

## Chapter 23

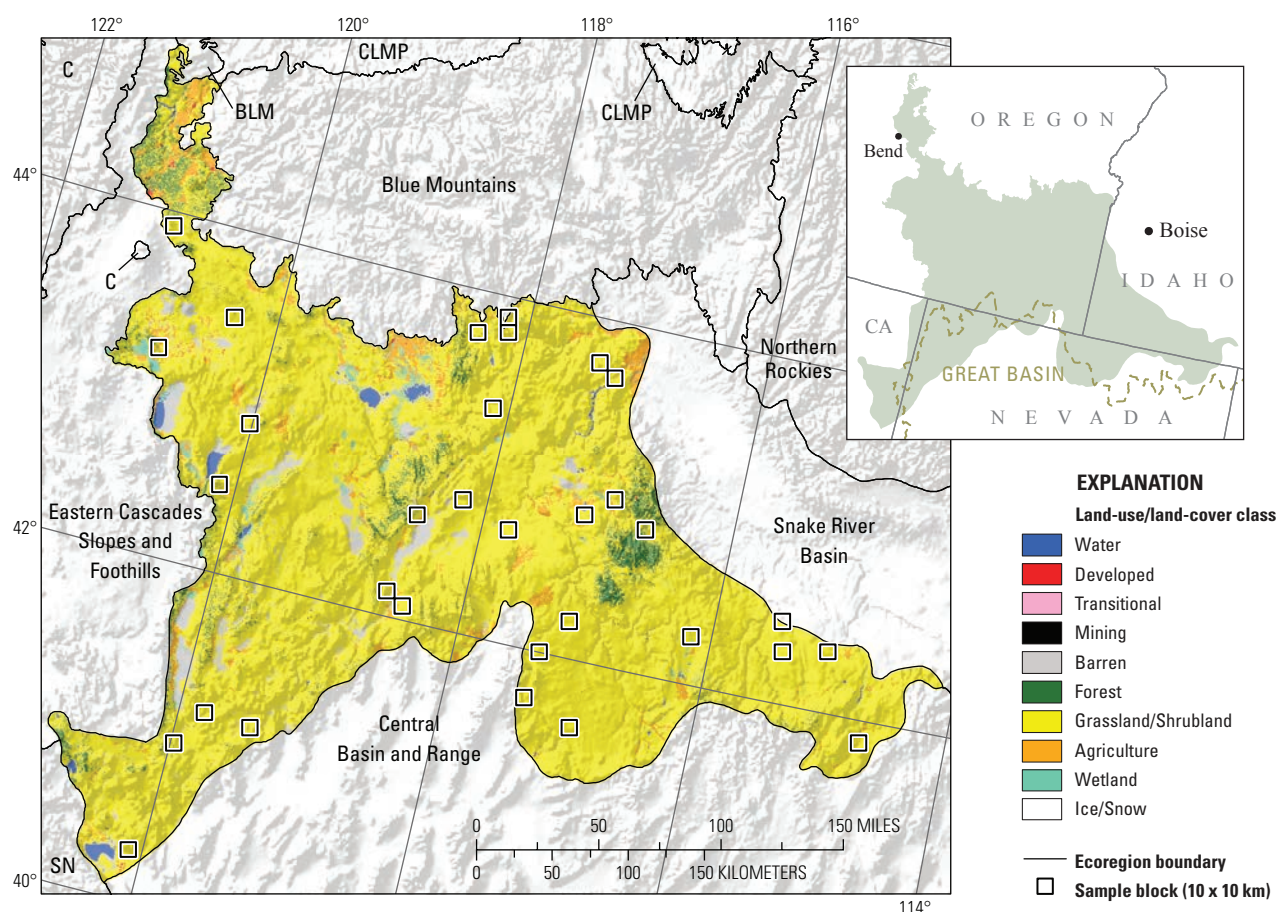
# Northern Basin and Range Ecoregion

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## Ecoregion Description

The Northern Basin and Range Ecoregion (Omernik, 1987; U.S. Environmental Protection Agency, 1997) is located in eastern Oregon (58.7 percent), northern Nevada (20.6 percent), southwestern Idaho (14.8 percent), and northeastern California (5.9 percent), encompassing the northern extent of the hydrographic Great Basin (Grayson, 1993). The ecoregion, which covers approximately 110,039 km<sup>2</sup> (42,486 mi<sup>2</sup>) of land, is bordered on the west by the Eastern Cascades Slopes and Foothills and

the Sierra Nevada Ecoregions, on the north by the Blue Mountains and the Snake River Basin Ecoregions, and on the south by the Central Basin and Range Ecoregion (fig. 1). Much like the other Basin and Range ecoregions in the western United States (for example, Central Basin and Range, Mojave Basin and Range, and Sonoran Basin and Range Ecoregions), the Northern Basin and Range Ecoregion is characterized by basin-and-range topography. The ecoregion contains several wide basins bordered by scattered low mountains. Big sagebrush (*Artemisia tridentata*), the predominant vegetation, is intermixed with grasslands. Despite regional aridity, natural springs and spring-fed wetlands



**Figure 1.** Map of Northern Basin and Range 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 10 x 10 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. See appendix 3 for definitions of land-use/land-cover classifications.

are scattered around the landscape, sustaining much of the region's wildlife (Oregon Department of State Lands, 2000).

Because most of the Northern Basin and Range Ecoregion is arid and soil development generally is poor, viable economic land uses are limited. Livestock (cattle and sheep) grazing, the predominant land use, occurs mostly in the grassland/shrubland landscapes (fig. 2). Some agriculture (mostly hay farming) occurs where reservoirs have been constructed along regional waterways. Mining and recreation also account for small fragments of local economy. Ultimately, the scarcity of economic activity explains the absence of any large municipalities and the general lack of developed land across the ecoregion's landscape.

Land-cover change in the ecoregion is caused primarily by livestock grazing. Grazing activity has effectively modified the contemporary fire regime, contributing to the loss of native-plant communities in the region (Miller and others, 2001) (fig. 3). Historical land-management practices

of unregulated grazing and fire suppression have led to increased fuel loads and nonnative-species invasion of rangelands (Oregon Department of State Lands, 2000). The most notable of these invasive species is cheatgrass (*Bromus tectorum*), which was introduced by settlers intending to feed domestic livestock by seeding areas devoid of native vegetation (Pellant and others, 2004). Cheatgrass and other introduced annuals not only outcompete native plants but also alter the fire regime by providing a denser, more continuous fuel source, which can extend the fire season (Pyke, 2002). Increased fire frequency eliminates native sagebrush in the short term, as the highly prolific seed-production capability of cheatgrass allows it to reestablish before sagebrush can take hold (Keeley, 2006; Pellant and others, 2004). Cheatgrass has ultimately created a positive-feedback mechanism for its own colonization, quickly expanding its range owing to frequent fires and its early reestablishment success in burned landscapes formerly occupied by sagebrush.



**Figure 2.** Area undergoing livestock grazing and hay farming in Northern Basin and Range Ecoregion. Land-use/land-cover classes shown are grassland/shrubland and agriculture.



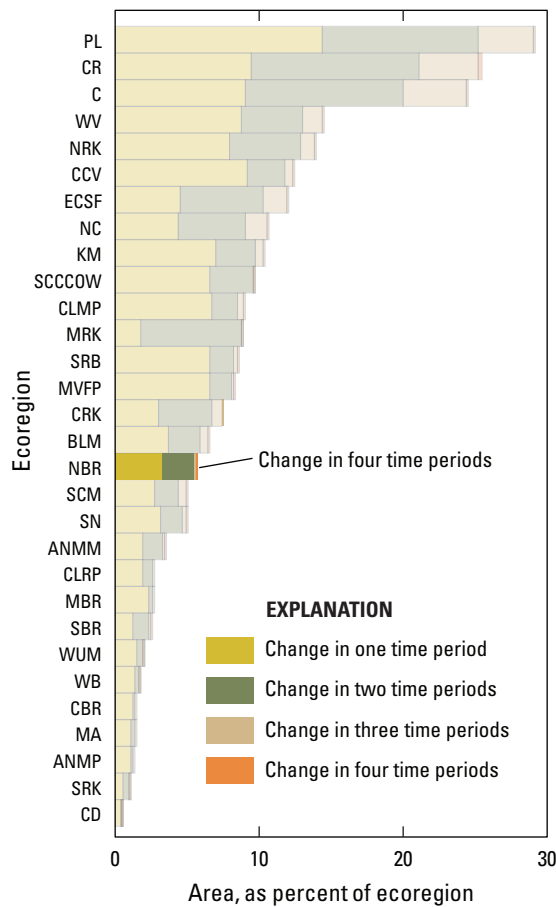
**Figure 3.** Shrubland being used as open rangeland for cattle in Northern Basin and Range Ecoregion. Charred shrubs illustrate nonmechanical disturbance of land cover by fire. Land-use/land-cover classes shown are grassland/shrubland and nonmechanically disturbed.

## Contemporary Land-Cover Change (1973 to 2000)

Between 1973 and 2000, the footprint (overall areal extent) of land-use/land-cover change in the Northern Basin and Range Ecoregion was 5.8 percent, or 6,430 km<sup>2</sup>. This can be interpreted as the amount of land that experienced change during at least one of the four time periods that make up the entire 27-year study period. This footprint of change translates to an estimated 3,631 km<sup>2</sup> of land that changed during one time period, 2,421 km<sup>2</sup> that changed during two time periods, 110 km<sup>2</sup> that changed during three time periods, and 220 km<sup>2</sup> that changed throughout all four time periods (table 1; fig. 4).

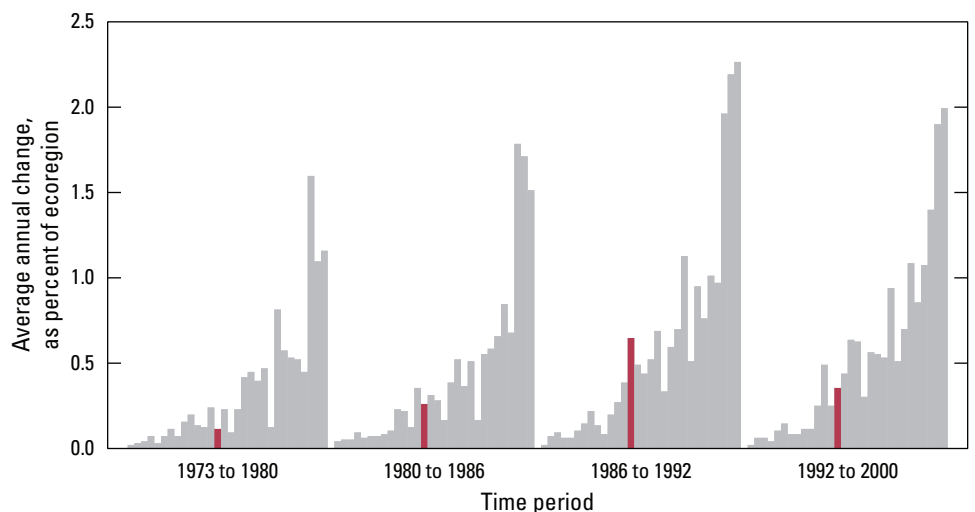
The average annual rate of change between 1973 and 2000 was 0.3 percent per year. This measurement, which normalizes the results for the 27-year study period to an annual scale, means that the region averaged 363 km<sup>2</sup> of change each year between 1973 and 2000 (table 2); however, this annual change varied between each of the four time periods. Between 1973 and 1980, the annual rate of change was 0.1 percent per year; this rate increased to 0.3 percent annually between 1980 and 1986 and 0.6 percent annually between 1986 and 1992. The normalized annual rate dropped back to 0.3 percent between 1992 and 2000 (table 2). Compared to the other ecoregions in the western United States, land-cover change in the Northern Basin and Range Ecoregion was relatively low (fig. 5).

In 2000, five of the eleven land-use/land-cover classes made up the majority of the Northern Basin and Range Ecoregion: grassland/shrubland (89.3 percent), forest (3.7 percent), nonmechanically disturbed (2.5 percent), agriculture (2.3 percent), and wetland (1.1 percent). Five other classes cumulatively made up the remaining 1 percent of the Northern Basin and Range Ecoregion landscape in 2000 (table 3).



**Figure 4.** Overall spatial change in Northern Basin and Range Ecoregion (NBR; darker bars) compared with that of all 30 Western United States ecoregions (lighter bars). Each horizontal set of bars shows proportions of ecoregion that changed during time periods 1, 2, 3, or 4; highest level of spatial change in Northern Basin and Range Ecoregion (four time periods) labeled for clarity. See table 2 for years covered by each time period. See appendix 2 for key to ecoregion abbreviations.

**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 Northern Basin and Range Ecoregion are represented by red bars in each time period.

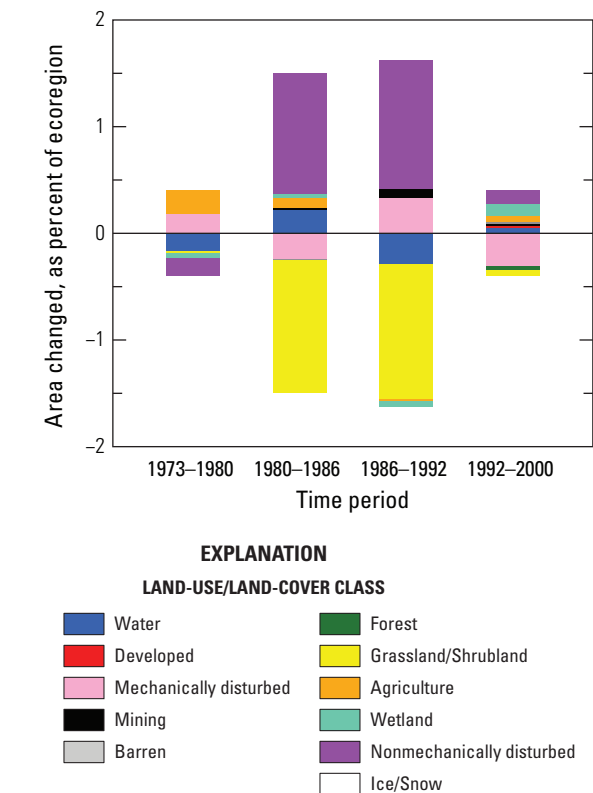


Between 1973 and 2000, the land-cover classes that experienced a measurable net change in relation to total ecoregion area include grassland/shrubland (2.6 percent decrease) and nonmechanically disturbed (which occupied 194 km<sup>2</sup> in 1973 and 2,713 km<sup>2</sup> in 2000, owing to fires) (fig. 6).

The “from class-to class” information afforded by a postclassification comparison was used to identify land-cover class conversions and to rank these conversions from highest to lowest (table 4). Although fieldwork confirmed the presence of many of the conversions listed in table 4, the ability to report these changes on the basis of interpretations was accomplished with varying degrees of uncertainty (as illustrated by the statistical error values in the table). In general, higher uncertainty arose where sampled changes were clustered spatially within the ecoregion rather than distributed evenly across the ecoregion.

Four of the top ten most prominent conversions are connected to nonmechanical disturbance of land cover by fire (fig. 7). Cumulatively, nonmechanical disturbance of grassland/shrubland resulted in the loss of an estimated 5,016 km<sup>2</sup>; however, much of this land experienced ecological succession, or regrowth, and by the end of the study period, 2,530 km<sup>2</sup> had converted back to grassland/shrubland (fig. 7; table 4). Areas that experienced fires in consecutive periods accounted for an additional 1,491 km<sup>2</sup> (table 4). The conversions to and from the water class also were common in the Northern Basin and Range Ecoregion (1,016 km<sup>2</sup> of gross change). Less common were the conversions from grassland/shrubland to agriculture and to mining.





**Figure 6.** Normalized average net change in Northern Basin and Range 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.** Area experiencing active nonmechanical disturbance of land cover by fire in Northern Basin and Range Ecoregion. Land-use/land-cover classes shown are grassland/shrubland, forest, and nonmechanically disturbed.

**Table 1.** Percentage of Northern Basin and Range Ecoregion land cover that changed at least one time during study period (1973–2000) and associated statistical error.

[Most sample pixels remained unchanged (94.2 percent), whereas 5.8 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	3.3	3.2	0.0	6.5	2.2	67.0
2	2.2	2.1	0.1	4.4	1.5	65.3
3	0.1	0.1	0.0	0.3	0.1	52.7
4	0.2	0.3	-0.1	0.5	0.2	97.7
Overall spatial change	5.8	3.9	2.0	9.7	2.6	44.7

**Table 2.** Raw estimates of change in Northern Basin and Range 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	0.8	0.5	0.3	1.2	0.3	42.8	0.1
1980–1986	1.6	1.0	0.6	2.6	0.7	43.3	0.3
1986–1992	3.9	2.7	1.2	6.5	1.8	47.2	0.6
1992–2000	2.8	2.1	0.7	4.8	1.4	50.2	0.3
Estimate of change, in square kilometers							
1973–1980	828	523	305	1,351	354	42.8	118
1980–1986	1,727	1,104	624	2,831	748	43.3	288
1986–1992	4,249	2,957	1,292	7,207	2,004	47.2	708
1992–2000	3,055	2,263	792	5,319	1,533	50.2	382

**Table 3.** Estimated area (and margin of error) of each land-cover class in Northern Basin and Range 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	0.5	0.4	0.1	0.0	0.1	0.1	0.1	0.1	0.4	0.2	3.8	2.5	91.9	2.6	2.0	0.9	1.0	0.5	0.2	0.3
1980	0.3	0.2	0.1	0.0	0.2	0.3	0.1	0.1	0.4	0.2	3.8	2.5	91.9	2.7	2.2	1.0	1.0	0.5	0.0	0.0
1986	0.6	0.4	0.1	0.0	0.0	0.0	0.1	0.1	0.4	0.2	3.8	2.5	90.7	2.7	2.3	1.0	1.0	0.5	1.1	1.0
1992	0.3	0.2	0.1	0.0	0.3	0.3	0.2	0.1	0.4	0.2	3.8	2.5	89.4	3.2	2.2	1.0	1.0	0.5	2.3	2.4
2000	0.3	0.2	0.1	0.1	0.0	0.0	0.2	0.1	0.4	0.2	3.7	2.5	89.3	3.9	2.3	1.1	1.1	0.5	2.5	3.2
Net change	-0.2	0.3	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.1	-2.6	3.3	0.3	0.3	0.1	0.2	2.3	3.3
Gross change	0.9	0.9	0.0	0.0	1.2	1.2	0.1	0.1	0.0	0.0	0.0	0.1	6.7	4.5	0.4	0.3	0.3	0.4	6.1	4.6
Area, in square kilometers																				
1973	551	401	62	49	59	84	73	57	463	183	4,156	2,792	101,150	2,908	2,177	964	1,152	526	194	282
1980	374	223	64	50	267	342	79	58	461	182	4,158	2,792	101,139	2,947	2,401	1,070	1,091	524	5	8
1986	619	386	68	53	1	1	97	65	458	182	4,157	2,791	99,752	2,974	2,492	1,132	1,145	523	1,250	1,060
1992	307	215	69	53	372	337	188	118	449	181	4,157	2,790	98,361	3,527	2,474	1,127	1,078	523	2,584	2,616
2000	378	229	80	65	30	25	219	133	451	181	4,111	2,783	98,309	4,301	2,538	1,178	1,210	548	2,713	3,571
Net change	-173	356	18	16	-29	89	146	116	-12	10	-45	60	-2,841	3,589	361	348	58	179	2,519	3,582
Gross change	1,016	997	18	16	1,305	1,340	152	116	28	21	48	60	7,387	4,965	444	342	381	404	6,670	5,066

**Table 4.** Principal land-cover conversions in Northern Basin and Range Ecoregion, showing amount of area changed (and margin of error, calculated at 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 <sup>2</sup> )	Margin of error (+/- km <sup>2</sup> )	Standard error (km <sup>2</sup> )	Percent of ecoregion	Percent of all changes
1973–1980	Water	Mechanically disturbed	256	341	231	0.2	30.9
	Grassland/Shrubland	Agriculture	226	183	124	0.2	27.2
	Nonmechanically disturbed	Grassland/Shrubland	193	280	190	0.2	23.3
	Mechanically disturbed	Water	59	84	57	0.1	7.2
	Wetland	Grassland/Shrubland	44	50	34	0.0	5.3
	Other	Other	51	n/a	n/a	0.0	6.1
	Totals		828			0.8	100.0
1980–1986	Grassland/Shrubland	Nonmechanically disturbed	1,250	1,060	718	1.1	72.4
	Mechanically disturbed	Water	237	315	213	0.2	13.7
	Grassland/Shrubland	Agriculture	95	96	65	0.1	5.5
	Grassland/Shrubland	Wetland	34	40	27	0.0	2.0
	Grassland/Shrubland	Mining	21	28	19	0.0	1.2
	Other	Other	90	n/a	n/a	0.1	5.2
	Totals		1,727			1.6	100.0
1986–1992	Grassland/Shrubland	Nonmechanically disturbed	2,482	2,528	1,713	2.3	58.4
	Nonmechanically disturbed	Grassland/Shrubland	1,139	961	651	1.0	26.8
	Water	Mechanically disturbed	313	330	224	0.3	7.4
	Wetland	Grassland/Shrubland	70	68	46	0.1	1.6
	Grassland/Shrubland	Mechanically disturbed	49	72	49	0.0	1.2
	Other	Other	195	n/a	n/a	0.2	4.6
	Totals		4,249			3.9	100.0
1992–2000	Grassland/Shrubland	Nonmechanically disturbed	1,279	1,558	1,055	1.2	41.9
	Nonmechanically disturbed	Grassland/Shrubland	1,193	1,669	1,131	1.1	39.0
	Mechanically disturbed	Wetland	152	220	149	0.1	5.0
	Mechanically disturbed	Grassland/Shrubland	144	127	86	0.1	4.7
	Grassland/Shrubland	Agriculture	73	104	70	0.1	2.4
	Other	Other	215	n/a	n/a	0.2	7.0
	Totals		3,055			2.8	100.0
1973–2000 (overall)	Grassland/Shrubland	Nonmechanically disturbed	5,016	4,243	2,875	4.6	50.9
	Nonmechanically disturbed	Grassland/Shrubland	2,530	2,450	1,660	2.3	25.7
	Water	Mechanically disturbed	569	662	449	0.5	5.8
	Grassland/Shrubland	Agriculture	407	345	234	0.4	4.1
	Mechanically disturbed	Water	354	345	234	0.3	3.6
	Other	Other	983	n/a	n/a	0.9	10.0
	Totals		9,860			9.0	100.0

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