

## AN ABSTRACT OF THE THESIS OF

Stacey M. Detwiler for the degree of Master of Science in Water Resources Policy and Management presented on May 26, 2016.

Title: Rivers and Roads: Exploring How Environmental Governance Impacts State Management of Forest Roads

Abstract approved:

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This study explores how environmental governance mechanisms affect state management of forest roads to address the chronic delivery of sediment to streams in Oregon, Washington, and California on private and state forestlands. Forest roads can degrade water quality and harm aquatic life when runoff mobilizes fine sediments from the road surface into streams. This study uses content analysis and semi-structured interviews with experts in each state to describe and evaluate the environmental governance mechanisms that shape state approaches to forest road management. General trends, such as the strong role of the Endangered Species Act and weaker role of the Clean Water Act, were found across all three states in varying degrees. In Washington, the role of tribal reserved rights emerged as a unique driver of policy compared to Oregon and California. This research reveals that federal laws around non-point source pollution and endangered species conservation play out differently in different contexts and can be used to inform decision-making as the EPA assesses potential changes to management of forest roads at the federal level under the Clean Water Act.

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Rivers and Roads: Exploring How Environmental Governance Impacts State  
Management of Forest Roads

by  
Stacey M. Detwiler

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

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Stacey M. Detwiler, Author

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# **Rivers and Roads: Exploring How Environmental Governance Impacts State Management of Forest Roads**

## Chapter 1. Introduction

Forest roads are found across forestlands in the United States where they are built primarily to access timber for logging. Typically unpaved, these roads may be temporary or permanent, but can have long-lasting effects on the landscape. Forest roads affect rivers and streams by intercepting, concentrating, and diverting flows of water (NCASI, 2001; Williams, 1999). By compacting and exposing forest soils, forest roads increase runoff, which accelerates erosion (NCASI, 2001; Swank et al., 1989). Forest roads can degrade water quality and impair aquatic habitat when increased runoff mobilizes fine sediments into streams (NCASI, 2001; Van Meerveld et al., 2014). This hydrologic connection may occur when water runs directly off of the road surface into a stream or when it is first channelized into a drainage network of ditches and culverts and then into a stream. Studies show that these connections can be an important source of fine sediments that flow into streams (Bilby et al., 1989; Ketcheson and Megahan, 1996; Furniss et al., 2000). Increased fine sediments can degrade habitat for salmonids by smothering critical spawning gravel and filling in pools (Endicott, 2008; Akay, 2008; Klein, 2012). Habitat loss and degradation is one of four primary “factors for decline” of threatened or endangered salmon and steelhead in Oregon, Washington, and California (Good et al., 2005). Management of forest roads is an evolving field of policy at both the federal level and among the states, particularly in the western coastal states of Oregon, Washington, and California where climate, the regional importance of timber harvesting, and the presence of iconic salmon species intersect.

### 1.1 Definitions and Scope

For the purposes of this research, a “forest road” refers to active and inactive roads as defined by the Oregon Forest Practices Act (FPA) on private or state forestlands in Oregon, Washington, and California and includes both native and aggregate surfaced roads. Under the Oregon FPA regulations, “active roads” are defined as “roads currently

being used or maintained for the purpose of removing commercial forest products” and “inactive roads” are defined as “roads used for forest management purposes exclusive of removing commercial forest products” (OAR 629-600-0100(3); OAR 629-600-0100(39)). This research does not address management of vacated or legacy roads, as defined by the Oregon FPA. Further, although forest roads can affect water quality and aquatic life in a number of ways, from increasing the potential for mass movements of sediment to reducing canopy cover, this research is focused on the impacts of fine sediments mobilized over time by precipitation events (Gucinski, 2001; Trombulak and Frissell, 2000).

Under the federal Clean Water Act (CWA), runoff from forest roads that transports fine sediments into streams is currently regulated as “non-point source pollution.” The CWA categorizes water pollution as either a point source or a non-point source. Point sources are defined as “any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture” (33 U.S.C. § 1362(14)). Non-point sources are effectively any type of water pollution that is not considered a point source, such as runoff.

## 1.2 Impacts of Forest Roads on Streams

Forest roads alter hydrologic and geomorphic processes in several ways that can impair water quality and degrade aquatic habitat. Networks of forest roads affect forest hydrology by increasing overland flow and drainage density and reducing time to peak flow. Additionally, forest roads can act as a source of fine sediment to streams. Forest roads have also been shown to have an increased rate of mass movement, which transports coarse sediment and wood to streams (Endicott, 2008; Wemple et al., 2001; Gucinski, 2001). These episodic events are outside of the scope of this research, however,

due to the focus of analysis upon the impacts of chronic delivery of sediment to streams from smaller precipitation events over time.

Networks of forest roads can increase overland flow due to the lower infiltration rate of the road surface compared to the surrounding forest and the interception of sub-surface flow down the hillslope (Wemple, 1996; Van Meerveld et al., 2014; Trombulak and Frissell, 2000). In other words, when precipitation hits a compacted forest road surface, it is less able to soak into the soil and instead runs along the surface. The road itself, often cut into the side of a hillslope, can also interrupt the movement of sub-surface flow, essentially diverting it onto the surface. Studies show that increased overland flow can occur even with low intensity precipitation events (Croke et al., 2005). When this increased runoff is diverted into ditches, channels, gullies, or other flow pathways, it can effectively increase the overall drainage density of the watershed (Wemple et al., 1996; Gucinski, 2001). In a study of two watersheds in the western Cascades of Oregon, Wemple et al. (1996) found that forest road segments in the study area increased drainage density by 36 percent for one watershed and by 39 percent for the other. These hydrologic connections can alter the time that it takes for water to move into a stream and can reduce the time to peak flow (Wemple et al. 1996; Gucinski, 2001). In effect, this means that forest roads not only increase surface runoff, but also can alter stream flow (Croke et al., 2005; Gucinski, 2001). These effects vary both in time and space, depending on how recently the road has been constructed, where the road is located on the hillslope, and the scale of analysis whether at the hillslope scale or basin-wide (Wemple et al., 2001). These interactions are complex and research is ongoing to better understand the connections between forest road networks and forest hydrology (Gucinski, 2001).

In addition to the potential impacts to forest hydrology, forest roads can act as a source of fine sediment to streams. Croke et al. (2005) note that “unsealed road surfaces and logging tracks can be regarded as one of the most hydrologically active areas within a logged forest for the majority of low to moderate rainfall events” (p. 265). In other words, forest roads represent an area of potentially high hydrologic connectivity between

the road surface and streams (La Marche and Lettenmaier, 2001). Increased overland flow can accelerate erosion from the road surface, transporting silt from the breakdown of the road surface or that is forced upwards from the road bed (Van Meerveld, 2014). Fine sediment can then be transported from the road surface directly into streams through channels, gullies, or ditches, or indirectly through overland flow pathways (Croke et al., 2005). Multiple studies demonstrate that forest roads can result in increased erosion rates in watersheds (Beschta, 1978; Reid and Dunne, 1984; Furniss et al., 1991; Luce and Black, 1999). A report by the National Council for Air and Stream Improvement (NCASI) found that forest roads are the primary source of erosion from forestry activities and are responsible for an estimated 90 percent of sediment loadings to streams (2001). Comprehensive literature reviews, such as the “National Level Assessment of Water Quality Impairments Related to Forest Roads and Their Prevention by Best Management Practices” prepared for the EPA by the Great Lakes Environmental Center, caution that the movement of sediment to streams and interaction with forest roads is complex and not yet fully understood (Endicott, 2008).

Although the presence of fine sediment is an important component to stream health, the increased rate of sediment production due to forest road networks can result in negative consequences for water quality and aquatic life (Wemple et al., 2001; Gucinski, 2001). Endicott (2008) notes that fine sediments can be transported downstream where they may accumulate in particular sites, amplifying the cumulative effects of multiple sources (2008). Increasing sediment loads in streams increases turbidity (Endicott, 2008). Increased fine sediments can smother critical spawning gravel for salmon and reduce habitat for the macroinvertebrates upon which juvenile salmon feed (Endicott, 2008; Akay, 2008; Klein, 2012). Studies have shown that the amount of fine sediment in spawning gravels is inversely proportional to the survival of juvenile salmonids (Chapman, 1988; Weaver and Fraley, 1993; Gucinski, 2001). Fine sediments can fill pools used by salmonids, resulting in decreased habitat areas and increased fish mortality (Alexander and Hansen, 1986; Bjornn et al., 1977). As of 2005, there were 26 evolutionarily significant units (ESUs) of salmon and steelhead species listed as threatened or endangered under the federal Endangered Species Act (ESA) across Oregon,

Washington, California, and Idaho (Good et al., 2005). At the broadest level, the National Oceanic and Atmospheric Administration (NOAA) points to habitat degradation and loss as one of four primary “factors for decline” for West Coast salmon and steelhead in all three states (Good et al., 2005).

### 1.3 Environmental Governance Mechanisms

In order to address potential harmful impacts to water quality and aquatic life, forest roads are managed under a network of environmental governance mechanisms, including federal and state laws, programs, and regulations. Environmental governance is defined by Lemos and Agrawal (2006) as “the set of regulatory processes, mechanisms and organizations through which political actors influence environmental actions and outcomes.” Regarding the potential impacts to water quality and aquatic species, the relevant environmental governance mechanisms associated with forest roads are those related to non-point source pollution and endangered species conservation. More specifically, this study focuses on federal regulatory mechanisms to address non-point source pollution and endangered species conservation. The interactions of environmental governance mechanisms is highly complex and, although alternative mechanisms are considered, this narrower scope was selected intentionally to describe how states understand and address their obligations to comply with federal mandates. This allows for an assessment and comparison of the role that these particular environmental governance mechanisms play in Oregon, Washington, and California to describe and explore how those mechanisms affect policy outcomes, or how forest roads are managed, in each state.

There are a number of studies that have focused on differences in state implementation of federal law. For example, Craig and Roberts (2015) discuss the important differences in how states approach their obligations to manage non-point source pollution under the Clean Water Act (CWA). The authors discuss how local or regional factors may drive state approaches, writing:

“Congress made a conscious decision to leave regulation of nonpoint source pollution to the states when it comprehensively amended the Federal Water Pollution Control Act. The result has been a *de facto* fifty-state experiment in regulation--or, often, non-regulation--of this type of water pollution, with different states pursuing (or not pursuing) regulation of nonpoint sources in response to local and regional drivers” (p. 2).

In their analysis of agricultural non-point source pollution, Craig and Roberts (2015) highlight how “local and regional drivers” may shape a state’s approach to addressing non-point source pollution with varying degrees of regulation. Hardy and Koontz (2008) also emphasize the importance of analyzing different flexible and “state-specific” approaches to managing non-point source pollution. In effect, the flexibility under the CWA related to state management of non-point source pollution might result in different policy outcomes to address the same problem.

In addition to regulation of non-point source pollution, states may take different approaches to meeting endangered species regulation. As Tarlock (1995) notes, the “partnership federalism” model of the ESA “allows state and local governments to define the content of federal mandates” (p. 1351). Melious (2001) builds on this by arguing that how states choose to address ESA requirements reflects the different roles that states can play in endangered species regulation. For example, a state may act more as a “proprietor” where it balances the protection of endangered species with its responsibility to protect economic interests. As another example, a state may also respond proactively to the threat of a threatened or endangered species listing by developing plans or programs in an effort to avoid a listing. These types of decisions may reflect the role of different environmental governance mechanisms, or the “local and regional” drivers described by Craig and Roberts (2015).

In summary, this research builds upon the existing literature related to environmental governance, state approaches to regulating non-point source pollution and endangered species, and the choice of policy approaches adopted by states to meet federal mandates.



Specifically, this research explores how federal regulatory mechanisms in Oregon, Washington, and California affect state policy outcomes to address the chronic delivery of sediment to streams from forest roads.

#### 1.4 Evolving Forest Road Policy

Management of forest roads at the national and state levels is an evolving field of policy. Since the early 2000s, litigation has emerged over the question of whether runoff from forest roads should be regulated as a point source or as a non-point source under the Clean Water Act (CWA). Two cases, one in California in 2001 and another in Oregon in 2007, addressed allegations that the network of ditches, culverts, and pipes used to drain forest roads were unpermitted point sources in violation of the CWA (*Envtl. Prot. Info. Ctr. v. Pac. Lumber Co.*, 2003; *Nw. Env'tl. Def. Ctr. v. Brown*, 2011). As a non-point source, forest roads are managed using Best Management Practices (BMPs) developed by each state. As a point source, landowners would be required to apply for National Pollutant Discharge Elimination System (NPDES) permits that could increase monitoring requirements or alter existing standards and practices.

In the California case, the U.S. District Court, as part of its analysis, held that the CWA lacks clear Congressional intent in its definition of a point source and that discharges from ditches and culverts that drain forest roads may be a point source under the law (*Envtl. Prot. Info. Ctr. v. Pac. Lumber Co.*, 2007). In other words, it was not clear that Congress intended to exclude forest roads as a point source. In the Oregon case, the 9<sup>th</sup> Circuit held in *NEDC v. Brown* that forest roads are point sources when runoff is channelized into ditches and culverts and that the Environmental Protection Agency (EPA) lacked authority to exempt a specific category of discharges without clear Congressional intent (*Nw. Env'tl. Def. Ctr. v. Brown*, 2011).

In 2013, the case was appealed to the Supreme Court. Shortly before the oral argument, the EPA issued a final version of its amendment to the Industrial Stormwater Rule. This amendment clarified that point source permits under the National Pollutant Discharge

Elimination System (NPDES) were only required for specific discharges related to silvicultural activity under the Silviculture Rule (*Decker v. Nw. Env'tl. Def. Ctr.*, 2013). As a result, the Court only addressed the Environmental Protection Agency's (EPA) discretion to develop exemptions for specific categories of discharges from point source permitting under the National Pollutant Discharge Elimination System (NPDES) (*Decker v. Nw. Env'tl. Def. Ctr.*, 2013). This effectively upheld the status quo of runoff from forest roads managed as a non-point source.

In 2014, Congress passed the Agricultural Act of 2014 ("the Farm Bill") that included language prohibiting NPDES permits for silvicultural activities, including stormwater discharges from forest roads ("Agricultural Act of 2014," 2014). How forest roads are regulated under the CWA remains an open question, however, as the EPA is currently in the process of responding to the terms of a settlement agreement that requires them to determine whether CWA Section 402(p)(6) compels them to regulate stormwater discharges from forest roads under a Phase II stormwater program without permits by May 2016 ("Notice of Opportunity to Provide Information on Existing Programs," 2015). If the EPA determines that it is required to regulate forest roads under 402(p)(6), the agency could establish national performance standards, best practices, or other guidance materials on how to manage this source of pollution that is currently left to the states. This could have potential ramifications for state management if the balance of power in determining best management practices (BMPs), performance standards, or other management requirements is shifted from the states to the federal EPA. For example, if regional BMPs are adopted, it could potentially minimize or eliminate any variation in state approaches.

### 1.5 Forest Roads in Oregon

Oregon was selected as the focus of this research due to its prominent role in the national debate regarding how runoff from forest roads is managed under the Clean Water Act (CWA) in the 2013 Supreme Court case *Decker v. NEDC*. Additionally in 2015, the National Oceanic and Atmospheric Administration (NOAA) and the Environmental

Protection Agency (EPA) rejected Oregon’s Coastal Nonpoint Pollution Control Program required under the Coastal Zone Act Reauthorization Amendments (CZARA). Of the 33 states and territories that are required to have Coastal Nonpoint Pollution Control Programs, Oregon’s plan is the first to have been rejected by the agencies (“Coastal Nonpoint Pollution Control Program,” n.d.). More specifically, NOAA and EPA rejected the plan because the state failed to adopt acceptable forest management measures related to its treatment of legacy forest roads. Legacy roads, although not explicitly within the scope of this analysis, are older or historic forest roads on the landscape. In two reports leading up to this determination, NOAA described ongoing concerns with sediment delivery to streams from forest roads. In the proposed finding in 2013, the EPA and NOAA stated:

“The federal agencies remain concerned that a significant percentage of the road network on forest lands in Oregon continues to deliver sediment directly into streams, and that new drainage requirements are triggered only when road construction or reconstruction takes place. It is not clear how the rules address water quality impairment associated with legacy roads and a large portion of the existing road network where construction/reconstruction is not proposed” (“Oregon Coastal Nonpoint Program NOAA/EPA Proposed Finding,” 2013, p. 9).

As a result of this rejection, funding for Oregon’s Non-Point Source Program under CWA Section 319 has been withheld for fiscal year 2015 (“Nonpoint Source Implementation 319 Grants,” n.d.).

Additionally, in the 1990s, Oregon attempted to avoid the listing of Oregon Coast coho salmon under the federal Endangered Species Act (ESA) through the establishment of the Oregon Coastal Salmon Restoration Initiative (OCSRI) (Arha et al., 2005). Under the Oregon Plan, as it became known, the state pursued voluntary measures to incentivize private landowners to upgrade forest roads to minimize impacts to salmon (Behan et al., 2005). The 2010 Federal Register Notice “Listing Endangered and Threatened Species: Completion of a Review of the Status of the Oregon Coast Evolutionarily Significant Unit of Coho Salmon” revealed scientific uncertainty regarding whether the practices

allowed under the Oregon Forest Practices Act, the primary state law regulating forest management and forest roads, were protective of Oregon Coast coho salmon. Specifically, the report was unable to determine whether the watershed effects of forest roads were adequately addressed to protect salmon. The report states, “Since there are no limitations on cumulative watershed effects, road density on private forest lands, which is high throughout the range of this ESU [Evolutionarily Significant Unit], is unlikely to decrease” (“Listing Endangered and Threatened Species,” 2010, p. 29500). In 2011, NOAA retained its listing of Oregon Coast coho salmon as threatened under the federal Endangered Species Act (ESA). In the Federal Register notice retaining the listing status, the agency notes that factors that contribute to the decline of Oregon Coast coho salmon include “Historical and ongoing timber harvest and road building [that] have reduced stream shade, increased fine sediment levels, reduced levels of instream large wood, and altered watershed hydrology” (“Listing Endangered and Threatened Species,” 2011, p. 35766).

In summary, Oregon was selected as a focus for research due to its role in high profile litigation over management of forest roads under the CWA, potential concerns related to withheld CWA Section 319 funding, and the retained listing of threatened salmonid species. Washington and California were selected to compare with Oregon’s approach to better understand where states with similar climates, existing timber industry, presence of endangered salmonid species, and geographical location might differ or adopt similar approaches to forest road management.

## 1.6 Research Question

This study explores how environmental governance mechanisms affect policy outcomes in Oregon, using California and Washington as potential models for alternative approaches, to address chronic sediment delivery to streams. Building from Lemos and Agrawal’s (2006) definition of environmental governance, this research analyzes the role of federal regulatory mechanisms related to non-point source pollution and endangered species conservation in shaping state management of forest roads in Oregon, Washington,

and California. Although additional environmental governance mechanisms, such as certification programs, were considered, the scope of this analysis is focused on these federal regulatory mechanisms. Specifically, this research poses the following question:

1. How do environmental governance mechanisms affect state management of forest roads in Oregon, Washington, and California?

This research uses content analysis and interviews with experts to describe and compare the roles that environmental governance mechanisms play in shaping management of forest roads to address the chronic delivery of sediment to streams in three states. The results of this inquiry contribute to the broader literature around environmental governance and regulation of non-point source pollution and endangered species. In an applied policy context, these results were used to develop recommendations for Oregon and may help to inform policymaking processes in the state following any changes to federal regulation of forest roads under the Clean Water Act as a result of the EPA's forthcoming determination ("Notice of Opportunity to Provide Information on Existing Programs," 2015).

## **Chapter 2. Methods**

### 2.1 Study Design

This research uses qualitative analysis under a Framework approach methodology (Ritchie and Spencer, 1994). Qualitative research involves an inductive process that explores the data to identify themes and patterns where existing research may be limited or existing theories do not effectively apply (Creswell, 2003). This analytical approach uses the researcher as the primary data collection mechanism, uses textual and descriptive data, and analyzes perceptions (Cresswell, 2003). The Framework approach for applied policy research incorporates five interrelated steps to explore the data and develop justifications or associations (Ritchie and Spencer, 1994). In this methodology, the researcher examines the data, develops a thematic framework of key issues and concepts,

codes the data, “charts” the data by bringing together coded themes and sub-themes, and interprets the results by developing connections, explanations, or strategies (Ritchie and Spencer, 1994). This study explores the perceptions of experts related to the role of environmental governance mechanisms in shaping policy outcomes in Oregon, Washington, and California to manage forest roads.

## 2.2 Data Collection

Data were collected in two phases. In phase one, I conducted a content analysis of technical documents, such as Forest Practices Acts, federal laws, agency guidance documents, and other resources. Results were used to inform the second phase of data collection and to triangulate results. In phase two, I used purposive and snowball sampling to identify experts in state agencies, non-profits, timber companies, and industry associations in Oregon, Washington, and California for semi-structured interviews (Ritchie et al., 2013). The process of data collection is represented in Figure 1.

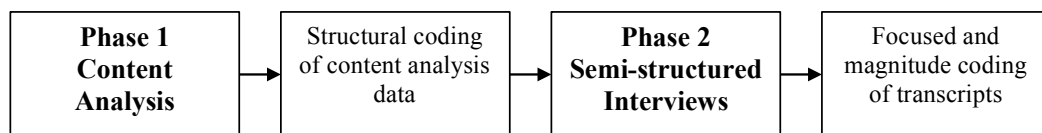


Figure 1. Data Collection Process

### 2.2.1 Phase 1: Content Analysis

For the first phase of data collection, I conducted a content analysis of written documents related to the management of forest roads, including but not limited to the Oregon, California, and Washington Forest Practices Acts and related regulations, agency guidance documents, technical reports, and peer-reviewed scientific articles. Academic databases, such as Academic Search Premier and JStor, Google scholar, and Google search were used to identify written documents. Content analysis data provide important technical information that allows the researcher to better understand the issues discussed

by participants in interviews and that can inform broader patterns (Cresswell, 2003). Additionally, this method allows for triangulation of interview data to improve the validity of the research (Robson, 1993). In other words, data collected in the content analysis creates context for the results of the interview data.

### 2.2.2 Phase 2: Semi-Structured Interviews

Following the collection of documents for the content analysis, I used the results to inform the development of the semi-structured interview protocol. Following approval from the Institutional Review Board (IRB), I conducted a total of nineteen semi-structured, hour-long interviews either in person or over the telephone with experts from state agencies, family-owned and industrial timber industry companies, landowner associations, and non-profits from Oregon, Washington, and California (see Appendix 1 and 2). Interviews were conducted between August 2015 and January 2016.

Semi-structured interviews provide the opportunity to explore how experts view the role of different governance mechanisms in each state shaping the policy outcomes related to the management of forest roads. Gray (2014) writes that semi-structured interviews are an effective approach when “the objective is to explore subjective meanings that respondents ascribe to concepts of events” (p. 386). This method allows participants to discuss other issues and ideas that may shift or expand the direction of the research within the established scope (Gray, 2014). Some limitations of interviews include the potential for the researcher to bias responses from the participants and the variation in knowledge and eloquence of participants in conveying their ideas and responses (Cresswell, 2003; Gray, 2014). In order to minimize interviewer bias, I developed an interview protocol, which was adhered to for each interview. Additionally, the reliability of the interview data was triangulated using the results from the content analysis.

A purposive sampling protocol was used to select participants with specific knowledge and expertise related to forest road management (Ritchie et al., 2013). Participants were recruited intentionally to include those with knowledge about the history and status of

scientific research related to chronic sediment delivery to streams from forest roads, non-point source pollution under the Clean Water Act, application of the Endangered Species Act, forest management, timber harvesting, and forest road construction. Initial interview participants were identified using information gathered in the content analysis through public websites. Snowball sampling, where participants identify and suggest other potential participants, was also used to identify additional experts (Gray, 2014). Potential participants were contacted by email followed by a phone call or follow-up email approximately one week later (see Appendix 3). The breakdown of interview participants by type and state are shown below in Figures 3 and 4.

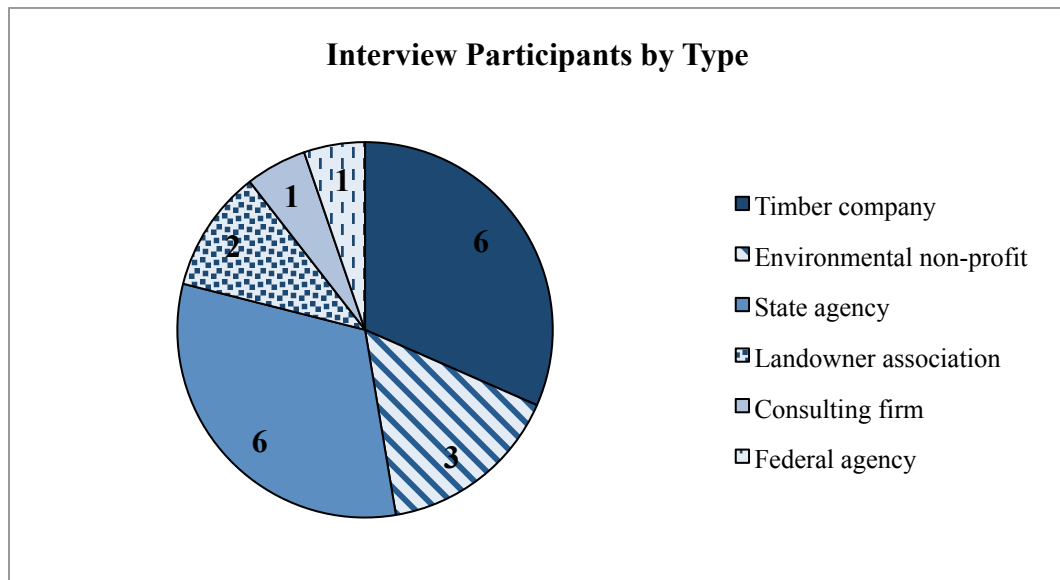


Figure 2. Interview Participants by Type



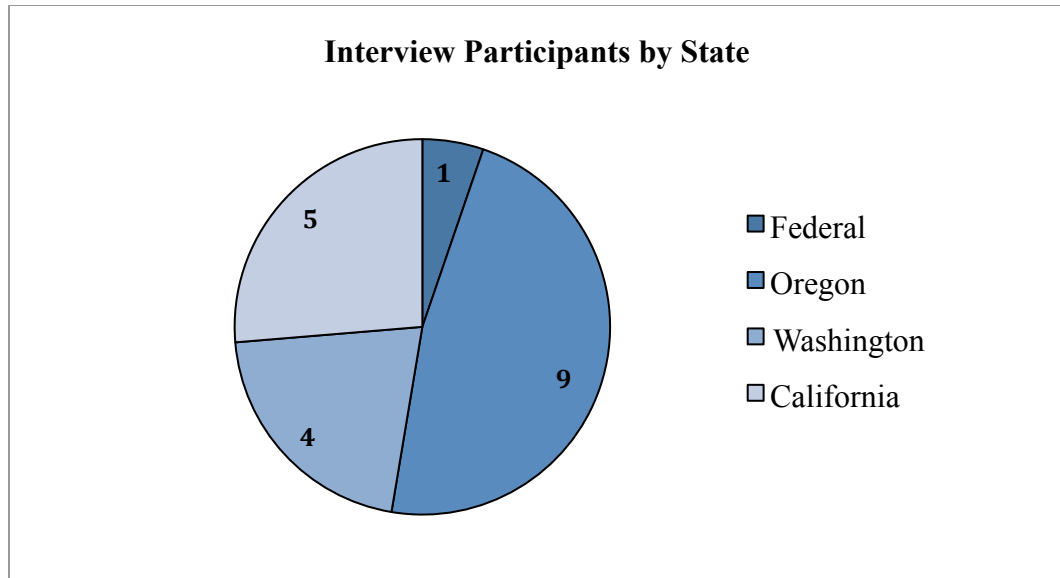


Figure 3. Interview Participants by State

After obtaining informed consent, I conducted interviews lasting approximately one hour. The interviews were audio recorded and the researcher took notes. Each interview was semi-structured, guided by an interview questionnaire (see Appendix 4). Participants were asked the current management of forest roads to address potential chronic delivery of sediment to streams in each state, the impact of *Decker v. NEDC*, the role of federal laws such as the Endangered Species Act in shaping management, and alternative approaches such as voluntary programs. I de-identified the interview data and transcribed the audio files within a week. Notes were also copied into an electronic file with my impressions.

### 2.2.3 Study Reflexivity

Positioning the researcher within the context of the study informs the analysis and interpretation of the data collected. As Gray (2014) writes, “reflexivity involves the realization that the researcher is not a neutral observer and is implicated in the construction of knowledge” (p. 606). In qualitative research, the researcher is the primary instrument of data collection and analysis and, as a result, his or her observations may be selective or biased (Gray, 2014; Cresswell, 2003). One of the strengths of qualitative

research, however, is the ability of the researcher to make informed interpretations or, “the ability to differentiate between what is important and what is not” (Gray, 2014, p. 175). In other words, the researcher’s expertise can be used to strengthen and inform the analysis. Reporting any potential biases can increase transparency into the inherently subjective process of interpreting qualitative content analysis and semi-structured interview data.

I brought substantial expertise on the Clean Water Act to the study with previous professional experience on urban stormwater issues for a national non-profit organization. Additionally, through this professional experience, I had several years of interviewing experience used to develop research reports. In order to minimize bias, I conducted a comprehensive search of the literature related to forest roads, from engineering manuals to agency guidance documents and created a standardized interview questionnaire to guide each interview with the same questions and structure (Appendix 4). I followed interviewing best practices by establishing rapport and actively working to not bias responses (Gray, 2014; Cresswell, 2003).

Over the course of the data collection, my initial assumptions related to forest roads shifted. At the start of the study, I theorized that Best Management Practices (BMPs) used for forest roads were ineffective and that larger timber companies might be resistant to upgrading forest roads. Over the course of the study period, I took a Forest Road Engineering course at Oregon State University to learn firsthand about the process of constructing forest roads and made site visits to forest roads on state and private forestlands. Through the process of data collection, my perception of BMPs and the role of timber companies substantially changed. The literature shows that, when implemented correctly, BMPs are generally effective at mitigating sediment delivery to streams. Interviews with participants from small, medium, and large timber companies in Oregon, Washington, and California revealed a stated strong interest in stewardship and compliance with existing regulations.

In summary, identifying any biases of the researcher, clearly addressing strategies used to mitigate bias, and discussing shifts in perspectives that occurred in the data collection process help to increase transparency in the interpretations made of the data. Researcher reflexivity informs the data collection and analysis processes and positions the role of the researcher in the study.

#### **2.2.4 Study Validity**

Validity in qualitative research establishes the credibility or accuracy of the research (Ritchie and Lewis book). The fundamental question underpinning the validity of a qualitative research study, as posited by Lewis and Ritchie (2013), is: “Are we accurately reflecting the phenomena under study as perceived by the study population?” (p. 274). In this case, I worked to ensure that the perceptions of the experts interviewed related to the role of federal regulatory mechanisms in shaping policy approaches for forest roads were accurately conveyed and interpreted in the findings. As part of this effort, I attempted to increase the validity of the study in a number of ways. Materials collected in the content analysis were used to inform the development of the interview questionnaire. This questionnaire was used to standardize and organize the semi-structured interviews around the objectives of the research (Gray, 2014). The information collected in the content analysis not only informed the interview questions, but also allowed the researcher to triangulate the results of the interviews (Cresswell, 2003). I recruited participants using purposive sampling from different key categories of experts in each state in an effort to include a variety of perspectives and experiences (See Figure 3). As shown in Figure 3, more participants were interviewed from Oregon due to the focus of the research on forest road management in Oregon. Some selection bias of participants may have occurred due to any difficulty in recruiting participants, possible gaps in the content analysis, or in the suggestions of the participants themselves under the snowball sampling approach. In each interview, best practices such as building trust and prompting participants to expand upon their answers were employed (Gray, 2014; Cresswell, 2003). Participants were recruited and interviews continued until I started to reach content saturation. Termed “redundancy” by Lincoln and Guba (1985, p. 202), content saturation

occurs when participants provide little or no new information. Rowley (2012) suggests that six to eight hour-long interviews are often an appropriate sample size to set as a baseline. In this research, a total of 19 hour-long semi-structured interviews were conducted.

## **2.3 Data Analysis**

Content analysis materials were analyzed using a structural coding approach in the Computer Aided Qualitative Data Analysis Software (CAQDAS) program NVivo (Saldana, 2009). The categories developed from this analysis were used to inform recruitment of interview participants and the semi-structured interview questions as well as to triangulate the results from the interview responses. I created a codebook with different codes informed by the content analysis and initial interview responses (Appendix 5).

Following the development of the codebook, focused coding of the transcripts was used to generate key categories of environmental governance mechanisms that affect forest road management of sediment delivery to streams (Saldana, 2009). Magnitude coding of the interview transcript data was used to rank participants' stated perceptions of the role those governance mechanisms played as strong, moderate, weak, or neutral (Saldana, 2009). The results of this second round of coding were analyzed in NVivo using text and matrix queries to assess how different types of environmental governance mechanisms were ranked by participants in each state. Data were charted by state and mechanism to allow for comparison and interpretation across cases and themes. The results of the coding queries were triangulated using the results of the content analysis coding.

## **Chapter 3. Results and Discussion**

### **3.1 Content Analysis**

#### **3.1.1 Federal Mechanisms**

The results of the content analysis reveal that the primary federal regulatory mechanisms associated with forest road management are the Clean Water Act (CWA), the Endangered Species Act (ESA), and the Coastal Zone Act Reauthorization Amendments (CZARA). Each of these laws and the ways in which they may impact state management of forest roads is summarized in the following sections. These summaries are intended to provide context from which to read and interpret the results of the semi-structured interviews.

#### 3.1.1.1 The Clean Water Act

Runoff from forest roads has traditionally been considered and managed as a non-point source of pollution under the federal Clean Water Act (CWA). Unlike point source discharges, which are regulated through a permit system under the National Pollutant Discharge Elimination System (NPDES) program, non-point sources are managed under state non-point source management programs (“Clean Water Act Section 319,” 2013). As required under Section 319 of the CWA, states must develop a program to identify categories of non-point sources and appropriate best management practices (BMPs) to address those sources (33 U.S.C. § 1329). Related programs, such as training, enforcement, or financial assistance, and specific milestones for pollution reduction must be identified. Section 319 also establishes a grant program to support implementation of state non-point source programs (33 U.S.C. § 1329). In Oregon, Washington, and California, BMPs are generally developed and implemented under each state’s Forest Practices Act and related regulations. The consensus in the literature on forest road BMPs is that they are often effective, if implemented and maintained correctly (Ice, 2004; Sugden et al., 2012; Loehle et al., 2014; Ice, 2011). BMP practices across Oregon, Washington, and California are generally similar.

Non-point sources, including forest roads, may be more stringently regulated under Section 303(d) of the Clean Water Act when an impaired water body that fails to meet state water quality standards is listed on a state’s impaired waters list, also known as the “303(d) list.” States are required to rank those impaired waters and develop a pollution

cap, known as a Total Maximum Daily Load (TMDL), which establishes limits for pollution levels from different sources. Importantly, TMDLs can include both point and non-point sources (33 U.S.C. §1313).

Over the past fifteen years, questions emerged regarding whether forest roads that channel runoff into ditches and pipes should be regulated, not as non-point sources with state BMPs, but under the NPDES permitting program as point sources. According to the EPA, non-point sources of surface water pollution typically result from land runoff, seepage, hydrologic modification, drainage, precipitation, and atmospheric deposition. Effectively, a non-point source is any source of water pollution that is not a point source. A point source is defined by the Clean Water Act as “any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture” (33 U.S.C. § 1362(14)).

Litigation regarding whether forest roads should be regulated as point sources emerged in 2001 when the Environmental Protection Information Center (EPIC) brought a citizen suit under the CWA against Pacific Lumber Company and Scotia Pacific Lumber Company (PALCO) and the US EPA. EPIC alleged that PALCO’s network of culverts and ditches used to drain unpaved forest roads on its timberlands in the Bear Creek watershed in Humboldt County, California substantially increased sediment loads to Bear Creek. As a result, EPIC alleged, PALCO was in violation of the CWA by allowing unpermitted “point sources” to discharge pollutants into a water of the United States. As part of its analysis of the parties’ claims, the U.S. District Court held that the CWA lacks clear Congressional intent regarding the definitions of point sources and non-point sources and that ditches and culverts that drain forest roads may be considered point sources under the law (*Envtl. Prot. Info. Ctr. v. Pac. Lumber Co.*, 2007).

In 2007, the Northwest Environmental Defense Center (NEDC) filed a citizen suit under

the Clean Water Act against Marvin Brown, the Oregon State Forester, and the Oregon Board of Forestry. NEDC alleged that stormwater runoff that flows from forest roads into ditches and culverts are “point sources” and require a permit under the Clean Water Act’s National Pollutant Discharge Elimination System (NPDES). The district court held that these discharges were exempt from the NPDES permitting program under the Environmental Protection Agency’s (EPA) Silvicultural Rule 40 C.F.R. § 122.27 (*Nw. Env’tl. Def. Ctr. v. Brown*, 2011). In 1974, EPA promulgated regulations exempting several types of discharges from the NPDES program, including silvicultural activity, which is generally known as the Silvicultural Rule (*Nw. Env’tl. Def. Ctr. v. Brown*, 2011).

In 2011, NEDC appealed the district court’s decision to the 9<sup>th</sup> Circuit, which reversed the district court’s ruling. The 9<sup>th</sup> Circuit held that the EPA does not have the authority to specifically exempt a category of discharges without Congressional intent and that stormwater runoff from forest roads becomes a point source when it is channelized and conveyed into ditches and pipes. In other words, stormwater runoff from logging roads discharged from pipes, culverts, and ditches require a NPDES permit (*Nw. Env’tl. Def. Ctr. v. Brown*, 2011).

In 2013, the Oregon case was appealed to the Supreme Court by the Oregon state forester. Three days before the oral argument of the case, the EPA issued a final version of an amendment to the Industrial Stormwater Rule to clarify that point source permits under the National Pollutant Discharge Elimination System (NPDES) are only required for certain discharges enumerated in the Silviculture Rule. The Silviculture Rule, first promulgated in 1974, defines the types of discharges associated with logging activity that are considered point sources and require NPDES permits, unless exempted by statute. Under the CWA, discharges of only stormwater are exempt from NPDES permits, unless they are associated with industrial activity. This 2013 amendment clarified that the Industrial Stormwater Rule only applies to four types of point source discharges, rock crushing, gravel washing, log sorting, and log storage facilities (*Decker v. Nw. Env’tl. Def. Ctr.*, 2013). In other words, NPDES permits are only required for those four types of discharges described in the Silviculture Rule. When the Supreme Court then heard the case, they addressed EPA’s discretion in developing exemptions through regulation for

stormwater runoff from forest roads. This effectively upheld the status quo of forest roads regulated as non-point sources using state BMPs, exempt from the NPDES permitting program (*Decker v. Nw. Env'tl. Def. Ctr.*, 2013). One year later, the Agricultural Act of 2014 (referred to as the Farm Bill) included language that specifically prohibits the EPA from requiring a NPDES permit for silvicultural activities (“Agricultural Act of 2014,” 2014).

Critically, however, neither the Supreme Court decision nor the Farm Bill may preclude the EPA from establishing a Phase II stormwater program for forest roads that does not require permitting under CWA 402(p)(6) (33 U.S.C. § 1342(p)(6)). Such a program could rely upon performance standards, guidance, best management practices, or other strategies to manage forest roads (“Notice of Opportunity to Provide Information on Existing Programs,” 2015). In 2014, NRDC and the Environmental Defense Center (EDC) filed a writ of mandamus to require the EPA to respond to the question raised in *EDC v. EPA* in 2003 regarding whether CWA 402(p)(6) compels the agency to regulate stormwater discharges from forest roads. Under the terms of the settlement agreement, the EPA is required to issue a final determination by May 26, 2016 (“Notice of Opportunity to Provide Information on Existing Programs,” 2015). As a result, at the time of this research, forest roads remain regulated as non-point sources under state BMP programs. However, their management under the CWA may change in the future following the EPA’s final determination in May 2016.

### 3.1.1.2 The Endangered Species Act

In combination with the Clean Water Act, the Endangered Species Act (ESA) also affects management of forest roads on state and private forestlands. As demonstrated by the literature, forest roads can mobilize fine sediments that smother spawning gravel and reduce habitat for macroinvertebrates, which degrades habitat for salmon (Endicott, 2008; Akay, 2007). According to a 2005 status report, there are 26 evolutionarily significant units of salmon and steelhead listed under the ESA in Washington, Oregon, California, and Idaho (Good et al., 2005). Following the listing of these aquatic species that may be



negatively affected by chronic delivery of sediment to streams from forest roads, states have developed different approaches to address ESA compliance.

Under the ESA, Section 9 prohibits a “take” of individual members of listed species, defined as to “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct” (16 U.S.C. §1532(19)). The term “harm” is further defined in regulation promulgated by the U.S. Fish and Wildlife Service (USFWS) and later adopted by the National Marine Fisheries Service (NMFS) in 1999 to mean “an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering” (“Endangered and Threatened Wildlife and Plants,” 1999). In other words, a take of a listed species can include directly or indirectly harming listed species such as by killing individuals or destroying their habitat (Easley et al., 2001). Under guidance released by NMFS around take of listed salmon and steelhead, the agency includes “constructing, maintaining, or using inadequate bridges, roads, or trails on stream banks or unstable hill slopes adjacent to or above a listed species habitat” as one type of activity that is considered to have a high potential to result in harm (“A Citizens Guide to the 4(d) Rule,” 2000, p. 5.)

Further, under Section 9 any “person,” defined broadly to include individuals, businesses, and government agencies, may be liable for a take of a listed species. States and local governments may be indirectly liable for both permitting activities or not acting to address activities that harm listed species and result in takes (Fischman and Hall-Rivera, 2002). Take prohibitions may be limited or tailored for threatened species under Section 4(d), known as the “4(d) rules” (Fischman and Hall-Rivera, 2002). Under the 4(d) rules for 14 evolutionarily significant units (ESUs) of salmon and steelhead in Washington, Oregon, California, and Idaho, the Section 9(a)(1) prohibitions on take apply with certain exceptions. These exceptions include the presence of incidental take permits under Section 10 of the ESA, permits for ongoing scientific research, some habitat restoration and fish harvest activities, and others (“A Citizens Guide to the 4(d) Rule,” 2000).

Under Section 10 of the ESA, landowners may pursue an incidental take permit (ITP) to enable them to carry out otherwise legal activities, such as timber harvesting, that may result in an incidental take of listed species. As part of the ITP process, applicants are required to develop and submit a Habitat Conservation Plan (HCP). The HCP must include an evaluation of potential impacts resulting from an incidental take of a listed species, a plan to monitor, reduce, and mitigate those effects, available funding to ensure implementation of the plan, a discussion of alternative activities and a rationale provided for the chosen activity, and any additional measures that may be required by the USFWS or the National Oceanic and Atmospheric Administration (NOAA) (“Habitat Conservation Plans,” 2005). Private landowners that submit HCPs and receive ITPs are also granted “no surprises” assurances that ensure that additional measures or restrictions will not be applied without the consent of the landowner as long as they are in compliance with the terms of their existing HCP (“Habitat Conservation Plans,” 2005).

In the midst of potential listings of many salmon and steelhead species in the 1990s, landowners in Oregon, Washington, and California took divergent approaches to ESA compliance. Effectively, landowners in Washington and California more widely pursued HCPs where Oregon landowners did not. In an effort to avoid the listing of Oregon Coastal coho, the state of Oregon developed the Oregon Coastal Salmon Restoration Initiative (OCSRI) in 1995, or the “Oregon Plan” (Arha et al., 2005). The Oregon Plan relied primarily on voluntary approaches to incentivize private landowners to upgrade forest roads (Behan et al., 2005; Arha et al., 2005). Between 1997 and 2006, private landowners reported improving 1,582 miles of roads; 3,200 peak flow improvements, such as culvert upgrades; 7,851 surface drainage improvements; and 809 stream crossing improvements (Morgan, 2012).

Despite these improvements, the Oregon Plan was not successful in staving off a listing of Oregon Coastal coho. After the National Marine Fisheries Service (NMFS) changed its listing of Oregon coastal coho from threatened to not warranted in 1997, the Federal District Court for Oregon ruled in *Oregon Natural Resources Council v. Daley* that this

change was “arbitrary and capricious” because NMFS could not rely on voluntary measures in a listing determination (Golightly, 1999; *Oregon Nat. Res. Council v. Daley*, 1998). Despite continued litigation, the Oregon Coastal coho remains listed as a threatened species as of 2011 (“Listing Endangered and Threatened Species,” 2011). The results of the content analysis revealed only one current HCP for aquatic species related to forest management activities in Oregon (“Habitat Conservation Agreements,” n.d.). In 2008, the City of Portland submitted its application for an incidental take permit together with an HCP for ESA listed salmonid species under the jurisdiction of NOAA as part of its efforts to better protect the watershed that provides its main source of drinking water supply (“City of Portland Bull Run Habitat Conservation Plan,” n.d.; “Habitat Conservation Plans in Oregon,” 2015).

In contrast, landowners in both Washington and California approached the proposed listing of salmon and steelhead by developing HCPs. One influential HCP in California was adopted in 1999 by the Pacific Lumber Company, the Scotia Pacific Holding Company, and the Salmon Creek Corporation, collectively referred to as “PALCO” and now known as the Humboldt Redwoods Company (HRC) (“Habitat Conservation Plan for the Properties of The Pacific Lumber Company,” 1999). A number of landowners, including the Green Diamond Resource Company and others, have since developed and implemented HCPs for aquatic species related to forest management (“Habitat Conservation Agreements,” n.d.). Washington took a unique approach by adopting a statewide HCP for aquatic species following the passage of the Forest and Fish rule package in an effort to maintain compliance with ESA requirements. The Forest and Fish rule package was passed in 2001 and generally requires landowners to bring forest roads up to current standards under Road Maintenance and Abandonment Plans (RMAPs) (Walters and Rodgers, 2014). Calhoun (2005) notes that some of the intended benefits of the statewide HCP included increased regulatory certainty for forest landowners and improved environmental outcomes. The approved HCP covers approximately 9.3 million acres of primarily state and private forestland (“NOAA’s National Marine Fisheries Service Permit for Incidental Take,” 2006).

### 3.1.1.3 The Coastal Zone Act Reauthorization Amendments (CZARA)

In addition to the CWA, non-point sources in coastal states are further regulated under the federal Coastal Zone Management Act (CZMA). The 1990 Coastal Zone Act Reauthorization Amendments (CZARA) require states with Coastal Zone Management Programs to implement Coastal Nonpoint Pollution Control Programs (“Protecting Coastal Waters from Nonpoint Source Pollution,” 2014). Jointly administered by NOAA and the EPA, state Coastal Nonpoint Solution Control Programs must implement management measures that ensure maintenance and attainment of state water quality standards and may require additional measures as required by the EPA for particular land uses or impaired coastal waters (“Coastal Nonpoint Pollution Control Program,” 1993). If states do not adopt an approvable Coastal Nonpoint Pollution Control Program, they are subject to the withholding of CWA Section 319 funding for each fiscal year until the program is approved (16 U.S.C. § 1455b(4)).

As of 2015, Oregon’s 319 funding has been withheld due to the failure of the state, specifically DEQ and ODF, to adopt an approvable Coastal Nonpoint Pollution Control Program (“Nonpoint Source Implementation 319 Grants,” n.d.). In 2009, Northwest Environmental Advocates (NWEA) sued the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Environmental Protection Agency (EPA) challenging the conditional approval of Oregon’s Coastal Nonpoint Pollution Control Program (*Northwest Env. Adv. v. Locke, et al.*, 2009). Under the terms of the settlement agreement, the agencies were required to release a Federal Register notice with a proposed decision by November 2013 and a final decision by May 2014 (“Final Settlement Agreement,” 2010). In February 2015, the agencies released their final decision to reject Oregon’s program based on the state’s failure to develop additional management measures for forestry, including management of legacy forest roads (“Coastal Nonpoint Pollution Control Program,” 2015). As a result, federal funding for Oregon’s 319 program under the CWA has been withheld (“Nonpoint Source Implementation 319 Grants,” n.d.). In contrast, California’s Coastal Nonpoint Pollution Control Program was fully approved in 2000. Conditional approval of Washington’s

program was granted in 1998 and final approval is still pending (“Coastal Nonpoint Pollution Control Program,” n.d.).

Additionally, the terms of the settlement agreement required Oregon Department of Environmental Quality (DEQ) to issue “implementation-ready” TMDLs for Oregon’s coastal region, beginning with the mid-coast. The DEQ was required to issue the Mid-Coast TMDL by June 2013, but notified the federal agencies that this deadline would not be met (“Water Quality Total Maximum Daily Loads Program,” n.d.). According to a January 2015 presentation to the Sediment Technical Working Group, the watershed has been characterized and a literature review conducted of potential pollutants. The DEQ is currently in the process of the source and linkage analysis where monitoring data and modeling are used to establish the targets for pollutant loads (Bryant, 2015).

### 3.1.2 State Forest Practices Acts

At the state level, the primary laws and regulations around forest roads in Oregon, Washington, and California fall under the state Forest Practices Acts. Additionally, each state has a unique network of state water quality and endangered species conservation laws, voluntary approaches, as well as interactions among state agencies and stakeholders that shape forest road management to address chronic delivery of sediment to streams. The following is not intended as a comprehensive description of these interactions for each state, but provides a brief summary of each state’s Forest Practices Acts and other environmental governance mechanisms that may shape forest road policy.

#### 3.1.2.1 The Oregon Forest Practices Act and Rules

In 1971, the Oregon legislature passed the Oregon Forest Practices Act (OR FPA) to encourage the economic use and maintenance of forestlands that is consistent with management of air, water, soil, fish, and wildlife resources (ORS 527.630(1)). Under the OR FPA, the Board of Forestry for developing and enforcing related regulations in coordination with other state agencies to meet the purposes of the Act (ORS 527.630(3)).

The BOF is composed of seven members of the public appointed by the Governor and confirmed by the state Senate (“State of Oregon: Board and Committees,” n.d.). The Oregon Department of Forestry (ODF) is the lead state agency in implementing and enforcing the OR FPA.

In a Memorandum of Understanding (MOU), the Oregon Department of Environmental Quality (DEQ) delegated its authority to implement CWA requirements on non-federal forestlands to ODF (“Sufficiency Analysis,” 2002). The BOF in consultation with the Environmental Quality Commission (EQC) is responsible for developing Best Management Practices (BMPs) that, to the maximum extent practicable (MEP), ensure that non-point source discharges from forest operations do not impair the achievement or maintenance of water quality standards (“Sufficiency Analysis,” 2002). Further, the OR FPA states that operators conducting or proposing to conduct forest practices with BMPs shall not be deemed in violation of water quality standards (ORS 527.770).

Under the OR FPA, operators are required to submit “written plans” to notify ODF when building or reconstructing roads near streams (OAR 629-605-0150(1); OAR 629-605-0170). Under OAR 629-605-0170(11)(b), timber harvest operations that require written plans may begin after ODF provides comments or, if no comments are provided by the agency, the operation can begin any time 14 days after the comments have been received by ODF. In other words, if ODF does not have the resources or the ability to respond substantively to address concerns in a written plan within 14 days, the operation can begin regardless. Additionally, the OR FPA requires drainage systems on new or reconstructed roads that minimize the “risk of sediment delivery to waters of the state” (OAR 629-625-0330(1)). Currently, there are no requirements for a statewide inventory of existing forest roads in Oregon. In 2003, a rule change known as the Wet Weather Rule required operators to use durable surfacing to prevent the formation of ruts or mud on active roads in use during wet weather that drain into streams. Further, this rule required operators to stop hauling when the road surface is deeply rutted or covered by a layer of mud and visibly increasing turbidity in streams with domestic water use or use by fish (OAR 629-625-0700(1-3)).

Compliance with the OR FPA, as illustrated in the 2013 Forest Practices Compliance Audit released by ODF, reveals that data collected from 200 sites of roads connected to streams over a one-year period show a 98 percent compliance rate with forest road regulations. However, the report cautions that gullies were observed on 26 percent of surveyed roads and 43% of culverts were partially or completely blocked (Clements et al., 2013).

### 3.1.2.2 The Washington Forest Practices Act and Rules

The Washington Forest Practices Act (WA FPA) was passed in 1974. In Washington, the Department of Natural Resources (DNR) is the lead state agency charged with regulating forest practices in the state (WA FPA annual report HCP). The Washington Board of Forestry (BOF) is an independent state agency that develops regulations to implement and enforce the WA FPA on non-federal and non-tribal forestlands. The BOF is composed of 13 members including the Commissioner of Public Lands or their designee; a representative from DNR, Commerce, Ecology, Agriculture, and the Washington Department of Fish and Wildlife (DFW); and eight members appointed by the governor including a representative from a timber products union, a forest landowner, an independent logging contractor, an elected county commissioner or council member, and four members of the public (Walters and Rodgers, 2014).

The history of the WA FPA is marked by a series of substantive rule packages that affected forest road management on private and state forestlands. In 1988, the Timber Fish and Wildlife (TFW) rule package passed, which created a cooperative process under which stakeholders such as timber industry representatives, tribes, and environmental groups could work together to develop rules related to forestry activities (“Forests and Fish Report,” 1999). With the passage of the Salmon Recovery Act and the release of the Forest and Fish Report, the BOF promulgated the Forest and Fish rule package in 2001. This rulemaking requires small and large landowners to submit Road Maintenance and Abandonment Plans (RMAPs) to DNR detailing how they will bring forest roads and

culverts up to compliance with current road standards for construction, maintenance, and abandonment by 2021. As of 2011, 22,793 miles of forest roads had been improved (Walters and Rodgers, 2014). The RMAPs require landowners to fix the “worst first,” prioritizing roads where upgrades will provide the most benefit to public resources (“Forests and Fish Report,” 1999; “Improving Forest Roads and Culverts,” n.d.). Additionally, the Forest and Fish Rule package requires inventorying of existing roads and “orphaned” forest roads, defined as roads a landowner has not used for forest practices since 1974 (WAC 222-24-052 (4)).

Following the Forest and Fish rule package in 2001, Washington Department of Ecology (DOE) as the designated agency responsible for implementing the requirements of the CWA, granted CWA assurances to the state’s forest practices program through 2009. With these assurances, forest practices were effectively de-prioritized in the development of Total Maximum Daily Loads (TMDLs) under the CWA. These assurances were extended pending completion research milestones to assess the effectiveness of existing forest management rules in achieving and maintaining water quality standards (2009 Clean Water Act Assurances Review, 2009). Additionally, in 2006 Washington built upon the Forest and Fish rule package to develop a statewide Habitat Conservation Plan (HCP) for aquatic species on private and state forestlands. This HCP serves to insulate landowners from Section 9 liability under the ESA and is implemented by Washington DNR, the Washington Department of Fish and Wildlife (WDFW), and the Washington Department of Ecology (DOE) (Walters and Rodgers, 2014).

The 2012-2013 Biennium Forest Practices Monitoring Report from DNR shows that, of 48 observations, 94 percent of haul routes were found to be in compliance with WA FPA rules (Obermeyer et al., 2014). Of these, 76% were found to have no delivery of sediment to streams and 18% with *de minimus* delivery where overland flow reached streams, but no increase in turbidity above background levels was observed. The primary cause of sediment delivery to streams was due to inadequate stream crossings, followed by the delivery of sediment from roads adjacent and parallel to streams (Obermeyer et al., 2014).



### 3.1.2.3 California's Z'Berg-Nejedly Forest Practices Act and Rules

In 1973, the California legislature passed the Z'Berg-Nejedly Forest Practices Act, replacing an earlier forest practices statute passed in 1945 that was ruled unconstitutional ("Forest Practices," 2012). The California Board of Forestry (BOF) develops forest policies for California and works with the California Department of Forestry and Fire (CALFIRE), the state agency responsible for enforcing forest practices regulations under the CA FPA ("About the Board," n.d.). Members of the BOF are appointed by the Governor, five of whom must represent the general public, three from the forest products industry, and one from the range-livestock industry ("About the Board," n.d.).

Operators are required to submit Timber Harvest Plans (THPs) prepared by Registered Professional Foresters (RFPs) under the CA FPA. The THP process is certified as an equivalent to the Environmental Impact Report (EIR) required by the California Environmental Quality Act (CEQA) (Cal. Code Regs., tit. 14 § 896(a)). This results in a substantive process that requires the RFP to determine any significant adverse impacts, evaluate cumulative impacts, and provide mitigation measures (Cal. Code Regs., tit. 14 §898). Additionally, under the CA FPA, hauling during the winter without a winter operating plan to mitigate erosion, movement of sediment into streams and compaction is prohibited (Cal. Code Regs., tit. 14, § 914.7, 934.7, 954.7).

Two recent rule packages in California are directly connected to forest roads and the chronic delivery of sediment to streams. Effective as of 2010, the CA BOF promulgated the Anadromous Salmonid Protection (ASP) Rules, which require limiting hauling on forest roads and landings within ASP watersheds to roads that are hydrologically disconnected from waterways where feasible. Additionally, the ASP Rules require prevention of visibly turbid water from reaching streams where it would create an increase in turbidity (Cal. Code Regs., tit. 14, § 916.9 (k)(1); "Anadromous Salmonid Protection Rules," 2010). Most recently, the Board of Forestry developed the "Road Rules" package, effective as of 2013, that extends the requirement for roads to be hydrologically disconnected from streams beyond ASP watersheds to encompass the

entire state. Additionally, the Road Rules package requires a statewide road erosion inventory to identify significant existing or potential erosion sites (Cafferata, 2015; Cal. Code Regs., tit. 14, § 923.2, 943.2, 963.2(5); Cal. Code Regs., tit. 14, § 923.4 [943.4, 963.4](a)).

In California, the State Water Resources Control Board (SWRCB) and nine Regional Water Quality Control Boards (RWQCBs) are the primary agencies responsible for implementing the CWA and the Porter-Cologne Water Quality Act (Lauffer, 2013). In 1988, the SWRCB, the BOF, and CALFIRE entered into a Management Agency Agreement (MAA) under which RWQCBs review and approve THPs (“Timber Operations,” 2016). Following approval of a THP by CALFIRE, landowners must apply for a permit from the RWQCB that establish conditions for discharges into waters of the state, known as Waste Discharge Requirements (WDRs) or Waivers of Waste Discharge Requirements (“Timber Operations,” 2016). In effect, this creates more of a dual permitting system in California with both CALFIRE and the RWQCB to approve forest operations, including the construction and improvement of forest roads.

In 2014, CALFIRE and the CA BOF released the results of the Monitoring Study Group (MSG) that evaluated the effectiveness of the CA FPA and rules between 2008 and 2013 (Brandow and Cafferata, 2014). The MSG randomly selected 126 THPs and 24 Nonindustrial Timber Management Plan-Notice of Timber Operations (NTMP-NTOs) to identify the rate of compliance with CA FPA requirements and whether those practices, when properly implemented, achieved environmental outcomes such as improved water quality. For each THP or NTMP-NTO, a 1/8-mile segment of road was monitored to assess compliance with CA FPA requirements by reviewing waterbreak spacing, waterbreak construction, and discharge into the forest. The results of the MSG work showed that 97 percent of monitored road segments either met or exceeded implementation of these requirements. Regarding effectiveness of the requirements, erosion from the road cut slope and fill slope surfaces, sediment transport outside of the road prism, and sediment transport into waterways were monitored. The results of the monitoring showed that 96 percent of the THP road segments did not have erosion from

the cut slope and 99 percent did not have erosion from the fill slope. Ninety-one percent of road segments did not show erosion from the road surface. Of the nine percent that did show erosion, this primarily took the form of rills. Overall, the results of monitoring between 2008 and 2013 demonstrate that not only are operators complying with CA FPA requirements for roads, but that those measures are largely effective at mitigating sediment delivery to streams (Brandow and Cafferata, 2014).

#### 3.1.2.4 Summary

In summary, the state Forest Practices Acts and related regulations for Oregon, Washington, and California have some similarities and important differences. These are summarized below in Table 1. All three statutes were adopted in the 1970s and require some type of written notification or plan. Each state has a Board of Forestry whose responsibilities generally include adopting regulations or policies to implement and enforce the Forest Practices Act. Beyond these structural similarities, there are important differences between the Forest Practices Acts of Oregon, Washington, and California.

Oregon does not currently require statewide forest road inventories, unlike Washington and California. Operators bring roads up to standards when the area is harvested, but there are no statewide requirements such as the Washington RMAP program to bring all forest roads up to current standards. One HCP for the Bull Run watershed was identified. Under the 2003 Wet Weather Rule, operators are required to use durable surface and to stop hauling when the road surface is deeply rutted or visibly increasing stream turbidity in streams classified for domestic use or fish.

Only in California is winter hauling generally prohibited without a plan to address and mitigate potential sediment delivery to streams. Additionally, only California currently requires statewide hydrologic disconnection of forest roads under its 2013 “Road Rules” package. Similarly, California is unique in that its Timber Harvest Plans (THPs) are equivalent to an Environmental Impact Report (EIR) under the state endangered species statute, the California Environmental Quality Act (CEQA). California also requires a permit, known as a Waste Discharge Requirement (WDR) or Waiver of Waste Discharge Requirement, from one of nine Regional Water Quality Control Boards (RWQCBs).

Landowners across the state, such as Green Diamond Resource Company, have developed HCPs.

In contrast, although Washington does not currently require statewide hydrologic disconnection, the 2006 Forest and Fish rule package requires operators to submit Road Maintenance and Abandonment Plans (RMAPs) to bring all forest roads into compliance with current road standards by 2021. Uniquely among the other two states, Washington has a statewide HCP for aquatic species that covers forest roads and the Washington Department of Ecology (DOE) effectively de-prioritized the role of forest management, including forest roads, in Total Maximum Daily Loads (TMDLs) by granting CWA assurances to operators in compliance with the WA FPA.

Table 1. Summary of Oregon, Washington, and California Forest Practices Acts Related to Management of Chronic Sediment Delivery from Forest Roads

Oregon	Washington	California
<p>No statewide forest road inventory required.</p> <p>Operators bring roads up to standards when the area is harvested.</p> <p>Written notification required when building or reconstructing roads near streams.</p> <p>BOF composed of seven members of the public appointed by the Governor and confirmed by the state Senate.</p> <p>OR DEQ delegated its authority to implement CWA requirements on non-federal forestlands to ODF.</p> <p>Wet Weather Rule (2003) requires use of durable road surface, prohibits hauling when road surface is deeply rutted or covered with a layer of mud and visibly increasing turbidity.</p>	<p>Statewide forest road inventory required.</p> <p>Landowners are required to submit Road Maintenance and Abandonment Plans (RMAPs) bring roads up to standards by 2021 under the Forest and Fish rule package (2001).</p> <p>BOF composed of 13 members including the Commissioner of Public Lands or their designee, a representative each from DNR, Commerce, Ecology, Agriculture, and Department of Fish and Wildlife, and eight members appointed by the governor including a representative from a timber products union, a forest landowner, and independent logging contractor, an elected county commissioner or council member, and four members of the public.</p> <p>WA DOE granted CWA assurances to the forest practices program. If in compliance with FPA, the considered to be meeting CWA requirements.</p> <p>Statewide HCP for aquatic species on state and private forestlands.</p>	<p>Statewide forest road inventory required.</p> <p>Operators are required to submit Timber Harvest Plans (THP) that act as a functional equivalent of the EIR process under CEQA.</p> <p>State Water Resources Control Board (SWRCB) and CALFIRE review and approve THPs. Following approval, operators must apply for a Waste Discharge Requirement or Waivers of Waste Discharge Requirements from the Regional Water Quality Control Board (RWQCB).</p> <p>BOF is composed of 9 members appointed by the Governor, five of whom must represent the public, three from the forest products industry, and one from the range-livestock industry.</p> <p>Hauling during the winter is prohibited without a winter operating plan to mitigate erosion, movement of sediment into streams, and compaction.</p> <p>Multiple landowner HCPs for aquatic species (e.g. Green Diamond Resources Company, Humboldt Redwoods Company).</p> <p>Road Rules package (2013) requires statewide hydrologic disconnection of forest roads and a statewide erosion inventory to identify significant existing or potential erosion sites.</p>

### 3.2 Semi-Structured Interviews with Experts in Oregon, Washington, and California

In the second phase of data collection, nineteen semi-structured interviews were conducted with experts from timber companies, state agencies, non-profits, and industry associations in Oregon, Washington, and California. Although participants were asked about specific governance mechanisms, such as the role of the federal Endangered Species Act, additional mechanisms emerged in the interviews. The results of the interview data highlight the complexity of interactions between different governance mechanisms in each of the three states. Beyond federal laws, participants also discussed the role of state laws and tribal reserved rights (see Table 2).

Table 2. Environmental Governance Mechanisms Described by Participants

<b>Environmental Governance Mechanisms</b>	<b>Strong</b>	<b>Moderate</b>	<b>Weak</b>
<i><b>Federal</b></i>			
Clean Water Act Point Source Litigation	2	7	17
Clean Water Act TMDLs	6	11	10
CZARA	0	0	5
ESA Aquatic Listings and HCPs	25	18	7
<i><b>State</b></i>			
State Clean Water Laws	2	2	0
State Endangered Species Acts	5	5	0
State Land Use Laws	2	0	1
<i><b>Other</b></i>			
Tribal Reserved Rights	5	2	0

As demonstrated above in Table 2, participants described a number of different environmental governance mechanisms connected to state management of forest roads.

Although participants discussed a number of different governance mechanisms, the following results and discussion focus on broader patterns identified from the data. Specifically, the strongest patterns that emerged from the data show:

- The important role that the ESA plays in driving policy outcomes around forest roads;
- The weak role of litigation regarding whether forest roads should be regulated as point sources or non-point sources under the CWA;
- The mixed role of CWA Total Maximum Daily Loads (TMDLs), which vary by state;
- The weak role of CZARA;
- The important role of tribal reserved rights in Washington; and
- The role of state clean water and endangered species laws in Washington and California and the role of land use laws in Oregon.

### 3.2.1 The Importance of the Endangered Species Act

After interviewing experts in Oregon, Washington, and California, analysis of the data illustrates the complex interactions among different types of environmental governance mechanisms. While no governance mechanism works in isolation, interview data show that participants found that the federal Endangered Species Act (ESA) plays a strong role in affecting management of forest roads to address chronic sediment delivery to streams in all three states. As demonstrated in Table 3, aquatic listings and Habitat Conservation Plans (HCPs) under the ESA were referenced a total of 25 times by participants as playing a strong role and 18 times by participants as playing a moderate role. As one medium-sized timber industry participant from Washington stated, “You know, if history is any indication of the future, then obviously that will be the driver. And I mean, it is now, it has been in the past, and certainly will, is looking like it will be in the future” (Interview, Sept. 22, 2015). Similarly, a state agency participant from Oregon noted, “The threat of the coastal coho listing pretty clearly drove a lot of effort to get roads under control and in better shape in the 90s and 2000s” (Interview, Dec. 7, 2015). In reference to the development of California’s “Road Rules” package requiring statewide hydrologic disconnection of forest roads, one California timber industry participant stated:

“The primary driver originally was the listing of, well the steelhead, coho, and chinook. And that put a big push from the Administration, so from the Governor's office originally, as well as from legislators and the EPA, to tighten the Forest Practices rules, to review the Forest Practices rules, and where necessary, tighten them in three areas” (Interview, Dec. 10, 2015).

These quotes illustrate the important role that participants found the ESA has played and may continue to play in shaping policy around forest roads to address the chronic delivery of sediment to streams.

Table 3. Ranked References by State for ESA Aquatic Listings and HCPs

	<b>Oregon</b>	<b>Washington</b>	<b>California</b>
<b>Strong</b>	5	10	10
<b>Moderate</b>	11	2	4
<b>Weak</b>	6	0	1

When grouped by state, as shown in Table 3, ten references to aquatic listings and HCPS for the ESA playing a strong role in affecting management were made by Washington participants and ten by California participants compared to the five by Oregon participants. In fact, some Oregon participants downplayed the role of the ESA. As one example, a participant from a small landowner association in Oregon stated:

“I believe the forest practice rules adequately protect salmonids. I know the National Marine Fisheries Service made a lot of noise about they don't think it's true, but there's absolutely no science that they have to show that the current rules don't adequately protect salmon...So, the real impact of ESA on private forestland or family woodland owners is probably not huge at this point in time” (Interview, Dec. 7, 2015).

Additionally, responses from Oregon participants reflect the history of Oregon’s approach to ESA compliance evaluated in the content analysis. Specifically, Oregon has demonstrated a preference for more flexible and voluntary approaches to meeting



obligations under the ESA. Examples of this preference include the development of the Oregon Plan and the general absence of HCPs for aquatic species. Specifically regarding the lack of HCPs in Oregon for aquatic species, one Oregon non-profit participant noted, “We can't get, we have no aquatic HCP in Oregon. On any land ownership. And the reason, there's a lot of reasons for that, but one of the reasons is that the state is not interested in ESA compliance” (Interview, Sept 21, 2015). Although the results of the content analysis identified one HCP that includes salmonid species held by the City of Portland for the Bull Run, this comment further emphasizes the difficulty of adopting HCPs in Oregon (“City of Portland Bull Run Habitat Conservation Plan,” n.d.). This difference may reflect the disparate approaches the states have taken to address compliance and liability under the ESA. As demonstrated by the environmental governance around forest road management, Oregon shows a preference for more voluntary and flexible approaches. For example, the Oregon Plan relied on incentivizing landowners to voluntarily upgrade and improve forest roads to address concerns regarding their impact on salmon habitat (Arha, 2005; Morgan, 2012). Further, the lack of landowner or statewide HCPs may indicate a potential vulnerability to liability under Section 9. This is exemplified by the 2014 NOI from the Crag Law Center, Center for Biological Diversity, and Oregon Wild alleging violations of Sections 4(d) and 9 under the ESA (“Sixty-Day Notice of Intent to Sue,” 2014).

In contrast, California and Washington have generally taken a more regulated approach to ensuring compliance with the ESA and insulating state agencies and landowners from potential liability under Section 9. Participants from Washington discussed the need for certainty as driving the Forest and Fish rules and the development of the statewide HCP. One Washington timber industry association participant stated, “Well that was, that's part of our deal here. The tribes didn't want to continue to sue people, the environmental community stood to get tremendous buffers and tremendous investments in fish habitat, fish passage, landowners got some certainty and assurance in the rules. So it was a win-win-win, everybody brought that to the table” (Interview, Dec. 16, 2015). One Oregon non-profit participant in discussing Washington's statewide HCP noted, “I think they [Washington] thought they would have ...in the long run, they'd have more regulatory

certainty, and the road system was part of that” (Interview, Sept 21, 2015). Similarly, California participants also noted the importance of certainty in pursuing HCPs or developing different rules. Unique to California, some participants discussed the role of HCPs becoming a model for statewide regulations. One industrial timber participant from California stated:

“But it's interesting relative to HCPs driving policy changes? There's no doubt about it in my mind that the PALCO HCP adopted in 1999, when you look at the current road rules package, there's the fingerprints of what's in that PALCO HCP, particularly hydrologic disconnection, it's all over it, as well as inventory and wet weather usage restrictions” (Interview, Dec. 10, 2015).

The results of interviews with California and Washington participants reveal that pursuing certainty in regulations was a driving factor in the creation of HCPs and even rule packages for forest road management. This demonstrates how the desire for greater certainty can bring stakeholders together and potentially result in a more regulated approach. This is in contrast to Oregon’s demonstrated preference for more flexible and voluntary measures.

### 3.2.2 The Weak Role of Point Source Litigation under the Clean Water Act

In contrast to the participants’ responses to the ESA, the ranked coded results of the interview data show that only two references were made to the impacts of the Supreme Court case, *Decker v. NEDC*, which broadly addressed the question of whether forest roads should be regulated as a point source under the CWA. As demonstrated in Table 1, 17 references were made to this case and the Clean Water Act more broadly playing a weak role. Table 4 compares ranked references from each of the three states. Of references made to *Decker v. NEDC* playing a weak role, five were from Oregon, nine were from California, and three were from Washington. References from Washington participants were evenly split between the case and the CWA playing a weak role and it playing a strong role. Critically, these results disprove the hypothesis based on Smith’s

analysis of watershed management in Oregon that the Clean Water Act would be an important driver of policy (2002).

Table 4. Ranked References by State for CWA Point Source Litigation

	<b>Oregon</b>	<b>Washington</b>	<b>California</b>
<b>Strong</b>	1	0	1
<b>Moderate</b>	1	3	3
<b>Weak</b>	5	3	9

In general, participants that considered the *Decker v. NEDC* case to play a weak role in affecting policy also discussed the perceived increased administrative burden for marginal water quality benefits. Many noted that regulating some forest roads as point sources under the Clean Water Act would not result in substantive changes in on-the-ground practices. As one participant from a large industrial timber company in California stated, “California would be way ahead if that lawsuit was, however you look at it, if these sources all became point sources and weren't non-point sources. So, not overly worried about it because we'd be, we already have a system set up to address that” (Interview, Dec. 10, 2015). Similarly, a participant from a large industrial timber company in Oregon noted that the results of litigation on this issue has had “Not such an impact, because I think those of us who have worked in roads and worked in it for a long time that think it's doing a pretty good job” (Interview, Aug. 7, 2015). One participant from a Washington state agency stated, “I don't think practically speaking it would actually result in any meaningful change in protection out there. There wouldn't be much to gain” (Interview, Dec. 10, 2015).

More mixed responses were found in Washington, where some participants emphasized the role that the Clean Water Act in combination with the ESA plays in affecting policies. Regarding the development of future regulations in Washington, one participant from a medium-sized timber company stated that the ESA “is what basically is going to drive additional, I think, future regulations and protection. Coupled with Clean Water Act, obviously, but it's all tied to listed species for the most part” (Interview, Sept. 22, 2015). Some participants from all three states that did discuss a stronger role of the Clean Water

Act mentioned it in combination with other governance mechanisms. Regarding the California “Road Rules” package passed in 2013, one participant from a California state agency noted, “That was the culmination of roughly ten years of back and forth discussion and so, a big part of that push was to bring into consideration Porter-Cologne Water Quality requirements and Clean Water Act as well as the state water quality legal requirements built off of that, so it was designed to address non-point source sediment in that context” (Interview, Dec. 10, 2015). A participant from an Oregon non-profit stated, “This question of hydrologic connectivity and the point source thing aside, which was a good lever to put in there because it gives you an incentive, it brought a focus to the problem, whether or not we ended up getting a point source regulation alternative, even though there were folks at EPA prepared to implement that. You get a focus on the discrete source and that also raises the question of whether or not the end cause discharge to a fish bearing stream could be an ESA take under Section 9” (Interview, Sept. 21, 2015). In general, however, the data show a trend for participants finding that the impacts of *Decker v. NEDC* and point source or non-point source regulation of forest roads under the Clean Water Act play a weak role in affecting forest road policies.

Specific to California, the nine references to the *Decker v. NEDC* case playing a weak role may reflect the more regulatory approach the state has taken to forest roads compared to Washington and Oregon. California already has an intensive dual permitting process through the substantive THPs and the WDRs. Some California participants discussed how little would change on the ground if a NPDES permitting process were instituted to manage forest roads as point sources. For example, one California large timber industry participant stated, “Because our Waste Discharge Requirements are so specific down to the individual holders and the individual potential, the slipping, fill failure, individual sites on the ground, they're already being inventoried, they're already being disclosed in the THP. The control, where it's feasible to control, is being described in the THP, and needs to be met under a specified timeline. California would be way ahead if that lawsuit was, however you look at it, if these sources all became point sources and weren't NPS sources” (Interview, Dec. 10, 2015). California participants in particular, where the state has generally taken a more regulated approach and effectively

requires a dual permitting system with the THPs and WDRs, generally found that the *Decker v. NEDC* case to play a minimal role in affecting policy around forest roads.

In summary, in contrast to the perceived strong role of the ESA, participants across all three states found the debate over whether forest roads should be regulated as a point source or as a non-point source to play a weak role in driving policy. Some of the California, Washington, and Oregon participants discussed how the NPDES permitting structure would be a poor fit to address runoff from forest roads. Others noted that the classification of forest roads as point sources would do little to change practices on the ground where sediment delivery to streams from forest roads is already effectively addressed by existing BMP requirements. In California, where effectively a dual permitting system already exists, participants found the case to play a particularly weak role. This finding indicates that participants across all three states were not very concerned about possible implications of the *Decker v. NEDC* case and might inform potential state responses to any changes in how forest roads are managed at the federal level following the EPA's determination to be released at the end of May 2016 ("Notice of Opportunity to Provide Information on Existing Programs," 2015).

### 3.2.3 Mixed Results for the Role of Clean Water Act TMDLs

Unlike responses to the role of the ESA or litigation around whether forest roads should be regulated as point sources under the CWA, participant responses to the role of CWA Total Maximum Daily Loads (TMDLs) differed by state. Nine references to TMDLs playing a moderate role were coded for California participants, whereas six references to TMDLs playing a weak role were coded for Oregon participants. Ranked references from Washington participants were split between the TMDLs playing a strong role and a weak role. As demonstrated in Table 5, these data illustrate how differences between the states may be reflected in participants' discussion of the role of TMDLs.

Table 5. Ranked References by State for CWA TMDLs

	<b>Oregon</b>	<b>Washington</b>	<b>California</b>
<b>Strong</b>	0	2	3
<b>Moderate</b>	2	0	9
<b>Weak</b>	6	3	1

These differences may indicate that the relative importance of TMDLs as a driver of policy is more affected by state laws and regulations that are in place. In California, nine references were made to TMDLs playing a moderate role and three to TMDLs playing a strong role. As one California state agency participant stated, “Fifteen to twenty years of TMDLs were definitely a reason why the road rules were put into place. TMDLs have been huge in terms of spurring improvement in different permits and then, things like the Forest Practice rules” (Interview, Dec. 7, 2015). In California where there are more stringent laws and regulations related to water quality, the presence of TMDLs can act as an additional driver to address forest road management. One California state agency participant noted:

“I think that the TMDLs here are not so much a regulatory process as they inform a regulatory process. And if you already have a regulatory mechanism in place, like WDRs or waivers, they just are used to help re-structure those. But if there's no, if you can't come to another regulatory vehicle, I don't, you know I'm not super familiar with how Oregon does it, you know, maybe people start to look at the TMDL as your regulatory mechanism, and I'm not sure how, how great they are at doing that” (Interview, Dec. 7, 2015).

In other words, TMDLs alone may not necessarily drive policy outcomes, but in combination with a strong regulatory framework, they may result in important policy changes.

The lack of a stronger regulatory framework may result in a weaker role for TMDLs, as demonstrated in Oregon. In fact, Oregon participants made six references to TMDLs

playing a weak role in affecting forest road management. One Oregon state agency participant stated:

“We haven't really tackled roads in a TMDL other than as a, roads are definitely the source and here's what you're going to do about them. I think that some of our TMDLs have pointed that they could be a source, or a potential source, and just sort of left it at that, left to the designated management agencies to identify their contributions and tell us what they're going to do about it” (Interview, Dec. 7, 2015).

At a broader level, one Oregon non-profit questioned the overall effectiveness of TMDLs as a tool to address non-point source pollution, noting:

“Despite all the efforts to get TMDLs promulgated, they really don't amount to anything because in most cases they have not changed what people do on the ground. So they're a huge big fat failure, not just in Oregon, but pretty much everywhere, for non-point sources” (Interview, Sept. 21, 2015).

This suggests that without additional enforcement or monitoring mechanisms such as those found in California, that TMDLs are not as strong of a driver for policy outcomes in Oregon. In effect, responses from Oregon demonstrated a general ambivalence towards the role of TMDLs in driving policy changes. However, some participants did point to the development of the Mid-Coast TMDL as a place where current management could shift to more effectively address any sediment pollution related to forest roads.

Washington participants demonstrated more mixed responses to the role of TMDLs in affecting policy. References among Washington participants were split, with 3 references to TMDLs playing a weak role and 2 references to TMDLs playing a strong role. Some participants from Washington discussed the state's Clean Water Act assurances for the WA FPA, which effectively de-prioritize forestry activities within TMDLs (“2009 Clean Water Act Assurances,” 2009). This may reflect why those participants viewed TMDLs

as playing a weaker role in affecting management of forest roads. One Washington state agency participant stated:

“One of the things that's a little unique here is [Washington Department of] Ecology granted Clean Water Act assurances, what we call them, to forest practices. And essentially what that said was that we would prioritize water quality exceedances on forestry lands for the purposes of developing TMDLs at the bottom of the list. We treat those as low priority” (Interview, Dec. 10, 2015).

In effect, as long as landowners are in compliance with Washington Forest Practice Act requirements, then Washington Department of Ecology (DOE) will look to other point source and non-point source discharges before requiring additional restrictions as needed. As one Washington landowner association participant put it:

“The assurances that we got potentially de-prioritized the TMDLs for forestry. Because they consider that, if you're doing this stuff, then you're really not our problem anymore and it's not our priority to continue to ratchet down the TMDLs for you, cause the assumption, if you're following these rules, is that things will improve” (Interview, Dec. 16, 2015).

These statements illustrate how TMDLs may be perceived as playing a weak role by Washington participants but for a different reason than Oregon participants. Unlike discussions of the strong role of the ESA and the weak role of the *Decker v. NEDC* case and the Clean Water Act more broadly, differences among participants emerged by state for the importance of TMDLs in affecting policy decisions.

#### 3.2.4 The Weak Role of CZARA

The Coastal Zone Act Reauthorization Amendments (CZARA) was identified in the content analysis as a third federal regulatory mechanism that may affect forest road management in the states. As demonstrated in Table 6, references were limited for



CZARA, but three references from Oregon participants and one reference from a Washington participant described it as playing a weak role in driving policy. In 2015, Oregon’s Coastal Nonpoint Pollution Control program was rejected by NOAA and the EPA and the state’s CWA Section 319 funds for its Non-Point Source Program were subsequently withheld. Several Oregon participants discussed this rejection and one specifically noted that ODF has “no stake in CZARA money” (Interview, 25 Sept., 2015). Although ODF has the delegated authority to address CWA compliance of forestlands, withholding funds from DEQ for the state’s CWA 319 Non-Point Source Program has little practical effect on ODF. Further, one Oregon small landowner association participant stated, “Everyone makes a big deal about CZARA, and what’s at risk to the state of Oregon is \$3 or \$4 million dollars of EPA funding...they can keep the darn money, don’t bother us” (Interview, 7 Dec., 2015). Although the references to CZARA in Oregon are limited, these quotations highlight a potential disconnect between the regulatory penalty and the incentive for ODF to update its requirements to make the Coastal Nonpoint Pollution Control program in compliance with CZARA.

Table 6. Ranked References by State for CZARA

	<b>Oregon</b>	<b>Washington</b>	<b>California</b>
<b>Strong</b>	0	0	0
<b>Moderate</b>	0	0	0
<b>Weak</b>	3	1	0

### 3.2.4 The Role of Tribal Reserved Rights in Washington

The importance of state differences regarding the role of TMDLs is also demonstrated by references to the role of tribal rights in affecting management around forest roads. Of the six total references made to the role of tribal reserved rights, three references from Washington participants were made to the strong role that these rights played (see Table 7). For the single reference to the role of tribal reserved rights each made by an Oregon and Washington participant, both were regarding the role of those rights in Washington. As one example, one Washington state agency participant stated that the primary drivers of the Forest and Fish rule package included several state agencies, the tribes, and the landowners (Interview, Dec. 10, 2015). A Washington timber industry association

participant similarly pointed to the role of tribes in the development of this rule package, noting that:

“We have tribes here that have treaty rights that date back to 1851 and there were a couple of Supreme Court decisions called Boldt I, Boldt II, that were both upheld by the Supreme Court. Which, first one gave tribes half of the catch rights for all of the fish. And so, the second Boldt decision then gave them half of the management, habitat management for fish. So that put them in a fairly big driver's seat to apply a lot of pressure one way or another” (Interview, Dec. 16, 2015).

Table 7. Ranked References by State for Tribal Reserved Rights

	<b>Oregon</b>	<b>Washington</b>	<b>California</b>
<b>Strong</b>	1 (about WA)	3	0
<b>Moderate</b>	0	1	1 (about WA)
<b>Weak</b>	0	0	0

When participants from Oregon and California did mention tribal reserved rights, it was always in the context of Washington. For example, regarding the development of the statewide HCP in Washington for aquatic species, one Oregon non-profit participant stated, “You don't have any statewide HCPs anywhere else except for Washington, they're a total experiment. It's pretty cool that they did it, but it was a confluence of a lot of different pressures. They had leadership from the elected official who was running DNR, they had a lot of pressure from the tribes to do better on salmon, and they had, I think, a fair amount of motivation from the federal agencies as well” (Interview, Sept. 21, 2015). In discussing differences between CA FPA regulations and the development of the Forest and Fish Rules in Washington, one California state agency participant described the cooperation between industry, the tribes, the state agencies, and academic institutions (Interview, Dec. 7, 2015).

The discussion of the role of tribal reserved rights in affecting forest road management in Washington may reflect a difference in capacity of Washington tribes to pursue litigation

compared with California or Oregon tribes. In the 1850s, a number of tribes in western Washington signed treaties with the state of Washington, known as the Stevens Treaties, to effectively renounce their right of land to the state while reserving their rights to fish off of their remaining reservation lands. As salmon populations dwindled, conflicts increased between tribal fishers and non-tribal commercial fishers. Tribal communities pursued remedies through the courts to preserve their fishing rights and led to the landmark *United States v. State of Washington* case in 1974, known as the Boldt Decision. Judge Boldt held that the tribes had the right to catch 50 percent of the harvestable salmon and steelhead and invalidated Washington's existing harvest regulations (*U.S. v. State of Washington*, 1974). The case was appealed and ultimately went to the Supreme Court, where it was upheld in 1979. In 1980, Judge Orrick ruled on the tribes' second claim and found that hatchery fish were included as part of the harvestable share. In 2001, the tribes moved forward to address their claim that the terms of the original Stevens Treaties also protected habitat for salmon, arguing that poorly constructed and maintained culverts owned by the state degraded salmon habitat and thus harmed tribal fishing rights. In 2007, under what is referred to as the "Culvert Case," Judge Martinez found in favor of the tribes, holding that the right to habitat protection is included in treaty fishing rights. In other words, activities that degrade salmon habitat, such as poor maintenance of culverts or ineffective management of forest roads, are vulnerable to a successful legal challenge in favor of tribal fishing rights (Blumm and Steadman, 2009).

The history of successful litigation of tribal fishing rights in Washington illustrates an important structural difference between Washington, Oregon, and California that could impact management of forest roads. This difference could have implications for the management of forest roads related to water quality and addressing chronic sediment delivery to streams. In "Enhanced fit through institutional interplay in the Pacific Northwest Salmon co-management regime," Ebbin (2002) evaluates the institutional changes to management of salmon that resulted following the Boldt decision. After conducting more than 100 interviews, participating in management directly as a fisheries biologist in Washington, and observing meetings, Ebbin (2002) concludes that the co-management between the state and tribes as a result of the Boldt decision resulted in a

better “fit” between the institutions that manage salmon and the natural resource itself. In other words, improved information sharing, critical review of technical analysis, and decentralization of state management have more closely aligned management of salmon with addressing issues. Ebbin (2002) notes the impact of the Boldt decision and the potential for the tribes to challenge habitat degradation as part of their tribal fishing rights. In fact, Ebbin (2002) writes, “The threat of a Phase II decision, however, has been used by the Washington tribes to bring government and industry officials to the table to negotiate alternative means for addressing habitat-related conflicts. Because of this, many respondents whom I interviewed for this research felt that the tribes have a ‘bigger hammer than the state’ when it comes to habitat issues” (p. 5). This assessment, even in advance of the 2007 Martinez decision around state-owned and maintained culverts, indicates the critical role that tribal fishing rights following the Boldt decision play in affecting management of salmon. As a result, the impacts of the Boldt decision may emerge as an important factor related to changes over time in state Forest Practices Acts related to managing forest roads to mitigate the chronic delivery of sediment into streams. As Blumm and Steadman (2009) note, the success of the Martinez decision indicates a legal strategy that the tribes may pursue in other areas, such as forest roads, to address habitat degradation that affects salmon populations. Further analysis of tribal reserved rights is beyond the scope of this paper, however the role of tribes in affecting management in Oregon and California should be considered with the Washington case as an example.

### 3.2.5 State Laws

State laws related to clean water, endangered species, and land use also emerged as environmental governance mechanisms that shape forest road policy. When asked about alternative governance mechanisms that affect forest road management beyond federal laws, some participants described the role of state laws. Although many participants did not reference state laws, a discussion of these results informs the broader analysis. Table 8 presents a summary of the ranked references by state related to state clean water, endangered species, and land use laws. The limited number of references to state laws constrains broader interpretations of the role of these state laws in each state. Importantly,

the references to the role of state laws primarily serve to illustrate the complex interactions among governance mechanisms at different scales in shaping state management of forest roads.

Table 8. Ranked References by State for State Clean Water, Endangered Species, and Land Use Laws

	Oregon	Washington	California
<b>State Clean Water Laws</b>			
Strong	0	0	1
Moderate	0	0	2
Weak	0	0	0
<b>State Endangered Species Acts</b>			
Strong	0	1	4
Moderate	0	0	5
Weak	0	0	0
<b>State Land Use Laws</b>			
Strong	2	0	0
Moderate	0	0	0
Weak	1	0	0

All references to state clean water laws were made by California participants about the Porter-Cologne Water Quality Control Act (“Porter-Cologne Act”) (see Table 8). Enacted in 1969, the Porter-Cologne Act established nine Regional Water Quality Control Boards (RWQCB) and the State Water Quality Control Board (SWQCB). The RWQCBs and the SWQCB are responsible for regulating point source discharges under NPDES permits and non-point source discharges under Waste Discharge Requirements (WDR) permits (“Federal, State, and Local Laws,” 2014). Related to the role of the Porter-Cologne Act in driving the 2013 “Road Rules package, one California large timber industry participant stated:

“That was the culmination of roughly ten years of back and forth discussion, and so, a big part of that push was to bring into consideration Porter-Cologne Water Quality requirements and Clean Water Act as well as the state water quality legal requirements built off of that” (Interview, Dec. 10, 2015).

No participants from either Washington or Oregon discussed the role of state clean water laws in driving forest road policy in either state. Rather than necessarily negating any role of state clean water regulation in Washington or Oregon, these results serve to highlight its role in California.

Similarly, references to state endangered species laws were also primarily from California participants. In California, the California Environmental Quality Act (CEQA) is based on the federal National Environmental Policy Act (NEPA). The California THP process under the CA FPA is considered a functional equivalent of the Environmental Impact Report (EIR) under CEQA. California participants discussed the burdensome nature of this process and the secondary role that CEQA played in developing forest road policy behind the federal ESA. For example, one California large industrial timber participant stated that a primary driver for the recently passed “Road Rules” package requiring statewide hydrologic disconnection of forest roads “basically comes from, a big push, a federal push by NOAA Fisheries, so federal Endangered Species Act, so that's what's behind it. And then following that, behind that, was state endangered species act, CEQA” (Interview, 10 Dec., 2015). The one participant who referred to the State Environmental Policy Act (SEPA) in Washington listed it as a secondary driver following the Boldt decision and the role of tribal reserved rights in the development of the Forest and Fish rule package (Interview, 16 Dec., 2015). No Oregon participants discussed the role of state endangered species regulation.

Although Oregon participants did not describe state clean water or endangered species laws, some did discuss the role of state land use laws. No California or Washington participants discussed state land use laws. Although a comprehensive analysis of land use law in Oregon is beyond the scope of this study, Oregon’s approach to land use is somewhat unique in the region. In 1973, the legislature adopted Senate Bill 100, which created the Department of Land Conservation and Development to develop statewide land-use goals and effectively shifted the authority of zoning and planning to a state agency rather than to local cities and counties (Hunnicut, 2006). Oregon’s approach, sometimes termed the “Oregon way,” has served as a model for other land use planning

efforts based on its statewide approach (Kline and Alig, 1999). Of most relevance to this study, this approach to land use planning may play a role in reducing the conversion of forestland to development and urban areas (Kline and Alig, 1999).

References to Oregon land use laws were primarily related to their broader role in limiting the conversion of forestland. One small landowner association participant emphasized the role of land use laws, stating, “The land use laws are huge. Absolutely huge. And they seem, the difference between the land use laws in the three states, always, or at least in my opinion, always gets ignored.” (Interview, 7 Dec., 2015). In contrast, however, an Oregon state agency participant described a minimal effect of Oregon’s land use laws on forest roads. This participant noted, “I’m sure people have mentioned land use laws. The function of our land use laws doesn’t have a direct impact on forest roads, you know, it prevents conversion of forestland...but that doesn’t directly impact forest roads” (Interview, 7 Dec., 2015). One Oregon non-profit participant described land use laws as a barrier to regulation of forest roads. This participant discussed Ballot Measure 37 that required the state to compensate property owners when land use laws enacted after the owner purchased the property reduced the property value or limited use of the property (Hunnicut, 2006). Specifically, this participant stated:

“The part of the inertia in terms of changing the status quo on these rules, or any of the other rules on forest land, is the fear of running amuck, or running afoul of the compensation requirement for land use restrictions. So, we had a ballot measure that basically tried to require compensation for land use restrictions that were not directly related to federal law...So that’s a big disincentive to regulatory approaches” (Interview, 21 Sept., 2015).

In other words, if a state regulation for forest roads cannot be clearly tied to federal requirements, then the state would potentially be required to compensate property owners for any decrease in property value or limitations of the use of their property. Due to the limited number of responses, it is impossible to draw further conclusions related to the

role of land use laws in affecting forest road policy. However, these responses highlight the range of perceptions potentially associated with state land use laws in Oregon.

In summary, these results indicate that federal regulatory mechanisms, particularly the ESA, play a much stronger role in affecting state policy related to forest roads in Oregon, Washington, and California. Importantly, however, these results were included to illustrate the complex interactions among governance mechanisms at different scales. While no broad conclusions should be drawn from these limited results, they do indicate potential differences between the states that should be further explored.

## **Chapter 4. Conclusions and Recommendations**

### 4.1 Conclusions

This study explores the role of environmental governance mechanisms in affecting state policy outcomes managing forest roads to address the chronic delivery of sediment to streams. Oregon was selected as the focus of this research due primarily to the state's prominent role in litigation around runoff from forest roads under the federal Clean Water Act (CWA), the 2015 rejection of the state's Coastal Nonpoint Pollution Control Program under the Coastal Zone Act Reauthorization Amendments (CZARA), and the National Oceanic and Atmospheric Administration's (NOAA) decision to retain the listing of Oregon Coast coho as a threatened species under the federal Endangered Species Act (ESA). Washington and California were selected to compare and describe how the three states have approached management of forest roads based on similarities to Oregon related to climate, the presence of forest roads, the importance of salmonid species, and geographical location.

The results of the content analysis indicate that the CWA, CZARA, and the ESA are the primary federal regulatory mechanisms associated with managing runoff from forest roads that transports sediment into streams. The results of the semi-structured interviews demonstrate that federal laws play out differently in different contexts. In other words, even though each state is obligated to comply with the CWA, the ESA, and CZARA, how



they approach that compliance can differ substantially. These different policy outcomes are revealed under the state Forest Practices Acts, which are the primary laws and regulations that address forest roads at the state level.

Analysis of interviews with study participants revealed two trends across all three states. First, the ESA played a strong role in affecting state management of forest roads in Oregon, Washington, and California. Second, the debate regarding whether forest roads should be managed as point sources under the CWA played a weak role in shaping management approaches in all three states. Within these broader trends, however, there are important differences in the actual policy outcomes of each state. The approach of each state to meeting requirements under the ESA and the CWA can be conceptualized along a spectrum ranging from a preference for a more regulated approach to a more voluntary one. In other words, all three states demonstrate a different level of precaution in terms of remaining in compliance with federal laws related to forest road policy. Along this spectrum, California's Forest Practices Act (FPA) and regulations fall on the more regulated side of the spectrum, Oregon's FPA and regulations fall towards the more voluntary side, and Washington's FPA and regulations would be found somewhere between the two. This spectrum is represented below in Figure 4.

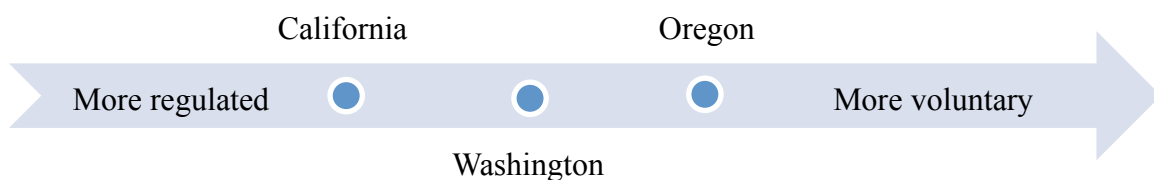


Figure 4. Spectrum of State Approaches

For example, although the ESA was perceived as a strong driver, each state has taken a divergent approach to compliance with this federal statute. California's FPA includes statewide hydrologic disconnection for forest roads and multiple landowner HCPs. As part of Washington's Forest and Fish rule package, the state developed a statewide HCP for aquatic species and requires forest roads to be upgraded across the state by 2021. At

the opposite side of the spectrum, Oregon uses a voluntary program under the Oregon Plan to incentivize forest road upgrades and has very few HCPs. Similarly, even though participants from all three states perceived litigation regarding whether forest roads should be managed as a point source under the CWA as weak in shaping policy, there were some differences in participant responses that mirror this spectrum. Some California participants focused upon the existing dual permitting system and substantive THP process that is the functional equivalent of an EIR under CEQA. Others focused on the existing monitoring and BMP requirements in place. Falling more in the middle of the spectrum, some Washington participants also discussed how little would actually change on the ground if NPDES permits were required. One Washington state agency participant described how difficult it could be to uphold stronger regulations when other neighboring states took less regulated approaches on water quality concerns. In contrast, while some Oregon participants also thought that no real differences would result, they were more concerned with the lack of flexibility from EPA, ongoing litigation from environmental groups, and the role of other less regulated non-point sources. The responses of participants related to the *Decker v. NEDC* case reflected the proposed placement of each state along this spectrum.

Beyond the strong role of the ESA and the weak role of point source litigation, four other patterns emerged from the data that highlight how state approaches to forest road management differ. First, the role of CWA TMDLs differed across the three states. Nine references to TMDLs playing a moderate role in shaping policy were from California participants, whereas six references to TMDLs playing a weak role were from Oregon participants. References from Washington participants were split between TMDLs playing a strong role and a weak role. This may indicate that the relative importance of TMDLs as a driver of state policy is affected by other state laws and governance mechanisms. For example, TMDLs may be perceived as weak in Washington because the Washington Department of Ecology (DOE) has granted CWA assurances to operators in compliance with the Washington FPA. This effectively de-prioritizes the role of forestry and forest roads in developing and implementing TMDLs and may be one reason why participants did not find TMDLs to play a strong role. In California, participants

described the strong regulatory framework that exists under which TMDL act as another layer of regulation. Some Oregon participants focused on the weakness of the TMDL process to address non-point source pollution in the absence of additional controls or measures. In contrast to the general patterns for the ESA and the debate over forest roads as point sources under the CWA, participant responses to the role of TMDLs showed more variation based on state. This may indicate that state laws or other environmental governance mechanisms affect how states comply with obligations under the CWA related to TMDLs.

In addition to state by state variation related to TMDLs, participants who discussed CZARA found it to play a weak role in driving state approaches to forest road management. Specifically, Oregon participants who described the role of CZARA identified the disconnect between ODF's responsibility to develop forest road regulations and the regulatory penalty under CZARA that withholds CWA Section 319 funding from DEQ for failing to adopt an approvable Coastal Nonpoint Pollution Control program based on the state's failure to upgrade forest management measures. Although the references to CZARA are limited, they indicate that this federal law plays a weak role in shaping forest road management.

Third, one pattern that emerged from the interviews was the role of tribal reserved rights in Washington. Participants from Oregon and California did not discuss the role of tribal reserved rights in their states, but if they did mention them, it was always in the context of Washington. From the Boldt decision in the 1970s to the Timber Fish and Wildlife rule package in the 1980s that included the tribes in a more collaborative rulemaking process under the FPA to the more recent Martinez decision, the results of this study indicate that tribal reserved rights have played and will likely continue to play a role in shaping forest road policy.

Finally, although interpretations are constrained due to the limited number of references, state laws emerged as an additional environmental governance mechanism that can shape forest road policy. Some participants from California made references to the role of the

Porter-Cologne Water Quality Act and CEQA as secondary drivers to the CWA and the ESA in shaping and developing rule packages. One participant discussed the role of SEPA in Washington also as a secondary driver following the role of the tribes in passing the Forest and Fish rule package. Although state clean water or endangered species laws were not mentioned by Oregon participants, land use laws were discussed. One barrier to regulation in Oregon around forest roads was attributed to a land use ballot measure. Due to the limited number of these references, broader interpretations are not possible. However, these results serve to highlight the numerous interactions among governance mechanisms at different scales in shaping forest road policy and indicate areas for future research.

#### 4.2 Recommendations

Based on these conclusions, Oregon should consider the approaches of both Washington and California in the context of this spectrum, evaluating both their benefits and limitations (see Figure 4). Although voluntary approaches provide benefits including increased flexibility and decreased costs, they may be less effective at achieving environmental outcomes without an enforceable backstop (Potoski and Prakash, 2004; Gianotti, 2016). As Gray and Shimshack (2011) write, “the literature consistently finds that there are large deterrence effects from environmental regulations that have ‘teeth’” (p. 17). In other words, voluntary mechanisms alone are typically less effective at achieving environmental quality goals than those that include enforceable mechanisms or monitoring (Gray and Shimshack, 2011; May, 2005; Van Gossum, 2012). Instead, research suggests that a mix of regulated and voluntary approaches may leverage the benefits of both approaches to result in improved environmental outcomes (Gianotti, 2016). Studies by Gunningham and Grabosky (1998) and Layzer (2008) demonstrate how enforceable mechanisms are critical to successful voluntary approaches. The creation of these “policy mixes” is important to the achievement of environmental goals, such as the reduction of chronic sediment delivery to streams from forest roads (Gianotti, 2016; Howlett, 2005).

In addition to evaluating its placement on this spectrum and the benefits of additional levels of precaution, Oregon should consider both potential shifts in EPA management of forest roads and in the role of tribes on this issue. Although participants from all three states did not perceive the *Decker v. NEDC* case to play an important role in shaping policy, Oregon should evaluate potential changes to state regulation that may occur if the EPA determines that it is compelled to regulate forest roads under a Phase II Stormwater Program (“Notice of Opportunity to Provide Information on Existing Program,” May 26, 2016). This could result in a shift towards state or regional performance standards or Best Management Practices developed by EPA rather than the state. Additionally, the impacts of the Boldt decision in Washington and the more recent Martinez case indicate an important role of tribes in the state. Further research is needed to better understand the role of tribes in Oregon related to forest road management, but it is possible that tribal reserved rights could play a larger role in shaping forest road policy. Oregon should consider the potential impacts of a stronger tribal presence on this issue and in watershed management related to salmonids, as demonstrated in Washington.

In conclusion, this study identifies the ESA as playing a strong role in shaping state policy in all three states. Forest road policy approaches of Oregon, Washington, and California fall along a spectrum from a preference for more regulated, precautionary approaches in California to more voluntary and flexible approaches in Oregon with Washington falling towards the middle. Although the role of litigation regarding whether forest roads should be regulated as a point source was perceived as weak by participants in all three states, their approaches similarly reflect the placement of each state along this spectrum. These conclusions provide support for Craig and Roberts (2015) assertions related to the importance of “local and regional” drivers in shaping state approaches to non-point source pollution and the variation in state approaches to ESA compliance described by Melious (2001) and Tarlock (1995). The role of CWA TMDLs most clearly reflects differences at the state level between Oregon, Washington, and California. CZARA was perceived as weak by participants, particularly in Oregon where participants described how the penalty applied for failing to adopt an approvable program based on forest management did not directly affect ODF. In Washington, the role of tribal reserved

rights emerged as an important driver of policy. At the state level, although references were limited, the discussion of the secondary roles of land use laws in Oregon and of state clean water and endangered species laws in California both emphasizes the complex interactions among environmental governance mechanisms and the importance of federal regulatory mechanisms.

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# APPENDIX 1. Institutional Review Board Approval



**EXEMPT  
DETERMINATION**

Date of Notification	06/15/2015		
Study ID	6917		
Study Title	Assessing Legal Levers and Alternative Governance Mechanisms to Manage Stormwater Runoff from Forest Roads for Salmon in Oregon		
Principal Investigator	Hannah Gosnell		
Study Team Members	Stacey Detwiler		
Submission Type	Initial Application	Date Acknowledged	06/15/2015
Level	Exempt	Category(ies)	2
Funding Source	None	Proposal #	N/A
PI on Grant or Contract	N/A	Cayuse #	N/A

The above referenced study was reviewed by the OSU Institutional Review Board (IRB) and determined to be exempt from full board review.

**EXPIRATION DATE:** 06/14/2020  
*The exemption is valid for 5 years from the date of approval.*

Annual renewals are not required. If the research extends beyond the expiration date, the Investigator must request a new exemption. Investigators should submit a final report to the IRB if the project is completed prior to the 5 year term.

- Documents included in this review:
- |   |  |  |
|---|--|--|
| <input checked="" type="checkbox"/> Protocol            | <input checked="" type="checkbox"/> Recruiting tools | <input type="checkbox"/> External IRB approvals        |
| <input type="checkbox"/> Consent forms                  | <input checked="" type="checkbox"/> Test instruments | <input type="checkbox"/> Translated documents          |
| <input type="checkbox"/> Assent forms                   | <input type="checkbox"/> Attachment A: Radiation     | <input type="checkbox"/> Attachment B: Human materials |
| <input checked="" type="checkbox"/> Alternative consent | <input type="checkbox"/> Alternative assent          | <input type="checkbox"/> Other:                        |
| <input type="checkbox"/> Letters of support             | <input type="checkbox"/> Grant/contract              |  |

**Comments:**

- Principal Investigator responsibilities:**
- Certain amendments to this study must be submitted to the IRB for review prior to initiating the change. These amendments may include, but are not limited to, changes in funding, , study population, study instruments, consent documents, recruitment material, sites of research, etc. For more information about the types of changes that require submission of a project revision to the IRB, please see: [http://oregonstate.edu/research/irb/sites/default/files/website\\_guidancedocuments.pdf](http://oregonstate.edu/research/irb/sites/default/files/website_guidancedocuments.pdf)
  - All study team members should be kept informed of the status of the research. The Principal Investigator is responsible for ensuring that all study team members have completed the online ethics training requirement, even if they do not need to be added to the study team via project revision.
  - Reports of unanticipated problems involving risks to participants or others must be submitted to the IRB within three calendar days.

- The Principal Investigator is required to securely store all study related documents on the OSU campus for a minimum of seven years post study termination.



## APPENDIX 2. IRB Approved Research Protocol

### RESEARCH PROTOCOL

June 15, 2015

1. Protocol Title: Assessing Legal Levers and Alternative Governance Mechanisms to Manage Stormwater Runoff from Forest Roads for Salmon in Oregon

#### PERSONNEL

2. Principal Investigator: Hannah Gosnell
3. Student Researcher(s): Stacey Detwiler
4. Co-investigator(s): N/A
5. Study Staff: N/A
6. Investigator Qualifications

- Hannah Gosnell, PI: PhD Geography

The Principal Investigator has over a decade of experience conducting qualitative research, including field interviewing and qualitative data analysis.

7. Training and Oversight

The principal investigator is an experienced researcher who is deeply familiar with the consent and confidentiality process. The PI will initiate regular group communications during data preparation and collection periods regarding interview consent, participant communication, and method protocol. No over enrollment is expected. We will be using a key informant sample protocol, therefore will only include participants with specific knowledge of or experience with our study landscape. We will reach out to participants intentionally and will not be recruiting broadly. No extended PI absence anticipated.

8. Conflict of Interest: No members of the study team, or any of their family members, have a financial or other business interest in the source(s) of funding, materials, or equipment related to this research study.

#### FUNDING

9. Sources of Support for this project (unfunded, pending, or awarded)
  - Unfunded

#### DESCRIPTION OF RESEARCH

10. Description of Research

The overall objectives of this research are to assess Oregon's treatment of stormwater runoff from forest roads regarding impacts to aquatic life and to evaluate opportunities to improve related policies and programs. Stormwater runoff from forest roads can send large volumes of suspended sediment into streams, which alters stream flow, impairs water quality, smothers critical spawning gravel for salmon, and reduces habitat for the macroinvertebrates upon which salmon feed.

Currently, stormwater runoff from forest roads is managed as non-point source pollution under the federal Clean Water Act. Under Section 319 of the Clean Water Act, states are required to develop non-point source programs and develop specific best management practices (BMPs) to mitigate the impacts of different categories of pollutants on surface water quality. In Oregon, following a Memorandum of Understanding with the Oregon Department of Environmental Quality, the primary responsibility to develop and implement BMPs for stormwater runoff from forest roads falls under the Oregon Department of Forestry (ODF). Critically, several reports from the National Oceanic and Atmospheric Administration (NOAA) have noted that the current treatment of stormwater runoff from forest roads under the Oregon Forest Practices Act may not adequately protect aquatic life.

This research builds on two recent judicial decisions regarding how stormwater runoff from forest roads is treated under the law. In 2011, the 9<sup>th</sup> Circuit Court held in *Northwest Environmental Defense Center v. Brown* that stormwater runoff from forest roads diverted into pipes, ditches, and culverts were point sources under the Clean Water Act. In 2013, the case was appealed to the Supreme Court in *Decker v. Northwest Environmental Defense Center*. Importantly, the Supreme Court did not overturn the ruling that these discharges were point sources. Instead, the Court addressed the question of deference to the U.S. Environmental Protection Agency's (EPA) authority to exempt sources, such as silviculture, through regulation. In 2014, Congress passed the Farm Bill which included language to explicitly exempt stormwater discharges from forest roads from permitting requirements under the National Pollutant Discharge Elimination System (NPDES) under the Clean Water Act. In the context of these decisions and existing criticisms of how Oregon addresses this source of water pollution, this research will examine potential legal levers and alternative governance mechanisms that could be applied in Oregon.

We expect that there are several important legal levers, such as the federal Endangered Species Act or the Total Maximum Daily Loads required under the Clean Water Act, that have not been fully implemented in regards to this issue. This research will use document analysis and interviews to assess potential scenarios under which these regulatory approaches are more fully applied to forest roads in Oregon. Additionally, we hypothesize that Oregon's approach to managing stormwater runoff from forest roads in regards to salmon habitat is weaker than California and Washington's approaches. This study will consider the Forest Practices Acts of all three states and alternative governance mechanisms that could be applied to forest roads in Oregon. As a result of this research, specific policy recommendations will be developed for Oregon to better manage stormwater runoff from forest roads, particularly in regard to salmon.

## 11. Background Justification

Forest roads are the primary source of erosion from forestry activities and are responsible for an estimated 90 percent of sediment loadings to streams. Through their construction, use, and maintenance, forest roads compact and expose forest soils, which decreases infiltration and results in increased runoff and erosion. When rainwater cannot easily infiltrate into the ground, it runs along the surface of the road where it picks up fine sediments. Runoff is typically then diverted into pipes and ditches, transporting potentially high volumes of sediment and water into nearby streams. High levels of sediment in streams degrades water quality and aquatic

habitat, posing a risk both to threatened species such as salmon and communities that rely on these watersheds as a source of drinking water.

A preliminary review of the literature reveals potential concerns with Oregon's existing management structure to address stormwater runoff from forest roads regarding aquatic life. In Oregon, compliance with best management practices (BMPs) under the Oregon FPA between 1987 and 1996 averaged from 96% to 98%. Although compliance rates with state BMPs are high, this does not mean that water quality impairments are not occurring. Analysis by the Oregon Department of Forestry (ODF) demonstrates that approximately 31% of the road length the agency surveyed may contribute sediment to streams. Additionally, a 1997 ODF report of the Kilchis watershed in western Oregon found that many operators do not comply with requirements to locate BMPs to filter runoff before it enters streams to mitigate sediment pollution.

In 2008, a report from the National Oceanic and Atmospheric Administration (NOAA) highlighted concerns over the impacts of forest roads as managed under the Oregon FPA for salmon. Specifically, the report states, "we remain concerned that a significant percentage of the road network on forest lands in Oregon continues to deliver sediment directly into streams, and that new drainage requirements are triggered only when road construction or reconstruction takes place. It is not clear how the rules address water quality impairment associated with legacy roads and a large portion of the existing road network where construction/reconstruction is not proposed" (EPA and NOAA-NMFS, 2008). Two years later, another NOAA report revealed scientific uncertainty regarding whether the practices allowed under the Oregon FPA were protective of Oregon Coast Coho salmon. Specifically, the report was unable to determine whether the watershed effects of forest roads were adequately addressed to protect salmon. In fact, the authors of the report state, "Since there are no limitations on cumulative watershed effects, road density on private forest lands, which is high throughout the range of this ESU [Endangered Species Unit], is unlikely to decrease" (NOAA-NMFS, 2010).

The literature also highlights differences between forest road management to address sediment pollution from forest roads in Oregon, California, and Washington under the states' respective Forest Practices Acts. Specifically, Oregon's Forest Practices Act (FPA) and related regulations are typically considered weaker than the comparable California and Washington statutes and regulations. For example, where California and Washington include more detailed criteria regarding road construction, design, and maintenance, the Oregon FPA uses broad language that effectively encourages compliance with best management practices. Limited enforcement authority, the lack of effective harvest plan review, and limited funding further weaken the OR FPA in regards to stormwater runoff from forest roads.

The purpose of this study is to assess the legal levers that exist to protect salmon from the impacts of stormwater runoff from forest roads and to identify specific policy recommendations for Oregon, drawing from Washington and California's respective approaches. First, this study will attempt to identify the impacts of stormwater runoff from forest roads on salmon habitat and how those impacts can be mitigated. Second, this research will address several different legal levers, such as the federal Endangered Species Act (ESA) or the establishment of Total Maximum Daily Loads (TMDLs) under the Clean Water Act (CWA) Section 303(d), which may protect salmon from the impacts of stormwater runoff from forest roads. Third, this study will

examine the approaches taken by Washington and California to address stormwater runoff from forest roads to protect aquatic life and drinking water quality.

12. Multi-center Study

a) Name and Federal Wide Assurance (FWA) number of each participating institution:

N/A

b) Contact name and information for IRB of record at each participating institution:

N/A

c) Contact name and information for the Investigator(s) at each participating institution:

N/A

d) Role of each participating institution (e.g., recruitment, sample/data collection, sample/data analysis, etc.):

N/A

e) Method for assuring all participating facilities have the most current version of the protocol:

N/A

f) Method for confirming that all amendments and modifications in the protocol have been communicated to participating sites:

N/A

g) Method for communicating to participating facilities any serious adverse events and unanticipated problems involving risks to subjects or others:

N/A

h) Method of communicating regularly with participating sites about study events:

N/A

i) Approval letters from all of the IRBs of record for all participating sites (or indicate that they are pending and provide upon receipt):

N/A

- j) Confirm that the PI at OSU will maintain documentation of all correspondence between participating sites and their IRBs of record:

N/A

13. External Research or Recruitment Site(s): N/A

#### 14. Subject Population

- A description of participant characteristics: Participant population will include key informants familiar with the history and status of scientific research on stormwater runoff from forest roads, forest policy, non-point source pollution under the Clean Water Act, application of the Endangered Species Act regarding threatened and endangered aquatic life, forest management, timber harvesting, and forest road construction. The population is not restricted to any gender or ethnic group or unique population.
- Total target enrollment number: 50
- Description of any vulnerable population(s): N/A
- Inclusion and exclusion criteria: Criteria are that the participants have knowledge about the history, science, policy, or management of stormwater runoff from forest roads.
- Recruitment:

Interviewees will be identified in one of the following three ways: (a) potential interviewees will be determined by the research team based on earlier outreach and research activities; (b) potential interviewees will be identified on public websites (e.g. public agency websites and community based organization websites); or, (c) interviewees will be asked to identify additional individuals or intermediary organizations that have experience with science, policy, or management regarding stormwater runoff from forest roads (e.g. snowball sampling method – see justification below). Interviewees will be contacted in one of the following three ways: (a) a letter will be sent to the interviewee followed by a phone call approximately one week later; (b) the interviewee will be contacted directly by phone to request an interview followed by either a mailing or email describing the project; or (c) the interviewee will be contacted via email, followed by a phone call or follow-up email approximately one week later.

Once interviewees have been recruited, a date, time and location will be set for the interview.

We anticipate interviews will take place between June 2015 and November 2016 depending on participant availability and researcher availability.

#### 15. Consent Process

Because the study poses minimal risks to subjects and is non-sensitive in nature, we will obtain oral consent. We will explain the study in our initial recruitment contact by mail, telephone or email (see Recruitment and Research Explanation Document). In that contact, we will explain

the purpose of the study and answer any questions the potential participant may have. We will ask if they are willing to participate and set up an interview time. Prior to starting the interview, we will go over the information outlined in our Recruitment and Research Explanation Document and answer all of the participant's questions in a way that assures they understand the research and their role. We will give them adequate time to consider their decision to participate.

We have included the verbal consent language embedded in our (attached) Recruitment and Research Explanation Document. Interview participants will be read or will read the verbal consent language before agreeing to participate in the interview and with their consent will be recorded. Participation in the survey will acknowledge participants' consent.

- **Children.** We will not be enrolling children in this study.
- **Non-English speakers.** We will not be enrolling non-English speakers in this study.
- **Student Records.** Student records will not be associated with this study.
- **Signatures on a consent form. N/A**
- **Significant new findings:** Significant new findings developed during the course of the research will not relate directly to participants or impact their willingness to continue participation.
- **Adult subjects with diminished capacity to consent.** We will not be enrolling subjects with diminished capacity to consent in this study.

#### 16. Assent Process **N/A**

#### 17. Eligibility Screening

We will not employ any screening procedures.

#### 18. Methods and Procedures

- Each interview will be designed to last from 1 – 1.5 hours, but interviewees will have the freedom to determine the amount of time they devote to being interviewed.
- Each interview will take place at a time and place convenient to the interviewee.
- Oral consent will be obtained before the interview begins
- Interviews will be semi-structured, guided by a questionnaire, which will be distributed to interviewees before the interview (see "Interview Guide").
- Each interview participant will be asked questions pertaining to his/her knowledge about and experience regarding stormwater runoff from forest roads.
- Interviews will be recorded using a digital recorder if the interviewee agrees to being recorded. Immediately after the interview, the interviewer will take a number of measures to protect the interviewee's anonymity. Recordings will be downloaded on a password-protected computer. The audio-recordings will be transcribed and coded. The name of the interviewee and other identifiers will be removed from the transcriptions and replaced with a number.
- If the interviewee decides not to be recorded, the interviewer will take notes and then transfer them to a computer. Immediately after the interview, the interviewer will remove

the interviewers name and other identifiers from these notes and replace them with a number.

- All transcriptions, code lists and interview notes will be kept on password-protected computers. Hard copies of notes will be kept in locked file cabinets in Dr. Gosnell's office.
- Hard copies and digital copies of the interview notes and transcriptions will be kept for the duration of the study and for at least 3 years post study termination, after which time they will be disposed of in a manner which maintains the confidentiality of the participants.
- A project revision will be submitted if activities related to this project have changed.

Data analysis will begin as soon as interviews are transcribed. Interviews will be analyzed using NVivo software.

- Compensation

There will be no compensation for participating in the research study.

- Costs

There will be no costs except for the time expenditure of the interview for the participants in this study.

- Drugs or Biologics

There are no drugs or biologics associated with this study.

- Dietary Supplements or Food

There are no dietary supplements or food products associated with this study.

- Medical Devices

There are no medical devices associated with this study.

- Radiation

There is no radiation associated with this study.

- Biological Samples

There are no biological samples associated with this study.

- Anonymity or Confidentiality

Hard copy data will be stored in a locked file cabinet in the PIs office for at least 3 years post study termination. It will also be stored in password-protected files (Excel and Word documents) accessible to the researchers. Audio files will be destroyed after transcription or embedded into qualitative software (NVivo) for analysis, also password protected.

Names, emails, and phone numbers of participants will be recorded so we can follow up with interviews or continued dialogue if necessary. The learning from this research will increase understanding around policy opportunities for Oregon to better address stormwater runoff from forest roads, particularly in regards to salmon. For data analysis purposes, we will give each participant a number and keep the name key associated to these numbers separate from our analysis documents. There is no risk to participants if identity or information is leaked. The information gathered will be about the participant's knowledge about and experience with

history, science, policy, or management of stormwater runoff from forest roads. These are information-gathering interviews to understand the policy, management, and science behind how stormwater runoff from forest roads are managed in Oregon, California, and Washington and to better understand potential legal levers and alternative governance mechanisms.

Publications will draw upon direct quotes and paraphrased language of the participants, as well as make thematic observations across the participants. Participants will not be individually identifiable in publications or presentations, though their affiliated organization might be identified.

We will not collect medical, personal, or educational records from participants. This study will not include sensitive information. The research is unfunded and data sharing and management will be through Oregon State University.

- Risks

There are no foreseeable risks associated with this study.

- Benefits

The information we gather may benefit participants who are interested in this kind of research and would like to see it proliferated. Otherwise there are no benefits associated with participation in this study. Researchers will offer to share study results with participants and will inform participants about the indirect benefits their participation in this project may provide.

- Assessment of the risks and benefits.

The potential benefit of the knowledge we gain in this research in terms of our ability to understand how stormwater runoff from forest roads are managed in Oregon and to develop specific recommendations to better protect aquatic life outweigh the minimal risk to and energy costs for participants.



## **APPENDIX 3. Recruitment Materials**

### **Interview Recruitment**

Dear XXX,

I am a graduate student in the Water Resources Policy and Management program at Oregon State University conducting research on the management of stormwater runoff from active and inactive forest roads in Oregon under the guidance of Dr. Hannah Gosnell. Based on your expertise in this issue area, I am inviting you to participate in my study.

I am specifically interested in potential legal levers to address stormwater runoff from forest roads, such as the Endangered Species Act or the application of Total Maximum Daily Loads (TMDLs) under the Clean Water Act, particularly following the recent 9<sup>th</sup> Circuit Court decision in *Northwest Environmental Defense Center v. Brown* and the 2013 Supreme Court decision in *Decker v. Northwest Environmental Defense Center*. Additionally, I am interested in specific impacts to aquatic life, particularly salmon, and alternative policy, incentive-based, or regulatory programs to address this potential source of surface water pollution. Participation in this study is, of course, voluntary.

If you agree to participate, the interview will take between 60 and 90 minutes and I will ask your opinion about potential legal levers and alternative governance mechanisms utilized by Washington and California that may come into play regarding stormwater runoff from forest roads in Oregon regarding protections for aquatic life. The questions will be open-ended and you will have the option of not responding to any of them if you prefer.

Please reply with a list of times you might be available for an interview during the weeks of XXX and XXX. I will follow up shortly to confirm.

Thanks in advance for your participation. I look forward to hearing from you soon.

Sincerely,

Stacey Detwiler

Study Title: *Assessing legal levers and alternative governance mechanisms to manage stormwater runoff from forest Roads for salmon in Oregon*

### **Interview Confirmation and Research Explanation Statement**

Dear XXX,

This email is to confirm our interview on XXX. The telephone number I have for you is: XXX. Is this the best number to call for our interview?

There are no foreseeable risks associated with this study. It is possible that others could learn that you participated in this study, but the information you provide will be kept confidential to the extent permitted by law. Voice recordings will be made only with permission and used to ensure our conversation is accurately represented. There are no direct benefits for participating in this study.

If you have questions about the research, please feel free to contact Hannah Gosnell (Gosnellh@geo.oregonstate.edu, 541-737-1222). If you have questions about your rights or welfare as a participant, please contact the Oregon State University Institutional Review Board (IRB) Office (IRB@oregonstate.edu, (541) 737-8008).

The purpose of this study is to increase understanding about the potential legal levers that could be applied in Oregon related to protecting aquatic life from the impacts of stormwater runoff from forest roads. Additionally, this research will inform strategies for Oregon to incorporate alternative approaches utilized by Washington and California. Finally, this research will identify policy recommendations for Oregon to manage stormwater runoff from forest roads to protect aquatic life.

Thank you in advance for your time and effort on behalf of this project.

Sincerely,

Stacey Detwiler

*Study Title: Assessing legal levers and alternative governance mechanisms to manage stormwater runoff from forest Roads for salmon in Oregon*

## **APPENDIX 4. Interview Guide**

### **Interview Guide**

Assessing Legal Levers and Alternative Governance Mechanisms to Manage Stormwater Runoff from Forest Roads for Salmon in Oregon

PI: Dr. Hannah Gosnell

#### **Background**

1. Please tell me about your background as it relates to the management of stormwater runoff from forest roads?
  - a. What is the nature of your position?
  - b. How long have you been connected to it?
  - c. What are your duties/responsibilities?

#### **Current Management of Stormwater Runoff from Forest Roads in Oregon**

1. How would you characterize Oregon's management of stormwater runoff from forest roads under the Oregon Forest Practices Act?
  - d. Does it effectively address impacts to aquatic life?
    - i. Can you provide examples to support your views?
  - e. Do you have any concerns about how stormwater runoff from forest roads is managed under the Oregon Forest Practices Act?
    - i. Can you provide examples to support your views?
  - f. In your opinion, are there other state regulations, statutes, or policies that impact management of stormwater runoff from forest roads in Oregon?

#### **Impacts of Stormwater Runoff from Forest Roads to Aquatic Life**

1. How would you characterize the impacts to aquatic life, specifically salmon, as a result of stormwater runoff from forest roads?
2. Are there other water quality concerns related to stormwater runoff from forest roads?

#### **Impacts of Recent Judicial Decisions**

1. How would you characterize the impact of the 9<sup>th</sup> Circuit Court decision in *Northwest Environmental Defense Center v. Brown* in 2011 on the management of stormwater runoff from forest roads?
2. How would you characterize the impact of the Supreme Court decision in *Decker v. Northwest Environmental Defense Center* in 2013 on the management of stormwater runoff from forest roads?

#### **Potential Legal Levers**

1. In your opinion, what role could the Endangered Species Act play in regulating stormwater runoff from forest roads to protect aquatic life?

2. In your opinion, what role could Total Maximum Daily Loads (TMDLs) under the Clean Water Act play in regulating stormwater runoff from forest roads to protect aquatic life?
3. In your opinion, are there other legal levers that might impact how stormwater runoff from forest roads is managed?
4. How likely do you think it is that these legal levers will be applied in Oregon to address impacts to aquatic life from stormwater runoff resulting from forest roads?
5. Are you concerned about the potential application of these legal levers?

#### **Alternative Governance Mechanisms**

1. How would you characterize Washington's approach to managing stormwater runoff from forest roads?
2. How would you characterize California's approach to managing stormwater runoff from forest roads?
3. In your opinion, could elements of Washington or California's approaches be applied in Oregon?
4. Are there governance mechanisms, policies, incentive-based programs, or other alternatives that could be applied in Oregon to address stormwater runoff from forest roads to protect aquatic life?

#### **Recommendations**

1. Do you have any recommendations for how Oregon could change its current management of stormwater runoff from forest roads to protect aquatic life?
2. What are the barriers to implementing changes to Oregon's current management of stormwater runoff from forest roads?
3. In your opinion, how could those barriers be addressed?

## APPENDIX 5. Code Book for Content Review and Interview Analysis

### CODING STRUCTURE

- **Institutions:** Defined as organizations or distinct entities that may directly regulate forest roads or inform and shape policy on management of forest roads.
  - **State agencies**
    - **Role they play in changing FR rules/laws:** This refers to how participants felt that the environmental governance mechanism in question drove changes to management of forest roads related to chronic delivery of sediment to streams.
      - **Strong:** The participant indicated that this mechanism was an important driver, major influence, or had a large impact on existing laws and regulations or that might play an important role in affecting management in the future.
      - **Moderate:** The participant indicated that this mechanism was one of several drivers that had somewhat of an impact on existing laws and regulations or that might play a role in affecting management in the future.
      - **Weak:** The participant indicated that this mechanism did not play much of a role in affecting management of existing laws or regulations and that it was unlikely to play much of a role in affecting management in the future.
      - **Neutral:** The participant didn't know whether this mechanism played a role in affecting management or might in the future, the participant didn't mention this mechanism at all, or the participant did not offer an opinion about whether this mechanism played a role or might play a role.
  - **Non-profits:** Defined as non-profit organizations that work on forest road policy, stormwater policy, or are in some other way involved in this issue.
    - **Role they play in changing FR rules/laws:** This refers to how participants felt that the environmental governance mechanism in question drove changes to management of forest roads related to chronic delivery of sediment to streams.
      - **Strong:** The participant indicated that this mechanism was an important driver, major influence, or had a large impact on existing laws and regulations or that might play an important role in affecting management in the future.
      - **Moderate:** The participant indicated that this mechanism was one of several drivers that had somewhat of an impact on existing laws and regulations or that might play a role in affecting management in the future.
      - **Weak:** The participant indicated that this mechanism did not play much of a role in affecting management of existing

laws or regulations and that it was unlikely to play much of a role in affecting management in the future.

- **Neutral:** The participant didn't know whether this mechanism played a role in affecting management or might in the future, the participant didn't mention this mechanism at all, or the participant did not offer an opinion about whether this mechanism played a role or might play a role.
- **Federal agencies:** Defined as federal agencies that are involved in managing forest roads.
    - **Role they play in changing FR rules/laws:** This refers to how participants felt that the environmental governance mechanism in question drove changes to management of forest roads related to chronic delivery of sediment to streams.
      - **Strong:** The participant indicated that this mechanism was an important driver, major influence, or had a large impact on existing laws and regulations or that might play an important role in affecting management in the future.
      - **Moderate:** The participant indicated that this mechanism was one of several drivers that had somewhat of an impact on existing laws and regulations or that might play a role in affecting management in the future.
      - **Weak:** The participant indicated that this mechanism did not play much of a role in affecting management of existing laws or regulations and that it was unlikely to play much of a role in affecting management in the future.
      - **Neutral:** The participant didn't know whether this mechanism played a role in affecting management or might in the future, the participant didn't mention this mechanism at all, or the participant did not offer an opinion about whether this mechanism played a role or might play a role.
  - **Industry Associations:** Defined as technical or policy associations that represent different timber industries, have timber companies as their members.
    - **Role they play in changing FR rules/laws:** This refers to how participants felt that the environmental governance mechanism in question drove changes to management of forest roads related to chronic delivery of sediment to streams.
      - **Strong:** The participant indicated that this mechanism was an important driver, major influence, or had a large impact on existing laws and regulations or that might play an important role in affecting management in the future.
      - **Moderate:** The participant indicated that this mechanism was one of several drivers that had somewhat of an impact

on existing laws and regulations or that might play a role in affecting management in the future.

- **Weak:** The participant indicated that this mechanism did not play much of a role in affecting management of existing laws or regulations and that it was unlikely to play much of a role in affecting management in the future.
- **Neutral:** The participant didn't know whether this mechanism played a role in affecting management or might in the future, the participant didn't mention this mechanism at all, or the participant did not offer an opinion about whether this mechanism played a role or might play a role.

- **Regulatory Mechanisms:** Defined as the laws, regulations, and rights structures related to forest road management, water quality protection, endangered species protection, or other environmental issues.

- **State Laws and Regulations:** Defined as laws and regulations passed in that state that are specific to that state.
  - **FPAs:** Defined as the Forest Practices Acts and Regulations in Oregon, Washington, or California
    - **Role they play in changing FR rules/laws:** This refers to how participants felt that the environmental governance mechanism in question drove changes to management of forest roads related to chronic delivery of sediment to streams.
      - **Strong:** The participant indicated that this mechanism was an important driver, major influence, or had a large impact on existing laws and regulations or that might play an important role in affecting management in the future.
      - **Moderate:** The participant indicated that this mechanism was one of several drivers that had somewhat of an impact on existing laws and regulations or that might play a role in affecting management in the future.
      - **Weak:** The participant indicated that this mechanism did not play much of a role in affecting management of existing laws or regulations and that it was unlikely to play much of a role in affecting management in the future.
      - **Neutral:** The participant didn't know whether this mechanism played a role in affecting management or might in the future, the participant didn't mention this mechanism at all, or the participant did not offer an opinion about whether this mechanism played a role or might play a role.

- **State ESAs:** Defined as state-level Endangered Species Act laws, regulations, or their equivalents (e.g., CEQA in California).
  - **Role they play in changing FR rules/laws:** This refers to how participants felt that the environmental governance mechanism in question drove changes to management of forest roads related to chronic delivery of sediment to streams.
    - **Strong:** The participant indicated that this mechanism was an important driver, major influence, or had a large impact on existing laws and regulations or that might play an important role in affecting management in the future.
    - **Moderate:** The participant indicated that this mechanism was one of several drivers that had somewhat of an impact on existing laws and regulations or that might play a role in affecting management in the future.
    - **Weak:** The participant indicated that this mechanism did not play much of a role in affecting management of existing laws or regulations and that it was unlikely to play much of a role in affecting management in the future.
    - **Neutral:** The participant didn't know whether this mechanism played a role in affecting management or might in the future, the participant didn't mention this mechanism at all, or the participant did not offer an opinion about whether this mechanism played a role or might play a role.
  
- **State clean water laws and regulations:** Defined as state-level water quality laws, regulations, or their equivalents (e.g. the Porter-Cologne Act in California).
  - **Role they play in changing FR rules/laws:** This refers to how participants felt that the environmental governance mechanism in question drove changes to management of forest roads related to chronic delivery of sediment to streams.
    - **Strong:** The participant indicated that this mechanism was an important driver, major influence, or had a large impact on existing laws and regulations or that might play an important role in affecting management in the future.
    - **Moderate:** The participant indicated that this mechanism was one of several drivers that had somewhat of an impact on existing laws and



regulations or that might play a role in affecting management in the future.

- **Weak:** The participant indicated that this mechanism did not play much of a role in affecting management of existing laws or regulations and that it was unlikely to play much of a role in affecting management in the future.
  - **Neutral:** The participant didn't know whether this mechanism played a role in affecting management or might in the future, the participant didn't mention this mechanism at all, or the participant did not offer an opinion about whether this mechanism played a role or might play a role.
- **State land use laws:** Defined as state-level laws, regulations, or their equivalents related to land use.
    - **Role they play in changing FR rules/laws:** This refers to how participants felt that the environmental governance mechanism in question drove changes to management of forest roads related to chronic delivery of sediment to streams.
      - **Strong:** The participant indicated that this mechanism was an important driver, major influence, or had a large impact on existing laws and regulations or that might play an important role in affecting management in the future.
      - **Moderate:** The participant indicated that this mechanism was one of several drivers that had somewhat of an impact on existing laws and regulations or that might play a role in affecting management in the future.
      - **Weak:** The participant indicated that this mechanism did not play much of a role in affecting management of existing laws or regulations and that it was unlikely to play much of a role in affecting management in the future.
      - **Neutral:** The participant didn't know whether this mechanism played a role in affecting management or might in the future, the participant didn't mention this mechanism at all, or the participant did not offer an opinion about whether this mechanism played a role or might play a role.
- **Federal Laws or Regulations:** Defined as national laws or regulations related to water quality or endangered species conservation, specifically the Clean Water Act, the ESA, and CZARA.

- **NW Forest Plan**
  - **Role they play in changing FR rules/laws:** This refers to how participants felt that the environmental governance mechanism in question drove changes to management of forest roads related to chronic delivery of sediment to streams.
    - **Strong:** The participant indicated that this mechanism was an important driver, major influence, or had a large impact on existing laws and regulations or that might play an important role in affecting management in the future.
    - **Moderate:** The participant indicated that this mechanism was one of several drivers that had somewhat of an impact on existing laws and regulations or that might play a role in affecting management in the future.
    - **Weak:** The participant indicated that this mechanism did not play much of a role in affecting management of existing laws or regulations and that it was unlikely to play much of a role in affecting management in the future.
    - **Neutral:** The participant didn't know whether this mechanism played a role in affecting management or might in the future, the participant didn't mention this mechanism at all, or the participant did not offer an opinion about whether this mechanism played a role or might play a role.
- 
- **CWA: The Clean Water Act**
  - **NPS/PS:** Defined as the NEDC v. Decker case and the potential for forest roads to be managed as a PS and require NPDES permits.
    - **Role they play in changing FR rules/laws:** This refers to how participants felt that the environmental governance mechanism in question drove changes to management of forest roads related to chronic delivery of sediment to streams.
      - **Strong:** The participant indicated that this mechanism was an important driver, major influence, or had a large impact on existing laws and regulations or that might play an important role in affecting management in the future.
      - **Moderate:** The participant indicated that this mechanism was one of several drivers that had somewhat of an impact on existing

- laws and regulations or that might play a role in affecting management in the future.
- **Weak:** The participant indicated that this mechanism did not play much of a role in affecting management of existing laws or regulations and that it was unlikely to play much of a role in affecting management in the future.
  - **Neutral:** The participant didn't know whether this mechanism played a role in affecting management or might in the future, the participant didn't mention this mechanism at all, or the participant did not offer an opinion about whether this mechanism played a role or might play a role.
- **TMDLs:** Defined as anything related to Total Maximum Daily Loads or 303(d) lists under the Clean Water Act
    - **Role they play in changing FR rules/laws:** This refers to how participants felt that the environmental governance mechanism in question drove changes to management of forest roads related to chronic delivery of sediment to streams.
      - **Strong:** The participant indicated that this mechanism was an important driver, major influence, or had a large impact on existing laws and regulations or that might play an important role in affecting management in the future.
      - **Moderate:** The participant indicated that this mechanism was one of several drivers that had somewhat of an impact on existing laws and regulations or that might play a role in affecting management in the future.
      - **Weak:** The participant indicated that this mechanism did not play much of a role in affecting management of existing laws or regulations and that it was unlikely to play much of a role in affecting management in the future.
      - **Neutral:** The participant didn't know whether this mechanism played a role in affecting management or might in the future, the participant didn't mention this mechanism at all, or the participant did not

offer an opinion about whether this mechanism played a role or might play a role.

- **ESA:** Defined as the Endangered Species Act.
  - **Role they play in changing FR rules/laws:** This refers to how participants felt that the environmental governance mechanism in question drove changes to management of forest roads related to chronic delivery of sediment to streams.
    - **Strong:** The participant indicated that this mechanism was an important driver, major influence, or had a large impact on existing laws and regulations or that might play an important role in affecting management in the future.
    - **Moderate:** The participant indicated that this mechanism was one of several drivers that had somewhat of an impact on existing laws and regulations or that might play a role in affecting management in the future.
    - **Weak:** The participant indicated that this mechanism did not play much of a role in affecting management of existing laws or regulations and that it was unlikely to play much of a role in affecting management in the future.
    - **Neutral:** The participant didn't know whether this mechanism played a role in affecting management or might in the future, the participant didn't mention this mechanism at all, or the participant did not offer an opinion about whether this mechanism played a role or might play a role.
  - **HCPs:** Defined as Habitat Conservation Plans under the Endangered Species Act.
    - **Role they play in changing FR rules/laws:** This refers to how participants felt that the environmental governance mechanism in question drove changes to management of forest roads related to chronic delivery of sediment to streams.
      - **Strong:** The participant indicated that this mechanism was an important driver, major influence, or had a large impact on existing laws and regulations or that might play an important role in affecting management in the future.

- **Moderate:** The participant indicated that this mechanism was one of several drivers that had somewhat of an impact on existing laws and regulations or that might play a role in affecting management in the future.
    - **Weak:** The participant indicated that this mechanism did not play much of a role in affecting management of existing laws or regulations and that it was unlikely to play much of a role in affecting management in the future.
    - **Neutral:** The participant didn't know whether this mechanism played a role in affecting management or might in the future, the participant didn't mention this mechanism at all, or the participant did not offer an opinion about whether this mechanism played a role or might play a role.
  -
- **CZARA:** Defined as CZARA
  - **Role they play in changing FR rules/laws:** This refers to how participants felt that the environmental governance mechanism in question drove changes to management of forest roads related to chronic delivery of sediment to streams.
    - **Strong:** The participant indicated that this mechanism was an important driver, major influence, or had a large impact on existing laws and regulations or that might play an important role in affecting management in the future.
    - **Moderate:** The participant indicated that this mechanism was one of several drivers that had somewhat of an impact on existing laws and regulations or that might play a role in affecting management in the future.
    - **Weak:** The participant indicated that this mechanism did not play much of a role in affecting management of existing laws or regulations and that it was unlikely to play much of a role in affecting management in the future.
    - **Neutral:** The participant didn't know whether this mechanism played a role in affecting management or might in the future, the participant didn't mention this mechanism at all, or the participant did not

offer an opinion about whether this mechanism played a role or might play a role.

- **Tribal Reserved Rights:** Defined as those rights reserved by tribal nations.
  - Tribal fishing rights
    - **Role they play in changing FR rules/laws:** This refers to how participants felt that the environmental governance mechanism in question drove changes to management of forest roads related to chronic delivery of sediment to streams.
      - **Strong:** The participant indicated that this mechanism was an important driver, major influence, or had a large impact on existing laws and regulations or that might play an important role in affecting management in the future.
      - **Moderate:** The participant indicated that this mechanism was one of several drivers that had somewhat of an impact on existing laws and regulations or that might play a role in affecting management in the future.
      - **Weak:** The participant indicated that this mechanism did not play much of a role in affecting management of existing laws or regulations and that it was unlikely to play much of a role in affecting management in the future.
      - **Neutral:** The participant didn't know whether this mechanism played a role in affecting management or might in the future, the participant didn't mention this mechanism at all, or the participant did not offer an opinion about whether this mechanism played a role or might play a role.

