

## **Descriptive Summary of the Coastal Changes in the Columbia River Estuary, Oregon, September 10, 1989, to July 12, 1993**

Forested lands dominated the landscape of the Columbia River Estuary, Oregon, with over 2.3 million acres (approximately 50 percent of the land) covered by evergreen, mixed, and deciduous forests. At over 150,000 acres, forestry transitions constituted the greatest change detected by the C-CAP land cover analysis in the Columbia River Estuary area of Oregon. These transitions represented a cyclic silviculture process, which involves the harvest and reforestation of predominantly evergreen and mixed forest stands. Historically, in the Northwest, land dedicated to forestry stays in forestry and was not influenced by human development. This is primarily due to steep slopes that restrict development.

Evergreen farming is a monoculture farming practice common to the Northwest region of the United States. This process was clearly illustrated by the initial change of evergreen forest to bare land following the clearing of a forest, after which grasses colonized the area transforming the land cover to grassland. Finally, after the reforestation of seedlings, this grassland started to develop into scrub/shrub, eventually reverting back to mature evergreen forest, which was then harvested again. This process was evidenced through the change of 70,000 acres of evergreen forest to scrub/shrub, 37,000 acres of evergreen forest to grassland, 30,000 acres of grassland to scrub/shrub, and 9,000 acres of scrub/shrub reverting to evergreen forest.

Mixed forest stands were clear-cut through silviculture practices and followed the same transitional regrowth patterns as evergreen forests. This was evidenced in the data set with over 27,000 acres of mixed forest changing to scrub/shrub, 13,000 acres of mixed forest converting to grassland, and over 3,700 acres of scrub/shrub reverting back to mixed forest. However, mixed forests were not reforested with a mixed forest seedling but rather with evergreen seedlings. In addition, some mixed forests were allowed to regenerate naturally through the transitional conversion to grassland, then scrub/shrub, and eventually reverting back to mature forest.

Below are three tables. The first two tables contain a data summary for the time 1 and time 2 images. These images were used to create the change image and their tables include; land cover classes, the number of pixels present in each class, and their corresponding values in acres.

The third table is a complete change matrix for time 1 and time 2 images and includes a smaller, generalized table, which groups similar classes together. Table three compares each class from time 1 to time 2 and illustrates the change that took place between classes. The table presents the total acres for each class, the total percent that each class represents, the total acres that changed, and the percent of change they represent.

### Tabular Summary: Crest, Oregon, September 10, 1989

	CLASS	PIXELS	ACRES	PERCENT
1	Unclassified	0	0	0.00%
2	High Intensity Developed	134201	20726	0.43%
3	Low Intensity Developed	305721	47216	0.99%
4	Cultivated Land	500272	77262	1.62%
5	Grassland	2496277	385526	8.06%
6	Deciduous Forest	565752	87375	1.83%
7	Evergreen Forest	12264051	1894063	39.62%
8	Mixed Forest	3429942	529721	11.08%
9	Scrub/Shrub	4938542	762710	15.95%
10	Palustrine Forested Wetland	278747	43050	0.90%
11	Palustrine Scrub/Shrub Wetland	288969	44628	0.93%
12	Palustrine Emergent Wetland	187764	28998	0.61%
13	Estuarine Forested Wetland	0	0	0.00%
14	Estuarine Scrub/Shrub Wetland	0	0	0.00%
15	Estuarine Emergent Wetland	125519	19385	0.41%
16	Unconsolidated Shore	348984	53897	1.13%
17	Bare Land	145027	22398	0.47%
18	Water	4946438	763929	15.98%
19	Palustrine Aquatic Bed	0	0	0.00%
20	Estuarine Aquatic Bed	0	0	0.00%
21	Tundra	0	0	0.00%
22	Snow/Ice	0	0	0.00%
	<b>TOTALS</b>	<b>30956206</b>	<b>4780884</b>	<b>100.00%</b>

### Tabular Summary: Crest, Oregon, July 12, 1993

	CLASS	PIXELS	ACRES	PERCENT
1	Unclassified	0	0	0.00%
2	High Intensity Developed	137776	21278	0.45%
3	Low Intensity Developed	331825	51247	1.07%
4	Cultivated Land	476904	73653	1.54%
5	Grassland	2729263	421508	8.82%
6	Deciduous Forest	518678	80105	1.68%
7	Evergreen Forest	11611979	1793357	37.51%
8	Mixed Forest	3191446	492888	10.31%
9	Scrub/Shrub	5654282	873249	18.27%
10	Palustrine Forested Wetland	270458	41770	0.87%
11	Palustrine Scrub/Shrub Wetland	282959	43700	0.91%
12	Palustrine Emergent Wetland	188696	29142	0.61%
13	Estuarine Forested Wetland	0	0	0.00%
14	Estuarine Scrub/Shrub Wetland	0	0	0.00%
15	Estuarine Emergent Wetland	126642	19559	0.41%
16	Unconsolidated Shore	347254	53630	1.12%
17	Bare Land	142478	22004	0.46%
18	Water	4945566	763794	15.98%
19	Palustrine Aquatic Bed		0	0.00%
20	Estuarine Aquatic Bed		0	0.00%
21	Tundra		0	0.00%
22	Snow/Ice		0	0.00%
	<b>TOTALS</b>	<b>30956206</b>	<b>4780884</b>	<b>100.00%</b>

Change Matrix and Tabular Summary: Crest, OR, from September 10, 1989 to July 12, 1993

	FROM / TO	High Intensity Developed	Low Intensity Developed	Cultivated Land	Grassland	Deciduous Forest	Evergreen Forest	Mixed Forest	Scrub/Shrub	Palustrine Forested Wetland	Palustrine Scrub/Shrub Wetland	Palustrine Emergent Wetland	Estuarine Forested Wetland	Estuarine Scrub/Shrub Wetland	Estuarine Emergent Wetland	Unconsolidated Shore	Bare Land	Water	Palustrine Aquatic Bed	Estuarine Aquatic Bed	Tundra	Snow/ice	Total Acres	Changed			
2	High Intensity Developed	20668	0	0	39	0	1	3	5	0	0	0	0	0	0	0	0	8	0	0	0	0	0	20,726	57	High Intensity Developed	
3	Low Intensity Developed	96	47005	0	111	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	47,216	211	Low Intensity Developed	
4	Cultivated Land	24	237	63448	12273	0	7	24	1027	0	39	75	0	0	0	0	0	87	10	0	0	0	0	77,262	13,814	Cultivated Land	
5	Grassland	156	908	9231	343381	3	10	48	29294	4	128	139	0	0	0	0	25	148	37	0	0	0	0	385,526	40,145	Grassland	
6	Deciduous Forest	-1	20	40	3577	79365	166	220	3928	13	1	8	0	0	0	0	0	36	1	0	0	0	0	87,375	8,010	Deciduous Forest	
7	Evergreen Forest	69	1044	237	36801	40	1783660	343	70992	17	2	9	0	0	0	0	0	43	773	31	0	0	0	1,894,063	110,403	Evergreen Forest	
8	Mixed Forest	23	381	107	12914	112	353	488358	27217	5	8	37	0	0	0	0	3	201	2	0	0	0	0	529,721	41,363	Mixed Forest	
9	Scrub/Shrub	185	1441	437	7321	571	8996	3776	738639	9	339	94	0	0	0	0	7	86	540	62	0	0	0	762,710	23,771	Scrub/Shrub	
10	Palustrine Forested Wetland	3	39	7	710	1	105	55	634	41308	86	82	0	0	0	0	1	61	7	0	0	0	0	43,050	1,742	Palustrine Forested Wetland	
11	Palustrine Scrub/Shrub Wetland	0	14	2	994	5	11	13	206	282	42890	168	0	0	0	0	0	42	2	0	0	0	0	44,628	1,739	Palustrine Scrub/Shrub Wetland	
12	Palustrine Emergent Wetland	2	17	9	351	0	14	9	25	23	145	28368	0	0	0	0	4	0	33	0	0	0	0	28,998	632	Palustrine Emergent Wetland	
13	Estuarine Forested Wetland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Estuarine Forested Wetland
14	Estuarine Scrub/Shrub Wetland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Estuarine Scrub/Shrub Wetland
15	Estuarine Emergent Wetland	0	1	0	6	0	18	1	8	12	8	6	0	0	0	19307	17	0	2	0	0	0	0	19,385	78	Estuarine Emergent Wetland	
16	Unconsolidated Shore	2	2	1	2	0	41	2	56	67	36	39	0	0	0	150	52856	519	122	0	0	0	0	53,897	1,041	Unconsolidated Shore	
17	Bare Land	43	133	117	964	2	23	31	821	1	2	38	0	0	0	12	335	19308	567	0	0	0	0	22,398	3,089	Bare Land	
18	Water	2	5	18	55	0	51	8	93	19	17	81	0	0	0	72	269	332	762917	0	0	0	0	763,929	1,612	Water	
19	Palustrine Aquatic Bed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Palustrine Aquatic Bed
20	Estuarine Aquatic Bed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Estuarine Aquatic Bed
21	Tundra	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Tundra
22	Snow/ice	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Snow/ice
<b>Total Acres</b>		<b>21,278</b>	<b>51,247</b>	<b>73,653</b>	<b>421,508</b>	<b>80,105</b>	<b>1,793,357</b>	<b>492,888</b>	<b>873,249</b>	<b>41,770</b>	<b>43,700</b>	<b>29,142</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>19,559</b>	<b>53,630</b>	<b>22,004</b>	<b>763,794</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4,017,967</b>		<b>Total Acres</b>	
<b>Percent of Total</b>		<b>0.53%</b>	<b>1.28%</b>	<b>1.83%</b>	<b>10.49%</b>	<b>1.99%</b>	<b>44.63%</b>	<b>12.27%</b>	<b>21.73%</b>	<b>1.04%</b>	<b>0.73%</b>	<b>0.00%</b>	<b>0.00%</b>	<b>0.49%</b>	<b>0.73%</b>	<b>0.00%</b>	<b>1.33%</b>	<b>0.55%</b>	<b>19.01%</b>	<b>0.00%</b>	<b>0.00%</b>	<b>0.00%</b>	<b>0.00%</b>	<b>247,106</b>		<b>Percent of Total</b>	
<b>Total Acres that Changed (Y2-Y1)</b>		<b>552</b>	<b>4,032</b>	<b>-3,609</b>	<b>35,962</b>	<b>-7,270</b>	<b>-100,706</b>	<b>-36,833</b>	<b>110,539</b>	<b>-1,280</b>	<b>-928</b>	<b>144</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>173</b>	<b>-267</b>	<b>-394</b>	<b>-135</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>247,106</b>		<b>Total Acres that Changed</b>	
<b>Percent Change</b>		<b>2.66%</b>	<b>8.54%</b>	<b>-4.87%</b>	<b>9.33%</b>	<b>-8.32%</b>	<b>-5.32%</b>	<b>-6.95%</b>	<b>14.49%</b>	<b>-2.97%</b>	<b>-2.08%</b>	<b>0.50%</b>	<b>0</b>	<b>0</b>	<b>0.89%</b>	<b>-0.50%</b>	<b>-1.76%</b>	<b>-0.92%</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>6.15%</b>		<b>Percent Change</b>	

FROM / TO	Developed	Cultivated	Grassland	Forested	Scrub/Shrub	Wetlands	Bare	Water	Total Acres	Changed	
Developed	67,770	0	149	5	7	1	9	0	67,942	172	Developed
Cultivated	261	63,448	12,273	41	1,066	123	87	10	77,310	13,862	Cultivated
Grassland	1,067	9,231	345,381	64	29,423	282	173	37	385,598	40,277	Grassland
Forested	1,575	390	54,011	2,994,120	102,869	101	1,063	41	2,654,173	160,051	Forested
Scrub/Shrub	1,640	439	8,315	13,568	782,373	561	669	64	807,629	25,256	Scrub/Shrub
Wetlands	75	18	2,070	232	873	132,680	70	43	136,062	3,382	Wetlands
Bare	181	118	965	166	916	345	73,020	690	76,401	3,382	Bare
Water	7	19	964	76	110	189	593	762,917	764,374	1,957	Water
<b>Total Acres</b>	<b>72,579</b>	<b>73,662</b>	<b>424,130</b>	<b>2,408,274</b>	<b>917,637</b>	<b>134,282</b>	<b>75,883</b>	<b>763,802</b>	<b>4,017,967</b>	<b>248,341</b>	<b>Total Acres</b>
<b>Percent of Total (Y2/Total)</b>	<b>1.81%</b>	<b>1.83%</b>	<b>10.56%</b>	<b>59.94%</b>	<b>22.84%</b>	<b>3.34%</b>	<b>1.88%</b>	<b>19.01%</b>		<b>6.18%</b>	
<b>Total Change (Y2-Y1)</b>	<b>4,637</b>	<b>-3,648</b>	<b>36,472</b>	<b>-145,900</b>	<b>110,008</b>	<b>-1,780</b>	<b>-718</b>	<b>-1,072</b>		<b>248,341</b>	
<b>Percent Change</b>	<b>6.33%</b>	<b>-4.72%</b>	<b>9.98%</b>	<b>-5.71%</b>	<b>13.62%</b>	<b>-1.31%</b>	<b>-0.94%</b>	<b>-0.14%</b>		<b>6.18%</b>	