

# Small Forest Landowners Database Validation & Data Analysis Study

Report for Clark County, WA

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# Small Forest Landowners Database Validation & Data Analysis Study

## Clark County

### **I. Introduction and Background:**

The Department of Natural Resources (DNR) Small Forest Landowner Office (SFLO) assembled a database of small forest landowners in a pilot project number FY01-154. A three month pilot project collected available parcel data from all Washington State counties with forestlands and assembled the information into a database. The purpose of the comprehensive spatially explicit database is to allow the SFLO to fulfill its' legislative mandate to:

- Report on non-industrial private forestland demographics,
- Analyze the cumulative effects of Alternate Plans,
- Describe the small forest landowner constituency, and
- Allow some spatial analysis of the forestland holdings by watershed, sub-watershed, or other community.

### **II. Objectives:**

There is no consistency with how counties collect and store parcel data. The majority of counties have non-spatial databases (no GIS). So it is necessary to analyze and evaluate the database that was developed for its' ability to generate appropriate and accurate reports. This project is focusing on specific areas in Eastern Washington, namely portions of Stevens and Spokane Counties (analysis done by Williamson Consulting, Colville, WA) and Western Washington, namely Clark, King and Whatcom Counties (analysis done by the Rural Technology Initiative, UW, Seattle, WA).

- Determine the percentage of non-industrial landowners that were identified using county tabular parcel data and county GIS data,
- Analyze the differences between generating reports using tabular data verses GIS data,
- Determine other resources available to identify forestland owners other than information from the county tax assessor. Technologies such as Landsat, orthophotos, and land use land cover datasets will be explored. It is anticipated that some combination of all of these technologies may be used in the final analysis.
- Determine if tabular data can be used to effectively generate accurate reports.
- Explore issues such as contiguousness, significant riparian ownership by watershed, and acreages.

All work will be coordinated with a similar effort being conducted in Eastern Washington by Williamson Consulting. RTI will coordinate the two concurrent efforts and select the methodology that will produce effective results. Clark, King and Whatcom Counties were selected as the three Westside counties for database validation based on their diverse geographic location and high quality GIS data. In addition to available GIS data, the three counties also contain 5 of the largest 10 cities in Washington<sup>1</sup>. Detailed analysis around these urban centers should provide a good baseline for monitoring conversion trends in the coming years.

### **III. Methods:**

All of the data for Clark County was obtained on CD from the Clark County GIS Department. In order to be spatially consistent with the raster LANDSAT data (raster data should not be re-projected if at all possible for spatial accuracy), all of the Clark County data layers were projected into the coordinate system of the LANDSAT datasets.

Projection: Stateplane  
Fipszone: 4602  
Datum: NAD 83  
Units: Meters  
Spheroid: GRS1980

To identify individual landowners in the Clark County Assessor's data the Assessor's owner name, "OWNER" was used. Some owners exist in the data more than once as an individual taxpayer may have more than one ASSR\_SN number (like business and personal). There is no easy way within the GIS data to determine exactly how many individual owners the data represent as addresses and names can be spelled slightly differently even for the same owner.

The first step in determining forested parcels in Clark County was to digitize the forestland from the Department of Natural Resources 1996 orthophotos of the county. Forestland for the entire county was digitized into an ArcINFO Coverage to take advantage of topology insuring that no polygon in the spatial forest layer overlapped another. In general the forested areas were easy to identify and digitize a boundary. Narrow timbered strips around streams, lakes or wetlands, highly populated areas and timbered areas less than approximately 5 acres in size were not included, see Appendix A – Maps Figure 6.

In addition to the orthophoto validation scheme, LANDSAT data was used to classify the forestland. The LANDSAT data was obtained from the Washington State Geographic Information Council (WAGIC). The LANDSAT data came in two different formats, single band tiff images for the Eastern 2/3 of the state and multi-band Imaging img

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<sup>1</sup> 2001 Population Trends for Washington State; Washington State Office of Financial Management, September 2001. Available on the web at <http://www.ofm.wa.gov/2002pop/2002pop.htm>

format images for the Western 1/3 of the state. All of the LANDSAT data was acquired in Stateplane, Washington State South Zone, NAD83, meters.

To classify the images two methods were explored. The first method was to use a routine built by Jeffrey Lee Moffett for his thesis work at the University of Washington<sup>2</sup>. This method of image classification uses custom C language code and ASCII image files to run Bayesian, Markov Chain Monte Carlo simulations on the images. While this method of image classification is excellent at classifying different types of forest ages, structures and species, it has a difficult time in the urban areas. This method of classification will continue to be explored for future NIPF projects as it is far superior in forest identification than the maximum likelihood method that was used for this project.

The second method of image classification was to use ESRI's ArcGrid image classification routines to make 5 classifications; Developed, Clear-cut, Young Forest, Mature Forest, and Water. This method of image classification was chosen for a few reasons, repeatability, fast run times, ease of use and availability. For exact usage of the commands see Appendix B – Tables & Charts Figure 18. The commands are:

- MAKESTACK – makes a stack of images for multi-band classification
- CLASSSAMPLE – creates training datasets for the supervised classification
- SAMPLESIG – creates an ASCII signature file for use in classification
- MLCLASSIFY – classifies the stack of images using maximum likelihood
- FOCALMAJORITY – removes single pixel anomalies in the classification
- BOUNDARYCLEAN – blocks up the classified pixels
- CON – conditional statement to extract forest from the 5 classes
- GRIDPOLY – converts the forest/non-forest grid to a polygon layer
- ELIMINATE – eliminates polygons less than 5 acres in size

This sequence of commands created a polygon layer similar to the ortho digitized forestland except that the data source was the LANDSAT images, see Appendix A – Maps Figure 7.

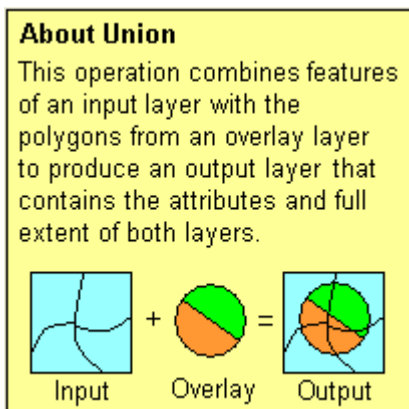
The second step in the analysis was to eliminate non-candidate parcels from the analysis. Clark County has an extremely large number of parcels due to the urban centers of Vancouver, Camas and Battle Ground. To make an analysis feasible (processing over 100,000 parcels may take over 24 hours for a single operation), parcels located within the designated Clark County urban growth lines were removed from the dataset. Eliminating these “urban” parcels from the analysis reduced the number of parcels from 133,560 to 33,729. To later identify the urban areas a flag item was added to the Clark County parcel data called “URBAN\_AREA”. For this analysis, we will only focus on parcels outside of the urban growth areas. See Appendix A – Maps Figure 8.

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<sup>2</sup> Simulation of bidirectional reflectance, modulation transfer, and spatial interaction for the probabilistic classification of Northwest forest structures using Landsat data; Jeffrey Lee Moffett; Thesis (Ph. D.) – University of Washington, 1988.

To identify industrial landowners who were not of interest, the DNR Small Forest Landowner Office purchased the Atterbury Western Washington Industrial Forestland Owner spatial dataset, see Appendix A – Maps Figure 9. This dataset came as an ArcInfo coverage which covered all of Western Washington. The spatial location of the industrial parcels in the Atterbury layer did not match up with the Clark County parcel GIS data and therefore had to be remanufactured by hand by visually identifying known industrial forestland owners by Owner Name in the Clark County GIS data. The Atterbury dataset was used to identify which owner names should be considered industrial in the Clark County parcel data and a flag item called “INDUSTRIAL” was added to the Clark County data. In addition to the Atterbury identified industrial owners, careful inspection of owner names added more owners to the industrial class. See Appendix A – Maps Figure 10.

Once the urban and industrial parcels were removed from the data, forested parcels could be identified. To identify forested parcels using the digitized and classified forestlands an overlay process was used. The quickest way to determine the total amount of potential forested land in the remaining parcels would have been to union the parcels with the forestlands, Figure 1.



**Figure 1 - In this example, the Input layer would be the parcel data and the Overlay layer would be the digitized forestland.**

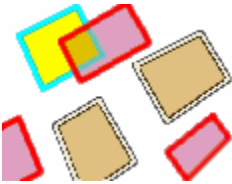
The problem with the union command or any of the overlay commands is that they don't properly represent the parcel data model. From an assessment and regulatory perspective, a parcel is either forested or it is not. In order to follow that paradigm with our analysis, overlay processes which dissect or split parcels were not used. Instead a model that allowed entire parcels to be either forested or non-forested was chosen. Two different methods of determining a parcels forested status were compared.

The first method was to require that a parcel be completely within a forested area in order to be considered forested, Figure 2. This method is the most conservative since it does not consider a 100 acre parcel as forested even if only 1 acre is not forested. Flag items called ORTHO\_WITHIN and LANDSAT\_WITHIN were created in the Clark County parcel data to store the selection for analysis.



**Figure 2 - The red features represent the forested areas. The highlighted cyan features represent parcels and are selected because they are completely within the forested area.**

The second method was to require that a parcel only had to intersect or touch a forested area in order for the parcel to be considered forested, Figure 3. This method is the most liberal since it considers a parcel as forested even if only 1 acre of a 100 acre parcel is forested. Flag items called ORTHO\_INTERSECT and LANDSAT\_INTERSECT were created in the Clark County parcel data to store the selection for analysis.



**Figure 3 - The red features represent the forested areas. The highlighted cyan features represent parcels and are selected because they intersect the red features.**

## **IV. Analysis and Discussion:**

### ***A. Where is the forestland?***

In order to be consistent with the Eastside validation effort done by Williamson Consulting, all acres in this analysis will refer to GIS acres unless explicitly stated otherwise. It is important to understand that even within the Clark County GIS, assessor's acreage values differ somewhat from the GIS acreage values, 83,182 and 83,216 respectively<sup>3</sup>. The total forested area digitized from the orthophotos is 233,886 acres. The total forested area digitized from the Landsat data is 216,090 acres. This digitized and image classified forest area represents all of Clark County and has a resolution of approximately 5 acres.

Since two methods were used to determine where forestland exists in Clark County, it is appropriate to use the forest area common to both of these methods as our determination of Clark County forestland. In order to find the area common to both the digitized orthophoto forest and the classified Landsat forest the two layers were unioned, a flag

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<sup>3</sup> This number represents all acres identified by Clark County GIS as open space forestland, designated forestland, classified forestland or timberland including industrial and non-industrial owners.



item was added indicating that a polygon existed in both forest layers and then dissolved on the flag item. This common forested area came out at 194,156 acres. As would be expected, this number is lower than either the digitized or Landsat forestland since each method of identification has some level of bias based on operator digitizing. See Appendix A – Maps Figure 11.

After identifying candidate forestland for potential non-industrial forestland the selection methods described in the methods section were performed on the common forestland. Two items were added to the parcel layer to store the selection information, COMMON\_WITHIN and COMMON\_INTERSECT. By selecting all parcels that intersect the common forestland (even a small sliver of parcel will mean the entire parcel is selected), 132,490 potential NIPF acres exist, Appendix A – Maps Figure 12. By selecting only parcels that fall completely within the common forestland only 34,423 acres are potential NIPF lands, Appendix A – Maps Figure 13.

More interesting and perhaps meaningful is that when analyzing parcels that fall completely within the common forestland only 42% (774 of 1,824 parcels) of the non-urban Small Forest Landowner Database NIPF acres are selected. When analyzing the parcels that intersect the common forestland 90% (1,481 of 1,824) of the non-urban Small Forest Landowner Database NIPF acres are selected. With only 1,213 acres (110 parcels) of urban parcels in the county it is significant that 48% of the parcels in the SFLO Database are on the edge of the common forestland. When you add in the 110 urban parcels, over 51% of the NIPF acreage and 82% of the NIPF parcels in Clark County are in the urban/rural interface or an urban area.

Farther from the urban/rural interface are the industrial and public lands. Major industrial and public landowners in Clark County are Weyerhaeuser, the Department of Natural Resources and Longview Fibre, see Table 1.

**Table 1 - Major industrial and public landowners in Clark County, WA.**

<b>OWNER</b>	<b>ACRES</b>
WEYERHAEUSER COMPANY	33,154
STATE FOREST BOARD	25,028
WASHINGTON STATE	16,766
STATE LAND	10,662
LONGVIEW FIBRE CO	7,017
USA	6,927
SCHOOL LAND	6,537
CLARK COUNTY	6,215
PACIFIC POWER & LIGHT CO	2,811
CITY OF CAMAS	2,122
STIMSON LUMBER CO	1,854
PORT OF VANCOUVER	1,597
US FISH & WILDLIFE SERVICE	1,591
CITY OF VANCOUVER	1,410
PLAS NEWYDD LLC	1,342
HILLS CAROL 30.75 INT	1,287
NATURAL RESOURCES DEPT	1,078
MID VALLEY RESOURCES INC	1,017
US FOREST SERVICE	959
FORT JAMES CAMAS LLC	900

Over 70% (81,977 acres) of the industrial land in Clark County is within the common forest area. Over 95% (111,009 acres) of the industrial land intersects the common forest. There are no industrial parcels within urban areas and the total industrial/public ownership is 116,821 acres. This statistic shows that the majority (70%) of industrial forestlands are not in the rural/urban interface.

***B. Potential NIPF lands:***

Potential NIPF land can be identified by looking at those parcels that fall within and intersect the common forestland. The common forestland is the area identified by both the digitized orthophoto forestland and the classified Landsat forestland. Within the common forestland there are 19,805 acres of land that could potentially be considered NIPF land. Of that 19,805 acres, the major land use codes as identified in the Clark County parcel GIS are: unused land cleared, single family unit, forestry operations, unused land timbered and mobile homes, see Table 2.

**Table 2 - Major acres by land use code for parcels within the common forestland and not industrial, not urban and not in the SFLO database.**

<b>PT1DESC</b>	<b>ACRES</b>
Unused land cleared.	6,083
Single family unit not sharing structure with other uses.	5,576
Unused land timbered.	2,103
Mobile home converted to real property.	2,006
Forestry operations	1,565
Military or naval bases, forts, stations, camps, training sites.	642
One or more mobile homes not affixed to the land (6xxxxxx accounts)	417
Parks with and including playgrounds, ball fields, and picnic areas.	271
Unused platted land.	249
Grain crops, cash, feed, seed, hay, alfalfa, and feed legumes.	246
UNIDENTIFIED BUILDINGS OR USE	129

Of the major land use codes, 3 have the potential to be NIPF land: unused land cleared, forestry operations and unused land timbered. The forestry operations designated parcels were not included in the Small Forest Landowner Database because the Clark County Assessors Office did not include them in the initial data collection for the project. With an average ownership size of 26 acres, it is likely that these parcels are non-industrial private forestland. The unused land cleared and unused land timbered use codes may also be potential NIPF. These unused parcels tend to be smaller in size, about 8.5 acres.

**Table 3 - Potential NIPF forestland acres: number of parcels and the number of owners those parcels represent for the “within common forestland” selection.**

<b>LANDUSE DESCRIPTION</b>	<b># OF PARCELS</b>	<b># OWNERS</b>	<b>AVERAGE SIZE</b>
Unused land cleared.	1,077	756	8.0
Unused land timbered.	297	232	9.1
Forestry operations	103	61	25.7

Intersecting the common forestland there are 101,021 acres of land that could potentially be considered NIPF land. Of that 101,021 acres, the major land use codes as identified by the Clark County parcel GIS are: single family unit, unused land cleared, mobile home, unused land timbered, and forestry operations, see Table 4. These three categories could represent as much as 9,751 acres and 1,049 owners.

**Table 4 - Major acres by land use code for parcels that intersect the classified Landsat forestland and not industrial, not urban and not in the SFLO database.**

<b>LANDUSE DESCRIPTION</b>	<b>ACRES</b>
Single family unit not sharing structure with other uses.	42,434
Unused land cleared.	24,964
Mobile home converted to real property.	9,612
Unused land timbered.	5,780
Forestry operations	2,879
Grain crops, cash, feed, seed, hay, alfalfa, and feed legumes.	2,739
One or more mobile homes not affixed to the land (6xxxxxx accounts)	2,416
Military or naval bases, forts, stations, camps, training sites.	2,387
Unused platted land.	1,371
Parks with and including playgrounds, ball fields, and picnic areas.	966
COMMUNITY SERVICES MILITARY	626
UNIDENTIFIED BUILDINGS OR USE	568
Designated, developed, and preserved unique geological, topological features	444
Farm buildings, facilities, and areas used for equipment, crop etc storage	425
Golf courses and clubhouses.	264
Treated or preserved poles, posts, dimension lumber	259
Pasture and range land (if exclusive use).	249
Railroad right-of-way.	235
Prime Developable Ground	223
Salvage and junk yards (excluding refuse dumps [496]).	165
Nonprofit business associations.	131
Primary and elementary schools.	103

Following the same trend as the parcels within the common forestland, parcels that intersect the forestland have similar land use codes. One major difference between the two selection methods is that single family homes nearly double the amount of acreage as the next closest land use category, unused land cleared. It is reasonable to expect that on the edges of the forest, more and more residential properties will exist. Again, as with the within selection, the parcels with the most potential to be NIPF lands are those with the land use codes: unused land cleared, unused land timbered and forestry operations. These three categories could represent as much as 33,623 acres and 2,947 owners.

**Table 5 - Potential NIPF forestland acres: number of parcels and the number of owners those parcels represent for the “intersects common forestland” selection.**

LANDUSE DESCRIPTION	# OF PARCELS	# OWNERS	AVERAGE SIZE
Unused land cleared.	3,162	2,229	11.2
Unused land timbered.	764	605	9.6
Forestry operations	175	113	25.5

It is perhaps the most probable that the land use codes “Forestry operations” and “Unused land timbered” are actually NIPF lands. Following this logic we can state that there are at least 3,668 and at most 8,659 additional NIPF acres in Clark County that were not included in the original Small Forest Landowner Database, see Table 6. These 8,659 acres represents 939 parcels and 710 unique owners, see Appendix A – Maps Figure 14. These parcels that intersect the common forestland have been added to the Small Forest Landowner Database as NIPF owners.

**Table 6 - Potential NIPF lands with land use codes "forestry operations" and "unused land timbered". It is likely that the number of potential NIPF lands falls somewhere between the two selection criteria, within and intersects.**

POTENTIAL NIPF	# PARCELS	# OWNERS	AVG ACRES	# ACRES
Within Forest, Not in DB	400	293	12.5	3,668
Intersect Forest, Not in DB	939	718	12.1	8,659

## V. GIS / Tabular Reports

One responsibility of the DNR Small Forest Landowner Office is to generate reports every 4 years outlining the current status of non-industrial forests in Washington State as outlined in the Salmon Recovery Act (House Bill 2091). The full text of the portion of the bill pertaining to reporting is included here for reference:

- (5) By December 1, 2000, the small forest landowner office shall provide a report to the board and the legislature containing:
- (a) Estimates of the amounts of non-industrial 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 non-industrial forest and woodland holdings in those size ranges;
  - (b) Estimates of the number of parcels of non-industrial 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 non-industrial 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 non-forest land uses, with estimates of the number of acres of non-industrial 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 non-industrial 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, 2002, and every four years thereafter, the small forest landowner 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.

Items (5)(d) and (e) and item (6) are beyond the scope of this report and must be answered by the DNR SFLO Office. Items (5)(a) through (c) can be answered to some degree by both the 2001 Small Forest Landowner Database and Clark County GIS data. For this report, all tabular data uses the assessor's acreage from the SFLO Database, all GIS data uses the GIS acreage. The NIPF parcels used for the analysis in the GIS are the same parcels that are in the SFLO Database. Potential NIPF acres as identified previously in this report are not included for consistency with the 2001 SFLO Database.

Generating the legislatively mandated Small Forest Landowner Office report using tabular data and GIS data create two different reports. One reason for the difference could be that the item stored in the database to relate the tabular data to the GIS data is not necessarily unique for every parcel. Additionally, assessor acres are used in the tabular statistics while GIS acres are used in the GIS statistics. A summary of the (5)(a) statistics can be found in Table 7.

**Table 7 – Differences between generating Salmon Recovery Act (5)(a) statistics using tabular and GIS methods.**

<b>ITEM</b>	<b>TABULAR</b>	<b>GIS</b>
(5)(a) acres of 20 acres or less by parcel	7,617	10,016
(5)(a) acres of 20 - 100 acres by parcel	22,719	19,741
(5)(a) acres of 100 - 1000 acres by parcel	8,099	5,342
(5)(a) acres of 1000 - 5000 acres by parcel	0	0
(5)(a) acres of 20 acres or less by owner	4,570	5,243
(5)(a) acres of 20 - 100 acres by owner	15,874	15,682
(5)(a) acres of 100 - 1000 acres by owner	15,267	12,866
(5)(a) acres of 1000 - 5000 acres by owner	2,723	1,309
(5)(a) persons with 20 acres or less	471	494
(5)(a) persons with 20 - 100 acres	379	371
(5)(a) persons with 100 - 1000 acres	67	64
(5)(a) persons with 1000 - 5000 acres	2	1

Using the Small Forest Landowner Database it is not possible to answer the question of contiguousness in reporting requirement (5)(b). While the SFLO Database is spatially explicit, the resolution of the data is at best ¼ mile and therefore can not accurately represent contiguousness, Figure 4. However, for Clark County we do have some residential information based on improvements to the land. For parcels of 20 acres or less, the SFLO Database shows that 38% of them have some residence on them. From the information it is not possible to tell if the residences are vacation homes or primary residences. See Table 8.



Figure 4 - The difficulty of determining contiguousness using tabular County Assessor data. Each tax parcel in the database is represented by a polygon that is the shape of the 640 acre section of land that the parcel is in.

Table 8 - SFLO Database residence information for parcels less than 20 acres in size.

RESIDENCE	# PARCELS	ACRES
Non Residence	660	4,347
Residence	398	3,405
Total	38% Residential	

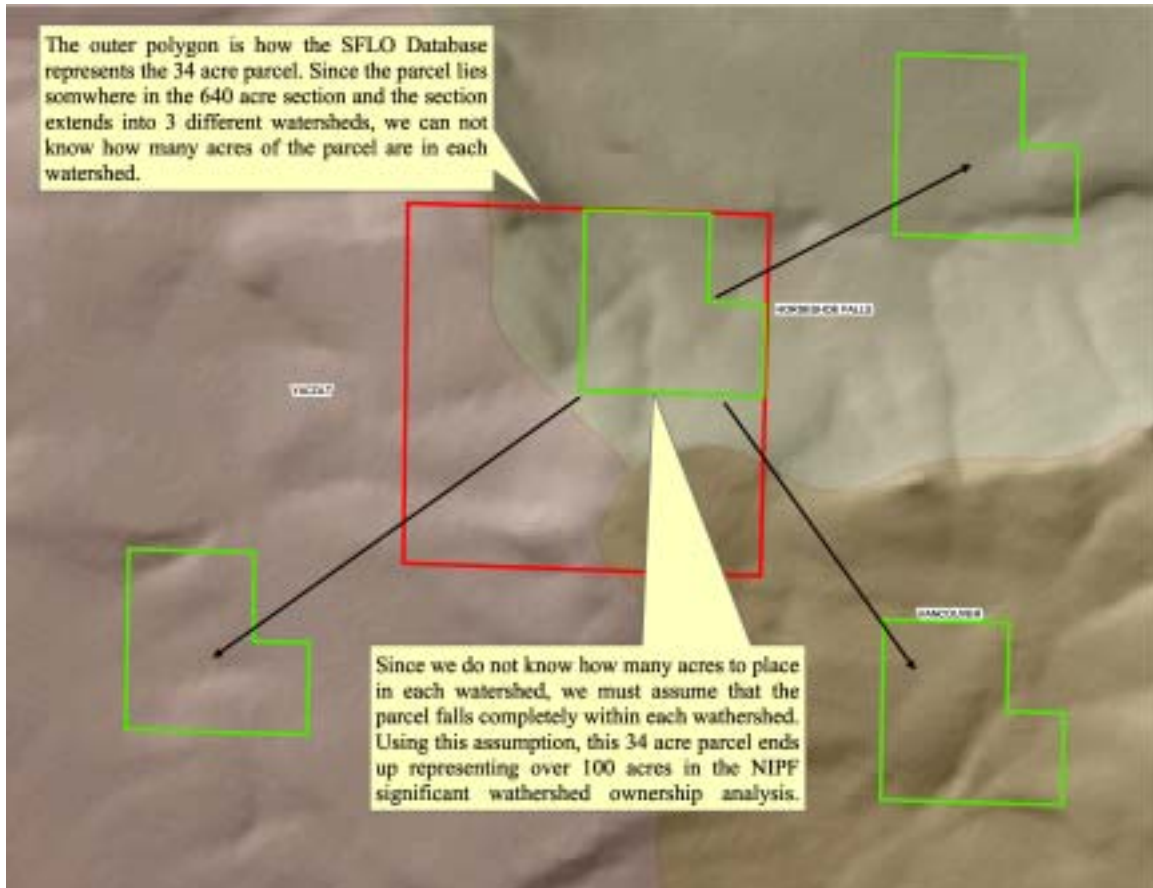
The Clark County GIS data has a somewhat better description of the residential status of NIPF parcels in the County, Table 9. The County GIS data lists out the particular type of structure on the property as well as the assessed value. The GIS data lists 35% of the parcels having some type of structure on them; however, the data does not have any information about the amount of usage or if they are primary residences. The tabular and GIS total acres of NIPF land with some type of structure on them compare well at 3,405 and 3,773 acres respectively.



**Table 9 - Clark County GIS residence information for parcels less than 20 acres in size.**

<b>BLDGTYPE</b>	<b># PARCELS</b>	<b>AVG VALUE</b>	<b>TOTAL ACRES</b>
Ranch	248	\$98,844.76	1,920
Finished	107	\$109,602.80	902
Unknown	60	\$124,780.00	445
2 Story	41	\$182,939.02	342
Split	14	\$142,878.57	79
Unfinished	5	\$54,740.00	56
BI Level	4	\$125,800.00	28
<b>Total</b>	<b>35% Residential</b>		

Identifying watersheds that have significant NIPF riparian or total ownership is difficult with the tabular data. Since the SFLO Database spatial information is based on legal descriptions, the resolution of the spatial component of the Database is limited to ¼ section at best. Due to the poor resolution, it is difficult to tell what watersheds a parcel may be in, Figure 5. If a section has acreage in multiple watersheds then which watersheds might the NIPF parcel in that section be in? Therefore, the numbers generated by the database overestimate the acres of NIPF lands in each watershed, see Table 11 and Appendix A – Maps Figure 16.



**Figure 5 - Representing parcels in the database as sections or quarter-sections causes uncertainty when determining which WAU's a parcel be in. This difficulty overestimates NIPF acreage in WAU's since we must assume that an ambiguous parcel is in all overlapping WAUs.**

Generating riparian ownership statistics with the SFLO Database is at best a very crude estimate of actual riparian ownership. Again, the spatial resolution of the tabular data makes it nearly impossible to get a good estimate of riparian statistics. Using the Clark County GIS data and the Department of Natural Resources stream data, Figure 15, we can get an excellent measurement of NIPF riparian ownership by watershed by intersecting the watersheds with riparian buffers and then unioning that layer with the GIS parcels, Table 10.

**Table 10 - Percent NIPF riparian ownership by watershed administrative unit. A 100 and a 200 foot buffer were used for the analysis with virtually no difference in the results.**

WAU	WRIA	100 FT	200 FT	DIFF
CANYON CREEK	LEWIS	1.2%	1.24%	3.23%
CATHLAPOTL	LEWIS	12.67%	12.4%	2.18%
CEDAR CREEK	LEWIS	20.03%	20.09%	0.3%
COPPER CREEK	LEWIS	0.7%	0.61%	14.75%
HORSESHOE FALLS	LEWIS	16.03%	15.96%	0.44%
LACAMAS	SALMON-WASHOUGAL	8%	8.14%	1.72%
LAKE MERWIN	LEWIS	3.81%	3.96%	3.79%
LITTLE WASHOUGAL	SALMON-WASHOUGAL	6.21%	6.4%	2.97%
MT ZION	SALMON-WASHOUGAL	3.72%	3.84%	3.12%
ROCK CREEK	LEWIS	8.54%	8.25%	3.52%
SILVERSTAR	SALMON-WASHOUGAL	1.7%	1.74%	2.3%
VANCOUVER	SALMON-WASHOUGAL	5.86%	6.07%	3.46%
WOODLAND	LEWIS	5.14%	5.23%	1.72%
YACOLT	LEWIS	10.24%	10.55%	2.94%

Generating watershed numbers with the GIS data is straight forward and requires only one overlay operation (union) to complete. The GIS identified acres associated with particular watersheds is highly accurate and it is interesting to note how close the tabular estimates were in most cases, see Appendix A – Maps Figure 17. With the exceptions of Cedar Creek and LaCamas WAUs the percent total NIPF ownership by watershed is very close.

**Table 11 - NIPF parcel acreage by WAU. Notice the high (and incorrect) total tabular acres caused by the uncertainty of parcel/watershed relationships.**

WAU	% NIPF (TABULAR)	% NIPF (GIS)	WAU ACRES
CANYON CREEK	2%	1%	42,851
CATHLAPOTL	6%	13%	36,677
CEDAR CREEK	52%	19%	21,377
COPPER CREEK	1%	0%	30,691
HORSESHOE FALLS	13%	16%	42,701
LACAMAS	24%	7%	14,829
LAKE MERWIN	5%	4%	34,442
LITTLE WASHOUGAL	6%	7%	22,755
MT ZION	3%	3%	21,482
ROCK CREEK	7%	7%	28,416
SILVERSTAR	1%	1%	40,447
VANCOUVER	5%	4%	125,008
WOODLAND	4%	3%	39,753
YACOLT	15%	12%	54,996
TOTAL ACRES	45,692	35,099	

## VI. Conclusions:

The 2001 Department of Natural Resources, Small Forest Landowner Office Small Forest Landowner Database is believed to be the first comprehensive, spatially explicit record of Washington's Small Forest Landowners and their land. The 2001 projects short timeline and continually changing scope left no time to validate the results of the data collection and compilation effort. This 2002 Database Analysis and Validation Study questions the comprehensiveness of the database and examines the GIS and tabular differences encountered when generating a sample report as outlined in the Salmon Recovery Act (House Bill 2091).

Using orthophotos and Landsat classification 194,156 acres of forestland were identified in Clark County. In and around the forestland that is common to both the Landsat and digitized forestland there are a potential 33,623 acres and 2,947 owners who were not included in the original SFLO Database. Of those owners the most likely NIPF lands are those with Clark County land use codes 'Forestry operations', and 'Unused land timbered'. The forestry operations and unused land timbered parcels represent 8,659 acres amounting to 939 parcels and 710 unique owners.

Generating legislatively mandated reports with the SFLO Database and the Clark County GIS yield similar results with most statistics only 10% - 15% different. Generating statistics on parcel acreages and numbers by size classes was very close for all size ranges except the 20 acre and less category where the assessor's acres came out far less than the GIS acres but the number of owners was nearly identical. Information on residence status in the SFLO database is limited to improvements/no improvements versus the Clark County GIS where information about type of structure and the value of the structures is available. Even given the differences in the tabular and GIS datasets, the results were similar, 38% and 35% respectively, have improvements.

Identifying watersheds with significant NIPF riparian or total ownership is difficult with the tabular data due to the lack of true spatial information in the database. However, when comparing total NIPF ownership by watershed the GIS and tabular methods came out very close. Riparian ownership by watersheds is possible using the Clark County GIS but is not possible with any sort of accuracy using the tabular database. Without spatially explicit, accurate GIS data, riparian statistics will be very difficult and time consuming to compile.

It appears that the SFLO database is a good representation of the NIPF ownership in Clark County, WA. Likely additional NIPF owners in Clark County were identified through visual (orthophoto) and automated (Landsat) methods. Tabular and GIS information was compared to assess the quality of the tabular database and reports were generated that provide the foundation for the statistics in the legislatively mandated Small Forest Landowner Office report. In Clark County, the Small Forest Landowner Database is a good tool for analyzing non-industrial ownerships and with the addition of a few more "forested" parcels, will be a complete picture of the NIPF ownership in the County.

## Appendix A – Maps

# Clark County, WA: Ortho Forest

June 20, 2002

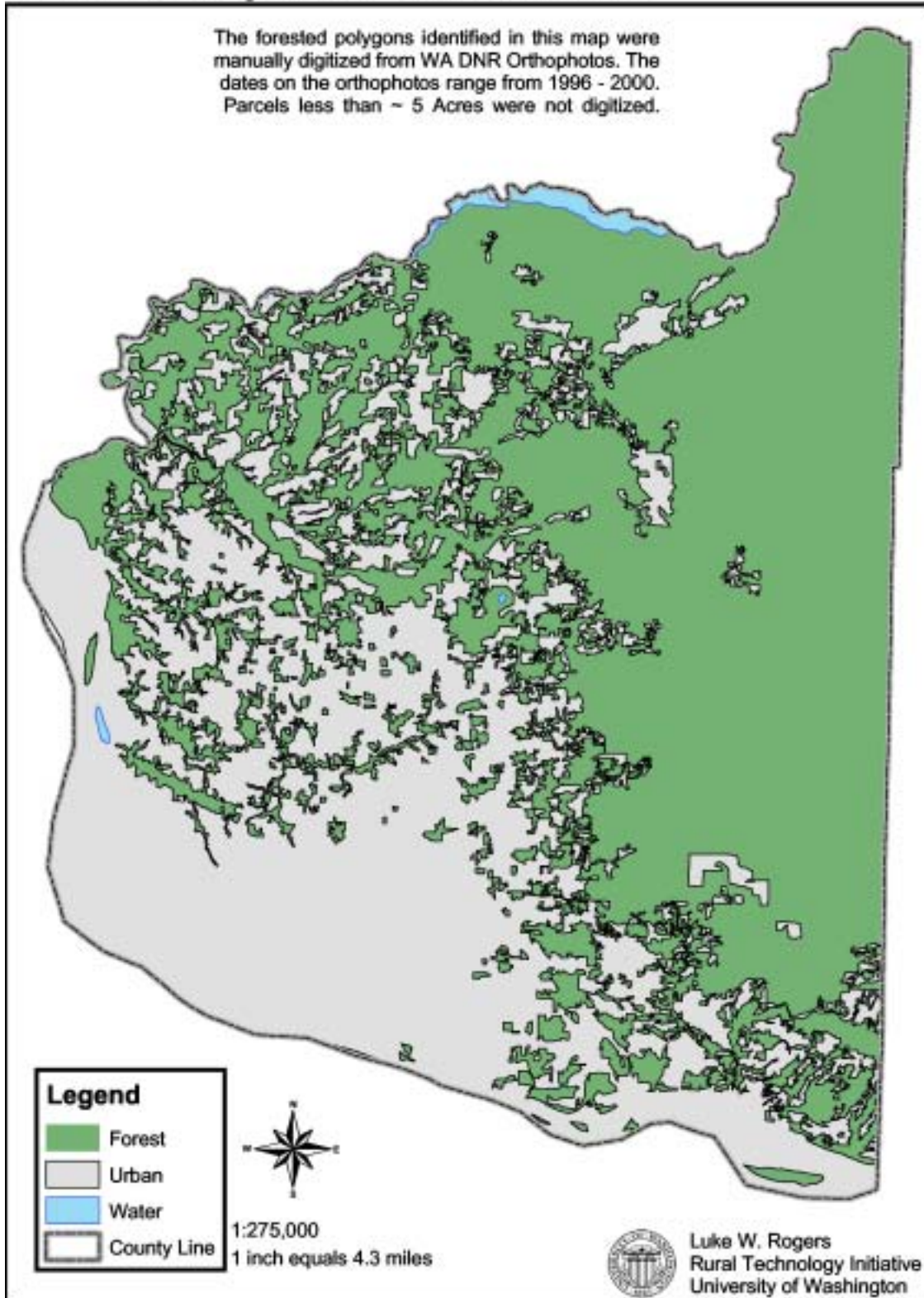


Figure 6 - Digitized forested areas in Clark County

# Clark County, WA: Landsat Forest

June 20, 2002

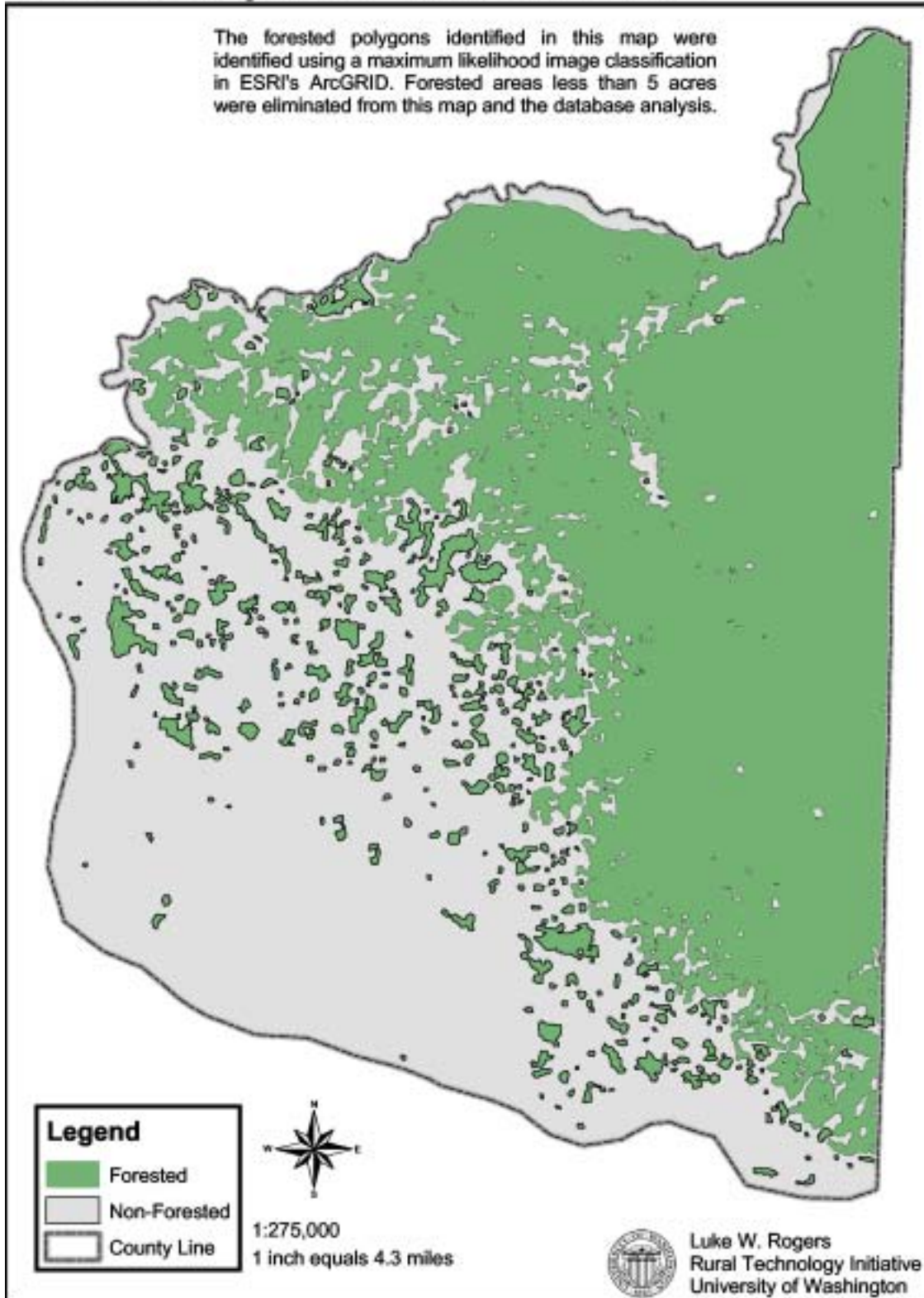


Figure 7 - Maximum likelihood Landsat classified forestland in Clark County.



# Clark County, WA: Urban Areas

June 20, 2002

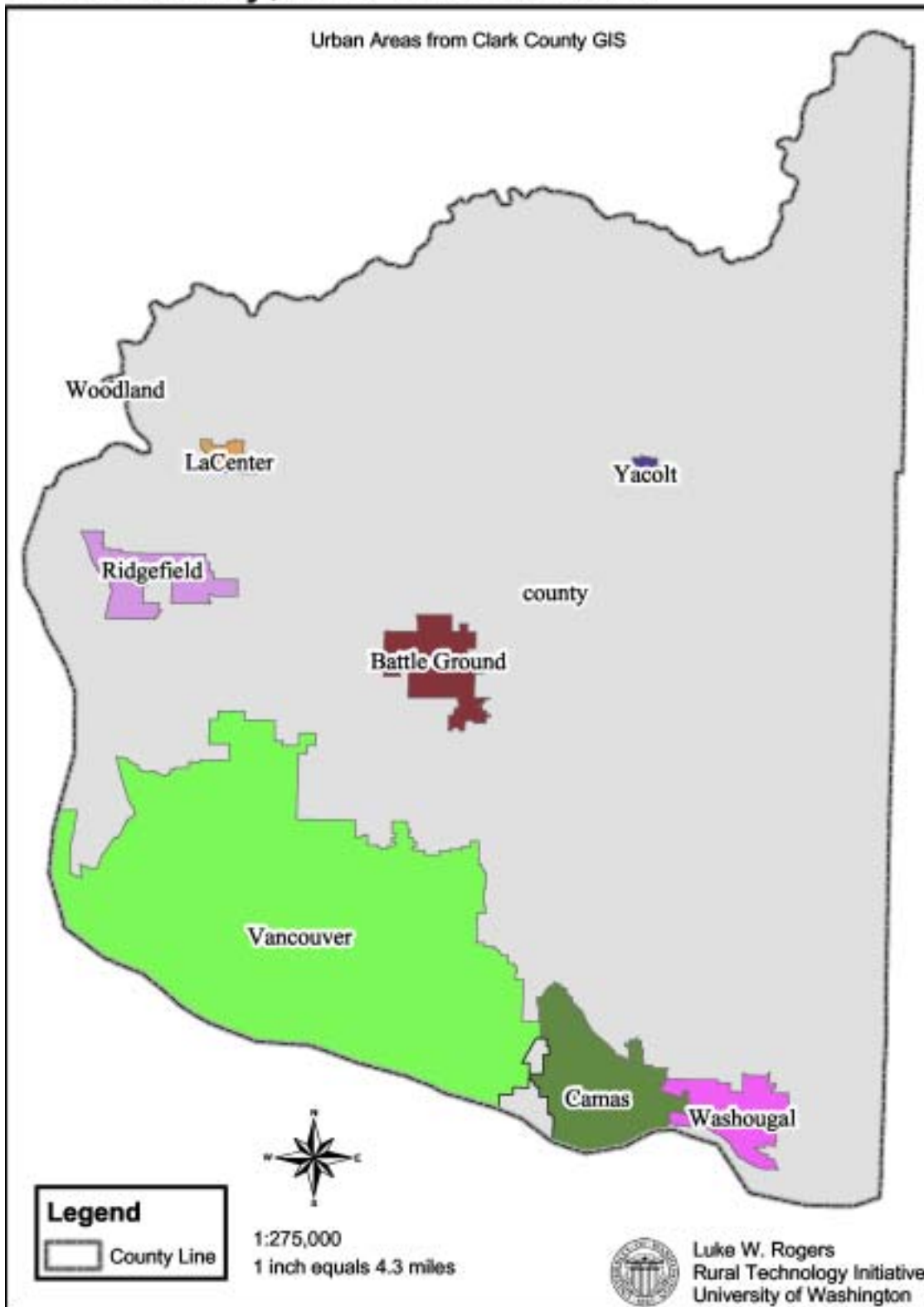


Figure 8 - Clark County urban areas that were removed from the analysis.

# Clark County, WA: Atterbury Industry

June 20, 2002

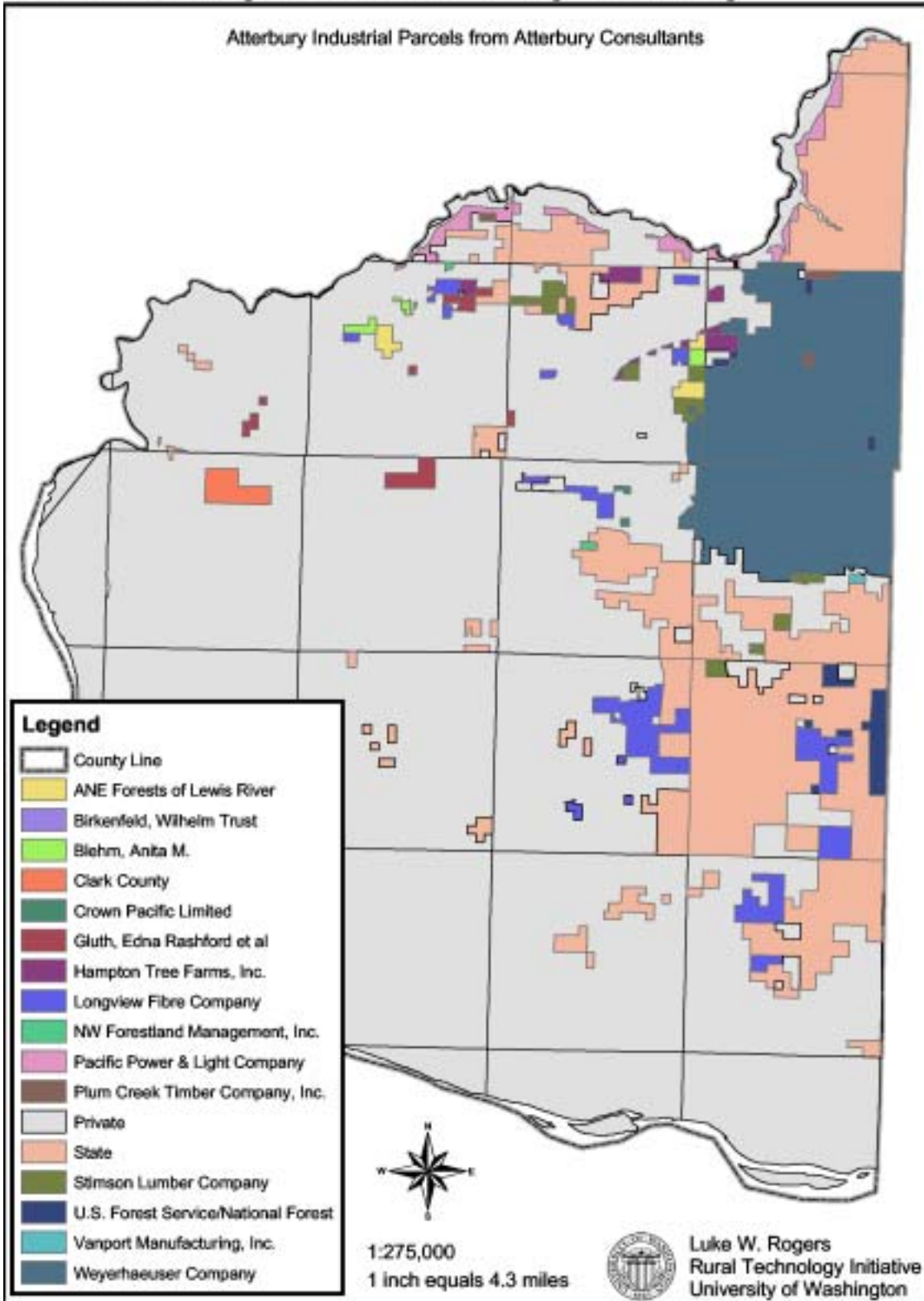


Figure 9 - Atterbury Industrial and Public parcels in Clark County.

# Clark County, WA: RTI Industry

June 20, 2002

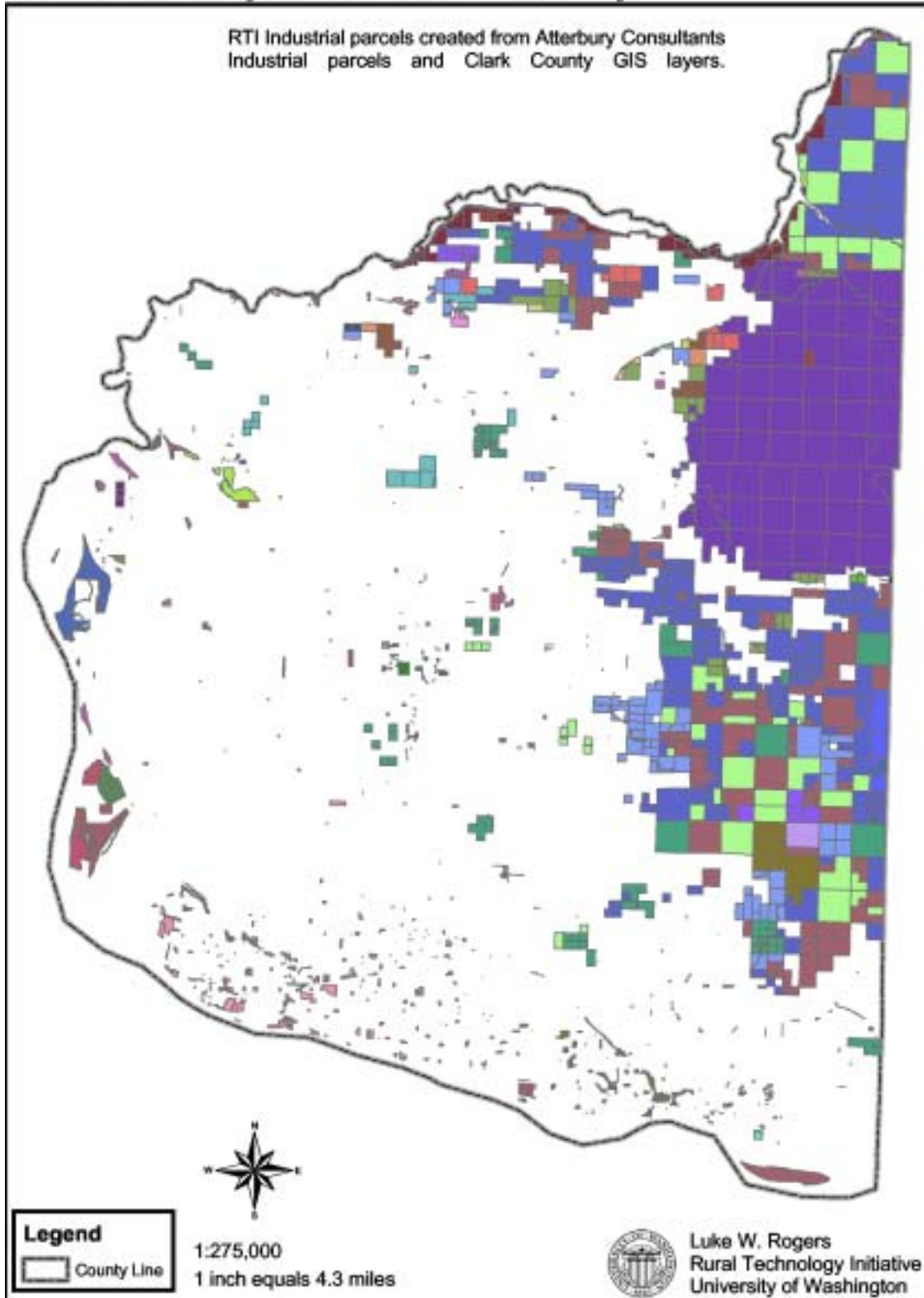


Figure 10 - RTI hand attributed industrial and public ownership.

# Clark County, WA: Common Forestland June 20, 2002

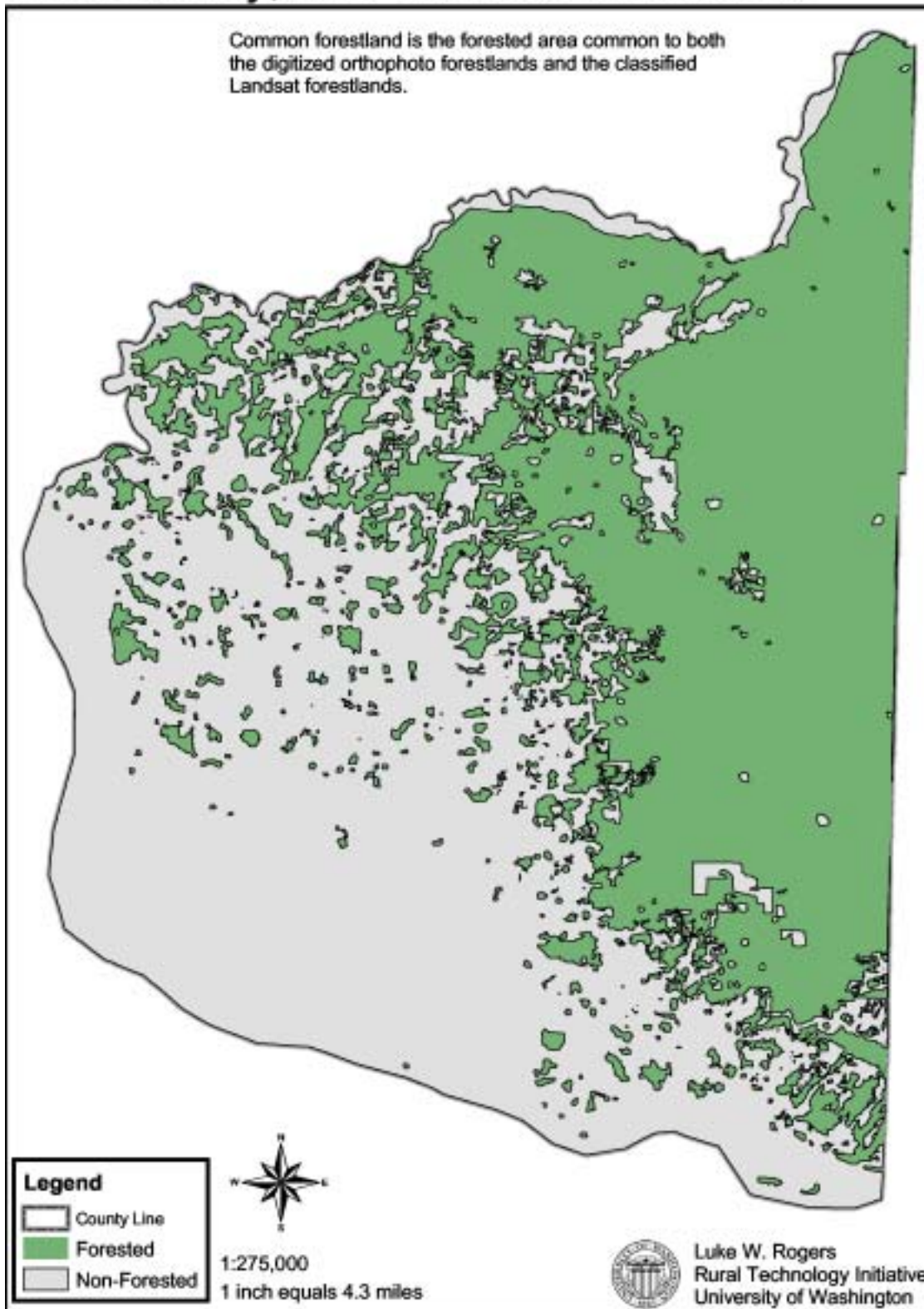


Figure 11 - Forested areas common to both the digitized forestland and the classified Landsat forestland.

# Clark County, WA: Parcels Intersect Forest

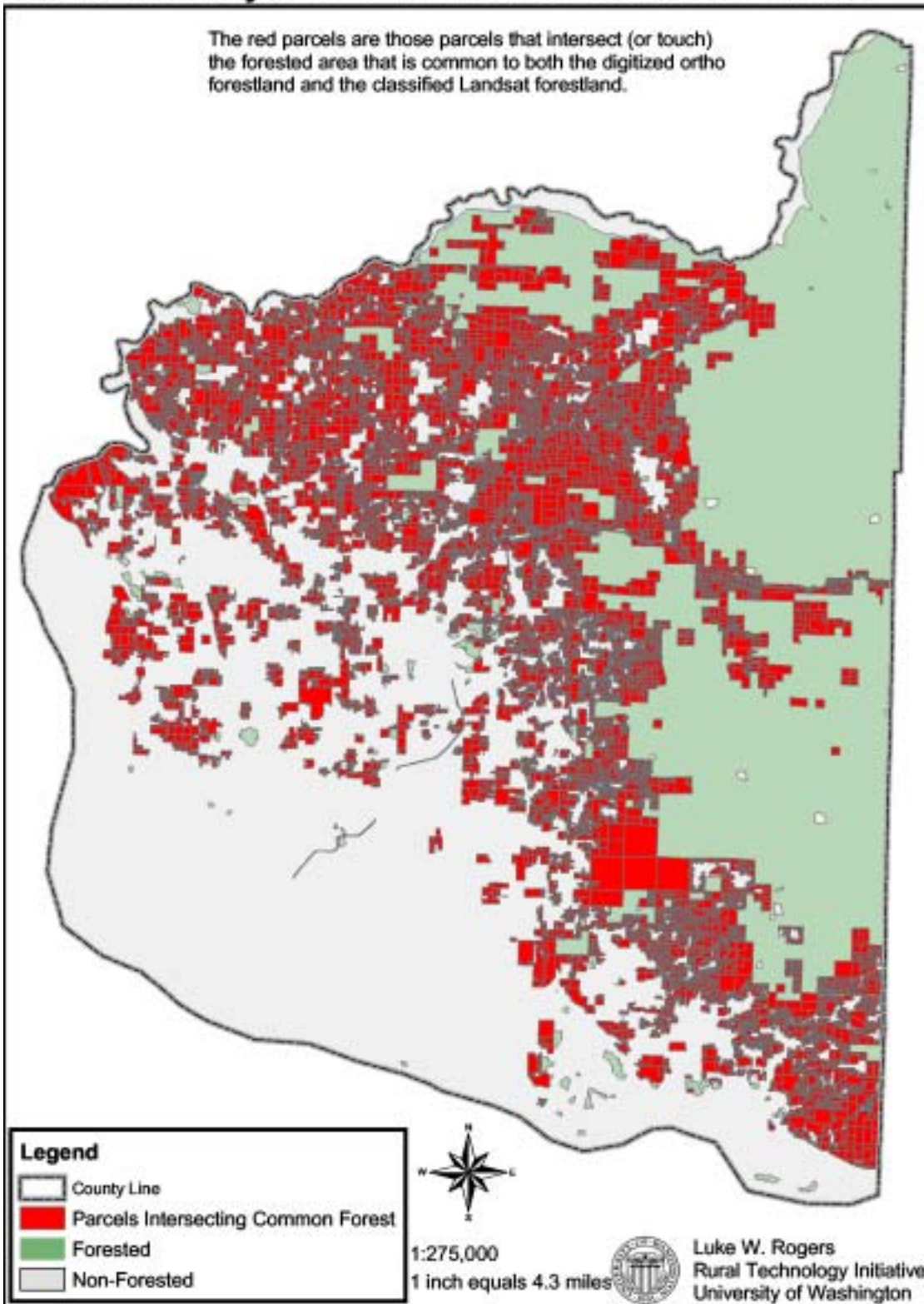


Figure 12 - Clark County GIS parcels that intersect the forested area common to both the digitized ortho forestland and the classified Landsat forestland.

# Clark County, WA: Parcels Within Forest

June 20, 2002

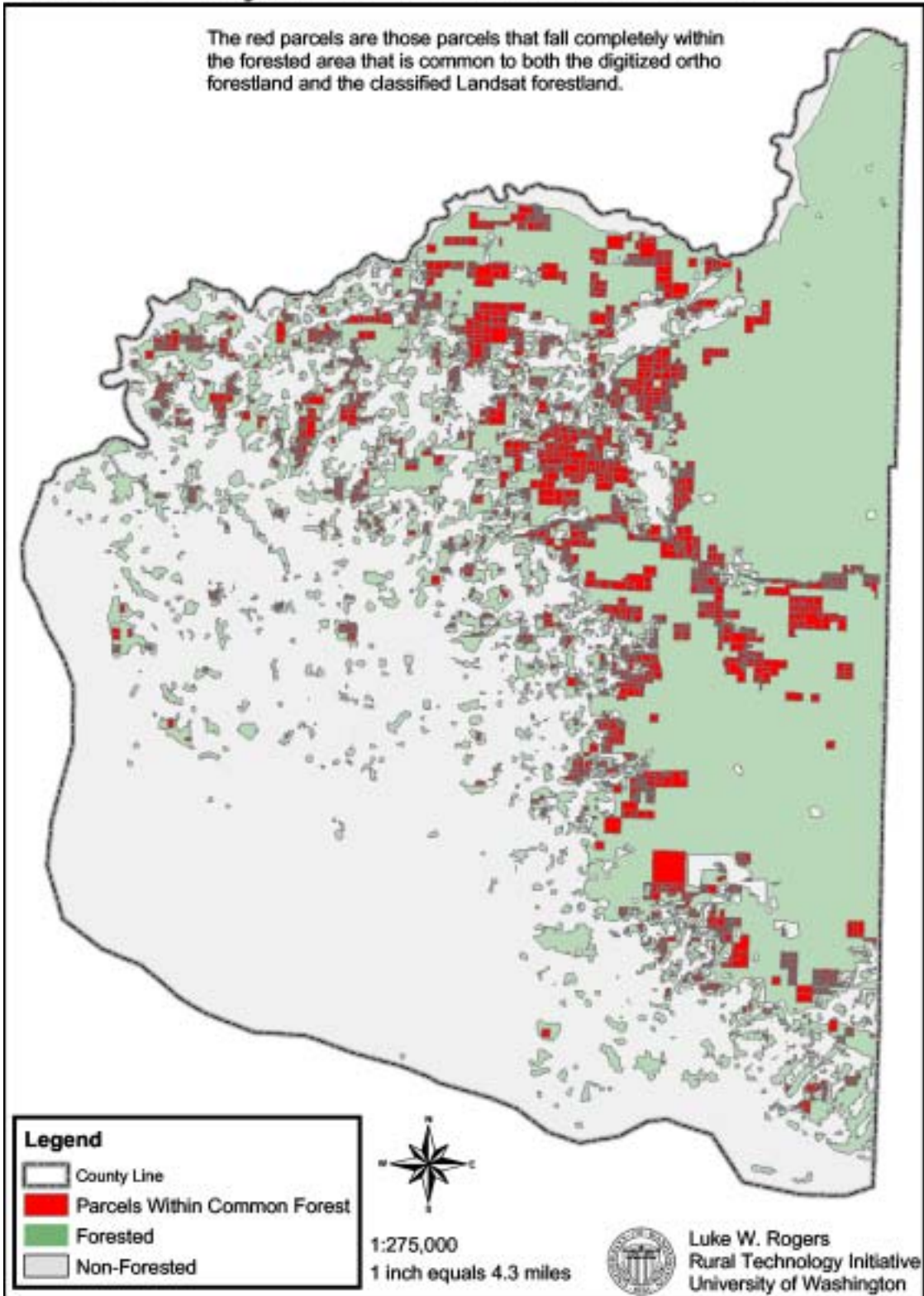


Figure 13 - Clark County GIS parcels that fall within the coreland common to both the digitized ortho forestland and the classified Landsat forestland.

# Clark County, WA: Potential NIPF Lands

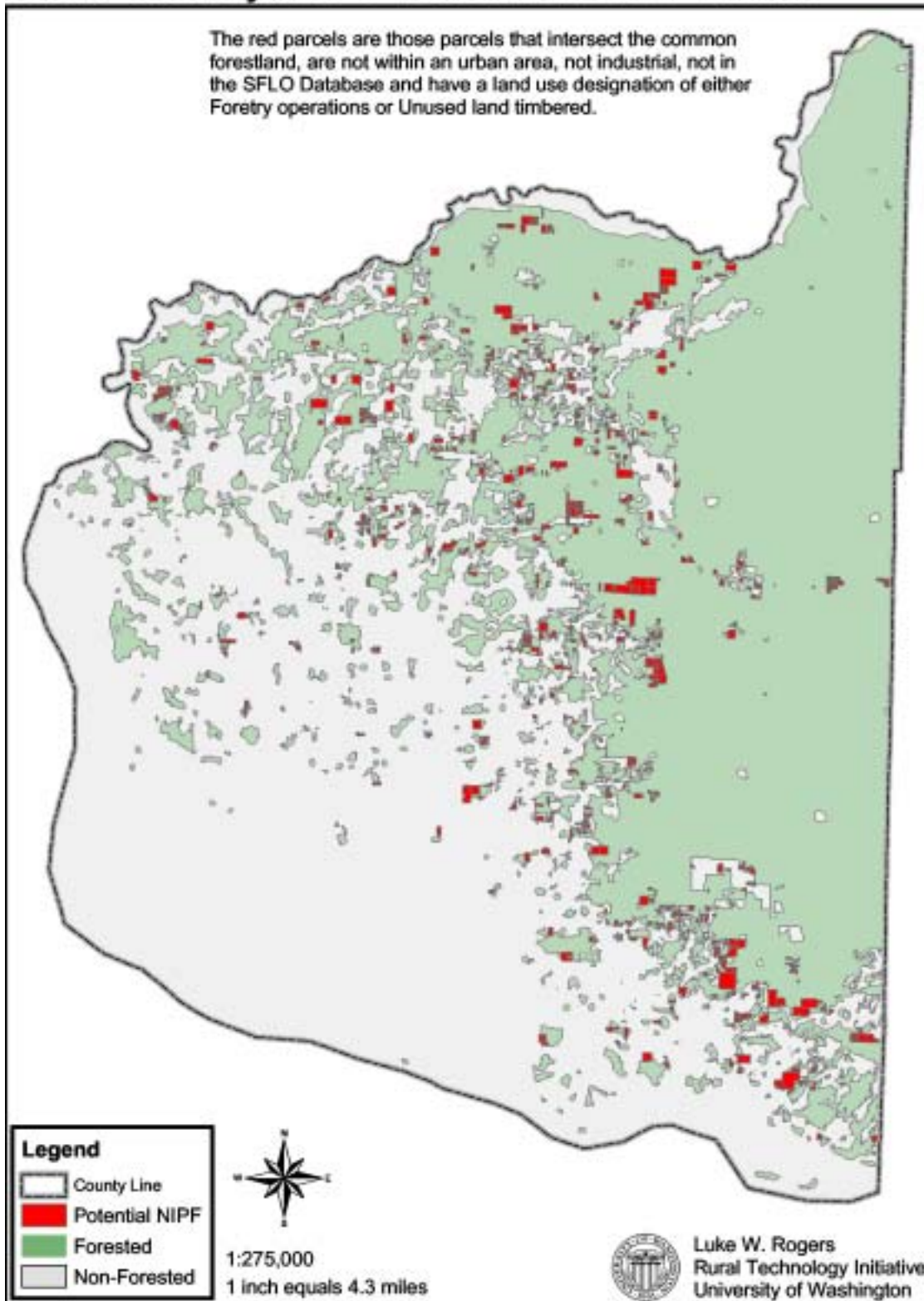


Figure 14 - Potential Clark County GIS parcels that could be NIPF land.

# Clark County, WA: Streams

June 20, 2002

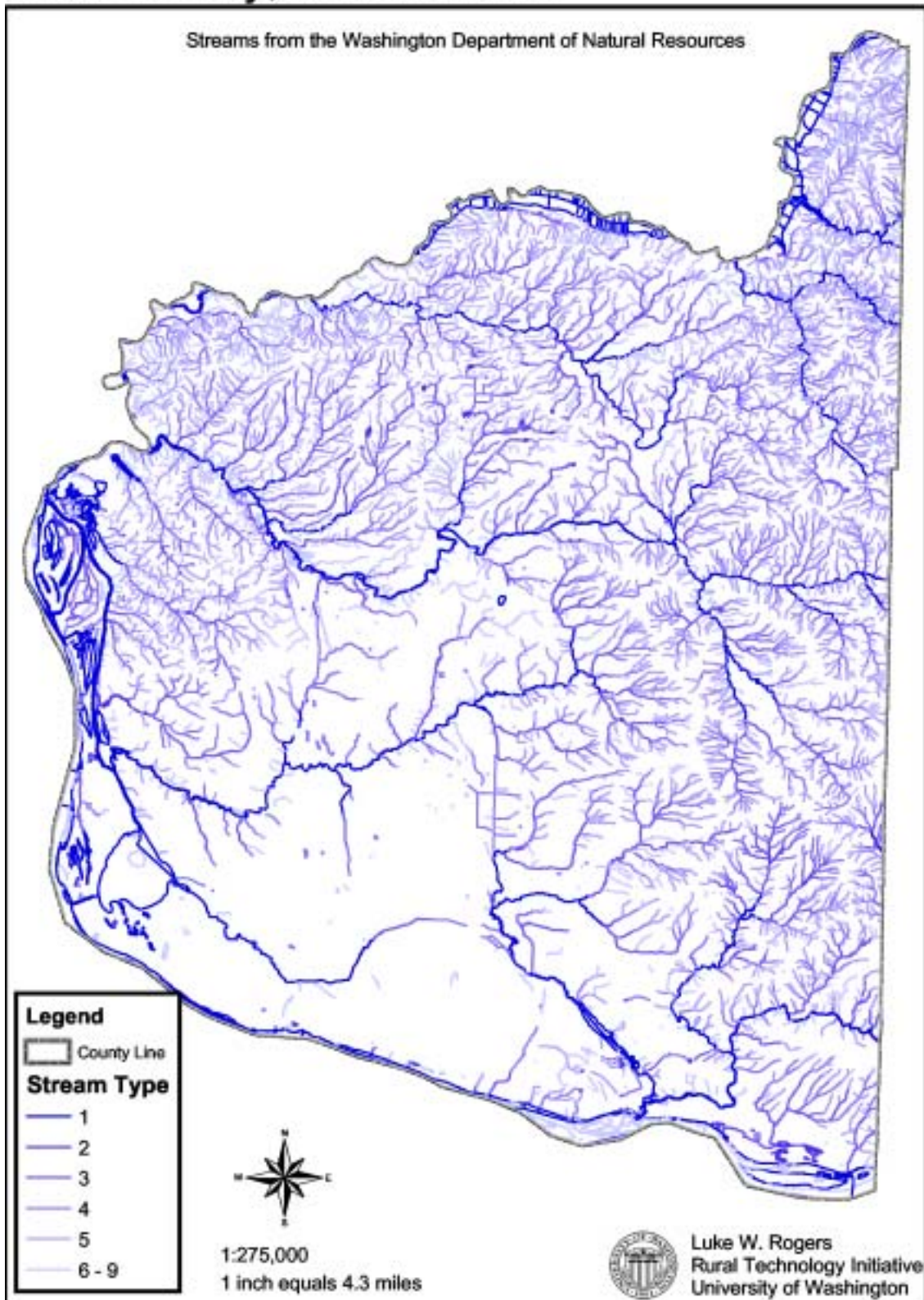


Figure 15 - Department of Natural Resources stream data for Clark County.



# Clark County, WA: DB Parcels by WAU June 20, 2002

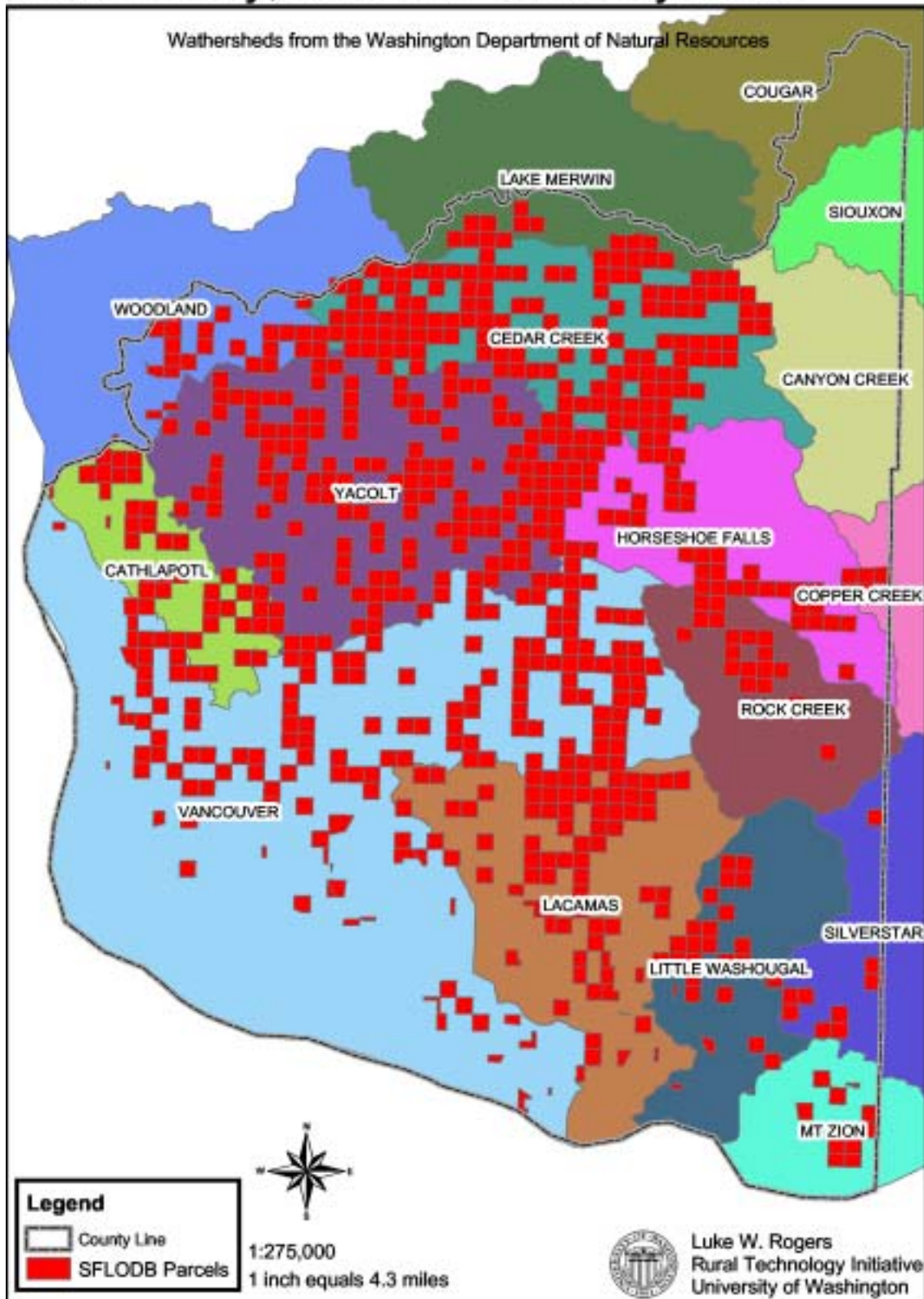


Figure 16 - SFLO Database parcels with 1/4 section resolution and the WAUs the parcels are in.

# Clark County, WA: GIS Parcels by WAU June 20, 2002

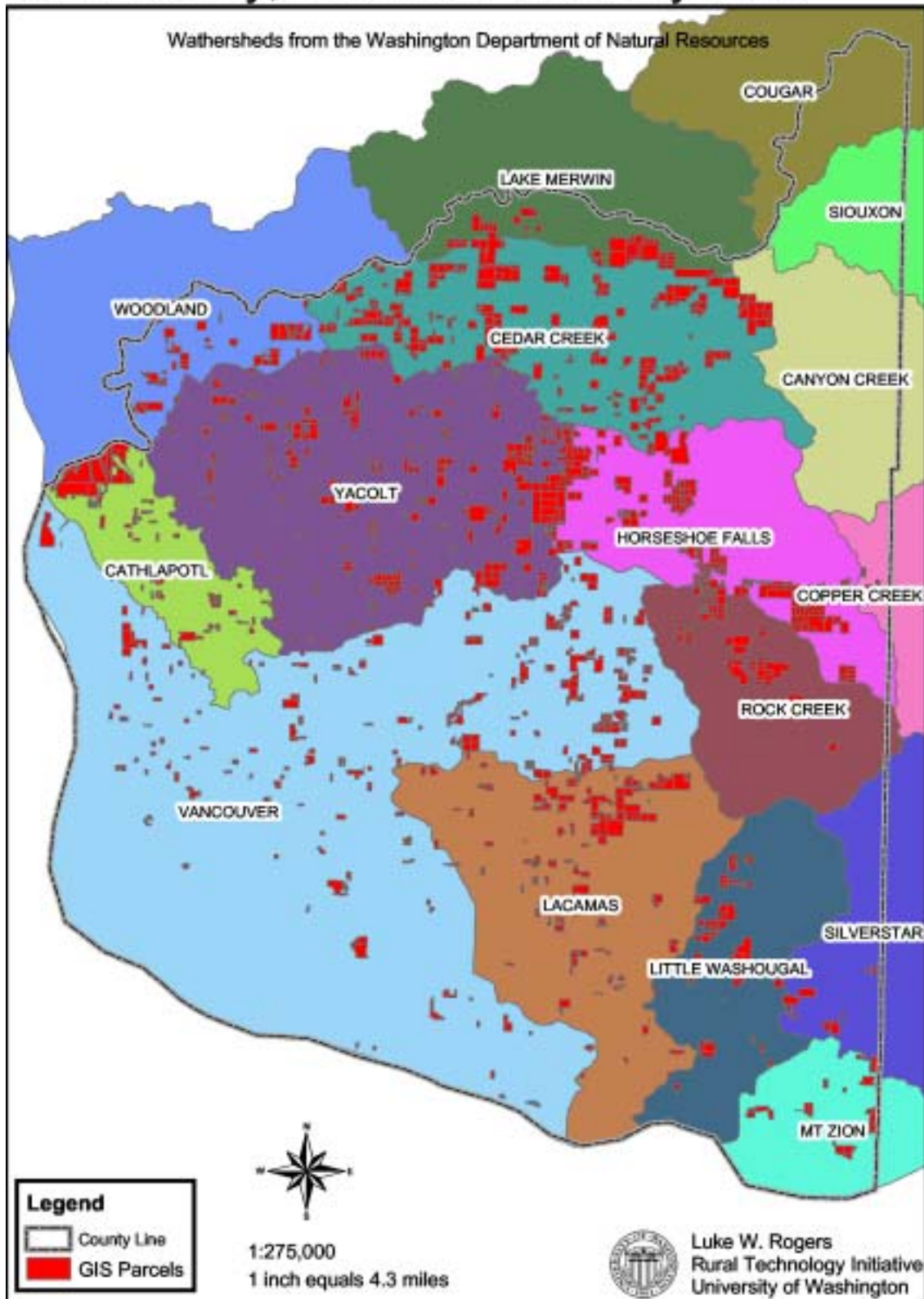


Figure 17 - GIS parcels and the WAUs the parcels are in.

## Appendix B – Tables & Charts

Command	Parameters	Output
MAKESTACK	RAWDATA LIST BAND1 BAND2 BAND3 BAND4 BAND5 BAND7	RAWDATA
CLASSSAMPLE	RAWDATA TR	TR
CLASSSIG	RAWDATA TR COVAR	MLRAW.GSG
MLCLASSIFY	RAWDATA, MLRAW.GSG, #, EQUAL	MLRAW
FOCALMAJORITY	MLRAW, CIRCLE, 5	MLRAW_FOCAL
BOUNDARYCLEAN	MLRAW_FOCAL, DESCEND	BNDCLEAND
CON	BNDCLEAND == 0, 0, BDNCLEAND == 4, 0, 1)	FOREST_GRID
GRIDPOLY	FOREST_GRID	FOREST_POLY
ELIMINATE	FOREST_POLY FORESTED	FORESTED

**Figure 18 - ArcGrid commands used to classify the 6 band LANDSAT data**