Chapter 6

Montana Valley and Foothill Prairies Ecoregion

By Janis L. Taylor

Ecoregion Description

The Montana Valley and Foothill Prairies Ecoregion comprises numerous intermountain valleys and low-elevation foothill prairies spread across the western half of Montana, on both sides of the Continental Divide (Omernik, 1987; U.S. Environmental Protection Agency, 1997). The ecoregion, which covers approximately 64,658 km^2 (24,965 mi^2), includes the Flathead Valley and the valleys surrounding Helena, Missoula, Bozeman, Billings, Anaconda, Dillon, and Lewistown (fig. 1). These valleys are generally characterized by shortgrass prairie vegetation and are flanked by forested mountains (Woods and others, 1999); thus, the valleys' biotas with regards to fish and insects are comparable. In many cases, the valleys are conduits for some of the largest rivers in the state, including Clark Fork and the Missouri, Jefferson, Madison, Flathead, Yellowstone, Gallatin, Smith, Big Hole, Bitterroot, and Blackfoot Rivers (fig. 2). The Montana Valley and Foothill Prairies Ecoregion also includes the "Rocky Mountain front," an area of prairies along the eastern slope of the northern Rocky Mountains. Principal land uses within the ecoregion include farming, grazing, and mining. The valleys serve as major transportation and utility corridors and also contain the majority of Montana's human population.

The Montana Valley and Foothill Prairies Ecoregion extends into 17 mostly rural counties throughout western Montana. Only three of the counties—Carbon, Yellowstone, and Missoula—are part of a metropolitan statistical area with

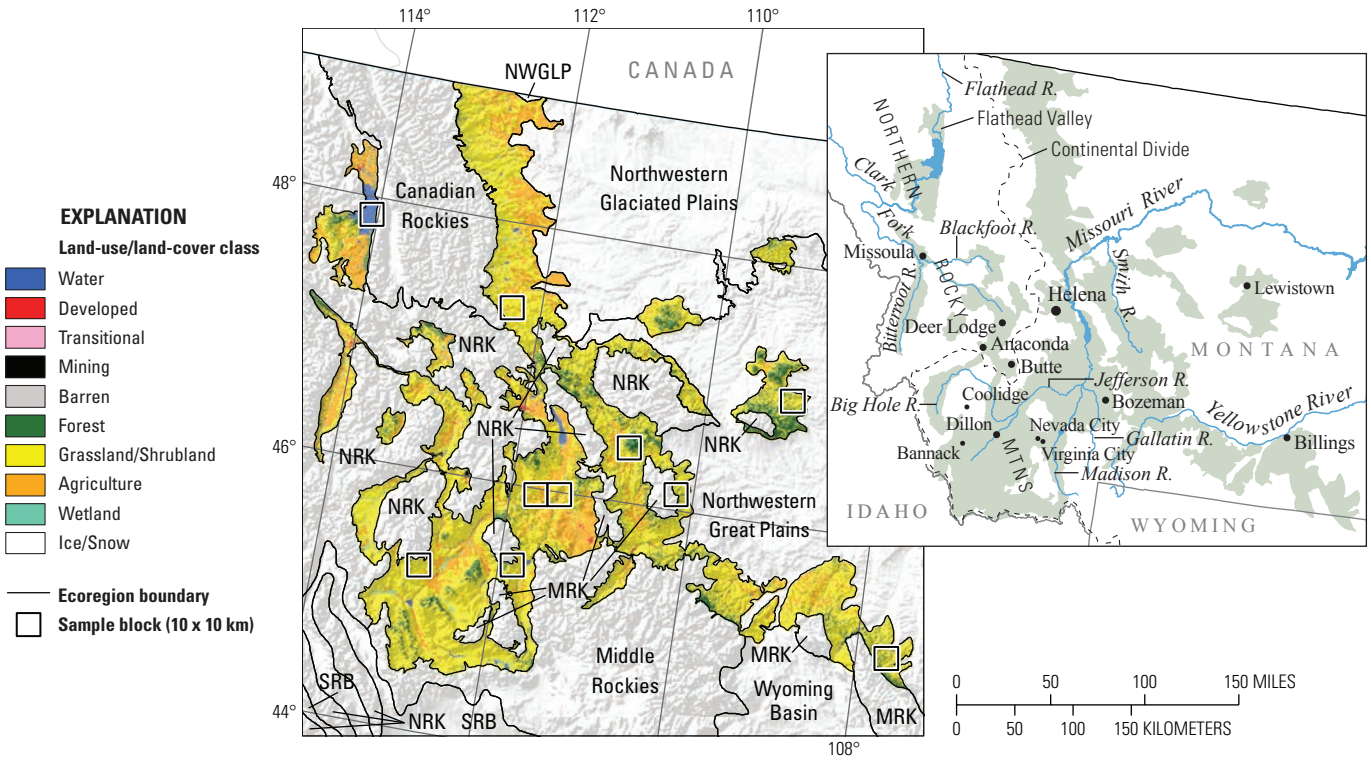

Figure 1. Map of Montana Valley and Foothill Prairies Ecoregion and surrounding ecoregions, showing land-use/land-cover classes from 1992 National Land Cover Dataset (Vogelmann and others, 2001); note that not all land-use/land-cover classes shown in explanation may be depicted on map; note also that, for this "Status and Trends of Land Change" study, transitional land-cover class was subdivided into mechanically disturbed and nonmechanically disturbed classes. Squares indicate locations of 20 x 20 km sample blocks analyzed in study. Index map shows locations of geographic features mentioned in text. Abbreviations for Western United States ecoregions are listed in appendix 2. Also shown on map are parts of two Great Plains ecoregions: Northwestern Glaciated Plains (NWGLP) and Northwestern Great Plains. See appendix 3 for definitions of land-use/land-cover classifications.

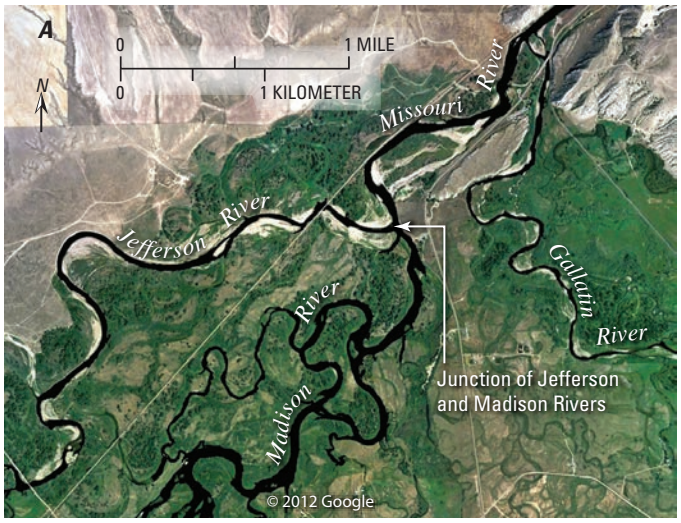

Figure 2. Headwaters of Missouri River in Montana Valley and Foothill Prairies Ecoregion. *A*, Satellite image showing Jefferson and Madison Rivers coming together to form Missouri River. Downstream from junction, note Gallatin River also joining Missouri River. *B*, View to west of junction of Jefferson and Madison Rivers. Photograph by Terry Sohl, 1999.

Figure 3. View of Trident Mine, Montana. Photograph by Terry Sohl, 1999.

contiguous built-up areas tied to an employment center. Nearly two-thirds of Montana residents live in nonmetropolitan counties (Albrecht, 2008). Ten of the counties within the ecoregion had population growth rates greater than national averages (9–13 percent) between 1970 and 2000 (table 1). Ravalli and Gallatin Counties had the highest growth rates. Population growth was largely due to amenity-related in-migration and an economy dependent on tourism, health care, and services. Counties that had population declines, such as Deer Lodge, Silver Bow, and Meagher Counties, also had declines in agriculture and mining activity, and they had railroad closures as well.

Climate varies from north to south and from the east side of the Continental Divide to the west side. However, all areas are semiarid with long cold winters and short growing seasons. In the western part of the ecoregion, Beaverhead, Bitterroot, Flathead, and Lolo National Forests provide the natural resources, particularly timber, that form the economic base for towns within nearby valleys. Mineral resources from mines in and around Anaconda, Deer Lodge, and Butte have long provided an economic base for these towns (fig. 3).

Contemporary Land-Cover Change (1973 to 2000)

The overall spatial change—the percentage of land area within the Montana Valley and Foothill Prairies Ecoregion where land cover changed at least once between 1973 and 2000—was 8.1 percent (5,252 km^2). Of that total, 6.5 percent (4,203 km^2) changed one time, and 1.5 percent (970 km^2) changed two or more times (table 2). Compared to the amount of overall change in each of the 30 western United States ecoregions, this ecoregion falls in the middle (fig. 4).

Total percent change in each of the four time periods ranged from a low of 1.6 percent (1,039 km^2) between 1973 and 1980 to a high of 3.4 percent (2,229 km^2) between 1992 and 2000. When annualized, the rates of change ranged from a low of 0.2 percent (148 km^2) per year between 1973 and 1980 to a high of 0.5 percent (317 km^2) per year between 1986 and 1992 (table 3; fig. 5).

Net change by time period for all land-use/land-cover classes are presented in figure 6. Grassland/shrubland accounted for 63.5 percent (41,030 km^2) of the ecoregion in 1973. By 2000, an additional 1.7 percent (1,104 km^2) of the ecoregion had converted into grassland/shrubland. Forest covered 18.3 percent (11,861 km^2) of the ecoregion in 1973 and had a net decrease during the study period of 3.5 percent (421 km^2). Agriculture covered 11.0 percent (7,115 km^2) of the land cover in 1973 and had a net decrease of 12.9 percent (920 km^2) during the study period (table 4). Net change doesn't always tell the whole story of change. Gross change, the area gained and lost by individual land-cover classes during each period, shows that,

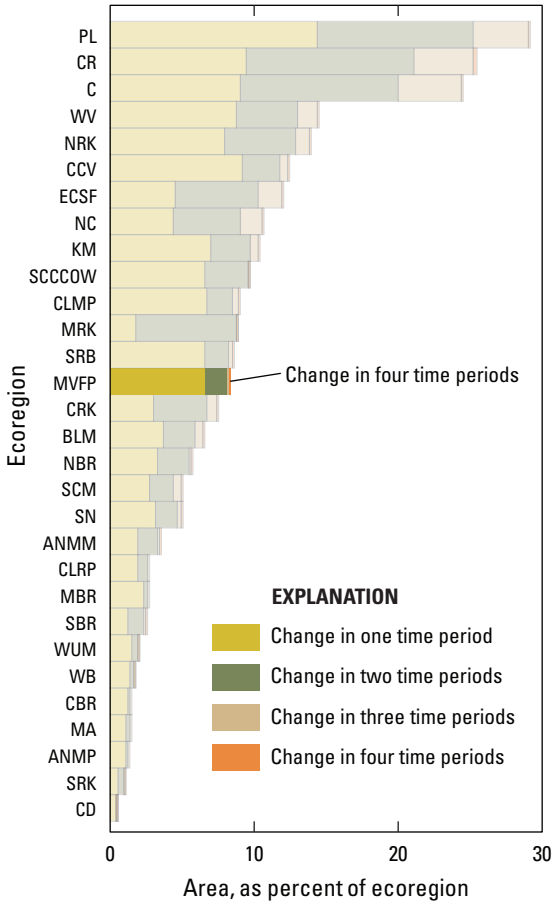

Figure 4. Overall spatial change in Montana Valley and Foothill Prairies Ecoregion (MVFP; darker bars) compared with that of all 30 Western United States ecoregions (lighter bars). Each horizontal set of bars shows proportion of ecoregion that changed during one, two, three, or four time periods; highest level of spatial change in Montana Valley and Foothill Prairies Ecoregion (four time periods) labeled for clarity. See table 3 for years covered by each time period. See appendix 2 for key to ecoregion abbreviations.

during the entire study period, individual classes fluctuated to a greater degree than net-change values reflect.

This increased amount of gross change can be further explained by the top two land-cover conversions. Overall, the top two conversions between 1973 and 2000 were agriculture to grassland/shrubland (2,918 km^2) and grassland/shrubland to agriculture (1,972 km^2) (table 5). The mechanical disturbance of forest by logging was the third most common conversion during the study period (371 km^2). The fourth and fifth most common conversions were forest to grassland/shrubland (344 km^2) and grassland/shrubland to forest (301 km^2), respectively. Grassland/shrubland to agriculture was the most common conversion in the first two time periods (1973–1980, 1980–1986), but this reversed in the last two time periods (1986–1992, 1992–2000) when agriculture to grassland/shrubland was the top conversion. This ecoregion has little developed land, and land-cover conversion to developed was very minor in all time periods.

When many of the valleys and prairies throughout the Montana Valley and Foothill Prairies Ecoregion were first homesteaded, farms and ranches sprang up, and some of them are still in existence (Malone, 1996). In the areas around Butte, Anaconda, and Deer Lodge, mining once brought great wealth to southwestern Montana. Towns like Virginia City, Nevada City, Bannack, and Coolidge formed around the search for gold, silver, and other minerals mined from the area (Malone, 1996). In its heyday, the Anaconda Mine was the richest mine on Earth. Many of the mining towns disappeared almost as quickly as they sprang up, whereas others stood the test of time and are still small towns today. Today (2012), the area around Anaconda, Butte, and the whole Upper Clark Fork River District are part of an Environmental Protection Agency Superfund site (Diamond, 2005). The ranching industry began about the same time as the mining industry. Cattle and sheep were raised to feed the miners and homesteaders, often replacing herds of buffalo and elk. Today (2012), ranching remains an important industry (fig. 7).

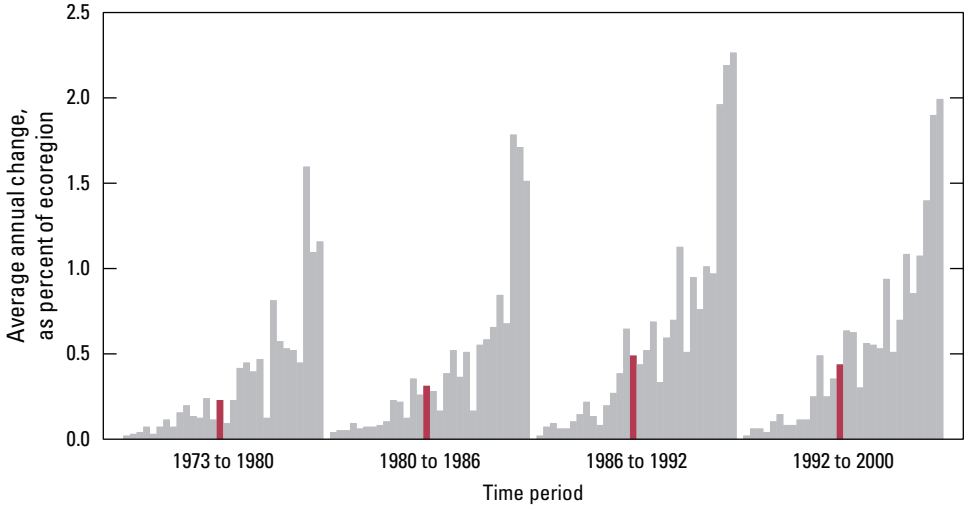

Figure 5. Estimates of land-cover change per time period, normalized to annual rates of change for all 30 Western United States ecoregions (gray bars). Estimates of change for Montana Valley and Foothill Prairies Ecoregion are represented by red bars in each time period.

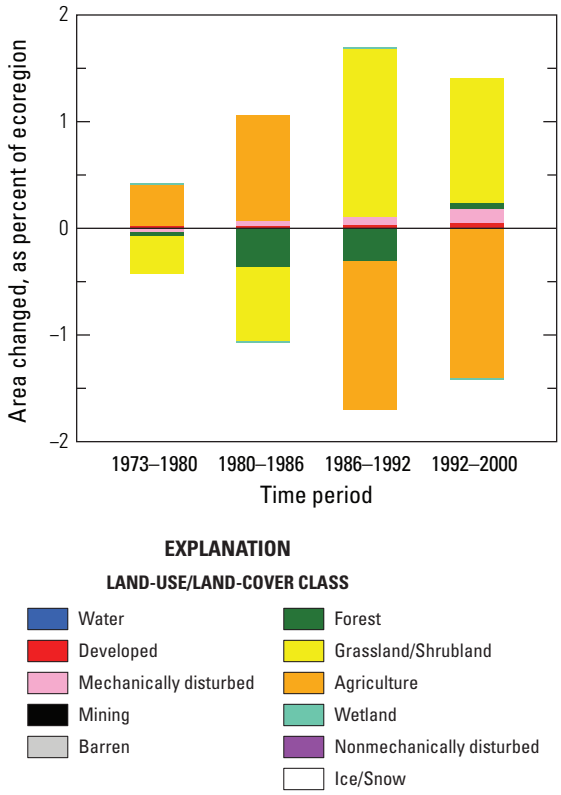

Figure 6. Normalized average net change in Montana Valley and Foothill Prairies Ecoregion by time period for each land-cover class. Bars above zero axis represent net gain, whereas bars below zero represent net loss. Note that not all land-cover classes shown in explanation may be represented in figure. See appendix 3 for definitions of land-use/land-cover classifications.

Figure 7. Sheep grazing in Montana Valley and Foothill Prairies Ecoregion. Photograph by Terry Sohl, 1999.

Figure 8. Large farm operation with granaries and numerous outbuildings in Montana Valley and Foothill Prairies Ecoregion. Photograph by Terry Sohl, 1999.

In the 1970s, global demand for wheat increased greatly, and rangeland and other grassland that had not previously been broken was planted with wheat. This trend continued into the 1980s as low-interest bank loans and tax credits for breaking new ground—also known as "sodbusting"—provoked speculators and investors to enter into farming (fig. 8). The trend of purchase, plow, and resell was also bolstered by National Farm Program incentives, such as diversion payments and deficiency payments (Watts and others, 1983). In the mid-1980s, the price of wheat plummeted as the world supplies became saturated, and farmers, both old and new, wanted out of farming. In 1986, the Conservation Reserve Program was started, in which farmers were paid to retire many of the fields broken in the 1970s (Leistritz and others, 2002). These national trends were seen to some degree in the Montana Valley and Foothill Prairies Ecoregion, with increases in agricultural land until 1986 and then declines in agricultural land as it converted back to grassland/shrubland between 1986 and 2000.

Table 1. Population change in 17 Montana counties between 1970 and 2000 (from Forstall, 1995).

County	1970	1980	1990	2000	Total change, # of persons	Change (Percent)
Metropolitan counties						
Carbon County	7,080	8,099	8,080	9,552	2,472	34.9
Yellowstone County	87,367	108,035	113,419	129,352	41,985	48.1
Missoula County	58,263	76,016	78,687	95,802	37,539	64.4
Rural counties						
Beaverhead County	8,187	8,186	8,424	9,202	1,015	12.4
Deer Lodge County	15,652	12,518	10,278	9,417	−6,235	−39.8
Fergus County	12,611	13,076	12,083	11,893	−718	−5.7
Flathead County	39,460	51,966	59,218	74,471	35,011	88.7
Gallatin County	32,505	42,865	50,463	67,831	35,326	108.7
Jefferson County	5,238	7,029	7,939	10,049	4,811	91.8
Lake County	14,445	19,056	21,041	26,507	12,062	83.5
Lewis and Clark County	33,281	43,039	47,495	55,716	22,435	67.4
Meagher County	2,122	2,154	1,819	1,932	−190	−9.0
Park County	11,197	12,660	14,562	15,694	4,497	40.2
Powell County	6,660	6,958	6,620	7,180	520	7.8
Ravalli County	14,409	22,493	25,010	36,070	21,661	150.3
Silver Bow County	41,981	38,092	33,941	34,606	−7,375	−17.6
Teton County	6,116	6,491	6,271	6,445	329	5.4

Table 2. Percentage of Montana Valley and Foothill Prairies Ecoregion land cover that changed at least one time during study period (1973–2000) and associated statistical error.

[Most sample pixels remained unchanged (91.9 percent), whereas 8.1 percent changed at least once throughout study period]

Number of changes	Percent of ecoregion	Margin of error (+/– %)	Lower bound (%)	Upper bound (%)	Standard error (%)	Relative error (%)
1	6.5	3.6	2.9	10.1	2.3	34.9
2	1.5	0.6	0.9	2.1	0.4	26.1
3	0.1	0.1	0.0	0.1	0.0	37.4
4	0.0	0.0	0.0	0.0	0.0	56.2
Overall spatial change	8.1	4.1	4.1	12.2	2.6	31.7

Table 3. Raw estimates of change in Montana Valley and Foothill Prairies Ecoregion land cover, computed for each of four time periods between 1973 and 2000, and associated error at 85-percent confidence level.

[Estimates of change per period normalized to annual rate of change for each period]

Period	Total change (% of ecoregion)	Margin of error (+/– %)	Lower bound (%)	Upper bound (%)	Standard error (%)	Relative error (%)	Average rate (% per year)
Estimate of change, in percent stratum							
1973–1980	1.6	0.5	1.1	2.1	0.3	21.3	0.2
1980–1986	1.8	0.7	1.1	2.6	0.5	24.4	0.3
1986–1992	2.9	1.7	1.2	4.6	1.1	36.6	0.5
1992–2000	3.4	2.6	0.8	6.0	1.7	47.9	0.4
Estimate of change, in square kilometers							
1973–1980	1,039	348	691	1,387	221	21.3	148
1980–1986	1,193	459	734	1,652	291	24.4	199
1986–1992	1,903	1,095	808	2,998	696	36.6	317
1992–2000	2,229	1,680	549	3,909	1,067	47.9	279

Table 4. Estimated area (and margin of error) of each land-cover class in Montana Valley and Foothill Prairies Ecoregion, calculated five times between 1973 and 2000. See appendix 3 for definitions of land-cover classifications.

	Water		Developed		Mechanically disturbed		Mining		Barren		Forest		Grassland/ Shrubland		Agriculture		Wetland		Non-mechanically disturbed	
	%	+/–	%	+/–	%	+/–	%	+/–	%	+/–	%	+/–	%	+/–	%	+/–	%	+/–	%	+/–
Area, in percent stratum																				
1973	6.1	8.7	0.3	0.2	0.1	0.1	0.0	0.0	0.5	0.4	18.3	6.5	63.5	11.3	11.0	6.3	0.3	0.3	0.0	0.0
1980	6.1	8.7	0.3	0.2	0.0	0.0	0.0	0.0	0.5	0.4	18.3	6.5	63.1	11.2	11.4	6.6	0.3	0.3	0.0	0.0
1986	6.1	8.7	0.4	0.2	0.1	0.1	0.0	0.0	0.5	0.4	17.9	6.3	62.4	11.1	12.4	6.8	0.3	0.3	0.0	0.0
1992	6.1	8.7	0.4	0.2	0.2	0.2	0.0	0.0	0.5	0.4	17.6	6.2	64.0	11.0	11.0	5.3	0.3	0.3	0.0	0.0
2000	6.1	8.7	0.5	0.3	0.3	0.3	0.0	0.0	0.5	0.4	17.7	6.3	65.2	11.4	9.6	3.8	0.3	0.3	0.0	0.0
Net change	0.0	0.0	0.1	0.1	0.2	0.3	0.0	0.0	0.0	0.0	−0.7	0.4	1.7	3.3	−1.4	3.4	0.0	0.0	0.0	0.0
Gross change	0.0	0.0	0.1	0.1	0.4	0.4	0.0	0.0	0.0	0.0	1.0	0.5	5.4	3.8	5.1	3.8	0.0	0.0	0.0	0.0
Area, in square kilometers																				
1973	3,915	5,611	204	142	41	49	21	32	306	287	11,861	4,197	41,030	7,288	7,115	4,094	165	168	0	0
1980	3,915	5,611	221	150	22	26	21	32	306	287	11,834	4,172	40,811	7,261	7,356	4,262	172	178	0	0
1986	3,915	5,611	232	157	59	59	21	32	306	287	11,600	4,062	40,357	7,187	8,001	4,390	167	170	0	0
1992	3,916	5,611	259	159	107	149	21	32	306	287	11,403	4,023	41,379	7,132	7,098	3,426	169	174	0	0
2000	3,917	5,610	298	196	186	222	21	32	303	287	11,441	4,060	42,134	7,345	6,194	2,431	164	167	0	0
Net change	2	3	93	78	145	175	0	0	−3	5	−421	286	1,104	2,152	−920	2,195	0	0	0	0
Gross change	4	4	93	78	273	227	0	0	3	5	630	355	3,509	2,446	3,297	2,461	20	30	0	0

Table 5. Principal land-cover conversions in Montana Valley and Foothill Prairies Ecoregion, showing amount of area changed (and margin of error, calculated a 85-percent confidence level) for each conversion during each of four time periods and also during overall study period. See appendix 3 for definitions of land-cover classifications.

[Values given for "other" class are combined totals of values for other land-cover classes not listed in that time period. Abbreviations: n/a, not applicable]

Period	From class	To class	Area changed (km^2)	Margin of error (+/– km^2)	Standard error (km^2)	Percent of ecoregion	Percent of all changes
1973–1980	Grassland/Shrubland	Agriculture	529	290	184	0.8	50.9
	Agriculture	Grassland/Shrubland	291	112	71	0.5	28.0
	Grassland/Shrubland	Forest	46	50	32	0.1	4.5
	Mechanically disturbed	Grassland/Shrubland	41	48	31	0.1	3.9
	Forest	Grassland/Shrubland	39	40	26	0.1	3.8
	Other	Other	93	n/a	n/a	0.1	8.9
		Totals	1,039			1.6	100.0
1980–1986	Grassland/Shrubland	Agriculture	729	359	228	1.1	61.1
	Forest	Grassland/Shrubland	193	185	118	0.3	16.1
	Agriculture	Grassland/Shrubland	104	54	34	0.2	8.7
	Forest	Mechanically disturbed	59	59	37	0.1	5.0
	Grassland/Shrubland	Forest	31	31	20	0.0	2.6
	Other	Other	78	n/a	n/a	0.1	6.5
		Totals	1,193			1.8	100.0
1986–1992	Agriculture	Grassland/Shrubland	1,236	1,056	671	1.9	64.9
	Grassland/Shrubland	Agriculture	334	295	188	0.5	17.6
	Forest	Mechanically disturbed	106	148	94	0.2	5.6
	Forest	Grassland/Shrubland	101	115	73	0.2	5.3
	Mechanically disturbed	Grassland/Shrubland	58	58	37	0.1	3.1
	Other	Other	68	n/a	n/a	0.1	3.6
		Totals	1,903			2.9	100.0
1992–2000	Agriculture	Grassland/Shrubland	1,288	1,552	986	2.0	57.8
	Grassland/Shrubland	Agriculture	380	235	149	0.6	17.1
	Grassland/Shrubland	Forest	198	293	186	0.3	8.9
	Forest	Mechanically disturbed	184	219	139	0.3	8.3
	Mechanically disturbed	Grassland/Shrubland	68	91	58	0.1	3.0
	Other	Other	111	n/a	n/a	0.2	5.0
		Totals	2,229			3.4	100.0
1973–2000 (overall)	Agriculture	Grassland/Shrubland	2,918	2,525	1,604	4.5	45.8
	Grassland/Shrubland	Agriculture	1,972	817	519	3.1	31.0
	Forest	Mechanically disturbed	371	417	265	0.6	5.8
	Forest	Grassland/Shrubland	344	255	162	0.5	5.4
	Grassland/Shrubland	Forest	301	393	249	0.5	4.7
	Other	Other	457	n/a	n/a	0.7	7.2
		Totals	6,364			9.8	100.0

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