Analysis of Trends in Land Cover Change in the Coastal U.S.

François G.F. Smith
MDA Federal Inc.

Nate Herold
NOAA Coastal Services Center

Coastal GeoTools Conference
Myrtle Beach SC
March 3, 2009

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The Coastal Change Analysis Program

- NOAA's National coastal land cover and change mapping program
- Inventory of intertidal areas, wetlands, and adjacent upland, produced/updated every 5 years
- Consistent, accurate products through standard data and methods
- Coastal Expression of the National Land Cover Database (NLCD)

1972 1986 1990 1995 2000

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Coastal Land Cover Classes

Developed
- Developed, High Intensity
- Developed, Medium Intensity
- Developed, Low Intensity
- Developed, Open Space

Agricultural
- Cultivated Crops
- Pasture/Hay

Rangeland
- Grassland/Herbaceous
- Scrub / Shrub

Forest Land
- Deciduous Forest
- Evergreen Forest
- Mixed Forest

Barren Land
- Barren Land
- Unconsolidated Shore

Water
- Open Water
- Palustrine Aquatic Bed
- Estuarine Aquatic Bed

Wetlands
- *Woody Wetlands*
  - Palustrine Forested Wetland
  - Palustrine Scrub/Shrub Wetland
  - Estuarine Forested Wetland
  - Estuarine Scrub/Shrub Wetland
- *Herbaceous Wetlands*
  - Palustrine Emergent Wetland
  - Estuarine Emergent Wetland

Perennial Ice/Snow

Alaska Only Classes*
- Dwarf Scrub
- Sedge/Herbaceous
- Lichens
- Moss

We've Got you Covered

1996-2001 Complete

2001 Date Only

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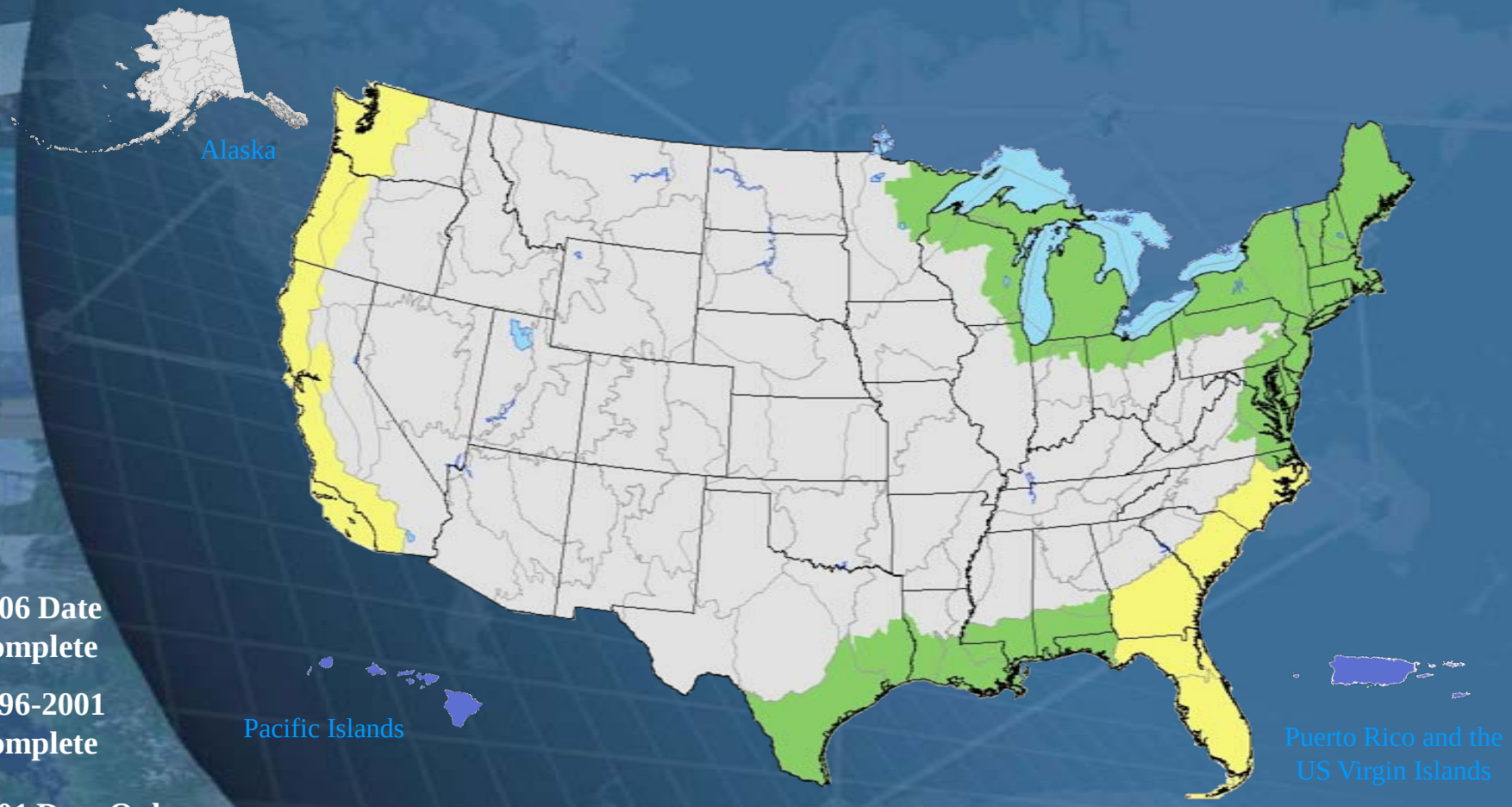
We've Got you Covered



- 2006 Date Complete
- 1996-2001 Complete
- 2001 Date Only

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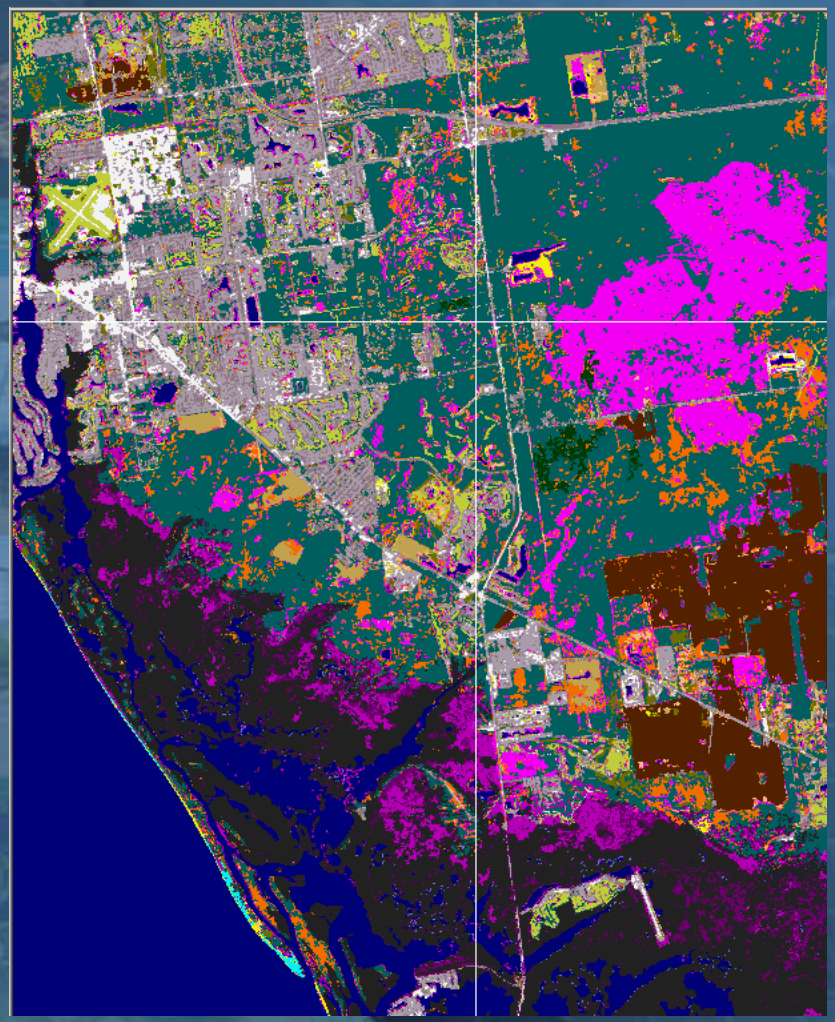
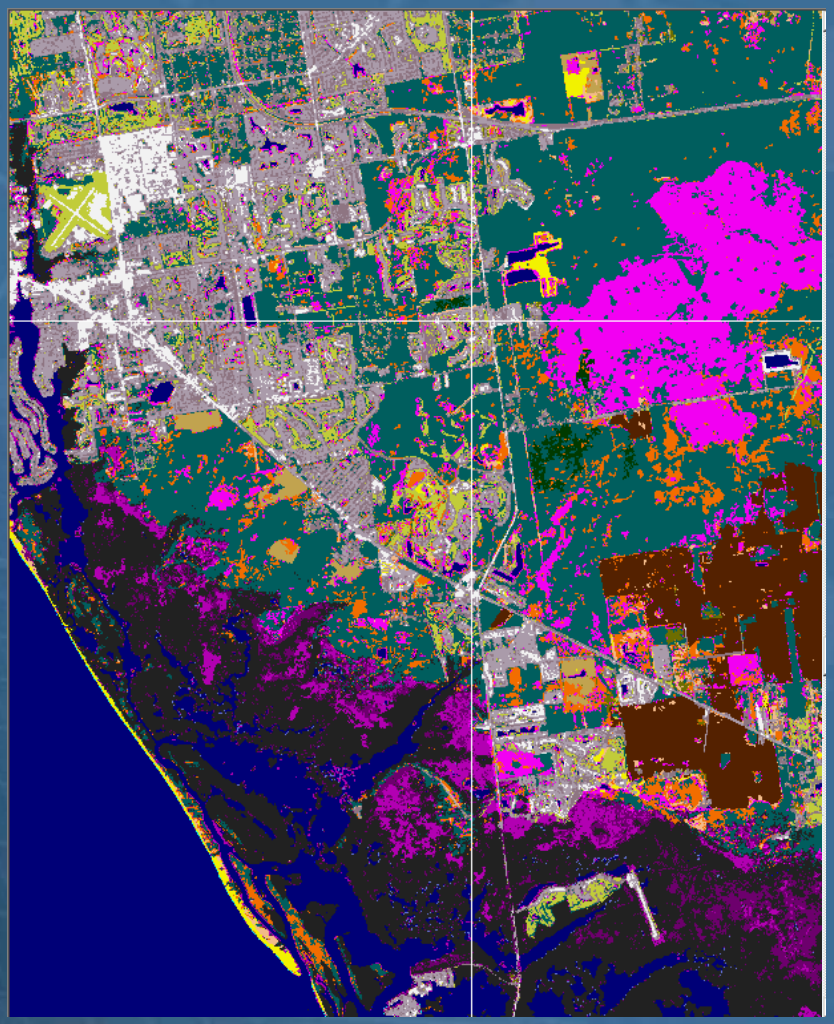
New Development – Rookery Bay NERR, FL

1996





2001

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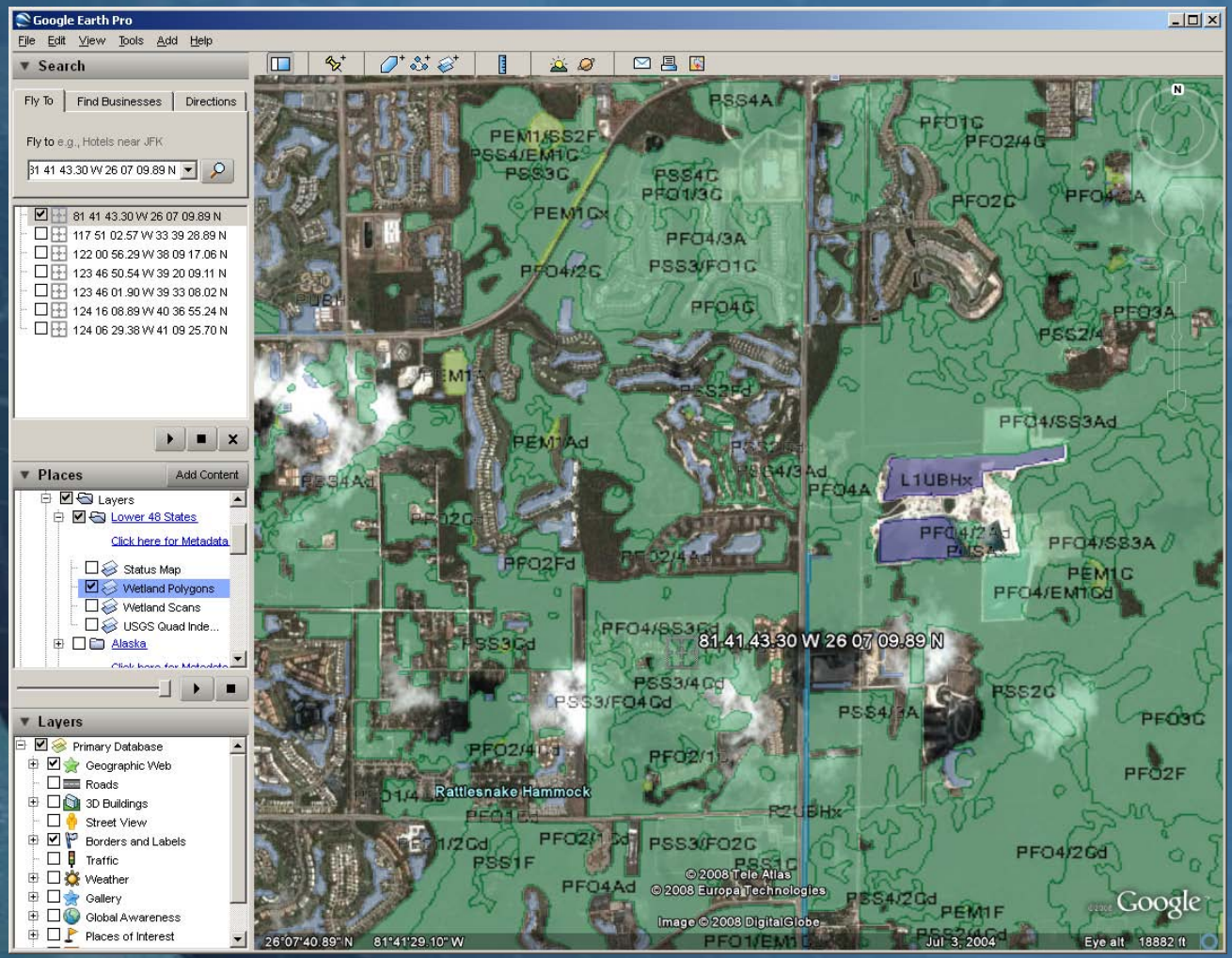
New Development – Rookery Bay NERR, FL



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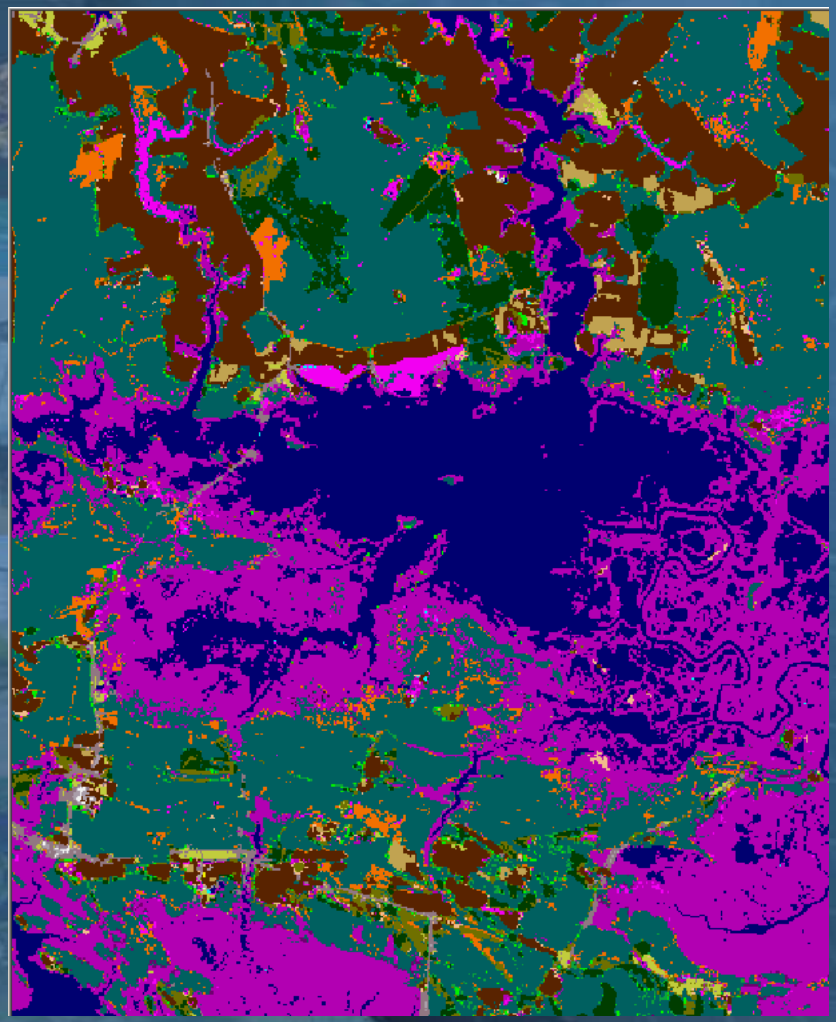
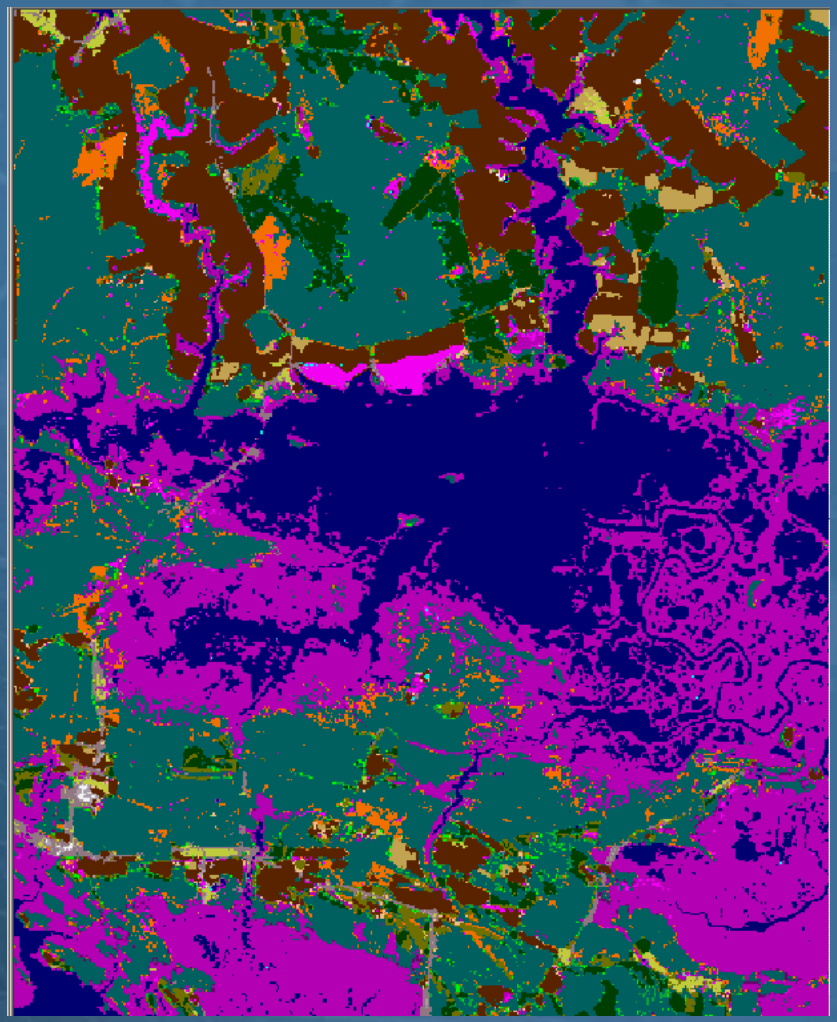
Marsh Loss – Blackwater NWR, MD

1996





2001

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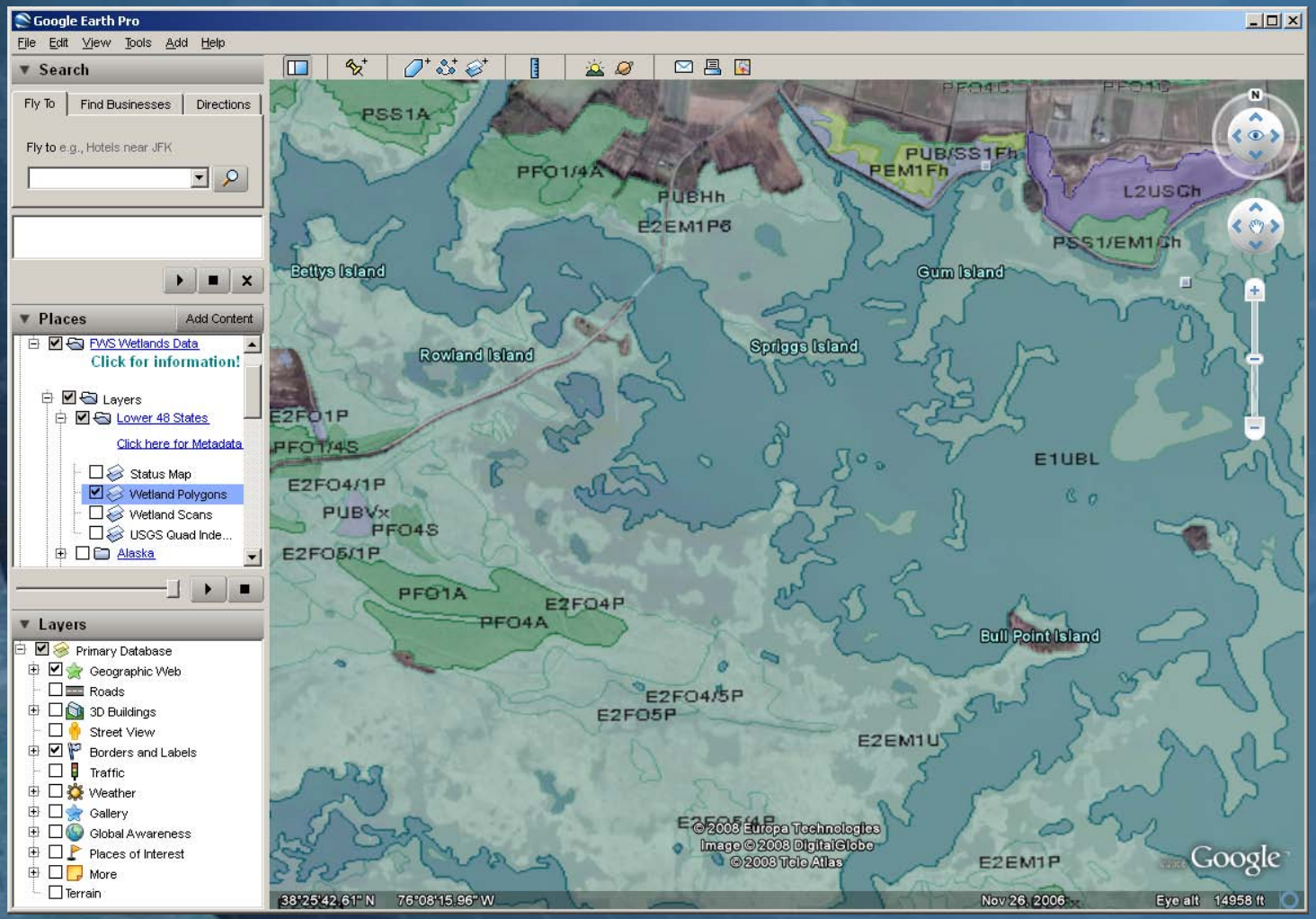
Marsh Loss – Blackwater NWR, Maryland



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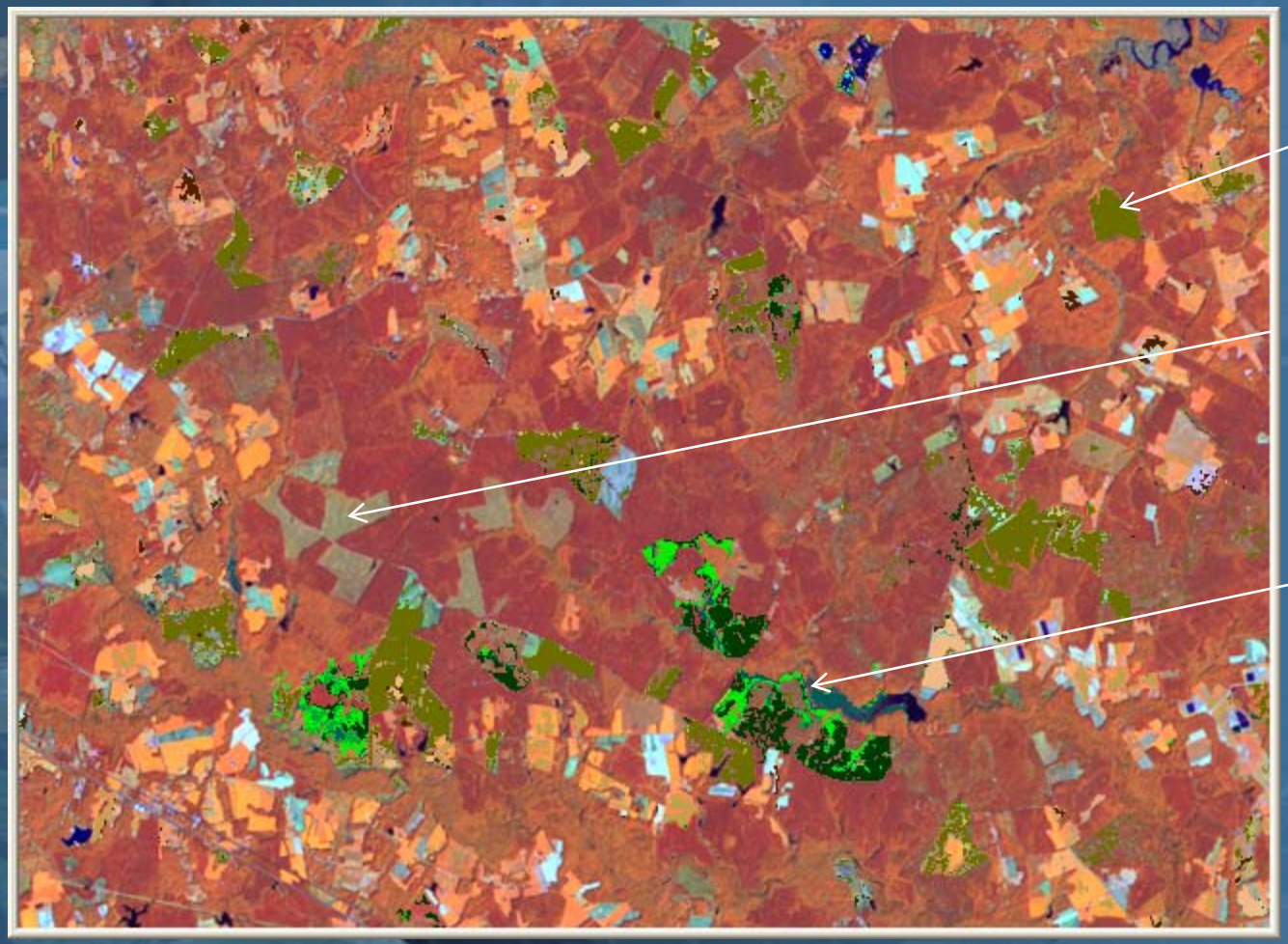
Evergreen Forest Harvest 1996 - 2001



Scrub replacing Evergreen Forest

Still scrub since 1996 harvest

Deciduous and Evergreen new growth

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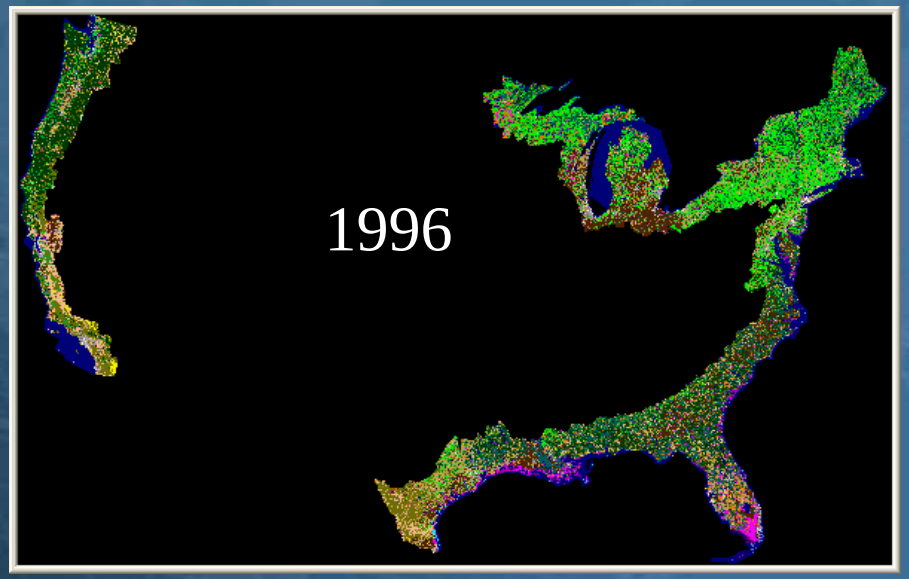
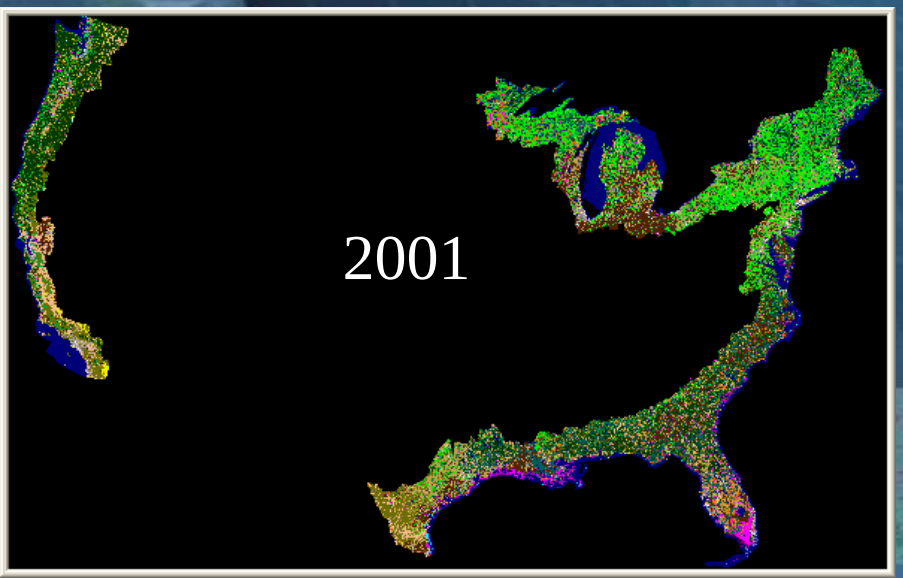
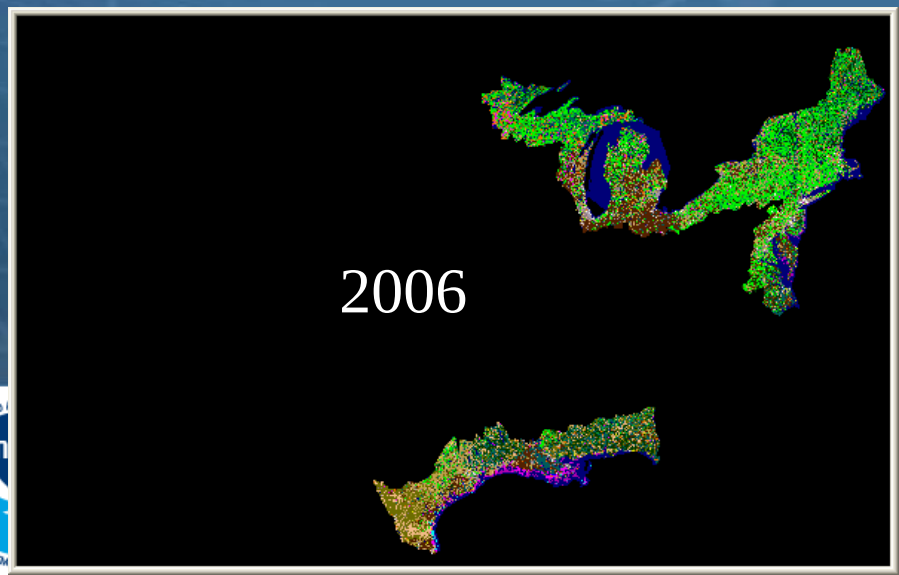
Completed C-CAP Dataset

1996, 2001, and 2006 dates of C-CAP LC







Land Cover Change in the Coastal US over 10 years

Trend in Changes Based on Analysis of C-CAP Data

- This study seeks to determine the major types of change in land cover categories over the time period of 1996-2006.
- The analysis is based the C-CAP data.
- Time periods analyzed
  - 1996-2001
  - 2001-2006
  - 1996-2006.
- Different types of changes are described:
  - Class that has changed the most by area
  - Class that changed the most percentage-wise
  - Biggest from-to class change by area
  - Most prolific urban change
  - Most prolific wetland change

Method of Analysis

Three Tools

- Bivariate Analysis
- Direct comparison of histogram tables
- Change Matrix
- Compared entire existing C-CAP data for each date.

7%

Bivariate Analysis

Raster Attribute Editor - ches_bay_2001_2006_provisional_20090204_bivariate.img(:Layer_1)

File Edit Help

Layer Number: 1

Row	Histogram	ED Code	ED Class	LD Code	LD Class	Bivariate Code	Change Description	Color
0	0	1	Background	0	Background	0	Background to Background	
1	22390434	1	Open Water	1	Open Water	101	Open Water to Open Water	
2	0	1	Open Water	2	Perennial Ice/Snow	102	Open Water to Perennial Ice/Snow	
3	294	1	Open Water	3	Developed, Open Space	103	Open Water to Developed, Open Space	
4	1706	1	Open Water	4	Developed, Low Intensity	104	Open Water to Developed, Low Intensity	
5	824	1	Open Water	5	Developed, Medium Intensity	105	Open Water to Developed, Medium Intensity	
6	1452	1	Open Water	6	Developed, High Intensity	106	Open Water to Developed, High Intensity	
7	14814	1	Open Water	7	Barren Land (Rock/Sand/Clay)	107	Open Water to Barren Land (Rock/Sand/Clay)	
8	308	1	Open Water	8	Deciduous Forest	108	Open Water to Deciduous Forest	
9	495	1	Open Water	9	Evergreen Forest	109	Open Water to Evergreen Forest	
10	22	1	Open Water	10	Mixed Forest	110	Open Water to Mixed Forest	
11	297	1	Open Water	11	Shrub/Scrub	111	Open Water to Shrub/Scrub	
12	934	1	Open Water	12	Grassland/Herbaceous	112	Open Water to Grassland/Herbaceous	
13	848	1	Open Water	13	Pasture/Hay	113	Open Water to Pasture/Hay	
14	4779	1	Open Water	14	Cultivated Crops	114	Open Water to Cultivated Crops	
15	1948	1	Open Water	15	Woody Wetlands	115	Open Water to Woody Wetlands	
16	13750	1	Open Water	16	Emergent Herbaceous Wetlands	116	Open Water to Emergent Herbaceous Wetlands	
17	0	2	Perennial Ice/Snow	1	Open Water	201	Perennial Ice/Snow to Open Water	
18	0	2	Perennial Ice/Snow	2	Perennial Ice/Snow	202	Perennial Ice/Snow to Perennial Ice/Snow	
19	0	2	Perennial Ice/Snow	3	Developed, Open Space	203	Perennial Ice/Snow to Developed, Open Space	
20	0	2	Perennial Ice/Snow	4	Developed, Low Intensity	204	Perennial Ice/Snow to Developed, Low Intensity	
21	0	2	Perennial Ice/Snow	5	Developed, Medium Intensity	205	Perennial Ice/Snow to Developed, Medium Intensity	
22	0	2	Perennial Ice/Snow	6	Developed, High Intensity	206	Perennial Ice/Snow to Developed, High Intensity	
23	0	2	Perennial Ice/Snow	7	Barren Land (Rock/Sand/Clay)	207	Perennial Ice/Snow to Barren Land (Rock/Sand/Clay)	
24	0	2	Perennial Ice/Snow	8	Deciduous Forest	208	Perennial Ice/Snow to Deciduous Forest	
25	0	2	Perennial Ice/Snow	9	Evergreen Forest	209	Perennial Ice/Snow to Evergreen Forest	
26	0	2	Perennial Ice/Snow	10	Mixed Forest	210	Perennial Ice/Snow to Mixed Forest	
27	0	2	Perennial Ice/Snow	11	Shrub/Scrub	211	Perennial Ice/Snow to Shrub/Scrub	
28	0	2	Perennial Ice/Snow	12	Grassland/Herbaceous	212	Perennial Ice/Snow to Grassland/Herbaceous	
29	0	2	Perennial Ice/Snow	13	Pasture/Hay	213	Perennial Ice/Snow to Pasture/Hay	
30	0	2	Perennial Ice/Snow	14	Cultivated Crops	214	Perennial Ice/Snow to Cultivated Crops	
31	0	2	Perennial Ice/Snow	15	Woody Wetlands	215	Perennial Ice/Snow to Woody Wetlands	
32	0	2	Perennial Ice/Snow	16	Emergent Herbaceous Wetlands	216	Perennial Ice/Snow to Emergent Herbaceous Wetlands	
33	0	3	Developed, Open Space	1	Open Water	301	Developed, Open Space to Open Water	
34	0	3	Developed, Open Space	2	Perennial Ice/Snow	302	Developed, Open Space to Perennial Ice/Snow	
35	4436588	3	Developed, Open Space	3	Developed, Open Space	303	Developed, Open Space to Developed, Open Space	
36	29676	3	Developed, Open Space	4	Developed, Low Intensity	304	Developed, Open Space to Developed, Low Intensity	
37	11882	3	Developed, Open Space	5	Developed, Medium Intensity	305	Developed, Open Space to Developed, Medium Intensity	
38	15233	3	Developed, Open Space	6	Developed, High Intensity	306	Developed, Open Space to Developed, High Intensity	
39	6408	3	Developed, Open Space	7	Barren Land (Rock/Sand/Clay)	307	Developed, Open Space to Barren Land (Rock/Sand/Clay)	
40	0	3	Developed, Open Space	8	Deciduous Forest	308	Developed, Open Space to Deciduous Forest	
41	0	3	Developed, Open Space	9	Evergreen Forest	309	Developed, Open Space to Evergreen Forest	
42	0	3	Developed, Open Space	10	Mixed Forest	310	Developed, Open Space to Mixed Forest	
43	0	3	Developed, Open Space	11	Shrub/Scrub	311	Developed, Open Space to Shrub/Scrub	
44	0	3	Developed, Open Space	12	Grassland/Herbaceous	312	Developed, Open Space to Grassland/Herbaceous	
45	0	3	Developed, Open Space	13	Pasture/Hay	313	Developed, Open Space to Pasture/Hay	
46	0	3	Developed, Open Space	14	Cultivated Crops	314	Developed, Open Space to Cultivated Crops	
47	0	3	Developed, Open Space	15	Woody Wetlands	315	Developed, Open Space to Woody Wetlands	
48	0	3	Developed, Open Space	16	Emergent Herbaceous Wetlands	316	Developed, Open Space to Emergent Herbaceous Wetlands	
49	0	4	Developed, Low Intensity	1	Open Water	401	Developed, Low Intensity to Open Water	
50	0	4	Developed, Low Intensity	2	Perennial Ice/Snow	402	Developed, Low Intensity to Perennial Ice/Snow	
51	0	4	Developed, Low Intensity	3	Developed, Open Space	403	Developed, Low Intensity to Developed, Open Space	

	1996	% early date	2001	% late date	area gained h	% area gained
High Intensity Developed	664102	0.50%	737385.03	0.55%	73,283.40	0.00
Medium Intensity Developed	1583030	1.18%	1689769.89	1.26%	106,739.82	0.00
Low Intensity Developed	3768107	2.81%	3919860.72	2.93%	151,754.22	0.00
Developed Open Space	1750632	1.31%	1832175.99	1.37%	81,544.14	0.00
Cultivated	15903093	11.87%	15867340.47	11.84%	- 35,752.59	- 0.00
Pasture/Hay	11602337	8.66%	11587469.76	8.65%	- 14,866.83	- 0.00
Grassland	3761972	2.81%	4308328.98	3.22%	546,356.88	0.00
Deciduous Forest	23675826	17.67%	23339339.46	17.42%	- 336,486.51	- 0.00
Evergreen Forest	12791465	9.55%	11666090.97	8.71%	- 1,125,374.13	- 0.01
Mixed Forest	9491413	7.09%	9037328.49	6.75%	- 454,084.74	- 0.00
Scrub/Shrub	9344286	6.98%	10492165.44	7.83%	1,147,879.08	0.01
Palustrine Forested Wetland	12464066	9.30%	12188957.94	9.10%	- 275,108.40	- 0.00
Palustrine Scrub/Shrub Wetland	2983971	2.23%	3013142.31	2.25%	29,171.79	0.00
Palustrine Emergent Wetland	2050297	1.53%	2059573.59	1.54%	9,276.84	0.00
Estuarine Forested Wetland	36	0.00%	523.89	0.00%	487.71	0.00
Estuarine Scrub/Shrub Wetland	8070	0.01%	7826.58	0.01%	- 243.36	- 0.00
Estuarine Emergent Wetland	1352670	1.01%	1338218.01	1.00%	- 14,452.11	- 0.00
Unconsolidated Shore	261332	0.20%	276861.15	0.21%	15,529.32	0.00
Bare Land	354710	0.26%	437562.09	0.33%	82,852.11	0.00
Water	20064984	14.98%	20078401.14	14.99%	13,416.84	0.00
Palustrine Aquatic Bed	37139	0.03%	35728.56	0.03%	- 1,410.75	- 0.00
Estuarine Aquatic Bed	49632	0.04%	49119.3	0.04%	- 512.73	- 0.00
Tundra	0	0.00%	0	0.00%	-	-
Snow/Ice	0	0.00%	0	0.00%	-	-
	133963170	**100.00%**	**133963169.8**	**100.00%**	-	0.00

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From/To	1996																										
2006	NO	HID	MID	LID	OSD	Cult	Past/Hay	Grass	Dec.	Evg.	Mix.	SS	Pal. F	Pal. S	Pal. E	Est. F	Est. S	Est. E	Uncon	Bare	Water	PAB	EAB	Tundra	Snow/Ice	Totals	% Loss
NO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	#DIV/0!
HID	0	662070	155323	99724	45931	126703	53791	52151	79303	33031	13741	30691	19803	3141	3321	0	8	1961	1491	26811	6151	1	0			737385	10.21
MID	0	637	1563913	147541	65371	306131	131741	106321	183191	93701	42711	65871	41501	7571	6511	0	2	1001	1361	44501	6971	191	1			1689770	7.45
LID	0	422	15961	3735617	112321	422141	135981	227381	229251	263361	124391	147701	74741	9741	8631	0	3	3021	2411	42051	18971	101	41			3919861	4.70
OSD	0	186	4741	25041	1719339	355421	168921	123761	161261	84581	47481	58631	39241	5761	5801	0	4	2011	871	33591	9331	71	0			1832176	6.16
Cult	0	941	2411	13341	21341	15531217	1444761	783721	230701	170091	99241	236871	219431	17361	38841	0	6	7071	1401	50011	23501	131	11			15867340	2.12
Past/Hay	0	341	2481	11721	36421	1182651	11279901	396721	252281	267161	231031	522911	118351	7921	14031	0	0	1371	601	23051	5841	791	0			11587470	2.65
Grass	0	421	1641	5561	3761	543661	286371	3103229	1280391	5687721	1484131	1370601	1155851	44071	26501	0	0	1961	2701	127591	25551	2471	71			4308329	27.97
Dec.	0	141	321	2111	4111	116221	15981	154391	23180194	92331	90331	1034021	29931	22861	6781	0	0	321	331	11141	10101	41	0			23339339	0.68
Evg.	0	11	151	861	1381	35291	15011	1310251	93891	10958222	308951	5073571	170741	42141	13121	0	0	181	291	6811	5971	71	0			11666091	6.07
Mix.	0	21	41	321	381	12991	3291	147271	113831	288191	8883647	917681	34721	9481	1401	0	0	91	61	3861	3181	01	0			9037328	1.70
SS	0	141	471	4581	2361	205001	642331	2911241	2008581	10863391	3407511	8353819	1071851	85251	69251	0	0	681	4631	73451	30651	2061	41			10492165	20.38
Pal. F	0	1	4	601	691	34881	89301	93071	27251	83911	39091	90341	12000749	904631	480311	131	0	411	441	3841	32891	271	0			12188958	1.54
Pal. S	0	4	61	551	301	37241	54371	92161	25531	187131	58051	61191	861881	2841493	250671	0	2	391	1441	4981	80341	181	0			3013142	5.70
Pal. E	0	31	111	901	711	26071	30481	29051	19311	24701	8811	52301	636971	211751	1930577	61	0	1761	6871	14091	215561	10401	31			2059574	6.26
Est. F	0	0	0	0	0	0	0	201	291	111	61	581	411	0	41	111	71	3341	0	0	21	0	0			524	97.92
Est. S	0	0	0	0	0	21	0	211	0	201	0	11	101	11	31	0	7470	2831	61	71	21	0	0			7827	4.56
Est. E	0	0	11	11	31	521	191	4441	171	561	31	251	541	311	2451	51	5261	1332815	5421	2911	27701	1981	1191			1338218	0.40
Uncon	0	37	63	52	15	1421	1301	1681	1051	861	811	1871	4301	1091	5501	0	21	15081	2447871	25861	247291	791	10151			2768661	11.59
Bare	0	453	562	924	1617	282921	90721	104921	223361	158181	97101	152881	67151	11111	12041	0	21	14491	34281	2976771	112281	1351	491			4375662	31.97
Water	0	881	1191	2271	1491	29171	58031	47081	26281	32951	24101	82361	82921	40191	243831	11	381	139121	99061	75441	19976421	31281	1771			20078401	0.51
PAB	0	0	0	0	0	341	1781	1411	311	261	71	4331	2761	391	8131	0	0	111	141	111	18171	318971	11			35729	10.72
EAB	0	0	0	0	0	0	21	01	61	21	31	01	01	11	21	0	0	1351	1611	171	5171	231	482501			49119	1.77
Tundra																										0	#DIV/0!
Snow/Ice																										0	#DIV/0!
Totals	0	664102	1583030	3768107	1750632	15903093	11602337	3761972	23675826	12791465	9491413	9344286	12464066	2983971	2050297	36	8070	1352670	261332	354710	20064984	37139	49632	0	0	12768 3314	
% Gain	#DIV/0!	0.31	1.21	0.80	1.79	2.34	2.78	17.51	2.09	14.33	6.40	10.60	3.72	4.77	5.84	69.90	7.44	1.47	6.33	16.08	0.44	14.12	2.78	#DIV/0!	#DIV/0!		
% Net Chng																											

Results

1996 - 2001

	1996	% early date	2001	% late date	area gained h	% area gained
High Intensity Developed	1023899.04	0.49%	1080238.14	0.51%	56339.1	0.03%
Medium Intensity Developed	2705047.11	1.29%	2835530.19	1.35%	130483.08	0.06%
Low Intensity Developed	5620804.74	2.67%	5859626.67	2.78%	238821.93	0.11%
Developed Open Space	2684418.93	1.28%	2795038.47	1.33%	110619.54	0.05%
Cultivated	21898861.65	10.40%	21886290.72	10.40%	-12570.93	-0.01%
Pasture/Hay	14763096.99	7.01%	14864467.23	7.06%	101370.24	0.05%
Grassland	9486798.21	4.51%	9550964.88	4.54%	64166.67	0.03%
Deciduous Forest	24624566.19	11.70%	24509308.95	11.64%	-115257.24	-0.05%
Evergreen Forest	32929875.99	15.64%	31808583.99	15.11%	-1121292	-0.53%
Mixed Forest	12422886.39	5.90%	12166210.44	5.78%	-256675.95	-0.12%
Scrub/Shrub	18614131.65	8.84%	19515771.99	9.27%	901640.34	0.43%
Palustrine Forested Wetland	19630472.22	9.33%	19044020.61	9.05%	-586451.61	-0.28%
Palustrine Scrub/Shrub Wetland	4603807.53	2.19%	4911742.35	2.33%	307934.82	0.15%
Palustrine Emergent Wetland	3893470.74	1.85%	4018295.88	1.91%	124825.14	0.06%
Estuarine Forested Wetland	201323.52	0.10%	202260.42	0.10%	936.9	0.00%
Estuarine Scrub/Shrub Wetland	104739.39	0.05%	105242.04	0.05%	502.65	0.00%
Estuarine Emergent Wetland	1987467.12	0.94%	1978825.77	0.94%	-8641.35	0.00%
Unconsolidated Shore	424484.64	0.20%	435051.54	0.21%	10566.9	0.01%
Bare Land	1272008.52	0.60%	1351772.91	0.64%	79764.39	0.04%
Water	31293499.05	14.87%	31266899.01	14.85%	-26600.04	-0.01%
Palustrine Aquatic Bed	43298.82	0.02%	43582.5	0.02%	283.68	0.00%
Estuarine Aquatic Bed	190125.45	0.09%	188980.92	0.09%	-1144.53	0.00%
Tundra	0	0.00%	0	0.00%	0	0.00%
Snow/Ice	73919.88	0.04%	74292.84	0.04%	372.96	0.00%
	210493003.8	**100.00%**	**210492998.5**	**100.00%**		

Results
1996 - 2001

- Total percent change in Land Cover = 3.98% for area studied
- Total hectares change = 8,375,270
- Biggest change was a loss in Evergreen Forest
  - 1,121,292 hectares
  - Forest harvesting for paper production (civiculture)
  - Accounts for about 13% of all change
- Second biggest change was a gain in Scrub/Shrub
  - 901,640 hectares
  - Also due to forest harvesting
- Biggest from-to class change was Evergreen Forest to Scrub/Shrub
- Most prolific urban class change was an increase in LID
  - 238,822 hectares
  - HID and MID also increased
- Biggest wetland change
  - Forested wetland loss – 586,452 hectares

Results

2001- 2006

	2001	% early date	2006	% late date	area gained h	% area gained
High Intensity Developed	694483	0.52%	737385.03	0.55%	42902.46	0.03%
Medium Intensity Developed	1652301	1.23%	1689769.71	1.26%	37468.44	0.03%
Low Intensity Developed	3906000	2.92%	3919860.72	2.93%	13860.99	0.01%
Developed Open Space	1814667	1.35%	1832175.99	1.37%	17509.23	0.01%
Cultivated	15800970	11.80%	15867340.29	11.84%	66370.23	0.05%
Pasture/Hay	11703570	8.74%	11587469.76	8.65%	-116099.82	-0.09%
Grassland	3907654	2.92%	4308328.98	3.22%	400675.23	0.30%
Deciduous Forest	23507090	17.55%	23339339.46	17.42%	-167750.1	-0.13%
Evergreen Forest	12218268	9.12%	11666090.97	8.71%	-552177.27	-0.41%
Mixed Forest	9213333	6.88%	9037328.49	6.75%	-176004.18	-0.13%
Scrub/Shrub	9918338	7.40%	10492165.44	7.83%	573827.94	0.43%
Palustrine Forested Wetland	12396213	9.25%	12188957.94	9.10%	-207255.51	-0.15%
Palustrine Scrub/Shrub Wetland	3012899	2.25%	3013142.31	2.25%	243.36	0.00%
Palustrine Emergent Wetland	2054731	1.53%	2059573.59	1.54%	4842.99	0.00%
Estuarine Forested Wetland	9	0.00%	523.89	0.00%	515.16	0.00%
Estuarine Scrub/Shrub Wetland	8113	0.01%	7826.58	0.01%	-286.29	0.00%
Estuarine Emergent Wetland	1346236	1.00%	1338218.01	1.00%	-8017.74	-0.01%
Unconsolidated Shore	275075	0.21%	276861.15	0.21%	1785.69	0.00%
Bare Land	405333	0.30%	437562.09	0.33%	32229.27	0.02%
Water	20041122	14.96%	20078401.14	14.99%	37278.81	0.03%
Palustrine Aquatic Bed	37052	0.03%	35728.56	0.03%	-1323.72	0.00%
Estuarine Aquatic Bed	49710	0.04%	49119.3	0.04%	-590.22	0.00%
Tundra	0	0.00%	0	0.00%	0	0.00%
Snow/Ice	0	0.00%	0	0.00%	0	0.00%
	133963164.5	**100.00%**	**133963169.4**	**100.00%**		

Results

2001- 2006

- **Total percent change in Land Cover = 2.33% for area studied**
- **Total hectares change = 3,126,304**
  - **2006 was not complete for every zone**
- **Biggest change was a gain in Scrub/Shrub**
  - 573,827 hectares
  - Forest harvesting for paper production
  - Accounts for about 18% of all change
- **Second biggest change was loss in Evergreen Forest**
  - 552,177 hectares
  - Also due to forest harvesting
- **Biggest from-to class change was Evergreen Forest to Scrub/Shrub**
- **Most prolific urban class change was an increase in HID**
  - 42,902 hectares
  - MID increased more than LID
- **Biggest wetland change**
  - Forested wetland loss – 207,252 hectares

Results

1996 - 2006

	1996	% early date	2001	% late date	area gained h	% area gained
High Intensity Developed	664102	0.50%	737385.03	0.55%	73283.4	0.05%
Medium Intensity Developed	1583030	1.18%	1689769.89	1.26%	106739.82	0.08%
Low Intensity Developed	3768107	2.81%	3919860.72	2.93%	151754.22	0.11%
Developed Open Space	1750632	1.31%	1832175.99	1.37%	81544.14	0.06%
Cultivated	15903093	11.87%	15867340.47	11.84%	-35752.59	-0.03%
Pasture/Hay	11602337	8.66%	11587469.76	8.65%	-14866.83	-0.01%
Grassland	3761972	2.81%	4308328.98	3.22%	546356.88	0.41%
Deciduous Forest	23675826	17.67%	23339339.46	17.42%	-336486.51	-0.25%
Evergreen Forest	12791465	9.55%	11666090.97	8.71%	-1125374.13	-0.84%
Mixed Forest	9491413	7.09%	9037328.49	6.75%	-454084.74	-0.34%
Scrub/Shrub	9344286	6.98%	10492165.44	7.83%	1147879.08	0.86%
Palustrine Forested Wetland	12464066	9.30%	12188957.94	9.10%	-275108.4	-0.21%
Palustrine Scrub/Shrub Wetland	2983971	2.23%	3013142.31	2.25%	29171.79	0.02%
Palustrine Emergent Wetland	2050297	1.53%	2059573.59	1.54%	9276.84	0.01%
Estuarine Forested Wetland	36	0.00%	523.89	0.00%	487.71	0.00%
Estuarine Scrub/Shrub Wetland	8070	0.01%	7826.58	0.01%	-243.36	0.00%
Estuarine Emergent Wetland	1352670	1.01%	1338218.01	1.00%	-14452.11	-0.01%
Unconsolidated Shore	261332	0.20%	276861.15	0.21%	15529.32	0.01%
Bare Land	354710	0.26%	437562.09	0.33%	82852.11	0.06%
Water	20064984	14.98%	20078401.14	14.99%	13416.84	0.01%
Palustrine Aquatic Bed	37139	0.03%	35728.56	0.03%	-1410.75	0.00%
Estuarine Aquatic Bed	49632	0.04%	49119.3	0.04%	-512.73	0.00%
Tundra	0	0.00%	0	0.00%	0	0.00%
Snow/Ice	0	0.00%	0	0.00%	0	0.00%
	133963170	**100.00%**	**133963169.8**	**100.00%**		

Results

1996 - 2006

- **Total percent change in Land Cover = 4.69% for area studied**
- **Total hectares change = 6,279,856**
- **Biggest change was a gain in Scrub/Shrub**
  - 1,147,879 hectares
  - Forest harvesting for paper production
  - Accounts for about 18% of all change
- **Second biggest change was a loss in Evergreen Forest**
  - 1,125,374 hectares
  - Also due to forest harvesting
- **Biggest from-to class change was Evergreen Forest to Scrub/Shrub**
- **Most prolific urban class change was an increase in LID**
  - 151,754 hectares
  - HID and MID also increased
- **Biggest wetland change**
  - Forested wetland loss – 275,108 hectares

Conclusions

Most Important Change Types in the US Coastal Areas in the Past 10 Years

- The most prolific environmental change is forest loss due to industrial harvesting and corresponding increase in scrub.
- The most prolific wetland change is wetland forest loss.
- The biggest trend in urban change is suburban growth.
- Over 4.5 % of the coastal area studied exhibited a change in class.
- There is not much difference in the types of change between 1996-2001 and 2001-2006.
- Raises questions:
  - Forests are being harvested faster than they can grow back.
  - Wetland forest (as categorized by NWI) are being harvested too.
  - Are we losing more or less forest over time? We'll know when we finish 2006.

Coastal Trends 1996 to 2001

- Area the size of Maine "changed" between 1996 and 2001
  - Largest area(s) of change a result of siviculture activities
  - Primarily in the Southeast and Eastern Gulf

- Development increase equal to 7.5 New York Cities (2,275 sq miles)
  - 10% of coastal counties account for almost half
  - Occurring at a faster rate in the Southeast (53%)
  - Primarily "low intensity"
    - commonly associated with suburban residential neighborhoods.

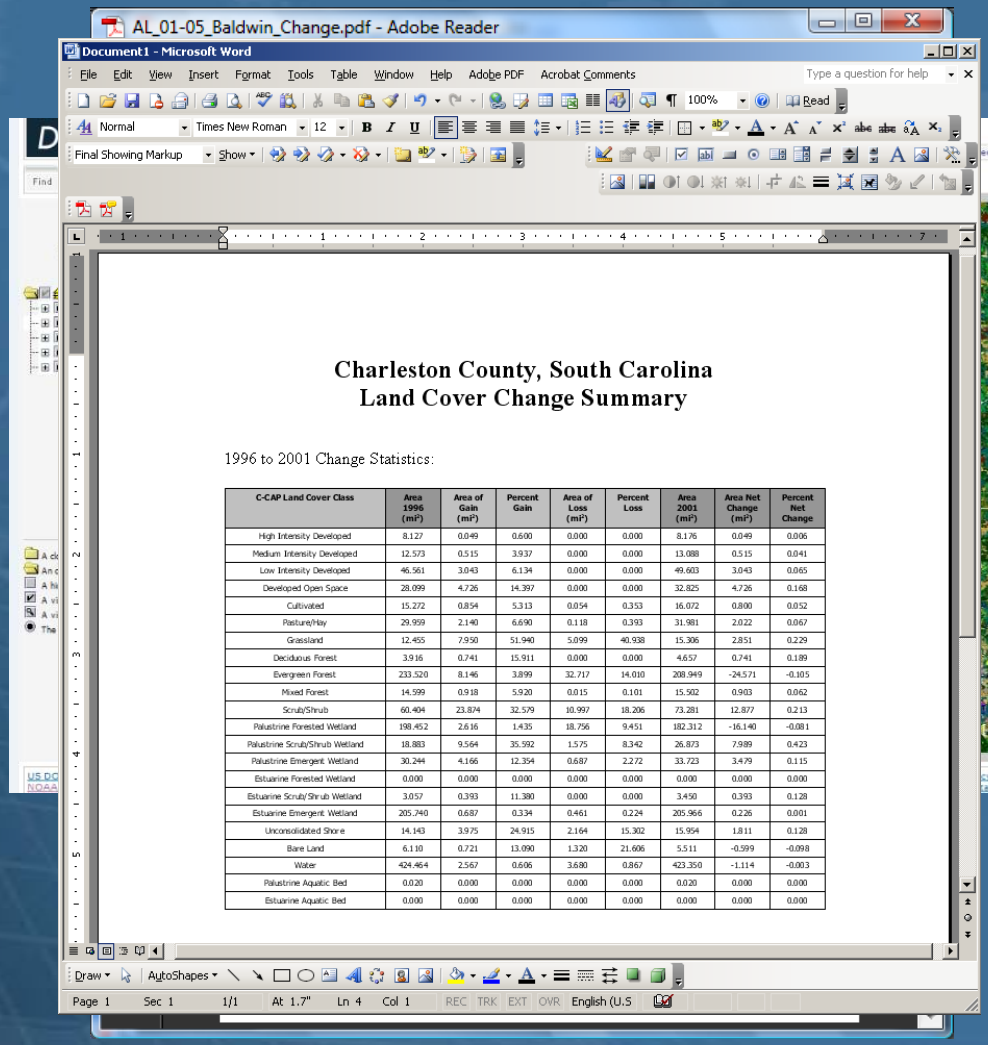
Future Studies

C-CAP will continue adding data back in time and forward

- Complete 2006 dataset.
- Expand this study all the way back to the 1970's.
- Continue study into the future.

C-CAP Land Cover Atlas

- Way for technical and non-technical users to:
  - Visualize land cover distribution, condition
  - Query and analyze specific changes of interest
  - Generate reports, maps, and summary info
- Sneak peak in Tech clinic Tomorrow



Charleston County, South Carolina
Land Cover Change Summary

1996 to 2001 Change Statistics:

C-CAP Land Cover Class	Area 1996 (mi²)	Area of Gain (mi²)	Percent Gain	Area of Loss (mi²)	Percent Loss	Area 2001 (mi²)	Area Net Change (mi²)	Percent Net Change
High Intensity Developed	8.127	0.049	0.600	0.000	0.000	8.176	0.049	0.006
Medium Intensity Developed	12.573	0.515	3.937	0.000	0.000	13.088	0.515	0.041
Low Intensity Developed	46.561	3.043	6.134	0.000	0.000	49.603	3.043	0.065
Developed Open Space	28.099	4.726	14.397	0.000	0.000	32.825	4.726	0.168
Cultivated	15.272	0.854	5.313	0.054	0.353	16.072	0.800	0.052
Pasture/Hay	29.959	2.140	6.690	0.118	0.393	31.981	2.022	0.067
Grassland	12.455	7.950	51.940	5.099	40.938	15.306	2.851	0.229
Deciduous Forest	3.916	0.741	15.911	0.000	0.000	4.657	0.741	0.189
Evergreen Forest	233.520	8.146	3.899	32.717	14.010	208.949	-24.571	-0.105
Mixed Forest	14.599	0.918	5.920	0.015	0.101	15.502	0.903	0.062
Scrub/Shrub	60.404	23.874	32.579	10.997	18.206	73.281	12.877	0.213
Palustrine Forested Wetland	198.452	2.616	1.435	18.756	9.451	182.312	-16.140	-0.081
Palustrine Scrub/Shrub Wetland	18.883	9.564	35.592	1.575	8.342	26.873	7.989	0.423
Palustrine Emergent Wetland	30.244	4.166	12.354	0.687	2.272	33.723	3.479	0.115
Estuarine Forested Wetland	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Estuarine Scrub/Shrub Wetland	3.057	0.393	11.380	0.000	0.000	3.450	0.393	0.128
Estuarine Emergent Wetland	205.740	0.687	0.334	0.461	0.224	205.966	0.226	0.001
Unconsolidated Shore	14.143	3.975	24.915	2.164	15.302	15.954	1.811	0.128
Bare Land	6.110	0.721	13.090	1.320	21.606	5.511	-0.599	-0.098
Water	424.464	2.567	0.606	3.680	0.867	423.350	-1.114	-0.003
Palustrine Aquatic Bed	0.020	0.000	0.000	0.000	0.000	0.020	0.000	0.000
Estuarine Aquatic Bed	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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