Central California Valley
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Ecoregion Description

The Central California Valley Ecoregion is an elongated basin extending approximately 650-km north to south through central California (fig. 1) (Omernik, 1987; U.S. Environmental Protection Agency, 1997). The ecoregion is bound by the Sierra Nevada mountain range to the east the Coast Range to the west. Characterized by its flat terrain, fertile soils, favorable climate, and with nearly 70 percent of its land in cultivation (NLCD, 2001), the Central California Valley accounts for more than half of California's agricultural production value and is one of the most important agricultural regions in the country (Kuminoff and others, 2000; Sumner and others, 2003). Commodities produced in the region include milk and dairy, cattle and calves, cotton, almonds, citrus, and grapes among others (U.S. Department of Agriculture, 2004; Johnston, W.E. and A.F. McCalla, 2004, Kuminoff and others, 2000). Six of the top eight agricultural producing counties in California are located at least partially within the Central California Valley Ecoregion (Kuminoff, 2000)(table 1). The Central California Valley is also home to nearly 5 million people spread throughout the ecoregion, including the major cities of Sacramento (state capitol), Fresno, Bakersfield, and Stockton (U.S. Census Bureau, 2000) (fig 1).

Contemporary Land Cover Change (1973 to 2000)

The overall spatial change in the ecoregion (i.e. the percentage of area that changed at least one time between 1973 and 2000) was estimated at 12.4 percent (+/- 3.0% at an 85% confidence interval) (table 2). Compared to other western ecoregions, change in the Central California Valley was above average (fig. 2). Total estimated change is highest in the first interval (1973-1980) with 5.7 percent of the ecoregion changing from one land cover type to another (table 3). When change estimates are normalized to account for the varying lengths of the temporal intervals, change is highest in the first interval (1973 to 1980; 0.8% per year) and then constant for the following three periods at just greater than 0.5 percent per year (fig. 3).

The largest change in any one land cover class between 1973 and 2000 was the loss of 1,777-km^2 of grasslands/shrublands (3.9 percent of total ecoregion area). In 1973, it was estimated that grasslands/shrublands accounted for 19.2 percent of the ecoregion while in 2000 the class accounted for 15.4 percent. The second largest change was the addition of 1,127-km^2 of developed covers (2.5 percent of ecoregion area); increasing from 6.5 to 9.0 percent of the ecoregion area. Agriculture, which accounted for more than 70% of ecoregion area, remained relatively stable throughout the study period with a net increase of 357-km^2 (0.8% of ecoregion area). Estimates of percent cover for all land cover classes by interval can be found in table 4 and estimates of average annual change by class can be found in figure 4.

The dominant land cover transition that occurred in the Central California Valley was the conversion of grasslands/shrublands to agriculture. This transition was most common near the ecoregion periphery, as historically open grazing lands were brought into agricultural production to grow grapes, nut crops, and citrus (Sleeter, B.M., and R. Auch,

unpublished data, 2004). This change may also be attributed to being part of the tilling cycle where farmers allow parcels of land to revert back to natural vegetation before eventually being brought back into production at a later date. This particular transition (grasslands/shrublandslands to agriculture) accounted for 45.0 percent of all change in the ecoregion. The second most common conversion was from agriculture to grasslands/shrublands (26.5 percent of all change). Again, a portion of this change can be attributed to the cycling of cropland in and out of production; although, another common instance where this transition was observed was at the edge of urban areas and new development (Sleeter, B.M., and R. Auch, unpublished data, 2004). As urban areas expand at their periphery agricultural land is converted, sometimes directly, to developed land. In many instances there is also a transition period where farm land converts to grasslands/shrublands prior to being developed. The third and fourth most common conversions were from agriculture and grasslands/shrublands to developed (9.2 and 4.9 percent of ecoregion change, respectively). Combined, the top four conversions account for 88 percent of all change in the ecoregion between 1973 and 2000. A detailed description of the most common land cover conversions for the Central California Valley can be found in table 5.

A major driver of change in the ecoregion was population growth. Population growth in the San Francisco Bay Area and Los Angeles, as well as in the Central Valley itself, has resulted in a high demand for land for urban uses. Within the ecoregion, as new development adjacent to existing urban areas converts agricultural land to homes, businesses and other urban uses, farms are relocating to the ecoregion periphery and in turn converting traditional grazing lands (grasslands/shrublands) into new agriculture uses. Annual climactic variability may also play a role in the rates, and more importantly the types of land cover conversions that occurred in the ecoregion. In all but the 1986 to 1992 interval the leading conversion was from grasslands/shrublands to agriculture and the second most common conversion was from agriculture to grasslands/shrublands. This pattern reversed itself during the 1986 to 1992 interval which also corresponded to a period of prolonged drought in California (fig. 5). During this period, irrigation water supply shortages coupled with increased cost and conservation efforts led to decreased production in some of the Central California Valley's primary crops such as cotton and rice (U.S. Department of Agriculture, 1991). In response to the reduced surface water supplies, producers who normally relied on irrigation increased groundwater usage, idled some land, sought to minimize waste, and shifted water to produce higher value crops (U.S. Department of Agriculture, 1991). In 1991, conservation efforts alone resulted in not irrigating 56,500 acres of corn, 36,000 acres of wheat, 12,600 areas of pasture, 9,200 acres of alfalfa, and 9,100 acres of sugar beats (U.S. Department of Agriculture, 1991) while surface water shortages resulted in a U.S. Department of Agriculture forecasted 14 percent decrease in cotton production and 23 percent decrease in rice production (U.S. Department of Agriculture, 1991).

The loss of farmland to urban uses is often assumed to be the single greatest threat to this region (Hart, 2003). While significant amounts of high quality farmland are being converted to permanent urban uses (an estimated 684 km^2 between 1973 and 2000), agriculture is evolving and in fact increasing in scale (Sleeter, B.M., unpublished data,

2007; Hart, 2003; Johnston and McCalla, 2004). Farmers continue to make use of advances in irrigation, such as drip systems, in an effort to cultivate lands once considered marginal for traditional crops (Charbonneau, 1993). Central California Valley agriculture continues it's adaptation through investments in higher-value, higher-risk crops, such as almonds and grapes, in exchange for traditional field crops such as alfalfa and grains (U.S. Department of Agriculture, 2004; Johnston and McCalla, 2004) (fig. 6). This is possible because these higher-value crops are able to be successfully cultivated on slopes at the ecoregion periphery and on soils of significantly lesser quality than those found on the fertile valley floor.

California has led the nation in agricultural cash receipts in every year since 1948 and in 1999 recorded nearly $25 billion while California farmers have increased their national share from 9.5% in 1960 to 13.1% in 1999 (Kuminoff, 2000). For comparison, Australia and Canada each had approximately $18.5 billion in cash receipts in 1999 (Kuminoff, 2000). Due to the ecoregion's economic importance, consequences of land cover change are of significant concern at multiple scales and will require detailed analysis. As California's population continues to increase additional demands will be placed on the Central California Valley ecoregion to support people and the agricultural complex they depend on, resulting in the continued evolution of the nation's most diverse agricultural region.

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FIGURES AND TABLES

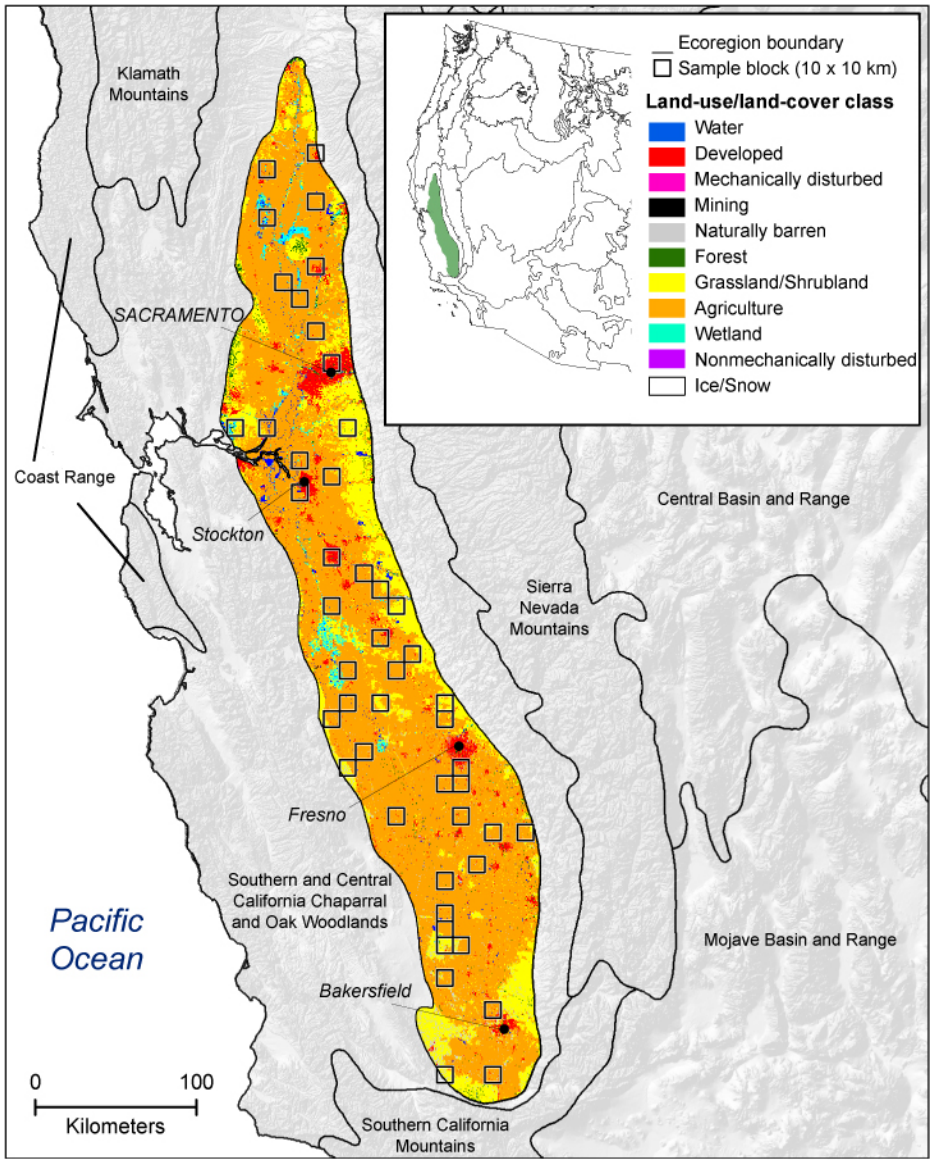

Figure 1: The underlying land cover is from the 1992 National Land Cover Database (Vogelmann and others, 2001). The 48, 10 km x 10 km sample sites for the Land Cover Trends project are shown in black. **Click on image to enlarge**

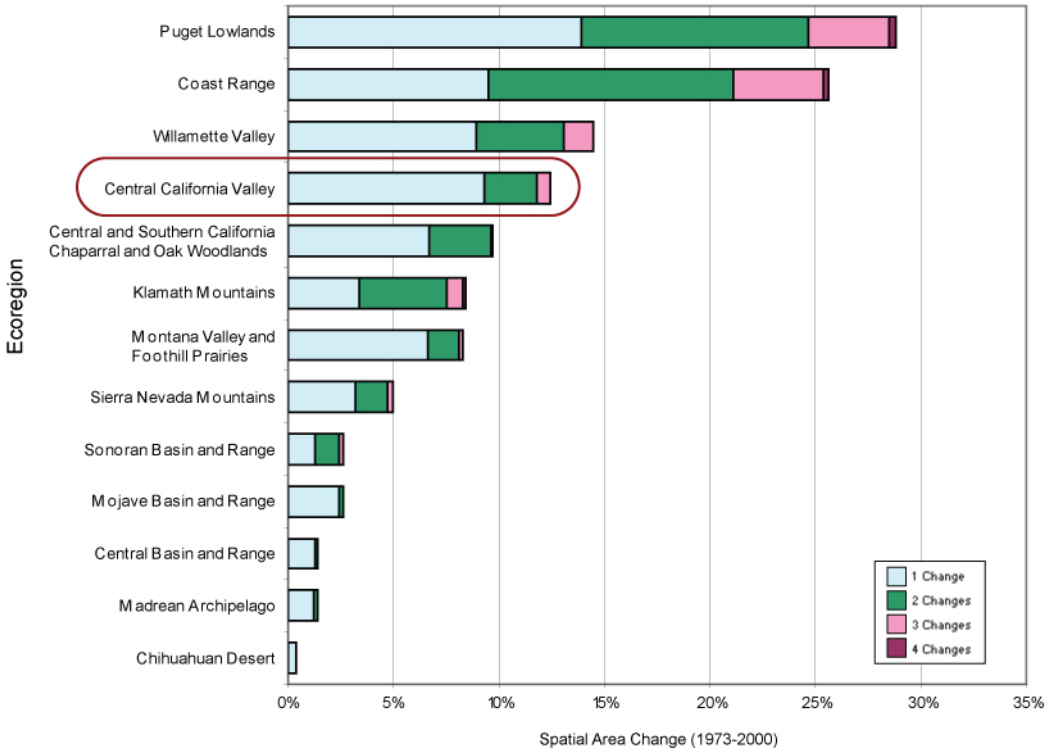

Figure 2: The overall spatial change in all completed Western U.S. ecoregions. Each bar chart shows the proportion of the ecoregion that experienced change on 1, 2, 3, or 4 dates. **Click on image to enlarge**

Figure 3: Estimates of land cover change per time interval normalized to annual rates of change for all western ecoregions (gray bars). Estimates of change by temporal interval for the Central California Valley are represented by the red bars. **Click on image to enlarge**

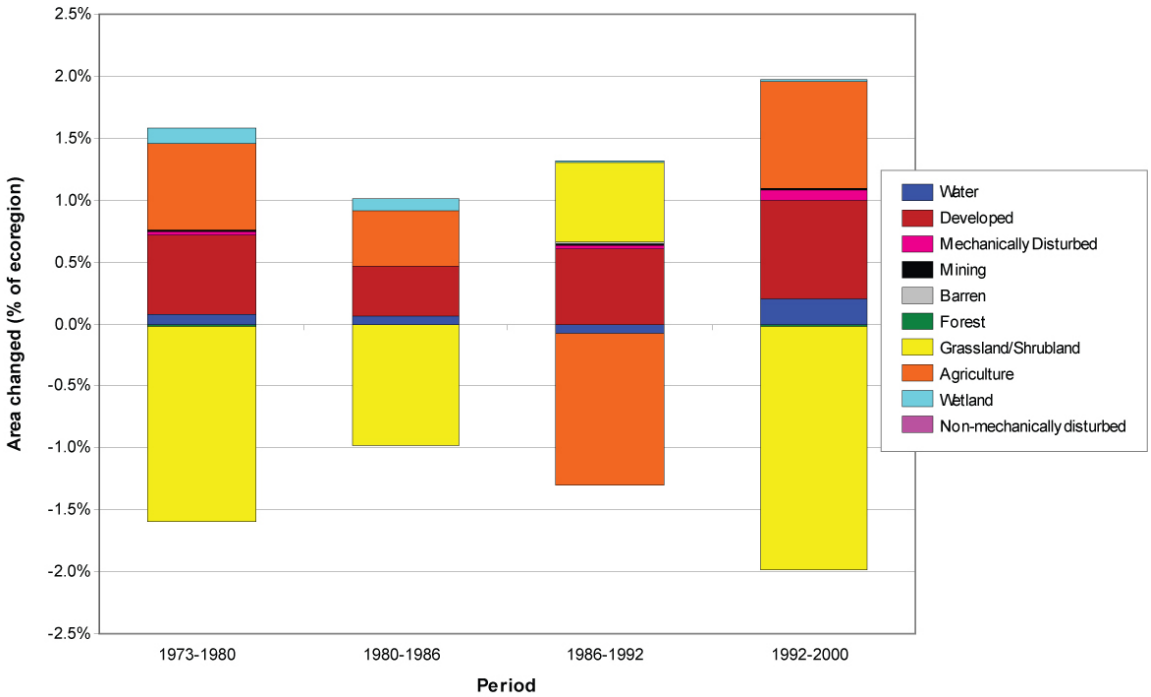

Figure 4: Per period net change for each mapped land cover class. Area above the zero axis represent net gains for a land cover class, while areas below represent net loss. **Click on image to enlarge**

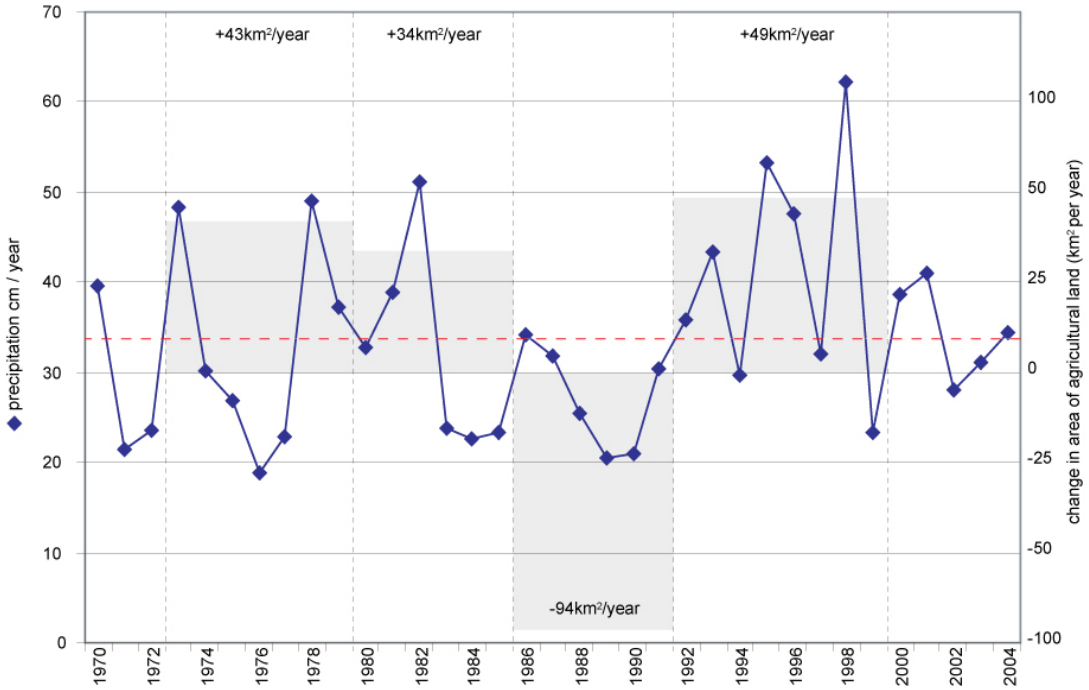

Figure 5: Comparison of net changes in the agriculture class and average annual precipitation. Precipitation calculated using precipitation data from PRISM Group, Oregon State University, 2004. Average precipitation for the period 1970 to 2004 is represented by the dashed red line. **Click on image to enlarge**

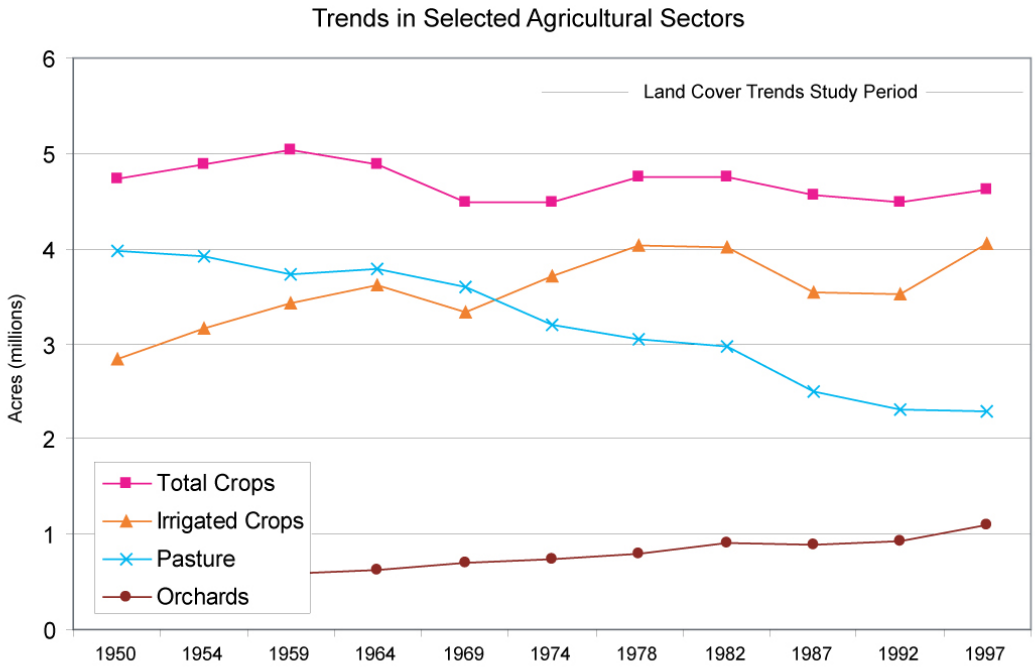

Figure 6: Changes in California agriculture (total crops, irrigated crops, pasture, and orchards) between 1950 and 1997 (U.S. Department of Agriculture, 2004)

Central California Valley Counties* by Gross Value of Agricultural Production in 1999**

CA County Rank (1999)	County	Value of Production ($ million)	Top Commodities***
1	Fresno	3,559	Grapes, Poultry, Cotton, Tomatoes, Milk
2	Tulare	3,075	Milk, Grapes, Navel and Valencia Oranges, Cattle and Calves, Plums
4	Kern	2,128	Grapes, Cotton & Processed Cottonseed, Citrus, Milk, Almonds & By-Products
5	Merced	1,534	Milk, Chickens, Almonds, Tomatoes, Cotton
6	San Joaquin	1,352	Grapes, Milk, Tomatoes, Cherries, Almond Meats
8	Stanislaus	1,210	Milk, Almonds, Chickens, Cattle & Calves, Tomatoes
12	Kings	901	Milk, Cotton, Cattle & Calves, Turkeys, Alfalfa Hay
14	Madera	700	Grapes, Milk, Almonds, Pistachios, Nursery Stock
18	Colusa	351	Rice, Processing Tomatoes, Almond M eats, Cucumber Seed, Rice Seed
19	Sutter	347	Rice, Prunes, Peaches, Tomatoes, Walnuts
21	Yolo	339	Processing Tomatoes, Winegrapes, Seed Crops, Rice, Alfalfa
22	Sacramento	293	Winegrapes, Milk, Bartlett Pears, Processing Tomatoes, Ornamental Nursery Stock
23	Butte	257	Milling Rice, Almonds, Prunes, Walnuts, Kiwifruit
24	Glenn	253	Rice Paddy, Dairy Products, Almonds, Prunes, Cattle & Calves
28	Solano	195	Processing Tomatoes, Nursery Stock, Alfalfa Hay, Winegrapes, Cattle & Calves
34	Yuba	108	Rice, Peaches, Walnuts, Cattle & Calves, Prunes
35	Tahama	97	Cattle & Calves, Walnuts, Prunes, Milk, Olives
37	Contra Costa	86	Bedding Plants, All Milk, All Tomatoes, Grapes, Sweet Corn
39	Placer	58	Rice, Cattle & Calves, Nursery, Chickens, Pasture & Range, Walnuts
47	Amador	19	Winegrapes, Cattle & Calves, Pasture & Range, Grain Hay, Alfalfa Hay
49	Mariposa	18	Cattle & Calves, Range, Misc. Livestock/Poultry Products, All Poultry
51	Calaveras	15	Cattle & Calves, Winegrapes, Poultry, Livestock & Poultry Products, Walnuts

* Defined as counties that intersect the boundary of the Central California Valley Ecoregion (Omernik, 1987; EPA, 1999)

**The “gross value of production” includes all farm production whether sold into usual marketing channels, or used on the farm where produced

***The “top commodities” column reflects information reported by the agricultural commissioners of each county. The level of detail reported differs by county. For example, some may report grapes (table, raisin, and wine) as an aggregate category, while others may report them as distinct categories.

Source: California Agricultural Statistics Service, 2000; Adapted from Kuminoff and others, 2000

Table 1: Gross value of agricultural production in 1999 by county in the Central Valley

	Overall spatial change	Number of changes			
		1	2	3	4
Percent of ecoregion	12.4%	9.3%	2.0%	0.6%	0.0%
Margin of error (85% confidence interval)	+/-3.0%	+/-2.0%	+/-1.3%	+/-0.3%	+/-0.0%

Table 2: Percentage of the ecoregion touched by change. 79.6 percent of all pixels in the ecoregion were unchanged throughout the study period, while 20.4 percent were touched by changed one or more times.

	Period			
	1973-1980	1980-1986	1986-1992	1992-2000
Total Change (% of ecoregion)	5.7%	3.3%	3.0%	4.1%
Margin of error (85% confidence interval)	+/-1.4%	+/-0.8%	+/-1.2%	+/-1.3%
Average annual rate of change (%/year)	0.8%	0.5%	0.5%	0.5%

Table 3: The overall spatial change in all Eastern U.S. ecoregions. Each bar chart shows the proportion of the ecoregion that experienced change on 1, 2, 3, or 4 dates. **Click on image to enlarge**

	1973		1980		1986		1992		2000		Net change 1973-2000	
Land-use/land-cover class	**km2**	**%**	**km2**	**%**	**km2**	**%**	**km2**	**%**	**km2**	**%**	**km2**	**%**
Water	298	0.7%	330	0.7%	357	0.8%	321	0.7%	412	0.9%	115	0.3%
Developed	2982	6.5%	3279	7.2%	3462	7.6%	3742	8.2%	4108	9.0%	1127	2.5%
Mechanically Disturbed	18	0.0%	27	0.1%	23	0.1%	366	0.8%	73	0.2%	55	0.1%
Mining	78	0.2%	87	0.2%	87	0.2%	92	0.2%	96	0.2%	18	0.0%
Barren	0	0.0%	0	0.0%	0	0.0%	46	0.1%	0	0.0%	0	0.0%
Forest	156	0.3%	147	0.3%	147	0.3%	147	0.3%	142	0.3%	-14	0.0%
Grassland/Shrubland	8807	19.2%	8084	17.7%	7639	16.7%	7933	17.3%	7030	15.4%	-1777	-3.9%
Agriculture	32802	71.6%	33118	72.3%	33324	72.8%	32765	71.5%	33159	72.4%	357	0.8%
Wetland	655	1.4%	714	1.6%	760	1.7%	769	1.7%	779	1.7%	124	0.3%
Non-mechanically disturbed	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Table 4: Percentages of each land cover class for the five mapped dates.

Period	From class	To class	Area changed (km2)	% of all changes
1973-1980	Grass/Shrub	Agriculture	1305	49.7%
	Agriculture	Grass/Shrub	748	28.5%
	Agriculture	Developed	177	6.7%
	Grass/Shrub	Developed	106	4.0%
	Agriculture	Wetland	71	2.7%
	Other classes	Other classes	216.5	8.3%
			2623.5	100.0%
1980-1986	Grass/Shrub	Agriculture	734	48.8%
	Agriculture	Grass/Shrub	316	21.0%
	Agriculture	Developed	98	6.5%
	Grass/Shrub	Developed	71	4.7%
	Agriculture	Water	57	3.8%
	Other classes	Other classes	227.6	15.1%
			1503.6	100.0%
1986-1992	Agriculture	Grass/Shrub	675	48.4%
	Grass/Shrub	Agriculture	271	19.4%
	Agriculture	Developed	160	11.5%
	Grass/Shrub	Developed	101	7.2%
	Water	Agriculture	44	3.2%
	Other classes	Other classes	144	10.3%
			1395	100.0%
1992-2000	Grass/Shrub	Agriculture	1024	54.5%
	Agriculture	Developed	249	13.3%
	Agriculture	Grass/Shrub	225	12.0%
	Grass/Shrub	Developed	89	4.7%
	Agriculture	Mech. Disturbed	62	3.3%
	Other classes	Other classes	230.2	12.2%
			1879.2	100.0%

Overall:

1973-2000	Grass/Shrub	Agriculture	3334	45.0%
	Agriculture	Grass/Shrub	1965	26.5%
	Agriculture	Developed	684	9.2%
	Grass/Shrub	Developed	366	4.9%
	Agriculture	Wetland	165	2.2%
	Other classes	Other classes	887.3	12.0%
			7401.3	100.0%

Table 5: The five most common land cover conversions for each of the four time periods.