



Appendix D

Road Density

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Introduction

Road density can be used to help understand the potential for impacts from road surface erosion, drainage, and sediment delivery to streams. Many factors affect the degree of impact to aquatic resources from roads, and there can be a greater possibility of adverse impacts as road density in a watershed increases. However, research indicates the relationship between the degree of impacts to aquatic resources and road density is not simple and linear. Nonetheless, road density may be used as an indicator variable. Road densities were estimated within the Forest Practices HCP (FPHCP) covered lands for the 12 analysis regions. Table D.1 shows the average road density by region and by WRIA, as well as the overall average road density, for covered lands. Average road density in the 12 regions ranged from 2.5 to 4.9 miles of road per square mile of covered lands with an overall average road density of 3.4. A description of the process to estimate road density follows.

Road Density Analysis Description for Road Density Table D.1

The road density analysis discussed in the FPHCP DEIS was completed on July 7, 2004 by the Western Washington Office of the U.S. Fish and Wildlife Service (Table D.1). The GIS data layers that were used in the analysis included the Washington Department of Natural Resources (DNR) base water resource inventory area (WRIA) boundary layer (1991), the DNR transportation layer (1996), and the Forests and Fish covered lands boundary layer (FPHCP) supplied by Tetra Tech, FW, Inc. (2004). The FPHCP boundary layer represents all lands covered by the FPHCP that are subject to the Washington Forest Practices Rules.

Road density was estimated from the following process: the DNR transportation layer was clipped with individual WRIA boundaries. Then the miles of roads and square miles of land were calculated by WRIA. Next, the clipped WRIA/DNR transportation layer was clipped to the FPHCP boundary layer. Then the miles of roads and square miles of land were calculated within the FPHCP boundary layer by WRIA. Finally, all results were placed in an excel spreadsheet. From the spreadsheet, road density was calculated by WRIA and grouped into the 12 analysis regions used in the DEIS. Road density was calculated as miles of road within FPHCP covered lands per square mile of covered lands. Average road density per region also was calculated, as was an overall average of all 12 regions, for FPHCP covered lands.

The road density figures shown in Table D.1 are estimates and are likely underestimates of the true road density on covered lands. The DNR transportation layer that was used was completed in 1996, the last comprehensive update to this layer. This layer likely omitted some roads that occurred on covered lands as of 1996, which for various reasons were not identified for inclusion into the layer. Also, since 1996, more roads have likely been built on covered lands that are not included in the 1996 layer.



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Table D.1. Average Road Density by Analysis Regions and by WRIA for FPHCP Covered Lands.

Region	WRIA #	Miles of Roads within Covered Lands	Square Miles of Covered Lands	Road Density within Covered Lands (mi./sq. mi.)
1	1	1,526.14	554.75	2.8
1	3	1,073.09	359.58	3.0
1	4	832.16	262.28	3.2
1	6	369.04	129.25	2.9
1	7	2,937.85	864.43	3.4
		Average Road Density of Covered Lands in Region:		3.0
2	8	1,249.35	315.34	4.0
2	9	1,368.24	302.87	4.5
2	10	1,950.99	447.63	4.4
2	11	2,306.18	467.74	4.9
2	12	195.65	29.04	6.7
2	13	968.64	186.9	5.2
		Average Road Density of Covered Lands in Region:		4.9
3	14	1,382.23	288.87	4.8
3	15	2,366.94	517.73	4.6
3	16	596.69	147.11	4.1
3	17	1,056.11	249.59	4.2
3	18	490.6	126.48	3.9
		Average Road Density of Covered Lands in Region:		4.3
4	2	344.97	113.67	3.0
4	5	1,049.5	364.43	2.9
		Average Road Density of Covered Lands in Region:		3.0
5	19	996.59	268.4	3.7
5	20	2,142.64	575.89	3.7
5	21	1,106.67	331.14	3.3
		Average Road Density of Covered Lands in Region:		3.6
6	22	3,646.39	996.82	3.7
6	23	4,959.64	1,079.63	4.6
6	24	4,191.64	902.14	4.6
		Average Road Density of Covered Lands in Region:		4.3
7	25	2,042.43	422.8	4.8
7	26	6,526.19	1,234.69	5.3
7	27	3,111.41	637.46	4.9
7	28	860.45	253.95	3.4
		Average Road Density of Covered Lands in Region:		4.6
8	29	1,201.85	339.25	3.5
8	30	1,392.68	473.41	2.9
8	31	96.09	70.58	1.4
8	37	184.51	67.73	2.7
8	38	315.85	104.49	3.0
8	39	1,374.56	418.66	3.3
8	40	164.48	45.37	3.6

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Region	WRIA #	Miles of Roads within Covered Lands	Square Miles of Covered Lands	Road Density within Covered Lands (mi./sq. mi.)
Average Road Density of Covered Lands in Region:				2.9
9	32	304.59	104.74	2.9
9	33	0.12	0.05	2.4
9	34	134.44	51.59	2.6
9	35	102.83	49.71	2.1
Average Road Density of Covered Lands in Region:				2.5
10	36	0.29	0.16	1.8
10	41	1.24	0.52	2.4
10	42	0.18	0.05	3.6
10	43	47.39	18.8	2.5
Average Road Density of Covered Lands in Region:				2.6
11	44	16.61	8	2.1
11	45	701.26	148.68	4.7
11	46	154.02	29.64	5.2
11	47	90.68	22.62	4.0
11	48	108.91	53.58	2.0
11	49	834.39	430.17	1.9
11	50	0.38	0.35	1.1
Average Road Density of Covered Lands in Region:				3.0
12	51	0	0	0.0
12	52	275.65	113.51	2.4
12	53	106	45.6	2.3
12	54	819.18	282.56	2.9
12	55	1,184.15	416.51	2.8
12	56	205.93	60.66	3.4
12	57	406.64	117.36	3.5
12	58	686.31	196.62	3.5
12	59	1,753.77	626.85	2.8
12	60	633.32	261.09	2.4
12	61	983.44	353.86	2.8
12	62	1,061.99	350.13	3.0
Average Road Density of Covered Lands in Region:				2.7
Overall Average Road Density of Covered Lands:				3.4

