
Land treatment costs

Runoff and soil erosion need to be at acceptable levels on fields where manure is applied to prevent manure and manure nutrients from being carried to rivers and streams with the runoff. A CNMP therefore includes criteria for soil erosion control on land on which manure is applied. At a minimum the conservation systems that need to be installed as part of a CNMP must meet NRCS Quality Criteria for soil erosion (see section III of the Field Office Technical Guide). Presently, States have established that the quality criterion for soil erosion is the sustainability level for crop production. The sustainability level of soil for crop production is also referred to as the soil loss tolerance level, or T. Fields with erosion rates greater than T need to have conservation practices installed that would reduce the erosion rate to T or less before manure can be applied.

Land treatment costs were calculated for all onfarm acres where manure would be applied after CNMP implementation. Erosion controls would also be expected to apply to off-farm land application. In the model simulation, however, it was assumed that land on manure-receiving farms with erosion rates greater than T would not be available for manure application because of the potential for additional costs. (See appendix B for criteria on land available for manure application.) It was also assumed that CNMP farms would bear the costs of land treatment rather than seek options to onfarm land application.

Estimating acres required for land treatment

The number of acres for which land treatment practices would be expected depends on the number of onfarm acres needed for manure application to meet CNMP application criteria and the portion of those acres that have soil erosion rates greater than T.

For calculating land treatment costs, application rate criteria for the after-CNMP scenario differed from criteria used to calculate nutrient management costs. Acres that would potentially need land treatment would include **all** the acres that would receive manure over **all** the years. Thus, for calculating land treatment

costs, application rate criteria for the after-CNMP scenario were simulated using phosphorus-based application rates for all farms where phosphorus was the limiting nutrient. Nitrogen-based application rates were used only for farms where nitrogen was the limiting nutrient. (Nitrogen was the limiting nutrient on only a few farms.) The number of acres that would receive manure over time includes about 9.8 million more acres than the 14.8 million used to calculate nutrient management costs in the after-CNMP scenario. (See appendix B for details on how land with manure applied was estimated.)

The number of acres with manure applied over time is presented in table 21, categorized by Land Resource Regions. The Land Resource Region was the geographic unit used to define land treatment needs and costs because soils, climate, water resources, land uses, and type of farming tend to be similar within each region. (A map of Land Resource Regions is presented in figure 16.) The model simulation shows that manure would be applied on 24.6 million onfarm acres over time, equivalent to an average of 96 acres per CNMP farm. The vast majority was cropland acres; pastureland acres comprised only about 11 percent of the total.

Only a portion of these acres, however, would have erosion at rates greater than T. The National Resources Inventory (NRI) was used to obtain estimates of existing soil erosion rates (USDA, ERS, 2000b). The soil erosion rates contained in the NRI were calculated using the Universal Soil Loss Equation (USLE), which is an estimate of sheet and rill erosion that is caused by rainfall and runoff. (Land treatment to control wind erosion was not included in the analysis since the purpose of a CNMP is to protect water quality.)

NRI data for the year 1997 were used, which is the most recent year for which NRI data exist for the full set of NRI sample points. County-level estimates of the number of acres with erosion rates of T to 2T, 2T to 4T, and greater than 4T were obtained from the NRI database. Separate estimates were made for cropland and pastureland. The percentage of cropland and pastureland acres in each county that was in each erosion category was calculated. These percentages were then applied to the cropland and pastureland acreage on each farm in the Census of Agriculture to estimate the acres on each farm that were in each erosion category. Since NRI data are for counties, and

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not individual farms, it was necessary to assume that all acres receiving manure on a farm had the same erosion profile as the county.

About 5.9 million onfarm acres are expected to have manure applied **and** have sheet and rill erosion rates greater than T after CNMPs are implemented (table 22). This subset represents about 24 percent of the acres with manure applied on CNMPs over time. The Land Resource Region **S**, which is in the Northeast, had the highest proportion of manured acres with erosion rates above T—47 percent. Other regions with relatively high proportions of manured acres with

erosion rates greater than T were **R** (34 percent, also in the Northeast), **N** (31 percent), **P** (29 percent), and **M** (27 percent). These five regions contain 82 percent of all the manured acres with erosion rates above T. Onfarm acres with manure applied and sheet and rill erosion rates above T are shown in figure 18. There are few acres in the West because of low rainfall and few cropland acres.

As shown in table 22, the bulk (55 percent) of the manured acres with erosion rates above T were for cropland with sheet and rill erosion rates between T and 2T. Cropland acres with erosion rates between 2T

Table 21 Total acres that would receive manure over time after CNMP implementation

| Land resource region | Number of farms | Cropland acres with manure applied | Pastureland acres with manure applied | Total | Acres per CNMP farm |
|----------------------|-----------------|------------------------------------|---------------------------------------|------------|---------------------|
| A | 2,127 | 135,372 | 59,057 | 194,429 | 91 |
| B | 2,849 | 170,870 | 41,705 | 212,575 | 75 |
| C | 3,432 | 432,909 | 65,148 | 498,057 | 145 |
| D | 3,050 | 206,426 | 39,302 | 245,729 | 81 |
| E | 1,211 | 76,555 | 18,451 | 95,006 | 78 |
| F | 5,476 | 667,232 | 45,477 | 712,709 | 130 |
| G | 3,597 | 348,381 | 36,013 | 384,394 | 107 |
| H | 11,358 | 1,077,157 | 141,890 | 1,219,047 | 107 |
| I | 707 | 26,549 | 15,642 | 42,192 | 60 |
| J | 3,243 | 153,430 | 101,452 | 254,882 | 79 |
| K | 26,870 | 2,463,985 | 108,785 | 2,572,770 | 96 |
| L | 11,504 | 1,274,577 | 60,164 | 1,334,741 | 116 |
| M | 89,240 | 8,758,072 | 429,473 | 9,187,545 | 103 |
| N | 32,171 | 1,514,743 | 607,140 | 2,121,884 | 66 |
| O | 1,041 | 40,110 | 21,818 | 61,928 | 59 |
| P | 23,770 | 1,365,719 | 579,174 | 1,944,893 | 82 |
| R | 14,694 | 1,500,260 | 105,557 | 1,605,817 | 109 |
| S | 13,429 | 1,160,135 | 149,806 | 1,309,941 | 98 |
| T | 4,508 | 492,651 | 42,335 | 534,986 | 119 |
| U | 608 | 27,523 | 30,469 | 57,992 | 95 |
| V | 154 | 13 | 6,291 | 6,304 | 41 |
| W | 31 | 3,350 | 10 | 3,360 | 108 |
| All regions | 255,070 | 21,896,019 | 2,705,160 | 24,601,179 | 96 |

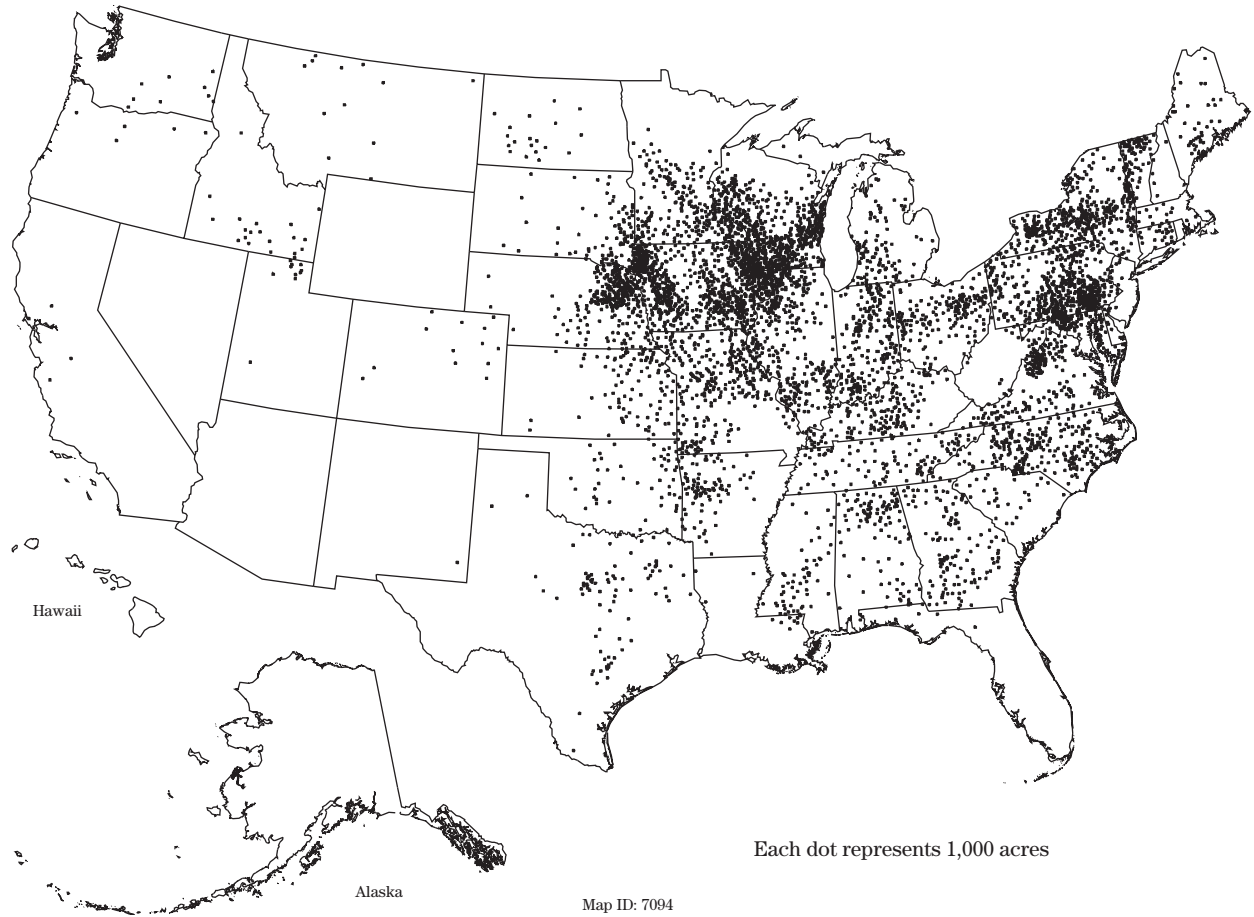
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and 4T comprised 29 percent, and cropland acres with erosion rates greater than 4T comprised 14 percent. Only about 3 percent of the 5.9 million acres with erosion rates above T were pastureland acres.

Table 22 Acres with manure applied and with sheet and rill erosion rates above T

| Land resource region (LRR) | -- Cropland acres with manure applied -- | | | - Pastureland acres with manure applied - | | | ---- All acres with manure applied ---- and erosion rate above T | | |
|----------------------------|--|--------------------|-------------------|---|--------------------|-------------------|--|------------|------------------------|
| | erosion rate 1-2 T | erosion rate 2-4 T | erosion rate >4 T | erosion rate 1-2 T | erosion rate 2-4 T | erosion rate >4 T | total acres | % of total | % of acres in each LRR |
| A | 3,272 | 501 | 385 | 170 | 201 | 88 | 4,617 | 0.1 | 2.4 |
| B | 19,462 | 9,005 | 854 | 336 | 366 | 22 | 30,044 | 0.5 | 14.1 |
| C | 1,864 | 351 | 691 | 776 | 215 | 0 | 3,897 | 0.1 | 0.8 |
| D | 9,760 | 3,249 | 1,706 | 374 | 238 | 5 | 15,332 | 0.3 | 6.2 |
| E | 4,359 | 1,153 | 951 | 60 | 12 | 4 | 6,539 | 0.1 | 6.9 |
| F | 26,758 | 5,225 | 1,194 | 544 | 140 | 0 | 33,861 | 0.6 | 4.8 |
| G | 9,977 | 3,516 | 1,548 | 93 | 108 | 25 | 15,267 | 0.3 | 4.0 |
| H | 82,521 | 23,390 | 6,440 | 4,299 | 52 | 0 | 116,702 | 2.0 | 9.6 |
| I | 5,069 | 755 | 207 | 45 | 5 | 10 | 6,091 | 0.1 | 14.4 |
| J | 33,768 | 14,059 | 2,427 | 2,263 | 1,268 | 173 | 53,959 | 0.9 | 21.2 |
| K | 288,667 | 129,927 | 49,594 | 998 | 569 | 0 | 469,756 | 7.9 | 18.3 |
| L | 147,049 | 81,486 | 37,206 | 1,154 | 149 | 33 | 267,077 | 4.5 | 20.0 |
| M | 1,382,185 | 714,559 | 325,550 | 14,423 | 4,765 | 757 | 2,442,239 | 41.3 | 26.6 |
| N | 303,485 | 194,390 | 99,295 | 38,389 | 18,506 | 6,582 | 660,647 | 11.2 | 31.1 |
| O | 4,623 | 397 | 191 | 578 | 51 | 2 | 5,842 | 0.1 | 9.4 |
| P | 291,612 | 144,029 | 110,146 | 14,621 | 6,876 | 2,355 | 569,640 | 9.6 | 29.3 |
| R | 298,759 | 162,399 | 80,675 | 828 | 189 | 92 | 542,941 | 9.2 | 33.8 |
| S | 270,700 | 202,425 | 111,397 | 14,014 | 10,807 | 4,120 | 613,463 | 10.4 | 46.8 |
| T | 40,841 | 7,649 | 2,344 | 64 | 53 | 0 | 50,950 | 0.9 | 9.5 |
| U | 741 | 0 | 0 | 2 | 0 | 0 | 743 | 0.0 | 1.3 |
| V | 1 | 0 | 0 | 412 | 80 | 53 | 546 | 0.0 | 8.7 |
| W | 335 | 0 | 0 | 1 | 0 | 0 | 336 | 0.0 | 10.0 |
| All regions | 3,225,809 | 1,698,465 | 832,801 | 94,442 | 44,650 | 14,322 | 5,910,488 | 100.0 | 24.0 |

Figure 18 Onfarm acres with manure applied and sheet and rill erosion rates above T (5.9 million acres)



Estimating per-acre costs for conservation systems

Land treatment costs were determined by estimating the cost of installing conservation systems, consisting of a collection of conservation practices, needed to reduce sheet and rill erosion to T on the 5.9 million acres with manure applied and with erosion rates above T. Generally, a conservation system needed to control erosion for acres with rates between 1 and 2 T would be less extensive and cost less to implement than a conservation system needed to control erosion for acres with higher erosion rates. The collection of conservation practices that comprise a conservation system vary according to the characteristics of the resource base—such as the soil type, climate, and topography—and the crops grown.

To capture these regional differences in the conservation systems needed to control erosion, conservation systems were derived for each state or groups of states in each Land Resource Region and for each of the three erosion categories. Separate conservation systems were derived for cropland and pastureland. Examples of these conservation systems for cropland are shown in appendix D, table D-1 for region S in the Northeast, table D-2 for region M in the Midwest, and

table D-3 for region R, also in the Northeast. (Cropland acres in these three regions accounted for about 75 percent of the total land treatment cost.) To account for differences in soil types, topography, and climate, more than one conservation system were often derived for a given State and Land Resource Region. Where this occurred, an estimate was made of the proportion of the acres that would be expected to need each conservation system, which was then used to calculate a weighted average cost for the State.

A per-acre cost of implementing each conservation practice was estimated (see tables D-1 to D-3 in appendix D). Conservation practice costs were obtained from state costs lists in the NRCS Field Office Technical Guides. State cost lists contain the typical cost of implementing a conservation practice and its components in that state. Cost lists reflect current information based on actual installations associated with various USDA programs, and are updated frequently. Thus, the cost of a particular conservation practice will often vary from state to state. Structural practices were annualized by amortizing over 10 years at 8 percent interest, as was done in this study for other capital investment items. A summary of per-acre costs for each land use and erosion category is presented in table 23.

Table 23 Average cost per acre for conservation systems needed to control sheet and rill erosion

| Land Resource Region | State | Cropland with erosion rate 1-2T | Cropland with erosion rate 2-4T | Cropland with erosion rate >4T | Pastureland with erosion rate 1-2T | Pastureland with erosion rate 2-4T | Pastureland with erosion rate >4T |
|----------------------|------------|---------------------------------|---------------------------------|--------------------------------|------------------------------------|------------------------------------|-----------------------------------|
| A | California | 54.12 | 54.12 | 54.12 | 0.00 | 0.00 | 0.00 |
| A | Oregon | 38.74 | 38.74 | 38.74 | 0.00 | 0.00 | 0.00 |
| A | Washington | 29.00 | 29.00 | 29.00 | 0.00 | 0.00 | 0.00 |
| B | Idaho | 5.28 | 5.61 | 5.61 | 0.00 | 0.00 | 0.00 |
| B | Oregon | 17.29 | 21.43 | 21.43 | 0.00 | 0.00 | 0.00 |
| B | Washington | 6.94 | 7.85 | 7.85 | 0.00 | 0.00 | 0.00 |
| C | California | 24.16 | 24.16 | 24.16 | 0.00 | 0.00 | 0.00 |
| D | Arizona | 6.81 | 6.81 | 6.81 | 0.00 | 0.00 | 0.00 |
| D | California | 24.16 | 24.16 | 24.16 | 0.00 | 0.00 | 0.00 |
| D | Colorado | 9.04 | 9.04 | 9.04 | 2.14 | 2.14 | 2.14 |
| D | Idaho | 5.65 | 5.65 | 5.65 | 0.00 | 0.00 | 0.00 |
| D | Nevada | 13.50 | 13.50 | 13.50 | 0.00 | 0.00 | 0.00 |
| D | New Mexico | 10.65 | 10.65 | 10.65 | 0.00 | 0.00 | 0.00 |
| D | Oregon | 16.56 | 16.56 | 16.56 | 0.00 | 0.00 | 0.00 |

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Table 23 Average cost per acre for conservation systems needed to control sheet and rill erosion—Continued

| Land Resource Region | State | Cropland with erosion rate 1-2T | Cropland with erosion rate 2-4T | Cropland with erosion rate >4T | Pastureland with erosion rate 1-2T | Pastureland with erosion rate 2-4T | Pastureland with erosion rate >4T |
|----------------------|--------------|---------------------------------|---------------------------------|--------------------------------|------------------------------------|------------------------------------|-----------------------------------|
| D | Texas | 21.46 | 21.93 | 21.93 | 10.04 | 15.52 | 15.52 |
| D | Utah | 12.38 | 12.38 | 12.38 | 0.00 | 0.00 | 0.00 |
| D | Wyoming | 7.40 | 7.40 | 7.40 | 7.47 | 7.47 | 7.47 |
| E | Colorado | 8.80 | 14.42 | 14.42 | 2.47 | 2.47 | 2.47 |
| E | Idaho | 1.94 | 1.94 | 1.94 | 0.00 | 0.00 | 0.00 |
| E | Montana | 5.16 | 12.76 | 12.76 | 5.81 | 5.81 | 5.81 |
| E | New Mexico | 2.70 | 2.70 | 2.70 | 0.00 | 0.00 | 0.00 |
| E | Oregon | 7.10 | 7.10 | 7.10 | 0.00 | 0.00 | 0.00 |
| E | Utah | 1.64 | 1.64 | 1.64 | 0.00 | 0.00 | 0.00 |
| E | Washington | 1.52 | 1.52 | 1.52 | 0.00 | 0.00 | 0.00 |
| E | Wyoming | 8.02 | 10.68 | 10.68 | 6.49 | 6.49 | 6.49 |
| F | Minnesota | 22.27 | 22.27 | 35.77 | 6.10 | 6.10 | 6.10 |
| F | Montana | 7.14 | 7.14 | 7.14 | 5.81 | 5.81 | 5.81 |
| F | North Dakota | 15.63 | 15.63 | 15.63 | 5.42 | 5.42 | 5.42 |
| F | South Dakota | 13.47 | 13.47 | 13.47 | 14.76 | 14.76 | 14.76 |
| G | Colorado | 4.51 | 4.51 | 4.51 | 2.14 | 2.14 | 2.14 |
| G | Montana | 2.52 | 2.52 | 2.52 | 3.38 | 3.38 | 3.38 |
| G | Nebraska | 6.89 | 6.89 | 6.89 | 8.75 | 8.75 | 8.75 |
| G | New Mexico | 11.20 | 11.20 | 11.20 | 0.00 | 0.00 | 0.00 |
| G | South Dakota | 5.78 | 5.78 | 5.78 | 14.22 | 14.22 | 14.22 |
| G | Wyoming | 6.32 | 6.32 | 6.32 | 7.47 | 7.47 | 7.47 |
| H | Colorado | 17.32 | 40.86 | 40.86 | 7.39 | 7.39 | 7.39 |
| H | Kansas | 14.91 | 45.27 | 45.27 | 12.83 | 12.83 | 12.83 |
| H | Nebraska | 16.48 | 36.40 | 36.40 | 20.43 | 20.43 | 20.43 |
| H | New Mexico | 54.61 | 59.52 | 59.52 | 0.00 | 0.00 | 0.00 |
| H | Oklahoma | 28.65 | 28.65 | 30.68 | 50.57 | 63.68 | 63.68 |
| H | Texas | 40.48 | 40.48 | 44.72 | 53.88 | 83.47 | 83.47 |
| I | Texas | 20.59 | 42.65 | 47.87 | 43.88 | 73.47 | 83.47 |
| J | Kansas | 24.35 | 52.96 | 62.92 | 66.03 | 78.58 | 95.15 |
| J | Oklahoma | 19.24 | 19.40 | 30.55 | 50.47 | 62.84 | 82.41 |
| J | Texas | 22.31 | 28.89 | 51.30 | 58.10 | 82.70 | 111.02 |
| K | Illinois | 51.66 | 64.18 | 64.18 | 31.37 | 42.86 | 93.38 |
| K | Michigan | 37.15 | 48.33 | 48.33 | 83.08 | 116.61 | 163.18 |
| K | Minnesota | 55.35 | 73.80 | 73.80 | 38.81 | 58.02 | 132.15 |
| K | Wisconsin | 47.90 | 47.90 | 47.90 | 36.83 | 51.22 | 129.88 |
| L | Indiana | 45.22 | 45.22 | 45.22 | 46.63 | 67.39 | 301.36 |
| L | Michigan | 37.15 | 37.15 | 37.15 | 83.08 | 116.61 | 206.03 |
| L | New York | 36.87 | 36.87 | 36.87 | 59.89 | 87.36 | 165.68 |
| L | Ohio | 31.19 | 31.19 | 31.19 | 84.79 | 108.63 | 321.79 |
| L | Wisconsin | 35.70 | 35.70 | 37.63 | 42.68 | 57.07 | 152.40 |

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Table 23 Average cost per acre for conservation systems needed to control sheet and rill erosion—Continued

| Land Resource Region | State | Cropland with erosion rate 1-2T | Cropland with erosion rate 2-4T | Cropland with erosion rate >4T | Pastureland with erosion rate 1-2T | Pastureland with erosion rate 2-4T | Pastureland with erosion rate >4T |
|----------------------|---------------|---------------------------------|---------------------------------|--------------------------------|------------------------------------|------------------------------------|-----------------------------------|
| M | Illinois | 155.61 | 155.61 | 155.61 | 30.53 | 49.56 | 93.42 |
| M | Indiana | 70.55 | 70.55 | 70.55 | 68.85 | 70.82 | 70.82 |
| M | Iowa | 67.19 | 90.70 | 222.63 | 51.37 | 113.83 | 172.78 |
| M | Kansas | 11.54 | 28.19 | 78.30 | 8.90 | 17.09 | 23.58 |
| M | Michigan | 61.50 | 71.40 | 90.16 | 78.48 | 97.12 | 156.87 |
| M | Minnesota | 113.98 | 116.00 | 120.84 | 46.31 | 58.05 | 132.18 |
| M | Missouri | 51.76 | 99.42 | 117.47 | 41.20 | 57.63 | 107.14 |
| M | Nebraska | 13.06 | 38.12 | 68.48 | 12.63 | 37.99 | 46.72 |
| M | Ohio | 35.37 | 36.95 | 44.85 | 78.29 | 102.20 | 142.86 |
| M | Oklahoma | 16.90 | 27.16 | 39.23 | 24.11 | 39.84 | 50.64 |
| M | South Dakota | 12.52 | 37.58 | 88.23 | 15.17 | 24.72 | 35.15 |
| M | Wisconsin | 51.78 | 52.84 | 64.60 | 21.86 | 48.77 | 129.95 |
| N | Alabama | 60.04 | 63.97 | 63.97 | 83.91 | 83.91 | 83.91 |
| N | Arkansas | 25.48 | 42.26 | 44.07 | 49.04 | 58.35 | 64.92 |
| N | Georgia | 38.50 | 57.79 | 57.79 | 71.00 | 71.00 | 71.00 |
| N | Illinois | 35.46 | 68.19 | 102.01 | 30.53 | 45.79 | 97.61 |
| N | Indiana | 35.07 | 65.87 | 97.78 | 39.57 | 65.00 | 127.06 |
| N | Kentucky | 47.30 | 47.30 | 47.30 | 79.19 | 79.19 | 79.19 |
| N | Maryland | 44.72 | 51.50 | 90.24 | 71.70 | 81.99 | 99.91 |
| N | Missouri | 30.15 | 58.27 | 86.40 | 41.20 | 53.05 | 110.44 |
| N | N. Carolina | 53.68 | 53.68 | 53.68 | 67.82 | 527.29 | 527.29 |
| N | Ohio | 35.37 | 36.95 | 44.85 | 78.29 | 102.13 | 142.79 |
| N | Oklahoma | 21.57 | 32.77 | 33.95 | 50.47 | 62.84 | 74.09 |
| N | Pennsylvania | 65.18 | 74.04 | 113.98 | 61.12 | 67.40 | 78.71 |
| N | Tennessee | 67.57 | 67.57 | 67.57 | 102.44 | 102.44 | 102.44 |
| N | Virginia | 78.00 | 85.28 | 85.28 | 114.35 | 114.35 | 114.35 |
| N | West Virginia | 54.21 | 57.26 | 108.82 | 39.30 | 46.31 | 59.84 |
| O | Arkansas | 18.21 | 25.33 | 58.78 | 49.04 | 58.35 | 58.35 |
| O | Illinois | 35.35 | 59.16 | 152.27 | 54.18 | 61.29 | 61.29 |
| O | Louisiana | 22.87 | 24.14 | 65.45 | 49.93 | 60.84 | 60.84 |
| O | Mississippi | 43.94 | 57.45 | 163.35 | 77.11 | 91.12 | 91.12 |
| O | Missouri | 20.64 | 42.15 | 175.92 | 43.00 | 69.83 | 69.83 |
| O | Tennessee | 32.78 | 44.26 | 111.47 | 87.23 | 100.59 | 100.59 |
| P | Alabama | 39.20 | 83.86 | 83.86 | 55.91 | 56.99 | 56.99 |
| P | Arkansas | 30.18 | 30.18 | 44.56 | 49.04 | 58.35 | 64.92 |
| P | Florida | 55.29 | 90.53 | 90.53 | 48.39 | 49.37 | 49.37 |
| P | Georgia | 38.50 | 72.15 | 72.15 | 68.47 | 68.47 | 68.47 |
| P | Illinois | 41.48 | 155.89 | 160.02 | 54.18 | 61.29 | 66.02 |
| P | Kentucky | 125.82 | 162.48 | 201.53 | 60.33 | 65.54 | 67.78 |
| P | Louisiana | 29.53 | 29.53 | 49.66 | 49.93 | 60.84 | 69.73 |
| P | Mississippi | 0.00 | 0.00 | 0.00 | 71.74 | 72.72 | 72.72 |
| P | N. Carolina | 34.13 | 42.95 | 42.95 | 646.29 | 670.71 | 670.71 |
| P | Oklahoma | 21.69 | 21.69 | 32.84 | 50.47 | 62.84 | 74.09 |

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Table 23 Average cost per acre for conservation systems needed to control sheet and rill erosion—Continued

| Land Resource Region | State | Cropland with erosion rate 1-2T | Cropland with erosion rate 2-4T | Cropland with erosion rate >4T | Pastureland with erosion rate 1-2T | Pastureland with erosion rate 2-4T | Pastureland with erosion rate >4T |
|----------------------|---------------|---------------------------------|---------------------------------|--------------------------------|------------------------------------|------------------------------------|-----------------------------------|
| P | S. Carolina | 167.16 | 212.98 | 261.23 | 79.19 | 102.74 | 104.68 |
| P | Tennessee | 108.49 | 138.32 | 170.07 | 94.99 | 100.51 | 102.44 |
| P | Texas | 31.45 | 35.56 | 57.05 | 58.10 | 82.70 | 99.84 |
| P | Virginia | 48.45 | 64.10 | 64.10 | 93.20 | 121.03 | 121.03 |
| R | Connecticut | 80.93 | 220.51 | 306.73 | 147.33 | 370.40 | 473.12 |
| R | Maine | 84.50 | 228.46 | 288.92 | 162.74 | 424.21 | 521.57 |
| R | Massachusetts | 75.84 | 257.79 | 401.50 | 99.65 | 371.91 | 470.48 |
| R | N. Hampshire | 89.40 | 396.49 | 407.16 | 164.97 | 641.82 | 834.19 |
| R | New Jersey | 75.50 | 226.57 | 280.64 | 145.86 | 391.17 | 496.91 |
| R | New York | 59.36 | 183.01 | 215.80 | 114.33 | 284.41 | 366.04 |
| R | Ohio | 55.37 | 258.25 | 417.77 | 276.13 | 653.21 | 887.11 |
| R | Pennsylvania | 85.95 | 188.83 | 316.70 | 149.43 | 300.74 | 345.54 |
| R | Rhode Island | 89.47 | 245.08 | 307.54 | 346.78 | 638.14 | 774.89 |
| R | Vermont | 66.73 | 182.51 | 243.06 | 157.20 | 374.21 | 491.73 |
| S | Delaware | 75.32 | 162.63 | 162.63 | 106.50 | 209.57 | 237.28 |
| S | Maryland | 76.92 | 135.37 | 135.37 | 138.73 | 244.22 | 273.12 |
| S | Massachusetts | 89.16 | 205.58 | 205.58 | 264.51 | 288.27 | 288.27 |
| S | New Jersey | 77.06 | 143.27 | 143.27 | 78.87 | 142.46 | 159.02 |
| S | New York | 62.19 | 173.46 | 173.46 | 122.12 | 131.40 | 131.40 |
| S | Pennsylvania | 86.50 | 226.21 | 226.21 | 78.87 | 142.46 | 159.02 |
| S | Virginia | 70.79 | 135.27 | 135.27 | 129.64 | 407.31 | 487.96 |
| S | West Virginia | 68.88 | 164.96 | 164.96 | 59.99 | 100.67 | 111.92 |
| T | Delaware | 60.90 | 90.11 | 142.49 | 57.48 | 116.25 | 116.25 |
| T | Florida | 58.85 | 58.85 | 58.85 | 52.49 | 75.31 | 75.31 |
| T | Georgia | 38.50 | 57.79 | 57.79 | 69.74 | 69.74 | 69.74 |
| T | Louisiana | 22.87 | 24.14 | 65.45 | 60.84 | 60.84 | 60.84 |
| T | Maryland | 58.02 | 92.33 | 154.17 | 54.35 | 138.59 | 138.59 |
| T | Mississippi | 37.99 | 37.99 | 37.99 | 79.19 | 102.74 | 102.74 |
| T | N. Carolina | 60.43 | 60.43 | 60.43 | 50.55 | 74.97 | 74.97 |
| T | New Jersey | 73.62 | 127.80 | 237.64 | 53.25 | 53.25 | 53.25 |
| T | S. Carolina | 48.79 | 48.79 | 48.79 | 79.19 | 102.74 | 102.74 |
| T | Texas | 14.00 | 22.23 | 74.68 | 0.00 | 82.70 | 82.70 |
| T | Virginia | 49.53 | 49.53 | 49.53 | 93.20 | 117.89 | 117.89 |
| U | Florida | 54.16 | 54.16 | 54.16 | 46.96 | 46.96 | 46.96 |
| V | Hawaii | 24.16 | 24.16 | 24.16 | 0.00 | 0.00 | 0.00 |
| W | Alaska | 24.16 | 24.16 | 24.16 | 0.00 | 0.00 | 0.00 |

Note: A zero cost was used for some states where there were very few pastureland acres with manure applied and with erosion rates above T.

Summary of land treatment costs

Land treatment costs were estimated by multiplying the number of acres expected to need erosion control times the per-acre cost for the conservation systems required. An adjustment factor was applied to the number of manured acres in each erosion category to account for erosion control practices that have been implemented since 1997. It was judged that about 10 percent of the acres with erosion rates above T have had conservation systems installed or adopted since 1997.

The annual average cost for the land treatment element of a CNMP was estimated to be \$1,721 per farm (table 24). Costs ranged from an average of \$1,267 for

small farms to \$3,925 for large farms. The highest average cost was for swine farms (\$3,615 per farm) because most swine are produced in the Midwest and the East where most of the acres with sheet and rill erosion occur. Land treatment costs were highest in the Northeast region where the average cost was \$4,465 per farm (table 25). Average cost exceeded the national average in the Appalachian and Corn Belt regions. The lowest land treatment costs were in the Pacific (\$67 per farm) and Mountain regions (\$77 per farm).

Overall, annual land treatment costs totaled \$443 million. Costs in the Northeast and the Corn Belt regions comprised over two-thirds of this total cost.

Table 24 Annual land treatment costs per farm, by livestock type and farm size

| Dominant livestock type or farm size class | Number of farms | Land treatment costs on cropland | Land treatment costs on pastureland | Total land treatment costs |
|--|-----------------|----------------------------------|-------------------------------------|----------------------------|
| Fattened cattle | 10,159 | 2,586 | 27 | 2,613 |
| Milk cows | 79,318 | 2,606 | 54 | 2,660 |
| Swine | 32,955 | 3,576 | 39 | 3,615 |
| Turkeys | 3,213 | 2,407 | 985 | 3,391 |
| Broilers | 16,251 | 826 | 393 | 1,220 |
| Layers/Pullets | 5,326 | 1,429 | 256 | 1,685 |
| Confined heifers/veal | 4,011 | 2,026 | 0 | 2,026 |
| Small farms with confined livestock types | 42,565 | 336 | 15 | 351 |
| Pastured livestock types | 61,272 | 344 | 13 | 357 |
| Specialty livestock types | 2,131 | 390 | 244 | 634 |
| Large | 19,746 | 3,565 | 359 | 3,925 |
| Medium | 39,437 | 2,749 | 147 | 2,897 |
| Small | 198,018 | 1,238 | 29 | 1,267 |
| All CNMP farms | 257,201 | 1,648 | 73 | 1,721 |

Costs Associated with Development and Implementation of Comprehensive Nutrient Management Plans
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Table 25 Annual land treatment costs per farm, by farm production region

| Farm production region | Number of farms | Land treatment costs on cropland | Land treatment costs on pastureland | Total land treatment costs |
|------------------------|-----------------|----------------------------------|-------------------------------------|----------------------------|
| Appalachian | 22,899 | 1,582 | 572 | 2,154 |
| Corn Belt | 71,540 | 2,286 | 26 | 2,312 |
| Delta States | 12,352 | 175 | 128 | 302 |
| Lake States | 52,817 | 983 | 6 | 990 |
| Mountain | 7,964 | 68 | 9 | 77 |
| Northeast | 31,598 | 4,447 | 18 | 4,465 |
| Northern Plains | 26,309 | 392 | 3 | 395 |
| Pacific | 7,974 | 58 | 10 | 67 |
| Southeast | 12,807 | 1,181 | 42 | 1,223 |
| Southern Plains | 10,941 | 283 | 51 | 334 |
| All CNMP farms | 257,201 | 1,648 | 73 | 1,721 |