SCHOOL OF ENVIRONMENTAL AND FOREST SCIENCES
UNIVERSITY of WASHINGTON
College of the Environment

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January 11, 2021

The Honorable Bernard Dean
Chief Clerk of the house
338B Legislative Building
Olympia, WA 98504

The Honorable Brad Hendrickson
Secretary of the Senate
312 Legislative Building
Olympia, WA 98504

Dear Chief Clerk Dean and Secretary Hendrickson,

Washington State Legislature tasked the School of Environmental and Forest Sciences within the College of the Environment at the University of Washington in Seattle to address a set of questions that broadly deal with the status of Washington's small forest landowners (SFLOs) and their lands, including their current state, trends, regulatory impacts, state policies and programs, and recommendations to help encourage "continued management of nonindustrial forests for forestry uses, including traditional timber harvest uses, open space uses, or as a part of developing carbon market schemes" (ESB 5330, p. 4).

In the submitted Report, we adopt a multi-pronged set of social and land use science methods to answer the Bill's questions. The use of property records and remotely sensed data allows for a "census" coverage of SFLO parcel data for the State and a comprehensive trends analysis.

Understanding SFLO objectives and needs is critical for understanding the trends in the data and for better policies and programs which support the continuing stewardship of their lands. The submitted Report explains in detail the forest ownership objectives and attitudes of SFLOs from four different surveys as well as in-depth interviews. Results show that the vast majority of SFLOs highly value environmental objectives and want their lands to stay in forest or open space use now and in the future. Even among SFLOs who are more interested in timber harvesting, results show that most SFLOs do not perceive an either/or trade-off between forest production and environmental objectives.

The submitted Report provides a comprehensive status and trends analysis as well as empirically-grounded recommendations for actions that the Legislature and the Forest Practices board may pursue to encourage continued retention of Washington's nonindustrial forest lands.

Please feel free to contact Dr. Rabotyagov at 206-685-3159, rabotyag@uw.edu or Mr. Rogers at 206-543-7418, lwrogers@uw.edu with any questions.

Sincerely,

Sergey Rabotyagov

Luke Rogers

CC:
Senate sponsors of SB 5330
House sponsors of HB 1273
Senator Van De Wege, Chair of the Senate Committee on Agriculture, Water, Natural Resources & Parks
Representative Blake, Chair of the House Committee on Rural Development, Agriculture, & Natural Resources
Washington State Forest Practices Board

Washington's Small Forest Landowners in 2020

Status, trends and recommendations after 20 years of Forests & Fish

January 11, 2021

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1 ACKNOWLEDGEMENTS

This research has been funded by the Washington State Legislature, through a legislative proviso, directing the School of Environmental and Forest Sciences at the University of Washington to complete a trends analysis of small forest landowners and their forestlands.

The authors of the report would like to acknowledge and thank the Washington Department of Natural Resources and the Small Forest Landowner Office for their candid and thoughtful responses to our inquiries and requests for data. We further thank Professor Dan Brown for his insight and feedback.

We would also like to thank the Washington Farm Forestry Association for their endless pursuit of facts and figures to help better understand the working forests of our State. The Washington State Forestland Database that enables this work and indeed this research itself would almost certainly not exist if not for their tireless efforts to support Washington's working forests. We acknowledge the enduring legacy of Steve Stinson, the first administrator of the Small Forest Landowner Office, whose love of Washington forests shapes research, policy, and education work to this day.

We further thank all the stakeholders and survey recipients who took the time to provide invaluable insight into Washington's small forests and their owners.

The authors of this report wish to acknowledge the Family Forest Research Center for granting us access to Washington State data from the USDA Forest Service National Woodland Owner Survey.

Lastly, we thank the county assessors, their GIS staff and the Washington State Association of County Assessors for their participation in both the Parcel and Forestland Database projects. Without the diligent work of our county assessors, their appraisers and their GIS personnel we could not have developed such a comprehensive platform to quantify and improve understanding of our State's natural resource lands. The data counties assemble and maintain is a critical resource for the State and we appreciate their willingness to share their data and knowledge.

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2 Research Highlights

2.1 Trends Highlights

- In 2007, there were 19.64 million acres of forest in Washington State. Forest acres declined by 394,000 acres (or 2%) by 2019.
- Small forest landowners (SFLO) account for 15% of forest acres. SFLO forest acres declined from 2.99 million acres in 2007 to 2.88 million acres in 2019 (a 3.7% decline). Total parcel acreage owned by SFLO declined from 5.04 million acres to 4.84 million acres (a 4% decline). The number of small forest landowners increased from 201,000 in 2007 to 218,000 in 2019 (or 8.5%). The number of SFLO parcels increased from 256,500 to 261,800 (or 2.1%).
- Seventy-seven percent of SFLO owned less than 20 acres in 2007 and accounted for 22% of forest acres. Small forest landowners who owned between 100 and 1000 acres accounted for the largest percent of forestland acreage (36%), followed by SFLO who owned between 20 and 100 acres (30%).
- Between 2007 and 2019, SFLO forest acres in the three smallest size classes (<20 acres, 20-100 acres, 100-1000 acres) declined by 117,000 acres while the two largest size classes (1000-5000 acres, 5000+ acres) increased by 13,500 acres.

- The number of owners increased across all size classes, with the largest increase in the 20-100 acres class (+9,700).
- Seventy-one percent of SFLO forest acres in 2007 were in the forestry or natural land use classes[1], followed by Residential (18%) and Agriculture (10%). By 2019, SFLO forest acres in forestry or natural land uses declined by 121,500 acres (or 5.7%) while Residential increased by 48,600 acres (or 9%).
- Parcels transitioned both out of and into the SFLO owner class. Between 2007 and 2019, approximately 450,000 acres (or 15%) left the SFLO class while 238,000 acres (an equivalent of 8% of 2007 area) transitioned into small forest landownership.
- Of the 67% of acres moving out of SFLO that remained forested, Private Industry (107,000 acres) was the largest destination owner class, followed by Private Other (60,000 acres), Tribal (50,000 acres), and Private Conservation (25,000 acres).
- The plurality of acres transitioning into SFLO were Private Industry in 2007 (92,000 acres).

2.2 Heterogeneous Small Forest Landowners

- Somewhere between 25,000 and 50,000 small forest landowners are likely anticipating selling all or some of their forest land in the coming 10 years. Somewhat fewer than 1 in 10 current SFLOs have likely ever sold or given away some, but not all, of their forest land.
- The most important aspects of ownership for SFLOs, on average, are beauty and scenery, provision of wildlife habitat and environmental benefits, and privacy and personal attachment. “The protection of water resources” ranks highly as an ownership objective among Washington State SFLOs.
- SFLOs who have a sole focus on income and investment from their forests may constitute a minority of ownerships, but they tend to own disproportionately more of the state’s Small Forest Land. Conversely, owners who tend to value their forest lands primarily for Family and Privacy purposes represent a substantial number of owners, but a very small amount of Small Forest Land. Many SFLOs who give low priority to timber harvesting still perform some kind of forest management in the course of their forest ownership.

2.3 SFLOs and Riparian Regulations

- A *minority of surveyed SFLOs say the riparian regulations have had a negative impact on their forest ownership.* However, the SFLOs who say the riparian regulations have had a negative

[1] See Appendix D – Land Use Code Aggregation Scheme Used in the Report

financial impact on their ownership tend to own more forest land than the SFLOs who have a non-negative evaluation of the regulations (see Figure 16 and Table 23).

- SFLOs overwhelmingly wish there were substantially more salmon in Washington streams and rivers. Respondents tend to disagree or be neutral on whether riparian regulations are fairly applied to SFLOs relative to other land uses.
- Compared to SFLOs with riparian forests on the west side of the state, SFLOs with riparian forests on the east side of the state overwhelmingly tend to think their forests are less relevant to fish habitat, have given less thought to the regulations, and do not necessarily think active management in buffers will be benign to riparian functions. Respondents who think their lands are not relevant to fish habitat and that the regulations are not fairly applied to them tend to be, but are not exclusively, SFLOs in western Washington with less than 200 forest acres.

2.4 SFLO Forest Land Sales and Land Use Change

- Across the State, more heavily forested parcels that are a part of a larger tract, and those owned by SFLOs with larger forest holdings, were less likely to be sold.
- At the same time, more actively managed parcels (evidenced by the extent of the road network and the existence of a harvest forest practices application) were more likely to be sold.
- Small Forest Land with riparian buffers were not sold more frequently compared to other Small Forest Land, with such parcels on the east side of the State being sold less frequently.
- Presence of riparian buffers was positively associated with land conversion to agricultural uses but not residential or other developed land use types.
- SFLOs with more acres of forest in riparian buffers (or a higher proportion of total forested acres in riparian buffers) had higher generalized regulatory concern, but only when they had forest lands in the western half of the state.
- There is, however, no significant association between general regulatory concern and past reported forestland sales. Stronger assessment of perceived challenges to "Ownership in the Future" (lack of a willing heir and development pressure) is associated with actual future (residential) conversion.
- We also find that landowners valuing their land as a place of residence is associated with actual future (residential) conversion.
- Sales of SFLO parcels are associated with subsequent transition to residential land uses on both East and West sides of the state.
- Parcels with more forest cover and parcels that are connected to larger tracts of forest are less often converted away from resource or open space uses.

- Westside SFLOs who manage larger forest holdings both sell and convert their lands less frequently than SFLOs with forest holdings on the east side of the State as well as Westside owners with smaller holdings.
- At the ownership-level, evidence suggests personal and family financial needs may be the most salient triggering events for land sales that subsequently put Small Forest Lands at risk for development.
- SFLOs generally do not plan on selling or transferring their forests as they approach old age, instead preferring to retain ownership for as long as possible.
- Projections based on existing trends suggest continued statewide conversion of SFLO forests into other uses.

2.5 Policies and Programs for SFLOs

- The SFLO Office does not have adequate funding and staffing to fulfill its legislative mandates.
- Despite substantial decreases in funding and personnel, the SFLO Office is evaluated positively by many stakeholders and survey respondents.
- Survey evidence suggests that paying for all outstanding Forestry Riparian Easement Program (FREP) easements would help mitigate the perceived negative impact of riparian regulations in general.
- In a counterfactual sense, the lack of FREP funding has not likely resulted in the loss of riparian habitat. However, in the counterfactual sense, the program does help retain lands in forestry and open space uses.
- Among survey respondents, more Alternate Plan applicants thought the process and outcomes were reasonable than applicants who thought the process and outcomes were not reasonable.
- The most common criticisms of Alternate Plans was that they are complicated and difficult and, at the end of the process, SFLOs don't get to harvest much more than existing regulations allow.
- Survey evidence suggests that SFLOs who are knowledgeable about Alternate Plans are among the SFLOs who feel they have been most negatively impacted by the State's riparian regulations; however, only 1 in 5 such respondents have a negative overall evaluation of their experience with Alternate Plans themselves.
- The Family Forest Fish Passage Program (FFFPP) is well reviewed by most landowners and stakeholders, with the most common survey comment being that the program is a good use of public funds on Small Forest Land.

2.6 RECOMMENDATIONS

2.6.1 A-level: unqualified recommendations with strong qualitative and quantitative support

- Provide additional and secure funding for the SFLO Office as well as other public organizations offering outreach, education, and technical assistance to SFLOs. In addition to existing focuses on forest health and timber production, include assistance with Alternate Plans, forest succession and legacy planning, and non-timber management objectives in outreach and education topics.
- Support policies that increase forest cover and forest connectivity in a way that is consistent with forest health.
- Expand Designated Forest Land taxation rules to include non-harvesting objectives.
- Discourage additional development near existing small forest land.
- Provide additional funding for the Family Forest Fish Passage Program.
- Provide stable support for ongoing SFLO spatial and survey data collection and research collaborations.

2.6.2 B-level: recommendations with strong qualitative and quantitative support that depend on State policy objectives

- Assuming continuation of the current Adaptive Management Program for riparian regulations, additional funding for FREP will help retain land in forest and open space use as well as mitigate the perceived negative impacts of riparian regulations for affected SFLOs. Alternatively, the creation of riparian regulations specific to SFLOs, that allow for more harvesting relative to *status quo* regulations, will alleviate the need for additional FREP funding.
- We find about half of surveyed SFLOs express interest in conservation easements. If the State of Washington is willing to use public funds to increase permanently conserved forest land by financially compensating SFLOs, a voluntary cost-effective conservation easement program based on the principles of competitive reverse auctions can be appropriate.

2.6.3 C-level: recommendations with somewhat less qualitative and quantitative support that warrant consideration

- Implementations of Washington's Forest Practices regulations are perhaps the most common point of contact between SFLOs and State agencies and should be considered as opportunities to facilitate continued stewardship of the State's Small Forest Land.
- The State might consider supporting a peer-to-peer service that can match existing SFLOs with new SFLOs and seek to link potential SFLO mentors with relatively new SFLOs who would benefit from peer-to-peer learning. Consider other "outside the box"

initiatives of this sort for SFLOs that are not necessarily typical state-administered programs.

- Tax the conversion of forest and open space land to non-resource uses using appropriate social cost of carbon estimates.
- Consider a variety of alternatives the State can pursue to support carbon benefits on Small Forest Lands. Ultimately, the current high fixed costs for participating in a carbon offset program will likely exclude the vast majority of Washington State SFLOs from existing voluntary and compliance carbon offsetting programs for the time being. However, offset markets are only one way to pay SFLOs for the carbon value of their lands.
- The State of Washington could consider taking a stronger leadership role in supporting the existing Transfer of Development Rights (TDR) marketplace. At a minimum, the State should consider expanding the regional TDR programs to include other counties with high conversion rates.

3 Executive Summary

3.1 Pertinent Land Trends in Washington

We developed an integrated Washington State Parcel and Forestland Database using 2007 and 2019 data, and summarized changes in forested parcels by owner class, owner size class, and land use class between 2007 and 2019.

- In 2007, there were 19.64 million acres of forest in Washington State. The distribution by owner class was: 42% managed by federal agencies; 39% privately owned; 10% managed by the state of Washington; 7% owned by tribes; and 2% managed by county and local municipalities. Forest acres declined by 394,000 acres (2%) by 2019.
- Small forest landowners account for 15% of forest acres. SFLO forest acres declined from 2.99 million acres in 2007 to 2.88 million acres in 2019 (a 3.7% decline). Total parcel acreage owned by SFLO declined from 5.04 million acres to 4.84 million acres (a 4% decline). The number of small forest landowners increased from 201,000 in 2007 to 218,000 in 2019 (or 8.5%). The number of SFLO parcels increased from 256,500 to 261,800 (or 2.1%).
- Seventy-seven percent of SFLO owned less than 20 acres in 2007 and accounted for 22% of forest acres. Small forest landowners who owned between 100 and 1000 acres

accounted for the largest percent of forestland acreage (36%), followed by SFLO who owned between 20 and 100 acres (30%). Between 2007 and 2019, SFLO forest acres in the three smallest size classes (<20 acres, 20-100 acres, 100-1000 acres) declined by 117,000 acres while the two largest size classes (1000-5000 acres, 5000+ acres) increased by 13,500 acres. The number of owners increased across all size classes, with the largest increase in the 20-100 acres class (+9,700).

- Seventy-one percent of SFLO forest acres in 2007 were from the "ForestOrNatural" land use class, followed by Residential (18%) and Agriculture (10%). By 2019, SFLO forest acres in "ForestOrNatural" declined by 121,500 acres while Residential increased by 48,600 acres. By number of parcels, Residential (47%) accounted for a slightly larger share than "ForestOrNatural" (43%) in 2007. SFLO parcel count in Residential increased by 12,100 parcels by 2019, while "ForestOrNatural" decreased by 4,000.
- Parcels transitioned both out of and into the SFLO owner class. Between 2007 and 2019, approximately 450,000 acres left the SFLO class while 238,000 acres transitioned into small forest landownership. Thirty-two percent (144,000 acres) of acreage transitioning out of SFLO was not forested in 2019. The majority of these acres where from the three smallest size classes and were zoned Agriculture (65,000 acres), ForestOrNatural (36,000 acres), and Residential (34,000 acres) in 2019. Of the 67% of acres moving out of SFLO that remained forested, Private Industry (107,000 acres) is the largest destination owner class, followed by Private Other (60,000 acres), Tribal (50,000 acres), and Private Conservation (25,000 acres).
- The plurality of acres transitioning into SFLO were Private Industry in 2007 (92,000). Acres that were not forest in 2007 that became SFLO in 2019 (59,000) were primarily from the three smallest size classes and classified as Agriculture.

3.2 Washington's Small Forest Landowners

Based on three new probability-based surveys of Washington's SFLOs, we are able to provide in-depth and generalizable characterization of not only SFLO lands but of SFLOs themselves. The surveys are the National Woodland Owner Survey ("NWOS", USDA FS, preliminary data), and purpose-built surveys of SFLO population ("GP" survey) and a of SFLO ownerships most likely affected by Forests and Fish rules ("FF" survey).

- Somewhere between 25,000 and 50,000 small forest landowners are anticipating likely selling all or some of their forest land in the coming 10 years. Somewhat fewer than 1 in 10 SFLOs who still own forest land report ever selling or giving away some of their forest land.
- An estimated 18,000 to 38,000 Washington State SFLOs (7 to 14%) are also farmers and/or ranchers. Fully 3 out of every 4 Washington State SFLOs have their home, vacation home, or cabin on or within a mile of their forest land.

- The estimated number of SFLO ownerships that have submitted a Forest Practices application (not the number of Forest Practices applications) in the past 10 years is similar to those who expect to submit an application in the coming 10 years: between about 25,000 to about 45,000 (about 9 to 17%). Over the course of 20 years, the weighted survey results suggest as many as about 69,000 SFLO ownerships may be submitting Forest Practices applications of some kind. (An ownership refers to the people or peoples who own specific forest property or collections of forest properties. For example, spouses tend to own property together, but so can siblings. It is possible for one person to be involved in multiple ownerships).
- As is common for similar classes of landowners in the United States and other Western countries, SFLOs tend to be older and have higher incomes than the general population. Mean SFLO age is estimated to be about 64 years old and mean household income to be about 115 thousand dollars per year.
- Despite differences in survey design, both the NWOS and GP surveys identify non-production objectives as most important to SFLOs. The top three most important aspects of ownership in NWOS were enjoyment of beauty and scenery, provision of wildlife habitat, and privacy, while the GP survey similarly suggested privacy, environmental benefits, and personal attachment as the most important aspects of ownership.
- The relatively low importance ascribed to timber products may be influenced by the reality that many SFLOs harvest infrequently. In a context in which an SFLO has decided to harvest timber, a specific harvest operation may be very important to an owner even if timber products *per se* are not generally an important objective to the ownership.
- Small Forest landowners in the State of Washington tend to care about the protection of water resources on their lands. "The protection of water resources" ranked highly as an ownership objective among Washington State SFLOs. Not taking into consideration the impact of riparian regulations on individual respondents, "the protection of water resources" ranked 5th out of 13 objectives for respondents to the NWOS, which is higher than the average importance of timber products. Among respondents to the GP survey "protection of water resources" also ranked higher than the average importance of harvesting timber, income from forest management, and income from potential forest land sales.
- The more forest land a person owns, the more they indicate income and investment as important objectives. Many owners who say income and investment are important objectives also say objectives such as nature & aesthetics and family & privacy are important. In other words, SFLOs who value income and investment from their forest land tend to also value other objectives.
- SFLOs who have a sole focus on income and investment from their forests may constitute a minority of ownerships, but they tend to own disproportionately more of the state's Small Forest Land.
- From the NWOS, almost all owners who say income and investment are important AND are smaller than 20 forested acres are on the west side of the state. At such small

acreages of forest ownership (less than 20 acres), it is difficult for any forest management to be economically viable. It is likely that the income opportunity available to these owners is selling the forest land or converting it to residential or commercial use.

- NWOS results suggest four main dimensions of ownership that explain close to 70% variation in owners' descriptions of their objectives: 1) Nature & aesthetics, 2) Recreation, non-timber forest products & hunting 3) Family & privacy, and 4) Income, investment & heirs. For instance, the more importance respondents ascribed to privacy and raising a family on their forest land, the less importance they tended to give to owning the land for timber products and *vice versa*.
- GP survey results suggest four latent dimensions of ownership that summarize primary landowner motivations. Explaining the most variation in responses (the first principal component, "Financial") is how important respondents considered the importance of harvesting timber for sale, the importance of income from forest management, and income from selling the forest land for development. The second dimension ("Spend time") reflects the importance respondents ascribe to spending time on their forest lands, recreation, and having privacy on the forest. The third dimension ("Enviro") indicates the importance of environmental benefits and how important it is that the land protects water resources. The fourth dimension ("Legacy") reflects the importance of the ownership of the forest land staying within the family and an owner's personal attachment to the forest. The importance ascribed to income from the potential sale of the forest land for residential or commercial development is negatively related to importance of legacy.
- Our analysis suggests that the importance of cutting timber for sale and income from forest management goes hand-in-hand with the expressed importance of potentially selling the property for residential or commercial development (both have high correlations with the Financial dimension). From the standpoint of the importance of ownership in general, the *importance of actively pursuing profitable forestry does not appear to be a defense against the conversion of forestry to non-forest uses*. This result likely means that as SFLOs tend to think more about the financial aspects of their ownership they tend to be aware of all options for financial gain, including selling the forest and/or converting it to non-forestry use.
- While financial objectives were more strongly identified as distinct ownership objectives in the GP survey, they are associated with legacy objectives in the NWOS analysis. The GP survey results also more clearly contrast the importance of financial objectives with the importance of privacy. The importance of legacy objectives is related to income and investment objectives in the NWOS analysis, while legacy objectives are more distinct in respondent answers to the GP survey.
- The results of both surveys show that Washington State SFLOs do not necessarily perceive a zero-sum competition between environmental and financial objectives.
- Clustering analyses from the NWOS survey helped us identify five different SFLO owner types based on objectives. We expressly advise against concluding that all Washington

State SFLOs will fit nicely into one of these five general types. Considering five types of Washington State SFLOs from the NWOS produces *two groups* that place a relatively high importance on *multiple objectives* and *three groups* that express a relatively higher importance on *one aspect* of ownership.

- The first group can be described as "Multi-Objective: everything," since this type ascribes above average importance to all aspects of ownership measured in the survey and are highly engaged with many aspects of owning a forested property. They likely spend a significant amount of their time and resources on the maintenance and improvement of their forests, including managing timber for profit. The second multiple objective group can be described as "Multi Objective: some" due to the above average importance given to Nature & aesthetics, Family & privacy, and Income, investment & heirs, but a lower than average importance to Recreation, non-timber forest products & hunting. The "Multi Objective: some" owner type typically spends less time physically working on or doing leisure activities in their forests compared to the "Multi-Objective: everything" type, but is still highly engaged in many other aspects of forest ownership. Taken together, *about half of all Washington respondents to the NWOS (46%) are highly engaged in multiple aspects of forest ownership, including managing the land for timber products.*

- Other ownership types tend to give relatively more focus to one out of the four dimensions of ownership from the PCA. One such type is the "Single Focus: aesthetics & nature" type, which tends to ascribe the least amount of importance to Income, investment & heirs as any other group. Another type is the "Single focus: financial interest" ownership type, which has, on average, more of an interest in Income, investment & heirs and the lowest interest in Family & privacy of any group. The final group is "Single focus: family & privacy," which ascribes an above average importance to Family & privacy but also the lowest importance to Nature & aesthetics of all groups.

Table 1 presents how many NWOS respondents are in each of the five generalized ownership types and how much wooded (forested) land they own.

Table 1: Five generalized owner types from Washington State respondents to the National Woodland Owner Survey.

Generalized owner types	*n*	% of respondents	median wooded acres	% wooded acres in sample
Multi-Objective: everything	82	25%	145	19%
Multi-Objective: some	67	21%	26	9%
Single focus: aesthetics & nature	57	18%	40	16%

Single focus: financial interest	57	18%	350	54%
Single focus: family & privacy	59	18%	21	2%
Total	322	100%		100%

- It is important to note in this typology of Washington SFLOs that the importance of Income, investment and heirs does not exclude other objectives. Of the two groups placing strong importance on multiple aspects of forest ownership (46% of all Washington respondents to the NWOS), both groups say Income, investment and heirs is important as well as Aesthetics & nature, and Family & privacy. *In other words, many Washington SFLOs think about timber income AND good environmental conditions on their lands instead of timber income OR having good environmental conditions on their forests.*
- Owner types with the heaviest focus on income and investment are a minority of SFLOs, but they own disproportionately more forest acreage than all other SFLOs. Also, owner types who tend to value their forest lands primarily for Family and Privacy purposes represent a substantial number of ownerships, but a very small amount of Small Forest Land.
- Issues identified in the surveys as having the most impacts on SFLOs include property taxes, wildfire, and the development of nearby lands for residential purposes. The top impacts on small forest land ownership indicated from the GP survey are similar to some of the top concerns of all US Family Forest Owners from the most recent NWOS (B. J. Butler et al. 2020). Perceived impacts of Forest Practices regulations all have the lowest average impacts on SFLO ownerships. The relatively low average perceived impacts of Forest Practices regulations is likely related to the low average importance given to financial ownership objectives. Since SFLOs who tend to value the financial aspects of their forest ownership tend to be a small number of SFLOs, but own substantially more of Washington State's small forest land, the low average impacts of Forest Practices regulations is not surprising.
- Despite the diversity of SFLO ownership objectives, roughly half of all ownership types from the NWOS have done some kind of harvest on their properties during their ownership tenure.
- Results of the GP survey confirm that SFLOs with objectives other than Financial objectives are actively engaging in forest management. Furthermore, respondents who reported submitting a Forest Practices application have a higher score for the perceived impact of Forest Practices regulations on their ownership.
- This analysis is an introduction to the diversity of the state's SFLOs and not a conclusive guide to understanding the ownership objectives of Washington SFLOs. Policy and

programs for SFLOs should give consideration to the different needs and objectives of owners.

3.3 Impacts of Riparian Regulations on SFLOs

- A *minority of surveyed SFLOs say the riparian regulations have had a negative impact on their forest ownership.* However, the SFLOs who say the riparian regulations have had a negative impact on their ownership own a majority of the land represented in the survey. In other words, the SFLOs who said the riparian regulations have had a negative financial impact on their ownership tend to own more forest land than the SFLOs who have a non-negative evaluation of the regulations (see Figure 16 and Table 23). Overall, there is much heterogeneity in how Washington's riparian regulations have impacted SFLOs and SFLO impressions of the intended environmental impacts of the regulations themselves.
- Almost half of all FF survey respondents are unable or unwilling to answer all three survey questions assessing the overall impact of the State's riparian regulations. We stress this result comes from a survey that was specifically constructed to reach SFLOs who are most likely to be impacted by the State's riparian regulations.
- SFLOs who say they have submitted a Forest Practices application in the past 20 years are more negative in their evaluation of the impacts the regulations have had on their ownership, although this result is closely related to the fact that SFLOs with more forest acres are more likely to say they have submitted a Forest Practices application. In other words, SFLOs who are more involved in forest management on their lands more often say the impacts of the State's riparian regulations have been negative.
- Somewhat less than 40% of FF survey respondents said they are intentionally avoiding the riparian zone in their forest management plans, with the most common reason being to avoid the risk of regulatory non-compliance. However, 39% of those who said they are avoiding the riparian zone in their harvest plans say they do not want to harvest there, which strongly suggests that not all SFLOs who are avoiding their riparian zones would harvest closer to their streams if they were allowed.
- On average, SFLOs tend to strongly agree that they wish there were substantially more salmon in Washington streams and rivers. Respondents agree least, on average, that riparian regulations are fairly applied to SFLOs compared to other land users. However, this question also has the highest frequency of "no opinion" answers, suggesting a substantial degree of indifference about the fairness of regulations across users, overall.
- We found a correlation between the belief that active management in existing buffers will not interfere with riparian function, having given much thought to the regulations, and thinking the regulations are not fairly applied to SFLOs.

- There were very clear differences between how Eastside SFLOs and Westside SFLOs think about riparian forest management issues. SFLOs with riparian forests on the east side of the state overwhelmingly tend to think their lands are less relevant to fish habitat, have given less thought to the regulations, and do not necessarily think active management in buffers will be benign to riparian functions. Respondents who think their lands are not relevant to fish habitat and that the regulations are not fairly applied to them tend to be SFLOs in western Washington with less than 200 forest acres. SFLOs in western Washington with more than 200 forested acres tend to have more moderate opinions about harvesting near streams, but have varying opinions about the relevance of their forest lands to fish habitat.
- Slightly less than half of FF survey respondents state any concern about riparian regulations. SFLOs with larger forest properties and on the west side of Washington State are more likely to state a concern. The most commonly expressed concern is that forestry will not be an economically viable land use in the future (27% of respondents), and the least commonly expressed concern is that SFLOs will have to sell all of their forest land because of riparian regulations (9% of respondents).
- The impacts of riparian regulations since 1999 vary substantially across SFLOs who own riparian forests. Those who have a negative evaluation of the State's riparian regulations tend to own more forest land, on average.
- Survey evidence suggests that SFLOs who are knowledgeable about Alternate Plans are among the SFLOs who feel they have been most negatively impacted by the State's riparian regulations; however, only 1 in 5 such respondents have a negative overall evaluation of their experience with Alternate Plans themselves. (More results concerning Alternate Plans and programs for SFLOs with riparian forests follow below).

3.4 Factors Associated With SFLOs' Forest Land Sales and Land Use Change

3.4.1 Sales

- Small Forest Land parcels with riparian buffers are not sold more frequently compared to other Small Forest Land, with such parcels on the east side of the State being sold less frequently. Small Forest Land parcels with riparian buffers are more frequently converted to agricultural use, but not to residential or more heavily developed land use types.
- *Across the State, more heavily forested parcels that are a part of a larger tract and those owned by SFLOs with larger forest holdings are less likely to be sold*. At the same time, *more actively managed parcels (evidenced by the extent of the road network and the existence of a harvest FPA) are more likely to be sold*. Expected population growth in the form of proximity to the urban growth boundary leads to a higher likelihood of sales, although existing population and development patterns have a differential effect on

sales for the West and East sides of Washington. Similarly, a distinct pattern across the mountain divide exists for parcels with higher forest productivity: while *higher productivity parcels are more likely to be sold in the West, it is lower productivity sites that are being exchanged in the land market on the Eastside*.

- Using both a survey from 2009 as well as a survey from 2020, we found that SFLOs with more acres of forests in riparian buffers (or a higher proportion of total forested acres in riparian buffers) expressed higher generalized regulatory concern; however, this result exists only for SFLOs with forest lands in the western half of the State. We highlight this result since these questions regarding regulatory concerns and perceived regulatory impacts made *no mention* of riparian regulations in either survey, yet we find statistically significant differences based on how much riparian forest Westside SFLOs owned.
- Survey results do not show a connection between regulatory concerns and past forest land sales. Further, analysis using the Forestland Database as well as two SFLO surveys fail to show an impact of riparian forestry regulations on forestland sales. Survey results from the NWOS, a 2009 survey of Washington landowners, and two surveys conducted in 2020 for this report indicate that regulatory concerns in general are not associated with past forest land sales among SFLOs who have sold some, but not all, of their forest land. Only 1 in 10 respondents to the two 2020 surveys who have ever sold forest land state "regulatory burden" as a reason for selling or giving away forest land; the far more common reasons given for selling forest land are "family circumstances" and "financial needs." Controlling for a variety of other factors, respondents who say the financial impact of riparian regulations on their forest ownership have been negative are no more likely to report having sold or given away forest land.
- A rare opportunity to connect survey-derived measures of landowner values or perceived challenges to real and observed land use change was exploited. We constructed "Legacy", "Environment/Wildlife", "Personal Residence" and "Income/Investment" as ownership value factors, and "Regulations" and "Ownership in the Future" as ownership challenge factors. We then tested whether these factors were significant in observed parcel land use change. Although regulatory concern was not a reliable predictor of land use change or sales, we do find that stronger assessment of *perceived challenges to "Ownership in the Future"* is associated with future (residential) conversion. *We also find that landowners valuing their land as a place of residence is associated with future (residential) conversion. S*urvey results show that owner age is not a reliable predictor of future land sales intentions, with many SFLOs planning to retain ownership into old age.
- Our analysis of survey data strongly suggests that many forestland sales are not necessarily planned. Family circumstances and financial needs top the list of reasons for having sold land in the past by SFLOs who still own forest land. Combined with the

results from the parcel database that forest land sales are a strong indicator of subsequent forest land conversion, results indicate that personal and family financial needs can be triggering events for land sales that subsequently put Small Forest Land at risk for development.

3.4.2 Land Use Change

- *Observed parcel sales* were predictive of SFLO parcel conversion to residential land uses on both East and West sides of the state.
- Similarly to the sales model, the *presence/size of riparian areas* were found to be significant predictors of transition to agricultural land use, but not residential or other land use.
- *Closer proximity to development* was associated with higher odds of residential conversion across the state, and parcels further from development were somewhat more likely to convert to agricultural uses on the Eastside. Proximity to public roads was positively associated with agricultural and residential conversion on the Eastside. *Proximity to the Urban Growth Boundary* was positively associated with the probability of land use conversion to residential land uses. Across the state, SFLO parcels located further away from the UGA were more likely to switch to agricultural uses.
- County-level median income was positively related to the probability of conversion to developed uses on the Westside, with a somewhat negative relationship with the odds of residential or agricultural conversion on the Eastside. Higher-income, lower-density growth areas in the West are more likely to see residential conversion; whereas, in the East, lower income but faster growing areas were associated with more residential SFLO conversion.
- We find that the *parcel size* has a positive impact on the probability of SFLO land use change toward *agricultural uses* across the state. *Tract (contiguous parcels under the same ownership) size* has a likewise positive impact on agricultural conversion probabilities across the state, with a smaller effect for the Eastside. While larger parcels on the Westside are less likely to convert to *residential uses*, they are more likely to transition to other Developed uses. Parcels belonging to larger tracts of forestland have a decreased likelihood of residential development (50% decrease in relative odds across the state for each 100 acre increase in tract size).
- Owners with larger land holdings are less likely to convert their land to residential or agricultural (for the Westside) uses. For each 100 acres of forested land owned by a SFLO, the parcel has 17% (14%) lower odds of being converted to residential uses for the Westside and Eastside, respectively. At the same time, Westside owners with larger forest holdings have been somewhat more likely to convert to developed uses. Overall, Westside *SFLOs with larger forest holdings* appear to be less likely to both sell and convert their forest lands.

- *Parcel road* extent is a significant predictor of residential conversion on the Westside: odds of residential conversion grew by 69% for each mile of identifiable roads located on the parcel.
- Percentage of an SFLO parcel judged to be a forest either through forest cover or designated forest land (DFL) designation is an important "retention" factor. Both on the West and the Eastside, a higher fraction of a parcel classified as forest is correlated with much lower odds of agricultural, commercial, and residential development.
- Projections of a range of outcomes consistent with our analysis suggests that the trend of SFLO forestland loss is expected to continue in the next decade under the status quo land use policies.
- While we find and report significant factors that affect the likelihood of an SFLO parcel being sold and/or developed, we do not see many "policy levers" emerging from observed sale and land use change behavior analysis. Proximity to existing development and the urban growth area does have a positive effect on conversion probabilities, and to the extent that broader land use policies create less landscape fragmentation where fewer SFLO parcels fall into close proximity to developed uses, that may reduce the future conversion likelihood.
- Active forest management history, as evidenced by a presence of a harvest FPA, does not by itself significantly impact conversion probabilities on the Westside and has a divergent effect on the Eastside, where harvested parcels are more likely to convert to non-residential and less likely to convert to residential development. Prior harvesting, however, is positively related to the probability of a sale on the Westside.
- While we find that potential FREP eligibility may be positively related to conversion to agricultural land uses, we do not see evidence that FREP eligibility or other riparian variables (size of the riparian zone and length and type of streams) have a significant effect of increasing likelihood of residential or non-residential development.
- *There is no evidence to suggest that riparian regulations are strong drivers of SFLO sales or conversion*.

3.5 Effectiveness and Implementation of Mitigation Programs

Overall, it was difficult for many survey respondents to say if the current efforts taken by the State of Washington adequately address the impacts of the Forests and Fish agreement. When asked if the programs created to address the Forests and Fish agreement adequately address the impacts of riparian regulations on their ownership, somewhat more than 1/3 of respondents "don't know" or don't answer the question, slightly less than 1/3 say the efforts moderately, substantially, or very much address impacts of the regulations, and slightly less than 1/3 say the efforts only somewhat or not at all address impacts of the regulations. Two out of three respondents say at least one additional measure could be taken to lessen the impact of

riparian regulations on their forest ownership. Most frequently requested measures are additional funding for programs to compensate SFLOs for the benefits their lands provide. The second most-frequently requested is additional regulatory flexibility, in general. The third most frequently requested is additional technical assistance for Stewardship foresters, assistance with alternate plans, FREP, and FFFPP. Specific requests relating to more details about the regulations, such as additional Alternate Plan templates, are less frequently requested.

3.5.1 Effectiveness of the Small Forest Landowner Office

Multiple sources of evidence confirm the SFLO Office does not have adequate funding and staffing to fulfill its legislative mandates. Despite substantial decreases in funding and personnel, the SFLO Office was well reviewed by many interviewees and survey respondents. Both interview and survey results showed that the SFLO Office tends to serve SFLOs who are relatively more active in harvesting, although the Office was also highly active in implementing the Forest Stewardship program up until the summer of 2019 when the program was transferred to the Forest Health division of DNR.

The SFLO Office is somewhat well known by survey respondents. The majority of evaluations about the SFLO Office are positive and it has reviews similar to those of comparable service providers (Extension Foresters and Conservation Districts). A small percentage of respondents commented on the SFLO Office's lack of staff and funding. The Forest Stewardship Program and assistance with Forest Practices applications are among the most common topics that respondents got help with from the SFLO Office. For respondents to the FF survey, FREP was among the most frequent topics of assistance by the SFLO Office. Alternate Harvest Plans and Road Maintenance and Abandonment Requirements are among the topics respondents asked least frequently about.

Respondents on the FREP waiting list, those having a paid easement, those on the FFFPP waiting list, those having a completed FFFPP project, and those who said they applied for an Alternate Plan more frequently had contact with the SFLO Office. Although respondents who said they had applied for an Alternate Plan had the highest average frequency of contact with the SFLO Office, few of them asked the SFLO Office about Alternate Plans. Respondents who had contact with the SFLO Office more often were likely to value their forests for financial objectives, value the environmental aspects of forest ownership, and feel relatively more impacted by the state's riparian regulations.

3.5.2 Forest Riparian Easement Program (FREP)

We do not find counterfactual evidence that non-participation in FREP has resulted in the loss of riparian habitat, as measured by forested buffer acres. Therefore, the lack of FREP funding has not resulted in the loss of riparian habitat. However, we find that FREP participation reduced the odds of conversion away from forestry land use by about 45% for all the FREP-

treated parcels. Thus, although FREP aims to compensate qualifying SFLOs for restricted riparian timber, it also is estimated to have a broader effect on forest land use retention, with at least a one-third counterfactual reduction in conversion risk for participating parcels. With reference to the economic literature, FREP has a "double dividend" of addressing both SFLO equity concerns and retaining land in forestry or open space use. Based on contracted parcels, the cost per (in the counterfactual sense) protected acre is estimated to be $8,119/acre.

Not only is being paid for all Forest Riparian Easements associated with a higher level of satisfaction with the compensation from the program, but having all outstanding easements paid for is also associated with a less negative assessment of the overall financial impact of riparian regulations. In other words, *our survey evidence indicates FREP is mitigating the perceived negative impact of riparian regulations for SFLOs who apply for and receive payment.*

For respondents who indicate they have been paid for their easements, only 8% express dissatisfaction with the payment. Some SFLOs, both those who have applied and those who have not, express that the amount of compensation is not adequate. Even more important than the financial compensation from FREP, the conditions of the easement need to be compatible with SFLO objectives. Although FREP mitigates the most negative perceptions of riparian regulations, some SFLOs simply do not want to enter into an easement. Interviews revealed substantial variation on how SFLOs consider the program, with some expressing enthusiasm, others expressing frustration at the loss of property rights, and still others saying FREP is a compromise that was the best of a bad set of alternatives from a SFLO perspective.

In addition to comments about the waiting time and partial compensation of FREP, some respondents complained about not hearing about the status of their easement for years.

Slightly more than half of owners who were offered but declined easements say they are either no longer interested, have sold the property to someone else, or the applicant has died. These reasons may be related to the multi-year waiting time required to receive payment. By far the most common reason respondents say they have not applied for FREP is because they have not heard of the program. There appear to be at least some owners who have not applied but may apply for the program if the waiting time was shorter.

3.5.3 Alternate Plans

Alternate Plans were a topic of much discussion in informal stakeholder conversations and formal interviews. Although there was general agreement that the existence of Alternate Plans is a good thing for SFLOs, opinions ranged from expressions that the process and outcomes are good and reasonable to expressions of great consternation and disappointment with current Alternate Plans. Most stakeholders and interviewees expressed that Alternate Plans, particularly so-called "full Alternate Plans" that cannot or do not utilize a template and require ID team site visits, are complex for most SFLOs to undertake.

Using the FF survey allowed us to ask 445 SFLOs who are very likely to be impacted by the Forests and Fish legislation about their knowledge of and experience with Alternate Plans. Only about a quarter of respondents who are very likely impacted by the Forests and Fish legislation said they had ever heard of Alternate Plans, which is about half the number who had heard of FREP, FFFPP, and the SFLO Office. Although only about 1 in 5 respondents who said they have applied for an Alternate Plan have a negative evaluation of the process, respondents who say they have applied for an Alternate Plan are overwhelmingly negative in their evaluation of the financial impacts that the riparian regulations have had on their forest ownership. The negative evaluation of the financial impact of the regulations is likely also related to the larger average forest ownership sizes of respondents who say they have applied for an Alternate Plan. In other words, results suggest SFLOs who take the time to educate themselves about the regulations and take sufficient interest in the Alternate Plan application process may be among the owners who feel most negatively impacted by riparian regulations.

While 53 respondents said they have ever applied for an Alternate Plan, we estimate that about the same number of respondents have actually used an Alternate Plan but did not know about it or do not remember it.

Respondents who said they have ever applied for an Alternate Plan, on average, own substantially larger forest properties than respondents who did not say they have applied for an Alternate Plan. The majority of respondents who said they have applied for an Alternate Plan (about 4 in 5) had a positive or neutral evaluation of the overall application process. While 22 respondents said the process and outcome of the Alternate Plan application were reasonable, 20 respondents offered at least some criticism of the process. Overall, the most common critiques of Alternate Plans can be summarized as follows: Alternate Plans are complicated and difficult and at the end of the process SFLOs don't get to harvest much more than existing regulations allow. However, there were more respondents who said they thought the process and outcome were reasonable than there were respondents who did NOT think the process and outcome were reasonable. Although complaints about inconsistencies in ID team applications of Alternate Plans were expressed by a number of interviewees, based on the FF survey, complaints about inconsistencies in how Alternate Plans are evaluated do exist, but they are fairly uncommon. By far the most common reasons for respondents not applying for Alternate Plans is lack of awareness about the option or simply not wanting to harvest in one's riparian zones.

It is clear from DNR data as well as the FF survey that relatively many SFLOs use Alternate Plan templates and relatively fewer do "full Alternate Plans." In that regard, Alternate Plan templates appear to facilitate many harvest operations and have likely had the effect of reducing the time and effort required to apply for Alternate Plans (so-called transaction costs in economic literature). Alternate Plan templates seem to meet the criteria of relatively wider adoption compared to "full Alternate Plans." However, overall awareness of Alternate Plans as

a management alternative is substantially lower than awareness of FREP, FFFPP, and the existence of the SFLO Office as a source of support.

3.5.4 Family Forest Fish Passage Program (FFFPP)

Survey results show the program is well reviewed by most, and overall the program is well appreciated. The most frequently checked comment is that respondents thought the program was a good use of public funds on their forest land. Also, from the standpoint of effective use of public funds, the fact that FFFPP applications are prioritized based on habitat considerations is an important and well-functioning feature of the program (i.e. the State can set its own priorities).

The most common criticism is that the owners could have had the new culvert or bridge installed for less than the cost of the project that was actually paid. We can recommend the State considers options to lower costs involved in replacing identified barriers, but the technical requirements of a sufficient fish stream crossing also has important biological and ecological considerations.

A small percentage of respondents seem to indicate that the impassable barrier is preventing them from harvesting, suggesting there may be some ownerships who fall through the cracks.

3.6 Summary of Recommended Actions to Help Keep Forest Lands Working

We offer a more detailed synthesis of several recommendations in terms of the actions that may help keep SFLO lands in forestry or open space uses in Synthesis of Recommendations. Based on the combination of known State objectives and the strength of evidence we found as a part of this Report, we separate the recommendations into three levels. A level recommendations are unqualified recommendations. These recommendations are justified given a known and codified policy objective of maintaining SFLO lands in resource and open space uses. The B level recommendations are recommendations we find strong qualitative and quantitative support for, but whether they should be pursued also depends at least partly on the policy objectives of the State of Washington. C level recommendations are solutions that we may not be able to demonstrate overwhelming support for, but they are worth exploring.

While the professional opinion of the authors of this report is that the most effective measures that can be taken to help keep Small Forest Land and their owners as a part of the landscape are additional, secure resources for outreach, education, and technical assistance for SFLOs, most of the measures recommended in this report are likely to at best have a marginal impact slowing the rate of forest conversion. We believe the State needs a larger, more innovative set of policy instruments (both traditional and non-traditional) to have a chance of significantly slowing Small Forest Land loss.

3.6.1 A-Level Policy Recommendations

3.6.1.1 A1. Secure Funding for the SFLO Office & Other Services for SFLOs

Additional and secure funding for the SFLO Office as well as other public organizations offering outreach, education, and technical assistance to SFLOs.

Universal across all stakeholder groups was a proposed increase in stewardship or technical foresters to assist landowners. All stakeholder groups referenced the need for a forester or individual who would walk with the landowner on their land to provide information, advice, and other recommendations.

Also, results show the SFLO Office tends to assist SFLOs who are relatively more interested in timber harvesting compared to SFLOs with other objectives, although its mandate is broader than assisting with harvest-related activities. Even SFLOs who harvest timber and submit Forest Practices applications have many different ownership objectives. Education, outreach, and Forest Practices regulations should consider that SFLOs have diverse objectives and needs including, but certainly not limited to, timber harvesting.

Interviewees across stakeholder groups have indicated that one of the prevailing requests of SFLOs is education in terms of forest health and regulation. Our survey work and existing knowledge on the importance of education and technical assistance in maintaining economic viability and ecological function of privately owned lands leads us to concur with these stakeholder-driven recommendations.

The association between legacy concerns and higher rates of forest conversion lends yet additional support to the need for investment in outreach, education, and forest stewardship services. Helping owners who feel challenged by lack of willing heirs and development pressure will, in all likelihood, help SFLOs who want to keep their forest lands forested.

SFLOs who are interested in learning more about the care, management, or protection of their forest lands tend to also think the public benefits their forests provide are important and overwhelmingly want to keep their forest land forested. Assistance for SFLOs who want to learn about the care, management, or protection of their lands is enabling owners who want to keep their lands forested into the future. While most landowners who receive assistance services are already interested in the care of their lands, there remains a great majority of owners who are interested in outreach services but have not received them. Additional technical assistance was the third most requested additional measure by FF survey respondents to address the impact of riparian regulations on their ownership.

We make three practical notes to conclude recommendations for additional and broader focused education and assistance services in addition to continuing the outreach focused on forest health.

First, one task for additional technical assistance foresters is to help SFLOs with completing technically challenging Alternate Plan applications. Although a minority of respondents who said they have submitted Alternate Plans offered a criticism of the process, the most common complaints were that the process is difficult and complicated and it does not allow much additional harvesting than what is allowed under existing rules. In the absence of changes to existing regulations, additional technical assistance foresters can help alleviate the difficulty and complexity of applying for Alternate Plans.

Second, assistance services should seek out SFLOs in western Washington who apply for harvesting and/or road building to begin discussions about forest conservation options and/or forest legacy needs.

Third, extension and stewardship foresters, as well as other State services, are well advised to specifically focus on forest succession planning and legacy conservation goals. Using a rare opportunity to follow-up on the actual land use outcomes of SFLO respondents, we find that SFLOs who feel more challenged by future ownership concerns (lack of a willing heir and development concerns) are more likely to have their forest properties converted away from forestry and open space land uses.

3.6.1.2 A2. Promote the Designated Forest Land Tax Program

Encourage afforestation/reforestation in a way that increases the density of forest cover on small forest land as well as enlarges existing forest tracts; however, this needs to be done in a way that is consistent with supporting forest health. We recommend continued emphasis on appropriate reforestation and afforestation and enrollment in DFL programs as a way to protect forests from conversion, especially if this is done in a way that increases forest connectivity and enlarges existing tracts of forest land. It is however important to balance afforestation or reforestation efforts with forest health concerns. Increasing enrollment in existing DFL programs and restructuring the DFL programs to allow for non-harvest management objectives are likely to serve the goal of forest retention.

Additionally, policies (which will likely be implemented at the county level) that discourage additional development near Small Forest Lands can help keep more forest land intact and relieve development pressure on remaining Small Forest Land.

3.6.1.3 A3. Fund the Family Forest Fish Passage Program

Robust funding for the FFFPP is likely to continue benefitting both the landowners and the public via its prioritization mechanism based on habitat considerations. No stakeholder interviewed suggested that FFFPP should receive less funding.

3.6.1.4 A4. Support Information Needs for Better SFLO Policies and Programs

Existing reporting requirements for the SFLO Office described in (Review of Legislative Reports and Fulfillment of RCW 76.13.110 (5) and (6)) make it clear that the SFLO Office and state policymakers require timely, reliable, and consistent sources of data on SFLOs and their lands. Providing ongoing support for the Washington State Parcel and Forestland Database is likely a cost-effective way to ensure ownership and land trends data is available for legislatively mandated reports. To complement the parcel database, the State should also consider establishing regular funding to perform periodic, updated surveys of the general population of Washington SFLOs. Stable support for ongoing data collection and research collaborations can provide a continued source of policy-relevant SFLO data and research.

3.6.2 B-Level Policy Recommendations

The B level are recommendations we find strong qualitative and quantitative support for, but they also depend at least partly on the policy objectives of the State of Washington.

3.6.2.1 B1. Fund the Forest Riparian Easement Program

The Forest Riparian Easement Program has been underfunded. Increasing funding for FREP would reduce the currently very long waiting times. Essentially, if the State wants to prioritize equity concerns of SFLOs from the Forests and Fish agreement and it wants to continue with its existing Adaptive Management Program for riparian forest regulations, then additional funding for FREP is an appropriate policy measure. A key reason funding for FREP is under B-level recommendations is that the State can alternatively decide to institute more relaxed riparian regulations for SFLOs, which will reduce the need for additional FREP funding. While FREP was a part of the original Forests and Fish agreement and was not intended to serve directly as a forest retention tool, we find that the program has a double dividend: it alleviates perceived regulatory impacts and keeps some land in forestry and open space land uses (in the additional, counterfactual sense). At the same time, we do not find that lack of FREP funding can be causally connected to loss of riparian habitat, regardless of land use classification. In addition to compensating landowners impacted by riparian regulations, the program appears to improve the perceived impact of the regulations, while also having some protective effect on forest land use (although not on riparian habitat).

Giving more funding to FREP to shorten the waiting time from application to approval to payment can both help to keep more small forest land in forestry land use and to address the perceived impacts of riparian regulations on SFLOs themselves. Additional funding for FREP and potential carbon payments were the most frequently requested measure that FF survey respondents said the State could take to address the impact of riparian regulations on their forest ownership. It is not an inexpensive program and, while there may be other alternatives to preserve the forest, we stress that FREP serves an important function of compensating SFLOs

who bear a relatively higher private cost of riparian habitat provisioning. In other words, it is addressing a matter of "distribution" not necessarily of "efficiency."

Informal and formal stakeholder conversations also revealed a desire on the part of those who are and have been involved in the administration of FREP to streamline the administrative approval process. For example, reducing the "high touch" nature of multiple people needing to approve the same FREP application multiple times. Efforts to look for efficiency improvements in various aspects of FREP are warranted.

The SFLO office should consider a better customer relationship management system (CRM) to let FREP applicants know about the status of their applications regularly and occasionally follow up with ownerships that have a paid easement since ownership may change hands and new owners are unaware of the details of the easement. Numerous stakeholders, interviewees, and some survey respondents expressed frustration that they have not heard about the status of their FREP application after it was initially submitted. A modern CRM can also help the SFLO Office in managing other programmatic, outreach, and education efforts. Given the preferences expressed by SFLOs themselves and interviewees, postal mail materials are the primary method of contact that many SFLOs seem to prefer.

3.6.2.2 B2. Pilot a Reverse-Auction Conservation Easement Program

The most direct way for the state to preserve SFLO forests of significance to the public without reallocating property rights is to purchase land use (development) rights. If the State is willing to use public funds to increase permanently conserved forest land, then pursuing a novel conservation easement program based on the principles of competitive reverse auctions can be appropriate. An enormous policy challenge is to create a competitive mechanism where bids of landowners to relinquish their rights to convert their forestland would be evaluated in a way that allows for true competition among bidders (improving allocative and budgetary efficiency) and that properly evaluates the public benefits stemming from such bids, including the issue of whether such benefits are additional (in the counterfactual sense).

The degree of complexity and technical sophistication in reverse auctions and bid acceptance decisions remains largely a matter of policymakers' preference, including the decision on how much to invest in the supporting technical expertise and infrastructure. Simpler scoring schemes can target conservation easements in areas of ecological benefit and under relatively higher threat of residential or heavy development.

We acknowledge that it will likely take substantial outreach and negotiation to produce a competitive and cost-effective mechanism to purchase conservation easements that is perceived as fair and equitable by SFLOs. Such a program will need to fulfill the criteria described above as well as achieve a reasonable acceptance among SFLOs themselves. Anecdotal evidence and personal experience working with family forest owners leads us to

advise that most SFLOs have a strong sense of what is fair, and a potential State-funded conservation easement program will need to fit within reasonable bounds of what many SFLOs consider to be “fair and reasonable.”

3.6.3 C-Level Policy Recommendations

C level recommendations are solutions that may not be able to demonstrate overwhelming support for, but they are worth exploring.

3.6.3.1 C1. Consider Forest Practices Regulations as a Tool for SFLO Outreach

First, we fail to find evidence that riparian small forest land (at the parcel-level) is being sold and/or converted away from resource land uses at higher rates compared to other small forest land. Results do confirm, however, that SFLOs with riparian forest land on the Westside of Washington tend to have higher generalized regulatory concerns compared to owners with less or no riparian forest land, or SFLOs on the eastside of Washington. We therefore do not further discuss specific changes to existing riparian regulations in terms of the impacts they may potentially have on forest land use retention, but in terms of addressing generally higher perceived regulatory burdens.

Second, we note the robust result that owners of larger amounts of forest land tend to be more interested in profitable timber management as an objective and therefore would likely benefit relatively more from the relaxation of Forest Practices regulations compared to SFLOs with smaller amounts of forest land under ownership. In addition, owners with large and contiguous forest properties under ownership are less likely to sell and/or convert their forest lands away from forestry land use.

Many indications from informal and formal interviews, write-in comments on the GP and FF surveys, requests for additional regulatory flexibility on the FF survey, and phone calls from survey recipients suggest that simplifying or otherwise lowering the complexity involved in Forest Practices regulations for SFLOs would be beneficial for even small-scale Washington SFLOs.

For riparian regulations specifically, the Adaptive Management Program is the mechanism through which such rule changes should be developed in the status quo policy framework. Under status quo riparian regulations, a minority of SFLOs representing a majority of the forest land base feel negatively impacted by the current rules produced from the Forests and Fish agreement. All indications are that Alternate Plan templates have greatly increased SFLO access to Alternate Plans while reducing the difficulty and costs of the application process. In the absence of SFLO-specific rules for riparian harvests, additional Alternate Plan templates would likely help to alleviate the perceived regulatory concerns of SFLOs with riparian forests in Western Washington.

Interviews and FF survey results confirm very clear differences in SFLO regulatory and forest health priorities on the east and west sides of the State. For the Eastside of Washington, riparian harvest issues are much less salient to SFLOs, while forest health and better aligning Forest Practices regulations with Eastside-specific ecological conditions are top priorities. A number of interviewees from various stakeholder groups expressed support for revisions to Forest Practices regulations based on science as well as the East/West divide that creates substantially different ecological conditions on different sides of the State. As the results of numerous surveys used in this report confirm, SFLOs with many different kinds of objectives, not always including profitable timber management, engage in active forest management. A great number of SFLO ownerships will encounter Forest Practices regulations at some point in their ownership tenures (as many as an estimated 69,000 ownerships over the course of 20 years). In that context, Washington's Forest Practices regulations are perhaps the most common point of contact between SFLOs and State agencies, and should be considered as an opportunity to facilitate continued stewardship of the State's Small Forest Land.

3.6.3.2 C2. Support Programs for SFLO Peer-to-Peer Connections

The State should consider supporting "outside the box" initiatives for SFLOs that are not necessarily typical state-administered programs. We offer one example of a peer-to-peer service that can match existing SFLOs with new SFLOs and seek to link potential SFLO mentors with relatively new SFLOs who would benefit from peer-to-peer learning. The State should consider supporting similar existing NGO and landowner organization initiatives with technical assistance and/or grant funding.

3.6.3.3 C3. Set Priorities for Potential SFLO Carbon Payment Programs

While not empirically evaluated in this work, taxing carbon emissions, including those resulting from land use change, is likely to be an important part of effective and cost-efficient climate change policies. As a part of broader climate policy, the State may consider imposing a fee on forests lost to development that could be, for example, based on the Environmental Protection Agency's Social Cost of Carbon. Such a fee on the conversion of land from forestry or open space uses to developed uses may have a modest impact on slowing forest conversion rates, but the revenue from the fee should be reinvested in forest retention programs.

With respect to policies for carbon sequestration specifically aimed at SFLOs, we place the recommendations from the chapter on forest carbon payments under the C-level recommendations. The State can best evaluate its alternatives by deciding if its goal is one of the following, or a prioritization of two or all goals: maximize SFLO participation in a potential carbon program (and to explicitly pursue a carbon compensation and/or a climate change *adaptation* strategy as a mechanism to help prevent the conversion of forestland to non-resource uses), maximize the climate impact of forest carbon sequestration, or facilitate SFLO participation in a particular voluntary or compliance offsetting market. In the context of this

Report, paying SFLOs for the carbon sequestration services from their land has the potential to make a contribution to maintaining small forestland as forests, but can be expected to have a modest impact on slowing conversion away from forestry land use.

3.6.3.4 C4. Support Transfer of Development Rights Markets

Similar to voluntary conservation easements, transfer of development rights (TDR) policies and programs have the potential to serve broader land use planning goals in a way that is theoretically cost-effective and market-driven. The state indeed has a regional framework in place (RCW 43.362 https://app.leg.wa.gov/RCW/default.aspx?cite=43.362&full=true), wherein the legislature "finds that current concern over the rapid and increasing loss of rural, agricultural, and forested land has led to the exploration of creative approaches to preserving these important lands, and that the creation of a regional transfer of development rights marketplace will assist in conserving these lands. Department of Commerce reports that "The Regional Transfer of Development Rights Alliance is a partnership of King County, Pierce County, Snohomish County, Kitsap County Forterra (formerly the Cascade Land Conservancy), the Washington State Department of Commerce and the Puget Sound Regional Council. (https://www.commerce.wa.gov/serving-communities/growth-management/growth-management-topics/development-rights/)

King County has the largest active TDR program (https://www.kingcounty.gov/services/environment/stewardship/sustainable-building/transfer-development-rights.aspx) and says that "The TDR Program is a voluntary, incentive-based, and market-driven approach to preserve land and steer development growth away from rural and resource lands into King County's Urban Area. The Program is based on free-market principles and prices that would motivate landowner and developer participation. Rural landowners realize economic return through the sale of development rights to private developers who are able to build more compactly in designated unincorporated urban areas and partner cities. The Program has protected over 144,500 acres of rural/resource land from 1998 to 2019." Although we did not focus explicitly on Washington's TDR market, it is worth noting that, by and large, the existing process is quite complex and introduces multiple layers of county, municipal, and public involvement. The complexities are rooted in the reality of the complex nature of land use causes, consequences, and attendant social, economic, and environmental impacts. At the same time, the existing complexity clearly hampers the efficacy of the TDR efforts in the state. Imposing constraints on developers which would induce demand for rights from forested lands as well as setting of important market parameters ('trading ratios', so called "receiving area ratios") has been delegated to county and municipal authorities. TDR programs in principle can easily accommodate more SFLO lands. At a minimum, based on the pattern of SFLO land conversion we observe in this Report, the state should consider expanding the TDR code to include other counties with high conversion rates.

The state could consider taking a stronger leadership role in supporting the TDR marketplace by committing to explicit state-wide caps of the form of “no net forest loss” (similar to existing “no net loss” provisions for the Shoreline Management Act, for example). It should be noted that a TDR program is (in principle) a market-based approach where buyers and sellers compete under a fairly simple set of rules. Real simplicity in a TDR program is very difficult to achieve, given the state’s existing regulations pertaining to land use and development Also, significant scientific simplifications would need to be developed and accepted for this policy option to become widely applicable. Parting with development rights is a fairly appealing option to many SFLOs, as we have found in this report. Thus, the barriers to utilizing TDR programs for forest retention largely do not lie on the supply side.

4 INTRODUCTION

Washington State Legislature, via ESB 5330, tasked the School of Environmental and Forest Sciences within the College of the Environment at the University of Washington in Seattle to address a set of questions that broadly deal with the status of Washington's small forest landowners (SFLOs) and their lands, including their current state, trends, regulatory impacts, state policies and programs, and recommendations to help encourage "continued management of nonindustrial forests for forestry uses, including traditional timber harvest uses, open space uses, or as a part of developing carbon market schemes" (ESB 5330, p. 4). ESB 5330, hereafter referred to as "the Bill," asked a specific set of questions, yet its impetus clearly lies in the broader understanding of the SFLO population and their lands and in overall better understanding of how the State can engage in effective and cost-effective action to support SFLOs as it relates to their stewardship of forested lands. Thus, we provide answers to the specific questions asked, as well as conduct analyses consistent with the broader intent of ESB 5330.

While the scope of this report is somewhat broader than providing our best available answers to the questions in the Bill, we recognize that the report is not intended as a comprehensive analysis of land use/land cover change in Washington State, an analysis of all aspects of Washington's forestlands, or an analysis of Forest Practices rules as they are applied to SFLOs.

The current Forests and Fish rules are a complex set of rules and regulations which were a result of an equally complex political, legal, and scientific effort, and while some of our work touches on policies and programs related to Forests and Fish, many aspects of Forests and Fish are outside the scope of the Report. This is consistent with the Bill's language, which directs the Report to focus on the small forest landowner office within the Department of Natural Resources, the Forest[ry] Riparian Easement Program (FREP), the alternate management or harvest plans, and the Family Forest Fish Passage Program (FFFPP). Within these, and consistent with the Bill's language, we focus on the economic, social, and land use aspects of these programs, recognizing that the ecological consequences or evaluation of technical proposals for modifying any of these programs require a further interdisciplinary and multi-stakeholder analysis consistent with existing legal, regulatory, and policy frameworks.

We adopted a multi-pronged set of social and land use science methods to answer the Bill's questions. As we discuss below, the Report is closely tied to a sub-area of study of non-industrial private forest landowners which is an internationally recognized research arena largely motivated by the same set of concerns that motivates Washington's SFLO domain: the presence of a significant portion of forest land base being held by a multitude of (often very) small private holdings. Consistent with research approaches taken elsewhere, we use cadastral and remotely sensed data at the parcel level, complementing those with local and regional socioeconomic indicators. The use of property records and remotely sensed data allows for a "wall-to-wall" coverage of SFLO parcel data for the State. However, while such "census" data is "wide" it is usually not "deep" enough in terms of understanding the relevant characteristics of the landowners, their objectives, attitudes, concerns, or other behavior not captured by land use records. In the course of our interactions with various stakeholders, numerous individuals expressed strong interest in better understanding the objectives and needs of Small Forest Landowners. Understanding SFLO objectives and needs is critical for understanding the trends in the data and for better policies and programs which support the continuing stewardship of their lands.

We use several social science methods to deepen our understanding of SFLOs and their behavior as well as the related policy and management environment. For data on landowners, we seek to triangulate our understanding of Washington's SFLOs using four distinct probability-based surveys (three of them new, two of which are pre-tested, piloted surveys conducted in full by the Report authors), informal conversations with stakeholders, as well as formal, in-person, semi-structured interviews with 29 interviewees representing five distinct stakeholder groups (University Extension, State Agencies, Tribal representatives, landowner organization-affiliated landowners, and un-affiliated landowners). Formal interviews resulted in 49 hours of recorded conversations. We also relied on publicly available legal and regulatory documents, as well as notes and minutes from relevant public meetings. The widespread prevalence of the novel coronavirus and the associated public health restrictions have complicated the work on

the Report, including limiting in-person stakeholder discussions to audio and video-conferencing options. Despite these limitations, we were able to collect robust quantitative and qualitative data on SFLOs and attendant land retention issues.

In terms of analytical social science tools, we used multivariate statistical and regression analyses of survey data, econometric and machine learning models of sales behavior and land use change, quasi-experimental methods for impact analysis (including matching and regression discontinuity analyses), and qualitative data analyses. We make the important observation that our earliest data on Washington Small Forest Land is from 2007 and our earliest data on Small Forest Landowners is from 2009. Ideally, policy impact analysis can employ "pre-intervention" data to establish a baseline for subsequent changes. In the context of analyzing the impacts of the Forests and Fish agreement on Small Forest Land, it would be ideal to also have data from 1999 or earlier. Changes to Small Forest Land that occurred between 2000 and 2007 are not reflected in the following analysis.

The issues of SFLOs in Washington State echo the management and policy issues elsewhere. The basic policy focus tradeoff is whether public agencies and programs focus on non-industrial owners as economic and social agents, potentially representing hundreds of thousands of individual and group owners and households, or whether the focus is on the forest land base controlled by non-industrial landowners. The tradeoff exists although clearly SFLOs and their lands are themselves a coupled subsystem in a broader coupled socio-ecological-economic system. Although Washington State is not unique in regards to small landowners, the definition of a SFLO in Washington is quite broad, and can capture owners ranging from those with a few acres of forested land to SFLOs which have sufficient land holdings to profitably engage in rotational forestry. The distribution of landowners by land holdings is highly asymmetrical, which further sharpens the land-vs-owner policy focus tradeoff. In practical terms, other versions of this kind of tradeoff can emerge, for example whether the public agencies and programs focus on the subset of timber-harvesting landowners or landowners as a whole.

The Report does not take an explicit position on how much priority *should* be given to the small forest land base relative to the population of SFLOs themselves, and instead presents information and commentary concerning both perspectives. A focus on the land base given the highly skewed land size ownership distribution, will have a likely practical implication that programs serving landowners with larger forest holdings will be prioritized by budget-constrained public agencies. A focus on the majority of SFLOs will likely prioritize programs for the modal SFLO who controls relatively little forested land. Justifications can be provided for both approaches, but, at the minimum, the policy focus decision needs to be transparent, informed by relevant data on economic, ecological, and cultural benefits non-industrial forests provide to their owners and the people of Washington, and recognize considerations of fairness and equity which apply both to the changing SFLO population and the taxpayers of the State. From the economic theory perspective, existing and future policies and programs have both the

distributional dimension (relevant to the population of all SFLOs) and the efficiency dimension (relevant to impacting as much small forest land as possible, regardless of ownership).

With respect to the distributional dimension, it is fairly clear to the Report authors (who themselves are not stakeholders in the process) that the history of Forests and Fish rules is rife with language relating to underlying re-definitions of property rights and the negotiations surrounding such re-definitions. This is evident through the occasional stakeholder use of terms such as "regulatory takings" or "broken promises" when discussing Forest and Fish rules and attendant mitigations for regulatory impacts, such as the role and function of the SFLO DNR office, FREP, alternate plans, and FFFPP. Forests and Fish rules were largely a grand compromise under external legal threat (driven by federal ESA requirements) which, not surprisingly, did not satisfy all parties involved (as evidenced, for example, by the notable absence of environmental groups from the original compromise). In the subsequent 20 years, some SFLOs believe that the State has not fully delivered on its commitments for mitigation of regulatory impacts. In this Report, we collect empirical evidence on the shape and overall prevalence of such beliefs in the SFLO population (including the population most likely affected by the regulations) yet the full adjudication of whether the State fully lived up to its FF commitments would likely require a set of legal analyses which is outside the scope of this Report and/or additional action by the Legislature.

Related to the distributional dimension of specific policy is a general perception among at least some SFLOs that they are under-appreciated or antagonized by the same general public who benefits from their forest stewardship. This Report explains in detail the forest ownership objectives and attitudes of SFLOs from four different surveys as well as in-depth interviews. Results show that while there is great diversity among owners, the vast majority of SFLOs highly value environmental objectives and want their lands to stay in forest or open space use and mostly intact for future generations. Even among SFLOs who are more interested in timber harvesting, results show that most SFLOs do not perceive an either/or trade-off between forest production and environmental objectives. In providing extensive context and background on SFLOs, the authors of this Report believe the following analysis can help provide an accurate and dispassionate, albeit limited, portrayal of who Washington's SFLOs are and how they think about the stewardship of their lands.

With respect to economic efficiency, the focus of public involvement on private lands largely ought to be on the external benefits or costs that private forest lands deliver to the public. A historical focus on extension education and technical assistance characteristic of agricultural and forestry extension activities has also at times been justified on economic efficiency grounds, and more recently such activities have adopted a more explicit task of promoting external benefits and reducing external costs from private lands. Forests deliver a wide range of external benefits, often described within the framework of "forest ecosystem services." Often (although not necessarily) external benefits from private forests are positively related to the

size of the private forest. Accounting for forest ecosystem services from forests in Washington generally or SFLO forests in particular is outside of the scope of this Report, yet considerations above may lead the policymakers to tailor its non-industrial private forest policies and programs toward land-based external benefits, which may in turn lead to a focus on landowners with larger forest holdings. Of course, size of holdings may be a poor proxy for external benefits, and we do suggest that an enhanced focus on such benefits (ecosystem services) can improve the effectiveness and relative efficiency of State efforts regarding SFLO lands.

The Bill stipulates that the authors may reach out to a variety of stakeholders for input. The largest group of stakeholders is the population of SFLOs itself. Throughout the Report, we aim to maintain the appropriate importance of the population of SFLOs and their lands. To the extent that is possible using the data collected, our strongest findings and recommendations are rooted in the "census" database of SFLO and other parcels in Washington as well as in probability-based surveys from which we are able to make cautious inference to the general population of SFLOs. Interviews and other qualitative data are crucial to providing the appropriate context, for better interpreting quantitative data, and for elucidating the breadth of issues and the depth of commitment of many stakeholders to Washington's forests and forestry. In the Report, we also seek to represent the perspective of the people of Washington, summarized well in the Legislative Declaration of RCW 84.34.10: "The legislature hereby declares that it is in the best interest of the state to maintain, preserve, conserve and otherwise continue in existence adequate open space lands for the production of food, fiber and forest crops, and to assure the use and enjoyment of natural resources and scenic beauty for the economic and social well-being of the state and its citizens." This approach allows us to look at questions of land use change in a way that is conditional on the above Declaration and considers maintenance of SFLO lands in open space or resource uses (agriculture or forestry) as a statewide goal.

4.1 Report Structure

Given the fact that specific questions were asked in the Bill, the major report sections reflect the questions and their sequence as posed. Reflecting the sequence of questions in the Bill, we start with the trends analysis. Following that, and given the charge in the Bill of "using the data from the trends analysis and other pertinent information," we describe three new probability-based SFLO surveys, followed by a brief introduction to Forest and Fish rules. We then describe inferences that are made from surveys to the population of SFLOs, providing an overview of their objectives, typologies, concerns, and regulatory impacts. In a small deviation from the sequence of questions in the Bill, we present the recommended actions the legislature can take to help keep forestland working at the end of the report. We also provide an Executive Summary and Appendices, containing the bulk of geospatial methodology for the trends

analysis and supplementary social science results. Finally, while the acronym “SFLO” is accepted, there exists some variation among the stakeholders and researchers as to whether it stands for “Small Forestland Owners” or “Small Forest Landowners” (notably, SB 5330 uses both). We may use both versions in the Report but the use remains neutral with respect to any other preferences expressed by stakeholders as they select their preference for how to spell out SFLO.

5 Trends Analysis Using the Washington Parcel and Forestland Database

An overview of forestland in Washington State is useful prior to addressing change in forestland owned by small forest landowners. Note that several types of acreage values are reported in this section. When possible, forest acres are reported. The term 'forest acres' is defined as either the area of the entire parcel when the parcel is enrolled in a designated forestland tax program; or the area of the forested portion of the parcel based on NLCD land cover. In some cases parcel acres are reported, defined as the entire area of the parcel.

In 2007, forests covered 19.64 million acres in Washington State. Forestland was distributed similarly between owner classes in each time period, with 42% managed by federal agencies, 39% privately owned, 10% managed by the state of Washington, 7% owned by tribes, and 2% managed by county and local municipalities. Among privately owned parcels, industry owned 24% of Washington forestland in 2007. Small forest landowners were the next largest owner class, accounting for 15% of forestland. Figure 1 shows the distribution of forest acres by owner class.

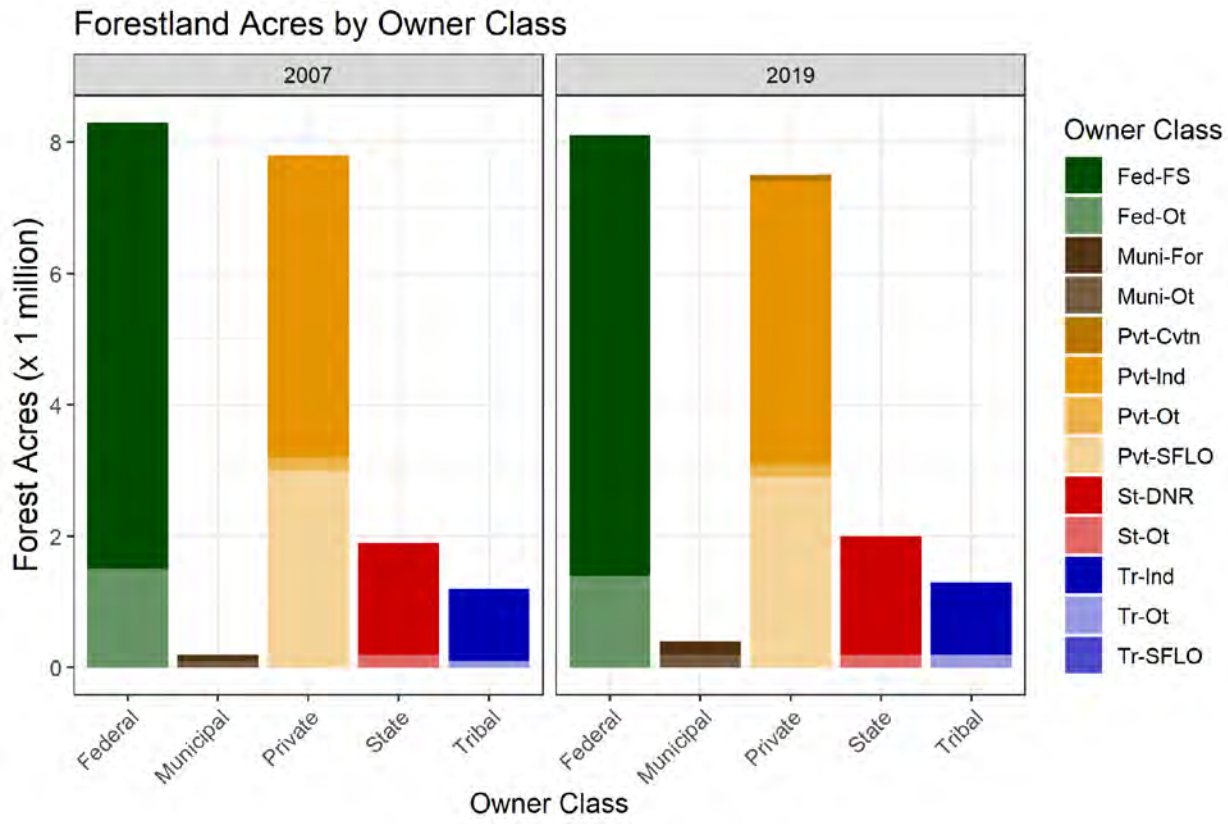

Figure 1. Washington's forestland acreage by owner class.

Counties varied in their proportion of private and publicly owned forestland. Figure 2 shows the distribution of forestland by owner class and county in 2007. Fifty-seven percent of forestland was in Western Washington. Among counties in Western Washington with a plurality of private ownership (Cowlitz, Grays Harbor, King, Lewis, Pierce), industry was the largest owner class. In Eastern Washington, SFLO was the largest owner class in Stevens and Spokane counties.

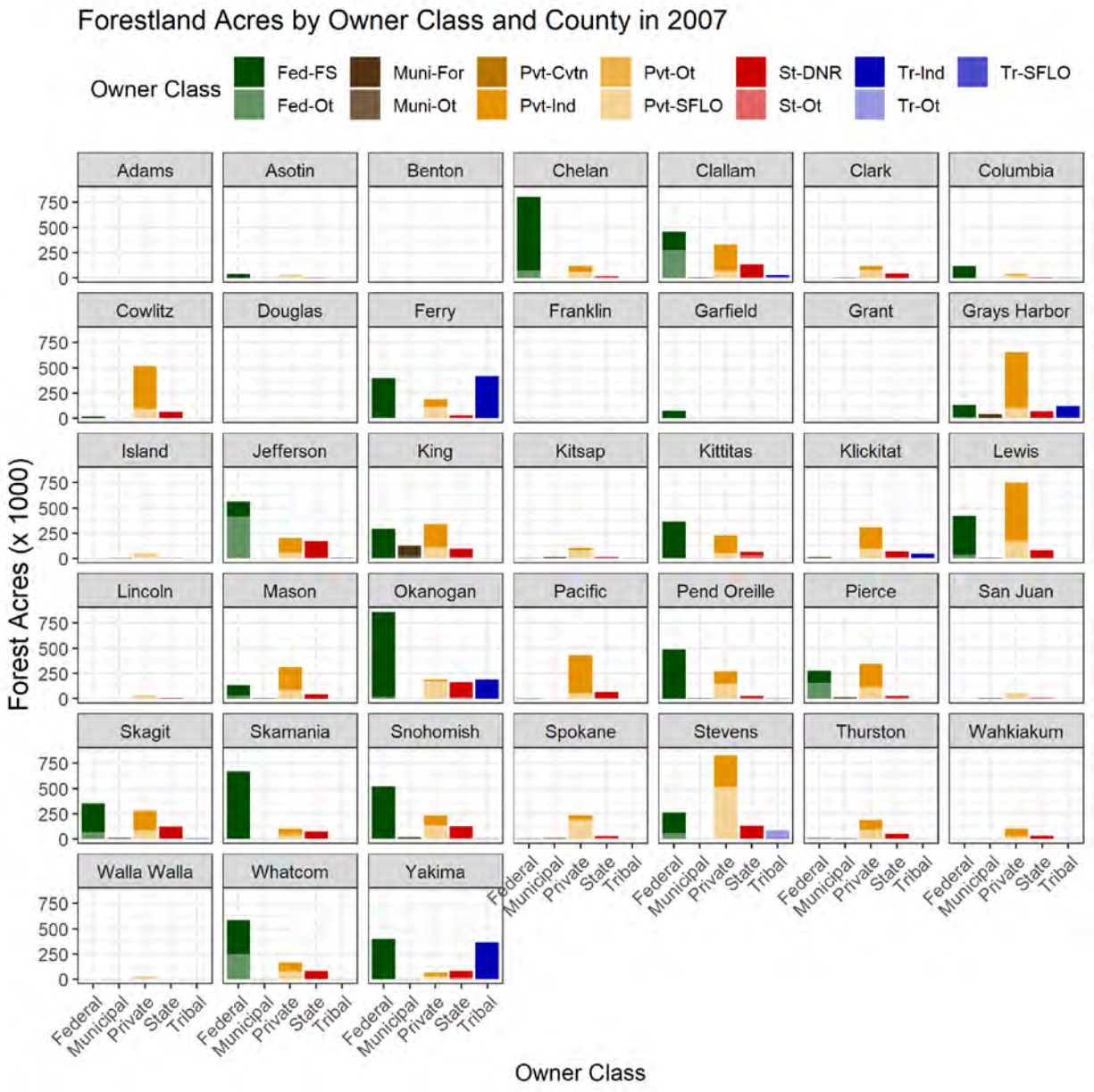

Figure 2. Washington's forestland in 2007

Changes in forestland between 2007 and 2019 included 1) the transfer of ownership for parcels that remained forested; 2) changes in land use designation for parcels that remained forested; 3) segregations and aggregations for parcels that remained forested; and 4) transition of parcels out of forestland due to changes in land use, forest cover, or parcel size. *In total, forest area declined by 394,000 acres to 19.24 million acres.* Figure 3 shows the change in forest acres by owner class and county.

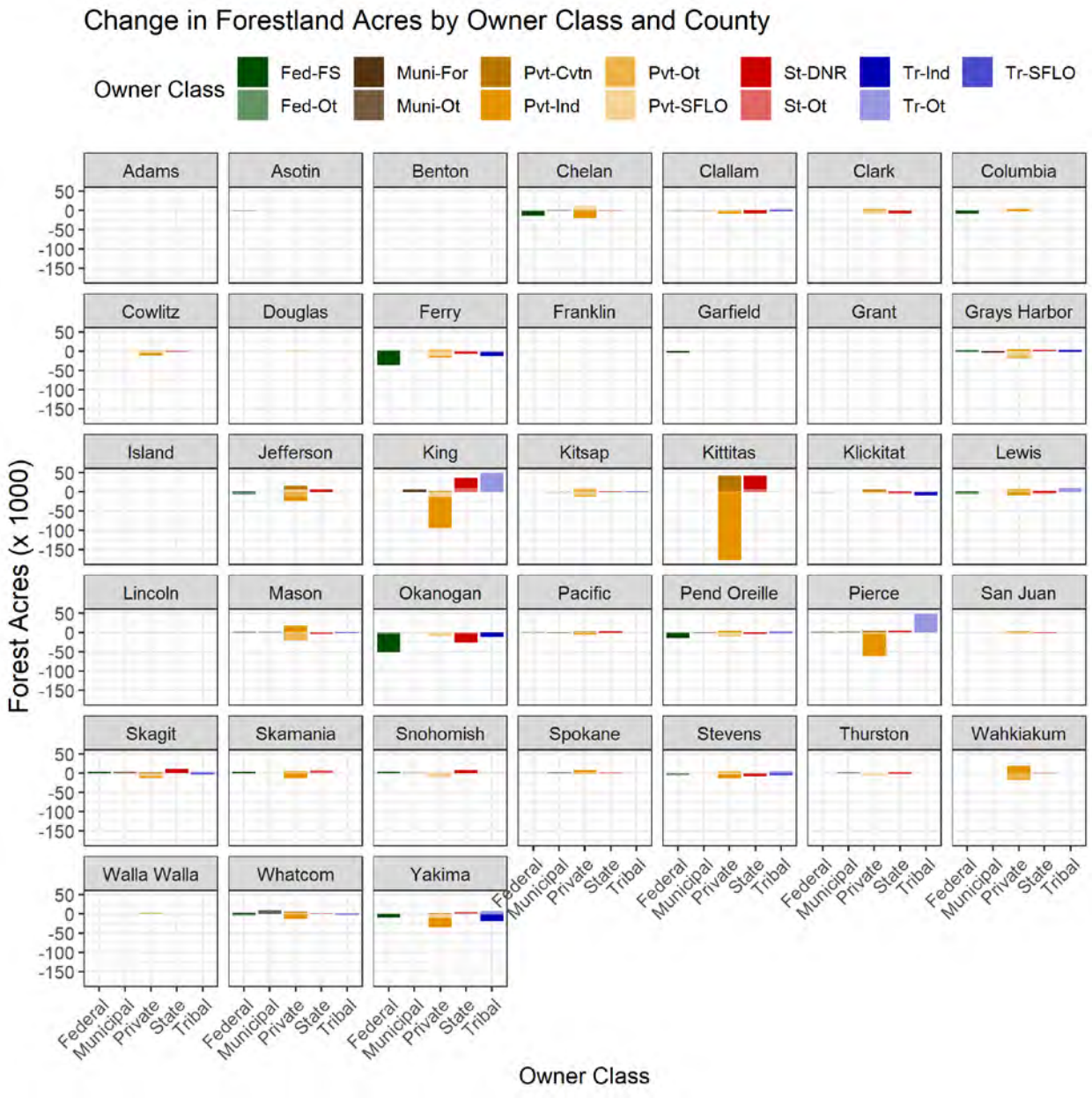

Figure 3. Change in Forestland From 2007 to 2019.

Private industry accounted for the largest change, losing 389,000 acres, with large declines occurring in Kittitas, King, and Pierce counties. Large land transactions can be identified with these changes. In Kittitas county, the establishment of the Teanaway Community Forest resulted in the sale of 50,000 acres of private industry forestland to the Department of Natural Resources in 2013 ("Teanaway Clears Way for First Community Forest" 2013). In 2014, The Nature Conservancy purchased 48,000 acres from Plum Creek to create the Central Cascade Forest ("Prized Cascade Forestland about Size of Tacoma to Be Preserved" 2014). The Tapash Sustainable Forest Collaborative purchased more than 25,000 acres of private forestland in Kittitas and Yakima counties ("Groups Help State Acquire Plum Creek Lands in Cascades | The Spokesman-Review").

Increases in Tribal acreage were related to decreases in private industry forestland in King and Pierce counties. The Muckleshoot Tribe purchased 96,000 acres of land from Hancock Natural Resource Group in 2013 ("Muckleshoots Buy Huge Forestland in 3 Counties" 2013). This purchase included forestland on either side of the King-Pierce county border. Sale of private industry forestland to small forest landowners also contributed to loss of industrial forestland. Statewide, 84,000 acres transitioned from private industry to SFLO.

Finally, large fires are a likely explanation for the decline in forest acres managed by the Forest Service in Okanogan and Ferry counties. The Okanogan Complex Fire (300,000 acres) and North Star Fire (218,000) burned in Okanogan and Ferry counties in 2015, one year prior to the Landsat imagery year used to develop the NLCD dataset used in this analysis.

5.1 Small Forest Landowners

5.1.1 Small Forest Landowner Definition

We defined Small Forest Landowner using a proxy for the definition in RCW 76.09.450 (harvesting no more than an average of 2 million board feet of timber per year) as timber harvest volumes by owner are not publicly available. Private and Tribal parcels not identified as industrial were eligible to be SFLO. We then estimated the number of acres an owner would need in management to meet the harvest level, based on average site productivity in Eastern and Western Washington. Threshold values were determined to be a maximum of 2500 acres in Western Washington and 9900 acres in Eastern Washington. Consistent with previous UW statistics and DNR Legislative Reports, the minimum size threshold to be considered SFLO was a 2-acre parcel with at least 1 acre of forest. More about how forestland ownership classes were developed can be found in Appendix C – 2019 Forestland Database Documentation.

5.1.2 Distribution of Small Forest Landowners in 2007

Forestland owned by SFLO was evenly distributed in area between Eastern and Western Washington. Stevens (17%), Spokane (7%), and Okanogan (6%) counties contained 30% of SFLO

forestland in both 2007 and 2019. Lewis county contained 5% of SFLO forestland, while all other counties contained less than 5%. In contrast to forestland area, a substantially larger share of parcels (71%) and owners (75%) were in Western Washington. Snohomish (8%), King (7%), Kitsap (7%), Pierce (7%), and Clark (5%) counties accounted for 34% of SFLO parcels. They accounted for 39% of owners. Spokane and Stevens counties each contained 7% of SFLO parcels. They contained 7% and 5% of owners, respectively. All other counties contain less than 5% of parcels and owners. Figure 4 shows the geographic distribution of SFLO parcels.

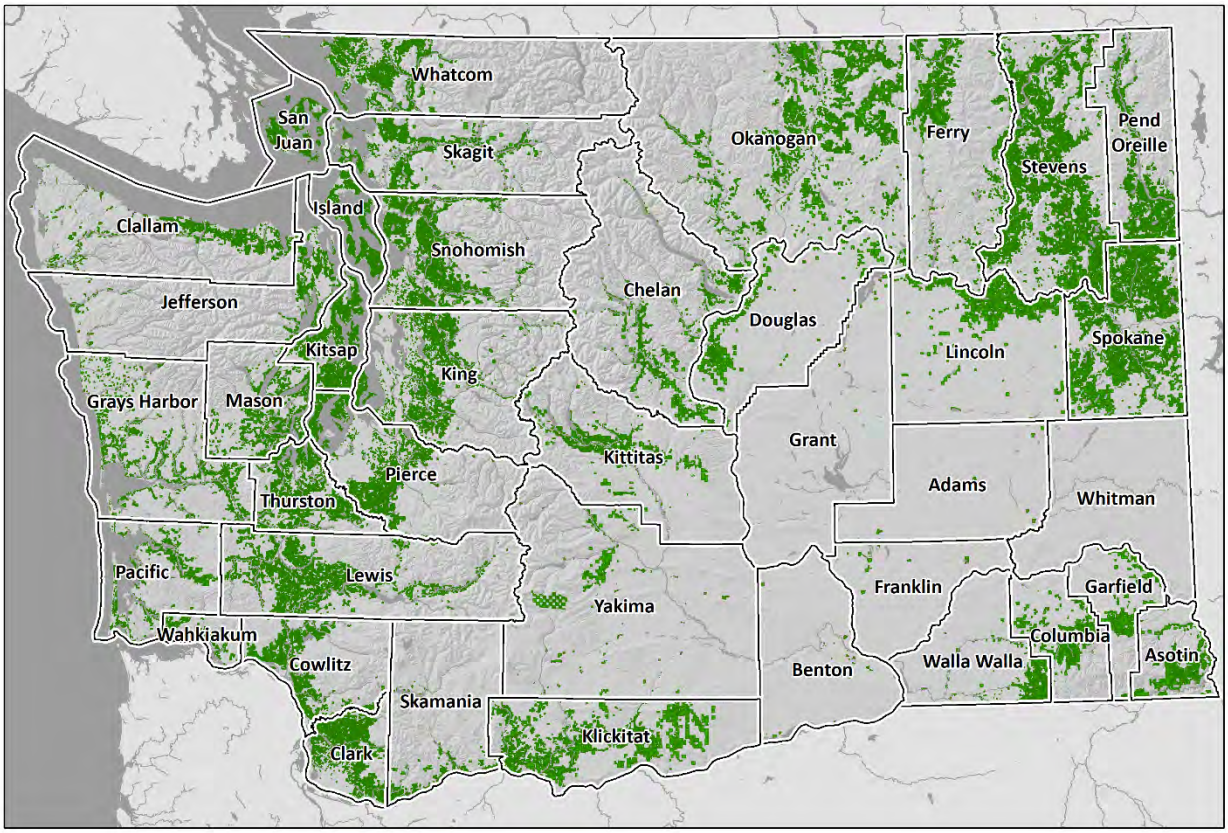

Figure 4. Distribution of SFLO parcels in Washington circa 2007.

Statewide, 77% of small forest landowners owned less than 20 acres in 2007. This group owned 22% of SFLO forestland. Small forest landowners who owned between 100 and 1000 acres accounted for the largest percent of forestland acreage (36%), followed by SFLO who owned between 20 and 100 acres (30%).

Figure 5 and Figure 6 show the distribution of SFLO parcel counts and forestland acres, respectively, by county and size class in 2007. Differences between Eastern and Western Washington counties were apparent. Most SFLO parcels and acres in Western Washington were in the smallest size class ('<20 acres'). In parts of Eastern Washington (Stevens, Okanogan, and Ferry counties), most parcels were in the '20-100 acres' size class while most forestland acres

were in the '100-1000 acres' size class. Spokane, Pend Oreille, and Chelan counties had the most parcels in the smallest size class ('<20 acres') and the most acres in the '100-1000 acres' size class. Parcelization was likely higher in these counties due to the cities of Spokane and Chelan. Similar differences between urban and rural counties can be identified in Western Washington. In more rural counties (Cowlitz, Grays Harbor, Lewis, Mason, and Pacific), most acres were from the '100-1000 acres' size class when compared to more urban counties (King, Snohomish, and Pierce).

By land use class, 43% of SFLO parcels and 71% of forest acres were classified as ForestOrNatural in 2007. Residential land use accounted for 47% of parcels (18% of forest acres). Eight percent of parcels (10% of forest acres) were Agriculture. In Western Washington, 54% of SFLO parcels were Residential and 40% were ForestOrNatural. In Eastern Washington, 21% of parcels were ForestOrNatural, followed by Residential (12%) and Agriculture (7%). By forest acres, ForestOrNatural comprised 68% and 74% of SFLO area in Western and Eastern Washington, respectively. Agriculture (16%) comprised a larger percentage of forests acres than Residential (9%) in Eastern Washington, while in Western Washington Residential (26%) was more common.

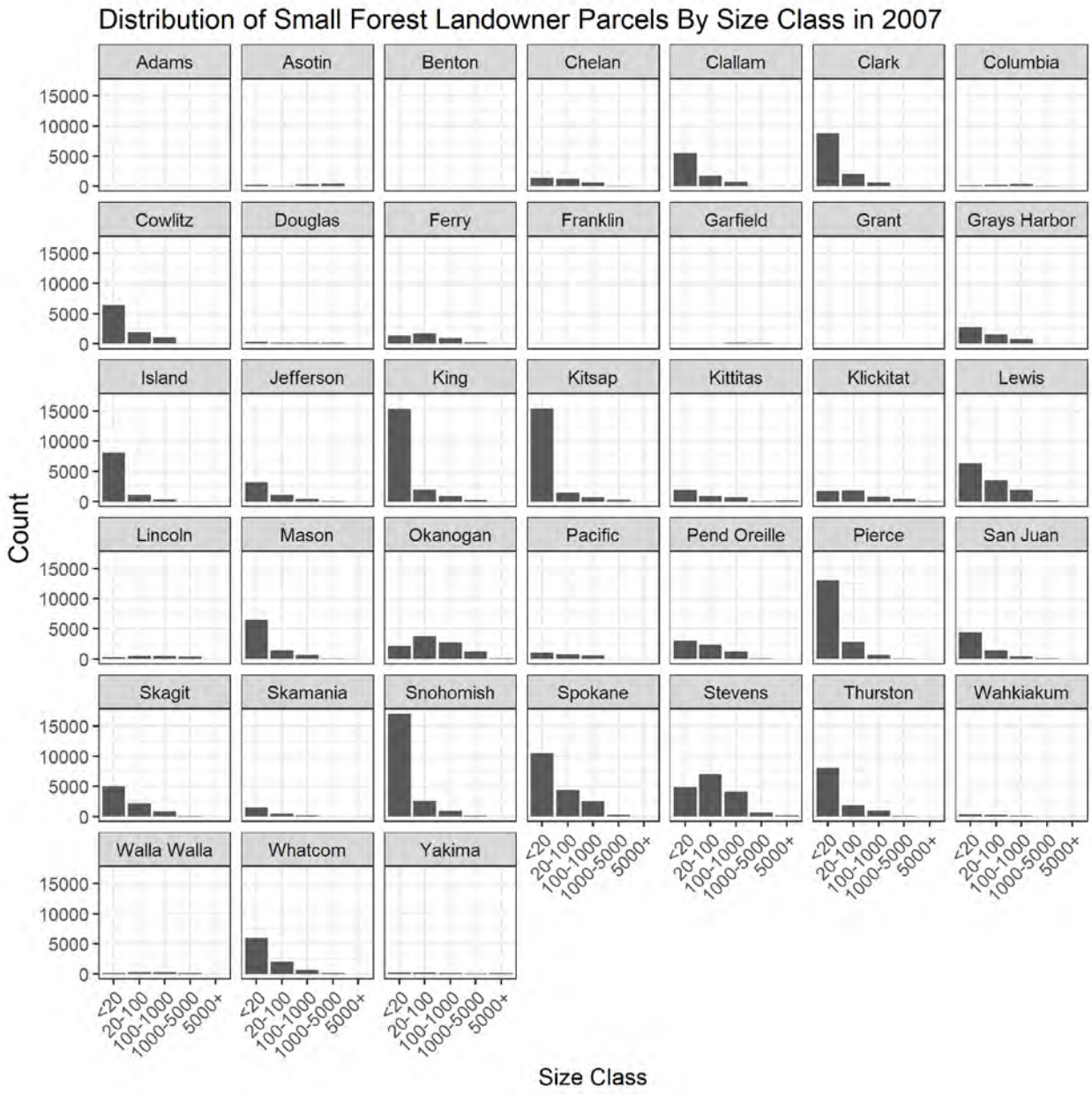

Figure 5. Distribution of Small Forest Landowner Parcels by Size Class in 2007.

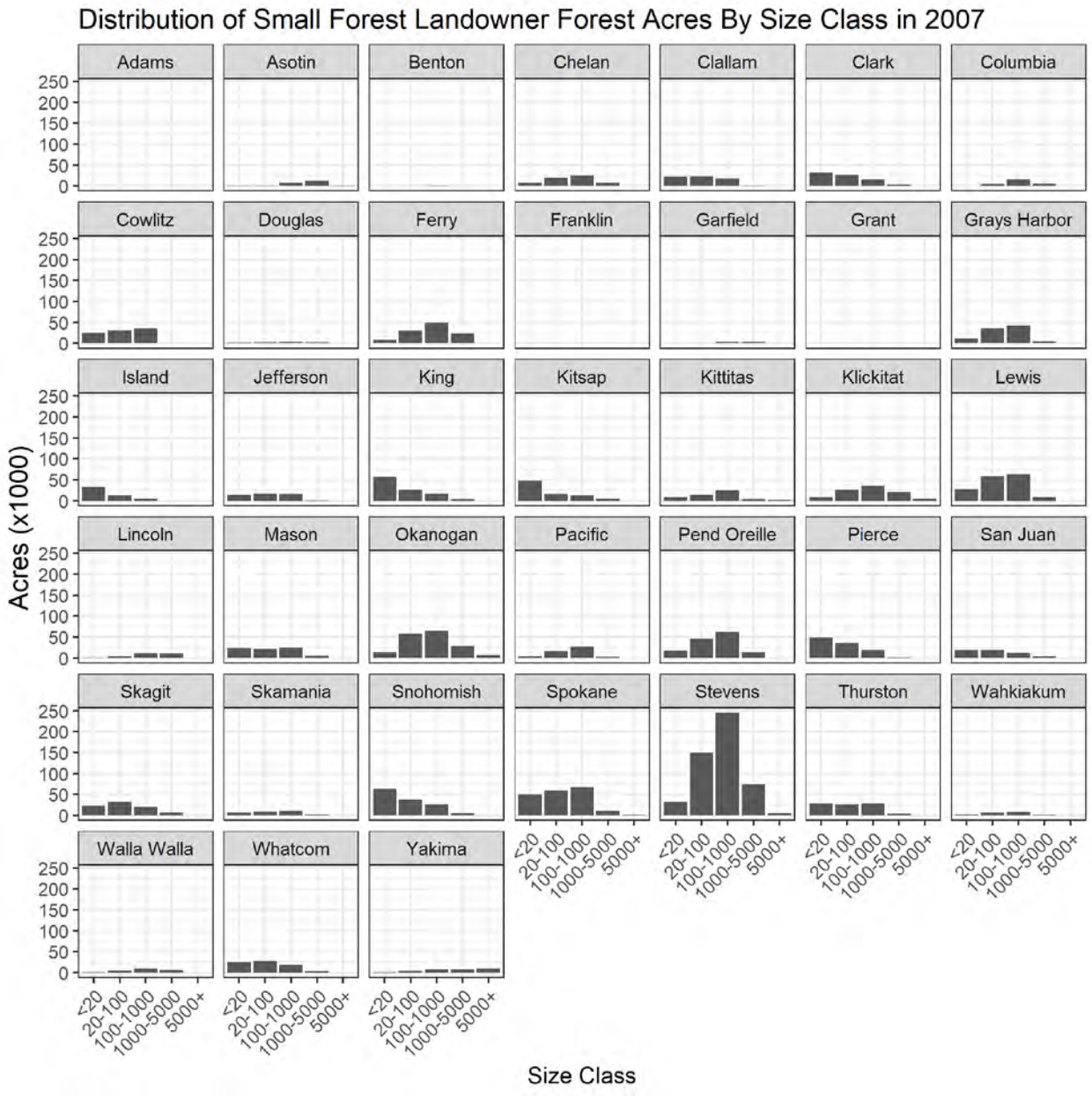

Figure 6. Distribution of Small Forest Landowner Forest Acres by Size Class in 2007.

5.2 Trends in SFLO Numbers

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(5)(b)(i) Have the number of small forestland owners increased or
decreased?

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The number of small forest landowners increased from 201,000 in 2007 to 218,000 (+17,000) in 2019, while the number of parcels increased from 256,500 to 261,800. The number of small forest landowners increased in 32 counties. The largest increases occurred in King (+6,000), Whatcom (+2,700), and Spokane counties (+1,300). Seven counties had fewer owners in 2019 than 2007, including Clark (-860) and Okanogan (-120) counties. By size class, the number of owners with 20 to 100 acres increased the most (+9,700). Statewide, the number of owners in each size class increased substantially (Table 2).

Table 2. Change in number of Small Forest Landowners between 2007 and 2019 by Size Class.

Size Class	Number of Owners 2007	Number of Owners 2019	Change
<20	155,305	158,438	3,133
20-100	36,926	46,605	9,679
100-1000	8,290	12,175	3,885
1000-5000	648	1,202	554
5000+	24	57	33
Total	200,895*	218,126*	17,231*

* Total owners statewide are less than the sum of classes as some parcels with multiple owners are duplicated in class counts.

Figure 7 shows the change in number of SFLO owners by size class and county. The increase in SFLO owners in King County is apparent. Other counties in Western Washington with development pressure such as Clark, Island, Kitsap, Pierce, and Snohomish counties declined in the smallest size class but increased in the next largest size classes. In Whatcom county, small forest landownership increased the most in the 20 to 100 acres size class. In Eastern Washington, most new SFLO owners were in Spokane and Stevens counties, with most owning 20 to 100 acres or 100 to 1000 acres.

Generally, the change in number of SFLO parcels by size class and county followed the same pattern as change in number of owners. Exceptions occurred in King, Spokane, and Whatcom counties. Those counties showed a substantial decrease in the number of parcels in the smallest size class despite an increase in the number of owners. In King County, for example, there were 830 fewer parcels for owners with less than 20 acres, but 3,400 new owners in the same size class. Statewide, the number of parcels owned by small forest landowners increased by 5,000 parcels.

The addition of family members to property titles occurred in some instances. Statewide, the number of parcels with multiple owners increased from 4,200 to 7,600. A sampling of these

parcel identified in some, but not all cases, the addition of owners in 2019 that shared a surname with owners in 2007. A complete review of the name data was beyond the scope of this study. The average number of owners per parcel increased from 1.04 to 1.10.

The number of small forest landowners cannot be broken out by land use class. Table 3 reports the number of parcels by land use class and changes between 2007 and 2019. The largest share of parcels was Residential land use, followed by ForestOrNatural. These classes each contain over 100,000 parcels, compared to 21,000 parcels in Agriculture. The number of small forest landowner parcels in Residential increased by 12,000 between 2007 and 2019. ForestOrNatural and Agriculture decreased by 4,000 and 2,100 parcels, respectively.

Table 3. Changes in the Number of Parcels by Land Use Class Between 2007 and 2019.

Land Use Class	Number of Parcels 2007	Number of Parcels 2019	Change
Agriculture	21,361	19,260	-2,101
Developed	1,663	1,727	64
ForestOrNatural	110,358	106,319	-4,039
None	1,385	620	-765
Other	2,102	2,052	-50
Residential	119,675	131,808	12,133
All Land Use Classes	256,544	261,786	5,242

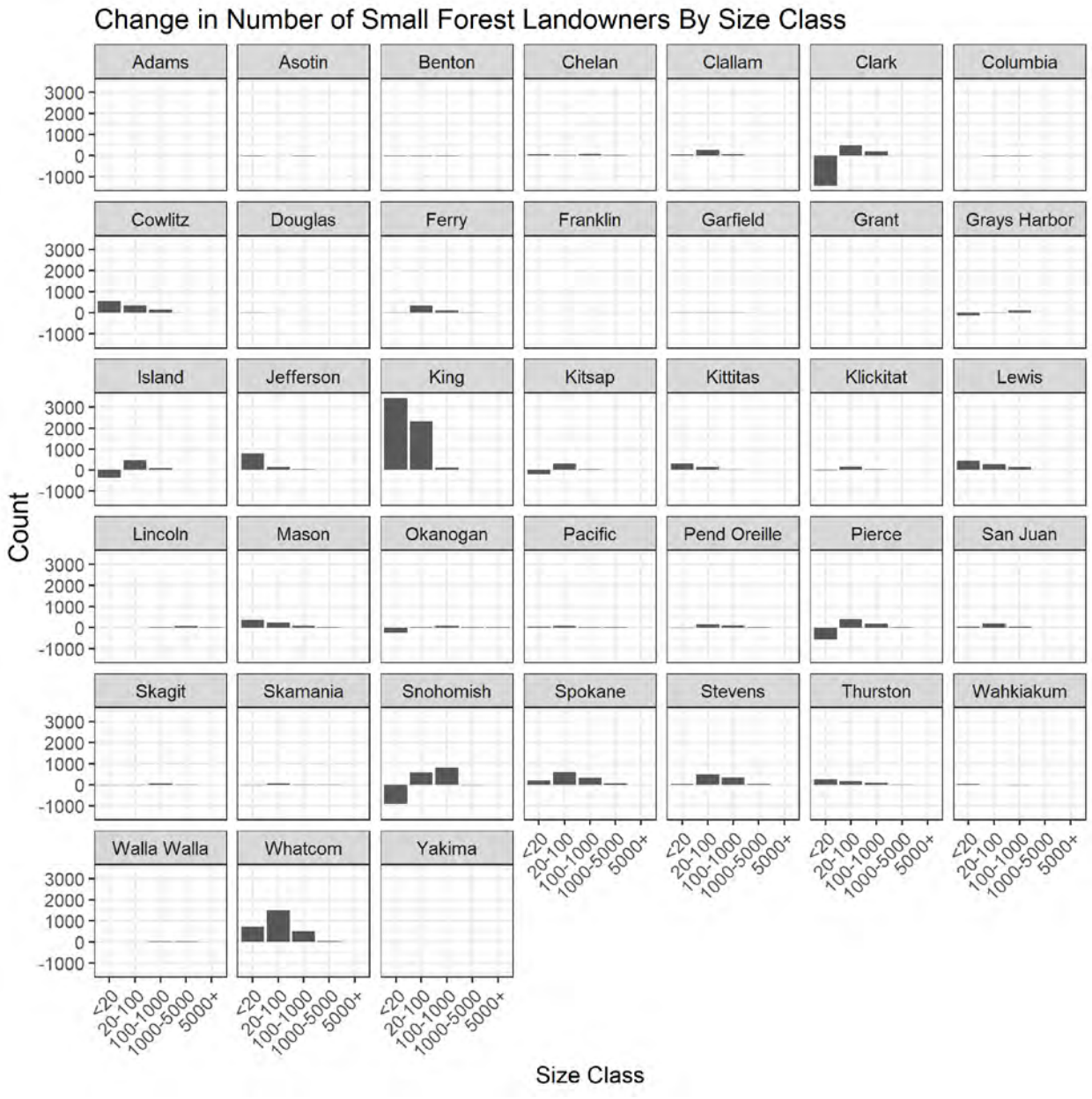

Figure 7. Change in the Number of Small Forest Landowners by Size Class.

5.3 SFLO Acreage Trends

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(5)(b)(ii)(A) Has the acreage held by small forestland owners
increased or decreased?

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The total parcel acreage owned by SFLO decreased from 5.04 million acres to 4.84 million acres (-209,500). Forestland decreased from 2.99 million acres to 2.88 million acres (-103,000), which is roughly twice the area of the City of Seattle. SFLO acreage declined in both Eastern and Western Washington, with decline in parcel area greater in Eastern Washington (-115,000 vs -94,000) while forestland loss was greater in Western Washington (-70,000 vs -33,000).

Between 2007 and 2019, acreage in the SFLO size class from 100 to 1000 acres declined by 60,000 acres. The two smallest owner size classes declined by approximately 28,000 acres. In contrast, forest acres in the two largest size classes increased by 13,500 acres (Table 4).

Table 4. Change in Small Forest Landowner Forest Acres by Owner Size Class and County.

Size Class	Forest Acres 2007	Forest Acres 2019	Change
<20	666,847	638,256	-28,591
20-100	907,128	878,907	-28,221
100-1000	1,071,265	1,011,229	-60,036
1000-5000	310,608	316,317	5,709
5000+	31,590	39,409	7,819
All Classes	2,987,438	2,884,118	-103,320

Figure 8 shows the change in SFLO forest acres by owner size class and county. Large declines occurred in Ferry County in the 100 to 1000 acres and 1000 to 5000 acres size classes; in Greys Harbor in the 20 to 100 acres size class; in King County across the three smallest size classes; in Stevens County in the 100 to 1000 acres size class; and in Yakima County in the 5000+ acres size class. Forest acres increased in Chelan and Stevens counties in the two largest size classes.

By land use class, over 121,000 forest acres from the ForestOrNatural land used class was lost by 2019. Forest acres from the Agriculture land use class declined by 21,000 acres, while Residential increased by over 48,000 acres. Figure 8 reports the change in forest acres owned by small forest landowners by land use class.

Table 5. Change in Forest Acres Owned by Small Forest Landowners by Land Use Class.

Land Use Class	Forest Acres 2007	Forest Acres 2019	Change
Agriculture	291,234	269,739	-21,495
Developed	13,173	12,448	-726
ForestOrNatural	2,112,577	1,991,064	-121,513

None	12,669	7,707	-4,962
Other	34,164	31,113	-3,051
Residential	523,622	572,263	48,641
All Land Use Classes	2,987,439	2,884,334	-103,106

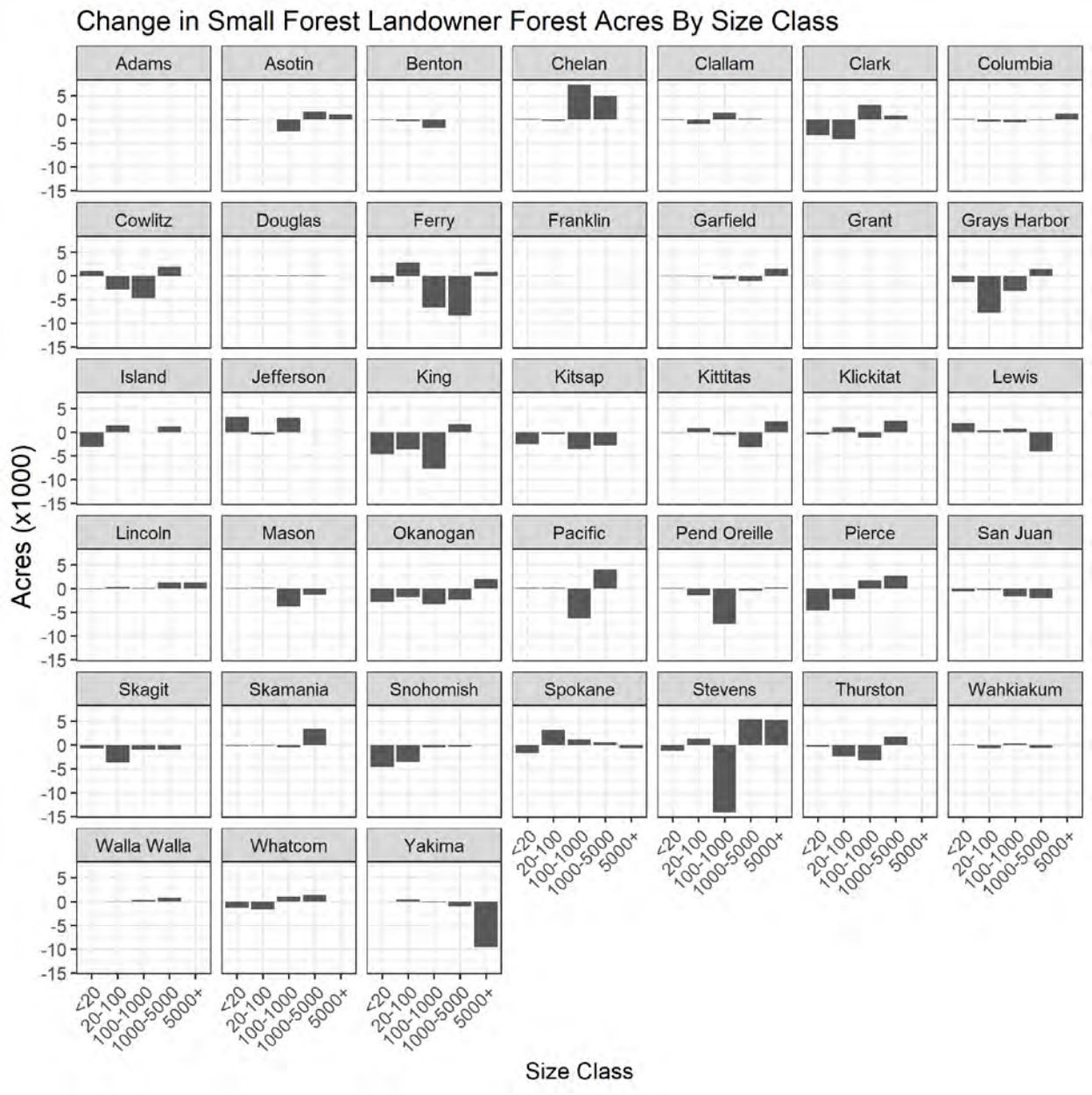

Figure 8. Change in Small Forest Landowner Forest Acres by SIze Class and County.

5.4 SFLO Land Transitions

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(5)(b)(ii)(B) Of the land no longer owned by small forestland
owners, what percentage was converted to nonforest use, became
industrial forestland, trust land, or some other use?

...
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We tracked the destination of parcels transitioning out of small forest landownership by owner class, size class, and land use class. Results are reported in and based on parcel acres to reflect how parcels were linked between the two time periods. While the total acreage owned by small forest landowners declined by 209,500, this represents a net change. Between 2007 and 2019, approximately 450,000 acres left the SFLO class while 238,000 acres transitioned into small forest landownership. Areas reported in this section can vary slightly from those reported above. They are useful for estimating change between classes but are considered less accurate for calculating change for a single class. Figure 9, Figure 10 and Figure 11 provide an accounting of acreage into and out of the SFLO class.

Thirty-two percent (144,000 acres) of acreage transitioning out of SFLO was not forested in 2019. By land use class, most acres were zoned Agriculture (65,000 acres) in 2019, followed by ForestOrNatural (36,000 acres), and Residential (34,000). Only 18% of acres were classified in the two largest owner size classes. Sixty-seven percent of acres moving out of SFLO remained forested, with Private Industry the largest destination owner class. The majority of these acres were in the ForestOrNatural land use class and from the two largest size classes.

The plurality of acres transitioning into SFLO were Private Industry and forested in 2007. These parcels were most commonly zoned ForestOrNatural and from larger owner size classes in 2007. In total, 178,000 acres that transitioned into SFLO were forested. Parcels not forested in 2007 contributed 59,000 acres to SFLO. These were classified Private Other and were mostly from the three smallest size classes. The most common land use class was Agriculture, followed by Residential, then ForestOrNatural.

Differences in total acres, land use class, and size class composition summarize the changes in small forest landownership. The proportion of small forest landowner parcels zoned for Residential and Agriculture land uses increased, while ForestOrNatural decreased. Parcels held by individuals owning more than 1000 acres increased. Acreage in the three smallest owner size classes decreased. The total acreage held by small forest landowners declined by over 200,000 acres, representing parcels moving both into and out of small forest landownership.

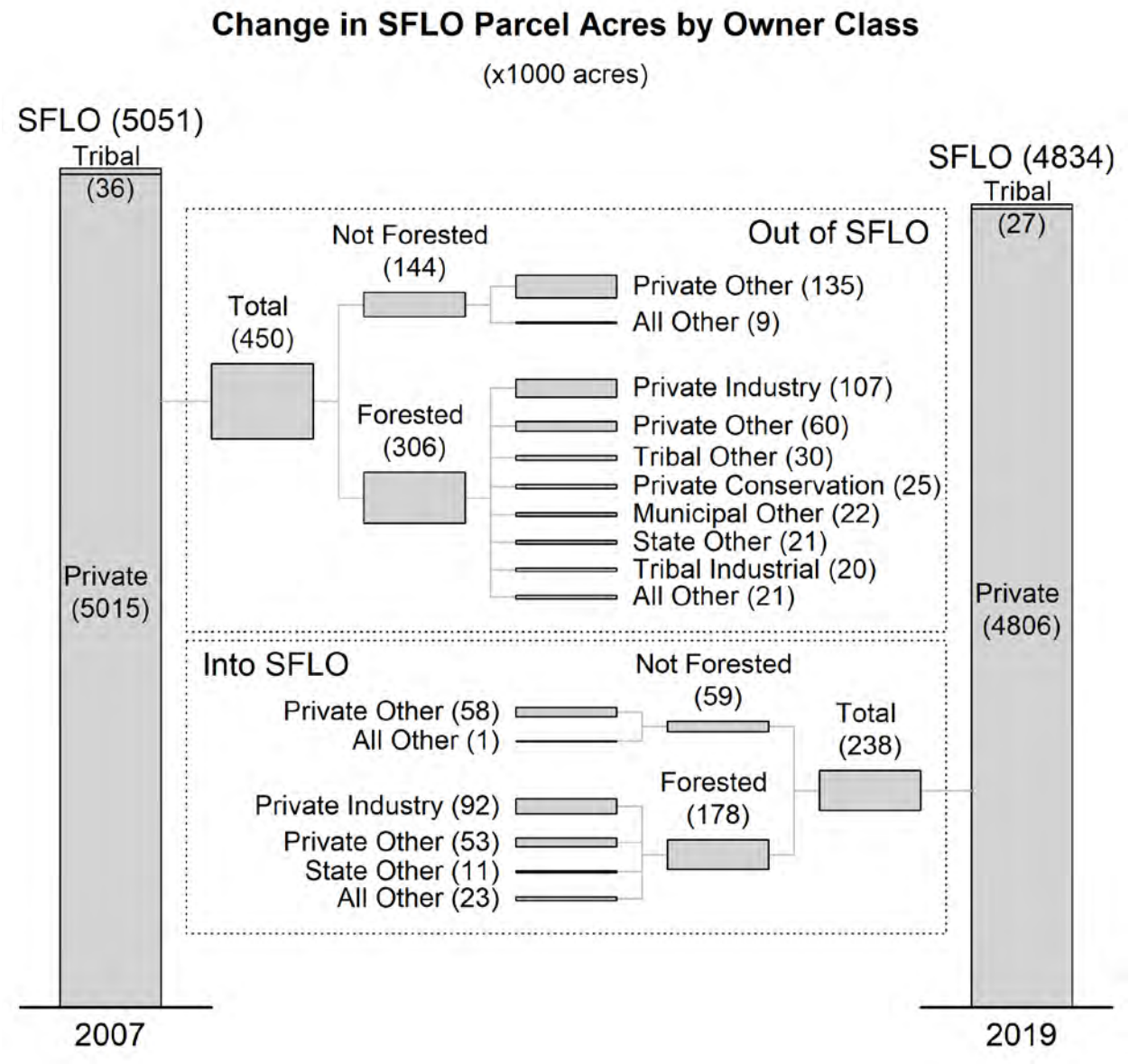

Figure 9. Change in Small Forest Landowner Parcel Acres by Owner Class from 2007 to 2019.

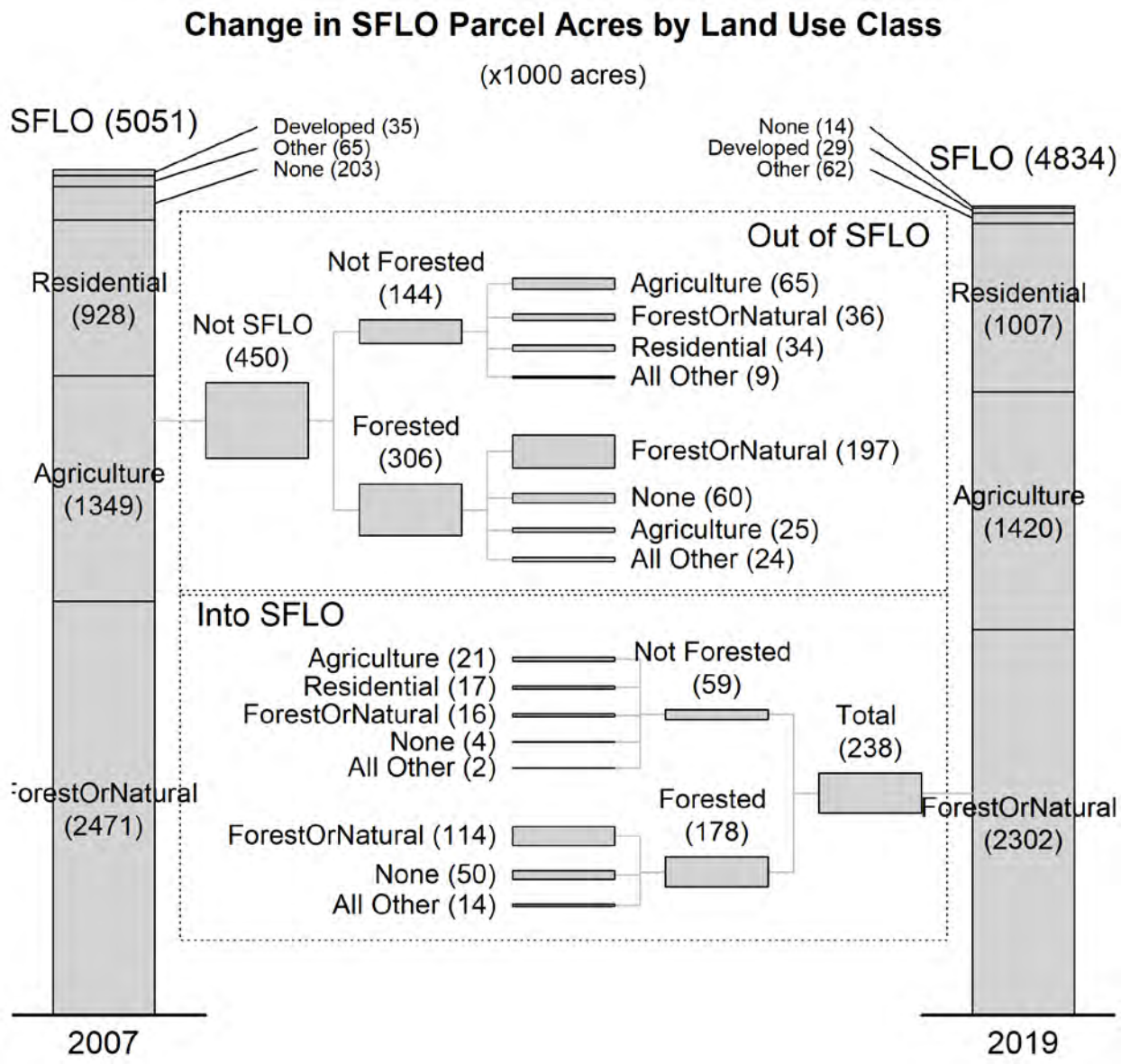

Figure 10. Change in Small Forest Landowner Parcel Acres by Land Use Class from 2007 to 2019.

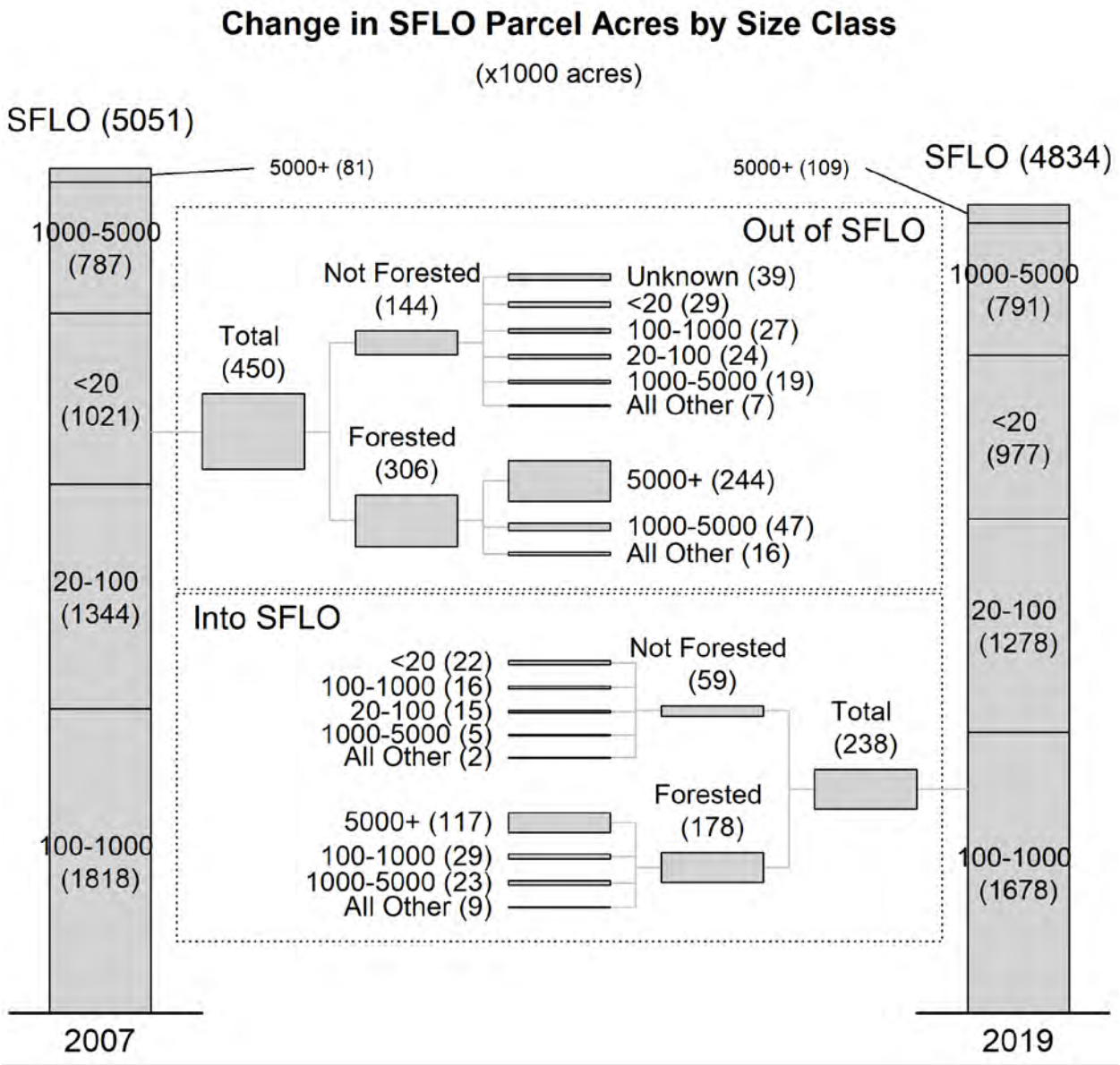

Figure 11. Change in Small Forest Landowner Parcel Acres by Size Class from 2007 to 2019.

As evident from above analysis, land use, land cover, and ownership dynamics are quite multi-faceted and complex in Washington State. SFLO lands are a similarly complex mix of land uses, tax designations, and forest cover. In the subsequent analyses, we aim to be explicit about which aspect of SFLOs and their lands we refer to. The main questions in the Bill refer to changes from SFLO state to other states, as well as refer to land devoted to forestry and open space uses (for instance, we highlight that almost 6% of SFLO-held forested acres devoted to forestry or open space uses were lost to other uses by 2019), and our analysis reflects such focus.

6 Other Pertinent Data Sources

(5)(c)(i) The school of environmental and forest sciences at the University of Washington, using the data from the trends analysis and other **pertinent information**…

...

6.1 Unofficial National Woodland Owner Survey Data 2018/2019 (NWOS)

We present some analyses using unofficial results from the 2018 USDA Forest Service's National Woodland Owner Survey (NWOS) along with a similar "intensification survey" also administered by the USDA Forest Service in 2019. The NWOS is a component of the USDA Forest Service's Forest Inventory and Analysis program and can be described as an area-based survey design. The details of how the NWOS is designed and administered can be found in Butler et al. (2020), although these data are not official data. In short summary, the probability of any given private forest owner being included in the sample frame of the NWOS is proportional to the size of his/her forest holdings. Analysis conducted using the NWOS is roughly representative of Small Forest Lands by *acreage* (in contrast to being representative of *the population of all Small Forest Land Ownerships*). A total of 183 private forest ownerships in the State of Washington

responded to the NWOS. This survey can be thought of as the "original Washington State NWOS".

The intensification survey was conducted after the standard NWOS and used the same sampling method as the standard NWOS. Ownerships that had been included in the sampling frame of the standard NWOS were excluded from sampling for the intensification survey. The content of the intensification survey is similar to the standard NWOS, but not all of the questions are the same between the two different versions. The following results use questions that were included in both surveys so that we can combine respondent answers from both surveys and treat them as if they were one survey. A total of 139 private forest ownerships in the State of Washington responded to the intensification survey. For the remainder of the analysis in this report, we will refer to the combined survey data from the "original Washington State NWOS" and the "intensification Washington State NWOS" as the Washington State respondents to the National Woodland Owner Survey (NWOS).

We use these unofficial NWOS data for two main purposes in this report. The first purpose is to describe the ownership objectives of Washington State Small Forest Land Owners. In the course of our interactions with various stakeholders, numerous individuals expressed strong interest in better understanding the objectives and needs of Small Forest Land Owners. Understanding SFLO objectives and needs is critical for understanding the trends in the data and for better policies and programs which support the continuing stewardship of their lands. We address this need by analyzing how respondents answered a series of 13 questions in a section titled "Your Reasons for Owning Wooded Land" in the NWOS. Using the most common statistical method to describe forest ownership objectives in the academic literature, we group respondents into five types of owners based on their objectives.

The second purpose of using NWOS data in this report is to explore patterns in prospective forest land sales or forest land transfers. The SB5330 report asks for an analysis of "why ownerships sold their lands" and the report answers that question based on the theory and available data but we use the NWOS data to explore *prospective trends* in what kinds of forest ownerships seem like they will sell or transfer their properties in the near future. As the focus of the prospective sales and transfers analysis, we use questions concerning how likely respondents are to sell or transfer their forest lands in the next 5 years and their interest in selling their forest lands if offered a good price.

6.2 Survey of the General Population of Washington State SFLOs ("GP Survey").

One of the surveys we conducted in 2020 specifically for this report selected recipients among the population of Washington State SFLOs from the Forestland Database, which we call the general population, or GP survey. The GP survey was created to help answer some of the

questions relevant to all small forest land and provide a baseline for comparison with SFLOs who own riparian forest land.

The design of the GP survey can be described as a stratified random sample with two strata based on total forest acreage holdings of Washington State SFLOs. Within each strata, respondents have an equal probability of being sampled, but the probability of sampling differs across strata. One strata consists of SFLOs who own 20 acres of less of total forestland. The other strata consists of SFLOs who own more than 20 total acres of forestland. Survey stratification is done for various reasons, including lowering sample variance and increasing the precision of statistical estimates (Καρατάσου and Karatassou, n.d.). In the case of the GP survey, we stratified to ensure a sufficient number of SFLOs with forest properties large enough for forestry to be a viable land use option were included in the survey. This is not to say that owners with smaller acreage are unimportant, but simply that such ownerships may face very different possibilities and constraints regarding the management and preservation of their forested land.[2]

According to the 2019 Forestland Database, the state has a total of 272,291 small forest land ownerships, of which 237,397 own less than 20 total forest land acres. Note that the survey used a slightly different definition for SFLO, specifying a 1-acre parcel with at least 1/2 acre of forest as compared to the 2/1 definition used in the census and trends reporting. This change of SFLO definition was necessary to increase the sample size in some of the survey strata related to FREP and FFFPP.

In our stratification, SFLOs with less than 20 total acres of forestland received 25% of all surveys, while they are about 87% of all Washington State SFLOs. Conversely, SFLOs with more than 20 acres of forestland received 75% of all surveys, while they are about 13% of the SFLO population. We compute sample design weights to use the general population to infer to the population of all Washington State SFLOs for selected questions. The survey weights compensate for the over-sampling of SFLOs with larger forest acreage, with weights being inversely proportional to a respondent's probability of being included in the sample (Cochran 1977). Sample design weights are calculated by first computing the sampling fraction for each strata (h) as follows

$$f_h = \frac{n_h}{N_h}$$

with N_h representing the population of a given strata, n_h representing the number of respondents in the sample from the respective strata. Since we use a one-stage sample design in which respondents belong to only one strata, the design weights are the same for all

[2] For example, it is common for some analysis of the National Woodland Owner Survey to exclude ownerships having less than 10 acres (e.g. Butler et al 2016).

individuals in strata h. Sample design weights are the inverse of the sampling fraction of each strata, as follows.

$$w_h = \frac{1}{f_h}$$

The GP survey was constructed following recommendations for best practices in survey methodology, called the Tailored Design Method (Dillman, Smyth, and Christian 2014). When possible, questions and answer formats from established landowner surveys, such as the NWOS, were used to inform the construction of survey questions. We also modified various questions from a 2016 survey conducted in selected New England states that was focused on the topic of forest legacy. We thank Paul Catanzaro and Marla Markowski-Lindsay of the Family Forest Research Center for sharing the text of the 2016 New England survey as well as their advice on survey design.

The GP survey went through numerous rounds of revision with the help of subject experts within the University of Washington, as well as stakeholders, including personnel from the Washington State Department of Natural Resources. In the final stages of pre-testing, cognitive interviews were conducted with SFLO volunteers in which one of the report's authors listened to the questions and concerns of those taking the survey to improve the clarity and construction of the survey. Early in the survey design phase, the University of Washington's Human Subjects Division reviewed the two proposed surveys and interview topics (IRB ID STUDY00009519). The project was assessed to pose minimal potential risk to those who choose to participate in the study and the human subjects aspects of the SB5330 work was granted "exempt status (Category 2)."

In effort to increase total responses while managing costs, we conducted a pilot survey to test a mixed-modal response format relative to a paper survey-only format. The mixed-modal survey format we tested is called a "web-first" format in which respondents receive an invitation to participate in an online version of the survey in their invitation letter with an explanation that they would also receive a paper survey in a subsequent mailing. Indications from the literature on survey methodology are that this method will likely result in somewhat lower response rate, but the exact difference in response rates compared to a paper-only survey design is likely to vary (Dillman, Smyth, and Christian 2014).

In the pilot survey, 150 SFLOs were selected using the sampling technique described above, with 75 ownerships being assigned to the web-first treatment and 75 being assigned to the paper-only treatment. Respondents in the two treatments were balanced based on total forest ownership size and location of forest holdings in the eastern and western half of the state. The response rate to the web-first treatment was slightly less than 15% while the response rate to the paper-only treatment was 29%. Given the substantial expected reduction in response rates using the web-first design, it was decided that a paper-only survey response mode should be

used to maximize response rates and reduce the influence of various forms of non-response bias. The pilot survey also allowed us to pre-test the Willingness-to-Accept bid offers described below.

One of the questions in the GP survey asked respondents about the per-acre payment they would require to permanently preserve all or part of their forestland in forestry use. The construction of this question was taken from the "stated preferences" economic literature on non-market valuation used to measure Willingness-to-Accept (Haab and McConnell 2003). In this case we wanted to measure the minimum amount of per-acre payment that SFLOs would accept to sell the development rights to their forestland. The question is posed as a binary referendum describing the terms and conditions of what is generally called a conservation easement, with one of the terms being a one-time, per-acre payment, and presenting respondents with Yes/No response categories. Only the per-acre payment varied in the surveys sent to respondents, with all other conditions remaining the same for all respondents. This form of valuation question is one of the earliest forms of stated preferences techniques (Train 2009) and was chosen because it is relatively straightforward for respondents to answer compared to alternatives. We also selected this question format because of its similarity to the survey conducted in selected New England states in 2016.

To select the range of monetary per-acre payments, we used a range of values from $250-$7,000 in the pilot survey and $1,000-$10,000 in the full survey. We used a uniform bid design (Kim and Haab 2004) in which the true Willingness-to-Accept distribution is assumed to exist strictly within a given range and the probability density is uniform across the range (i.e. a uniform distribution). The per-acre payment offers (or bids) were in $50 increments between the lower and upper bounds from the payment ranges explained in previous sentences and were sampled, with replacement, with equal probability from within the range of possible payment amounts. Published literature on private forest owner Willingness-to-Accept for conservation easements tend to suggest different ranges of payment amounts needed to convince owners to accept an easement, from well below $1,000 per acre in Rabotyagov and Lin (2013b), to $2,000 per acre in Kelly et al (2016). Standard practice, however, is to compensate landowners based on a percentage of the market value that their forestland may be worth if sold for residential or other developed use. We therefore included per-acre payment amounts substantially higher than what is sometimes offered due to the high prices that some Washington State SFLOs can receive for the sale of their forestland. About 50% of respondents to the pilot survey answered "Yes" to the Willingness-to-Accept question, indicating the range of values presented to respondents was appropriate.

Both the GP survey and the FF survey (described below) involved three rounds of mailings for each survey respondent. The structure and sequence of the mailings is modified from the sequence of mail contacts recommended in the Tailored Design Method (Dillman, Smyth, and Christian 2014). The first mailing was a letter notifying recipients that they would receive a

survey in about five days and explained the topics that the survey would cover. The second mailing included a paper copy of the survey and a letter explaining in more detail the purpose of the survey along with an assurance to respondents that their individual responses would be kept strictly confidential. About 10 days after the second mailing, a third letter was sent to respondents with a duplicate copy of the survey and another letter thanking respondents who had already responded and requesting a reply from those who had not yet responded. In short, multiple mailings increase response rates and help reduce non-response bias.

For the GP survey, a total of 3,000 SFLOs were selected to receive survey materials via postal mail. The first of the three waves of mailings were sent out on June 11th. In order to allow enough time to run all necessary analysis, we only considered responses that were received on or before September 2nd for the results in this report. By September 2, 2020, 758 surveys had been returned with 21 surveys being completely or mostly blank. With 737 usable surveys and no surveys being returned as undeliverable, the time-truncated GP survey results in this report has a cooperation/response rate of 24.6%. To put the response rate is context, the overall cooperation rate of the 2018 NWOS was 39.7%, which varied between over 60% in some states to less than 30% in others (B. J. Butler et al. 2020). A comparable survey of SFLOs conducted in the State of Washington in 2009 yielded a 15% response rate (Rozance and Rabotyagov 2014). Considering response rates to comparable surveys, the fact that this survey was conducted during the global health crisis of summer 2020, and the cooperation rate to the pilot survey, the cooperation rate to the GP survey is within reasonable expectations.

6.3 Survey of Washington State SFLOs With Riparian Forests ("FF Survey")

A second survey was conducted in 2020 to explore questions relevant to SFLOs who are most likely to have experience with the regulations, forest practices applications, and programs concerning the State's riparian forest regulations. Since this survey intended to reach Washington State SFLOs who have likely interacted with the State's Forests and Fish regulations, we call the second survey the "Forests and Fish survey", abbreviated "FF survey." The sample frame for this survey was designed to include SFLOs who meet at least one of four criteria, with three of the criteria being non-mutually exclusive. Using the Forestland Database, owners of land parcels on the "FREP list" (i.e. land parcels with a paid easement, those on the waiting list for payment, those that received an offer of payment but declined, and any combination of such status), owners of land parcels on the "FFFPP list" (i.e. land parcels with a completed fish passage project and/or on the waiting list), and owners with an Alternate Harvest Plan on file were all considered as ownerships with direct experience with the policy instruments named in SB5330.

We also included a control group in the FF survey sample frame to identify ownerships who may be eligible for FREP, FFFPP, and Alternate Plans but, for whatever reason, have not participated in any of the three. The control group was drawn from the Forestland Database and includes owners of land parcels who: meet the criteria of being a SFLO, have submitted an application for commercial thinning or final felling in the past 10 years (for either even-aged or continuous cover forest stands), have at least some forestland in a riparian buffer from a "fish stream" (type "F" or "S" stream), and do not meet any of the criteria described in the previous paragraph. While it is not unusual for survey samples to draw from participants in various landowner assistance programs or voluntary compensation programs (e.g. Farmer et al. 2015), to the authors' knowledge the sample frame used for the FF survey is unique in terms of how many criteria are applied to select survey recipients.

The FF survey sample selection criteria resulted in 402 ownerships from the "FREP list," 800 ownerships from the "FFFPP list," 516 ownerships with an Alternate Harvest Plan on file, and 877 ownerships meeting the mutually exclusive criteria for the control group. Applying the criteria described in the previous sentence resulted in roughly 2,400 total ownerships with unique addresses. From the 2,400 ownerships, we randomly selected 1,750 ownerships (73% of the estimated population for whom the Forests and Fish regulations are relevant) to receive the three waves of survey mailings for the FF survey. We draw attention to the relatively high percentage of SFLOs *estimated to be eligible for* FREP, FFFPP, and Alternate Plans who were given the opportunity to respond to the survey (almost 3 out of every 4 owners). For purposes of keeping statistical inference as straightforward as possible, the sample frames of the GP survey and the FF survey were allowed to overlap. In other words, SFLOs could have possible received both surveys, although few ownerships actually did.

The FF survey went through numerous rounds of revision, using mostly the same process as was used for construction of the GP survey. As with the GP survey, stakeholders, including those from various Washington State government agencies were consulted. In addition, extensive focus group meetings were conducted (over Zoom) with SFLOs who had extensive subject matter experience. As mentioned in the previous section, the FF survey was conducted after going through the University of Washington's Human Subjects Division review process.

The structure of the FF survey mailings was the same as the GP survey, using three waves of mailings and each recipient being sent two copies of the survey. The defined population for the FF survey is substantially smaller than the total amount of Washington State SFLOs. Given the smaller population of interest for the FF survey, a total of 1750 SFLOs were selected to receive survey materials via postal mail. The first of the three waves of mailings were sent out on June 17th. As with the GP survey, the analysis in this report only considers responses that were received on or before September 2, 2020 to allow time for analysis to be completed. By September 2, 2020, 447 surveys had been returned with 2 of them being blank or mostly blank. With 445 usable surveys and none being returned as undeliverable, the time-truncated FF survey results in this report has a cooperation rate of 25.4%. Although the sample frame of the FF survey is substantially different from the GP survey, the cooperation rates of the two are similar and within reasonable expectations.

7 Brief Overview of the Forests and Fish regulations

In 1999, the Washington State Legislature passed Engrossed Substitute House Bill 2091 (ESHB 2091) following the Forests and Fish Report, published the same year. The Forests and Fish Report was authored by the United States Fish and Wildlife Service, the National Oceanic and Atmospheric Administration, the United States Environmental Protection Agency Region 10, The Office of the Governor of the State of Washington, the Washington State Department of Natural Resources, the Washington State Department of Fish and Wildlife, the Washington State Department of Ecology, the Tribes, the Washington State Association of Counties, the Washington Forest Protection Association, and the Washington Farm Forestry Association (FFR 1999). The purpose of the Forests and Fish Report was to have the authors work together to create "biologically sound and economically practical solutions that will improve and protect riparian habitat on non-federal forest lands" in Washington State (FFR 1999). This involved four goals:

1. To provide compliance with the Endangered Species Act for aquatic and riparian-dependent species on non-federal forest lands;
2. To restore and maintain riparian habitat on non-federal forest lands to support a harvestable supply of fish;

3. To meet the requirements of the Clean Water Act for water quality on non-federal forest lands; and
4. To keep the timber industry economically viable.

The Forests and Fish Report acknowledged that the suggested rules and alterations of current rules would result in economic burden on forest landowners and the different landowners may experience the economic hardship disproportionately (FFR 1999). Thus, the Forests and Fish Report included the suggested creation of alternate plans and a compensation mechanism to alleviate this economic burden (FFR 1999).

The passage of ESHB 2091 authorized the Forest Practices Board to adopt an emergency rule until permanent rules could be made, or until June 30, 2001, whichever was sooner, regarding the Forests and Fish Report. ESHB 2091 highly encouraged the Forest Practices Board to include the Forests and Fish Report's recommendations. After adopting the permanent rules, the Forest Practices Board mandated to incorporate the scientifically-based adaptive management process as described in the Forests and Fish Report to determine rule effectiveness in salmon recovery.

ESHB 2091 also established the Small Forest Landowner Office, within the Department of Natural Resources, charged with being "a resources and focal point for small forest landowner concerns and policies" and having "significant expertise regarding the management of small forest holdings, governmental programs applicable to such holdings, and the forestry riparian easement program [FREP]." Additionally, the SFLO Office was charged with administering FREP and contract cruising for FREP easements. The SFLO Office would also assist landowners with alternate plans and help in the creation of these plans, along with monitoring the effect of alternate plans on the landscape. Along with the SFLO Office, came the establishment of an advisory committee, the Small Forest Landowner Advisory Committee, to assist the SFLO Office "in developing policy and recommending rules to the forest practices board." The final charge of the SFLO Office was to provide reports to the legislature and the Forest Practices Board regarding the demographics of SFLOs, trends in SFLO data, and any recommendations regarding SFLOs.

The Forestry Riparian Easement Program (FREP) was established in ESHB 2091 as a 50-year easement, held by DNR unless transferred to another state agency, unless it is deemed in the best interest of the state to terminate an easement early. The SFLO Office, with the establishment of FREP, would determine compensation to the landowner and the volume of qualifying timber for eligible easements applicants. However, ESHB stipulated that, "subject to available funding," the offered compensation would be fifty percent of the SFLO Office determination of value unless the regulatory impact is considered greater than average for a qualifying landowner, in which case the compensation could be increased up to one hundred percent.

The 20-Acre Exemption was also established. The 20-Acre Exemption would allow forest landowners of twenty contiguous acres or less, with less than a total of eighty acres ownership in the state, to receive less than mandated regulations when managing within the riparian buffer zones.

The SFLO Office, apart from the 20-Acre-Exemption Rule, would work with landowners to create alternate plans for the riparian buffers. Alternate plans would meet the riparian functions "while requiring less costly regulatory prescriptions" or be used to further "meet riparian function."

Finally, ESHB 2091 made amendments to the DFL and Open Space tax programs, regarding designations and dealings with FREP.

Chapter 222 of the Washington Administrative Codes are the Forest Practices for Washington State. Described below is the riparian management zone and associated buffers according to WAC 222 and DNR's Illustrated Forest Practices.

There are four categories of water types: S, F, Np, and Ns.

1. Water Type S: Type S waters are shorelines of the state as defined in RCW 90.58.030.
2. Water Type F: Type F waters are waterbodies or streams that are fish bearing or meet the criteria to potentially be fish bearing. These waters can be seasonal or perennial.
3. Water Type Np: Type Np waters are perennial waterbodies or streams that are non-fish bearing.
4. Water Type Ns: Type Ns waters are seasonal waterbodies or streams that are non-fish bearing.

For each water type there is a different buffer requirement, which is also dependent on whether the waterbody or stream is in Western or Eastern Washington. Buffer requirements also depend on the site class of the RMZ, which is reference to the capacity and quality of the soil to grow vegetation on forest land with a scale of I to V with I being the highest quality and V being the lowest quality. Bankfull width, or the distance between the banks of the waterway before water would move into the floodplain of the waterway, also determines the buffer requirements depending on if the bankfull width is greater or less than 15 ft. Finally, the RMZ is split into three different sections: the Core Zone, the Inner Zone, and the Outer Zone which all have different widths and restrictions on activities. Below are the adapted buffers of the RMZ for water type F and S and location in the state as provided in WAC 222 and DNR's Forest Practices Illustrated.

Table 6. Western Washington Water Type S and F RMZ Requirements (Bankfull Limitations for Inner and Outer Zones).

Site Class	Total RMZ Width	Core Zone Width[1]	Inner Zone Width		Outer Zone Width	
			Stream <=10’	Stream >10’	Stream <=10’	Stream >10’
I	200’	50’	83’	100’	67’	50’
II	170’	50’	63’	78’	57’	42’
III	140’	50’	43’	55’	47’	35’
IV	110’	50’	23’	33’	37’	27’
V	90’	50’	10’	18’	30’	22’

[1] No harvest is allowed.

Table 7. Eastern Washington Water Type S and F RMZ Requirements for Bankfull Width less than or equal to 15 feet.

Site Class	Total RMZ Width	Core Zone Width[1]	Inner Zone Width	Outer Zone Width
I	130’	30’	45’	55’
II	110’	30’	45’	35’
III	90’	30’	45’	15’
IV	75’	30’	45’	0’
V	75’	30’	45’	0’

[1] No harvest is allowed.

Table 8. Eastern Washington Water Type S and F RMZ Requirements for Bankfull Width greater than 15 feet.

Site Class	Total RMZ Width	Core Zone Width[1]	Inner Zone Width	Outer Zone Width
I	130’	30’	70’	30’
II	110’	30’	70’	10’
III	100’	30’	70’	0’
IV	100’	30’	70’	0’
V	100’	30’	70’	0’

[1] No harvest is allowed.

For Western Washington, if the inner zone has adequate shade and desired future condition is met, the landowner may conduct a partial harvest or thinning using one of two options: thinning from below or leave trees closest to water. For the outer zone in Western Washington, 20 riparian leave trees must be left per acre after harvest with requirements on species and size in WAC 222.

For Eastern Washington, depending on if the landowner is within bull trout habitat, meets adequate shade, and meets basal area requirements, the landowner may harvest within the inner zone. When harvesting in the inner zone, the landowner must leave a certain number, size, and type of tree, depending on whether the landowner is within the following elevation categories: Ponderosa Pine (<=2,500 ft), Mixed Conifer (2,501-5,000 feet), and High Elevation (>5,000 feet). For the outer zone, the landowner must leave trees according to the elevation categories: 10 dominant or co-dominant trees per acre in the Ponderosa Pine category, 15

dominant or co-dominant trees per acre in the Mixed Conifer category, and 20 dominant or co-dominant trees in High Elevation category.

In Western Washington, Np water types have 50 feet no touch RMZ at convergence with an S or F water type and several other restrictions for sensitive sites. The sensitive sites for Western Washington Np water types and their restrictions are as follows from DNR Forest Practices Illustrated:

1. Headwater spring or upper most point of perennial flow: 56-foot radius buffer centered on sensitive site.
2. Intersection of two or more Np water types: 56-foot radius buffer centered on the intersection.
3. Perennially saturated side-slope seep: 50-foot buffer from the outer edge of saturated area.
4. Perennially saturated headwall seep: 50-foot buffer from outer edge of saturated area.
5. Alluvial fan: No harvest within the alluvial fan.

For buffers when the Np water type converges with S or F water types, the following requirements are based on the length of the Np stream from the convergence. All buffers are a 50 foot no touch and begin at the intersection of the waterways.

- Np stream length from S or F waterway is greater than 1,000 feet
    - 500 feet of 50-foot no touch
- Np stream length from S or F waterway is greater than 300 feet but less than 1,000 feet
    - 50% of the entire length of Np stream or 300 feet, whichever is greater
- Np stream length from S or F waterway is less than or equal to 300 feet
    - The entire length of Np stream

For Western Washington Ns water type, there is a 30-foot equipment limitation zone.

In Eastern Washington, Np water types have a 50-foot RMZ with a 30-foot equipment limitation zone. If basal area and tree count requirements are met, the landowner may harvest using a partial cut strategy, or a limited clearcut strategy within the Np RMZ.

Eastern Washington Ns water types have a 30-foot equipment limitation zone.

8 Understanding Washington Small Forest Landowners

Understanding trends in Washington State small forest land and what steps can be taken to help keep small forest land forested requires understanding the context of small forest land ownership. The broader literature on private, non-industrial forest owners (NIPFs) and family forest owners (FFOs), indicates that small-scale private forest owners in Western countries are diverse in terms of their ownership objectives, environmental attitudes, and many other aspects (e.g. Newman and Wear 1993; Rickenbach and Kittredge 2009; Joshi and Arano 2009; Côté, Gilbert, and Nadeau 2015).[3] In contrast to agricultural landowners, many small-scale private forest owners are not reliant on their forest lands as a regular source of, or even as a supplement to, household income (Follo 2011). Therefore, small-scale private forest owners likely will not behave as exclusively profit-maximizing economic actors whose reactions to market conditions and policy instruments can be mostly predicted using typical economic behavioral assumptions. This fact makes modeling of small forest landowner behavior very

[3] The term "small forest land owner" is specific to the State of Washington. The vast majority of academic literature often refers to highly similar ownership classes such as Non-industrial Private Forest (NIPF) owners, Family Forest Owners (FFOs), and others. For the most part, the Washington definition of SFLO has a high degree of overlap with the criteria for NIPF owners and FFOs.

challenging, especially in the context of landscape-scale sale or land use change predictions. One of the fundamental challenges in this kind of research is that there often exists a large imbalance between the observable spatial and economic data (parcel and holding size, forest cover, forest productivity, etc.) and data on landowner objectives, non-financial motivations, and sociodemographic characteristics. In this report, we utilize both kinds of data, as well as provide additional validation of prospective survey-based research in terms of being predictive of actual observed land use changes.

Describing the diversity of Small Forest Land Owners using ownership objectives is one convenient way of describing the diversity of Small Forest Land Owners and offering insight on their actual and potential behaviors. There are, in principle, an unlimited number of ways to describe the diversity of Small Forest Land Owners. Small Forest Land Owners differ in terms of socioeconomics and demographics, occupations, decision-making strategies, and personal connection to their forest properties as well as ownership objectives. To summarize the academic literature on the topic of ownership objectives, small-scale private forest owners tend to place importance on many aspects of forest ownership other than income, but there is no consensus on exactly how to best describe and model ownership objectives of this kind of forest owner (Janota and Broussard 2008; Dayer, Allred, and Stedman 2014; Danley 2019). The methods we use represent one way of describing various aspects of SFLOs that may be relevant to understanding their behaviors, but we acknowledge that other valid methods exist.

The following analysis presents a generalized description of who Washington State SFLOs are in terms of their demographics, ownership objectives, and history of forest management practices. Given the diversity of Washington State SFLOs, we present a variety of analysis on several topics to give a broad view of the complexity involved in understanding SFLOs. The purpose of this introductory analysis is two-fold: first, to provide an introductory context to help interpret the specific findings of this report. The second purpose is to help policymakers and service providers understand this stakeholder group to better inform and tailor forest policy, service and education outreach, and communications.

8.1 Estimates of Washington State Small Forest Landowner Population Demographics

Applying survey design weights to select questions from the GP survey, Table 9 and Table 10 show population-level estimates for SFLO demographics and basic details of forest ownership. Table 9 shows the mean, standard error, and 95% confidence intervals for the estimated % of SFLOs and number of SFLO ownerships who: participate in the Designated Forest Land current use tax program, have a conservation easement on their property, anticipate selling some or all of their forest land in the coming 5 years, have ever sold or given away forest land, operate a farm or ranch on or within 1 mile of their forest land, have a home on or within 1 mile of their forest land, and who have submitted a Forest Practices application in the previous 10 years or expect to do so in the coming 10 years.

Table 9. Estimation of basic characteristics of SFLO ownership based on the GP survey.

	mean	SE (standard error)	lower bound-95%	upper bound-95%	# ownerships lower bound	# ownerships upper bound
Participation in Designated Forestland tax program	15.8%	0.0210	11.7%	19.9%	31,872	54,287
Has a conservation easement (development rights have been sold on the property)	3.9%	0.0129	1.4%	6.4%	3,682	17,451
Anticipates selling SOME forest land in next 5 years	13.9%	0.0234	9.3%	18.5%	25,431	50,408
Have ever sold or given away forest land	8.4%	0.0172	5.0%	11.8%	13,636	31,995
If the owner also farms on or near the forest land	10.4%	0.0186	6.7%	14.0%	18,258	38,111
Have a home on or near the forest land	76.4%	0.0287	70.7%	82.0%	192,607	223,241
Experience with Forest Practices applications						
Done in past 10 years	12.9%	0.0200	8.9%	16.8%	24,318	45,666
Will do in next 10 years	13.4%	0.0211	9.3%	17.6%	25,313	47,835
Either	20.3%	0.0253	15.4%	25.3%	41,849	68,854

(Total number of estimated Washington State SFLOs: 272,291. Estimated number of ownerships with 20 or fewer forested acres: 237,397. Estimated number of ownerships with more than 20 acres of forest land: 34,894.)

Of interest to note from Table 9 is the estimated participation in the Designated Forestland program spans the estimated number of Washington State SFLOs with more than 20 acres of forest land. Forest properties can be smaller than 20 acres and still participate in the Designated Forestland program, but these estimates confirm the tendency for larger forest properties to be in the program. Somewhere between 25,000 and 50,000 small forest land

owners are likely anticipating selling all or some of their forest land in the coming 10 years; however, the number of actual forest land sales may substantially differ from the number of ownerships who anticipate future forest land sales. Somewhat fewer than 1 in 10 SFLOs have likely ever sold some, but not all, of their forest land. We note the estimate of SFLOs who have ever sold some of their forest land will be an underestimation of total forest land sales since this statistic excludes SFLOs who sold ALL of their forest land.

An estimated 18,000- 38,000 Washington State SFLOs are also farmers and/or ranchers. Fully 3 out of every 4 Washington State SFLOs have their home, vacation home, or cabin on or within a mile of their forest land. The upper-bound estimate of how many SFLO ownerships have a house on their property is slightly below the estimated number of ownerships with 20 or fewer acres (223,241 compared to 237,397). The estimated number of SFLO ownerships that have submitted a Forest Practices application (not the number of Forest Practices applications) in the past 10 years is similar to those who expect to submit an application in the coming 10 years: between about 25,000 to about 45,000. Over the course of 20 years, the weighted survey results suggest as many as about 69,000 SFLO ownerships may be submitting Forest Practices applications of some kind.

Table 10 shows estimates of the average age and average income of Washington State SFLOs. As is common for similar classes of landowners, SFLOs tend to be older and have higher incomes than the general population (e.g. B. J. Butler et al. 2020; Haugen, Karlsson, and Westin 2016). For income, respondents were asked their total household income (including employment, social security, investments, or any other source) before taxes in 2019. The answer format allowed 7 possible income ranges from less than $25,000 to $200,000 or more.

Table 10. Estimate average age and income based on the GP survey.

	mean	SE	lower bound-95%	upper bound-95%
Age (average)*	63.8	0.8677	62.1	65.5
compare to 2019 US Census estimate that 15.9% of WA residents are 65 or older				
Income (average)^	$115,375.00	$5,220.20	$105,143.41	$125,606.59
while US Census estimate WA median household income was $70,116 between 2014 and 2018, Washington average household income is $110,680 based on 2020 IPUMS-CPS data				

(*missing 69 responses, or 9% of the sample did not report age, ^missing 130 responses, or 18% did not report income)

8.2 Forest Ownership Objectives (NWOS)

The series of questions from the NWOS we use to analyze Washington State Small Forest Land Owner ownership objectives ask respondents to state the importance of 13 ownership objectives on a 5 point scale. The scale ranges from "Not important" to "Very important" with another answer alternative in which respondents can mark "Not applicable." For these particular questions, we consider "Not applicable" responses to be the same as "Not important" since both answer possibilities indicate a particular aspect of ownership is not relevant to a respondent. The exact wording of the question prompt reads: How important are the following as reasons for why you currently own your wooded land in Washington?" Owners who own more than one property in the State of Washington are instructed to consider all of their properties in answering the question.[1]

Means and standard deviation of the thirteen ownership objectives variables are presented from the in Table 11. Of the ownership objectives asked about in the NWOS, enjoying beauty or scenery has the highest mean score (Beauty_Scenery). Of interest to this report, the importance ascribed to protecting water resources (Protect_Water) has the 5th highest average importance out of the 13 ownership objectives questions. While the importance of the forest property as a form of land investment has a slightly lower average score than protecting water resources. The average importance of "timber products, such as logs or pulpwood" as an ownership objective ranks 9th out of the 13 objectives. The average importance ascribed to owning forest land for "recreation other than hunting" and "to raise my family" rank relatively low (8th and 10th, respectively). It is likely that the lower relative importance of raising a family and recreation as ownership objectives reflect the increasing average age of family forest owners across the US (e.g. S. M. Butler, Butler, and Markowski-Lindsay 2017). In other words, there may be fewer Small Forest Land Owners raising their families on the land because many owners' children have already grown into adulthood.

Figure 12 presents the distribution of responses to the forest ownership objectives questions in descending order of frequency to the "very important" response category. The distribution of response frequencies shows that ownership objectives of hunting, collecting firewood, and non-timber forest products, such as berries or mushrooms, are important or very important to relatively fewer respondents. Figure 12 also shows a somewhat even split between ownerships that think raising a family on the land and timber products as an objective are important or very important and those who think it is of little importance or no importance. In other words, on average, ownerships in the State of Washington seem to have the most diversity of opinion concerning the importance of raising a family on the land, and the importance of owning forest land for timber products.

Table 11 shows the means and standard deviations of the importance of 13 ownership objectives from the USDA Forest Service, National Woodland Owner Survey. Objectives are

presented in descending order from the objectives with the highest average scores of importance to the lowest.

Table 11. Importance of Management Objectives from the National Woodland Owner Survey.

rank	Objective	mean	sd
1	Beauty_Scenery	4.14	1.17
2	Wildlife_Habitat	3.90	1.20
3	Privacy	3.85	1.36
4	Nature_Biodiv	3.84	1.23
5	Protect_Water	3.64	1.36
6	Land_Investment	3.52	1.39
7	Legacy	3.50	1.52
8	Recreation	3.20	1.39
9	Timber_Prods	2.83	1.63
10	Raise_Family	2.72	1.67
11	Firewood	2.38	1.34
12	Hunting	2.33	1.54
13	NonTimberProds	1.86	1.19

Some further insights can be drawn from Table 11 and Figure 12. First, the protection of water resources is a relatively important ownership objective for Washington State Small Forest Land Owners, on average. Separate from the details of regulations regarding water resources, the NWOS data show family forest owners tend to think the protection of water resources is important. On average, the importance of protecting water resources has a higher mean score than timber products as an ownership objective. Second, several objectives that can be generalized as "good environmental quality," rank as the most important forest ownership objectives. Beauty and scenery, protecting wildlife habitat, protecting nature and biodiversity, and protecting water resources are four of the top five ownership objectives when ranked by means. It is important to note that beauty and scenery, wildlife habitat, and the protection of nature and water resources may also correlate with things such as forest and agricultural productivity, higher property values, and aesthetic benefits, among others. Accordingly, the importance of good environmental quality in general implies other benefits of forest land ownership.

Third, the relatively low importance ascribed to timber products may be influenced by the reality that many Small Forest Land Owners harvest infrequently. Depending on the size of an owner's holdings and the site conditions on her/his property, some owners may only have the opportunity to harvest once or twice in her/his ownership (Wagner 2020). In a context in which a Small Forest Land Owner has decided to harvest timber, a specific harvest operation may be very important to an owner even if timber products *per se* are not generally an important objective to the ownership.

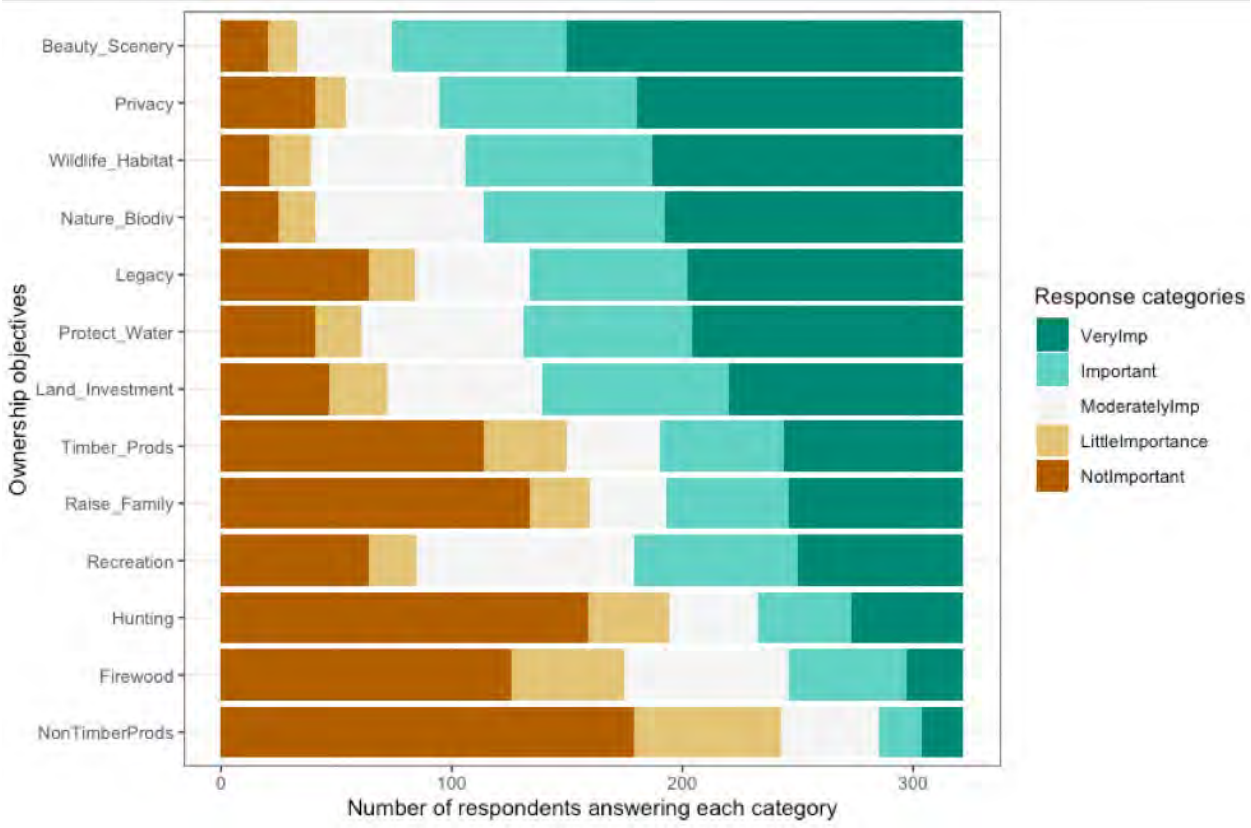

Figure 12. The distribution of answers to the 13 forest ownership objectives from the National Woodland Owner Survey. Objectives are presented in descending order of frequency of the "very important" response category.

It is important to stress the results in Table 11 and Figure 12 reflect the average importance ascribed to various objectives by ALL ownerships responding to the NWOS. A low average score for an objective does not mean those objectives are not important nor that they should be de-prioritized in public policy. For example, although hunting, firewood, and non-timber forest products have the lowest average scores among all respondents to the NWOS, these aspects of ownership are very important to some ownerships. The following section will further clarify the diversity of ownership objectives among SFLOs and why it is important.

8.3 Forest Ownership Objectives (GP Survey)

The series of questions from the GP survey we use to analyze Washington State Small Forest Land Owner ownership objectives ask respondents to state the importance of 15 ownership objectives on a 5 point scale. The scale ranges from "Not important" to "Very important" with another answer alternative in which respondents can mark "Not applicable." For these particular questions, we consider "Not applicable" responses to be the same as "Not important" since both answer possibilities indicate a particular aspect of ownership is not relevant to a respondent. The exact wording of the prompt reads: Please indicate how

important each of the following aspects of owning your forest land are to you and your household."

Weighted means and standard errors of the fifteen ownership importance variables are presented in

Table 12Table 12 which infers the importance of forest ownership objectives to all of Washington State's estimated 272,291 SFLOs). The fifteen aspects of forest land ownership asked about are as follows:

- I have privacy on my forest land (Privacy)
- My forest land provides environmental benefits (Enviro_benefits)
- My personal attachment to the land (Personal_attachment)
- Spending time on my forest land (Spend_time)
- My forest land protects water resources (Protect_water)
- Future ownership of my forest land stays within the family (Stays_family)
- My forest land provides benefits to the community (Com_benefits)
- Recreation on my forest land, other than hunting (Recreation)
- Raising my family on the land (Raise_family)
- Firewood and/or other non-timber products (Firewood_ntfp)
- Income from potential development or the sale of my forest land for residential use (Residential_dev)
- Hunting on my forest land (Hunting)
- Harvesting timber for sale (Timber_sale)
- Income from forest management contributes to my household's annual income (Income_mgmt)
- Income from potential development or the sale of my forest land for commercial use (Commercial_dev)

The average weighted scores of the importance of various aspects of forest land ownership from the GP survey produce a similar ranking to the ownership objectives questions from the NWOS. The average importance of objectives related to income, including harvesting timber for sale, income from forest management, and income from potential sale of the forest land for development, have the lowest weighted mean scores of all other objectives in the GP survey with the exception of hunting. The higher relative ranking of the importance of income-oriented objectives in the NWOS may be due to the differences in sampling frames that tends to capture forest owners with larger amount of forest property.

Table 12. Importance of Ownership (weighted). SE stands for "standard error." Weighted means and standard errors of the importance of 15 aspects of forest ownership objectives from the 2020 GP survey. Objectives are presented in descending order from the objectives with the highest average scores of importance to the lowest. The weights allow us to infer the importance of these aspects of ownership to the population of all Washington State's estimated 272,291 SFLOs.

rank	Aspect of ownership	mean	SE
1	Privacy	4.48	0.06
2	Enviro_benefits	4.35	0.06
3	Personal_attachment	4.34	0.07
4	Spend_time	4.26	0.08
5	Protect_water	4.11	0.08
6	Stays_family	3.31	0.10
7	Com_benefits	3.23	0.10
8	Recreation	3.18	0.11
9	Raise_family	3.09	0.11
10	Firewood_ntfp	2.60	0.09
11	Residential_dev	1.78	0.08
12	Hunting	1.65	0.07
13	Timber_sale	1.65	0.06
14	Income_mgmt	1.41	0.05
15	Commercial_dev	1.27	0.05

The unweighted distribution of answers to the importance of the 15 aspects is presented in Figure 13. We draw attention to the relatively high ranking of "the protection of water resources" in both the NWOS and the GP survey (5th in both surveys). Furthermore, the importance of raising a family on the land and recreation have among the highest variations (standard errors) in how important respondents tended to rank them. In other words, there is great variation in how Washington State SFLOs value their forests for these two aspects of ownership.

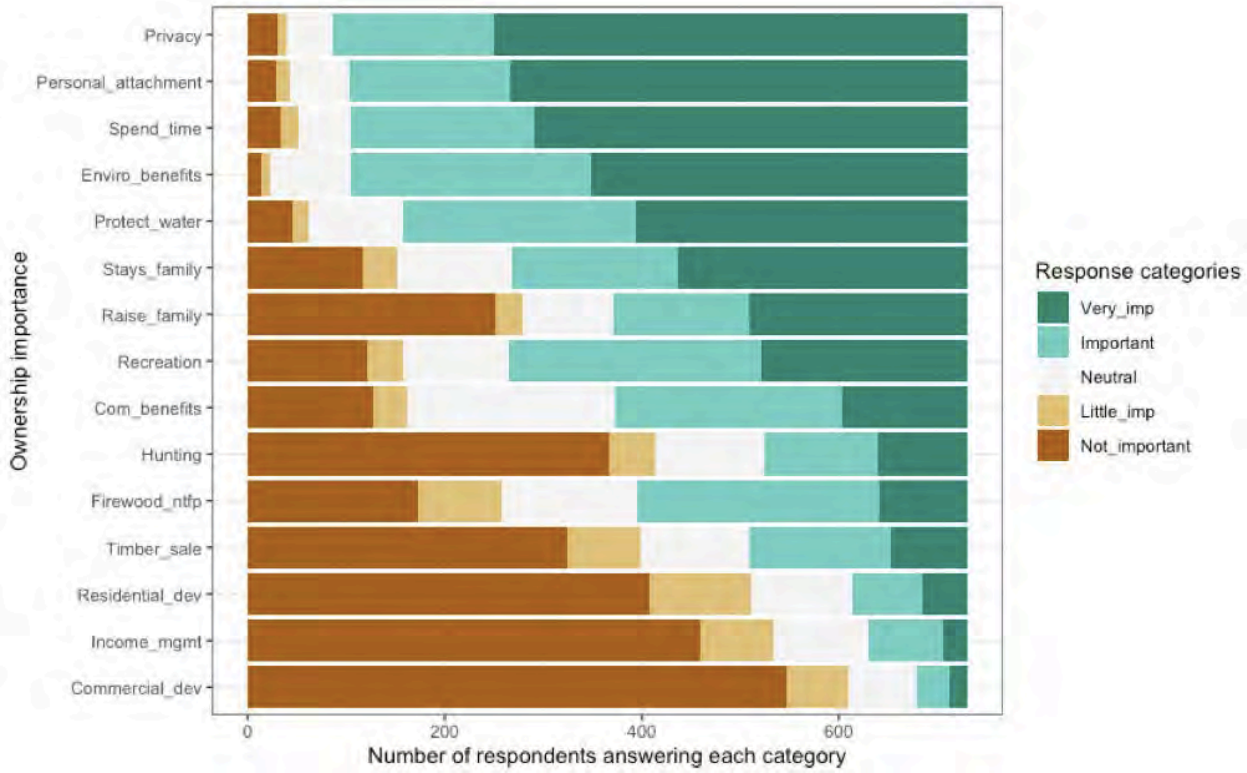

Figure 13. The distribution of answers to the importance of 15 aspects of forest ownership objectives from the 2020 GP survey. Objectives are presented in descending order of frequency of the "very important" response category.

8.4 Analyses of SFLO Ownership Objectives and Impacts on Forest Ownership

8.4.1 Principal component analysis: objectives

The first step in creating a typology of Washington SFLOs is by reducing the dimensionality of ownership objectives questions from the 13 original questions in NWOS (from Table 12) down to a smaller number of principal components. Principal component analysis (PCA) is an exploratory method used to describe relationships between data and, in our case, reduce the number of variables needed for analysis (Dunteman 1989). Each variable in a PCA has an imputed loading (correlation) associated with each respective principal component score, which is used to interpret each component (Jolliffe 2002). In short, we use the PCA to reduce the number of objectives from 13 down to a smaller number of components and then use individual-specific scores from the PCA for subsequent analysis.[4]

[4] To determine the proper number of principal components, we use the dual criteria of statistical fit and interpretability of the components themselves (Bro & Smilde, 2014). Our decision to use four principal components is based on: the Eigenvalue Test (keep all components with an eigenvalue equal to or greater than 1), the cumulative variance standard (include enough components to reach about 70% of cumulative variance), the scree plot test (include components until the difference in variance explained between components becomes constant), and a broken stick test (keep only the components with more variance than what can be expected from random noise). The tests indicate using between two and four components to be an appropriate choice.

Table 13. Principal component analysis on ownership objectives. Variable loadings with the highest scores are in bold (>0.6). The proportion of variance (Proportion Var.) shows how much variance each principal component explains in the data.

	Nature & aesthetic	Rec, ntfp & hunt	Fam & private	Inc, invest & heirs
enjoy beauty	**0.69**	0.037	0.543	-0.095
protect nature	**0.919**	0.083	0.149	0.018
protect water	**0.868**	0.089	-0.006	0.182
protect wildlife	**0.859**	0.137	0.096	0.065
land investment	0.147	0.069	0.089	**0.749**
privacy	0.317	0.11	**0.803**	-0.019
raise family	-0.048	0.217	**0.707**	0.351
pass to heirs	0.082	0.082	0.465	**0.609**
firewood	0.075	**0.646**	0.247	0.235
timber prods	-0.128	0.568	-0.266	**0.616**
non-timber prods	0.214	**0.739**	0.064	0.044
hunting	-0.052	**0.766**	0.015	0.119
recreation	0.345	**0.615**	0.315	-0.16
	1	2	3	4
SS loadings	3.134	2.357	1.93	1.579
Proportion Var.	0.241	0.181	0.148	0.121
Cumulative Var.	0.241	0.422	0.571	0.692

Table 13 shows the results of a varimax (orthogonally rotated) PCA with four components. The PCA shows that respondents tended to answer questions such that four latent ownership objectives emerge. Explaining the most variation in responses (the first principal component, “Nature & aesthetics”) is how respondents considered the importance of enjoying beauty or scenery, protecting nature or biological diversity, protecting water resources, and protecting or improving wildlife habitat. The second principal component (Recreation, non-timber forest products, & hunting: “Rec, ntfp & hunt”) reflects the importance of owning the forest for firewood, non-timber forest products such as berries or mushrooms, for hunting, and for recreation other than hunting. The third principal component (Family and Privacy: “Fam & private”) represents how respondents answered questions concerning the importance of owning the land to raise a family, and for privacy. Somewhat interestingly, the more importance respondents ascribed to privacy and raising a family on their forest land, the less importance they tended to give to owning the land for timber products and *vice versa*. The inverse relationship between privacy and raising a family on the forest land and the importance of timber products can be seen in the negative value on timber products in the third column of Table 13. The fourth principal component (Income, investment & heirs: “Inc, invest & heirs”)

reflects the importance respondents tended to give to owning the forest for land investment, for timber products such as logs or pulpwood, and to pass the land on to their children or other heirs.

In summary, the PCA on Washington State respondents to the NWOS suggests 4 main dimensions of ownership: 1) Nature & aesthetics, 2) Recreation, non-timber forest products & hunting 3) Family & privacy, and 4) Income, investment & heirs. Using the loadings and how each respondent answered each question, we use principal component scores to represent the importance each respondent ascribes to each dimension of ownership. It is important to note that the principal component scores are normalized and therefore reflect the importance that respondents gave to each dimension of ownership *relative to how other NWOS respondents answered the questions*. Therefore, a principal component score greater than 0 means that a respondent ascribes above average importance to that dimension of ownership relative to how important other respondents thought it was. Scores less than 0 mean the respondent ascribed a below average importance to that aspect of ownership. Scores of exactly 0 mean the respondent ascribed a level of importance to that aspect of ownership that is equal to the average importance given to it by all NWOS respondents.

There are certainly more dimensions of ownership that are important to Washington State SFLOs, but these four dimensions from the NWOS explain close to 70% variation in item response and give some important insights. To highlight one insight that is common to SFLOs in most states, and other western countries, we examine the relationship between the total size of forest acreage and the importance of income and investment. Generally speaking, the more wooded acres an ownership has, the more likely that the ownership will value their forests for, among other things, the importance of income and investment. Figure 14 shows respondent-specific PCA scores for the fourth component (Income, investment & heirs) on the vertical axis and the natural logarithm of respondents' total forested holdings on the horizontal axis. Numbers at the top of the figure show the actual forested acres at various points along the log scale. For example, at "3" on the horizontal axis ownerships have 20 total wooded acres and at "6" on the horizontal axis ownerships have 400 total acres of wooded land. Black dots are ownerships with forest in the east half of the state ("Eastside") and grey dots are ownerships with forest in the west half of the state ("Westside"). The dotted line is the average effect of the log of total wooded acres owned on the importance of income and investment from an OLS regression (see below).

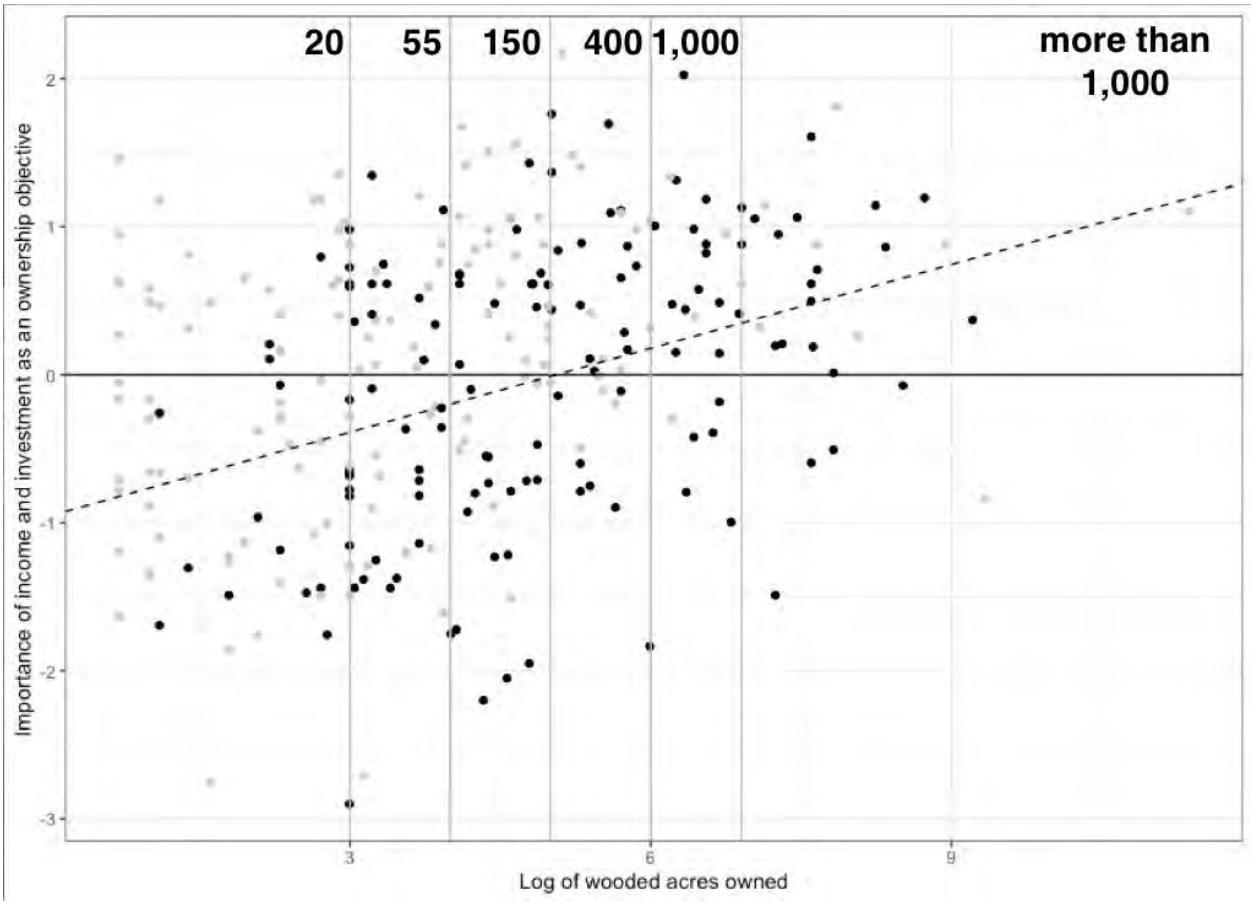

Figure 14. The relationship between the amount of wooded acres owned (log of wooded acres), and PCA scores for "Income, investment & heirs." SFLOs in the west half of the state are grey dots and those in the east half are black dots. Numbers at the top of the figure show the actual amount of wooded acres owned at various points on the log scale. The dotted line is the average association between log of wooded acres and the importance of income and investment from an OLS regression.

One insight from Figure 12 is how almost all ownerships who say income and investment are important AND are smaller than 20 forested acres exist on the west side of the state. At such small acreages of forest ownership (less than 20 acres), it is difficult for any forest management to be economically viable. The existence of grey dots above "0" on the left side of Figure 14 points to a pattern of concern about Small Forest Lands in Western Washington voiced by many in the state. Given that some owners of less than 20 forested acres in the West are interested in the income and investment from selling their forest lands, it would seem that the income opportunity available to these owners is selling the forest land or converting it residential or commercial use.

To confirm the general tendency for larger forest acreage to be associated with a higher relative importance of income, investment, and heirs to ownerships, we run an OLS regression between the two. We find a statistically significant relationship between the log of wooded acres owned and principal component scores for "Income, investment & heirs" while accounting for east/west differences (see output below).

Table 14. OLS regression of the log of forest acreage on the importance of income, investment & heirs.

Variable	Estimate	Pr (>|z|)
Log(wooded acres)	0.18875	2.86e-09***
West=1, East=0	0.35225	0.00181**
Intercept	-0.95450	2.86e-09***
Adjusted R-squared	0.1356	
n	285	

F-statistic: 23.28 on 2 and 282 DF, p-value: 4.386e-10

Note: Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 (*** p<0.001, ** p<0.01, * p<0.05)

The main interpretation of Figure 14, and the accompanying statistical model, is that as SFL Ownerships increase in the amount of wooded acres owned, ownerships have more possibilities to make plans for their forests as a resource. Conversely, Figure 14 also shows how parcelization of Small Forest Lands into smaller units likely has the average effect of decreasing SFLO's possibilities to manage their forests as a timber resource. The tendency for smaller ownerships to rank "Income, investment & heirs" as less important does not mean that smaller ownerships don't harvest timber; however, it lends quantitative support to qualitative findings that many SFLO timber harvests are not done as part of a long-term timber optimization plan. Figure 14 gives reason to be concerned about the impacts of parcelization not just for the amount of Small Forest Lands that are managed as a resource, but that parcelization can be a threat to the existence of Small Forest Lands. At the extreme end of parcelization into very small amounts of forest land, (i.e. the grey dots above "0" on the left side of Figure 14), selling forest land to developers may be a more attractive financial opportunity to SFLOs since opportunities for profitable forest management become increasingly difficult at very small acreages.

8.4.2 Principal component analysis on the importance of forest ownership

We also run an orthogonally rotated PCA on the 15 importance of ownership questions from the GP survey. The same procedures for selecting the number of components to use were applied to these questions as well. The GP survey asks different questions, uses a different sampling design and results in somewhat different measures of ownership objectives. Table 15 shows the results of a varimax PCA with four components. The PCA shows that respondents tended to answer questions such that four latent components of ownership importance emerge.

Explaining the most variation in responses (the first principal component, "Financial") is how important respondents considered the importance of harvesting timber for sale, the importance of income from forest management, and income from selling the forest land for

development. It is important to note, that the importance respondents ascribe to having privacy on their forest property is negatively related to how important respondents consider the financial aspect of owning their forests. To a lesser extent, the importance of the forest's environmental benefits and spending time on the forest property are also negatively related to the importance ascribed to financial aspects of forest ownership. The second principal component ("Spend time") reflects the importance respondents ascribe to spending time on their forest lands, recreation, and having privacy on the forest. The third principal component ("Enviro") indicates the importance of environmental benefits and how important it is that the land protects water resources. Important to note is that the importance ascribed to Hunting tends to be negatively related to the importance of environmental benefits and protecting water resources. The fourth principal component (Legacy) reflects the importance of the ownership of the forest land staying within the family and an owner's personal attachment to the forest. The importance ascribed to income from the potential sale of the forest land for residential or commercial development is negatively related to importance of legacy.

Table 15. Principal component analysis on importance of ownership topics. Variable loadings with the highest scores are in bold (>0.6). The proportion of variance (Proportion Var.) shows how much variance each principal component explains in the data.

	Financial	Spend time	Enviro	Legacy
Enviro_benefits	-0.17	0.13	**0.83**	0.06
Protect_water	-0.09	0.13	**0.81**	0.07
Privacy	**-0.25**	**0.71**	0.15	0.11
Spend_time	-0.17	**0.77**	0.20	0.21
Raise_family	0.14	0.36	0.00	0.39
Residential_dev	**0.65**	0.02	-0.08	**-0.42**
Income_mgmt	**0.73**	-0.02	0.10	0.30
Timber_sale	**0.78**	-0.04	-0.04	0.23
Commercial_dev	**0.69**	-0.04	-0.09	**-0.30**
Firewood_ntfp	0.37	0.44	-0.02	0.24
Hunting	0.44	0.41	**-0.33**	0.19
Recreation	0.17	**0.72**	0.09	0.05
Stays_family	0.12	0.13	0.01	**0.81**
Personal_attachment	-0.12	0.36	0.20	**0.60**
Com_benefits	0.13	0.06	0.69	0.04
	1	2	3	4
SS loadings	2.601	2.3	2.069	1.98
Proportion Var	0.173	0.153	0.138	0.113
Cumulative Var	0.173	0.327	0.465	0.575

The PCA on ownership importance from the GP survey shows more contrast between different dimensions of ownership relative to the PCA from the NWOS. We admit this is likely the case since we constructed the GP survey using results from the NWOS and had a narrow set of specific questions to answer from SB5330. Perhaps the contrast of most importance is the contrast between the importance of forest legacy (i.e. keeping forest ownership within the family and having a personal connection to the forest) and the importance of income from potentially selling the forest for commercial or residential development. Other results in this report will highlight the importance of forest legacy in keeping forest lands forested as well. Also of importance for the questions in this report is that as the importance of hunting tends to increase, the importance of environmental benefits and protecting water quality tends to decrease, and *vice versa*. The negative relationship between hunting and environmental quality may have to do with the need to manage the forest land specifically for game habitat instead of general environmental amenities.

Also of interest from the contrasts in various aspects of ownership is the negative association between the importance of having privacy on the forest land and the financial aspects of forest ownership. The negative association between privacy and financial objectives may be due to the fact that financial objectives tend to be more highly valued by SFLOs with large amounts of forest land, who may think about their forest land more as an asset to manage. Accordingly, enjoying privacy on one's land may not be relevant for owners who tend to think more about the financial income and investment that their forest lands represent.

We also note from the Financial component that the importance of cutting timber for sale and income from forest management goes hand-in-hand with the assessed importance of potentially selling the property for residential or commercial development (both have high correlations the Financial component). From the standpoint of the importance of ownership in general, the importance of actively pursuing profitable forestry does not appear to be a defense against the conversion of forestry to non-forest uses. This result likely means that as SFLOs tend to think more about the financial aspects of their ownership they tend to be aware of all options for financial gain, including selling the forest and/or converting it to a non-forestry use. The PCA scores from the importance of ownership questions will be used to help answer further questions in this report.

Some differences between the components of forest ownership objectives are important to note between the GP survey and the NWOS. First, financial objectives are more distinctly identified as a separate ownership objective in the GP survey, while they appear together with legacy objectives in the NWOS. Because PCA seeks to explain the maximum amount of variance in data, the distinctiveness of financial objectives in the GP survey PCA may be due to the four questions concerning financial objectives in the GP survey relative to the one question asked about timber products in the NWOS. In other words, having more questions about financial objectives is likely an important reason why they are more clearly and separately identified in

the GP survey PCA. The GP survey PCA also more clearly contrasts the importance of financial objectives with the importance of privacy, while there is somewhat of a negative relationship between environmental objectives and timber production in the NWOS PCA.

Based on the NWOS PCA, the importance of wildlife habitat is strongly related to environmental objectives; however, the GP survey PCA shows a negative relationship between the importance of hunting and environmental objectives. The importance of legacy objectives are related to income and investment objectives in the NWOS, while legacy objectives are more distinct in respondent answers to the GP survey. Finally, both surveys show that Washington State SFLOs do not necessarily perceive a zero-sum competition between environmental and financial objectives.

8.4.3 Principal component analysis of impacts on forest ownership

To complement the various important topics of forest land ownership, the GP survey also asked respondents about the impacts of various topics on their forest ownership. Respondents were asked to "please indicate how much each of the following topics impact the ownership of your forest land for you and your household." Thirteen topics were presented to respondents with a five point scale ranging from "No impact" to "High impact" with another alternative in which respondents could mark "Not applicable." Also for these questions, we consider "Not applicable" responses to be the same as "No impact" since both answer possibilities indicate that a particular topic is not relevant to the respondent. We follow the same methods of imputation and subsequent PCA analysis as done for the ownership objectives and importance questions; however, 36 respondents left all the impacts questions blank and were therefore excluded from the following analysis.

Table 16 shows the weighted means and standard errors of the thirteen ownership impacts questions. Using survey design weights, Table 16 infers the impacts that various topics have on all of Washington State's estimated 272,291 SFLOs. The thirteen topics asked about are as follows:

- Property taxes (Prop_tax)
- Wildfire hazard (Wildfire)
- Development of nearby lands for residential use (Residential_dev)
- Extreme weather events (Extreme_weather)
- Air or water pollution (Pollution
- Climate change (Climate_change)
- Development of nearby lands for commercial use (Commercial_dev)
- Regulations preventing development for residential use (Reg_residential_dev)
- Damage from other people (Damage_people)
- Regulations preventing development for commercial use (Reg_commercial_dev)
- Other Forest Practices regulations (Fpr_other)

- Forest Practices regulations for timber harvesting (Fpr_harvest)
- Forest Practices regulations for road maintenance (Fpr_roads)

Table 16. Weighted means and standard errors of the impacts that 15 topics have on forest ownership from the 2020 GP survey. Topics are presented in descending order from the topics with the highest average scores of importance to the lowest. The weights allow us to infer the impacts these topics have on ownership for the population of all Washington State's estimated 272,291 SFLOs.

Impacts on Small Forest Land Ownership (weighted)

rank	Issue of concern	Mean	Standard error
1	Prop_tax	3.45	0.09
2	Wildfire	3.22	0.10
3	Residential_dev	3.03	0.10
4	Extreme_weather	2.86	0.09
5	Pollution	2.84	0.10
6	Climate_change	2.79	0.10
7	Commercial_dev	2.72	**0.12**
8	Reg_residential_dev	2.67	0.10
9	Damage_people	2.58	0.10
10	Reg_commercial_dev	2.29	0.10
11	Fpr_other	1.98	0.09
12	Fpr_harvest	1.93	0.09
13	Fpr_roads	1.84	0.09

Topics having the most impacts on SFLOs include property taxes, wildfire, and the development of nearby lands for residential purposes. The top impacts on small forest land ownership indicated from the GP survey are similar to some of the top concerns of all US Family Forest Owners from the most recent NWOS (B. J. Butler et al. 2020). We note the perceived impacts of Forest Practices regulations all have the lowest average impacts on SFLO ownerships. The relatively low average perceived impacts of Forest Practices regulations is likely related to the low average importance given to financial ownership objectives. Since SFLOs who tend to value the financial aspects of their forest ownership tend to be a small number of SFLOs, but own substantially more of Washington State's small forest land, the low average impacts of Forest Practices regulations is not surprising.

Figure 15 shows the unweighted distribution of how much impact respondents said the selected topics have on their forest ownership. We note that SFLOs themselves tend to rank the development of nearby lands for residential or commercial purposes to be among the topics with the highest impact on their forest lands.

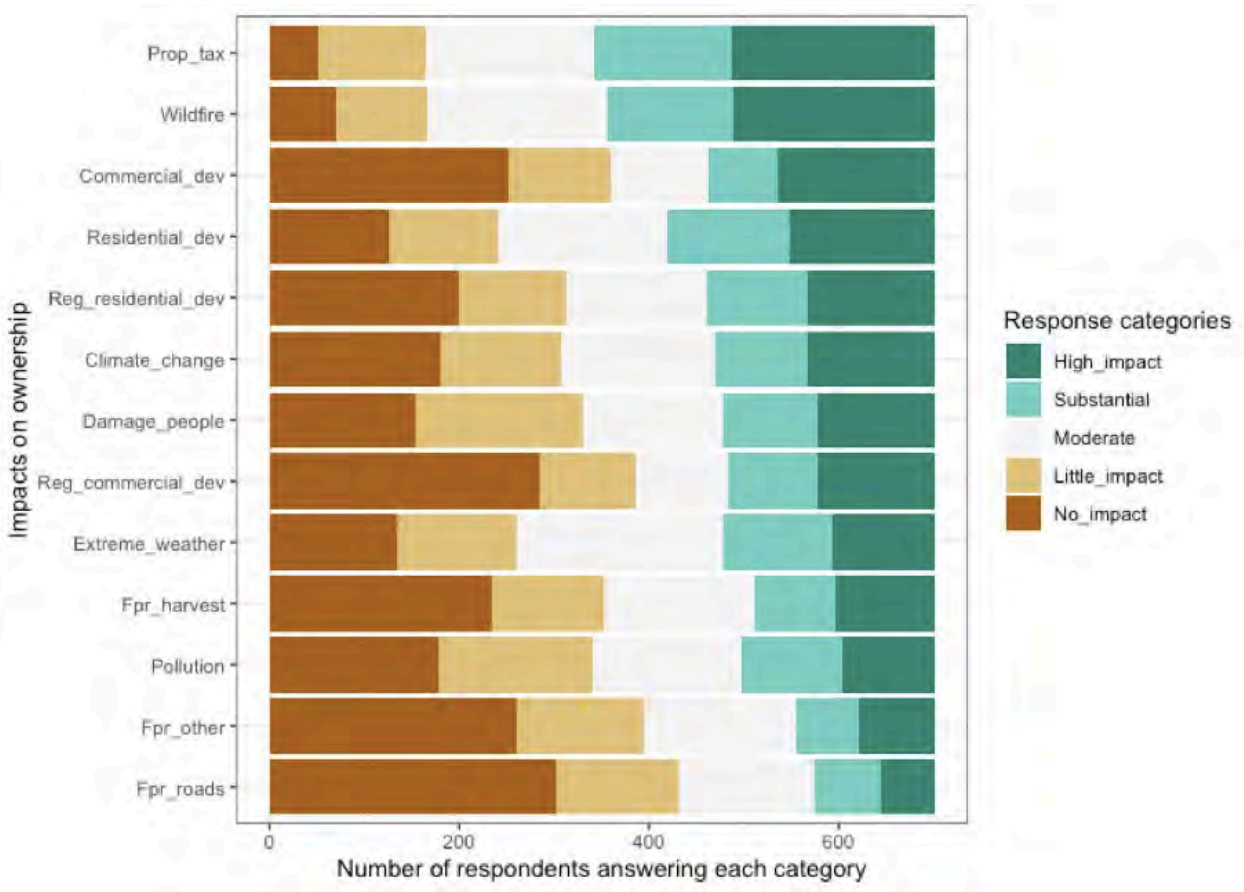

Figure 15. The distribution of answers concerning the impact of 13 topics on the forest ownership of respondents to the 2020 GP survey. Topics are presented in descending order of frequency of the "High impact" response category.

The PCA on the impacts questions results in three interpretable principal components of the impacts on their ownership that SFLOs tend to experience. The first principal component reflects the perceived impacts of development and regulations concerning development. The second principal component related to climate change, extreme weather, pollution and wildfire. The second principal component is therefore titled "Disturbance_damage" since the factors associated with it are either forest disturbance topics or damage from pollution. The third and final component is called "Fpr" because the factors with high loadings on this component are the impact of the three topics regarding Forest Practices regulations. We note that, although property taxes are understandably the topic of highest average concern to SFLOs, the topics that explain the most variation in the entirety of SFLO concern have to do with residential and commercial development. Similarly, although they have the lowest average perceived impacts, the topic of Forest Practices regulations explains almost 20% of the variance in SFLO concerns. Also of interest to note is the PCA does not suggest strong contrasts between various topics as did the PCA on the importance of ownership objectives.

Table 17. Principal component analysis on ownership impacts questions. Variable loadings with the highest scores are in bold (>0.6). The proportion of variance (Proportion Var.) shows how much variance each principal component explains in the data.

	Development	Disturbance_damage	Fpr
Fpr_harvest	0.119	0.039	**0.872**
Fpr_roads	0.210	0.163	**0.822**
Fpr_other	0.192	0.100	**0.873**
Wildfire	0.125	**0.616**	0.280
Climate_change	0.059	**0.859**	-0.018
Extreme_weather	0.077	**0.857**	0.130
Pollution	0.346	**0.763**	-0.023
Damage_people	0.564	0.425	0.109
Prop_tax	0.512	0.045	0.249
Residential_dev	**0.722**	0.248	0.017
Commercial_dev	**0.806**	0.202	-0.006
Reg_residential_dev	**0.727**	-0.010	0.295
Reg_commercial_dev	**0.789**	0.075	0.214

	1	2	3
SS loadings	3.14	2.761	2.500
Proportion Var	0.242	0.212	0.192
Cumulative Var	0.242	0.454	0.647

8.4.4 Owner objectives types and their relationship to other variables

The academic literature on private forest owners often uses Principal Component Analysis (PCA) and K-means clustering to categorize forest owners into groups that represent contrasting ownership objectives. Since the Principal Component Analysis and K-means clustering technique is so widely applied in describing private forest owners (see review in Ficko et al. 2019), we apply this method to the NWOS data to make our results comparable to other studies.

Grouping Small Forest Land Owners into discrete ownership objectives types may produce insights relevant for forest policy. Forests are under increasing pressure to serve as a source of renewable materials as well as to provide a host of environmental and ecological services that benefit society. Commensurately, policymakers and service providers face increasing demands to develop forest policy tools and strategies that engage Small Forest Land Owners in sustainable forest management (e.g. Cubbage, Harou, and Sills 2007). A complexity of forest policy goals requires governments to use multiple “tools of public action” (Salamon 2002) in forest policy, such as: well designed regulatory frameworks, current use land taxes, cost-share programs, and voluntary compensation programs, among many others.

Describing different types of SFLO ownership objectives may offer insights into how the full range of public policy and programs for SFLOs can be designed so that forest policy functions more effectively for these owners. The literature on private forest owners argues that forest owner management objectives can be considered as manifestations of underlying value orientations held by landowners (e.g. Karppinen 2000). Psychological value hierarchy theories argue that individuals with different value orientations will express different attitudes and behavioral intentions based on their personally held values and attitudes (e.g. Schwartz 1992). Essentially, grouping SFLOs into different types based on their forest ownership objectives may reveal opportunities to better tailor policy and programs to reach a diversity of SFLOs.

We stress that the types of SFLOs we identify with the National Woodland Owner Survey should be interpreted with care. First and foremost, we will present a limited number of different kinds of forest owners, but do not claim to have captured the full diversity of SFLO ownership objectives. Different methods and different surveys will likely produce somewhat different discrete owner types. In other words, we encourage readers to think of the following typology as only one way of describing a subset of Washington State SFLOs. After we present results, we will provide more detailed commentary on how these results may or may not be useful to policymakers and service providers.

To create owner types based on the four objectives identified from the NWOS, we run a K-means cluster on respondent principal component scores. In short, the K-means method produces groupings of owner types in a way that maximizes differences between owner types and minimizes differences within ownership types. The K-means solution of best fit[5] produces five different SFLO ownership objectives types. We stress that these five types of SFLOs are a generalization based on respondents to the NWOS. It is more likely that each individual SFLO exists on a continuum of ownership objectives rather than as one of a small number of discrete types, such as the distribution of how important respondents say “Income, Investment, & Legacy” is from Figure 14. Nonetheless, in the academic literature, using a small number of generalized ownership objectives types is a common way to produce insights about SFLOs. We therefore present some analysis of five different types of Washington State SFLOs, but

[5] The K-means clustering algorithm uses the Euclidian distance between respondents’ four principal component scores to maximize the differences between clusters and minimize within-cluster differences considering the given number of clusters (K) and 50 different starting values for cluster means. A key limitation of the K-means method is that the outcome is highly dependent on the number of clusters (K), which must be chosen by the researcher. To determine K, we use the Pseudo F test to find the K that produces the largest differences between clusters and the smallest differences within clusters relative to other possible choices for K. The pseudo F test suggests a K=5 clustering solution, which is what we present here since the solution provides interpretable ownership types.

expressly advise against concluding that all Washington State SFLOs will fit nicely into one of these five general types.

Considering five types of Washington State SFLOs from the NWOS produces two groups that place a relatively high importance on multiple objectives and three groups that express a relatively higher importance on one aspect of ownership. The five ownership types are presented in

Table 18. The first group can be described as “Multi-Objective: everything,” since this type ascribes above average importance to all four dimensions of ownership. The “Multi-Objective: everything” type can be thought of as owners who are highly engaged with many aspects of owning a forested property. They likely spend a significant amount of their time and resources on the maintenance and improvement of their forests, including managing timber for profit.

The second multiple objective group can be described as “Multi Objective: all but Rec, ntfp & hunt” due to the above average importance given to Nature & aesthetics, Family & privacy, and Income, investment & heirs, but a lower than average importance to Recreation, non-timber forest products & hunting. The “Multi Objective: all but Rec_NTFP_hunt” owner type typically spends less time physically working or doing leisure activities in their forests compared to the “Multi-Objective: everything” type, but is still highly engaged in many other aspects of forest ownership. Taken together, about half of all Washington respondents to the NWOS (46%) are highly engaged in multiple aspects of forest ownership, including managing the land for timber products.

Other ownership types tend to give relatively more focus to one out of the four dimensions of ownership from the PCA. One such type is the “Single Focus: aesthetics & nature” type, which tends to ascribe the least amount of importance to Income, investment & heirs as any other group. Another type is the “Single focus: financial interest” ownership type, which has, on average, more of an interest in Income, investment & heirs and the lowest interest in Family & privacy of any group. The final group is “Single focus: family & privacy,” which ascribes an above average importance to Family & privacy but also the lowest importance to Nature & aesthetics of all groups.

Table 18. Five generalized owner types from Washington State respondents to the National Woodland Owner Survey.

Generalized owner types	n	% of resp	median wooded acres	% wooded acres in sample
Multi-Objective: everything	82	25%	145	19%
Multi-Objective: all but Rec_hunt_NTFP	67	21%	26	9%
Single focus: aesthetics & nature	57	18%	40	16%
Single focus: financial interest	57	18%	350	54%
Single focus: family & privacy	59	18%	21	2%
total	322	100%		100%

The literature on family forest owner ownership objectives consistently shows that non-economic forest ownership objectives are prominent among family forest owners (e.g. Majumdar, Teeter, and Butler 2008; Favada et al. 2009; Ficko et al. 2019; Kumer and Štrumbelj 2017), and Washington State SFLOs are similar to SFLOs in other areas of the US and Western Europe in this regard. It is important to note in this typology of Washington SFLOs that the importance of Income, investment & heirs does not exclude other objectives. Of the two groups placing strong importance on multiple aspects of forest ownership (46% of all Washington respondents to the NWOS), both groups say Income, investment & heirs is important as well as Aesthetics & nature, and Family & privacy. In other words, many Washington SFLOs think about timber income AND good environmental conditions on their lands instead of timber income OR having good environmental conditions on their forests.

The percentage of respondents belonging to each ownership type is presented in Table 18, along with the median amount of wooded acres owned by the respondents in each owner type. The owner type with the largest median wooded ownership acreage by far is the “Single focus: financial interest” type. Owners in the “Single focus: financial interest” group tend to have much larger properties than owners in other groups, which again underscores the relationship between financial and investment objectives and the amount of forested acres owned. Having the second highest median amount of forest acres in ownership is the “Multi-Objective: everything” ownership type.

“Multi-Objective: all but rec_ntfp_hunt,” “Single focus: aesthetics & nature,” and “Single focus: family & privacy” ownership types all have much smaller median forested acres in ownership. The “Single focus: family & privacy” ownership type has the smallest median forested acreage ownership of all groups, which is consistent with many ownerships in this group being residential landowners who also happen to have forests on their property. The column in

Table 18 titled “% wooded acres in sample” shows how much forested acreage is collectively owned by respondents from each respective ownership type as a percentage of the total forested acres owned by all respondents to the NWOS. For example, the 25% of respondents in the “Multi-Objective: everything” type own 19% of all forested acres represented in the Washington State NWOS.

It is important to note from Table 18 that although about 18% of respondents are in the “Single focus: financial interest” ownership type, this ownership group collectively owns more than half of all acres represented in the Washington State NWOS (54%). Conversely, although 18% of respondents are in the “Single focus: family and privacy” ownership type, this ownership group only owns 2% of all acres represented in the Washington State NWOS. These differences illustrate the reality that ownerships with the heaviest focus on income and investment are a minority of SFLOs, but they own disproportionately more forest acreage than all other SFLOs. Also, ownerships who tend to value their forest lands primarily for Family and Privacy purposes represent a substantial number of ownerships, but a very small amount of Small Forest Land.

Table 19. Percent of Eastern and Western Washington ownerships in each ownership type.

	East (n)	West (n)	% East	% West
Multi-Objective: everything	52	30	33%	18%
Multi-Objective: all but rec_ntfp_hunt	26	41	17%	25%
Single focus: aesthetics & nature	26	31	17%	19%
Single focus: financial interest	21	36	13%	22%
Single focus: family & privacy	32	27	20%	16%
total	157	165	100%	100%

* χ -squared= 16.266, df = 8, p-value= 0.03872

To acknowledge the substantial differences between SFLOs in the Eastern and Western halves of the state, Table 19 shows the percent of ownerships in each owner type for Eastern Washington and the percent of ownerships in each owner type for Western Washington. In the West there are relatively more “Single focus: financial interest” owners and “Multi Objective: all but rec_ntfp_ hunt” owners. In the East, there are more “Multi Objective: everything” owners. The differences are statistically significant at the 5% level using a chi- squared difference of proportions test (χ-squared = 16.266, df = 8, p-value = 0.03872). We can interpret these differences to mean that SFLOs in Eastern Washington who are highly engaged with forest ownership more often work and recreate on their lands compared to their counterparts in Western Washington. Also, there are more SFLOs in Western Washington who focus their interests on the investment and income opportunities of forest ownership compared to SFLOs in the East. These differences based on location in the Eastern or Western half of the state merely scratch the surface of how SFLOs tend to differ based on the East/West divide, not to mention regional differences within Eastern and Western Washington. The important point for readers to take from Table 19 is that Washington State SFLOs differ based on where their

properties are located in the state and policy, assistance, and outreach efforts should be tailored based on geographical differences, among other considerations.

Another important finding from the five ownership types is that many respondents, regardless of their stated objectives, have done some kind of timber harvesting since they have owned their forests. Even among the two owner types that express a below average importance to Income, investment & heirs (i.e. "Single focus: aesthetics & nature" and "Single focus: family & privacy"), 46% and 42% of respondents, respectively, say that logs, pulp, or wood chips have been cut on their land at some point during their ownership. While the "Single focus: financial interest" ownership types have cut logs, pulp, or wood chips more frequently than all other ownership types, somewhere around half of all ownership types have done so at least once during their ownership tenure. Additionally, "Multi-Objective: everything" and "Single focus: family & privacy" owner types tend to use their lands as a supply of firewood more frequently than other owner types.

The important point to take from Table 20 is the great diversity among SFLOs who cut timber, yet all of them need to navigate Washington's Forest Practices Applications. Some SFLOs who cut timber will be highly interested in preserving or enhancing the aesthetic and biodiversity value of their forests (such as "Single focus: aesthetics & nature owners"), and some will want the harvest to preserve the forest as a part of a private residence (such as "Single focus: family & privacy owners"). According to these data, many Washington SFLOs have done some kind of commercial timber operation on their lands even though they do not place a high importance on their lands as a source of income and investment. Policymakers and service providers should be aware that SFLOs will often desire a balance of multiple objectives in their harvest operations. The NWOS data complements our qualitative findings that many SFLOs are not necessarily managing their lands to maximize the timber value of their forests, but often harvest timber as a way to pay for needs in the lives of owners that are not always connected to their forest lands (such as children's education, retirement, and tax purposes, etc.).

Table 20. Who cuts timber products? Frequency of cutting for commercial purposes (logs, pulp, or chips), and cutting for firewood based on ownership objective type.

Generalized owner types	% cut logs, pulp or chips	% cut firewood
Multi-Objective: everything	59%	54%
Multi Objective: all but Rec_NTFP_hunt	48%	36%
Single focus: Aesthetics and nature	46%	39%
Single focus: financial interest	60%	35%
Single focus: family and privacy	42%	51%

In identifying five different generalized types of Washington SFLOs, we encourage policymakers and service providers to think of these five types as an introduction to the diversity of the state's SFLOs and not a conclusive guide to understanding the ownership objectives of

Washington SFLOs. This typology of SFLO types in the State of Washington shows how policy and programs for SFLOs will need to navigate the different needs and objectives of owners.

8.4.5 Importance of ownership, impacts, and forest management

We directly apply the individual-specific principal component scores from the importance of owning forest land and impacts on forest ownership to briefly describe which respondents said they have submitted Forest practices applications in the past 10 years and those who anticipate submitting a forest practices application in the coming 10 years. Compared to the previous section, we omit the K-means cluster analysis on the principal component scores and look at average differences between the respective principal components.

Table 21 shows the average differences in the individual-specific principal component scores for respondents who reported submitting a forest practices application in the last 10 years. For principal components concerning the importance of forest land, respondents with higher scores for the Financial, Legacy, and Spending time principal components more frequently reported submitting a Forest Practices application. Although the largest difference in mean scores is from the Financial principal component, the results confirm that SFLOs with objectives other than Financial objectives are actively engaging in forest management. From the Impacts on forest ownership principal components, respondents who reported submitting a Forest Practices application have a higher score for the perceived impact of Forest Practices regulations on their ownership.

Table 21. Average differences in principal component scores among respondents to the GP survey based on which respondents reported submitting a Forest Practices application in the previous 10 years.

	Importance of owning forest land				**Impacts on forest ownership**		
	Financial	Spend time	Enviro	Legacy	Develop-ment	Disturbance damage	Fpr (regs)
Submitted Forest Practices App. last 10 years	0.510	0.087	0.045	0.189	-0.087	-0.020	0.469
Otherwise	-0.239	-0.041	-0.021	-0.088	0.042	0.010	-0.223
p value from Welch two sample t test	2.20E-16 (***)	0.091 (*)	0.400	0.001 (***)	0.108	0.710	2.20E-16 (***)

Table 22 shows the average differences in principal component scores for respondents who said they anticipate submitting a Forest Practices application in the coming 10 years and all other respondents. For the most part, the principal component scores that were significant for respondents who reported having submitted a Forest Practices application in the previous 10 years are significant for respondents who anticipate submitting a Forest Practices application in the coming 10 years. The exception is that the average principal component scores for "Spend time" is no longer significantly different and respondents who anticipate submitting a Forest Practices application have a significantly higher average principal component score for environmental objectives, "Enviro." What is likely more important than the significance of "Spend time" in previous Forest Practices applications and significance of "Enviro" for future Forest Practices applications is that the mean scores for every "importance of owning forest land" component is positive in both Table 21 and Table 22. In other words, SFLOs who report being active with Forest Practices applications tend to be more engaged with all four aspects of forest ownership.

Table 22. Average differences in principal component scores among respondents to the GP survey based on which respondents anticipate submitting a Forest Practices application in the coming 10 years.

	Importance of owning forest land				**Impacts on forest ownership**		
	Financial	Spend time	Enviro	Legacy	Develop-ment	Disturbance damage	Fpr (regs)
Anticipate submitting Forest Practices App. Next 10 years	0.594	0.064	0.179	0.357	0.010	-0.020	0.490
Otherwise	-0.245	-0.026	-0.074	-0.147	-0.004	0.009	-0.211
p value from Welch two sample t test	2.20E-16 (***)	0.2508	0.001 (***)	9.94E-10 (***)	0.861	0.7134	2.20E-16 (***)

As a word of caution to policymakers, the academic literature is still inconclusive on exactly how SFLO ownership objectives influence owner behavior. While it is intuitive to expect family forest owners to engage in different kinds of forest management or participate in different policy programs, forest ownership objectives often do not have the expected associations with forest management decisions or voluntary program participation (Danley 2019; Dayer, Allred, and Stedman 2014; Eggers et al. 2014; Floress et al. 2019; Urquhart, Courtney, and Slee 2012).

One possible explanation is that SFLOs can make similar decisions for different reasons (for example, one publication about forest owner typologies is titled “Your policy, my rationale” (Deuffic, Sotirov, and Arts 2018). Therefore it is advisable to approach each individual SFLO as a person with his or her own unique needs while making policy instruments, such as Forest Practices Applications, compatible with a wide range of landowner needs and objectives.

8.4.6 Summary

- Small Forest Landowners in the State of Washington tend to care about the protection of water resources on their lands. “The protection of water resources” ranks highly as an ownership objective among Washington State SFLOs. Not taking into consideration the impact of riparian regulations on individual respondents, “the protection of water resources” ranks 5th out of 13 objectives for respondents to the NWOS, which is higher than the average importance of timber products. Among respondents to the GP survey “protection of water resources” also ranks higher than the average importance of harvesting timber, the income from forest management, and the income from potential forest land sales.
- The more forest land a person owns, the more important income and investment tends to be for that ownership. Many ownerships that say income and investment is important as a forest ownership objective also say objectives such as Nature & aesthetics and Family & privacy are important. In other words, SFLOs who value income and investment from their forest land tend to also value other objectives as well.
- SFLOs who have a sole focus on income and investment from their forests may constitute a minority of ownerships, but they tend to own disproportionately more of the state’s Small Forest Land.
- Despite the diversity of SFLO ownership objectives, roughly half of all ownership types from the NWOS have done some kind of harvest on their properties during their ownership tenure. From the GP survey, respondents who say they have submitted a Forest Practices application in the past or intend to do so in the future tend to be more engaged with multiple aspects of forest ownership. Conversely, SFLOs who have not harvested timber are also diverse in their objectives.
- This analysis is an introduction to the diversity of the state’s SFLOs and not a conclusive guide to understanding the ownership objectives of Washington SFLOs. Policy and programs for SFLOs should give consideration to the different needs and objectives of owners. We also caution against over-interpreting these ownership objectives results since there are many factors in addition to ownership objectives needed to adequately explain SFLO behavior.

8.5 Regulatory Impacts on SFLOs

8.5.1 Evaluation of the overall impact of riparian regulations on forest ownership.

We frame the FF survey results regarding the Forests and Fish regulations by first presenting sample-level responses to three questions asking respondents to evaluate the overall impact of Washington State riparian regulations since 1999. Just before asking the three questions concerning respondents' overall assessments of the State's riparian regulations, respondents were informed of the following:

"The regulations intended to protect endangered salmon habitat in Washington State (RCW 76.09.055) acknowledge the disproportionate negative economic impact they impose on Small Forest Land Owners. Alternate Plans, Alternate Plan templates, FREP, FFFPP, and the Small Forest Landowner Office are intended to lessen the economic burden of forest riparian regulations on Small Forest Land Owners."

The first overall evaluation question asks: *"Considering financial aspects only, how would you describe the impact that riparian regulations since 1999 have had on your forest ownership in the State of Washington?"* We refer to the first question as the "financial impacts" question. The second overall evaluation question asks: Considering your overall assessment of their intended environmental impacts, what is your impression of Washington State's forest riparian regulations for small forest lands since 1999? We refer to the second question as the "impressions" question. The third overall evaluation question asks: To what extent do you feel that the efforts described above (Alternate Plans, Alternate Plan templates, FREP, FFFPP, and the Small Forestland Owner Office) and other services available to Small Forest Land Owners adequately address the economic impacts of riparian forest regulations for your ownership? We refer to the third question as the "extent addressed" question.

The three overall evaluation questions tended to have a high rate of respondents answering either "don't know" or leaving the questions blank. In total, only 233 out of 445 respondents (or 52%) gave an answer to all three questions that was not "Don't know." For the "financial impacts" and "impressions" questions, 26% and 27% either answered "Don't know" or didn't answer the question, respectively. For the "extent addressed" question, 39% either answered "Don't know" or didn't answer the question. To give some context, the rate of non-response to the question asking respondents their household income in 2019 was 17% in the FF survey. With such a high non-response rate to these questions, we make the somewhat obvious conclusion that many respondents to the FF survey have difficulty giving an assessment of the full impacts that riparian regulations have had on their forest ownership and particularly if the actions taken by the State adequately address those impacts. Note that this phenomenon is occurring in the FF sample, which is designed to capture the SFLO subpopulation most affected by the riparian regulations and policies.

As explained in the presentation of the FF survey design, the sample frame for the FF survey includes SFLOs who own at least one parcel that has been involved in FREP, FFFPP, or Alternate Plans, or meets a range of other criteria that includes having a Forest Practices application for thinning or harvesting on file with DNR. Essentially, most respondents in the FF survey have actively been engaged with harvesting and/or the specific instruments regarding the Forests and Fish regulations. The exception would be respondents who bought a parcel meeting those criteria after the harvest took place or after an application was made to FREP, FFFPP, or Alternate Plans. Nevertheless, we investigate the possibility that even among the FF survey respondents the importance of timber harvesting may be positively related to the size of forest holdings. The following analysis will therefore present survey results for respondents as well as by the amount of forest land owned by respondents. For example, the average amount of forest acres owned by respondents who gave an answer to all three overall evaluations questions (excluding "Don't know" responses) is 139 acres, while the average forest acres owned by all other respondents is 359 acres. The difference is significant at the 1% level (Welch two sample T-test, t = -3.1344, df = 96.168, p-value = 0.002), which means there is evidence that SFLOs with larger amounts of forest land tend to have an opinion about the overall impacts of the State's riparian regulations.

Figure 16 shows answers to the "financial impacts" question. Due to the low frequency of the "somewhat positive" and "very positive" responses, they are combined into one category ("positive"). Combining two of the answer categories, 42% of respondents say the regulations have had a somewhat or very negative financial impact on their ownership. Conversely, 58% of respondents either "don't know," didn't respond to the question, said the regulations have had little to no impact, or even had a positive impact.

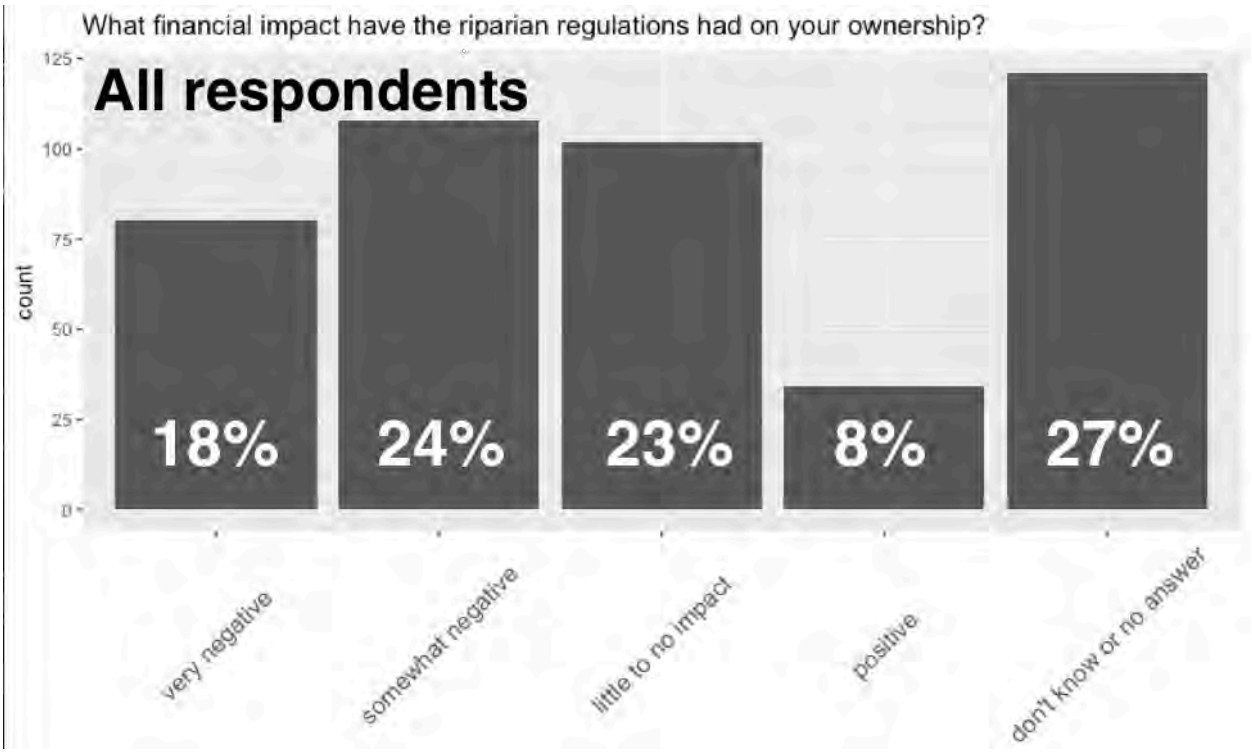

Figure 16. Evaluations of the financial impact that riparian regulations have had on SFLOs: by percentage of FF survey respondents.

Table 23 uses the results from Figure 16 to aggregate the amount of forest land owned by respondents based on their answers to the "financial impact" question. Although respondents who say the regulations have had a "very negative" impact on their forest ownership only represent 18% of FF survey respondents, they own 37% of all forest land represented in the FF survey with an average of almost 359 forested acres. Viewed by small forest land (as opposed to small forest land owners), about 60% of the small forest land in the FF survey is owned by respondents who say the regulations have been "somewhat negative" or "very negative" in their financial impact. Despite significant heterogeneity in landowner response, i.e., the majority of *land owners who are subject to riparian regulations* do not say they have experienced negative financial impacts, *the majority (about 60%) of the land base* is owned by respondents who report somewhat negative or very negative financial impacts.

Table 23. Evaluations of the financial impact that riparian regulations have had on SFLOs: of respondents who answered each category, how much forest land do they own?

	Very negative	Somewhat negative	Little or no impact	Positive	No opinion or no answer
average forest acreage	358.99	179.56	77.46	143.65	155.55

% of forest in sample	37%	24%	10%	6%	23%

Figure 17 shows the answers to the "impressions" question. Relative to the "financial impacts" question in Figure 16, respondents impressions of the intended impacts of the regulations are more uniformly distributed among respondents. Although the percentage of respondents who "don't know" or didn't answer the question is similar to the "financial impacts" question, about ¼ of all respondents have a "somewhat" or "very positive" view of the intention of the regulations. We note the fact that more respondents have a positive view of the intended impact of the State's riparian regulations than those who say the effect of the regulations have been positive on their own ownership.

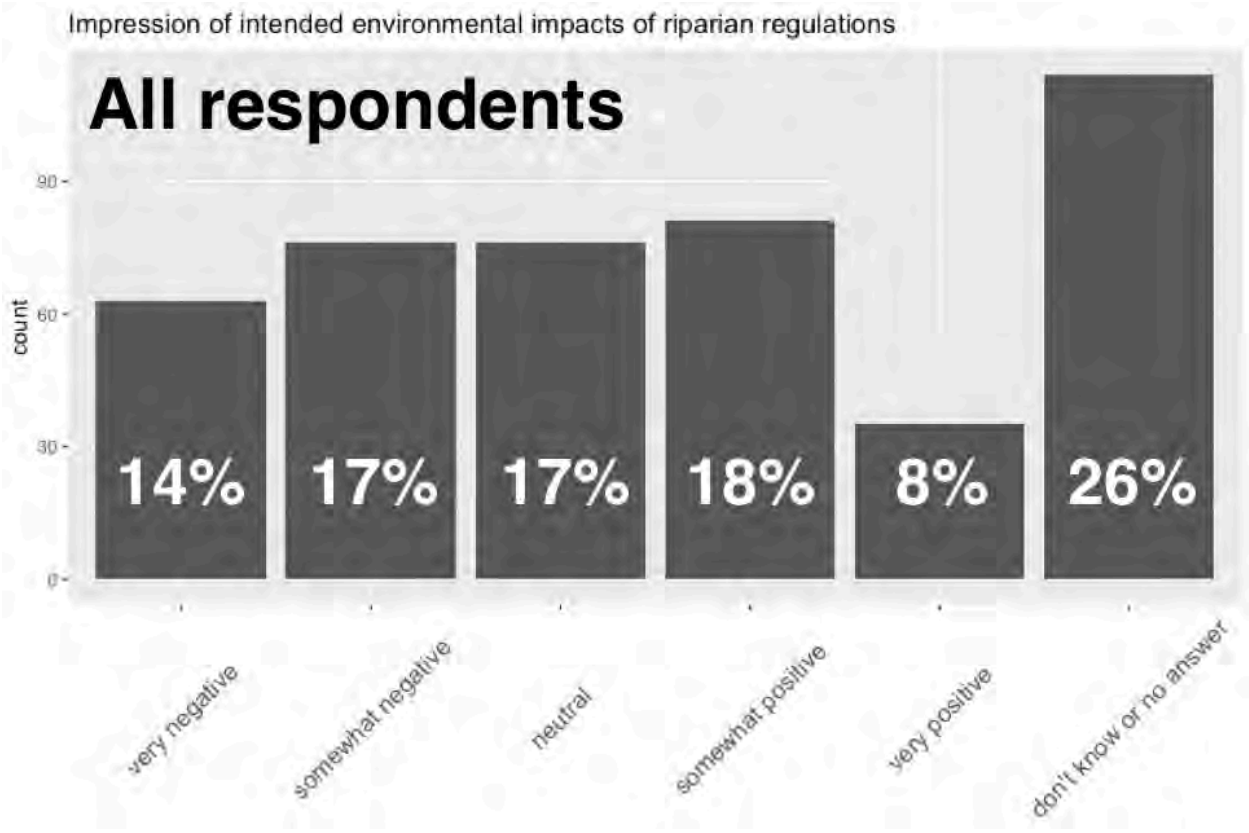

Figure 17. Respondent impressions of the intended environmental impacts of forest riparian regulations since 1999.

Table 24 uses the results from Figure 17 to aggregate the amount of forest land owned by respondents based on their answers to the "impressions" question. Although 31% of respondents said they have a "very negative" or "somewhat negative" impression of the intended environmental impacts of the State's riparian regulations, those respondents own 50% of all forest land represented in the FF sample. The average forest acreage of respondents decreases from about 332 acres for respondents who answered "Very negative" to 235 acres

for those answering “Somewhat negative” to about 138 acres for respondents who said they have a “Neutral” impression of the intention of the regulations. The average forest acreage of respondents with “Somewhat positive” and “Very positive” impressions of the intended impacts of the regulations is lower than the other response categories, while those who “Don’t know” or did not answer own about 160 acres on average. Table 24 shows a generally inverse relationship between the amount of forest acreage respondents own and their impression of the intended effects of riparian regulations.

Table 24. Impressions of the intended environmental impacts of riparian regulations: of respondents who answered each category, how much forest land do they own?

	Very negative	Somewhat negative	Neutral	Somewhat positive	Very positive	No opinion or no answer
average forest acreage	331.92	235.33	137.81	101.00	118.35	159.01
% of forest in sample	27%	23%	13%	10%	5%	22%

Similar to results from the “impacts” question, there is substantial heterogeneity in landowner response to the “impressions” question. Similar to the “impacts” question, the majority of landowners who are subject to riparian regulations have a non-negative impression of the intended impacts of the regulations, while half the land base (50%) is owned by respondents who report a somewhat negative or very negative impression of the intended impacts of the regulations.

Figure 18 shows the answers to the “extent addressed” question. Of the three questions asking respondents about the overall impact of the State’s riparian regulations, the “extent addressed” question has the highest rate of “Don’t know” or blank answers by far. We hypothesize the high “don’t know or no answer” rate to the “extent addressed” question is likely due to the fact that the question presumes the following about respondents: they have direct experience with the riparian regulations, can imagine the counter-factual of what management they would do if the regulations were not in place, and they are sufficiently knowledgeable about Alternate Plans, FREP, FFFPP, and the Small Forestland Owner Office to assess how well they address the impact of the regulations. Still, about 42% of respondents say that the efforts the State has undertaken address the impacts of riparian regulations “somewhat” or “moderately.” About 11% say the State has “substantially” or “very much” addressed the impacts of riparian regulations for their ownership.

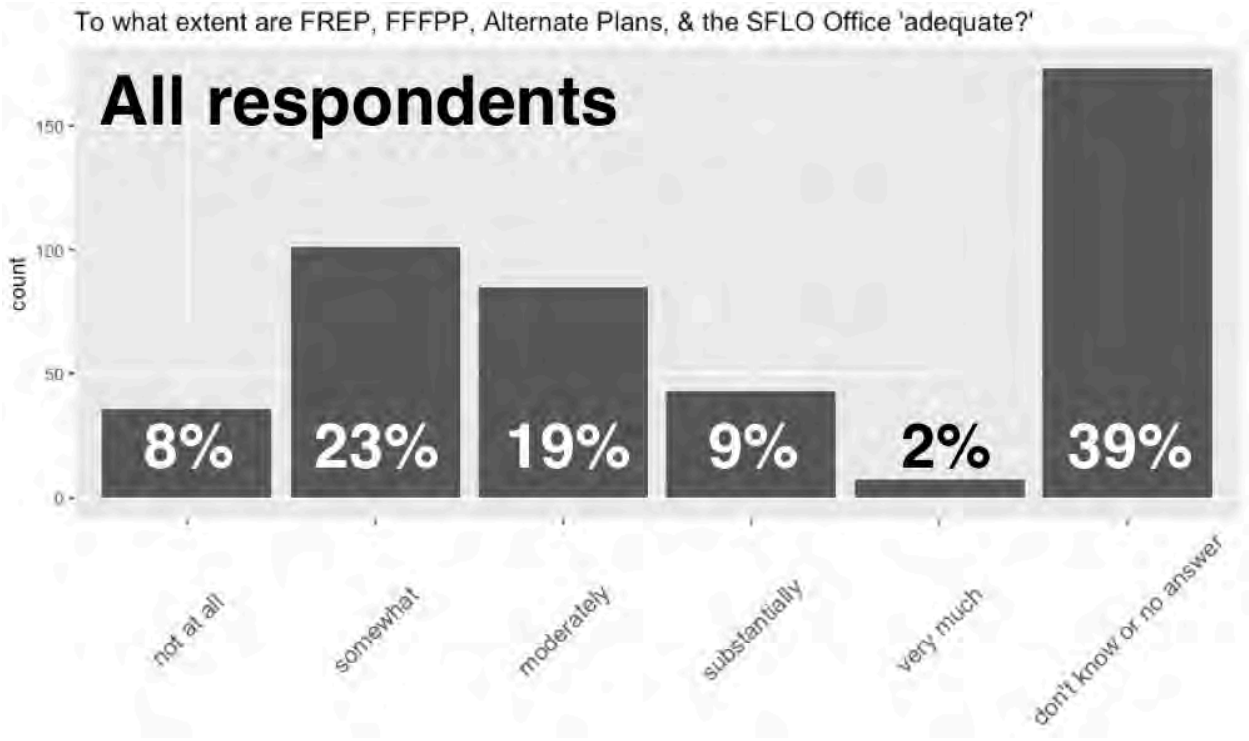

Figure 18. To what extent respondents feel that the State's efforts adequately address the economic impacts of riparian forest regulations for their ownership.

Table 25 uses the results from Figure 18 to aggregate the amount of forest land owned by respondents based on their answers to the "extent addressed" question. The largest difference between Figure 18 and Table 25 is that while 23% of respondents said the efforts taken by the state have "somewhat" addressed the impacts of riparian regulations on their forest land, those respondents own 38% of the forest land represented in the FF survey. While 39% of respondents did not answer the question or said they "Don't know," those respondents own 31% of the forest land represented in the FF survey. For the "financial impacts" and "impressions" questions, those who chose the most negative response categories had the most forest land, on average. Somewhat different from the other two overall impacts questions, owners with the largest properties, on average, said the efforts of the State "somewhat" address the impacts of riparian regulations instead of the most extreme negative response of "not at all." We also note that respondents who said the efforts of the state have "moderately" addressed the impacts of riparian regulations on their ownership have the second largest forest properties, on average, after respondents who answered "somewhat." Not only do a minority of respondents say that the efforts of the State only "somewhat" or do "not at all" address the impacts of riparian regulations for their ownership, but less than half of the land base (43%) is owned by respondents who say the State has only "somewhat" or "not at all" addressed the impacts of the riparian regulations.

Table 25. To what extent have the State's efforts addressed the impact of riparian regulations: of respondents who answered each category, how much forest land do they own?

	Not at all	Somewhat	Moderately	Substantially	Very much	No opinion or no answer
average forest acreage	118.11	303.31	168.12	114.29	101.43	145.66
% of forest in sample	5%	38%	18%	6%	1%	31%

This overview of the impacts the Forests and Fish regulations have had on SFLOs shows a difference between the impacts on Small Forest Land Owners and Small Forest Land. The impacts of the State's riparian regulations have uneven (or heterogenous) impacts on SFLOs, but those who feel negative financial impacts from the regulations own a majority of the forest land base represented in the FF survey. While almost 2/3 of respondents have a non-negative view of the regulations' intended environmental impacts, those who have a negative view of the regulations' intended impacts own half of the forest land represented in the FF survey. Furthermore, respondents who believe the State's efforts have only "somewhat" addressed the impacts of riparian regulations on their forest properties own disproportionately more forest land compared to other respondents. In summary, the impacts of the State's riparian regulations are heterogenous across SFLOs, but the more forest land a person owns, the more negative they tend to be in their assessment of the financial impact of the regulations, the regulations' intended environmental impacts, and the extent to which the State has adequately addressed the impacts of the regulations.

Based on comments from both formal and informal stakeholder conversations, we further examine differences in selected overall impacts questions based on which respondents said they have submitted a Forest Practices application in the previous 20 years. Some stakeholders expressed that SFLOs typically don't think the riparian regulations are a problem until they attempt forest management in their riparian buffers and encounter the regulations for the first time. We consider that being aware of submitting a Forest Practices application is a proxy for respondents who are more aware of the details of forest management and thus more likely to know the details of the riparian regulations. However, we also note the tendency of larger ownerships to be more interested in the financial aspects of forest land ownership (from the NWOS and GP surveys) and, accordingly, should also be more likely to engage in forest management. The 276 respondents (62% of FF survey respondents) who said they have submitted a Forest Practices application in the past 20 years own an average of 256 forest acres while all other respondents own an average of 50 forest acres (the difference is significant at the 1% level using a Welch two sample t test: t = -6.0025, df = 295.53, p-value = 5.682e-09). We therefore stress that differences between SFLOs who say they have submitted a Forest

Practices application in the past 20 years and all other respondents are substantially confounded by differences in the amount of forest acres owned.

Figure 19 shows the perceived financial impact that riparian regulations since 1999 have had on respondents who said they have submitted a Forest Practices application in the past 20 years (FP app = Yes). Figure 20 shows the perceived financial impact that riparian regulations since 1999 have had on respondents who said they have NOT submitted a Forest Practices application in the past 20 years (FP app = No). Among respondents who did not say they have submitted a Forest Practices application in the past 20 years, 43% either answered "Don't know" or did not answer the question regarding the financial impact of riparian regulations on their ownership compared to 17% of respondents who said they have submitted a Forest Practices application. A slight majority of respondents (56%) who said they have submitted a Forest Practices application in the past 20 years said the financial impact of the regulations on their ownership have been negative compared to just 18% of respondents who did not say they have submitted a Forest Practices application. The differences in frequencies between Figure 19 and Figure 20 are significant at the 1% level using a Chi-squared difference of proportions test (X-squared = 68.489, df = 4, p-value = 4.731e-14).

Overall, engaging in active forest management (and being aware of at least enough detail to know what a Forest Practices application is) is associated with a more negative assessment of the impact of riparian regulations; however, this result may have to do with differences in average forest acreage between the two groups. It may be possible that respondents who have not been involved with submitting a Forest Practices application will become more negative in their assessment of the impacts of the riparian regulations when and if they do so in the future, but we have no way of identifying how many respondents may become more negative after submitting a Forest Practices application. We also checked for differences between the two groups for the "impressions" question and the "extent addressed" questions and found similar statistical differences of the same kind. Respondents who said they have submitted a Forest Practices application in the past 20 years are more negative in their impressions of the intended impacts of the State's riparian regulations and to what extent the State has adequately addressed the impacts of riparian regulations.

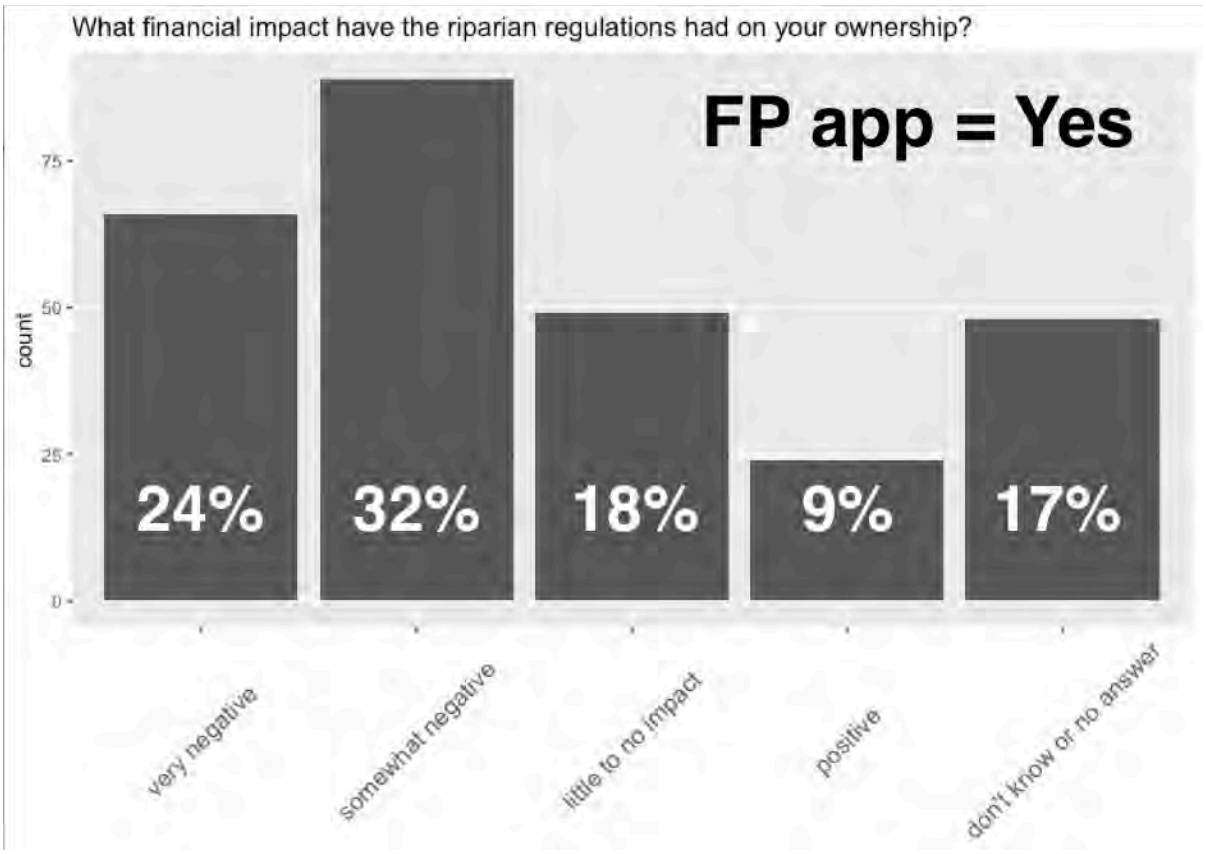

Figure 19. Evaluations of the financial impact that riparian regulations have had on SFLOs: for FF survey respondents who said they have submitted a Forest Practices application in the past 20 years (FP app = Yes).

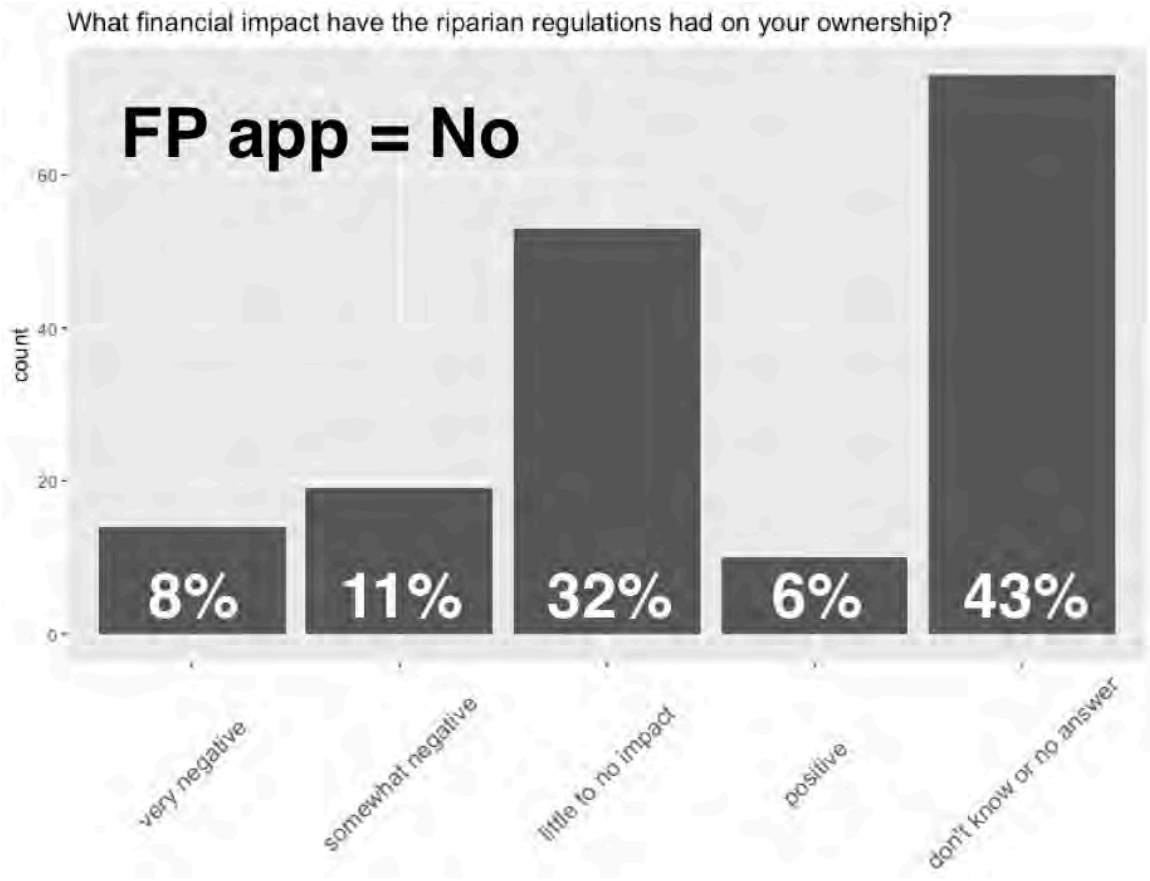

Figure 20. Evaluations of the financial impact that riparian regulations have had on SFLOs: for FF survey respondents who said they have NOT submitted a Forest Practices application in the past 20 years (FP app = No).

Also based on comments from both formal and informal stakeholder conversations, we examine differences in selected overall impacts questions based on when respondents first came to own their forest properties or if they purchased or inherited their properties from a parent or other relative. Numerous stakeholders expressed the sentiment that "*it is only the people who owned forests before 2000 who are still upset about the regulations, but newer owners have accepted the regulations or knew what they were getting into when they bought the forest*." We group respondents into two groups, with one group comprising respondents who became forest owners before 2000 as well as respondents who said they inherited or bought their forest property from a parent or other relative (pre 2000 & legacy owners). While SFLOs who purchase property on the open market are more likely to have made the choice to purchase their forests, those who inherit or purchase from a relative may likely not have had a choice in which forest property to own. We admit that respondents may have owned forest property before 2000 without owning riparian forest land pre-Forests and Fish legislation. By the same logic, respondents could have inherited forest land that has no riparian forest and acquired riparian forests through some other means. Accordingly, there is some imprecision in our ability to identify respondents who owned riparian forests before the Forests and Fish

legislation as well as those who are legacy owners of riparian forests and arguably did not choose to own riparian forests.

Figure 21 shows the perceived financial impacts of the riparian regulations for “pre 2000 & legacy owners.” About 1 out of every 4 such respondents did not answer the question or said they “don’t know” while 41% said the impacts have been “very negative” or “somewhat negative.” Figure 22 shows the perceived financial impacts of the riparian regulations for respondents who have owned forest land since 2000 and did not inherit the land or purchase it from a parent or relative (post 2000 owners). Although a higher percentage of the “post 2000 owners” do not answer the question or say they “don’t know” 47% say the impacts have been “very negative” or “somewhat negative” on their ownership. The differences in the distribution frequencies between Figure 21 and Figure 22 are significant (at the 5% level) using a Chi-squared difference of proportions test (X-squared = 9.6179, df = 4, p-value = 0.04738). Essentially, the “post 2000 owners” are more likely to not have or not express an opinion OR be negative in their assessment of the financial impacts the regulations have had on their forest ownership.

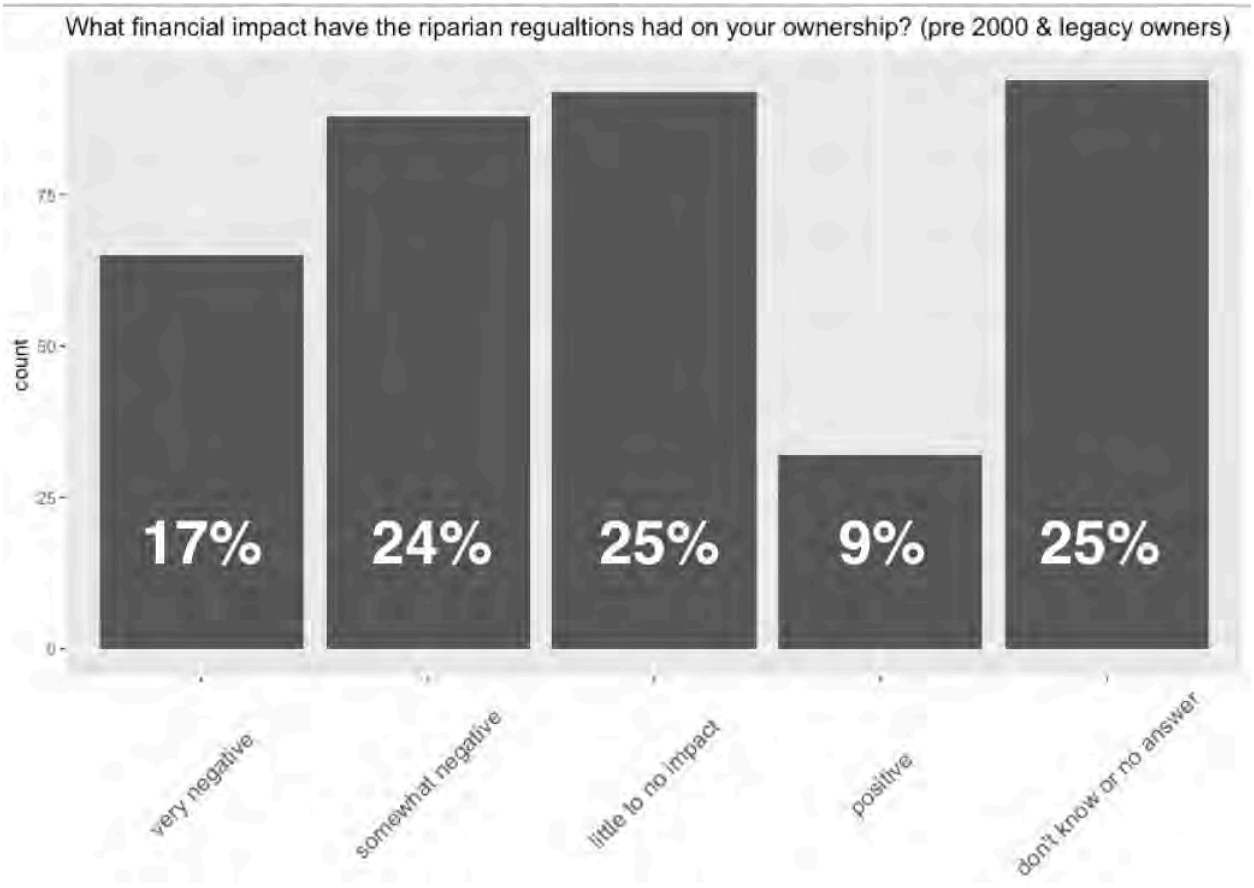

Figure 21. Evaluations of the financial impact that riparian regulations have had on SFLOs: for FF survey respondents who owned forest land before 2000 as well as owners who inherited their forests or bought them from parents/ relatives.

These data do not confirm the occasional folk wisdom that it is only the SFLOs who owned their forests pre-Forests and Fish regulations who think the regulations are a problem. We suspect an important reason for this result is because of the sample frame used for the FF survey. Since the criteria for selection requires survey recipients to own a property that is or has been on the FREP or FFFPP lists, have an Alternate Plan on file, or an application for thinning or felling, then the FF survey respondents are more likely to be active forest managers relative to the general population. If "post 2000 owners" also included SFLOs who have bought their properties and have NOT pursued management then the result may be different.

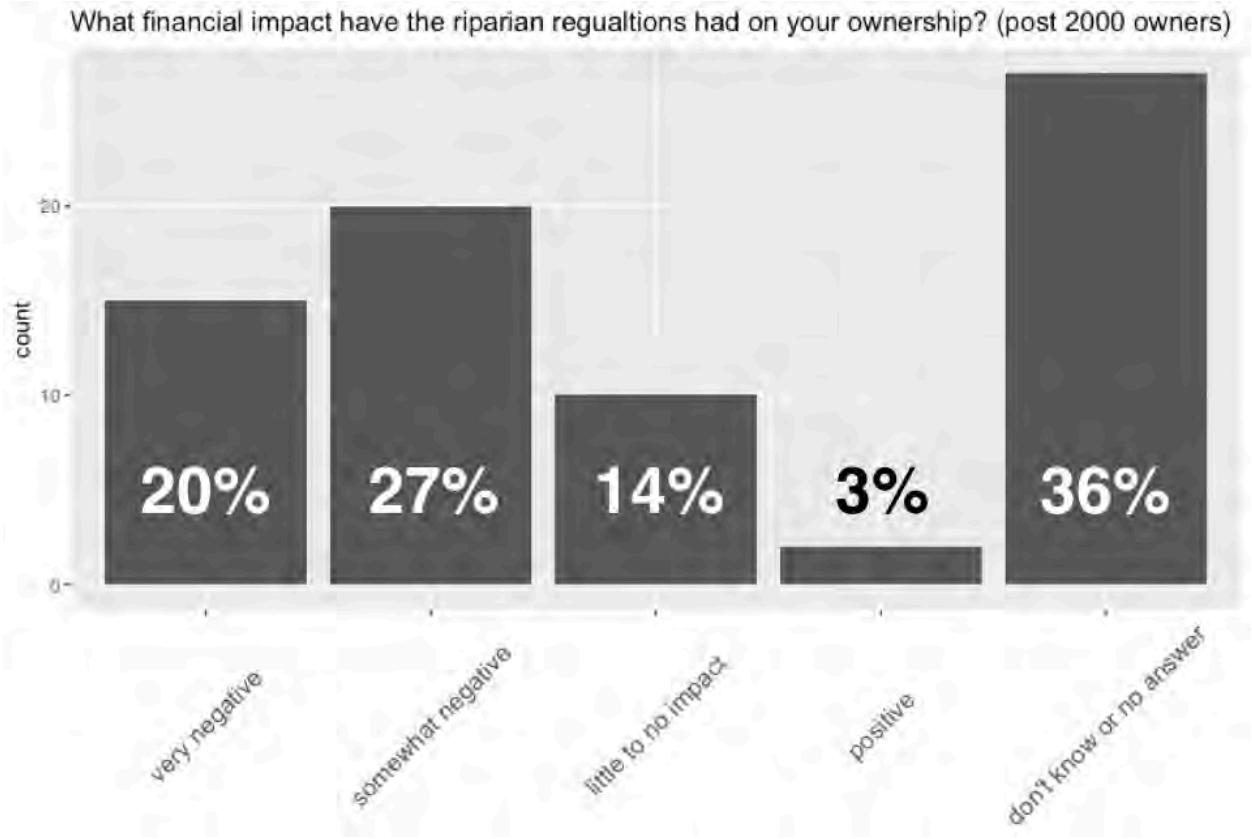

Figure 22. Evaluations of the financial impact that riparian regulations have had on SFLOs: for FF survey respondents who owned forest land from 2000 or later.

To briefly summarize the "overall impressions questions," the FF survey shows that the perceived impacts of Washington's Forest and Fish riparian regulations are diverse across SFLOs. A substantial percentage of respondents are unwilling to answer the questions or say they "don't know," suggesting that many SFLOs are not necessarily thinking about the regulations in a way that our survey questions can capture. *A key finding is that a minority of SFLOs are negative in their evaluations of the impacts of the regulations, but the majority of the forest land base in the survey is owned by SFLOs who say the impacts have been negative*. Owners who are aware they have submitted a Forest Practices application in the past 20 years

tend to own more forest land, and they also tend to be more negative in their evaluation of the regulations. We do not find that SFLOs who have bought their forests after the Forests and Fish agreement are more positive in their assessment of the regulations.

8.5.2 Are SFLOs avoiding the riparian zones in their forest management?

As various stakeholders made clear, the riparian regulations not only place limitations on the harvesting that can be done near streams, but the complexity of the regulations may be causing SFLOs to avoid management in their riparian zones to avoid the trouble of interacting with the regulations at all. We will therefore present some results on how many FF survey respondents say they are avoiding the riparian zones in their forest management (either in the past or in future plans) and the frequency of different reasons given for avoiding the riparian zone. Although these results do not present a true counterfactual of the harvesting activities that would take place in the absence of the increased restrictions on harvesting, it can suggest how many SFLOs have at least considered what management they would do in their riparian zones but have not pursued the option.

Figure 23 shows the frequency of responses given to the question: have you intentionally avoided the riparian zone in your management plans before or do you plan to do so in the future? Similar to the overall impacts question, results show that a substantial minority of respondents say they "do not know." Somewhat less than 40% of respondents say they have intentionally avoided the riparian zone in their past management or intend to avoid it in the future. Slightly less than 1 out of three respondents (32%) say they have not specifically avoided their riparian zones. The difference in the average amount of forest acres owned by respondents who answered "Yes" compared to all other respondents is not significant.

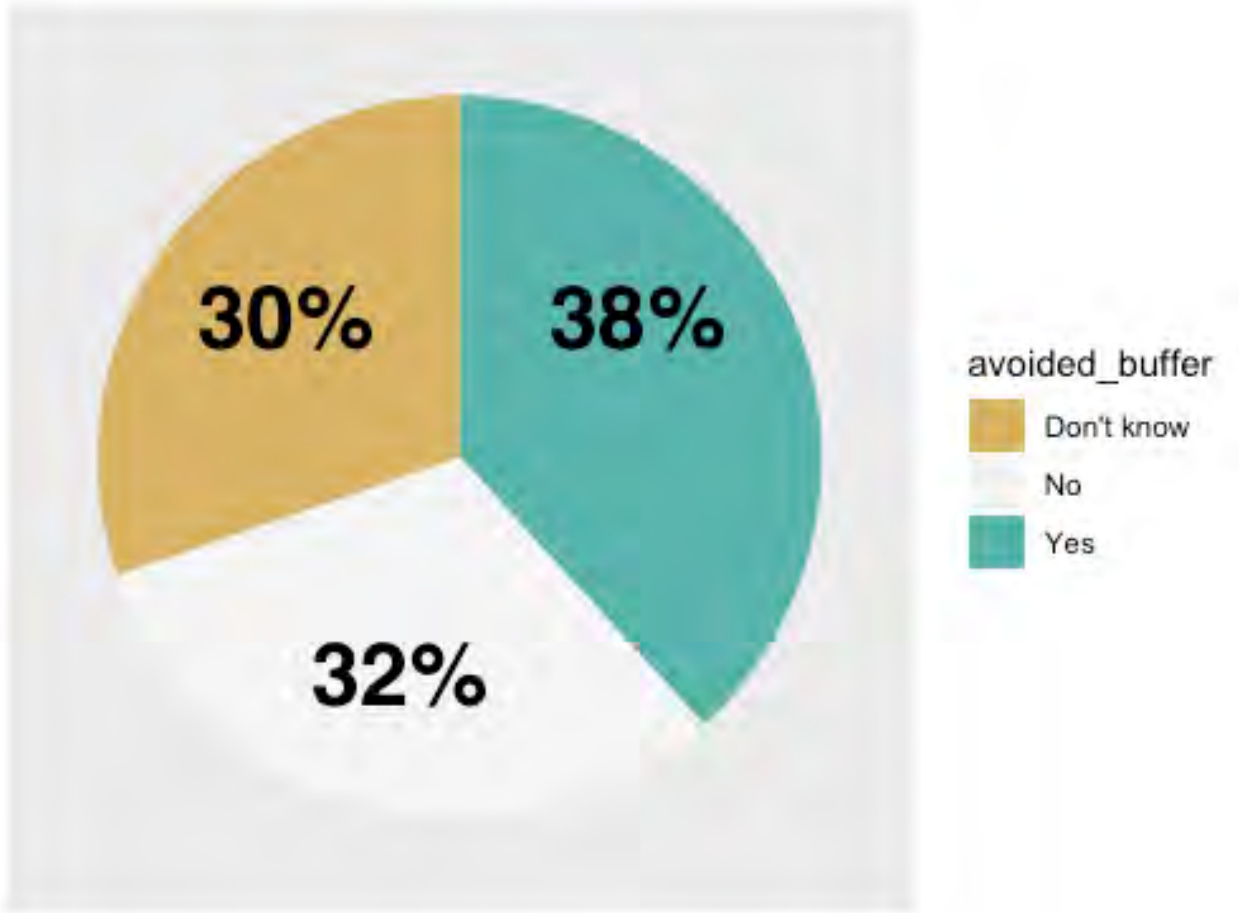

Figure 23. Frequency of responses to "have you intentionally avoided the riparian zone in your management plans before or do you plan to do so in the future?"

Figure 24 shows the frequency of different reasons given for avoiding the riparian zone in past or future management plans. Avoiding the risk of not correctly following the regulations was the most commonly marked reason (43% of respondents who said they had avoided the riparian zone), followed by "I didn't/ don't want to harvest there" (39% of respondents who said they had avoided the riparian zone). Overall, we find much heterogeneity in avoidance of the riparian zone by SFLOs. Of the important minority who say they have avoided their riparian areas, the high frequency of answers to "don't want to harvest there" suggests that not all SFLOs who are avoiding their riparian zones would harvest closer to their streams if they were allowed.

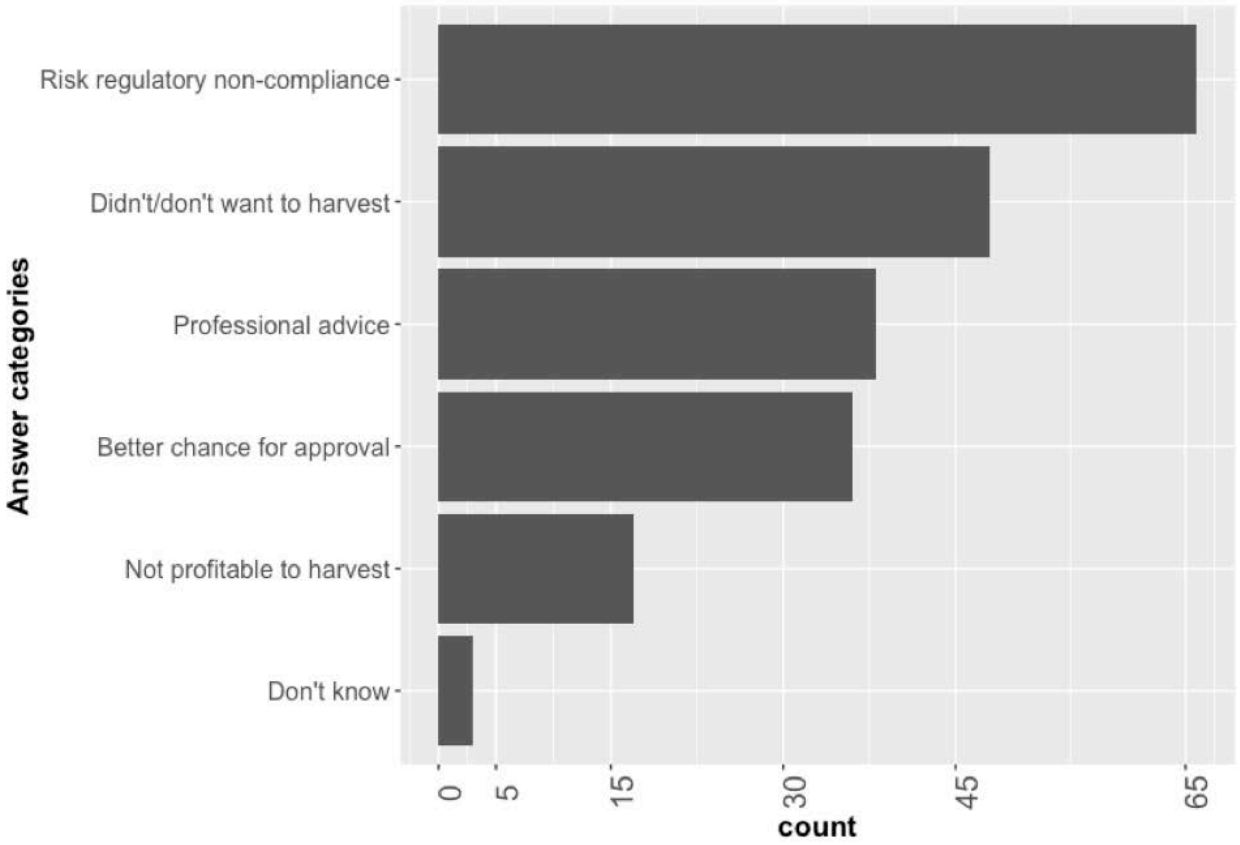

Figure 24. Of the 38% of FF respondents who said they are actively avoiding the riparian zone in their forest management: frequency of reasons given for why respondents are avoiding the riparian zone.

8.5.3 Attitudes toward harvesting near streams

As background, and to give context to the broader attitudinal characteristics of SFLOs and riparian regulations, we present results of a series of attitude questions from the FF survey. The actual text of the eight attitude questions asked is shown in Table 26. Respondents were prompted with the following text "considering the topics of water, streams, fish, and regulations on your forest land, please state your strength of agreement or disagreement with the following statements." Answers were given on a five-point scale ordered scale with a "Not applicable" alternative as follows: "Strongly disagree," "Disagree," "Neutral," "Agree," "Strongly Agree." The distribution of respondents answers to the 8 attitude questions is presented in Figure 25.

Table 26. Mean and variance of respondent agreement/ disagreement with various statements.

Opinion question	mean	Variance
I wish there were substantially more salmon in Washington State rivers and streams	4.126	1.286
I think my forest land ownership in general is beneficial for salmon and/or other fish	3.852	1.667
I have given much thought to the regulations regarding the protection of water, streams, and fish on my forest land	3.807	1.179
I think what happens on and near my forest land has an important impact on fish	3.620	1.650
Conditions on lands and streams downstream of my forest land have an important impact on fish passage on my forest land	3.596	2.079
I think active forest management within the riparian buffers on my forest land would not interfere with stream functions	3.578	1.609
Conditions on lands and streams upstream of my forest land have an important impact on fish passage on my forest land	3.312	2.206
I think regulations regarding water, streams, and fish in the State of Washington are fairly applied to small forest lands compared to other land uses	2.708	1.432

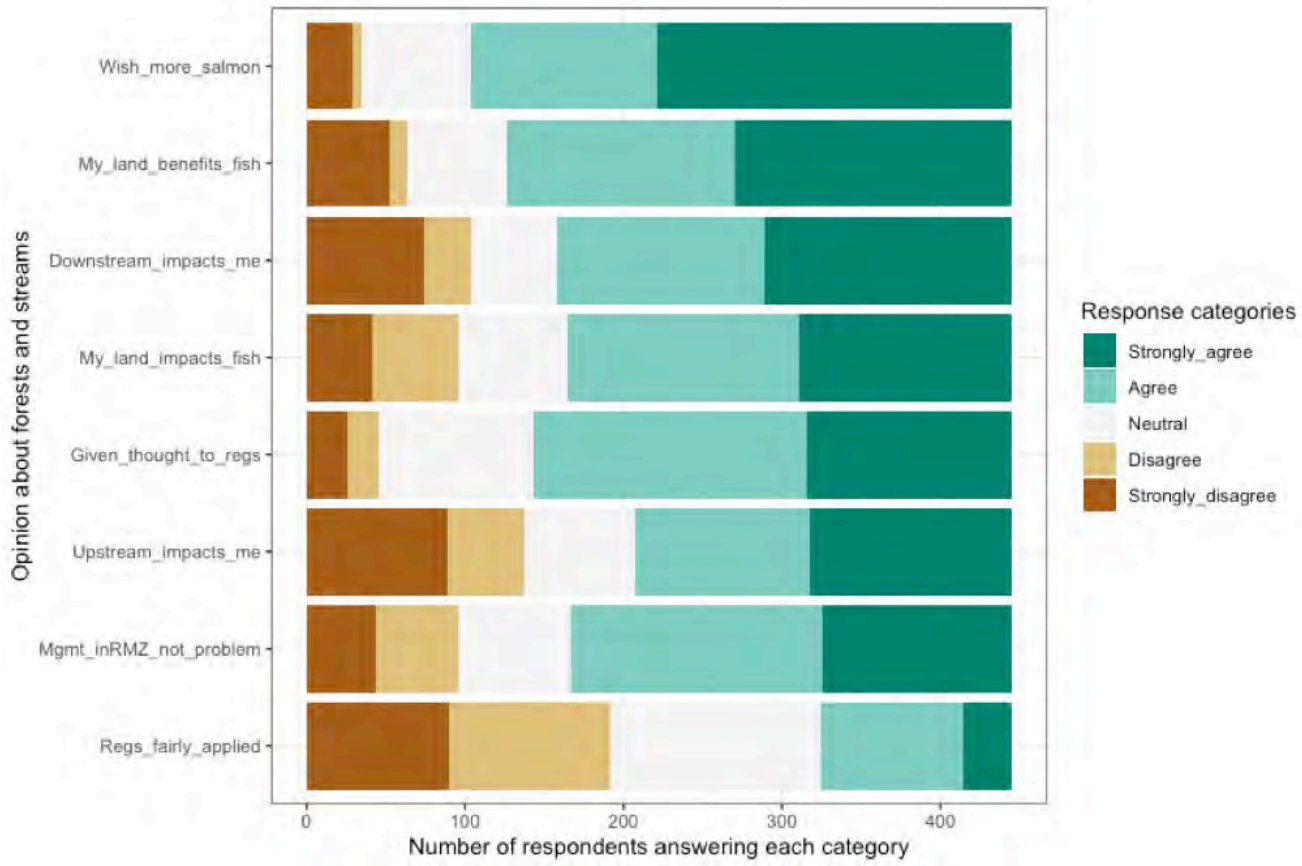

Figure 25. The distribution of respondent opinions concerning forests, forest management, and streams.

The questions with the highest average agreement among FF survey respondents are "wishing there were more salmon in Washington State rivers and streams," "believing forest ownership in general is beneficial for salmon and/or other fish," and that people feel "they have given much thought to the regulations." The question with the lowest average agreement concerns the fairness of regulations regarding water, streams, and fish on SFLO lands compared to other land uses. On average, SFLOs tend to have a high average agreement that salmon and other fish habitat are important and an average score slightly below "Neutral" that the regulations are fairly applied to SFLOs relative to other land owners. We also note the question regarding the fairness of the regulations has the highest frequency of "Neutral" answers compared to any other attitude question, as seen in Figure 25.

To facilitate interpretation of how respondents tended to answer the attitude questions, we apply a PCA with oblique rotation to explore patterns in how FF respondents tended to answer the attitudes questions. PCA with oblique rotation is similar to the PCA with orthogonal rotation (such as the other PCAs presented in this report), but the components themselves are allowed to be correlated with each other. We used the same process to determine the number of

components to retain as the PCAs from the NWOS and the GP surveys. Results of an obliquely rotated PCA with two components are presented in Table 27.

Table 27. Principal component analysis of attitudes questions from Table 26 using oblique rotation.

	My forest is relevant to fish	**Mgmt in buffers acceptable, regulations not fair**
I wish there were substantially more salmon in Washington State rivers and streams	0.575	0.027
I think my forest land ownership in general is beneficial for salmon and/or other fish	**0.702**	0.222
I think what happens on and near my forest land has an important impact on fish	**0.879**	-0.173
Conditions on lands and streams *upstream* of my forest land have an important impact on fish passage on my forest land	**0.863**	-0.069
Conditions on lands and streams *downstream* of my forest land have an important impact on fish passage on my forest land	**0.826**	0.048
I think [riparian regulations] in the State of Washington are fairly applied to SFLOs compared to other land uses	0.368	**-0.609**
I think active forest management within the riparian buffers on my forest land would not interfere with stream functions	-0.056	**0.762**
I have given much thought to the [riparian regulations] on my forest land	0.335	**0.631**
	1	2
SS loadings	3.275	1.437
Proportion Var	0.409	0.180
Cumulative Var	0.409	0.589
Correlation between 1 & 2	0.119	

Table 27 shows the first component of attitudes is strongly correlated with thinking what happens on and near one's forest land is important to salmon and/or other fish, what happens upstream and downstream of one's forest land, and owning forest land in general is beneficial

to fish. This component can be interpreted as how relevant respondents think their forest land is to fish. The second component correlates positively with thinking forest management within riparian buffers would not interfere with stream function and giving much thought to the riparian regulations. Also, the second component is negatively related to agreement that riparian regulations are fairly applied to SFLOs. The second component therefore represents both a belief that forest management within existing buffers is unproblematic for stream functions as well as a belief that the regulations are not fairly applied to SFLOs. In general, the more that respondents say they have thought about riparian regulations, the less they tend to think the regulations are fairly applied to SFLOs. It is worth noting that the correlation between the two components is positive, but modest at slightly above .10.

We explored relationships between these two attitude measures and other factors and find a strikingly clear result in Figure 26. Respondents who only owned forest land on the Eastside almost exclusively had negative scores for the second principal component "Management in buffers acceptable, regulations not fair" and tended to have negative scores for the first principal component "My forest is relevant for fish." Respondents in the East half of Washington State tend to not think their forests are relevant to fish (tend to be on the left side of the vertical line) and say they have not given much thought to the regulations and don't think they are unfair (they are almost exclusively below the horizontal line). Regarding the clustering of black dots (Eastside only owners) in the lower left-hand corner of Figure 26, we advise readers that this is an unusually clear pattern to emerge from an attitude survey.

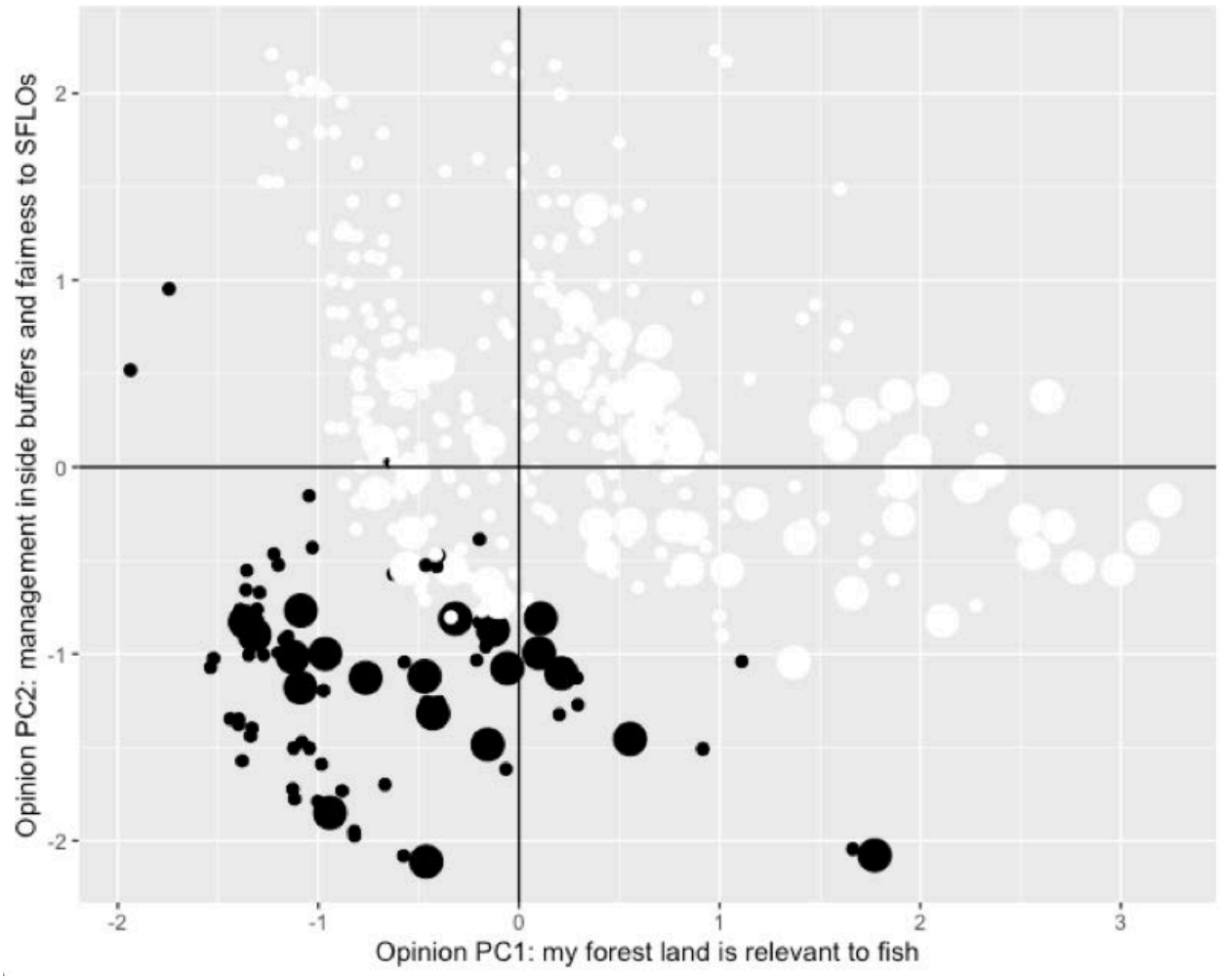

Figure 26. Map of how relevant respondents think their forest lands are to fish (horizontal axis) and how much respondents have thought about riparian regulations, how much they think management within buffers would not interfere with stream function. Black dots represent respondents with forest land ONLY on the Eastside, while larger dots are respondents who own 200 acres or more of forest land.

We further note the concentration of respondents in the upper left-hand corner of Figure 26 are Westside SFLOs who tend to own less than 200 total acres of forest land. *In other words, respondents who think their lands are not relevant to fish, think management within buffers would not interfere with stream function, and think the regulations are not fairly applied to SFLOs tend to be Westside SFLOs with less than 200 total acres of forest land*. Westside SFLOs with 200 forest acres or more (I.e. larger white dots) tend to be concentrated to the right of the vertical line, indicating an agreement that their forests are relevant to fish, although some are to the left of the vertical line. Westside SFLOs with 200 forest acres are more also tend to have relatively moderate scores for the second principal component, “Management in buffers acceptable, regulations not fair” (shown on the vertical axis). Although Westside SFLOs with 200 forest acres or more tend to think their forests are relevant to fish, they tend to be more

moderate in how fair they think the regulations are and if forest management would interfere with riparian function.

8.5.4 Concerns about the impacts of riparian regulations

FF survey respondents were directly asked their concerns regarding the consequences of riparian regulations. Slightly less than half of respondents express a concern (45%), with the most common concern being that forestry will not be an economically viable land use in the future (27% of respondents). The second most frequently listed concern is that the land will not remain forested in the future because of the regulations (16% of respondents). Considering respondents who were either concerned that they may have to sell some of their forest land or all of their forest land, 16% of respondents are concerned they may have to sell forest land because of the regulations. In a later section, we will show that roughly 9% of respondents to the GP and FF surveys who said they have sold forest land in the past report regulatory burdens as at least one reason for selling forest land. The percentage of FF respondents who say they are concerned they may have to sell forest land is somewhat higher than the percentage who say they have ever sold forest in the past because of regulatory burdens. However, the concern that FF respondents will have to sell all of their forest land is the least commonly given concern.

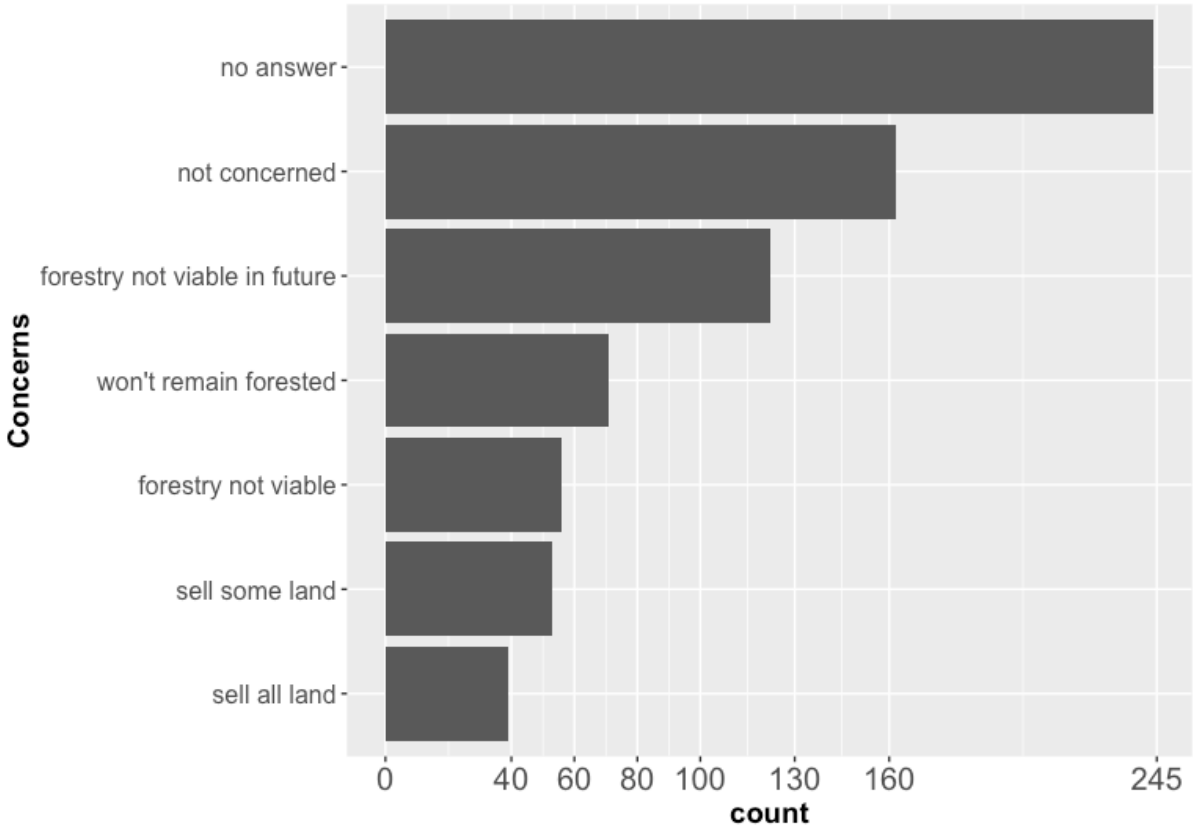

Figure 27. Frequency of concerns respondent concerns ONLY regarding the impact of forest riparian regulations.

Respondents who state any concern tend to have, on average, larger amounts of forest land compared to respondents who do not state a concern (224 acres compared to 143 acres, significant at the 10% level). There is, however, no significant difference in the average amount of forest acres owned by respondents who are concerned they may have to sell some or all of their forest land and all other respondents. *Respondents who only own forest land on the east side of Washington State are less likely to report any concern about the regulations (36%) compared to respondents who own land on the west side of the state (47%, with the difference being statistically significant at the 10% level using a Chi-squared difference of proportions test: X-squared = 3.2245, df = 1, p-value = 0.07254)*. A bit more than 1/3 of respondents say they are generally not concerned about the impacts of the riparian buffers on their forests.

To summarize the results of SFLO concerns, slightly less than half of respondents state any concern at all about riparian regulations and larger forest land owners on the west side of Washington State are more likely to state a concern. Those who say they are concerned they may have to sell some or all of their forest land because of the regulations comprise only 16% of all respondents.

8.5.5 Generalized concerns about government regulation and riparian forests.

To put concerns about riparian regulations in context, we use the 2009 (S. S. Rabotyagov and Lin 2013b) survey and the GP survey to see if ownership of riparian forests is associated with generalized regulatory concerns. Survey recipients to both the 2009 survey and the GP survey were selected without considering riparian forest ownership and therefore include some respondents who own riparian forests as well as some respondents who own little or no forest in riparian buffers. There are at least two advantages to testing the relationship between generalized concerns about regulation and riparian forest ownership: first, we can make statements about the concerns of SFLOs with riparian forests relative to SFLOs with less riparian forest or no riparian forests. Essentially, comparing generalized concerns between SFLOs with different amounts of riparian forests allows pseudo-counterfactual comparison of what regulatory concern would be with less riparian forest or none at all.

As a second justification, as the overall impacts questions from the FF survey reveal, it can be very difficult for survey respondents to answer highly specific questions about riparian regulations. Generalized questions about regulatory concern or the perceived impact of Forest Practices regulations are relatively easier to answer (taking item non-response rates as an indicator of ease or difficulty of answering a question). Furthermore, differences in generalized concern based on the amount of riparian forest under ownership can show a subtle yet important impact of riparian regulations: how much does riparian forest ownership influence generalized regulatory perceptions *even when not asking specifically about riparian regulations.*

Since the 2009 survey is matched to individual parcels, we compare the total amount of core and inner buffer acres to the principal component reflecting perceived regulatory challenges.

An ordinary least squared regression (OLS regression) was used with the principal component scores as the dependent variable and the total amount of buffer acres as the independent variable. For the entire sample, there is no significant relationship between core + inner buffer acres and individual-specific principal component scores for perceived regulatory challenges. For respondents with parcels on the west side of the state, however, the two way relationship shows a positive and significant relationship (p = 0.017). Put simply, the more buffer acres respondents have the more they tend to feel challenged by government regulation in general, but this result only holds for respondents on the westside of the Washington. Figure 28 shows the results of a linear regression confirming the relationship between buffer acres and regulatory concerns and the 95% confidence interval of the average relationship.

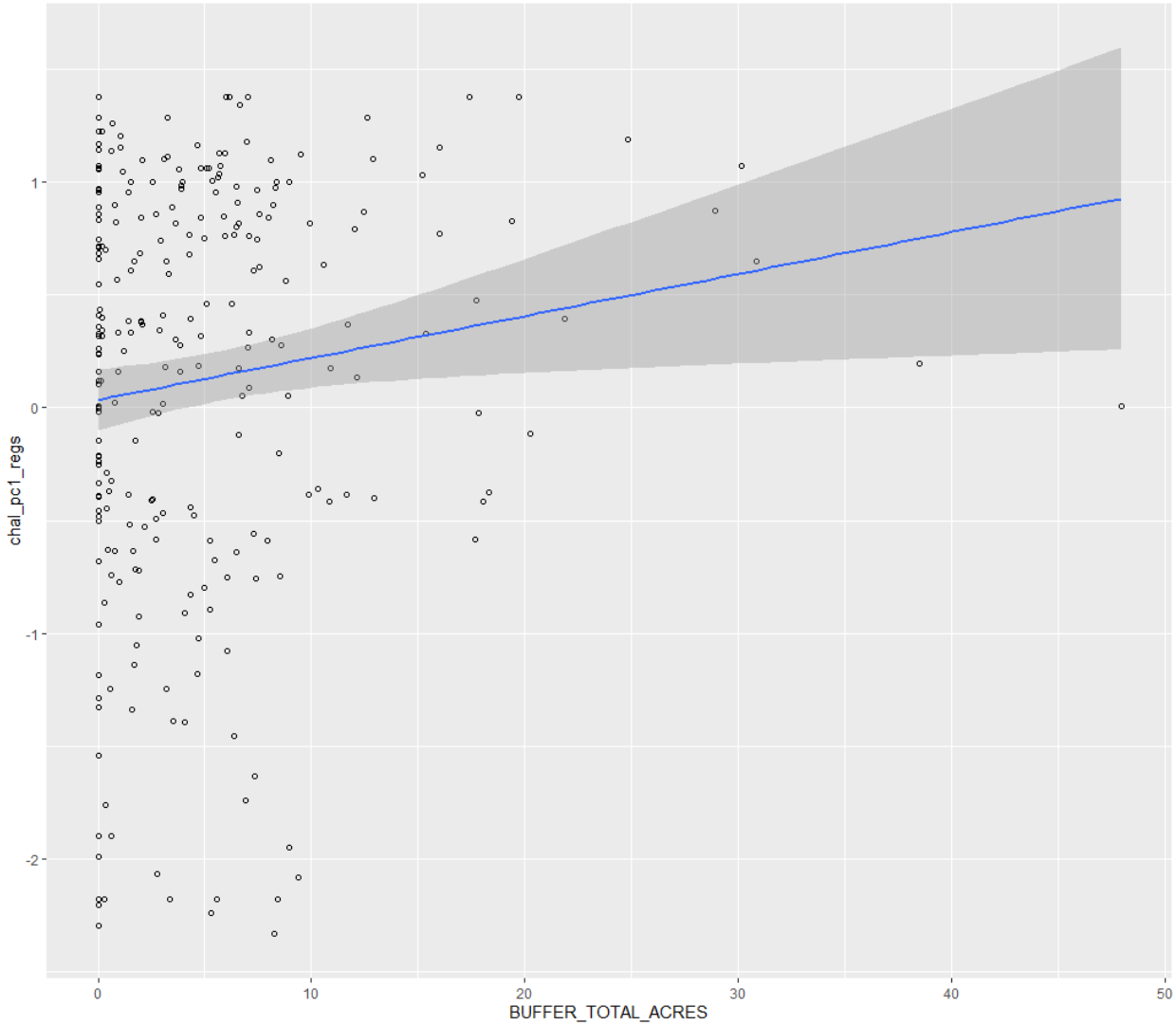

Figure 28. Visualization of the average relationship between total buffer acres (core + inner) and the regulatory concern principal component. Using the 2009 survey of SFLOs.

We also use the GP survey to explore the relationship between forested buffer acres and the principal component scores for perceived impacts of Forest Practices regulations. For the GP survey, we aggregate characteristics of SFLOs forest ownership and therefore consider the proportion of total forest land ownership that exists within core and inner riparian buffers. Using an OLS regression, we control for a variety of variables that are also likely to have an influence on perceived regulatory impacts, including but not limited to: gender, the natural log of the amount of forest acres under ownership, and having submitted a Forest Practices application in the past 10 years. The results of the regression are presented in Figure 29.

```
Call:
lm(formula = impacts3_fpr ~ Female + tenure + log_ac_wood + prop_for_buf *
    West + Fpar10_yn * West, data = GP2_tenure)

Residuals:
    Min      1Q  Median      3Q     Max
-2.5305 -0.6446 -0.1182  0.5916  3.0904

Coefficients:
                  Estimate Std. Error t value Pr(>|t|)
(Intercept)       -0.687801   0.138044  -4.982 8.05e-07 ***
Female            -0.133446   0.079171  -1.686 0.092363 .
tenure             0.000490   0.002237   0.219 0.826640
log_ac_wood        0.191130   0.029172   6.552 1.15e-10 ***
prop_for_buf      -0.373480   0.329465  -1.134 0.257381
West              -0.158232   0.106534  -1.485 0.137954
Fpar10_yn          0.094564   0.117174   0.807 0.419937
prop_for_buf:West  0.670431   0.376291   1.782 0.075266 .
West:Fpar10_yn     0.516935   0.155535   3.324 0.000938 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.8991 on 653 degrees of freedom
  (24 observations deleted due to missingness)
Multiple R-squared:  0.1914,    Adjusted R-squared:  0.1815
F-statistic: 19.32 on 8 and 653 DF,  p-value: < 2.2e-16
```

Figure 29. OLS regression model of the relationship between the proportion of forest land in riparian buffers (core + inner) and perceived impacts of Forest Practices regulations.

Once again, the proportion of forest land that exists within core and inner buffer acres (prop_for_buf) does not have a significant relationship with perceived impacts of Forest Practices regulations for the whole state. However, the interaction term between prop_for_buf and owning forest land on the west side of Washington (at the bottom of the list of Coefficients) is significant and positive. *The result from the GP survey reflects the same result from the 2009 survey: there is a significant and positive relationship between having more forested buffer acres and having higher perceived regulatory impacts, but only for SFLOs on the west side of Washington State*.

A few other control variables are important to mention from Figure 29. First, the natural log of forest acres owned is significant and positive, which is consistent with larger SFLOs having a greater interest in the financial aspects of forest management. Female respondents are significantly less likely to say they feel impacted by Forest Practices regulations. Also highly important to note is that respondents with forest properties on the west side of Washington State who say they have submitted a Forest Practices application in the previous 10 years say they are significantly more impacted by Forest Practices regulations. We draw attention to the fact that the relationship between reporting a Forest Practices application in the past 10 years and increased perception of the impact of Forest Practices regulations exists for SFLOs with forests in western Washington, but the relationship is not significant state-wide.

8.5.6 Testing the "discontinuity effect" for the 20-acre exemption rule

One way of testing for the causal impact of the expanded buffers from the Forests and Fish legislation is by using what is called a "regression discontinuity design" at the boundary of where the more stringent buffer relations apply. There is a "20-acre exemption" for forested properties that are a maximum of 20 acres that allows for a simplified and smaller buffer (the pre-1999 buffer widths plus 15%), as long as the owner(s) of the parcel own no more than a total of 80 forested acres. The intuition behind a regression discontinuity design is that the 20 acre boundary is mostly arbitrary so that parcels that are slightly smaller than 20 acres and slightly larger than 20 acres are more or less similar in terms of how often they will be sold or converted to non-forestry uses. If there are differences in outcomes between the "un-treated observations" (in this case parcels that appear to be eligible for the 20 acre exemption) and "treated observations" (in this case parcels that are not eligible for the 20 acre exemption) that are all close to 20 acres in size, then the difference can be attributed to the more stringent buffer regulations. We used a regression discontinuity approach to test the hypothesis that the presence of riparian buffers is a factor in landowner sales and subsequent land use conversion probability. We do not find evidence that parcels which are able to use the 20-acre exemption rules are sold and/or converted at a higher probability than other parcels.

8.5.7 Summary

- A minority of SFLOs are negative in their evaluations of the impacts of riparian regulations, but the majority of the forest land base in the FF survey is owned by SFLOs who say the impacts have been negative. Overall, there is much heterogeneity in how Washington's riparian regulations have impacted SFLOs and SFLO impressions of the intended environmental impacts of the regulations themselves.
- Almost half of all FF survey respondents are unable or unwilling to answer all three questions assessing the overall impact of the State's riparian regulations, suggesting that many SFLOs are not necessarily thinking about the regulations in a way that our survey can capture.
- SFLOs who say they have submitted a Forest Practices application in the past 20 years are more negative in their evaluation of the impacts the regulations have had on their ownership, although this result is closely related to the fact that SFLOs with more forest acres are more likely to say they have submitted a Forest Practices application. (see 1 above)
- We do not find that SFLOs who have bought their forests after 1999 are more positive in their assessment of the riparian regulations. This result is likely due to the sampling criteria used for the FF survey that excludes SFLOs who have not been involved in FREP, FFFPP, Alternate Plans, or commercial harvesting.
- Somewhat less than 40% of FF survey respondents said they are intentionally avoiding the riparian zone in their forest management plans with the most common reason being to avoid the risk of regulatory non-compliance. 39% of those who said they are avoiding the riparian zone in their harvest plans say they do not want to harvest there, which strongly suggests that not all SFLOs who are avoiding their riparian zones would harvest closer to their streams if they were allowed.
- On average, SFLOs tend to have a high level of agreement that they wish there were substantially more salmon in Washington streams and rivers. Respondents have, on average, the lowest agreement with the statement that riparian regulations are fairly applied to SFLOs relative to other land uses; however, this question also has the highest frequency of "no opinion" answers.
- Multivariate statistics show the second most important component of attitudes regarding forest management near streams reflects the belief that active management in existing buffers will not interfere with riparian function, having given much thought to the regulations, and thinking the regulations are not fairly applied to SFLOs.
- SFLOs on the east side of the state overwhelmingly tend to think their lands are less relevant to fish habitat, have given less thought to the regulations, and do not necessarily think active management in buffers will be benign to riparian functions. Respondents who think their lands are not relevant to fish habitat and that the regulations are not fairly

applied to them tend to be SFLOs in western Washington with less than 200 forest acres. SFLOs in western Washington with more than 200 forested acres tend to have more moderate opinions about harvesting near streams, but have varying opinions about the relevance of their forest lands to fish habitat.

- Slightly less than half of FF survey respondents state any concern about riparian regulations. SFLOs with larger forest properties and on the west side of Washington State are more likely to state a concern. The most commonly expressed concern is that forestry will not be an economically viable land use in the future (27% of respondents), and the least commonly expressed concern is that SFLOs will have to sell all of their forest land because of riparian regulations (9% of respondents).
- Having more acres of forests in riparian buffers (or a higher proportion of total forested acres in riparian buffers) is associated with higher generalized regulatory concern, but only for SFLOs with forest lands in the western half of the state.

9 SMALL FOREST LANDOWNERS: LAND SALES AND LAND USE CHANGE

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(5)(A) Determine which factors contributed to small forestland
owners selling their land;

...
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9.1 THEORETICAL REASONS FOR SFLOS SELLING THEIR FOREST LAND AND/ OR LAND USE CONVERSIONS

The majority of our answer to this question comes from empirical analysis; however, it is important to briefly outline some theoretical reasons why small forestland owners sell their forests. There are at least three, non-mutually exclusive, theoretical explanations for why small forest land owners sell their properties. Each theoretical explanation is a generalization that can describe and contextualize a host of specific factors.

9.1.1 The economics of land use change

The first explanation is that the economics of land use change can indirectly cause land sales as a part of forest conversion to other uses. If the economic returns between managing a

particular forested property as forest are lower than the returns to converting that land to some other kind of use, then it is financially profitable to convert the forest to another land use (Alig and Plantinga 2004; Bradley et al. 2007). Economic pressures for land use conversion can trigger the sale of small forestlands, particularly if a forest is being converted to residential, commercial, or agricultural use.

The financial returns to forestry tend to be lower relative to other land uses, which can be a strong incentive for SFLOs to sell their properties to others who wish to develop the land. As of 2007 in the State of Washington, the value of forestland in timber production was below county assessor's estimate of the property value if the land were developed for an estimated 1.2 million acres of SFLO land in Washington State (Rogers and Cooke 2007). In other words, the financial incentive for SFLOs to sell their forestlands to developers, or to develop their forestlands themselves, existed on an estimated 1.2 million acres of small forestlands.

It is important to note that the economic returns to forestry as a land use include not only the income that forestry can yield to landowners, but also the non-timber benefits of owning a forested property (for a well-known, early example of incorporating both timber and non-timber value in the forest harvest decision, see Hartman 1976). Non-timber benefits of forest ownership include aesthetic and recreational enjoyment, the intrinsic value of protecting the environment and wildlife habitat, and the importance of forestland as an intergenerational family legacy, among other benefits (Aguilar, Kelly, and Danley 2019). The literature on families and individuals who own forested land consistently shows that non-financial forest ownership objectives are prominent among family forest owners throughout the US and other Western countries (B. J. Butler and Leatherberry 2004a; Majumdar, Teeter, and Butler 2008; Ficko et al. 2019). Some Washington State SFLOs are non-governmental organizations with explicit conservation objectives, such as the Nature Conservancy. The non-timber benefits of forestland ownership increase the economic value of forestlands to owners such that an owner may choose to retain ownership of her forestland despite being able to make a financial profit from its sale and/or conversion to another use.

9.1.2 The life cycle or Volvo Effect

The second theoretical reason why SFLOs sell their properties is because the sale of forestland may be part of the small forest land ownership life cycle. Although there is a rich literature on life-cycle effects in a variety of contexts, how these dynamics impact private forest owners has received little attention (Markowski-Lindsay et al. 2016; S. M. Butler, Butler, and Markowski-Lindsay 2017). Viewing SFLOs through a life-cycle lens means that certain patterns and behaviors can be expected perhaps based on the age of owner and/or perhaps based on the length of their forest ownership tenure. According to the SFLO life-cycle hypothesis, younger SFLOs may become more similar to older SFLOs in terms of their forest ownership objectives, forest management decisions, or plans to sell some or all of their forestland as they age. If the

age of the owner is an important driver of actual sales or intentions to sell forest land, then it may be expected that, for example, SFLOs plan to sell their forestland as they become older.

In blunt terms, as individual SFLOs age the risk of mortality increases which can cause owners to sell their properties preemptively (i.e. before their death). Since many SFLOs share ownership of their properties with a spouse or domestic partner, or collectively with siblings or other family members, the death of one owner may be a triggering event for the remaining owners to sell the forest property. Butler et al (2017) explored the owner life-cycle theory using the 2013 USDA National Woodland Owner Survey (NWOS) to find that the oldest generation of family forest owners were most likely to anticipate selling or transferring their properties in the next 5 years. Important to note is that only about 30% of NWOS respondents in the oldest age group anticipated selling or transferring their properties within the coming 5 years. In other words, although the actual or anticipated mortality of SFLOs may be a triggering event for property sales, many owners may still choose to retain ownership of their forestlands into old age.

In our analysis of unofficial NWOS survey data from Washington State and our own survey of Washington SFLOs conducted for this report, we do not find age to be a significant factor in *expectations* of future forestland sales. This finding is consistent with Markowski-Lindsay et al (2016) who found that although the same drivers of forestland sales or bequests are experienced by most owners, such as age and health, incidents that trigger sales can happen at any time during an owner's life. The insignificance of age in intentions to sell may reflect both the tendency for people to live longer as well as the decision to maintain ownership of forestland for as long as possible in old age. As one respondent to the GP survey wrote when asked about having ever sold any forest land:

> *"No, I will live here until I die- 87 years old."- GP* survey respondent

Alternatively, the life-cycle hypothesis may also mean that forest owner objectives and intentions can be explained based on the length of time that that people have owned their forest properties, or ownership tenure. If ownership tenure is an important explanation for forestland sales, then owners who have owned their forests for longer periods of time may, for example, have a greater chance of having sold some of their forest land in the past. It is also possible that owners who have owned their properties for short periods of time, for example, someone who has inherited forestland, may be more likely to sell their forest land. In our 2020 general population survey of Washington SFLOs as well as our survey of SFLOs impacted by the state's riparian regulations, we find that respondents who have owned forest property for longer periods of time more frequently report having sold some, but not all, of their forestland compared to respondents who have owned forestland for shorter time periods. If opportunities for forestland sales occur more or less randomly throughout the time a person owns forestland,

then owning forestland for longer may simply mean a person has had more opportunities to sell forestland.

Other life events may also impact the decisions of SFLOs to sell their properties, such as marriage and divorce, paying for a child's education, and retirement. SFLOs forestlands are an asset that can be harvested or sold to meet a life-cycle event instead of taking a loan from a bank (J. L. Greene and Blatner 1986; Brazee and Meilby 2010). As it relates to timber harvesting, the phenomenon of private forest owners using their forest properties as a source of income to meet immediate financial needs is called "The Volvo Effect" (Johansson and Löfgren 1985). It is easy to hypothesize a similar "Volvo Effect" in which SFLOs choose to sell all or part of their forested properties to meet a financial need within the ownership (such as paying for a child's college tuition). Selling all or part of one's land may also be a way for some SFLOs to finance their retirement (Markowski-Lindsay et al. 2016). Using a timber harvest or forestland sale to finance a need that is not directly related to the forest itself is similar to the tenure lifecycle effect discussed in the previous paragraph. To the extent that the timing of many life events are uncertain or unforeseeable, many forestland sales may be difficult for policymakers to anticipate.

9.1.3 The treadmill effect

The third theoretical reason SFLOs may sell their properties is that owners may have difficulties keeping up with the changing social, ecological, and economic demands of maintaining their forestlands. The treadmill effect in land economics was first suggested as a "product price" effect in which early adopters of new technology produce agricultural or forestry products more efficiently and are able to make higher profits in the short term (Robinson 1989). As more farmers or forest owners adopt the new technology, production increases overall, which leads to a fall in prices and hence lower profits even with new technologies (Levins and Cochrane 1996). The net effect of the treadmill effect is to make it more difficult, particularly for smaller forest owners, to maintain ownership of their forest lands. One of the important mechanisms that drives small landowners out of forestry or agriculture is the need to acquire larger and larger amounts of land in order for forestry to be economically viable. In other words, on the technology treadmill, increasing economies of scale mean that owners of small amounts of forestland may not be able to generate enough profit from forestry to cover their costs of maintaining forestland (Meyfroidt et al. 2018).

In a broader context, regulations on harvesting in riparian zones may function in similar fashion to the treadmill effect since they exclude some forest land from commercial harvesting and thus make it more difficult for forestry to be an economically viable land use for small landholders. Given that SFLOs, by definition, own smaller amounts of forestland, restrictions on harvesting trees in riparian management zones mean large forestland owners may be better able to absorb the losses from management restrictions if they can shift their management to

non-riparian areas. Evidence for the treadmill effect of riparian regulations is something that should be apparent in trends of forestland sales and conversion away from forest and natural resource land use for land parcels with forested buffers.

9.1.4 Summary

The theoretical reasons for why SFLOs sell forestland presented here is not meant to be an exhaustive set of theoretical explanations for forestland sales. We encourage readers to think of these various theories as complementary to each other. For example, the "Volvo Effect" may go hand-in-hand with the economics of land use change for forest land with a higher disparity between economic return for forestry use and residential or other developed land use. Essentially, in order to sell forestland to finance a family need, like paying college tuition, the forestland must be valuable enough to sell at a profit. The theories presented point to reasons for forest sales that have to do with forestland market conditions as well as the needs of SFLOs themselves.

Apart from the Economics of Land Use Change, the theoretical reasons for forestland sales do no imply that sales will lead to the conversion of forestland away from forestry use. In fact, many SFLOs in the State of Washington qualify as SFLOs without necessarily owning land that is classified as forest or natural resource land use. So, some SFLO forestland sales may not run the risk that the forest will be converted away from forestry use because it isn't currently classified as forest land use. Forestland sales can be complex and owners may face a multitude of decisions, including selling some or all of their forestland.

The sale of forestland is merely one way that forests may be converted to residential or other developed use. Selling a part of one's forestland so that a previously larger contiguous tract of forestland becomes owned by more than one ownership is often called parcelization. Forestland sales that cause parcelization may indirectly be a driver of land use change over time as the required economies of scale to sustain forestry as an economically viable land use further push SFLOs with very small amounts of forest land out of forestry. Figure # serves as an illustration of how conservation motives, bequest options, and forestland sales form a complicated decision structure that most SFLOs will at some point have to face.

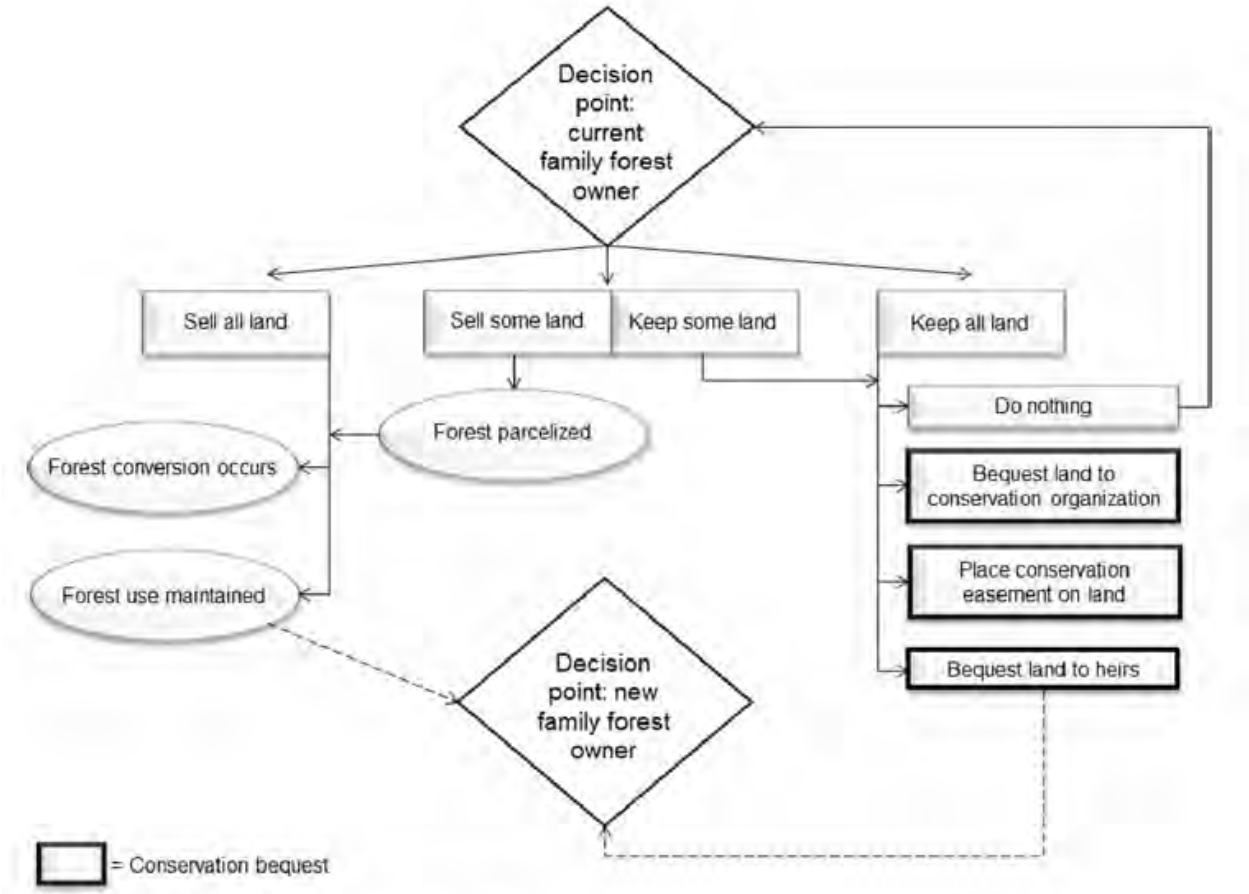

Fig. 2 Stage 2 of FFO future ownership and use decisions

Figure 30. A description of how forestland sales influences future land use. Reproduced from (Markowski-Lindsay et al. 2016)

9.2 Past Forestland Sales in 2020 Surveys

Sections 9.3 and 9.4 below test for a variety of factors involved in forest land sales and conversion of parcels away from "ForestOrNatural" land use. Here we also present a comparison between how many respondents to the GP survey and the FF survey respondents say they have sold their forest land in the past and how frequently "regulatory burden" is given as at least one reason for past sales. Clearly implied in the language of SB5330 is if Washington's riparian regulations have lead to more land sales and/or conversion of forest land away from forestry or open space use. Analysis presented below of a survey from 2009 shows that respondents to SFLO surveys tend to self-select such that inferring to the population of all SFLOs using survey data is sometimes problematic. Nevertheless, as at least one check for evidence of riparian regulations causing forest land sales, we compare the incidence of past forest land sales between GP survey respondents to FF survey respondents.

We argue that a higher frequency of FF survey respondents reporting past forest land sales may be an indication of riparian regulations causing forest land sales. Aside from self-selection among survey respondents, this approach is also subject to a phenomenon called "survivor bias." In this case, survivor bias could occur since we only observe the SFLOs who have been able to maintain their forest land ownership for roughly 20 years after the passage of the Forests and Fish act. Findings from section 9.3 concerning a proxy variable called "FREP eligibility," however, do not suggest that respondents to the FF survey have been substantially impacted by survivor bias as a consequence of owning land subject to forest riparian regulations. Ultimately, comparing the frequency of past land sales between GP and FF survey respondents can only show potential impacts of forest riparian regulations *for SFLOs who sell some but not all of their forest land*. The analysis in sections 9.3 and 9.4 are more definitive concerning the impact of riparian regulation on forest land sales and conversion away from forestry or open space land use.

Both the GP and the FF survey ask respondents if they have ever sold or given away any of their forest land in Washington and presents respondents with a list of reasons for why they have ever sold or given away forest land. We ran a logit model to test the characteristics associated with GP respondents who report ever having sold or given away forest land in the past for comparison purposes and present results in Figure 31. Respondents with larger forest properties (log_ac_wood), with forest land in the western half of the State, with longer ownership tenures are significantly more likely to report having sold or given away forest land (the latter is expected as those who own their forests longer also have a longer time horizon over which to have engaged in land sales). We also include the PC scores for perceived impacts of Forest Practices regulations on forest ownership (impacts3_fpr) and the proportion of respondent forest land existing in core and inner riparian buffers (prop_for_buf), but neither were significant. Respondents 65 years of age and older are also not more statistically likely to report having ever sold forest land.

```
Call:
glm(formula = Past_transf_yn ~ impacts3_fpr + log_ac_wood + West +
    Fpar10_yn + tenure + Over65 + prop_for_buf, family = "binomial",
    data = GP2_Past_transf)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.7348  -0.6372  -0.4603  -0.3114   2.5734

Coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept)  -4.057412   0.456246  -8.893  < 2e-16 ***
impacts3_fpr  0.083190   0.117246   0.710 0.477991
log_ac_wood   0.388698   0.098412   3.950 7.82e-05 ***
West          0.485172   0.233443   2.078 0.037679 *
Fpar10_yn     0.375782   0.247058   1.521 0.128253
tenure        0.023970   0.006458   3.711 0.000206 ***
Over65        0.079011   0.234041   0.338 0.735670
prop_for_buf -0.662125   0.613289  -1.080 0.280307
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 617.92  on 662  degrees of freedom
Residual deviance: 546.50  on 655  degrees of freedom
AIC: 562.5
```

Figure 31. Logit model of the characteristics of GP survey respondents who said they have ever sold or given away forest land.

Comparing respondents to the two surveys, about twice the percentage of FF survey respondents said they have ever sold or given away forest land (17.5%) compared to the percentage of GP survey respondents who said they have ever given away forest land (8.5%). However, about 80% of the FF survey respondents own property on the west side of Washington, and about 18% of western Washington respondents to the GP survey reported having ever sold forest land before. Also, in the GP survey, owning more forest land and having a longer ownership tenure are positively associated with selling forest land in the past. FF survey respondents tend to own more wooded land and, on average, have owned forest land for 3 years longer than the GP survey respondents. As far as the overall frequency of

respondents reporting past forest land sales, the differences between FF survey respondents and GP survey respondents can be attributed to westside/eastside differences and somewhat to ownership size and tenure length differences between the two groups of survey respondents.

As a third check for evidence of riparian regulations influencing the frequency of past forest land sales using the GP and FF surveys, we look at the frequency of reasons given by respondents for having sold or given away forest property. Figure 32 shows the frequency of reasons given for selling or giving away some, but not all, forest land by GP survey respondents and Figure 33 shows the same for FF survey respondents. The relative frequency of reasons given is qualitatively similar among both sets of respondents, with "family circumstances" and "financial needs" topping the list of most frequently given reasons for having sold forest land. Closure of a nearby timber mill is among the least frequently cited reason by both sets of respondents. Among GP and FF survey respondents who said they have ever sold or given away forest land, 9% of each group reported "regulatory burden" as at least one reason for doing so.

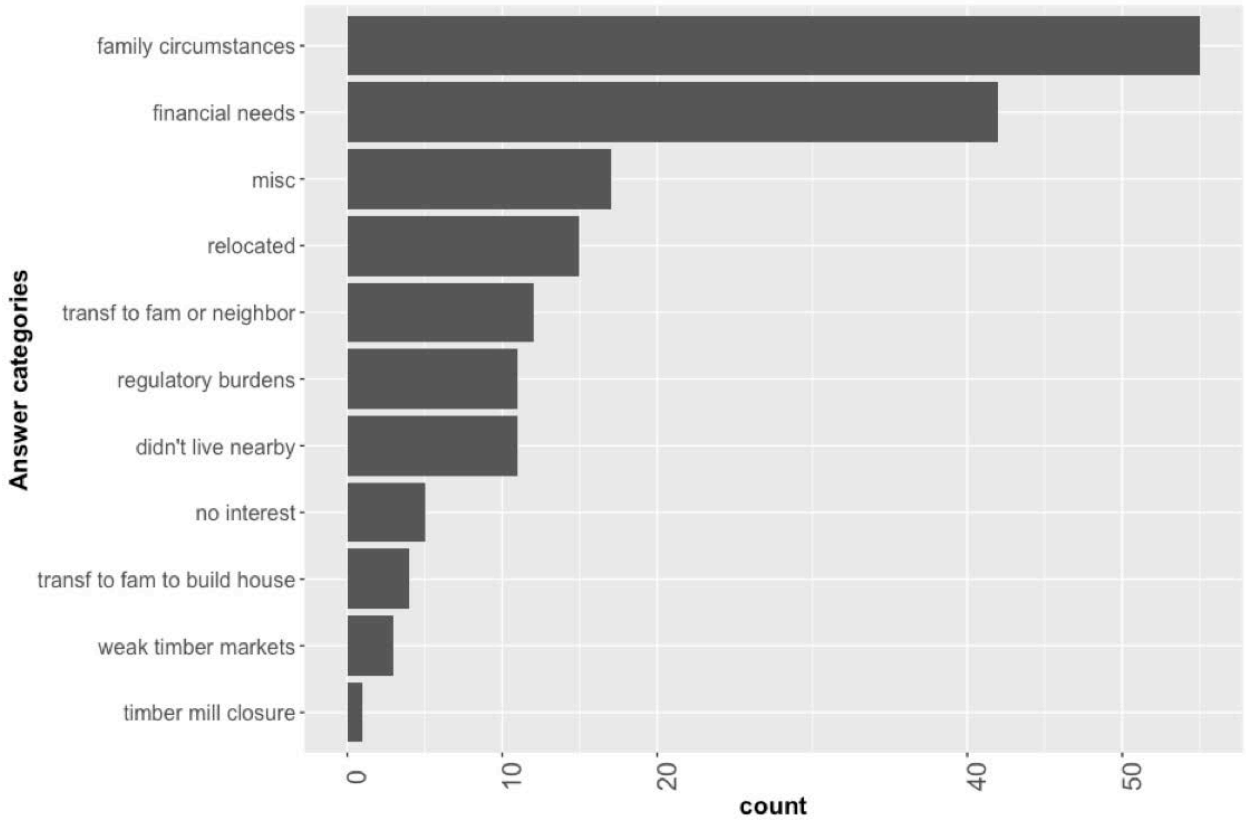

Figure 32. Frequency of reasons given for selling or giving away forest land by GP survey respondents.

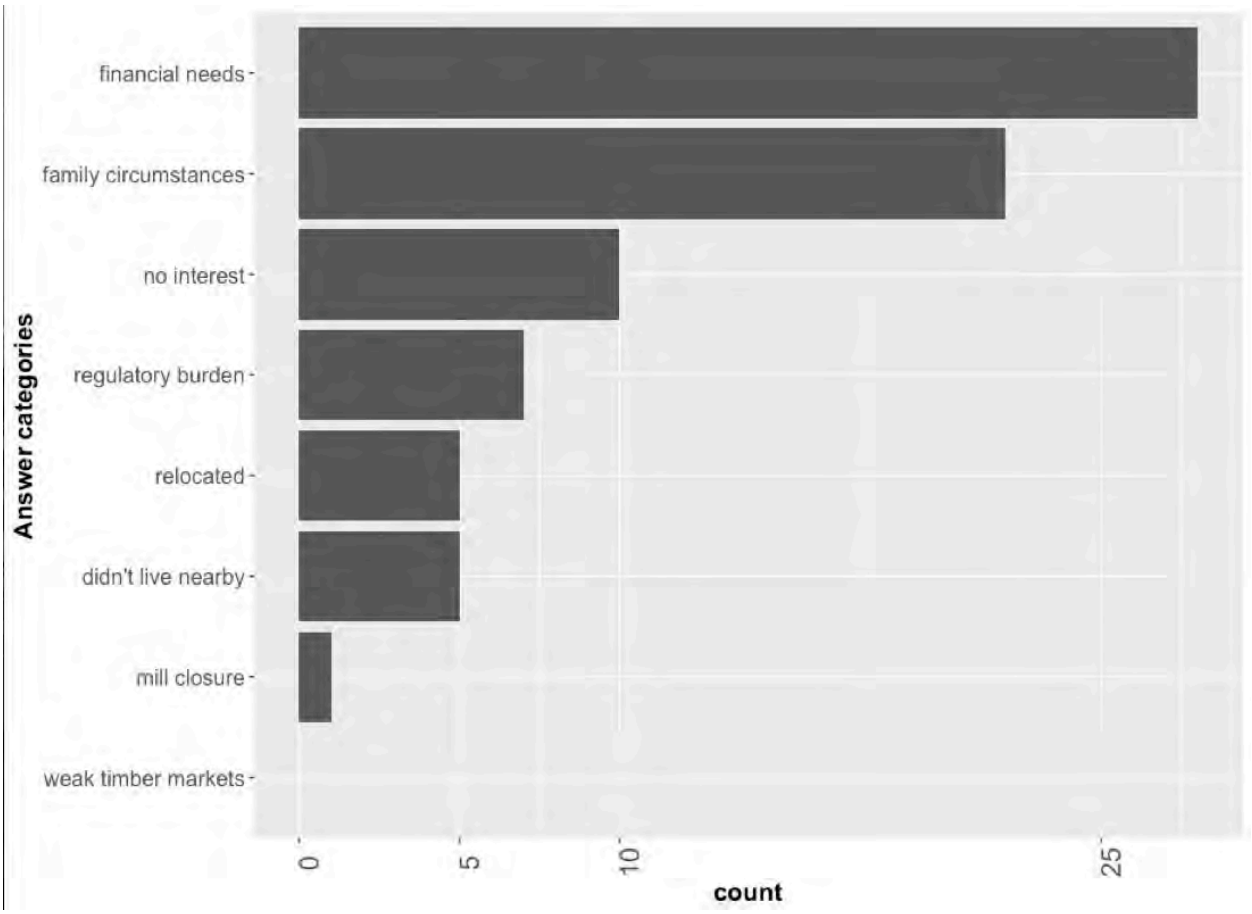

Figure 33. Frequency of reasons given for selling or giving away forest land by FF survey respondents.

As a fourth and final check for evidence of riparian regulations causing forest land sales, we run a logit model with FF survey respondents to check the factors associated with having ever sold forest land in the past, shown in Figure 34. Again, longer ownership tenure is positively and significantly associated with past sales while owners who only own forest land on the east side of Washington less often report having sold or given away forest land. Respondents who said they have submitted a Forest Practices application in the past 20 years (Fpar10_YN) are more likely to report having sold or given away forest land. Respondents who say the impact of the riparian regulations on their ownership have been negative (eval_riparian_regs_NEG) are somewhat more likely to report having ever sold forest land, but the relationship is not significant. The proportion of respondent forest land in core or inner buffers is negative and significant, which would be consistent with SFLOs divesting of their riparian forest land and keeping non-riparian forest land. However, without knowing how much riparian forest land respondents owned before 2000, we cannot say that results from Figure 34 are evidence of FF respondents selling their riparian forests.

```
Call:
glm(formula = sold_forest_land_WA_YN ~ ln_ac_wood + prop_for_buf +
    East_only + eval_riparian_regs_NEG + tenure + Over65 + Fpar10_YN,
    family = "binomial", data = FF1_sales)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.3038  -0.6525  -0.4717  -0.2846   2.5683

Coefficients:
                          Estimate Std. Error z value Pr(>|z|)
(Intercept)             -2.7814312  0.4412533  -6.303 2.91e-10 ***
ln_ac_wood               0.0005777  0.0011257   0.513 0.607839
prop_for_buf            -1.0839164  0.5939296  -1.825 0.068002 .
East_only               -0.7100302  0.3920994  -1.811 0.070165 .
eval_riparian_regs_NEG   0.4335220  0.2915669   1.487 0.137049
tenure                   0.0287609  0.0084980   3.384 0.000713 ***
Over65                   0.0148007  0.2978547   0.050 0.960369
Fpar10_YN                0.7884261  0.3559159   2.215 0.026746 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 400.34  on 427  degrees of freedom
Residual deviance: 356.28  on 420  degrees of freedom
AIC: 372.28
```

Figure 34. Logit model of the characteristics of FF survey respondents who said they have ever sold or given away forest land.

While it would not be definitive, *four ways of checking for the impact of riparian regulations on the past forest sales (or gifts) of GP and FF survey respondents do not provide any evidence that riparian regulations have led to forest land sales*. Although FF survey respondents more frequently report having sold forest land compared to GP survey respondents, the differences are mostly due to a higher proportion of FF survey respondents owning land in western Washington. Regulatory burden is given as a reason for past forest land sales by 9% of both GP and FF survey respondents who have ever sold forest land. The relatively low frequency of regulatory burdens given as a reason for past land sales and the higher frequency of “family circumstances” and “financial needs” suggests that some SFLOs indeed sell forest land because

of regulations; however, forestry regulation-induced sales may be sufficiently infrequent to avoid detection using statistical models.

The main story from the survey data is that many forestland sales are not necessarily planned. Family circumstances and financial needs top the list of reasons for having sold land in the past by SFLOs who still own forest land.

9.2.1 Factors influencing intentions or expectations of future forest sales

We ran an obliquely rotated PCA on the Washington NWOS questions asking respondents for their level of agreement or disagreement with a series of statements concerning the future of their forest lands. The questions included in analysis asked respondents if they "Strongly disagree," "Disagree," "Neither agree nor disagree," "Agree," and "Strongly agree." The questions are as follows:

"-I want my wooded land to stay wooded

-I would sell my land if I was offered a reasonable price

-I want to know more about my wooded land

-I have a strong emotional attachment to my wooded land

-I believe my wooded land provides benefits to my community"

The first principal component that emerges has a positive correlation with how strongly respondents agreed they would sell their land if they were offered a good price and a negative correlation with how much respondents agree they have a strong emotional attachment to their wooded land. The second principal component is strongly correlated with how much respondents want to learn more about their wooded land and agreement that their land provides benefits to the community. Respondents were also asked how likely it is they will sell or give away any of their wooded land in the next five years with answer categories of: "Extremely unlikely," "Unlikely," "Undecided," "Likely," and "Extremely likely." We visualize respondent-specific principal component scores in Figure 35 for respondents owning forest land in western Washington and Figure 36 for respondents owning forest land in eastern Washington.

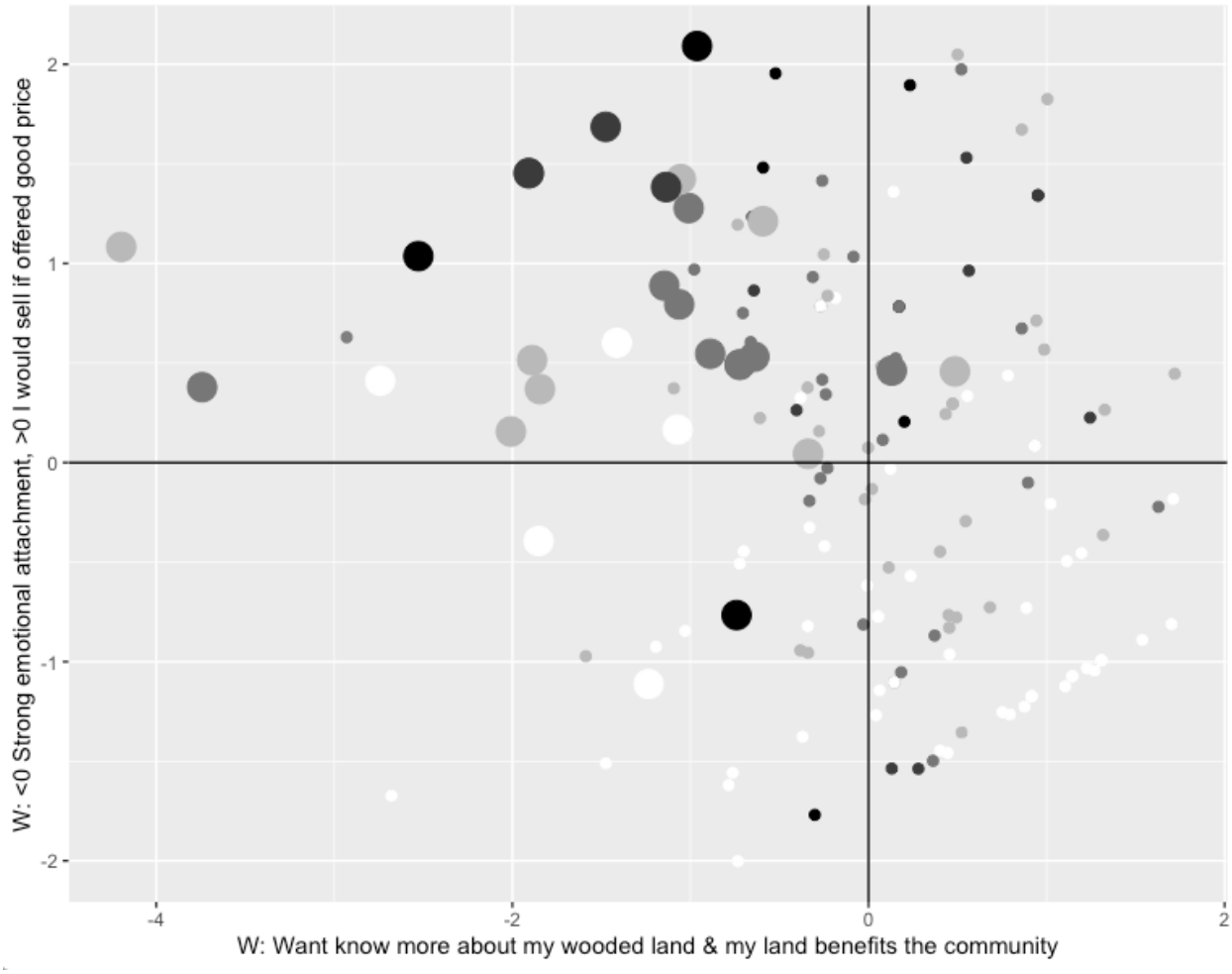

*Figure 35. (NWOS) Seemingly high-conversion-risk future sales, **western** Washington SFLOs. Large dots do either disagree or are neutral in if they want their land to stay wooded. Dots are colored with lighter dots saying it is less likely they will sell or give away any wooded land in the next 5 years with darker dots saying it is more likely they will sell or give away any wooded land in the next 5 years.*

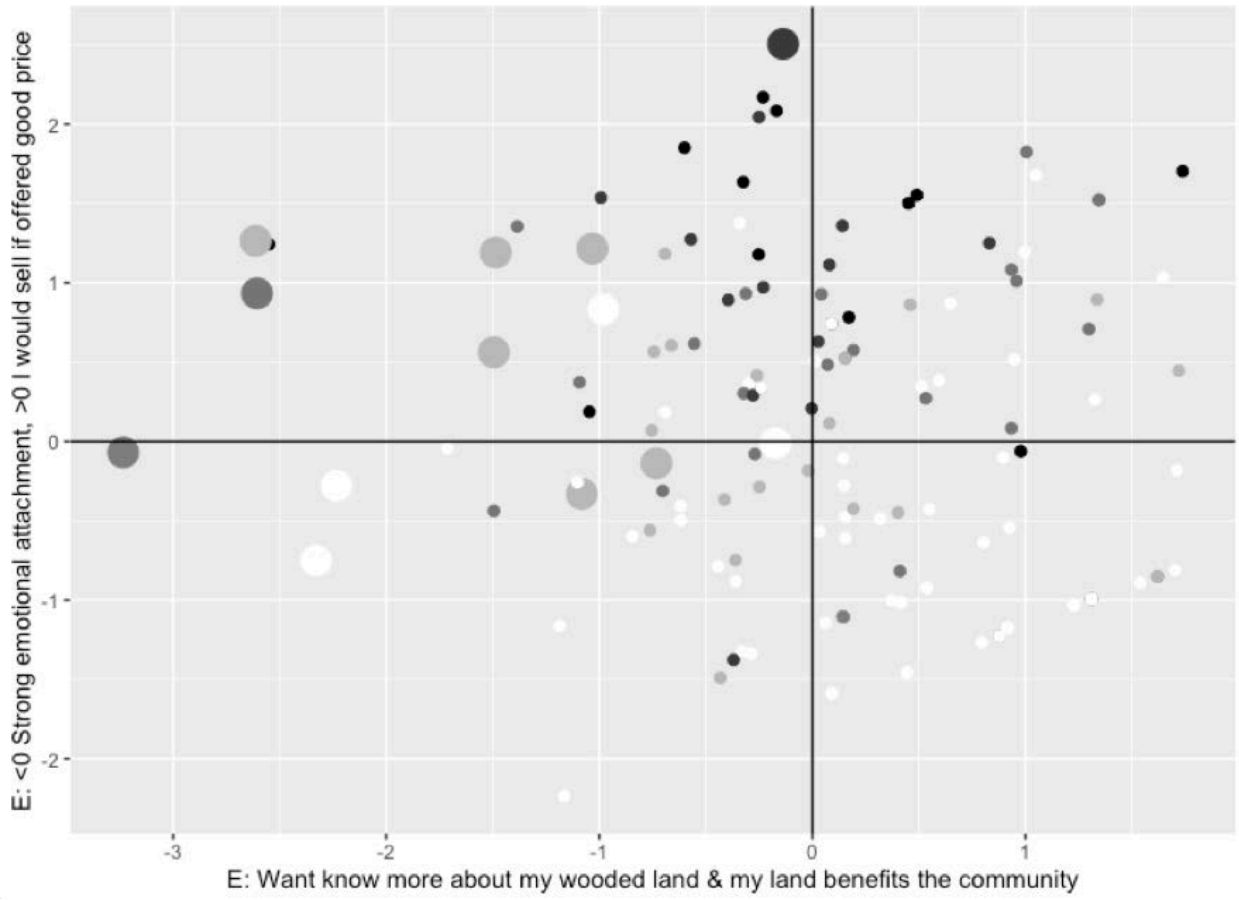

Figure 36. (NWOS) Seemingly high-conversion-risk future sales, ***eastern*** *Washington SFLOs. Large dots do either disagree or are neutral in if they want their land to stay wooded. Dots are colored with lighter dots saying it is less likely they will sell or give away any wooded land in the next 5 years with darker dots saying it is more likely they will sell or give away any wooded land in the next 5 years.*

In both Figure 35 and Figure 36, the further to the right on the horizontal axis respondents are means they are more interested in learning more about their wooded land and they tend to think their wooded land benefits their community. The further to the left the horizontal axis respondents are the less interested they are in learning more about their wooded land and they tend to disagree their wooded land benefits their community. The higher up on the vertical axis respondents are the more interested they are in selling forest land if offered a reasonable price while the further down on the vertical axis respondents are the more they have a strong emotional attachment to their wooded land. Large dots are respondents who either disagree or are neutral in if they want their land to stay wooded. Dots are colored with lighter dots saying it is less likely they will sell or give away any wooded land in the next 5 years with darker dots saying it is more likely they will sell or give away any wooded land in the next 5 years.

The intuition of Figure 35 and Figure 36 is that large, dark dots in the upper left corner of the figures appear to be a higher risk for forest land sales that may lead to the conversion of forest land away from forestry or open space uses. We posit that the large dark dots in the northeast corner of Figure 35 and Figure 36 are owners who represent "seemingly high conversion risk sales." Important to note in these figures is that almost no respondents who are interested in learning more about their forest properties and express an interest in the public benefits of their forests appear to fall into the category "seemingly high conversion-risk sales." Also, respondents who express a strong emotional attachment to their forest land tend to not fall into the category of "seemingly high conversion-risk sales."

To confirm results from the NWOS, we asked GP survey respondents similar questions to the NWOS questions analyzed in the paragraphs above. We also ran a PCA with oblique rotation on the following questions from the GP survey:

> *"-How interested are you in learning more about the care, management, or protection of your forest land?*
>
> *-[How important is] my personal attachment to the land*
>
> *-How important is it to you that your land remain forested in the future after you no longer own it?*
>
> *-[How important is it that] my forest land provides benefits to the community*
>
> *-[How important is] income from potential development or sale of my forest land for commercial use*
>
> *-[How important is] income from potential development or sale of my forest land for residential use"*

Results of the PCA with oblique rotation and two principal components are shown in Table 28. The first principal component is positively correlated with how important respondents say the income from potential residential or commercial development is to them and negatively correlated with how strongly respondents want their land to stay forested. We call this component "May develop" since high scores indicate the respondents may be interested in developing their forest properties. The second principal component is positively correlated with

wanting to learn more about one's forest land and how important respondents think it is that their forest provide benefits to their community. We note highly similar results between the NWOS and the GP survey in terms of what variables tend to be correlated in respondent answers.

Table 28. Principal component analysis of questions regarding the future of owner's forest land from the GP survey.

Questions	**May develop**	**Engagement**
Want to learn more about my forest land	0.171	**0.709**
Personal attachment to my forest land	-0.235	0.474
Want my land to stay forested	**-0.31**	0.648
My forest land benefits the community	0.217	**0.743**
Income from potential commercial development is important	**0.876**	0.096
Income from potential residential development is important	**0.854**	0.006
Proportion Var.	0.288	0.285
Cumulative Var.	0.288	0.572
Correlations between components	-0.253	

Figure 37 and Figure 38 map the principal component scores from Table 28 in a similar manner to the mapping presented from the NWOS in Figure 35 and Figure 36.

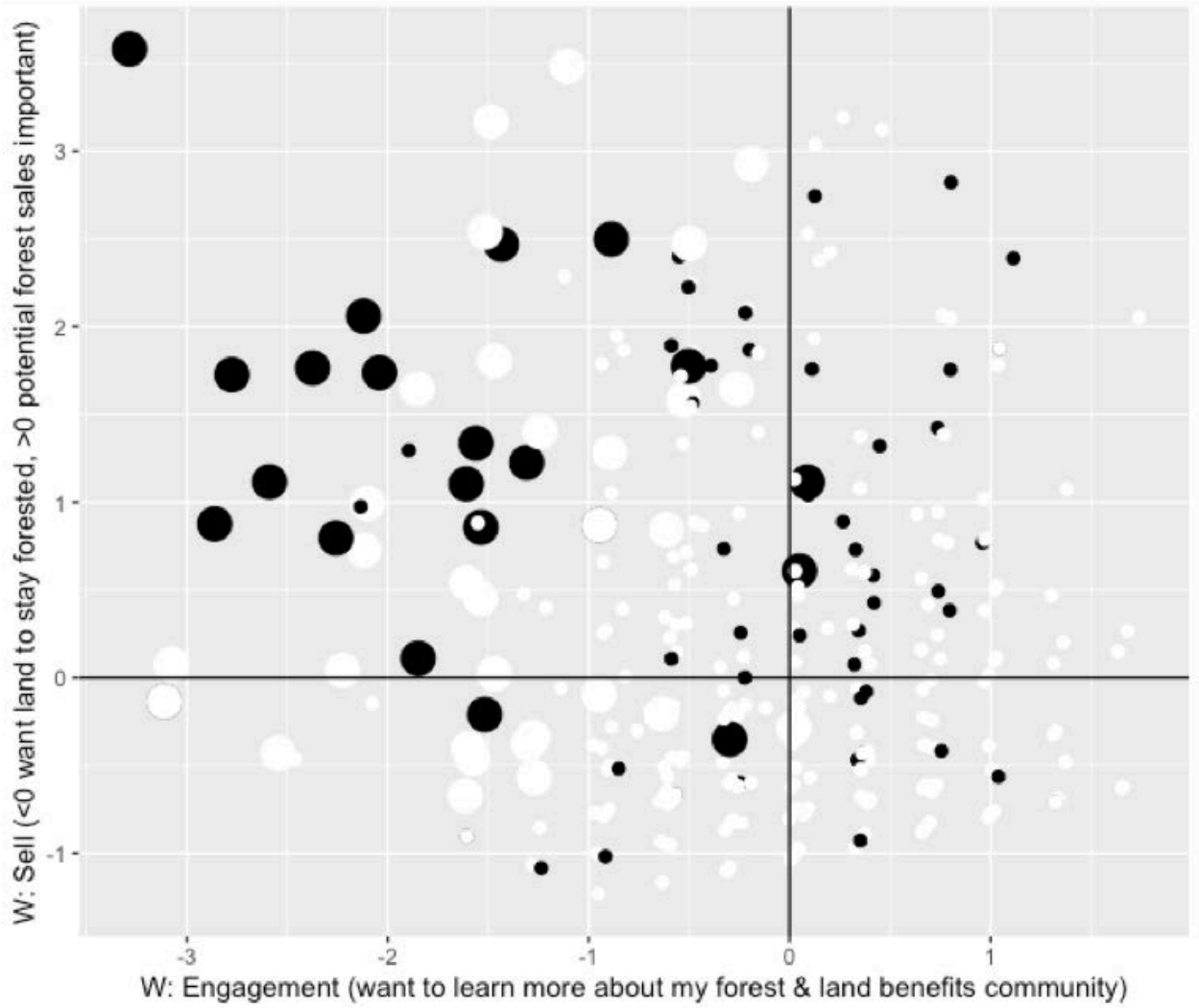

*Figure 37. (GP survey) Seemingly high-conversion-risk future sales, **western** Washington SFLOs. Large dots say it is either "not important" or "of little importance" that their land remain forested in the future after they no longer own it. Dark dots say they expect to sell all or part of their forest land in the next 5 years and white dots did NOT say they expect to sell land in the coming 5 years.*

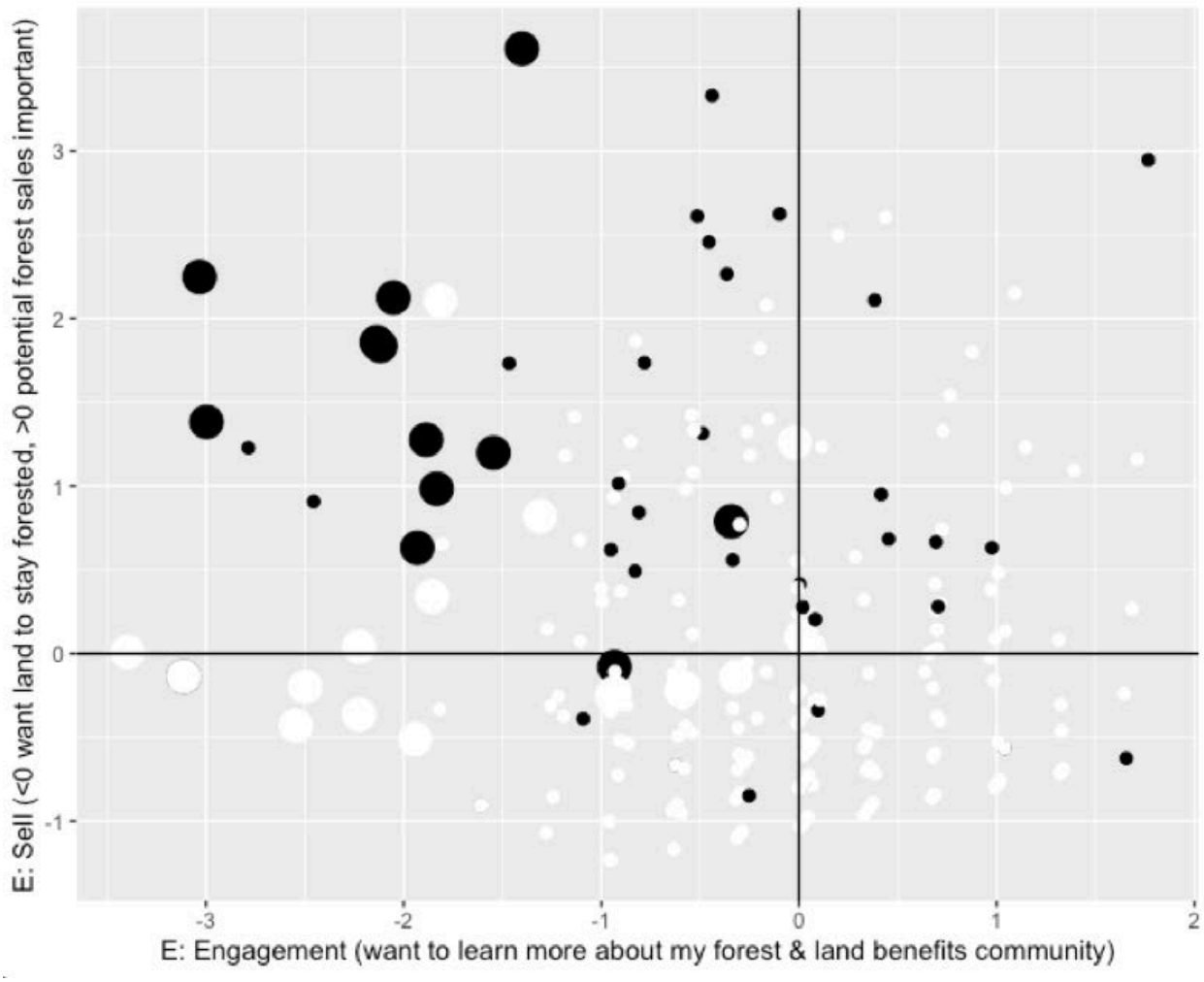

*Figure 38. (GP survey) Seemingly high-conversion-risk future sales, **eastern** Washington SFLOs. Large dots say it is either "not important" or "of little importance" that their land remain forested in the future after they no longer own it. Dark dots say they expect to sell all or part of their forest land in the next 5 years and white dots did NOT say they expect to sell land in the coming 5 years.*

Again, large dark dots in the upper left-hand corner of Figure 37 and Figure 38 represent respondents who are seemingly at risk for high forest conversion-risk sales. Figure 37 and Figure 38 mostly replicate the finding from the NWOS that interest in learning more about one's forestland and interest in the benefits one's forest provide to the community go hand-in-hand. Furthermore, an interest in learning more about one's forest land is negatively correlated with interest in selling forestland for development. Table 29 shows the percentage of SFLOs and percentage of Small Forest Land seemingly at risk for sales that could lead to conversion from the NWOS and GP surveys. The GP survey estimates a somewhat higher percentage of respondents and forest land will be at risk for sales that could lead to development in the coming 5 years than the NWOS. Overall, about 4% of Small Forest Land in Washington is estimated to be a higher risk for sales that may lead to conversion based on the GP survey.

Based on the NWOS survey, about 3% of Small Forest Land in western Washington is estimated to be a higher risk for sales that may lead to conversion. Note that these numbers, if extrapolated to the roughly decadal scale, match fairly well with historical conversions reported above.

Table 29. Percentage of respondents and forest land that appear to be at risk for sales in the coming 5 years that may lead to forest land conversion away from forestry or open space uses.

	West		East	
	% respondents	% forest land	% respondents	% forest land
Seemingly high conversion risk sales (GP survey)	3.9%	3.3%	4.0%	4.3%
Seemingly high conversion risk sales (NWOS)	3.0%	2.6%	< 0.0%	< 0.0%

To summarize, two independent surveys confirm that an interest in learning more about the care, management, or protection of one's forest land and belief that the forest provides public benefits is associated with a desire to keep forests as forests. These results are a strong indication that assistance services (such as stewardship and extension foresters, among others) which help SFLOs learn more about the care, maintenance, and protection of their forest lands are helping owners who want to keep their forests forested. Combined with our interview results and overview of the Forests and Fish legislation, this result lends further support to this report's recommendation for the State of Washington to invest in long-term and secure funding for outreach, education, and stewardship services for SFLOs. Moreover, the results suggest that such efforts need to reach SFLOs not currently engaged with their land, and outreach and education needs to continuously expand its presence among a growing number of SFL owners.

9.3 Empirical Analysis of Sales

Guided by the theoretical frameworks of small forest landowner land sales, we use the Parcel and the Forestland Database and other data to a) estimate an empirical model of factors which are related with the observed (recorded in county records) parcel sales and b) conduct a related land use change analysis of SFLO parcels. As described above, sales of land owned by SFLOs is neither a necessary nor a sufficient factor for land conversion. The focus of the report is on retaining SFLO land that is dedicated to forestry or open space uses. As a result, the empirical analyses below are conditional on earliest available data on SFLO parcels being in the "ForestOrNatural" land use category.

We investigate, based on the available data, the factors that have contributed to the outcome of a SFLO parcel being sold. Note that this analysis only includes aggregated socioeconomic characteristics and should be viewed as complementary to the sale intentions analysis from the survey sources. The theories of sale behavior have guided our initial selection of variables, and model selection was guided by likelihood ratio tests and sensitivity analyses. We also conducted machine learning classification as well as regularized logistic regression (LASSO) checks and results were consistent across different approaches. We use 30% of the parcel data as the estimation sample to reduce the potential issues of spatial interdependence and to avoid overfitting problems. We present the sales model results in this section but note that the more relevant question is the contribution of sales to the transition of SFLO land from forestry or open space land use, which is the question addressed in the following section.

We used the WA State database records to identify SFLO-owned parcels which have been sold in the time since the earliest parcel data became available. Based on parcel and ownership characteristics, we created a "FrepEligible" variable which can be thought of as a proxy for *potential* eligibility for the FREP program. The "FrepEligible" indicator variable includes SFLO parcels which may have a commercially reasonable harvest, as required by RCW 76.13.120 based on parcel and ownership size, with any riparian forest land. We included the proxy for FREP eligibility in the sales model in order to test the conjecture that parcels which may have a relatively larger burden of riparian regulations may be sold at a higher relative rate. Recognizing that the East and West sides of Washington are very different across many relevant characteristics, we estimated two separate sets of sale behavior models, one for the Westside, another for the Eastside (best pooled model specification included many significant interaction terms with the "West" indicator) and we present separate models for the ease of coefficient interpretation. Summary statistics and variable descriptions are presented in Table 50.

Table 51 presents the sales model estimates. First, one fact is apparent: the logistic models of observed sales behavior using the data that is fairly easily observable are not very useful for prediction of sales of individual parcels (the Tjur's (2009) R-squared values are quite low). This is consistent with observations discussed above which suggest that an SFLO sale decision is a highly heterogenous and a poorly predictable process. The variables we include in the model are consistent with theoretical foundations of sale behavior but clearly do not amount to a sufficient and confident set of predictors of sales in the real world. The models correctly predict sale or no sale status of the parcel with about a 63% accuracy out of sample, which is only a marginal improvement over predicting that a parcel's sale probability is equal to the overall sample share of parcels sold (26%), in which case the naïve classifier predicts correctly about 62% of the time. This is a fairly common feature of logit models (W. H. Greene 2002, p. 686). While better predictive models could possibly be developed, we maintain the relative simplicity and interpretability of logistic regressions. Our sales models should not, in general, be used to predict whether a particular parcel may be sold in the future. Instead, a more productive

interpretation of our results is to look at the change in relative odds of a sale event versus no sale. This is how we present and interpret the estimated coefficients.

9.3.1 Harvesting behavior

In the sales model results table, we show estimated odds ratios of sale vs no-sale event over the study temporal horizon (from earliest available data, generally 2007, to 2019). We present two specifications for Westside (I-II) and two specifications for the Eastside (III-IV). For significant factors influencing the probabilities of a sale event, we focus on models I and III. Models II and IV aim to resolve a question of some interest to NIPF research community: do harvests appear to lead to subsequent sales? While it's not in general possible to fully establish a causal relationship through such observational studies, we want to separate the instances where the filed harvest FPA preceded the sale event from those where a harvest FPA was filed after the sale event. Models II and IV are estimated on the data where harvest FPA preceded a sale event. While we see that observing a harvest FPA is positively (and significantly) correlated with a sale event for both West and Eastside when all data is included (models I and III), the relationship disappears for the Eastside (model IV, OR=0.985, n.s.) and the odds ratio declines for Westside parcels (OR = 1.218 vs OR = 1.476 for all Westside parcels) when only considering a harvest FPA before a sale event. Thus, for Westside parcels, we can say that harvesting behavior is not only associated with sales behavior more broadly, but is significantly correlated with *subsequent* sales. For Eastside parcels, harvesting behavior is correlated with sales, but not necessarily with subsequent sales.

9.3.2 Riparian areas

The presence/size of riparian areas were not found to be significant predictors of sales behavior, which is consistent with the analysis based on the survey data. We do include the results for the FREP eligibility proxy which broadly captures both the possible impact of riparian regulations and the existing policy intent associated with the FREP program. Proxied FREP eligibility is not significantly associated with observed sales.

9.3.3 Spatial and demographic drivers

We tested a number of parcel-level and county-level economic and demographic variables. At the county level, we hypothesized that population growth (proxied by county-level population density change over the 2010-2018 period) may be positively related to sales behavior. In addition, we tested a measure of population-driven development pressure called a gravity index which represents an inverse-distance-weighted average of population centers within 60 miles from each parcel (intuitively speaking, such indices describe a "pull" of population centers within a plausibly commutable distance and are generally hypothesized to be positively related to residential development). Changes in county population density are not found to be significantly related to sales behavior. The weighted population pressure (gravity index), even

when rescaled to represent tens of thousands of people nearby, had a very small positive effect on the odds of a sale on the Westside and a very small negative effect on the odds of a sale on the Eastside. Neither the coarser (county-level, not shown) nor a finer (gravity index) measures of population status and change appear to have a strong impact on SFLO sales behavior (where we again point out that sales are not equivalent to a loss of parcel to forestry or open space uses). We also tested several parcel-level distance variables which can offer evidence of spatial 'attraction' or 'repellance'. Distance to nearest development could be related to a parcel's development (and possibly a sale). For the sample of all Westside parcels, we do not find a significant effect of distance to nearby development, while for the Eastside parcels (model III), the odds of a sale increase with distance to nearby development (OR = 1.125, $p<0.01$). Distance to public roads has a positive effect on the odds of a sale (OR = 1.17, $p<0.05$) on the Eastside, while the significance is marginal on the Westside (OR = 1.12, $p<0.1$). These findings could be consistent with the buyers' preferences for privacy, especially if the buyers are other SFLOs who express such desire frequently (see survey results). Distance to DNR and US Forest Service land is not significant for the Eastside parcels. However, in the Westside sample, odds of a sale go up 5% for each mile further away from DNR land and decline by about 0.6% for each mile closer to USFS land. Given that DNR land is more actively managed, this could be consistent with the buyers' preferences for less future forest management activity nearby. Finally, although we did not see a strong effect of observed population changes on sale odds, the future development potential embedded in proximity to the Urban Growth Boundary has a positive impact on the probability of a sale: in a manner that is consistent across West and Eastside, every 0.1 mile distance increase from the UGA decreases the odds of a sale by 3% ($p<0.01$) on the Westside and by 4% on the Eastside ($p<0.05$). County-level median income (in 2013) has been found to be negatively related to the odds of a sale on the Westside (OR = 0.88, $p<0.01$) but positively related to odds of a sale on the Eastside (OR = 1.46, $p < 0.01$). We will discuss the effect of county income in the context of the land use change model below.

9.3.4 Parcel and ownership characteristics

The WAGIS database allows for spatial identification of an individual parcel as well as the identifiable tract to which a parcel belongs and contains the best estimate of the size of the total and forested land under the same ownership. These characteristics may influence the probability that a particular parcel has been sold over the study period. We find that the parcel acreage has no significant impact on the probability of a sale for Westside parcels, while on the Eastside, a parcel that is 100 acres larger, *ceteris paribus*, has 26% lower odds of having been sold ($p<0.01$). *Tract acreage* has a negative impact on the odds of a sale across the state (OR = 0.93, $p < 0.05$ for Westside, OR = 0.91, $p < 0.01$ for Eastside), suggesting that if a parcel is a part of a contiguous, identifiable land tract it is less likely to be sold, everything else being equal. Total forest land ownership is important in explaining sales behavior for the Westside and not for the Eastside: for each 100 acres of forested land owned by a Westside SFLO, the parcel has

6% lower odds ($p < 0.01$) of being sold. Westside SFLOs who manage larger forest holdings may be more reluctant to sell their forestland parcels. *Parcel road* extent (in miles) is a strong predictor of sales on the Westside: odds of a sale grow by 42% for each mile of identifiable roads located on the parcel. *Forest productivity*, as measured by the State's Site Class Index, enters into the sales model in distinct ways for the Westside and Eastside parcels. We use the site class index as a continuous variable since the index levels I-IV for the East and West sides of Washington represents a linear mapping to corresponding site productivity. For the Westside, parcels that have been identified as "productive" (Site Index less than or equal to V) have a higher baseline risk of a sale (OR = 1.14, $p < 0.1$) and the odds of a sale are relatively smaller for less productive (higher site class) parcels (OR = 0.91, $p < 0.01$). Most productive (siteclass I) parcels have 3% higher odds of a sale compared to non-productive parcels on the Westside (product of 1.138 and 0.911). This is consistent with positive correlation between what may make a parcel attractive to potential buyers (lower elevation and slope) and the underlying productive potential of a parcel for forestry uses. On the Eastside, on the other hand, productive parcels are less likely to be sold (combined odds ratio of 0.77 for a siteclass I parcels), and odds of a sale grow with a decrease in forest productivity (in increase in the site class index).

The strongest parcel-level predictor of sales is the parcel's initial (earliest available parcel data) forest cover ("PercentForest"). Both on the West and the Eastside, higher forest cover is correlated with much lower odds of a sale (OR = 0.54, $p < 0.01$ for Westside, OR = 0.44, $p < 0.01$ for Eastside). The finding is robust to different specifications and holds after we control for harvesting FPA activity.

In our empirical analysis of past sales behavior, we have identified a number of factors that are significantly related to the probability of a parcel being sold over the study period. As outlined in the discussion of existing conceptual descriptions of drivers of land sales, many potentially important variables are not available to us in the analysis of observed sales. Those include socioeconomic characteristics of the landowners (age, land ownership tenure, management objectives, legacy planning concerns, etc.) as well as a host of other difficult to observe landowner-specific or location-specific idiosyncratic factors. However, we are able to use the survey results to be able to assess the likely importance of landowner-specific information in their reports of past or anticipation of future sales.

9.3.5 Summary of findings for sales behavior modeling

With respect to the observable characteristics influencing sales of SFLO parcels, we find that a range of factors are related to landowners selling their land.

- Across the State, more heavily forested parcels that are a part of a larger tract and those owned by SFLOs with larger forest holdings are less likely to be sold.
- At the same time, more actively managed parcels (evidenced by the extent of the road network and the existence of a harvest FPA) are more likely to be sold.
- Expected population growth in the form of proximity to the urban growth boundary leads to a higher likelihood of sales, although existing population and development patterns have a differential effect on sales for the West and East sides of Washington.
- Similarly, a distinct pattern across the mountain divide exists for parcels with higher forest productivity: while higher productivity parcels are more likely to be sold in the West, it is lower productivity sites that are being exchanged in the land market on the Eastside.
- Presence or size of riparian areas are not significantly associated with sales behavior.

9.4 Empirical Analysis of Land Use Change

While the language of the Bill specified sales as the focal outcome, we also consider a broader question of SFLO parcels' land use change. Fundamentally, it is not the precise category of the land owner that serves to maintain the state's private forests for forestry and open space uses. Thus, we develop a parcel-level model of land use change over the study period. In this model, we seek to test the factors (which include a record of whether a parcel was sold) which are associated with recorded changes in the parcel land use.

As with the sales model, our main purpose is inference rather than prediction (although we do iterate forward in time and provide estimates of land use change probabilities conditional on 2019 parcel data below). We use a workhorse multinomial logit model (Train 2009) for characterizing the probabilities of mutually exclusive categorical outcomes. Like the sales model, we provide estimates conditional on the earliest available land use of "ForestOrNatural" and use 30% of the resulting parcel data for estimation. We use the same set of independent variables in the land use change model as in the sales model, except we also test the effect of county-level population density change over 2010-2018 period (mean 8.67 persons per sq.km, sd of 13.04). Like the sales modeling, we find that the two main regions of Washington State are best described by their own models (Chow tests for pooling reject a pooled model, $p<0.001$). Based on 2019 land use categories, we construct 4 distinct land use types, with the corresponding sample percentages: "ForestOrNatural" (83.6%), "Agriculture" (1.5%), "DevelopedOther" (0.68%), and "Residential" (14.3%). We did test model specifications where the fate of SFLO parcels was modeled as a binary forestry/non-forestry outcome, and found

that those models performed substantially worse, reflecting the fact that these land use aggregated types are conceptually and materially different, with differential impacts on probabilities of land use transitions. For example, among the SFLO parcels which were classified as “ForestOrNatural” in the earliest available forestland database, parcels that have undergone “DevelopedOther” conversion were more than 3 times larger than those that underwent residential conversion, on average. Models where “DevelopedOther” were aggregated with the “Residential” category showed qualitatively very similar results. While we need some aggregation among all the distinct land use codes, we wish to estimate models on as disaggregated choice data as practical, given that choice aggregation may introduce econometric issues (Wong, Brownstone, and Bunch 2019). While transitions to heavily developed uses are fairly rare, the large size of our dataset allows for parameter and marginal effect identification in the estimation and bootstrapped samples, although for some variables we do see much wider confidence intervals for the odds ratios and the marginal effects, especially when trying to capture the fairly rare event of the transition into the “Developed” category.

In terms of the out-of-sample predictive ability, the Westside model correctly categorizes 72.7% of parcels across all land use categories, and the Eastside model correctly captures 79.4% of land use categories (Cohen’s Kappa of 0.1 ($p<0.001$) for both models indicates significant but fairly weak predictive power). Similarly to the sales model, we expect that there are many factors describing the individual landowner circumstances that have remained unobserved. Similar predictive performance was observed when random forest machine learning models were used, indicating that it is the contribution of the unobservable characteristics as opposed to the features of the multinomial logit model that is likely responsible for difficulties associated with parcel-level land use change predictions. We should note that a range of sociodemographic characteristics including local educational attainment levels, unemployment, and demographic shares were tested and were not found to have a robust relationship with parcel-level land use change.

In the results below, we report the table of model coefficients in the odds ratio form and also offer odds ratio plots where red dots represent a decrease in the odds of a particular land use class compared to “ForestOrNatural” and the blue dots represent an increase (Figure 39 and Figure 40). Amarginal change in the probability of a specific outcome depends on the probabilities of other alternatives (Train 2009). We compute both the odds and the (relative) marginal effects on probabilities of a forestry or open land use SFLO parcel transitioning to an alternative land use state. We also present bootstrapped (500 replicates) marginal effects in the graphical form, which offer a visual interpretation of the model results in terms of the relative change in a probability of an outcome following a change in the independent variable, all other things being equal.

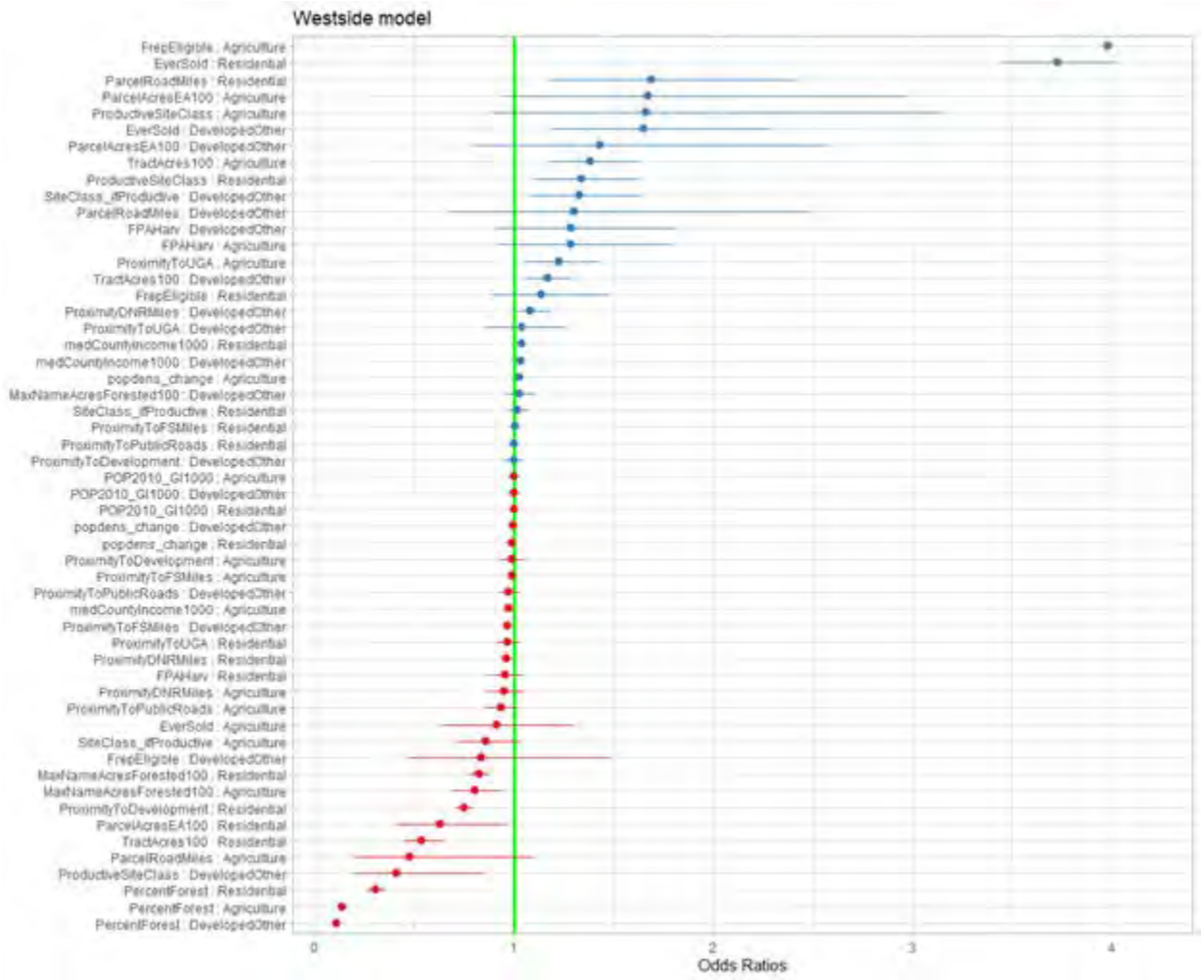

Figure 39. Model coefficient plots (odds ratio form); red dots represent a decline, blue dots an increase in the odds of an alternative land use compared to ForestOrNatural category, Westside.

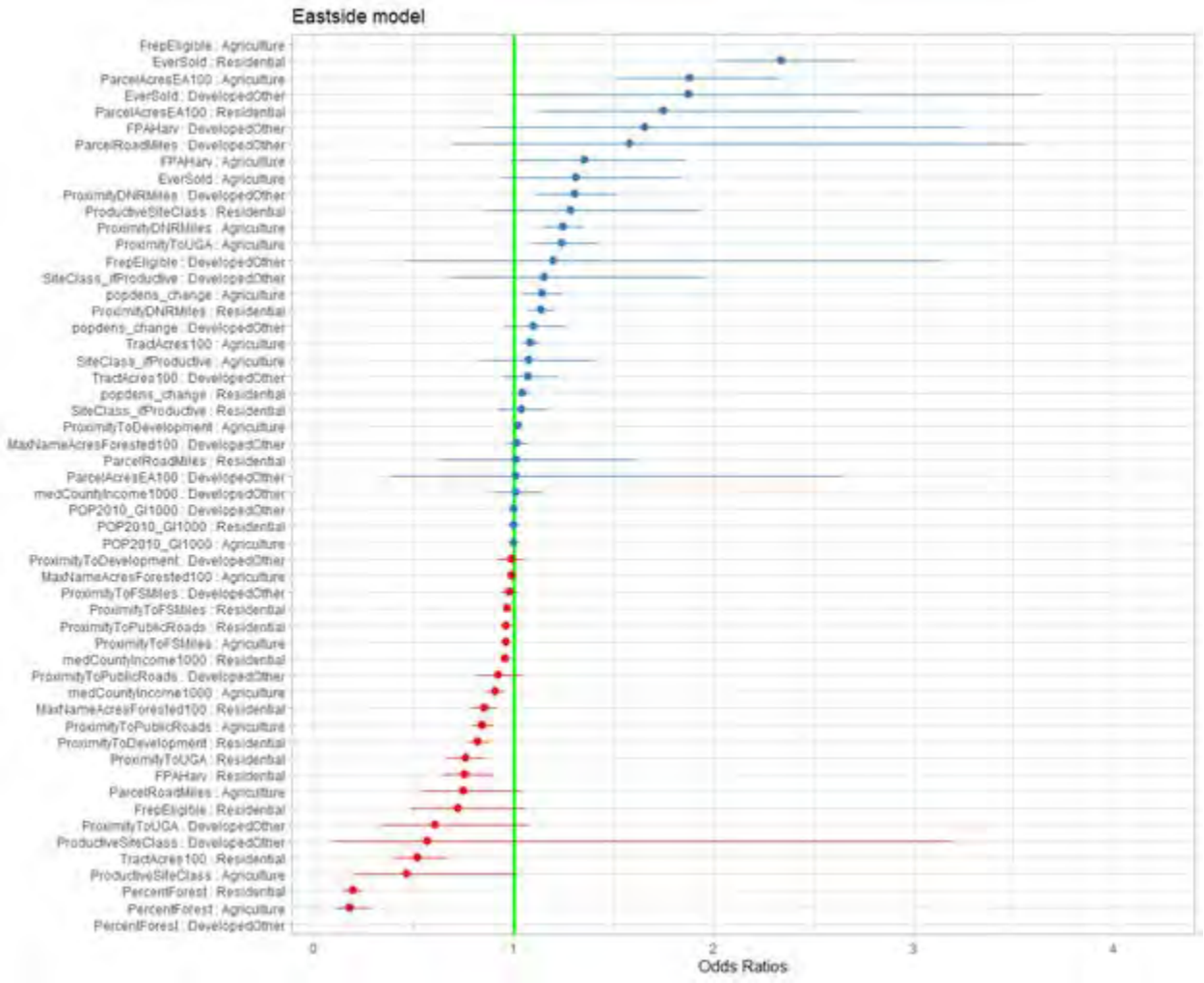

Figure 40. Model coefficient plots (odds ratio form); red dots represent a decline, blue dots an increase in the odds of an alternative land use compared to ForestOrNatural category, Eastside.

We first present the overview of the results and discuss the different factors found to have lead to land use change on SFLO parcels in greater detail below.

While sales and land use change are not the same phenomenon, many of the same factors found significant in the sales model also play a role in parcel land use changes, although if a sequential sale then land use change process was at play, we would expect that upon controlling for a parcel sale, the variables that only influence land use change via the sale pathway would either change their sign or lose statistical significance. We see some evidence for this kind of phenomenon in the harvesting FPA variable. In both the West and Eastside land use change models, existence of a prior harvest FPA is not associated with land use change toward developed or residential uses, and in fact on the Eastside, prior harvesting is associated with a lower probability of residential development (OR = 0.76, $p<0.01$) (while being weakly significant in positively associating with the transition to Agricultural land uses (OR = 1.36, p

<0.1). In limited evidence that harvesting may contribute to subsequent residential development via the sale pathway on the Westside, we see that a) harvesting is positively associated with subsequent Westside sales (see the sales model II in Table 51) and b) harvesting is no longer a significant predictor of a land use change once we control for a prior sale. Thus harvesting on the Westside does not appear to lead to conversion independently of an ownership change but may lead to a parcel sale which results in subsequent conversion.

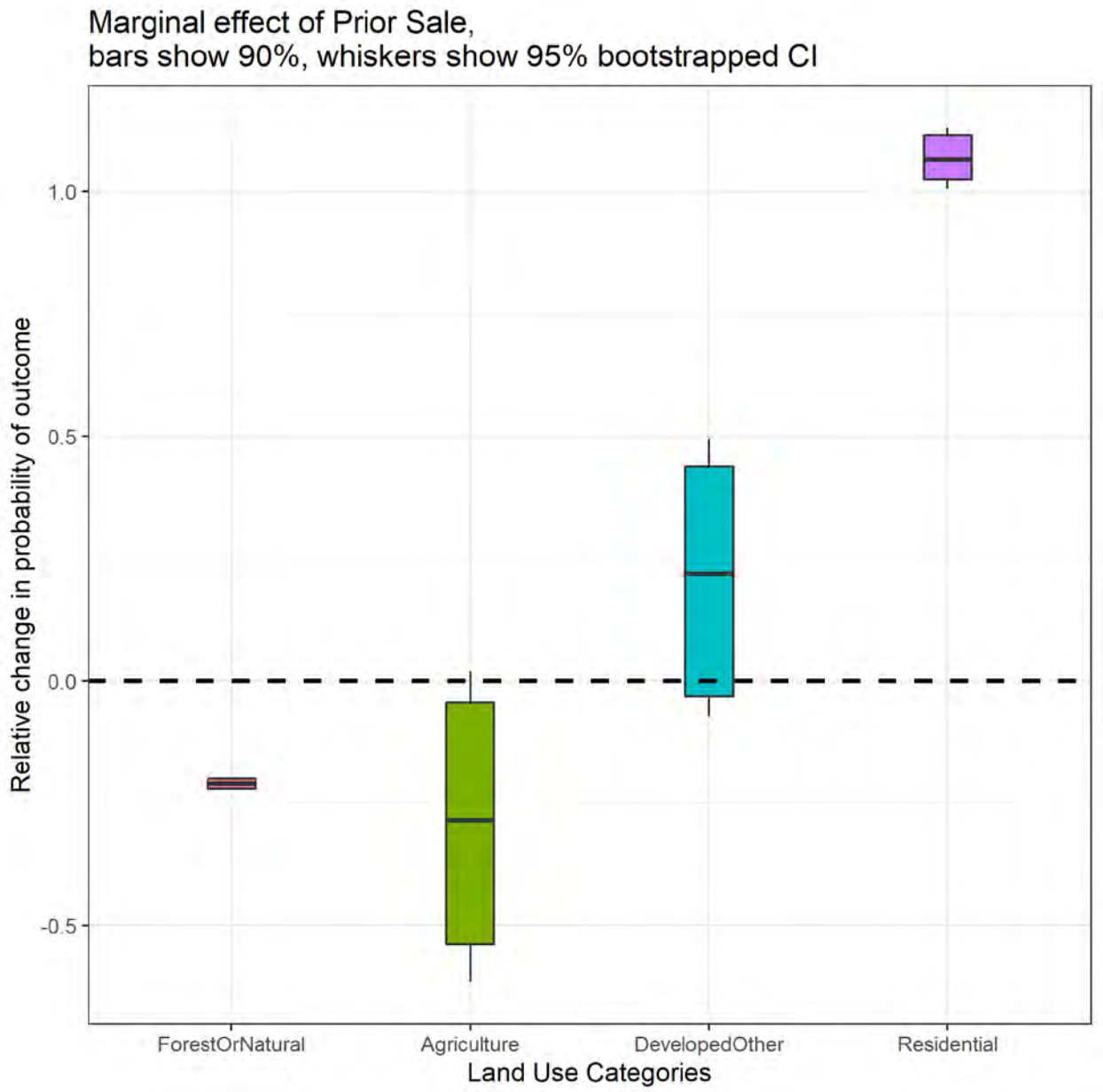

Figure 41. Marginal effect of prior sale, Westside model

On its own, an event of a parcel sale means that an SFLO is more likely to transition to residential land uses on both sides of the state (Figure 41, Figure 42). While the coefficient on conversion to non-residential developed uses for the Westside is significant in the estimation sample, bootstrapped 90% confidence interval dips below 0 which limits our ability to say that the effect is significant in the conventional sense. However, the effect on residential development is large, leading to a 107% relative increase in the probability of residential conversion (101-113%, 95% CI), and a corresponding 21% decline in relative probability of forest retention.

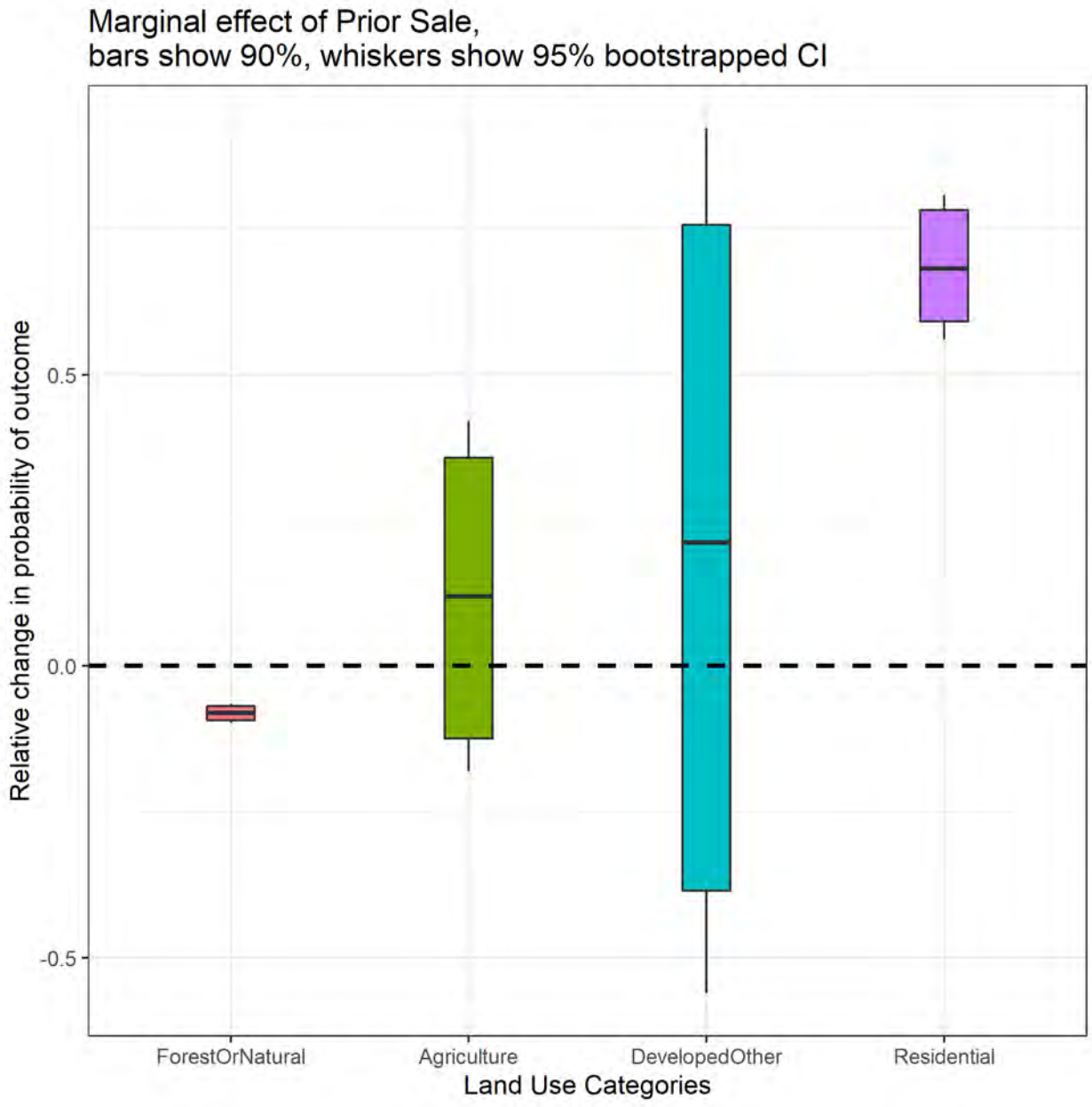

Figure 42. Marginal effect of prior sale, Eastside model

9.4.1 Riparian areas

Similarly to the sales model, the presence/size of riparian areas were not found to be significant predictors of land use change. We again test the FREP eligibility proxy which broadly captures both the possible impact of riparian regulations and the existing policy intent associated with the FREP program. Interestingly, FREP eligibility is only significantly associated with a higher likelihood of transition to agricultural land uses (OR = 3.98 for Westside, OR = 4.68 for Eastside, $p < 0.01$) and is not associated with residential or other development on the Westside, while leading to a 27% lower relative probability of residential development on the Eastside (marginally significant in bootstrap simulations at $p < 0.1$). See Figure 99 and Figure 100 for marginal effects plots.

9.4.2 Spatial and demographic drivers

We again tested a number of parcel-level and county-level economic and demographic variables. At the county level, we hypothesized that population growth (proxied by county-level population density change over the 2010-2018 period) may be positively related to land use changes. In addition, we again tested the gravity index (POP2010_GI1000) described above.

Changes in county population density (*ceteris* paribus) are found to be significantly related to agricultural land use transition (OR = 1.03 Westside, OR = 1.14 Eastside, $p <0.01$) and Figure 103 and Figure 104. With respect to residential development, changes in population densities are associated with slightly lower odds of residential conversion on the Westside (OR = 0.99, $p<0.01$) and somewhat higher odds for the Eastside (OR = 1.05, $p<0.05$). The weighted population pressure (gravity index), had a small effect on the odds of residential conversion but bootstrapped marginal effects show a more pronounced negative impact on residential development probability (Figure 105 and Figure 106). This is somewhat counterintuitive for the Westside model; we tested other gravity indices, both static (for 2019) and dynamic (changes over 2010-2019), and Westside results were similar. Eastside results show about a 10% increased relative probability of residential development for a marginal change in the gravity index ($p<0.05$).

We also tested several parcel-level distance variables which can offer evidence of spatial ‘attraction’ or ‘repellance’. Distance to nearest development (Figure 43 and Figure 44) could be related to a parcel’s development (and possibly a sale).

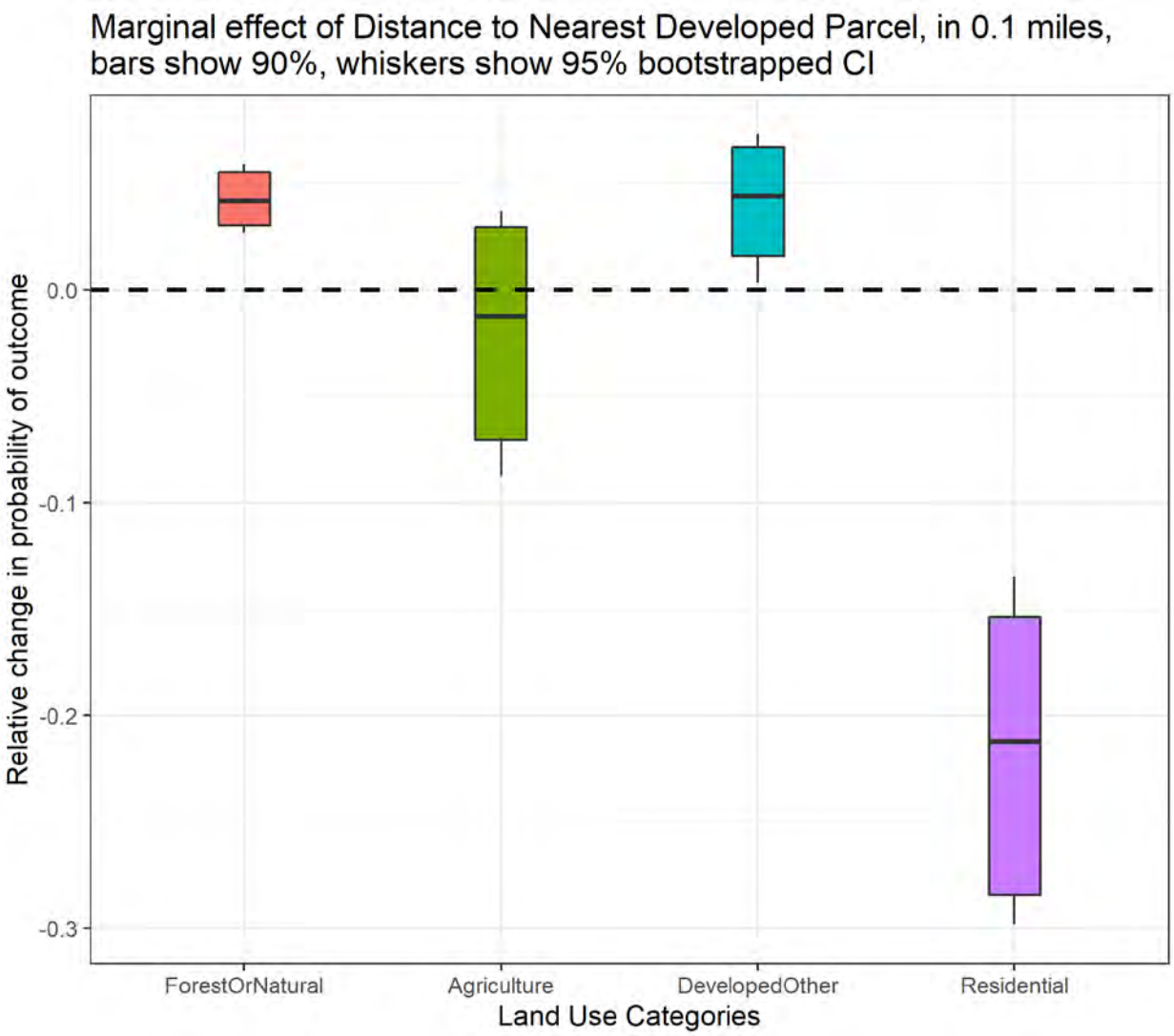

Figure 43. Marginal Effects of Distance to Nearest Development, Westside Model

We do find that proximity to development is associated with higher odds of residential conversion across the state (OR for distance increase of 0.75 and 0.82 in West and Eastside models, $p < 0.01$), and parcels further from development are somewhat more likely to convert to agricultural uses on the Eastside (OR = 1.02, $p<0.05$). Distance to public roads (marginal effects in Figure 109 and Figure 110) has a negative impact on agricultural (OR = 0.85, $p <0.01$) and residential (OR = 0.96, $p<0.01$) conversion on the Eastside. Distance to DNR land on the Eastside is positively associated with SFLO conversion, while it's negatively associated with residential conversion on the Westside (OR = 0.97, $p < 0.01$), although the effect is very small (Figure 111 and Figure 112). Similarly small effects are observed for distances to the US Forest Service land (Figure 113 and Figure 114). Although one could hypothesize that, given that DNR land is more actively managed, residential areas' inhabitants may prefer to be further away from more intensively managed land, we do not see strong evidence of these preferences.

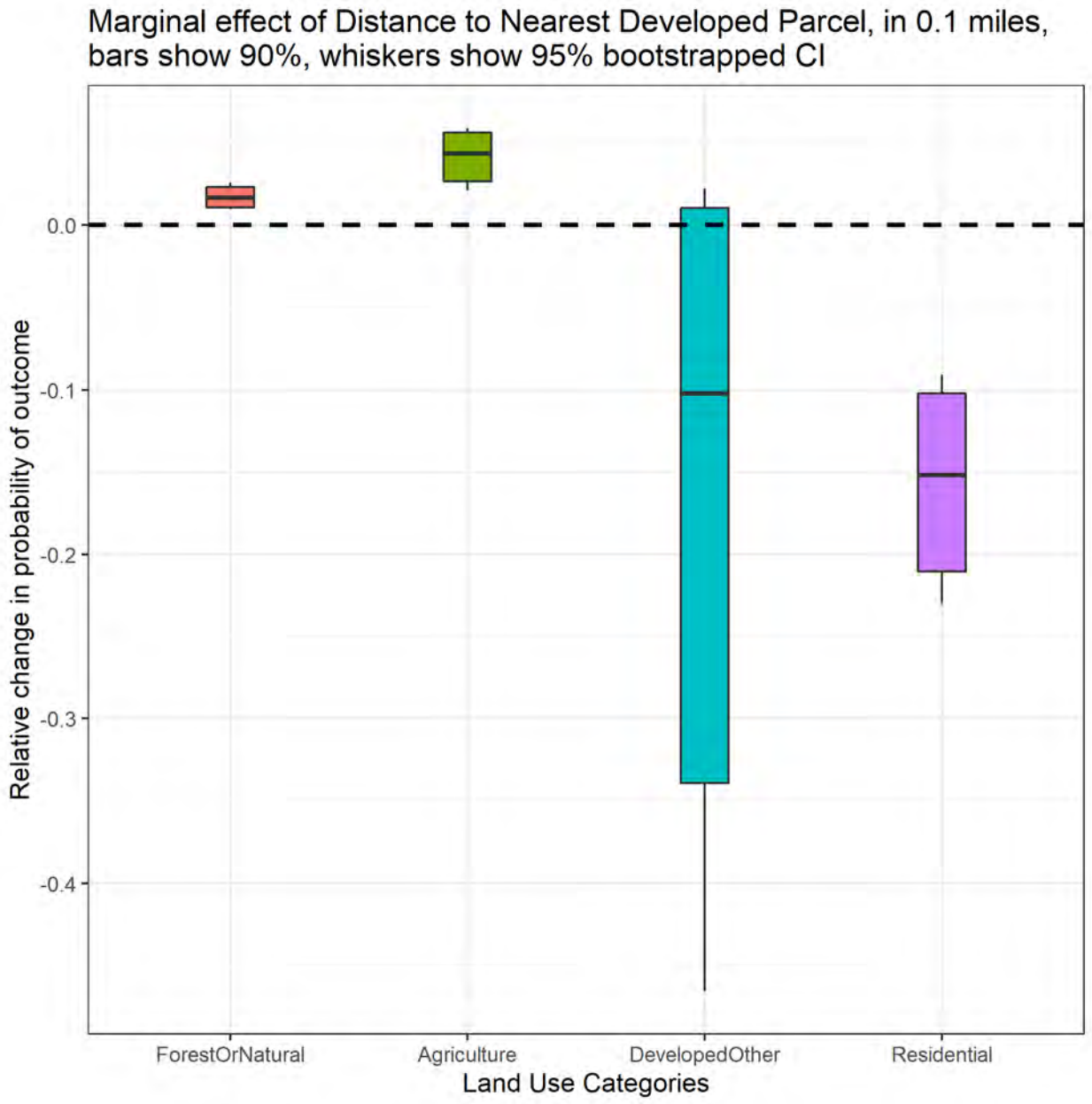

Figure 44. Marginal Effects of Distance to Nearest Development, Eastside Model

Finally, although we did not see a strong effect of observed population changes on land use change, the future development potential embedded in proximity to the Urban Growth Boundary has a positive impact on the probability of land use conversion to residential land uses. The effect is seen (OR = 0.76, $p<0.01$) for the Eastside model in the odds ratios but only emerges in bootstrapped marginal effect simulations (Figure 107) for the Westside parcels ($p<0.05$). Across the state, SFLO parcels located further away from the UGA are more likely to maintain a resource use but switch to agricultural uses (Figure 107 and Figure 108).

County-level median income (in 2013) has been found to be positively related to the probability of residential and development conversion on the Westside (OR = 1.04/1.03, p <0.01/0.05), Figure 101, and somewhat lower odds of residential or agricultural conversion on the Eastside (Figure 102). We see that Westside and Eastside residential conversion of SFLOs follow a different pattern: higher income, lower density growth areas in the West are more likely to see residential conversion, whereas in the East, it is lower income but faster growing areas that are associated with more residential SFLO conversion.

We also need to emphasize that the effects presented represent marginal changes in probabilities with all other variables held constant, which is a proper way of coefficient interpretation but marginal effects of a particular sign represent a conditional relationship and are not identical to the presence of a bivariate trend relationship between predicted probabilities and the variable in question. For example, although the marginal impact of the gravity index is negative on the Westside residential development probability, a partial dependence plot of the gravity index (using the out-of-sample predicted probabilities) shows that when we see how the gravity index changes in the overall Westside sample, the estimated residential development probability in fact trends up (Figure 45), but those trends are heterogenous across Westside counties (Figure 115). Similarly, a partial fitted trend between population density change and probability of residential development is slightly positive.

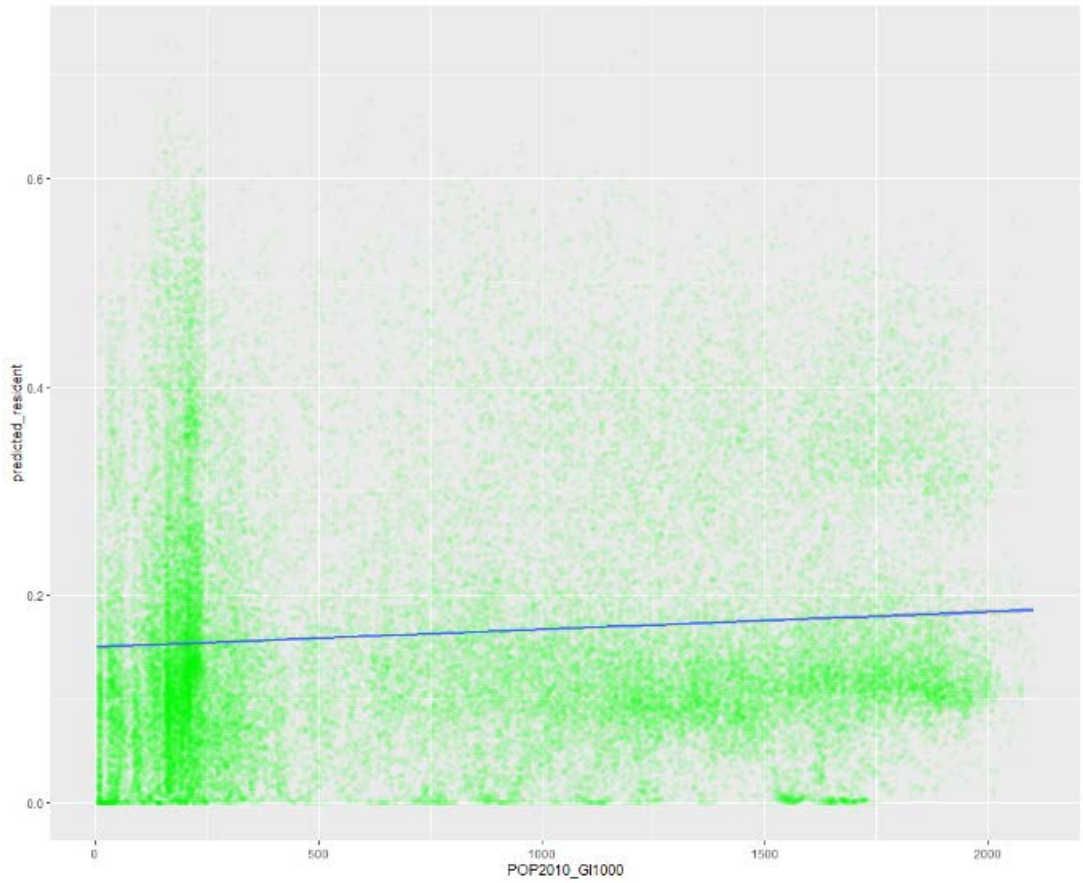

Figure 45. Example of partial dependence plots using the gravity index: gravity index vs. residential conversion risk, Westside

9.4.3 Parcel and ownership characteristics

We find that the parcel acreage has a positive impact on the probability of SFLO land use change toward for agricultural uses across the state. Larger parcels on the Westside are less likely to convert to residential uses (OR = 0.63, $p<0.05$, bootstrapped marginal effect significant). *Tract acreage* has likewise a positive impact on agricultural conversion probabilities across the state, with a smaller effect for the Eastside (Figure 118, Figure 119). While larger tracts are more likely to transition to Developed uses on the Westside (OR = 1.17, $p<0.05$), parcels belonging to larger tracts of forestland are similarly "protected" against residential development (50% decrease in relative odds across the state for each 100 acre increase in tract size).

While total forest land ownership was only important in explaining sales behavior for the Westside and not for the Eastside, larger owners are less likely to see their land convert to residential or agricultural (for the Westside) uses. For each 100 acres of forested land owned by a SFLO, the parcel has 17% (14%) lower odds ($p < 0.01$) of being converted to residential uses for the Westside and Eastside, respectively. At the same time, similarly to the effect of tract

size, Westside owners with larger forest holdings have been somewhat more likely to convert to developed uses (7% increase in probability, 95% CI: (0.6-12)%). Overall, we see that Westside SFLOs who manage larger forest holdings appear to be more reluctant to both sell and convert their forest lands.

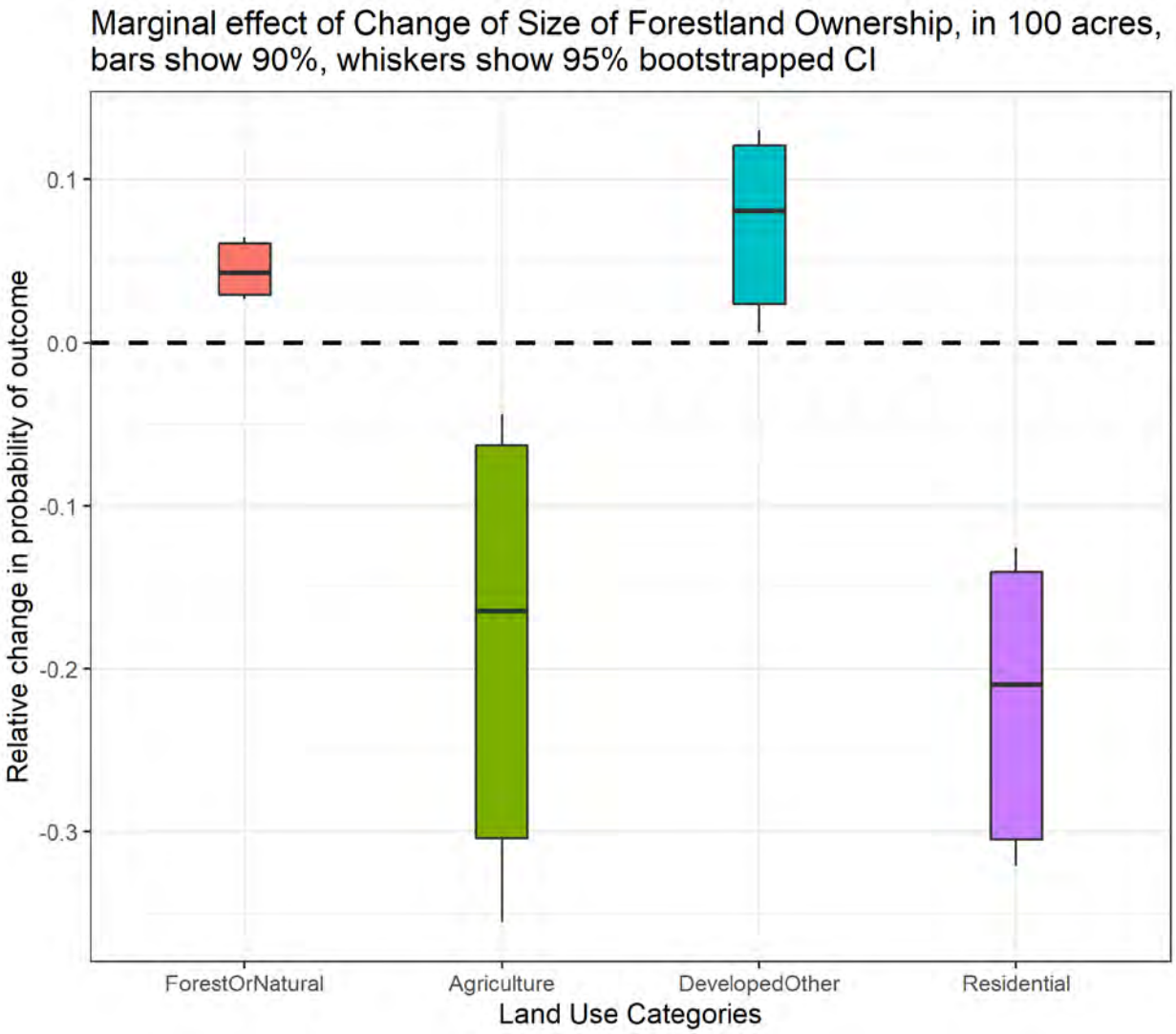

Figure 46. Marginal Effects of Size of Forest Ownership, Westside Model

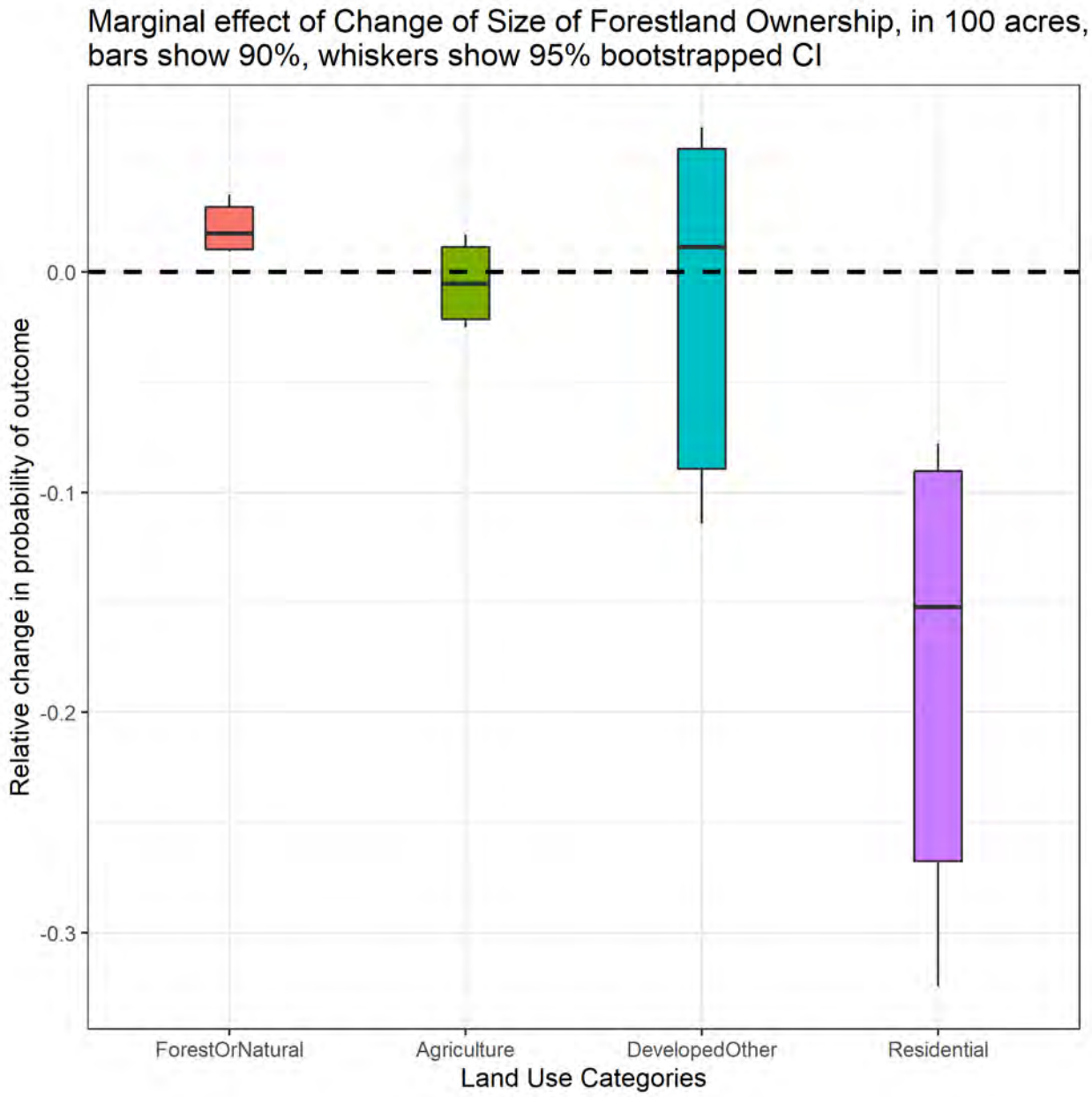

Figure 47. Marginal Effects of Size of Forest Ownership, Eastside Model

Parcel road extent (in miles) is a strong predictor of sales on the Westside and we also see it as a significant predictor of residential conversion: odds of residential conversion grow by 69% for each mile of identifiable roads located on the parcel (Figure 48). Parcels with more roads are less likely to be converted to agricultural uses on the Westside (marginal effect of -109.4%, 95% CI: (-185.7, -50.8)%)) as well as the Eastside (odds ratio significant at 10% but the bootstrapped marginal effect of –32.3% significant at 5% level of significance), Figure 120.

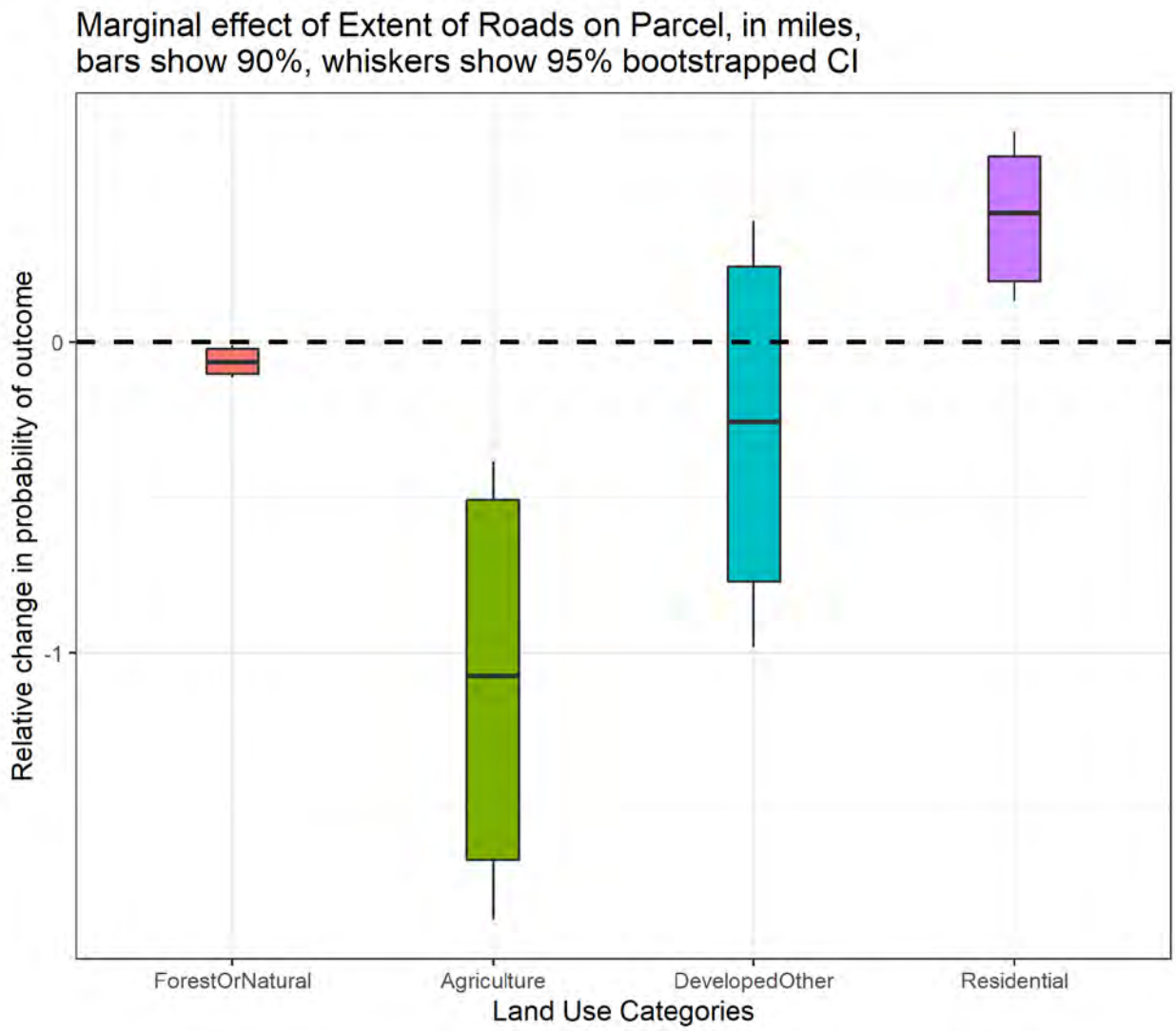

Figure 48. Marginal Effects of Parcel Roads, Westside Model

Forest productivity, as measured by the State's Site Class Index, emerges as a predictor of land use change for the Westside model only (Figure 121, Figure 122). For the Westside, parcels that have been identified as "productive" (Site Index less than or equal to V) have a higher baseline risk of residential conversion (OR = 1.34, p <0.01), lower odds of heavier development (OR = 0.41, p<0.05, yet the bootstrapped marginal effect is not significant), with less productive (higher site class) parcels (among the productive parcels) having a higher estimated risk of transitioning to developed uses. As with the sales model, the results are consistent with the presence of a positive correlation between what may make a parcel attractive to potential residential use (lower elevation and slope) and the underlying productive potential of a parcel for forestry uses. While productivity index is correlated with the sales activity on the Eastside, no separate significant pathways of correlation between site forest productivity and land use change emerge.

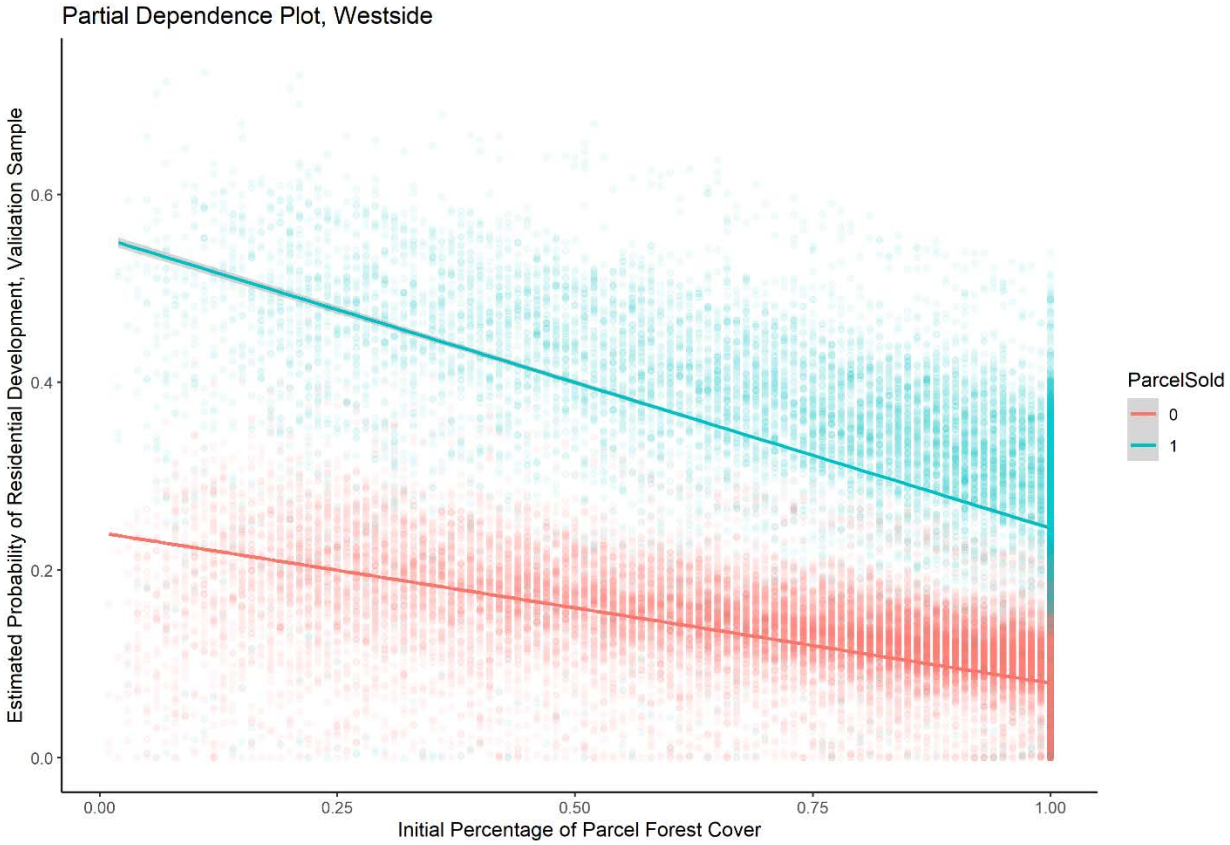

Figure 49. Parcel forest percentage and estimated probability of residential development, validation sample, Westside

Similarly to the sales model, one of the strongest parcel-level predictors of land use changes is the parcels' initial (earliest available parcel data) forest cover or designated forestland land use code ("PercentForest"). Both on the West (Figure 123) and the Eastside (Figure 124), higher

fraction of a parcel being a forest either by land cover or by designated land use is correlated with much lower odds of agricultural (OR = 0.14, p < 0.01 for Westside, OR = 0.18, p <0.01 for Eastside), commercial (OR = 0.11, p < 0.01 for Westside, OR = 0.06, p <0.01 for Eastside), and residential development (OR = 0.31, p < 0.01 for Westside, OR = 0.20, p <0.01 for Eastside). The finding is robust to different specifications and holds after we control for harvesting FPA activity and sales activity. Partial

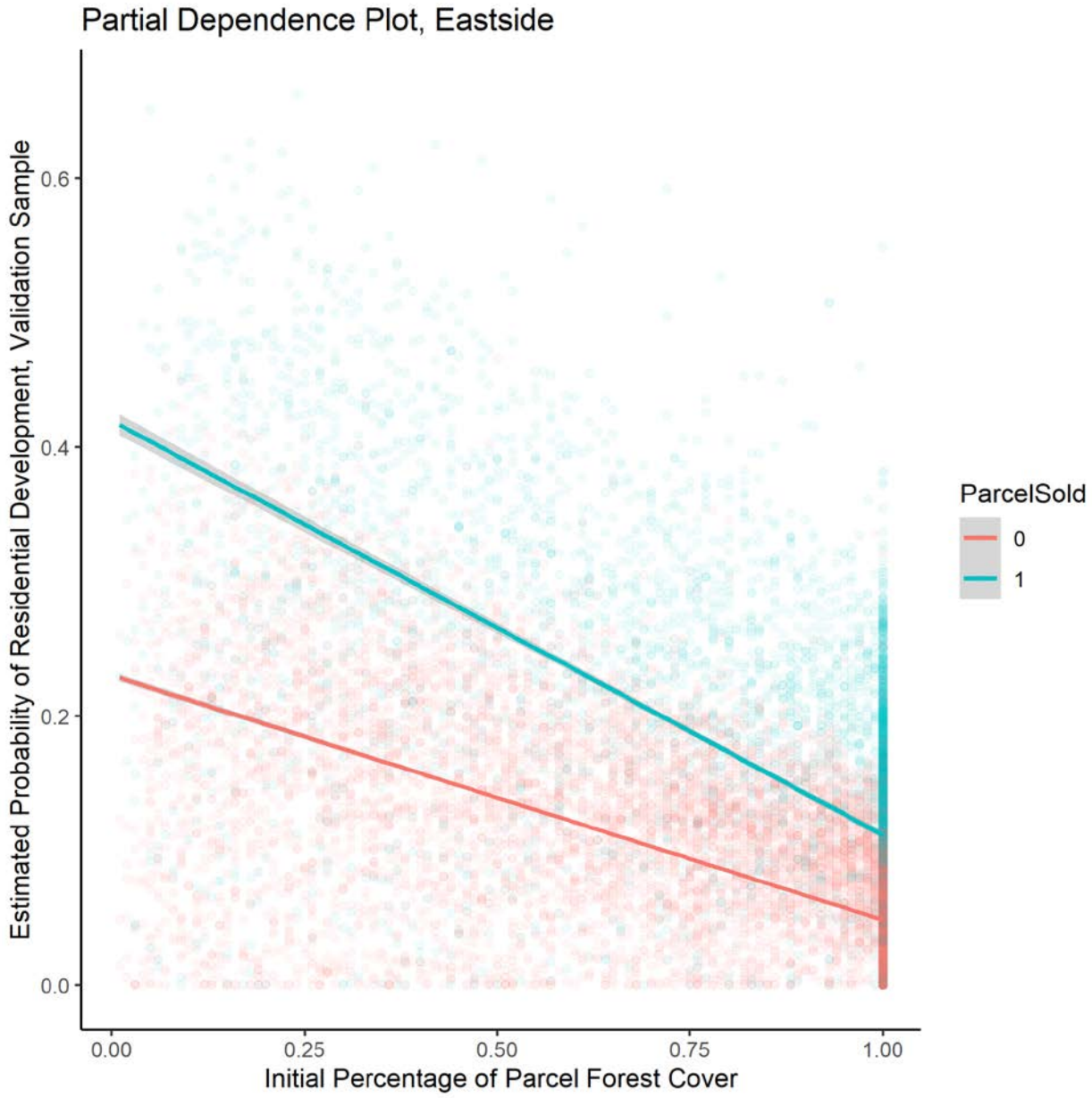

Figure 50. Parcel forest percentage and estimated probability of residential development, validation sample, Eastside

dependence plots (Figure 49, Figure 50) for two models show a consistent effect of sales and initial forest share on residential development probability.

9.4.4 Summary of land use change model findings

- An *event of a parcel sale* means that an SFLO is more likely to transition to residential land uses on both sides of the state.
- Similarly to the sales model, the *presence/size of riparian areas* were found to be significant predictors of transition to agricultural land use, but not residential or other land use. A FREP eligibility proxy which broadly captures both the possible impact of riparian regulations and the existing policy intent associated with the FREP program is only significantly associated with a higher likelihood of transition to agricultural land uses (OR = 3.98 for Westside, OR = 4.68 for Eastside, $p < 0.01$) and is not associated with residential or other development on the Westside, while leading to a 27% lower relative probability of residential development on the Eastside (marginally significant in bootstrap simulations at $p < 0.1$).
- *Proximity to development* is associated with higher odds of residential conversion across the state and parcels further from development are somewhat more likely to convert to agricultural uses on the Eastside. Distance to public roads has a negative impact on agricultural and residential conversion on the Eastside.
- *Proximity to the Urban Growth Boundary* has a positive impact on the probability of land use conversion to residential land uses. Across the state, SFLO parcels located further away from the UGA are more likely to maintain a resource use but switch to agricultural uses.
- County-level median income is positively related to the probability of residential and development conversion on the Westside, with a somewhat negative relationship with the odds of residential or agricultural conversion on the Eastside. We see that Westside and Eastside residential conversion of SFLOs follow a different pattern: higher income, lower density growth areas in the West are more likely to see residential conversion, whereas in the East, it's lower income but faster growing areas that are associated with more residential SFLO conversion.
- We find that the *parcel acreage* has a positive impact on the probability of SFLO land use change toward for *agricultural uses* across the state. *Tract acreage* has likewise a positive impact on agricultural conversion probabilities across the state, with a smaller effect for the Eastside.
- Larger parcels on the Westside are less likely to convert to residential uses. While larger tracts are more likely to transition to Developed uses on the Westside, parcels belonging to larger tracts of forestland are "protected" against residential development (50% decrease in relative odds across the state for each 100 acre increase in tract size).

- Owners with larger land holdings are less likely to see their land convert to residential or agricultural (for the Westside) uses. For each 100 acres of forested land owned by a SFLO, the parcel has 17% (14%) lower odds of being converted to residential uses for the Westside and Eastside, respectively. At the same time, similarly to the effect of tract size, Westside owners with larger forest holdings have been somewhat more likely to convert to developed uses Overall, Westside *SFLOs who manage larger forest holdings* appear to be more reluctant to both sell and convert their forest lands.
- *Parcel road* extent is a significant predictor of residential conversion on the Westside: odds of residential conversion grow by 69% for each mile of identifiable roads located on the parcel.
- Percentage of an SFLO parcel judged to be a forest either through forest cover or DFL designation is an important "retention" factor. Both on the West and the Eastside, higher fraction of a parcel classified as a forest is correlated with much lower odds of agricultural, commercial, and residential development.

9.5 Forward-Looking Estimates

With the caveat that the land use model's predictive ability is modest, we "time-shift" the relevant independent variables and apply the model to 2019 SFLO parcels in "ForestOrNatural" land use categories to provide a broad estimate of the future conversion probabilities and expected acreages. We no longer have sales or harvest application histories to draw upon but spatial (distances variables) and sociodemographic variables have been updated to reflect future expected median county income, distance-weighted population gravity index and county population density change. We used Washington State's Office of Financial Management data to obtain and project forward the population growth rate (calculated on 2010-2019 period) and the median incomes (calculated on 2008-2019 period and then projected forward to 2025). We estimate the model excluding sales and harvest history variables, retain the coefficients, compute the predicted probabilities, and then simulate land use choices using 500 random draws to compute the (conditional on parameter estimates) distributions of land use change across Washington counties. The results can be interpreted as extrapolating the trends observed in the past 10-12 years to 10-12 years from 2019, so roughly to 2030.

We map the estimated conversion probabilities and can see that conversion to Residential uses follows an expected pattern of residential development surrounding the population centers in the State (Seattle, Spokane), as well as of the I-5 corridor and of the impact that Portland has on residential development near Vancouver, WA.

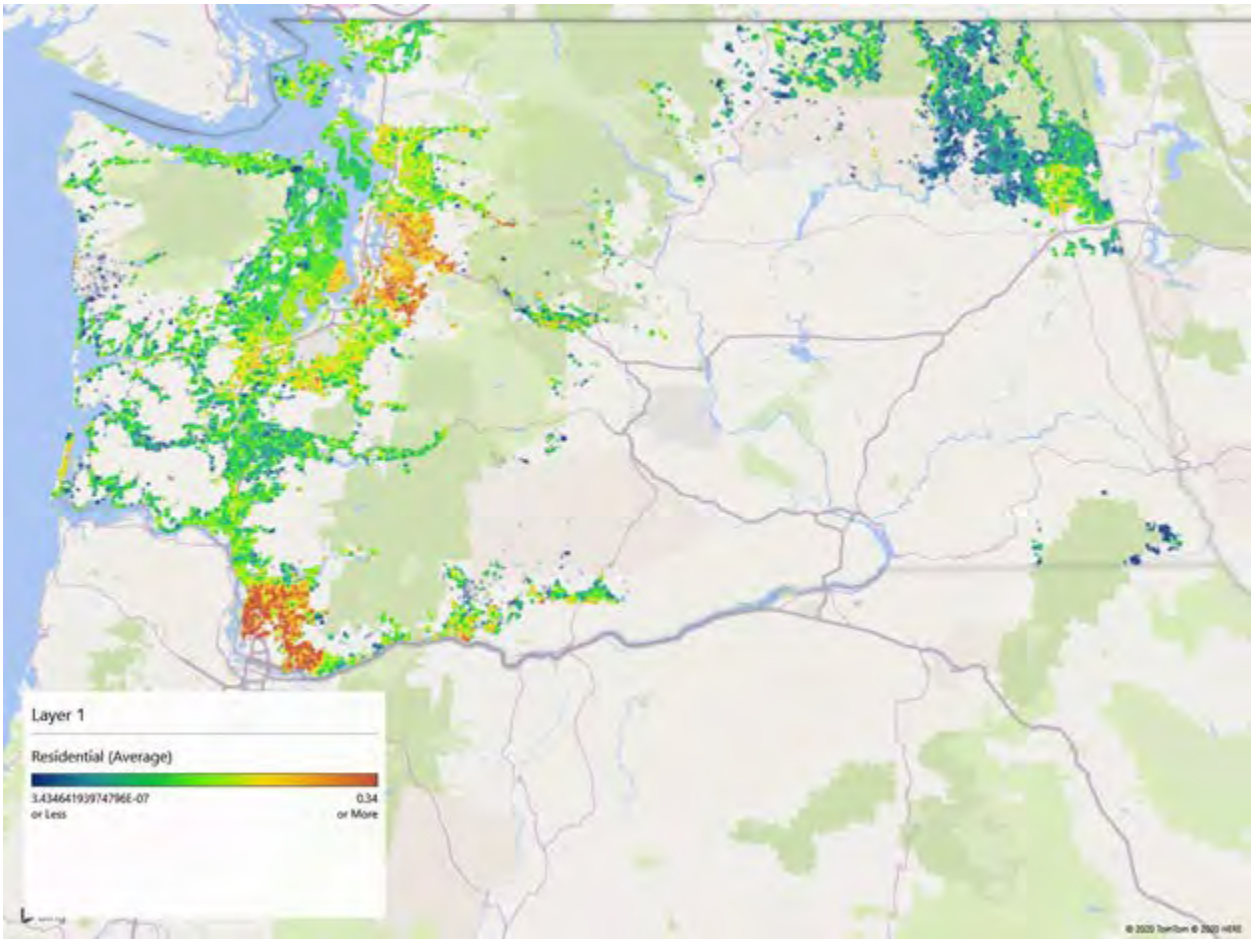

Figure 51. Heatmap of estimated probabilities of conversion to Residential land use category.

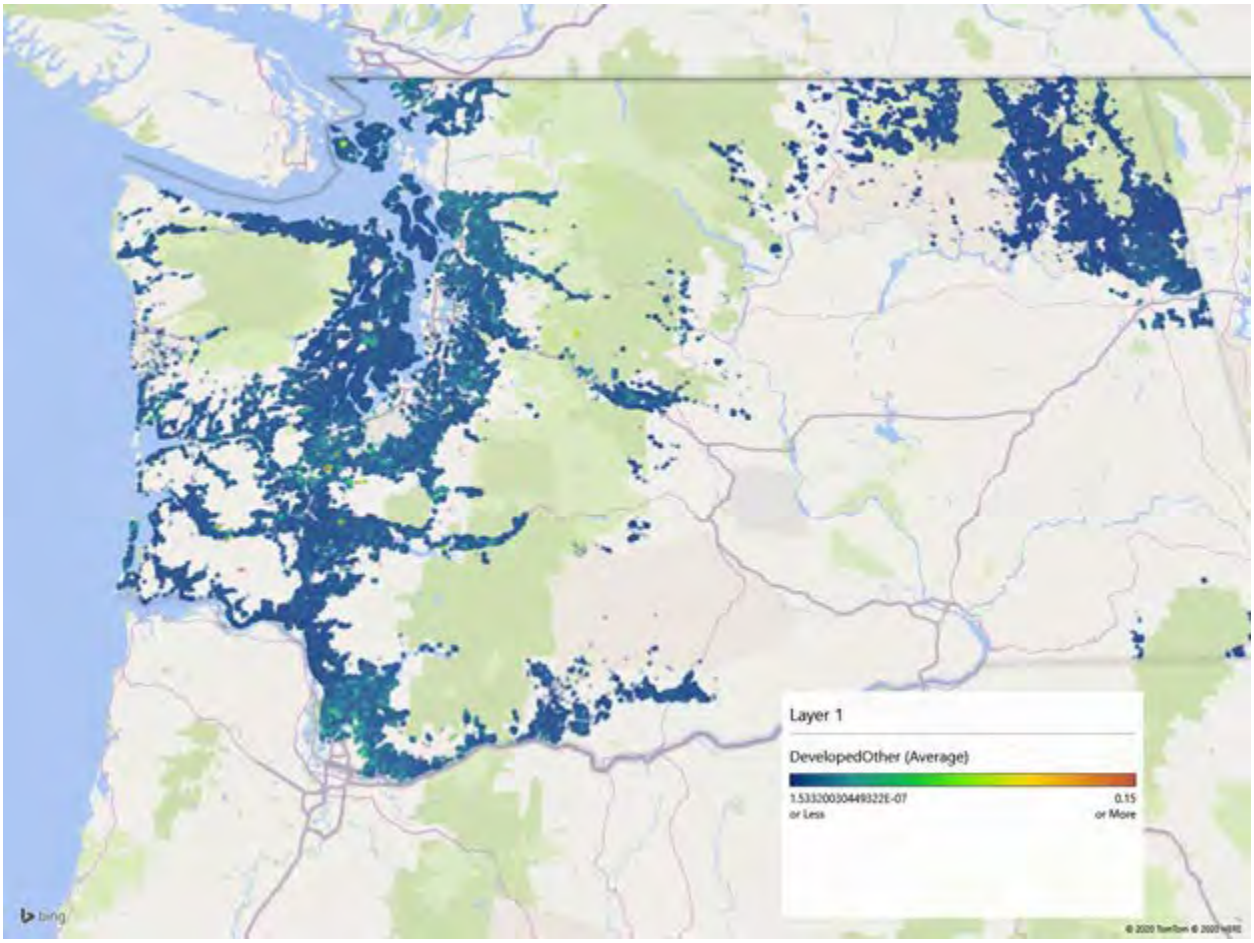

Figure 52. Heatmap of estimated probabilities of conversion to "DevelopedOther" land use category.

Estimated development probabilities also show a largely expected pattern of non-residential development associated with the proximity to population centers and transportation corridors. However, given that larger parcels in larger tracts owned by SFLOs with larger holdings are estimated to be at a higher risk of non-residential development, the model may also be picking up locations of higher development probability that respond to those factors. Again, we note that the modeling replicates aggregate land use change trends and may highlight the overall factors and geographic distribution of land use change but should not be used to predict with any great confidence the fate of an individual SFLO parcel, as a multitude of unobserved factors, including but not limited to a presence of any such development opportunities, remain relevant. At the same time, this and other models of its kind could find use in assessing the *expected* risk of conversion and such assessments may enter into potential ways of scoring parcels prioritized for conservation.

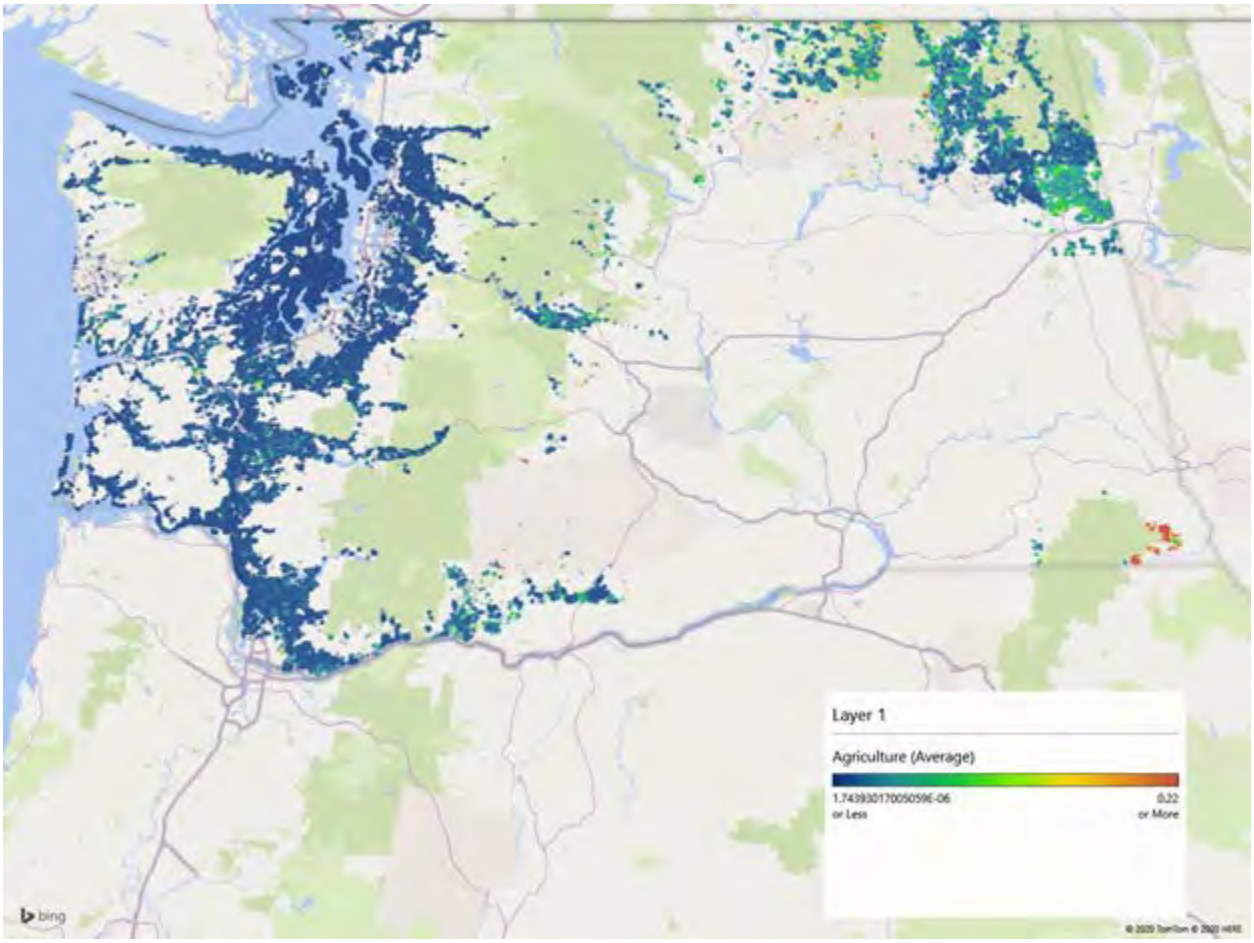

Figure 53. Heatmap of estimated probabilities of conversion to agricultural land use category.

Similarly, shifting of resource land use to agricultural uses is estimated to continue to be more of the Eastside phenomenon, although some agricultural conversion has been occurring and is expected to continue on the Westside. The maps highlight geographic patterns of continued expected conversion and we present summaries of statewide, regional, and county-level estimates below.

The simulated land use changes implicitly, via the estimated model, assume the continuation of land use policies across the state, as well as the continuation of population and income trends. We report the simulated conversions in acres of *forested land* on SFLO parcels, as well as the shares of forested SFLO land. Given that historical conversion has been observed, it is not surprising that projecting forward results in non-trivial but heterogenous SFLO conversion. We also note that the model was estimated to classify land use categories, which are themselves somewhat endogenous with respect to land use policies adopted across Washington counties, so we expect similar classification patterns to be represented in the forward-looking projections. Overall, we estimate that about 98 thousand acres of Eastside SFLO parcels (representing 9.4% of forested SFLO acres) will transition to other uses, while close to 80

thousand acres (representing 9% of forested SFLO acres) will transition to non-forestry uses on the Westside of the State. Table 30 presents the summaries of estimated regional conversions by type:

Table 30. Estimated regional SFLO forest land conversions.

	Westside		Eastside	
Conversion category	Forested Acres	Percent of total forested acres	Forested Acres	Percent of total forested acres
Agricultural	10733.2	1.2	59898.4	5.7
Non-residential development	10342.0	1.2	4225.0	0.4
Residential	58529.6	6.6	34102.6	3.3
Total	**79646.4**	**9.0**	**97949.2**	**9.4**

While the Eastside is estimated to lose more overall forested acres in forestry uses, most of Eastside conversion is expected to occur among resource uses, with forested acres converting to agricultural use categories (almost 60 thousand acres on the Eastside versus about 11 thousand acres on the Westside). Residential conversion is the largest mode of land use conversion anticipated on the Westside, with almost 59 thousand acres (6.6% of forested SFLO acres) expected to convert, compared to the still sizeable 34 thousand (3.3% of forestland SFLO acres) on the Eastside. Non-residential development is expected to be on par with agricultural conversion on the Westside (10 thousand acres, 1.2%), with less than half of that acreage expected to convert on the Eastside (4.2 thousand acres, 0.4%).

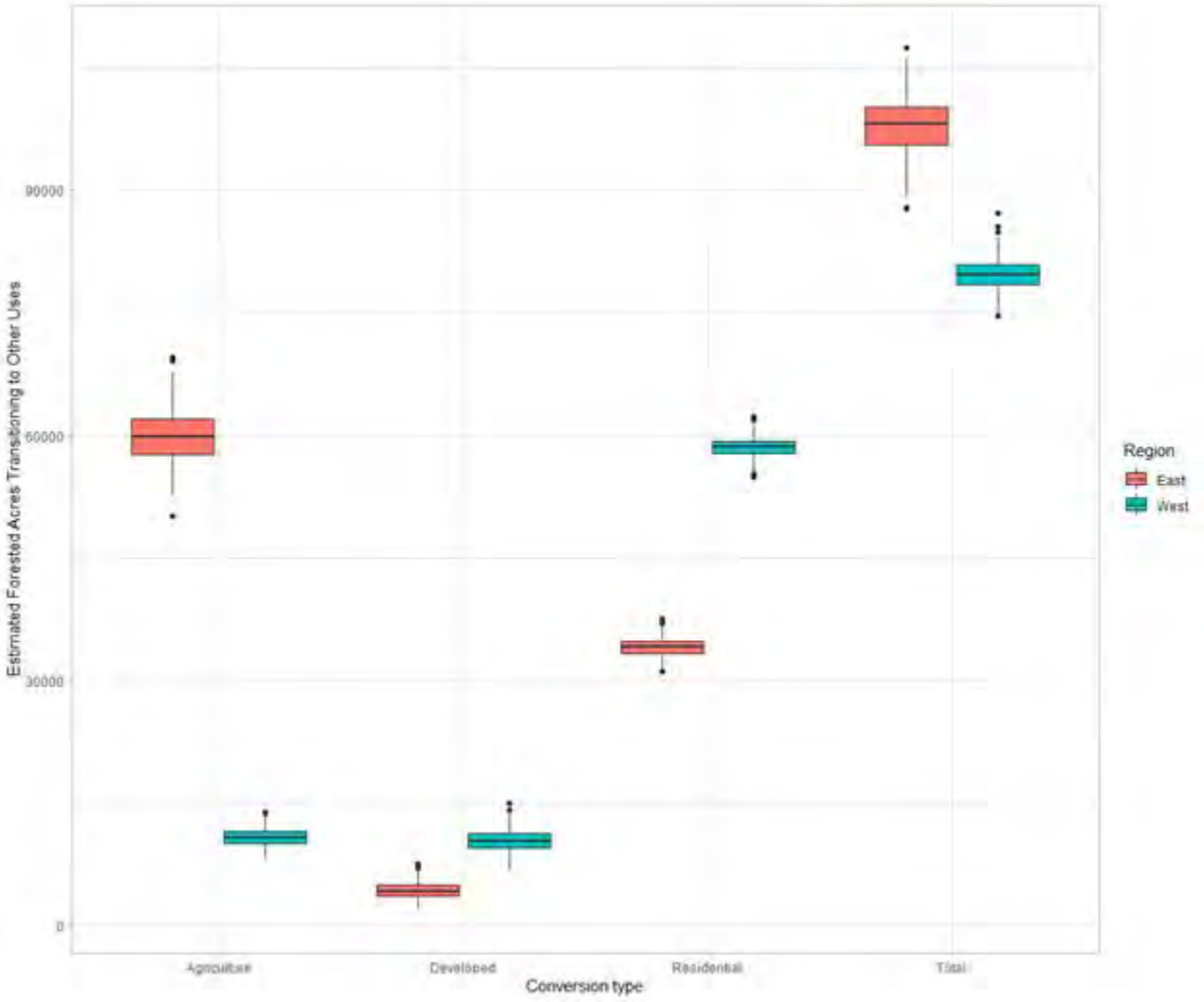

Figure 54. Simulated SFLO conversion acreage, by conversion type and region. Bars show empirical 95% confidence intervals derived from 500 probability of land use change draws.

For Westside, both the maps of conversion probabilities and Figure 55 and Table 31

Table 31 below show that the proximity to Seattle and Portland MSAs appear to continue to put conversion pressure on SFLO parcels. In terms of share of existing SFLO forestland lost, Clark (near Portland, OR) and King counties have the highest estimated relative expected total conversion. Following them is the third smallest, in terms of forestland acreage, San Juan county, where land is under constant pressure for development, and then the I-5 corridor counties of Pierce, Thurston, and Snohomish lead in terms of relative forestland conversion. In terms of absolute conversion, it's the counties bracketing King county from the south and the north and located along the I-5 corridor, of Lewis, Pierce, and Snohomish, that are expected to lose the most of forested SFLO acres in absolute terms.

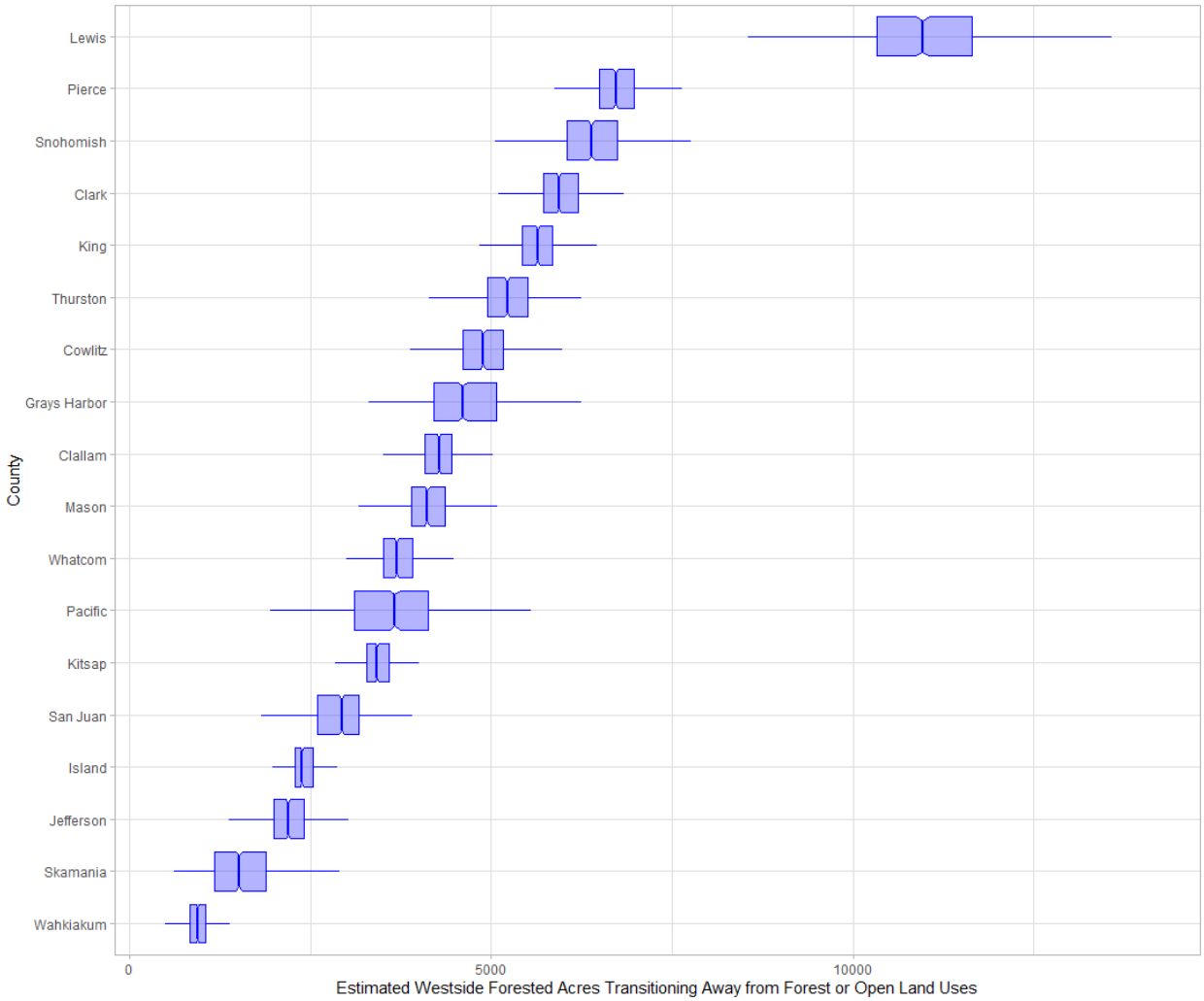

Figure 55. Simulated total absolute conversion of SFLO forest land, Westside.

Table 31 and Figure 55 above show the breakdown of conversion categories expected at the county level.

Table 31. Westside expected forest acreage conversion, by type.

County	Total expected conversion	Expected Residential conversion	Expected Development conversion	Expected Agriculture conversion
Clallam	4,270	3,401	303	572
Clark	5,920	4,998	432	500
Cowlitz	4,911	3,867	356	675
Grays Harbor	4,681	2,574	746	1,294
Island	2,415	2,122	151	139
Jefferson	2,198	1,533	283	409
King	5,620	5,097	299	270
Kitsap	3,449	2,876	387	194
Lewis	10,958	6,532	2,135	2,246
Mason	4,121	3,280	450	402
Pacific	3,666	1,874	1,192	580
Pierce	6,733	5,644	486	597
San Juan	2,903	1,759	523	624
Skamania	1,511	706	508	319
Snohomish	6,413	4,988	873	516
Thurston	5,210	3,682	724	814
Wahkiakum	953	718	71	151
Whatcom	3,738	2,915	349	474
Total	**79,646**	**58,530**	**10,342**	**10,733**

Overwhelmingly, in the county breakdown of projected conversion for the Westside, the largest type of conversion is residential development, followed by the "DevelopedOther" category which broadly describes non-residential development.

We now turn to the Eastside county-level breakdown. Most of the expected conversion on the Eastside is expected to occur among resource land uses (transition to Agriculture). At the same time, a sizeable share of existing SFLO forested acreage is expected to convert to residential land uses, with relatively little in terms of non-residential development expected, with the exception of Stevens County.

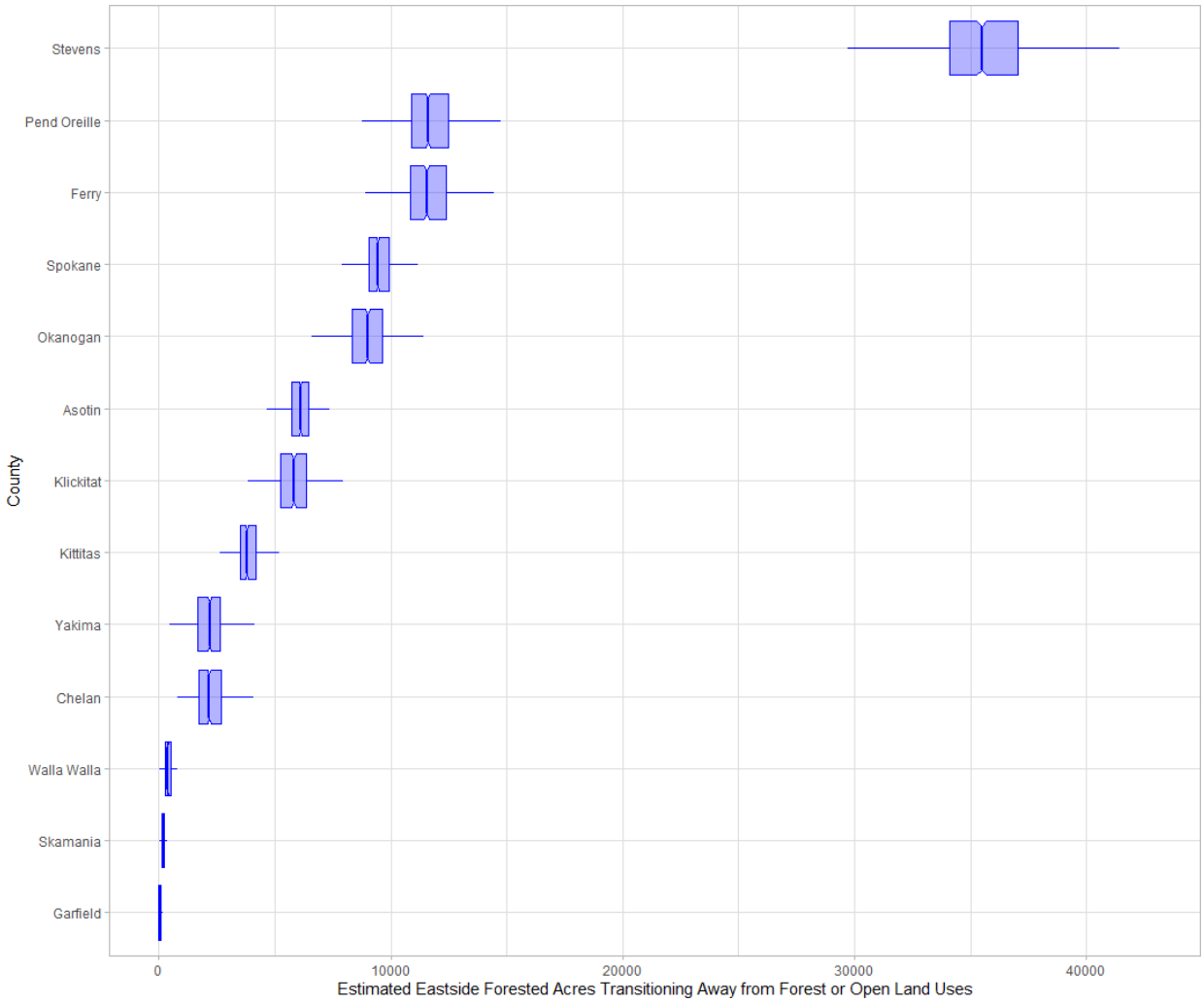

Figure 56. Simulated total absolute conversion of SFLO forest land, Eastside.

In relative terms, Asotin County is expected to have the largest transition (to Agricultural uses), while Stevens county (the county with very large SFLO acreage) expected to see most of transition (again to Agricultural uses) in terms of acreage.

Table 32. Eastside expected forest acreage conversion, by type.

County	Total expected conversion	Expected Residential conversion	Expected Development conversion	Expected Agriculture conversion
Asotin	6,084	90	70	5,909
Chelan	2,182	752	91	1,328
Ferry	11,555	2,949	283	8,334
Garfield	84	13	1	67
Kittitas	3,853	2,123	192	1,502
Klickitat	5,827	2,856	270	2,649
Okanogan	9,014	3,946	689	4,389
PendOreille	11,691	4,938	491	6,283
Skamania	175	126	7	41
Spokane	9,485	4,944	346	4,204
Stevens	35,591	11,035	1,695	22,714
WallaWalla	409	107	14	265
Yakima	2,213	134	20	2,071
Total:	**97,949**	**34,103**	**4,225**	**59,898**

As can be seen on the probabilities heat maps above, a lot of residential conversion on the Eastside appears to be concentrated around Spokane and in river valleys (notably Columbia and Pend Oreille) where existing federal and tribal land ownership may restrict the supply of developable land.

9.6 Discussion

In this section, we evaluated the factors which have contributed to SFLO parcels being sold and converted to other uses. We identified a range of parcel-specific, location-specific, ownership-specific, and broader economic and sociodemographic factors which are plausibly causally related to the sale and/or conversion decision. We use the land use change model to project a range of outcomes consistent with estimated probabilities of land use change. The trend of SFLO forestland loss is expected to continue in the next decade under the status quo land use policies (implicitly recovered via observed land use changes). Evaluation of county-specific land use regulations and their potential effects on SFLO conversion is outside the scope of this report. However, to the extent that local land use policies contributed to observed historical land use changes, their effects are represented in the forward looking projections, while we cannot present counterfactual simulations of any specific land use policy parameters at the county level.

Often, the land use change models are parameterized using relative net returns to alternative land uses (e.g., net returns to development, forestry, agricultural uses). We have tested county-level agricultural net returns in our models and did not find those variables to be related to land use change behavior at the parcel level. We do include indicators of forest productivity and find that more productive forest parcels are more likely to be converted to residential uses on the Westside, which goes against the simple interpretation of higher forest income potential serving to reduce the conversion probability. The usual gap in economic returns to SFLOs between forestry and developed uses is very large, and small changes in forestry income potential are not likely to contribute to large changes in development probabilities on SFLO parcels (although for Washington private forests, Brent and Rabotyagov (2013) do find small "protective" effects of increasing relative net returns to forestry). We also do not have good parcel-level data on the parcel's value in alternative uses. While for some SFLO parcels, we do observe "highest and best use" valuation recorded by county assessors, parcels in current use taxation programs are not evaluated for their developed value potential. Instead, we proxy the development potential value of a specific parcel using the fundamental characteristics which are likely to be related to the development value of the parcel in land markets: that is, the parcel-specific locational and county-level economic and population growth characteristics.

While we find and report significant factors that affect the likelihood of an SFLO parcel being sold and/or developed, we do not see many "policy levers" emerging from observed sale and land use change behavior analysis. Forest productivity correlates with higher risk of residential development, so any policy which would correlate with higher forestry return would yield higher residential conversion probability in our model. Proximity to existing development and the urban growth area does have a positive effect on conversion probabilities, and to the extent that broader land use policies create less landscape fragmentation where fewer SFLO parcels fall into close proximity to developed uses, that may reduce the future conversion likelihood. Not surprisingly, overall SFLO parcel conversion is occurring near major population centers and the connecting transportation network (although the marginal effects of each of those variables do not all follow the expected sign or are significant). This suggests, in an obvious fashion, that patterns of urban growth and development affect the demand for developable resource lands, including SFLO parcels. Policies adopted via the Growth Management process and other policies pursued by counties and municipalities which accommodate higher density residential development are likely to put less pressure on SFLO parcels. At the same time, as the trends analysis indicates, the number of people becoming SFLOs has grown and is expected to grow in the future.

Active forest management history, as evidenced by a presence of a harvest FPA, does not by itself significantly impact conversion probabilities on the Westside and has a divergent effect on the Eastside, where harvested parcels are more likely to convert to non-residential and less likely to convert to residential development. Prior harvesting, however, is positively related to

the probability of a sale on the Westside, which in turn is positively related to the probability of conversion. Again, separate from a sale decision, any policy affecting likelihood of harvesting would not change land use in our model. Simulating policies to reduce harvesting behavior could lower the estimated likelihood of a sale and in turn reduce the conversion likelihood. We, however, strongly suspect that harvesting and sales are often a part of the same decision process and the estimated coefficient on harvesting in the sales equation is not structural in the sense of allowing for counterfactual simulations. Causal claims in observational data are very difficult to establish and we again caution against the confident interpretation of the sales model as suggesting that somehow preventing harvesting could prevent sales and development. Also, we should note that in the land use change models which excluded the sale indicator, harvesting behavior was not associated with a higher likelihood of conversion. And, of course, harvesting timber remains an important objective for many SFLOs not to mention the importance of timber for the forest products industry.

Similarly, sales are clearly associated with conversions (although not in a necessary or sufficient way). Disposition of SFLO land remains the owner(s)' decision and no policy proposals of trying to curtail property rights of forest landowners will be discussed.

We did look for evidence that the size of the riparian zone (using different buffer metrics), length and type of streams, or actual/potential eligibility for the FREP program have a significant and robust effect either in the sales or land use change decision. While we find that proxied FREP eligibility may be positively related to conversion to agricultural land uses, we do not see evidence that FREP eligibility proxy or other riparian variables have a significant effect of increasing residential or non-residential development. *As a result, based on these and prior analyses, there is not substantial rationale to consider riparian regulations to be strong drivers of SFLO sales or conversion*.

Prior (recorded in the earliest available Forestland Database) percent of an SFLO parcel that is under forest cover (or belongs to the DFL land use class) is a strong and consistent variable that is negatively correlated with both sales and conversion. While it's possible that there is some endogeneity in the coefficient , it's likely to be a low-regret strategy to recommend continued emphasis on appropriate reforestation and afforestation on non-designated forestlands as a way to protect forests from conversion, as well as to maintain designated forestland programs (we provide quasi-experimental matching analysis explicitly focused on the DFL program below). Percentage of an SFLO parcel being forested or whether the parcel was in the DFL program negatively influencing sales and conversion decisions was a robust finding and maintained its sign and significance when we controlled for harvesting behavior and site productivity on both the West and the Eastside.

The story and empirical analysis of sales and land use changes on SFLO lands is complex. As discussed above, one of the challenges associated with land use modeling is a general lack of

owner-specific characteristics such as age, income, ownership tenure and objectives, and so on, which may influence the conversion decision. We complement the current analysis with several comprehensive surveys which aim to fill that gap. At the same time, survey-based analyses come with their own problems. One of the problems is fairly low sample sizes which, even if the sample is representative of the SFLO population or their land, makes generalizations in terms of extent and location of land use change difficult. The second is the issue of sample selectivity. Over a decade ago, we conducted a survey of SFLO landowners with the explicit focus of "working forest retention" (results reported in Lin 2010; Rabotyagov and Lin 2013b; Rozance and Rabotyagov 2014). We matched the original survey results to parcels in the 2019 WAGIS Database. As a result, we found several interesting features of the fate of the original survey respondent parcels which add to our current report and demonstrate both the challenge of sample selectivity in landowner surveys and the need to have access to difficult-to-measure landowner characteristics in predicting conversion of forest lands. We briefly report on the key findings below.

9.7 Importance of Landowner Subjective Evaluations on Observed Land Use Change

We also model land use change using the spatially matched sample from a 2009 survey of Washington small forest landowners. The 2009 survey drew parcels from the 2007 Washington Forestland Database (Rogers and Cooke 2007) and Lin (2010) matched the responses to specific parcels in the 2007 database. Although the sampling for the 2009 survey ensured that survey recipients are indeed legally defined Small Forestland Owners for the State, the recipients were free to answer the question about the parcel which they felt was under the most threat in terms of forest conversion. As a result, the matching process outlined in Lin (2010) found the parcels which were owned by the respondents but, although the recipients were asked to think about their "forestland", there is no guarantee that the legal land use code definition for the survey parcels had to be associated with land use categories explicitly connected to forestry land uses. Nonetheless, based on the responses, it was clear that the respondents thought about the parcels they referred to as forested land. In the models below, we focus on the fate of the 510 (out of total 807 survey parcels matched to 2019 data) 2009 survey parcels which were originally categorized as "ForestOrNatural" in terms of land use categories.

While this is a somewhat "sidebar" analysis, we note that it serves two important purposes, both for improving the understanding of SFLO decisions in Washington but also for the broader NIPF-focused community. A lot of existing NIPF research draws either on geo-referenced, cadaster-level and remote sensing data, or on survey results, but not often both. Even rarer is the ability to evaluate ex-post the importance of survey (essentially, stated-preference) data on observed (revealed preference) outcomes. Also we are now in the position to evaluate the extent of sample selection along the conversion dimension. The original survey was focused on forest retention and included a willingness-to-accept choice experiment for working forest

conservation easements. We thus expect that it would be a landowner concerned with being able to continue with their land in forestry that would respond to such a survey, but without looking at the realized history of survey parcel conversions as compared to population conversion rates, it's impossible to assess the sample selectivity aspect.

With respect to sample selectivity, we see that a survey that focused on forest retention (while originally aiming to get representative results for the whole SFLO population) attracted respondents whose parcels ended up developing at an order of magnitude greater rate than the population rate we estimate in the trends analysis: 73% of the survey "ForestOrNatural" parcels converted to other uses, with 61% lost to residential conversion. While it's difficult to generalize the quantitative magnitude of selection elsewhere, it's clear that respondents' interest and involvement in survey matters drives survey response and selectivity. Partly as a result of this finding, we made sure that the SFLO general and FF surveys we undertaken in 2020 were as neutral and broadly applicable to all SFLO respondents as possible. For example, the title of the 2020 surveys were both "Washington Small Forest Land Owner Survey" and the art on cover pages simply showed forest and mountains for the GP survey and a stream running through a forest for the FF survey.

We followed the same methodology as the main land use change analysis outlined above, estimating a multinomial logit of land use change. The objective was to specifically look at the effect of difficult to observe (except in a survey setting) and corresponding latent variables associated with subjective perceptions of development pressure and ownership values, objectives, and challenges.

While clearly selected for the respondents whose land turned out to be much more at risk of conversion than the general population, the 2009 survey sample still offers an important glimpse in validating the real-world impact of anticipated changes or other objectives or concerns on actual land use change outcomes. With respect to prospective intentions, the original 2009 survey respondents were asked whether their land will be converted, and we are able to observe the realized 2019 state of their parcels. Somewhat surprisingly, the direct anticipation that a "substantial portion" of their parcel will be developed was not a significant predictor of realized land use change. Subjective evaluation of "great development" pressure on their forested parcel was predictive of agricultural conversion but not of other types.

We used 12 survey items to construct 4 "value" and 6 items to construct 2 "challenge" factors using a principal component analysis. Based on item loadings, we constructed "Legacy", "Environment/Wildlife", "Personal Residence" and "Income/Investment" as ownership value factors, and "Regulations" and "Ownership in the Future" as ownership challenge factors. We used the individual factor scores in the multinomial land use change model.

Because of the highly selected nature of the survey respondent data, the interpretation of the results is better thought of as "among those who are very likely to convert", a particular impact

was observed, as opposed to generalizing it to the population level. Nonetheless, one may expect that if landowners convert their forests due to struggles with regulatory burdens, the signal of "Regulations" challenge scores would be even stronger in the self-selected sample. Surprisingly, we do not find the subjective evaluation of being burdened by regulations as predictive of subsequent conversion (for any conversion types). At the same time, we do find that stronger assessment of perceived challenges to "Ownership in the Future" is associated with future (residential) conversion, with a mean marginal effect of 10.5% increase in the probability of residential development, and 27.3% decrease in probability of continuing in forest uses.

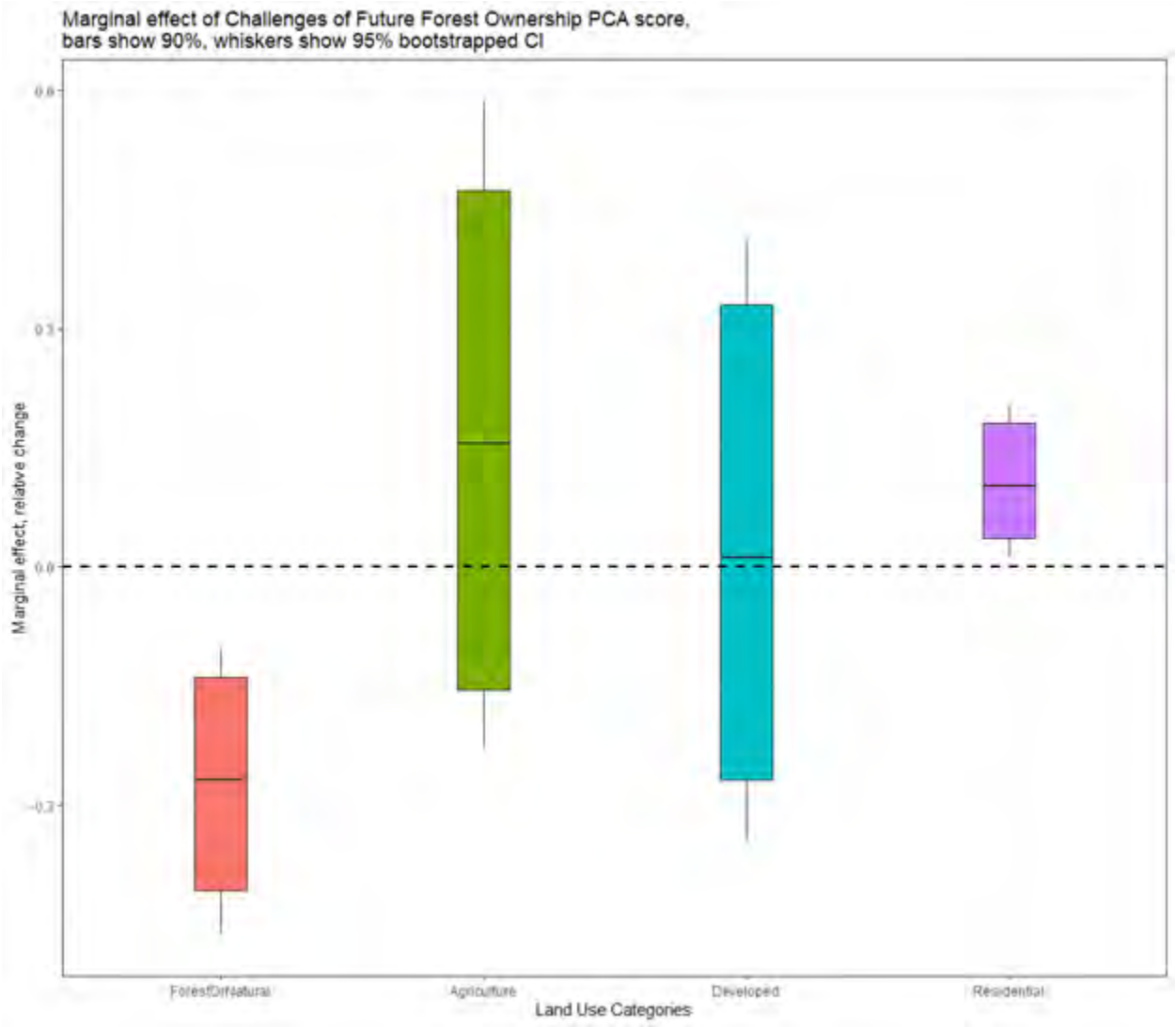

Figure 57. Bootstrapped marginal effects of future ownership challenges, 500 draws.

In another piece of evidence that subjective evaluations and elicited ownership objectives do correlate with observed land use change, we find that among the survey respondents, those

who value their forested land more for residential use reasons, are more likely to see their land converted to residential (12.9% increase in relative probability), but not non-residential (55.3% decrease in relative probability), development.

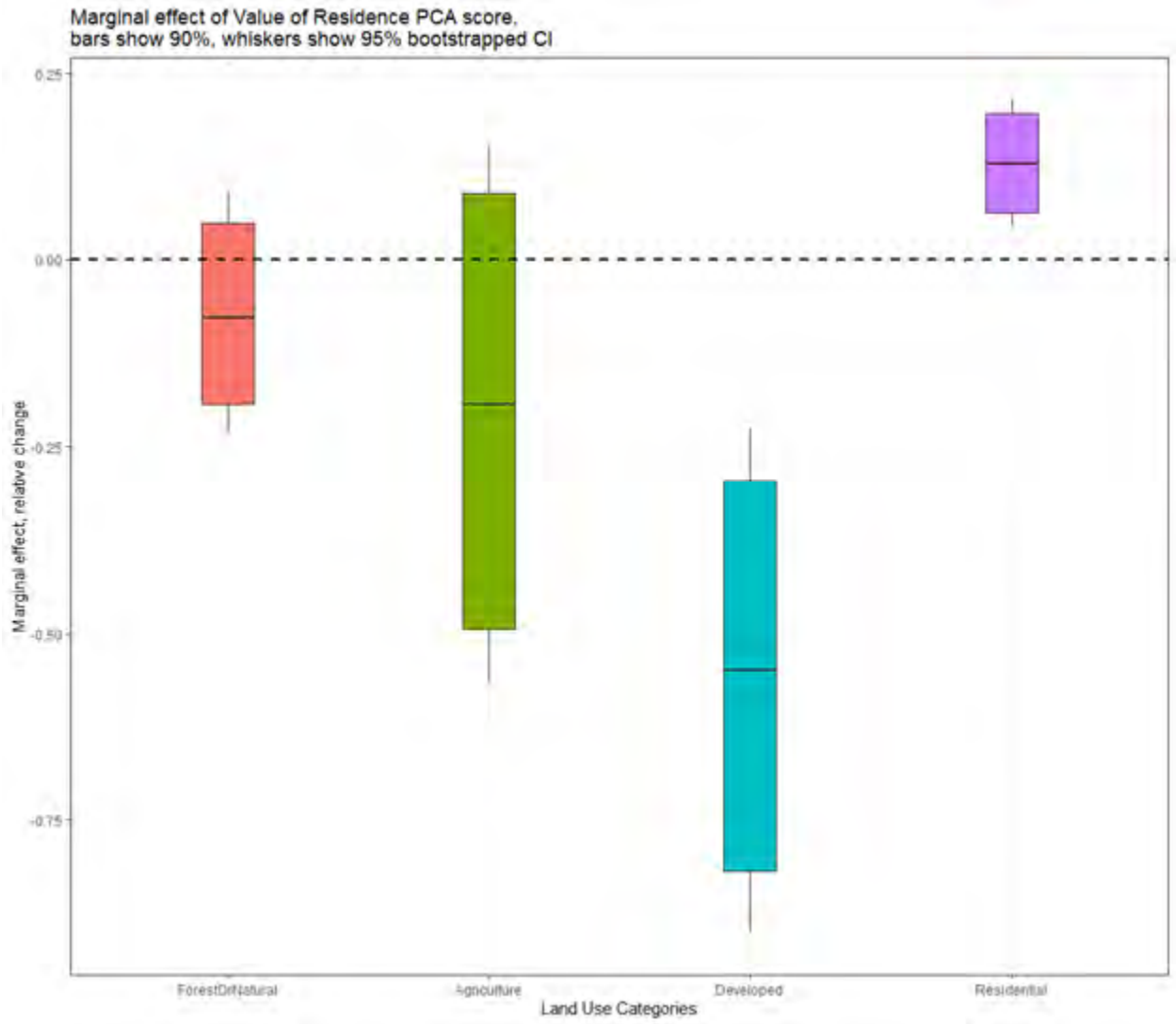

Figure 58. Bootstrapped marginal effects of value of residence score, 500 draws.

The survey parcels developed for residential uses also tended to do so in closer proximity to other development ($p<0.05$), and both residential and non-residential development was associated with increases in population density between 2010 and 2018 ($p < 0.01$).

Thus, the results of this analysis present a mixed picture with respect to the importance of reported development intentions or pressures, as well as of measures associated with landowner values or challenges perceived. While we do not see financial, environmental, legacy values significantly associated with subsequent development, valuing their land as a place to

live is associated, in a reasonable fashion, with a higher likelihood of residential and a lower likelihood of non-residential development.

Most importantly, this analysis provides a rare glimpse into the connection between psychometric constructs and subsequent behavior among SFLOs. While we are once again hampered by the observational nature of the data and clear sample selectivity issues in terms of making truly causal claims, it does appear that those landowners who feel that it will be difficult to continue owning their land as forest land in the future are also more likely to convert their land. We do not know which SFLOs will choose to convert their land in the future. However, the 2020 surveys and the attendant analyses do identify factors which tend to alleviate challenges of continued ownership in forestry uses versus those that place future burdens on existing landowners. Our policy suggestions are provided below, but all of them serve the broad goal of enabling continued SFLO tenure on their forested lands.

We also should note that the psychometric constructs are based on 2009 responses (well after the passage of the Forest and Fish Rules), and we are assessing the state of survey respondent parcels for 2019. Clearly, much can change over time, including the potential responses of SFLOs to the survey items. As mentioned above, for the self-selected sample, if a particular construct such as valuing their legacy is important in the population, its importance is likely to be amplified in the self-selected sample. At the same time, we expect the signal of past psychometric constructs to attenuate over time. The results likely reflect the net effect of these countervailing tendencies.

Finally, we note that the 2009 survey provided a basis for estimates of payments landowners would find sufficient to enter into temporary or permanent conservation easements. The results are reported in Rabotyagov and Lin (2013b). The latest assessment of the survey sample with respect to eventual conversion indicates that these willingness-to-accept values have been estimated on what turns out to be a sample of landowners whose land was truly at risk of conversion, which is a more policy-relevant subpopulation of SFLOs. This would suggest that SFLOs not considering development would be even more likely to accept an easement payment, while not providing a lot of land protection in the additionality sense. At the same time, as evident from the main land use change analysis, a policymaker would likely not be able to precisely screen parcels with respect to conversion risk easily if an easement payment were to be offered. 2020 surveys estimate higher permanent conservation easement willingness-to-accept than the 2009 survey, yet both surveys suggest that a significant share of SFLOs would accept monetary compensation for forest retention. The challenge would be to increase additionality for better budgetary cost-effectiveness.

9.7.1 Summary of follow-up analysis on 2009 survey sample

- A rare opportunity to connect survey-derived measures of landowner values or perceived challenges to real and observed land use change was exploited
- We constructed “Legacy”, “Environment/Wildlife”, “Personal Residence” and “Income/Investment” as ownership value factors, and “Regulations” and “Ownership in the Future” as ownership challenge factors. We then tested whether these factors were significant in observed parcel land use change.
- One may expect that if landowners converted their forests due to struggles with regulatory burdens, their original assessment that regulations represented a challenge to their continued forest ownership would be related to observed land conversion. However, we *do not find the subjective evaluation of being burdened by regulations as predictive of subsequent conversion* (for any conversion types).
- We do find that stronger assessment of *perceived challenges to “Ownership in the Future”* is associated with future (residential) conversion. We also find that landowners valuing their land as a place of residence is associated with future (residential) conversion.

10 Assessment of Existing Regulatory Impact Mitigations

5(C) Assess the effectiveness and implementation of the programs created in RCW 76.13.100(2) which described three programs to assist small forestland owners and mitigate the disproportionate economic impact.

Overall, our interviews and the supplied budgetary information give insight into the budgetary trends of the SFLO Office and its associated programs. Most interviews suggest that the SFLO Office, FREP, and FFFPP are underfunded. Some interviews indicate that the SFLO Office was fulfilling its purpose and was adequately funded early on. Interviews indicate that the Great Recession of 2007-2009 was when funding became short, as reflected in the budgetary data. Budgetary data also indicates that funding from FREP and the operation of the SFLO Office have been under pre-recession levels after the 2007-2009 biennium. The SFLO Office has not been able to fulfill its legislative duty with complete legislative reports, which is attributed to the lack of resources to gather the necessary information and data. Some interviews across stakeholder groups suggest that the SFLO Office, FREP and FFFPP constitute a “broken promise” due to the lack of funding yet provide a positive view on the purpose of these programs.

10.1 Assessment of the Small Forest Landowner Office

5(C) (I) Evaluating the effectiveness of the small forest landowner office: Does it have adequate resources and authority to successfully address landowner concerns? Has it received adequate funding to implement fully the duties as assigned through RCW 76.13.110?

Part of the Forests and Fish Report of 1999 recommended the creation of a Small Forest Landowner Office. This recommendation was carried over into ESHB 2091, now known as the Forests and Fish Rule. Washington RCW 76.13.110 describes the Small Forest Landowner Office as being "a resource and focal point for small forestland owner concerns and policies and shall have significant expertise regarding the management of small forest holdings, governmental programs applicable to such holdings, and the forestry riparian easement program [FREP]." Along with providing expertise on governmental programs, the Small Forest Landowner Office was charged with administering "the provisions of the forestry riparian easement program" along with assisting "in the development of small landowner options through alternate management plans or alternate harvest restrictions appropriate to small landowners" and "develop criteria to be adopted by the forest practices board in rules and a manual for alternate management plans or alternate harvest restrictions." The SFLO Office was also charged with evaluating the "cumulative impacts" of these alternate plans within "subbasin or watershed level" and adjusting alternate plans to minimize "negative impacts on essential riparian function within a subbasin or watershed." The final charge of the SFLO Office is "a report to the board and the legislature containing" estimates recommendations, and trends concerning small forest landowners.

To evaluate the SFLO Office and its authority, as requested, the evaluation shall consider the following:

- Stakeholder perceptions and descriptions of what the purpose is of the Small Forest Landowner Office and fulfillment of that purpose;
- Stakeholder opinions of interactions with and the staff members within the Small Forest Landowner Office;
- Stakeholder perceptions of the resources and the quality of those resources that the Small Forest Landowner Office has at its disposal;
- A basic budgetary review of the Small Forest Landowner Office and associated programs; and
- A review of legislative reports, as charged to complete, by the Small Forest Landowner Office.

10.1.1 Understanding Purpose: "A resource and focal point of small forestland owner concerns"

"A resource and focal point of small forestland owner concerns" is a broad and sweeping description of the purpose of the SFLO Office. To understand what stakeholders believe the small forest landowner office should be, we interviewed several stakeholder groups, including Washington State Extension Forestry staff and faculty (extension officers), Department of Natural Resource administrators and staff (state employees), members of small forest landowner associations (association members), and small forest landowners that do not have current membership with landowner associations that were interviewed, totaling in 28 interviewees. We asked interviewees how they would describe the purpose of the SFLO Office, or a hypothetical SFLO Office, depending on if the interviewee knew of the office.

In general, interviewees covered a range of purposes they believed the SFLO Office should embody. As a list, the purpose of the office, as perceived by stakeholders, is to support small landowners through technical assistance, regulatory assistance, stewardship education, regulatory education, general education, administrating assistance programs, advocacy, supporting landowner objectives, and adapting to landowner needs as they arise. State employees offered the most universal range of purposes that the office embodies by stating that all landowner objectives should be represented through the SFLO Office and the SFLO Office needs to be adaptable. An outlier of purposes comes from the association member interviews, where one of the purposes of the office is to be an advocate for small forest landowners to the State of Washington and the Forest Practices Board.

Extension officers described the purpose of the SFLO Office as supporting small forest landowners through financial means, regulatory education, stewardship education, and technical assistance. As one extension officer remarked:

> *"I think the Small Forest Landowner Office in spirit was set up to help landowners and really ought to have somebody there that can take the time and […] help owners understand […] why something is the way it is."*

Another extension officer stated that the SFLO Office was "to alleviate some if not all of that [regulatory] pressure." This statement was qualified with financial and regulatory support to the landowners. Nevertheless, not all extension officers agreed on the purpose of the Small Forest Landowner Office. While some supported a SFLO Office that focused on regulatory pressure, others thought that the SFLO Office should encompass more. As one extension officer stated:

"I think it should be about a lot more than forest practice."

The extension officer continued by stating the SFLO Office should also consider forest health, stewardship, and on the ground assistance.

Interviewees from landowner associations extended beyond that of what the extension officers described and deviated from certain purposes. Association members suggested that the SFLO Office has the purpose of education, developing alternate plans, advocating for small forest landowners, providing technical assistance, regulatory assistance, and serving as administrators of assistance programs. Association members targeted regulatory assistance more often compared to other interviewees in describing the purpose. One association member stated:

"I think the role of the office should be to be a voice of support and policy and [sic] to the forest practice board of the needs of small forest landowners of the state."

Association members listed a variety of technical assistance they believed the SFLO Office should provide, including working through Forest Practice Applications, water typing, road maintenance and abandonment plans, alternate plans, slope delineation, and buffer delineation.

State employees described the SFLO Office as providing technical assistance, regulatory assistance, education, administering assistance programs, alleviating economic burdens, supporting landowners in all of their management objectives, and adapting to landowner concerns in the future. As one state employee summarized:

"Well, I think the […] purpose that our organization, the Small Forest Landowner Office really is a main focal point is to try to keep forest land in forest land and we do everything we can to help landowners do that, to keep them from converting, to help them maintain healthy forest, to help them protect the resources out there, and to help them […] reach their management objectives."

Most state employees emphasized the broad range of duties of the SFLO Office, correlating with the broad range of objectives that small forest landowners have. As a unique comment, some state employees highlighted the adaptability of the SFLO Office for the future needs and objectives of small forest landowners and with respect to the new scientific and technical information. Another highlight is a state employee stating that the SFLO Office listens to small landowners who are not as actively involved with the office, to ensure their needs are

addressed and represented in the office. A concluding remark on this adaptability and hearing from all landowners is as follows:

> *"So that's, uh, I guess I'm saying that we have to change with what the landowners want, as far as to keep their land and forest land, whether it's more expertise on timber harvests, whether it's more expertise on how to increase water quality, whatever [...] they want, we're going to have to be able to adapt in the future. And they're going to let us know. And we should be asking them."*

Unaffiliated landowners presented a unique perspective, with some suggesting the SFLO Office should be more focused on regulatory practices and others saying the SFLO Office should be universally providing regulatory and non-regulatory assistance. Interviewees from this group, overall, suggested that the SFLO Office purpose should include stewardship assistance, regulatory assistance, technical assistance, and general education. As one interviewee suggested:

> *"I think, it's probably its most useful, it would have two pieces in my mind. One would be to help people like myself, manage their forests to increase its habitat value. And the other would be to help people who want to commercially log their forest; do it in a way that meets all the state laws and regulations."*

10.1.2 SFLO Office Fulfilling Perceived Purposes

Interviewees across the stakeholder groups varied on the degree in which the SFLO Office was fulfilling perceived purposes. Overall, most interviewees, who could comment on the SFLO Office as it is currently, indicated that the SFLO Office had room for improvement but also presented several strengths. Interviewees indicate that the SFLO Office does not provide all the services that the office's perceived purposes suggest. However, most interviewees also indicate that this is not a failure of the office but a lack of funding and staffing which will be discussed in the budget analysis section. The purpose that is perceived to not be fulfilled is the SFLO Office being an advocate for small forest landowners. An association member provided a summary that embodies this overall commentary:

> *"Well, what it was intended to be, is not what it is."*

Association member interviews indicated that the SFLO Office is not providing technical assistance, regulatory assistance, and advocacy that they believe it should be. Some of these

interviewees felt like the SFLO Office had not advocated to the Forest Practices Board or the State of Washington enough to ease the regulatory burden through the implementation of new alternate plans or other small forest landowner rules. Of these interviewees, a subset thought that DNR was not allowing the SFLO Office to advocate for the small forest landowners. Other association members feel that the SFLO Office no longer provides the technical assistance that they were promised. This varies from slope delineation to help with Forest Practices Applications.

However, even with these stated shortfalls, association members indicated that they remain supportive of the SFLO Office, especially of its existence and of its staff. As one association member said:

> *"I may have mentioned that earlier but over the past 20 years whereas the mission of the office hasn't changed its ability to fulfill its mission has changed."*

Positive comments of the SFLO Office regard its newsletter and the staff providing information and answering questions regarding pertinent topics. Some supported the recent hiring of a regulatory assistance forester.

Shifting to extension officer interviews, not all interviewees believe that the SFLO Office has fulfilled this purpose, or the purpose they believe the office should have, commenting on the SFLO Office perceived focus on the forest practice rules. This included one extension officer commenting:

> *"They don't serve the small forest landowner community."*

The extension officer also remarked that the SFLO Office should be renamed the "Small Harvester's Office" instead, due to the office's perceived focus on forest practices.

However, extension officers have a positive perception of the SFLO Office, including its staff. One extension officer reflected positively regarding the newsletter and other brochures that the SFLO Office provides. Extension officers also offered positive reflections on the provision of technical assistance:

> *"And they're doing really good job in terms of providing technical assistance for the rules."*

State employees recognized the office is not living up to its requirements. Nevertheless, most of the interviews were positive, usually saying that they were doing the best they could, and focused more on the shortfalls in funding and staffing. One state employee emphasized this point when asked what success would look like for the SFLO Office:

> *"So, having enough money to fulfill the program requirements and then have enough staffing to be able to help all the landowners that really need help."*

Many of the unaffiliated landowners could not comment on the SFLO Office's fulfillment of its purpose. Those who could comment varied from the SFLO Office writing too much instead of acting to being supportive of SFLO Office sponsored classes. Other than these comments, the unaffiliated landowners were unaware or did not interact with the office enough to want to comment.

10.1.3 Understanding the Expertise and Staff of the SFLO Office

Our interviews illustrated an overall positive perception of the SFLO Office staff in terms of interactions and expertise. Only one interviewee indicated that some of the SFLO Office staff may not truly be there for small forest landowners. In addressing the RCW, an Extension officer summarized the overall view of the SFLO Office staff with:

> *"[…] the expertise is there. Presently, there's just not that much of it."*

Interviewees indicated that the staff are dedicated, knowledgeable, competent, helpful, and supportive. The couple of criticisms are that some staff members may not be as dedicated as they should be, which is a minority opinion in the interviews, and that the SFLO Office is understaffed. One interviewee suggested that the SFLO Office is not as helpful due to the understaffing, with another calling the SFLO Office "criminally understaffed." One interviewee stated that they became involved by helping with the backlog of helping people, with sometimes SFLO Office redirecting calls to the interviewee.

In the fulfilment of the RCW of having the expertise to help and inform small forest landowners, the SFLO Office fulfills its duty when only considering the quality of the staff that is currently within the SFLO Office. The SFLO Office is not in fulfillment when considering the quantity of the staff within the office to provide expertise to landowners. With one interviewee stating that they helped out the SFLO Office, while not being an employee of the office, suggests a lack of capacity to address small forest landowner concerns, needs, and questions. However, while the RCWs do not require the SFLO Office to be sufficiently providing this expertise, the argument

could be made that quality and quantity are both necessary to have “significant expertise” (RCW 76.13.110).

10.1.4 Budgetary Description of the Small Forest Landowner Office

The Small Forest Landowner Office has received funding from multiple sources throughout its history. Budgetary data available described the sources and levels of funding since the 2001-2003 biennium for the Small Forest Landowner Office, the Forestry Riparian Easement Program, the Family Forest Fish Passage Program, the Forest Stewardship Program, and the Regulatory Technical Assistance Program. Additionally, full-time employment (FTE) information was provided for the Small Forest Landowner Office, Forestry Riparian Easement Program, and the Family Forest Fish Passage Program. All data was provided by the DNR. Data was not located for the 2001-2003 biennium for the Small Forest Landowner Operating Budget (Hitchens and McDonald 2020).

The Small Forest Landowner Office received funding from the State of Washington in a General Fund, Forests and Fish Support Account, State Building Construction Account, and State Toxics Control Account. The Forest Stewardship Program was funded through Federal funds. Table 33 and Table 34 describes the allocation of funds from each account to the Forestry Riparian Easement Program and the Family Forest Fish Passage Program, with Table 35 describing allocations to the operating budget of the Small Forest Landowner Office. The General Fund from the State of Washington makes up most of the operating budget for the Small Forest Landowner Office and is present in every biennium. The Forests and Fish Support Account is funds restricted to specific uses and was allotted to the Small Forest Landowner Office from 2011 to 2015 by the State Legislature. The State Building Construction Account provides the funding for the Forestry Riparian Easement Program and the Family Forest Fish Passage Program. The State Toxics Control Account is funds restricted to specific uses and was allotted to the Small Forest Landowner Office from 2015 to the current biennium of 2019-2021. The federal funds are from the United State Forest Service and are specifically for the forest stewardship program for stewardship foresters, a wildlife biologist, and cost-share assistance programs. The Forestry Riparian Easement Program received one-time supplemental funding in the 2009-2011 biennium from the Forests and Fish Support Account. The Family Forest Fish Passage Program received one-time supplemental funding in the 2011-2013 biennium from the Jobs Bill. The federal funds are from the United State Forest Service and are specifically for the forest stewardship program for stewardship foresters and cost-share assistance programs (Hitchens and McDonald 2020).

Table 33. Forestry Riparian Easement Program Funding Allocation by Biennium.

Biennium Allocation	SBCA Allocation	FFSA Allocation	FTE
2001-2003	$3,750,000	-	1.8
2003-2005	$4,000,000	-	3.5

2005-2007	$8,000,000	-	2.0
2007-2009	$10,300,000	-	2.5
2009-2011	$500,000	$600,000	2.1
2011-2013	$1,000,000	-	-
2013-2015	$2,000,000	-	2.5
2015-2017	$3,500,000	-	3.5
2017-2019	$3,500,000	-	3.5
2019-2021	$2,900,000	-	3.8

Table 34. Family Forest Fish Passage Program Funding Allocation by Biennium.

Biennium Allocation	SBCA Allocation	State Toxics Account/Capital	FTE
2003-2005	$2,000,000	-	1.0
2005-2007	$4,000,000	-	-
2007-2009	$6,000,000	-	1.0
2009-2011	$5,000,000	-	1.0
2011-2013	$2,000,000	$10,000,000	1.0
2013-2015	$2,000,000	-	1.0
2015-2017	$5,000,000	-	1.0
2017-2019	$5,000,000	-	1.0
2019-2021	$5,000,000	-	1.0

Table 35. Small Forest Landowner Office Operating Funding Allocation by Biennium without Federal Forest Stewardship Funding.

Biennium	GF-State	FFSA	STCA	Total Allocation	FTE
2001-2003	$559,995	-	-	-	3.0
2003-2005	$894,300	-	-	$1,019,300	4.8
2005-2007	$664,786	-	-	$1,190,286	2.6
2007-2009	$2,514,586	-	-	$4,408,986	6.7
2009-2011	$320,000	-	-	$3,191,800	2.0
2011-2013	$371,700	$89,400	-	$3,608,800	2.0
2013-2015	$372,300	$179,800	-	$4,682,500	3.0
2015-2017	$267,400	-	$113,600	$3,044,951	2.0
2017-2019	$300,000	-	$121,00	$1,221,900	2.0
2019-2021	$413,200	-	$132,100	$545,300	2.5

Table 36. Federal Funding Allocation to Small Forest Landowner Office for the Operation of the Forest Stewardship Program.

Biennium Allocation	Federal GF Allocation	Forest Stewardship FTE
2001-2003	-	-
2003-2005	$125,000	1.2
2005-2007	$525,500	2.1
2007-2009	$1,894,400	5
2009-2011	$2,871,800	3
2011-2013	$3,147,700	3
2013-2015	$4,130,400	4.5
2015-2017	$2,663,951	3.7
2017-2019	$800,900	3
2019-2021	-	-

The Small Forest Landowner Office budgets show an overall decrease for budgetary highs since 2001. Before further discussion, the Small Forest Landowner Office no longer houses the Forest Stewardship Program, which moved to DNR's Forest Health and Resiliency Division in July of 2019 with Cost-Share Assistance funding being moved to regions in 2017. The Small Forest Landowner Office no longer receives federal funding to support the Forest Stewardship Program due to these changes in administrative structure. Federal funding to the Forest Stewardship Program during the program's time in the Small Forest Landowner Office is illustrated in Table 36 and Figure 62. The Forest Health and Resiliency Division continues to receive federal funding to support the Forest Stewardship Program. The federal funding of the Forest Stewardship Program in the Forest Health and Resiliency Division is not reflected in this report.

The Small Forest Landowner Office Operating Fund (state funds) and the Forest Riparian Easement Capital Fund both experienced financial highs in the 2007-2009 biennium with $2,514,586 and $10,300,000, respectively. The following biennium of 2009-2011 gave steep decreases in funding for both accounts, with the Small Forest Landowner Office Operating Fund (state funds) falling 87% to $320,000 and the Forestry Riparian Easement Capital Fund falling 89% to $1,100,000. The Family Forest Fish Passage Program also experienced a financial high in the 2007-2009 biennium with $6,000,000. The following biennium of 2009-2011 did bring a decrease in fund allocation with a 17% decrease to $5,000,000. The Family Forest Fish Passage Program, however, received a significant increase in funds from the 2012-2014 Jobs Bill of $10,000,000. Since the Jobs Bill, the Family Forest Fish Passage Program has remained at state funding of a $5,000,000 allotment.

Due to the Forest Stewardship Program no longer being within the Small Forest Landowner Office, meaningful trends cannot be described.

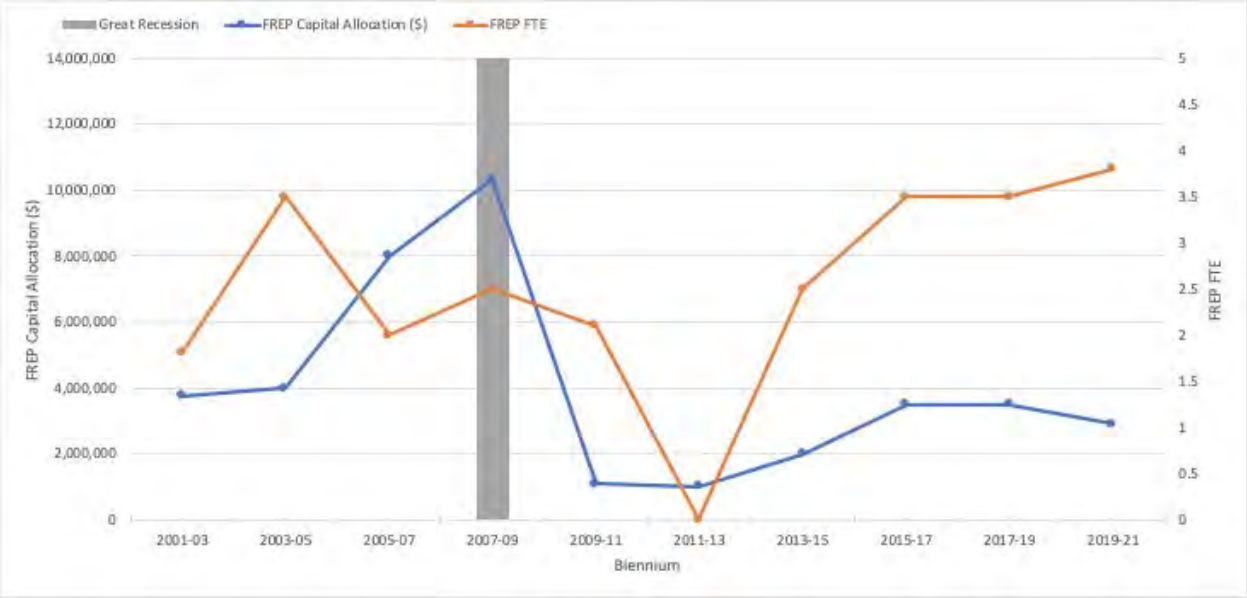

Figure 59. Forestry Riparian Easement Program Capital Fund Allocation and FTE by Biennium with the Great Recession.

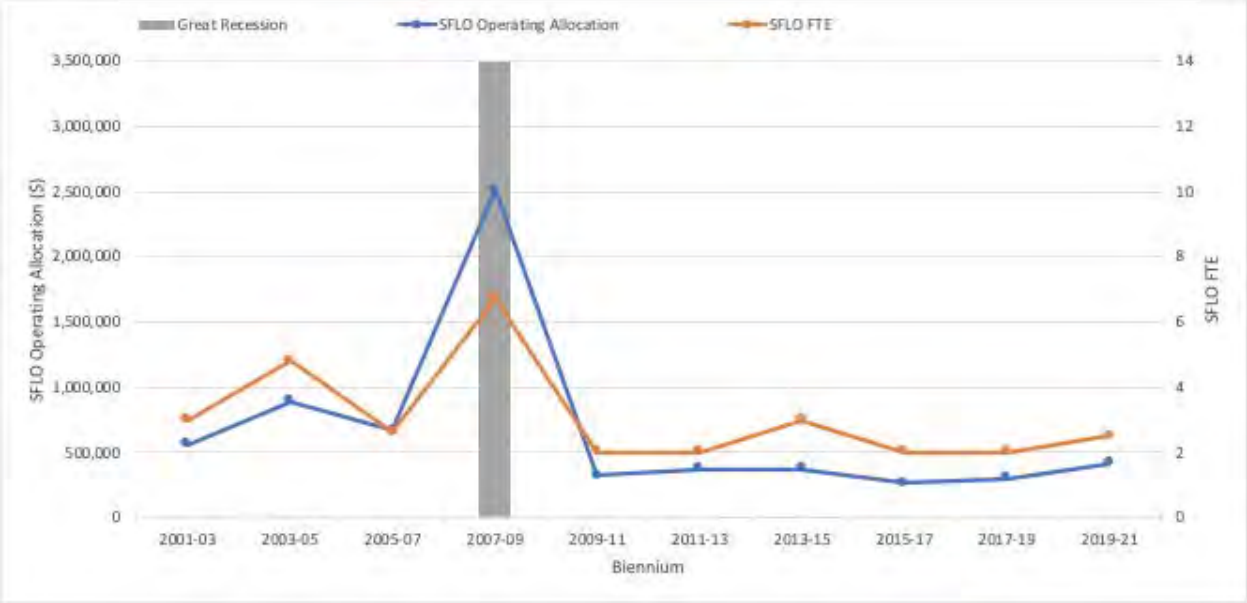

Figure 60. Small Forest Landowner Office Operating Fund Allocation and FTE by Biennium with the Great Recession.

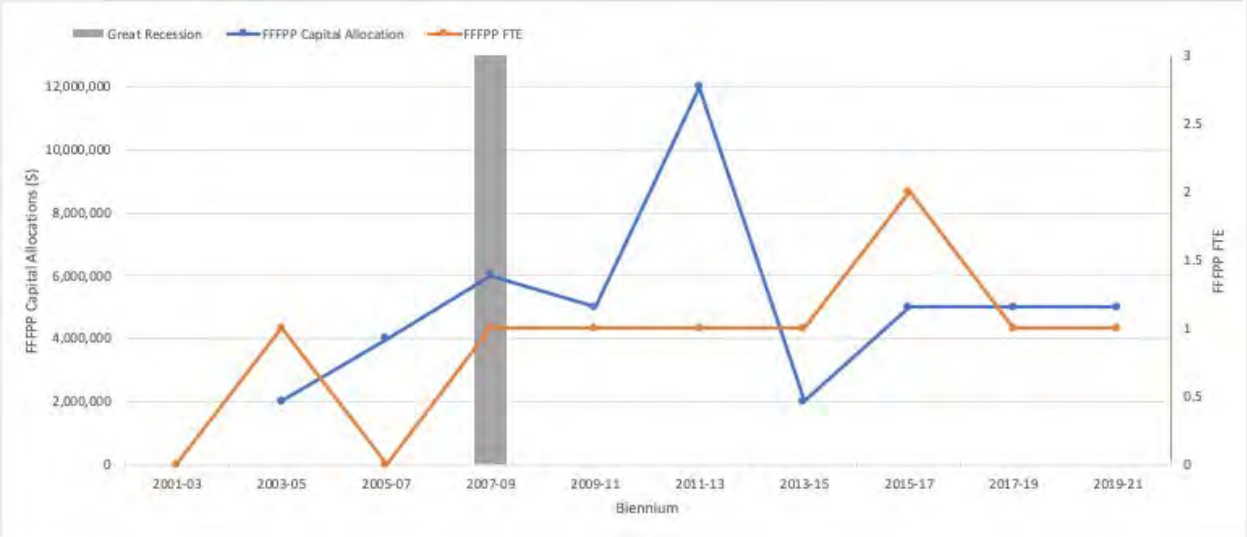

Figure 61. Family Forest Fish Passage Program Capital Fund Allocation and FTE by Biennium with the Great Recession.

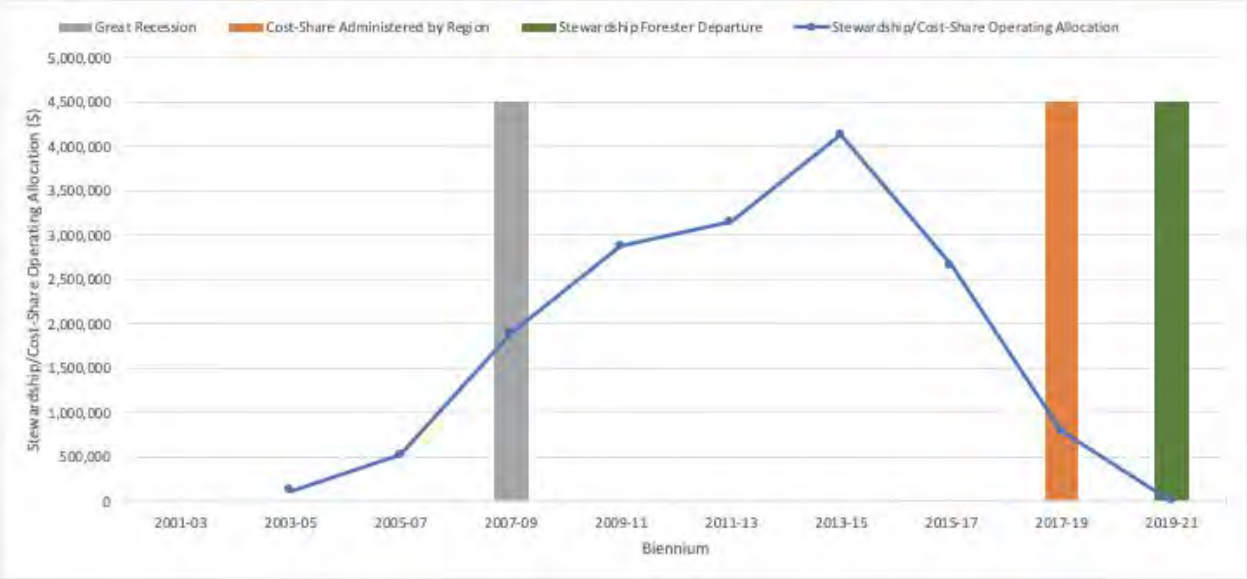

Figure 62. Federal Funding for the Stewardship and Cost-Share Assistance Operating Fund Allocation by Biennium with the Great Recession, Cost-Share Assistance moving to be Administered by Region, and Stewardship Forester Departure from the Small Forest Landowner Office.

10.1.5 Budgets and Staffing: Interview Narrative

Our interviews tell a story of the SFLO Office once being fully functioning and providing the resources which it was charged with providing. The extension officer, association member, and state employee stakeholder groups all indicated that there have been dramatic losses in funding and staffing for the SFLO Office and the Capital programs, which is supported by the

above budgetary data. Of these stakeholder groups, some interviewees point to the Great Recession of 2007-2009, being the turning point in SFLO budgets.

> *"But as soon as the Great Recession took place, they're down to I think this year there's four people on it, it used to have 18 people. And much of the services that were promised, technical assistance services that were promised under Forest and Fish are no longer there."*

> *"Of course, the first administrator was Steve Stinson. And I think they had like 12 or 15 people in the department providing services and, of course, are supposed to manage the FFFPP program. But that was considered non-essential work when the 2008 recession hit and just got […] wiped out."*

> *"[T]he budget has […] been decreased dramatically from when the small landowner office was first created."*

> *"Yes, so I'd say funding has definitely changed and initially started like what [Interviewee 36a] said there were region staff and in every program or in every region, and now we're down to none in the region and one assisting."*

> *"I've worked with the Small Forest Landowner Office quite closely my entire career. They've been whittled down quite a bit from what the original office was. They used to have an education and outreach person. And then they had several people that worked on the easement, the riparian easement program, several people that worked on the fish passage program. And they had all these, what they called alternate plan foresters, and those guys all kind of helped each other with […] some other of the road maintenance and abandonment foresters…"*

Budgetary data illustrates financial highs for the operating budget and the FREP capital budget during the Great Recession biennium, followed by financials that are lower than pre-recession allocations. FFFPP shows a localized high financial biennium allocation during the Great Recession biennium, followed by a decrease, then another increase to the operational high from the federal Jobs Bill. However, when not considering federal supplementation of the Jobs Bill through state accounts, FFFPP also had its financial high during the Great Recession biennium. However, the program now operates at higher levels then pre-recession allocations.

Our interviews also indicate that stakeholders believe that the SFLO Office needs more funding and more staffing. State employees suggest that the SFLO Office needs more funding and staffing in order to fulfill program requirements and to help landowners. One state employee stated they "don't want to increase the awareness without having the funding to back" those programs up. The employee later included that this lack of funding is a "huge impediment" for getting eligible landowners involved. An association member thought the staffing levels in the SFLO office were not adequate, stating that there are only two or three people available for more than 200,000 small forest landowners.

> *"That office needs to be fully funded as promised."*

10.1.6 Review of Legislative Reports and Fulfillment of RCW 76.13.110 (5) and (6)

The SFLO Office is also charged with creating reports to the Forest Practices Board and the State Legislature containing the following information and timeline as defined in RCW 76.13.110:

> "(5) By December 1, 2002, the small forestland owner office shall provide a report to the board and the legislature containing:
>
> (a) Estimates of the amounts of nonindustrial forests and woodlands in holdings of twenty acres or less, twenty-one to one hundred acres, one hundred to one thousand acres, and one thousand to five thousand acres, in western Washington and eastern Washington, and the number of persons having total nonindustrial forest and woodland holdings in those size ranges;
>
> (b) Estimates of the number of parcels of nonindustrial forests and woodlands held in contiguous ownerships of twenty acres or less, and the percentages of those parcels containing improvements used: (i) As primary residences for half or more of most years; (ii) as vacation homes or other temporary residences for less than half of most years; and (iii) for other uses;
>
> (c) The watershed administrative units in which significant portions of the riparian areas or total land area are nonindustrial forests and woodlands;
>
> (d) Estimates of the number of forest practices applications and notifications filed per year for forest road construction, silvicultural activities to enhance timber growth, timber harvest not associated with conversion to nonforestland uses, with estimates of the number of acres of nonindustrial forests and woodlands on which forest practices are conducted under those applications and notifications; and
>
> (e) Recommendations on ways the board and the legislature could provide more effective incentives to encourage continued management of nonindustrial forests and woodlands for forestry uses in ways that better protect salmon, other fish and wildlife, water quality, and other environmental values.
>
> (6) By December 1, 2004, and every four years thereafter, the small forestland owner office shall provide to the board and the legislature an update of the report described in subsection (5) of this section, containing more recent information and describing:

(a) Trends in the items estimated under subsection (5)(a) through (d) of this section;

(b) Whether, how, and to what extent the forest practices act and rules contributed to those trends; and

(c) Whether, how, and to what extent: (i) The board and legislature implemented recommendations made in the previous report; and (ii) implementation of or failure to implement those recommendations affected those trends."

The SFLO Office submitted reports to the Forest Practices Board and the State Legislature for the years 2001, 2002, 2004, 2008, 2012, and 2016. The initial report in 2001, not required by RCW 76.13.110, provides an initial overview of the SFLO Office and a demographic report of Washington State small forest landowners based on previous surveys. This report requested the creation of a GIS database of small forest landownership and warned that without such a database, the SFLO Office would not be able to fulfill its legislative duties in providing meaningful information and trends in future legislative reports.

The 2002 report provided the first legislatively mandated report to the Forest Practices Board and the State Legislature based on RCW 76. This report defined small forest landowners as being between 5 and 5,000 acres using tax records from the 35 forested counties in Washington State, effectively defining a small forest landowner as having at least 5 acres. The SFLO Office noted that this data was coarse and found it very difficult to be able to be used for approximating proximity to water types and watersheds and determining contiguous landownership. As a result, this report continued the request for the creation of a state-wide GIS database on small forest landownership. Overall, the 2002 report was unable to provide full answers to (5)(b) and (5)(d) as contiguous ownership could not be defined with tabular data and FPA data was not yet been collected in a way that could be quantified. The 2002 report recommended funding FREP at $5 million for the 2003-2005 biennium, streamlining processing of FREP applications, revising valuation methods for FREP, legally protecting FREP easements without degrading property value, the creation of an alternate plan process, the creation of alternate plan templates, the creation of an alternate plan monitoring program, the creation of long-term applications, the creation of an SFLO database, pursuance of educational outreach regarding the Forest and Fish Rules, the hiring of a grants funds manager, the creation of a programmatic habitat conservation program, and investment in small forestry business development.

The 2004 legislative report provided less information than the 2002 report. The SFLO Office was only able to collect information for two counties in 2004 for (5)(a) and could not yet provide a trends analysis due to only two years of information for the two counties information was collected for (2001 and 2004 data from Thurston and Okanogan County). The SFLO Office stated that it did not have enough resources to collect data from the two counties it received data

from in regard to (5)(b) and so was unable to provide information in the report. The same was stated for (5)(c), that the SFLO Office did not have the resources to re-collect data. For (5)(d) the Forest Practice Application Review System (FPARS), which could provide information for the October 28, 2002 to October 31, 2003 calendar year, did not have the information to determine small forest landowner FPAs. So, the SFLO Office provided an estimation for SFLO applications. The SFLO Office made the following recommendations in 2004: increasing funding for FREP to decrease the backlog of 75 applicants, the creation of rules so small forest landowners could use the alternate plan process to create long-term permits, to fully fund the FFFPP, a small forest land GIS analysis, and increased staffing for the SFLO Office. The SFLO Office stated it was unable to complete (6)(a), (6)(b), (6)(c) due to the lack of data to provide trends. Regarding previous recommendations, the SFLO Office noted it was no longer pursuing a private effort for programmatic habitat conservation plans, the office had decreased FREP processing time, an overstocked conifer stands template was created, an alternate plan monitoring process was still being developed, and a grant writer had been hired.

In 2008, the SFLO Office reported its use of the Rural Technology Initiative (RTI) database of forest parcels for its demographic report. The definition of a small forest landowner used in this report changed to a landowner whose potential harvest was under 2 MMBF, which calculated out to be 2500 acres for Western Washington and 9990 acres for Eastern Washington, with at least 1 acre of forested land. With the RTI database, the SFLO Office was able to fully answer (5)(a) and (5)(c) with a high degree of confidence. (5)(b) was still estimated due to no statewide code for residency. For (5)(d), FPARS was only able to provide information on small forest landowner FPAs from 2007 onwards. Recommendations of 2008 included: fully funding FREP, fully fund FFFPP, develop more alternate plan templates and other regulatory incentives, secure funding for an inventory of fish passage barriers on small forest landowner forest land, secure federal stimulus dollars for more fish passage repairs, seek to improve and update the RTI database, develop a conifer restoration template, increase funding and staffing for the Forest Stewardship Program, support the establish of the “Office of Conservation of Family Forest Landowner” within the Office of the Governor. The SFLO Office stated that it was not able to complete (6)(a), (6)(b), and (6)(c) due to the differences of data collected in previous reports and the new RTI database. The SFLO Office noted that the RTI database would need to be updated for future trends, Regarding previous recommendations, the SFLO Office stated that FREP required an increase in funding even with previous increases in funding to decrease the backlog of applicants, the Forest Practices Board created long term FPAs (LTAs) for small forest landowners outside of the alternate plan process, the overstocked conifer-dominated RMZ template was approved, FFFPP was popular and there was a need for more funding, more funding would be needed to update the RTI database, and that more staff had been hired in the SFLO Office which decreased FREP processing times and supported LTAs.

In the 2012 legislative report, the definition of a small forest landowner changed to increase the lower range of acreage for one acre of forested land to contiguous ownership of 2 or more forested acres. Without recent updates to the RTI database, (5)(a) was based on the 2008 data with the new small forest landowner definition applied. (5)(b) was still an estimate due to no state-wide code for residency. (5)(c) was completed. The SFLO Office was able to complete (5)(d) for the entire time between reports for the first time. The SFLO Office was unable to provide trends in (6)(a), (6)(b), and (6)(c) without an updated RTI database and warned that, without funding and updates to the RTI database, future reports would also not be able to report trend data. The SFLO Office made the following recommendations in 2012: an update to the SFLO database, increase funding and staffing for FREP, increase funding and staffing FFFPP, develop a conifer restoration template and other regulatory incentives, secure funding for a state-wide inventory of fish passage barriers on small forest landowner lands, and increase funding and staffing for the Forest Stewardship Program. Regarding previous recommendations, the SFLO Office noted that funding had decreased for FREP and FFFPP and no action had been taken or achieved on the remaining recommendations that were explained previously, including the creation of "Office of Conservation of Family Forest Landowner" within the Office of the Governor.

In the latest report prior to this study, the 2016 legislative report similar information compared to the 2012 report due to no new update to the RTI database, leaving (5)(a) based on the 2007 data. (5)(b) was still an estimate due to no state-wide code for residency. (5)(c) and (5)(d) were completed. (6)(a), (6)(b), and (6)(c) were not able to show meaningful trends due to the RTI database not being updated since 2007 and none of the previous recommendations had been implemented. The recommendations and updates on previous recommendations were the same as the 2012 report.

Overall, the SFLO Office has not been able to fulfill the requests set out by RCW 76.13.110 (5) and (6). The SFLO Office has stated that a lack of resources, previously unavailable information, and the lack of a dynamic state-wide database of small forest landowners are the causes of its inability to answer these requests in a meaningful way. Table 37 reflects and summarizes the fulfillment of these requests:

Table 37. SFLO Office Degree of Fulfillment of RCW 76.13.110 (5) and (6).

Year	(5)(a)	(5)(b)	(5)(c)	(5)(d)	(5)(e)	(6)(a)	(6)(b)	(6)(c)
2002	~	~	~	N	Y	N	N	N
2004	~	N	N	~	Y	N	N	N
2008	Y	~	Y	~	Y	N	N	N
2012	~	~	Y	Y	Y	N	N	N
2016	~	~	Y	Y	Y	N	N	N

N = Was not fulfilled, Y = Was completely fulfilled, ~ = Was partially completed or completed with stated uncertainty

10.1.7 Survey results to help evaluate the SFLO Office

Overall, the SFLO Office is fairly well known by SFLOs and is positively evaluated similar to other organizations of its kind. From the 2020 general population survey, 44.5% of respondents said they had heard of the SFLO Office and 34% reported getting assistance from the SFLO Office with a specific topic. From the 2020 forests and fish survey, 58.5% of respondents said they had heard of the SFLO Office and about 39% reported getting assistance from the SFLO Office with a specific topic. In the general population survey, we asked respondents to evaluate their satisfaction with the SFLO Office and present the results in Figure 63. As can be seen in Figure 63, the majority of respondents did not give an evaluation of the SFLO Office and not all respondents who reported getting assistance from the SFLO Office reported how satisfied they were with the office. Of respondents offering an evaluation of the SFLO Office other than "not applicable," 8% are "less than satisfied," 29% give a "neutral" assessment, and 64% are "satisfied."

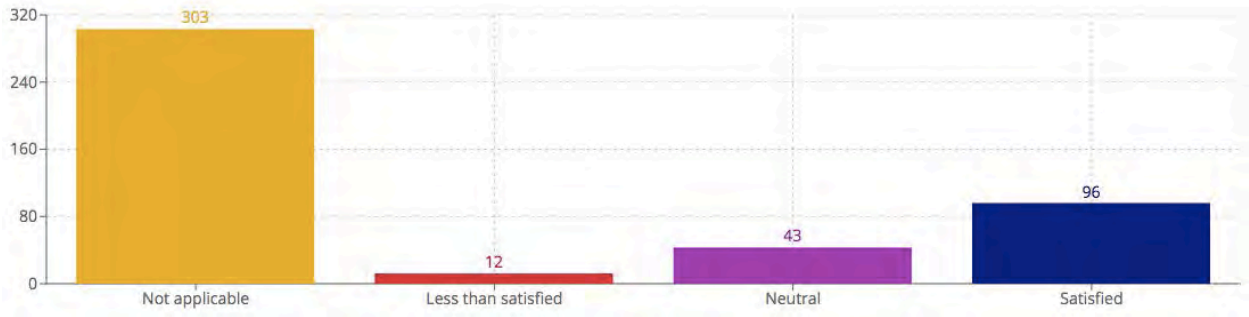

Figure 63. SFLO satisfaction with the SFLO Office.

We compared the evaluations of the SFLO Office to evaluations of other government agencies, conservation districts, and extension foresters (excluding the "not applicable" response). Although we asked respondents their level of satisfaction with various organizations, such as non-profit organizations and professional foresters, the SFLO Office is similar in kind to other government agencies, conservation districts and extension foresters. Satisfaction with the SFLO Office is statistically higher compared to "Government agency (not the Small Forest Landowner Office)" (X-squared = 7.6598, df = 2, p-value = 0.02171) but is statistically the same as satisfaction with conservation districts and extension foresters (X-squared = 3.6557, df = 2, p-value = 0.1608, and X-squared = 2.3488, df = 2, p-value = 0.309, respectively).

The Forests and Fish survey respondents who had contact with the SFLO Office were asked to comment on "how the experience went and if anything could have been improved" using an open text response format. Of the 194 respondents who said they had contact with the SFLO Office about a specific topic, 135 left a comment about the SFLO Office in the open text field. Overall 69% (about 2/3) of the open text responses had specifically positive feedback about their contact with the office. About 10% had some kind of negative feedback about the office,

which is similar in frequency to how often “less than satisfied” was marked by the general population survey respondents (8%). Of the 12 respondents who had negative feedback, half of them said they wanted the staff to have given them more detailed information about regulations or technical options for forest management. Interestingly, 13 respondents (10%) made a comment about the lack of funding allotted to the SFLO office. Below we present some selected comments about the SFLO Office from the forests and fish respondents:

Example of positive evaluation:

> *“My interactions with the Small Forest Landowner Office have always been positive, informative and helpful. They are the first people I go to with questions, issues or education.”*

Example of comments about lack of resources (1):

> *“Good People- No Budget.”*

Example of comments about lack of resources (2):

> *“Always a helpful and knowledgeable resource. There is just one DNR person handling our large county. There used to be two. More DNR resources would be great.”*

Overall, the surveys suggest a bit less than half of SFLOs have heard of the SFLO Office and the percentage of SFLOs who have heard of the SFLO Office is higher among respondents who are actively engaged in forest management. Most evaluations of the SFLO Office are positive and a few SFLOs (about 1 in 10) have a negative evaluation their experience with the office. Some respondents even comment on the lack of funding given to the SFLO Office.

10.1.8 Who contacts the SFLO Office for assistance and what do they ask about?

Using respondents from the general population survey, we tested for differences in the “objectives” and “impacts/concerns” principal component scores to look for average differences between respondents who reported getting assistance from the SFLO Office and respondents who had not. Average principal component scores and Welch two sample t tests for average differences are presented below in Table 38Table 38. Average forest ownership objectives (principal component) scores for general population survey respondents based on if they had contact with the SFLO Office about a specific topic.. Those who have had contact with

the SFLO Office tend to put more importance on financial objectives as well as environmental objectives of their forest ownership. The significantly higher average principal component scores for financial and environmental objectives likely reflects a role of assisting with forest practices applications as well as facilitating programs like Forest Stewardship. We draw attention to the result that the average of all principal component scores for respondents who have had contact with the SFLO office are positive and the average for respondents who have not had contact with the SFLO office are negative. The positive average scores of all principal component objectives scores indicates that SFLOs who reach out to the SFLO office for assistance tend to be more engaged with multiple aspects of forestland ownership relative to SFLOs who have not utilized the SFLO office.

Table 38. Average forest ownership objectives (principal component) scores for general population survey respondents based on if they had contact with the SFLO Office about a specific topic.

	Average principal component scores for ownership objectives			
	Financial	Spend_time	Environmental	Legacy
Have contacted SFLO office about specific topic	0.432	0.008	0.141	0.040
Otherwise	-0.144	-0.003	-0.047	-0.013
p value from Welch two sample t test	5.91E-10 (***)	0.8942	0.02477 (**)	0.5535

(***- 1% level, ** 5%- level and *- 10% level of significance)

Table 39 shows differences in average ownership impacts/concerns principal component scores based on general population survey respondents who have contacted the SFLO Office about a specific topic and those who have not. The only significant difference is that owners who have received assistance from the SFLO Office state they are relatively more impacted by Washington State Forest Practices Regulations. Respondents who have had contact with the SFLO Office feel, on average, less impacted by land development issues, but the difference is not significant.

Table 39. Average forest ownership impacts/concerns (principal component) scores for general population survey respondents based on if they had contact with the SFLO Office about a specific topic.

	Average principal component scores for "impacts on forest ownership"		
	Development	Disturbance_damage	Fpr (regs)
Have contacted SFLO office about specific topic	-0.031	0.035	0.318
Otherwise	0.011	-0.012	-0.111
p value from Welch two sample t test	0.6186	0.5584	8.18E-07 (***)

(***- 1% level, ** 5%- level and *- 10% level of significance)

Figure 64 shows the frequency of topics the GP survey respondents discussed with the SFLO Office. The most frequently asked about topics are Forest Practices Applications and the Forest Stewardship Program, followed by events for landowners. The least asked about topics are road regulations and Alternate Harvest Plans. Overall, Table 38,

Table 39 and Figure 64 show that SFLOs who utilize the SFLO Office tend to be more engaged with active forest management, value the income that forestry generates, and have stronger environmental ownership objectives.

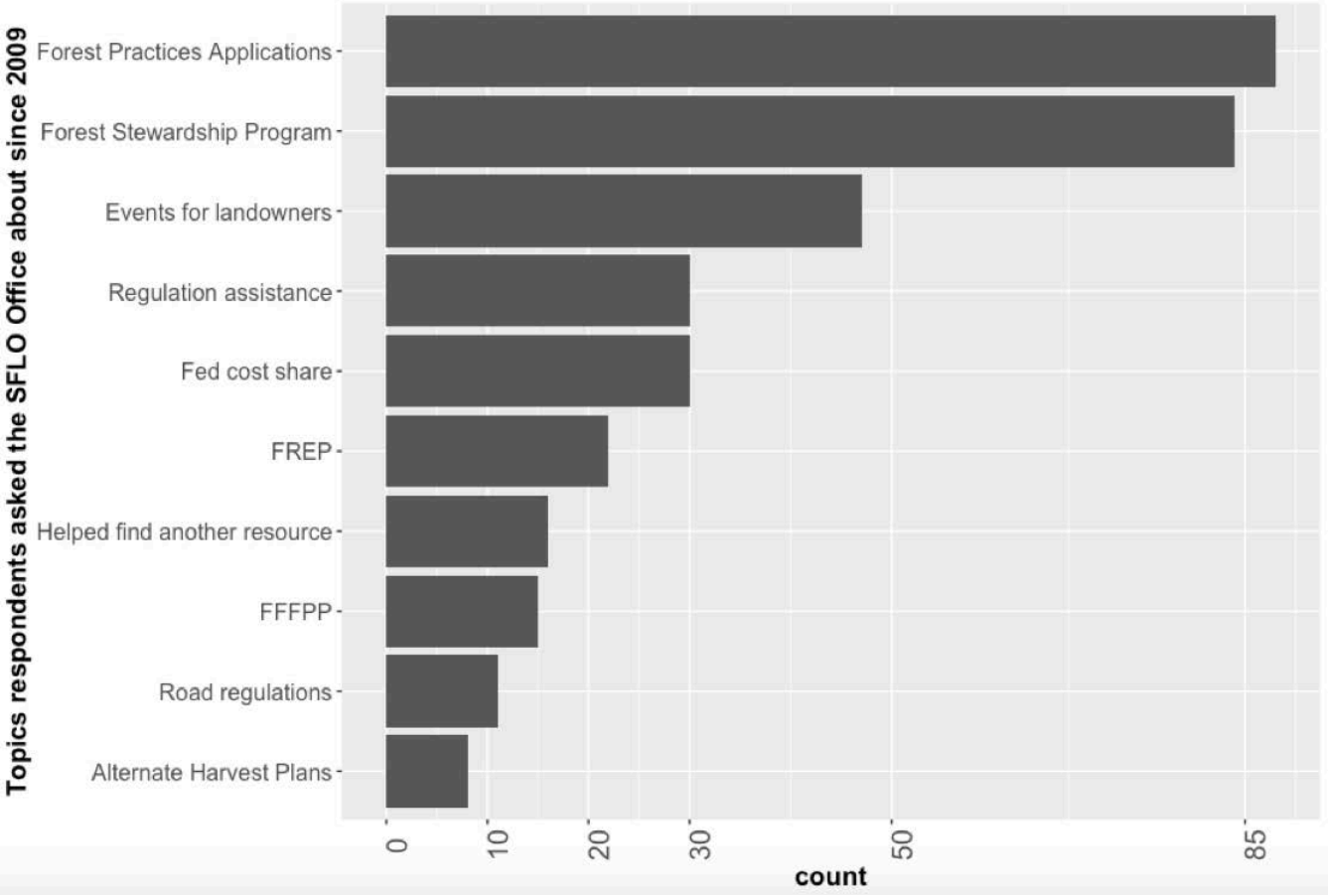

Figure 64. Topics GP survey respondents asked the SFLO Office about since 2009.

To explore the relationships between the topics that the SFLO Office assist SFLOs with, we ran a Multiple Correspondence Analysis on the topics that respondents tended to ask about in combination. Multiple Correspondence Analysis (MCA) is similar to Principal Component analysis, but applies to categorical variables instead of continuous variables (Abdi and Valentin, n.d.). The loading matrix of the Multiple Correspondence Analysis is presented in

Table 40 and the associations of the different topics with the components is presented in Figure 65. We take two insights from the Multiple Correspondence Analysis: first, only about 33% of the variation in the topics SFLOs tend to ask about in combination can be explained by a small number of components (or dimensions).

Table 40. MCA results for relationships between the topics GP survey respondents asked the SFLO Office about. Showing only the first two dimensions.

	Dim 1	Dim 2
FindOtherResource (0)	0.481	0.029
FindOtherResource (1)	5.046	0.300
ForestStewardship (0)	0.345	14.885
ForestStewardship (1)	0.410	17.720
FREP (0)	1.900	0.022
FREP (1)	13.989	0.159
FFFPP (0)	1.321	0.052
FFFPP (1)	14.879	0.585
Roads (0)	1.354	0.040
Roads (1)	21.292	0.628
FedCostShare (0)	1.465	1.805
FedCostShare (1)	7.521	9.265
FPAapplication (0)	0.019	1.633
FPAapplication (1)	0.021	1.782
AltHarvest (0)	0.851	0.083
AltHarvest (1)	18.730	1.831
Regulations (0)	1.154	3.122
Regulations (1)	5.925	16.026
EventsLandowners (0)	0.842	7.672
EventsLandowners (1)	2.456	22.363
Perc. Var	20.4%	13%
Cum. Var		33.4%

While there is a great deal of variation in the kinds of topics respondents ask about in combination, Figure 65 shows a visualization of how distinct different kinds of topics are from each other. Figure 65 illustrates that road regulations, Alternate Harvest Plans, FFFPP, and FREP are similar topics (i.e. they all have a strong association with Dim 1 and a low association with Dim 2) while Forest Stewardship and events for landowners are similar topics (i.e. they all have a strong association with Dim 2 and a low association with Dim 1). Although respondents can and do ask about both sets of topics, the Multiple Correspondence Analysis suggests the three programs/ applications for SFLOs with riparian forests in addition to road regulations are a distinct kind of topic of assistance offered by the SFLO Office. Regulation assistance “regs” and federal cost share programs “fed_costshare” are somewhat associated with both dimensions.

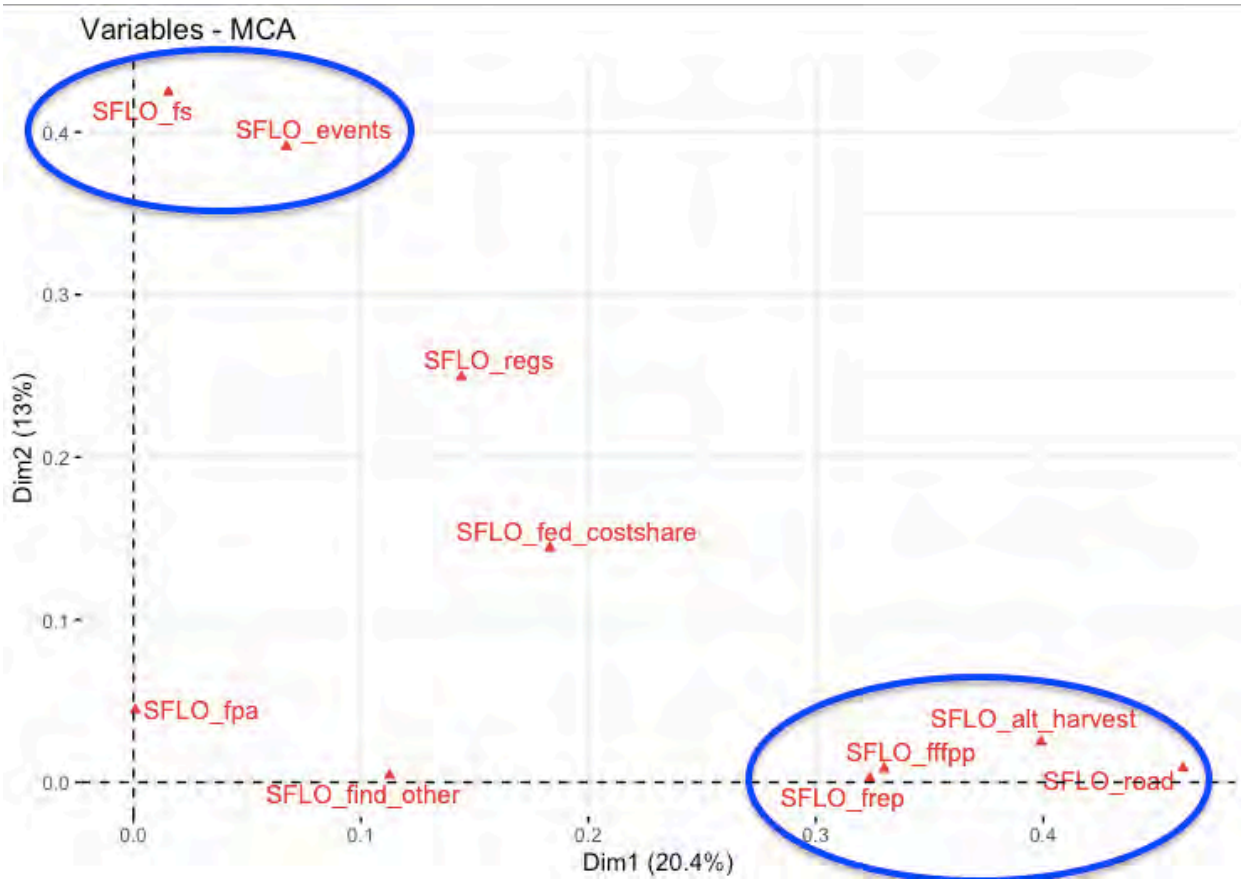

Figure 65. Associations of different topics with dimensions identified in a Multiple Correspondence Analysis of topics general population respondents got help with from the SFLO Office. "FS" stands for "Forest Stewardship" and "events" stands for "events for landowners." "Road" stands for "road maintenance and abandonment requirements."

Turning to respondents to the FF survey, Figure 66 shows the overall frequency of topics respondents discussed with the SFLO Office. The overall ranking of topics asked about are similar between the two sets of respondents. Forest Practices applications and Forest Stewardship are among the most frequently asked about topics. FREP is the second most frequently inquired about topics for by the FF survey respondents and FFFPP is somewhat more frequently asked about compared to general population respondents. Interestingly, Alternate Harvest Plans are the second least inquired about topic even by respondents who are impacted by the state's riparian forestry regulations.

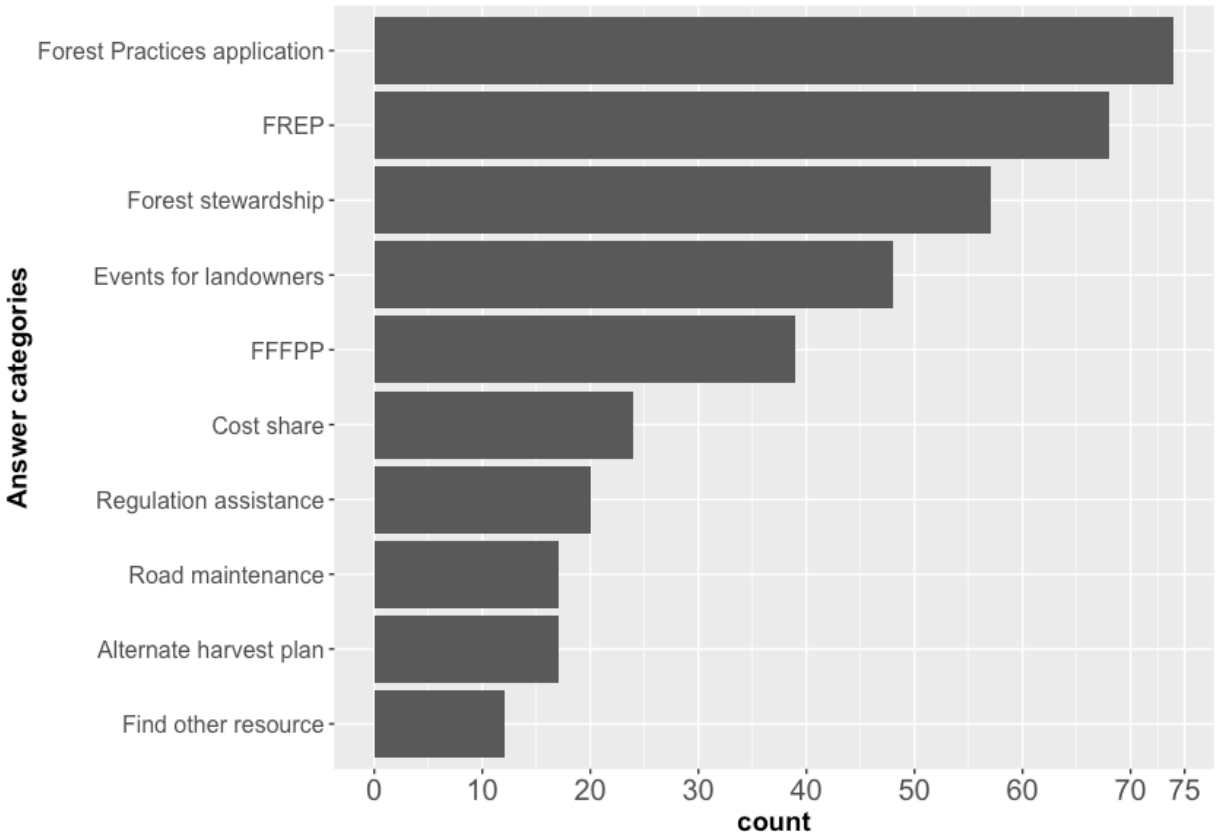

Figure 66. Topics FF respondents asked the SFLO Office about.

Of SFLOs who are on the FFFPP waiting list or have a completed FFFPP project on their land, 54% have had contact with the SFLO Office. Of SFLOs who are on the FREP waiting list or have a paid easement, 60% have had contact with the SFLO Office. Of respondents who said they had applied for an Alternate Harvest Plan, 75% have had contact with the SFLO Office. Although SFLOs who said they had applied for an Alternate Harvest Plan were substantially more likely to have had contact with the SFLO Office (40 out of 53 had contacted the SFLO Office about a specific topic), only 14 had asked the SFLO Office about Alternate Plans specifically.

The following analysis of Figure 67 and Figure 68 illustrate the finding that owners who think the regulations have caused them difficulty tend to be reaching out to the SFLO Office for assistance. Respondents who have had contact with the SFLO Office more frequently have an opinion about the impacts of the forests and fish regulations on their ownership compared to respondents who have not had contact with the SFLO Office about a specific topic (See Figure 67 and Figure 68). Respondents who have not had contact with the SFLO Office about a specific topic also tend to be less negative in their assessment of the financial impact that riparian regulations have had on their ownership since 1999. The differences between Figure 67 and Figure 68 are statistically significant using a Chi-squared difference of proportions test (X-squared = 37.264, df = 4, p-value = 1.589e-07). Figure 67 and Figure 68 are consistent with

results from Table 38 showing that respondents who have had contact with the SFLO Office are more engaged with various aspects of forest ownership.

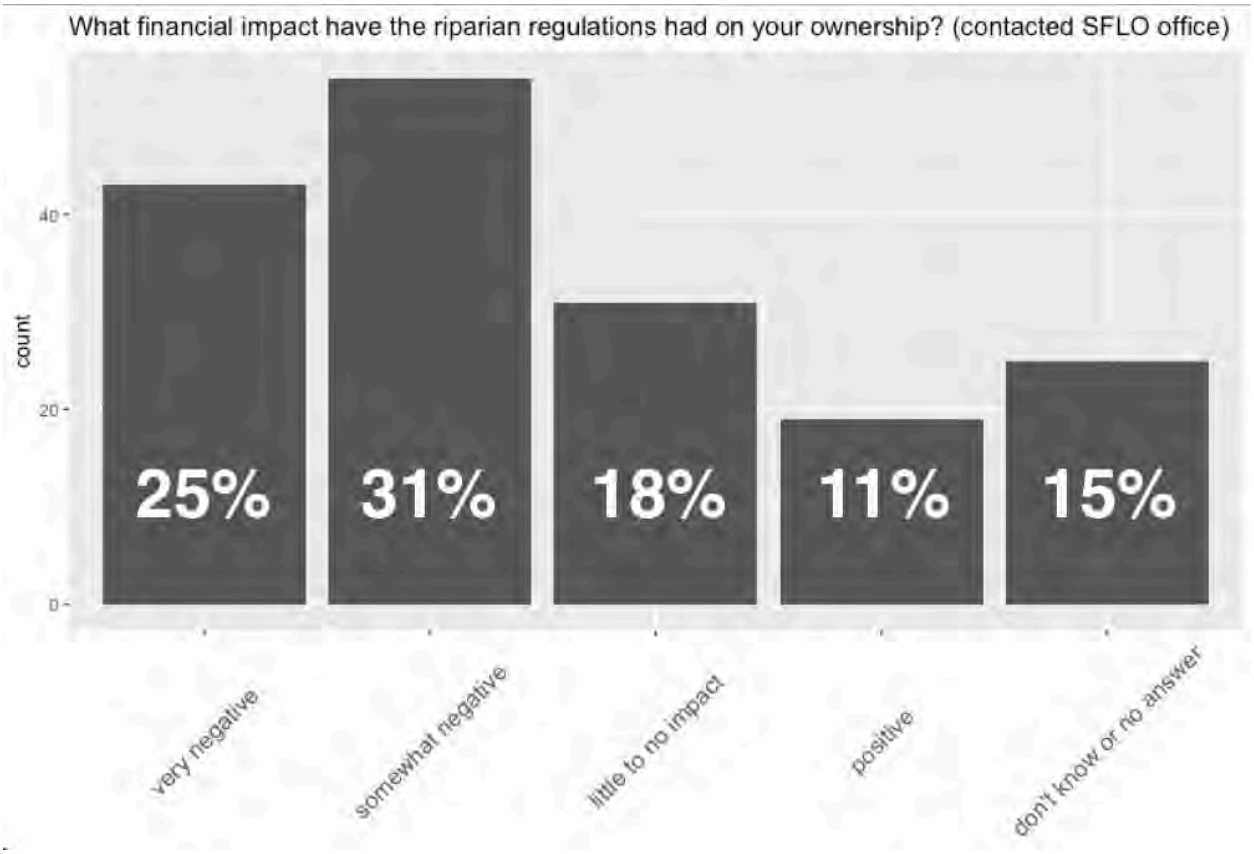

Figure 67. Evaluation of the financial impact riparian regulations have had since 1999: respondents who had contact with the SFLO Office.

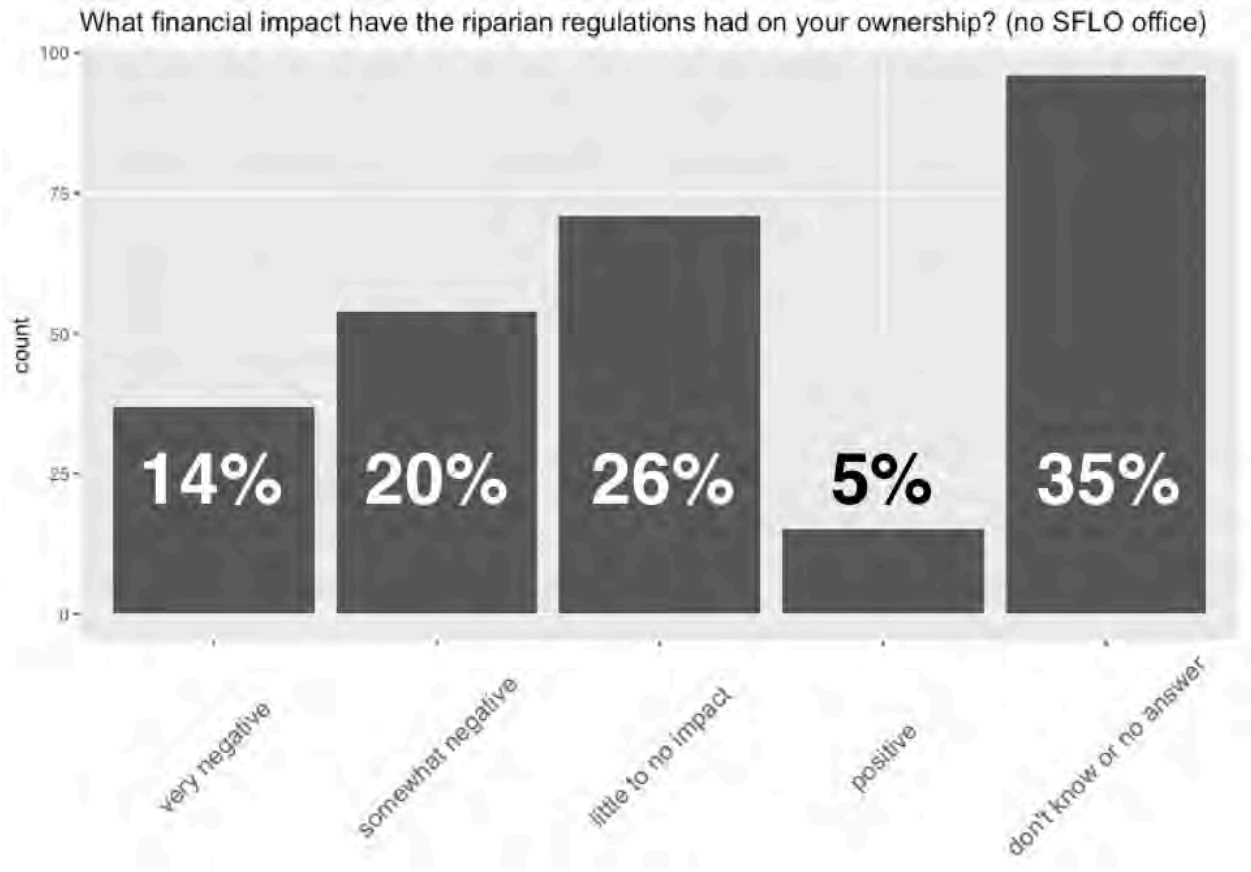

Figure 68. Evaluation of the financial impact riparian regulations have had since 1999: respondents who had NO contact with the SFLO Office.

10.1.9 Summary of survey responses regarding SFLO office

- The SFLO Office is somewhat well known by survey respondents. The majority of evaluations about the SFLO Office are positive and it has reviews similar to those of comparable service providers (Extension Foresters and Conservation Districts). A small percentage of respondents comment on the SFLO Office's lack of staff and funding.
- The Forest Stewardship Program and assistance with Forest Practices applications are among the most common topics that respondents got help with from the SFLO Office. For respondents to the Forests and Fish survey, FREP was among the most frequently topics of assistance by the SFLO Office. Alternate Harvest Plans and Road Maintenance and Abandonment Requirements are among the least frequently asked about topics.
- Respondents on the FREP waiting list or those having a paid easement, those on the FFFPP waiting list or a completed project, and those who said they applied for an Alternate Plan more frequently had contact with the SFLO Office. Although respondents who said they had applied for an Alternate Plan had the highest average frequency of contact with the SFLO Office, few of them asked the office about Alternate Plans.

- Respondents who had contact with the SFLO Office more often: value their forests for financial objectives, value the environmental aspects of forest ownership, and feel relatively more impacted by the state's riparian regulations.

10.2 Forest Riparian Easement Program

5 (C) (II) Forest riparian easement program: Does the structure of the program adequately address economic impact to small forestland owners? Has funding kept up with need? Has the lack of funding resulted in the loss of riparian habitat?

10.2.1 Understanding the Goal of FREP according to Interviewees

We asked our interviewees about what they thought the goal for FREP was to understand how stakeholders described FREP. Across stakeholder groups, there were the common themes of economic alleviation of the disproportionate regulatory burden of increased buffers and to protect riparian function. Individual interviewees varied on what they considered the main goal of FREP is, with economic alleviation of regulatory takings being the most common. One state employee summarized FREP as being predominantly for the economic alleviation with the additional benefit of protecting riparian function:

> *"…first with FREP the additional buffers, the wider width and buffers on small forest landowners and their having planned to utilize some of that economic benefit from those buffers and that was taken away from them. […] But additional benefit is conservation easement for 50 years and the protection of riparian functions on fish bearing and non-fish bearing stream, then that's provided to the citizens of Washington for 50 years. So that is a subsequent benefit. The goal, though, was for economic mitigation..."*

However, our state employee and affiliated landowner interviews had variation from these two common themes. State employees also suggested that FREP was to maintain forest land and prevent conversion. One state employee stated that landowners might feel like they are getting a "good deal" compared to other landowners and they will take the easement while also considering that the next generation will deal with the aftermath once the 50 years easement is complete.

For our affiliated landowner interviews, several interviewees brought up that FREP is to compensate for the "regulatory taking" of their private property. One affiliated landowner stated that FREP was to "satisfy WFFA" so that WFFA would support the Forests and Fish Legislation.

"The goal of FREP is to compensate landowners for trees they have to leave in the buffer and, and this is the interesting legal social issue is that normally when you have a taking, like condemning land for a freeway or whatever you got to you have to compensate the landowner, typical, but this whole thing was framed slightly differently to avoid that legal requirement."

10.2.2 Understanding Interviewee Perceptions of FREP

Our interviewees varied on how they felt about FREP. Overall, the majority of our interviewees supported FREP as written or as a concept. In practice, interviewees appear divided on whether FREP is a good or practical program. The greatest division between interviewees comes from the affiliated landowner stakeholder group. Otherwise, state employees who support FREP acknowledged that FREP is not operating optimally. One state employee said that they understood that landowners may not like or want FREP as a landowner might not want a government-related easement on their property or do not appreciate that FREP is a partial compensation program.

"The Forestry Riparian Easement Program has given out millions of dollars to landowners for the buffers that they're required to leave around water and wetlands, streams and wetlands. That's huge, right? Because just 20 years ago, you know, the buffers on these things were essentially minimal. They were practically non-existent. And now, you know, depending on the […] site class you have, you might be leaving upwards of a 200-foot buffer, which if you only have 10, or 15 acres is a maybe a big chunk of your property, right. And, so, these programs have allowed landowners to keep their land and forest and I think that's a huge win, right?"

In our affiliated landowner stakeholder group, there is frustration around FREP ranging from the waiting period, partial compensation, or having their property rights taken away. Some of our interviewees from Eastern Washington stated that they would rather maintain their rights to the RMZ with the hope that they could manage the RMZ at a later date, referring to their belief the current Forest Practices Rules are not applicable to the Eastern Washington regional ecology and that they would like to manage their riparian areas for fire resiliency. A similar concept was brought up by other affiliated landowners and an unaffiliated landowner where these interviewees suggested that there needs to be follow-up management of the riparian easement, either for achieving the desired future condition or to check that the easement is respected.

> *"It's, so FREP […] the program has given some relief* to some landowners. […] I don't want to participate in FREP, I would rather manage my trees and that includes right to the stream to get us back to fire resilience."

The affiliated landowner interviews also ranged from calling FREP a "wonderful program" to "inherently flawed." One interviewee called it the "wrong program, but there was no other alternative." Another interviewee suggested that they do not like FREP since landowners could provide the same benefits for a lesser cost through alternative plans. Another affiliated landowner considered FREP a "good model" for other programs regarding cultural resources. Finally, the affiliated landowner interviews, with one extension interview, referred to the uncertainty of what happens after the 50-year easement is complete, with the affiliated landowner interviewees suggesting it will be another "battle."

Across stakeholder groups, there is support and positive perceptions regarding FREP from the majority of interviewees and stakeholder groups, with unaffiliated landowners and state employees being universally supportive and extension universally supporting FREP, though having some disagreement about the legislative promise of FREP. Some affiliated landowners supported FREP as a concept, whereas others had frustrations concerning FREP. Universal negative perceptions of FREP referred to the long waitlist. Other negative perceptions appear to stem from the ideology of property rights or about the management of easements after they are established.

10.2.3 FREP Budgets Interview Narrative

FREP was also largely considered to be underfunded by state employees, extension officers, association members, and unaffiliated landowners. These stakeholder groups give ranges of four to twenty years of small forest landowners waiting to receive funding from the FREP program. Some extension officers indicated that the lack of funding has made landowners take FREP less seriously. One state employee suggested that the lack of funding for FREP and other programs means the forest practices laws remain "slanted against" small forest landowners. Association member interviews suggest that small forest landowners have not received what they were promised in Forests and Fish. Association member interviews also claim that by not fully funding FREP, the State of Washington gets to say, "we're compensating landowners for the take of forest land," while only making a "token effort." Unaffiliated landowners who know of FREP also suggest that the program is underfunded, with one claiming that it took six and a half years to receive their allocation.

> *"Financially, you know, it's seven years in the hole. What more can I say?"*

"But FREP for sure is underfunded: absolutely underfunded."

Our interviews suggest that not all believe FREP should be funded. However, this statement is often supplemented with caveats. Some association member interviews suggest that the creation of a small forest landowner rule, which would allow for more harvest within the riparian management zones, would alleviate some if not all financial burden of FREP on the state. Some of the association members also state the vice versa converse of this comment: if FREP was fully funded, there would be less pressure for another alternate plan template or a small forest landowner rule.

Some of our interviews with extension officers, association members, and state employees call FREP a broken promise due to the lack of funding. One extension officer called FREP a broken promise, yet indicated that perhaps the funding should be invested in stewardship instead, while also recognizing FREP as a regulatory obligation. Other extension officer interviews do not blame DNR or the SFLO Office for the lack of funding but place the responsibility with the Legislature. Several association member interviews directly call FREP a promise that was not fulfilled or kept. One interviewee suggested that it was after 2007 that FREP no longer kept up with funding and another suggested after ten years.

10.2.4 Evaluation of FREP from the FF survey

To directly have SFLOs evaluate FREP, the FF survey asks respondents a series of questions regarding FREP. Of all FF survey respondents, 49% said they have at least heard of FREP. Respondents who said they have a paid easement, are on the waiting list, or both comprise about 27% of the survey sample (or 118 respondents).[6] Of the 118 respondents who indicated they have a paid easement, are on the waiting list, or both: 87 indicate they have an easement on their land and no application on the waiting list, 31 indicate they are on the waiting list and do not have a paid easement, and at least 16 indicate they have multiple easements approved and/or on the waiting list. The last category (having multiple easements approved and/or additional applications on the waiting list) completely overlaps with the first category (have a paid easement) and hence the total of the three categories is 16 more than 118. Figure 69 shows the distribution of answers to the question "to what extent are you satisfied with the financial compensation you have received or anticipate receiving from FREP?" from all 118 respondents.

[6] Only 8 respondents said they received approval for FRP but decided against it. For an overview of the reasons why SFLOs turn down FREP when presented with a payment offer, we instead use data collected by the SFLO Office since 8 respondents are too few to make inferences.

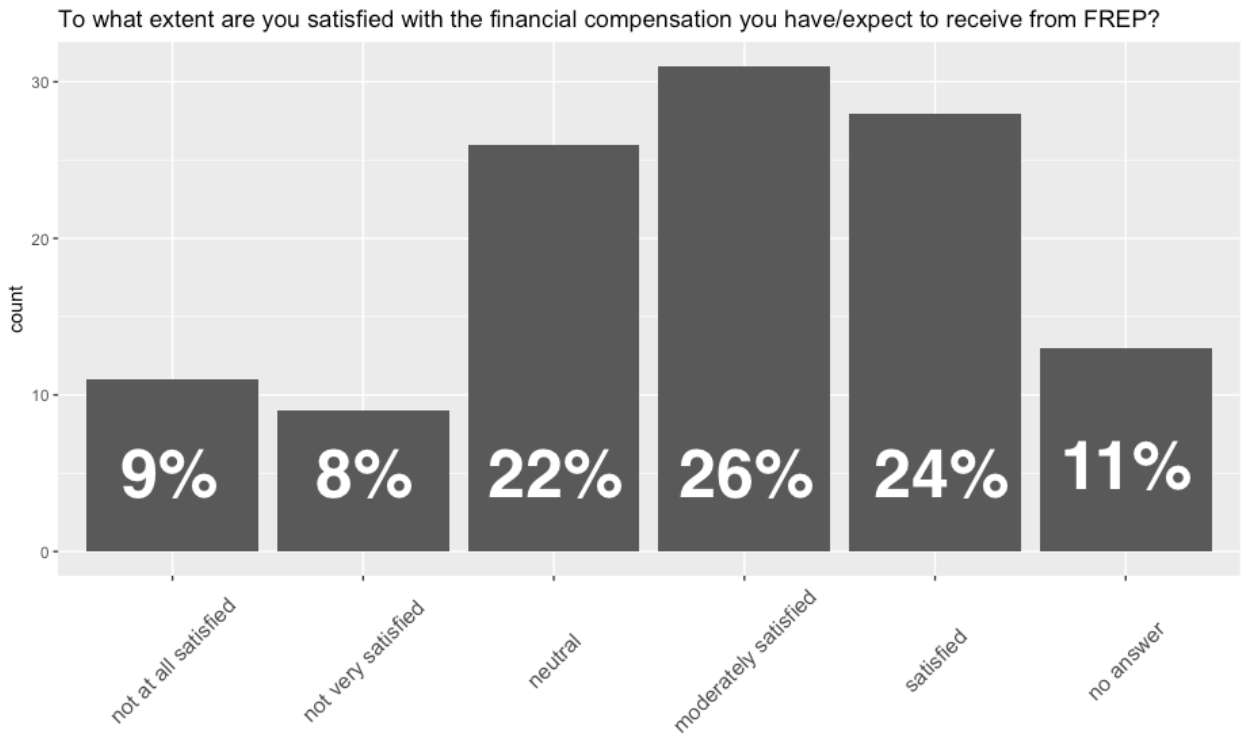

Figure 69. Distribution of answers to how satisfied or dissatisfied FF survey respondents are with the payment or expected payment from FREP.

As Figure 69 shows, half of all respondents (50%) are either “moderately satisfied” or "satisfied" with the financial compensation from FREP. Only 17% say they are “not at all satisfied” or “not very satisfied” with the financial compensation. Since respondents who have a paid easement may have a different evaluation of the financial compensation relative to respondents who are on the waiting list for payment, we further group respondents to present the satisfaction question. We create two sub-groups: one is respondents who indicate they ONLY have a paid easement on their land (71 respondents) and another group is respondents who indicate they have at least one application on the waiting list (31 respondents). The satisfaction of respondents with ONLY a paid easement is presented in Figure 70 and the satisfaction of respondents with at least one application on the waiting list is presented in Figure 71.

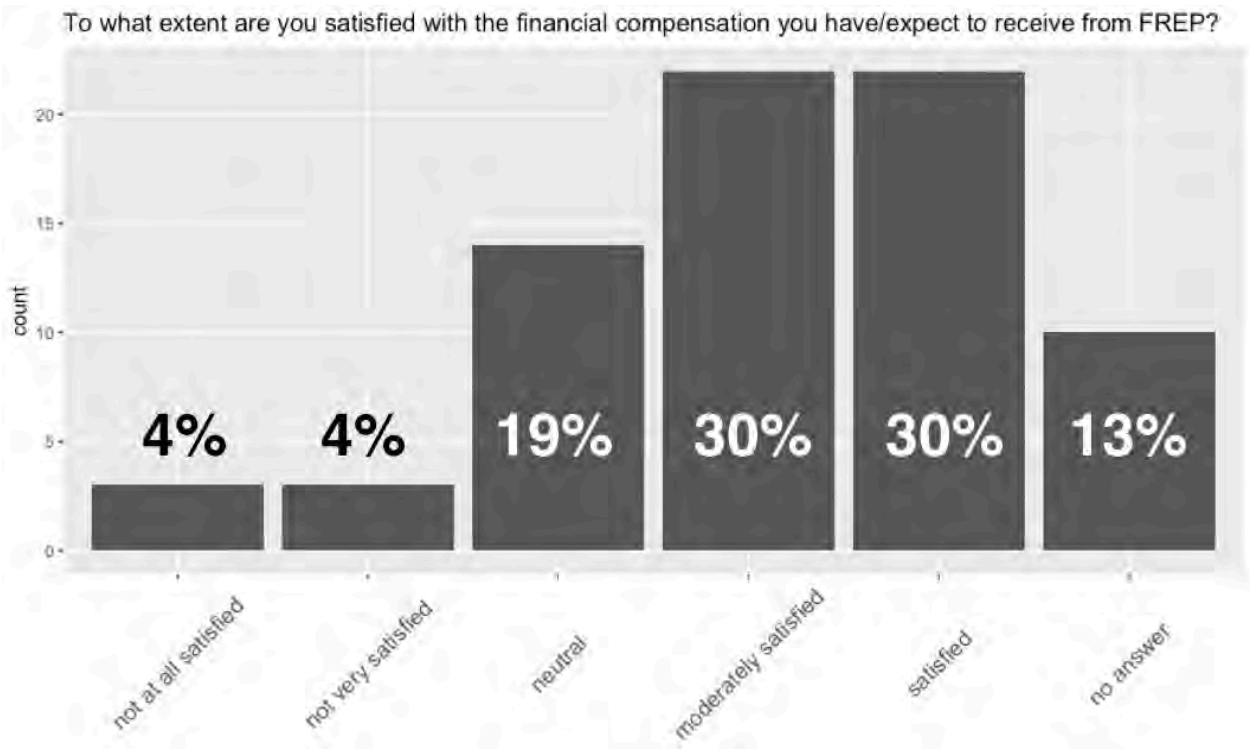

Figure 70. Distribution of answers to how satisfied or dissatisfied FF survey respondents are with the payment or expected payment from FREP, for respondents with ONLY a paid easement.

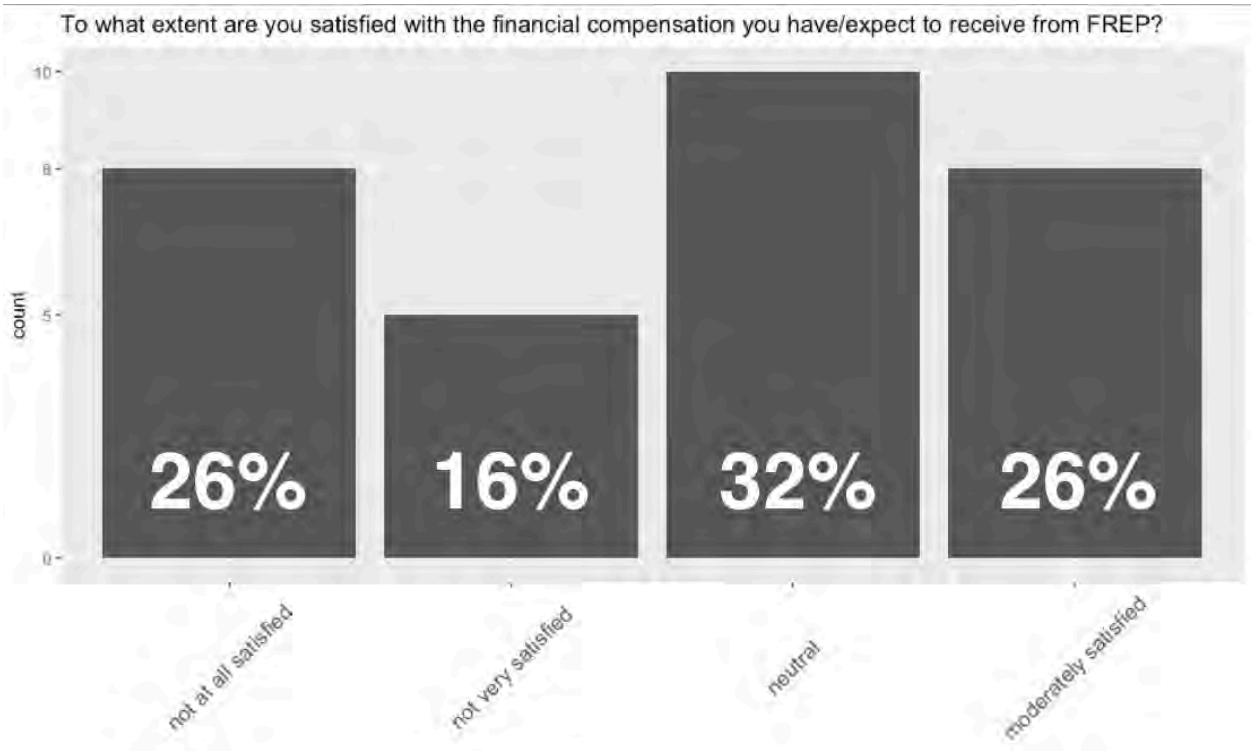

Figure 71. Distribution of answers to how satisfied or dissatisfied FF survey respondents are with the payment or expected payment from FREP, for respondents with AT LEAST one application on the waiting list for payment.

Comparing Figure 70 and Figure 71, 60% of respondents with only a paid easement are "moderately satisfied" or "very satisfied" with the payment from FREP while only 26% of respondents with at least one application on the waiting list are "moderately satisfied" with the payment they expect to receive. Conversely, only 8% of respondents with only a paid easement are "not at all satisfied" or "not very satisfied" with the financial compensation while 42% of respondents with at least one application on the waiting list are "not at all satisfied" or "not very satisfied." The difference is significant at the 1% level using a Chi squared differences of proportion test (X-squared = 29.272, df = 5, p-value = 2.05e-05).

Since a core purpose of FREP is to partially compensate SFLOs for the foregone financial value (opportunity cost) of their forests in additional buffers since 1999, we also looked at differences between how respondents evaluated the overall financial impact of riparian regulations based on their FREP status. Figure 72 shows the overall perceived financial impact of riparian regulations for respondents who have been paid for FREP and did not report having any applications on the waiting list for payment. Figure 73 shows the overall perceived financial impact of riparian regulations for respondents who have at least one application on the FREP waiting list.

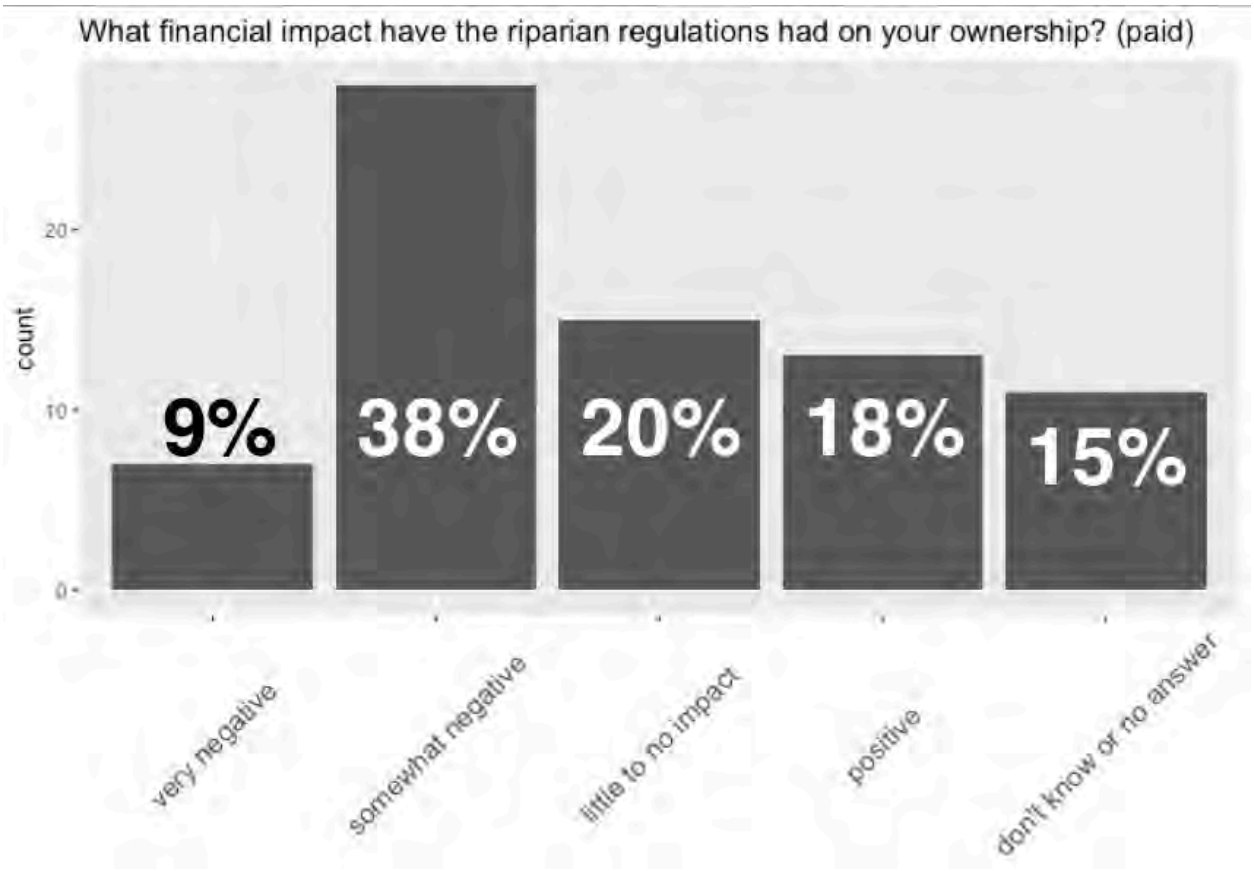

Figure 72. Evaluations of the financial impact that riparian regulations have had on SFLOs: only respondents who have been paid for FREP and do not have an application on the waiting list.

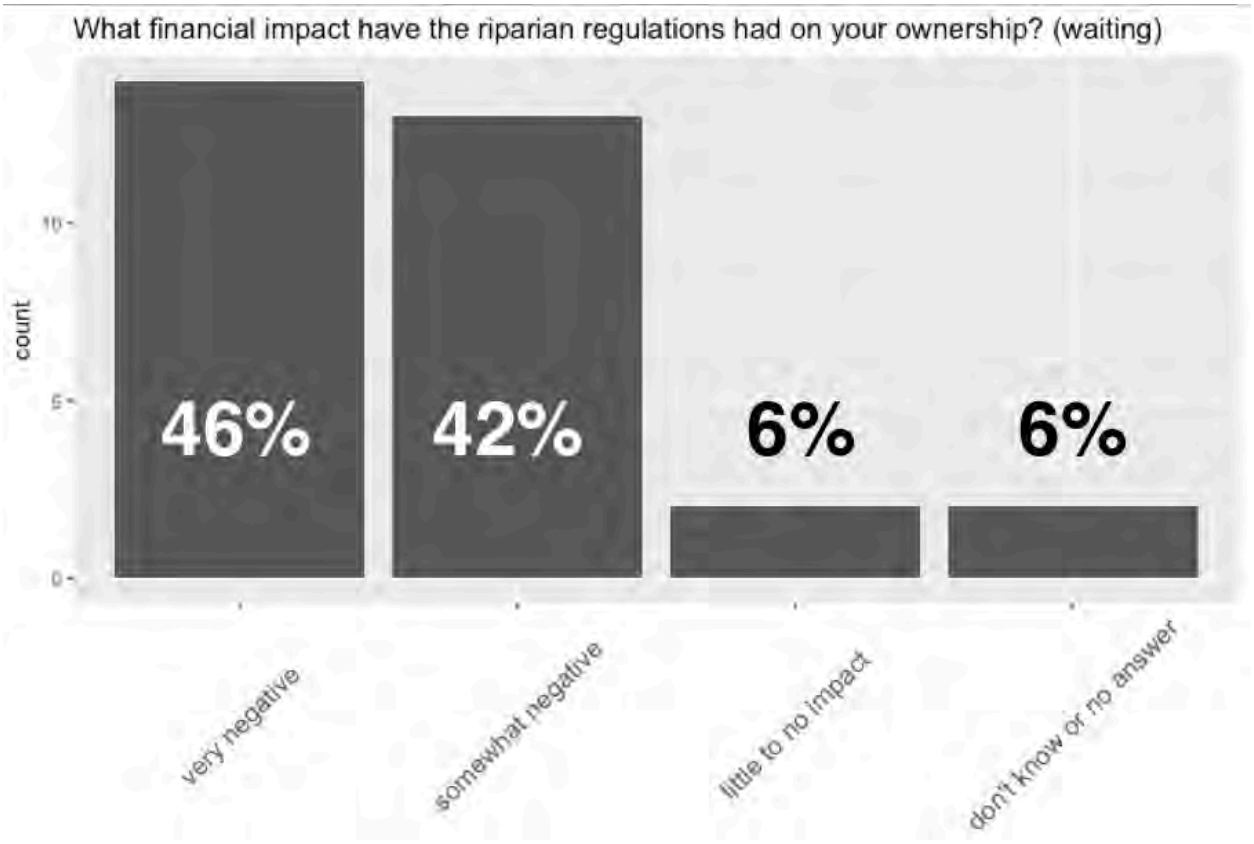

Figure 73. Evaluations of the financial impact that riparian regulations have had on SFLOs: only respondents who have at least one application on the FREP waiting list for payment.

As Figure 72 and Figure 73 show, respondents with only paid easements have a much less negative assessment of the financial impacts of the riparian regulations on their ownership, on average, compared to respondents with at least one application on the FREP waiting list. About 38% of respondents with only a paid easement say the regulations have had "little to no impact" or even a "positive" impact on their ownership compared to just 6% of respondents with at least one FREP application on the waiting list. The difference is even more stark for the percentage of respondents who say the financial impact of the regulations have been "very negative" on their ownership. Compared to just 9% of respondents with only a paid easement, 46% of respondents who have FREP application on the waiting list say the impact of riparian regulations on the forest land ownership have been "very negative." The differences between satisfaction shown in Figure 72 and Figure 73 are significant at the 1% level using a Chi squared difference of proportions test (X-squared = 23.289, df = 4, p-value = 0.0001108).

We note that FREP is a first-come-first-served program when it comes to distributing payments, so there is some self-selection in which respondents have been paid for their easements. Although owners with only paid easements and no easements on the waiting list have applied for FREP earlier than those with an easement on the waiting list, it is reasonable to assume at

least some of the differences between Figure 72 and Figure 73 are due to the effect of payment itself (instead of simply the order of when respondents applied to FREP). Therefore, the differences between Figure 72 and Figure 73indicate that having been paid for all riparian easements seems to reduce the perception that the financial impacts of Washington State's riparian regulations are "very negative" and somewhat increase the perception that the regulations have "little or no impact."

Respondents were also asked to rate the importance of various aspects of FREP. Figure 74 shows the distribution of respondents answers to how important various aspects of FREP are to them. Information from friends or other land owners is the least important aspect of the topics presented in the survey. The most important aspect is that the conditions of the easement match owners' management objectives. We advise readers that the compatibility of the easement with the owner's objectives is the most important of the topics presented in the survey, even more so than the financial compensation. As confirmed by informal stakeholder dialogue, *if an owner is not willing to grant the State an easement, then FREP is simply not an option for that owner*. Easements entail a contract with the State that some owners will simply not want to consider. In the open comments field asking respondents why they have not applied for FREP, almost 30 respondents specifically said they do not want to grant an easement to the State. Although these data indicate being paid for FREP mitigates the most negative perceptions of Washington's riparian forest regulations, there will be a portion of SFLOs who will probably never consider applying to FREP.

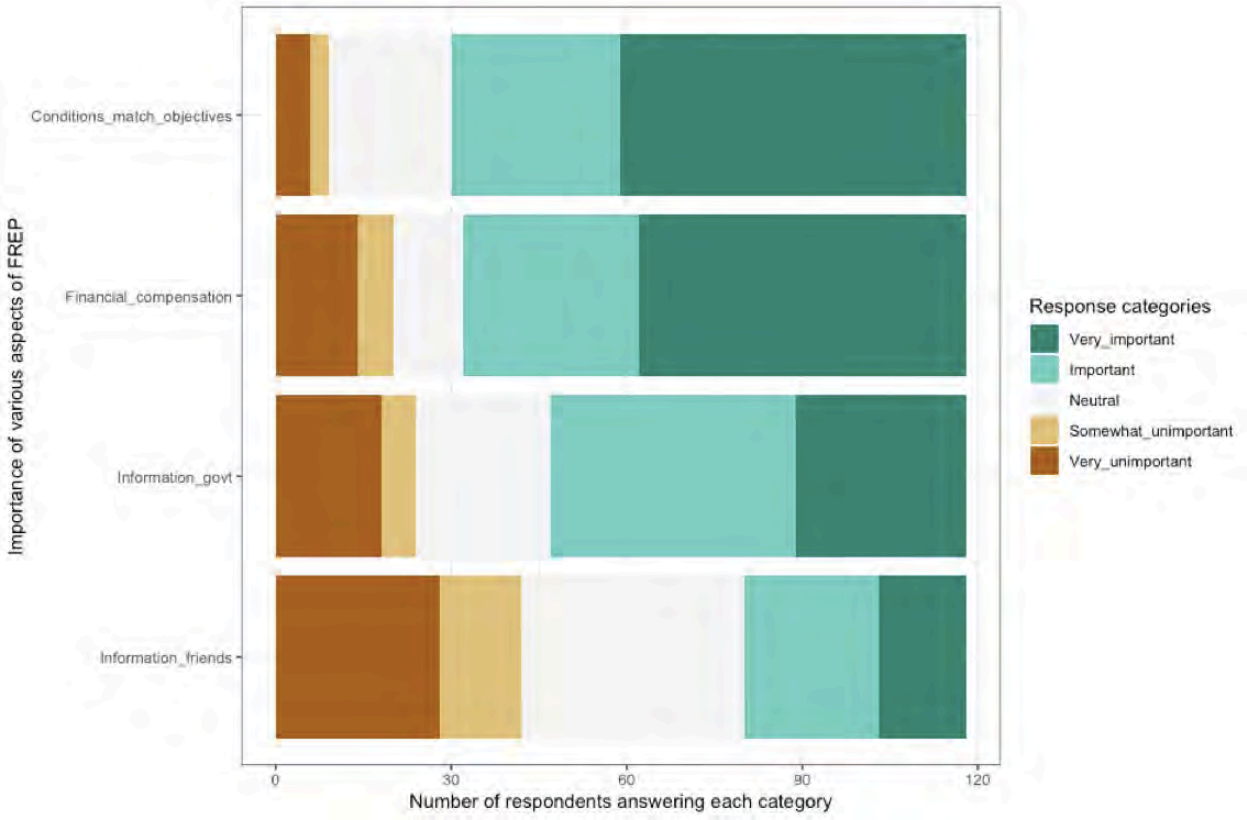

Figure 74. How important are the following aspects of FREP?

To allow for respondents to give open-ended feedback about FREP, respondents were given an open text field to "share any additional comments about how the Forest Riparian Easement Program could be improve based on your experience and what works well about it." Of those who indicated they are on the FREP list or have a paid easement, a summary of the most common comments is presented in Figure 75. The most common comments concern the waiting time for receiving payment and/or the lack of funding. Limited funding is the primary reason for the long waiting time for payment.

A number of respondents expressed the opinion that the compensation from the program is too low given the restrictions on harvesting. Although the program was designed to compensate for the difference in riparian buffer sizes before the 1999 regulation change and current buffer sizes, a few respondents also point out that the distinction between pre- and post-Forests and Fish buffers is not relevant. What is important to some is the value of all trees they cannot harvest, regardless of if they could have been cut before 1999. This is an indication that while FREP is the result of a negotiated agreement with Washington SFLOs, some owners disagree with the compromise. It is also important to note that FREP is designed to partially compensate SFLOs. This is reflected in one respondent's write-in evaluation of FREP that is perhaps tongue-in-cheek or perhaps dead serious:

Write-in comment about satisfaction with FREP: "It's better than a stick in the eye!"

Some SFLOs on the FREP waiting list commented that they have not heard back from the State about the status of their easement and that they are far down on the waiting list. The comment that SFLOs on the FREP waiting list are not frequently contacted to update them on the status of their application also came up in informal stakeholder conversations. With a current average waiting time of six years to be paid for FREP, applicants will likely go long periods of time without hearing about the status of their applications.

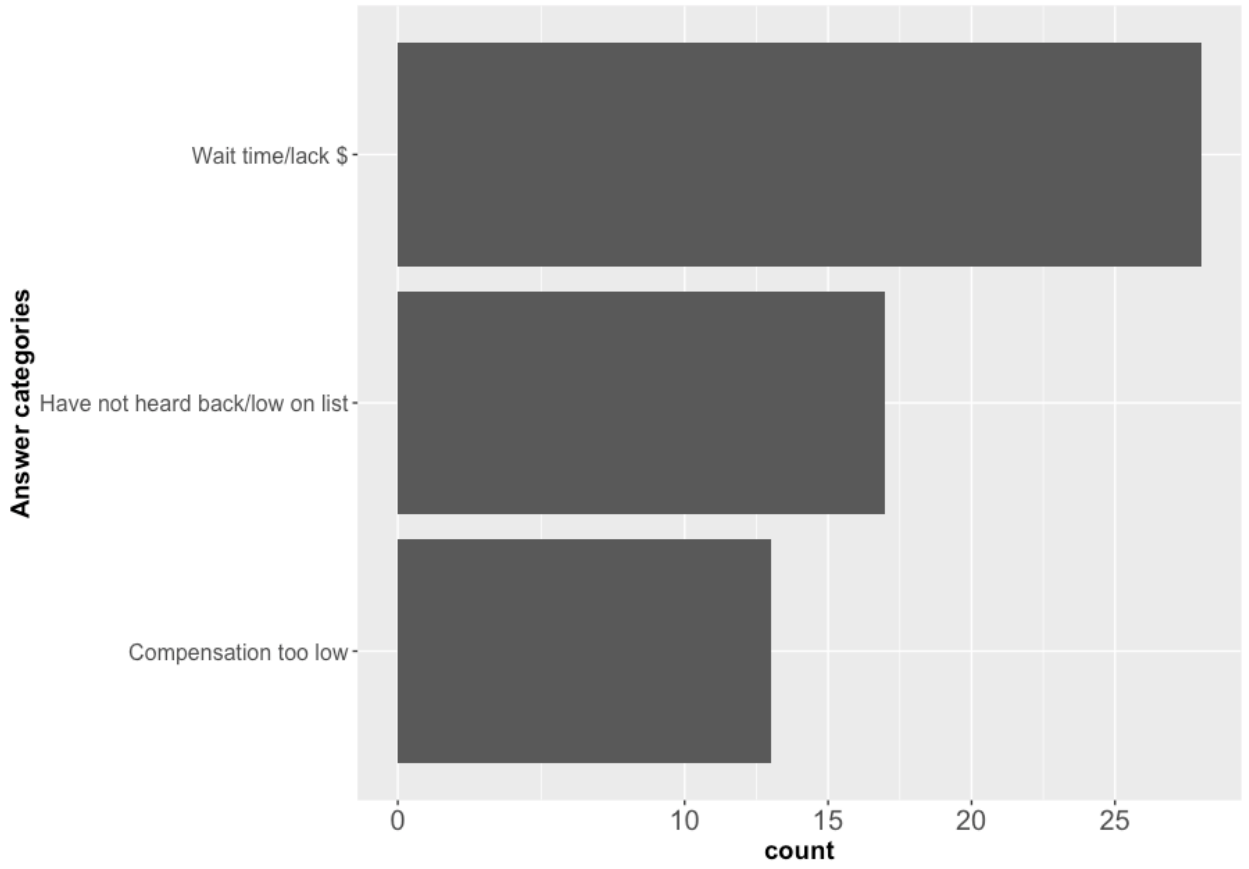

Figure 75. Summary of the most common comments given about FREP by those who have a paid easement, are on the waiting list, or both.

The SFLO Office follows up to ask SFLOs who have declined a FREP payment offer why they turned down the payment and cancelled the easement. Approximately 19% of all paid easements or easements on the waiting list had been declined as of 2019. Based on information provided by the SFLO Office, we summarized the reasons given for why the easement was declined and present the result in Table 41. The most common reason given was that the owners are no longer interested when they receive the offer (30% of all declined

offers). A quarter of those who decline the offer say the owner has either died or they have sold the property. Both of these reasons together, no longer being interested and the owner having died or sold the property, constitute 55% of declined payment offers. Although we cannot confirm it, the multiple year average waiting time may be at least one cause for SFLOs no longer being interested, the owner having died, or the property already being sold to another person. Slightly more than a quarter of declined payments (27%) occur because the owner does not meet the technical requirements for FREP. About 9% of SFLOs who decline payment offers say the payment is too low and 5% cannot obtain a subordination agreement.

Table 41. Reasons given for declining FREP payment offer. Data supplied from the SFLO Office.

Reason	Freq	Proportion
No longer interested	32	30%
Not qualify	28	27%
Died or sold property	26	25%
Not enough $	9	9%
No Subord agree	5	5%
(no reason given)	5	5%
total	**105**	**100%**

Finally, those who are not interested in FREP or have yet to apply for FREP were asked using an open text field why they are not interested or have not applied. Figure 76 summarizes the most common comments given for not applying to FREP. By far the most common reason given for not applying to FREP is that SFLOs did not know about the program (more than twice the frequency of any other reason given). The partial payment from FREP being too low is the next most common reason given, with 34 respondents saying the payment is not sufficient or not worth the trouble of applying. The long wait time does seem to discourage some SFLOs from applying who may otherwise apply. FREP requires that applicants have a qualifying harvest adjacent to the easement, and 24 respondents seem to indicate they have not applied for FREP because they are not able to perform a qualifying harvest. A handful of respondents (4) said they have not applied for FREP because they are “waiting to see” if the State will change its riparian regulations.

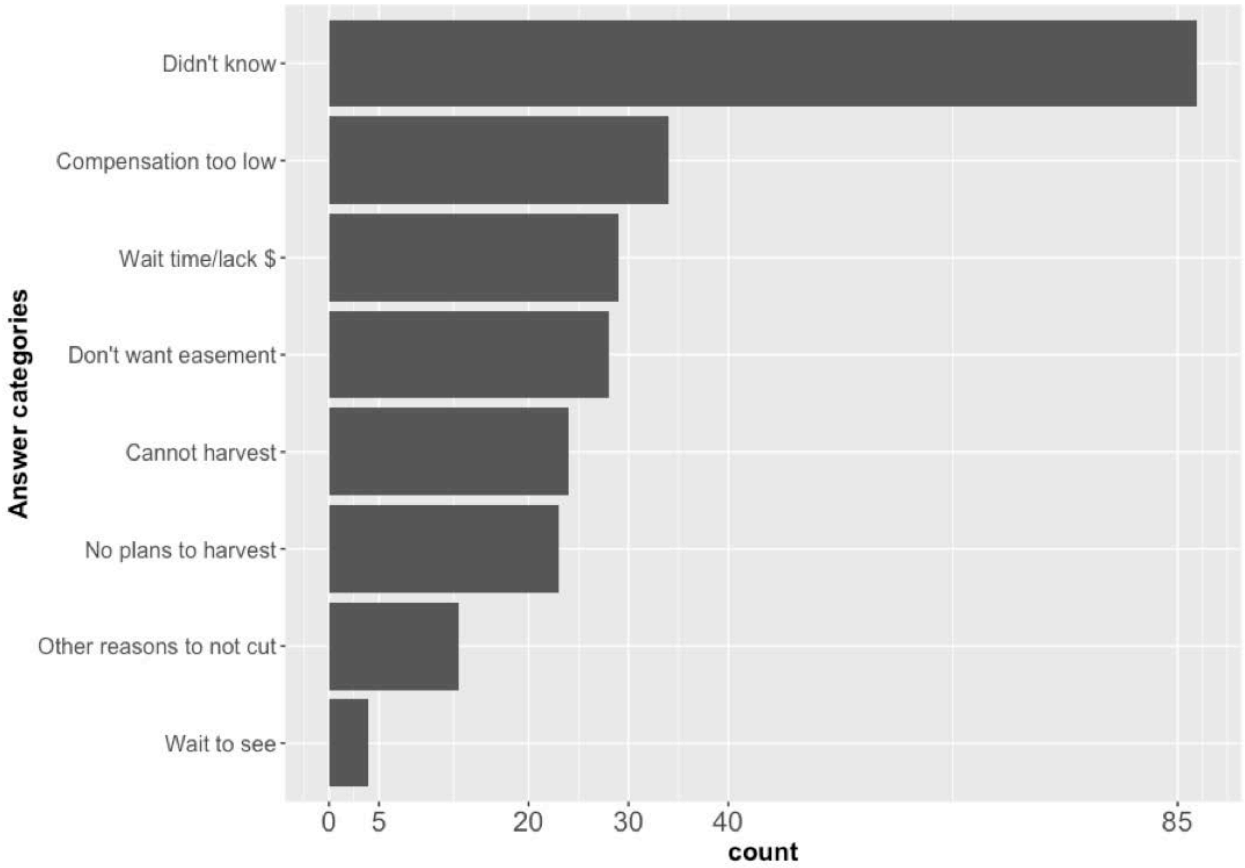

Figure 76. Reasons why respondents have not applied for FREP.

We conclude the section by highlighting an example written comment from the FF survey showing lack of knowledge about FREP and the issues created from the current 6-year average waiting time:

> *"I didn't know the program existed. There is a small stream that runs through one corner of the property. It does not have enough water in summer to support fish. If I were younger I would be interested in the program because the riparian zone is populated with large cedar and fir. But I do not believe I will be alive in 6 yrs to see the benefits."*

10.2.5 Survey summary

- About half of FF survey respondents say they have heard of FREP.
- Not only is being paid for all Forest Riparian Easements associated with a higher level of satisfaction with the compensation from the program, but having all outstanding easements paid for is also associated with a less negative assessment of the overall financial impact of riparian regulations. In other words, *evidence from the FF survey indicates FREP is mitigating the perceived negative impact of riparian regulations for SFLOs who apply and receive payment.*
- For respondents who indicate they have been paid for their easements, only 8% of respondents express dissatisfaction with the payment. Some SFLOs, both those who have applied and those who have not, express that the amount of compensation is not adequate.
- Even more important than the financial compensation from FREP, the conditions of the easement need to be compatible with SFLO objectives. Although FREP mitigates the most negative perceptions of riparian regulations, some SFLOs simply do not want to enter into an easement.
- In addition to expected comments about the waiting time and partial compensation of FREP, some respondents complained about not hearing about the status of their easement for years.
- Slightly more than half of owners who decline easements say they are either no longer interested, have sold the property to someone else, or the applicant has died. These reasons may be related to the multi-year waiting time required to receive payment.
- By far the most common reason why respondents say they have not applied for FREP is because they have not heard of the program. There appear to be at least some owners who have not applied but may apply for the program if the waiting time was shorter.

10.2.6 Observable impacts of FREP

Attributing observed changes in outcomes of interest to a participation in any program is a challenging task, as observed changes could be due to a host of other factors other than program participation. Ideally, a randomized controlled experiment could offer insight on the effect of program participation ("treatment") on the outcomes of interest (e.g., riparian habitat condition or land conversion). Given that randomized data is not available and we are not in a position to create such experimental conditions, we turn to the next best alternative, that is, quasi-experimental methods. Similar to the terminology of randomized controlled experiments, such methods aim to compare "treatment cases" (e.g., program participants) to "controls". Many methods for explicitly or implicitly creating a control or a set of controls for each case have been developed, including propensity score matching, regression discontinuity methods, instrumental variables methods, natural experiment designs, distance matching,

coarsened exact matching, and genetic matching methods. The basic challenge of evaluating outcomes of participants in any program is that participants self-select into the program and thus their outcomes (whether or not they actually participate in a program) could be substantially different from non-participants. For example, in the case of a forest landowner entering into a conservation easement contract, that landowner may have been interested in retaining their land in forest uses regardless of participation and if we simply compare conversion rates across lands with easements and without, we would be overestimating the impact of an easement contract on land protection. The basic intuition of methods that aim to address the self-selection problem is to try to control for the factors that influence the participation decision and find controls (non-treated) observations which mirror the treated cases but for the program participation (subject perhaps to truly random idiosyncratic differences).

In our case, we know that SFLOs self-select (subject to eligibility criteria) into the waiting pool for FREP funding. Survey and interview results show that landowners apply for FREP for a variety of reasons, which means that we are not likely to be able to control for some of the factors that drive the FREP participation decision. At the same time, we do have a rich set of data for parcels themselves. Also, there are many SFLO parcels which could be eligible for FREP based on size and stream characteristics, which are distributed across counties and other geographically identifiable areas of the State. This allows us to use observable parcel characteristics to find closely matching control parcels to parcels which have a funded FREP contract or are on the waiting list. Furthermore, because the number of SFLO parcels is fairly large, we are able to control *exactly* for parcel county and the Stumpage Value Area, which means that for every FREP "case" parcel we search for "control" parcels within the same county *and* Stumpage Value Area. This allows us to implicitly control for unobserved county economic, demographic, land use policy and other characteristics, as well as to control for the underlying broad site productivity conditions and timber infrastructure conditions represented by SVA designations.

We use a wide range of observable parcel and landowner characteristics to construct controls: parcel acreage, tract acreage, total size of overall and forest land ownership, harvesting history (submitted harvest FPA), distances to nearest development, the Urban Growth Boundary, DNR and USFS land, and public roads. We also use the sizes of core, inner, and outer buffers, as well as total stream feet in the matching process.

In terms of the matching method, we used propensity score and genetic matching (Sekhon 2011; Jr and Sekhon 2011; Diamond and Sekhon 2012) and report the results of genetic matching, which is a more general matching method which uses evolutionary computation to find better covariate balance. While these estimates represent our best attempt at dealing with the selection problem, we recognize that additional unobservable factors may be related to the FREP participation decision, and while we aim to reduce the bias in our estimates of effects on

the outcomes it is again a feature of observational data that absence of bias due to the presence of unobserved confounders cannot be claimed with confidence. We find 22,947 parcels which with complete data which constitute the total likely FREP-eligible "matching pool" from which controls are selected and weighted using the genetic matching procedure.

10.2.6.1 Matching results for the loss of riparian habitat

We first address the explicit question of evaluating the effect of lack of FREP funding on riparian habitat loss. We construct the remotely sensed estimates of forest cover in the riparian zones for the earliest available parcel data and for 2019 parcel data, and use the difference as the estimate of loss/gain in forest cover. We focus on the results where the treatment is either having a funded FREP contract or a parcel's presence on the funding waitlist. This allows us to estimate "treatment" effects or effects where "intention to treat" is present (since parcels currently on the waitlist would have to withdraw their application if their owners converted the parcels, we focus on the outcomes of "cases" versus "controls"). This gives us a broader estimate of the effectiveness of the FREP program. With respect to the "lack of funding" question (with lack of funding evidenced by long wait times for FREP applicants), we rely on the "selection on observables" assumption embedded in the matching analysis. That is, we assume that "control" parcels would have been just as likely to apply for FREP but for the lack of funding (propensity score matching method makes this connection explicit, for example).

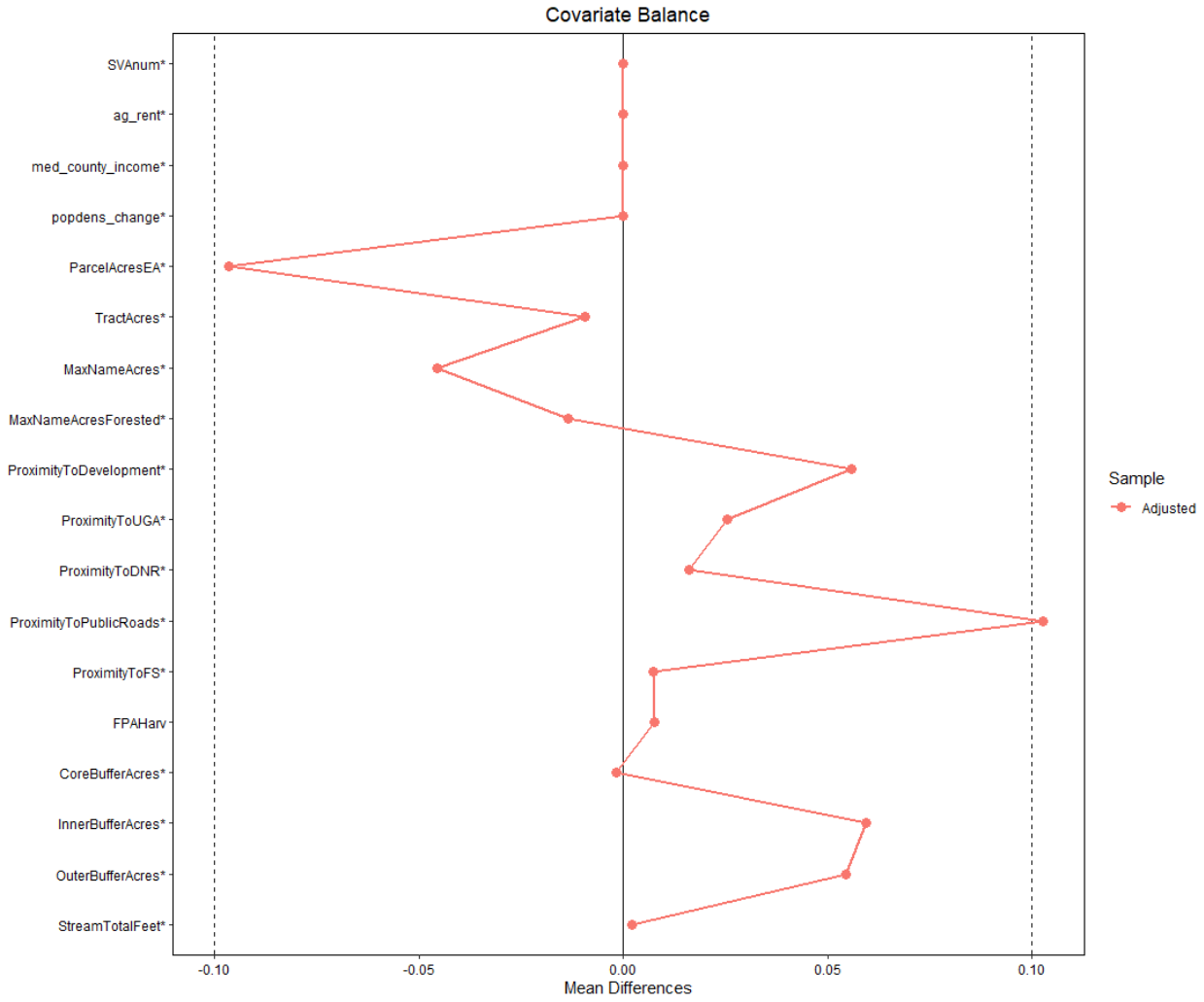

Figure 77. Covariate balance example, matched sample (funded FREP parcels).

We construct counterfactual scenarios and look at whether those parcels with a recorded FREP application (or those with a funded FREP) -- *cases*-- end up with a different riparian condition than those parcel which have been discovered in the database which match closely to the program parcels along a range of observable attributes – *controls.* We are generally able to find good matches even with insisting of looking for matched parcels within the intersection of county and SVA (Figure 77). With respect to the question on whether FREP funding has any effect on the size of the forested buffer, we conducted matching exercises using both the funded and the funded in addition to FREP waitlist parcels, and found no spatially meaningful or strongly statistically significant effect on forest cover in different riparian buffer comparisons (core, inner, outer zones).

Table 42. Estimated change in forested buffer acres, by buffer zone, genetic matching case-control analysis, average effect on the treated (positive values indicate FREP-"treated" parcels saw an increase in forested riparian area).

Treatment group, matched *n*	Core buffer	Inner buffer	Outer buffer
Funded, 682 (2 dropped by exact matching)	0.05 (n.s.)	-0.04 (n.s.)	-0.02 (p <0.1)
Funded and in queue, 924 (2 dropped by exact matching)	-0.07 (n.s.)	-0.05 (n.s.)	-0.02 (p <0.05)

We find no quasi-experimental evidence that parcels which otherwise would have been in FREP list (based on matching criteria) see different riparian habitat condition (as measured by forest cover). All the effects are trivial from the spatial perspective, and the only (marginally for the funded treatment group) significant effect is one a trivial 0.02 acre decrease in the outer buffer zone for the treatment group. Occasional withdrawals from the FREP waitlist or declined FREP contracts exist but even if riparian habitat of those parcels suffers it's impossible to attribute any potential riparian habitat changes to limits on FREP funding in a causal sense. Inclusion of contracts which were recorded as cancelled in the matching exercise did not change the analysis results.

10.2.6.2 Matching results for effect of FREP on forest retention

While the section above suggests that we cannot attribute meaningful riparian forested acreage changes to FREP participation, as a part of the same matching analysis, we look at the *land use change* across parcels which have a FREP (funded or in waiting) versus those that do not. While FREP is largely a riparian-focused program, it may have an effect of serving the aims of forest retention. We want to assess its effectiveness in the counterfactual sense.

Table 43. Forest retention, FREP cases and matched controls (funded treatment sample and combined funded/in waiting treatment sample).

Funded FREP parcels, n=680		**FREP participants**	
		ForestOrNatural LU in 2019	Not ForestOrNatural LU in 2019
Matched controls	ForestOrNatural LU in 2019	463 (control in forestry/case in forestry)	**60 (control in forestry/case NOT in forestry)**
	Not ForestOrNatural LU in 2019	**109 (control NOT in forestry/case in forestry)**	48 (control not in forestry/case not in forestry)
Funded and in queue FREP parcels, n=922		FREP participants	
		ForestOrNatural LU in 2019	Not ForestOrNatural LU in 2019
Matched controls	ForestOrNatural LU in 2019	588	**94**
	Not ForestOrNatural LU in 2019	**170**	70

The 2 sections of

Table 43 describe the land use agreement table. Rows break down matched control parcels by their 2019 state (whether they are in the ForestOrNatural state), while columns break down treated (FREP) parcels by their 2019 state. Matched cases and controls were assessed for their 2019 land use category. For each case/control pair, 4 outcomes represented in the table are possible: both parcels were retained in forest uses, both parcels transitioned away from forest uses, case (FREP) parcel transitioned but control did not, or case (FREP) parcel was retained in forest uses but control transitioned away from forest uses. When both cases and controls have the same outcome, clearly no effect is present. However, if more of the treated parcels are retained when controls transitioned than the opposite scenario, we can infer that treatment (FREP) has a forest land use retention effect. The ratio of disparate outcomes (for example, 94/170 in the second part of the table) provides an estimate of the odds of conversion, which is 0.55 (94/170), 95% CI of (0.42-0.72) for the funded and in queue FREP parcels, and 60/109=0.55, 95% CI of (0.39-0.74) for the funded FREP parcels. In other words, we find that FREP participation reduces the odds of conversion by about 45% for all the FREP-treated parcels. Thus, although FREP aims to compensate qualifying SFLOs for restricted riparian timber, it also is estimated to have a broader forest retention effect, with at least a one-third counterfactual reduction in conversion risk for participating parcels. In the additional sense, FREP (funded and waitlist) protects 8318 (5409 for funded contracts) acres, or about 16.7% (15.0% for funded acres) of all FREP treated acres. Based on contracted parcels, the cost per (in the counterfactual sense) protected acre is estimated to be $8,119/acre.

10.3 Family Forest Fish Passage Program (FFFPP)

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5 (C) (IV) Has the family forest fish passage program addressed
economic impact to landowners and fish passage barriers
adequately?
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10.3.1 Understanding the Purpose of FFFPP from Interviews

We asked our interviewees what they thought the goal of FFFPP was. Across stakeholder groups, interviews gave three common goals with one of these goals being universal with all stakeholder groups. Interviewees widely think that FFFPP is to improve fish passage by removing barriers. Meanwhile, state employees, affiliated landowners, and extension officers considered FFFPP as an economic mitigation mechanism to help landowners remove their fish barriers. These stakeholder groups also highlighted the regulatory obligation alleviation of removing inadequate passages during harvests, as long as the passage is on the FFFPP list. Specifically, RCW 76.09.440 states: “The department shall not disapprove a forest practices application filed by a small forestland owner on the basis that fish passage barriers have not been removed or replaced if the small forestland owner filing the application has committed to participate in the program established in RCW 76.13.150 for all fish passage barriers existing on

the block of forestland covered by the forest practices application, and the fish passage barriers existing on the block of forestland covered by the forest practices application are lower on the funding order list established for the program than the current projects that are capable of being funded by the program."

10.3.2 Understanding Interviewee Perceptions of FFFPP

FFFPP is widely considered a positive program with our interviewees. None of our interviewees suggested that the program should be removed. However, some of our interviewees discuss that the idea of public funds going to a private individual conflicted with their ideology. Nevertheless, our interviewees highlighted the benefits of landowners receiving a permanent upgraded structure on their property that relieves them of regulatory obligation of removing the fish barrier, which is described in RCW 76.09.440, and, once a barrier is replaced, fish habitat is opened up. Lack of funding and staff underlined some of the drawbacks that interviewees considered.

Overall, all of our stakeholder groups stated that FFFPP is a benefit for landowners. Some interviewees suggested that losing the program would be detrimental. Several interviewees stated that FFFPP helps landowners stay on the land by allowing for affordable stream crossings that are feasible within small landowner budgets.

> *"If you're gonna replace a culvert, I mean, that could be a fifty or one*-hundred-thousand dollar proposition if it's on a fish bearing stream. For a landowner, like us, if we had 20 or 30 acres of forest land, that might force you to sell your property, right. And so that does a really good job of, at least I like to think it's a good job of helping to keep land in forest."

One major complaint revolved around the resulting structure after the project. As a state employee described, the landowners get a permanent, upgraded structure on their property that immediately opens up fish habitat. However, some of the affiliated landowners indicated that they felt that the projects were over-engineered and costs the program more than necessary. These interviewees think that these projects could be done at a lower cost so that more projects could be completed. Other affiliated landowners had frustration for lower priority projects that may never be funded, and sometimes the landowners will need to pay out of pocket to complete the project if that crossing is necessary. A state employee noted that some of the high and medium priority projects are not being completed due to many high priority projects being added to the FFFPP list. While interviewees have frustration about lower priority projects being funded, the priority system is considered a positive aspect of the program. A state employee interviewee said that reducing the waitlist requires more staffing and funding for FFFPP.

"But we want to try to hit we want to try to get the highest priority projects always and that's our requirement is we're supposed to fix the worst first the ones that provide the most benefit to the resource: meaning how many how many miles a habitat it opens up? The number of species of benefit? So, we're always looking for the good higher priority projects. Even though we've got 1,000 on the list, we want to get the biggest bang for our buck. And we that takes an ongoing outreach effort to to [sic] find those. So, needing the resources to be able to do that, I think is is [sic] needed and I don't have enough staffing to be able to do that."

10.3.3 FFFPP Budgetary Interview Narrative

FFFPP is also considered underfunded according to our interviews with all stakeholder groups. State employee, extension officer, and association member groups all include an interview in which the waitlist for FFFPP is mentioned. One state employee suggested that some landowners may never receive their FFFPP funding. An extension officer stated that the demand is greater than the supply. One association member stated that the last time they printed out the waitlist, it was seven pages long. Beyond not being able to provide for the landowners that signed up, one state employee stated the following:

"The FFFPP: we don't have enough resources to conduct all the outreach that we need to conduct to be able to get landowners to sign up for the program."

While FFFPP is considered underfunded by all stakeholder groups, our interviews with association members indicated that FFFPP is funded more so than FREP. According to the budgetary data, this is true for every year after the 2007-2009 biennium, excluding the 2013-2015 biennium when FREP and FFFPP received the same allotment. One interviewee with the association member group stated that it is important to remember that FFFPP was not part of the original Forests and Fish Rule, since:

"The reason that's important to me […], is because the legislature started funding FFFPP and not funding the forest, FREP, the Forest Riparian Easement Program."

Another association member interviewee suggested that the state likes to fund FFFPP more than FREP since:

"…they get to claim a victory on 'aren't we good stewards of our habitat of our environment? Look, we funded this program and it's replaced so many barriers and now we've gained this many more miles of potential fish habitat."

At the same time, no interview suggested that FFFPP should receive less funding. While some interviews suggested that the fish passage culverts funded by FFFPP are over-engineered and could be made simpler with less funds, these suggestions did not include overall remarks on less funding for the program. Like FREP, FFFPP is considered a broken promise in some interviews with association members and extension officers.

10.3.4 Survey evaluations of FFFPP

In the FF survey, respondents were asked a series of questions about the Family Forest Fish Passage Program (FFFPP). First, 47% of respondents say they had heard of FFFPP before the survey. Slightly more than 1 out of 3 respondents were familiar enough with FFFPP to answer what their impression of the program was from other landowners. Figure 78 shows the impressions of the 37% of FF survey respondents, which are overwhelmingly either positive, or neutral.

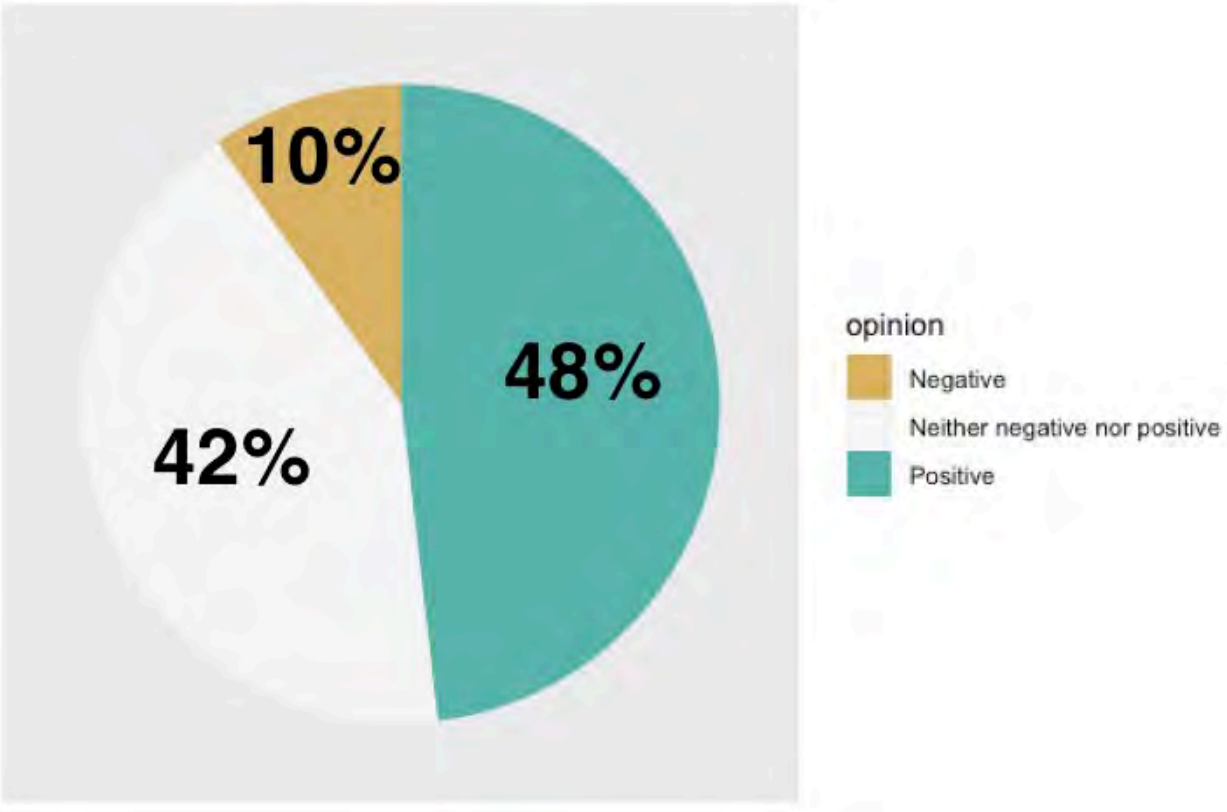

Figure 78. Respondent answers to the question "if you received information about FFFPP from another land owner or neighbor, what was your impression of FFFPP from that information?"

We also ask respondents which statements apply to them because of FFFPP. Figure 79 shows the frequency of responses for which statement applies to the respondents who have a completed FFFPP project on their lands or are on the waiting list. The top two responses are that FFFPP is a good use of public funds on my forest land and that the barrier to fish passage was corrected. For context, slightly more than half of respondents on the FFFPP waiting list or with a completed project said the program was a good use of public funds on their properties. With 47 respondents who say they have a completed project on their land and 56 who say they are on the waiting list, 35 respondents said they are too far down the priority list to expect the FFFPP will actually be implemented on their land.

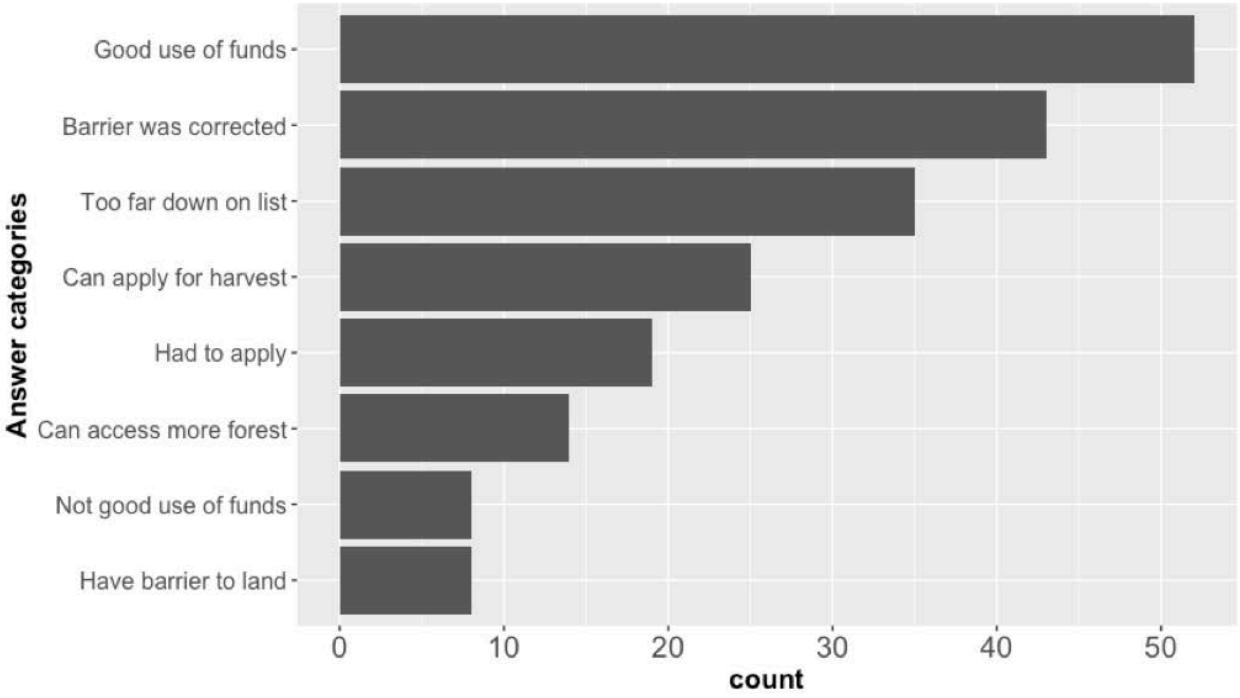

Figure 79. Frequency of responses to "If you have a completed FFPP project or are on the waiting list, please indicate which of the following statements apply to you because of FFFPP.

One feature of FFFPP is that it relieves a landowner with an identified fish passage barrier (as per state regulatory guidelines) of having to correct the fish passage barrier for a Forest Practices application to be approved. Even being on the waiting list allows SFLOs to submit and have their Forest Practices applications approved. About 1 out of 4 respondents on the waiting list or with a completed FFFPP project on their land said they are now able to apply for timber harvesting because of being involved in the program. In informal stakeholder conversations, one potential problem with the FFFPP program can be that landowners may have a barrier to fish passage that simultaneously blocks access harvesting access to other parts of their land (since it cannot be used to cross the stream) but their application is de-prioritized on the FFFPP list. In such cases, SFLOs may be not be able to manage some or all of their land because a new

fish passage crossing is needed, but is unlikely to ever be provided by the program. Figure 79 suggest that maybe as many as 8% of the FF survey respondents who have ever been on the FFFPP list may be in such a situation.

Respondents were also asked “if you have a completed FFFPP project on your land, how satisfied are you with the program?” About half of respondents who say they have ever been on the FFFPP list having at least one project on the waiting list. Accordingly, a bit fewer than half of those involved with FFFPP respondents did not answer the question. Figure 80 shows the distribution of how satisfied respondents were with the program. Most respondents who gave an answer were at least moderately satisfied (40 respondents) with an equal number of respondents who answered “neutral” or less than satisfied (9 respondents in each category). With minor exception (around 1 in 10 respondents who seem to be negative about it), FFFPP is very well reviewed by relevant FF survey respondents.

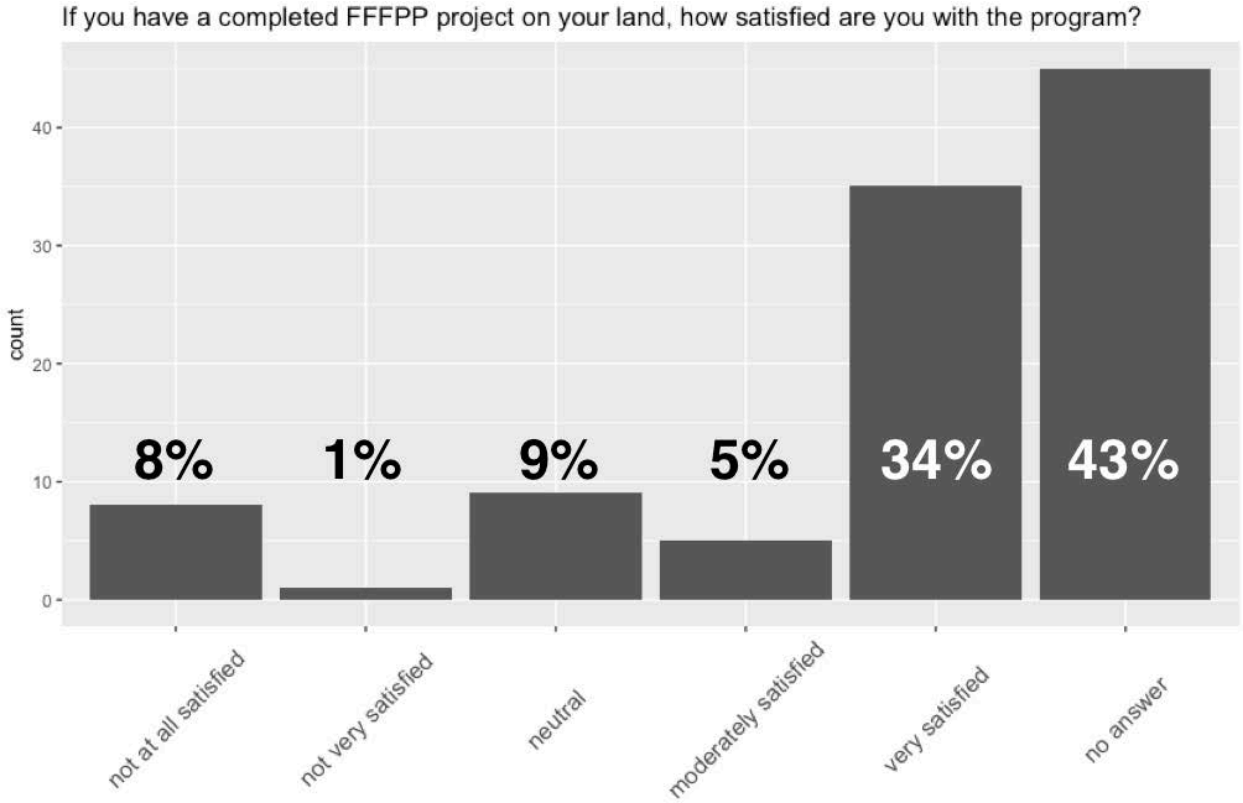

Figure 80. Respondent answers to the question: if you have a completed FFFPP project on your land, how satisfied are you with the program?

Finally, we gave respondents an open response field to express any additional comments about how FFFPP could be improved based on their experience and what works well about it. Most of the comments had positive things to say about the program. The second most common comments had to do with the long wait time involved in the program for some respondents. As the interview results also confirm, some respondents express that the program is very

expensive and that efficiency improvements can be made (such as having a contractor do the same or a similar job for less money).

Very few respondents, only 3, said they replace the identified fish passage barrier themselves.

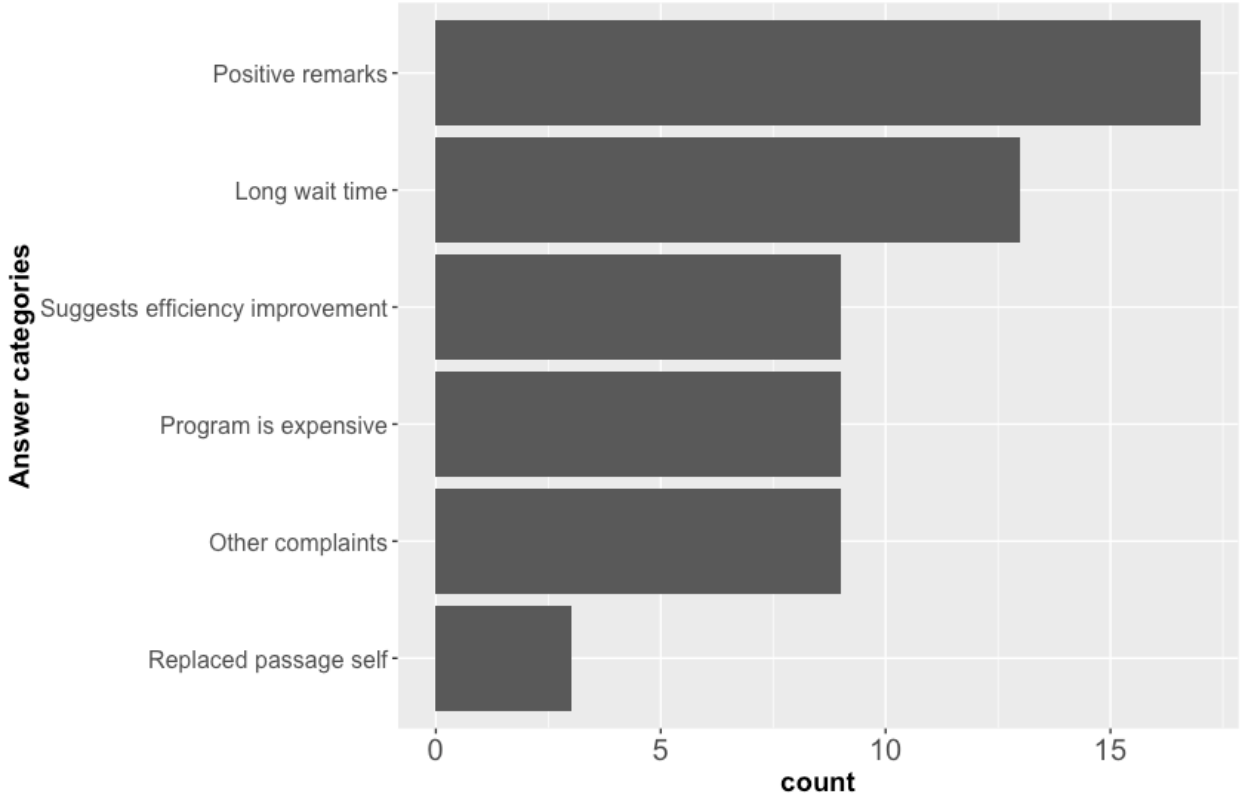

Figure 81. Frequency of topics brought up in open response field asking respondents how FFFPP could be improved based on their experience and what works well about it.

10.3.4.1 Summary of survey evaluations of FFFPP

- Survey results show the program is well reviewed by most. The most frequently checked comment is that respondents thought the program was a good use of public funds on their forest land. Also, from the standpoint of effective use of public funds, the fact that FFFPP applications are prioritized based on habitat considerations is an important and well-functioning feature of the program (i.e. the State can set its own priorities).
- The most common criticism is that the owners could have had the new culvert or bridge installed for less than the cost of the project that was actually paid. We can recommend the State *may* consider options to lower costs involved in replacing identified barriers, but the technical requirements of a sufficient fish stream crossing also has important biological and ecological considerations.

- A small percentage of respondents seem to indicate that the impassable barrier is preventing them from harvesting, suggesting there may be some ownerships who fall through the cracks, but overall the program is appreciated.

10.4 Alternate Plans

5 (C) (III) Have meaningful alternate management plans or alternate harvest restrictions been developed for smaller harvest units?

It is difficult to interpret what constitutes a *meaningful* alternate management plan or harvest restriction. There currently exists the 20-acre exemption for harvests on smaller parcels, a process for Alternate Plan harvest applications (sometimes called a "Full Alternate Plan"), and two templates for Alternate Plan harvest plans in western Washington (a Fixed-Width Template and an Overstocked Stand Template). One possible way to interpret if existing alternate management plans and restrictions are meaningful is if they are reasonably well understood and used by SFLOs. Another alternative standard is by exploring how those who use the alternate management plans evaluate their experience. Ultimately, we do not claim to answer whether existing alternate plans are meaningful, but instead we present an assessment of how SFLOs experience Alternate Plans.

It is also important to state that we were not able to use one of the standard tools of survey assessment for policy analysis. While using a randomized control trial or causal inference techniques (such as matching) are ideal to establish evidence for causal effects, it is ideal to ask survey respondents their opinions of existing policy *relative to alternative policies*. Essentially, a preferred economic way to assess preferences for (and opportunity costs of) policies is to ask survey respondents about a *change* to an existing policy or to compare choice scenarios with different "attributes" of a given policy. One example of asking survey respondents to make a prospective choice about policy changes is the GP survey question asking if respondents would consider entering into a conservation agreement with given conditions and a per-acre payment.

After extensive dialogue with various stakeholders, it was deemed infeasible to present SFLOs with a "prospective choice" in which buffer sizes are reduced relative to what they are now. The reason it was considered infeasible to present SFLOs with different policy alternatives is due to the complexity of existing regulations. There are five different site classes, each with different core, inner, and outer buffer widths depending on stream type. Furthermore, the buffer widths differ in western and eastern Washington. Stated plainly, there is too much complexity in the rules to ask about changes to each of the different site classes on different sides of the state AND there is too much uncertainty in the data to reliably estimate how to ask about each SFLO's site-specific buffers. Greater complexity in survey questions causes a multitude of problems, such as: higher non-response rates, answer fatigue, and difficulty of knowing if respondents answered questions according to the directions given to them. So, although question L (below) seems to ask how SFLO applications for FREP may change if SFLOs were allowed to cut closer to streams, we are not able to use preferred survey questions to estimate if and how SFLOs would substitute FREP for additional harvesting opportunities.

10.4.1 Exploration of Alternate Plans using FF survey results.

Although roughly half of all FF survey respondents said they have heard of FREP and FFFPP, 26.5% of respondents said they had ever heard of Alternate Plans. With a substantially smaller percentage of survey respondents who were aware of Alternate Plans, only 53 respondents (12% of all respondents) said they have ever applied for an Alternate Plan. Of those 53 who said they have ever submitted an Alternate Plan, 4 said they applied for an Alternate Plan but were unsuccessful. The FF survey suggests Alternate Plans have a long-run "full failure rate" of about 8% (just below 1 in 10); however, it is important to note that sometimes a single SFLO applies for multiple Alternate Plans. At least one respondent expressed in the write-in fields that he/she has done numerous Alternate Plans, but one of them was rejected. Hence, we call the 8% estimate rate of unsuccessful Alternate Plan applications the "full failure rate" since it implies the respondents have not been successful with any Alternate Plan application.

With only 53 respondents who said they applied for an Alternate Plan, we were concerned about having enough responses for statistically valid analysis. To investigate why so few FF survey respondents said they had applied for Alternate Plans, we re-checked the survey respondents against available data from the Forestland Database. As explained in the introduction to the FF survey, one of the criteria used to sample SFLOs was to select owners of parcels that have an Alternate Plan on file.[7] Using the polygon identification numbers of the parcels associated with SFLO properties, we checked to see which respondents own a land parcel with an Alternate Harvest plan on file. We obtained a Forest Practice Application dataset from the Department of Natural Resources. This layer was intersected with SFLO parcels from the Forestland Database. Inaccuracies in the parcel and FPA geometries required selection of a minimum overlap threshold to associate applications with parcels. Name and parcel identification numbers in the FPA data were compared to values in the Parcel Database to calibrate the threshold value.

Upon confirming the FF survey respondents who own a parcel that appear to have an Alternate Plan associated with the parcel, we then cross-referenced these respondents against respondents who specifically answered "No" to the question "Have you ever applied for an Alternate Plan?" We identified 110 FF survey respondents who we estimated to own a parcel with an Alternate Plan on file who said they have not applied for an Alternate Plan. We refer to the 110 respondents who, to the best of our knowledge, own parcels associated with an Alternate Plan but said they have not applied for an Alternate Plan "AP mystery respondents." We then utilize the fact that the FF survey invites respondents to write their names and contact information on the survey if they would like to be interviewed for the SB5330 project. Of the

[7] Actually, a single Alternate Plan application can involve numerous parcels, so the owner of any given parcel associated with an Alternate Plan was considered as an owner meeting the Alternate Plan criteria for the FF survey sample frame.

110 FF survey respondents who own a parcel with an Alternate Plan on file and said they have not applied for an Alternate Plan, 28 of them wrote their name on the survey. Using these 28 respondents, we then manually checked the Alternate Plan applications to see if the respondent names on the FF surveys matched the landowner name on the Alternate Plan application.

The following analysis of which respondents said they have not submitted an Alternate Plan but have their names on the Alternate Plan application is summarized in Table 44. Out of the 28 "AP mystery respondents," 5 had been incorrectly identified due to an error in matching Alternate Plans to SFLOs. Of the remaining 23, 7 respondents had bought the parcel after the Alternate Plan was approved. Of the remaining 16, 1 had not actually written their name legibly on the FF survey and an additional 2 only wrote their first names on the survey. Overall, the full names of 13 out of the 28 "AP mystery respondents" were the same on the FF survey as on the Alternate Plan application. The first names of the 2 respondents who only wrote their first names on the FF survey also matched with the first name of the owner who signed the Alternate Plan application.

Table 44. Identifying respondents who did not say they have applied for an Alternate Plan, but the name on the FF survey matches the land owner name on the Alternate Plan application.

	n respondents
All "AP mystery respondents"	**28**
Correctly identified	23
Bought after the application	7
Illegible name on FF survey	1
Only first name on FF survey	2
First and last name same on FF survey and AP application	13
Rate of "didn't know or forgot" out of identified AP applicants	46-54%

Out of the 28 respondents we identified as "AP mystery respondents" about half of them actually applied for an Alternate Plan, but did not say they had applied for an Alternate Plan on the FF survey (called "don't know or forgot" in Table 44). Recall there are a total of 110 FF survey respondents who we were able to identify as "AP mystery respondents" but only able to confirm the names of 28. The results from Table 44 suggests as many as half of the 110 "AP mystery respondents," or about 55 respondents, actually have applied for an Alternate Plan, but either did not know it or have forgotten about it. To put that in perspective, we estimate there may be as many FF survey respondents who have applied for an Alternate Plan and did not know or forgot about it as there are respondents who said they have applied for an Alternate Plan.

Of the 13 FF survey respondents for whom we can confirm the same first and last names on the survey as on the Alternate Plan application, all of them were approved, but two of them were revised from the original application. Ten of the applications used one of the two westside templates, and 3 were so-called “Full Alternate Plans” for hardwood conversion that required ID team visits.

It is not straightforward to interpret the results from Table 44. On one hand, Alternate Plans are by far the instrument that FF survey respondents are least familiar with and it is hard to see how they are a “meaningful” option for SFLOs if so few know it is even an option. On the other hand, SFLOs do not need to be aware of Alternate Plans in order for them to be applied in harvesting operations on their forest lands. It is not intuitive that SFLOs can be unaware that an Alternate Plan was carried out on their land, but we suspect the high estimated frequency of SFLOs who “didn’t know or forgot” that an Alternate Plan harvest occurred is due to the highly technical nature of Alternate Plans. Most SFLOs need to use contractors for harvest operations on their lands, and it is most likely that the contractors take care of many details of the harvest operation without the landowner being involved in all aspects of the harvest. One way of thinking about it is that asking SFLOs about Alternate Plans is like asking people what kinds of tax deductions they took on their income taxes last year. Filing personal income tax can be difficult and complicated. Many people may not remember a specific detail of their tax returns when asked, even though they were involved in preparing the overall tax return. In summary, forest management is now a highly professionalized business and the details of Alternate Plans, as many other details of forest management, appear to be handled by the professionals in many Alternate Plans.

With the caveat that perhaps as many FF survey respondents have had Alternate Plan harvests conducted on their property and are unaware of it as there are respondents who report they have applied for an Alternate Plan, we present evaluations of how FF survey respondents evaluate Alternate Plans. Of the 53 respondents who said they have ever applied for an Alternate Plan, only 12 did not indicate they used a template for the Alternate Plan. With only 12 respondents who appear to indicate they have only done ”full Alternate Plans” it is difficult to draw conclusions specifically about non-template Alternate Plans from the FF survey. Much of the analysis we present, therefore, applies to either Alternate Plan templates or SFLOs who have applied for both Alternate Plan templates and “full Alternate Plans.” Checking for differences in average forest ownership size shows respondents who said they have applied for an Alternate Plan own an average of 614 forest acres compared to the 122 average forested acres owned by respondents who did not report submitting an Alternate Plan. The difference between average acres owned is significant at the 1% level using a Welch two-sample t test ($t = -3.426$, $df = 50.888$, p-value = 0.00122).

Considering only respondents who said they have ever applied for an Alternate Plan, Figure 82 shows the distribution of answers to the question “what was your overall experience of the

[Alternate Plan] application process?" Slightly less than half of the 53 respondents who said they have ever applied for an Alternate Plan said their experience with overall process was positive, slightly less than 1/3 of respondents said their experience was neutral, and slightly more than 1/5 of respondents said the experience was negative. We again note that Figure 82 largely reflects the opinions of SFLOs who have used Alternate Plan templates for at least one of their Alternate Plan harvests.

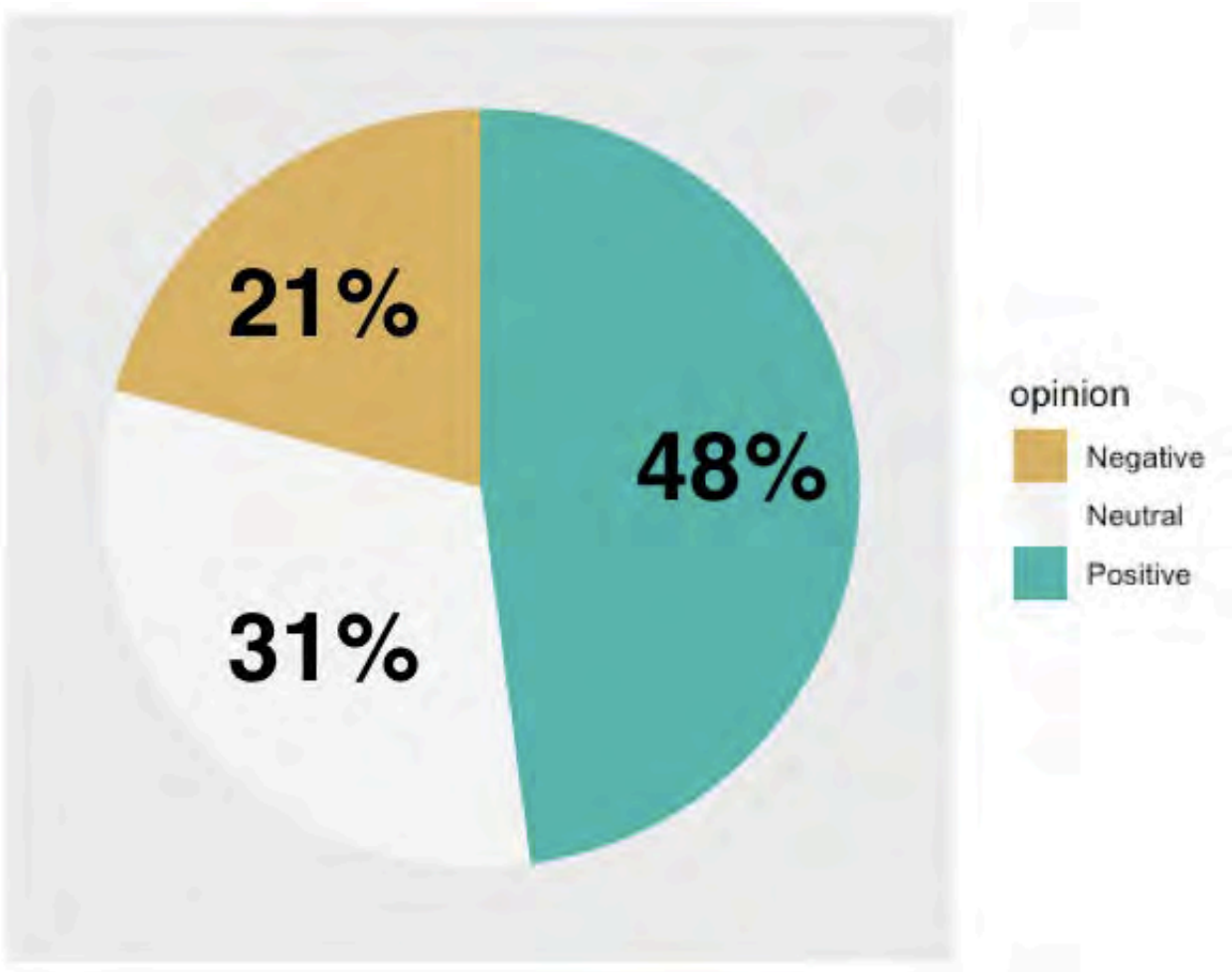

Figure 82. Evaluations of the overall experience of applying for an Alternate Plan, only considering the 53 respondents who report ever having applied for an Alternate Plan.

Respondents were asked "if you have ever applied for an Alternate Plan, please indicate what went well about the process?" Figure 83 shows the frequency of opinions expressed by respondents about what went well about the Alternate Plan. Almost half of respondents who said they have applied for an Alternate Plan (25 out of 53 respondents) said the income was important to them and their household. The second-most frequently checked opinion (22 out of 53 respondents) was "I think the process and outcome were reasonable." Nineteen respondents said they like that the Alternate Plan template simplified the process. Reflecting

the fact that some SFLOs who apply for Alternate Plans tend to perform many Alternate Plans, 17 respondents indicate they intend to apply for additional Alternate Plans. Of importance to if respondents think about FREP as an alternative to Alternate Harvest plans (as opposed to as complementary or completely separate) 12 respondents said they prefer harvesting with an Alternate Plan *instead of* applying for FREP while 16 respondents said they like that they can harvest with an Alternate Plan *and also* apply for FREP.

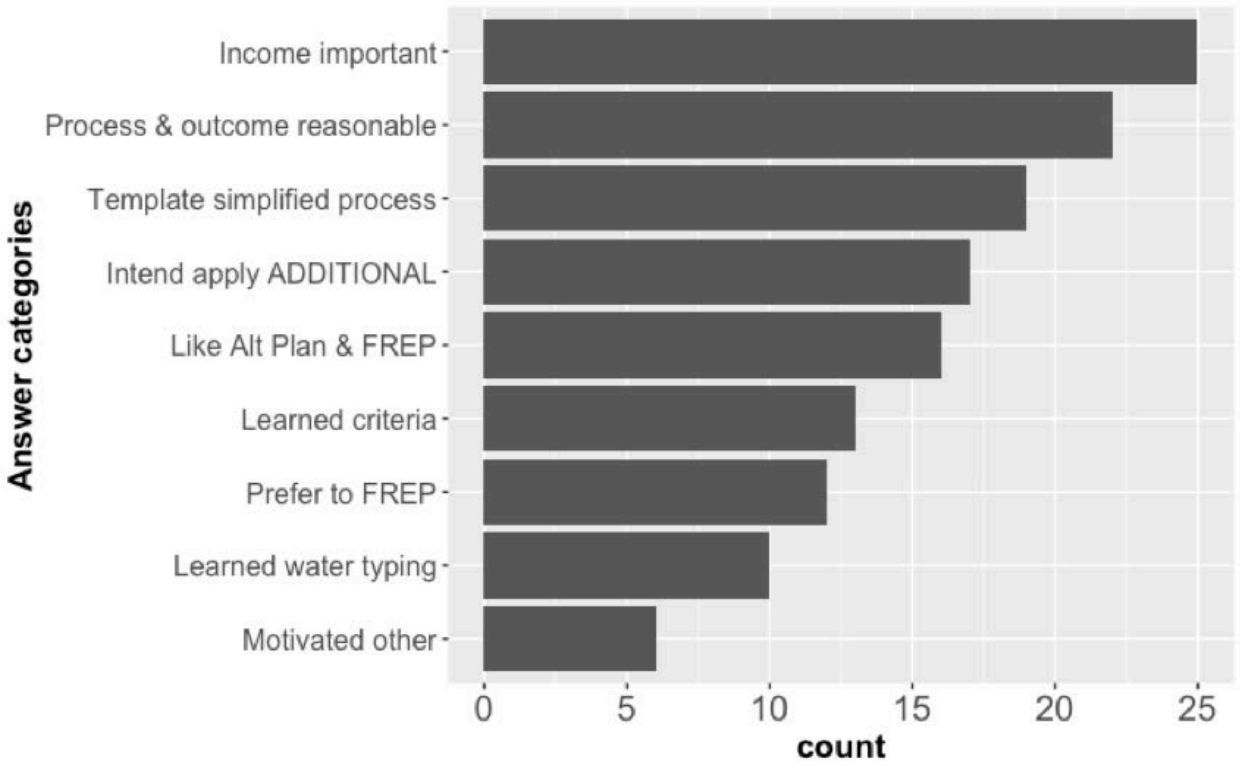

Figure 83. Opinions of what went well about the Alternate Plan process, for respondents who said they have ever applied for an Alternate Plan.

A separate question asked respondents "if you have ever applied for an Alternate Plan, please indicate what could be improved about the process?" Figure 84 presents the frequency of opinions express about what respondents felt can be improved about the Alternate Plan application process. By far the most common comment was respondents wish they could have harvested more than the Alternate Plan allowed (28 respondents). In fact, the only comment expressed by the majority of respondents who said they applied for an Alternate Plan is they wish they could have harvested more than the plan allowed. The second and third most frequently expressed opinions were that the process took too long (12 respondents), and that respondents wish they had more assistance throughout the process (13 respondents). Nine respondents (or 17% of those who said they have ever submitted an Alternate Plan) said they did not think the Alternate Plan was evaluated fairly. For context, 41.5% of respondents said they thought the process and outcome were reasonable.

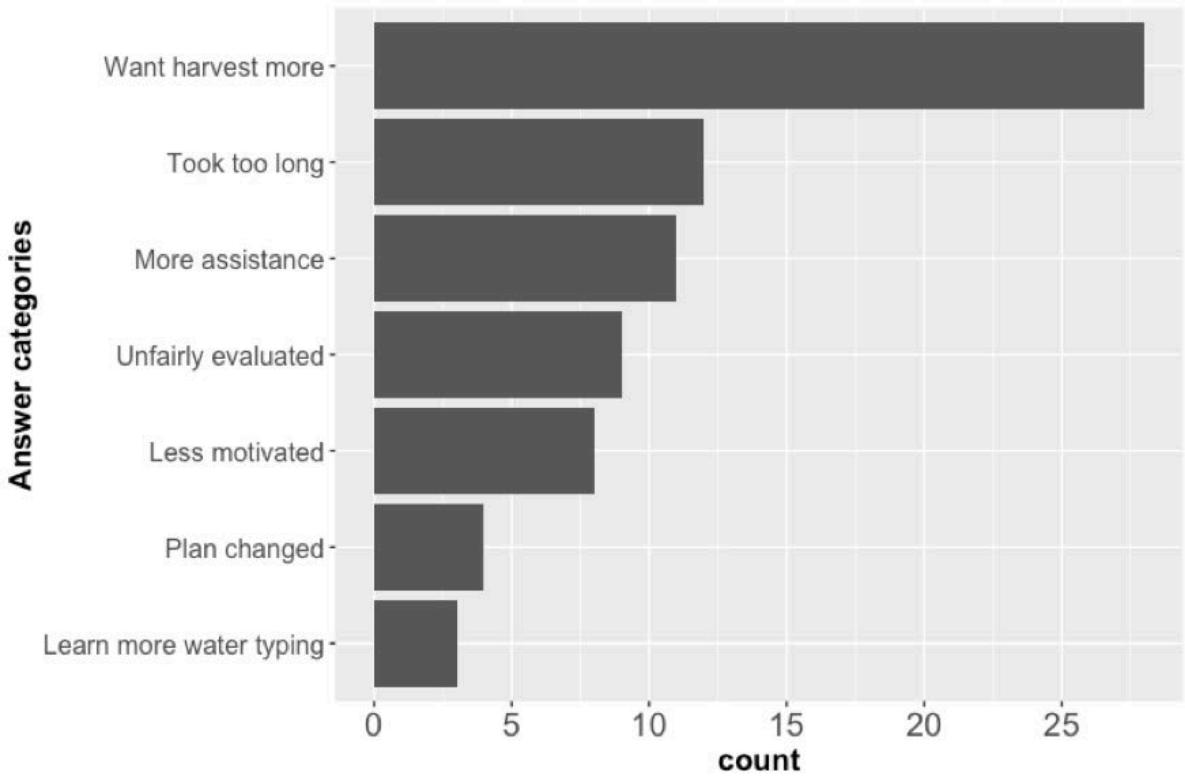

Figure 84. Opinions of what could be improved about the Alternate Plan process, for respondents who said they have ever applied for an Alternate Plan.

We also offered respondents an open comment field to express what went well about the Alternate Plan process and what could be improved; however, these field were almost always used to offer critiques of the Alternate Plan process. Although 21% of respondents who said they have applied for an Alternate Plan said they had a negative experience with the process, 38% (20 respondents) offer a written critique of process. By far, the most common write-in comments concern the general difficulty of the process and/or rules as well as expressions of how limiting the existing rules are in terms of what the land owner can do with the trees. Four write-in comments seem to indicate positive aspects of the Alternate Plan process. Some examples of apparently positive remarks are given below:

> *"Alternate Plans can seem overwhelming but [are] worth the process."*

> *"My family hired a forestry consultant who took care of this process. Because of his knowledge the process went well."*

> *"I felt I had good technical assistance from my forester. But could have been led astray by other agencies other than DNR with regard to hardwood converting."*

The following are some examples of generalized comments about complexity and difficulty:

> *"Too complicated, too many players involved."*

> *"As stated before, attempting to be compliant is difficult."*

> *"It does take a lot of work and time to document what is there now and what you plan to do, not an easy process. Need more templates for several different sections."*

Related to the issue of complexity and difficulty, some respondents expressed concerns about the restrictive nature of Alternate Plans. Some examples of comments about the restrictive nature of what is allowed to be cut with an Alternate Plan are given below:

> *"Felt the required set back was more extensive than it needed to be."*

> *"Too many restrictions to the point that it was not economically feasible."*

Two write-in comments in particular make a point of time-inconsistencies in how Alternate Plans have been administered.

> *"We had 2 alternate plans approved in the early years. In both cases a DNR forester from the SFLO [Office] was assigned to help us. Now there seems to be less assistance and cooperation. I've been told an option I want to pursue has no chance of approval, but others in the state have gotten similar plans."*

> *"I have done many Alternate Plans and every time the agencies and tribes add more arbitrary conditions and restrictions."*

As stated previously, there seem to be few FF survey respondents who have only applied using so-called "full Alternate Plans" that require more detailed applications and a site team visit. We use two ways to check if respondents who seem to have submitted only "full Alternate Plans" have substantially different evaluations of the overall process. First, since there are no Alternate Plan Templates available for SFLOs in eastern Washington, we look at only

respondents who said they have applied for an Alternate Plan and have forest land only on the eastern side of the state (6 respondents). Of the 6 respondents, 1 was “negative,” 3 were “neutral,” 1 was “positive,” and 1 did not evaluate the process. The second check we used was by looking only at respondents who said they have applied for an Alternate Plan but did not indicate they used a template (12 respondents). Of those 12 respondents, 2 were “negative,” 2 were “neutral,” 6 were “positive,” and 2 did not evaluate the process. Although we have very few respondents who appear to have only used “full Alternate Plans,” there is no evidence that such respondents are more negative in their overall evaluation of the application process relative to respondents who used at least one Alternate Plan template.

We now turn to a question that asks respondents “if you have never applied for an Alternate Plan, why not?” Figure 85 shows the frequency of reasons respondents gave for why they have not applied for Alternate Plans. By far the most common reasons given for not applying for an Alternate Plan are that respondents “need more information about these plans” (134 respondents) and “I am not interested in harvesting in my riparian forest land” (115 respondents). The distant third and fourth most frequently given reasons are that the plans are either too complicated (50 respondents) or because of lack of technical assistance to apply (42 respondents). Regarding if SFLOs think about FREP and Alternate Plans as unrelated, complementary, or substitute options, 23 respondents say they decided to apply for FREP instead of submitting an Alternate Plan. One of the least often checked reasons for not applying for an Alternate Plan (16 respondents) is that “I don’t think Alternate Plans are fairly evaluated.”

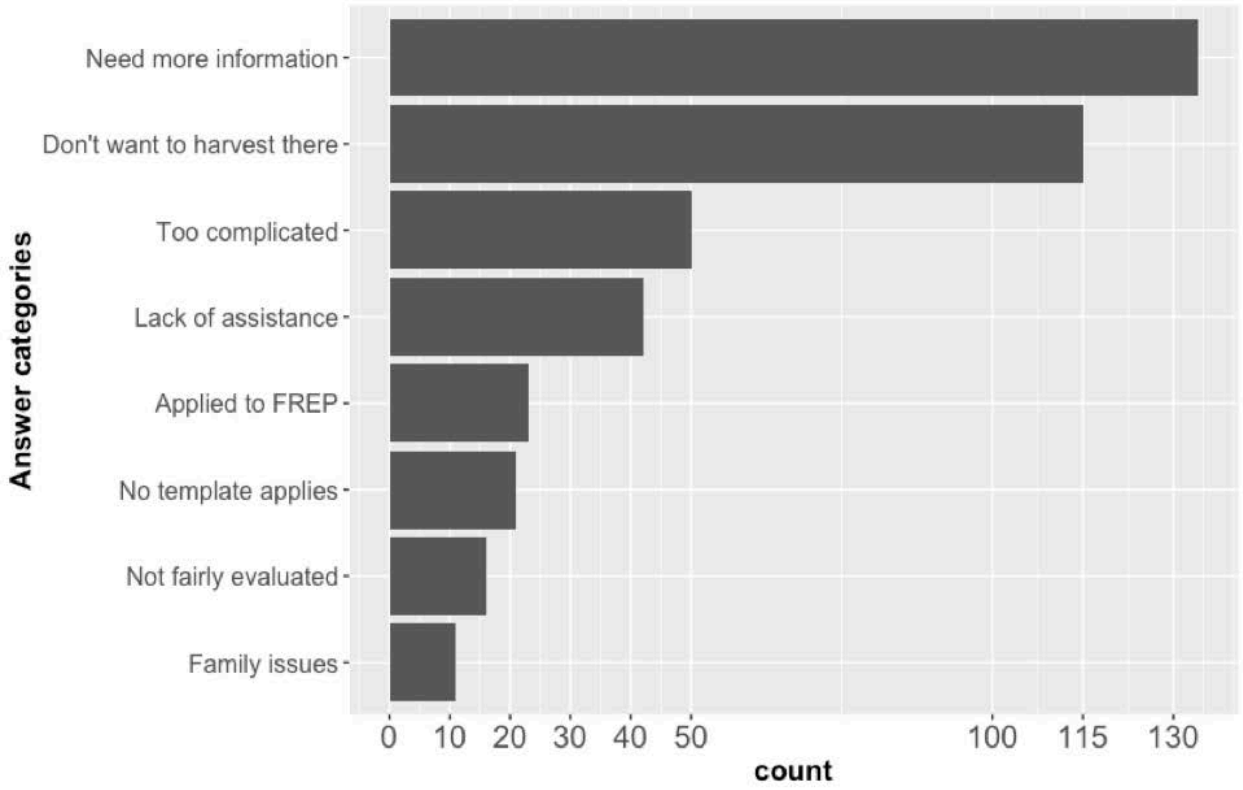

Figure 85. Reasons given for never applying to an Alternate Plan.

We also offered respondents an open text field to say why they have not applied for Alternate Plans. As with the options presented in Figure 85, comments that respondents had not heard of Alternate Plans were common in the open text field responses. Two examples about general lack of awareness are given below:

> *"Didn't know there was such a thing as an Alternate Plan. The DNR certainly never mentioned it."*

> *"Didn't know it existed. I have a small creek through my land that I want to see protected."*

Some respondents indicated they may be willing to learn more about Alternate Plans or wish they had known about them before making other decisions (example below).

"Alternate Plans were not available when applied for FREP or [was] not aware of them..."

A small number of write-in responses were more specific in their reasons for not applying for Alternate Plans (two examples below).

"The cost and time it takes does not seem to pencil out. How do you prove your plan is as good or better than standard buffers?"

"The DNR had given us an approved permit. Once [another ID team member] got involved they changed their mind..."

Although we anticipated some landowners to have purchased their properties knowing about the riparian regulations, only one respondent specifically wrote a comment to that effect. One other respondent also stated that they shifted their management plans to non-riparian areas (both comments below).

"I purchased my riparian forest land with knowledge that I should leave a 150' buffer for streams and wetlands."

"We have concentrated our harvest avoiding riparian areas."

Since Alternate Plans were created to provide some relief to the SFLOs who are disproportionately negatively impacted by Washington's riparian forest regulations, we checked to see how respondents who said they have applied for Alternate Plans evaluated the overall impact of the riparian regulations on their ownership. Specifically, we focus on the question "*Considering financial aspects only*, how would you describe the impact that riparian regulations since 1999 have had on your forest ownership in the State of Washington?" Figure 86 shows the perceived financial impact of riparian regulations of the 53 respondents who said they have ever submitted an Alternate Plan. Figure 86 shows that respondents who say they have applied for an Alternate Plan have an overwhelmingly more negative evaluation of the impact of riparian regulations relative to all other respondents. For comparison, Figure 87 shows the perceived financial impact of riparian regulations for respondents who did not say they have applied for an Alternate Plan.

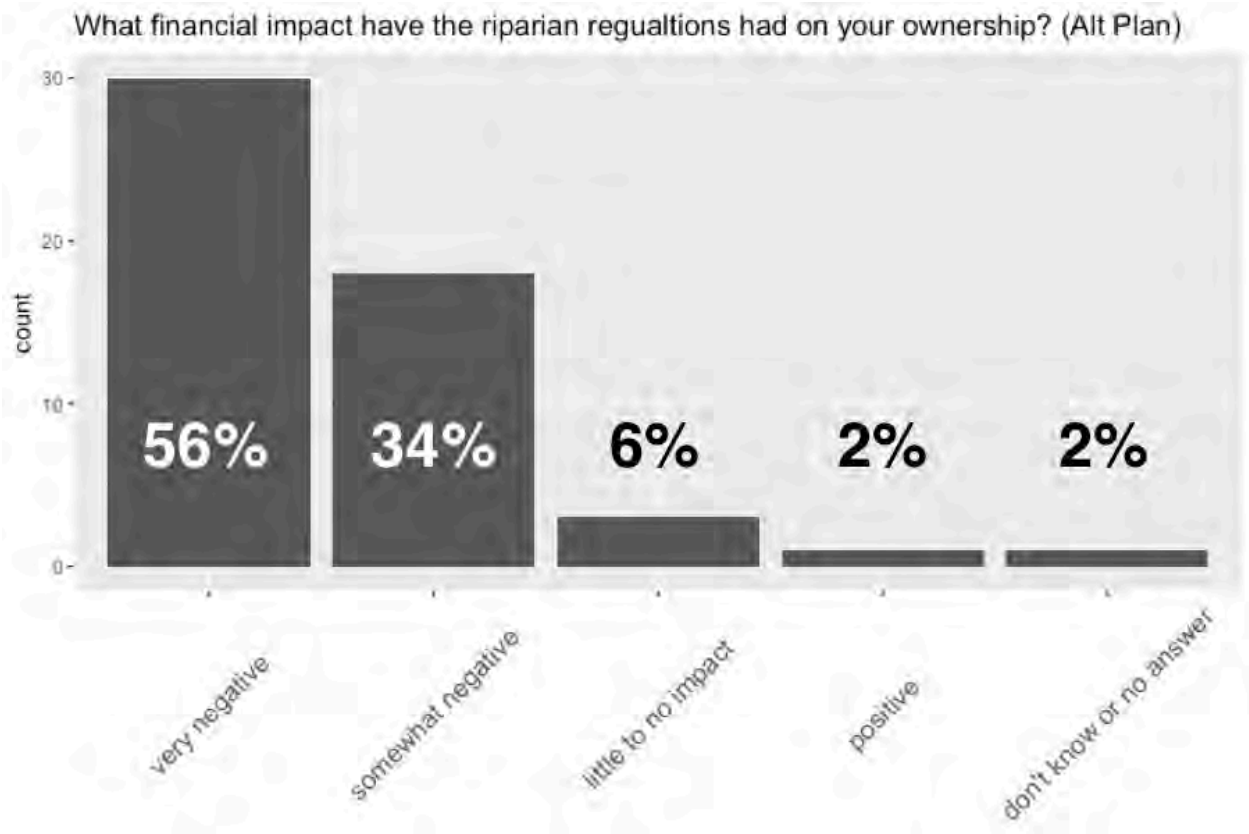

Figure 86. Evaluation of the financial impact that riparian regulations have had on respondent's forest ownership. Only for respondents who say they have ever applied for an Alternate Plan.

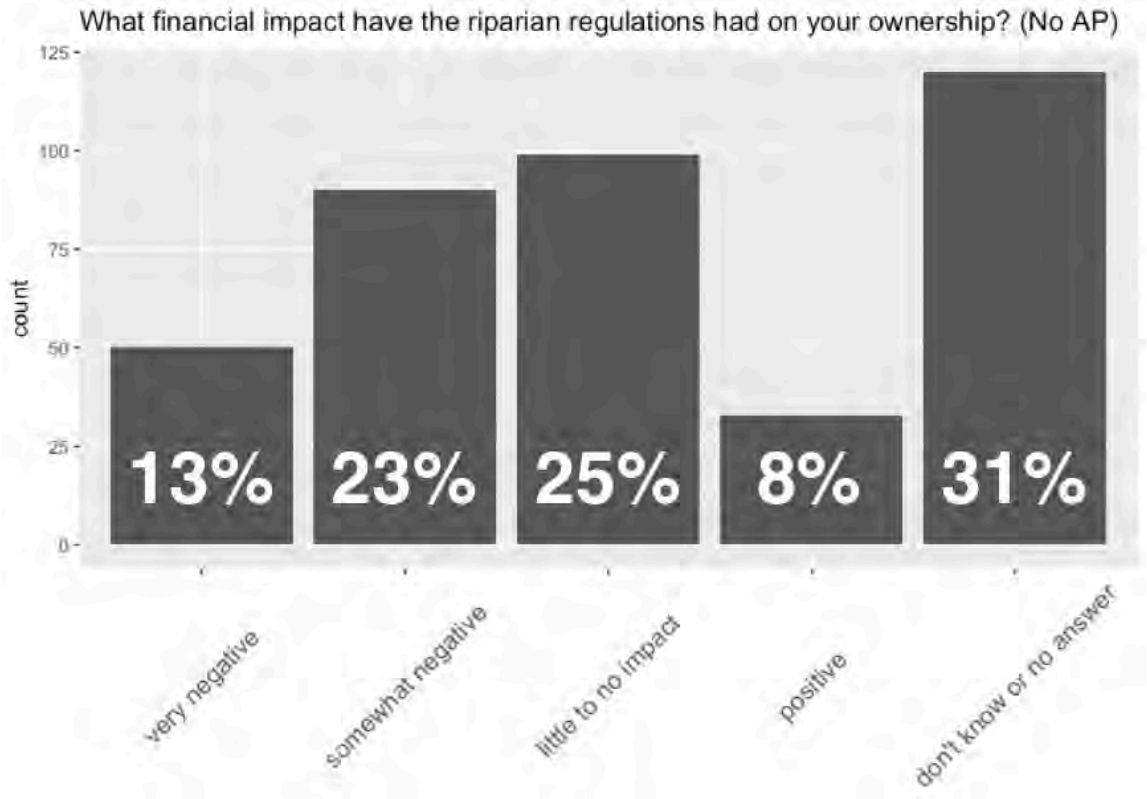

Figure 87. Evaluation of the financial impacts that riparian regulations have had on respondent's forest ownership, for respondents who did NOT say they have applied for an Alternate Plan.

Of the 80 respondents who said the regulations have had a "very negative" financial impact on their forest ownership, 30 of them (or about 38%) say they have applied for an Alternate Plan. Fully 90% of respondents who say they have applied for an Alternate Plan say the impacts of the regulations on their ownership have been either "very negative" or "somewhat negative" compared to 36% of all respondents who did not say they have applied for an Alternate Plan. While 33% of respondents who did not say they have ever applied for an Alternate Plan said the regulations have had "little or no impact" or even a "positive" impact, only 8% of respondents who say they have ever applied for an Alternate Plan said the same. Also of note is that 31% of respondents who do not say they have ever applied for an Alternate Plan don't know or did not answer the question about financial impacts from riparian regulations but only 1 respondent (2% of respondents who say they have applied for an Alternate Plan) said the same. The differences between Figure 86 and Figure 87 are significantly different at the 1% level using a chi-squared difference of proportion test (X-squared = 76.857, df = 4, p-value = 8.063e-16).

10.4.1.1 Summary of survey results regarding alternate plans

- The low number of FF survey respondents who said they have ever applied for an Alternate Plan prompted us to check on respondents who did not say they had applied for an Alternate Plan but appeared to own a parcel associated with an Alternate Plan application.

While 53 respondents said they have ever applied for an Alternate Plan, we estimate that about the same number of respondents have actually used an Alternate Plan but did not know about it or do not remember it.

- Respondents who said they have ever applied for an Alternate Plan, on average, own substantially larger forest properties than respondents who did not say they have applied for an Alternate Plan. Recall, respondents with larger properties, on average, have significantly more negative evaluations of the financial impacts the regulations have had on their ownership.
- The majority of respondents who said they have applied for an Alternate Plan (about 4 in 5) had a non-negative evaluation of the overall application process. While 22 respondents said the process and outcome of the Alternate Plan application were reasonable, 20 respondents offered at least some criticism of the process. Overall, the most common critiques of Alternate Plans can be summarized as follows: Alternate Plans are complicated and difficult and at the end of the process SFLOs don't get to harvest much more than existing regulations allow.
- Although only about 1 in 5 respondents who said they have applied for an Alternate Plan have a negative evaluation of the process, respondents who say they have applied for an Alternate Plan are overwhelmingly negative in their evaluation of the financial impacts that the riparian regulations have had on their forest ownership. The negative evaluation of the financial impact of the regulations is likely also related to the larger average forest ownership sizes of respondents who say they have applied for an Alternate Plan. In other words, results suggest SFLOs who take the time to educate themselves about the regulations and take sufficient interest in the Alternate Plan application process may be among the owners who feel most negatively impacted by riparian regulations.
- Based on the FF survey, complaints about inconsistencies in how Alternate Plans are evaluated do exist, but they are fairly uncommon. By far the most common reasons for respondents not applying for Alternate Plans is lack of awareness about the option or simply not wanting to harvest in one's riparian zones.
- It is clear from DNR data as well as the FF survey that many SFLOs use Alternate Plan templates and relatively fewer do "full Alternate Plans." In that regard, Alternate Plan templates appear to facilitate many harvest operations and have likely had the effect of reducing the time and effort required to apply for Alternate Plans (so-called transaction costs in economic literature). Again, we do not claim to be able to answer if existing Alternate Plans are meaningful, but Alternate Plan templates seem to meet the criteria of relatively wider adoption compared to "full Alternate Plans." However, overall awareness of Alternate Plans as a management alternative is substantially lower than awareness of FREP, FFFPP, and the existence of the SFLO Office as a source of support.

10.4.2 Understanding Alternate Plans from Stakeholder Interviews

The alternate plan process received more commentary than the other assistance programs in our interviews. For all stakeholders, the concept of alternate plans for SFLOs is a beneficial thing. The implementation of the alternate plan process, the available templates, and Interdisciplinary Teams (ID Teams) resulted in many different perspectives, ranging from "heartache" to a "good process." Overall, across stakeholder groups a single positive aspect is detected: the alternate plan process allows for regulatory flexibility for SFLOs. Amongst stakeholder groups, other positive benefits are that alternate plans keep SFLOs financially viable in forestry and that these plans can help the RMZ. The negative perceptions of alternate plans across stakeholder groups—except for the unaffiliated landowner group, which several of the interviewees were unfamiliar with the alternate plan process—are that alternate plans are too complex for landowners who are not trained in forestry and the process is intimidating even for those who are familiar. Other negative perceptions from individual or two stakeholder groups included that the monitoring and follow-up is poor, some consulting foresters will not help with alternate plans due to complexity, professional help from a consulting forester makes an alternate plan minimally, if at all, financially viable, and ID Teams are inconsistent, and that alternate plans are not financially feasible for Eastern Washington.

For the extension stakeholder group, the interviewees overall had positive perceptions about the alternative plan process. One extension officer suggested that active management would achieve the objectives, in terms of future desired conditions, better than alternate plans. Another acknowledged the complexity of alternate plans for landowners due to a lack of experience in timber management. This interviewee accredited this complexity and lack of experience to the intimidation that some landowners may have concerning the alternate plan process.

> *"I think it's, it's needed. I think it's good. I think it also makes it there's always a challenge when a landowner can't just go and look up the forest practices rules that apply to them."*

State employees stated that alternate plans are a good thing, specifically highlighting templates and the flexibility that all alternate plans provide to the landowner. One interviewee stated that alternate plans are becoming more common and increased usage should be considered a win. This state employee also recognized that landowners may feel a "little disconcerted" with alternate plans due to the "arduous process," amount of time, and ID Teams. State employees also agreed that alternate plans are complex while also acknowledging that alternate plans are complex since they are specific management deviations from the rules, making the complex process necessary. Our interviews also indicated that the SFLO Office no longer has the

"expertise" in the form of enough staffing to help with the alternate plan process. Similar to the affiliated landowners, a state employee noted that there is no alternate plan template for Eastern Washington and that a template would be well adopted. Finally, several state employees thought that the SFLO Office does not have the resources to adequately monitor alternate plans, as required by statute, and that DNR has been "trying to institute a real robust monitoring plan for alternate plans."

> *"It's something that landowners feel a little disconcerted about because of the amount of time and this process and having to have ID teams and that sort of thing. But I think those are necessary."*

Affiliated landowner interviews suggest interviewees valued alternate plans but had frustrations about several components of the process. First, several affiliated landowners indicated that the alternate plan process is complex and "very intimidating." A couple of the interviewees stated that their consulting foresters will not conduct an alternate plan due to their complexity. For those whose consulting foresters will complete an alternate plan, interviewees suggested that alternate plans will not increase profit marginally due to the incurred costs of having a consulting forester. The alternate plan would need to include high-value timber to be financially feasible rather than a loss. These interviewees also said that Eastern Washington, with its lower timber values, does not have financially beneficial alternate plans when using a consulting forester. For one interviewee who is otherwise employed, the alternate plan process forced them to take time off multiple times when the first ID Team did not work out well and cost them by bring their forester back in for support and in the form of facing the "hostilities" of the ID Team again. For those who do not have a consulting forester and conduct the alternate plan themselves, state that the process takes up a great deal of time. A retired affiliated landowner completes the alternate plans on their own time and says that it would be "tough" to having a consultant do the work. This interviewee also said that without the alternate plan process, "we would lose our family."

With ID Teams, interviewees have had mixed experiences, from hostile to mutually beneficial. One affiliated interviewee spoke of a time when a member of an ID Team requested that the interviewee do an inventory of their alternate plan zone only to be told by the ID Team member that "we can't trust you people." Another interviewee said that it was a learning experience for the members of the ID Team and for the landowner, and the process was enjoyable. The main complaints concerning ID Teams are that the teams are inconsistent, and the results depend on who speaks the loudest or what kind of mood the team is in.

For the templates, affiliated landowners again have mixed opinions. The overstocked stand template is considered good; however, it is not used much and not economically viable. The

fixed width buffer template is considered easy, but some interviewees suggest that it leaves more buffers than less in some situations. Overall, the affiliated landowners are supportive of templates, but they would like a simpler option and a template for Eastern Washington.

> *"But the intimidation, the personal, I was very intimidated and now I only did it because I had done a lot of research. And I wanted to learn more about the process. I wouldn't of benefit out of it. You know, and I in hindsight, I do believe they helped me. But did I have a lot of fear in doing that? Yes, I did. If I was an, more of an average small landowner, not involved and not caught up in all of this policy stuff, I wouldn't have done it for anything."*

Only a couple of our unaffiliated landowners were familiar with alternate plans. Those who said that they were familiar have a positive perception of alternate plans though note that the process is complicated, and that follow-up is poor.

10.4.3 Would meaningful alternate harvest restrictions reduce the financial burden on the forest riparian easement program?

We repeat the previous caveat that the complicated nature of site-specific riparian harvest restrictions led us to forgo the preferred stated preferences survey methods to explore potential changes in SFLO harvesting behavior under revisions to existing alternate harvest restrictions. Instead, we restrict our discussion to inferring based on existing alternate harvest restrictions. There are some respondents who indicate they prefer harvesting using an Alternate Plan instead of applying for the Forest Riparian Easement Program (12 out of 53 who said they have ever applied for an Alternate Plan). There are some respondents who say they applied to FREP after considering Alternate Plans or perhaps even attempting one without success. We also find, however, that some respondents say they can apply for Alternate Plans *and* apply for FREP (16 respondents).

Using the parcel database, the correlation between parcels with a FREP application (paid or on the waiting list) and those that have applied for an Alternate Plan is positive. *In other words, Alternate Plan applications and FREP applications tend to co-occur* instead of parcels having EITHER an Alternate Plan application or FREP application. Based on existing data, without being able to assess specific changes to alternate harvest restrictions, most SFLOs do not perceive an "either/ or" choice between FREP and Alternate Plans. If a "meaningful alternate harvest restriction" means making the Alternate Plan process easier for SFLOs, then evidence does not suggest there will be a substantial decrease in FREP applications, although some ownerships will likely decide not to apply for FREP. Without presenting estimates of budgetary or personnel needs, we note efforts to increase SFLO use of existing Alternate Plans would likely entail at least some additional cost to the State. Such additional costs associated with increasing SFLO

use of existing Alternate Plans include, but would not be limited to: outreach and education to raise awareness of Alternate Plans among SFLOs, assistance to SFLOs to complete Alternate Plan applications, and, if the volume of applications increase sufficiently, additional staff to review Alternate Plan applications.

From another standpoint, FREP compensation is based on the difference between the estimated financial value of harvestable timber using pre 1999 buffer sizes compared to current buffer sizes. If “meaningful alternate harvest restrictions” means allowing smaller buffers, then reducing buffer size should reduce the amount of forest that would need to be included in calculating most FREP compensation payments. Reducing buffer sizes on small forest land could therefore have the effect of reducing the amount of money paid for most individual Forest Riparian Easements. As informal stakeholder conversations revealed, the argument that allowing SFLOs to cut closer to streams can reduce the cost of FREP is sometimes used as a talking point to advocate for smaller buffers.

11 SFLOs and Carbon Markets

This section provides an overview of carbon policy options for small forest landowners. In sum, existing carbon crediting standards are not likely to be appealing to a vast majority of SFLOs, although those on the larger end of the holding size distribution may be able to find it beneficial to participate in offset programs as a part of, for example, California's carbon market. Overall, the question of whether the State should invest significant resources into a program rewarding carbon sequestration on SFLO lands depends on what type, if any, broader carbon market policy is adopted at the State level. It seems more feasible to pursue other alternatives for compensating SFLOs for the carbon value of their forests other than participating directly in voluntary or compliance offsetting programs, for the time being at least.

11.1 Carbon Markets Executive Summary

In 2019, the Washington State legislature approved ENGROSSED SUBSTITUTE SENATE BILL 5330 "SMALL FORESTLAND OWNERS—ANALYSIS". This legislation calls for the University of Washington to submit an analysis to the Washington Forest Practices Board reviewing policy options and effectiveness related to the effectiveness of forest conservation and management policies, including an explicit consideration of forest carbon markets and policy options related to small forestland owners:

(5)(b)(iv) Could a program be developed to facilitate small forestland owner's participation in carbon markets?

...

(7) The policy analysis must use the trends analysis, the regulatory impact analysis, and other data to provide recommendations on ways the forest practices board and the legislature can provide more effective incentives to encourage continued management of nonindustrial forests for forestry uses, including traditional timber harvest uses, open space uses, or as part of developing carbon market schemes.

This report offers a brief review of the history of carbon offset and conservation incentive policies that are most relevant to the development of a program to facilitate increased adoption of activities by small forestland owners that would contribute to the drawdown of atmospheric carbon (and avoid carbon release due to forestland conversion). It includes discussion of both offset and non-offset policy approaches, describes the strengths and weaknesses of existing initiatives, and highlights emerging efforts to resolve longstanding barriers for small forestland owners.

To address the implicit motivation behind (5)(b)(iv): Yes, State-level programs could be developed to effectively facilitate additional carbon sequestration by small forestland owners. One of the first decisions lawmakers and State agents must resolve is whether the policy goal is fundamentally to facilitate landowner participation in carbon (offset) markets, or rather to more generally facilitate adoption of forest practices that increase carbon storage and sequestration in forests and wood products by landowners (whether or not they ultimately sell carbon offsets). In other words, Small Forest Land Owners (SFLOs) may not need to participate in actual carbon offset markets to be compensated for the carbon value of their forests and forest management practices. The nature of markets and the supporting incentive policies and programs the State could employ to facilitate landowner access to are diverse and evolving.

It is also critically important to distinguish which desirable behaviors incentives and markets will plausibly catalyze, and for which they will likely be ineffective. The best available data and science indicate carbon incentives and markets would be unlikely to substantially alter the conversion of forested lands to developed uses; in contrast, incentives or markets appear much more likely to facilitate substantial adoption of improved forest management and afforestation/reforestation actions if they are well-designed and adequately and sustainably funded.

Innovation continues in the realm of voluntary and compliance carbon offset schemes focusing on resolving systemic barriers confronting small landowners and overcoming legitimate legal and policy constraints involved with offsets. However, no offset market initiative in the USA involving small landowners keeping forests as forests has ever progressed beyond a pilot phase (although the most recent wave of initiatives are attracting investment at a much larger scale than similar efforts that preceded them in the past decade). Ultimately, the current high fixed

costs for participating in a carbon offset program will likely exclude the vast majority of Washington State SFLOs from participating. Programs to bring many SFLOs together to enter an offsetting program as a group are the only foreseeable way to achieve the substantial economies of scale required, but such aggregation initiatives are still far from ready for widespread adoption or endorsement by the State.

In contrast, direct incentive and pay-for-performance programs supporting conservation and sustainable management practices have historically proven to be much more accessible and shown much higher participation rates among non-industrial private landowners. These non-market and market-adjacent policies are likely to provide the most instructive framework for the State to design new policies that would be both cost-effective and accessible for small landowners. We encourage any carbon-driven policies enacted by the State to be designed so that the State does not assert control or ownership of carbon stocks or benefits accomplished by SFLOs, which could preclude them from future participation in offset markets, if current barriers to SFLO participation are resolved.

11.2 Prevailing Approaches to Forest Carbon Incentives

Conceptually, forest carbon incentives can be described within five major categories. These categories are not all mutually exclusive, and several programs may be considered hybrids that span multiple categories:

1. Voluntary offset crediting programs
   Carbon offset credits are sold to voluntary buyers. Credits are typically generated through a third-party certification program. Port Blakely's carbon offset project is a clear example of this type. Although the Nisqually Land Trust was certified under the California Compliance Offset Protocol, it sold credits to Microsoft outside of any regulatory mandate, so could also be considered a voluntary carbon market project. Similarly, Amazon recently announced (Palmer 2020) it would contribute $10 million to a family forest pilot project in Pennsylvania led by The Nature Conservancy and American Forest Foundation.

2. Compliance offset programs
   Carbon offset credits are sold to buyers (or middlemen) who intend for these credits to ultimately be surrendered by a company to comply with a regulatory mandate. For Washington forest owners, access to compliance carbon markets is currently limited to California's cap-and-trade program. The projects by the Colville and Spokane Tribes in Washington State are clear examples of this type.

3. Practice-based payment programs
   Landowners receive payments under short-term contracts based on the adoption of specific practices or activities. These types of programs are often known as cost-share because they generally subsidize rather than completely fund the conservation or management activity. Longstanding examples funded by the US Farm Bill include the Environmental Quality Incentives Program (EQIP), Conservation Reserve Program (CRP), and Wetland Reserve Program.

   Cost-share practices are often designed with multiple conservation or improved management outcomes in mind, and many practices covered by existing programs affect forest carbon sequestration. Carbon sequestration often occurs as a "co-benefit" of these conservation programs and incentives. A review prepared by American Forests to support forthcoming recommendations by the Carbon Sequestration Advisory Group to Washington Department of Natural Resources identifies that as of 2017, 10,903 CRP contracts were active in Washington State covering 1.2 million acres; EQIP has provided $6.2 M for 1,287 separate forest management or "timber stand improvement" contracts, and $5.2M for 1,764 reforestation projects (Kittler In Preparation).

4. Performance-based payment programs
   Landowners receive payments based on indicators directly or indirectly related to the perceived cost or value of a desired conservation outcome. Carbon may be a "co-benefit" and is not necessarily the performance indicator used to specify a payment rate. The Conservation Stewardship Program (CSP), in addition to practice-based cost-share payments, offers per-acre payments for activities such as "Planting for high carbon sequestration rate" and "Increase on-site carbon storage". To date, CSP and carbon incentive payments under Farm Bill programs have seen little-to-no use in Washington State, although the framework for doing so is technically present.

   The Family Forest Carbon Program launched by American Forest Foundation and The Nature Conservancy (American Forest Foundation 2020) and the NCAPX (Natural Capital Exchange) program launched by SilviaTerra (SilviaTerra 2020; Parisa, Nova, and Vermeer 2020) both focus on family forest owners in Pennsylvania as part of their pilot phases. These two programs follow different approaches to pay landowners for short- to medium term (1-20-year contracts) and are discussed further below.

   Other programs such as Washington's Forest Riparian Easement Program (FREP) could, in part, be considered a performance-based approach because the value of payments is related to the value of trees retained to protect fish habitat. Transfer of Development Rights (TDR) Programs, depending on implementation parameters, may also be considered as performance-based payment programs.

5. Marketing of certified forest products
   Landowners complete a certification of sustainable forest management which can be used to market certified forest products. Although these standards typically do not provide payments for specific conservation outcomes, the access to markets and, in some cases, potential for higher prices for certified wood products may represent an indirect form of a market-based conservation incentive payment. An Ecosystem Service Procedure (FSC International 2018) recently released by the Forest Stewardship Council (FSC) represents the first instance of a sustainable forest management certification offering an additional layer of certification to quantify ecosystem service outcomes, including carbon sequestration among several others. There are nearly 290,000 acres of family forest lands certified under the American Tree Farm System and nearly 200,000 acres of forest lands (not limited to family forests) certified under FSC in Washington. Several green building programs including LEED and Living Building either require or award additional points to builders for using certified wood products in their construction. When forest management certification programs require forest management practices which result in the sequestration of additional carbon relative to

common practice, they can be considered to provide an indirect or embodied carbon benefit that could be rewarded in a comparable manner to performance-based payment programs (D. D. Diaz et al. 2018).

11.3 A Brief History of Forests in Carbon Markets

The systems and standards used historically in carbon markets have generally been designed to achieve large-scale and cost-effective carbon reductions. For offset crediting, these systems and standards originated to manage risks that offset claims were invalid. It is important to acknowledge at the outset that carbon markets and offset programs have not fundamentally been designed with goals of engaging small landowners (or landowners at all). Offsets typically represent a small component (<10%) of cap-and-trade programs or are fueled by voluntary corporate initiatives related to sustainability and social responsibility. Carbon offsets and carbon markets have been designed from the outset to help polluters identify, acquire, and surrender pollution permits and generate independently-verifiable and confidently-quantified emission reduction credits at the lowest possible cost. Although there have been subsequent modifications and modest innovations in widely-used carbon market policies and programs to try and provide better access and reduce barriers to entry, increasing the engagement or participation of small landowners has never been a fundamental policy goal in the design of these programs.

When carbon offsetting began appearing in the 1990s, forest carbon projects were prominent (Brown and Adger 1994). Over the first decades of carbon offset activity, numerous concerns regarding offset quality and credibility surfaced. In the 2000s, the market gradually moved the business of offsetting away from a prevailing theme of *caveat emptor,* or buyer beware (Bayon et al. 2012), towards more standardized, rigorous, and costly approaches. Because offset crediting at this time was fundamentally motivated by polluting firms voluntarily seeking to claim reduced climate impacts, the infrastructure that organically emerged to govern offset credit accounting and trading was first-and-foremost intended to manage risks facing offset credit buyers (as opposed to landowners or carbon project proponents). For example, an offset buyer claiming to have spent $10 million to support tropical forest protection and tree planting did not want to find out (usually in the press) that no trees were ever actually planted, that the land they were trying to protect was ultimately deforested anyways, or that traditional communities were being forced out of their homelands and livelihoods to make way for their new carbon project.

As regulatory programs such as the Kyoto Protocol's Clean Development Mechanism were developed and began to permit the issuance and trading of carbon offsets under a regulatory/compliance framework, the rigor of offset crediting soon expanded to reflect the risk that the public bears from increased emissions in the form of unmitigated climate impacts if offset projects were not "real, measurable, and… additional to any that would occur in the absence of the certified project activity" (UNFCCC 1997). A wide variety of offset accounting standards and third-party verification programs came into being to ensure that emissions

reduction claims were not invalid, inflated, or involving harm to local communities or biodiversity. Over time, third-party certification, including extensive documentation, measurement, reporting, and verification components became the norm rather than the exception (D. Diaz, Hamilton, and Johnson 2011; Hamilton et al. 2009).

Direct investment and alternative payment schemes to enable forest carbon projects and jurisdiction-wide initiatives have persisted alongside compliance carbon offset markets as well. For example, the World Bank's Forest Carbon Partnership Facility launched in 2008 to support developing countries to reduce emissions from deforestation and forest degradation, enhance and conserve forest carbon stocks, and sustainably manage forests, also known as "REDD+" (World Bank 2008).

The history of demand for credits and funding from voluntary and compliance carbon markets for forest and other carbon projects has been a very bumpy one. Market failures range from temporary to permanent collapses of market activity and demand ranging from the looseness of the cap for the northeastern US Regional Greenhouse Gas Initiative (Ramseur 2019), the "flooding" of the European Union Emissions Trading Scheme (EU 2016), and the collapse of the Chicago Climate Exchange (Gronewold 2011) following its failure to garner federal endorsement when cap-and-trade policies began to be debated in the US Congress. It is important to recognize that the availability of funding from carbon markets to support forest carbon activities is fundamentally controlled by policy decisions that are often completely unrelated to forests, such as the "tightness" of a carbon cap, carbon tax rate, limits on the use of offset credits by regulated polluters, geographic restrictions and other eligibility criteria, voluntary corporate carbon reduction commitments, and linkages between domestic and international carbon markets which may have different standards. For policymakers interested in facilitating access to carbon incentives for small landowners, ensuring stability and reliability of funding should be a clear concern and priority. Unpredictable and volatile funding is likely to dramatically discourage landowner trust and willingness to participate in new programs.

California's cap-and-trade program, which became operational in 2013, has provided a noteworthy exception to the boom-bust pattern observed in almost every other domestic or international carbon market. By the time this program started, several major offset certification programs had become well-established including the Verified Carbon Standard (now known as Verra), the American Carbon Registry, and the Climate Action Reserve. Together, these standards were responsible for the certification of the overwhelming majority of forest carbon offset credits (Hamilton et al. 2009; D. Diaz, Hamilton, and Johnson 2011). When California adopted its first Compliance Offset Protocol for US Forest Projects, it essentially copied the voluntary standard originally developed by the Climate Action Reserve into a regulatory framework and has continued to mirror incremental changes to that standard in new updates to Compliance Offset Protocol over time. By August 2020, California had issued over 140 million offset credits (each credit represents one metric ton of CO_2-equivalent emissions reduced or avoided) to 448 forest carbon projects scattered across the USA, representing 84.5% of all offset credits issued.

In Washington State, 3 forest carbon offset projects are certified under California's compliance program and 1 under the American Carbon Registry standard. Of note, the 3 California compliance projects in Washington include the second-smallest forest carbon offset project certified in the program (the 520 acre Ashford III project developed by Nisqually Land Trust); the two other projects have been developed by the Colville and Spokane Tribes (covering over 487,000 and 95,000 acres, respectively). Port Blakely verified the 10,000-acre Winston Creek Project with the American Carbon Registry in 2018.

11.4 Carbon Program Design and Barriers Facing Small Forestland Owners

11.4.1 Offset Programs

Forest carbon offset programs tend to group forestry activities into three types: afforestation/reforestation (A/R), improved forest management (IFM) and reducing emissions from deforestation and forest degradation (REDD), which is often referred to as "avoided conversion" in US forest carbon projects.

The major barriers and hurdles to adoption of forest carbon projects have been relatively consistent since the 1990s (Brown and Adger 1994; American Forest Foundation 2020; Foley, Richter, and Galik 2009; Charnley, Diaz, and Gosnell 2010; Galik, Cooley, and Baker 2012; S. S. Rabotyagov and Lin 2013a; Peterson St-Laurent, Hagerman, and Hoberg 2017; Fischer, Cullen, and Ettl 2017; E. Marland et al. 2017; Fain et al. 2018; Wise et al. 2019). These barriers flow in large part from unique challenges in demonstrating of "additionality", "permanence", and "verifiability" that distinguish forest carbon projects from other offset project types that involve highly-engineered and controlled processes (e.g., landfill gas capture, anaerobic digesters for manure and agricultural waste, destruction of high-potency greenhouse gases, etc.). A more detailed non-technical discussion of these terms can be found in *A Landowner's Guide to Carbon Offsets, Credits, and Incentives*(D. Diaz and Davies 2016)

Commonly cited barriers to offset projects for forest projects include:

- Lack of awareness about programs among landowners and trustworthy intermediaries. Small landowners have diverse interests and motivations for owning and managing forest lands (Bliss 2003; 2008; B. J. Butler and Leatherberry 2004b; B. J. Butler et al. 2016). They respond more consistently to trusted agents and programs that acknowledge and speak directly to their own unique motivations and concerns (B. Butler et al. 2014; Zobrist and Rozance 2015; Andrejczyk, Butler, Dickinson, et al. 2016; Andrejczyk, Butler, Tyrrell, et al. 2016). Forest carbon programs have typically emerged completely independently from landowner education and extension programs that support fundamental stewardship planning and financial and technical assistance. Carbon project developers rarely have a local presence in a landowner's community and limited relationships with people and service providers that landowners have developed trusting relationships with over time.

- Complexities of carbon program rules and standards

Relatively few landowners have written plans or technical proficiency related to forest management planning, growth-and-yield modeling, or other project development, registration, and transactions involved with accessing carbon funding. 28% of non-industrial forest owners in the Pacific Northwest with more than 10+ acres of land are estimated to have a written forest management plan, although 74% are estimated to have "good stewardship attitudes but are not highly engaged in managing their land" (Sustaining Family Forests Initiative 2016). From our survey of Washington State SFLOs with riparian forest land, we also saw limited awareness of programs that can partially compensate landowners for some of the trees in riparian buffers. About half of SFLO respondents with riparian forests in the State of Washington were aware of the Forest Riparian Easement Program, even among landowners with a Forest Practices Application on file.

Carbon project activities and documentation often bear little-to-no relationship with the more fundamental components of forest management and conservation that landowners encounter as they become more active in learning about and managing their lands. Simplified guides and educational materials have been designed targeting non-industrial owners (D. Diaz and Davies 2016; Current et al. 2009) and carbon sequestration and offset-related short-courses are increasingly found in Extension programming and events (e.g., Stewart 2020).

- **Exceptional costs and complexity for forest inventory and monitoring**
  There is clear evidence that uncertainties in offset accounting and crediting are much larger for modeling of hypothetical forest management scenarios over 100 years and the choice of equations used to translate tree measurements into carbon estimates (Fischer, Cullen, and Ettl 2017) compared to uncertainties due to sampling strategies. Offset protocols commonly include requirements or auditing procedures that render permanent fixed-area plots the only feasible option, and involve sampling intensities, methods and auditing procedures that go well beyond those needed to ensure sustainable management (D. Diaz and Delaney 2011). These costs are largely driven by the need to confidently and accurately estimate the carbon reductions achieved for each individual project and credit issued, as compared to inventory and monitoring methods that would be involved with confidently or accurately estimating the volume of emissions reductions achieved across all landowners and projects participating in carbon reducing activities.

- **High upfront costs for documenting and registering projects**
  Costs to prepare project documentation, register with a carbon standard, conduct carbon accounting involving growth-and-yield modeling, harvest scheduling and optimization, and to cover fees imposed by a carbon project registry are immense. Most estimates place startup costs at over $100,000 per standalone project, and virtually every review of forest carbon protocols has concluded that offset projects are only likely to be feasible for landowners with at least 3,000-5,000 acres or more (Covell 2011; Foley, Richter, and Galik

2009; Galik, Cooley, and Baker 2012; E. Marland et al. 2017; Wise et al. 2019). That rules out somewhere around 97-99% of family forest owners in Washington.

- **Costs and complexity of ongoing third-party verification**
  Every carbon offset program requires forestland enrolled in carbon offset projects to be subject to independent auditing and verification. These audits may include re-measurement of inventory plots as well as desk and field audits regarding timber and other management activities, reviews of record-keeping, and monitoring of natural disturbances. Third-party verification of offset projects commonly costs $25,000 or more per project (E. Marland et al. 2017; Covell 2011), and will be repeated periodically (e.g., every 5-10 years) throughout the life of a project.

- **Long contractual terms and risks assumed by landowners**
  Enrollment and contractual obligations for landowners in carbon offset projects usually involve long timeframes (e.g., 30-100 years) that often extend beyond a landowner's lifetime. These contractual obligations borne by the landowner often extend beyond any arrangements initially made with companies who develop the project and get it certified. These commitments bind the landowners to decades of monitoring, reporting, and verification costs and obligations despite the fact that many carbon projects only produce offset credits and revenues for a relatively shorter period (e.g., 5-10 years).

  Agreements between landowners and project developers and between landowners and carbon registries may prohibit certain management activities and in general reduce management flexibility. Commitments may extend beyond a landowner's own lifetime and often intersect with major uncertainties related to climate change impacts, intergenerational land transfer, and challenging markets for forest products.

- **Unfavorable competitive landscape and revenue sharing terms**
  Prices reported in carbon market studies typically report volume-weighted averages prices. These values help indicate overall market value, but are heavily skewed towards transactions from the largest projects which sell credits at the lowest prices. These market signals imply a "going rate" for forest carbon in the voluntary markets currently around $4.30 per credit (Donofrio et al. 2020). Voluntary markets are fundamentally "buyer's markets" where project developers and landowners are price-takers rather than price-setters. Information and market experience may be very asymmetric. In contrast, in compliance offset markets there is generally clearer price signal and apparent demand for credits to all market participants. Through personal experience as an originator of voluntary carbon offset contracts from 2011-2012 and as a proponent for a family forest project in carbon credit negotiations in years that followed, the primary author of this section of the Report has witnessed negotiations fall apart with buyers or project investors asserting "take it or leave it" prices drawn directly from industry-wide reports that assume small landowners have to compete with million-acre forest projects. Some buyers also prefer to

take a stake in a project and may bring expectations of a 50%+ share of future project revenues in exchange for modest upfront payments while the landowner and project developer bear the ongoing risks of maintaining and monitoring the project. In these kinds of markets, it is very easy for landowners to see half or more of the value of the carbon they are sequestering be quickly consumed by middlemen.

- **Insufficient carbon prices to justify costs of new practices**
  Carbon market prices rarely approach levels at which they begin to compete with timber value. Prior professional experience with carbon project developers and growth-and-yield modeling typically shows that the financial balance tipping towards setting-aside working forests for carbon benefits occurs when carbon is at least \$40-50/tCO_2e. Academic research has generally predicted that raising carbon prices first lead to extended harvest rotations as forest owners shift from shorter rotation lengths focused on net present value of timber toward biologically-optimal rotations that generate more carbon and timber on average, tipping over into a decision to set-aside forests when carbon revenues (to the landowner) exceed timber value (van Kooten, Binkley, and Delcourt 1995; Sohngen and Brown 2008; Hoel, Holtsmark, and Holtsmark 2014). In project types such as Avoided Conversion where the alternative for a landowner is to develop their property into a higher-valued use, carbon credits are unlikely to even remotely approach the opportunity cost a landowner faces by foregoing development. Our own survey question asking SFLOs their willingness to enter into easement contracts in Washington State indicate that payments on the scale of \$3,000-5,000 per acre, on average, would be necessary to attract landowners into an easement agreement. If a landowner received 50% of a generously priced \$10/tCO_2e carbon sale, to cover this \$3,000-\$5,000/acre value, the landowner would need to protect 600-1,000 metric tons of CO_2e/acre. The maximum carbon stocking observed across old growth forests on the most productive soils in western Oregon and Washington is 600-800 tCO_2e/acre (Smithwick et al. 2002; Gray, Whittier, and Harmon 2016). **Without much higher carbon prices, virtually no landowners would ever see compelling financial justification to choose carbon storage over development based on carbon value alone.**

11.4.2 Direct Payment Programs

Almost all non-offset payment programs are administered by State or Federal agencies. These programs have historically seen much larger participation rates than offset programs and have a much stronger track record of reaching small forestland owners in particular.

Surveys and reviews of landowner participation in cost-share, incentive, and Extension programming have generally suggested that these programs tend to serve landowners who are already engaged in some kind of forest management or conservation activities (B. Butler et al. 2014; Zobrist and Rozance 2015; Andrejczyk, Butler, Dickinson, et al. 2016; Sustaining Family Forests Initiative 2016; VanBrakle 2015). However, a majority of landowners believed to be interested in active forest stewardship remain unengaged in active management or programs for landowners (B. Butler et al. 2014; Zobrist and Rozance 2015; Andrejczyk, Butler, Dickinson,

et al. 2016; Sustaining Family Forests Initiative 2016; VanBrakle 2015). For carbon programs, it is likely that any State-administered carbon payment program will attract "early-adopter" Washington State SFLOs who would likely maintain the carbon value of their forests even without the program. This is also true in offset markets like California's, where the first generation of projects typically came from large conservation landholdings or hunting lodges where the maintenance of desirable forest conditions was already likely, albeit at an opportunity cost to the landowner.

Because direct payment programs could achieve carbon benefits that are not directly used to permit additional pollution, there would not be a strict requirement that each landowner and each individual ton of carbon reductions meet costly or complex offset criteria such as additionality, permanence, or third-party verification. Direct payment programs are evaluated on the effectiveness and efficiency of achieving the policy goal at the level of the whole program, not at the level of individual owners, properties, or individual tons of carbon benefits achieved. Similarly, because direct payment programs do not create tradable credits that need to be fungible with other carbon credits, the program can be adjusted as needed over time to improve participation or effectiveness without the complications involved with inter-state or international offset markets.

Recommendations for federal stewardship program assistance have generally been to reduce the complexity of activities requiring access to assistance (e.g., less emphasis on written Forest Management Plans) and a broader focus on more general technical assistance and educational programming (B. Butler et al. 2014; Andrejczyk, Butler, Dickinson, et al. 2016; Andrejczyk, Butler, Tyrrell, et al. 2016), particularly to engage the larger group of landowners who might be interested, but remain unengaged.

Enrollment in State- and Federal-run cost-share and incentive programs may require landowners and service providers to complete numerous forms to comply with legislative and regulatory requirements for programs. The level of effort required to participate in a State-administered incentive program aimed at carbon benefits pales in comparison to offset programs where landowners will need to hire professional project developers and spend tens-to-hundreds of thousands of dollars in the process or gaining access to the offset market. Considering the current barriers to carbon offset market participation for individual SFLOs, all indications are that direct payment programs that include, but may not be limited to, forest carbon values can achieve higher participation rates with lower costs to participants.

11.4.3 Emerging Efforts to Resolve OFFSET Barriers for Small Forestland Owners

Most of the barriers described above in offset markets have been long-standing issues. Several approaches have been taken to reduce barriers for smaller project and small forestland owners. These efforts are not necessarily mutually exclusive and could be pursued jointly. These interventions include:

- **Creating a distinct and simplified set of rules for smallholder projects**

This is one of the earliest options provided for carbon offset projects, exemplified by the Kyoto Protocol's Clean Development Mechanism adoption of "small scale" methodologies with simplified baseline and project accounting rules ("CDM: Small Scale CDM Methodologies" n.d.). However, none of the other major offset standards now in use in the USA have followed this path. These standards generally offer one or more of the options described below rather than providing a simplified approach exclusively for smallholders.

- **Providing aggregation options for landowners to be enrolled as a group**
  With the notable exception of California's Compliance Offset Protocol, all the other carbon protocols active in the USA provide methods for grouping landowners together into a single project. Some standards provide methods to allow enrolling landowners on an ongoing basis, while others are limited to the group established at the outset of the project. Despite the existence of rules for aggregation among most forest carbon standards, only one has seen substantial success to date in terms of enrolling dozens of landowners and continuing to grow over time. Since becoming certified under the American Carbon Registry in 2010 (American Carbon Registry 2010), the GreenTrees Afforestation/Reforestation project has since enrolled over 500 landowners across the Mississippi Basin (ACRE Investment Management 2020). There are not currently any Improved Forest Management or Avoided Conversion projects that have yet succeeded in enrolling and certifying groups of landowners under a carbon offset standard, although several are reported to be in the process of doing so.

  The carbon project development firm ecoPartners successfully verified a single small forestland owner in Oregon in 2019 following a "pseudo-aggregation" model targeting California's Compliance Offset Program (American Carbon Registry 2020). The program "Forest Carbon Works" (Forest Carbon Works, Inc. 2020) was involved with a Regional Conservation Partnership Program (described further below) in Oregon and Washington seeking to enable small landowner access to carbon markets. Apart from a novel smartphone-based forest inventory tool, Forest Carbon Works intended to provide a templatized approach to project development and documentation to enable "batch verification" of multiple small forest owners in a region simultaneously.

  American Forest Foundation (AFF) and The Nature Conservancy (TNC) have recently announced a small landowner aggregation program, the "Family Forest Carbon Program", which is currently being piloted in Pennsylvania (American Forest Foundation 2020). This program is expected to provide shorter-term contracts and to pursue certification under new practice-based methodology currently being developed for consideration by the Verified Carbon Standard/Verra.

  In both the ecoPartners and AFF/TNC approaches, the landowner or project developer/aggregator takes on the risks of long-term project compliance, monitoring, etc. The general premise is that once a critical mass of enrolled landowners has been met, the risks involved with any single owner leaving the program or failing to comply with relevant standards can be mitigated, in aggregate, by other landowners entering the program over

time. There will presumably be consequences for landowners who exit a program early, although the terms of these agreements are generally private contracts between the landowner and the project developer.

- **Permitting use of remote sensing and model-assisted forest carbon estimation systems**
  Forest inventory and monitoring expenses can be a major cost for project development and ongoing verification. The rapid expansion of remote sensing technologies, including satellite imagery, aerial imagery, and lidar, often in combination with computationally intensive modeling techniques (e.g., machine learning) are providing unprecedented abilities to cost-effectively estimate forest conditions over large landscapes. California's Compliance Offset Protocol currently exclusively requires ground-based inventory methods and remains the most expensive approach among existing standards. The Verified Carbon Standard/Verra remains the only carbon standard to provide a methodology explicitly for the purpose of enabling the use of remote-sensing and "model-assisted" forest carbon assessment using a combination of field sampling and model fit with remote sensing data (Terra Global Capital 2015).

  The company SilviaTerra, which has developed a nationwide forest mapping methodology based on remote-sensing, recently announced a pilot project in Pennsylvania which would fundamentally rely on annual monitoring of carbon stocks and management activities based on their mapping technology (SilviaTerra 2020; Parisa, Nova, and Vermeer 2020). SilviaTerra's approach has not been proposed or certified under any third-party carbon standard to date.

- **Subsidizing offset project costs and effort**
  Financial and technical assistance can be designated from State or Federal cost-share and incentive programs expressly for the purpose of facilitating carbon offset project development. Under the USDA NRCS Regional Conservation Partnership Program, a project entitled "Unlocking Carbon Markets for Non-Industrial Private Forest Landowners in the Pacific Northwest" piloted this approach from 2015-2019. This project, led by the Pinchot Institute for Conservation, provided $900,000 in the forms of both financial and technical assistance for family forest owners from northwestern Oregon to southwestern Washington (NRCS Oregon 2016).

  This RCPP project emphasized completion of forest carbon inventories for landowners in an effort to streamline feasibility assessment and offset project development. Although the project initially intended to steer landowners toward an aggregated carbon project under the American Carbon Registry (ACR) or Verified Carbon Standard (VCS)/Verra standards, a variety of setbacks including the retreat of a voluntary offset buyer from the project as well as technical hurdles uncovered in the aggregation and enrollment procedures for landowners under both ACR and VCS standards led to numerous mid-course corrections. From 2018-2019, the project shifted course to focus on a collaboration with ecoPartners' Forest Carbon Works program, which ultimately culminated in the certification of the smallest forest carbon project ever verified under the California Forest Carbon Offset

Protocol: the 118-acre Raincloud Tree Farm in Clackamas County, Oregon (American Carbon Registry 2020).

- **Requiring shorter contractual terms**
  Lengths for multi-year conservation contracts with landowners through the Conservation Reserve, Wetlands Reserve, and Grassland Reserve Programs are generally 10-20 years.

  Although several studies and reviews have repeatedly identified the length of contract terms as a barrier for carbon market access by forestland owners (Charnley, Diaz, and Gosnell 2010; S. S. Rabotyagov and Lin 2013a; E. Marland et al. 2017; Wise et al. 2019), all carbon offset standards generally require carbon project enrollment for at least 20 years. 20-40-year project crediting periods are common. For voluntary carbon projects, certification obligations generally terminate after this timeframe. In contrast, the California Compliance Offset Protocol for US Forest Projects adopts the most extreme example, imposing 100 years of monitoring following the last year that credits are issued to a project. In general, these requirements are directly tied to the requirement that offset credits be considered permanent.

  To attract landowners to voluntary standards, initiatives such as the AFF/TNC Family Forest Carbon Program involve an intermediary between the carbon offset standard and the landowner. This aggregator role involves an intermediary organization taking on the risks of carbon project compliance and verification with the standard and enrolling a large number of landowners under relaxed terms. The aggregator bears the risks of keeping enough landowners and carbon storage enrolled in the carbon project over time.

  The single-year carbon rental concept of SilviaTerra's NCAPX program represents the shortest contract length proposed for any forest carbon offset program to date.

- **Carbon rental as an alternative to permanent offsets**
  Because offset credits are intended to permit or mitigate the emission of additional pollution, the requirement that carbon offsets represent permanent emission reductions has always been a challenging hurdle for carbon projects involving ecosystems like forests.

  Nevertheless, the concept of temporary/renewable carbon offset credits or carbon rental is not new (G. Marland, Fruit, and Sedjo 2001; Sohngen and Mendelsohn 2003; Fearnside, Lashof, and Moura-Costa 2000; Fearnside 2002; Herzog, Caldeira, and Reilly 2003; Lintunen, Laturi, and Uusivuori 2016). In fact, the first compliance forest carbon offset crediting protocols under the Kyoto Protocol's Clean Development Mechanism (CDM) awarded Afforestation/Reforestation projects one of either *temporary* or *long-term* Certified Emissions Reductions (tCERs and lCERs, respectively) that needed to be renewed periodically by carbon buyers using forest carbon credits for compliance purposes (Dutschke and Schlamadinger 2003; Galinato et al. 2011).

  In 2015, a forest carbon rental program was among recommendations for state forest carbon policies proposed by the Forest Climate Group (Forest Climate Working Group 2015). In simplest terms, carbon rental involves paying landowners for carbon benefits

provided over a short-term basis (e.g., 1-10 years) as opposed to requiring carbon benefits to be maintained permanently. At the end of a carbon rental contract, landowners return to a standard legal environment with no carbon-related constraints on their management. In the same sense that renting a house on a yearly basis is a lot cheaper than buying one, the rental price per ton of CO2 for one year would be much smaller than the price per ton of CO2 sequestered forever. This approach is comparable to how the NRCS Conservation Reserve Program "rents" soil conservation on erodible croplands by providing landowners an annual payment.

Nevertheless, no independent forest carbon certification program since the CDM has attempted a temporary crediting or carbon rental strategy. Instead, all contemporary forest carbon standards retain the commitment to permanence for each credit and adopt a "buffer pool" mechanism which sets aside a portion of a forest carbon project's credits essentially as an insurance policy to cover the risk that forest carbon storage is eventually reversed due to unintentional disturbances at some point in the future.

SilviaTerra's NCAPX program being piloted in Pennsylvania represents the first program to explicitly adopt a carbon rental approach to forest carbon crediting (SilviaTerra 2020; Parisa, Nova, and Vermeer 2020). NCAPX proposes selling credits that represent ton-years (a metric ton of CO_2-equivalent carbon benefit provided for one year) rather than permanent tons. NCAPX is not currently affiliated with any existing carbon certification standard, and it is not yet clear whether third-party verification will be involved.

11.4.4 Tradeoffs Between Offset and Non-Offset Approaches

Many barriers facing small landowner participation in forest carbon activities are unique to offset programs. This flows from the direct linkage between carbon-reductions and the release of carbon pollution which create the need to ensure offset crediting does not result in the release of additional pollution or other unintended harms to people or the environment by polluters or by carbon projects.

In contrast, direct and indirect incentive approaches, including practice-based and performance-based programs, do not necessarily rely on a direct pairing of carbon reductions on a one-to-one basis with permits to emit pollution. For example, programs like the Conservation Reserve and Conservation Stewardship Programs pay landowners for adopting practices and delivering benefits without any direct relation to other entities causing riparian damage or degrading ecosystems.

It is also possible to fund performance-based and practice-based programs using revenue collected from polluting entities without a direct pairing of emissions-reductions and pollution. For example, California's Greenhouse Gas Reduction Fund (GGRF) has been allocated over $11 billion since 2013 funded by a portion of the State's revenues collected in quarterly auction of pollution permits under the compliance cap-and-trade program (State of California 2020). The GGRF has directed this funding into a wide variety of climate mitigation ***and adaptation*** projects and initiatives, with a focus on actions poorly suited for offset programs. GGRF's funding of the

California Department of Forestry and Fire Protection has enabled a particular emphasis on funding for fire prevention, prescribed fire, and work in the wildland-urban interface that would not be possible through offsetting. Forest conservation, wildfire mitigation, and conservation easement programs administered by California agencies have been appropriated $928 million by State legislators from 2013-2020.

The effectiveness of incentive programs at achieving positive carbon benefits across enrolled landowners remains a central policy concern, but is distinct from the narrower concept and requirement for "additionality" involved with offsetting approaches.

The level and sustainability of funding for both compliance offset and incentive programs are fundamentally controlled by climate polices adopted by local, state, and federal governments. These are not "natural markets" with supply and demand based on intrinsically-valuable products and assets like those that drive timber harvest and other forest management decisions, and virtually all demand in compliance offset markets arises emerges and is maintained (or not) by policymakers.

11.5 Recommendations for State Policy Opportunities

Establishing a successful carbon payment program for SFLOs will require more than a single program functioning in isolation. An important choice for the State to resolve regarding development of a new incentive or cost-share program is whether the goal is fundamentally to facilitate landowner participation in carbon (offset) markets, or rather to more generally facilitate adoption of forest practices that increase carbon storage and sequestration in forests and wood products by landowners (whether or not they ultimately sell carbon offsets). Furthermore, it is also worth acknowledging that forest carbon sequestration is not necessarily aligned with climate adaptation priorities, particularly for dry forests where restoration to improve forest health and resilience is desirable.

The State can best evaluate its alternatives by deciding if its goal is one of the following, or a prioritization of two or all goals: maximize SFLO participation in the program (and to explicitly pursue a carbon compensation and/or a climate change *adaptation* strategy as a mechanism to help prevent the conversion of forestland to non-resource uses), maximize the climate impact of forest carbon sequestration, or facilitate SFLO participation in a particular voluntary or compliance offsetting market. In the context of this report, paying SFLOs for the carbon value of their land has the potential to make a contribution to maintaining small forestland as forests, but can be expected to have at best a modest impact on slowing conversion away from forestry land use.

There are several generalized options that the State of Washington can pursue regarding SFLOs and the carbon value of their forestlands. Depending on what goal the State chooses, or in what order these goals are prioritized, different types of policy options would be preferable to others. The intention in the recommendations given here is to describe some of the most relevant approaches in general terms and the advantages and uncertainties of each option.

Each option could entail different kinds of program design to implement a carbon-based policy, many of which have been reviewed in this chapter.

11.5.1 Building Technical Capacity, Knowledge, and Awareness of Forest Carbon Values

Regardless of the specific carbon program the State decides to pursue, if any, there are a number of measures the State of Washington can take to build the technical capacity and knowledge that will be the foundation of any foreseeable payment-for-carbon program.

A) Education and outreach to assist SFLOs with the forest management aspect of carbon should be a part of any strategy Washington adopts, and can be incorporated along with the policy options presented below. If the State focuses on the adoption of carbon-friendly practices whether or not carbon credits are ultimately sold, then investments in landowner education and financial and technical assistance are likely to provide the most broadly-accessible strategy for involving the largest number of small forestland owners. Following the approach recommended by the Forest Climate Working Group (Forest Climate Working Group 2015), these investments could be targeted to specific geographies and cover specific forest practices where the greatest impact might be expected. For example, outreach and education regarding extending even-age harvest rotations could be concentrated on landowners in western Washington with a history of timber harvesting. This kind of education and outreach will be important for additional carbon payment programs by fostering an informed and engaged group of SFLOs who would likely be among the first landowners to participate in a payment program.

B) To facilitate confident quantification of carbon impacts (and monitoring of forest changes more generally), the State could invest in data collection, processing, and sharing of remote sensing data and forest inventory data to enable transparent model-assisted prediction of forest conditions at property-scales. An example of this approach would be processing of aerial imagery from the National Agriculture Imagery Program (NAIP) into point clouds and layers derived from these point clouds that are made publicly available across the entire State on a regular basis. These data have been produced from 2017 for internal use by Washington Department of Natural Resources to map and characterize the forest lands managed by the State, but are not publicly distributed.

C) The state should continue monitoring the various pilot programs currently underway to aggregate SFLOs in carbon markets. In particular, it will be important to judge whether current pilot programs are able to successfully attract and retain large numbers of landowners with clear terms and manageable transaction costs for participants.

D) Programs to compensate Washington SFLOs for the carbon value of their lands at any meaningful level of enrollment will require significant amounts of funding for extended periods of time. It is hard to predict which, if any, of recent and ongoing pilot projects to enroll large numbers of landowners in carbon offset programs ultimately prove out and

scale up. Unless and until the State adopts its own broader carbon pricing and incentive policy framework, it may be difficult to secure long-term funding for a SFLO carbon program. Regardless of whether the State adopts a tax/fee-based or cap-and-trade market-based carbon policy, both carbon pricing approaches could generate significant revenue that could be used to establish a sustainable fund for direct payment policies. In the meantime, targeted investments in extension activities to increase landowner awareness and investments in research and development focused on honing tools and technologies aligned with fundamental forest assessment and planning activities that are prerequisites for carbon programs are most likely to find widespread future use.

E) Particularly in the case of forestland conversion, it may also be prudent for the State to consider imposing a fee or tax related to the cost of carbon emissions associated with forest loss to development. The value of carbon lost due to forest conversion could be priced using, for example, the Environmental Protection Agency's Social Cost of Carbon (Interagency Working Group on Social Cost of Greenhouse Gases 2016). If the State adopts a cost of carbon as a policy tool, it should also consider communicating and integrating this understanding into policies that regulate practices known to cause substantial carbon emissions but unlikely to be regulated under statewide carbon tax or cap-and-trade types of policies.

11.5.2 Key Policy Options

In conjunction with the capacity building measures for carbon value on small forest land, there are a number of generalized options for policy programs regarding SFLOs and the carbon value of their forest lands. Of course, the education and outreach efforts described in A could be considered a policy program for the carbon value of small forest land.

Option 1 - Attempt to engage SFLOs in voluntary and compliance carbon offset markets directly: this course of action will require a substantial investment on behalf of the State for aggregation and various forms of landowner assistance while the many pilot programs have not shown a proven way to solve existing issues. Unless the state identifies or creates a specific market for SFLOs to sell their carbon credits, it may be necessary to institute a carbon tax as discussed above. **Based on our review of similar attempts, we assess this option to entail a high cost to the State and the prospects for success will be highly uncertain.**

If the focus is instead on enabling landowners to participate in carbon offset transactions, there are several types of targeted investments that could be made. These include identifying one or more State-preferred carbon certifications or market programs and providing technical and financial assistance for landowners to complete strategic forest inventory measurements, complete a written Forest Management Plan, and receive consistent educational outreach and resources focused on the State-preferred market programs.

The option of the State to select a preferred certification pathway would provide a unique opportunity for State policymakers to propose targeted changes to existing certification standards to resolve existing barriers to small landowner participation. However, it is important to consider that voluntary carbon offsets are fundamentally a buyers' market. If the State advances carbon policies that are perceived to weaken the credibility or rigor of voluntary carbon offset standards, it is possible that voluntary carbon buyers would steer clear of these credits. For example, offset policy recommendations regarding landowner aggregation, and modern inventory methods assisted by remote sensing would likely be less controversial than changes such as reducing baseline and additionality screening requirements or shortening enrollment or crediting periods.

The direct entrance of the State into a market-making role could involve a number of strategies to de-risk carbon project investments and activities (Bonnie et al. 2020). A State agency could assume responsibility for aggregating landowners into cohorts or other groups for certification (or assign or award such a responsibility to one or more private or non-profit entities). The adoption of a statewide aggregator role would provide rapid economies of scale and lead more quickly to streamlined enrollment and eligibility procedures. Other options for de-risking carbon projects could involve the State providing guarantees in the form of offtake/purchase agreements, low-rate financing or forgivable loans or grants, or subsidizing insurance policies for landowners and carbon project developers. Perhaps most fundamentally, one of the clearest signals the State could send to facilitate market access would be establishing a comprehensive Statewide policy that places a price on carbon emissions.

Given the rapid and ongoing evolution of carbon offset markets, unless and until the State adopts its own carbon pricing and incentive framework, it will likely be hard to predict which, if any, of recent and ongoing pilot projects ultimately prove out and scale up. In the meantime, targeted investments in extension activities to increase landowner awareness and investments in research and development focused on honing tools and technologies aligned with fundamental forest assessment and planning activities that are prerequisites for carbon programs are most likely to find widespread future use.

Option 2- Pilot a short-term carbon rental program with the State of Washington acting as the carbon renter with an emphasis on forests remaining forests (improved forest management). This will have lower cost than Option 1 and may be more promising in terms of the number of SFLOs who may be able to participate with lower costs for participation to SFLOs; however, since few projects of this kind have been attempted, we assess this option may also have a high uncertainty of success. Because carbon rental payments will be lower than what payments would be for permanent carbon sequestration, this type of program will be less effective than easements or long-term contracts in preventing the conversion of forestlands under development pressure.

Financial and technical assistance in State and federal cost-share and incentive programs have a clear track record of engaging millions of acres and hundreds of thousands of

landowners. The model of short-term contracts with clear payment terms and expectations for enrollment offers a better match for most small forest owners than most approaches to carbon offset certification.

A good example of how this program may work for SFLO's would be to model California's Greenhouse Gas Reduction Fund (i.e. collect carbon tax revenue in one of the ways described above) and distribute funding to SFLOs via a carbon rental modeled off the design of, for example, the federal Conservation Reserve Program (CRP).

Option 3- Explore possibilities for including supplemental/additional carbon payments as a co-benefit in existing programs, such as FREP. This option may also include addressing climate change adaptation on small forest land, which is one way of describing the intention of the Firewise program. This option has a relatively higher likelihood of attracting higher participation rates compared to Options 1 & 2 and has an advantage of being able to utilize existing programs instead of creating new programs. It may not, however, be the best option if the goal is to maximize the climate impact of forest sequestration.

Option 4- Simply wait and see how the numerous pilot projects turn out, particularly ones trying to aggregate landowners for group certification of carbon offsets. When and if a successful example program emerges out of the initial stages that seems prudent to emulate, then the State can take the successful design features and attempt a similar program. Option 4 is essentially Option 1, but delayed to wait for additional information about how to design the program. We advise that this strategy will work best if the state enacts at least some of the "capacity building" efforts described in A-E in the meantime.

12 Recommended Ways to Encourage SFLO Forests Retention

(7) The policy analysis must use the trends analysis, the regulatory impact analysis, and other data to provide recommendations on ways the forest practices board and the legislature can provide more effective incentives to encourage continued management of nonindustrial forests for forestry uses, including traditional timber harvest uses, open space uses, or as part of developing carbon market schemes.

In this section, we first describe and report on the recommendations which were suggested as a part of the stakeholder interviews. We then describe in greater detail the policy tools of conservation easements and current use taxation, and provide relevant evidence gleaned from our work with respect to their likely efficacy and efficiency as forest retention tools. Carbon-related recommendations are provided in greater detail above. We also describe the survey-based results of current state of forestry regulations and report on some suggestions we have heard from the general populations of SFLOs. We conclude the section with the summary of recommendations for retaining SFLO forestlands in Washington.

12.1 Policy Proposals as Suggested and Derived from Stakeholder Interviews

Per the charge of SB5330, we reached out to a range of stakeholders for input. We asked interviewees to create or revise policies or programs directed towards SFLOs or small forest land. Our goal was to understand what our stakeholder groups thought would be programs or policies that would benefit the small forest landowner community or small forest land across the state. Some suggestions were specific to a certain interviewee while others were universal across stakeholder groups and interviews within our stakeholder groups. In this section, we will describe the suggestions and proposals that were common in our interviews with stakeholder groups. Suggestions that were rare or only pertained to one interview are not considered here. We synthesize stakeholder recommendations below. For several of these recommendations, we lack concrete empirical or theoretical evidence to support them, while others align well with our empirical findings and/or broader knowledge and theory of public policy aimed at private landowners.

12.1.1 Amending the Forest Practices Rules

One of the policy proposals common among all stakeholder groups is amending the Forest Practices Rules. All stakeholders and interviews within stakeholder groups had a different proposal concerning the Forest Practices Rules. The following is a list of proposals.

1. A science-based overhaul of the Forest Practices Rules.
2. A permanent SFLO Rule that is simpler and includes more flexibility for SFLOs.
3. An alternate plan template or other approach for SFLOs.
4. Best Management Practices ideology of other states approach.
5. Separate Forest Practices for Eastern Washington.
6. Separate Forest Practices for SFLOs.
7. Expansion of the 20 Acre-Exemption.

For these proposals, interviewees did not fully develop a proposal within the interview process, with some stating a proposal while acknowledging that they are not knowledgeable enough to explain the proposal further. This applies to the first proposal on the above list. The interviewee indicated that they believe there needs to be a science-based overhaul of the Forest Practices Rules and believes that this proposal has been mentioned but does not seem to gain traction.

As for the second point of the list, some SFLOs believe that a SFLO rule that is simpler and has more flexibility would include a smaller buffer for SFLOs. Some interviewees who stated this proposal argue that SFLOs are diverse and have different management plans. With this, the SFLOs are not all going to harvest their smaller buffers once the rule is installed. Others

believed increase management within the RMZ would increase habitat quality. Another suggestion with an SFLO rule would be a different forest practices application or policy process for SFLOs. One interviewee stated that some consulting foresters may not do small projects due to low returns and DNR stewardship foresters are not able to help with forest practices applications so a streamlined process may be beneficial. This portion of the proposal came from the stakeholders in the Landowner Association, Unaffiliated Landowner, and State Employee stakeholder groups.

The third point of an alternate plan template or other approach for SFLOs has support in the State Employee and Landowner Association groups. A state employee interviewee indicated that the Washington Farm Forestry Association alternate plan template proposal needed to be seriously considered as there seemed to be sound science behind the template proposal. The Landowner Association, with many of those interviewed from the Washington Farm Forestry Association and the Washington Tree Farm Program, indicated that they would like a template or some other form of SFLO flexibility when it comes to harvesting. However, one SFLO provided the thought that DNR does not want a template since DNR does not have the resources or ID teams to manage a highly popular template.

An Extension interviewee suggested the fourth point of Best Management Practices of other states would be a preferred approach for Washington. However, the interviewee did not go into detail about this proposal.

In regards to the fifth point and sixth point, of separate forest practices for Eastern Washington and of separate forest practices for SFLOs, these proposals came from the Landowner Association interviews. The overall descriptions of these proposals were not in detail. For Eastern Washington, the forest practices should be applicable to the regional ecology. Separating forest practices for SFLOs would be like a specific SFLO rule but entirely separate from the current forest practices.

The final portion of this overall proposal came from a landowner association interviewee who indicated that the way to approach SFLO forest practices would be to expand the 20-Acre Exemption to include 20-acre harvest units or less. With this expansion, SFLOs who harvest in smaller units compared to their industrial counterparts would be able to benefit from the lessened restrictions.

In general, all stakeholder groups have indicated that the Forest Practices Rules need to be altered or amended in some way. While some interviewees are supportive of the Forest Practices Rules as they currently are, this universal stakeholder group proposal for change within the Forest Practices Rules suggests exploration of this proposal is warranted.

12.1.2 SFLO Rule and FREP Discussion

Another proposal that enjoyed substantial discussion concerned the need for an SFLO rule or template with a fully funded FREP, or the converse of alleviating pressure on FREP with an SFLO rule or template. This discussion included proponents on both sides, with some interviewees more in favor of creating an SFLO rule or template so that pressure on FREP would be alleviated or even abolishing FREP altogether, and others suggesting fully funding FREP would mean that there is no need for an SFLO rule or template besides current templates. The interviewees who prefer an SFLO rule or template compared to FREP argue that it would be better for the environment, alleviate the state budget obligation, and be beneficial to landowners. On the other hand, the interviewees who commented on a fully funded FREP would alleviate the need for an SFLO rule or template discussed that FREP would replace the lost economic benefit of not managing the riparian area.

This discussion indicates that there are three viable solutions: (1) FREP is fully funded to alleviate the pressure for developing a SFLO rule or template, (2) an SFLO rule or template is created to alleviate funding pressure on FREP, and (3) a compromise of fully funding FREP until an effective SFLO rule or template is developed. While the first two of these viable solutions are directly from interviewees, the third is derived from the discussion. Other compromises and solutions are possible as combinations from the addressed concerns. Our consideration of empirical evidence that the relaxation of regulatory requirements would lead to lower demands on the FREP program, the effectiveness of FREP as a potential forest retention tool, or of any recommended changes to the program are outlined above.

12.1.3 Increased Stewardship, Technical Assistance Foresters, and General Education

Universal across all stakeholder groups was a proposed increase in stewardship or technical foresters to assist landowners. Our interviews indicate that there is a need and a want for more technical assistance and education to support landowners. All stakeholder groups have specifically stated more stewardship foresters or foresters to support technical assistance would help. Besides specifically noting stewardship foresters, all stakeholder groups referenced a forester or individual who would walk with the landowner on their land to provide information, advice, and other recommendations. Some interviewees offered more extension foresters would help. In terms of the number of foresters that are needed, extension interviews suggested a stewardship forester and extension forester for every DNR region pairing.

Similar to indicating the want for more stewardship foresters and technical assistance foresters, interviewees across stakeholder groups have indicated that one of the prevailing wants of SFLOs is education in terms of forest health and regulation. Some landowner interviewees stated that they would like to better understand the resources that are available to them. Other landowners would like to know how to improve forest health or habitat quality. Finally, other landowners would like to know more about regulations. State employees stated that the lack of

education is a big issue for landowners. Extension interviews also stated landowners seem to be increasingly interested in Extension education programs, but outreach and getting landowners to attend programs that are most beneficial to them can be difficult. A landowner association interview also indicated that most landowners want to do the right thing, but some do not know how to do it. This frequent discussion about education and technical assistance for SFLOs indicates a need for a proposal addressing these wants or needs. *Our survey work and existing knowledge on the importance of education and technical assistance in maintaining economic viability and ecological function of privately owned lands allows us to concur with these stakeholder-suggested recommendations.*

12.1.4 Fish Passage Corrections on Federal, State, County, and Railroad Infrastructure

Our interviews with the Extension, Unaffiliated Landowners, and Landowner Associations had multiple suggestions or complaints about fish passages on county, state, federal, or railroad infrastructure. Some interviewees indicated that they would like to see those passages removed for the benefit of fish habitat or so that their waterways would be accessible to fish. Other interviewees argued that if landowners must correct fish passages, then these groups need to abide by the same standards. A landowner interviewee felt that FFFPP projects or landowner projects to improve fish passage seem irrelevant if other groups do not improve their passage. One landowner claimed that their stream was labelled a fish bearing stream even though there is no access due to a county culvert blocking fish from going into the landowner's property. Overall, there appears to be support from these stakeholder groups for the federal government, the state, the counties, and the railroads to improve fish passage so that either fish habitat is improved, or so that landowner efforts on fish passage will produce increased usable fish habitat. *We did not study non-SFLO issues directly but are supportive of an integrated approach for resource management across ownership types.*

12.1.5 Increased Tax Incentives

For all stakeholder groups, interviewees indicated that there should be more tax incentives directed towards SFLOs, that existing tax incentive programs need to be adjusted, or new taxes should be imposed on other groups to increase revenue for SFLO cost-share programs or education. While this is a theme across stakeholder groups, the following list includes some of the specific proposals:

1. Any tax incentive.
2. SFLO clean air and environmental benefit tax and education.
3. State-Wide Public Benefit Rating System (PBRS).
4. Extension or Landowner Assistance Assessment.
5. Review and Standardization of Designated Forest Land and Open Space.

The first proposal is vague in its description as given by interviewees. A state employee and an unaffiliated landowner both indicated that more tax incentives would be beneficial. The interviews indicated that landowners need financial burden alleviation in the form of less taxes.

A landowner association interviewee indicated that an additional tax should be directed towards those who benefit from the environmental services that SFLOs provide. This tax would be dedicated to supporting cost-shares and other programs that support landowners. The same interviewee also suggested that there should be education directed towards urban centers regarding how these taxes support landowners for the public good. This proposal has two portions that can be implemented together to separately: such as only an education program, only a new tax on beneficiaries of environmental services, or a combination of education and a tax. *We broadly support education efforts targeted at SFLOs and the public at large which describe the economic, social, and environmental connections between places across the state. The stakeholders describe essentially a scheme for payment for ecosystem services, which deserve further study. Elsewhere we note that forest conversion should be taxed (at the minimum) at the rate of social cost of resulting carbon emissions.*

An extension interviewee suggested that the state should implement a Public Benefits Rating System like that of King County. The interviewee indicated that this program should be implemented by the state to ensure there is consistency in application instead of counties applying it inconsistency. A landowner interviewee who is part of the King County PBRS highlighted its benefit and their appreciation of the program. With support from a user of the program and a suggestion from another interviewee, there is support for a wider application of the PBRS. *While we did not evaluate any county programs specifically, a benefits rating system is necessary for effective and cost-effective policies for maintaining forest ecosystem services and we add that a broader state-wide benefits rating system, ideally in conjunction with the competitive reverse auction process, is a goal we recommend the State considers seriously. We note that the current statutory language (https://apps.leg.wa.gov/RCW/default.aspx?Cite=84.34.055) appears to describe public benefits rating systems as a tool for (voluntary) tax relief as opposed to the tool for targeted land protection via easements.*

For a new assessment in regards to either support for landowner assistance or extension support comes from a couple of interviews with the Extension stakeholder group. This assessment would be levied on parcels to support SFLO education or assistance through the Extension or otherwise as a reflection of the public goods that SFLOs provide.

The final specific proposal in this theme considers DFL and Open Space Taxation. This suggestion came from Extension interviews. Our interviewees suggested that the language around DFL and the Open Space Taxation programs could be troublesome to landowners. One suggestion would be to create an easier transition between generations for a parcel in DFL

without new generations or landowners paying back-taxes. Another consideration is that counties apply rules for DFL and Open Space differently and that increased consistency may be more beneficial for SFLOs. A final idea is to remove the lower acreage limit for eligibility (which we note may be somewhat challenging given that the lower limit has been decreased to 5 acres in 2014 by SB 6180).

12.1.6 Addressing the Lack of Timber Production Infrastructure in Eastern Washington

Our interviews with the state employees, landowner associations, and the extension referenced the lack of mill infrastructure, mainly in Eastern Washington, being an economic burden for landowners in either final product timber or pulp production from thinning operations. A common comment was that it is often hours to a mill for Eastern Washington landowners. A couple of Extension interviews suggested that the distance and economics of using Eastern Washington mill infrastructure discourages active management and negatively affects forest health. Landowner Association interviews argued that managing forest land in Eastern Washington as an SFLO produces a net economic loss to the landowner due to the lack of mill infrastructure, with one landowner stating they do not produce any profit from managing their 600 acres and attributing the lack of mills to economic burden.

An extension interview suggested that this could be mitigated via a program that subsidized transportation costs to a mill. Another suggested small scale or community mills around the state to support small harvests or forest health operations to increase economic viability. A final proposal from Extension interviews offered a small forest landowner cooperative that would follow Japanese or European models that would include log-auction yards for small loads, log sort yards, foresters, drying kilns, and other services to improve SFLO support.

12.2 Current Use Taxation as a Retention Tool

Current/resource use taxation programs are a common tool used to encourage continued land use and stewardship in uses which are likely to provided substantial cultural and non-market benefits (most commonly agriculture and forestry), and is widely used across the United States (Kilgore et al. 2018). Chapter 84.34 RCW describes such framework for Washington State. Recent national analyses found that forestry-focused current use taxation programs have an inverted-U-shaped appeal, if we consider the value in alternative ("highest and best", most commonly developed) uses. That is, for forest lands with a low development potential, the value differential is not large enough to make participation in forestry use taxation program economically beneficial to the landowner, while lands with a very high development potential, differential taxation programs also fail to provide sufficient compensation for the landowner, given that they restrict (or impose costs on) forest conversions (Frey et al. 2019). Differential use taxation programs are generally quite popular and provide significant tax relief to the landowners who maintain their lands as forest lands. Given that such programs are voluntary, a reasonable question (both from the research and public policy perspective) is whether such programs provide forest protection. If, for example, such programs only attract those landowners who do not intend to develop their forest lands, then they do not provide a "protective" function and only implicitly shift the tax burden away from forest landowners (thus perhaps compensating the participants for provision of forest public goods). Similarly to FREP and other voluntary programs, questions of additionality arise.

The stakeholders suggest a positive effect of the DFL programs (which are administered at the county level and are described in 84.34 RCW). Similarly to our analysis of FREP participation, in order to provide additional empirical evidence on the likely effectiveness of DFL with respect to forest retention, we use quasi-experimental matching methods to address the counterfactual question of "what likely would have happened to DFL-enrolled parcels had they not been enrolled in DFL".? We use the same genetic matching protocol as in our analysis of FREP participation.

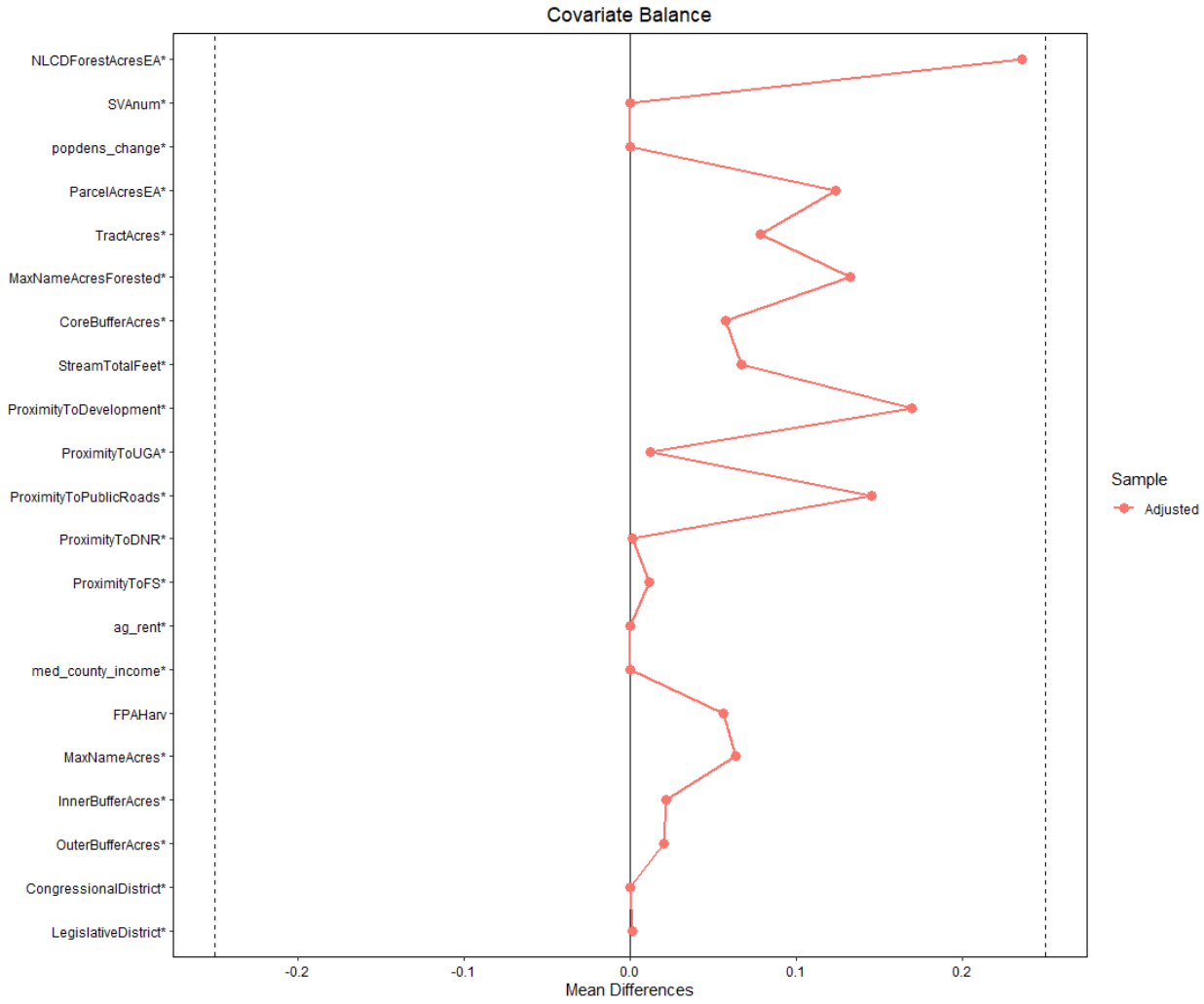

Figure 88. Matching variables and their balance in the analysis of DFL-enrolled parcels.

We matched 31,133 parcels enrolled in the DFL programs for which all the covariates were observed in the forestland database to non-enrolled parcels. We matched across a wide range of covariates, forcing an exact match to county-level variables and the SVA zone. All matched variables ended up within 0.25 standard mean difference, with NLCD forest cover remaining somewhat larger in the case sample. As in the FREP case, matching estimates can be interpreted as causal if several assumptions, including of selection on observable characteristics, hold. We have a fairly rich set of parcel and spatial characteristics, as well as county-level variables, yet, as the sales and land use analysis indicates, these characteristics don't fully explain the sales and conversion outcomes. It is possible or even likely that some unobserved variables exist which both affect the DFL enrollment and the conversion decision. For that reason, and due to the fact that DFL indicator was not a robust predictor of sales or conversion in the models which used unmatched samples, we caution the reader from over-interpreting the results below as truly causal. Instead, we suggest that these results provide a

strand of empirical evidence that can be useful in understanding whether, to the best of our available data, parcels that are similar to DFL enrolled parcels follow the same or significantly different land use trajectories.

First, because the number of case parcels is fairly large, we actually are able to compare the complete land use transition matrices for the case (DFL-enrolled) and comparable control parcels. Table 45 below describes the two distributions, which are statistically significantly different ($p < 0.001$):

Table 45. Land use transitions for case (DFL) parcels.

		case parcels in 2019 database				
		Agriculture	**Developed**	**ForestOrNatural**	**Other**	**Residential**
case parcels in 2007 database	**Agriculture**	181	0	24	0	6
	Developed	2	1	2	0	0
	ForestOrNatural	417	60	28673	108	1129
	Other	0	0	1	5	0
	Residential	36	1	470	1	77

Table 46. Land use transitions for matched control (non-DFL) parcels.

		matched control parcels in 2019 database				
		Agriculture	**Developed**	**ForestOrNatural**	**Other**	**Residential**
matched control parcels in 2007 database	**Agriculture**	4415	26	625	7	336
	Developed	0	196	22	3	21
	ForestOrNatural	368	47	14696	111	1650
	Other	2	10	80	525	86
	Residential	191	14	740	11	7012

We note that since the modeled DFL participation is derived from the land use category 88, we did not use prior land use classification as a criterion for matching pool selection, instead relying on actual parcel characteristics, including parcel size and forested area.

Table 47 focuses on the matched pairs with respect to whether they retained their forestry or open space land use in 2019.

Table 47. Forest retention, DFL case parcels and matched controls.

		DFL parcels	
		ForestOrNatural LU in 2019	Not ForestOrNatural LU in 2019
matched control parcels in 2007 database	ForestOrNatural LU in 2019	15376 (control in forestry/case in forestry)	**796 (control in forestry/case NOT in forestry)**
	Not ForestOrNatural LU in 2019	**13803 (control NOT in forestry/case in forestry)**	1228 (control not in forestry/case not in forestry)

Table 47 describes the land use agreement table across cases and matched control parcels. Rows break down matched control parcels by their 2019 state (whether they are in the ForestOrNatural state), while columns break down treated (DFL) parcels by their 2019 state. Matched cases and controls were assessed for their 2019 land use category. For each case/control pair, 4 outcomes represented in the table are possible: both parcels were retained in forest uses, both parcels transitioned away from forest uses, case (DFL) parcel transitioned but control did not, or case (DFL) parcel was retained in forest uses but control transitioned away from forest uses. When both cases and controls have the same outcome, clearly no effect is present. However, if more of the treated parcels are retained when controls transitioned than the opposite scenario, we can infer that treatment (DFL) has a forest land use retention effect. The ratio of disparate outcomes (796/13803) provides an estimate of the odds of conversion, which is 0.06, 95% CI of (0.054-0.062). In other words, we find that DFL participation reduces the odds of conversion by about 94% for all the DFL-treated parcels (effect on the treated). In terms of acreage, the counterfactual forestry land use protection effect is estimated to extend across 667,599.1 acres which comprises 49.9% of total DFL-enrolled parcel acreage. Thus, the estimated relative additionality of the DFL program is substantial: almost exactly ½ of DFL-enrolled acreage is additional forest protection.

To add a qualitative dimension to the analysis of DFL, the GP survey asks respondents their opinions about DFL/ Open Space as well as reasons for why respondents had NOT enrolled in DFL. Almost 44% of respondents say they own at least some forest/agricultural property that is enrolled in DFL or Open Space (recall, using sample weighting the estimated percentage of DFL participants among all Washington SFLOs is about 16%). We note that the Open Space tax designation was included as an option since some respondents may recognize the older name of the current use tax program for forest land. Also, we point out that we expect respondents to the GP survey to be more interested and engaged with various aspects of forest ownership. Therefore, this analysis may be thought of as how SFLOs with relatively higher interest in their forest properties think about DFL.

Of those who say they have at least one property in DFL, Figure 89 shows the distribution of how important various aspects of DFL are to the respondents. Most important to respondents, on average, is that the program is an important reason they are able to continue owning forest land and that the program discourages development on the forest land now and in the future. *Respondents overwhelmingly tended to disagree with the statement that they plan to drop out of DFL in the future*. At the same time, database analysis shows about 5.6% of DFL parcels transitioning to other non-forestry uses. There is a somewhat roughly even split between respondents who say the program compensates for harvesting restrictions and those who say that is not important, with a sizable proportion of respondents being neutral on the question.

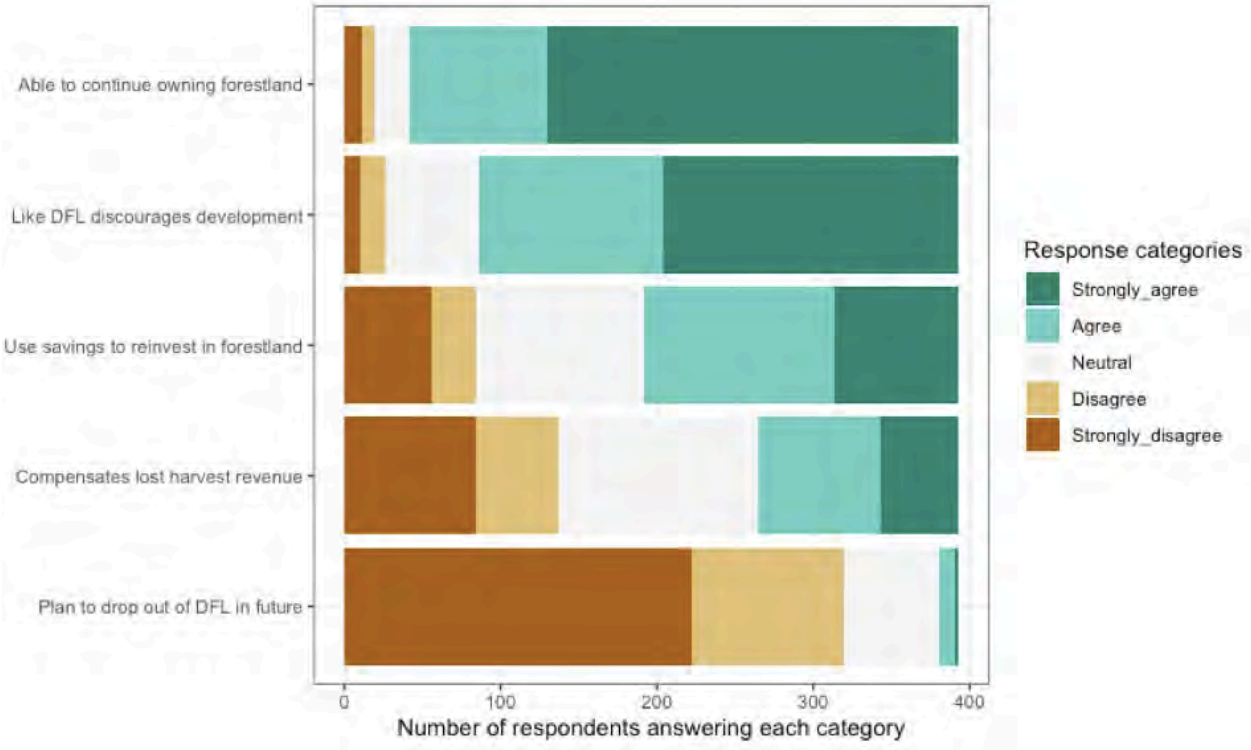

Figure 89. Distribution of how strongly respondents agree/disagree with various statements about DFL.

Figure 90 shows the frequency of reasons given for why respondents have not enrolled some or all of their forest land in the DFL program. By far the most common reason was that respondents had not heard of the program (more than twice the frequency of the next most common reason given). The second most common reason GP survey respondents said they did not have any forest land in DFL is because they do not manage their forest property for timber. Several survey recipients called us (at the number listed on the survey materials) to express their *concern that they feel required to cut their forest lands because of their involvement in DFL* although they wanted to leave their trees standing. So, the requirement for forest land to be managed as timber as a condition of DFL is not only an issue for SFLOs who have decided to stay out of the tax program. The third most common reason given was that the program would

not lower the respondent's taxes by much. Since the best alternative use value of some small forest land is very close to the land's value in forestry, there is little reason to enroll a parcel that otherwise has very low property taxes even without the program. Finally, there are indeed some respondents (34 out of 344, or about 10%) who explicitly say are not enrolled in DFL because they may want to develop the land or sell to someone who wants to develop the land.

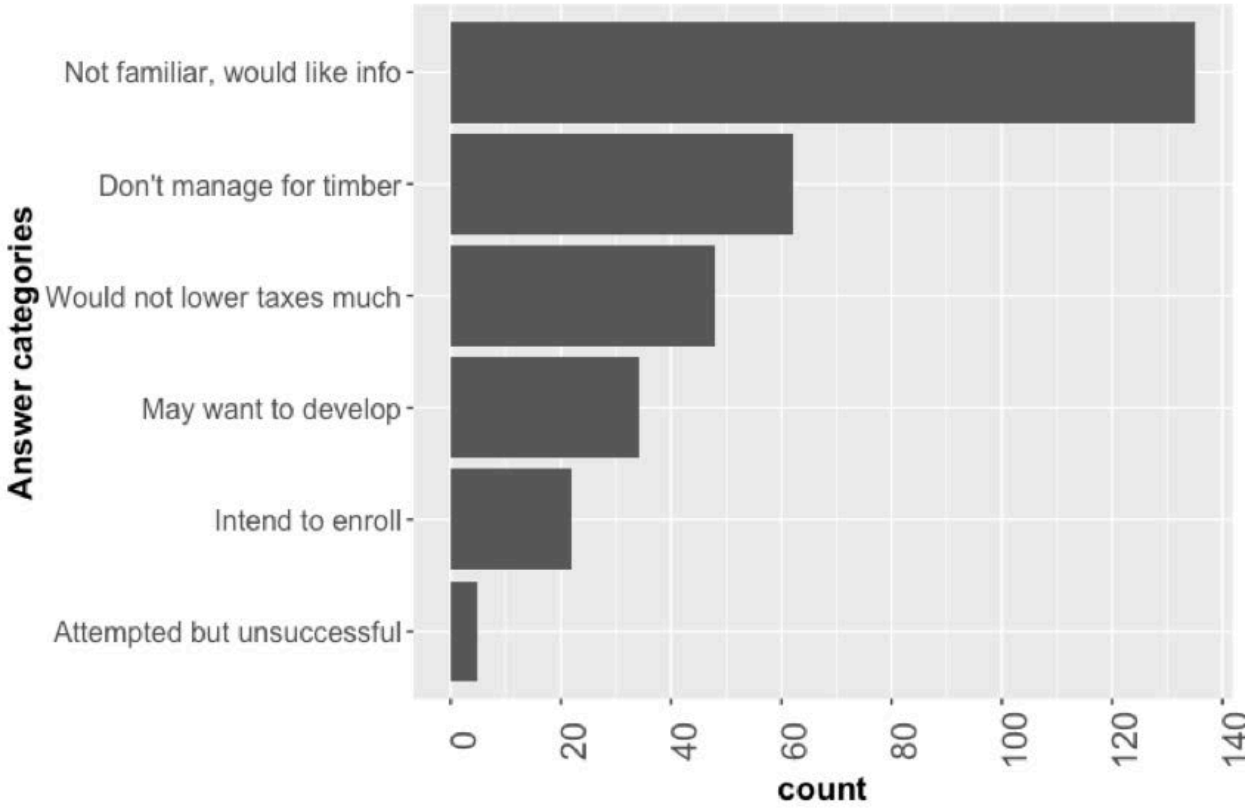

Figure 90. Frequency of reasons given for why respondents have not enrolled in the DFL program.

Thus, stakeholder feedback and other empirical evidence suggest that DFL enrollment not only provides property tax relief and support to existing landowners but also appears to have an additional effect in terms of forest retention across the State. Maintenance and process improvements for the DFL and Open Space programs are likely to continue to be an important tool in the policy toolkit for SFLO forest retention. At the same time, given that recent changes decreases eligibility criteria to 5 acres, it's perhaps difficult to recommend further reductions in acreage. Easing requirements that forest land be actively managed for timber as a condition of DFL seems like it could increase participation in the program as well as ease concerns of some SFLOs who are already enrolled in DFL but do not want to harvest trees on their properties. RCW 84.33.035 (5) states: "'Forestland' is synonymous with 'designated forestland' and means any parcel of land ... that is ... devoted primarily to growing and harvesting timber." If the objective of the State is to maintain forest or open space uses regardless of harvesting timber, then our empirical analysis suggests that a way to leverage the DFL program for additional

forest retention would be to relax the harvesting focus of the DFL program and admit applications (conditional on appropriate forest management plans) which do not envision managing land for harvesting timber. In any case, improved landowner education and outreach can help enroll more landowners in these programs, which is likely to be providing additional forest protection benefits.

12.3 Conservation Easements

The most straightforward and direct way to keep forest land forested is to legally prevent the conversion of land in forestry or open space use from being converted to non-forestry uses *with the voluntary consent of the landowner*. This is often done though the purchase of development rights, or conservation easements, that specify what kinds of land use are legally allowed on a particular property. As explained in the introduction of the GP survey, we outlined the typical terms and conditions for conservation easements, including a per-acre payment, for conserving forest land into perpetuity and asked GP survey respondents if they would consider such an agreement.

Almost 48% of GP survey respondents said they would consider entering into a conservation easement contract. For comparison, about 4% of GP survey respondents say they currently have a conservation easement somewhere on their forest property. We contrast the high interest in conservation easements from the GP survey to results from the FF survey in which interest in "additional opportunities to sell the development rights to my forest land..." was one of the least frequently measures that respondents said would help their ownership. The way that the question was framed, by explaining the terms and conditions of a standard conservation easement as well as presenting a per-acre payment amount without mentioning the phrase "conservation easement," is in all likelihood the reason for receiving such a high level of interest in the GP survey relative to the FF survey. We cannot understate the importance of how presenting the concept of a conservation easement to SFLOs as an initial idea is crucial to creating interest in a conservation payment program.

The exact wording of the conservation easement interest question reads as follows:

"Consider an option that would allow you to permanently prevent future residential and commercial development on some or all of your land, while allowing other uses such as farming, forestry, and recreation to continue.

-These limits on the uses of your land would need to be followed by you and future owners forever

-You would not be able to subdivide your land

-Allowing public access to your land would be optional

-The land's property taxes may be reduced significantly

-You still own your land and could sell it to whom you want

-If you sold the land you would receive less than the full market value, because it can no longer be developed

-For each acre of land you designate in the agreement, you would receive the following one-time, lump sum, per acre payment $ [randomized dollar amount from $250-$7,000 for the pilot and $1,000-$10,000 in the full survey].

Would you do this?"

This question is from of Stated Preferences valuation question called a Willingness-to-Accept (WTA) question which attempts to estimate the a*verage minimum* payment that would be required for a SFLO to enter some or all of their land into a conservation easement. As part of standard pre-testing, cognitive interviews of several volunteer SFLOs revealed that survey respondents are often not completely sure about their answer and that some respondents who answer "no" say they may actually consider such an option if they knew more about it. Likewise, some respondents who answered "yes" are not positive if they would enter into such an agreement. Our analysis should therefore be interpreted as the amount of per-acre payment that makes SFLOs interested in considering what is essentially a conservation easement. These numbers may not be exactly what is needed for SFLOs to "sign on the dotted line" and actually enter some or all of their land into such an agreement.

We calculate the "truncated mean willingness to accept" as explained in Lee and Mjelde (2007) for our formal analysis of the average per-acre payment required to convince SFLOs to permanently prevent residential or commercial development on their forest lands. The most important aspect of truncated mean willingness to accept to note is that it truncates bid offers at $10,000 and does not consider SFLOs who, being opposed to the concept of conservation easements, would likely never sell the development rights to their forest land at virtually any price in the calculation of a mean value. Different respondents were randomly presented with different bids and the bids are not conditioned on the estimated development value of the respondent's forest land. These per-acre payments should be thought of as payments unconditional on the economic or ecological value of SFLO properties.

Estimating mean WTA requires a logit model, which we present in Figure 91. Female landowners and owners over the age of 65 are significantly less interested in conservation easements. Respondents with a bachelor's degree or higher and those who have submitted a Forest Practices application in the past 10 years or expect to submit a Forest Practices application in the next 10 years are significantly more interested in conservation easements. Considering respondents who only own forest land in a single county, we also add some county-level variables to the easement acceptance model and find that population density

change is significantly and negatively related to interest in conservation easements. In other words, higher population growth means there is greater pressures on land development for residential and commercial reasons, and respondents are aware of the opportunities they would be giving up if they entered into a conservation easement. Finally, the sign on the per-acre payment offered to respondents (Easem_bid) is positive and significant, meaning that respondents are more likely to express interest in a conservation easement when the offered per-acre payment is higher.

	coeff.	std. Error	sig
intercept	-1.254	0.042	**
log_ac_wood	0.071	0.066	
Easem_bid	0.000	0.000	*
Female_yn	-0.399	0.182	*
uni	0.668	0.164	***
Age_over65	-0.404	0.160	*
Fpar_past_fut	0.381	0.177	*
POP_DEN_CHANGE_2010_2018	-0.020	0.010	*
AVG_AG_RENT	0.000	0.000	
Bach_higher	1.879	1.369	

Figure 91. Logit model results of which GP survey respondents say they would consider a conservation easement for a given, randomized per-acre payment.

Based on the logit model presented in Figure 91, and using the delta method to calculate standard errors (Jackson 2011), the truncated mean WTA for a conservation easement unconditional on the development value of forest land is $4,663 per acre. The lower and upper bounds of the average estimate using a 95% confidence interval are $4,280 and $5,045 per acre, respectively. Perhaps the right way to interpret this range of average WTP is that approaching any two randomly chosen SFLOs with a per-acre payment offer for permanent forest conservation between $4,280 and $5,045 suggests that at least one of the two will be willing to listen to the idea.

To provide an alternate way of analyzing GP survey respondents' interest in conservation agreements in relation to the per-acre payment they were offered, we present some analysis of predicted probabilities at the means. Using predicted probabilities at the means, we fix the covariate values for all explanatory variables and only let the per-acre payment vary (Muller and Maclehose 2014). Figure 92 shows the predicted probabilities at the means of a statistically average respondent answering "Yes" to the easement question based only on variation in the per-acre payment offer. Statistically speaking, there is a fairly large range of per-acre bid offers that generate a predicted acceptance rate within the 95% confidence range of the predicted acceptance rate at the highest offered payment ($10,000). The red line in Figure 92 shows a predicted probability of acceptance (at the means) of 0.48 (or 48%) and the range of bid offers

that give a response rate statistically identical to 48%. Essentially, the predicted probability of a respondents marking “Yes” in response to the conservation easement question does not statistically increase above per-acre payment offers of $3,150.

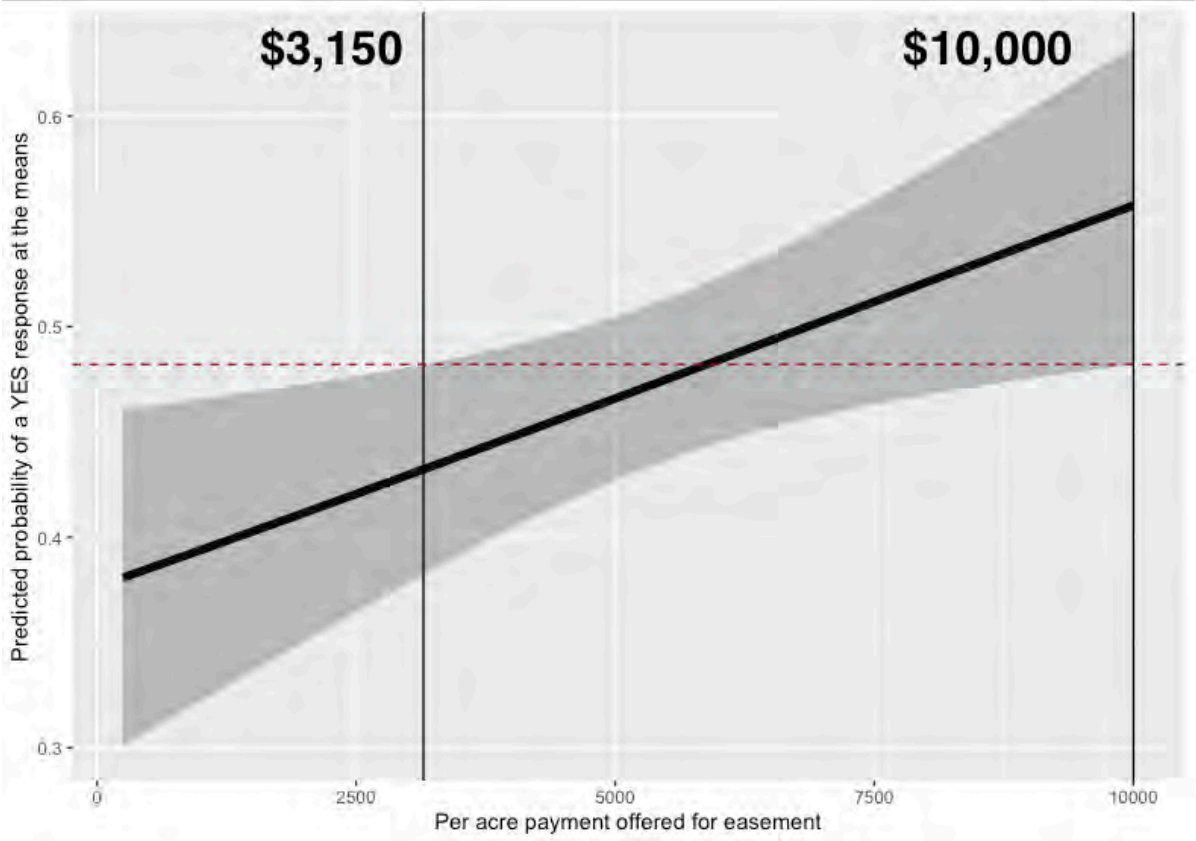

Figure 92. Predicted probability of conservation easement acceptance using predicted probabilities at the means to isolate the influence of per-acre payments. The shaded region shows the 95% confidence interval of predicted probability of acceptance.

12.3.1 An exploratory study/pilot program for conservation easements using a reverse auction mechanism

Responses to the GP survey indicate that Washington SFLOs are very receptive to the idea of selling development rights in the form of conservation easements. It is also well established that landowners do prefer temporary to permanent easement contracts, although personal communication with the authors of the 2016 New England forest legacy survey found that landowners actually preferred permanent contracts to 50-year term conservation easements. Recently, Lewis and Polasky (2018) extend the idea of reverse auctions to allow for non-permanent, 2-stage land conservation reverse auctions and describe the potential policy in detail. At the same time, many public and private conservation interests insist that development rights need to be given up in perpetuity. We recognize that term easements present one option for forest conservation, and the structure of the policy we discuss can be modified for term easements, in which case we recommend Lewis and Polasky’s approach.

Regardless of the temporal dimension of easement, we wish to suggest that the State consider approaches centered around reverse auctions. In what follows, we assume that the subject of the reverse auction would be a permanent easement contract, consistent with forestry or open space land uses.

The theoretical appeal of reverse auctions is described in numerous existing publications, including Polasky et al. (2014) (especially see Supplementary Text). Here we wish to briefly argue for the State to consider investing in a pilot study of implementing reverse auctions for forest conservation that explicitly recognize two features of the socially efficient provision of landscape ecosystem services: 1) costs of conservation are private information and the public/conservation organizations do not have access to it and 2) the overall contribution to ecosystem services depends on the spatial configuration of conservation. Both of these facts are central to the kinds of mechanisms that Polasky et al. (2014) and (S. Rabotyagov et al. 2013a) independently describe. Below we sketch out the approach and outline the kinds of investments and coordination that would be required to implement such mechanisms in practice and to directly engage SFLOs in its implementation. We outline the broad approach which would go beyond SFLOs and would involve other privately held lands, forested and not, as well as would require coordination or (at the minimum) information sharing across State, Federal, Tribal, NGO, municipal land owners and managers.

Reverse (procurement) auctions involve multiple sellers and typically a single buyer (in this case, the State, with possible County, municipal, or private partnerships would act as a buyer). As we see in this report, private landowners continuously make decisions regarding their lands, including the decisions of sales and conversion to more economically attractive uses. A reverse auction would ask private landowners to submit bids for development rights. Under certain conditions (Polasky et al. 2014), the bids would reflect true opportunity costs of development (including the future option value) as estimated by the private landowners. The buyer (acting in public interest) would evaluate the set of bids both in terms of their location and biophysical characteristics as well as in terms of the cost submitted. In general (with an exception of carbon sequestration), specific parcel's contribution to the public benefit is dependent on a) statically, on the landscape pattern around it, and b) dynamically (with respect to the auction program) on the bids and the eventual action at the other parcels. For example, parcel A submits a bid to retain land as forestland, while being adjacent to a National Forest (static dependence) and located upstream to another parcel B which also submits a bid. Wildlife habitat benefit stemming from conserving parcel A depends on its adjacency to a National Forest, while fish protection benefit depends on whether parcel B protects fish passage on its stream. As a result, the buyer's evaluation of bids from parcels A and B need to be done jointly. This is the essence of the mechanism Polasky et al. (2014) and S. Rabotyagov et al. (2013) proposed. The key difference is that Polasky et al. (2018) stipulate that the buyer is able to assess the full portfolio of received bids, run an optimization exercise where net (monetized) ecosystem services

benefit is maximized, conditional on the set of bids and all other land use decisions present, and then pay the parcels for which the incremental value of ecosystem services is larger than their bid, a payment equal to the incremental value of ecosystem services in the optimal allocation. S. Rabotyagov et al. 2013 operate under a cost-efficiency framework where the bidders are paid the value of their bids, if their parcels are selected, using biophysical models, to attain an ecosystem service target (nutrient reduction in their case) agreed upon by the buyer.

Polasky et al.'s approach is more attractive because it obviates the need for multi-objective assessment of each proposed portfolio of accepted bids and allows for the focus on monetized metrics of economic efficiency. The price of that simplicity is the requirement to conduct and accept monetary valuation measures of non-market ecosystem services. An approach based on strictly cost-efficiency principles would require multi-objective assessment and, even when multi-objectively optimal Pareto-frontiers of tradeoffs are solved for, some stakeholder-driven discovery of relative weights on different objectives would have to take place in order to select which bids are accepted or not. Both approaches are feasible given the technical capacity existing in the State but bid evaluation process would require significant investments in such decision support tools and data. The complexity of bid evaluation is a) necessitated by the science of interconnections of landscape ecosystem benefits but also b) has been shown to improve the incentives for truthful revelation of landowner opportunity costs as they cannot easily "shade" their bids upward if they know a priori that their parcel has high ecosystem service value and that their bid would be viewed favorable based on that criterion.

Simpler versions of such a system where parcels are assigned fixed and known ecological benefits scores and the evaluation of bids is based on the "score points per dollar bid" indicator are not likely to be economically efficient or cost-efficient yet would improve the efficiency of any publicly supported program for purchasing conservation easements. An even simpler reverse auction ranking bids solely on the basis of bid costs of development rights would be even more inefficient as it would ignore the benefit side entirely. That said, a "zero cost" working forest conservation easement program whereby the landowners freely transfer development rights to the State and where the State's only costs are legal and administrative, would be a low-regret, "low-hanging fruit" program that may be appealing to some SFLOs who wish to ensure that their land remains a working forest in perpetuity. We note that the existing FREP description allows for donation of riparian timber to the State, and similar language could be used to provide for SFLOs willing to donate land use rights to the State.

We should also note that Polasky et al (2014) and Polasky and Lewis (2018) correctly point out that these programs could be implemented if the property rights are partially reversed and the landowners bid for the right to develop their land. The economic efficiency properties, following Coase theorem, are not affected, however such rights reallocations, regardless of how anyone assesses them from outside of efficiency perspectives, would objectively engender strident opposition and legal challenges on the part of landowners

The exact auction mechanism and the decision support involved are beyond the scope of this report as it is one of the suggestions we introduce. Reverse auctions for conservation easements or potentially for other conservation actions on private land would be a departure in how conservation programs are typically set up in the United States. Some opposition to reverse auctions has existed due to the fact that by their design they would yield unequal pay for different landowners. At the same time, if the State commits to cost-effective investments in conservation on private lands, targeted payments are required. At the same time, it is likely that an additional feasibility and scoping study would be required before significant state resources are committed to a reverse auction program. It is crucial that such a reverse auction mechanism is communicated with key landowning stakeholders to ensure it is both understood and accepted by land owners.

We note that a reverse auction mechanism for private, non-industrial forest owners with bids evaluated using an ecosystem service benefit criterion was carried out in Finland between 2003 and 2007. The Finnish reverse auction pilot program was part of a larger program called METSO that aimed to conserve a sufficient amount of spatially proximate old growth forest in Southern Finland (Korhonen, Hujala, and Kurttila 2013). Private, non-industrial forest owners were encouraged to submit bids for a project called “Trading in Nature Values” in which the Finnish government would lease the biodiversity benefits of landowner’s forests for a period of 10 years. The Trading in Nature Values program required participating landowners to refrain from final felling during the contractual 10-year period. The program attracted 352 bids from landowners and enrolled 158 forest stands, representing 1,520 hectares (3,756 acres) of forest land. Overall, the reverse auction mechanism achieved its central purpose of lowering program costs (personal communication, Professor Markku Ollikainen, University of Helsinki). While the Finnish Trading in Nature Values reverse auction program required participating owners forgo forest harvesting for a limited time period, the suggestion we make is to use a similar reverse auction mechanism to keep land in forest or open space use in perpetuity but would allow owners to pursue any kind of management practice consistent with forestry or open space use. Therefore, although a reverse auction mechanism would be a departure from a normal way of paying SFLOs for the various ecosystem services their forests provide, a similar program has actually been administered with some notable success.

An important insight from the literature on Non-Industrial Private Forest Owners and Family Forest Owners is, although many owners may want their forest lands to stay forested into the future, few owners enter into formal conservation contracts. Ma et al (2012) use the National Woodland Owner Survey to estimate less than 2% of all US family forest owners have a conservation easement somewhere on their forest properties. The GP survey estimates that between 1.5% and 6.5% of Washington SFLOs have a conservation easement on part or all of their property, which puts Washington State within range of the national average for percentage of SFLOs with a conservation easement on their properties. Results from the GP

survey shows that, when presented with the terms and conditions of a typical forest conservation easement that include a per-acre payment, there is tremendously more interest in conservation easements than there are SFLOs who have an easement.

12.4 Other Forest Retention Tools

Even if a new conservation easement program based on reverse auctions was extraordinarily successful and doubles or triples the amount of forest land protected under conservation easements, the vast majority of small forest land in the State of Washington will still not be protected with conservation easements. Using conservation easements, or other standard tools, to conserve forest land simply will not be able to conserve enough forest to ensure enough forest ecosystem services will be provided to meet social demands. Other tools are needed to reach SFLOs who won't consider conservation easements or other legal methods to keep their forest lands forested as lands pass from one owner to another to another. A vital part of forest land changing hands from generation to generation is to avoid conversion away from forest land cover, forest land use, and properties being split up into smaller ownership units (parcelization).

Alternative instruments, including non-permanent tools with non-legally binding conditions, may be one way of helping keep forest land forested as land passes from existing owners to future owners. To explore alternative ways of keeping forests forested, we asked several questions adapted from the 2016 New England forest legacy survey mentioned previously. One important aspect of keeping forests forested is preventing small forest land from being further subdivided into smaller units that subsequently have higher conversion rates to non-forestry uses (e.g. Kilgore and Snyder 2016). Figure 93 shows the frequency of GP survey responses to the question "which of the following statements best describes what you want to happen regarding keeping your land intact or subdividing your land (dividing your property into smaller ownerships)? Two out of every three respondents who answered the question said they want their forest lands to stay intact as a single property or they would like to keep most of it together as a single property. Somewhat less than 1 in 5 respondents (17%) said they have not decided, and only 5% say that any subdivision is fine with them. Overall, the vast majority of respondents to the GP survey either want their forest properties to remain intact as one property, mostly intact, or have not decided.

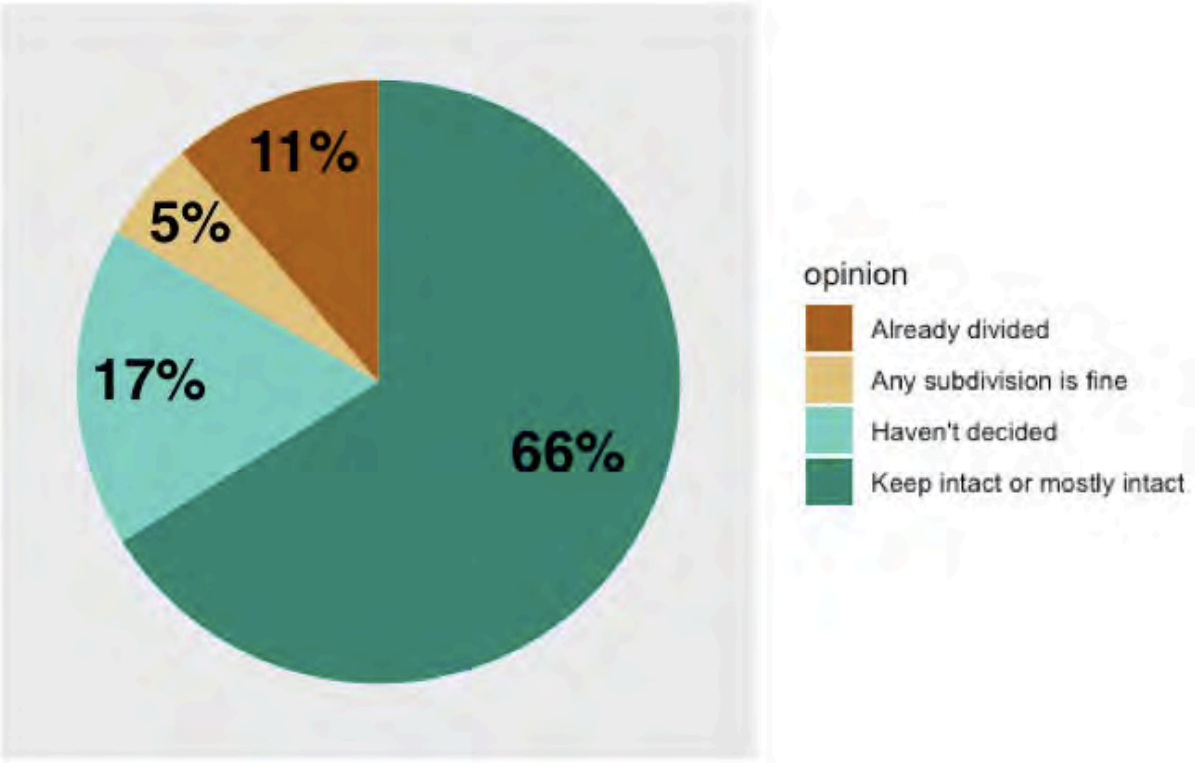

Figure 93. Frequency of GP survey respondent answers to the question: which of the following statements best describes what you want to happen regarding keeping your land intact or subdividing your land (dividing your property into smaller ownerships)?

Respondents were also asked "how important is it to you that your land remain forested in the future after you no longer own it?" Of those answering the question, 69% say it is "important" or "very important" their land remain forested. The clear picture from the GP survey is that many SFLOs want their land to remain forested and intact in the future. Also from the 2016 New England forest legacy survey, we explore SFLO interest in service in which a forest owner who does not wasn't to see his/her land developed and does not want to "tie the next owners hands" with an easement will have a chance to select the next landowner to make sure they have similar goals or visions for the land. Even without a legal commitment to keep the land undeveloped, it may be enough for some landowners to simply know the next landowner and trust what they say they will do with the land. We therefore modified a question based off programs run by non-governmental organizations to help match new farmers with older farmers who are preparing for retirement.

Respondents were therefore asked the following extended-form question:

"A number of agricultural organizations link retiring farmers with new farmers as a way to maintain farms. Consider a similar service that links forest landowners to buyers with similar ownership goals as a way to maintain their land.

-There is no charge for this service

-You can select a buyer who you think will use the land as you would like to see it used.

-The new owner isn't legally obligated to use it the way you would like.

-This service can also be used to link experienced landowners with newer landowners to provide advice and expertise."

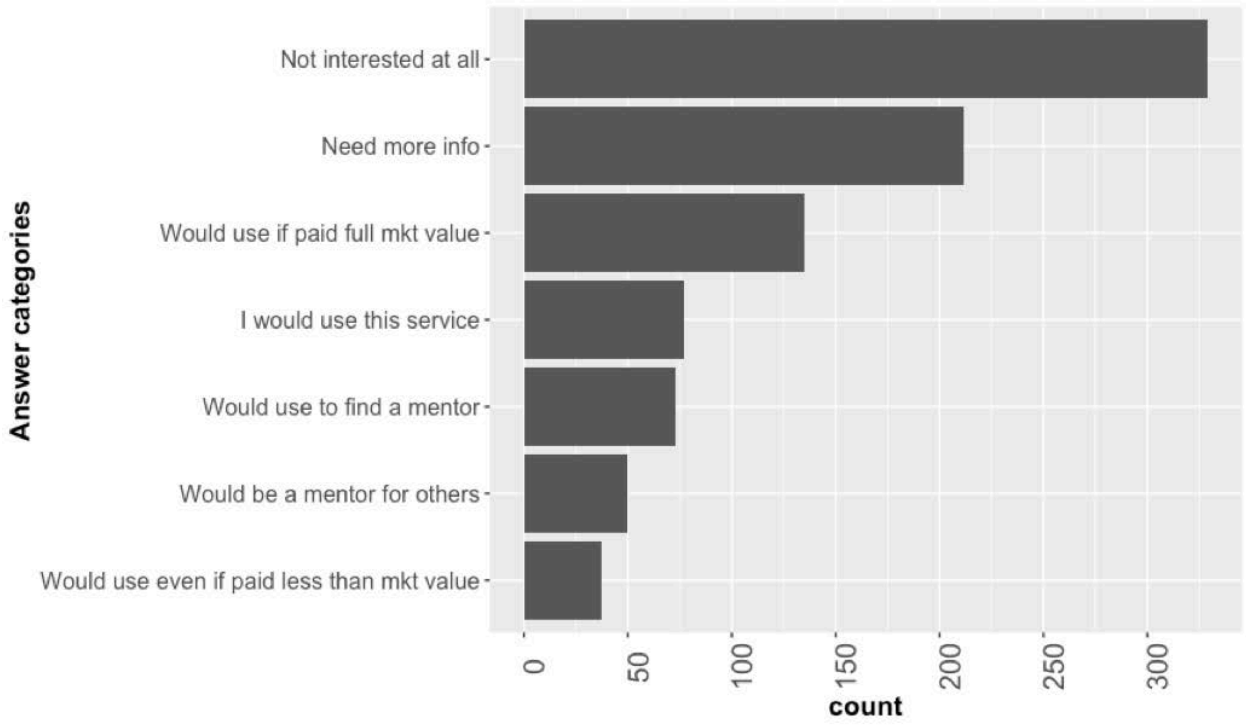

Figure 94. Frequency of responses to the question about the forest owner-to-owner matching service.

Many owners gave multiple answers to the question about the owner-to-owner matching service. As Figure 94 shows, the most common answer was that respondents were not interested at all, followed by respondents saying "I need more information." Overall, 32% of respondents expressed an interest in the hypothetical service beyond simply saying they need more information. We note the most frequent expression of interest in the service is that respondents would use the service if the new owner paid full market value for the property and the LEAST frequent expression of interest is that respondents would use the service even if the new owner paid less than the full market value of the property.

In summary, a service that helps to match existing SFLOs with new SFLOs is an appealing idea to about 1 in every 3 GP survey respondents. Some SFLOs say they would be interested in being a mentor to other SFLOs or finding another SFLO mentor from such a service. We also note, however, that most of those who express interest in such a service still want to recover the full market value of their land. Figure 94 raises the concern that although SFLOs overwhelmingly

say they want their properties to remain forested and intact, most of the respondents interested in the forest owner matching service indicate they still want to be paid the fair market value of the land. The low frequency of GP respondents who indicate they would consider selling their forests to like-minded owners below standard market prices raises the question of just how much SFLOs are willing to give up financially to keep their forests forested and intact in the future.

12.5 Suggestions From SFLO Surveys

As presented in Section A, one of the questions with the highest "item non-response rate" is the FF survey question asking "to what extent do you feel that the efforts described above (Alternate Plans, Alternate Plan templates, FREP, FFFPP, and the Small Forestland Owner Office) and other services available to Small Forest Land Owners adequately address the economic impacts of riparian forest regulations for your ownership?" Figure 95 reproduces the sample-level distribution of responses to the "extent addressed" question from Section A to remind readers that many FF survey respondents were unable or unwilling to answer the question. Figure 95 shows that somewhat more than 1/3 of respondents "don't know" or don't answer the question, slightly less than 1/3 say the efforts moderately, substantially, or very much address impacts of the regulations, and slightly less than 1/3 say the efforts only somewhat or not at all address impacts of the regulations.

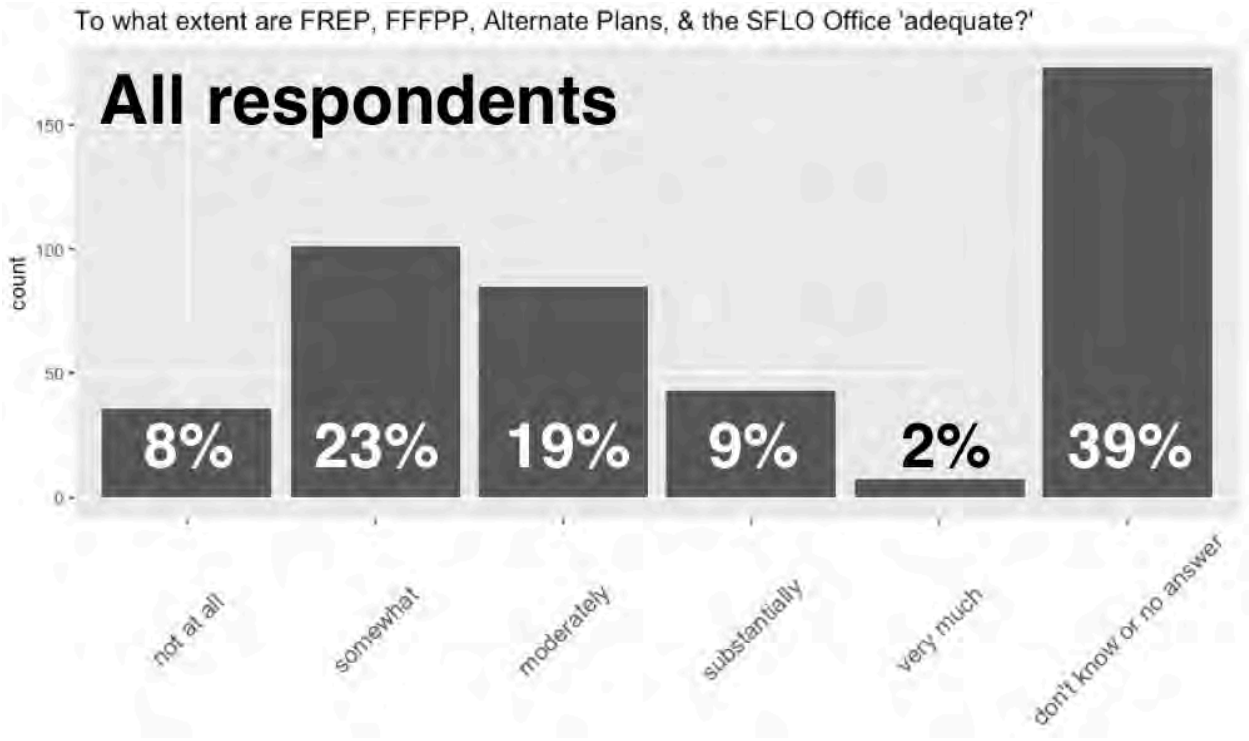

Figure 95. FF survey repsondent's answer to the question: "to what extent do you feel that the efforts described above (Alternate Plans, Alternate Plan templates, FREP, FFFPP, and the Small Forestland Owner Office) and other services available to Small Forest Land Owners adequately address the economic impacts of riparian forest regulations for your ownership?"

In a somewhat similar response rate to the "extent addressed" question, 2/3 of FF survey respondents indicate at least one additional measure that could be taken by the State of Washington to address the impacts of riparian forest regulations on their ownership. Figure 96 shows the frequency of additional measures FF survey respondents said could be taken to address the impacts of riparian forest regulations on their ownership. The most frequently requested measures are funding for programs that compensate SFLOs for the environmental benefits of their lands (carbon value) and/or the restrictions on harvesting in riparian zones (FREP and FFFPP).

The next most commonly requested measure is the unspecified "more regulatory flexibility" option. Third most common is a series of three topics that are related to additional State-provided assistance: additional assistance in the form of stewardship foresters, technical assistance to apply for FREP/FFFPP, and technical assistance to apply for Alternate Harvest Plans. Next most common are requests for additional Alternate Plan templates, followed by "opportunities to sell the development rights to my forest land (usually via a conservation easement). Least often requested is technical assistance with two specific topics: help with protocol stream typing, and help with steep slope delineation.

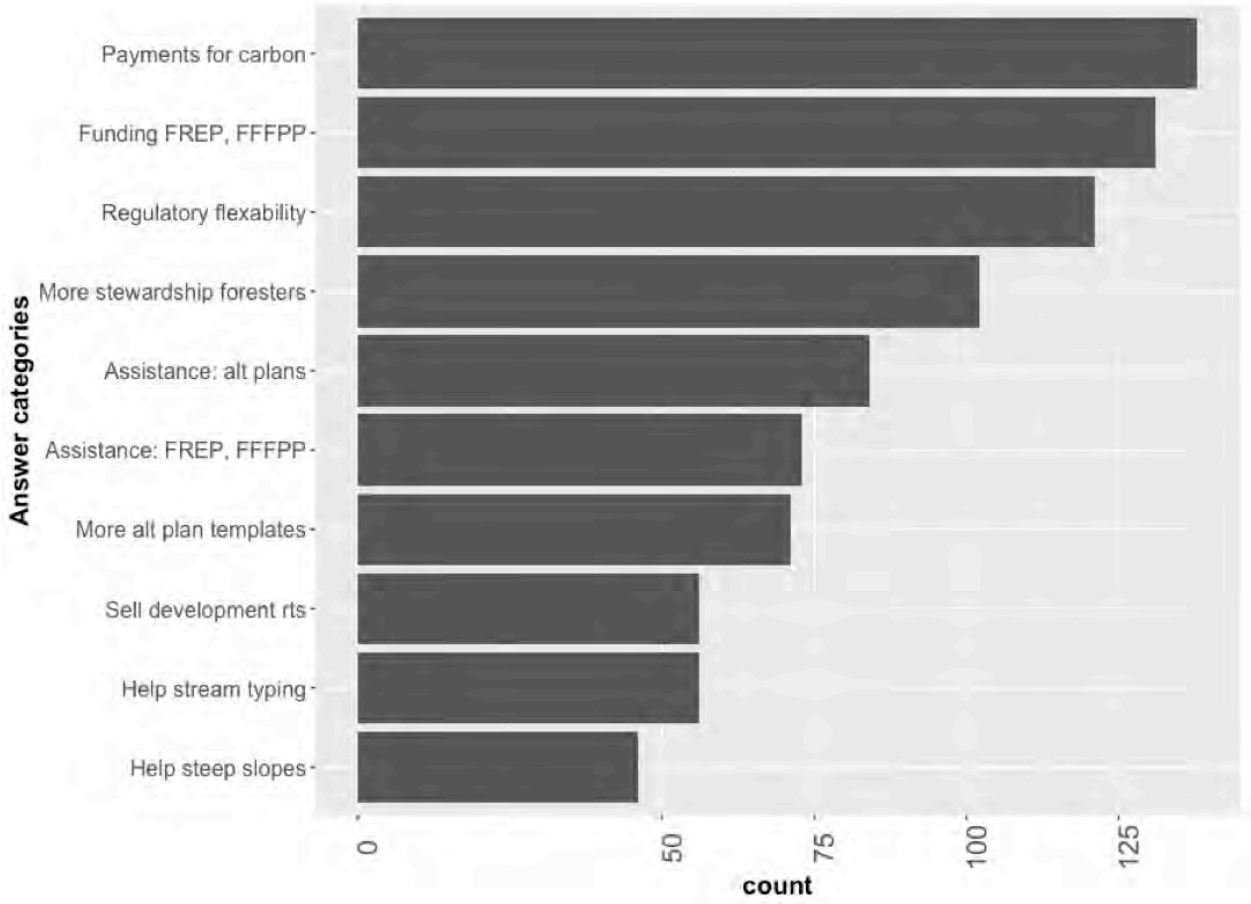

Figure 96. Frequency of what additional measures FF survey respondents said could be taken to address the impacts of riparian forest regulations on your ownership?

The frequency of additional measures requested by FF respondents who said the overall financial impacts of riparian regulations on their forest ownership have been negative is similar. The main difference is that "regulatory flexibility" is more often requested than programs to compensate SFLOs and the third most common request from respondents who said the financial impacts have been "very negative" on their ownership is for "Additional Alternate Plan templates." *The higher relative frequency of requests for "Additional Alternate Plan templates" by respondents who say the impact of riparian regulations have been "very negative" on their forest ownership is consistent with our key finding about Alternate Plans.* Essentially, FF survey respondents who have taken the time and effort to educate themselves about the details of Alternate Plans and say they have attempted at least one on their property are among those who feel most negatively impacted by the State's riparian regulations.

To interpret the frequency of additional measures requested by FF survey respondents, it is not surprising that "more regulatory flexibility" is a commonly requested measure. It is a generalized statement requiring no specific knowledge of any particular regulation. What is noteworthy is that funding for programs to compensate SFLOs are *more popular than*

generalized regulatory relief. Figure 96 allows us to conclude that State funding for programs to compensate SFLOs is very popular and appreciated by SFLOs. We add a caveat that the question only asks respondents about "opportunities to be paid for the carbon value of my forest land" without specifying any terms or conditions. As Section N makes clear, the details of how a carbon payment program is organized can entail substantial conditions on SFLOs in order to receive payment. We are confident that presenting SFLOs with the requirements of participation in any given carbon payment program would result in fewer survey respondents indicating interest in such a program.

13 SYNTHESIS OF RECOMMENDATIONS

We offer several recommendations in terms of the actions that may help keep SFLO lands in forestry or open space uses. Based on the combination of known State objectives and the strength of evidence we found as a part of this Report, we separate the recommendations into three levels. A level recommendations are unqualified recommendations. These recommendations are justified given a known and codified policy objective maintaining SFLO lands in resource and open space uses. The B level recommendations are recommendations we find strong qualitative and quantitative support for, but they also depend at least partly on the policy objectives of the State of Washington. C level recommendations are solutions that we may not be able to demonstrate overwhelming support for, but they are worth exploring. While the professional opinion of the authors of this report is that the most effective measures that can be taken to help keep Small Forest Land and their owners as a part of the landscape are additional, secure resources for outreach, education, and technical assistance for SFLOs, most of the measures recommended in this report are likely to at best have a marginal impact slowing the rate of forest conversion. The State needs a larger set of policy instruments (both traditional and non-traditional) and it needs to be innovative to have a chance of significantly slowing Small Forest Land loss.

13.1 A-Level Policy Recommendations

13.1.1 A1. Secure Funding for the SFLO Office & Other Services for SFLOs

Additional and secure funding for SFLO Office as well as other public organizations offering outreach, education, and technical assistance to SFLOs. While the SFLO office has been performing quite well under the funding and staffing limitations, it is clear from multiple lines of evidence that SFLO office needs additional resources in order to fulfil its legislatively mandated mission. As we discuss in the introduction, the relative focus of the SFLO office (I.e., relative focus on land base and harvesting versus on a broader set of objectives of the population of people owning the land) remains a point of potential tradeoffs but a more robustly supported Office can minimize the extent of such tradeoffs in its work.

Universal across all stakeholder groups was a proposed increase in stewardship or technical foresters to assist landowners. All stakeholder groups have specifically stated more stewardship foresters or foresters to support technical assistance would help. Besides specifically noting stewardship foresters, all stakeholder groups referenced a forester or individual who would walk with the landowner on their land to provide information, advice, and other recommendations. Some interviewees expressed that more extension foresters would help. In terms of the number of foresters that are needed, extension interviews suggested a stewardship forester and extension forester for every DNR region pairing. Also, results show the SFLO Office tends to assist SFLOs who are relatively more interested in timber harvesting compared to SFLOs with other objectives, although its mandate is broader than assisting with harvest-related activities. Even SFLOs who harvest timber and submit Forest Practices applications have many different ownership objectives. Education, outreach, and Forest Practices regulations should consider that SFLOs have diverse objectives and needs including, but certainly not limited to, timber harvesting.

Interviewees across stakeholder groups have indicated that one of the prevailing requests of SFLOs is education in terms of forest health and regulation. Some landowner interviewees stated that they would like to better understand the resources that are available to them. Other landowners would like to know how to improve forest health or habitat quality. Finally, other landowners would like to know more about regulations. State employees stated that the lack of education is a big issue for landowners. Extension interviews also stated landowners seem to be increasingly interested in Extension education programs, but outreach and getting landowners to attend programs that are most beneficial to them can be difficult. A landowner association interview also indicated that most landowners want to do the right thing, but some do not know how to do it. This frequent discussion about education and technical assistance for SFLOs indicates a need for a proposal addressing these wants or needs. *Our survey work and existing knowledge on the importance of education and technical assistance in maintaining economic*

viability and ecological function of privately owned lands allows us to concur with these stakeholder-driven recommendations.

Some survey results that support additional investment in education and technical assistance to SFLOs are worth repeating for this recommendation. First, legacy concerns being linked to higher rates of forest conversion lends yet additional support to investing in outreach, education, and forest stewardship services. Helping owners who feel challenged by lack of willing heirs and development pressure will in all likelihood help SFLOs who want to keep their forest lands forested. Second, the results of two different surveys confirm that SFLOs who are interested in learning more about the care, management, or protection of their forest lands tend to also think the public benefits their forests provide are important and overwhelmingly want to keep their forest land forested. Assistance for SFLOs who want to learn about the care, management, or protection of their lands is enabling owners who want to keep their lands forested into the future. The bulk of results from the Non-Industrial Private Forest Land owner literature suggests that while most landowners who receive assistance services were already interested in the care of their lands, there remains a great majority of owners who are interested in outreach services but have not received them. We also repeat the finding that additional technical assistance was the third most requested additional measure by FF survey respondents to address the impact of riparian regulations on their ownership.

We make three practical notes to conclude recommendations for additional and broader focused education and assistance services. First, one task for additional technical assistance foresters is to help SFLOs with completing technically challenging Alternate Plan applications. Although a minority of respondents who said they have submitted Alternate Plans offered a criticism of the process, the most common complaint is that the process is difficult and complicated and does not allow much additional harvesting than what is allowed under existing rules. In the absence of changes to existing regulations, additional technical assistance foresters can help alleviate the difficulty and complexity of applying for Alternate Plans. Second, the land use change modeling work in the Report leads us to suggest that assistance services should seek out SFLOs in western Washington who apply for harvesting and/or road building as leads to begin discussions about forest conservation options and/or forest legacy needs. Third, extension and stewardship foresters, as well as other State services, are well advised to specifically focus on forest succession planning and legacy conservation goals. Using a rare opportunity to follow-up on the actual land use outcomes of SFLO respondents, we find that SFLOs who feel more challenged by future ownership concerns (lack of a willing heir and development concerns) are more likely to have their forest properties converted away from forestry and open space land uses.

13.1.2 A2. Promote the Designated Forest Land Tax Program and Tax Forest Development

A2) Encourage afforestation/ reforestation in a way that increases the density of forest cover on small forest land as well as enlarges existing forest tracts; however, this needs to be done in a way that is consistent with supporting forest health. We recommend continued emphasis on appropriate reforestation and afforestation and enrollment in DFL programs as a way to protect forests from conversion, especially if this is done in a way that increases forest connectivity and enlarges existing tracts of forest land. We also caution, however, that increasing the intensity of forest cover may have adverse forest health impacts depending on site-specific conditions. It is therefore important to balance afforestation or reforestation efforts with forest health concerns. Increasing enrollment in existing DFL programs and restructuring the DFL programs to allow for non-harvest management objectives are likely to serve the goal of forest retention.

13.1.3 A3. Fund the Family Forest Fish Passage Program

Robust funding for the FFFPP is likely to continue benefitting both the landowners and the public via its prioritization mechanism based on habitat considerations. The Program has received relatively few complaints from the FF survey respondents. FFFPP is also considered underfunded according to our interviews with all stakeholder groups. While some stakeholder groups have expressed concerns that FFFPP was receiving priority over FREP, while FFFPP was not a part of the original Forest and Fish agreement, we should note that issues of equity of mitigation or compensation should ideally be addressed by means which do not undermine a popular and cost-effective program for enhancing private lands while providing habitat benefits to the public. This is echoed in the fact that no stakeholder interviewed suggested that FFFPP should receive less funding. While some interviews suggested that the fish passage culverts funded by FFFPP are over-engineered and could be made simpler with less funds, these suggestions did not include overall remarks on less funding for the program. Subject to appropriate engineering and design standards for fish passage barrier removal, the state *may* further look for opportunities to increase efficiency by allowing SFLOs to find competing contractors who may be able to correct barriers at lower costs.

13.1.4 A4. Support Information Needs for Better SFLO Policies and Programs

Existing reporting requirements for the SFLO Office described in (Review of Legislative Reports and Fulfillment of RCW 76.13.110 (5) and (6)) make it clear that the SFLO Office and state policymakers require timely, reliable, and consistent sources of data on SFLOs and their lands. Since SFLO lands exist in the broader land use context, full description of land trends requires a description of other land ownerships, land uses, and land cover types in Washington, as exemplified by the “wall-to-wall” nature of the Washington Parcel and Forestland Database. As we describe above, the SFLO Office relies on the statewide parcel database and its creators for information needed to accurately report the state and trends of Washington SFLOs and their lands. The current Report provided funding for the comprehensive database update, yet

without continued support, the information will become outdated over time. Given the comprehensive geospatial nature of the task that the SFLO Office is charged with, the compilation of the underlying data for the trends reports needs to be done by geospatial analysis professionals. While state agencies house many such professionals, the School of Environmental and Forest Sciences possesses the existing expertise with the parcel database, and providing ongoing support for data collection and processing tailored to the needs of the SFLO Office is likely a cost-effective way to ensure ownership and land trends data is available for legislatively mandated reports. To complement the parcel database, the State should also consider establishing regular funding to perform periodic, updated surveys of the general population of Washington SFLOs.

RCW 76.13.110 also requires the following of the SFLO Office:

> (e) Recommendations on ways the board and the legislature could provide more effective incentives to encourage continued management of nonindustrial forests and woodlands for forestry uses in ways that better protect salmon, other fish and wildlife, water quality, and other environmental values.
>
> (6) By December 1, 2004, and every four years thereafter, the small forestland owner office shall provide to the board and the legislature an update of the report described in subsection (5) of this section, containing more recent information and describing:
>
> (a) Trends in the items estimated under subsection (5)(a) through (d) of this section;
>
> (b) Whether, how, and to what extent the forest practices act and rules contributed to those trends; and

One can note that some of the questions the SFLO Office is tasked with addressing as a part of RCW 76.13.110 are quite similar to the questions we address in this Report. As we describe above, geospatial, cadastral, and administrative data such as program or harvesting applications are necessary but not in general sufficient to address such questions.

We recommend that the state supports the SFLO Office in terms of demographic, socioeconomic, attitudinal, and other data needed to a) better address its reporting requirements and b) to better understand the population of SFLOs in order to more effectively tailor programs and recommend policies that promote SFLO forest retention objectives. This understanding at the national level is reflected in the ongoing National Woodland Owner Survey which is a part of the Forest Inventory and Analysis National Program and the existence of the partially federally supported Family Forest Research Center in Amherst, Massachusetts. At a minimum, we recommend the State support SFLO Office in its cooperation with the NWOS

program as well as with the Washington State University Cooperative Extension. University of Washington conducted fairly extensive surveys of Washington SFLOs as a part of data collection for this Report. The Family Forest Research Center has conducted a so-called "intensification survey" of Washington SFLOs to assist the SFLO Office with its reporting needs, and could perform a similar service in the future. Combined with surveys similar to the general population (GP) survey in this Report, future surveys could continue to provide necessary information for the four-year SFLO Office reports. Stable support for collaboration among the SFLO Office, the NWOS program, WSU Extension, and the University of Washington researchers can ensure a continued fulfillment of the legislative obligations and provide a continuing source of policy-relevant SFLO data and research.

13.2 B-Level Policy Recommendations

The B level are recommendations we find strong qualitative and quantitative support for, but they also depend at least partly on the policy objectives of the State of Washington.

13.2.1 B1. Fund the Forest Riparian Easement Program

The Forest Riparian Easement Program has been underfunded. Increasing funding for FREP would reduce the currently very long waiting times. Essentially, if the State wants to prioritize equity concerns of SFLOs from the forests and fish agreement and it wants to continue with its existing Adaptive Management Program for riparian forest regulations, then additional funding for FREP is an appropriate policy measure. While FREP was a part of the original Forest and Fish agreement and was not intended to serve directly as a forest retention tool, we find that the program has a double dividend: it alleviates perceived regulatory impacts and keeps some land in forestry and open space land uses (in the additional, counterfactual sense). At the same time, we do not find that lack of FREP funding can be causally connected to loss of riparian habitat, regardless of land use classification. The primary argument for FREP is also one of equity and compensation (a partial Coasian compensation resulting from the reallocation of property rights occurring via the Forest and Fish rules), which means that a cost efficiency comparison with other methods of preserving forest land use is not necessarily the criteria to use for whether to recommend more funding for the program. In addition to compensating landowners impacted by riparian regulations, the program appears to improve the perceived impact of the regulations, while also having some protective effect on forest land use (although not on riparian habitat).

Giving more funding to FREP to shorten the waiting time from application to approval to payment can both help to keep more small forest land in forestry land use and to address the perceived impacts of riparian regulations on SFLOs themselves. We repeat the finding that additional funding for FREP and potential carbon payments were the most frequently requested measure that FF survey respondents said the State could take to address the impact of riparian

regulations on their forest ownership. It is not an inexpensive program and, while there may be other alternatives to preserve the forest, we stress that FREP serves an important function of compensating SFLOs who bear a relatively higher private cost of riparian habitat provisioning. In other words, it is addressing a matter of "distribution" not necessarily of "efficiency." At the same time, some marginal changes can be made to the program without sacrificing its intent. In the spirit of maintaining forest land base in perpetuity, the terms of the riparian easement could be amended to extend the duration of the easement (currently 50 years with the ability to re-apply after the 50-year term limit expires), potentially into perpetuity. While we did not explicitly evaluate such policy changes in our surveys, such changes would likely have a two-fold effect. First, it may make those who wish to preserve the future development option less likely to apply for a program, thus alleviating the waiting list backup. Secondly, such changes would likely reduce the additionality of FREP in terms of its effectiveness as a broader forest retention tool (which was not its original intent).

Also, RCW regarding FREP stipulates that no more than 50% of funds should go to timber cruises for valuation purposes. While our report is not evaluating timber cruise methodologies or accuracy, we would like to note that in the spirit of aiming to reduce the (transaction) costs associated with timber cruises for FREP, SFLO office and DNR should study ways to leverage new remote sensing technologies which could be utilized for timber assessments in order to save on assessment costs and thus stretch FREP budgets further, reducing the waiting times for FREP applicants and allowing other qualifying landowners to apply. Informal and formal stakeholder conversations also revealed a desire on the part of those who are and have been involved in the administration of FREP to streamline the administrative approval process. For example, reducing the "high touch" nature of multiple people needing to approve the same FREP application multiple times. Efforts to look for efficiency improvements in various aspects of FREP are warranted.

The SFLO office should consider a better customer relationship management system (CRM) to let FREP applicants know about the status of their applications regularly and occasionally follow up with ownerships that have a paid easement since ownership may change hands and new owners are unaware of the details of the easement. Numerous stakeholders, interviewees, and some survey respondents expressed frustration that they have not heard about the status of their FREP application after it was initially submitted. A modern CRM can also help the SFLO Office in managing other programmatic, outreach, and education efforts. Given the preferences expressed by SFLOs themselves and interviewees, postal mail materials are the primary method of contact that many SFLOs seem to prefer

Typically additional outreach and education is recommended for programs for family forest owners, but with the current waiting list time being so long it is not clear that additional awareness of FREP (and presumably more owners on the waiting list) would be beneficial. We

would give priority to decreasing the average expected time on the waiting list over additional marketing of FREP.

We conclude recommendations concerning FREP by repeating that these recommendations assume that riparian regulations regarding Small Forest Lands remain mostly unchanged from what they are now. If changes are made, such as a separate set of regulations specific to SFLOs, or an expansion of the 20 acre exempt rule to apply to more forest land, then the justification and need for additional FREP funding may *potentially* decline.

13.2.2 B2. Pilot a Reverse-Auction Conservation Easement Program

The most direct way for the state to preserve SFLO forests of significance to the public without reallocating property rights is to purchase land use (development) rights. If the State is willing to use public funds to increase permanently conserved forest land, considering that SFLOs have an estimated average income substantially higher than the average Washingtonian, then piloting a novel conservation easement program based on the principles of competitive reverse auctions can be appropriate. We describe the elements of such a program above. An enormous policy challenge is to create a competitive mechanism where bids of landowners to relinquish their rights to convert their forestland would be evaluated in a way that allows for true competition among bidders (improving allocative and budgetary efficiency) and that properly evaluates the public benefits stemming from such bids, including the issue of whether such benefits are additional (in the counterfactual sense). In a broader conservation literature, some authors contend that land protection benefits paid for with public dollars are not 'real' if they are not additional. To a large extent, the issue can never be fully resolved because it relies on counterfactual analysis.

As a practical compromise, however, we would suggest that underlying risk of conversion estimated by land use change risk models we present above or other such models or even simpler risk assessment tools could produce information relevant to the scoring of landowner bids in terms of expected additionality of purchased easements. At the same time, other benefit information would also enter into the bid scoring process, which would allow for a reasonable implicit tradeoff to be made between benefits and stated costs of easements and the unobservable estimate of additionality of conservation protection. As we discuss above, the degree of complexity and technical sophistication in reverse auctions and bid acceptance decisions remains largely a matter of policymakers' preference, including the decision on how much to invest in the supporting technical expertise and infrastructure. Simpler scoring schemes can target conservation easements in areas of ecological benefit and under relatively higher threat of residential or heavy development. The areas where such pressures are relatively higher are not surprising, and can be found in the maps presented above.

We acknowledge that it will likely take substantial outreach and negotiation to produce a competitive and cost-effective mechanism to purchase conservation easements that is

perceived as fair and equitable by SFLOs. Such a program will need to fulfill the criteria described above as well as achieve a reasonable acceptance among SFLOs themselves. Anecdotal evidence and personal experience working with family forest owners leads us to advise that most SFLOs have a strong sense of what is fair, and a potential State-funded conservation easement program will need to fit within reasonable bounds of what many SFLOs consider to be "fair and reasonable."

On a practical note, our results show that as SFLOs become older, they are less willing to entertain the possibility of a conservation easement. So, the topic of conservation alternatives, both easements and other options, should be a topic of conversation for SFLOs of all ages and ownership tenure lengths instead of something reserved for SFLOs who are actively seeking legacy planning advice.

13.3 C-Level Policy Recommendations

C level recommendations are solutions that may not be able to demonstrate overwhelming support for, but they are worth exploring. While the professional opinion of the authors of this report is that the most cost-effective measures that can be taken to help keep Small Forest Land and their owners on the landscape are additional, secure resources for outreach, education, and technical assistance for SFLOs, many of the measures recommended in this report are likely to at best have a marginal impact slowing the rate of SFLO forest conversion. The State needs a larger set of policy instruments (both traditional and non-traditional) and it needs to be innovative to have a chance of significantly slowing Small Forest Land loss. At the same time, sweeping policy proposals would invariably involve other land use classes and ownerships. Broader land use policy for the state is outside of the scope of the current Report, with the existing Growth Management Act providing the current framework. As a matter of overall land use policy, a focus on SFLO lands exclusively would not be either effective or efficient. Bradley et al (2007) provide many recommendations still relevant today with respect to maintaining Washington's working forests (Bradley et al. 2007).

13.3.1 C1. Consider Forest Practices Regulations as a Tool for SFLO Outreach

First, we fail to find evidence that riparian small forest land (at the parcel-level) is being sold and/or converted away from resource land uses at higher rates compared to other small forest land. Results do confirm, however, that SFLOs with riparian forest land on the westside of Washington tend to have higher generalized regulatory concerns compared to owners with less or no riparian forest land, or SFLOs on the eastside of Washington. We therefore do not further discuss specific changes to existing riparian regulations in terms of the impacts they may potentially have on forest land use retention, but in terms of addressing generally higher perceived regulatory burdens.

Second, we note the robust result that owners of larger amounts of forest land tend to be more interested in profitable timber management as an objective and therefore would likely benefit relatively more from the relaxation of Forest Practices regulations compared to SFLOs with smaller amounts of forest land under ownership. In addition, ownerships with large and contiguous forest properties under ownership are less likely to sell and/or convert their forest lands away from forestry land use.

However, many indications from informal and formal interviews, write-in comments on the GP and FF surveys, requests for additional regulatory flexibility on the FF survey, and phone calls from survey recipients suggest that simplifying or otherwise lowering the complexity involved in Forest Practices regulations for SFLOs would be beneficial for even small-scale Washington SFLOs. For riparian regulations specifically, the Adaptive Management Program is the mechanism through which such rule changes should be developed in the status quo policy framework. Under status quo riparian regulations, a minority of SFLOs representing a majority of the forest land base feel negatively impacted by the current rules produced from the Forests and Fish agreement. All indications are that Alternate Plan templates have greatly increased SFLO access to Alternate Plans while reducing the difficulty and costs of the application process. In the absence of SFLO-specific rules for riparian harvests, additional Alternate Plan templates would likely help to alleviate the perceived regulatory concerns of SFLOs with riparian forests in Western Washington.

Interviews and FF survey results confirm very clear differences in SFLO regulatory and forest health priorities on the east and west sides of the State. For the eastside of Washington, riparian harvest issues are much less salient to SFLOs, while forest health and better aligning Forest Practices regulations with eastside-specific ecological conditions are top priorities. A number of interviewees from various stakeholder groups expressed support for revisions to Forest Practices regulations based on science as well as the East/West divide that creates substantially different ecological conditions on different sides of the State. As the results of numerous surveys used in this report confirm, SFLOs with many different kinds of objectives, not always including profitable timber management, engage in active forest management. While this report does not offer specific recommendations for changes to Forest Practices regulations, we advise that a great number of SFLO ownerships will encounter Forest Practices regulations at some point in their ownership tenures (as many as an estimated 69,000 ownerships over the course of 20 years). In that context, Washington's Forest Practices regulations are perhaps the most common point of contact between SFLOs and State agencies, and should be considered as an opportunity to facilitate continued stewardship of the State's Small Forest Land.

13.3.2 C2. Support Programs for SFLO Peer-to-Peer Connections

The State should consider supporting "outside the box" initiatives for SFLOs that are not necessarily typical state-administered programs. We offer one example of a peer-to-peer service that can match existing SFLOs with new SFLOs and seek to link potential SFLO mentors with relatively new SFLOs who would benefit from peer-to-peer learning. The State should consider supporting similar NGO initiatives with technical assistance and/or start-up grant funding.

13.3.3 C2. Set Priorities for Potential SFLO Carbon Payment Programs

While not empirically evaluated in this work, taxing carbon emissions, including those resulting from land use change, is likely to be an important part of effective and cost-efficient climate change policies. The State can consider imposing a fee on forests lost to development that could be, for example, based on the Environmental Protection Agency's Social Cost of Carbon. Such a fee on the conversion of land from forestry or open space uses to developed uses may have a modest impact on slowing forest conversion rates, but the revenue from the fee should be reinvested in forest retention programs. Additionally, policies (which will likely be implemented at the county level) that discourage additional development near Small Forest Lands can help keep more forest land intact and relieve development pressure on remaining Small Forest Land.

With respect to policies specifically aimed at SFLOs, the State can best evaluate its alternatives by deciding if its goal is one of the following, or a prioritization of two or all goals: maximize SFLO participation in a potential carbon program (and to explicitly pursue a carbon compensation and/or a climate change *adaptation* strategy as a mechanism to help prevent the conversion of forestland to non-resource uses), maximize the climate impact of forest carbon sequestration, or facilitate SFLO participation in a particular voluntary or compliance offsetting market. In the context of this report, paying SFLOs for the carbon sequestration services of their land has the potential to make a contribution to maintaining small forestland as forests, but can be expected to have a modest impact on slowing conversion away from forestry land use.

Specific policy options and recommendations for carbon payment programs can be found in the "Recommendations for State Policy Opportunities" section at the end of the carbon payments chapter.

13.3.4 C4. Maintain Wood Processing Infrastructure

Our interviews with the State Employees, Landowner Associations, and the Extension referenced the lack of mill infrastructure, mainly in Eastern Washington, being an economic burden for landowners. Some stakeholders suggested small scale or community mills around the state to support small harvests or forest health operations to increase economic viability. Some prior evidence (Brent and Rabotyagov 2013) suggests that developments which would

increase utilization of forest biomass and result in additional infrastructure may have a modest impact on overall forestland retention in the state. We do note that very few of survey respondents listed a lack of processing infrastructure as a reason for selling or planning to sell their land. Although it has not been a subject of analysis in this report, it is not unlikely that the forest health benefits alone of such efforts to boost timber production infrastructure may be sufficient to justify such efforts.

13.3.5 C5. Support Transfer of Development Rights Markets

Similar to voluntary conservation easements, transfer of development rights (TDR) policies and programs have the potential to serve broader land use planning goals in way that is theoretically cost-effective and market-driven. The state indeed has a regional framework in place (RCW 43.362 https://app.leg.wa.gov/RCW/default.aspx?cite=43.362&full=true), wherein the legislature "finds that current concern over the rapid and increasing loss of rural, agricultural, and forested land has led to the exploration of creative approaches to preserving these important lands, and that the creation of a regional transfer of development rights marketplace will assist in conserving these lands. (2) A transfer of development rights is a market-based exchange mechanism that encourages the voluntary transfer of development rights from sending areas with lower population densities to receiving areas with higher population densities. When development rights are transferred through a transfer of development rights exchange, permanent deed restrictions are placed on the sending area properties to ensure that the land will be used only for approved activities, activities that may include farming, forest management, conservation, or passive recreation. Additionally, in a transfer of development rights exchange, the costs of purchasing the recorded development restrictions are borne by the developers who receive the transferred right in the form of a building credit or bonus. (3) The legislature further finds that a successful transfer of development rights program must consider housing affordable to all economic segments of the population, and economic development programs and policies in designated receiving areas. Counties, cities, and towns that decide to participate in the regional transfer of development rights program for central Puget Sound are encouraged to adopt comprehensive plan policies and development regulations to implement the program that do not compete or conflict with comprehensive plan policies and development regulations that require or encourage affordable housing. Participating cities and towns are also encouraged to use the development of receiving areas to maximize opportunities for economic development that supports the creation or retention of jobs. (4) Participation in a regional transfer of development rights program by counties, cities, and towns should be as simple as possible. (5) Accordingly, the legislature has determined that it is good public policy to build upon existing transfer of development rights programs, pilot projects, and private initiatives that foster effective use of transferred development rights through the creation of a market-based program that focuses on the central Puget Sound region. A regional transfer of development rights program in the central

Puget Sound should be voluntary, incentive-driven, and separate, but compatible with existing local transfer of development rights programs." Washington law charges the Department of Commerce with funding "a process to develop a regional transfer of development rights program" which is subject to Growth Management (RCW 36.70A**)** laws. Department of Commerce reports that "The Regional Transfer of Development Rights Alliance is a partnership of King County, Pierce County, Snohomish County, Kitsap County Forterra (formerly the Cascade Land Conservancy), the Washington State Department of Commerce and the Puget Sound Regional Council. The Alliance works to encourage cities to participate in the conservation of farm, forestry and open space land through Transfer of Development Rights (TDR) in the four central Puget Sound counties (King, Pierce, Snohomish, and Kitsap). The Department of Commerce is an active partner, providing direct technical assistance to counties and cities in the four-county central Puget Sound region." ("Growth Management Development Rights" n.d.)

King County has the largest active TDR program ("Transfer of Development Rights - King County" n.d.) and says that "The TDR Program is a voluntary, incentive-based, and market-driven approach to preserve land and steer development growth away from rural and resource lands into King County's Urban Area. The Program is based on free-market principles and prices that would motivate landowner and developer participation. Rural landowners realize economic return through the sale of development rights to private developers who are able to build more compactly in designated unincorporated urban areas and partner cities. The Program has protected over 144,500 acres of rural/resource land from 1998 to 2019. This market in development rights allows rural landowners to receive financial compensation without having to sell or fully develop their land. Developers are financially motivated to purchase development rights from the TDR market as they are able to put additional dwelling units in their projects." Although we did not focus explicitly on Washington's TDR market, it is worth noting that, by and large, the existing process is quite complex and introduces multiple layers of county, municipal, and public involvement. The complexities are rooted in the reality of the complex nature of land use causes, consequences, and attendant social, economic, and environmental impacts. At the same time, the existing complexity clearly hampers the efficacy of the TDR efforts in the state.

Setting development caps or other rules encouraging demand for development rights from forest lands and of important market parameters ('trading ratios', so called "receiving area ratios") has been delegated to county and municipal authorities. l. Explicit setting of caps (constraints) on land development is clearly a very contentious issue and delegation of such responsibility to the local levels may create a situation where no county or municipality wishes to constrain development unilaterally. TDR programs in principle can easily accommodate more SFLO lands. At a minimum, based on the pattern of SFLO land conversion we observe in this Report, the state should consider expanding the TDR code to include other counties with high conversion rates.

The state could consider taking a stronger leadership role in supporting the TDR marketplace by committing to explicit state-wide caps of the form of “no net forest loss” (similar to existing “no net loss” provisions for the Shoreline Management Act, or the charge, under the Growth Management Act, for counties to conserve resource lands, for example). It should be noted that a TDR program is (in principle) a market-based approach where buyers and sellers compete under a fairly simple set of rules. Real simplicity in a TDR program is very difficult to achieve, given the state’s existing regulations pertaining to land use and development: Shoreline Management Act, the Growth Management Act, the Hydraulic Permitting Act, and the Model Toxics Control Act. Aside from economic, social, and regulatory challenges, simplifying TDR programs would also run into difficulties historically present with creating tradeable permit programs for complex, potentially interdependent, and multi-objective ecological endpoints. Thus, drastic simplification of TDR rules would require significant compromises on the part of the affected stakeholders but also in terms of environmental science. Reasonable approximations can, in principle, be developed, but would require significant investment and stakeholder buy-in. Overall, parting with development rights is a fairly appealing option to many SFLOs, as we have found in this report. Thus, the barriers to utilizing TDR programs for forest retention largely do not lie on the supply side.

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15 Appendix A – General Population Survey

SCHOOL OF ENVIRONMENTAL & FOREST SCIENCES
UNIVERSITY of WASHINGTON
College of the Environment

WASHINGTON

Small Forest Landowner Survey

Box 352100, University of Washington, Seattle, WA 98195-2100
Phone: (206) 221 7434 Email: danleyb@uw.edu

Instructions

The owner who makes most of the decisions about your forest land in Washington should answer this survey.

If this survey is received by a company or other organization, please have a person knowledgeable about the organization's forest land in Washington answer the survey.

To answer questions with a circle or checkbox, please use either a cross mark (X) or fill in the circle or checkbox completely with a pencil or pen.

To answer questions with text boxes, please write your answers clearly inside the space provided. You will have an opportunity to write additional comments at the end of the survey.

General Questions about Your Ownership

1. How many total acres of land do you own in the State of Washington?
(round to closest whole acre) ☐☐☐☐☐☐☐

2. How many of those acres are forested?
(round to closest whole acre) ☐☐☐☐☐☐☐

3. Do you currently own more than one separate, unconnected forest property in Washington?

- ○ Yes
- ○ No

4. What category best describes your ownership? *(check all that apply)*

- ☐ Individual or jointly owned with my spouse
- ☐ Jointly owned, with other family members or friends
- ☐ Family partnership or family LLC or LLP
- ☐ Family trust or estate
- ☐ Corporation or business

5. Do you have your home, vacation home, or a cabin on or within a mile of your forest land in Washington?

- ○ Yes
- ○ No
- ○ Not Applicable

6. Have you submitted a Forest Practices Application in the previous 10 years?

- ○ Yes
- ○ No

If you answered YES to question 6, Did you carry out the management practice in the application?

- ○ Yes
- ○ No

5010 *To respond:* ☒ *or* ● 3910 0001

7. Do you anticipate submitting a Forest Practices Application in the coming 10 years?

- ○ Yes
- ○ No

IF you answered NO to question 7, why not?

- ☐ I am not interested in harvesting timber
- ☐ There is/will be nothing ready to cut
- ☐ I need more information or assistance to make this decision
- ☐ Differences of opinion within the ownership
- ☐ I may not own the property in the next 10 years

Other *(please specify)*

8. Do you own any land that is farmed or ranched within 1 mile of any of your forest land in Washington?

- ○ Yes
- ○ No

If you answered YES to question 8: If any of your farm or ranch land has been converted to forestry within the past 10 years, please indicate the reasons why you planted trees or allowed trees to grow on your land. *(check all that apply)*

- ☐ For tax purposes
- ☐ I participate in an incentive program, such as a cost share or CRP
- ☐ To assist in agricultural or ranch production
- ☐ To improve water quality
- ☐ For aesthetic reasons
- ☐ For hunting purposes
- ☐ For recreation
- ☐ Other

5010 *To respond:* ☒ *or* ● 3910 0002

9. How did you get your forest land? *(check all that apply)*

- ☐ Inherited
- ☐ Purchased from parents or other relatives
- ☐ Purchased from a non-relative
- ☐ Received as a gift
- ☐ Other

10. What generation landowner are you?

- ☐ First generation
- ☐ Second generation
- ☐ Third generation
- ☐ Fourth generation or more
- ☐ Not sure

11. Since what year have you personally owned your forest land in Washington?

☐☐☐☐

12. Are you a member of a natural resource, landowner, or environmental organization that addresses issues related to your forest land?

- ○ Yes
- ○ No

If you are a member of any natural resource, landowner, or environmental organization, in which organization(s) are you a member?

5010 *To respond:* ☒ *or* ● 3910 0003

The importance of your forest land

13. Please indicate how important each of the following aspects of owning your forest land are to you and your household. *(check one for each item)*

	Not important	Of little importance	Neutral	Important	Very Important	Not applicable
My forest land provides environmental benefits	○	○	○	○	○	○
My forest land protects water resources	○	○	○	○	○	○
I have privacy on my forest land	○	○	○	○	○	○
Spending time on my forest land	○	○	○	○	○	○
Raising my family on the land	○	○	○	○	○	○
Income from potential development or the sale of my forest land for residential use	○	○	○	○	○	○
Income from forest management contributes to my household's annual income	○	○	○	○	○	○
Harvesting timber for sale	○	○	○	○	○	○
Income from potential development or the sale of my forest land for commercial use	○	○	○	○	○	○
Firewood and/or other non-timber products	○	○	○	○	○	○
Hunting on my forest land	○	○	○	○	○	○
Recreation on my forest land, other than hunting	○	○	○	○	○	○
Future ownership of my forest land stays within the family	○	○	○	○	○	○
My personal attachment to the land	○	○	○	○	○	○
My forest land provides benefits to the community	○	○	○	○	○	○
OVERALL, how important is your forest land to you and your household?	○	○	○	○	○	○

To respond: ⊗ *or* ●

Current use tax programs

To encourage the continued existence of forests in the State of Washington there are a number of programs that reduce or eliminate property taxes for forest land. Some programs vary by county, but the statewide programs are Designated Forest Land (DFL) and Open Space Land.

14. Please indicate your current involvement with tax reduction programs in the State of Washington *(check all that apply)*

- ☐ One or all of my forest/agricultural properties are enrolled in Open Space
- ☐ One or all of my forest/agricultural properties are enrolled in Designated Forest Land
- ☐ One or all of my forest properties are enrolled in another Washington State current use tax program
- ☐ None of my land is enrolled in these programs *please skip to question 17*

15. If you own land enrolled in a reduced or current use tax program (Open Space, Designated Forest Land (DFL) or another program), please indicate your level of agreement or disagreement with the following statements. *(check one for each item)*

	strongly disagree	disagree	neutral	agree	strongly agree	not applicable
The reduced tax status is an important reason I am able to continue owning my forest land	○	○	○	○	○	○
I use savings from DFL and/or Open Space to re-invest in my forest land	○	○	○	○	○	○
The tax program compensates for the harvest revenue I lose due to restrictions on timber management	○	○	○	○	○	○
I like that the reduced tax program discourages development on my forest land now and in the future	○	○	○	○	○	○
I plan to drop out of the reduced tax program at some point in the future	○	○	○	○	○	○

5010 *To respond:* ☒ *or* ● 3910 0005

16. Would you recommend or have you recommended the same reduced or current use tax program you are enrolled in to other landowners?

- ○ Yes
- ○ No

17. If none of your properties are enrolled in a reduced or current use tax program, please indicate which (if any) of the following statements describe your opinion about these programs. *(check all that apply)*

- ☐ I intend to enroll some or all of my land into a reduced or current use tax program
- ☐ I am not familiar with these programs but would like to receive more information about them
- ☐ I am not interested in these programs because I may want to develop the land or sell to someone who does
- ☐ I am interested in these programs but not eligible because I do not manage my wooded land for timber harvesting
- ☐ I have attempted to enroll in at least one of these programs but have been unsuccessful
- ☐ The program(s) would not lower my taxes much

Other *(please specify)*

The future of your forest land

18. Have you ever sold or given away any of your forest land in Washington?

- ○ Yes
- ○ No

19. If you have sold or given away any of your forest land in Washington, why did you do so? *(check all that apply)*

- ☐ financial needs
- ☐ family circumstances
- ☐ weak timber markets
- ☐ no interest in maintaining the land
- ☐ relocated somewhere else
- ☐ didn't live nearby
- ☐ nearby timber mill closure(s)
- ☐ regulatory burdens

Other *(please specify)*

To respond: ☒ or ●

20. **Consider an option that would allow you to permanently prevent future residential and commercial development on some or all of your land**, while allowing other uses such as farming, forestry, and recreation to continue.

- These limits on the uses of your land would need to be followed by you and future owners forever
- You would not be able to subdivide your land
- Allowing public access to your land would be optional
- The land's property taxes may be reduced significantly
- You still own your land and could sell it to whom you want
- If you sold the land you would receive less than full market value, because it can no longer be developed
- For each acre of land you designate in the agreement, you would receive the following one-time, lump sum, per acre payment ☐

Would you do this?

○ Yes
○ No

Regarding question 20, how certain are you of your answer of "Yes" or "No"?

1-not at all certain, 2-slightly certain, 3-moderately certain, 4-very certain, 5-extremely certain *(check only one)*

not at all certain	1	2	3	4	5	extremely certain
	○	○	○	○	○	

21. Have development rights been sold or voluntarily given away on any of your forest land in Washington by either you or a previous owner? This is usually done in the form of a conservation easement. *(check only one)*

○ Yes ○ No ○ Don't know

22. Do you anticipate selling all or part of your forest land in the State of Washington sometime within the next 5 years? *(check only one)*

○ Yes
○ No

5010 *To respond:* ☒ *or* ● 3910 0007

23. To whom do you anticipate selling or transferring all or part of your forest land? *(check all that apply)*

- ☐ Children or grandchildren
- ☐ Other relatives
- ☐ Friends or neighbors
- ☐ Whomever offers the best price
- ☐ A charitable organization or land trust
- ☐ Spouse
- ☐ Haven't decided
- ☐ Not Applicable

24. How important is it to you that your land remain forested in the future after you no longer own it?
1-not important, 2-a little important, 3-moderately important, 4-important, 5-very important *(check only one)*

not important 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ very important

25. Separate from the sale or transfer of forest land is the issue of forest land being developed for residential or commercial real estate purposes. Currently, how do you rate the existing development pressure on your forest land? *(check only one)*

☐ great ☐ moderate ☐ low ☐ NA

26. Do you anticipate a substantial portion of your forest land will be developed?

○ Yes
○ No

If you answered "YES" to question 25, when do you anticipate the development will take place? *(check only one)*

☐ 0-5 years ☐ 5-10 years ☐ 10-15 years ☐ 15-20 years ☐ 20+ years

27. Which of the following statements best describes what you want to happen regarding keeping your land intact or subdividing your land (dividing your property into smaller ownerships)?

- ☐ I would like it to remain intact as a single property
- ☐ I would like to keep most of it together as one property
- ☐ Subdividing the property in any way is fine with me
- ☐ It is already divided
- ☐ I have not decided what I want to happen

5010 *To respond:* ☒ *or* ● 3910 0008

28. A number of agricultural organizations link retiring farmers with new farmers as a way to maintain farms. **Consider a similar service that links forest landowners to buyers with similar ownership goals as a way to maintain their land.**

- There is no charge for this service
- You can select a buyer who you think will use the land as you would like to see it used
- The new owner isn't legally obligated to use it the way you would like
- You are not obligated to choose anyone
- This service can also be used to link experienced landowners with newer landowners to provide advice and expertise

Which of the following describes your interest regarding this type of service for your land? *(check all that apply)*

- ☐ I would use this service
- ☐ I would choose someone from this service who has similar goals if they paid me the full market value of my land
- ☐ I would choose someone from this service who has similar goals even if they paid me less than the full market value of my land
- ☐ I would be interested in this service to get advice from experienced landowners
- ☐ I would be interested in this service as a way for me to help newer landowners
- ☐ I need more information
- ☐ I am not interested in this service at all

5010 *To respond:* ☒ *or* ● 3910 0009

Impacts on your forest ownership

29. Please indicate how much each of the following topics impact the ownership of your forest land for you and your household. *(check one for each item)*

	No impact	A little impact	Moderate impact	Substantial impact	High impact	Not applicable
Forest Practices regulations for timber harvesting	○	○	○	○	○	○
Forest Practices regulations for road maintenance	○	○	○	○	○	○
Other Forest Practices regulations	○	○	○	○	○	○
Wildfire hazard	○	○	○	○	○	○
Climate change	○	○	○	○	○	○
Extreme weather events	○	○	○	○	○	○
Air or water pollution	○	○	○	○	○	○
Damage from other people	○	○	○	○	○	○
Property taxes	○	○	○	○	○	○
Development of nearby lands for residential use	○	○	○	○	○	○
Development of nearby lands for commercial use	○	○	○	○	○	○
Regulations preventing development for residential use	○	○	○	○	○	○
Regulations preventing development for commercial use	○	○	○	○	○	○

Information and assistance needs

30. How interested are you in learning more about the care, management, or protection of your forest land?

1-not at all interested, 2-slightly interested 3-moderately interested, 4-very interested, 5-extremely interested *(check only one)*

not at all interested 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ extremely interested

5010 *To respond:* ⊗ *or* ●

3910 0010

31. Have you heard of the Washington State DNR Small Forest Landowner Office?

- ○ Yes
- ○ No

32. If you have had contact with the Small Forest Landowner Office in the last 10 years, what did they assist you with? *(check all that apply)*

- ☐ They helped me find another resource
- ☐ Forest Stewardship Program
- ☐ Forestry Riparian Easement Program
- ☐ Family Forest Fish Passage Program
- ☐ Road Maintenance & Abandonment Requirements
- ☐ Federal Cost Share Programs
- ☐ Forest Practices Applications
- ☐ Alternate Harvest Plans
- ☐ Regulation assistance
- ☐ Events for landowners

33. Which of the following topics would be helpful for you to know more about in order to make a decision about future ownership and/or use of your forest land? *(please check all that apply)*

- ☐ Will/Living will
- ☐ Trust
- ☐ Conservation easement/restriction
- ☐ Current use property tax programs
- ☐ Financial value of my land
- ☐ Ecological value of my land
- ☐ Tax issues
- ☐ Finding a local professional
- ☐ Ways to work with my family to achieve future goals
- ☐ How to find people interested in becoming forest owners
- ☐ Information on extreme weather events
- ☐ I don't need any information

Other *(please specify)*

5010 To respond: ☒ or ● 3910 0011

34. If you have received information in the last 10 years about the care, management or protection of your forest land, how satisfied were you with that information from the following sources? *(Check one for each item. If you did not receive information from that source, please mark "not applicable.")*

	Not applicable	Less than satisfied	Neutral	Satisfied
Small Forest Landowner Office	○	○	○	○
Government agency (not the Small Forest Landowner Office)	○	○	○	○
Private or non-profit organization	○	○	○	○
Professional forester	○	○	○	○
Conservation district	○	○	○	○
Extension forester	○	○	○	○
Neighbor	○	○	○	○
Relative	○	○	○	○

35. **How do you currently get information** and advice about the care, management, or protection of your forest land and **how would you prefer** to get information or advice related to your forest land?
(check all that apply)

	Currently get information	Prefer in the future
Written materials, such as brochures or other publications	☐	☐
Social media (such as Facebook)	☐	☐
Internet (non-social media)	☐	☐
Conference, class, or workshop	☐	☐
Have someone visit my land	☐	☐
Email or e-newsletter	☐	☐
Talk to a neighbor	☐	☐
Talk to an expert	☐	☐

5010

To respond: ☒ *or* ●

3910 0012

General questions about you

36. What is your age?

☐☐☐

37. What is your gender?

☐ Male
☐ Female

38. What is your formal educational background?

☐ Less than 12th grade
☐ High school diploma/GED
☐ Some college/Associate degree
☐ College diploma
☐ Graduate diploma

39. What percentage of your income comes from the forest land that you own (on an annual basis)? ☐☐☐

40. What was your total household income (including employment, social security, investments, or any other source) BEFORE taxes in 2019?

☐ $less than 25,000
☐ $25,000- 49,999
☐ $50,000-74,999
☐ $75,000-99,999
☐ $100,000-149,999
☐ $150,000-199,999
☐ $200,000+

5010 *To respond:* ☒ *or* ●

3910 0018

If there are any additional comments or concerns that you would like to share, please write them below.

Thank you for participating in this survey!
Please return the survey in the postage-paid envelope provided. If you are interested in the results of this survey, watch for our report to Washington State Senate Bill SB5330 in late 2020 or early 2021.

To respond: ⊗ *or* ●

16 Appendix B – Forest and Fish Survey

SCHOOL OF ENVIRONMENTAL & FOREST SCIENCES
UNIVERSITY of WASHINGTON
College of the Environment

Washington **Small Forest Landowner** Survey

SCHOOL OF ENVIRONMENTAL AND FOREST SCIENCES
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Phone: (206) 221 7434 Email: danleyb@uw.edu

Instructions

The owner who makes most of the decisions about your forest land in Washington should answer this survey.

If you are part of more than one group that owns forest land, please respond for the group (or ownership) that exists at the address listed on the outside of the envelope.

If this survey is received by a company or other organization, please have a person knowledgeable about the organization's forest land in Washington answer the survey.

To answer questions with a circle or checkbox, please use either a cross mark (X) or fill in the circle or checkbox completely with a pencil or pen.

To answer questions with text boxes, please write your answers clearly inside the space provided. You will have an opportunity to write additional comments at the end of the survey.

General Questions about Your Ownership

1. How many total acres of land do you own in the State of Washington?
(round to closest whole acre) ☐☐☐☐☐☐☐

2. How many of those acres are forested?
(round to closest whole acre) ☐☐☐☐☐☐☐

3. What category best describes your ownership? *(check all that apply)*

- ☐ Individual or jointly owned with my spouse
- ☐ Jointly owned, with other family members or friends
- ☐ Family partnership or family LLC or LLP
- ☐ Family trust or estate
- ☐ Corporation or business

4. Have you submitted a Forest Practices Application in the previous 20 years?

- ○ Yes
- ○ No

5. Did you inherit your forest property or purchase it from a parent or other relative?

- ○ Yes
- ○ No

6. Since what year have you personally owned your forest land in Washington?

☐☐☐☐

7. Are you a member of a natural resources organization, a landowner organization, or an environmental organization that addresses issues related to your forest land?

- ○ Yes
- ○ No

8269 *To respond:* ⊗ *or* ● 3929 0001

If you are a member of any resource, landowner, or environmental organization, in which organization(s) are you a member?

Your opinions

8. Considering the topics of water, streams, fish, and regulations on your forest land, please state your strength of agreement or disagreement with the following statements. *(check one for each item)*

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Not applicable
I wish there were substantially more salmon in Washington State rivers and streams	○	○	○	○	○	○
I think my forest land ownership in general is beneficial for salmon and/or other fish	○	○	○	○	○	○
I think what happens on and near my forest land has an important impact on fish	○	○	○	○	○	○
Conditions on lands and streams *upstream* of my forest land have an important impact on fish passage on my forest land	○	○	○	○	○	○
Conditions on lands and streams *downstream* of my forest land have an important impact on fish passage on my forest land	○	○	○	○	○	○
I think regulations regarding water, streams, and fish in the State of Washington are fairly applied to small forest lands compared to other land uses	○	○	○	○	○	○
I think active forest management within the riparian buffers on my forest land would not interfere with stream functions	○	○	○	○	○	○
I have given much thought to the regulations regarding the protection of water, streams, and fish on my forest land	○	○	○	○	○	○

8269 *To respond:* ⊗ *or* ● 3929 0002

The Forestry Riparian Easement Program (FREP)

The Forestry Riparian Easement Program (FREP) is a voluntary conservation program that partially reimburses land owners for the value of the trees they are required to leave to protect fish and riparian habitat. The program provides compensation for a minimum of 50 percent of the timber value within the easement.

The average wait time from application to approval/funding is approximately 6 years.

9. Have you heard of FREP before this survey?

- ☐ Yes
- ☐ No

10. What is the current status of your forest land as it relates to FREP? *(check all that apply)*

- ☐ There is an easement currently on my land *(skip to question 12)*
- ☐ My application is on the FREP waiting list *(skip to question 12)*
- ☐ I have multiple easements on my land or on the waiting list *(skip to question 12)*
- ☐ I received approval for FREP but decided against it
- ☐ None of the above

11. If you are not interested in FREP or have yet to apply for FREP, please list the reasons why.

8269 *To respond:* ☒ *or* ● 3929 0003

12. If you have a Forestry Riparian Easement on your land or are on the waiting list, please answer the following questions about the importance of FREP on your forest land. *(check one for each item)*

	Very unimportant	Somewhat unimportant	Neutral	Important	Very important	Not applicable
How important is it that conditions of the easement match your management objectives?	○	○	○	○	○	○
How important was the information you received from friends or other land owners in your decision regarding FREP?	○	○	○	○	○	○
How important was the information you received from a government representative in your decision regarding FREP?	○	○	○	○	○	○
How important was the financial compensation in your decision?	○	○	○	○	○	○

13. To what extent are you satisfied with the financial compensation you have received or anticipate receiving from FREP?
1-not at all satisfied, 2-not very satisfied, 3-neutral, 4-moderately satisfied, 5-very satisfied
(check only one)

Not at all satisfied 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ Very satisfied

Please share any additional comments about how the Forestry Riparian Easement Program could be improved based on your experience and what works well about it.

8269 *To respond:* ⊗ *or* ● 3929 0004

Alternate Plans for riparian forests

Alternate Plans are a way to provide relief to land owners, including Small Forest Land Owners, who want to continue active forest management but have forests in riparian areas. Using Alternate Plans, land owners develop management prescriptions that will protect water resources in alternative ways from what is prescribed in Forest Practices rules. To be approved, Alternate Plans must provide protection for public resources at least equal in overall effectiveness to the protection provided by the Forest Practices Act and rules. Most Alternate Plan applications on Small Forest Lands in Western Washington are done using a simplified template. No Alternate Plan templates currently exist for Eastern Washington.

14. Have you intentionally avoided the riparian zone in your management plans before or do you plan to do so in the future?

- ○ Yes
- ○ No
- ○ Don't know

15. If you answered YES to the previous question, why did you do so? *(check all that apply)*

- ☐ Avoid the risk of not correctly following the regulations
- ☐ Better chance for the harvest application to be approved
- ☐ Advice from a professional
- ☐ I didn't/don't want to harvest there
- ☐ Not profitable to harvest there
- ☐ Don't know

Other *(please specify)*

16. Had you heard of Alternate Plans before this survey?

- ○ Yes
- ○ No

8269 To respond: ☒ or ● 3929 0005

17. Have you ever applied for an Alternate Plan?

- ○ Yes
- ○ Yes, but it was unsuccessful
- ○ No *(skip to question 22)*

18. If the Alternate Plan was a template, which one? *(check all that apply)*

- ☐ Fixed Width Riparian Management Zone
- ☐ Overstocked Stand

19. If you harvested using an Alternate Plan or attempted to do so without success, what was your overall experience of the application process? *(check only one)*

☐ Negative ☐ Neutral ☐ Positive

20. If you have ever applied for an Alternate Plan, please indicate what went well about the process? *(check all that apply)*

- ☐ I think the process and outcome were reasonable
- ☐ I learned more about determining water types, and site class maps
- ☐ I learned more about the criteria for assessing an Alternate Plan
- ☐ The process motivated me to take additional actions for the care, management, or protection of my forest land
- ☐ As a result of this process, I intend to apply for Alternate Plans in the future
- ☐ The income from harvesting was important to me and my household
- ☐ I liked that the Alternate Plan template simplified the process
- ☐ I preferred harvesting with an Alternate Plan *instead of* applying for FREP
- ☐ I like that I can harvest with an Alternate Plan *and also* apply for FREP

Other *(please specify)*

8269 *To respond:* ☒ *or* ● 3929 000€

21. If you have ever applied for an Alternate Plan, please indicate what could be improved about the process? *(check all that apply)*

- ☐ More technical assistance throughout the process
- ☐ The process took too long
- ☐ The Alternate Plan I submitted is quite different from what we ended up doing
- ☐ I would have liked to learn more about determining water types
- ☐ I don't feel the plan was evaluated fairly
- ☐ I wish I could harvest more than the Alternate Plan allowed
- ☐ As a result of this process, I am less motivated to submit other Alternate Plan applications in the future

Other *(please specify)*

22. If you have never applied for an Alternate Plan, why not? *(check all that apply)*

- ☐ I am not interested in harvesting in my riparian forest land
- ☐ I need more information about these plans
- ☐ Lack of technical assistance to apply
- ☐ Ownership/ family issues in decision-making
- ☐ Too complicated
- ☐ No template applies to my land
- ☐ I don't think Alternate Plans are fairly evaluated
- ☐ I decided to apply for FREP instead of trying to submit an Alternate Plan

Other *(please specify)*

8269 *To respond:* ☒ *or* ● 3929 0007

The Family Forest Fish Passage Program (FFFPP)

The Family Forest Fish Passage Program (FFFPP) assists private forest landowners in replacing culverts and other stream crossing structures that keep trout, salmon, and other fish from reaching upstream habitat. Road culverts and other structures that are aging, too small, or improperly installed can block fish from reaching their spawning grounds, and young rearing salmon from reaching the ocean. The program provides 100% funding for the replacement of eligible barriers with new structures. Applying to FFFPP allows landowners with a fish passage barrier on their land to harvest timber even if the barrier has not been corrected.

23. Had you heard of FFFPP before this survey?

- ○ Yes
- ○ No *(skip to question 24)*

23b. If you received information about FFFPP from another land owner or neighbor, what was your impression of FFFPP from that information?

- ☐ Negative
- ☐ Neither positive nor negative
- ☐ Positive

24. What is the current status of your forest land as it relates to FFFPP?
(check all that apply)

- ☐ I have a completed FFFPP project on my land
- ☐ I have applied for FFFPP and am on the waiting list
- ☐ I plan to apply for FFFPP in the future *(skip to question 27)*
- ☐ I have not applied for FFFPP and do not plan to do so *(skip to question 27)*

8269 *To respond:* ⊗ *or* ● 3929 0008

25. If you have a completed FFFPP project or are on the waiting list please indicate which of the following statements apply to you *because of FFFPP*.
(check all that apply)

- ○ I am/was able to apply for timber harvest because I applied for FFFPP
- ○ The fish passage barrier was corrected
- ○ More of my forest land is now accessible for harvesting
- ○ I am too far down the priority list to expect a FFFPP project to actually be completed on my forest land
- ○ I applied to FFFPP because I had to
- ○ I think FFFPP is a good use of public funds on my forest land
- ○ I *do not* think FFFPP is a good use of public funds on my forest land
- ○ I have an existing barrier to fish passage on my land that is preventing access to a substantial portion of my forest land

26. If you have a completed FFFPP project on your land, how satisfied are you with the program?
1-not at all satisfied, 2-not very satisfied, 3-neutral, 4-moderately satisfied, 5-very satisfied
(check only one)

not at all satisfied	1	2	3	4	5	very satisfied
	○	○	○	○	○	

Please share any additional comments about how FFFPP could be improved based on your experience and what works well about it.

8269 *To respond:* ⊗ *or* ●

3929 0009

Information and assistance needs

27. How interested are you in learning more about the care, management, or protection of your forest land?

1-not at all interested, 2-slightly interested 3-moderately interested, 4-very interested, 5-extremely interested *(check only one)*

not at all interested 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ extremely interested

28. Have you heard of the Washington State DNR Small Forest Landowner Office?

○ Yes
○ No

29. If you have had contact with the Small Forest Landowner Office, what did they assist you with? *(check all that apply)*

- ☐ They helped me find another resource
- ☐ Forest Stewardship Program
- ☐ Forestry Riparian Easement Program
- ☐ Family Forest Fish Passage Program
- ☐ Road Maintenance & Abandonment Requirements
- ☐ Federal Cost Share Programs
- ☐ Forest Practices Applications
- ☐ Alternate Harvest Plans
- ☐ Regulation assistance
- ☐ Events for landowners

30. If you have had contact with the Small Forest Landowner Office please comment on how the experience went and if anything could have been improved.

8269 *To respond:* ☒ *or* ● 3929 0010

Overall impacts

31. Have you ever harvested using a "20 acre exemption"?

- ○ Yes
- ○ No
- ○ Don't know

32. Have you ever sold or given away any of your forest land in Washington?

- ○ Yes
- ○ No

33. If you have sold or given away any of your forest land in Washington, why did you do so? *(check all that apply)*

- ☐ financial needs
- ☐ family circumstances
- ☐ weak timber markets
- ☐ no interest in maintaining the land
- ☐ relocated somewhere else
- ☐ didn't live nearby
- ☐ nearby timber mill closure(s)
- ☐ regulatory burden

Other *(please specify)*

The regulations intended to protect endangered salmon habitat in Washington State (RCW 76.09.055) acknowledge the disproportionate negative economic impact they impose on Small Forest Land Owners. Alternate Plans, Alternate Plan templates, FREP, FFFPP, and the Small Forest Landowner Office are intended to lessen the economic burden of forest riparian regulations on Small Forest Land Owners.

34. *Considering financial aspects only,* how would you describe the impact that riparian regulations since 1999 have had on your forest ownership in the State of Washington?
(check only one)

- ○ Very negative
- ○ Somewhat negative
- ○ Little or no impact
- ○ Somewhat positive
- ○ Very positive
- ○ Don't know

8269 To respond: ☒ or ● 3929 0011

35. *Considering your overall assessment of their intended environmental impacts*, what is your impression of Washington State's forest riparian regulations for small forest lands since 1999?
(check only one)

○ Very negative ○ Somewhat negative ○ Neutral ○ Somewhat positive ○ Very positive

○ Don't know

36. To what extent do you feel that the efforts described above (Alternate Plans, Alternate Plan templates, FREP, FFFPP, and the Small Forestland Owner Office) and other services available to Small Forest Land Owners *adequately address* the economic impacts of riparian forest regulations for your ownership?
(check only one)

○ Not at all ○ Somewhat ○ Moderately ○ Substantially ○ Very much

○ Don't know

37. What additional measures could be taken by the State of Washington to address the impacts of riparian forest regulations on your ownership? *(check all that apply)*

☐ Additional technical assistance in the form of stewardship foresters
☐ Additional Alternate Plan templates
☐ Technical assistance to apply for Alternate Harvest Plans
☐ Technical assistance to apply for FREP/FFFPP
☐ Additional funding for FREP and FFFPP
☐ Opportunities to sell the development rights to my forest land (usually via a conservation easement)
☐ Opportunities to be paid for the carbon value of my forest land
☐ Help with protocol stream typing
☐ Help with steep slope delineation
☐ More regulatory flexibility

Other *(please specify)*

8269 *To respond:* ☒ *or* ●

3929 0012

38. *Considering the impact of forest riparian regulations only*, which of the following concerns do you have about the future of your forest land? *(check all that apply)*

- ☐ I may have to sell or transfer *all of my forest land*
- ☐ I may have to sell or transfer *some of my forest land*
- ☐ I am concerned my forest land will not remain forested in the future
- ☐ I am concerned that forestry *is not currently* economically viable on my forest land
- ☐ I am concerned that forestry *will not be economically viable* on my forest land in the future
- ☐ I am generally not concerned about forest riparian regulations on my forest land

Other *(please specify)*

General questions about you

39. What is your age?

☐☐☐

40. What is your gender?

- ☐ Male
- ☐ Female

41. What is your formal educational background?

- ☐ Less than 12th grade
- ☐ High school diploma/ GED
- ☐ Some college/Associate degree
- ☐ College diploma
- ☐ Graduate diploma

42. What percentage of your income comes from the forest land that you own (on an annual basis)? ☐☐☐

8269 *To respond:* ☒ *or* ● 3929 0018

43. What was your total household income (including employment, social security, investments, or any other source) BEFORE taxes in 2019?

- ☐ $less than 25,000
- ☐ $25,000- 49,999
- ☐ $50,000-74,999
- ☐ $75,000-99,999
- ☐ $100,000-149,999
- ☐ $150,000-199,999
- ☐ $200,000+

If you are interested in further sharing your experiences of forest ownership in an online or telephone interview, please write you name and email address in the space below. By giving us your contact information you may be contacted with an invitation for a follow-up interview with researchers from the University of Washington.

Thank you for participating in this survey!
Please return the survey in the postage-paid envelope provided. If you are interested in the results of this survey, watch for our report to Washington State Senate Bill SB5330 in late 2020 or early 2021.

8269 *To respond:* ☒ *or* ● 3929 0014

17 APPENDIX C – 2019 FORESTLAND DATABASE DOCUMENTATION

The Washington State Parcel Database is a standardized, statewide dataset developed at the University of Washington in collaboration with state agencies and participants of the Parcels Working Group (Rogers and Cooke 2007). It was designed to support a wide range of research and analysis needs by making available a consistent, detailed, and regularly updated parcel layer. Versions were developed in 2007, 2009, 2010, and 2012, with a partial update in 2016. The Washington State Forestland Database is derived from the Parcel Database and integrates ownership, forest, water, economic, and other attributes for all forested parcels in the state.

The methods used to develop the 2019 version of the Washington State Parcel and Forestland Databases are described below. To analyze change in small forest landownership, we determined the first spatial version of the Forestland Database for each county (generally 2007). We identified and compared parcels owned by Small Forest Landowners (SFLO) at each point in time. Attributes were added to SFLO parcels to analyze the causes of small forest landowner behavior including forest practice applications, participation in small forest landowner programs, and sale and inheritance events.

17.1 PARCEL DATABASE

17.1.1 Data Acquisition

We acquired parcel geometry and attribute data for 2019 from each County Assessor's Office. Parcel data was also obtained from the Washington State Departments of Natural Resource and Fish and Wildlife, the United States Forest Service, and the United States Bureau of Land Management. Sales data was acquired from each county and from the Washington State Department of Revenue.

17.1.2 Data Normalization

We normalized the data into the Washington State Parcel Database format. Data included site address, owner name, mailing address, property value, land use code, and transaction (e.g. sale, inheritance, etc.) type and date. Multiple owners, land use codes, and transactions could be associated with a parcel. Duplicate tabular data was identified and precluded from the database. Spatial data was normalized by identifying duplicate and multipart polygons.

17.1.3 Name Normalization

We analyzed the Parcel Database to identify individuals owning property across multiple counties. The Levenshtein distance measures similarity between two text strings by calculating the number of characters needed to be changed to make them equal ("Dictionary of Algorithms and Data Structures" n.d.). Owner name and address data was used to compare each pair of

owners in the database. We identified a threshold distance value below which owners were likely the same.

17.1.4 Owner Classification

We classified each parcel into five owner classes: Private, Municipal, Tribal, State, and Federal. Classification was primarily based on name. However, data provider, and supplemental data were sometimes necessary to determine owner class.

17.2 Forestland Database

17.2.1 Parcel Flattening

Parcels from county, state, and federal data providers often overlap. To create a parcel layer with wall-to-wall coverage without overlap for the state, we prioritized parcels in the following order: 1) parcels from county data providers that were identified as Private; 2) parcels from state data providers; 3) county parcels that were classified as Municipal or Tribal; 4) parcels from federal data providers that were identified as Federal; 5) county parcels with any other owner classification; 6) federal parcels with any other owner classification.

17.2.2 Buffering Streams and Waterbodies

Washington Forest Practice Rules and Regulations restrict management near streams and wetlands. To characterize parcels by management zone, we acquired the Department of Natural Resources Watercourse Hydrography and Water Body datasets. Buffer rules for streams are based on fish habitat suitability, presence or absence of water year-round, soil productivity, and other factors (WAC 222-16-031). Wetland buffers are determined by wetland size and classification (WAC 222-16-035). We modeled buffer rules to create a statewide management zone layer consisting of core, inner, outer, and wetland zones. Area not in a management zone was determined to be upland.

17.2.3 Identifying Forestland Parcels

The flattened parcel layer was intersected with several datasets to summarize parcel attributes. First, forest cover was estimated for each parcel from the USGS National Land Cover Database (NLCD). We then used two criteria to identify parcels for the Forestland Database: 1) parcels with a land use code of 87, 88, 92, or 95; or 2) parcels with at least 1 acre of forest (NLCD code 41, 42, or 43). Parcels smaller than 2 acres were excluded.

17.2.4 Attributing Forestland Parcels

Parcels were intersected with spatial layers to summarize management zones and determine hydrological, jurisdictional, and economic attributes. We calculated total acres, forest (by land

use code or NLCD code) acres, forest cover (by NLCD code only) acres, acres by management zone, and acres of water for each parcel. Stream and road length on each parcel were summed, and the haul zone and stumpage value zones were identified. We also determined location attributes including county, Water Resource Inventory Area (WRIA), Watershed Administrative Unit (WAU), congressional district, and legislative district.

Next, we calculated proximity metrics for each parcel in the Forestland Database. Proximity was defined as the Euclidean distance from parcel centroid to closest point for the layer of interest. Attributes included distance to developed parcels (land use code < 70), urban growth area, public road, any road, Designated Forestland (land use code 88), Department of Natural Resources land, and Forest Service land.

17.2.5 Owner Subclassification

Parcels were further classified into owner subclasses based on name, parcel attributes, or supplemental spatial data. All owner subclasses are described in Table 48. The definition for Small Forest Landowner is described in the next section.

Table 48. Owner Class and Owner Subclass descriptions.

Owner Class	Owner Subclass	Description
Private	Industrial	Large industrial forest management companies identified by name
Private	Small Forest Landowner	Private owners with at least 2 acres of parcel AND 1 acre of forest cover OR land use code 87, 88, 92, 95 AND less than 2500 acres in W WA OR less than 9990 acres in E WA
Private	Conservation	Private conservation owners identified by name
Private	Other	Other large private landowners including real estate companies and ranches
Municipal	County	Grays Harbor county forestland
Municipal	Watershed	County forestland managed for water production, including Cedar River Watershed (King County), Pierce County Watershed
Municipal	Other	Other city and county owned forestland including parks
Tribal	Industrial	Forestland owned by tribes with large forest management program including Colville, Makah, Muckleshoot, Quinault, Spokane, and Yakima
Tribal	Small Forest Landowner	Tribal owners with at least 2 acre of parcel AND 1 acre of forest cover OR land use code 87, 88, 92, 95 AND less than 2500 acres in W WA OR less than 9990 acres in E WA
Tribal	Other	Other tribal forestland
State	DNR	Forest Trust land managed by the Washington State Department of Natural Resources
State	Other	Other forestland owned by Washington State including Department of Fish and Wildlife
Federal	Forest Service	Forestland managed by the US Forest Service
Federal	Other	Forestland managed by other federal agencies including the US Fish and Wildlife Service

17.2.6 Small Forest Landowner Definition

We defined Small Forest Landowner using a proxy for the definition in RCW 76.09.450 (harvesting no more than an average of 2 million board feet of timber per year) as timber harvest volumes by owner are not publicly available. Private and Tribal parcels not identified as industrial were eligible to be SFLO. We then estimated the number of acres an owner would need in management to meet the harvest level, based on average site productivity in Eastern and Western Washington. Threshold values were determined to be a maximum of 2500 acres in Western Washington and 9900 acres in Eastern Washington. Consistent with previous UW statistics and DNR Legislative Reports, the minimum size threshold to be considered SFLO was a 2-acre parcel with at least 1 acre of forest.

17.2.7 SFLO Forest Practice Applications

Forest Practice Application (FPA) data was obtained from the Department of Natural Resources. This dataset was intersected with SFLO parcels. A minimum overlap threshold was used to associate applications with parcels. Name and parcel identification numbers in the FPA data were compared to values in the Parcel Database to calibrate the threshold value. The dates of the most recent commercial harvest and alternate plan applications were added to SFLO parcels.

17.2.8 SFLO Forest Riparian Easement Program Participation

Forest Riparian Easement Program (FREP) data was obtained from the Department of Natural Resources. FREP data contains an FPA identification number and was joined to parcels through the FPA intersect analysis. Parcels participating in FREP were checked by comparing name and parcel identification numbers with data in the Parcel Database. A field indicating participation in FREP was added to SFLO parcels.

17.2.9 SFLO Family Forest Fish Passage Program Participation

A Family Forest Fish Passage Program (FFFPP) dataset acquired from the Department of Natural Resources included latitude and longitude of applicants. A point feature was created and intersected with SFLO parcels. Owner name and address data was compared to data in the Parcel Database to check the spatial join. A field indicating participation in FFFPP was added to SFLO parcels.

17.2.10 Sales and Inheritance

We identified the most recent sale and inheritance transactions for each SFLO parcel. Sales data from county assessors and from the Department of Revenue were used to determine these attributes.

17.2.11 Linking 2007 and 2019 Forestland Parcels

To analyze change between the 2007 and 2019 versions of the Forestland Database, parcels were linked between the two time periods. Exact and fuzzy matching of parcel geometries were used to pair approximately 80% of parcels with high confidence. In cases of parcel segregation, aggregation, and boundary changes, and when parcel boundaries were edited to address errors in the data, a one-to-one match between time periods was not possible. For this set, parcels in each period were intersected to establish parent-child relationships between each version.

18 Appendix D – Land Use Code Aggregation Scheme Used in the Report

Table 49. Aggregation of State Department of Revenue Land Use Codes

WALU Code	DOR Description	Aggregated category
11	Household, single family units	Residential
12	Household, 2-4 units	Residential
13	Household, multiunits (5 or more)	Residential
14	Residential condominiums	Residential
15	Mobile home parks or courts	Residential
16	Hotels/motels	Residential
17	Institutional lodging	Residential
18	All other residential not elsewhere coded	Residential
19	Vacation and cabin	Residential
21	Food and kindred products	Developed
22	Textile mill products	Developed
23	Apparel and other finished products made from fabrics, leather, and similar materials	Developed
24	Lumber and wood products (except furniture)	Developed
25	Furniture and fixtures	Developed
26	Paper and allied products	Developed
27	Printing and publishing	Developed
28	Chemicals	Developed
29	Petroleum refining and related industries	Developed
30	Rubber and miscellaneous plastic products	Developed
31	Leather and leather products	Developed
32	Stone, clay and glass products	Developed
33	Primary metal industries	Developed
34	Fabricated metal products	Developed
35	Professional scientific, and controlling instruments; photographic and optical goods; watches and clocks-manufacturing	Developed
36	Not presently assigned	Developed
37	Not presently assigned	Developed
38	Not presently assigned	Developed
39	Miscellaneous manufacturing	Developed
41	Railroad/transit transportation	Developed
42	Motor vehicle transportation	Developed
43	Aircraft transportation	Developed
44	Marine craft transportation	Developed

45	Highway and street right of way	Developed
46	Automobile parking	Developed
47	Communication	Developed
48	Utilities	Developed
49	Other transportation, communication, and utilities not classified elsewhere	Developed
50	Condominiums - Other than residential condominiums	Developed
51	Wholesale trade	Developed
52	Retail trade - Building materials, hardware, and farm equipment	Developed
53	Retail trade - General merchandise	Developed
54	Retail trade - Food	Developed
55	Retail trade - Automotive, marine craft, aircraft, and accessories	Developed
56	Retail trade - Apparel and accessories	Developed
57	Retail trade - Furniture, home furnishings and equipment	Developed
58	Retail trade - Eating and drinking	Developed
59	Other retail trade	Developed
61	Finance, insurance, and real estate services	Developed
62	Personal services	Developed
63	Business services	Developed
64	Repair services	Developed
65	Professional services	Developed
66	Contract construction services	Developed
67	Governmental services	Developed
68	Educational services	Developed
69	Miscellaneous services	Developed
71	Cultural activities and nature exhibitions	Other
72	Public assembly	Developed
73	Amusements	Developed
74	Recreational activities	Other
75	Resorts and group camps	Other
76	Parks	Other
77	Not presently assigned	Other
78	Not presently assigned	Other
79	Other cultural, entertainment, and recreational	Other
81	Agriculture (not classified under current use law)	Agriculture
82	Agriculture related activities	Agriculture
83	Agriculture classified under current use chapter 84.34 RCW	Agriculture
84	Fishing activities and related services	Other
85	Mining activities and related services	Other
86	Marijuana grow operations	Other

87	Not presently assigned	ForestOrNatural
88	Designated forest land under chapter 84.33 RCW	ForestOrNatural
89	Other resource production	ForestOrNatural
91	Undeveloped land	ForestOrNatural
92	Noncommercial forest	ForestOrNatural
93	Water areas	Other
94	Open space land classified under chapter 84.34 RCW	ForestOrNatural
95	Timberland classified under chapter 84.34 RCW	ForestOrNatural
96	Not presently assigned	ForestOrNatural
97	Not presently assigned	ForestOrNatural
98	Not presently assigned	ForestOrNatural
99	Other undeveloped land	ForestOrNatural

19 APPENDIX E – SALES AND LAND USE MODEL DATA AND RESULTS

Table 50. Sales and land use model variables descriptions and summary statistics

Variable	Description	N	Missings (%)	Mean	SD
EverSold	1 if parcel observed sold, 0 otherwise	110228	0.00	0.26	0.44
FPAHarv	1 if harvesting application found, 0 otherwise	110228	0.00	0.32	0.47
popdens_change	County-level population density change, 2010-2018	110131	0.09	7.60	12.17
POP2010_GI1000	Gravity Index for 2010, in 1000s	110228	0.00	574.43	613.21
medCountyIncome1000	Median County Income, in $ thousands	110228	0.00	50.45	9.41
ParcelAcresEA100	Parcel size, in 100 ac	110228	0.00	0.22	0.40
TractAcres100	Tract size, in 100 ac	110228	0.00	0.46	1.41
PercentForest	Share under forest cover or 1 if in DFL	110228	0.00	0.81	0.26
MaxNameAcresForested100	Forested Acres under the same ownership, in 100 ac	110228	0.00	1.22	4.81
FrepEligible	Proxy for FREP eligibility based on parcel size, ownership size, and presence of streams	110228	0.00	0.13	0.33
ProximityToDevelopment	Distance to nearest developed parcel, in 0.1 mi	110228	0.00	1.41	5.21
ProximityToUGA	Distance to the Urban Growth Area, in 0.1 mi	110228	0.00	0.45	0.89
ProximityToPublicRoads	Distance to nearest public road, in 0.1 mi	110228	0.00	2.20	3.85
ProximityDNRMiles	Distance to nearest DNR land, miles	110228	0.00	1.67	1.63

ProximityToFSMiles	Distance to nearest USFS land, miles	110228	0.00	11.92	11.04
ParcelRoadMiles	Extent of roads on a parcel, miles	110228	0.00	0.11	0.29
ProductiveSiteClass	1 if site class is smaller or equal to 5, 0 otherwise	104664	5.05	0.88	0.32
SiteClass_ifProductive	Site class if site class is less than or equal to 5, 0 otherwise	104664	5.05	2.25	1.13

Table 51. Parcel Sales Models Coefficient Estimates

	Westside sales (I)			**Westside, only harvest before sale (II)**			**Eastside sales (III)**			**Eastside, only harvest before sale (IV)**		
Predictors	*Odds Ratios*	*CI*	*p*	*Odds Ratios*	*CI*	*p*	*Odds Ratios*	*CI*	*p*	*Odds Ratios*	*CI*	*p*
(Intercept)	1.102	0.850 – 1.429	0.465	0.796	0.609 – 1.041	0.095	0.199	0.090 – 0.440	**<0.001**	0.099	0.043 – 0.229	**<0.001**
FPAHarv	1.476	1.377 – 1.582	**<0.001**	1.217	1.130 – 1.310	**<0.001**	1.238	1.120 – 1.369	**<0.001**	0.988	0.888 – 1.100	0.829
FrepEligible	0.974	0.847 – 1.119	0.708	0.933	0.801 – 1.086	0.373	0.897	0.772 – 1.040	0.152	0.872	0.738 – 1.029	0.106
MaxNameAcresForested100	0.933	0.912 – 0.952	**<0.001**	0.913	0.890 – 0.935	**<0.001**	0.997	0.989 – 1.004	0.403	0.996	0.988 – 1.004	0.363
POP2010_GI10000	1.001	1.000 – 1.002	**0.001**	1.001	1.000 – 1.002	**0.002**	0.988	0.981 – 0.994	**<0.001**	0.992	0.985 – 0.999	**0.029**
medCountyInc10k	0.882	0.844 – 0.920	**<0.001**	0.919	0.879 – 0.961	**<0.001**	1.231	1.042 – 1.455	**0.014**	1.458	1.224 – 1.737	**<0.001**
ParcelAcres100	0.864	0.695 – 1.071	0.186	0.782	0.617 – 0.984	**0.039**	0.762	0.639 – 0.901	**0.002**	0.734	0.597 – 0.895	**0.003**
TractAcres100	0.931	0.877 – 0.985	**0.016**	0.957	0.898 – 1.015	0.154	0.922	0.883 – 0.959	**<0.001**	0.914	0.870 – 0.955	**<0.001**
PercentForest	0.538	0.476 – 0.607	**<0.001**	0.587	0.518 – 0.665	**<0.001**	0.592	0.492 – 0.714	**<0.001**	0.445	0.369 – 0.537	**<0.001**
DistDevelopmentMi	0.917	0.818 – 1.022	0.126	0.861	0.746 – 0.985	**0.035**	1.124	1.029 – 1.228	**0.009**	1.183	1.074 – 1.305	**0.001**
ProximityToUGA	0.928	0.880 – 0.976	**0.004**	0.946	0.898 – 0.995	**0.033**	0.974	0.921 – 1.028	0.342	0.937	0.880 – 0.996	**0.038**
DistPublicRoadsMi	1.118	0.981 – 1.275	0.094	1.033	0.894 – 1.193	0.654	1.142	1.009 – 1.293	**0.035**	1.167	1.017 – 1.340	**0.028**
DistDNRMi	1.054	1.035 – 1.074	**<0.001**	1.055	1.036 – 1.075	**<0.001**	0.994	0.955 – 1.034	0.780	1.015	0.972 – 1.058	0.501
DistFSMi	0.994	0.991 – 0.998	**0.001**	0.995	0.991 – 0.998	**0.004**	1.005	0.998 – 1.012	0.187	0.997	0.989 – 1.005	0.443
ParcelRoadMi	1.423	1.154 – 1.753	**0.001**	1.366	1.095 – 1.700	**0.005**	1.165	0.938 – 1.440	0.161	1.178	0.925 – 1.495	0.180
Elevation	1.000	1.000 – 1.001	0.182	1.001	1.000 – 1.001	**0.001**	1.000	1.000 – 1.001	0.097	1.000	1.000 – 1.001	**0.009**
ProductiveSiteClass	1.148	1.000 – 1.319	0.050	1.076	0.933 – 1.241	0.315	0.716	0.555 – 0.923	**0.010**	0.671	0.512 – 0.879	**0.004**
ProductiveSiteClass : SiteClass_ifProductive	0.907	0.875 – 0.941	**<0.001**	0.936	0.902 – 0.971	**<0.001**	1.110	1.026 – 1.200	**0.009**	1.147	1.056 – 1.246	**0.001**
Observations	21783			21413			9636			9457		
R^2 Tjur	0.020			0.016			0.016			0.026		

AIC	25111.627	24179.409	10666.531	9766.201
log-Likelihood	-12537.814	-12071.704	-5315.265	-4865.100

Table 52. Land Use Multinomial Logit Models Coefficient Estimates

	Westside LU2019			Eastside LU2019		
Predictors	*Odds Ratios*	*CI*	*p*	*Odds Ratios*	*CI*	*p*
(Intercept) : Agriculture	0.147	0.030 – 0.726	**0.019**	2.781	0.396 – 19.520	0.304
(Intercept) : DevelopedOther	0.012	0.003 – 0.057	**<0.001**	0.010	0.000 – 2.211	0.095
(Intercept) : Residential	0.052	0.035 – 0.078	**<0.001**	2.699	0.990 – 7.357	0.052
EverSold : Agriculture	0.912	0.639 – 1.301	0.610	1.315	0.940 – 1.839	0.110
EverSold : DevelopedOther	1.653	1.192 – 2.292	**0.003**	1.878	0.970 – 3.634	0.061
EverSold : Residential	3.726	3.447 – 4.029	**<0.001**	2.340	2.016 – 2.716	**<0.001**
FPAHarv : Agriculture	1.286	0.921 – 1.795	0.140	1.357	0.991 – 1.858	0.057
FPAHarv : DevelopedOther	1.286	0.915 – 1.808	0.147	1.657	0.844 – 3.254	0.142
FPAHarv : Residential	0.955	0.868 – 1.051	0.348	0.758	0.644 – 0.892	**0.001**
popdens_change : Agriculture	1.031	1.012 – 1.051	**0.001**	1.144	1.047 – 1.249	**0.003**
popdens_change : DevelopedOther	0.996	0.977 – 1.015	0.677	1.100	0.952 – 1.272	0.194
popdens_change : Residential	0.993	0.988 – 0.997	**0.003**	1.045	1.007 – 1.083	**0.020**
POP2010_GI1000 : Agriculture	1.000	0.999 – 1.000	0.234	1.001	0.999 – 1.004	0.316
POP2010_GI1000 : DevelopedOther	1.000	0.999 – 1.000	**0.047**	1.003	0.999 – 1.007	0.123
POP2010_GI1000 : Residential	1.000	1.000 – 1.000	**<0.001**	1.001	1.000 – 1.002	**0.009**
medCountyIncome1000 : Agriculture	0.972	0.941 – 1.004	0.081	0.908	0.866 – 0.953	**<0.001**
medCountyIncome1000 : DevelopedOther	1.032	1.001 – 1.063	**0.042**	1.011	0.891 – 1.147	0.865
medCountyIncome1000 : Residential	1.040	1.033 – 1.048	**<0.001**	0.959	0.936 – 0.983	**0.001**
ParcelAcresEA100 : Agriculture	1.674	0.941 – 2.975	0.079	1.883	1.521 – 2.331	**<0.001**
ParcelAcresEA100 : DevelopedOther	1.435	0.800 – 2.574	0.226	1.012	0.388 – 2.641	0.980
ParcelAcresEA100 : Residential	0.631	0.411 – 0.968	**0.035**	1.752	1.125 – 2.728	**0.013**

TractAcres100 : Agriculture	1.385	1.174 – 1.633	**<0.001**	1.085	1.045 – 1.126	**<0.001**
TractAcres100 : DevelopedOther	1.172	1.062 – 1.293	**0.002**	1.075	0.946 – 1.222	0.269
TractAcres100 : Residential	0.538	0.448 – 0.646	**<0.001**	0.523	0.408 – 0.670	**<0.001**
PercentForest : Agriculture	0.137	0.084 – 0.225	**<0.001**	0.180	0.111 – 0.292	**<0.001**
PercentForest : DevelopedOther	0.112	0.067 – 0.188	**<0.001**	0.057	0.021 – 0.155	**<0.001**
PercentForest : Residential	0.307	0.264 – 0.357	**<0.001**	0.196	0.152 – 0.254	**<0.001**
MaxNameAcresForested100 : Agriculture	0.806	0.687 – 0.946	**0.008**	0.988	0.969 – 1.008	0.243
MaxNameAcresForested100 : DevelopedOther	1.030	0.965 – 1.100	0.377	1.016	0.964 – 1.072	0.549
MaxNameAcresForested100 : Residential	0.825	0.770 – 0.883	**<0.001**	0.853	0.789 – 0.922	**<0.001**
FrepEligible : Agriculture	3.977	2.547 – 6.212	**<0.001**	4.677	3.311 – 6.607	**<0.001**
FrepEligible : DevelopedOther	0.837	0.470 – 1.489	0.545	1.196	0.455 – 3.143	0.717
FrepEligible : Residential	1.138	0.874 – 1.484	0.337	0.721	0.490 – 1.062	0.098
ProximityToDevelopment : Agriculture	0.991	0.927 – 1.059	0.790	1.023	1.005 – 1.042	**0.013**
ProximityToDevelopment : DevelopedOther	1.002	0.960 – 1.045	0.939	0.989	0.921 – 1.062	0.755
ProximityToDevelopment : Residential	0.751	0.704 – 0.801	**<0.001**	0.822	0.772 – 0.874	**<0.001**
ProximityToUGA : Agriculture	1.227	1.050 – 1.434	**0.010**	1.244	1.087 – 1.423	**0.001**
ProximityToUGA : DevelopedOther	1.041	0.854 – 1.269	0.692	0.606	0.341 – 1.077	0.088
ProximityToUGA : Residential	0.970	0.912 – 1.033	0.344	0.764	0.675 – 0.864	**<0.001**
ProximityToPublicRoads : Agriculture	0.938	0.861 – 1.023	0.148	0.845	0.795 – 0.899	**<0.001**
ProximityToPublicRoads : DevelopedOther	0.975	0.924 – 1.029	0.357	0.925	0.815 – 1.050	0.229
ProximityToPublicRoads : Residential	1.004	0.981 – 1.028	0.721	0.963	0.938 – 0.989	**0.005**

ProximityDNRMiles : Agriculture	0.954	0.866 – 1.050	0.332	1.247	1.149 – 1.353	<**0.001**
ProximityDNRMiles : DevelopedOther	1.083	0.993 – 1.181	0.070	1.305	1.119 – 1.522	**0.001**
ProximityDNRMiles : Residential	0.966	0.942 – 0.990	**0.006**	1.140	1.075 – 1.209	<**0.001**
ProximityToFSMiles : Agriculture	0.989	0.973 – 1.006	0.202	0.962	0.940 – 0.986	**0.002**
ProximityToFSMiles : DevelopedOther	0.971	0.953 – 0.990	**0.002**	0.980	0.941 – 1.021	0.326
ProximityToFSMiles : Residential	1.007	1.003 – 1.012	**0.001**	0.970	0.958 – 0.981	<**0.001**
ParcelRoadMiles : Agriculture	0.477	0.207 – 1.102	0.083	0.750	0.540 – 1.042	0.086
ParcelRoadMiles : DevelopedOther	1.302	0.681 – 2.488	0.425	1.578	0.700 – 3.555	0.271
ParcelRoadMiles : Residential	1.691	1.183 – 2.417	**0.004**	1.015	0.638 – 1.613	0.951
ProductiveSiteClass : Agriculture	1.664	0.880 – 3.146	0.117	0.464	0.212 – 1.017	0.055
ProductiveSiteClass : DevelopedOther	0.413	0.199 – 0.857	**0.018**	0.569	0.101 – 3.194	0.522
ProductiveSiteClass : Residential	1.339	1.103 – 1.626	**0.003**	1.285	0.854 – 1.935	0.229
SiteClass_ifProductive : Agriculture	0.860	0.716 – 1.033	0.108	1.080	0.833 – 1.400	0.563
SiteClass_ifProductive : DevelopedOther	1.329	1.077 – 1.642	**0.008**	1.154	0.681 – 1.958	0.594
SiteClass_ifProductive : Residential	1.020	0.970 – 1.073	0.439	1.042	0.922 – 1.177	0.512
Observations	85988			38448		
R^2 McFadden	0.117			0.171		
AIC	20682.670			7431.543		
log-Likelihood	-10284.335			-3658.771		

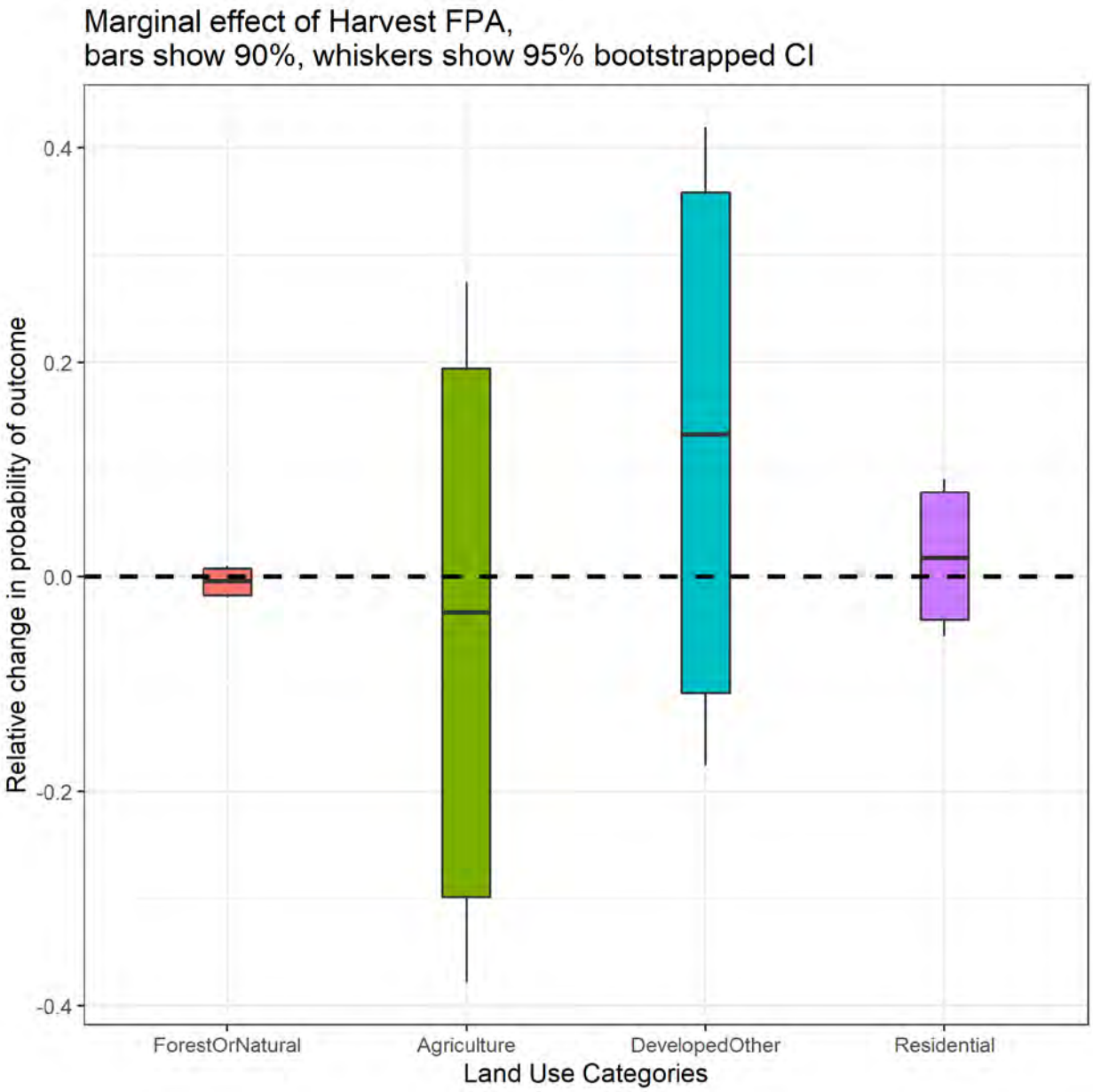

Figure 97. Marginal Effects of Harvesting, Westside model

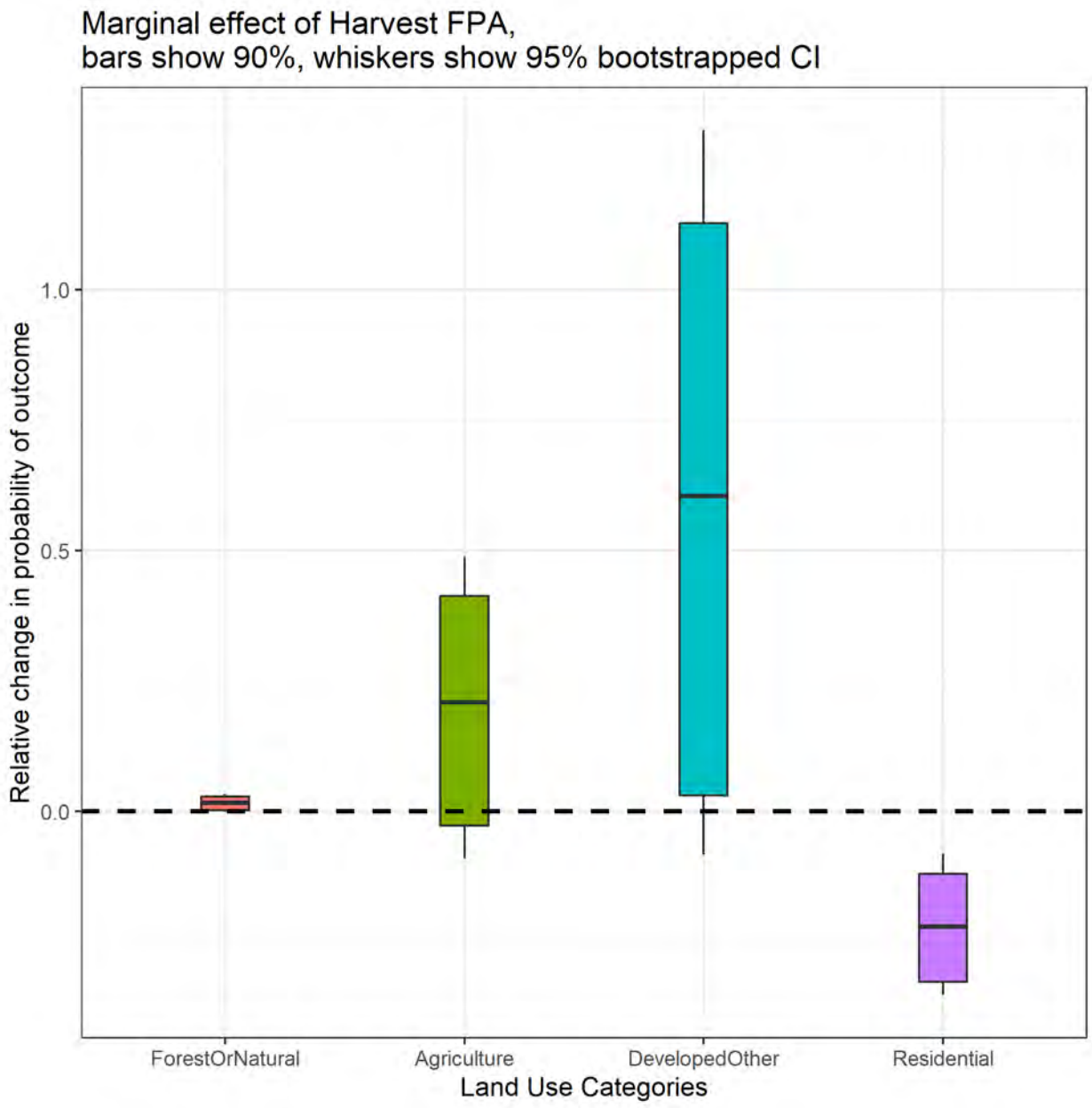

Figure 98. Marginal Effects of Harvesting, Eastside Model

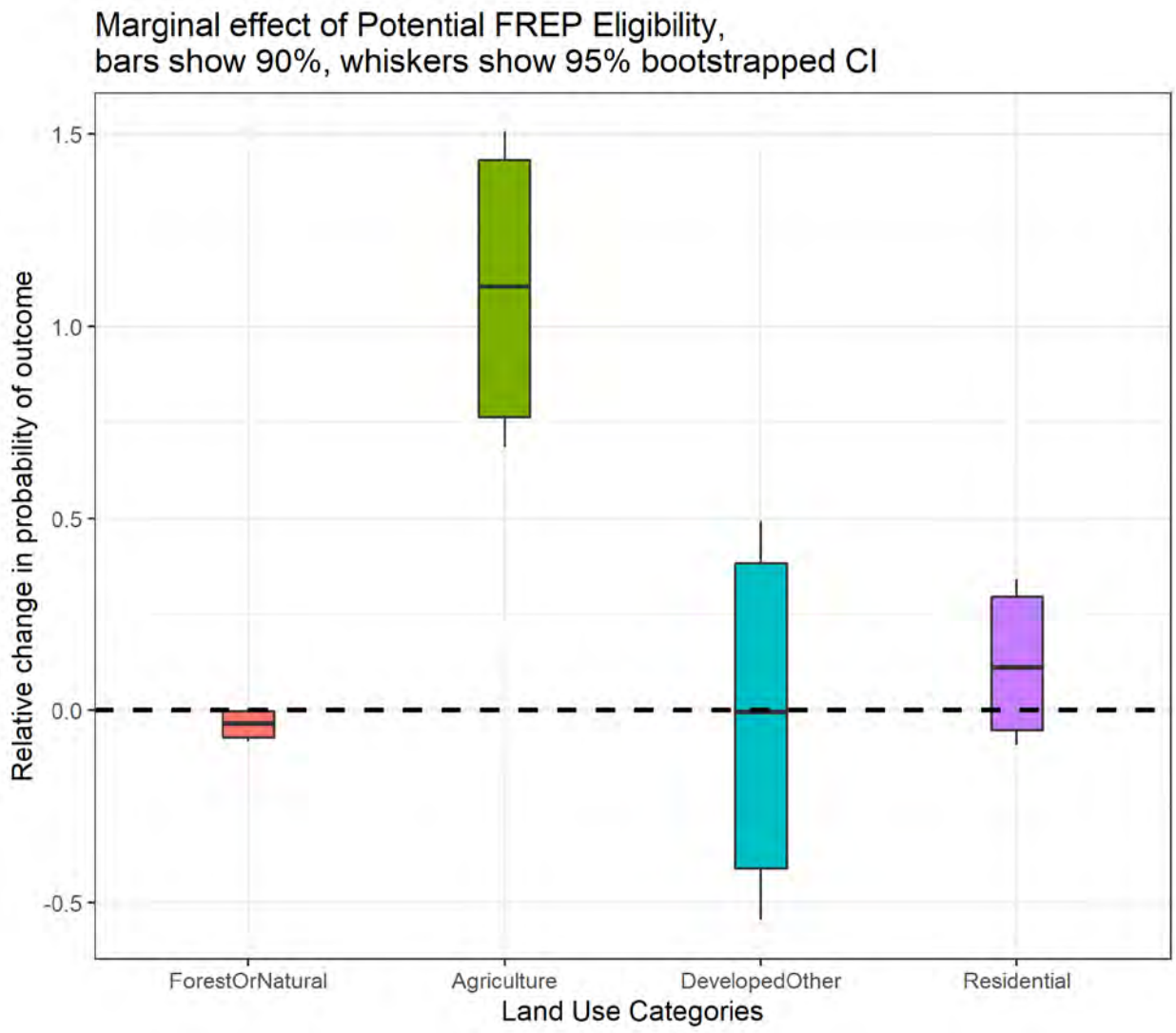

Figure 99. Marginal Effects of FREP Eligibility, Westside Model

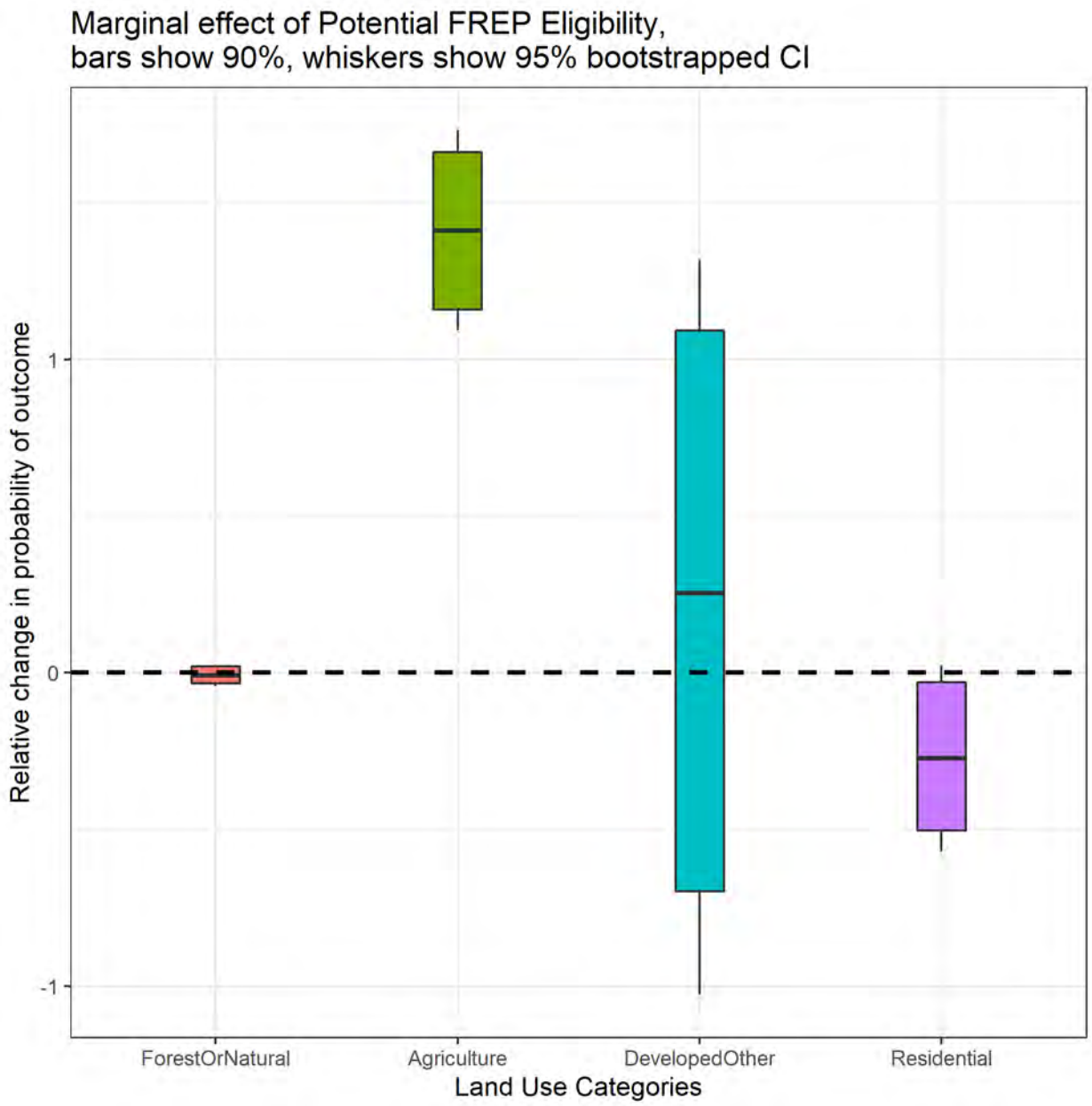

Figure 100. Marginal Effects of FREP Eligibility, Eastside Model

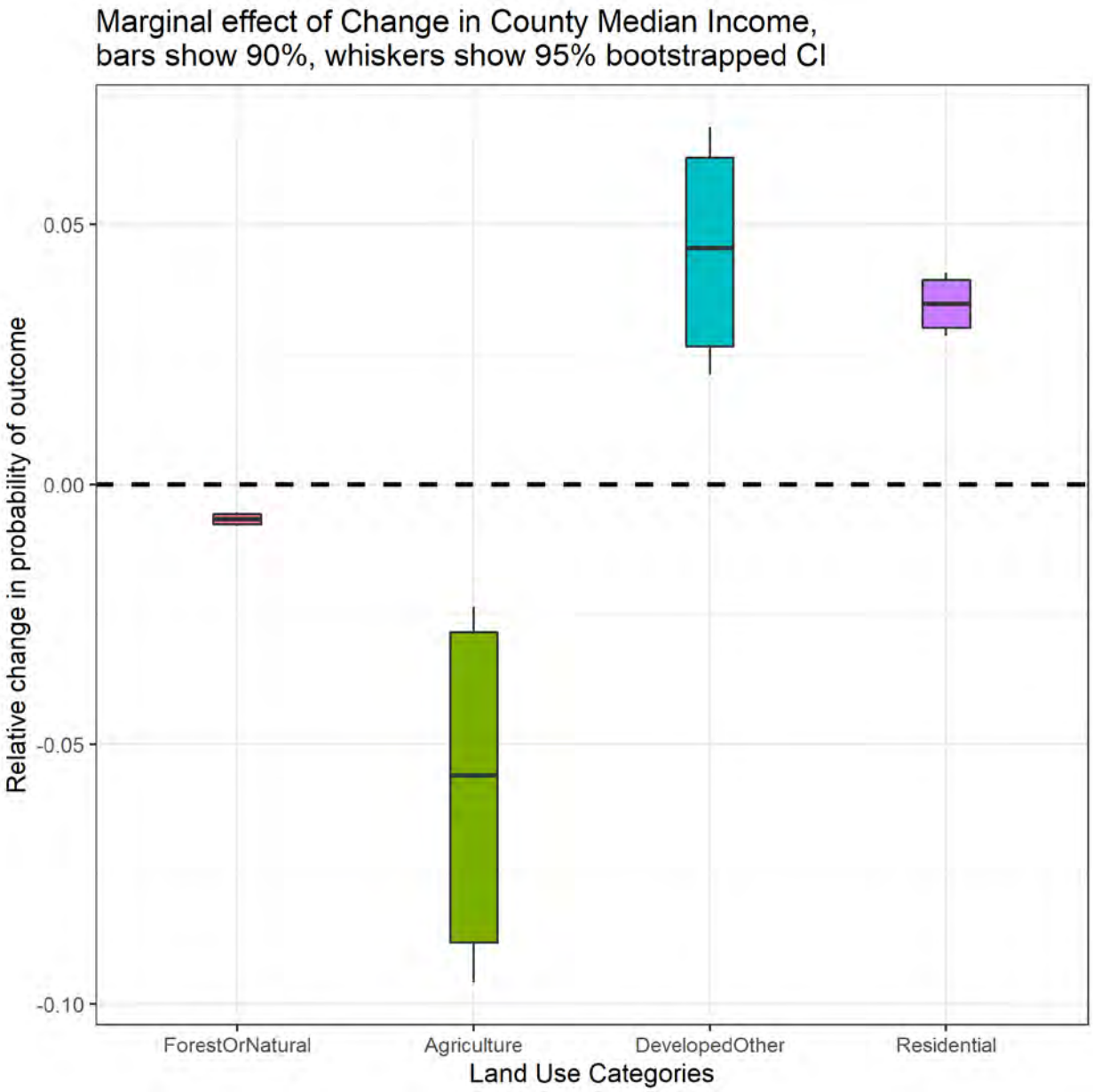

Figure 101. Marginal Effects of Median County Income, Westside Model

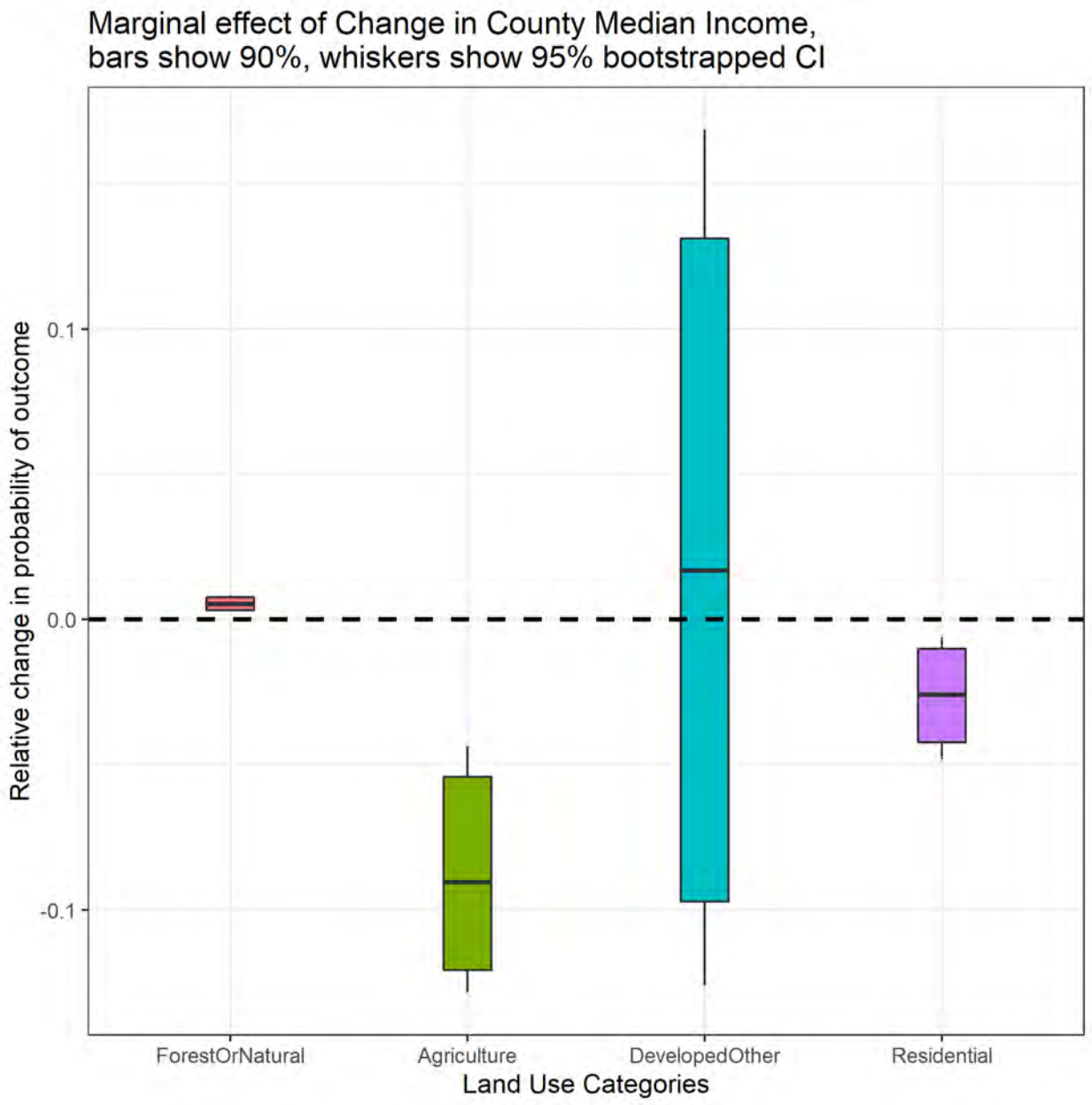

Figure 102. Marginal Effects of Median County Income, Eastside Model

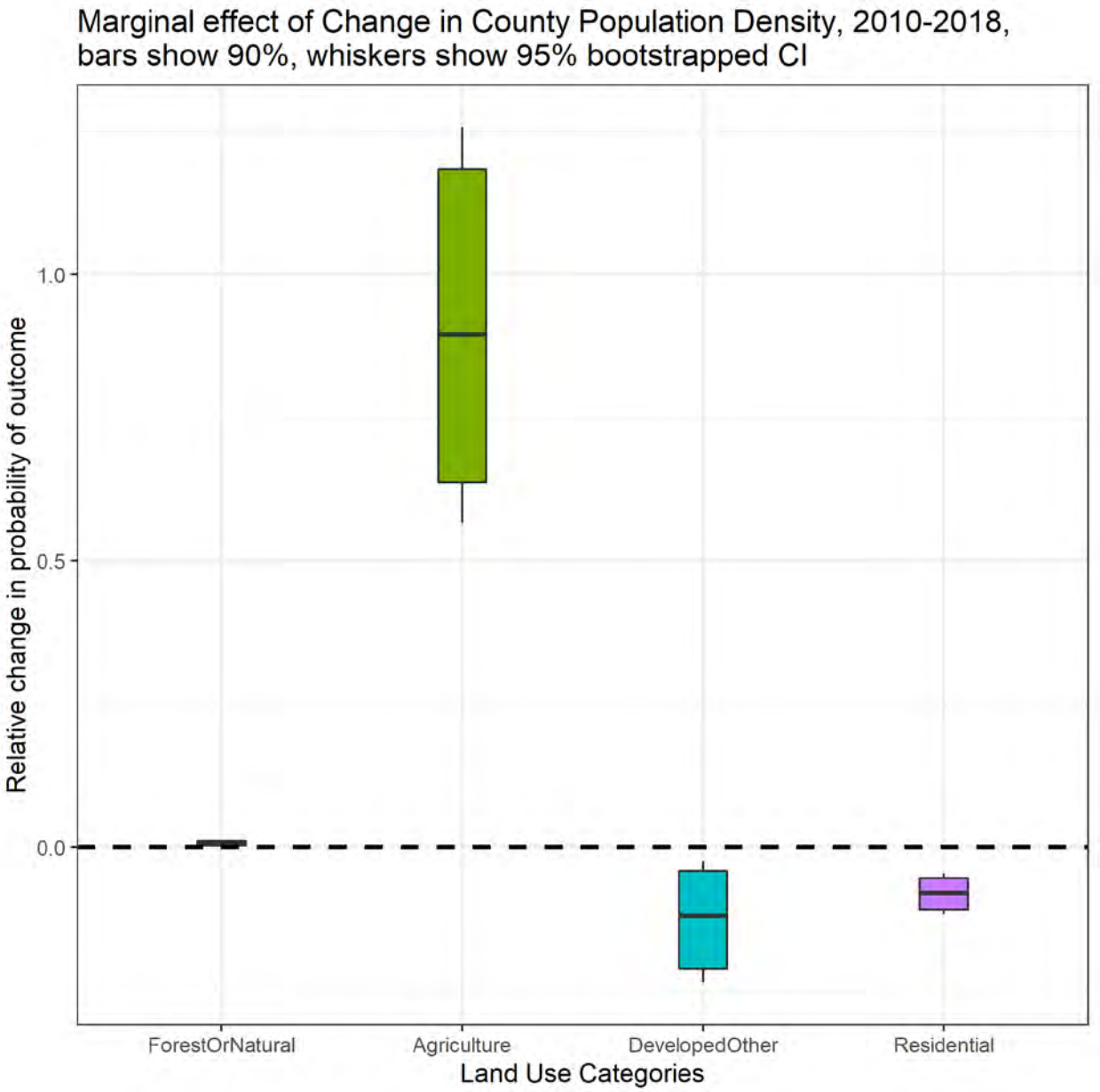

Figure 103. Marginal Effects of Population Density Change, Westside Model

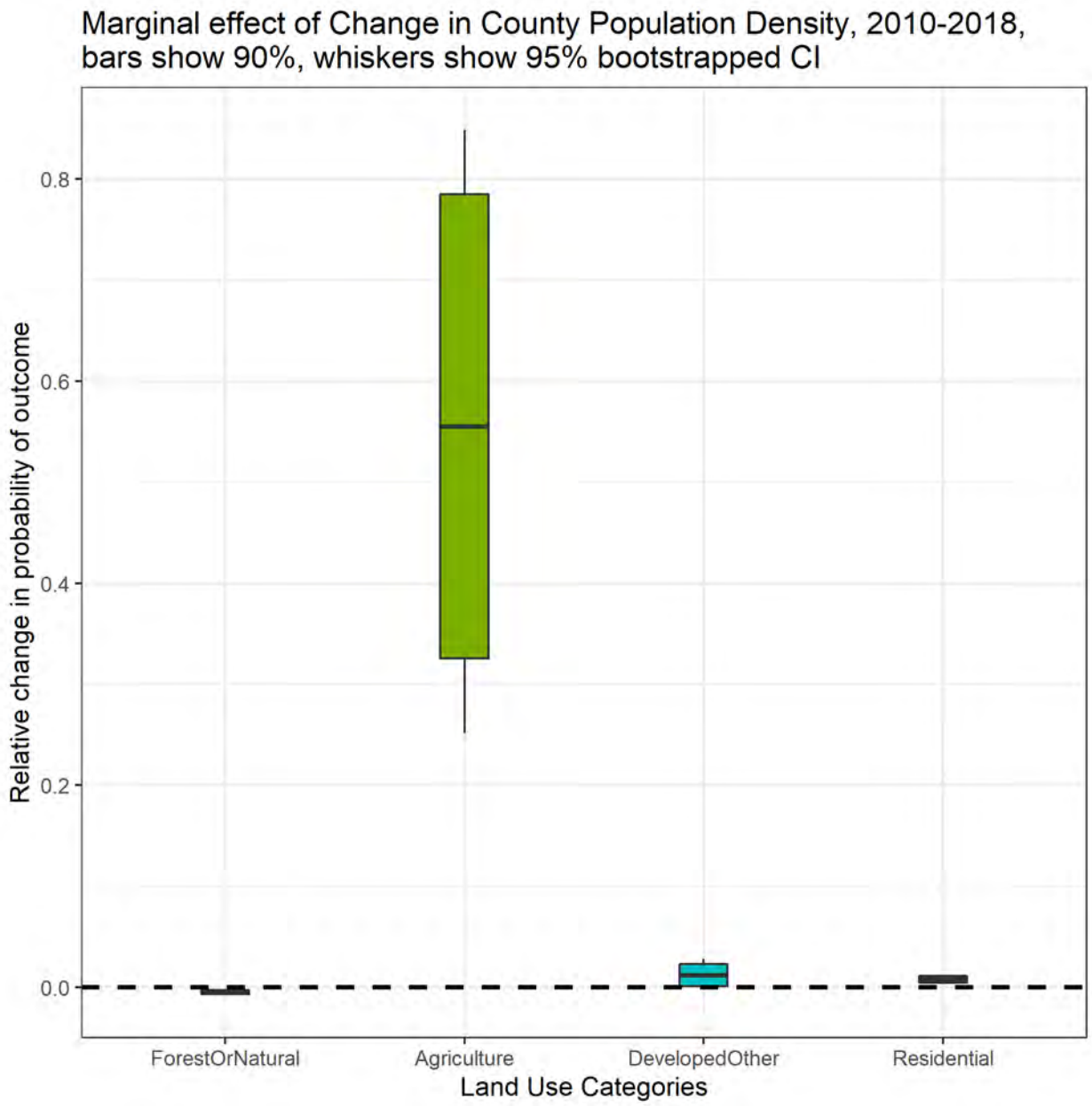

Figure 104. Marginal Effects of Population Density Change, Eastside Model

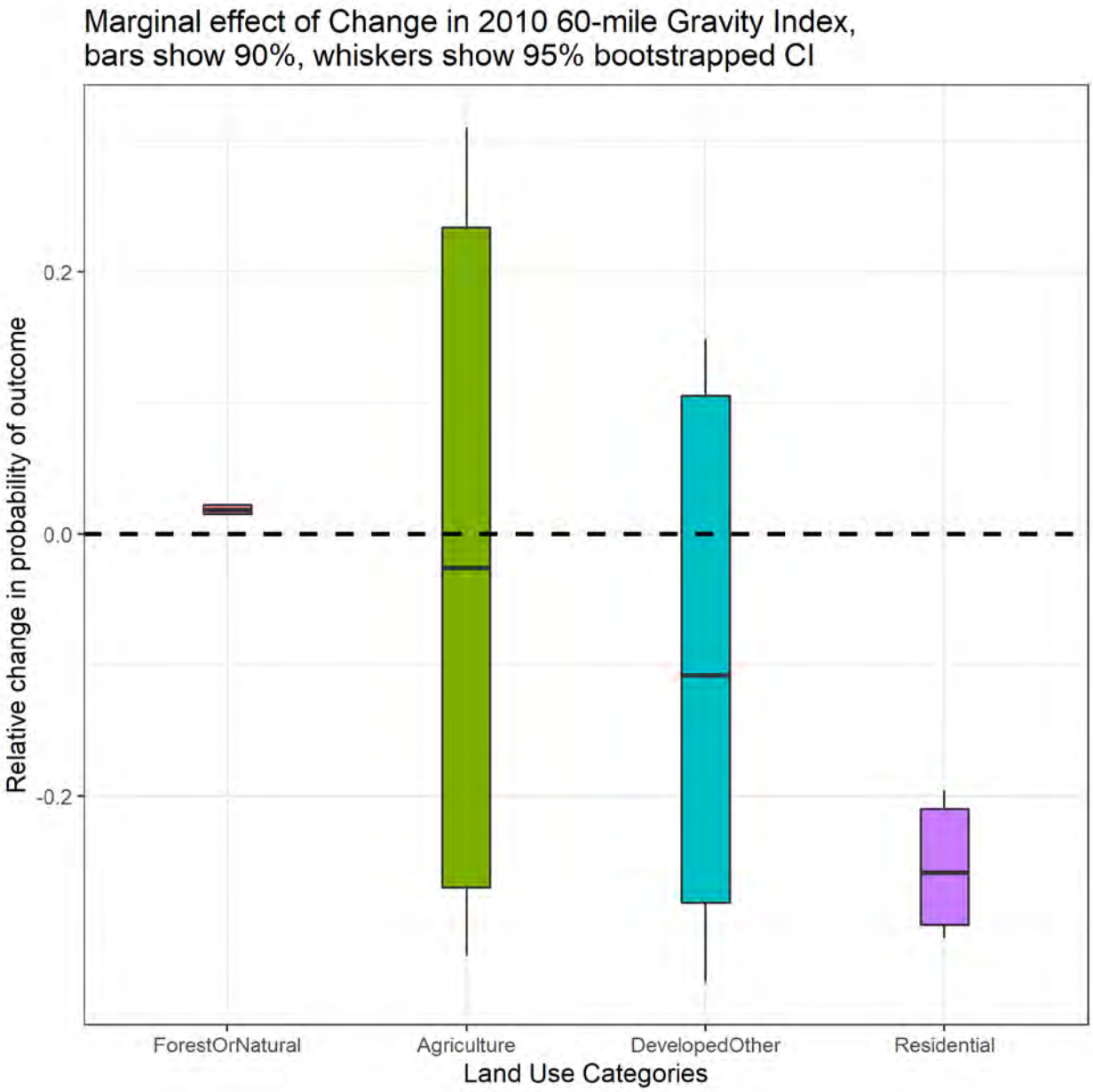

Figure 105. Marginal Effects of Population Gravity Index, Westside Model

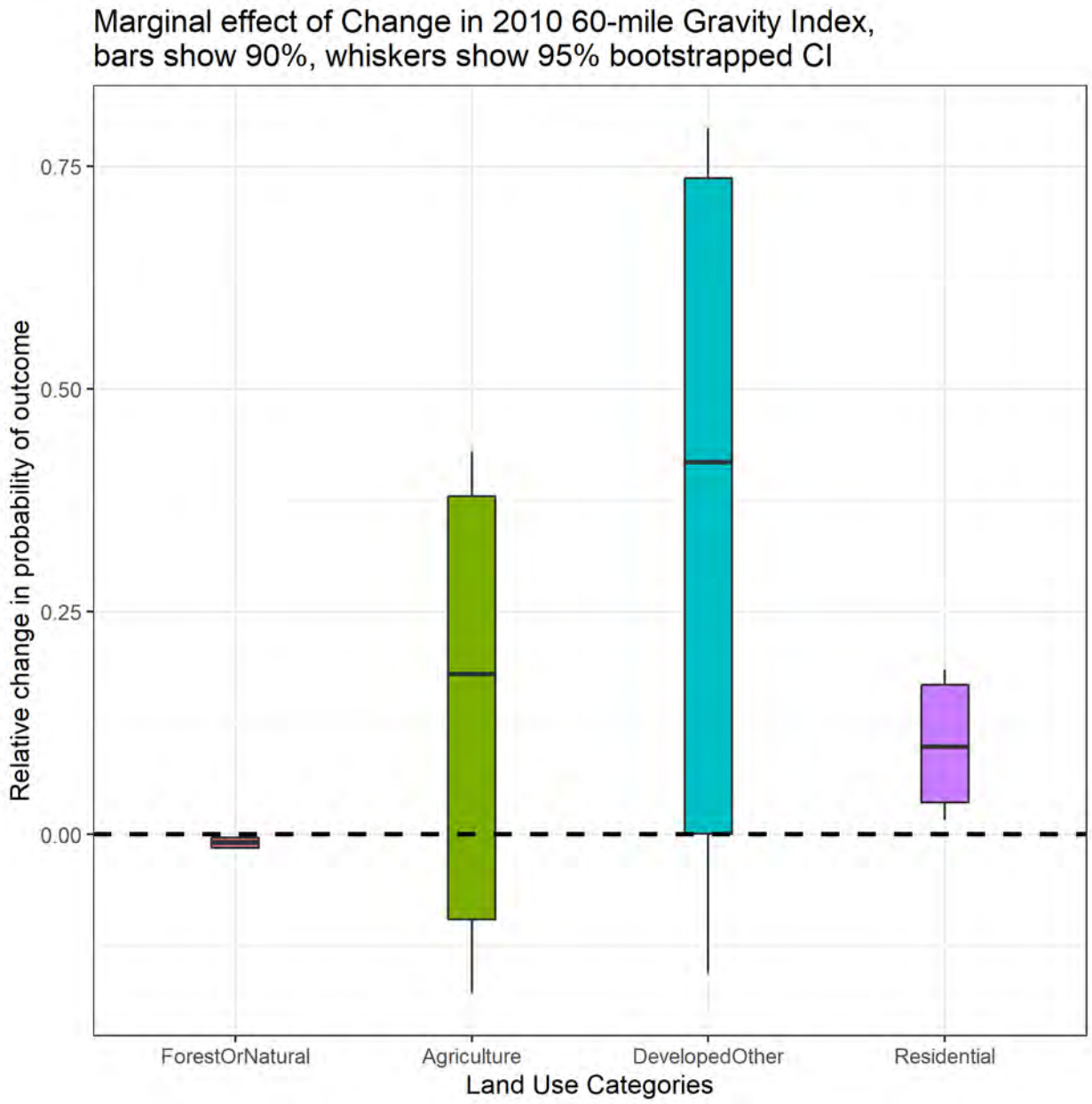

Figure 106. Marginal Effects of Population Gravity Index, Eastside Model

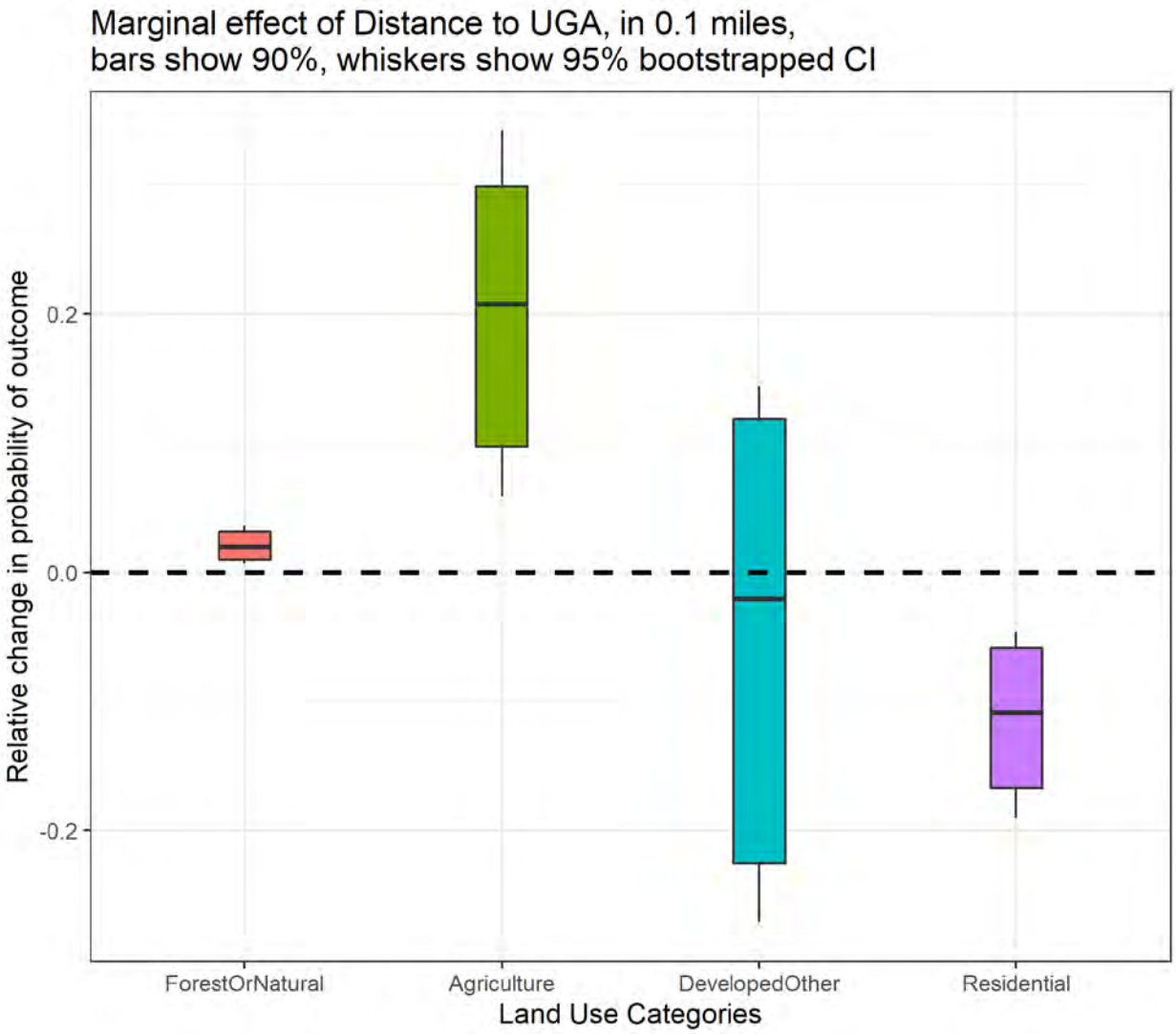

Figure 107. Marginal Effects of Distance to Urban Growth Area, Westside Model

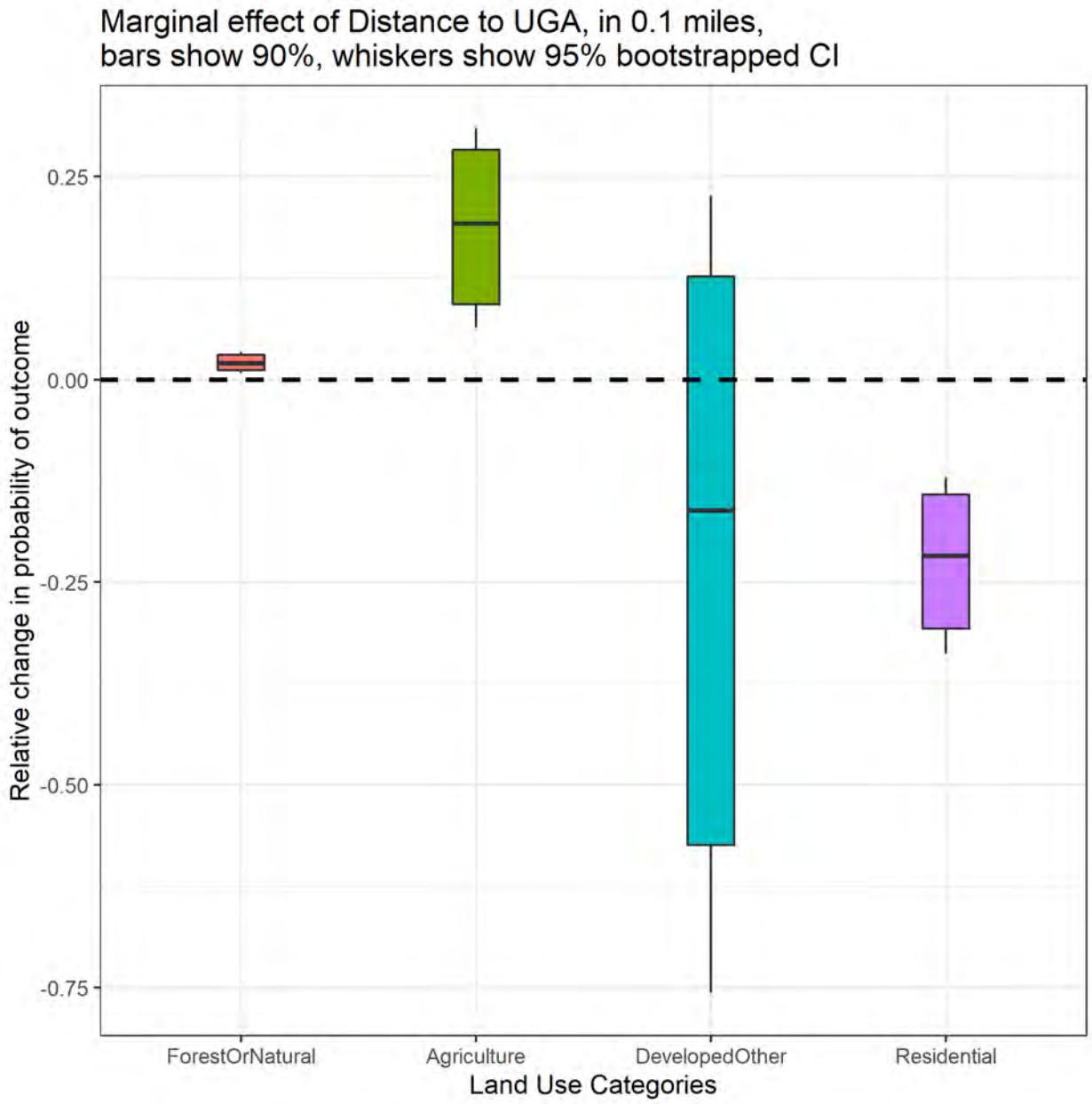

Figure 108. Marginal Effects of Distance to Urban Growth Area, Eastside Model

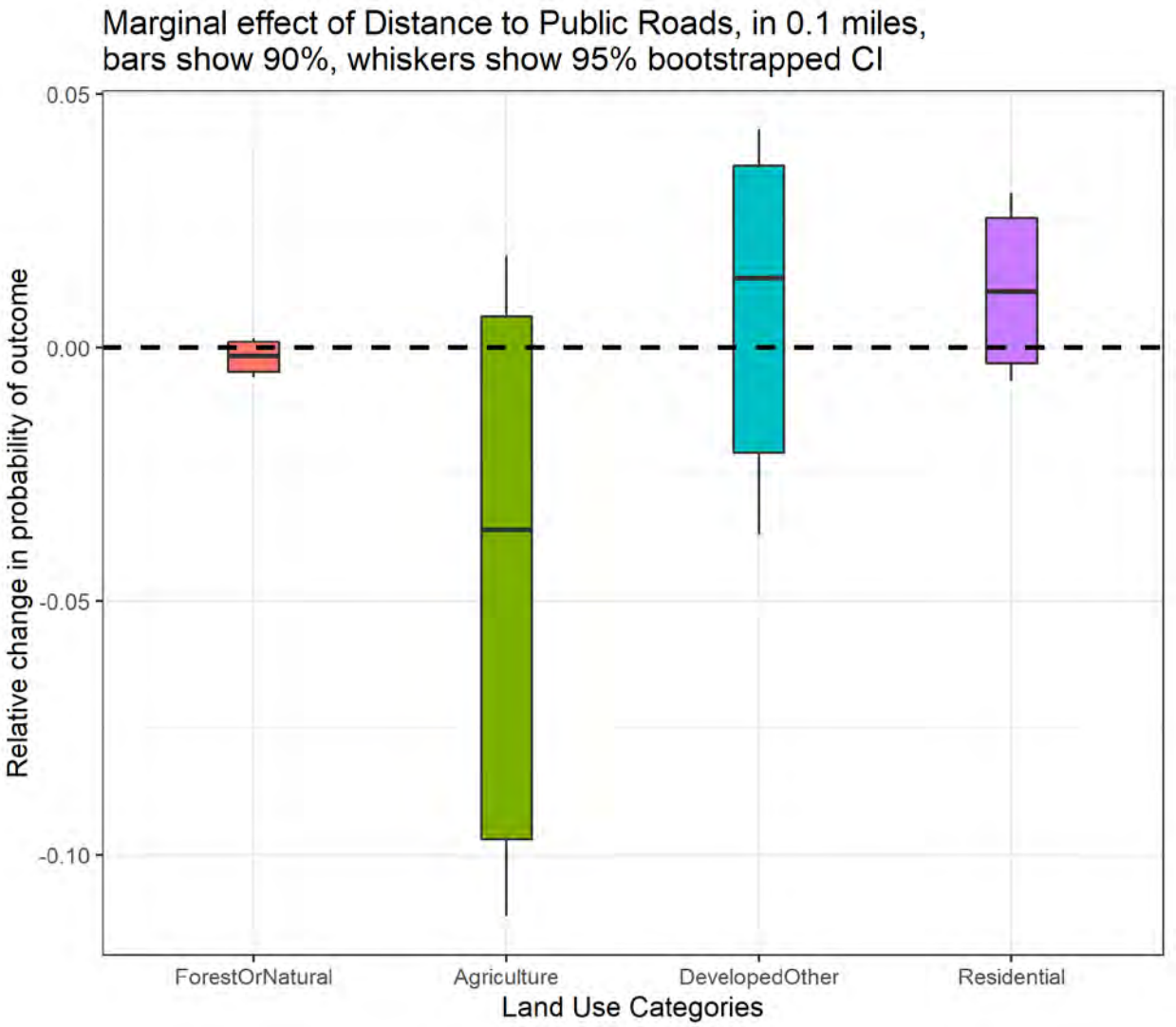

Figure 109. Marginal Effects of Distance to Public Roads, Westside Model

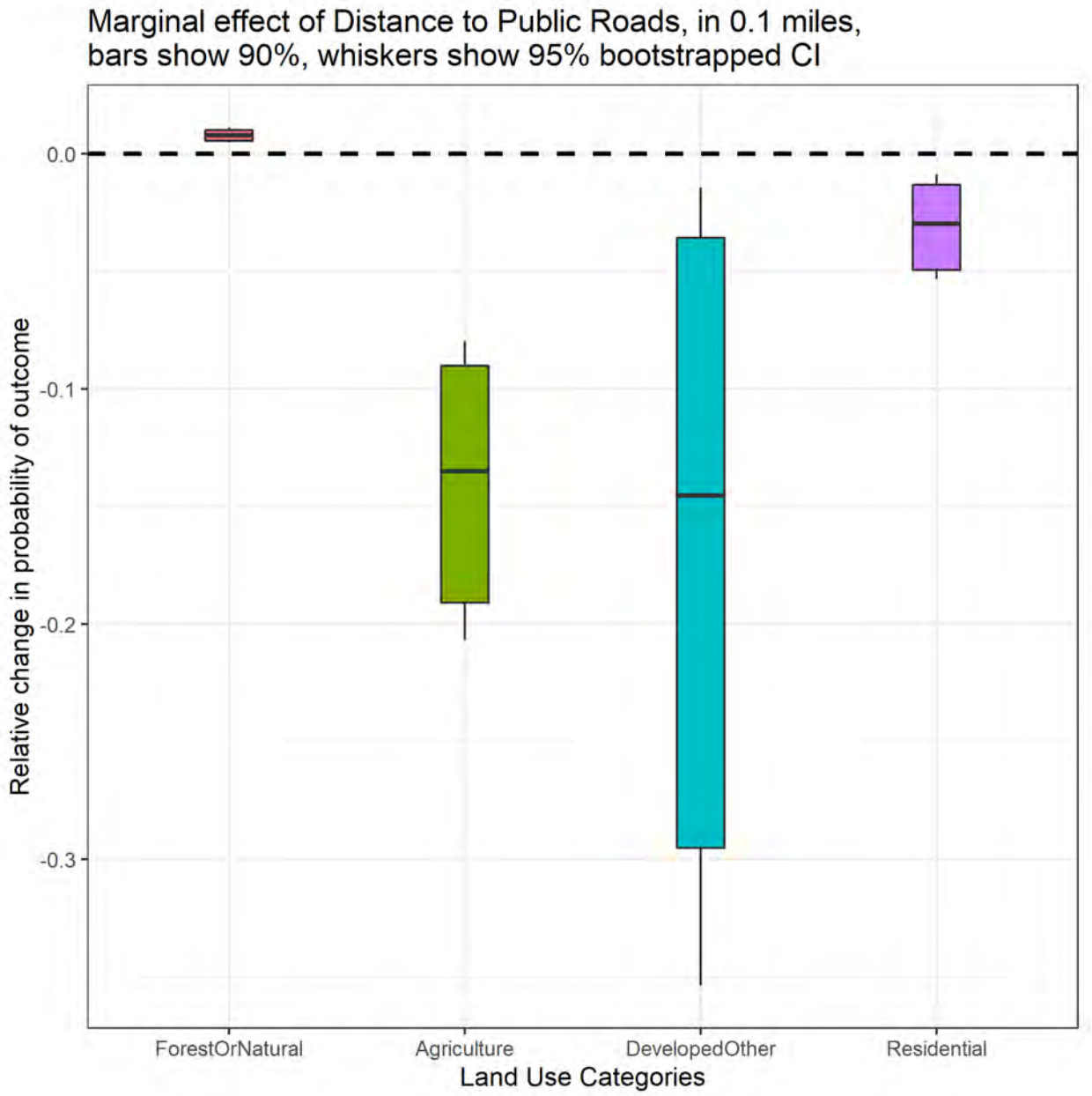

Figure 110. Marginal Effects of Distance to Public Roads, Eastside Model

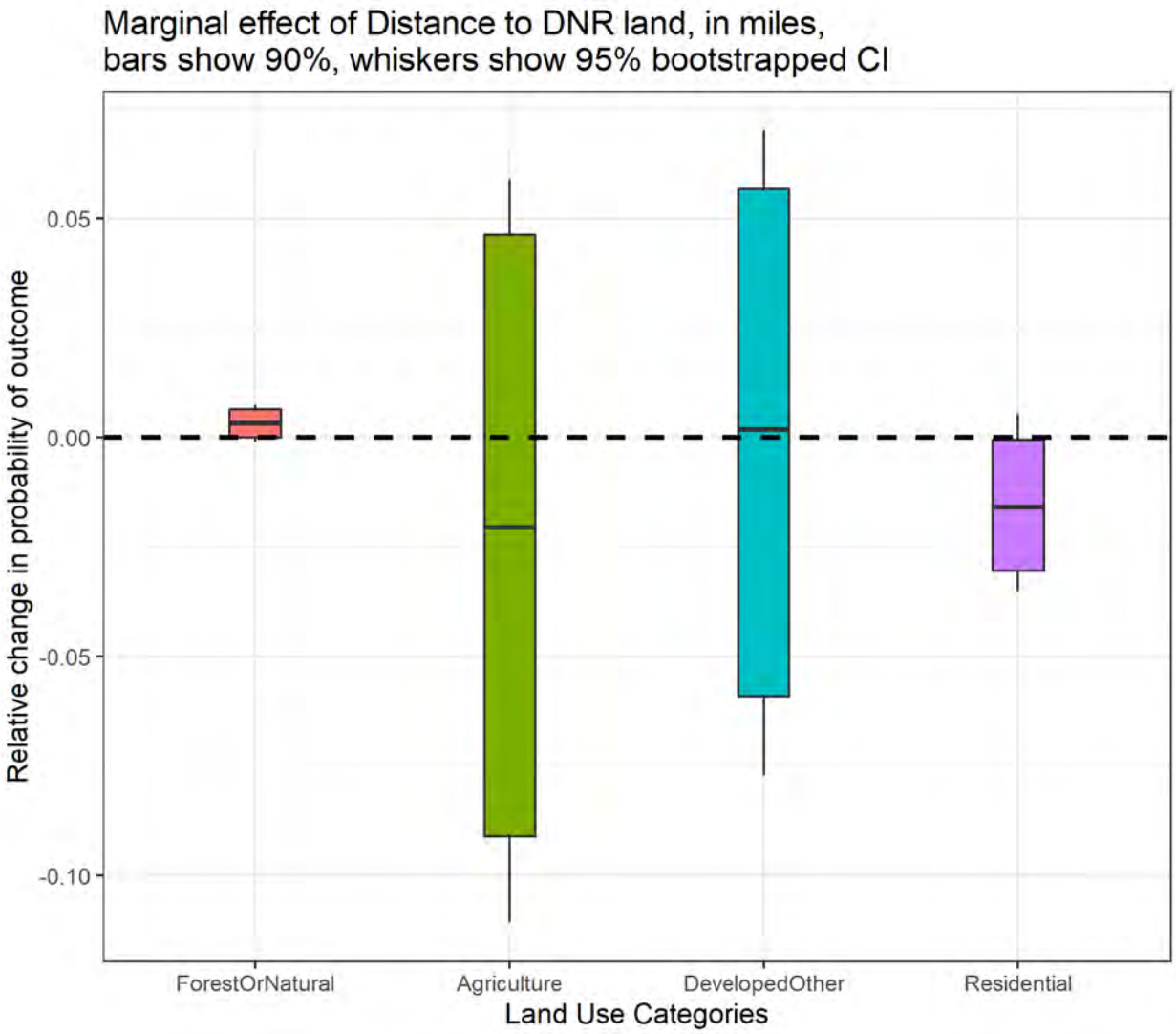

Figure 111. Marginal Effects of Distance to DNR Land, Westside Model

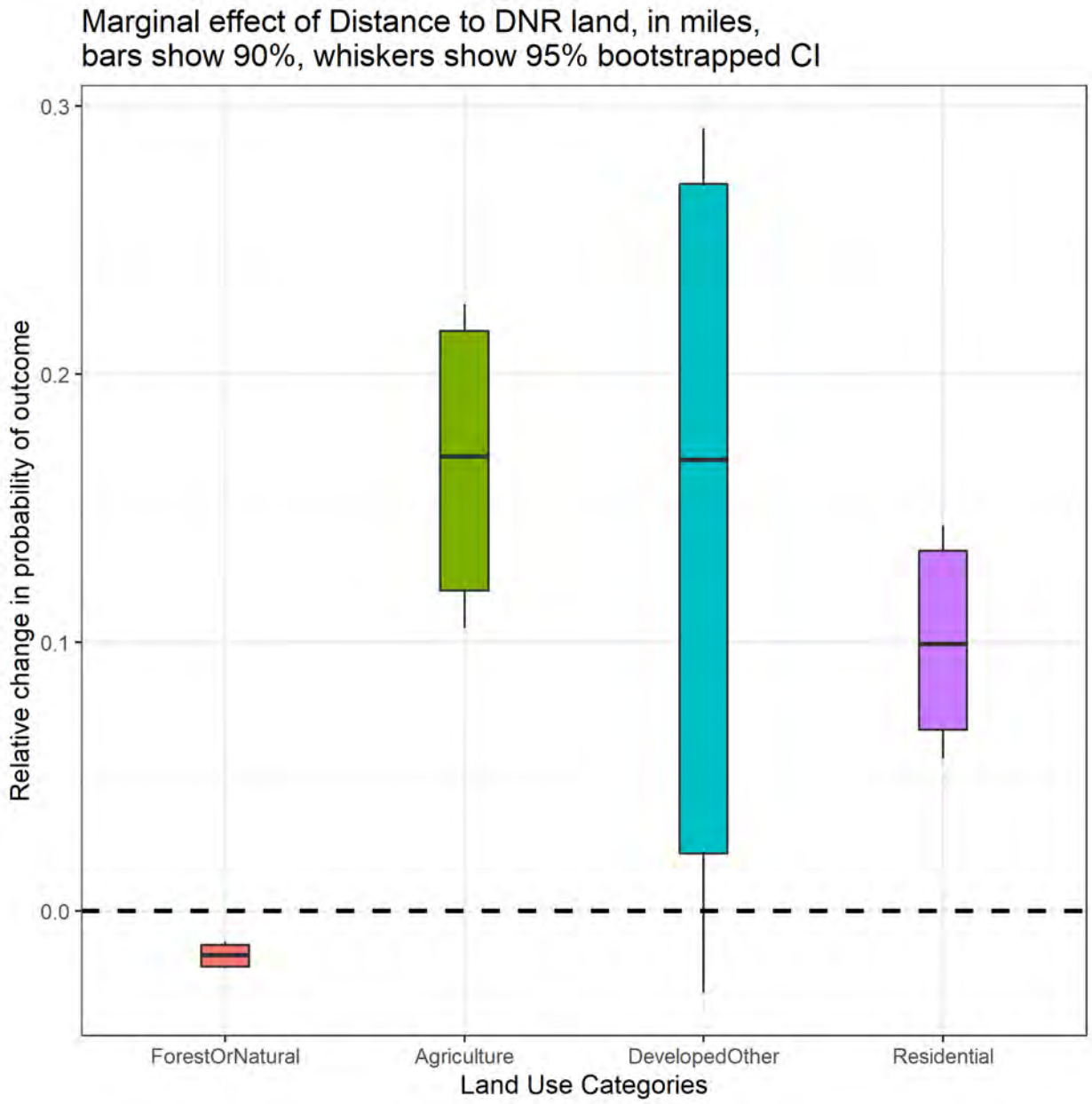

Figure 112. Marginal Effects of Distance to DNR Land, Eastside Model

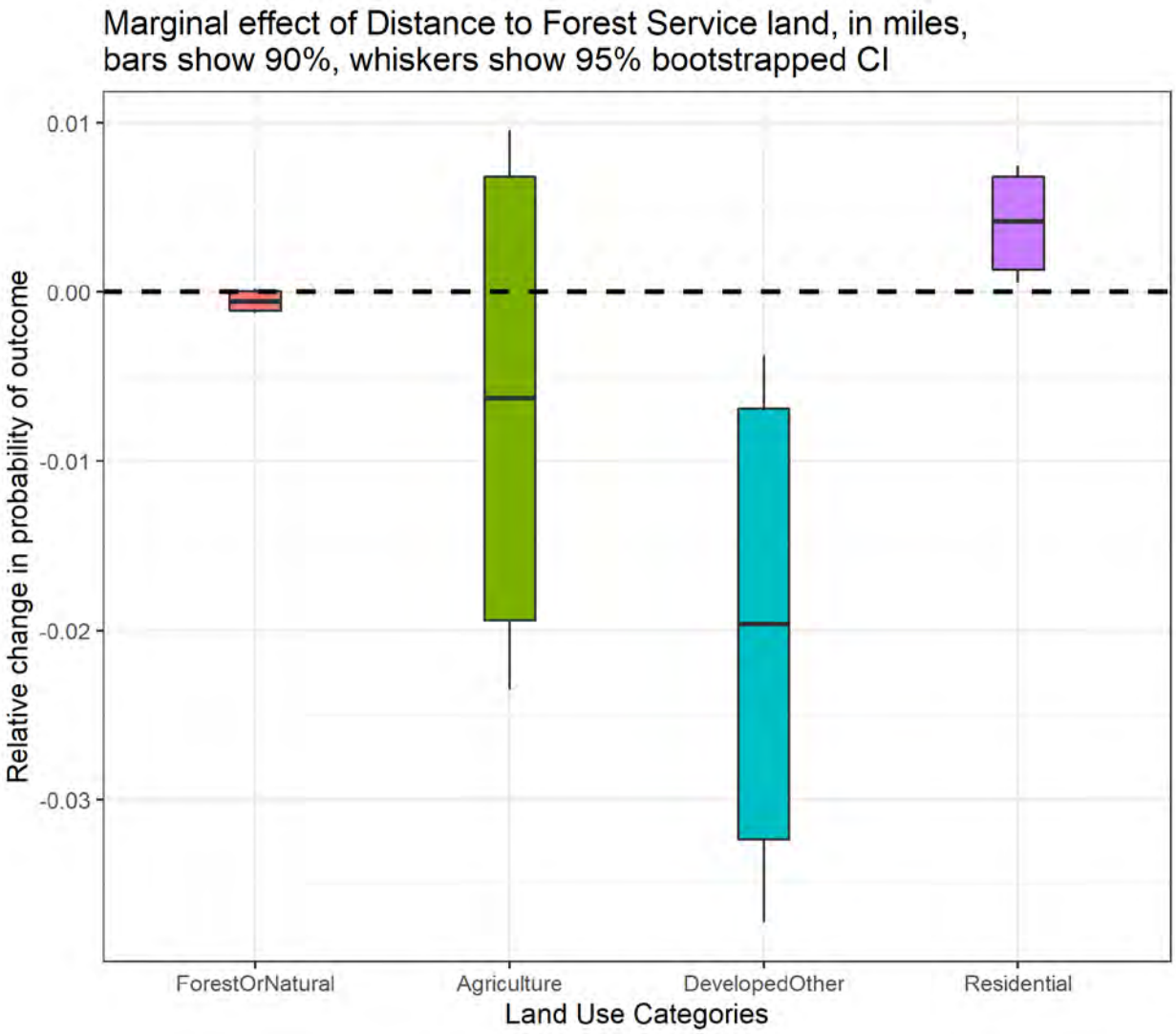

Figure 113. Marginal Effects of Distance to Forest Service Land, Westside Model

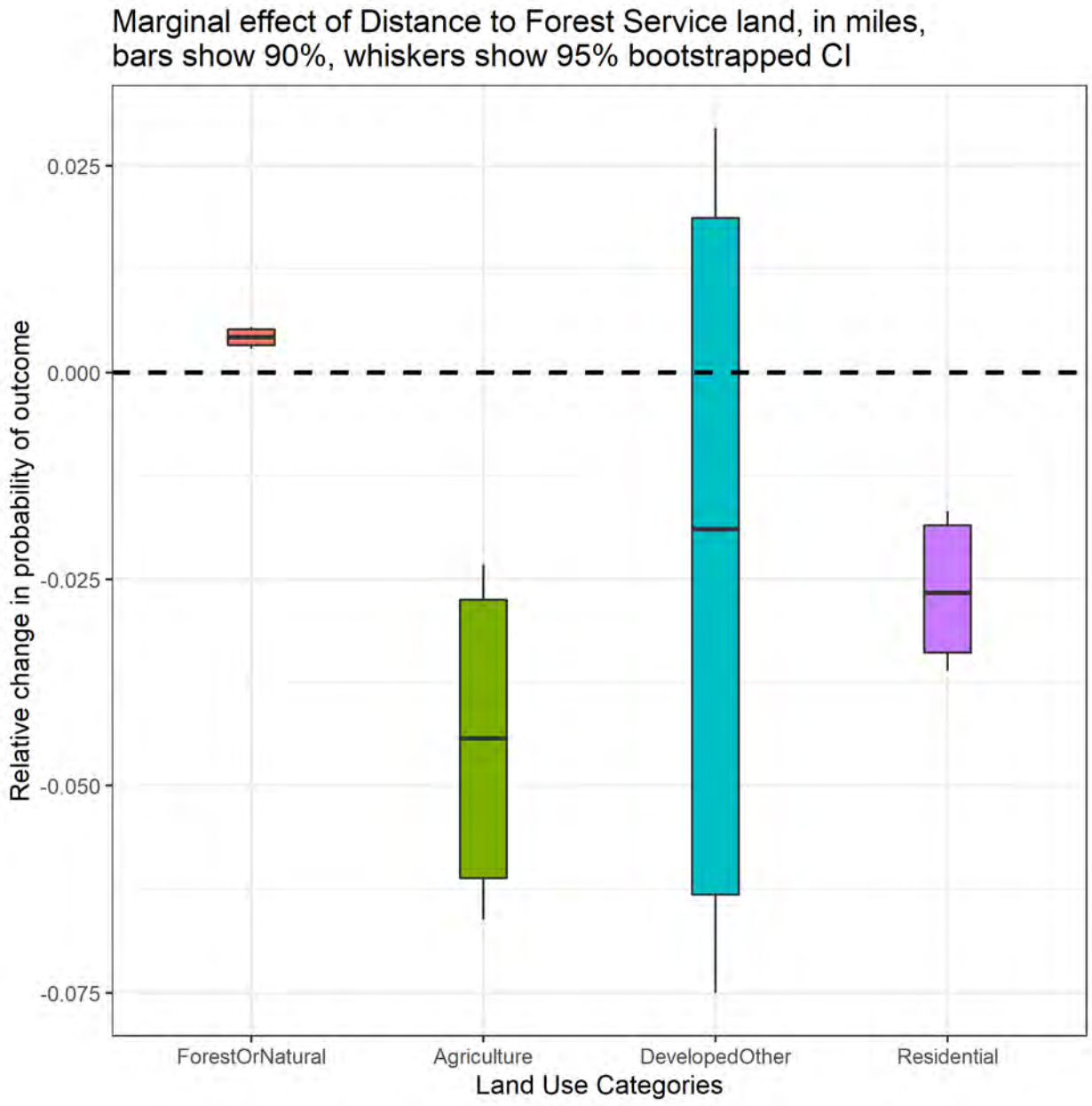

Figure 114. Marginal Effects of Distance to Forest Service Land, Eastside Model

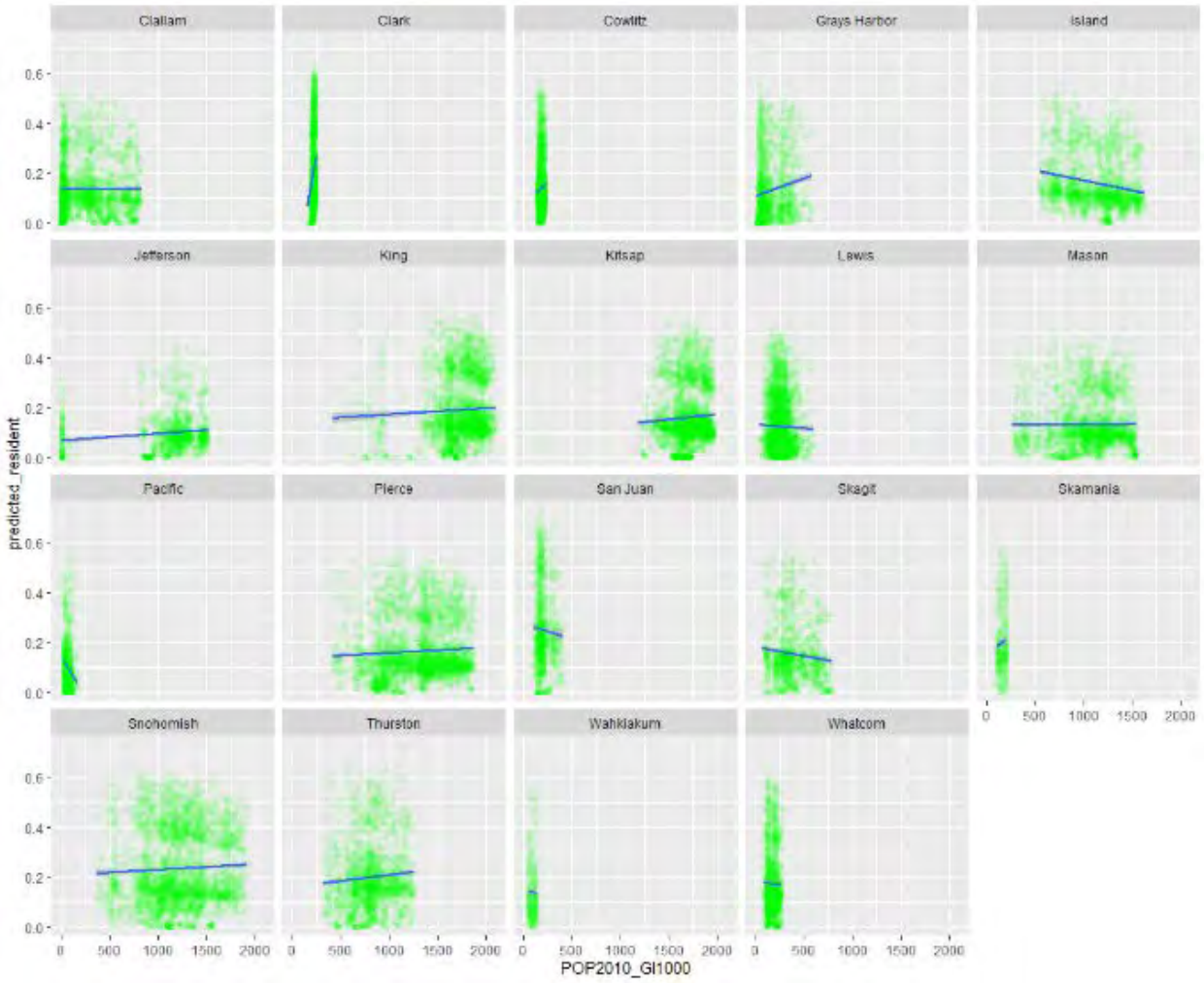

Figure 115. Partial Dependence Plot of Population Gravity Index vs. Residential Conversion Risk, by county, Westside.

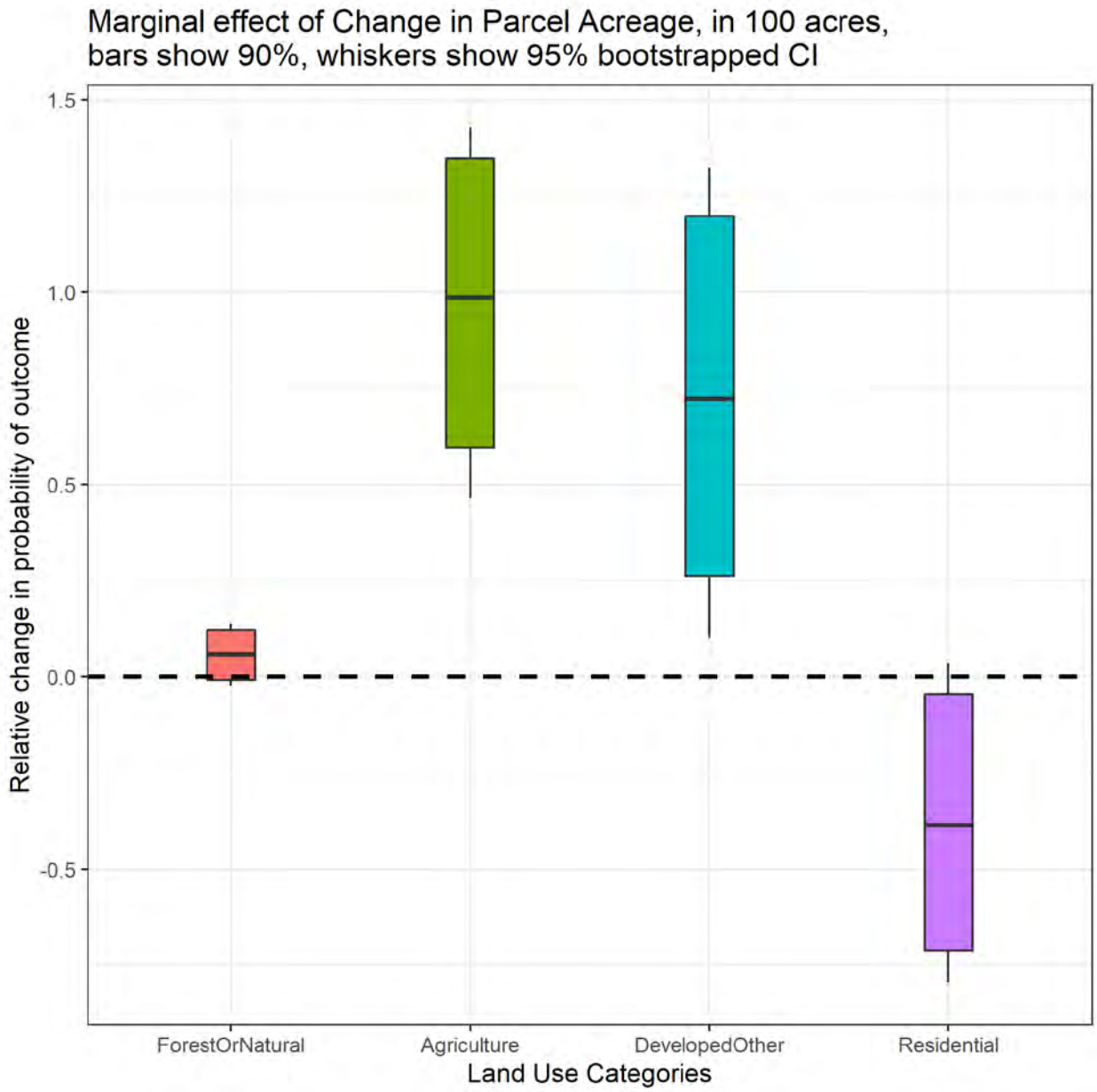

Figure 116. Marginal Effects of Parcel Acres, Westside Model

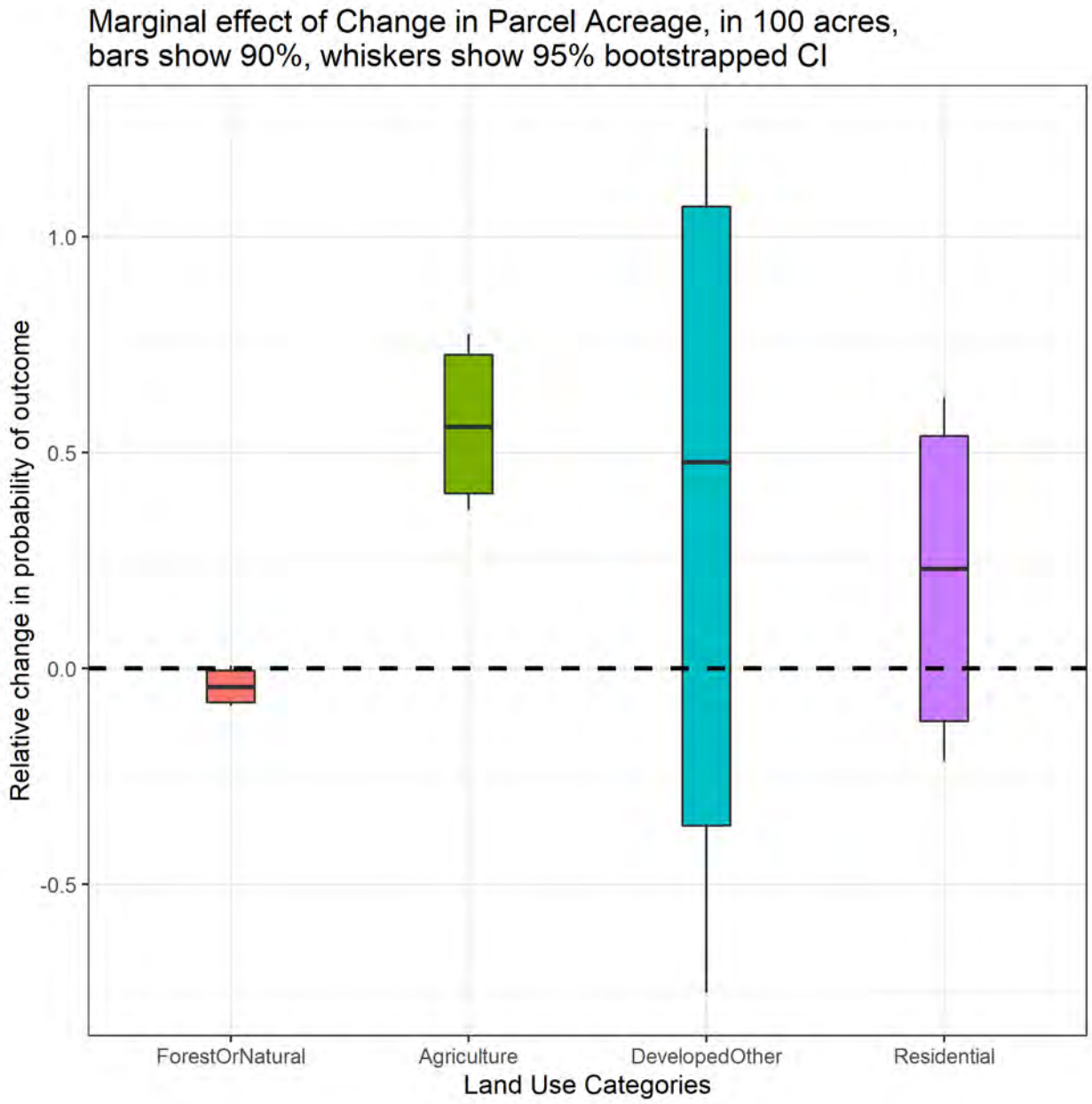

Figure 117. Marginal Effects of Parcel Acres, Eastside Model

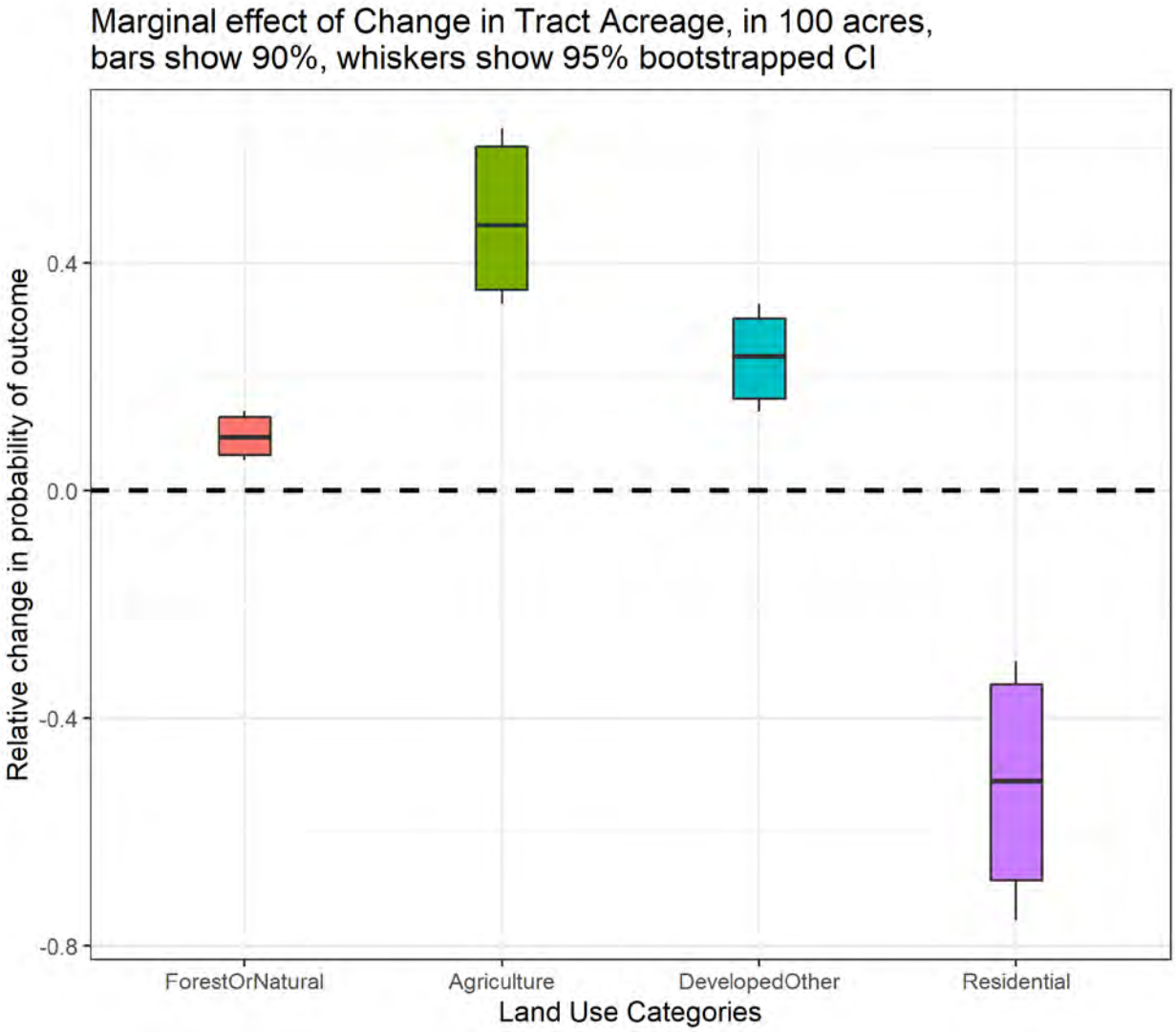

Figure 118. Marginal Effects of Tract Acres, Westside Model

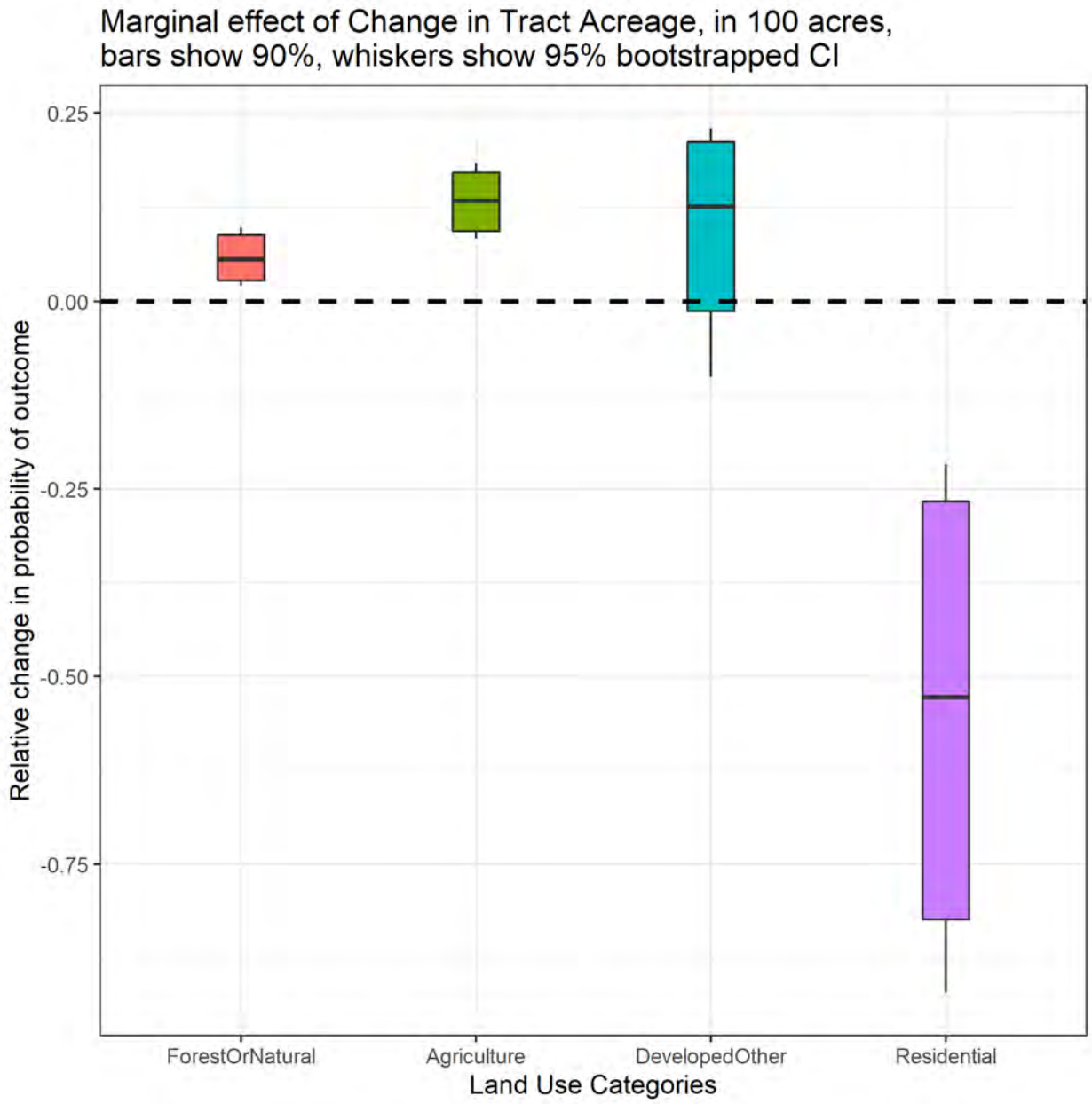

Figure 119. Marginal Effects of Tract Acres, Eastside Model

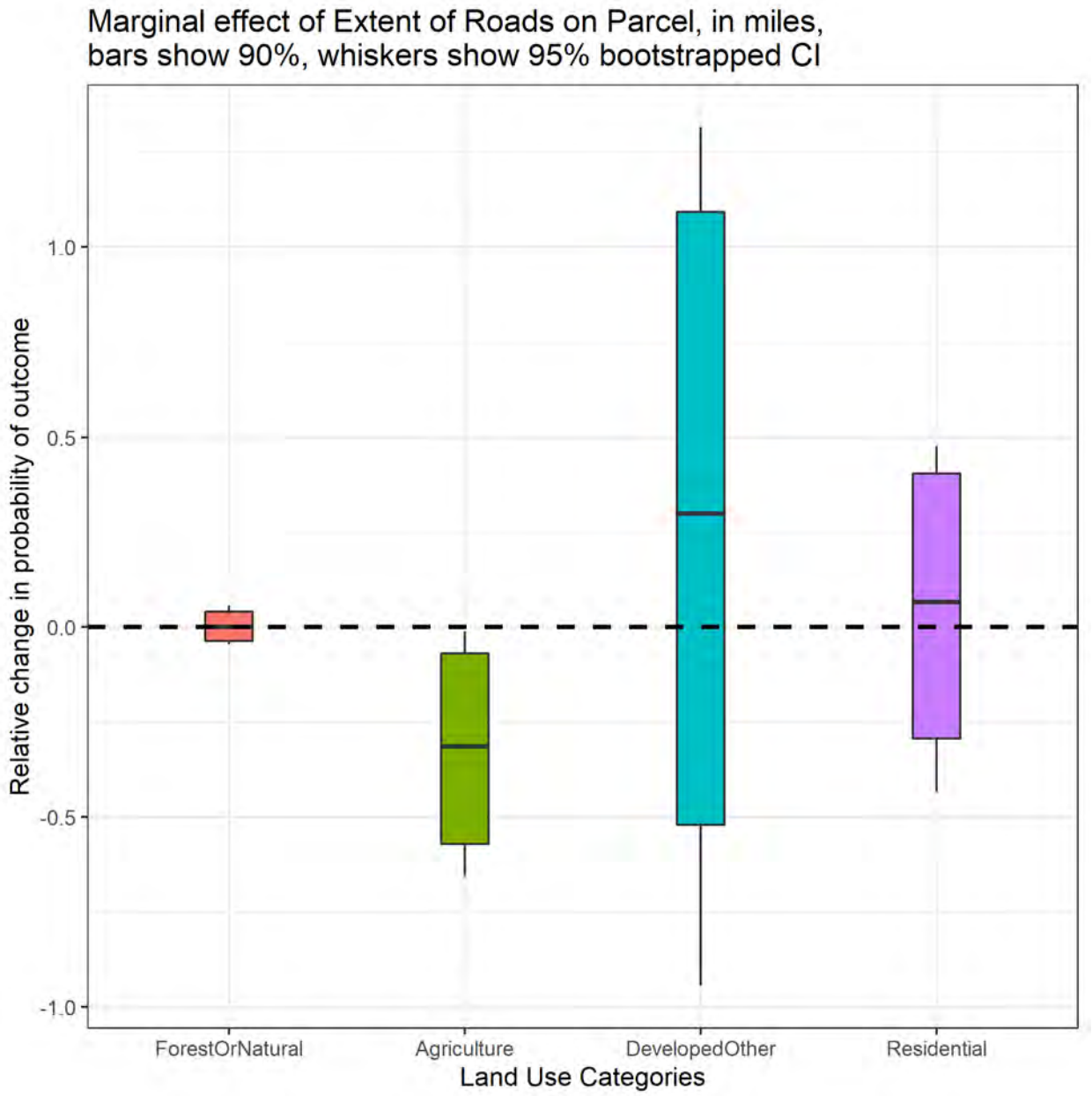

Figure 120. Marginal Effects of Parcel Roads, Eastside Model

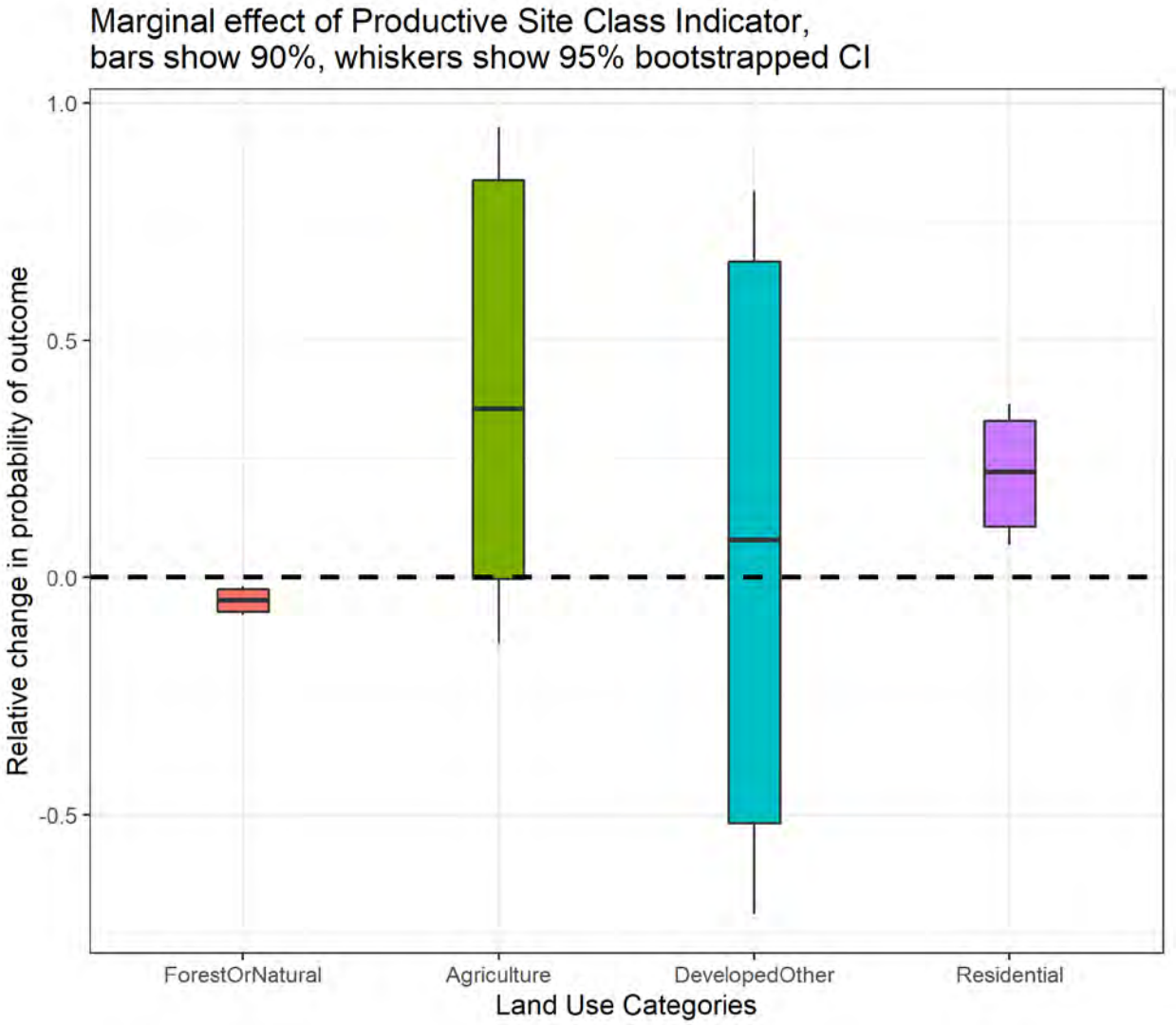

Figure 121. Marginal Effect of Productive Forest Siteclass, Westside Model

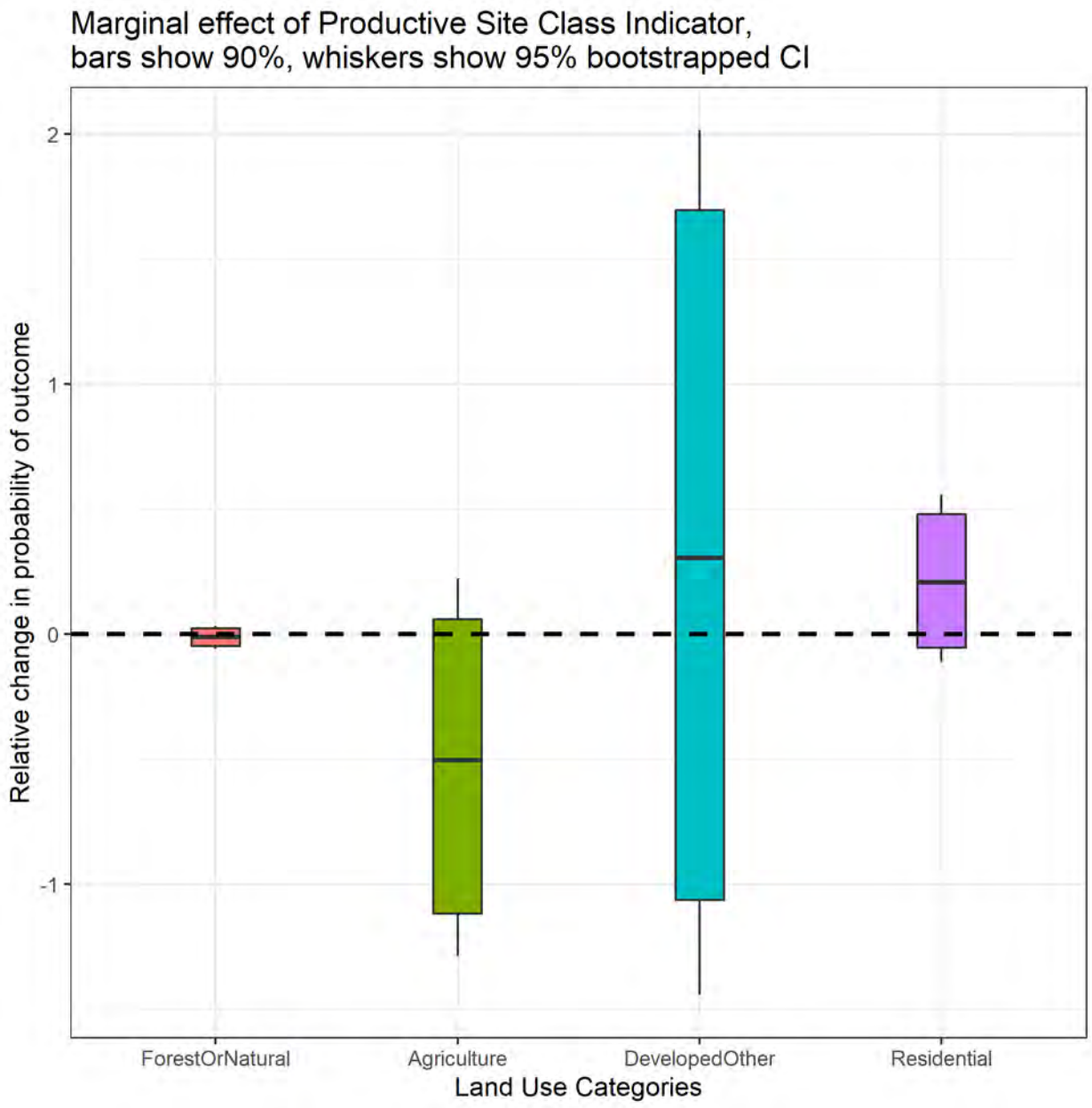

Figure 122. Marginal Effect of Productive Forest Siteclass, Eastside Model

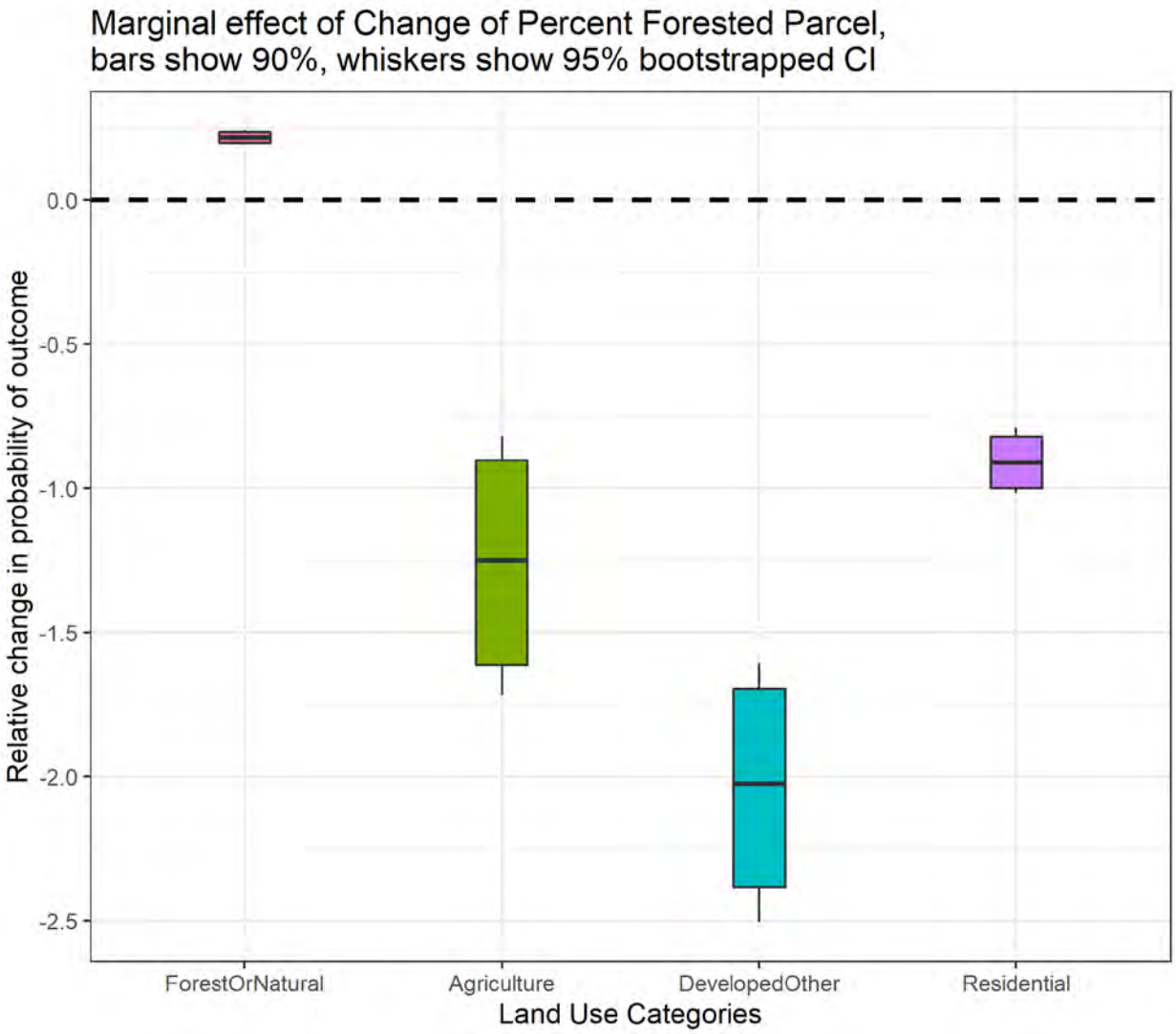

Figure 123. Marginal Effects of Percent Forest, Westside Model

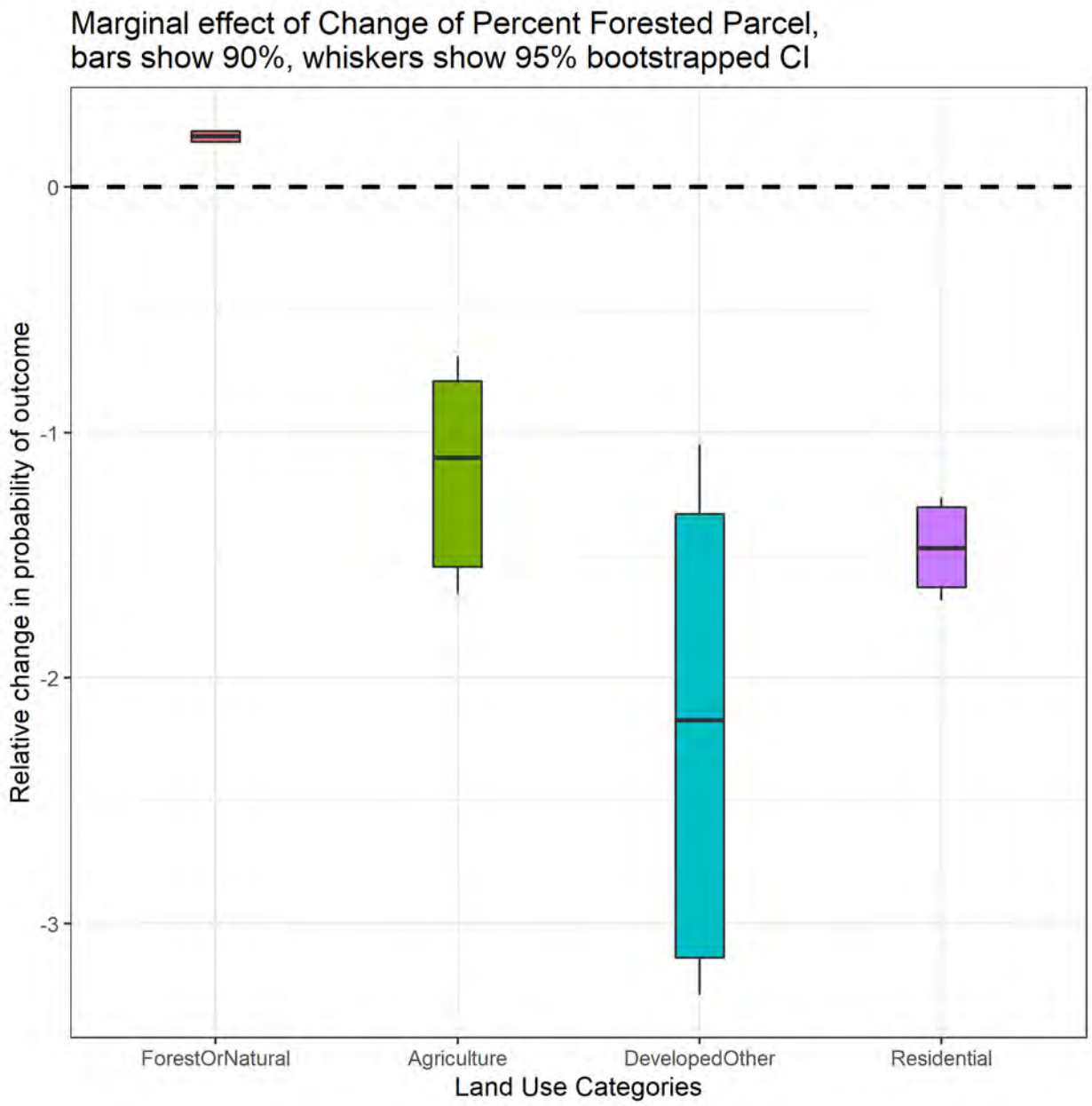

Figure 124. Marginal Effects of Percent Forest, Eastside Model

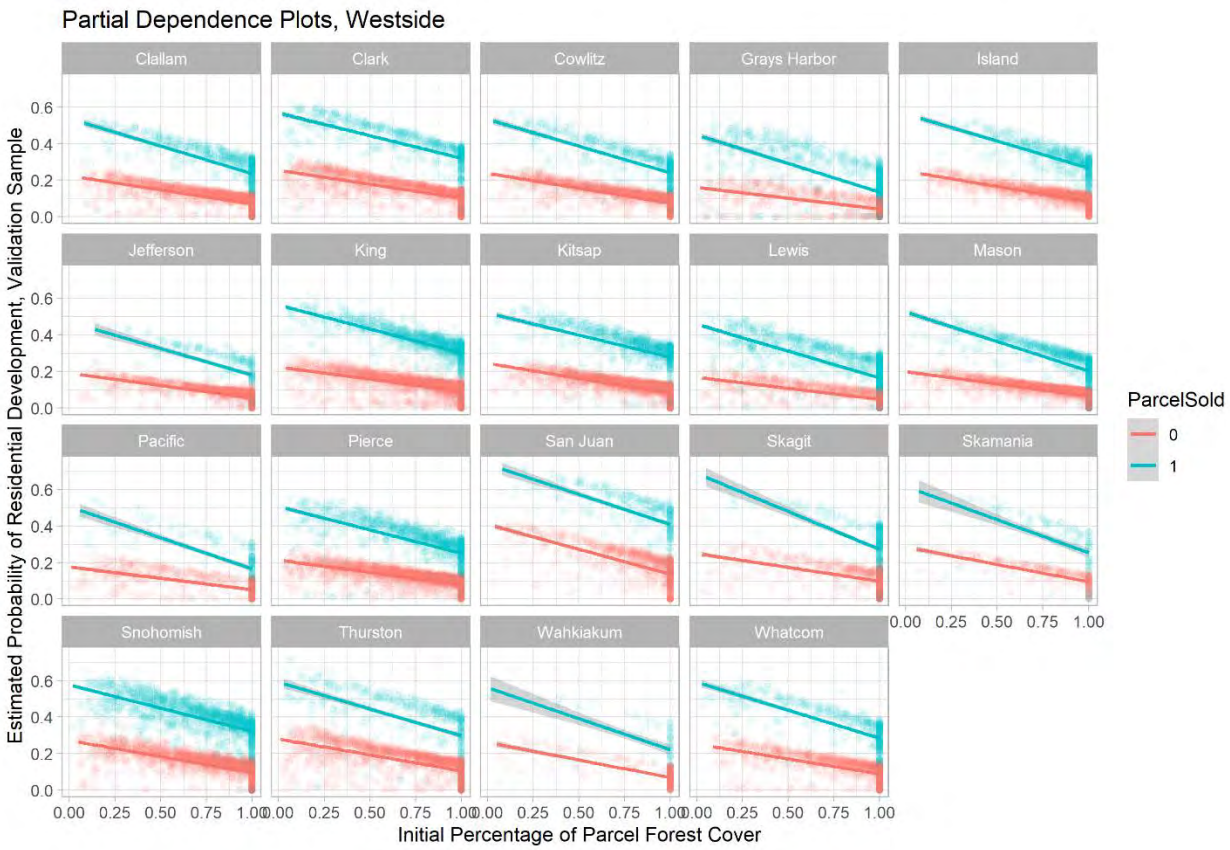

Figure 125. Partial Dependence Plots, Percent Forest vs. Conversion, Westside

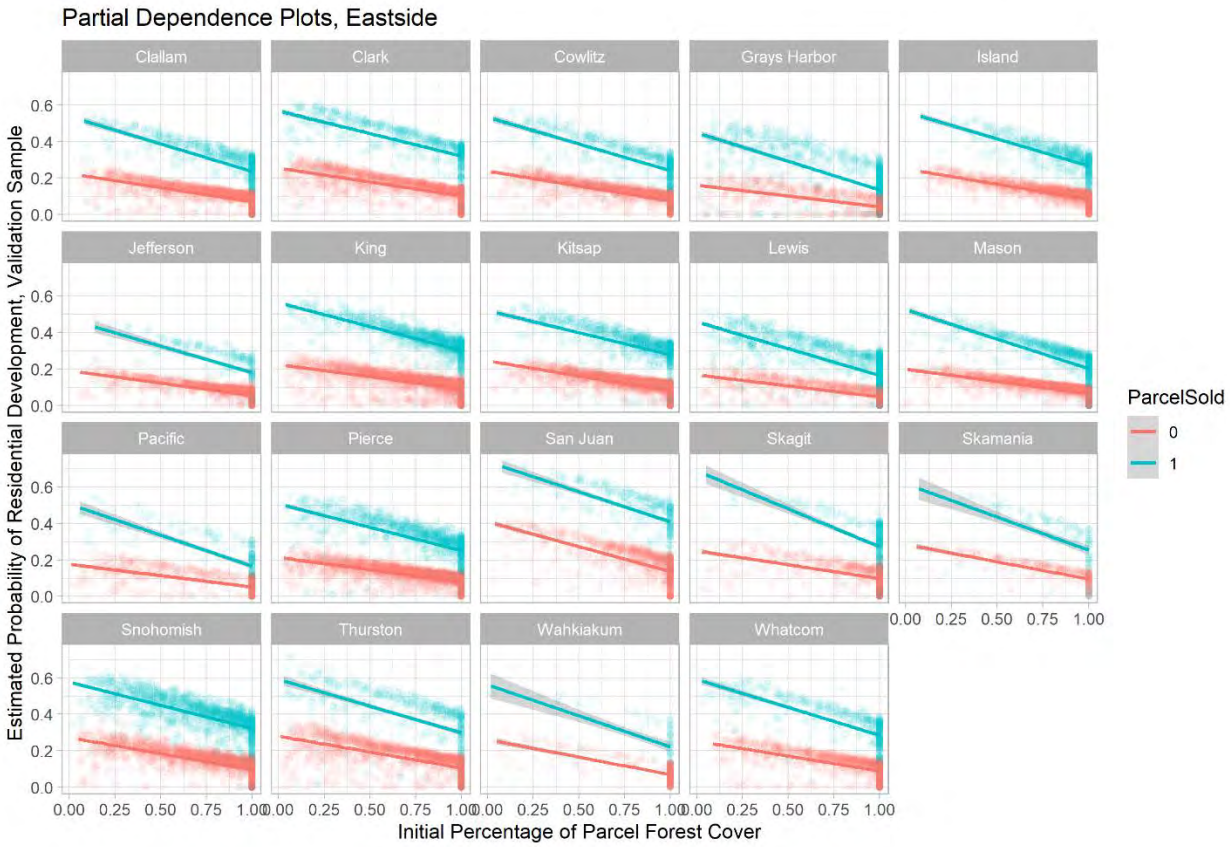

Figure 126. Partial Dependence Plots, Percent Forest vs. Conversion, Eastside

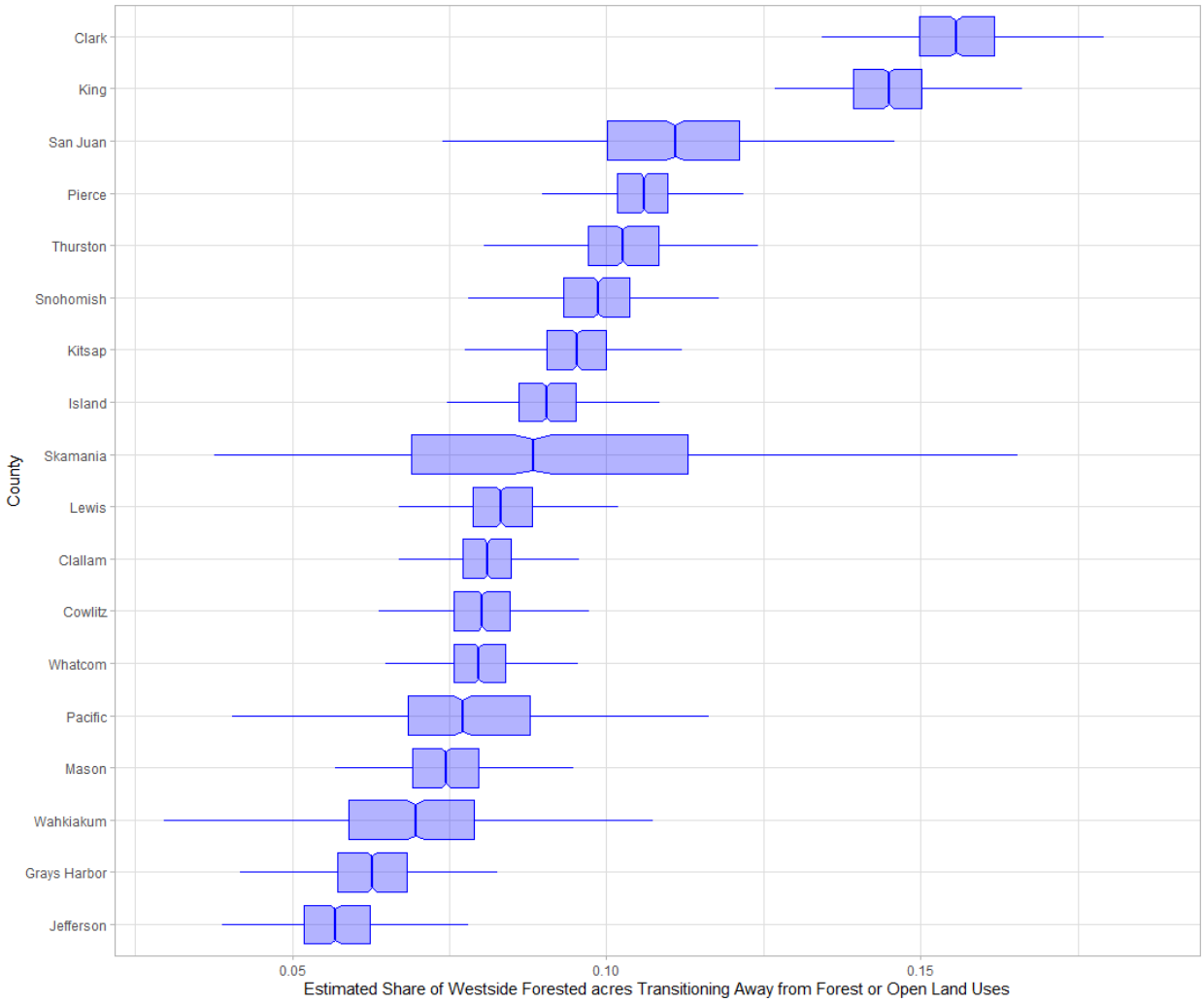

Figure 127. Simulated relative conversion of SFLO forest land, Westside

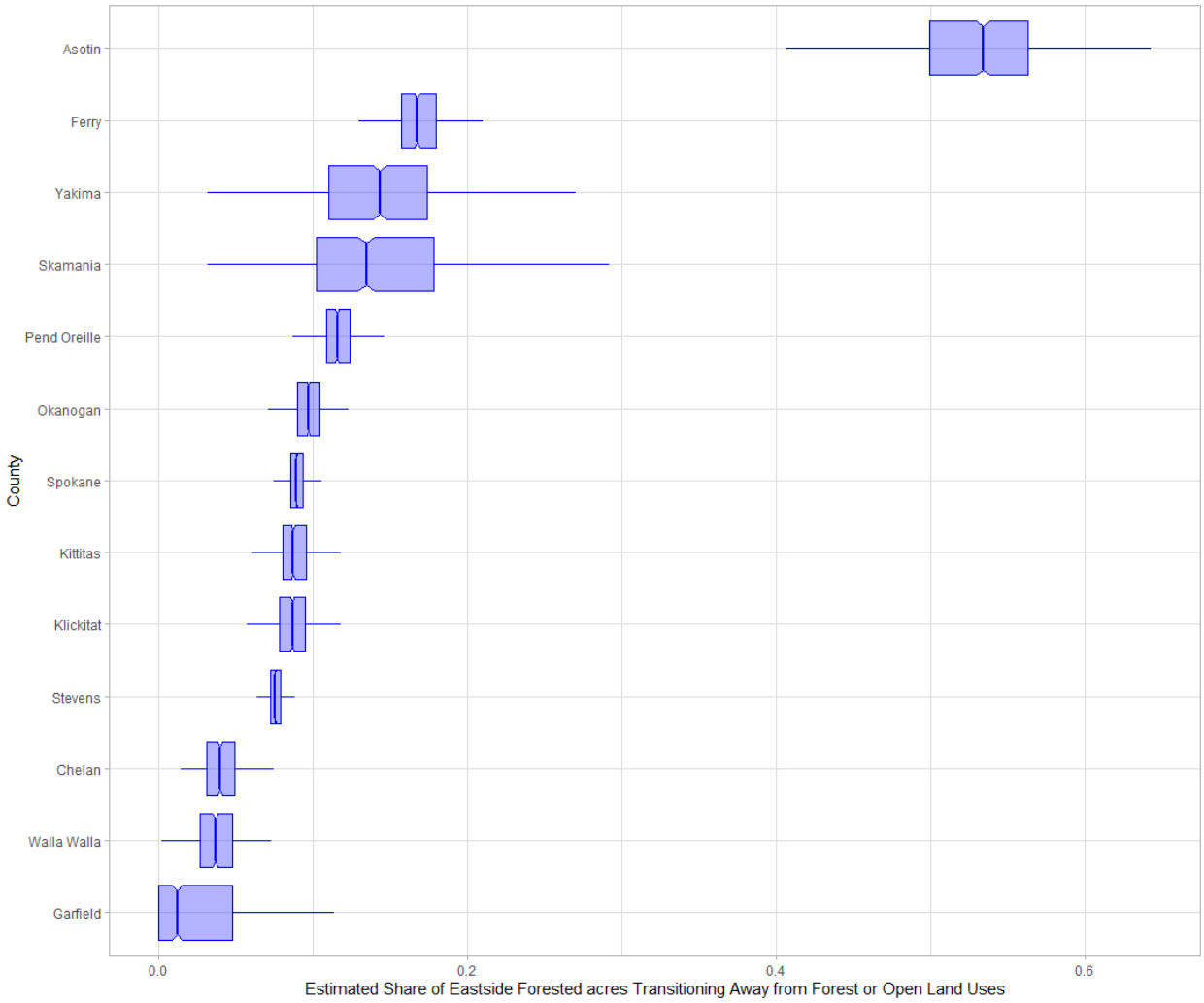

Figure 128. Simulated relative conversion of SFLO forest land, Eastside

20 Appendix F – Data and Maps

20.1 Data

Extracts from the 2007 and 2019 Washington State Forestland Database that were used to generate the charts and tables used in this report can be downloaded using the links below.

- Circa 2007 Forestland Database Spreadsheet
- Circa 2019 Forestland Database Spreadsheet
- 2007 – 2019 Forestland Change Spreadsheet

More data may be found at https://nrsig.org/projects/small-forest-landowner-regulatory-impacts

20.2 Maps

County level map books and high-resolution versions of the map graphics in this report can be downloaded using the links below.

- Circa 2007 Washington State Forestland Ownership
- Circa 2019 Washington State Forestland Ownership
- Circa 2007 County-Level Forestland Ownership
- Circa 2019 County-Level Forestland Ownership
- 2007 – 2019 County-Level Small Forest Landowner Classification Change
- 2007 – 2019 County-Level Industrial Forest Landowner Classification Change

More maps may be found at https://nrsig.org/projects/small-forest-landowner-regulatory-impacts