Descriptive Summary of the Changes in Coastal Yakutat Bay, Alaska, October 29, 1986, to July 12, 1993

Snow and ice dominated the landscape of Yakutat Bay, Alaska, with over 4 million acres (approximately 56 percent of the land) covered by snow and ice. Yakutat Bay, Alaska, embodied more natural changes than any other C-CAP project to date. These natural changes included seasonal differences, beach line erosion, the movement of hydrographic features, and glacial processes. At over 3.9 million acres, transitions from snow and ice to bare land cover, caused by seasonal differences in the imagery dates, constituted the greatest change detected by the C-CAP land cover analysis in Yakutat Bay.

Glacial processes characterized by the movement of the Hubbard Glacier were evident by the conversion of bare land to snow and ice. Between 1986 and 1993 the glacier covered more than 43,000 acres. In 1986, the Hubbard Glacier made an unusually rapid advance, blocking Russell Fjord's sole access to the ocean. Water levels in the fjord, fed by approximately 140 tributary streams, rose rapidly to 25 meters above sea level forming "Russell Lake" before the ice dam finally broke four months later. This phenomenon is apparent when examining the different data sets.

While no one knows exactly what the glacier will do next, experts hypothesize that within the next decade it will again block off the entrance of the fjord. During this next occurrence, however, the leading edge of the glacier is expected to be much higher (125 meters) than before, and the ice dam may persist for years or even centuries. If this indeed happens, the water level in the fjord will rise over 40 meters and begin to exit at the south end, approximately 25 miles from the glacier. This will result in a great change in habitat for the surrounding rivers and wetlands. The initial flood will inundate the land and flood the Situk River. C-CAP data showed how the mouth of the Situk River has already changed from 1986 to 1993. The channel and mouth of the river are moving northeast. This natural phenomenon represents a unique opportunity to study the reaction of an environment under change.

Ophir Creek at Yakutat, Alaska, represented a prime example of how human activities affected the natural environmental stability of a watershed and forest. In the early 1990s the Ophir Creek watershed was logged extensively for the silviculture industry. This caused significant changes in the watershed and the nearby streams that were valued for the salmon that populated them.

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: Yakutat Bay, Alaska, October 29, 1986

	CLASS	PIXELS	ACRES	PERCENT
0	Background	0	0	0.00%
1	Unclassified	197262	43870	0.60%
2	High Intensity Developed	0	0	0.00%
3	Low Intensity Developed	1453	323	0.00%
4	Cultivated Land	0	0	0.00%
5	Grassland	198614	44171	0.61%
6	Deciduous Forest	0	0	0.00%
7	Evergreen Forest	1119191	248901	3.41%
8	Mixed Forest	0	0	0.00%
9	Scrub/Shrub	880638	195849	2.68%
10	Palustrine Forested Wetland	101483	22569	0.31%
11	Palustrine Scrub/Shrub Wetland	326952	72712	1.00%
12	Palustrine Emergent Wetland	205155	45625	0.63%
13	Estuarine Forested Wetland	0	0	0.00%
14	Estuarine Scrub/Shrub Wetland	0	0	0.00%
15	Estuarine Emergent Wetland	22085	4912	0.07%
16	Unconsolidated Shore	40229	8947	0.12%
17	Bare Land	1609492	357941	4.90%
18	Water	8846749	1967463	26.96%
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	19265365	4284500	58.71%
	TOTALS	**32814668**	**7297783**	**100.00%**

Tabular Summary: Yakutat Bay, Alaska, July 12, 1993

	CLASS	PIXELS	ACRES	PERCENT
0	Background	0	0	0.00%
1	Unclassified	0	0	0.00%
2	High Intensity Developed	0	0	0.00%
3	Low Intensity Developed	1533	341	0.00%
4	Cultivated Land	0	0	0.00%
5	Grassland	157557	35040	0.48%
6	Deciduous Forest	0	0	0.00%
7	Evergreen Forest	1085115	241323	3.31%
8	Mixed Forest	0	0	0.00%
9	Scrub/Shrub	999460	222274	3.05%
10	Palustrine Forested Wetland	101095	22483	0.31%
11	Palustrine Scrub/Shrub Wetland	325272	72339	0.99%
12	Palustrine Emergent Wetland	213207	47416	0.65%
13	Estuarine Forested Wetland	0	0	0.00%
14	Estuarine Scrub/Shrub Wetland	0	0	0.00%
15	Estuarine Emergent Wetland	24650	5482	0.08%
16	Unconsolidated Shore	77013	17127	0.23%
17	Bare Land	2876582	639734	8.77%
18	Water	8758276	1947787	26.69%
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	18194957	4046448	55.45%
	TOTALS	**32814717**	**7297794**	**100.00%**

Change Matrix and Tabular Summary: Yakutat Bay, Alaska, from October 29, 1986 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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**	High Intensity Developed
3	Low Intensity Developed	0	322	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**323**	**1**	Low Intensity Developed
4	Cultivated Land	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**	Cultivated Land
5	Grassland	0	2	0	26826	0	13	0	8031	1	10	2	0	0	1	0	5134	7	0	0	0	4144	**44,171**	**17,345**	Grassland
6	Deciduous Forest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**	Deciduous Forest
7	Evergreen Forest	0	9	0	135	0	236999	0	8806	31	43	2	0	0	3	6	1951	340	0	0	0	577	**248,902**	**11,903**	Evergreen Forest
8	Mixed Forest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**	Mixed Forest
9	Scrub/Shrub	0	4	0	1726	0	2203	0	180744	22	237	14	0	0	13	5	6285	145	0	0	0	4451	**195,849**	**15,105**	Scrub/Shrub
10	Palustrine Forested Wetland	0	1	0	4	0	224	0	176	21598	296	139	0	0	5	1	82	43	0	0	0	4	**22,569**	**975**	Palustrine Forested Wetland
11	Palustrine Scrub/Shrub Wetland	0	1	0	77	0	24	0	941	614	69453	459	0	0	84	59	807	158	0	0	0	37	**72,712**	**3,259**	Palustrine Scrub/Shrub Wetland
12	Palustrine Emergent Wetland	0	0	0	7	0	5	0	67	85	136	44481	0	0	80	54	602	100	0	0	0	9	**45,625**	**1,145**	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**	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**	Estuarine Scrub/Shrub Wetland
15	Estuarine Emergent Wetland	0	0	0	4	0	3	0	4	2	27	26	0	0	4166	254	348	75	0	0	0	2	**4,912**	**745**	Estuarine Emergent Wetland
16	Unconsolidated Shore	0	0	0	15	0	1	0	69	1	45	56	0	0	134	4984	2442	1174	0	0	0	25	**8,947**	**3,963**	Unconsolidated Shore
17	Bare Land	0	2	0	646	0	17	0	8866	43	867	1135	0	0	714	3021	305594	3732	0	0	0	33304	**357,941**	**52,347**	Bare Land
18	Water	0	0	0	34	0	0	0	206	6	808	870	0	0	112	7831	22479	1933850	0	0	0	1267	**1,967,464**	**33,614**	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**	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**	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**	Tundra
22	Snow/Ice	0	0	0	5050	0	0	0	10276	0	0	0	0	0	0	0	283248	1430	0	0	0	3984500	**4,284,505**	**300,005**	Snow/Ice
	Total Acres	**0**	**341**	**0**	**34,523**	**0**	**239,490**	**0**	**218,186**	**22,401**	**71,923**	**47,184**	**0**	**0**	**5,311**	**16,215**	**628,973**	**1,941,052**	**0**	**0**	**0**	**4,028,319**	**5,320,069**		**Total Acres**
	Percent of Total	**0.00%**	**0.01%**	**0.00%**	**0.65%**	**0.00%**	**4.50%**	**0.00%**	**4.10%**	**0.42%**	**1.35%**	**0.89%**	**0.00%**	**0.00%**	**0.10%**	**0.30%**	**11.82%**	**36.49%**	**0.00%**	**0.00%**	**0.00%**	**75.72%**			**Percent of Total**
	Total Acres that Changed (Y2-Y1)	**0**	**18**	**0**	**-9,648**	**0**	**-9,411**	**0**	**22,338**	**-169**	**-789**	**1,559**	**0**	**0**	**400**	**7,269**	**271,032**	**-26,411**	**0**	**0**	**0**	**-256,186**		**440,405**	**Total Acres that Changed**
	Percent Change	**0**	**5.51%**	**0**	**-21.84%**	**0**	**-3.78%**	**0**	**11.41%**	**-0.75%**	**-1.09%**	**3.42%**	**0**	**0**	**8.14%**	**81.24%**	**75.72%**	**-1.34%**	**0**	**0**	**0**	**-5.98%**		**8.28%**	**Percent Change**

FROM / TO	Developed	Grassland	Forested	Scrub/Shrub	Wetlands	Bare	Water	Snow/Ice	Total Acres	Changed	
Developed	322	0	0	0	0	1	0	0	**323**	**1**	**Developed**
Grassland	2	26,826	14	8,041	14	5,134	7	4,144	**44,182**	**17,356**	**Grassland**
Forested	10	139	258,848	9,321	79	2,040	383	581	**271,401**	**12,552**	**Forested**
Scrub/Shrub	5	1,803	2,863	251,375	1,205	7,156	302	4,488	**269,197**	**17,822**	**Scrub/Shrub**
Wetlands	1	92	256	1,187	141,648	2,207	375	52	**145,818**	**4,170**	**Wetlands**
Bare	2	661	63	9,847	2,995	316,041	4,906	33,329	**367,844**	**51,803**	**Bare**
Water	0	646	8	1,014	1,796	30,310	1,933,850	1,267	**1,968,889**	**35,039**	**Water**
Snow/Ice	0	5,050	0	10,276	1	283,248	1,430	3,984,500	**4,284,505**	**300,005**	**Snow/Ice**
Total Acres	**342**	**35,215**	**262,051**	**291,062**	**147,738**	**646,137**	**1,941,253**	**4,028,360**	**5,320,069**	**438,749**	**Total Acres**
Percent of Total (Y2/Total)	**0.01%**	**0.66%**	**4.93%**	**5.47%**	**2.78%**	**12.15%**	**36.49%**	**75.72%**		**8.25%**	
Total Change (Y2-Y1)	**19**	**-8,966**	**-9,350**	**21,865**	**1,920**	**278,293**	**-27,637**	**-256,144**		**438,749**	
Percent Change	**5.92%**	**-20.29%**	**-3.44%**	**8.12%**	**1.32%**	**75.66%**	**-1.40%**	**-5.98%**		**8.25%**	