PROJECT BRIEF

Small Forest Land Owner Parcel Identification and County GIS Data Compilation for Washington State Clallam and Jefferson Counties

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Executive Summary

Washington's forests owned by small forest land owners represent approximately half of the total private forestland in the State. Lower in elevation than industrial forestlands, these parcels are often found in the spawning regions of many of Washington State's salmon streams and present an excellent opportunity for cost-share and assistance programs aimed at salmon habitat access and restoration. Washington State's departments of Fish and Wildlife (WDFW) and Natural Resources (DNR) have teamed with many local fish enhancement groups to identify existing fish blockages and habitat enhancement opportunities. It is unknown, however, which landowners qualify for assistance programs aimed at small forest land owners.

A Geographic Information System-based (GIS-based) approach to locating parcels owned by small forest land owners (SFLOs) using county assessor tax roles, GIS parcel data, and Landsat satellite imagery was developed to assist in the prioritization and identification of habitat enhancement opportunities on non-industrial forest lands in Washington State. This approach identifies certain and probable small forest land owners and allows local fish enhancement groups to prioritize work and contact individual landowners.

The Rural Technology Initiative has already completed this same analysis for Thurston and Okanogan counties for the Small Forest Landowner Office and a similar analysis for Clark, Lewis, and Cowlitz counties for the Lower Columbia Fish Recovery Board. This project completes the parcel identification and barrier analysis for Jefferson and Clallam counties.

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Introduction

Restoration of Washington's threatened and endangered salmon runs can be assisted by focusing restoration efforts in areas where the most habitats can be created for the least cost. The Washington State Department of Fish & Wildlife and the Department of Natural Resources, along with many local fish enhancement groups, have come together to locate and survey many of Washington's salmon streams. These surveys produced Geographic Information System (GIS) layers which show the location, condition, and fish passage status of dams, culverts, and fishways throughout the state. This information, combined with knowledge of who owns the land, can help local groups and funding agencies identify target restoration areas.

Currently, there are a variety of stream restoration assistance programs targeted specifically at non-industrial private forestlands (NIPFs) and small forest land owners (SFLOs); however, it is difficult to identify land owners in this group without door-to-door surveys. This project provides the funding groups with targeted information and mailing lists for land owners eligible for these funding programs using a combination of GIS and tabular data analysis.

The State of Washington's harvest-based definition of a small forest landowner created in the Salmon Recovery Act, defines SFLOs as those who harvest less than two million board feet on an annual basis [RCW 76.13.120(2)(c)]. Unfortunately, the currently available information on harvest levels is not detailed enough to locate or identify small forest land owners. Alternatively, a previous acreage-based definition considered non-industrial forests and woodlands [also known as NIPFs] as "those suburban acreages and rural lands supporting or capable of supporting trees and other flora and fauna associated with a forest ecosystem, comprised of total individual land ownerships of less than five thousand acres and not directly associated with a wood processing or handling facilities" [RCW 76.13.010(4)]. Therefore, this acreage-based definition was used in the identification of possible small forest land owners eligible for stream restoration financial assistance programs.

For the purposes of this project, identification of these small forest land owners was based on two assumptions: 1) land ownerships less than 5,000 acres and taxed as forest or timberland have a high likelihood of meeting the acreage-based definition, and 2) forested lands of certain sizes have the potential of meeting the same definition. County assessor tax roles and GIS parcels, collected from Clallam and Jefferson counties, were used to identify those parcels which have land use codes taxed as forestland, timberland, or open space to identify SFLOs. Additionally, classified Landsat satellite imagery of forest and non-forest cover was intersected with all parcels, regardless of land use, to identify acres of forest land on each parcel; this resulted in the identification of Possible SFLOs. With the data produced during this project, it is possible to further identify Possible SFLOs by selecting parcels with non-conflicting land use codes, such as open space or other non-residential or commercial uses, if desired.

This project summary describes the data used in the analysis, the methods used to determine SFLOs, and some general statistics about these lands.

Data

County Data

This project collected and analyzed parcel and in-stream barrier data for Washington's North Olympic Peninsula, limiting the study area to Clallam and Jefferson counties. Clallam County includes the entire Lyre-Hoko Water Resource Inventory Area (WRIA) and portions of Soleduc, Elwah-Dungeness, and Quilcene-Snow. Jefferson County includes the remaining portions of Soleduc, Elwah-Dungeness, and Quilcene-Snow, as well as portions of Queets-Quinault and Skokomish-Doswallips. Figure 1 shows the study area for this project, outlined in blue.

Previous projects covered WRIAs in Clark, Cowlitz, Lewis, Thurston, and Okanogan counties. The data and results from these projects can be acquired from the Lower Columbia Fish Recovery Board and the Washington Department of Natural Resources, Small Forest Landowner Office.

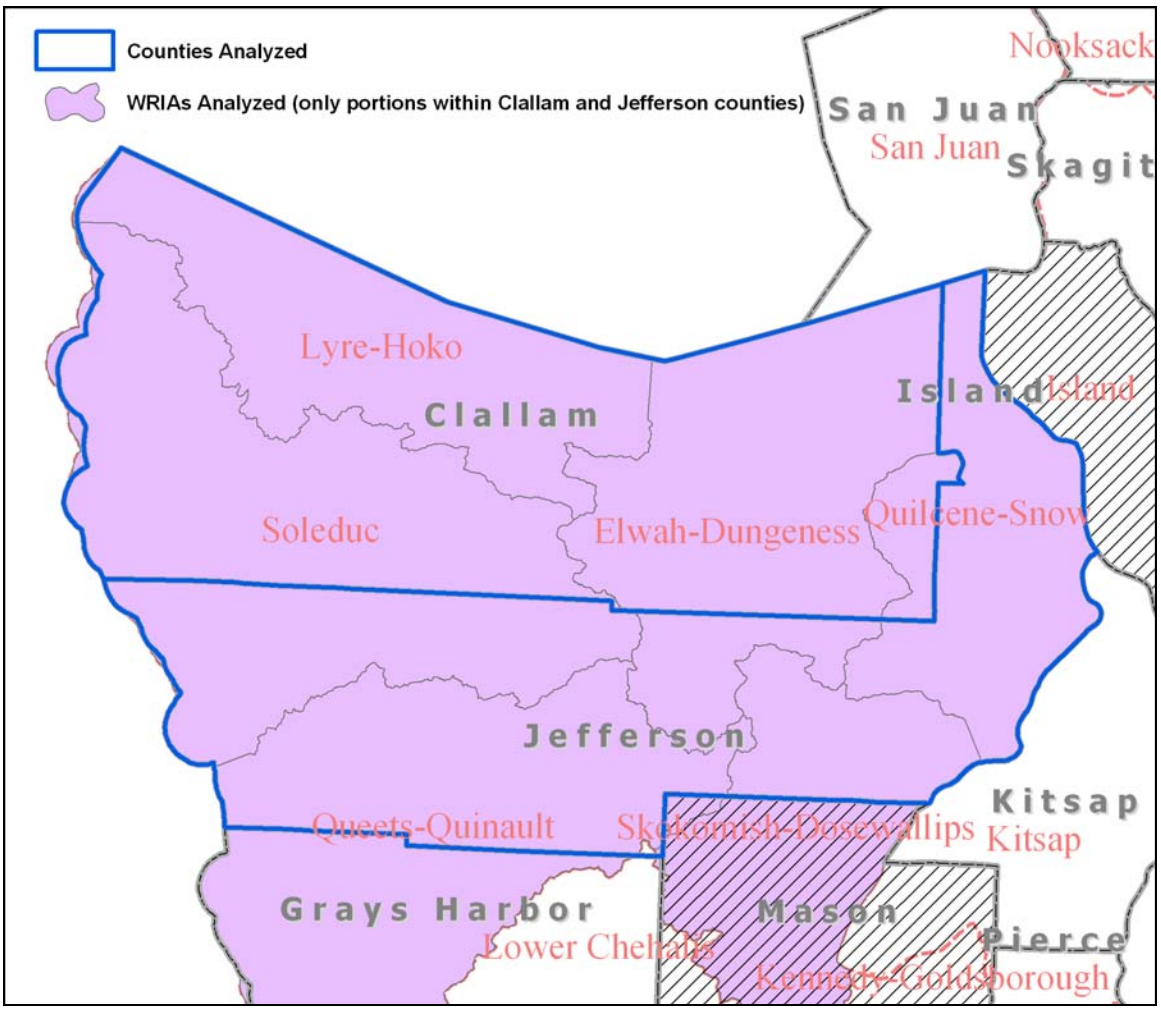
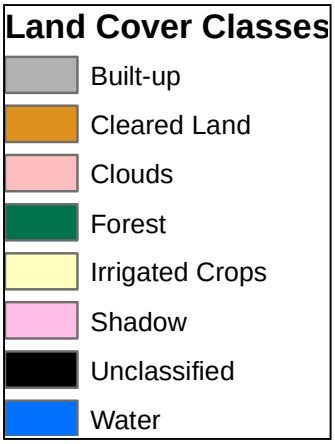


Figure 1. Study Area

Landsat Data

Landsat satellite images were used to identify forest and non-forest areas in Clallam and Jefferson counties. The images were classified into forest and non-forest cover as part of a land use change analysis done in cooperation with the U.S. Forest Service in the summer and fall of 2005. Eight images were collected, to cover all of Washington, and land cover classification was done for all images using a program called *eCognition*. The final mosaiced and classified image was clipped to include just the areas in Clallam and Jefferson counties to use for this project. The scenes that covered the project's study area were acquired in the summer of 2004, and range from July to August.



The original Landsat images were classified into a variety of land cover classes in *eCognition*, and aggregated into forest and non-forest categories in *ArcGIS*. Some land cover classes are more difficult to identify correctly than others. Recent forest harvest activity is very hard to distinguish from bare soils and cleared agricultural lands. In order to more accurately define areas of parcel as forest or non-forest, it was necessary to group obvious forest harvest activity, such as clearcuts and patch cuts completely surrounded by forest, into forest cover. This was done by running an analysis that selected areas of cleared land greater than 2 hectares in size that were completely surrounded by classified forest cover, and reclassifying these areas as forest cover. This resulted in a more accurate depiction of forested land, whether it was harvested or not, across the counties' landscape.

An accuracy assessment was conducted using a stratified random sample of points scattered across the study area. At the randomly selected points, aerial photos were compared to the classified land cover and the percent match between the photo and the land cover was 95%. The largest error was distinguishing between cleared land and built-up land; this is mainly due to the similar spectral signature shared by totally bare land and urban cover (concrete, pavement, bare ground, etc.).

Using satellite images for land cover classification is limited by the pixel size and classification accuracy. Landsat images store 30 meter by 30 meter pixels, meaning that any land cover less than 900 square meters is not discernable. Furthermore, applying land cover classification to individual parcels is not entirely accurate. Nevertheless, for the purposes of this project, to identify land owners potentially eligible for financial assistance in restoring stream habitat and removing fish barriers, this level of land cover accuracy is appropriate. The users of this data, however, must use this data with caution when applying it to other projects and analysis.

Non-private lands were removed from the images before classification; therefore, the final land cover layer does not show forest cover for areas that are obviously forested on public lands. The following image (Figure 2) shows the forest grid in relation to the county boundaries, with the other classified land uses appearing in the non-forest areas. The areas with no data are blank.

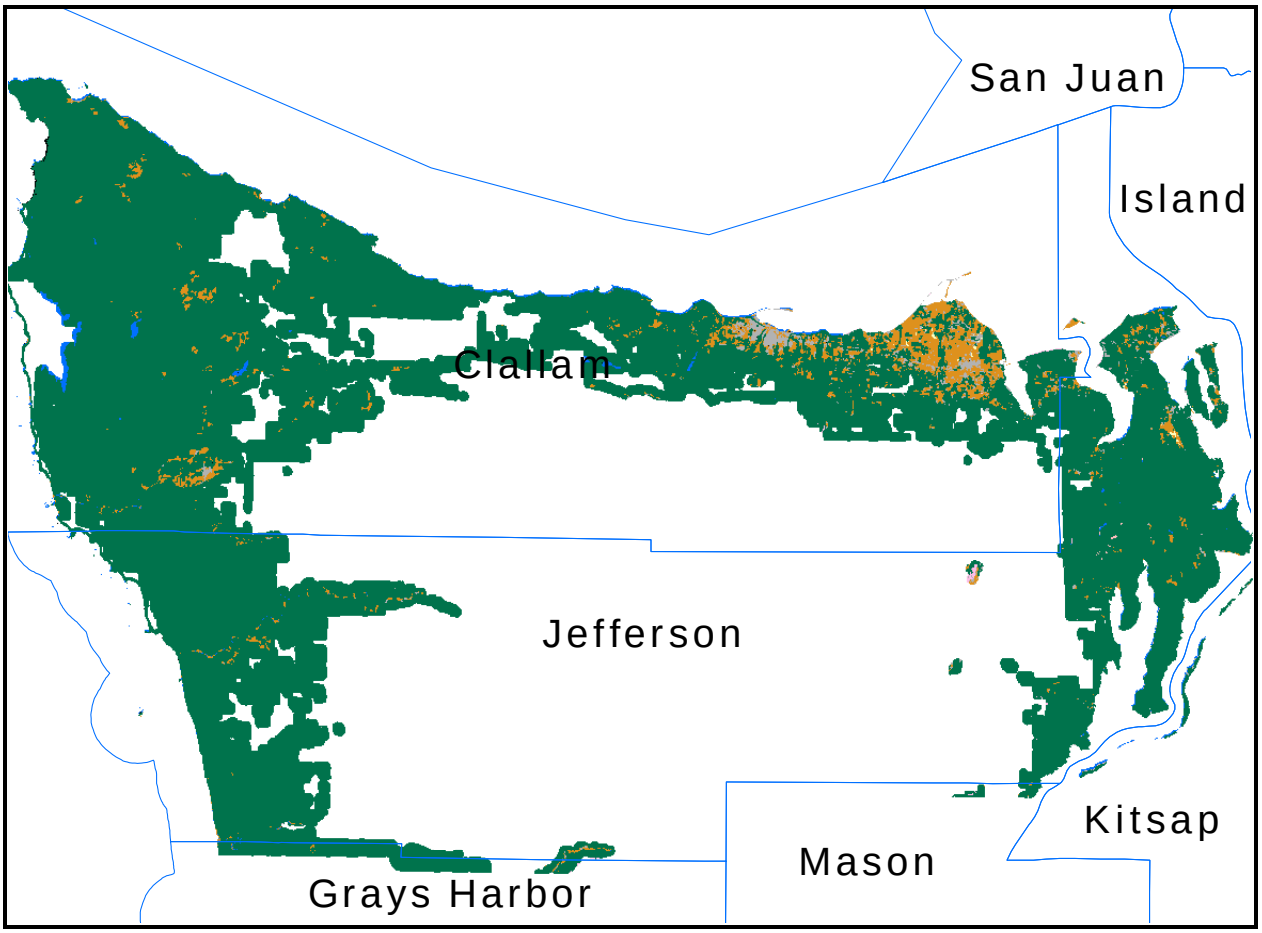


Figure 2. Land Cover in Clallam and Jefferson Counties

Analysis

Standardizing Parcel Data

Counties store assessor parcel data in many different formats including ArcSDE, Geodatabases, Coverages and Shapefiles. In addition to storing the data in different formats, every county uses different attributes with diverse values. These differences make inter-county analyses difficult and inconsistent. To assist end uses of the data with their analyses, a single cross-county format was created. This cross-county format includes information like the owner name and address, the parcel size, land use, location, ownertype, timber acres, percent forest, and more. Before any analysis was done, a series of standard empty fields were added to the original parcel data from each county to allow for a final standard table.

All analysis was done using a combination of ArcGIS geoprocessing tools and Microsoft Access update and select queries. The process for each county differs, since each county stores data in different formats. A process table was built for each county, documenting the analysis steps; these process tables are shown in the Appendix, as well as saved with each county's analysis workspace.

The data is stored in a variety of forms, all easily accessible using either ArcCatalog, ArcMap, Access, and Windows Explorer. A relatively skilled GIS and Access user could update all of the data, as well as see the process used for all parts of the analysis.

Identifying Small Forest Land Owners

Small Forest Land Owners were identified using two methods. The first method used only the county assessor's tax roles to identify parcels that have land uses taxed as forestland, timberland, or open space. The second method used Landsat imagery to construct a forestland layer, which was intersected with the parcel data to determine percentage and amount of forestland per parcel.

Industrial and Public Owner Types

Industrial forestlands were distinguished using local knowledge of the forestry industry and unique land owners with more than 5,000 acres of land in each county. Industrial owners, such as Weyerhaeuser, Boise Cascade, Longview Fibre and other entities owning more than 5,000 acres, were not considered SFLOs and were categorized as "industrial" owners. Additionally, public lands were distinguished by a series of queries to identify land owned and administered by federal, state, and local governments. The queries used for this selection are listed in the Appendix. The remaining parcels were sorted into four categories: SFLO, Possible SFLO, and Possible FPP (eligible for Fish Passage Program funding opportunities), and Other/Unknown.

Land Use Codes: Identifying SFLO

County assessors typically follow a land use tax scheme that is closely related to Washington's state land use coding scheme. Although there are some variations, the land uses that are typically found relating to forestland are as follows: 87 - Classified forest land, 88 - Designated forest land, 92 - Noncommercial forest, 94 - Open space land, and 95 - Timberland. According to county assessors, these tax designations indicate that a parcel is being managed as forestland or is protected under a conservation agreement. Clallam County followed the same land use tax

scheme as the state codes, while a crosswalk had to be developed to relate Jefferson County's data with the state codes. This crosswalk is saved in the Jefferson County working database.

Forested Acres: Identifying Possible SFLO and Possible FFP

The identification of Possible SFLO and FFP parcels required additional analysis, and was based on forest land cover analysis using Landsat satellite images. It is estimated that somewhere around half of Washington's non-industrial private forests are not in forest tax classifications. These parcels typically have land uses that do not conflict with forestry, but little data exists on what land uses are likely. Previous analyses have focused on assessor land use codes of: 89 – Other resource protection, 91 – Undeveloped land, and 99 – Other undeveloped land. This method resulted in a significantly larger number of parcels being identified as SFLO in the previous studies.

For this analysis, however, all forested parcels of a certain size, regardless of land use classification, were considered as possible small forest land owners to ensure that all potential recipients of forest land assistance programs were identified. Overlaying the forest/non-forest layer on the parcels enabled the calculation of forested acres and percent forest of each parcel. For this analysis, parcels that had at least 5 acres of forested land (timberacres), regardless of the size of the total parcel, and that were not already identified as SFLO by land use codes were considered Possible SFLOs. Parcels with at least 1 acre of forested land were identified as Possible FFP.

Remaining Parcels: Identifying Other/Unknown

All remaining parcels, not already identified as industrial, public, SFLO, Possible SFLO, or Possible FFP, were classified as other/unknown. These included parcels less than 1-acre and/or not taxed as forest land, timber land, or open space.

Coding Owner Type

Table 1 lists the codes and short descriptions associated with the owner types assigned to each parcel during the analysis. It is important to remember that the codes are assigned based on both size of the individual parcel as well as the unique owner. For example, a parcel of land owned by a known industrial owner would be considered industrial, even if it is less than 5,000 acres.

Table 1. Owner types identified in the analysis and the associated codes used in the datasets.

Owner Type Status Codes	
CODE	**DESCRIPTION**
0	Other/Unknown
1	SFLO
3	Industrial
4	Public
5	Possible SFLO - minimum of 5 forest acres
6	Possible FPP - minimum of 1 forest acre

Since one goal of this project was to be able to merge with previously analyzed data, no parcels were assigned a code of "2" for owner type, since this code was used for analysis done for the Lower Columbia Fish Recovery Board (Clark, Lewis, and Cowlitz counties). In that project, an

owner type of “2” represented Possible SFLO defined as having at least 75% forest cover and a non-conflicting land use code.

Identifying Potential Fish Blockages

By overlaying potential in-stream barriers, collected by the Washington Department of Fish and Wildlife, over all parcels in each county, it is possible to determine which parcels may be eligble for potential fish habitat restoration or barrier removal funding. A mailing list and dataset was produced that lists the parcels and all respective attribute data. These attributes also include the status, location, and other information of the culvert, dam, or fishway on the property.

Results

Parcels

Combining assessor tax roles with remote sensing techniques yielded two to four times as many candidate 5-acre and larger SFLOs compared to using assessors tax roles alone. Table 2 and Table 3 show the number and acres of parcels by owner type for Clallam and Jefferson counties. The SFLO owner type parcels are the parcels that are identified by using the assessors land use tax codes. The industrial parcels are those that are owned by identified industrial corporations using the owner name in the assessors' data. Public parcels are those identified as city, county, state, or federal lands. The Possible SFLO parcels are those that are not taxed as forestlands but have at least 5 acres of forest. The possible FPP parcels are those that are not taxed as forestland but have at least 1 acre of forest. Additional tabular statistics can be found in the Appendix.

Since multiple WRIAs cross the county boundaries, all data is presented by county rather than WRIA. If needed, however, the data is stored in each county's analysis workspace by WRIA as well as by county.

Table 2. Number of parcels and acres by owner type for all parcel sizes in Clallam County.

Clallam County Parcels and Acres by Owner Type		
Description	**# of Parcels**	**Acres**
Other/Unknown	29145	25891.13
SFLO	3453	49766.17
Industrial	2045	266612.23
Public	2782	29261.06
Possible SFLO	6935	23824.78
Possible FPP	11040	43171.52

Table 3. Number of parcels and acres by owner type for all parcel sizes in Jefferson County.

Jefferson County Parcels and Acres by Owner Type		
Description	**# of Parcels**	**Acres**
Other/Unknown	22978	9942.48
SFLO	1486	35929.65
Industrial	1520	137965.17
Public	3897	426062.21
Possible SFLO	2848	31755.22
Possible FPP	5593	16327.64

In addition to the identified SFLO lands that are taxed as forestland, previous analyses have identified possible SFLO lands as forested parcels that have assessor land use codes of: 89 – Other resource protection, 91 – Undeveloped land, and 99 – Other undeveloped land. The data shown in the above tables (Table 2 and Table 3) include all parcels regardless of the assessor land use code. As a comparison, Table 4 and Table 5 show the number of parcels and the corresponding acres for parcels that are either taxed as forestland by the county assessor, or have a minimum amount of forest land and a non-conflicting land use code. By limiting Possible SFLO by non-conflicting land use codes, the number of parcels was reduced to 1,092, compared to just the acreage-based definition of 6,935 parcels for Clallam County. The Possible SFLOs were reduced to 1,258 from 2,848 for Jefferson County. Depending on the objectives of the data use, one method may be more appropriate than the other.

Table 4. Clallam County parcels that are taxed as forestland, or have land use codes 89, 91, or 99.

Clallam County Non-Conflicting Parcels and Acreages by Owner Type		
Description	**# of Parcels**	**Acres**
SFLO (same as above)	3453	49766.17
Possible SFLO	1092	9581.62
Possible FPP	2505	8125.18

Table 5. Jefferson County parcels that are taxed as forestland, or have land use codes 89, 91, or 99.

Jefferson County Non-Conflicting Parcels and Acreages by Owner Type		
Description	**# of Parcels**	**Acres**
SFLO (same as above)	1486	35929.65
Possible SFLO	1258	12822.98
Possible FPP	2298	6696.57

Some financial assistance programs are only directed at parcels larger than 5-acres. The data produced in this project is able to be queried for a variety of objectives and requirements. Table 6 and Table 7 show one example of a query built to pull out only parcels larger than 5-acres.

Table 6. Clallam County parcels 5-acres and larger by owner type

Clallam County Parcels 5 Acres or Larger by Owner Type		
Description	**# of Parcels**	**Acres**
Other/Unknown	852	6513.25
SFLO	2460	46652.23
Industrial	1812	266216.47
Public	3722	714413.26
Possible SFLO	2782	29261.06
Possible FPP	925	6437.97

Table 7. Jefferson County parcels 5-acres and larger by owner type

Jefferson County Parcels 5 Acres or Larger by Owner Type		
Description	**# of Parcels**	**Acres**
Other/Unknown	68	2312.46
SFLO	1165	35390.63
Industrial	1232	137565.86
Public	1815	424578.11
Possible SFLO	2848	31755.22
Possible FPP	233	1636.96

As shown above, a wide variety of data is stored in each county's analysis workspace, and can be queried and summarized with ease. The following tables show the number of parcels and associated acres for SFLOs in each county, by a variety of different parcel sizes.

Table 8. Clallam County SFLOs by Parcel Sizes

Clallam County Small Forest Land Owners (SFLOs) by Total Parcel Sizes				
Parcel Sizes	**# of Parcels**	***% of Total***	**Acres**	***% of Total***
5-20 Acres	1645	*67%*	15522.63	*33%*
21-100 Acres	790	*32%*	27015.47	*58%*
101-1000 Acres	25	*1%*	4114.13	*9%*
1001-5000 Acres	0	*0%*	0	*0%*
Total	2460	*100%*	46652.23	*100%*

Table 9. Jefferson County SFLOs by Parcel Sizes

Jefferson County Small Forest Land Owners (SFLOs) by Total Parcel Sizes				
Parcel Sizes	**# of Parcels**	***% of Total***	**Acres**	***% of Total***
5-20 Acres	440	*38%*	5490.55	*16%*
21-100 Acres	690	*59%*	23927.55	*68%*
101-1000 Acres	35	*3%*	5972.52	*17%*
1001-5000 Acres	0	*0%*	*0*	*0%*
Total	1165	*100%*	35390.62	*100%*

Barriers

Statistics for the inventoried in-stream features, culverts, dams and fishways, and fish passage barrier status are shown in the following tables. A status of "yes" means that the barrier is a potential fish blockage, while "no" is not a fish blockage.

Table 10. Clallam County culvert barrier status by owner type.

Clallam County Culvert Barrier Status by Owner Type				
Description	**Yes**	**No**	**Unknown**	**No Data**
Other/Unknown	14	4	2	5
SFLO	17	9		3
Industrial	41	11	1	17
Public	118	40	11	124
Possible SFLO	15	4	2	4
Possible FPP	13	8	1	5

Table 11. Clallam County dam barrier status by owner type

Clallam County Dam Barrier Status by Owner Type				
Description	**Yes**	**No**	**Unknown**	**No Data**
Other/Unknown				
SFLO	3			
Industrial	2			
Public	7			
Possible SFLO	2			
Possible FPP	2	1		

Table 12. Clallam County fishway barrier status by owner type.

Clallam County Fishway Barrier Status by Owner Type				
Description	**Yes**	**No**	**Unknown**	**No Data**
Other/Unknown	1	1		
SFLO	1	2		
Industrial	1	8		
Public	5	10	1	
Possible SFLO	1	2		
Possible FPP				

Table 13. Jefferson County culvert barrier status by owner type.

Jefferson County Culvert Barrier Status by Owner Type				
Description	Yes	No	Unknown	No Data
Other/Unknown	1	4		16
SFLO	20	26		26
Industrial	40	19		32
Public	53	15	3	67
Possible SFLO	38	33		26
Possible FPP	26	11	1	22

Table 14. Jefferson County dam barrier status by owner type.

Jefferson County Dam Barrier Status by Owner Type				
Description	Yes	No	Unknown	No Data
Other/Unknown				
SFLO				
Industrial	3			
Public	2	1		
Possible SFLO	9			
Possible FPP	7	3		

Table 15. Jefferson County fishway barrier status by owner type.

Jefferson County Fishway Barrier Status by Owner Type				
Description	Yes	No	Unknown	No Data
Other/Unknown				
SFLO		1		
Industrial		1		
Public	1	1		
Possible SFLO		3		
Possible FPP		2		

Streams

Stream data from the Washington State Department of Natural Resources was overlaid on the parcels to determine the stream and shoreline lengths associated with the different owner types. Washington Department of Natural Resources recently reclassified stream segments into new hydrological line types: artificial connector, interior – double banked, interior – in water body, single, watercourse/body perimeter, and unknown/unclassified. In addition to the hydrological line type, DNR recently reclassified all streams into new water types (previously Types 1-9): shoreline (s), fish habitat (f), non-fish habitat (n), unknown (u), and mapped with no water type (x). The DNR hydro data steward will be able to provide insights into the usefulness of the data on different types of streams, as well as comment on the accuracy of the hydro data at the parcel level. Tables 16-19 show stream statistics for hydrological line types and water types by owner type.

Table 16. Clallam County stream miles by DNR hydro line type.

Clallam County Stream Miles by Owner and Water Type						
OWNERTYPE	Artificial connector	Interior - double banked	Interior - in water body	Single	Watercourse/ body perimeter	Unknown/ Unclassified
Other/Unknown	0.65	2.47	1.65	53.51		0.05
SFLO	1.11	15.94	2.66	269.06	0.64	1.82
Industrial	6.74	37.84	11.98	2330.27	3.21	17.32
Public	6.96	104.81	20.61	4195.82	1.89	8.35
Possible SFLO	0.71	9.22	2.25	129.82	0.75	0.27
Possible FPP	0.95	5.40	1.13	80.77	0.02	0.17

Table 17. Jefferson County stream miles by DNR hydro line type.

Jefferson County Stream Miles by Owner and Water Type						
OWNERTYPE	Artificial connector	Interior - double banked	Interior - in water body	Single	Watercourse/ body perimeter	Unknown/ Unclassified
Other/Unknown	0.24	1.20	0.03	35.08		0.02
SFLO	1.04	7.47	1.30	222.22	0.03	0.43
Industrial	6.58	5.33	5.86	1216.74	0.27	4.27
Public	8.26	76.85	5.71	3538.89	0.38	5.34
Possible SFLO	1.69	4.54	1.78	183.89		0.57
Possible FPP	1.37	1.13	0.35	66.43		0.00

Table 18. Clallam County stream miles by DNR water type code.

Clallam County Stream Miles by Owner and DNR Stream Type				
OWNERTYPE	Fish Habitat	Non-Fish Habitat	Shoreline	Unknown
Other/Unknown	32.90	16.82	3.85	4.76
SFLO	127.29	117.17	42.95	3.81
Industrial	777.07	1475.00	138.37	16.93
Public	1297.75	2834.02	87.42	119.24
Possible SFLO	74.64	46.72	19.03	2.61
Possible FPP	45.11	27.23	12.90	3.20

Table 19. Jefferson County stream miles by DNR water type code.

Jefferson County Stream Miles by Owner and DNR Stream Type				
OWNERTYPE	Fish Habitat	Non-Fish Habitat	Shoreline	Unknown
Other/Unknown	11.85	21.10	3.11	0.51
SFLO	87.03	117.99	26.12	1.35
Industrial	384.08	821.71	24.17	9.09
Public	1075.11	2446.92	101.51	11.91
Possible SFLO	85.06	91.09	11.55	4.78
Possible FPP	24.03	37.41	5.61	2.23

Maps & Datasets

Map sets produced for the project show the location and identification information for all of the in-stream structures in the WDFW database overlaid on the known and possible SFLO and FPP parcels. These map sets, see Figure 3, and the associated reports and spreadsheets can be used to locate individual blockages and the parcels that they are on. With this information, interested groups can contact individual landowners about the fish passage barrier on their property. All of the reports and maps produced for this project were products of either Access or ArcMap. The Map Series extension was used to produce the tiled maps, and the Report function in Access was used to produce the mailing lists. More information about the maps and associated reports can be found in the Appendix.

Figure 3. Example map sheet.

Conclusion & Recommendations

Utilizing county assessor tax roles is an effective way to identify Small Forest Land Owners in Washington State. However, many of Washington's NIPF are not taxed as forestland. Often, owners are not aware of the tax benefits associated with a forest tax classification or their parcel is too small to realize the benefit. It is estimated from previous studies conducted surrounding the 2001 Small Forest Land Owner Database that there are likely twice as many non-industrial forests in Washington State as can be identified solely from county assessor tax information. Identification of these parcels and their owners can be assisted by using remote sensing techniques (to identify forest land) in combination with county assessor tax information.

Validation of this method of identifying small forest land owners requires on-the-ground surveys of land owners. The outreach efforts of local fisheries enhancement groups can help to verify the validity of this approach. Future efforts to identify NIPF using remote sensing and assessor tax roles could benefit from information gained from these local groups.