for the University of Minnesota, <http://doi.org/10.13020/D6XW2H>.
- Stanfield, B. J. (2000). *Land Ownership and Forest Cover in the Oregon Coast Range: Spatial Pattern and Social Ground-Truthing* [Master of Science]. Oregon State University.
- Thorne, K., MacDonald, G., Guntenspergen, G., Ambrose, R., Buffington, K., Dugger, B., ... & Holmquist, J. (2018). US Pacific coastal wetland resilience and vulnerability to sea-level rise. *Science Advances*, 4(2), eaao3270.
- Tillamook County, Oregon. (2020). Comprehensive Plan.
- Upper Nehalem Watershed Council. (n.d.). *Upper Nehalem Watershed Council*.
<https://unwc.nehalem.org/>
- U.S. Census Bureau (2018). American Community Survey Response Rates. Url:
<https://www.census.gov/acs/www/methodology/sample-size-and-data-quality/response-rates/>
- U.S. Census Bureau. (2018). American Community Survey, 2018 American Community Survey 5-Year Estimates, Table B01003 [Generated by Jasmine King]. Using Data.Census.Gov.
<https://data.census.gov/cedsci/>
- U.S. Census Bureau. (2018). American Community Survey, 2018 American Community Survey 5-Year Estimates, Table B05001 [Generated by Jasmine King]. Using Data.Census.Gov.
<https://data.census.gov/cedsci/>
- U.S. Census Bureau. (2018). American Community Survey, 2018 American Community Survey 5-Year Estimates, Table B06009 [Generated by Jasmine King]. Using Data.Census.Gov.
<https://data.census.gov/cedsci/>

- U.S. Census Bureau. (2018). American Community Survey, 2018 American Community Survey 5-Year Estimates, Table B09001 [Generated by Jasmine King]. Using Data.Census.Gov. <<https://data.census.gov/cedsci/>>
- U.S. Census Bureau. (2018). American Community Survey, 2018 American Community Survey 5-Year Estimates, Table B16005 [Generated by Jasmine King]. Using Data.Census.Gov. <<https://data.census.gov/cedsci/>>
- U.S. Census Bureau. (2018). American Community Survey, 2018 American Community Survey 5-Year Estimates, Table B17001 [Generated by Jasmine King]. Using Data.Census.Gov. <<https://data.census.gov/cedsci/>>
- U.S. Census Bureau. (2018). American Community Survey, 2018 American Community Survey 5-Year Estimates, Table B19301 [Generated by Jasmine King]. Using Data.Census.Gov. <<https://data.census.gov/cedsci/>>
- U.S. Census Bureau. (2018). American Community Survey, 2018 American Community Survey 5-Year Estimates, Table DP02 [Generated by Jasmine King]. Using Data.Census.Gov. <<https://data.census.gov/cedsci/>>
- U.S. Census Bureau. (2018). American Community Survey, 2018 American Community Survey 5-Year Estimates, Table DP03 [Generated by Jasmine King]. Using Data.Census.Gov. <<https://data.census.gov/cedsci/>>
- U.S. Census Bureau. (2018). American Community Survey, 2018 American Community Survey 5-Year Estimates, Table DP04 [Generated by Jasmine King]. Using Data.Census.Gov. <<https://data.census.gov/cedsci/>>
- U.S. Census Bureau. (2018). American Community Survey, 2018 American Community Survey 5-Year Estimates, Table DP05 [Generated by Jasmine King]. Using Data.Census.Gov. <<https://data.census.gov/cedsci/>>
- U.S. Census Bureau. (2018). American Community Survey, 2018 American Community Survey 5-Year Estimates, Table S0101 [Generated by Jasmine King]. Using Data.Census.Gov. <<https://data.census.gov/cedsci/>>
- U.S. Census Bureau. (2018). American Community Survey, 2018 American Community Survey 5-Year Estimates, Table S0601 [Generated by Jasmine King]. Using Data.Census.Gov. <<https://data.census.gov/cedsci/>>
- U.S. Census Bureau. (2018). American Community Survey, 2018 American Community Survey 5-Year Estimates, Table S2201 [Generated by Jasmine King]. Using Data.Census.Gov. <<https://data.census.gov/cedsci/>>

- U.S. Census Bureau. (2018). American Community Survey, 2018 American Community Survey 5-Year Estimates, Table S2701 [Generated by Jasmine King]. Using Data.Census.Gov. <<https://data.census.gov/cedsci/>>
- U.S. Census Bureau. (2018). American Community Survey, 2018 American Community Survey 5-Year Estimates, Table S2801 [Generated by Jasmine King]. Using Data.Census.Gov. <<https://data.census.gov/cedsci/>>
- Wedel, J. R., Shore, C., Feldman, G., & Lathrop, S. (2005). Toward an Anthropology of Public Policy. <https://journals-sagepub-com.ezproxy.proxy.library.oregonstate.edu/doi/abs/10.1177/0002716205276734>
- Wondzell, S. M., & King, J. G. (2003). Post-Fire Erosional Processes in the Pacific Northwest and Rocky Mountain Regions. *Forest Ecology and Management*, 75 – 87.
- Wright, T., Tomlinson, J., Schueler, T., Cappiella, K., Kitchell, A., & Hirschman, D. (2006). Direct and Indirect Impacts of Urbanization on Wetland Quality. Office of Wetlands, Oceans and Watersheds | U.S. Environmental Protection Agency.
- Wu, H., Kimball, J. S., Elsner, M. M., Mantua, N., Adler, R. F., & Stanford, J. (2012). Projected climate change impacts on the hydrology and temperature of Pacific Northwest rivers. *Water Resources Research*, 48, W11530. <https://doi.org/10.1029/2012WR012082>
- Yin, J., Yin, Z., Wang, J. et al. National assessment of coastal vulnerability to sea-level rise for the Chinese coast. *J Coast Conserv* 16, 123–133 (2012). <https://doi.org/10.1007/s11852-012-0180-9>
- Yost, A. (2019). Oregon Department of Forestry’s Annotated History of Climate Change-Related Policy in Oregon And the Board of Forestry - A Decadal Overview -.
- Zybach, B. (2003). The Great Fires: Indian Burning and Catastrophic Forest Fire Patterns of the Oregon Coast Range. 1491-1951 [Doctor of Philosophy]. Oregon State University.

Appendix II. Tables

Table 1. List of and descriptions for U.S. Census Bureau ACS variables used for the social vulnerability analysis (U.S. Census Bureau 2019).

Variable	Description
65PLUS	Estimate of total population 65 years and older
AGFOREST	Estimate of civilian employed population 16 years and over in agriculture, forestry, fishing and hunting, and mining
BIPOC	Estimate of total population – White population (Estimate of population that are Black, Indigenous & People of Color)
CITIZENSHIP	Total estimate of U.S. citizens, population born in the United States
DISABILITY	Estimate of Total Civilian Noninstitutionalized Population with a disability
EMPLOYED	Estimate of civilian employed population 16 years and over
GROUPQTRS (Group Quarters)	Estimated population living in group quarters. A group quarters is a place where people live or stay, in a group living arrangement, that is owned or managed by an entity or organization providing housing and/or services for the residents. Group quarters include such places as college residence halls, residential treatment centers, skilled nursing facilities, group homes, military barracks, correctional facilities, and workers' dormitories.
INCOME	Estimate of per capita income in the past 12 months (in 2018 inflation-adjusted dollars)
INSURED	Estimated population with health insurance. Health Insurance. This question measures the insured and uninsured by asking about coverage through an employer, direct purchase from an insurance company, Medicare, Medicaid or other government-assistance health plans, military health care, VA health care, Indian Health Service, or other types of health insurance or coverage plans. Plans that cover only one type of health care (such as dental plans) or plans that only cover a person in case of an accident or disability are not included.

LTDENG (Limited-English)	Estimate of population that speaks limited-English. The Bureau asks three questions to gather data on those speaking a language other than English at home, what that language is, and how well each person speaks English.
MOBILE HOME	Estimated population living in mobile homes (An HU may be a house, an apartment, a mobile home or trailer, a group of rooms, or a single room that is occupied (or, if vacant, intended for occupancy) as separate living quarters).
MUNIT (Multi-Unit Housing)	Estimate of multi-unit housing (Sum of housing units of 2 or greater per structure)
NO DIPLOMA	Estimated population that did not receive a HS diploma
NO PHONE	Estimate of occupied housing units with no access to telephone service
NO VEHICLE	Estimate of occupied housing units with no vehicle available
NON-CITIZEN	Estimate of population of non-U.S. citizens (persons born outside of the United States)
POVERTY	Estimate of income in the past 12 months below poverty level
SINGLE-PARENT	Estimate of total single parent households (Male householder, no wife + Female householder, no husband)
SNAP	Estimate of households receiving food stamps/SNAP
UNDER18	Estimated population under 18 years old
UNEMPLOYED	Estimated population of unemployed persons 16 years and older in the civilian labor force
UNINSURED	Estimated population without health insurance. Health Insurance. This question measures the insured and uninsured by asking about coverage through an employer, direct purchase from an insurance company, Medicare, Medicaid or other government-assistance health plans, military health care, VA health care, Indian Health Service, or other types of health insurance or coverage plans. Plans that cover only one type of health care (such as dental plans) or plans that only cover a person in case of an accident or disability are not included.

Table S1. Decadal Land Use & Policy History of Statewide, Federal and Local Oregon coastal, forest and environmental management.

1800s

Year(s)	Land Use	Policy
1800	Fire 2 ½ miles south of Mist - burned thousands of acres in Nehalem (Johnson 1999) **fire	
1800s-1918	A great deal of freighting down the river, as it was the primary mode of transportation at the time (Hennessey 2005) **water/log drives	
1827	Sawmills by the river (Miller 2005). Typical logging operations were family owned, consisting of 8-10 men who logged a small area, using a oxen to drag the logs to the stream in Nehalem (ODOF 2005) **logging	
1840-1890	Several forest fires swept over much of the area in Alsea (Haney et al. 1995, Hennessey 2005) **fire	
1845	**Fire (prescribed/controlled burns); Large downed wood found extensively in the streams, rivers, and riparian corridors of the NW (Benner 1991) **water	
1846	**Fire in Alsea (Haney et al. 1995, Hennessey 2005)	
1850		Donation Land Law, large pieces of Oregon Territory land were donated to settlers (Miller 2005); <u>(land/ownership)</u>
1862		Federal Homestead Act, 160 acre parcels could be purchased for a small fee (Miller 2005) <u>(land/ownership)</u>

1864		First forestry law in Oregon(Miller 2005) <u>(forestry)</u>
1868	Pioneers settled the towns of Nehalem and Wheeler in the Nehalem watershed (Johnson 1999) **development	
1870	(1) Railroad logging in timber harvest begins (Miller 2005) **logging/transportation ; first oregon wood pulp mill (Miller 2005) **mills + (2) Sawmills were opened around 1870 by Jacob Lehnherr, 1880s by James Kirkendall, 1882 by William Ferguson, 1889 by Ferguson and Amsten, and the 1890s by Abram Thrush and Vinnie Arrington (Combs 1962). Prior, Ferguson, and Devitt operated a sawmill at the headwaters of the Middle Fork of the Coquille River. The mill was surrounded by excellent timber of fir, cedar, and sugar pine with a production capacity of 3,000 board feet per day (Meinke et al. 1999). **mills	Congress approved granting of land to approve building of railroads between Portland and California <u>(transportation)</u>
1872	Railroad reached the north (Coquille) & opened a new avenue for transportation (Meinke et al. 1999)	
1873	Pioneers were coming to Nehalem Valley to settle and clear land for farming (Nehalem) (Johnson 1999) **development	
1876		Congress authorized employment of a Forestry Agent by the Federal Department of Agriculture and Franklin Hough became the 1st forester (Miller 2005) <u>(forestry)</u>
1877-1878	Pittsburg lumber mill built, powered by a 20 ft. dam across the East Fork of the	

	Nehalem River (Johnson 1999) **mills/dams	
1879	A wagon road from Camas Valley to Myrtle Point was completed in 1879 (Coquille) (Meinke et al. 1999) **transportation	USGS founded (Rabbitt 2019) (environment)
1880		US Division of Forestry created (Miller 2005) (forestry)
1880-1930s	(1) Significant agriculture usage + (2) Docks and seawalls built along the southern portion of Alsea Bay (Hennessey 2005) **diking + (3) A large variety of fruit, grains, and grasses were grown in the Camas Valley area in Coquille (Meinke et al. 1999) **agriculture	
1880-1957	Log drives on Alsea River + log drives on Coquille River on both forks [25+ known splash dams] + log drives on Nehalem River + [4 known splash dams] **log drives (Miller 2010)	
1881	First of Coquille River mouth jetty projects begins by the USACE (Benner et al. 1992) **diking	
1883	First transcontinental railroad connecting Portland with the east; before then, logs were primarily delivered to the mill via bodies of water (Miller 2005) **transportation	
1884	(1) Steam powered machine used to move logs within the woods instead of animals -- "Steam donkey" (Miller 2005) **logging + (2) US Army Corps of Engineers became involved in tidal section Coquille River channel	

	maintenance (removing large wood). Much of this was done to dredge to restore the channel to navigable depth in places where the river had begun to shoal (Benner et al. 1992) **dredging + (3) Sawmills near Waldport & Tidewater in Alsea (Hennessey 2005) + (4) Small sawmills were operated at Rock Creek, Dairy Creek near Vernonia, Pittsburg, and Vernonia in Nehalem (ODOF 2005)	
1887-1912	State deed to James Doty for lower site in Alsea (Hennessey 2005) **land ownership	
1888	Dirt roads built to transport goods from Alsea to Tidewater (Hennessey 2005) **transportation	
1889-1902	(1) The USACE periodically pulled snags from the 37 miles from Myrtle Point to Bandon + The Roseburg-Coos Bay Stage line operated from 1888 to 1891 in Coquille (Benner et al. 1992) **dredging + (2) "Army engineers had a crew of men working all summer shooting out a better channel down the river" in Alsea (Hennessey 2005) **dredging	
1890s	Wing dams, pile dikes and shore protection were constructed along the upper tidal Coquille in addition to the snagging and dredging work; river travel standard method of transporting goods and people on the Coquille River (Benner et al. 1992) **transportation	
1891		Congress authorized the President to withdraw public lands from the

		public domain as forest reserves by Executive Order (Miller 2005) <u>(forestry)</u>
1892	The river between Myrtle Point and Coquille was snagged **dredging , and a wing dam was constructed at Robers Island in an attempt to direct the water to one side of the island into the main channel (Benner et al. 1992) **dams	
1893		The Cascade Range Forest Reserve (later designated as a National Forest) was created by Presidential proclamation (Miller 2005) <u>(forestry)</u>
1894	(1) Railroads to Coos Bay offered another export route for lumber in Coquille (Benner et al. 1992) **transportation/logging + (2) Flood Event in Nehalem (Johnson 1999)	
1896	USACE contracted with Noble and Saunders to do extensive channel rehabilitation in the upper river in Coquille (Benner et al. 1992) **dredging	
1897	During summer, the company (Noble and Saunders) spent 37 days removing snags from the river & dredged 2402 cubic yards of shoal material from the 5/8 mile stretch between Roberts Landing on the Coquille and Rackeffs Landing to form a 50 ft wide and 4 ft deep channel (Benner et al. 1992) **dredging	An Act for the Administration of the Forest Reserves was passed by Congress as the basis for operating the National Forests (Miller 2005) <u>(forestry)</u>
1899	Last major snagging and dredging effort was begun by the USACE on the upper	Oregon Legislature declares 30 miles of beach as a public highway from Columbia River to south line of

	river to restore the channel; over 29, 400 cubic yards of material were dredged from almost a mile of channel segments to produce a 50 feet wide and 4 feet deep channel (Benner et al. 1992) **no work was done on south fork due to funding limitations	Clatsop County (Miller 2005) <u>(transportation/coast)</u>
--	--	---

1900-1910

<i>Year(s)</i>	<i>Land Use</i>	<i>Policy</i>
<i>1800s-1918</i>	A great deal of freighting down the river, as it was the primary mode of transportation at the time (Hennessey 2005) **water/log drives	
<i>1880-1930s</i>	Significant agriculture usage in Alsea (Hennessey 2005)	
<i>1880s-1920</i>	Docks and seawalls built along the southern portion of Alsea Bay (Hennessey 2005) **diking	
<i>1880-1957</i>	log drives on Alsea River + log drives on Coquille River on both forks [25+ known splash dams] + log drives on Nehalem River + [4 known splash dams] **log drives/splash dams (Miller 2010)	
<i>1887-1912</i>	State deed to James Doty for lower site in Alsea (Hennessey 2005) **land ownership	
<i>1900</i>	Splash dams were being used due to being more convenient and effective in transporting logs in Coquille (Benner et al. 1992, Meinke et al. 1999)	
<i>1901</i>	USACE observed that maintaining a	(US) Bureau of Forestry created

	navigable channel in the upper tidal river did not appear to be economically feasible in Coquille (Benner et al. 1992)	(Miller 2005) (forestry)
1901-1926	(1) Extensive log drives occurred on the Nehalem River + (2) Potential splash dams on the North Fork Nehalem River (Johnson 1999)	
1902	USACE abandoned the project to maintain a channel on the upper river above Coquille city with the exception of some sporadic snagging work (Benner et al. 1992) **dredging + First hatchery on the Alsea River watershed near the town of Alsea (Hennessey 2005)	
1902-1924	USACE maintained the river 25miles below the city of Coquille (Coquille) (Benner et al. 1992) **dredging	
1902-1930	Wheeler sawmill in operation (Nehalem) (Johnson 1999)	
1905	Another hatchery established on Drift Creek, closed in 1906 in Alsea (Hennessey 2005)	(1) The Oregon State Legislature passed a law requiring burning permits during severe fire weather and authorizing county courts to appoint fire wardens. These laws became the forerunners of Oregon's Forestry Code, but they lacked teeth and organization (Miller 2005). (forestry) + (2) US Forest Service established (forestry) (Miller 2005)
1905-1935	At least 25 dams built, and 122 miles of channel were involved in transporting logs. blasting boulders and removing channel wood was also	

	necessary to clear the channel for both forms of log drives (including non augmented flow) in Coquille **dredging (Benner et al. 1992)	
1907	A third hatchery established in 1907 on the Alsea River at the mouth of Rock Creek, closed after 1 year in 1908 in Alsea (Hennessey 2005)	The State Legislature created a Board of Forestry to investigate forest conditions, designate a fire season and outlaw incendiary fires. (Miller 2005) (forestry)
1908	Extensive logging on the headwaters for distances of 30, 26, and 18 miles above Myrtle point on the north, south and middle forks in Coquille (Benner et al. 1992)	(1) Much of lands converted to Suislaw National Forest **ownership from State to Federal gov (forestry) + (2) US Forest Service appointed first Regional Forester (forestry) (Miller 2005)
1909	(1) Port of Nehalem was formed (Johnson 1999) **dredging/transportation + (2) The Camas Valley Coal Company was incorporated on October 30, 1909 - By 1913 the company had ceased operating in Coquille (Meinke et al. 1999) **mining	(1) Klamath-Lake Counties Forest Fire Association became the first fire association in Oregon (forestry) + (2) An Oregon Conservation Commission is created by the Legislature to study the resource situation in the state (environment) (Miller 2005)

1910-1920

<i>Year(s)</i>	<i>Land Use</i>	<i>Policy</i>
1880s-1920	Docks and seawalls built along the southern portion of Alsea Bay (Hennessey 2005) **diking	
1880-1957	Log drives on Alsea River + Log drives on Coquille River on both forks [25+ known splash dams] + log drives on Nehalem River + [4 known splash dams] (Miller 2010)	

1887-1912	State deed to James Doty for lower site in Alsea (Hennessey 2005) **land ownership	
1901-1926	Extensive log drives occurred on the Nehalem River + potential splash dams on the North Fork Nehalem River (Johnson 1999)	
1905-1935	At least 25 dams built, and 122 miles of channel were involved in transporting logs. blasting boulders and removing channel wood was also necessary to clear the channel for both forms of log drives (including non augmented flow) in Coquille (Benner et al. 1992) **dredging	
1910	A fourth hatchery was established on the Alsea River at Scott Creek (operated until 1913) (Hennessey 2005)	Money was appropriated by the 1910 River and Harbor Act to restore the river's depth (Benner et al. 1992) (Coquille) (water/coast)
1911	(1) 130,020 cubic yards of material were dredged from these shoals to restore the channel to about a 10 ft depth and a width of 80-100 ft + (2) USACE removed 343,108 cubic yards of sand from the areas of six shoals + Port of Coquille formed (Benner et al. 1992) + (3) Railroad connecting Portland with Tillamook County completed (Nehalem) **transportation + (4) The town of Timber thriving, small sawmill and railroad tracks built in Nehalem (Johnson 1999) **transportation	State legislators enacted a law creating a new seven-member Board of Forestry, a State Forester, and a deputy for the appointment of fire wardens. Francis A. Elliott was appointed as the first State Forester (Miller 2005) (forestry)
1913		(1) Legislature amends 1899 law, and declares all beaches as a state highway

		<u>(transportation/coast)</u> + (2) The Compulsory Forest Fire Patrol Law enacted by the Legislature required all forest landowners to pay their share of fire protection cost. <u>(forestry) (Miller 2005)</u>
1913-1928	Port of Coquille spent at least \$26,000 in the culling of the bankside vegetation (Benner et al. 1992) **dredging	
1914-1918	Demand for Alsea Sitka spruce for aircraft construction + roads, schools, etc. **logging Homesteading on national forest lands begins in Alsea **land ownership/development (Hennessey 2005)	WWI (Miller 2005)
1915	(1) High lead logging (Miller 2005) + (2) newly formed Port of Bandon spent \$43,842 to restore and deepen the existing channels in Coquille (Benner et al. 1992) **dredging + (3) A hatchery was established near Tidewater and operated continuously until 1952 (Alsea) + (4) Lower site owned by Augusta Day, upper site owned by Martha Goin (Martha's family - the Kent family - owned land along Drift Creek and farmed a previously wooded and logged parcel of land) in Alsea (Hennessey 2005) **land ownership	State laws were passed to limit the weight of vehicles based on the size of tires. (Miller 2005) <u>(transportation)</u>
1915-1917	Railroad built from Waldport to Toledo Mill to transport logs in Alsea (Hennessey 2005) **transportation/logging	
1916	(1) William Northrup cleared brush,	

	logs and debris from Myrtle Creek & Middle Fork Boom Company also cleared banks and opened up the channel. Landowners along the forks probably at times clear sections of the channel for boat traffic (Coquille) (Benner et al. 1992) **dredging + (2) Dam constructed to "secure an adequate number of eggs for the station" (removed in 1929) Alsea (Hennessey 2005) **dams	
1916-1923	(1) The Port of Coquille (after USACE retired from the job) removed over 356,000 cubic yards of sand and other bottom material over an 11 year period (the purpose was to maintain the main Coquille channel above the Fishtrap Landing at about river mile 29, and the South Fork below Myrtle Point, for navigational purposes. some periodic dredging may have occurred beyond 1923 in Coquille (Benner et al. 1992) + (2) Jetty at mouth of Nehalem River completed (Johnson 1999) **diking	
1918	(1) New model of gasoline chain saw used to fell timber (Miller 2005); common practice was "cut out and get out" -- landowners harvested timber, burned the slash to obtain state forestry releases and then simply stopped paying property taxes (ODOF 2005) **logging + (2) Logging of Oregon-American Company lands started along the bottomlands in the Rock Creek drainage and then fanned out into the surrounding hills in Nehalem (ODOF	

	2005)	
1919	The first wagon road along the Alsea, linking the towns of Alsea and Waldport, is completed (Hennessey 2005) **transportation	The Legislature authorized the exchange of 70,000 acres of scattered state-owned forestlands in Southwest Oregon for a single tract of equal acreage owned by the federal government (Resulted in establishment of the Millicoma Tract) (See 1929) (Miller 2005) (forestry)
1919-1926	(1) Bureau of Public Road finishes a rock road from Corvallis to Waldport (Alsea) (Hennessey 2005) **transportation + (2) Southern Pacific Railroad from Tillamook to Portland was largely completed, which allowed for logging to begin in earnest using small privately constructed logging railroads **transportation/logging (the Oregon American Company was formed following a purchase of the DuBois tract in 1917 and conducted extensive logging after) in Nehalem (ODOF 2005)	

1920-1930

<i>Year(s)</i>	<i>Land Use</i>	<i>Policy</i>
1880-1930s	Significant agriculture usage in Alsea (Hennessey 2005)	
1880-1957	log drives on Alsea River + log drives on Coquille River on both forks [25+ known splash dams] + log drives on Nehalem River + [4 known splash dams] (Miller 2010)	
1901-1926	Extensive log drives occurred on the	

	Nehalem River + potential <i>splash dams</i> on the North Fork Nehalem River (Johnson 1999)	
1905-1935	At least 25 <i>dams</i> built, and 122 miles of channel were involved in transporting logs. blasting boulders and removing channel wood <i>**dredging</i> was also necessary to clear the channel for both forms of <i>log drives</i> (including non augmented flow) (Coquille) (Benner et al. 1992)	
1913-1928	Port of Coquille spent at least \$26,000 in the culling of the bankside vegetation (Coquille) (Benner et al. 1992) <i>**dredging</i>	
1915-1936	Relatively small forest fire in Alsea watershed (Zybach 2003) <i>**fire</i>	
1916-1923	The Port of Coquille (after USACE retired from the job) removed over 356,000 cubic yards of sand and other bottom material over an 11 year period (the purpose was to maintain the main Coquille channel above the Fishtrap Landing at about river mile 29, and the South Fork below Myrtle Point, for navigational purposes. some periodic dredging may have occurred beyond 1923) in Coquille (Benner et al. 1992) <i>**dredging</i>	
1919-1926	(1) Bureau of Public Road finishes a rock road from Corvallis to Waldport (Hennessey 2005) <i>**transportation</i> + (2) Southern Pacific Railroad from Tillamook to Portland was largely completed, which allowed for logging to begin in earnest using small	

	privately constructed logging railroads (the Oregon American Company was formed following a purchase of the DuBois tract in 1917 and conducted extensive logging after) in Nehalem (ODOF 2005) **transportation/logging	
1920s	By the 1920's gypo loggers focused on cedar, because the clear lumber could be used for boat building and battery stock (Coquille) (Meinke et al. 1999) *logging	
1920	(1) Increase in utilization of douglas firs -- weren't perceived as valuable previous to WWII (Miller 2005) **logging + (2) Motorized truck influenced logging methods by avoiding railroad construction -- could more easily log deeper into the forest at a lower cost (Miller 2005) **transportation/logging + Logging Activity Exploded & Dike wall constructed to direct river flow (and logs) towards the Wheeler sawmill in Nehalem (Johnson 1999)	(1) The Oregon State Board of Forestry adopted a forest policy for the state calling for increased protection, a forest nursery, insect control and formation of State Forests. (forestry) + (2) The Office of Forest Pathology was established by the US Forest Service in Portland (forestry) (Miller 2005)
1921		The State Legislature passed the Insect Pest Control Law and an Insect and Disease Management Program in Oregon was established (Forest Log, Apr 1986, p. 3). (Miller 2005) (environment/forestry)
1922	The wagon road following the Middle Fork of the Coquille River, connecting Coos Bay and Roseburg, was improved between 1922 and 1924 in Coquille (Hennessey 2005)	

	**transportation + Railroad to Vernonia built in Nehalem (Johnson 1999) **transportation	
1923	Fire suppression equipment required in logging operations (Miller 2005)	The Legislature strengthened forest fire laws by requiring fire suppression equipment in logging operations and sawmills (forestry) (Miller 2005)
1924	By 1924 the Pacific Highway was paved through Douglas County opening it to all weather travel in Coquille (Meinke et al. 1999) **transportation	The Clarke-McNary Law enacted by the 68th Congress on June 7, 1924 replaced the Weeks Law acknowledging the federal government's responsibility for a share of the problems of unproductive cutover lands, protection and taxation (environment/forestry) (Miller 2005)
1924-1948	USACE stopped dredging the river above the river mouth area of Bandon in Coquille (Benner et al. 1992)	
1925		(1) Legislature passed "closed season" that restricted debris burning and other practices (forestry) + (2) Oregon's first Land Acquisition Act was passed. This act provided for the acceptance by the State of Oregon of forest land by gift or donation; however, no lands were acquired under this act (forestry) + (3) The first state forest nursery was established eight miles north of Corvallis under terms of the Clarke-McNary Act of 1924 (forestry) (Miller 2005)
1926	(1) I.A. Mcleary sold the lower site (as one tax lot) to Louis and Margaret Stonebreaker (Alsea) (Hennessey 2005) **land ownership + (2) most logging operations closed when	

	humidity fell below 30% (Miller 2005) + (3) Hatchery operations at Foley Creek began in Nehalem (Johnson 1999)	
1929		A progressive "Forest Fee and Yield Tax Law" was enacted by the Legislature. (forestry) + Elliot State Forest created with Siuslaw forest land (Alsea) (forestry) (Miller 2005)

1930-1940

Year(s)	Land Use	Policy
1880-1957	Log drives on Alsea River + log drives on Coquille River on both forks [25+ known splash dams] + log drives on Nehalem River + [4 known splash dams] (Miller 2010)	
1905-1935	At least 25 dams built, and 122 miles of channel were involved in transporting logs. blasting boulders and removing channel wood was also necessary to clear the channel for both forms of log drives (including non augmented flow) in Coquille (Benner et al. 1992) **dredging	
1924-1948	USACE stopped dredging the river above the river mouth area of Bandon in Coquille (Benner et al. 1992)	
1929-1940	(1) Highway 101 and bridge over Alsea Bay are finished & Alsea Southern Railroad tracks are removed (Hennessey 2005) **transportation + (2) Two dams on Nehalem River were removed (ODOF 2005)	

1930	(1) Logging trucks became more efficient (Miller 2005) + (2) Bridge in Vernonia built for \$12,000 in Nehalem (Johnson 1999) **transportation	
1930s	(1) Camp Remote, a Civilian Conservation Corps (CCC) camp, was established in Camas Valley in the early 1930s. The CCC camp housed approximately 200 men. The men at the camp slashed timber for road right-of-way construction and conservation work (Meyers 1983). **logging + (2) The first C&D sawmill was built at Bradford Station, which was the site of the old Arrington Mill. It burned in 1942 (Coquille) (Meinke et al. 1999) + (3) CCC camps in Siuslaw National Forest in Alsea (Hennessey 2005) **logging	Great Depression
1930s-1950s	Majority of the state forest lands in the upper Nehalem watershed were acquired by the State of Oregon during this time (many of these lands were privately owned but reverted to local counties due to delinquent tax payments after destructive fires occurred between 1933 and 1945 - the counties deeded these lands to the state for reforestation and future management) **land ownership/logging (ODOF 2005)	
1931	First practical diesel tractor developed for use in the woods (Miller 2005) **logging	The OR Legislature provided the governor authority to close, by proclamation, any forest area to all forms of entry during periods of high fire hazard. Insect control laws were strengthened. A new acquisition law

		provided that the state could acquire forestland for formation of State Forests. (forestry) (Miller 2005)
1933	(1) "Tillamook Burn" in August (hit in 6 year intervals through 1951) -- this initiated salvage logging , which many believed to have negative ecological impacts; even worse than the fires themselves (Donato et al. 2006) + (2) Flood Event in December in Nehalem (Johnson 1999)	(1) "Rules of Forest Practice": At a meeting in Washington, D. C., private, state and federal representatives drew up the "Rules of Forest Practice." These rules were a part of Article X of the National Industrial Recovery Act and had the effect of federal law (forestry) + (2) Passage of Operator Permit Law (forestry) + (3) The Civilian Conservation Corps (CCC) Act was passed by Congress. (forestry) (Miller 2005)
1933-1945		Massive reforestation program in parts of Nehalem Watershed due to destructive fires -- commercial harvest resumed in the 1950s (forestry) (ODOF 2005)
1934		Humidity Regulations involved under the Permit Law (forestry) (Miller 2005)
1935	(1) Larger tractors were being manufactured and being put into use for logging operations such as road building, yarding logs and firefighting -- most were diesel (Miller 2005) + (2) Commercial fishing on the Nehalem River (Johnson 1999)	(1) OR Legislature broadened the Forest Code (forestry) (Miller 2005) + (2) Snag Felling law passed (forestry) (Miller 2005) + River and Harbor Act of 1935 (water/coast) (Benner et al. 1992)
1936	The Middle Fork Lumber Company operated until 1936 in Coquille (Meinke et al. 1999) **logging	
1937		(1) The State Forester recommended acquisition of state forests as a necessary part of a balanced forestry

		program. The Legislature gave broader authority to handle tax delinquent lands (forestry) . + (2) Congress passed the Oregon and California Revested Lands Administration Act (environment) + (3) The O & C Sustained Yield Act was passed by Congress (environment/transportation) (Miller 2005)
1939	(1) Highball logging on a highgrade system was practiced to produce a higher volume of wood at a lower cost (Miller 2005) + (2) large piles of logs had accumulated along the upland edge of the wetland across from the lower site (Hennessey) *not shown on Aerial photo; on upper site, a small area of forest has been cleared in Alsea (Hennessey 2005) logging	OR Acquisition Act (land/forestry) (Miller 2005)
1939-1945	WWII; after the war, use of contractors and trucks to haul logs out of the woods became more common (Miller 2005) **transportation/logging	

1940-1950

<i>Year(s)</i>	<i>Land Use</i>	<i>Policy</i>
1924-1948	USACE stopped dredging the river above the river mouth area of Bandon in Coquille (Benner et al. 1992)	
1939-1945	WWII; after the war, use of contractors and trucks to haul logs out of the woods became more common (Miller 2005) **transportation/logging	
1940	Highway 34 bridge completed in Alsea	

	(Hennessey 2005) **transportation	
1940s	Barclay & Noble own upland and eastern portion of the wetland area - local suppliers of lumber to Marion Carey's planning mill **land ownership (upland area near the lower wetland site was logged by the 1950s) in Alsea (Hennessey 2005)	
1941	(1) Highway 101 completed along coast (Johnson 1999) **transportation + (2) "Salmonberry Fire" damaged Cook Creek and Salmonberry River drainages in Nehalem (Johnson 1999) **fire	(1) A revised State Forest Acquisition Act was approved by the Legislature (forestry) + (2) The Oregon Forest Conservation Act was passed by the Legislature: It promoted regeneration of the forests following harvest through natural seed sources and artificial reforestation. Persistent pressure at the federal level for public control was eventually ended by passage of the Oregon Forest Conservation Act. This new departure in forest legislation recognized the rights of the public in private property, based upon the contribution that forests make toward the well-being of the citizens. Continuous growth of timber on these lands was made a public policy of the State of Oregon (forestry) (Miller 2005)
1942	The owners (of C&D) then purchased a mill in Camas Valley, which burned in 1951, so they moved their operation to the present site in Riddle... Timber production became the major influence on the landscape in the Upper Middle Fork Coquille WAU after World War II. The increased demand for housing lumber and the transportation	Civilian Conservation Corps discontinued(forestry) (Miller 2005)

	improvements allowed for a marked increase in lumber production in Coquille (Meinke et al. 1999) **logging	
1943		(1) A Forest Land Management Research Program was implemented in the Tillamook Burn to research ways to rehabilitate, reforest, and aerially seed the burned area (forestry) . + (2) Log Branding Law (forestry) + (3) Board of Forestry established its own Service Forestry Program in Cooperation with the US Forest Service (forestry) (Miller 2005)
1944	Two man saw (Miller 2005) **logging	
1945	(1) Area along the Alsea River is cut off from Aerial photograph; but upland forest and wetland appear to have had little direct influence from human activities. but, the adjacent upland area of the wetland just upstream along Drift Creek appears in the photo as recently logged. <i>*the other wetland, previously used for agriculture is still under cultivation; clearing is no longer visible; selective logging being done by residents</i> + (2) upper site wetland areas being used for residential homes (Alsea) (Hennessey 2005) **development + (3) State Officials approved construction of Highway 42 in 1945, which improved the road from Roseburg to Coos Bay. The construction of Highway 42 allowed for faster and easier access and an increase in travel throughout the WAU.	

	After the construction of Highway 42 was completed the BLM and private timber companies began building more roads on their timber lands in Coquille (Meinke et al. 1999) **transportation/logging + (4) Old growth timber gone in Nehalem (Johnson 1999) **logging	
1940s-1960s	(1) As the 19th century moved on, a revolutionary change in technology took place, involving both intensive use of the horse to replace manpower, and the mechanization of farming operations to take the place of the horse. Steam power, gasoline engine tractors, and electricity took over many of the labor intensive jobs of mowing, harvesting, threshing, and cleaning the grain **agriculture + (2) wetland areas being used for agriculture in Alsea (Hennessey 2005)	
1946	Through 1971, tideland areas around the mouth of Lint Slough are filled in Alsea (Hennessey 2005) **diking	(1) OR Board of Forestry establishes an Emergency Fire Suppression Fund (forestry) + (2) BLM was created and given responsibility for managing O & C lands (Oregon and California Railroad Company) (environment) (Miller 2005)
1947		(1) Severance Tax Law enacted by the OR Legislature (forestry) + (2) Legislature permits counties to zone private land (environment) (Miller 2005)
1948	An attempt is made to blast a channel along the south side of the estuary near the city docks in Alsea (Hennessey 2005) **dredging	Oregon voters agreed to finance rehabilitation of the Tillamook Burn and other denuded state-owned lands scattered throughout Oregon

		(forestry) (Miller 2005)
1949	(1) Logging operators spent over \$2.16 million this year in complying with forest fire laws (Miller 2005) + (2) Rehabilitation began on the Tillamook Burn area in Nehalem (Johnson 1999) **fire + (3) Both private and Federally managed land contributed to the harvest of timber and lumber production over the last 50 years. (Meinke et al. 1999) **logging	

1950-1960

Year(s)	Land Use	Policy
1950s	(1) Railroad spur across Alsea Bay was dismantled **transportation + (2) Significant increases in development in Alsea watershed (more roads & landowners with smaller average lot sizes - found along the opposite side of the Alsea River) **transportation/development + (3) More private lumber companies constituted an increased landowner class (Oregon Pulp & Paper Co.) in Alsea (Hennessey 2005) **land ownership/logging	
1952	(1) Experimented with thinning trees to produce lumber; also started harvest of second growth timber (Miller 2005) **logging + (2) Georgia-Pacific, an industrial timber company began acquiring more lands and by 1970 had "converted from 110-120 year old second growth timber to plantations" (Hennessey); a large log raft appears	(1) The Severance Tax Law of 1947 (a tax on timber harvest for research purposes) was revised to include an additional 4 cents per thousand board feet for the establishment of a Westside Emergency Fire Cost Fund to help pay for major forest fires. (forestry) + (2) The State Forestry Department entered into a cooperative agreement to provide fire protection on BLM managed forest

	next to the lower site; logging has increased in upper site **land ownership/logging + (3) in aerial photo, no roads of crop usage of the area is apparent + (4) roads have increased in upper site of Alsea, especially above the eastern portion of Barclay Meadows (Hennessey 2005) **transportation/development	lands in western Oregon. (forestry) (Miller 2005)
1954	Forest closure act strengthened: restricted use of power-driven equipment, required permits for construction of sawmills in the forest, and prohibited fuse and caps, and explosives on tops of trees (Miller 2005) **logging	The Forest Closure Act was strengthened. (forestry) (Miller 2005)
1955	Flood Event in Nehalem (Johnson 1999) + In 1955, the Uranium Oil and Gas Company drilled 4,368 feet and found gas deposits at 1,900 feet in Coquille (Meinke et al. 1999) **mining	(1) Two new department divisions were approved by the Board of Forestry effective July 1 (forestry) + (2) Legislature adopts law to regulate land partitions and subdivisions (land/environment) + (3) State land management became a major program of the Forestry department. (forestry) (Miller 2005)
1956	(1) The upstream end of the north channel is dammed (to divert river flow through the south channel) + (2) Lower wetland site owned by Stonebreaker; upland site owned by J. Wolfe (Alsea) (Hennessey 2005) **land ownership + (3) Commercial gill net fishing ended in estuary in Nehalem (Johnson 1999)	
1957	Vernonia sawmill closed in Nehalem (Johnson 1999)	A Log Patrol Act was adopted in Oregon. (forestry) (Miller 2005)
1958	Aerial photos show logging and the	

	associated roads are more widespread on the western site of Drift Creek (most roads run down to one of the sloughs and is likely a point to transfer logs to the river) in Alsea (Hennessey 2005) **transportation	
1959	(1) Portion of the upland forest has been cleared **logging + (2) A dirt road has been built along the upland edge of the upper site **transportation ; western dock and boardwalk have disappeared in Alsea (Hennessey 2005)	

1960-1970

<i>Year(s)</i>	<i>Land Use</i>	<i>Policy</i>
1960	The Forest Service dramatically increased harvest averaging 250 acres per year until the 1980s (Miller 2005) **logging; direct disturbances appear to be minimal during the 60s in the lower site in Alsea (Hennessey 2005)	
1961		(1) An act of the 1961 State Legislature provided the department with the Official name, "State Forestry Department. (forestry) + (2) Legislature allows special property tax assessment for land used exclusively for farming (land/environment) (Miller 2005)
1963	(1) A dam is completed one half-mile up Lint Slough to impound waters for the Oregon State Game Commission Fish Hatchery (Hennessey 2005) + (2) South channel and several small boat	Legislature creates Exclusive Farm Use (EFU) zone and uses allowed in that zone (ORS Chapter 215) (land/environment) (Miller 2005)

	channels are dredged in Alsea (Hennessey 2005)	
1964		Passage of the National Wilderness Act created 9 million acres in wilderness areas (environment) (Miller 2005)
1966	(1) Precommercial thinning an important practice (Miller 2005) **logging + (2) Nehalem Hatchery began operations on the North Fork Nehalem (Johnson 1999)	
1967		Oregon legislature passes the “Beach Bill,” affirming the public’s rights to Oregon’s dry-sand beaches (coast) (Miller 2005)
1968	A jetty parallel to the south shore of the bay is built on the east side of the mouth of Lint Slough to improve boat moorage in Alsea (Hennessey 2005) **diking	
1969	(1) Slash burning governed by wind forecast s (Miller 2005) **logging + (2) Margaret Stonebreaker sold property to Sarah Mayea in Alsea (Hennessey 2005) **land ownership	(1) Oregon Supreme Court upholds constitutionality of the Beach Bill in Thornton v Hay (coast) (Miller 2005) + (2) National Environmental Protection Act (environment)

1970-1980

Year(s)	Land Use	Policy
1970-1985	(1) 76% decline in wood at river mouths (Benner et al. 1992) **water/logging + (2) Agricultural use of tidal wetlands waned, by 1974 only 25% of the land suitable for agriculture is being farmed; now it	

	supports recreational housing in Alsea (Hennessey 2005) **development	
1971	Helicopter logging (Miller 2005)	(1) The Oregon Forest Practices Act was passed to place responsibility for protecting Oregon's forest environment on the forest landowner and the logging operators. (forestry) + (2) Oregon Legislature adopts Senate Bill 10, which requires every city and county in the state to have a comprehensive land use plan that meets state standards. The law was weak, however, because it failed to establish an effective enforcement mechanism or a program of technical assistance from the state. Most cities and counties refuse to develop plans (land/environment) (Miller 2005)
1972		(1) US Coastal Zone Management Act (coast) (NOAA 2020) + (2) Rules for implementing the Oregon Forest Practices Act were developed by regional committees. (forestry) (Miller 2005)
1973	(1) A new computer-based Geographic Information System called Map Model was implemented to process forest inventory data to help managers make consistent decisions about management options. A computer program (OSCUR) was designed to process state forestland data and categorize a number of forest operations. OSCUR stands for Ownership, Site, Cover, Use and Rating. (Miller 2005) **logging + (2) Tillamook Burn Rehabilitation completed in Nehalem (Johnson	(1) Endangered Species Act passed by Congress requiring protection of listed threatened and endangered fish and wildlife species (environment) + (2) On May 29, SB 100 is approved after much negotiation and compromise, and is signed by Governor McCall. The bill creates the Land Conservation and Development Commission (LCDC) and the Department of Land Conservation and Development (DLCD). Senate Bill 101 creates statewide protections for farmland by further amendments to the EFU zone (ORS 215). LCDC's first

	1999) **fire	major task is to adopt the Statewide Planning Goals to govern the development of local comprehensive land use plans. (land/environment) (Miller 2005)
1974	Gangle family owns tax lots 300 and 200 in Alsea (Hennessey 2005) **land ownership	(1) A new Forest Land Liability Law became effective Jan. 1, 1974. (forestry) + (2) The Oregon State Board of Forestry assumed a new role in the affairs of forestland resources concerned with Oregon's timber supply (forestry) + (3) On December 27, LCDC adopts the first 14 Statewide Planning Goals. (land/environment) (Miller 2005)
1975		On December 6, LCDC adopts Goal 15 (Willamette River Greenway) (land/environment) (Miller 2005)
1976		(1) The report "1976--Timber for Oregon's Tomorrow" was prepared by the Forest Resource Lab at Oregon State University at the request of the Board of Forestry (forestry) + (2) On October 8, Medford and Central Point become the first cities to have LCDC approve, or "acknowledge," their comprehensive plans (land/environment) + (3) On November 2, by a vote of 57% to 43%, the first ballot measure to repeal SB 100 and the Statewide Planning Program is defeated (land/environment) + (4) On December 18, LCDC adopts goals 16-19, protecting coastal resources. Those goals became effective in 1977 (coast) (Miller 2005)
1977		(1) The Forestry Department developed a Value at Risk Classification ("VARC") to help plan a more effective

		fire organization to recognize the many values exposed to a fire (forestry) + (2) The Forestry Program for Oregon (FPFO), initiated in 1974 with a resource study, was adopted by the Board of Forestry at a special meeting (forestry) + (3) On July 8, Gilliam County is the first county to have its comprehensive plan acknowledged (land/environment) + (4) Three new wilderness areas were created in Oregon in 1977 by the Endangered Wilderness Act (environment)
1978		(1) The US Forest Service and Carter Administration recommended 427,000 acres be set aside as wilderness in Oregon and another 384,000 were to be studied further for wilderness characteristics. Another 2.2 million acres were declared not suitable for wilderness, and were to be released from study for other uses (environment) + (2) The Board of Forestry voted to place additional controls on the use of 2,4,5-T and Silvex + More than 1.25 million acres of private forestland in Oregon were diverted to non-timber uses between 1952 and 1977, almost all of this during the previous seven years. (forestry) (Miller 2005)
1979	Property sold to Robert and Elaine Cristler in Alsea (Hennessey 2005) **land ownership	

1980-1990

Year(s)	Land Use	Policy
---------	----------	--------

1980s	(1) Harvest decreased a bit but averaged ~210 acres per year in the 1990s (Miller 2005) **logging + (2) A dam was removed from the Cochran mill pond area (Nehalem) (ODOF 2005) + (3) From 1980 to 1992, 12 fires burned approximately 230 acres within the Upper Middle Fork Coquille WAU. Most of the fires were human caused. Five fires were caused by lightning burning approximately one acre in Coquille (Meinke et al. 1999)	
1982	(1) Logging near site has become much more prominent in lower site; many new logging roads and clearcuts are visible in the area; a large clearcut and logging road is visible in the drainage above the wetland in the upper site + another smaller cut and associated roads are apparent closer to the wetland + (2) proliferation of residential homes and docks along the river, especially in the eastern portion of Barclay meadows (Alsea) (Hennessey 2005) **development + (3) The Standley Site, located at the west end of the WAU, was excavated in 1982 and 1983 in response to the realignment of Highway 42 in Coquille (Meinke et al. 1999). **transportation	(1) Despite a deep recession that is blamed on land use planning, the third effort to repeal SB 100 is defeated (55%-45%). The following year, the legislature creates a process for the "periodic review" and update of local land use plans (land/environment) + (2) The Board of Forestry adopted an update of its 1977 "Forestry Program for Oregon (forestry) + (3) In 1982, the Oregon Legislature allowed the State Forester to lower the price of timber under contract to be more in line with the market. This was done to prevent wide scale bankruptcies among timber companies. On the average, most timber prices were reduced to about half of the bid price (forestry) (Miller 2005) + (4) Lincoln & Tillamook County Comprehensive Plans approved (Lincoln County 1982, Tillamook County 2020) (land/environment)
1983	The Standley Site, located at the west end of the WAU, was excavated in 1982 and 1983 in response to the realignment of Highway 42 in Coquille (Meinke et al. 1999) **transportation	(1) A bill passed by the 1983 Oregon State Legislature changed Arbor Day to Arbor Week in Oregon, scheduled for the first full week each April (forestry) + (2) Oregon legislature adopts major reforms to Oregon Land Use Law (ORS

		chapters 197 and 215), including revisions to the "exceptions process" and the EFU zone, and permitting the designation of marginal lands <u>(land/environment)</u> (Miller 2005)
1984		A new Board of Forestry, consisting of nine voting members and three advisory members, was appointed by the Governor and approved by the Senate. <u>(forestry)</u> (Miller 2005)
1985		(1) During the closing hours of the 1985 Oregon State Legislature, additions to Forestry's Resource Planning Section were funded as part of the Governor's economic development proposal <u>(forestry)</u> . (Miller 2005) + (2) Coos County Comprehensive Plan is revised and submitted for acknowledgement. Approved in March, 1985 (Coos County Board of Commissioners et al. 1985) <u>(land/environment)</u>
1986		The Conservation Reserve Program (CRP) is a new Federal Voluntary Cropland Retirement Program (1986) designed to reduce erosion. <u>(sediment)</u> (Miller 2005)
1987	Nineteen eighty-seven was the most severe fire year in the last 50 years, and one of the two worst in the last 120 years, yet the acreage burned was only 30 percent of the average acreage historically burned by wildfire in Oregon. (Coquille) (Meinke et al. 1999)	(1) One of the most significant pieces of forestry legislation was passed by the 1987 Legislature when HB 3396 was signed into law <u>(forestry)</u> + (2) The Columbia River Gorge National Scenic Area Act leads to the creations of the bi-state Columbia River Gorge Commission <u>(land/environment)</u> (Miller 2005)
1987-1988		Forest Service released management

		plans for Oregon's National Forests: The US Forest Service completed publication of draft environmental impact statements and proposed land and resource management plans for all of Oregon's 13 national forests (forestry) . (Miller 2005)
--	--	---

1990-2000

Year(s)	Land Use	Policy
1990	Flood Event in Nehalem (Johnson 1999)	The updated Forestry Program for Oregon (FPFO) was approved by the Board of Forestry on January 3. (forestry) (Miller 2005)
1991		(1) Oregon Ocean Resources Management Act (coast) + (2) LCDC, with support from the Oregon Department of Transportation (ODOT), adopts the Transportation Planning Rule. The rule creates a partnership program called Transportation and Growth Management (TGM), between DLCD and ODOT to enable the integration of land use and transportation planning (land/transportation) + (3) The 1991 Legislature passed Senate Bill 1125 which makes significant changes to the Oregon Forest Practices Act. (forestry) + (4) The Stream Enhancement initiative was born in 1991 when the Department of Forestry, Department of Fish & Wildlife, and Oregon Forest Industries Council made a commitment to work together to improve fisheries habitat on private forest land in Oregon.

		<u>(environment)</u> (Miller 2005)
1992		LCDC adopts amendments to Goals 3 and 4, permitting the identification and designation of high –value and important farm lands, and small scale resource (secondary) lands. Becomes effective August 7, 1993 <u>(land/environment)</u> (Miller 2005)
1993	(1) commercial thinning a main practice (Miller 2005) **logging + (2) Buster Kittle and Raymond Flerschinger bought the property & currently own it today* in Alsea (Hennessey 2005) **land ownership + (3) Private lands account for approximately 61 percent (41,247 acres) of the Upper Middle Fork Coquille WAU (see Table 8 and Map 11). Private ownership in the Camas Valley area consists mainly of agricultural and urban lands (3,917 acres). The rest of the private lands are mainly forested lands intermingled with BLM-administered lands. Satellite imagery from 1993 was the most current data available to characterize private lands. Approximately 44 percent of the private lands have been harvested in the past 30 years. (Coquille) (Meinke et al. 1999) **logging	(1) In 1993, a comprehensive NWFP was initiated to end the impasse over management of Federal forest lands in the Pacific Northwest within the range of the Northern spotted owl. With the signing of the Northwest Forest Plan Record of Decision in 1994, a framework and system of Standards and Guidelines were established, using a new ecosystem approach to address resource management. <u>(environment/forestry)</u> + (2) The Forest Resource Trust, passed by the 1993 Legislature and administered by the Oregon Department of Forestry, provides low-interest loans to people wanting to make substantial contributions to the long-term health of Oregon's economy and environment <u>(environment/forestry)</u> + (3) Oregon legislature adopts a comprehensive bill to revise Oregon land use provisions for the protection of farm and forest lands, to permit lot-of-record dwellings on such lands, and directs LCDC to repeal its rules providing for the designation of small-scale resource lands (HB 3661) <u>(environment)</u> (Miller 2005)

1994	(1) MidCoast watershed councils formed: THE MIDCOAST WATERSHEDS COUNCIL WORKS IN AN AREA OF NEARLY ONE MILLION ACRES, INCLUDING ALL STREAMS DRAINING FROM THE CREST OF THE COAST RANGE TO THE PACIFIC, FROM THE SALMON RIVER AT CASCADE HEAD TO CAPE CREEK AT HECETA HEAD. basin-wide biologic assessment processes, alongside more singular stream restoration projects (culvert replacements, livestock fencing, large wood placements, dike alterations, and riparian planting) (Midcoast Watershed Council) **watershed council + (2) The Coquille Watershed Association (CoqWA) was formed in 1994 by a small group of local citizens who were concerned about the health of the watershed and its natural resources. Since that humble beginning, CoqWA has established programs in restoration, monitoring, and education that are valued and supported throughout the watershed (Coquille Watershed Association)	(1) LCDC adopts rules to implement HB 3661 and to provide additional protections for high-value farmland (land/environment) + (2) The Oregon Territorial Sea Plan (TSP) was first adopted in 1994 and consists of goals and policies that act as a coordination framework and guide for agencies to use while managing resources within the territorial sea (coast) (Miller 2005)
1995		(1) The Elliott State Forest Habitat Conservation Plan (HCP) was approved under auspices of the Federal Endangered Species Act (environment) + (2) A new committee focuses on incentives for private forest landowners (forestry) + (3) Structure Based Management (SBM) is a new approach for managing state forest lands to produce a variety of forest structure types that provide a diverse and sustainable flow

		of benefits being developed in the Northwest Oregon's State Forests Long Range Management Plan. (forestry) (Miller 2005)
1996	Major Flood Event (Johnson 1999) + Upper Nehalem Watershed Council formed (Upper Nehalem Watershed Council)	
1997	Lower Nehalem Watershed Council formed (Nehalem) (Lower Nehalem Watershed Council)	Oregon Supreme Court upholds LCDC rules that protect high-value farmland adopted to implement HB 2661. (Lane County v LCDC) (land/environment) (Miller 2005)
1998		(1) The Board of Forestry unanimously approved a subcommittee's recommendation for administrative rules for the management of state forestlands (forestry) (Miller 2005)
1999		(1) The seven-member Oregon Board of Forestry has been empowered by the Oregon Legislature to supervise all matters of forest policy within Oregon. (forestry) + (2) An Executive Order directs ten state agencies to protect salmonids. (environment) (Miller 2005)
2000s	Several small dams exist in the Wheeler Management Basin in Nehalem (ODOF 2005)	
2000		Oregon Department of Forestry is divided geographically into three administrative areas comprised of districts (forestry) (Miller 2005)
2001		The preamble, goals, and policies of

		this document were adopted by the Land Conservation and Development Commission May 4, 2001, and were thereby added to the Oregon Territorial Sea Plan <u>(coast)</u> (Miller 2005)
2002		U.S. National Fire Plan (U.S. Forest Service (USFS)) -- encourage forest fuel reduction treatments on a grand scale. Proponents assert that these treatments, when effective, benefit watersheds because higher-severity fire can sometimes trigger severe soil erosion and elevated peak flows. <i>**Mechanical fuel reduction treatments typically involve the same suite of activities as logging, with the same set of impacts to soils, runoff, erosion, sedimentation, water quality, and stream structure and function.</i> <u>(forestry)</u> (Rhodes 2007)
2003		Healthy Forests Restoration Act of 2003 -- encourages forest fuel reduction treatments on a grand scale. Proponents assert that these treatments, when effective, benefit watersheds because higher-severity fire can sometimes trigger severe soil erosion and elevated peak flows <u>(forestry)</u> (Rhodes 2007)
2004		On November 2, Oregon voters pass Ballot Measure 37 (61% - 39%). The measure provided that governments must pay owners, or forego enforcement by repealing, changing, or not applying restrictions, when certain land use restrictions reduce

		property value (found unconstitutional in 2005 - reinstated in 2006) <u>(land/environment)</u> (Miller 2005)
2005		The Oregon legislature passed Senate Bill 82 (The Big Look), creating the Oregon Task Force on Land Use Planning. The task force is charged with conducting a comprehensive review of the Statewide Planning Program and making recommendations to the 2009 Legislature for any needed changes to land-use policy <u>(land/environment)</u> (Miller 2005)
2007		(1) On November 6, Oregon voters pass Ballot Measure 49 (62%-38%). Measure 49 modifies Measure 37, clarifying private landowners' rights to build homes; extending rights to surviving spouses; limiting large developments; and protecting farmlands, forestlands, and groundwater supplies <u>(land/environment/forestry)</u> (Miller 2005) + (2) HB 3543 is signed into law. Establishes the Global Warming Commission and the Climate Change Research Institute; identifies the State Forester as an ex-officio member of the Commission. The Commission mission is to recommend ways to coordinate state and local efforts to reduce Oregon's greenhouse gas emissions, and to help the state, local governments, businesses, and Oregonians prepare for the effects of climate change <u>(environment)</u> (Yost 2019).

2010		(1) The Board of Forestry receives update on the forest climate change workgroup responsible for developing recommendations for the contributions that the forest sector could make to greenhouse gas reductions, listed in HB 3543 and potential research to address predictions that have been made by climatologists <u>(environment)</u> + (2) The Global Warming Commission releases the Interim Roadmap to 2020. This project offered recommendations for how Oregon can meet its 2020 greenhouse gas reduction goals (10% below 1990 levels), get a head start toward its 2050 goal (75% below 1990 levels), and build a clean-energy-based economy <u>(environment)</u>. + (3) The Oregon Climate Change Research Institute releases the Oregon Climate Assessment Report requested by the Oregon Legislature via HB 3543. The report assesses the state of climate AGENDA ITEM 3 Attachment 1 Page 9 of 16 change science including biological, physical, and social science as it relates to Oregon and likely effects on the state <u>(environment)</u>. + (4) The State of Oregon issues the Climate Change Adaptation Framework. This effort was initiated by Governor Kulongoski's request to Directors of several state agencies, universities, research institutions, and extension services to develop an adaptation plan <u>(environment)</u>. (Yost 2019).
2011		(1) Oregon's Land Conservation and

		Development Commission adopts Recommendations on Greenhouse Gas Reduction Targets required by Senate Bill 1059 (2010) and House Bill 2001 (2009) direct that set targets for metropolitan areas to plan for reductions in greenhouse gas emissions from cars and light trucks (land/environment) (Miller 2005) + (2) The Oregon Board of Forestry releases the 2011 Forestry Program for Oregon, which included Goal G. Improve carbon sequestration and storage and reduce carbon emissions in Oregon's forests and forest products (forestry) (Yost 2019).
2013		The Board of Forestry approves the Climate Change section of its exploratory Emerging Issues work plan (forestry) (Yost 2019).
2014		On January 15, DLCD releases "Preparing for a Cascadia Subduction Zone Tsunami: A Land Use Guide for Oregon Coastal Communities," which is unique in its effort and referenced by coastal communities around the world (coast) (Miller 2005)
2015		The Oregon Board of Forestry, at the March 2015 meeting, heard from Andrew Yost, Forest Ecologist, and Kevin Birch, Forest Resources Planning Director, on the work completed on the Climate Change topic in Emerging Issues work plan. They discussed an Annotated History of Climate Change – Related Policy in Oregon and a set of recommendations

		for an overall approach to adapting to the effects of climate change through consideration of climate change issues in the context of the Board and regular agency business, planning, and budgeting <u>(forestry)</u> (Yost 2019)
2018		(1) The Oregon Legislature created the Carbon Policy Office in 2018 (HB 5201) <u>(environment)</u> + (2) The Oregon Department of Forestry presented preliminary estimates of carbon stored in Oregon's forests to the Oregon Legislature, Joint Interim Committee on Carbon Reduction. The presentation also described the work with the Office of Carbon Policy and Forest Inventory and Analysis (FIA) Program of the United States Forest Service <u>(forestry)</u> + (3) The Oregon Global Warming Commission submitted a report titled "Forest Carbon Accounting Project Report 2018" to the Oregon Department of Forestry as part of the Departments public process to continue assessing forest carbon topics <u>(environment)</u> . (Yost 2019)

Appendix III. Figures

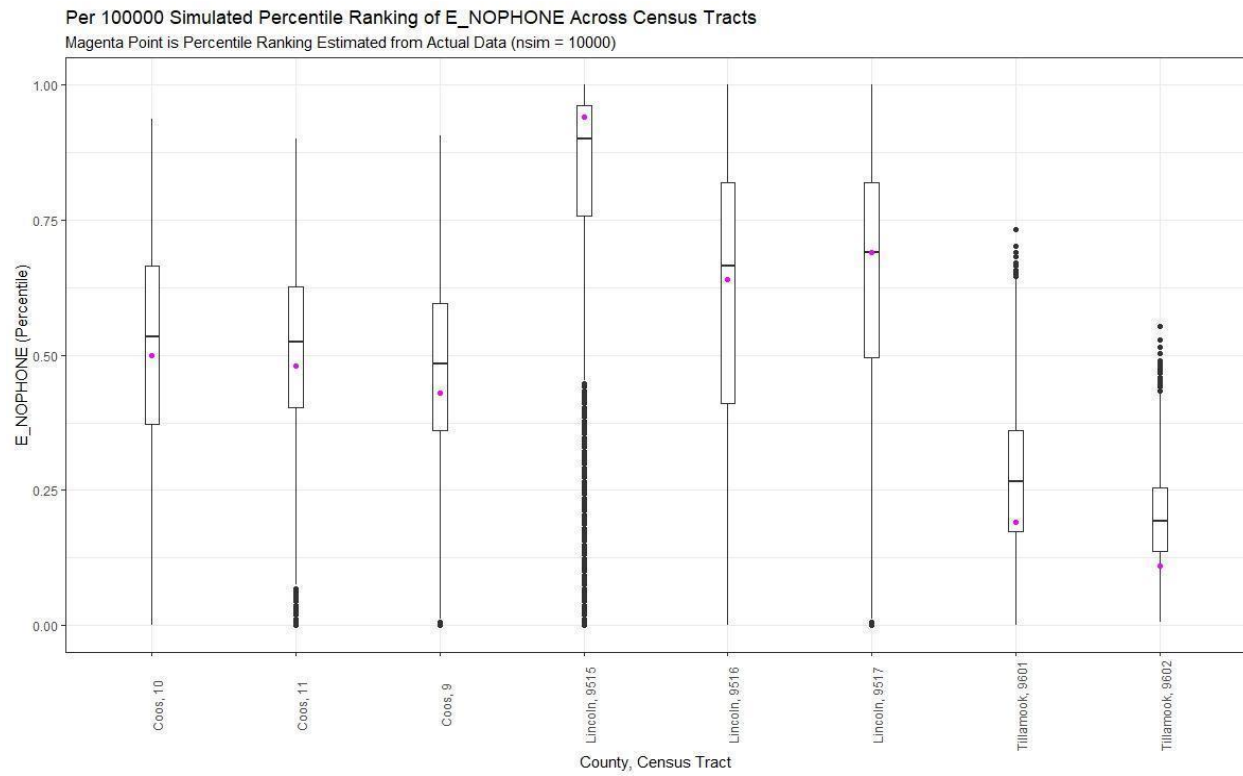


Figure S1. Boxplot of simulated per 100000 percentile rankings of the eight census tracts of interest for the no access to phone variable.

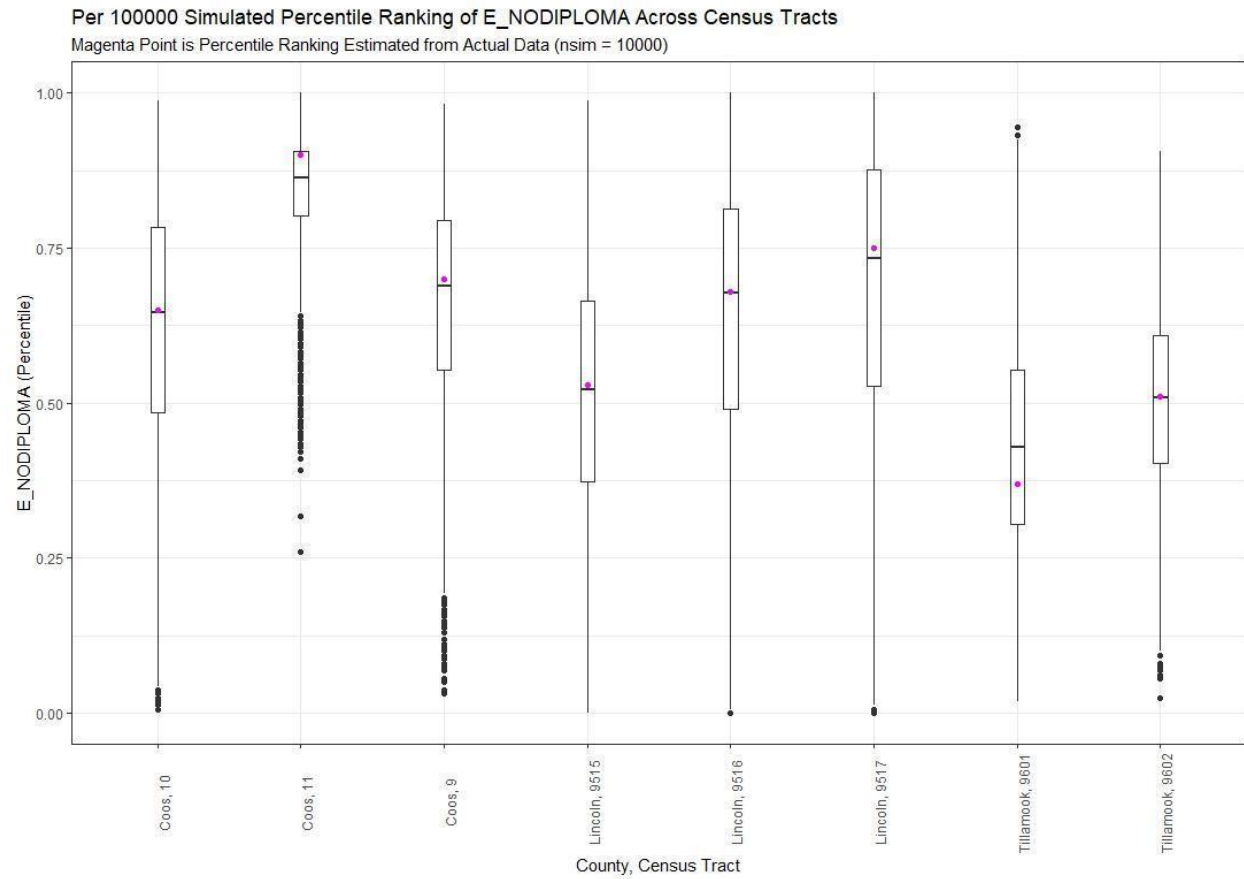


Figure S2. Boxplot of simulated per 100000 percentile rankings of the eight census tracts of interest for the no diploma variable.

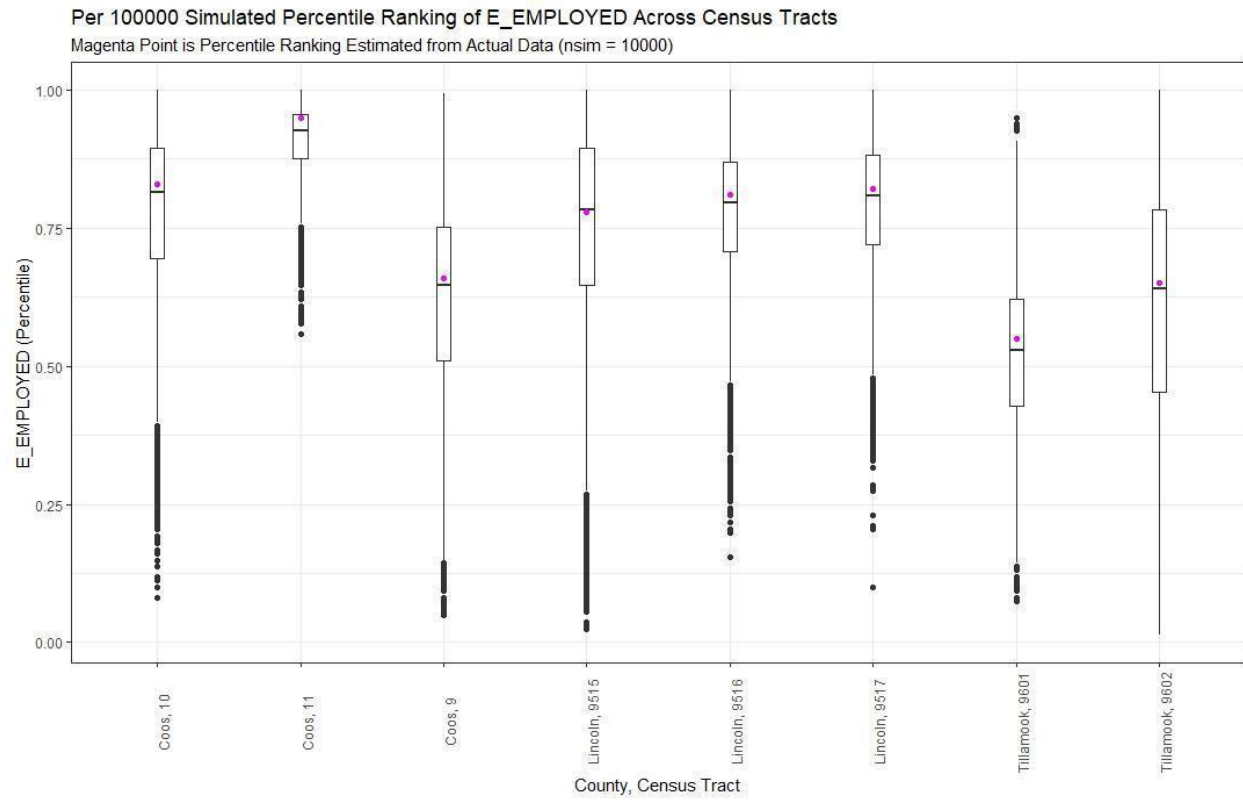


Figure S3. Boxplot of simulated per 100000 percentile rankings of the eight census tracts of interest for the employed variable.

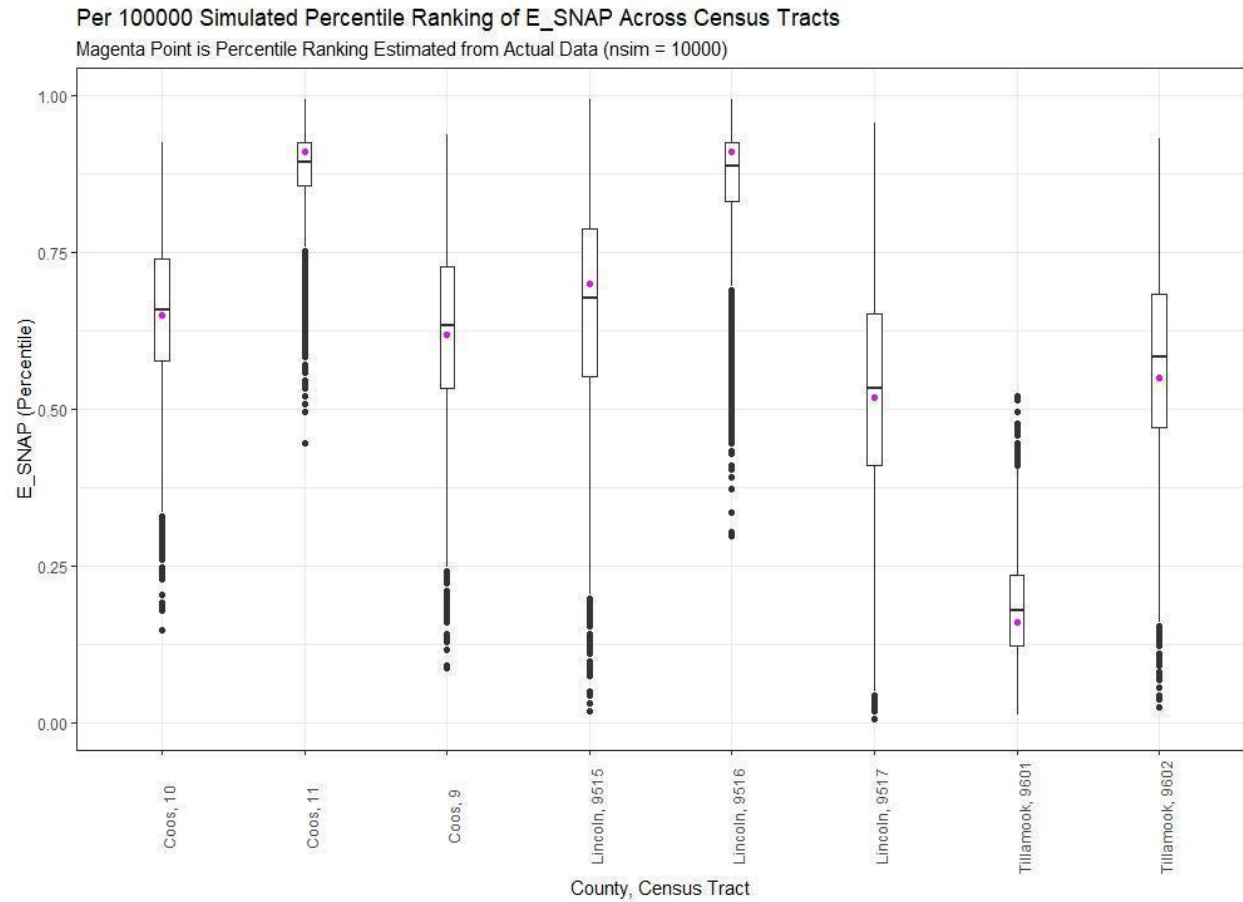


Figure S4. Boxplot of simulated per 100000 percentile rankings of the eight census tracts of interest for the SNAP variable.

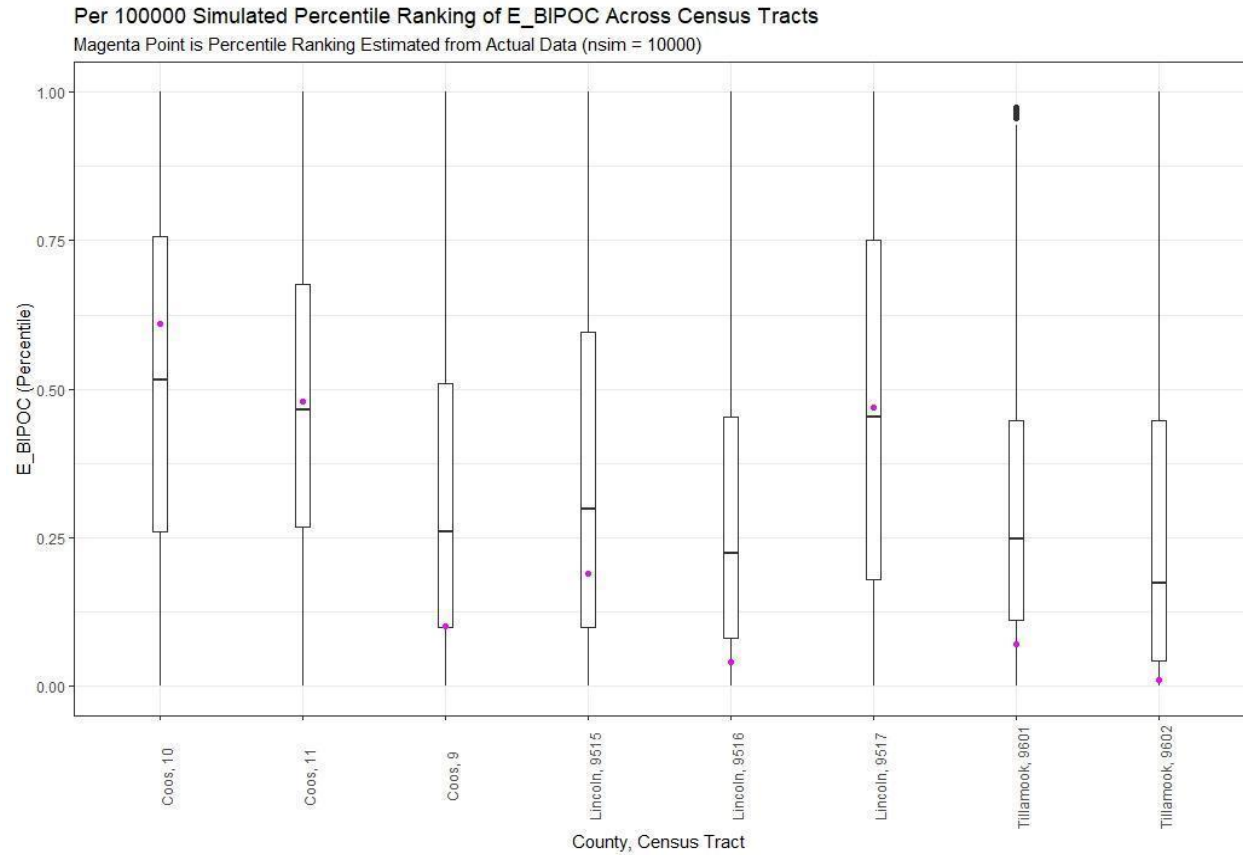


Figure S5. Boxplot of simulated per 100000 percentile rankings of the eight census tracts of interest for the BIPOC variable.

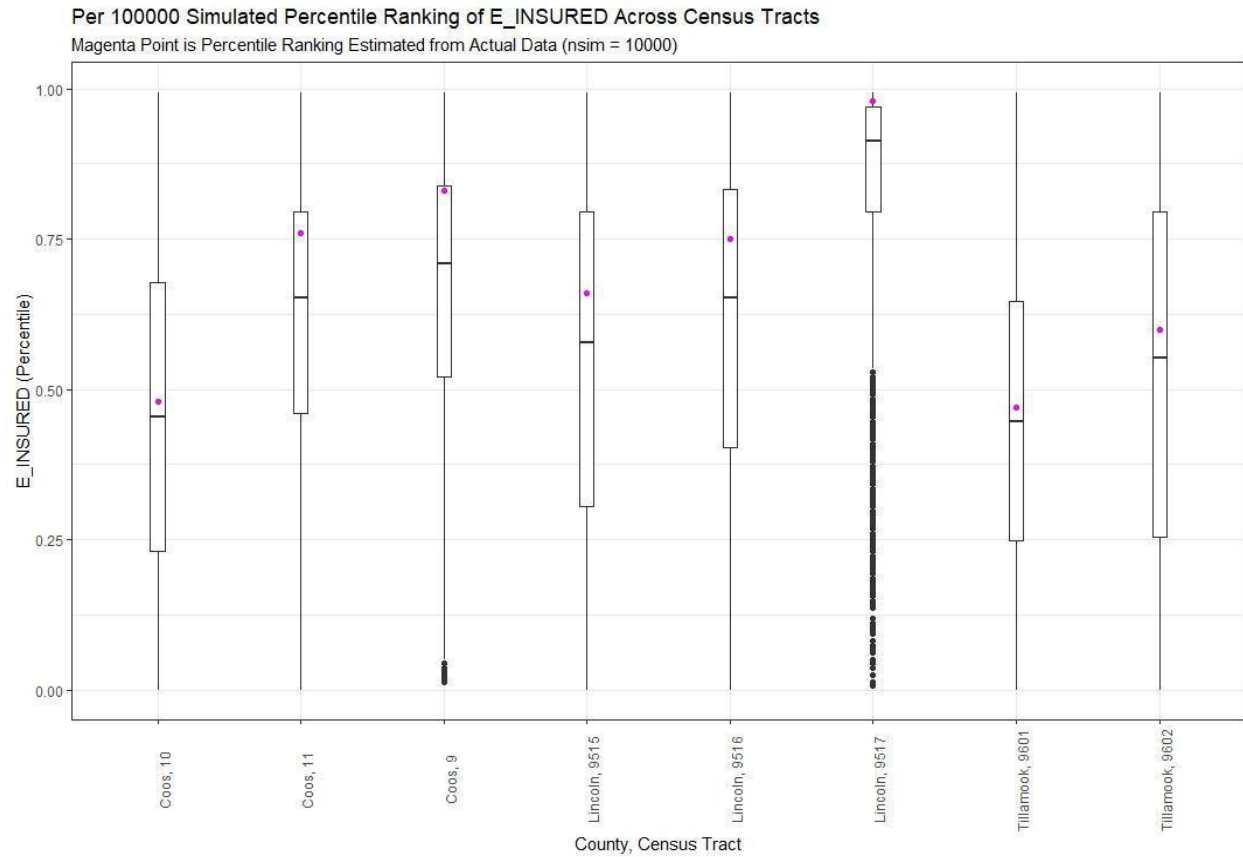


Figure S6. Boxplot of simulated per 100000 percentile rankings of the eight census tracts of interest for the insured variable.

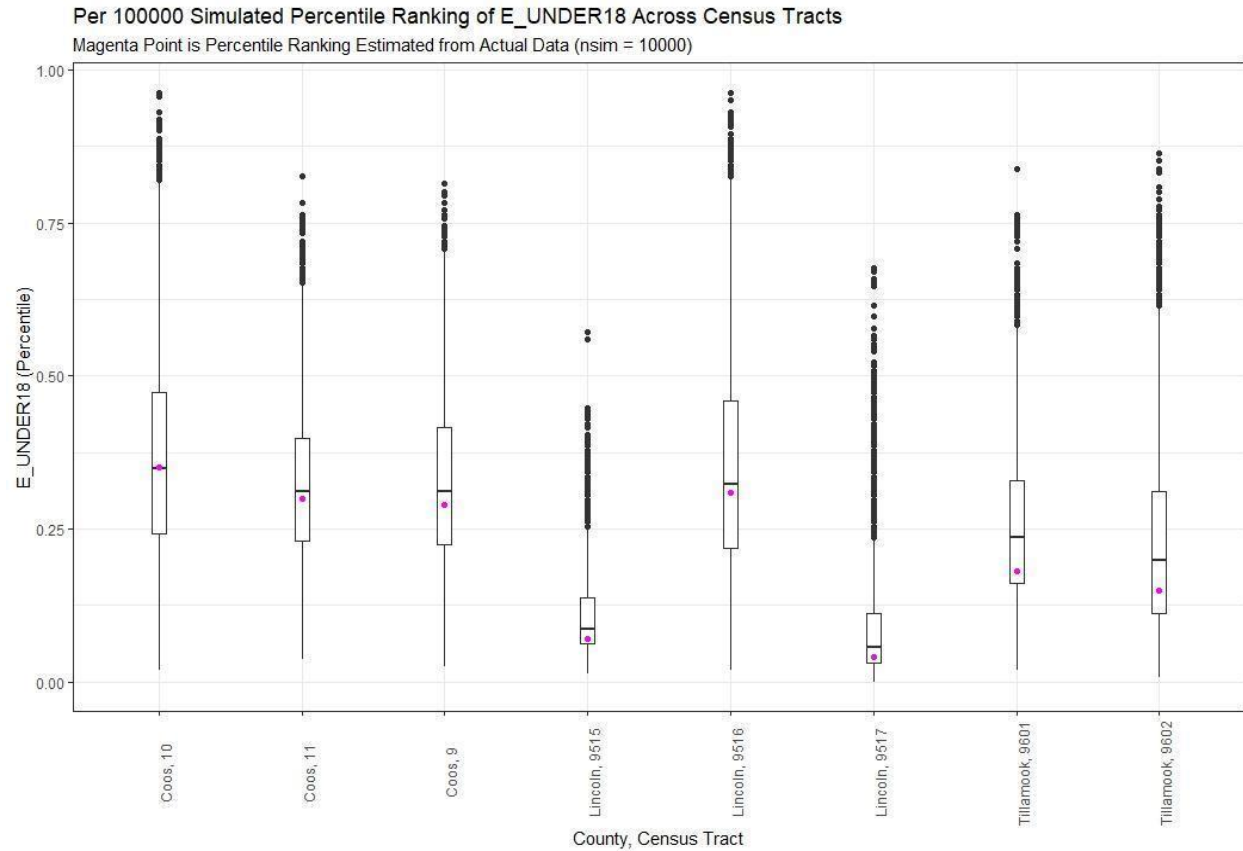


Figure S7. Boxplot of simulated per 100000 percentile rankings of the eight census tracts of interest for the under 18 variable.

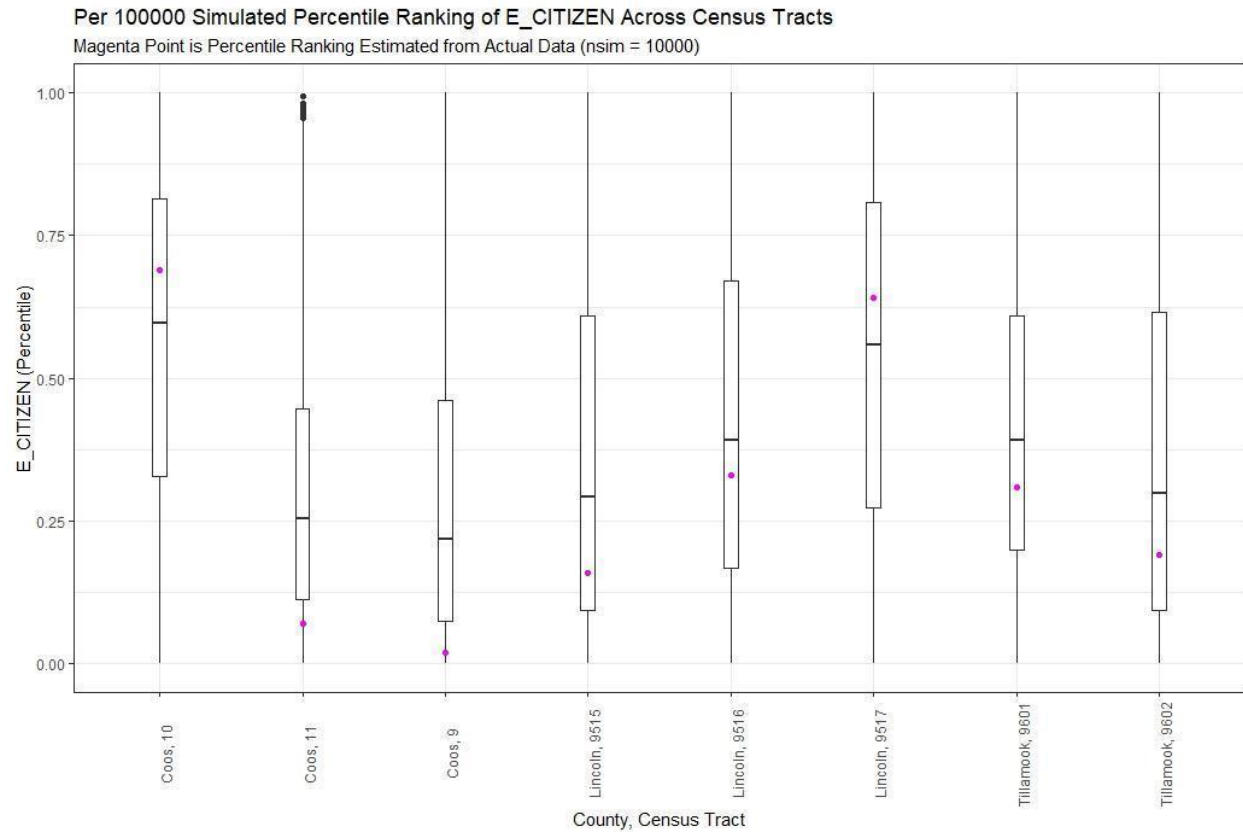


Figure S8. Boxplot of simulated per 100000 percentile rankings of the eight census tracts of interest for the citizen variable.

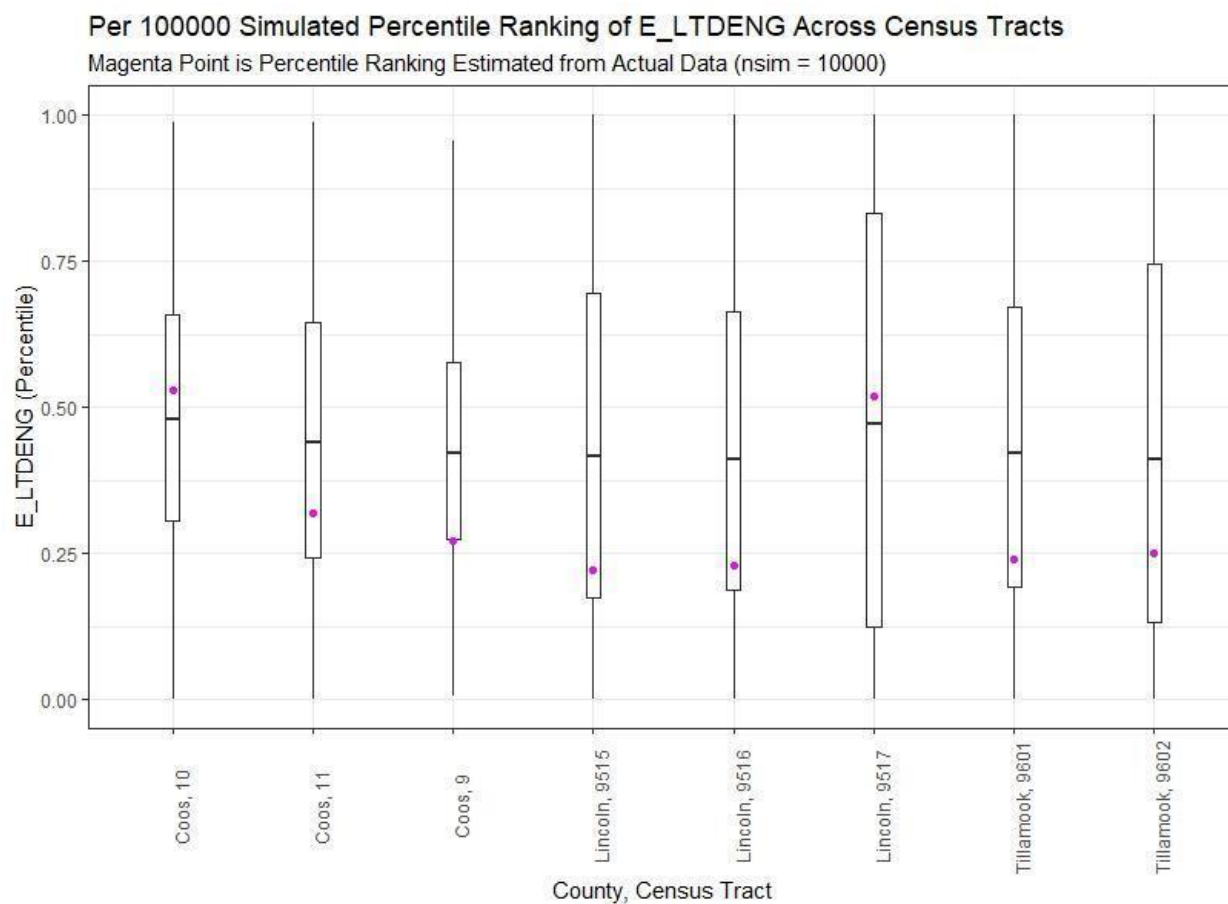


Figure S9. Boxplot of simulated per 100000 percentile rankings of the eight census tracts of interest for the limited english variable.

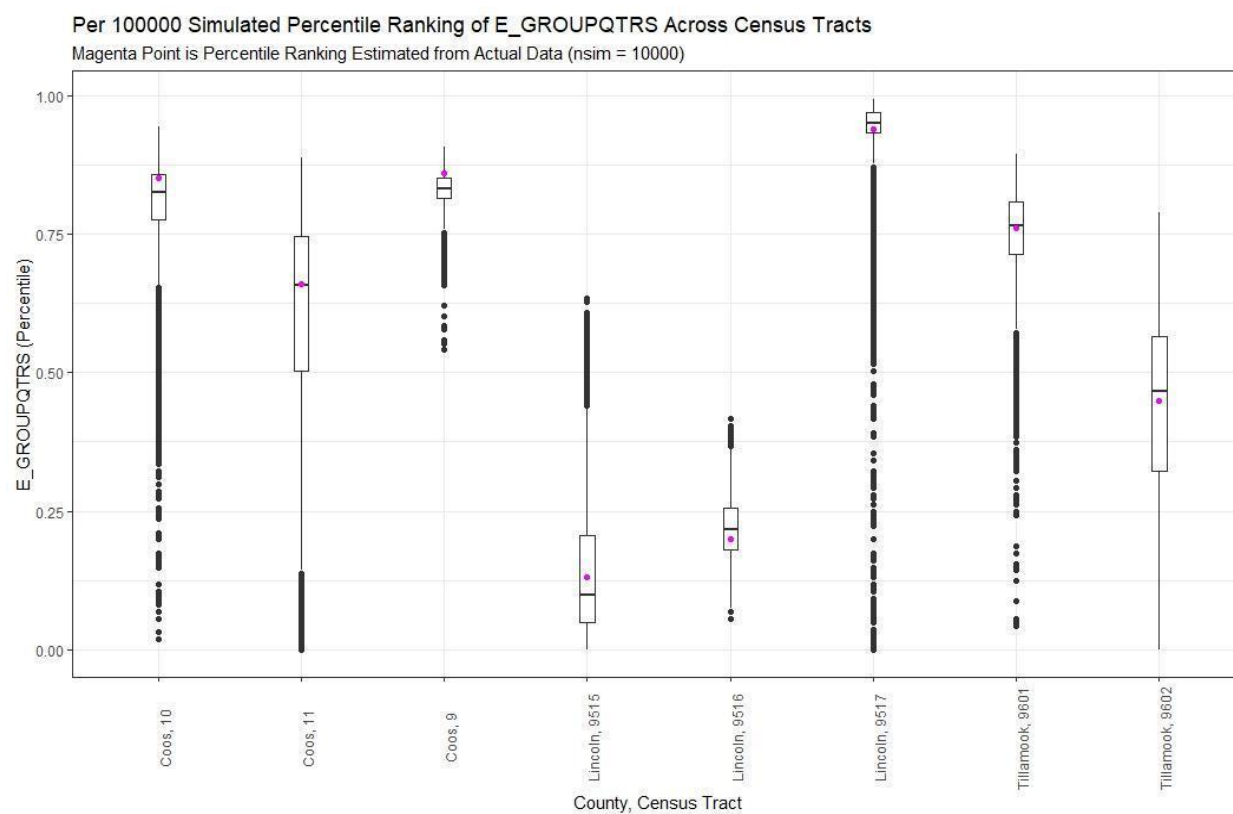


Figure S10. Boxplot of simulated per 100000 percentile rankings of the eight census tracts of interest for the multi-unit housing variable.

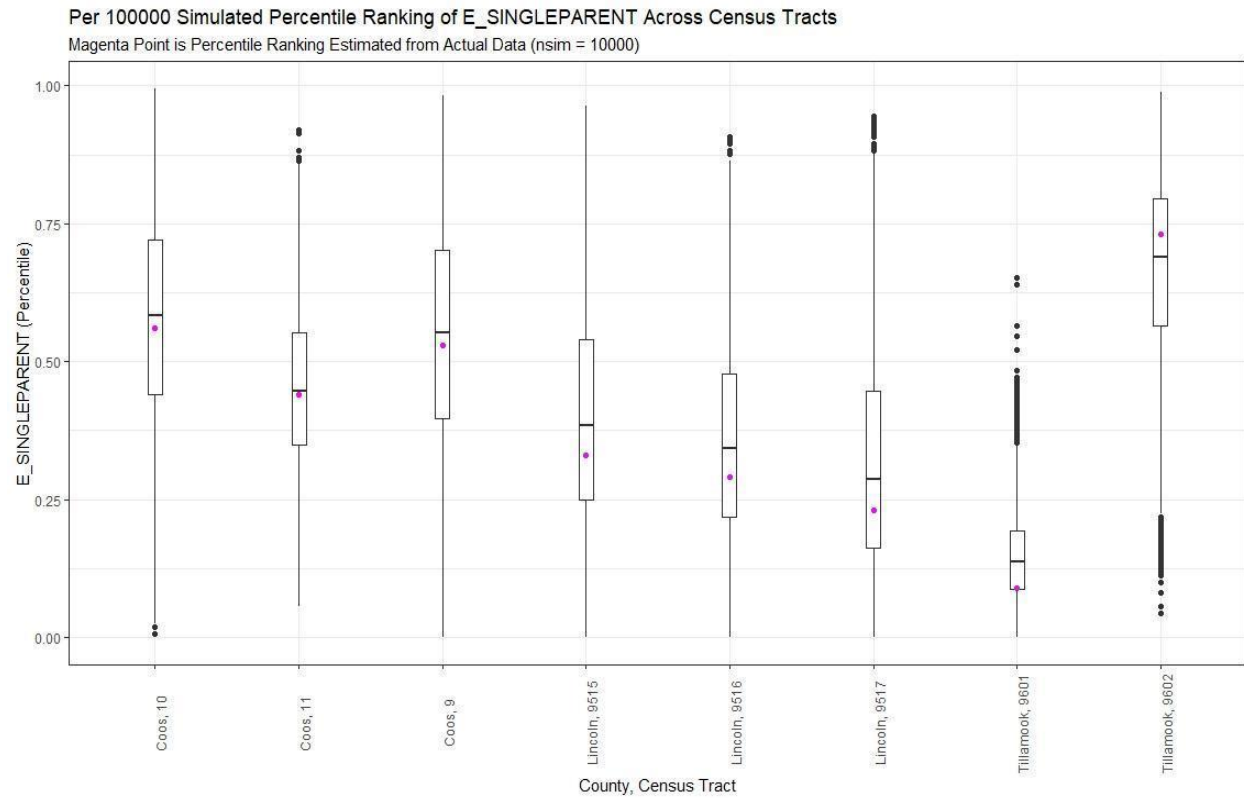


Figure S11. Boxplot of simulated per 100000 percentile rankings of the eight census tracts of interest for the single parent variable.

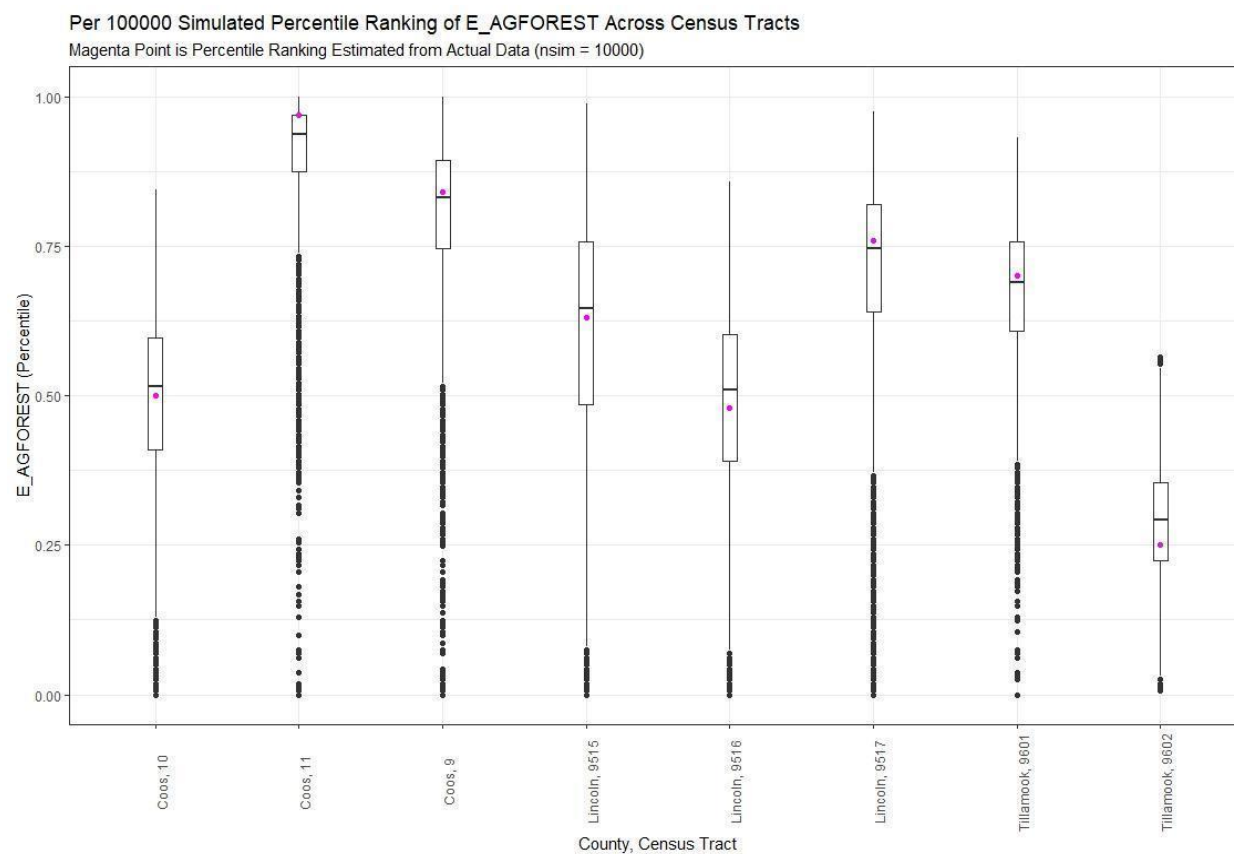


Figure S12. Boxplot of simulated per 100000 percentile rankings of the eight census tracts of interest for the agforest variable.

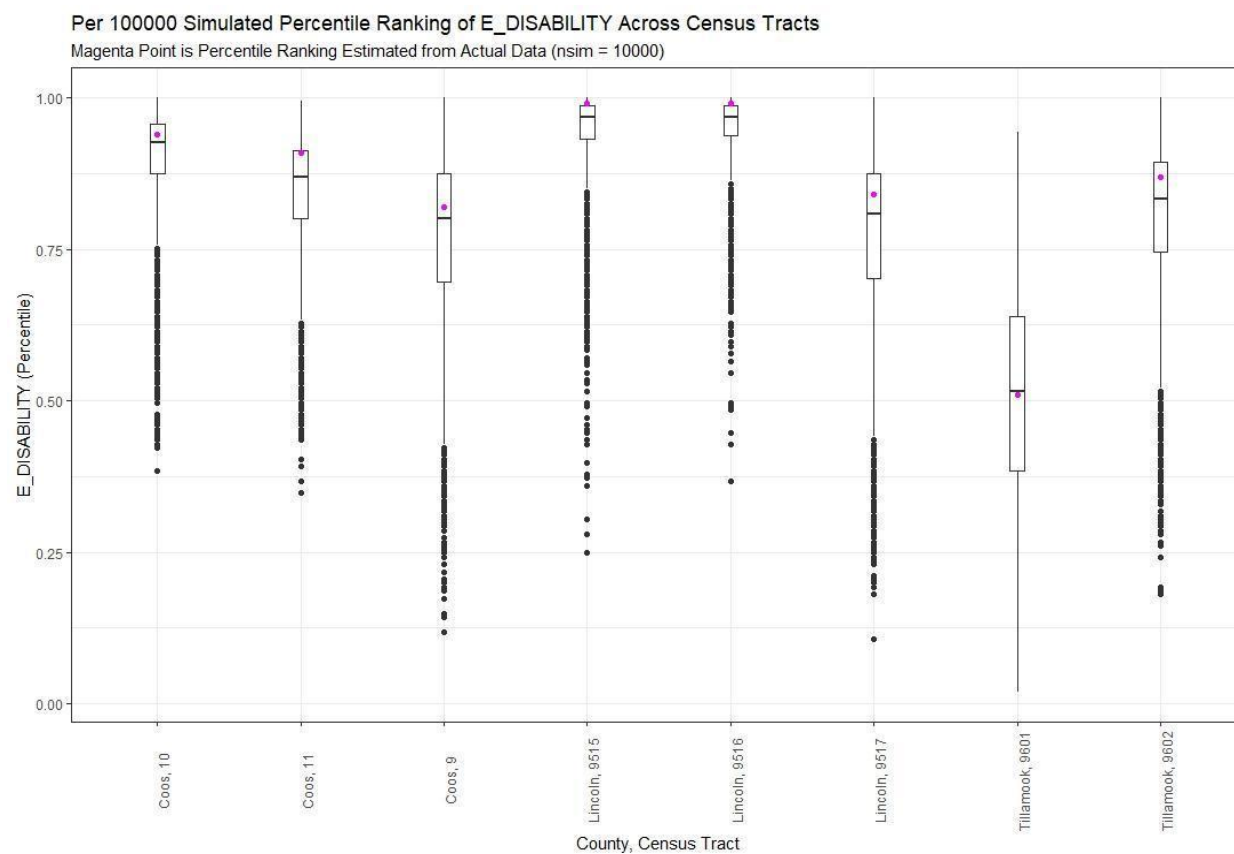


Figure S13. Boxplot of simulated per 100000 percentile rankings of the eight census tracts of interest for the disability variable.

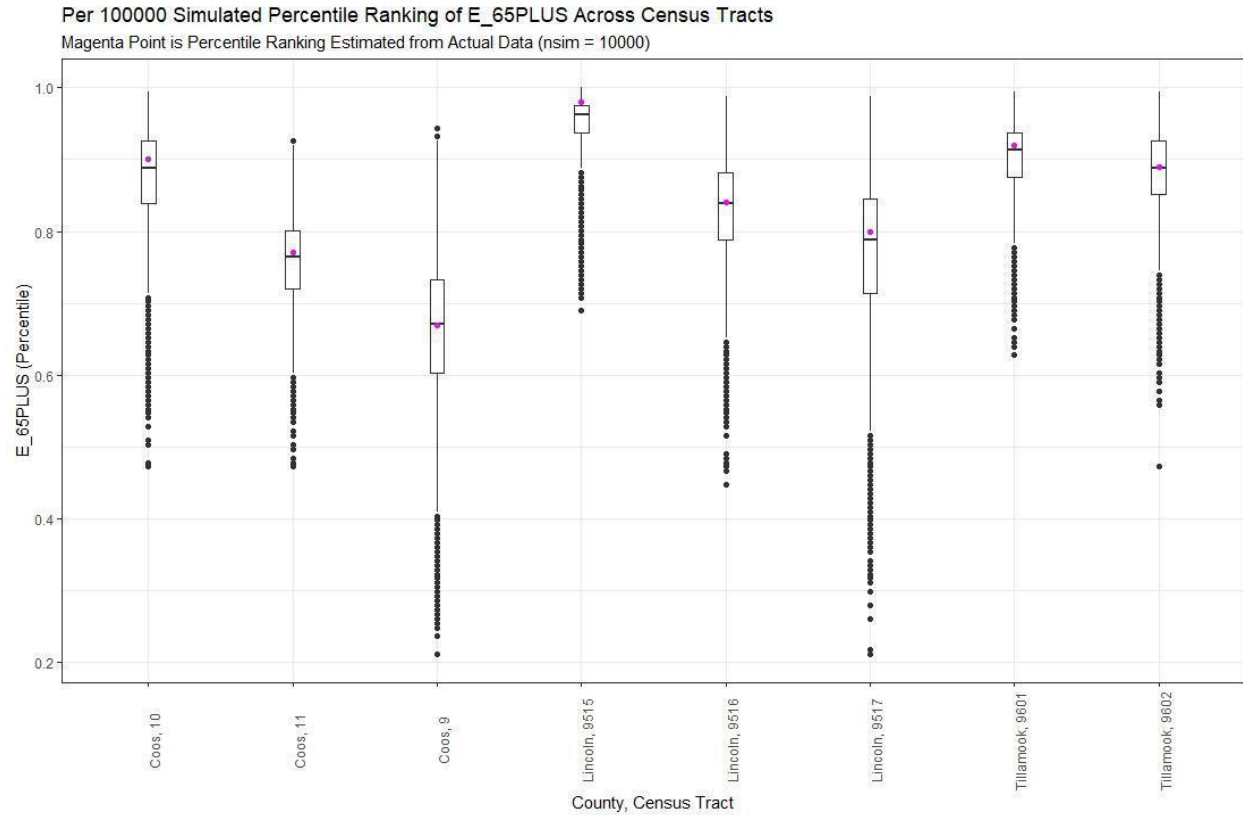


Figure S14. Boxplot of simulated per 100000 percentile rankings of the eight census tracts of interest for the 65 plus variable.

