Miscellaneous Report 132—1975

Crop Equivalent Rating Guide for Soils of Minnesota

R.H. RUST
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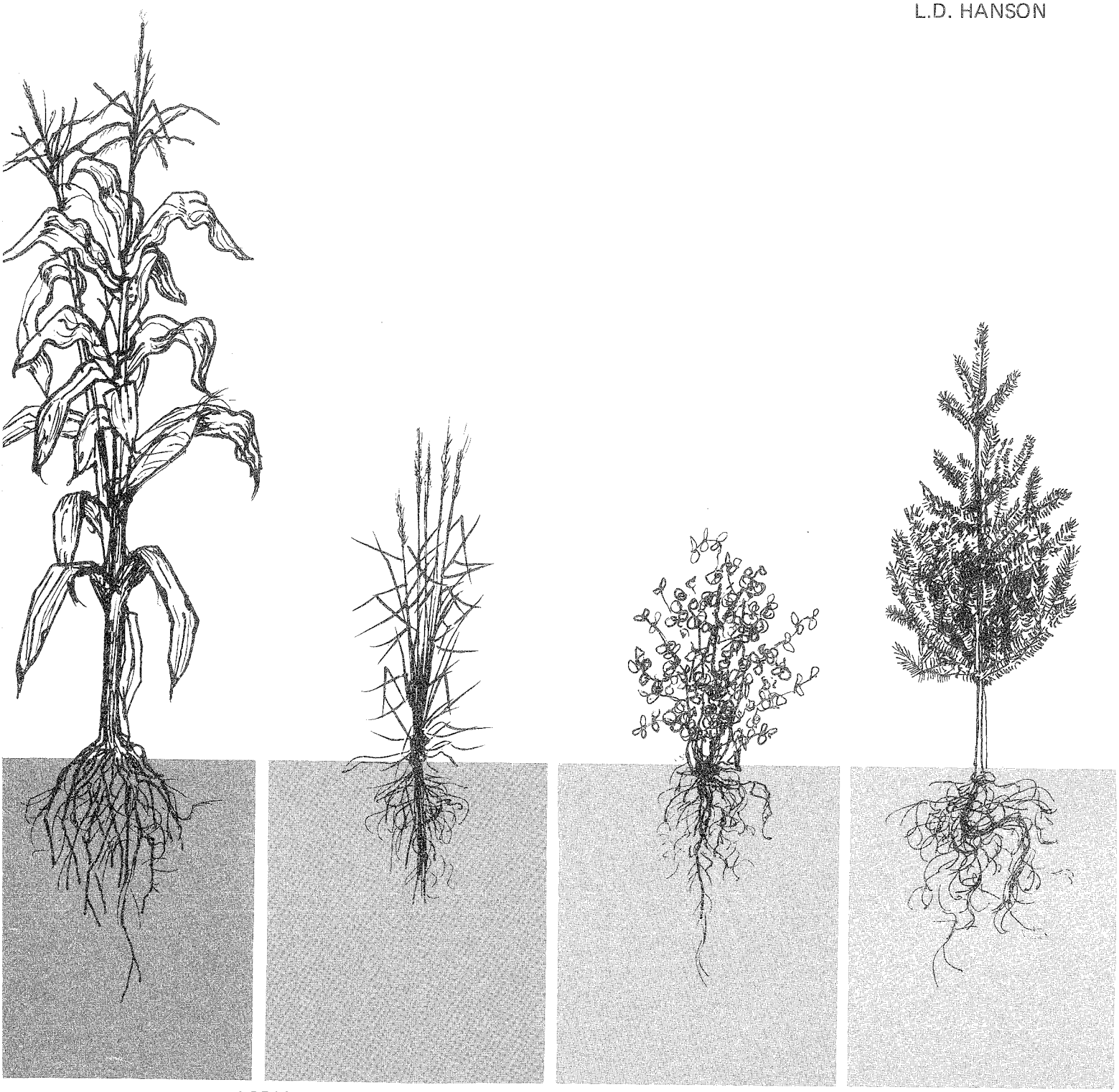

AGRICULTURAL EXPERIMENT STATION • UNIVERSITY OF MINNESOTA

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ACKNOWLEDGMENT

This miscellaneous report includes contributions and observations from more than 600 Minnesota farmers during 16 years (1956-72). They have provided soil management and crop production information on a great variety of Minnesota soils. Soil Conservation Service soil scientists, district conservationists, county agricultural agents, and research workers in the Department of Soil Science also made contributions from their studies on fertility management, tillage operations, and climatology. Special acknowledgment is due D. D. Barron, E. L. Bruns, L. M. Chamberlain, J. E. Cummins, H. L. Hokanson, R. R. Lewis, D. E. DeMartelaire, R. O. Paulson, and G. A. Poch of the Soil Conservation Service for review and contributions to table 7.

The Department of Agricultural and Applied Economics, through its Farm Management Association records and Farm Business records program, has provided many of the production costs.

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R. H. Rust and L. D. Hanson

INTRODUCTION

Minnesota soils are the foundation for large, diversified agricultural and forest industries. The agricultural industry generates about 40 percent of the wealth of the state from the productivity of 24 million acres of cropland. Forest use dominates the soils and climate of another 18 million acres. This land use adds $500 million annually to the state's economy.

Minnesota soils do not uniformly produce crops and trees. Soils vary from acid peat bogs of northern areas to gently rolling, dark-colored deep loamy soils in southern areas, the latter producing 200 bushels of corn in favorable years under superior management.

Information has been compiled on the nature of soil resources, suitability and productivity for crops, pasture, and timber. This report is designed to summarize and to use this information in the form of soil maps, and to answer practical questions about the relative productivity of specific tracts of land.

One of the most important decisions of farm management is to assess the crop potential of tracts of land. In Minnesota, this involves some 24 million acres under cultivation and large acreages in permanent pasture or woodland. The decisions to cultivate land involve several possible levels of management. By "level" is meant some set of inputs—of tillage, fertilizer, weed and insect control, harvesting procedures—that will allow maximum yield at an affordable cost.

No one set of management suggestions can be applied with uniform success over all soils or even over a wide range of soils. Therefore, it is extremely difficult to assess the effects of varying management. Reliable estimates of sustained (or attainable) yield must be acquired by (1) observing the same soil over time within a definable range of management and by (2) observing a well-defined set of management rules over time on different but related soils. Option (1) is preferable, but usually more costly to accomplish. Both options have been used in this report.

Not least in the evaluation of yield estimates is a recognition of the ever changing technology. This could mean new varieties, new fertilizer, herbicide, and weedicide formulations, new tillage methods (also seeding and harvesting), and new knowledge of soil properties affecting plant growth. Also, the prevalence of new plant diseases or disease vectors must continually be monitored. The use of irrigation, especially sprinkler irrigation, in a mostly rain-fed agriculture generally reduces the variability in soil moisture supply.

Any estimate of yield—whether of an annual or perennial crop—must be *re-evaluated at least every 5 years,* (table 7).

In summary, crop yield is the result of the interaction of natural environment and management factors. The two environment factors—soil and climate—are fixed in time and space and can be organized on maps. Management and technology are generally independent of location so the yield estimates developed in this report are in terms of specified levels of management and technology.

PRODUCTIVITY RATINGS

Productivity ratings have become rather widely used, in most instances reflecting physical (as opposed to economic) productivity of the soils for the most commonly grown crop or crops. Productivity is usually estimated for one or two levels of management.

In table 7 a moderate level of management has been selected: one employed by at least 50 percent of operators based on sampling information.

This level of management will include the following:

1. Water table management on soils where necessary.
2. Erosion control practices on soils where needed.
3. Use of limestone and other soil amendments as indicated by soil tests.
4. Use of herbicides for weed control and insecticides as needed.
5. Use of adapted varieties in populations related to soil moisture and fertility supply.
6. Harvest procedures that minimize losses.
7. Timeliness of all operations related to seeding, cultivation, weed and insect control, and harvesting.

WEATHER

Even with a defined management system, or systems, on well-characterized soils, there is a third major variable (or set of variables) implicit in climate. Many additional aspects of climate, besides total rainfall, must be evaluated during the growing season. These can include—soil temperature, rainfall distribution and temperatures, wind velocities, cloud cover, frost occurrence, seasonal progression of moisture (more correctly, soil moisture) and temperature (often now in terms of growing degree days), and others—all operating individually, collectively, and with interaction (Gross and Rust, 1972). Studies done over a period of time are necessary to fairly assess the relationship of weather to yield.

Weather, particularly during the growing season, is a major contributor to yield variability. A study by Gross (1968) concluded that nearly two-thirds of the yield variability in corn could be associated with monthly temperature and soil moisture variations, the latter being rather directly related to growing season, rainfall distribution, and evaporation.

From the Red River Valley in the northwest to the Mississippi Valley of southeastern Minnesota, growing season precipitation is about two-thirds of the annual total, figures 1 and 2. Additionally there are air temperature fluctuations affecting above ground growth rates as well as germination, nitrogen metabolism, and other root environmental conditions.

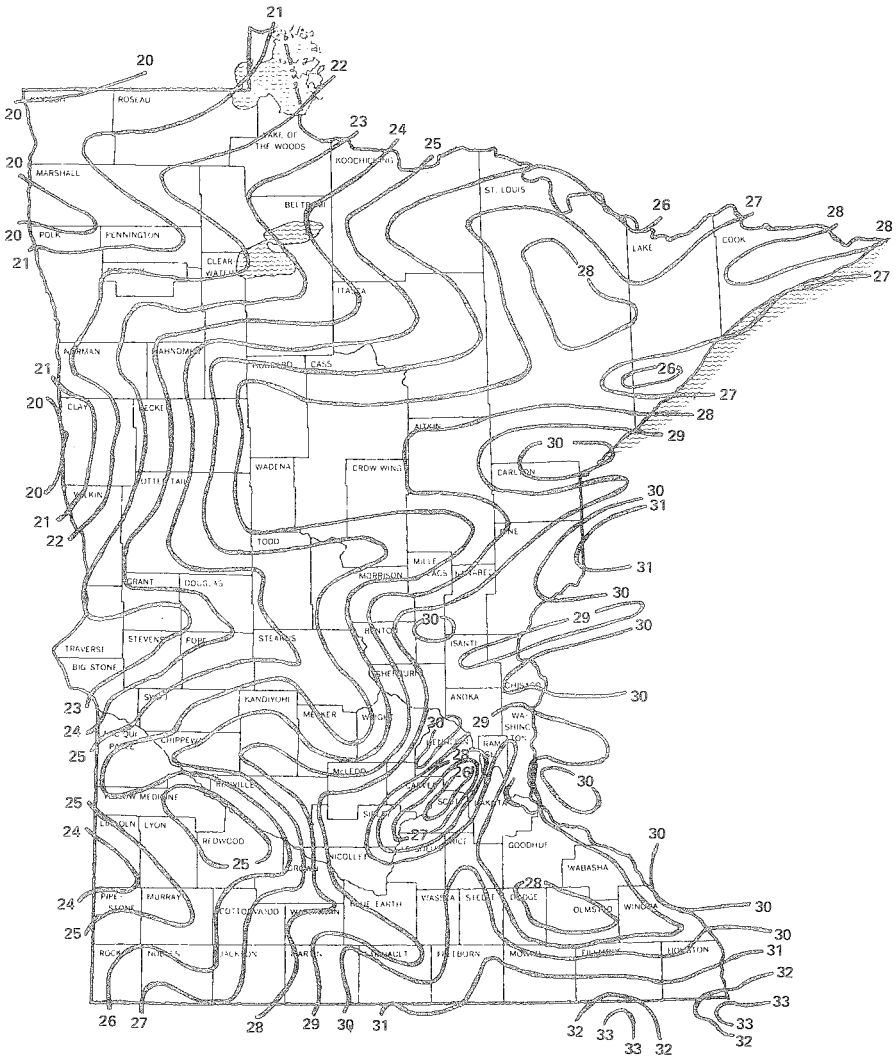

Figure 1. Average annual precipitation (in inches). Source: Climate of Minnesota, Part IX—Precipitation normals, 1941-1970, Donald G. Baker and Earl L. Kuehnast. Manuscript in preparation.

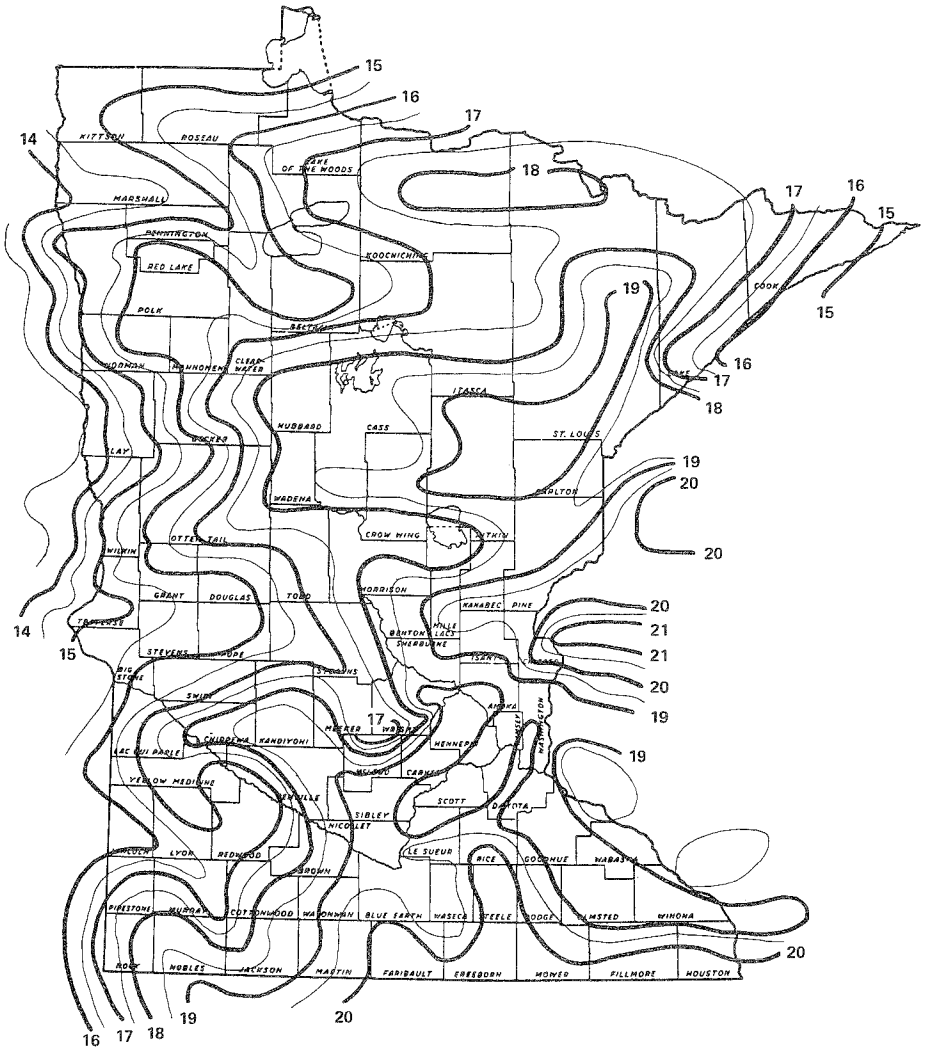

Figure 2. Average growing season precipitation, April through September 1941-1970. Source: Climate of Minnesota, Part IX—Precipitation normals, 1941-1970, Donald G. Baker and Earl L. Kuehnast. Manuscript in preparation.

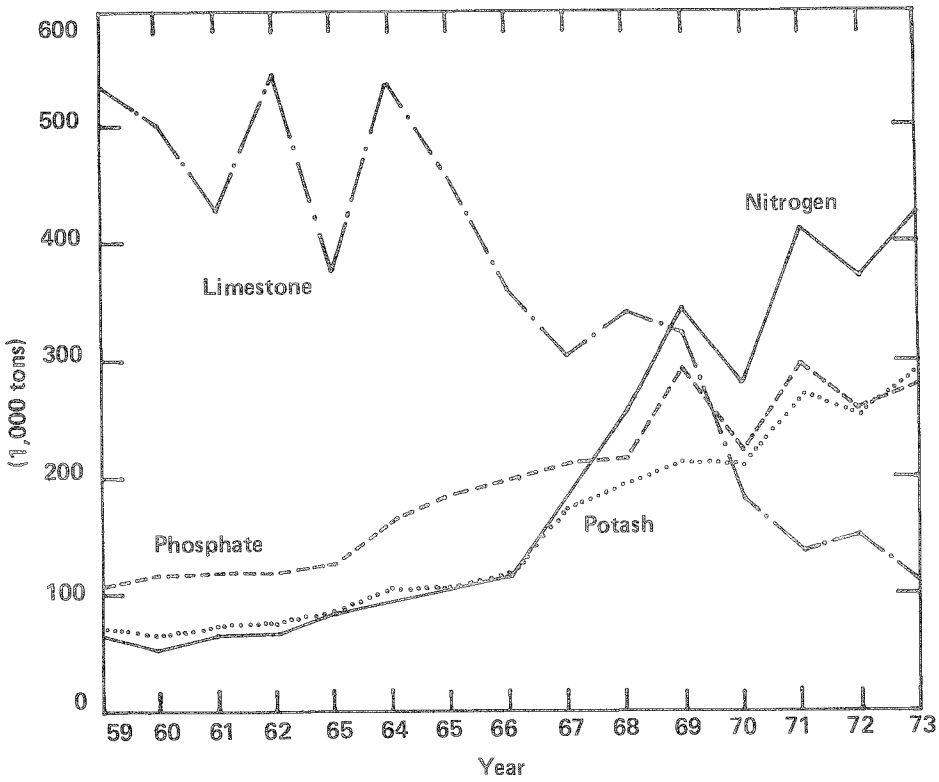

Figure 3. Consumption of limestone and commercial fertilizers in Minnesota (1959-73). Source: USDA Statistical Reporting Service, Special Circular 7, 1974.

SOIL AMENDMENTS

The use of fertilizer in Minnesota has increased dramatically during the 15 years from 1959-73, figure 3.

Nitrogen consumption in 1974 is estimated at 410,000 tons, mostly on corn, wheat, oats, and barley.

Phosphate consumption in 1974 is estimated at 268,000 tons, mostly on corn, wheat, oats, and soybeans.

Potash consumption in 1974 is estimated at 322,000 tons.

Limestone use in 1974 was 114,000 tons. Its use has declined in recent years.

In 1964:

All crops received—24 pounds N, 17 pounds P, 27 pounds K/acre.

Corn received, on average—30 pounds N, 17 pounds P, 30 pounds K/acre.

Oats—10 pounds N, 10 pounds P, 8 pounds K/acre.

Soybeans—2 pounds N, 13 pounds P, 21 pounds K/acre.

(Buxton and Elder, 1968).

From figure 3 it is apparent that fertilizer use in Minnesota doubled from 1964 to 1973. Much of this increase occurred in the principal corn and soybean growing areas where research and practice clearly demonstrated a large yield response especially to N and particularly on the more poorly drained soils (Hanson and Grava, 1960).

PESTICIDES

In 1972, it was estimated that 85 percent of corn acreage was treated with pesticides (herbicides or insecticides or both); 75 percent of soybeans; 78 percent of small grains; in 1973, 90 percent of corn; 86 percent of soybeans; and 86 percent of small grains (Crop and Livestock Reporting Service, September 1974).

TIMELINESS

Timeliness of operations is often the difference between average and above-average production. It has been suggested by Nelson (quoted by Boisvert and Jensen, 1973) that the difference in yield between corn planted the first half of May and corn planted the last half may be about 15 bushels in southwestern Minnesota. Nelson points out that delayed planting not only is costly in corn production, but also in soybean production, which commonly follows.

DEVELOPMENT OF CROP EQUIVALENT RATINGS

In recent years a *crop equivalent rating* of soils has been developed. The word "equivalent" means that in the usual diversity of crops grown in Minnesota, an effort is made to express dollar equivalence in net return for the most commonly grown crops.

The *crop equivalent ratings* should reflect the relative net economic return per acre of soil when managed for cultivated crops, permanent pasture, or for forestry, whichever use is computed as giving the highest net return. To derive a net income figure for all soils of interest and then to rank them, using 100 as equivalent to the highest rating, requires consideration of several items.

First, the gross productivity of the soil unit must be evaluated at a given level of management and for a particular combination of crops on the cultivated land. This study uses a moderate level of management, previously defined as that being used by at least half of the farmers on the soil under consideration. The *particular combinations of crops* is that prevailing on a given soil as indicated in table 8, derived from the Conservation Needs Inventory (1971). The CNI information is not specific in regard to kind of row crop or grain crop, but this can be reasonably estimated from consideration of local cropping practice. Where one crop, such as corn or spring wheat, dominates, that crop largely determines gross productivity. For most soils, several crops are considered in calculating the income estimates.

Thus, taking the production estimates for the specific cropping sequence times the market value provides a gross value for the "rotation" occurring on a given soil. Prices used in table 1 represent a 5-year average.

Costs of production must be subtracted from the gross production value figure. These costs can be considered as fixed and variable. Fixed costs are primarily the land charge: investment interest charge, taxes, permanent improvements such as drainage systems, terraces, or other structures. Variable costs include seed, fertilizer, tillage, and harvesting. Some production costs have been assembled from record-keeping projects of the Department of Agricultural and Applied Economics, tables 2 and 3.

In lieu of reliable production cost figures, it is possible to review the physical and chemical limitations to production on different soils and to scale these limitations to "dollar equate costs," table 10.

To illustrate the method of deriving a crop equivalent rating (CER) three examples follow:

(1) Nicollet: B slope, 1 erosion

	Corn	Soybean	Oats	Alf-Mix Hay	Other
% land use	50	20	10	5	15
Yield	120 bu	40 bu	85 bu	4.5T	
Unit price (dollars)	1.22	3.33	.68	22.00	
Gross value	146.40	133.20	57.80	99.00	
Per distrib. (A)	73.20	26.64	5.78	4.95	
Fixed costs	18.00	18.00	18.00	18.00	
Variable costs	42.00	23.00	18.00	22.00	
Total costs	60.00	41.00	36.00	40.00	
Per distrib. (B)	30.00	8.20	3.60	2.00	
Net (A–B)	43.20	18.44	2.18	2.95	

Total/net acre = 66.77
Let $66.77 be equivalent to CER of 100

(2) Barbert: A slope, 1 erosion

	Corn	Soybean	Oats	Alf-Mix Hay	Other
% land use	60	20	5	5	10
Yield	100 bu	35 bu	75 bu	4.0 T	
Unit price (dollars)	1.22	3.33	.68	22.00	
Gross value	122.00	116.55	51.00	88.00	
Per distrib. (A)	73.20	23.30	2.55	4.40	
Fixed costs	18.00	18.00	18.00	18.00	
Variable costs	47.00	28.00	23.00	27.00	
Total costs	65.00	46.00	41.00	45.00	
Per distrib. (B)	39.00	9.20	2.05	2.25	
Net (A–B)	34.20	14.10	.50	2.15	

Total net/acre = 50.95
If 66.77 = 100 (CER)
Then $\frac{50.95 \times 100}{66.77} = 76$ (for CER)

(3) Bearden: A slope, 1 erosion

	Sugar beets	Soybeans	Wheat	Oats	Barley	Alf-Hay	Pasture	Other
% land use	10	5	25	15	15	15	5	10
Yield	15 T	20 bu	40 bu	70 bu	45 bu	3.6 T	90 animal unit days	
Unit price (dollars)	15.00	3.33	2.15	.68	1.10	22.00	.20	
Gross value	225.00	66.60	86.00	47.60	49.50	79.20	18.00	
Per distrib. (A)	22.50	3.33	21.50	7.14	7.42	11.88	.90	
Fixed cost	10.00	8.00	8.00	8.00	8.00	8.00	8.00	
Variable cost	80.00	20.00	22.00	17.00	18.00	20.00	0	
Total cost	90.00	28.00	30.00	25.00	26.00	28.00	8.00	
Per distrib. (B)	9.00	1.40	7.50	3.75	3.90	4.20	.40	
Net (A–B)	13.50	1.93	14.00	3.39	3.52	7.68	.50	

Total net acre = 44.52
If 66.77 = 100 (CER)
Then $\frac{44.52 \times 100}{66.77} = 67$ (for CER)

CONSIDERATION OF PASTURE AND TIMBER IN RATINGS

Since row crop production is not recommended on slopes over 12 percent, because of soil and water loss, soils which occur on these and steeper slopes should be evaluated for permanent pasture and/or timber production. Less reliable data are available on gross production of either permanent pasture or woodland species than for annual crops. In table 7 site index values have been included on soils where woodland production can be considered. Where soils are used for woodland production exclusively and where cultivated cropping is a feasible alternative, the Crop Equivalent Rating (CER) may be adjusted downward (generally). A CER about half the values in table 7 is suggested. This adjustment is based on the long-term expectation of net return per acre from woodland production.

Table 4 provides some estimate of timber production in cubic feet per acre as related to the site index of different tree species.

The list of soils in table 7 includes about 425 soil series and about 500 mapping units. That is, some soil series occur frequently on more than one range of slope or more than one erosion condition.

This list is about a third of the total mapping units in use in Minnesota, but is considered representative. Within the county mapping legends (now published in some 20 counties) there are additional slope and erosion units. Adjustments of the CER values for other slope and erosion unit is suggested in table 5.

A climatic adjustment of the CER value may be desirable in some counties. The table 7 values should be considered appropriate in the presently defined Minnesota "geographic center" of the series.

A suggested adjustment, where deemed advisable, follows:

If the annual average rainfall of the county under consideration differs an inch or more from that shown in figure 2 for the "geographic center" of the series, then for each inch above total average rainfall, add 5 percent to the CER listed and for each inch below total average rainfall, subtract 5 percent. Additional research is underway to evaluate this consideration more correctly.

Since the CER values listed assume water management where needed on soils under cultivation, adjustments may be necessary if drainage or other water management is incomplete. A suggested adjustment follows:

If the soil requires surface or tile drainage for a moderate level of production, and if a given acreage lacks this input, the CER used should be about 20 percent of the table 7 figure. This adjustment may apply only to a portion of the soil acreage on a given tract, if drainage exists on other portions.

A PROCEDURE FOR USING CROP EQUIVALENT RATINGS

A procedure for use of crop equivalent ratings and soil maps has been developed and is in use in some counties in several states. It makes use of soil maps and crop equivalent ratings to characterize the productivity of agricultural land. The productivity is related to market values, as expressed by sales of agricultural land or other indices of the economic value of agricultural land. The following eight steps are involved:

1. Obtain soil map and legend.

Soil maps prepared by soil scientists provide an inventory of the soil resources of an area. The mapping units outlined on the map provide a basis for soil-use suggestions and for crop-yield and/or crop equivalency estimates. Soil maps are prepared cooperatively by the Soil Conservation Service and the Minnesota Agricultural Experiment Station (figure 4).

2. Determine appropriate soil use categories.

In many Minnesota counties, nearly all of the agricultural land is in crop production. In some, pasture and timber acreages are significant. If significant, separate soil-use categories may need to be established for each use. It is often easier to consider only the cropland use, making adjustments for land in timber, brush, or pasture.

3. Obtain crop equivalent ratings for each soil mapping unit.

A crop equivalent rating expresses the relative net productivity of a soil. These can be prepared by soil scientists who have mapped the soils in the county and have gathered the necessary crop production information from sources such as research plots and farm records. Using table 7 as a guide, CER's can be prepared for cropland, pastureland, and woodland.

4. Measure and record acreage of each mapping-unit category in each tract of agricultural land in the county.

The measurements may be made with a planimeter, grid, or electronic area calculator. Most acreage measurements are done on 40-acre tracts.

5. Calculate a crop equivalent rating for each 40-acre tract of agricultural land.

A tract-productivity index may be calculated by using the acreage and CER for each soil-mapping unit in a tract. The acreage is multiplied by the CER to obtain a soil contribution for each mapping unit. The soil contributions are added together, then the total is divided by the number of acres in the tract. The result is a tract-productivity index. It is a weighted index of the soil productivity of the tract (table 6).

6. Obtain data on selling price, earning value, cash rent figure and/or appraised value of agricultural land in representative soil areas. One or more of these indicators of dollar value of agricultural land may be used to determine the range, in dollar value or earning capacity, of tracts of land with a range in CER values. The indicators may be obtained locally, with the assistance of individuals and organizations interested in land values. The selling price of

bona fide sales of agricultural land has usually given an excellent correlation with the CER of the tracts involved.
7. Determine the relationship of CER and one or more measures of dollar value of the representative tracts (figure 5). A curve (or graph) may be prepared by plotting the measure of dollar value along the horizontal axis and the CER along the vertical axist. Once the CER of the tract is known, an estimated value of a tract of land can be determined from a graph. If preferred, a table can be prepared from the graph showing CER in one column and estimated values in an adjoining column.
8. Prepare schedule of adjustments for location, roads, special soil conditions, etc., and apply to estimated values obtained in step 7. These values will often require adjustment to fit local conditions not measured by the CER. The estimated values can also be a guide for local assessment officials to arrive at more equitable tax assessments for agricultural land.

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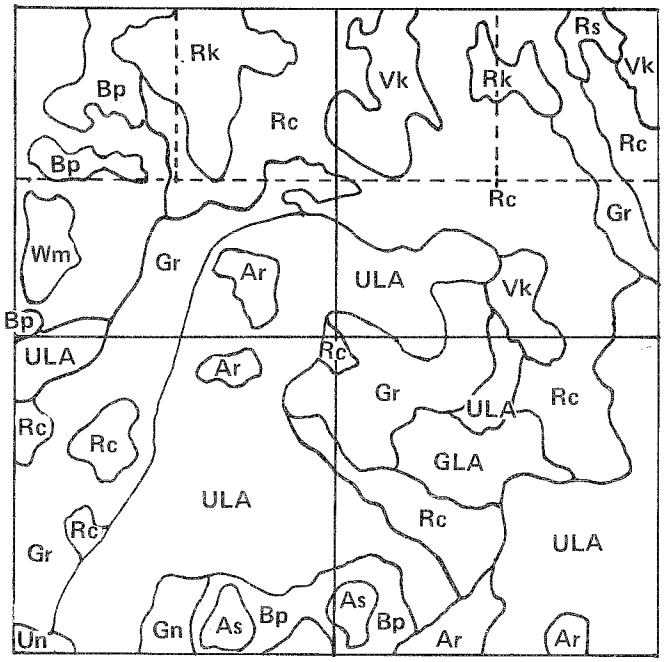

Figure 4. Outline of soil map of section 3, Lockhart Township, Norman County

Symbols	Soils
Ar	Arveson Loam
As	Arveson and Hamar soils
Bp	Borup and Glyndon loams
GLA	Glyndon loam, 0 to 2 percent
Gn	Glyndon loam, wind eroded
Gr	Grimstad fine sandy loam
Rc	Rockwell fine sandy loam
Rk	Rockwell and Kratka soils
Rs	Roliss loam, depressional
ULA	Ulen fine sandy loam, 0 to 2 percent
Vk	Viking clay loam
Wm	Wheatville loam

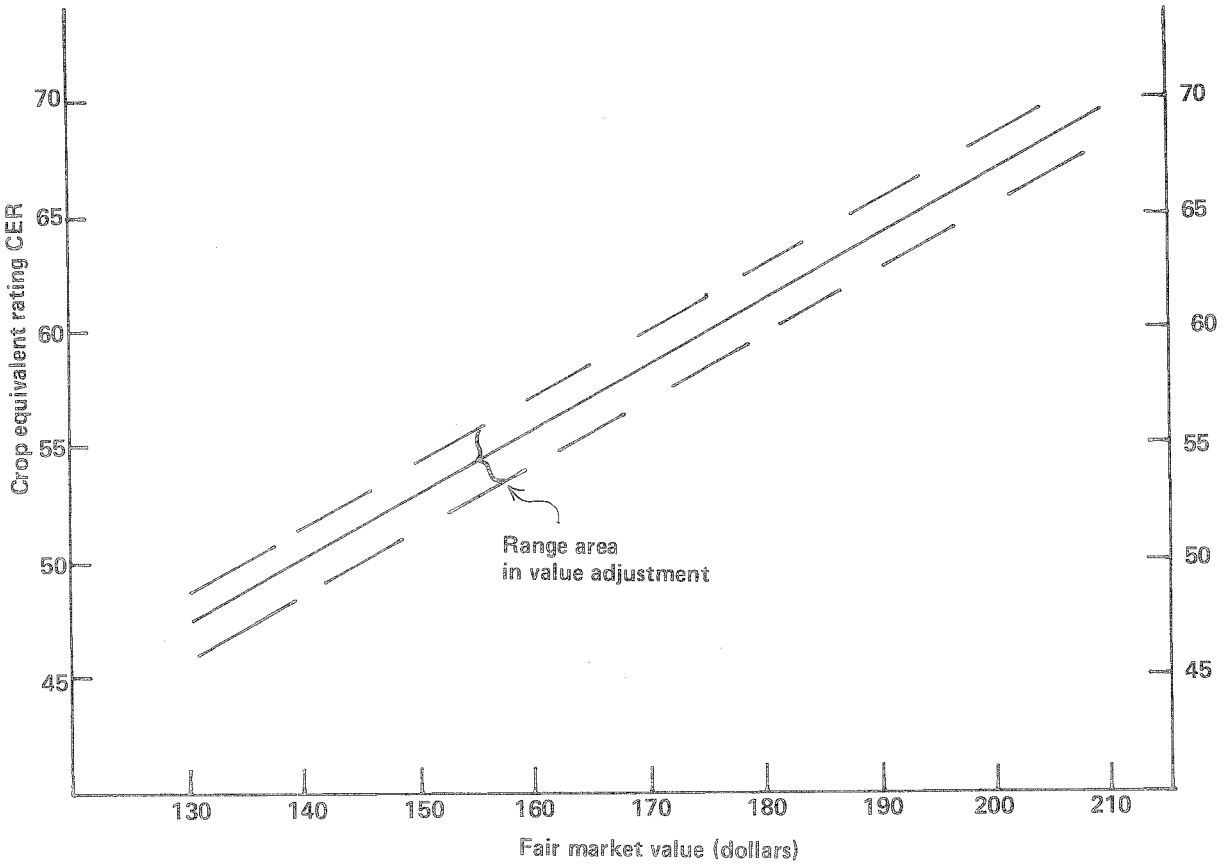

Figure 5. Possible relationship of crop equivalent rating to fair market value Norman County (1971-73)

Table 1. Average prices received for some principal crops by Minnesota farmers, 1969-73 (Crop and Livestock Reporting Service)

	Corn	Soy-beans	Wheat	Oats	Barley	Alf-Hay
	dollars					
1969	1.05	2.37	1.46	.56	.80	20.50
1970	1.18	2.79	1.59	.59	.93	19.50
1971	1.01	3.08	1.37	.56	.84	20.00
1972	1.15	3.45	1.73	.64	.94	21.50
1973	2.20	5.65	4.58	1.11	2.01	27.00
Average	1.32	3.47	2.15	.69	1.10	21.70

Table 2. Production costs per crop acre as reported by Minnesota cooperators keeping farm business records (1969-73)

	Southern counties[1]	Northern counties[2]	East-Central counties[3]
Fixed costs	dollars		
Taxes	4.95	1.71	2.13
Land investment (a) 6%	11.30	4.76	4.35
Fences			
Drainage investment (a) 6%	(13.00)[4]		
Machinery investment (a) 6%	3.20	1.25	2.00
Variable costs			
Fertilizers, herbicides, etc.	19.00	7.32	9.76
Tractor and machinery	23.43	15.30	22.85
Total	61.88	30.34	41.09

1. Counties generally south of a line from Elbow Lake to Hastings.
2. Counties generally north of a line from Fergus Falls to Pine City.
3. Counties included: Anoka, Benton, Isanti, Kanabec, Meeker, Mille Lacs, Morrison, Sherburne, Stearns, Todd, and Wright. Values estimated from 1973 data (only available).
4. Drainage investment is a cost only on those soils having installations. Drainage costs in this period ranged from $200 to $250 per acre (excluding outlet costs) as reported by Department of Agricultural Engineering Extension Service.

Table 3. Variable costs of crop production per acre for different crops as reported by cooperators in the Minnesota Farm Management Association (1969-73)

	Corn		Soybeans		Oats		Wheat		Alf-Hay	
	S.E.[1]	S.W.[2]	S.E.	S.W.	S.E.	S.W.	S.E.	S.W.	S.E.	S.W.
	dollars									
1969	26.76	27.24	8.52	8.14	6.32	6.86	6.26	11.09	10.74	10.43
1970	29.22	28.74	9.78	8.36	4.85	7.73	7.80	14.77	10.52	9.17
1971	31.96	31.36	10.06	9.01	8.00	7.79	11.53	9.66	9.35	12.11
1972	35.65	32.13	12.71	9.42	8.90	8.15	9.05	10.13	13.07	13.64
1973	41.43	39.54	15.98	11.97	8.11	10.10	19.18	14.38	18.14	15.76
Average	32.94	31.80	11.41	9.38	7.24	8.13	10.76	12.01	12.36	12.22

1. Southeastern counties—Dakota, Dodge, Freeborn, Goodhue, LeSueur, Mower, Nicollet, Olmsted, Rice, Scott, Steele, Wabasha, Waseca, Winona.
2. Southwestern counties—Cottonwood, Faribault, Jackson, Martin, Murray, Nobles, Pipestone, Redwood, Watonwan.

Table 4. Annual production by species and site index

Class	9	8	7	6	5	4	3	2
growth (cu. ft.)	90+	80-90	70-80	60-70	50-60	40-50	20-40	−20
Species	--- Site index ---							
Red pine	67+	62-66	57-61	52-56	47-51	42-46	35-41	-35
Jack pine					59-70	48-58	32-47	-32
White spruce	50+							
Tamarack	48+	44-47	39-43	35-39	31-34			
Cedar						38+	21-38	-21
Hardwoods	79+	75-78	70-74	65-69	60-64	55-59	40-54	-40
Oak			68-77	59-67	49-58	40-48		
Aspen	77+	70-76	64-69	58-63	53-57	48-52	39-47	-39
Black spruce							24-40	-24

Source: North Central Forest Experiment Station unpublished data.

Table 5. Percent changes in CER suggested for slope and erosion units (of the same soil series) not listed in table 7

Given: CER for A slope, 1 erosion.

Erosion condition	Slope (percent)		
	B(2-6)	C(6-12)	D(12-18)
0 or 1 (none)	-5%	-20%	-30%
2 (moderate)	-10	-25	-35
3 (severe)	-15	-35	-45

If soils are shallow to rock or have relatively impermeable subsoils, percentage changes should be decreased by at least 5 additional percent in any category.

Table 6. Example of acreage measurement and calculation of average crop equivalent rating for a portion of Section 3, Lockhart Township, Norman County, Minnesota

Section 3 Lockhart

3-1	CODE	CER*	ACRES	CER X ACRES
Gr	39.	62.	10.31	638.99
Rc	60.	56.	18.16	1016.69
Rk	61.	28.	3.68	103.12
Rs	63.	40.	3.73	149.26
Vk	81.	63.	4.79	301.47
Avg. CER–54.3			40.66	2209.53
3-2				
Rc	60.	56.	21.40	1198.24
Rk	61.	28.	2.53	70.90
Vk	81.	63.	15.62	984.26
	56.9		39.55	2253.40
3-3				
Gr	39.	62.	1.38	85.63
Rc	60.	56.	21.40	1198.24
Rk	61.	28.	16.63	465.77
Vk	81.	63.	.55	34.93
	44.6		39.97	1784.57
3-4				
Bp	16.	66.	13.62	898.68
Gn	37.	66.	17.96	1185.19
Rc	60.	56.	2.18	121.82
Rk	61.	28.	5.28	147.78
	60.3		39.03	2353.48

BP–Borup and Glyndon
Gn–Glyndon
Gr–Grimstad
Rc–Rockwell
Rk–Rockwell and Kratka
Rs–Roliss
Vk–Viking

* CER values in this example will not always agree with those in table 7. Variations are due to geographic location, local soils, or combinations of soils used in the soil mapping.

Table 7. Crop equivalent ratings (CER) and yield estimates of principal crops and pasture and site indexes for timber on representative soils of Minnesota. Yield estimates should be considered as attainable over an average period of 5-10 years with moderate level of management.

Soil series	Slope[1]	Erosion[2]	CER	Corn	Spring wheat	Alfalfa hay	Bluegrass pasture	Site index timber species[3]	Minnesota geographic center
				..... bu		T/A	AUD[4]		
Aastad	A	1	65	75	35	4.0	115	75/Aspen	Stevens
	B	1	62						
Aazdahl	A	1	70	75		4.0	115		Grant
	B	1	65						
Adolph	A	1	55	70		3.5	100		Kanabec
Afton	A	1	70	88		4.1	115		Pipestone
Ahmeek	B	1	40			3.5	115	75/Aspen	Carlton
	C	1	35			3.2	100		
	D	1	30			3.0	85		
Almena	A	1	50	60		3.0	85		Chisago
Alvin	B	1	60	70		3.4	95		Goodhue
Amery	A	1	45			3.5	100	75/Aspen	Carlton
	B	1	40						Carlton
Ankeny	B	1	45	68		2.4	70		Freeborn
Anoka	A	1	60	70		3.5	100	55/Oak	Anoka
	B	1	55	70		3.5	100	55/Oak	
Antigo	A	1	50	67		3.1	90	75/Aspen	Washington
	B	1	48	58		3.1	90		
Arcola	A	1	60	75		4.2	120		Washington
Arenzville	A	1	75	110		4.0	125		Wabasha
Arland	B	1	50	65		3.2	95		Dakota
	C	1	45	58		3.0	85		
	D	1	40			2.7	75		
Arveson	A	1	45		30	2.5	95		Norman
Arvilla	A	1	30	52	29	2.7	75		Swift
	B	1	28	50	29	2.4	65		
Athelwold	A	1	66	75		3.5	110		Pipestone
Augsburg	A	1	63		40	3.5	100	75/Cottonwood	Norman
Badger	A	1	40		35	3.5	100	60/Aspen	Roseau
Barbert	A	1	76	100		4.0	115		Blue Earth
Barnes	B	1	65	70	33	3.6	105		Pope
	C	1	60	60		2.4	70		
Baroda	A	1	80	100		4.5	130	60/Cottonwood	Blue Earth
Barrows	A	1	30			2.0	60	38/B.Ash	Crow Wing
Barto	noncropland		10					45/Aspen	Lake
Baudette	A	1	60			4.5	120	60/Red Pine	Koochiching
Bearden	A	1	67		40	3.6			Norman
Beauford	A	1	85	110		5.0	140		Blue Earth
Becker	A	1	57	80		4.0	115	70/Aspen	Sherburne
Bellechester	noncropland		15				30	45/ Oak	Goodhue
Beltrami	A	1	61	55		4.5	125	60/Red Pine	Becker
Bena	A	1	45			2.5	85	55/Red Pine	Itasca
Benoit	A	1	30	50	20	2.0	80		Swift
Beotia	A	1	52	72		3.4	95		Lincoln
	B	1	49	65		3.1	85		
Bertrand	A	1	75	115		4.5	125	65/Red Oak	Houston
	B	1	71	110		4.3	120		
Beseman	A	1	5					25/Black Spruce	Carlton

1. Letters refer to the following categories of slope steepness: A—0-2 percent slope; B—2-6 percent slope; C—6-12 percent slope; D—12-18 percent slope.
2. The numbers 1 and 2 indicate the amount of erosion which had occurred on a particular soil area at the time of the field survey. A number 1 in the table would be the same erosion class as a soil map symbol without an erosion notation. This means that less than 25 percent of the surface soil has been removed. A number 2 class indicates that moderate erosion has occurred or 25 to 75 percent of the surface soil has been removed.
3. The site index number is the estimated height of a stand of trees of the species indicated, growing on the particular soil after 50 years of undisturbed growth.
4. AUD = animal unit days.

Table 7 (continued). Crop equivalent ratings (CER) and yield estimates of principal crops and pasture and site indexes for timber on representative soils of Minnesota. Yield estimates should be considered as attainable over an average period of 5-10 years with moderate level of management.

Soil series	Slope[1]	Erosion[2]	CER	Corn	Spring wheat	Alfalfa hay	Bluegrass pasture	Site index timber species[3]	Minnesota geographic center
				..... bu		T/A	AUD[4]		
Billet	A	1	60	70		3.4	95		Goodhue
	C	1	50						
Biscay	A	1	70	80		3.0	85	80/Cottonwood	Steele
Bixby	A	1	60	70		3.5	100		Dodge
Blackhoof			25(D)[1]			3.4	100	38/B. Ash	Carlton
Blomford	A	1	43	60		3.0	85	65/Oak	Anoka
	B	1	41					60/Oak	
Blooming	B	1	90	120		4.5	125		Steele
	C	1	80	100		4.0	115		
	D	1	70						
Blue Earth	A	1	65	75		3.0	90	34/Black Ash	Martin
Bluffton	A	1	55	55		4.0	115	60/Aspen	Isanti
Bold	C	1	35	50		2.5	70		Goodhue
Boone	B	2	25	40		2.0	60		Dakota
Borup	A	1	58	60	35	3.5	110		Norman
Braham	A	1	42	55		3.0	85		Anoka
	B	1	37	48		3.0	85		
Brainerd	A	1	50	70		4.0	125	75/Aspen	Crow Wing
	B	1	48	65		4.0	125	66/Aspen	
Brickton	A	1	67	80		4.0	110	60/Aspen	Isanti
Brodale	noncropland		10				30	0-35/Red Cedar	Goodhue
Brookings	A	1	70	80		3.5	95		Pipestone
	B	1	66	75		3.4	90		
Brophy	noncropland		10				50		Douglas
Brownton	A	1	80	110		4.5	125	60/Cottonwood	Blue Earth
Burkhardt	A	1	40	55		2.1	60		Dakota
Burnsville	B	1	47	55		2.5	70	50/Red Pine	Wright
Buse	B	1	40	50	30	3.0	85		Lincoln
	C	1	35	40	25	2.5	70		
Calco	A	1	75	95		4.0	115		Blue Earth
Campia	B	1	45	75			115		Washington
	C	1	40	70			110	60/Red Pine	
Canisteo	A	1	82	110		4.0	115		Steele
Carlos	noncropland		10						Douglas
Caron	A	1	70(D)	75			115		Rice
Cashel	A	1	56		40		95		Polk
Cathro	A	1	35(D)				90	40/Balsam Fir	Chisago
Chaseburg	A	1	65	83		3.3	95		Wabasha
	B	1	60	80		3.2	90		
Chaska	A	1	65	85		4.0	115		Carver
Chelsea	B	1	23	50		2.0	70		Goodhue
	C	1	20	40		1.8	65		
	D	1	18			1.5	55	50/Red Pine	
Chetek	A	1	35	50		2.5	70		Mille Lacs
	B	1	33	45		2.3	65	50/Red Pine	
Chilgren	A	1	55			3.5	90	75/Aspen	Koochiching
Clarion	B	1	90	110		4.0	115		Watonwan
Clontarf	A	1	37	60	30	2.5	70	50/Red Pine	Swift

1. Letters refer to the following categories of slope steepness: A—0-2 percent slope; B—2-6 percent slope; C—6-12 percent slope; D—12-18 percent slope; (D) refers to drained condition.
2. The numbers 1 and 2 indicate the amount of erosion which had occurred on a particular soil area at the time of the field survey. A number 1 in the table would be the same erosion class as a soil map symbol without an erosion notation. This means that less than 25 percent of the surface soil has been removed. A number 2 class indicates that moderate erosion has occurred or 25 to 75 percent of the surface soil has been removed.
3. The site index number is the estimated height of a stand of trees of the species indicated, growing on the particular soil after 50 years of undisturbed growth.
4. AUD = animal unit days.

Table 7 (continued). Crop equivalent ratings (CER) and yield estimates of principal crops and pasture and site indexes for timber on representative soils of Minnesota. Yield estimates should be considered as attainable over an average period of 5-10 years with moderate level of management.

Soil series	Slope[1]	Erosion[2]	CER	Corn	Spring wheat	Alfalfa hay	Bluegrass pasture	Site index timber species[3]	Minnesota geographic center
				..... bu		T/A	AUD[4]		
Cloquet	B	1	38			3.2	90	70/Aspen	Carlton
	C	1	35			3.0	85	50/Red Pine	
Clyde	A	1	75	102		4.3	120		Mower
Collinwood	A	1	95	120		4.0	115		Blue Earth
	B	1	90	115		3.8	105		
Colo	A	1	77	104		3.6	100		Wabasha
Colvin	A	1	58		35	1.8	50	40/E.Cottonwood	Norman
Comfrey	A	1	65	85		3.5	100	60/E. Cottonwood	Watonwan
Copaston	B	1	35	55		2.8	80	40/Bur Oak	Carver
	C	1	30	50		2.6	75	40/Bur Oak	
Cordova	A	1	87	110		4.0	115		Le Sueur
Cormant	A	1	33			2.5	90		Cass
Crofton	C	1	29	53		2.7	75		Rock
Cromwell	A	1	41			3.5	100	70/Aspen	Carlton
	B	1	36			3.3	95	65/Aspen	
Cushing	A	1	45	70		4.0	115		Chisago
	B	1	40	65		3.5	100		
Dakota	A	1	65	80		3.5	100	65/N. Red Oak	Dakota
	B	1	60	75		3.5	100	60/N. Red Oak	
Dalbo	A	1	60	80		4.5	125	85/Aspen	Isanti
	B	1	57	75		4.5	125		
Darfur	A	1	70	85		3.5	100		Blue Earth
Darnen	B	1	70	75	40	4.0	125		Swift
Dassel	A	1	55	65		3.0	80		Meeker
Dawson	A	1	10, 50(D)[1]			4.5	125	15/Black Spruce	Carlton
Deerwood	A	1	28				70		Kittson
Derinda	C	1	30	60		2.4	65		Winona
	D	1	15			1.5	40		
Dickinson	A	1	55	80		3.0	85		Blue Earth
	B	1	50	75		2.9	80		
Dickman	A	1	49	55		2.5	70		Hennepin
	B	1	47	50		2.5	70		
Dodgeville	B	1	55	60		3.4	95		Goodhue
	C	1	45	50		2.9	80		
Doland	A	1	60	70	35	3.3	100		Stevens
Dorchester	A	1	80	100		5.0	140		Houston
Dorset	A	1	30	50		2.5	70	55/Red Pine	Todd
Dovray	A	1	55	75		4.0	110		Lac Qui Parle
Downs	B	1	90	115		5.0	140		Olmsted
	C	1	75	100		4.8	135		
Dubuque	C	2	40	50		2.7	75		Goodhue
Duelm	A	1	53	70		3.0	85	81/Aspen	Sherburne
	B	1	50						
Duluth	B	1	41			4.0	115	75/Aspen	Carlton
	C	1	36			4.5	125		
Dunbarton	B	1	40	60		3.0	85		Winona
	C	1	36	48		2.5	70		
	D	1	28						

1. Letters refer to the following categories of slope steepness: A—0-2 percent slope; B—2-6 percent slope; C—6-12 percent slope; D—12-18 percent slope; (D) refers to drained condition.
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Table 7 (continued). Crop equivalent ratings (CER) and yield estimates of principal crops and pasture and site indexes for timber on representative soils of Minnesota. Yield estimates should be considered as attainable over an average period of 5-10 years with moderate level of management.

Soil series	Slope[1]	Erosion[2]	CER	Corn	Spring wheat	Alfalfa hay	Bluegrass pasture	Site index timber species[3]	Minnesota geographic center
				..... bu		T/A	AUD[4]		
Dundas	A	1	77	85		3.5	100		Dakota
Dusler	A	1	45			4.5	125	75/Aspen	Carlton
Edison	A	1	46	60	35	2.5	70		Swift
Egeland	A	1	32	55		2.8	80		Rock
Eleva	B	1	55	70		2.5	70		Goodhue
	C	1	45	65		2.3	65		
	D	1	35	60		2.0	55		
Embden	A	1	31	58	26				Swift
Emmert	B	1	24			1.9	55	50/Jack Pine	Mille Lacs
	C	1	21			1.6	45		
Enstrom	A	1	39		25	3.0	85		Kittson
	B	1	34		22	3.0	85		
Erin	B	1	73	90		4.3	120		Rice
	C	1	63	80		4.0	110	65/Red Pine	
	D	1	58						
Estelline	A	1	56	59		2.7	75		Pipestone
	B	1	53	58		2.6	70		
Estherville	A	1	42	60		2.7	75		Hennepin
	B	1	40	55		2.5	70		
Etter	B	1	42	55		2.7	75	60/Oak	Dakota
	C	1	35	50		2.5	70	55/Oak	
Everly	B	1	80	83		4.0	110		Nobles
	C	1	75						
Fairhaven	A	1	80	80		3.0	100	75/Cottonwood	Wright
	B	1	75	75		2.7	85	70/Cottonwood	
Fargo	A	1	67	75	45	4.5	125		Norman
Farrar	B	1	57	85		3.5	100		Blue Earth
Faxon	A	1	55	85		3.0	85	65/Cottonwood	Scott
Fayette	B	1	85	105		4.3	125		Houston
	C	1	70	90		4.0	115		
	D	1	60	75		3.6	100	80/Oak	
Fedji	A	1	55	60		3.0	85		Blue Earth
Fieldon	A	1	70	70		3.5	100		Blue Earth
Flak	B	1	48	75		3.5	100	75/Aspen	Benton
Flaming	A	1	33			2.5	70		Norman
Flandreau	A	1	57	60	39	2.9	80		Pipestone
	B	1	53	53	31	2.7	75		
Flom	A	1	60	80	40	4.0	110		Lac Qui Parle
Floyd	A	1	78	105		4.4			Mower
Foldahl	A	1	60		40	4.0	110	18/E. Red Cedar	Kittson
Forada	A	1	52	50	25	3.0	85		Otter Tail
Fordville	A	1	50	58	35	2.9	80		Lincoln
Forman	A	1	64	68	37	3.5	100		Stevens
	B	1	61	65	30	3.2	90		
Formdale	B	1	63	65	30	3.2	90		Grant
Fossum	A	1	28		20	3.0	85		Norman
Foxhome	A	1	50	60	40	3.5	105	85/Cottonwood	Norman

1. Letters refer to the following categories of slope steepness: A—0-2 percent slope; B—2-6 percent slope; C—6-12 percent slope; D—12-18 percent slope; (D) refers to drained condition.
2. The numbers 1 and 2 indicate the amount of erosion which had occurred on a particular soil area at the time of the field survey. A number 1 in the table would be the same erosion class as a soil map symbol without an erosion notation. This means that less than 25 percent of the surface soil has been removed. A number 2 class indicates that moderate erosion has occurred or 25 to 75 percent of the surface soil has been removed.
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Table 7 (continued). Crop equivalent ratings (CER) and yield estimates of principal crops and pasture and site indexes for timber on representative soils of Minnesota. Yield estimates should be considered as attainable over an average period of 5-10 years with moderate level of management.

Soil series	Slope[1]	Erosion[2]	CER	Corn	Spring wheat	Alfalfa hay	Bluegrass pasture	Site index timber species[3]	Minnesota geographic center
				..... bu		T/A	AUD[4]		
Fram	A	1	65			3.4			Kittson
Freeon	A	1	64	89		3.1	85	75/Aspen	Pine
	B	1	61	70			80	70/Aspen	
Freer	A	1	60	80		3.0	85	75/Aspen	Kanabec
Frontenac	noncropland		10				50	60/Red Oak	Goodhue
Fulda	A	1	57	80	34	3.9	110	70/Cottonwood	Lincoln
Gale	B	1	70	90		3.5	100	55/Red Oak	Wabasha
	C	1	60	85		3.5	100		
	D	1	50	80		3.0	85		
Galva	A	1	75	70		4.3			Nobles
Garnes	A	1	61		45	4.0	110	60/Red Pine	Roseau
Garwin	A	1	90	120		3.3	95		Olmsted
	B	1	86						
Glencoe	A	1	80	85		3.5	100		Steele
Glyndon	A	1	67		40	4.0	100	75/Cottonwood	Clay
Gonvick	A	1	65	55	45	4.0	100	80/Aspen	Becker
	B	1	62	50	45	3.7	100		
Granby	A	1	65	80		3.0	85		Blue Earth
Grays	B	1	84	100					Blue Earth
Grimstad	A	1	64		35	3.5	100		Norman
Grogan	A	1	85	80		3.0	85		Blue Earth
	B	1	80	75		2.7	75		
Growton	A	1	60	85		4.5	125	72/Aspen	Anoka
Grygla	A	1	48			3.0	85	70/Aspen	Marshall
Guckeen	A	1	87	110		4.5	125		Faribault
	B	1	80	105		4.3	120		
Halder	A	1	52	70		3.0	85	75/Aspen	Kanabec
Hamar	A	1	34	50	29	2.1	60		Swift
Hamel	A	1	82	95		4.0	115	85/Cottonwood	Hennepin
	B	1	75						
Hamerly	A	1	64		35	3.2	70		Clay
	B	1	61						
Hangaard	A	1	34		20	2.5	65		Red Lake
Hanska	A	1	69	85		4.0	115		Freeborn
Hantho	A	1	58	79		3.6	100		Swift
Harps	A	1	80	105		4.0	110		Nicollet
Hattie	B	1	26	60	35	3.5	95		Stevens
Haug	A	1	33(D)[1]		30	4.1	115		Marshall
Havanna	A	1	78	85		4.5	125		Steele
Hayden	B	1	75	95		4.5	125		Hennepin
	C	1	66	85		4.2	115	65/Red Pine	
Hayfield	A	1	73	75		3.5	100		Mower
Hecla	A	1	35	50	21	2.2	65		Swift
Hegne	A	1	57		40	3.5	115	75/Cottonwood	Polk
Heyder	B	1	65	80		4.5	125	75/Aspen	Anoka
Hibbing	B	1	41			4.3	120	77/Aspen	St. Louis
	C	1	36			4.0	115		
Hillet	A	1	57	80		3.0	85	55/Aspen	Benton

1. Letters refer to the following categories of slope steepness: A—0-2 percent slope; B—2-6 percent slope; C—6-12 percent slope; D—12-18 percent slope; (D) refers to drained condition.
2. The numbers 1 and 2 indicate the amount of erosion which had occurred on a particular soil area at the time of the field survey. A number 1 in the table would be the same erosion class as a soil map symbol without an erosion notation. This means that less than 25 percent of the surface soil has been removed. A number 2 class indicates that moderate erosion has occurred or 25 to 75 percent of the surface soil has been removed.
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				..... bu		T/A	AUD[4]		
Hiwood	A	1	33			2.5	70	50/Red Pine	Roseau
	B	1	28			2.3	65		
Hixton	B	1	49	45		2.5	70		Wabasha
	C	1	42	40		2.2	60		
Holdingford	B	1	58	80		4.5	125	75/Aspen	Stearns
	C	1	53	75		4.2	115		
Hubbard	A	1	38	60		3.0	85	55/Red Pine	Sherburne
	B	1	36	55		2.8	80		
Huntsville	A	1	80	115		4.5	125		Winona
Ihlen	B	1	53	65		3.0	85		Rock
Indus	A	1	47			4.0	110	75/Aspen	Koochiching
Insula	noncropland		5				35	60/Jack Pine	Lake
Isan	A	1	44	55		2.5	70		Hennepin
Isanti	A	1	42	55		2.5	70	75/Aspen	Anoka
Joy	A	1	100	135		4.5			Goodhue
Judson	A	1	90	97		3.6	100		Wabasha
	B	1	84	90		3.3	90		
Kamrar	B	1	85	90		3.5	100		Blue Earth
Kanaranzi	A	1	52	75		3.5	100		Nobles
	B	1	48	70		3.2	90		
	C	1	42	55		3.0	85		
Kasota	A	1	79	85		3.5	100		Carver
	B	1	75	80		3.2	90		
Kasson	A	1	80	95		4.2	115		Olmsted
Kato	A	1	73	85		4.0	115	75/Cottonwood	Steele
Kegonsa	C	1	45	70					Goodhue
Kennebec	A	1	87	125		4.8	135		Houston
Kenyon	A	1	84	115		4.8	135		Dodge
	B	1	80	110		4.6	130		
Kilkenney	B	1	75	90		4.4	125		Steele
	C	1	65	80		4.0	115		
Kingsley	B	1	50	70		3.2	90	60/Oak	Washington
	C	1	42	60		3.0	85		
Kingston	B	1	100	120		4.5	125		Brown
Kittson	A	1	65		45	4.0	115		Norman
Klinger	B	1	89	123		4.2	115		Olmsted
Kranzburg	B	1	61	72		3.1	85		Pipestone
Kratka	A	1	40			2.5	70		Polk
Lamoure	A	1	60	65		3.0	100		Lincoln
Langhei	B	1	38	50	25	2.7	75		Otter Tail
	C	1	33	40	20	2.4	70		
Langola	A	1	38	60		2.8	80	70/Aspen	Benton
La Prairie	A	1	61	86	35	3.8	105		Lincoln
	B	1	35	45		2.5	70		
	C	1	30			2.0	55		
Lasa	B	1	35	45		2.5	70		Blue Earth
	C	1	30			2.0	55		

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Table 7 (continued). Crop equivalent ratings (CER) and yield estimates of principal crops and pasture and site indexes for timber on representative soils of Minnesota. Yield estimates should be considered as attainable over an average period of 5-10 years with moderate level of management.

Soil series	Slope[1]	Erosion[2]	CER	Corn	Spring wheat	Alfalfa hay	Bluegrass pasture	Site index timber species[3]	Minnesota geographic center
				..... bu		T/A	AUD[4]		
Lawson	A	1	85	125					Houston
Lemond	A	1	65	65		3.5	100		Freeborn
Leota	A	1	70	90		3.8	105		Murray
Lerdal	B	1	65	90		4.5	125		Freeborn
	C	1	55	80		4.0	110		
Lester	B	1	86	100		4.5	125	70/Red Oak	Carver
	C	1	75	90		4.0	110		
LeSueur	A	1	92	120		4.5	125	85/Cottonwood	Carver
	B	1	87	110		4.3	120		
Lilah	A	1	25	45		1.6	45		Winona
	B	1	23	40		1.5	40		
	C	1	20	35		1.3	35		
Lindstrom	C	1	80	110		4.5	125		Goodhue
	D	1	70	100		4.0	110		
Lino	A	1	41	60		2.8	80	80/Aspen	Anoka
Lismore	A	1	70	80		3.7	100		Lincoln
Litchfield	A	1	52	60		2.5	70		Meeker
	B	1	49						
Lobo	noncropland		5					25/Black Spruce	St. Louis
Loxley	A	1	5				30	25/Black Spruce	Carlton
Lura	A	1	77	85		3.5	100		Blue Earth
McIntosh	A	1	62	70	40	4.0	115		Mahnomen
	B	1	59						
Maddock	A	1	30		19	1.6	45		Swift
	B	1	28		16	1.4	40		
	C	1	24						
Madelia	A	1	95	120		4.5	125		Watonwan
Mahtowa	A	1	45			4.0	115	45/Black Spruce	Carlton
Malachy	A	1	39	65	30	3.0	85		Stevens
Marcus	A	1	70	90		3.9	105		Rock
Marna	A	1	85	120		4.0	115		Blue Earth
Marquette	B	1	21			1.6	45	60/Aspen	Beltrami
Marshan	A	1	84	85		4.0	115	75/Cottonwood	Dodge
Marysland	A	1	49	55		3.0	85		Swift
Mavie	A	1	45		27	3.0	90	75/Cottonwood	Pennington
Maxcreek	A	1	89	120		4.5	125		Freeborn
Maxfield	A	1	90	120		4.5	125		Goodhue
Mayer	A	1	83	80		3.0	85		Nicollet
Mazaska	A	1	75	95		3.5	100	75/Cottonwood	Rice
Medary	B	1	76	80		3.6	100		Goodhue
Menahga	A	1	30			2.5	70	55/Red Pine	Cass
	B	1	27			2.3	65	50/Red Pine	
Meridian	A	1	54	55		3.1	90		Wabasha
Merton	A	1	100	130		5.0	140		Steele
	B	1	94	125		4.8	135		
Merwin	A	1	5					25/Black Spruce	Carlton
Metogga	A	1	10, 70(D)[1]	75			80		Rice

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Table 7 (continued). Crop equivalent ratings (CER) and yield estimates of principal crops and pasture and site indexes for timber on representative soils of Minnesota. Yield estimates should be considered as attainable over an average period of 5-10 years with moderate level of management.

Soil series	Slope[1]	Erosion[2]	CER	Corn	Spring wheat	Alfalfa hay	Bluegrass pasture	Site index timber species[3]	Minnesota geographic center
				..... bu		T/A	AUD[4]		
Milaca	B	1	60	75		3.6	100	75/Aspen	Kanabec
	C	1	50	74		3.2	90		
Millerville	A	1	10, 46(D)	65			70		Douglas
Minneiska	A	1	65	105		4.0			Wabasha
Minneopa	A	1	70	75		3.0	85		Blue Earth
Minnetonka	A	1	82	100		4.0	115		Hennepin
Moland	B	1	90	120		4.5	125	55/Walnut	Rice
	C	1	84	100		4.0	115		
Moody	B	1	61	83		3.1	85		Pipestone
Mooselake	A	1	15					35/Black Spruce	Pine
Mora	A	1	57	85		4.5	125	75/Aspen	Kanabec
Mosomo	noncropland		15				35	65/Jack Pine	Aitkin
Mt. Carroll	B	1	85	100		4.4	125		Wabasha
	C	1	73	90		4.1	115		
Nebish	B	1	59	55	40	4.0	125	75/Aspen	Itasca
	C	1	50	50	35	3.8	115	70/Aspen	
Nemadji	A	1	41			3.0	85	70/Aspen	St. Louis
Nessel	A	1	76	90		4.6	130	60/Walnut	Hennepin
Newfound	noncropland		5					60/Red Pine	Lake
Newglarus	C	1	40	80		3.5	95	65/Oak	Winona
	D	1	35	70		3.0	80		
Newry	A	1	84	95		4.5	125		Steele
Nicollet	A	1	100	125		4.7			Watonwan
	B	1	94	120		4.5			
Nokasippi	A	1	40			2.2	80	60/Aspen	Benton
Nokay	A	1	45	70		3.0	110	75/Aspen	Crow Wing
Nordness	B	1	29	36		1.4	40		Houston
	C	1	25						
Northcote	A	1	63		43	4.0	115		Kittson
Nowen	A	1	59	85		3.5	100	74/Aspen	Anoka
Nutley	B	1	49	72	36	3.6	100		Stevens
Nymore	A	1	38			2.3	65	55/Jack Pine	Morrison
	B	1	36			2.2	60	55/Jack Pine	
Oak Lake	A	1	71	90		3.7	105		Lincoln
Ocheydan	B	1	95	84		3.5	100		Faribault
	C	1	80	79		3.4	95		
Ogilvie	A	1	60	85		4.0	110	70/Aspen	Benton
Oldham	A	1	45	65	30	3.5	100		Lac Qui Parle
Omega	A	1	36			2.5	85	65/Jack Pine	Pine
	B	1	32			2.3	80		
Onamia	A	1	45	55		2.8	75	55/Red Pine	Kanabec
	B	1	43	50		2.7	75		
Ontonagon	A	1	41			4.0	115	40/Black Spruce	Carlton
Opole	A	1	63	80		4.5	125	75/Aspen	Stearns
Orion	A	1	70	105		4.0	110		Goodhue
Osakis	A	1	26	55		2.5	70		Stearns
Ostrander	B	1	80	100		4.5	125		Dodge

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Table 7 (continued). Crop equivalent ratings (CER) and yield estimates of principal crops and pasture and site indexes for timber on representative soils of Minnesota. Yield estimates should be considered as attainable over an average period of 5-10 years with moderate level of management.

Soil series	Slope[1]	Erosion[2]	CER	Corn	Spring wheat	Alfalfa hay	Bluegrass pasture	Site index timber species[3]	Minnesota geographic center
				bu		T/A	AUD[4]		
Otterholt	B	1	72	85		4.1	115		Washington
	C	1	65	75		3.6	100		
Paget	A	1	60	85		4.5	125	75/Aspen	Benton
Palms	A	1	70(D) [1]	100					Blue Earth
Palsgrove	C	1	50	75		3.5	105	65/Oak	Houston
	D	1	44			3.3	95		
Parent	A	1	55	75		4.0	115	38/B. Ash	Kanabec
Parnell	A	1	60	80	30	4.0	110		Stevens
Percy	A	1	55		40	3.0	100		Kittson
Plainfield	B	1	30	46		2.0	60		Wabasha
	C	1	25			1.8	50		
Poinsett	A	1	63	68		3.3	95		Lincoln
Pomroy	B	1	36	42		2.0	55	55/Oak	Benton
Poppleton	A	1	33		20	2.3	70	45/Bur Oak	Marshall
Port Byron	B	1	92	110		4.3	120		Goodhue
	C	1	85	95		4.0	110		
Prebish	A	1	53	65		2.8	85	55/Aspen	Benton
Primghar	A	1	73	85		4.3	120		Rock
Quam	A	1	60	80	30	4.0	110		Douglas
Quetico	noncropland		5					40/Jack Pine	Lake
Racine	B	1	85	100		4.5	125		Dodge
Ransom	A	1	85	100		3.5	100		Nobles
Rasset	B	1	35	55		2.1	60		Wright
	C	1	30	50		1.9	55	50/Oak	
Rauville	noncropland	1	15				85		Lincoln
Readlyn	A	1	85	115		4.8	135		Rice
Redby	A	1	33			2.5	75	70/Aspen	Beltrami
Renova	B	1	76	88		4.5	125	60/Walnut	Dodge
	C	1	64	85		4.3	120		
Renshaw	A	1	37	50	18	2.3	65		Pipestone
Rifle	A	1	10, 60(D)	80				30/Black Spruce	Douglas
Rockton	B	1	67	90		3.6	100		Olmsted
	C	1	56	75		3.0	85		
Rockwell	A	1	52	55	40	3.5	100	75/Cottonwood	Norman
Rockwood	B	1	43	50	30	3.6	100	70/Aspen	Hubbard
	C	1	36	45		3.4	95		
Rolfe	A	1	70	85		3.0	95		Martin
Roliss	A	1	55		40	3.8	110		Marshall
Ronneby	A	1	60	85		4.5	125	75/Aspen	Benton
Rothsay	A	1	60	75		4.5	125		Wilkin
	B	1	50	70		4.5	120		
Rushmore	A	1	85	100		4.0	110	75/Cottonwood	Nobles
Salida	B	1	15	35		2.0	55		Wright
	C	1	13			1.6	45		
Santigo	B	1	65	75		4.0	110		Washington
	C	1	55	70		3.5	100		
Sargeant	A	1	65	75					Mower

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Soil series	Slope[1]	Erosion[2]	CER	Corn	Spring wheat	Alfalfa hay	Bluegrass pasture	Site index timber species[3]	Minnesota geographic center
				..... bu		T/A	AUD[4]		
Sartell	B	1	36	45		2.3	65	60/Red Pine	Sherburne
	C	1	30			2.0	55	55/Red Pine	
Schapville	B	1	45	70		3.1	85		Goodhue
Seaton	B	1	82	90		4.2	120		Goodhue
	C	1	68	80		4.0	115		
Seelyeville	A	1	10, 30(D)[1]			3.5	100	25/Black Spruce	Kanabec
Shakopee	A	1	51	60		3.0	85		Swift
Shible	A	1	45	55		2.5	70		Swift
Shields	A	1	65	80		3.0	85	90/Cottonwood	Steele
Shooker	A	1	58	75		3.5	100	75/Aspen	Cass
Shorewood	B	1	73	90		4.5	120	70/Oak	Hennepin
	C	1	63	85		4.0	110		
Shullsburg	B	1	55	85		2.8	100		Goodhue
Sigsbee	B	1	63	85		4.0	110	55/Walnut	Freeborn
	C	1	55	80		3.5	100	50/Walnut	
Sinai	B	1	58	65	35	3.4	95		Lincoln
Sioux	A	1	20	35	14	1.1	30		Swift
	B	1	18	32	12	1.0	25		
Skyberg	A	1	73	95		3.8	110		Dodge
Soderville	A	1	47	60		3.0	85		Anoka
Sparta	A	1	35	45		1.4	40		Dakota
Spencer	A	1	58	90		4.0	115	65/Red Pine	Washington
	B	1	55	85		3.8	105		
Spicer	A	1	80	110		4.5	125		Martin
Spooner	A	1	50			4.5	125	75/Aspen	Koochiching
Spottswood	A	1	50	55		2.4	80		Swift
Storden	B	1	60	80		3.0	85		Cottonwood
	C	1	50	70		2.8	80		
Strandquist	A	1	38	25		2.5	70		Marshall
Suamico	noncropland		10					25/B. Spruce	Cass
Svea	A	1	75	82	41	3.6	100		Pope
	B	1	70	78	36	3.4	95		
Sverdrup	A	1	45	55		2.7	75		Otter Tail
Swenoda	A	1	64	65	29	2.9	80		Swift
	B	1	60						
Syrene	A	1	30		20	2.0	55		Norman
Talcot	A	1	71	85		4.0	115		Carver
Tama	B	1	95	118		5.0	140		Fillmore
Taopi	A	1	70	95		5.0	140		Mower
Tara	A	1	66	75	40	3.7	115		Swift
Taylor	A	1	50			4.0	115	77/Aspen	Beltrami
Tell	A	1	65	70		3.4	95		Wabasha
	B	1	60	63		3.1	85		
Terril	B	1	95	120		4.6	130		Blue Earth
Toivola	noncropland		10				40	50/Jack Pine	St. Louis
Tonka	A	1	65	69	29	2.9	80		Stevens
Torning	A	1	22	40	20	2.0	55		Swift

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				..... bu		T/A	AUD[4]		
Trent	A	1	70	70		3.7	105		Pipestone
Trosky	A	1	61	75		4.0	110		Pipestone
Truman	A	1	100	120		4.5	125		Martin
	B	1	95	115		4.3	120		
Udolpho	A	1	68	80		3.5	100		Dodge
Ulen	A	1	45	55	30	2.5	85		Norman
Urness	A	1	60	70		3.0	90		Grant
Vallers	A	1	60	75	32	3.0	75		Clay
Vasa	A	1	90	120		5.0	140	70/Basswood	Olmsted
Vienna	B	1	61	72		3.0	85		Pipestone
Viking	A	1	53		40	3.5	105		Polk
Vlasaty	B	1	79	90		4.5	125	70/Oak	Dodge
Wadena	A	1	60	75		3.5	100		Stearns
	B	1	55	70		3.2	90		
Wahpeton	A	1	75	43		3.8	105		Polk
Waldorf	A	1	85	120		4.0	110		Jackson
Warba	A	1	50			4.4	125	75/Aspen	Cass
Warman	A	1	41			3.0	85	45/Black Spruce	Kanabec
Waubay	A	1	67	68		3.6	100		Lincoln
Waukegan	A	1	80	85		3.5	100	60/Oak	Dakota
	B	1	76	80		3.5	95		
Waukon	B	1	65	65	35	3.6	95		Otter Tail
	C	1	60	60	33	3.4	90	60/Red Pine	
Webster	A	1	90	120		4.4			Martin
Whalan	C	1	50	65		3.0	85		Dodge
	D	1	45	50		2.3	65		
Wheatville	A	1	67		40	3.5			Norman
Whitewood	A	1	65	70		3.5	100		Pipestone
Winger	A	1	58	65	40	3.8	105		Mahnomen
Zimmerman	B	1	40	50		3.0	80	60/Jack Pine	Anoka
	C	1	35			2.0	60		
Zumbro	A	1	60	55		3.0	85	70/Aspen	Wabasha

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Table 8. Percentage distribution of cultivated, permanent pasture and forested land use on representative soils of Minnesota from analysis of conservation needs inventory data (11)

Soil series[1]	Corn and other row crops	Small grains	Rotation hay[2]	Permanent pasture[3]	Commercial and non-commercial forest	Other[4]	Estimated acreage of soil[5]
Aastad	45	30	10	5	–[6]	10	410,400
Aazdahl	(45)[7]	(30)	(5)	(5)		(15)	
Adolph	5	10	10	30	35	10	171,300
Afton	40	15	–	35	–	10	9,300
Ahmeek	–	(5)	(5)				
Almena	(15)	(15)	(20)	(10)	(35)	(5)	
Alvin	(15)	(30)	(30)	(15)	(5)	(5)	
Amery	(20)	(20)	(20)	(15)	(15)	(5)	
Ankeny	(40)	(20)	(20)	(15)	–	(5)	
Anoka	30	15	15	15	10	15	20,600
Antigo	25	15	25	10	20	5	57,300
Arcola	(15)	(25)	(25)	(10)	(20)	(5)	
Arenzville	35	–	10	30	15	10	25,100
Arland	(25)	(20)	(20)	(15)	(15)	(5)	
Arveson	10	35	20	10	15	10	363,000
Arvilla	40	20	15	10	5	10	122,700
Athelwold	55	25	5	5	–	10	3,300
Augsburg	(30)	(40)	(10)	(5)	(5)	(10)	
Badger	–	20	15	30	30	5	141,500
Barbert	70	–	10	10	–	5	4,300
Barnes	45	25	20	3	2	5	1,188,400
Baroda	(75)	(5)	(5)	(5)	–	(10)	
Barrows	–	–	–	10	80	10	105,000
Barto	–	–	–	–	(100)	–	
Baudette	5	30	15	5	35	10	52,700
Bearden	15	55	15	5	–	10	554,300
Beauford	75	5	5	5	–	10	49,700
Becker	60	5	5	15	5	10	12,200
Bellechester	–	–	–	(80)	(20)	–	
Beltrami	10	5	10	10	60	5	378,300
Bena	–	(5)	(5)	(5)	(80)	(5)	
Benoit	5	5	15	60	10	5	34,200
Beotia	60	20	5	5	–	10	43,400
Bertrand	45	20	25	5	5	–	10,700
Beseman	–	–	–	(80)	(20)	–	
Billett	(20)	(15)	(15)	(35)	(10)	(5)	
Biscay	50	5	15	15	5	10	59,000
Bixby	50	15	10	5	10	10	5,300
Blackhoof	–	–	5	(95)	–	–	
Blomford	20	20	40	10	5	5	23,400
Blooming	(50)	(15)	(10)	(5)	(5)	(5)	
Blue Earth	40	15	–	30	5	10	68,800
Bluffton	2	3	10	15	60	10	135,400
Bold	(20)	(20)	(20)	(30)	(5)	(5)	
Boone	25	20	10	15	30	–	26,000
Borup	30	40	5	5	5	15	76,400
Braham	50	5	25	10	10	–	48,900
Brainerd	10	10	10	15	50	5	286,500
Brickton	10	20	30	20	10	10	18,000

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Table 8 (continued). Percentage distribution of cultivated, permanent pasture and forested land use on representative soils of Minnesota from analysis of conservation needs inventory data (11)

Soil series[1]	Corn and other row crops	Small grains	Rotation hay[2]	Permanent pasture[3]	Commercial and non-commercial forest	Other[4]	Estimated acreage of soil[5]
Brodale	–[6]	–	–	(85)[7]		(5)	79,600
Brookings	(40)	(30)	(10)	(10)	–	(10)	
Brophy	–	–	(5)	(95)	–	–	
Brownton	(60)	(10)	(10)	(10)	–	(10)	
Burkhardt	20	20	30	25	–		23,500
Burnsville	30	10	30	5	15	10	47,500
Buse	(30)	(20)	(30)	(8)	(2)	(10)	
Calco	55	5	5	20	10	5	67,800
Campia	(15)	(25)	(25)	(10)	(20)	(5)	
Canisteo	65	10	5	15	–	5	697,300
Carlos	–	–	(5)	(95)	–	–	
Caron	(10)	–	(10)	(80)	–	–	
Cashel	–	(10)	(10)	(70)	(10)	–	
Cathro	–	–	(5)	–	(95)	–	
Chaseburg	20	5	10	40	15	10	15,900
Chaska	(75)	–	–	(25)	–	–	
Chelsea	35	20	20	20	–	5	1,000
Chetek	5	5	20	10	55	5	601,900
Chilgren	–	5	5	15	70	5	120,600
Clarion	60	15	10	3	2	10	1,257,400
Clontarf	(60)	(20)	(5)	(5)	(5)	(5)	
Cloquet	5	2	5	10	70	8	240,000
Clyde	50	5	10	25	2	8	77,800
Collinwood	(70)	(10)	(10)	(5)	–	(5)	
Colo	(75)	(5)	(5)	–	(10)	(5)	
Colvin	35	40	5	15	–	5	482,900
Comfrey	25	5	10	50	10	–	77,200
Copaston	50	10	10	20	5	5	5,500
Cordova	60	5	5	10	10	10	84,000
Cormant	5	5	–	5	80	5	336,500
Crofton	(35)	(20)	(20)	(15)	–	(10)	
Cromwell	–	(5)	(5)	(15)	(70)	(5)	
Cushing	(15)	(25)	(25)	(10)	(20)	(5)	
Dakota	50	20	20	5	2	3	79,900
Dalbo	30	20	15	25	5	5	26,900
Darfur	80	5	–	10	–	5	7,600
Darnen	40	10	20	20	2	8	49,200
Dassel	30	10	10	40	5	5	2,000
Dawson	–	(5)	(5)	(5)	(85)	–	
Deerwood	–	–	(5)	(85)	(10)	–	
Derinda	(5)	(10)	(10)	(55)	(20)	–	
Dickinson	45	15	20	10	5	5	105,500
Dickman	40	25	20	10	–	5	96,700
Dodgeville	20	20	20	20	10	10	8,500
Doland	(60)	(20)	(10)	–	–	(10)	
Dorchester	50	5	5	20	10	10	93,100
Dorset	20	10	15	25	20	10	46,600
Dovray	40	35	10	10	–	5	3,900
Downs	35	20	25	10	–	10	90,000

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Table 8 (continued). Percentage distribution of cultivated, permanent pasture and forested land use on representative soils of Minnesota from analysis of conservation needs inventory data (11)

Soil series[1]	Corn and other row crops	Small grains	Rotation hay[2]	Permanent pasture[3]	Commercial and non-commercial forest	Other[4]	Estimated acreage of soil[5]
Dubuque	15	5	10	40	30	–[6]	131,300
Duelm	25	20	25	15	10	5	26,500
Duluth	–	(5)[7]	(5)	(10)	(75)	(5)	
Dunbarton	(10)	(10)	(10)	(40)	(30)	–	
Dundas	35	20	15	10	15	5	42,400
Dusler	–	(5)	(5)	(10)	(80)	–	
Edison	(40)	(35)	(10)	(5)	–	(10)	
Egeland	(40)	(20)	(15)	(10)	(5)	(10)	
Eleva	(10)	(10)	(30)	(30)	(15)	(5)	
Embden	(35)		(15)	(5)	–	(10)	
Emmert	5	5	10	5	70	5	22,800
Enstrom	–	(25)	(25)	(25)	(20)	(5)	
Erin	(10)	(25)	(30)	(20)	(10)	(5)	
Estelline	50	20	15	5	–	10	16,400
Estherville	30	20	15	20	5	10	347,700
Etter	50	30	10	10	–	–	5,300
Everly	(65)	(10)	(10)	(5)	–	(10)	
Fairhaven	60	20	5	10	–	5	23,100
Fargo	20	50	15	3	2	10	554,500
Farrar	70	10	10	5	–	5	10,100
Faxon	5	15	5	70	00	5	4,500
Fayette	30	20	20	20	5	5	613,400
Fedji	20	50	15	–	5	10	7,300
Fieldon	60	10	5	20	00	5	8,400
Flak	5	5	5	5	80	–	550,400
Flaming	5	10	15	50	15	5	66,500
Flandreau	70	15	10	–	–	5	3,600
Flom	45	20	10	10	5	10	629,300
Floyd	55	10	10	15	–	10	284,800
Foldahl	(5)	(45)	(15)	(15)	(15)	(5)	
Forada	10	10	5	45	20	10	16,400
Fordville	40	30	15	5	5	5	62,000
Forman	35	45	10	5	–	5	12,500
Formdale	(35)	(45)	(10)	(5)	–	10	
Fossum	5	30	25	10	20	10	118,700
Foxhome	5	30	20	30	10	5	23,000
Fram	(5)	(50)	(25)	(10)	(5)	(5)	
Freeon	10	10	10	25	40	5	94,000
Freer	10	15	20	30	25	–	78,100
Frontenac	–	–	–	(10)	(90)	–	
Fulda	50	25	20	5	–	–	21,000
Gale	(5)	(5)	(15)	(50)	(20)	(5)	
Galva	(60)	(20)	(10)	(5)	–	(5)	
Garnes	5	20	5	15	50	5	49,900
Garwin	25	15	15	45	–	–	1,900
Glencoe	50	15	5	20	5	5	401,600
Glyndon	30	60	5	–	–	5	72,500
Gonvick	10	40	20	10	20	–	20,900
Granby	(85)	(5)	(5)	(5)	–	–	

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Table 8 (continued). Percentage distribution of cultivated, permanent pasture and forested land use on representattive soils of Minnesota from analysis of conservation needs inventory data (11)

Soil series[1]	Corn and other row crops	Small grains	Rotation hay[2]	Permanent pasture[3]	Commercial and non-commercial forest	Other[4]	Estimated acreage of soil[5]
Grays	(80)[7]	(5)	(5)	(5)	–[6]	(5)	
Grimstad	20	50	25	–	5	–	205,200
Grogan	75	15	–	5	–	5	4,900
Growton	(20)	(20)	(20)	(15)	(15)	(10)	
Grygla	–	10	15	–	70	5	280,800
Guckeen	70	5	5	5	5	10	76,900
Halder	10	5	15	20	40	10	44,600
Hamar	30	20	25	25	–	–	46,500
Hamel	(25)	(15)	(20)	(15)	(15)	(10)	
Hamerly	35	35	10	5	–	15	221,300
Hangaard	5	25	20	35	5	10	71,900
Hanska	60	5	5	20	10	–	24,900
Hantho	60	25	10	2	3	–	68,300
Harps	60	10	5	20	–	5	194,500
Hattie	(40)	(35)	(10)	(10)	–	(5)	
Haug	–	(5)	(10)	(75)	(10)	–	
Havana	(70)	(5)	(5)	(5)	(10)	(5)	
Hayden	40	10	15	10	10	15	401,300
Hayfield	75	10	5	2	2	6	8,000
Hecla	20	15	25	25	5	10	40,200
Hegne	(15)	(55)	(15)	(5)	–	(10)	
Heyder	50	10	15	10	10	5	137,400
Hibbing	–	5	15	10	60	10	252,700
Hillet	(5)	(10)	(15)	(60)	(5)	(5)	
Hiwood	–	5	10	10	70	5	180,800
Hixton	20	20	20	20	20	–	2,200
Holdingford	20	20	25	5	30	–	31,500
Hubbard	35	20	15	10	10	10	303,500
Huntsville	75	–	–	10	10	5	3,000
Ihlen	50	30	5	15	–	–	5,100
Indus	–	2	10	3	75	10	
Insula	–	–	–	(5)	(95)	–	
Isan	(30)	(10)	(10)	(50)	(5)	–	438,400
Isanti	20	15	15	20	15	15	121,200
Joy	(70)	(10)	(10)	–	–	(10)	
Judson	25	10	20	25	15	5	53,600
Kamrar	(65)	(10)	(10)	(5)	(5)	(5)	
Kanaranzi	60	–	–	40	–	–	900
Kasota	40	15	25	10	5	5	12,800
Kasson	55	20	10	–	10	5	93,400
Kato	55	15	10	10	–	10	32,800
Kegonsa	(50)	(20)	(15)	(5)	(5)	(5)	
Kennebec	(70)	(10)	(10)	(10)	–	–	
Kenyon	50	20	10	5	5	10	152,700
Kilkenny	–	–	50	50	–	–	1,000
Kingsley	15	15	25	20	10	15	33,200
Kingston	55	15	20	–	–	10	24,400
Kittson	30	40	15	5	–	10	142,900
Klinger	(75)	(10)	(5)	(5)	–	(5)	

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Table 8 (continued). Percentage distribution of cultivated, permanent pasture and forested land use on representative soils of Minnesota from analysis of conservation needs inventory data (11)

Soil series[1]	Corn and other row crops	Small grains	Rotation hay[2]	Permanent pasture[3]	Commercial and non-commercial forest	Other[4]	Estimated acreage of soil[5]
Kranzburg	45	30	20	5	–[6]	10	126,200
Kratka	–	10	40	40	10	–	400
Lamoure	45	5	10	30	–	10	13,900
Langhei	(30)[7]	(30)	(20)	(15)	–	(5)	
Langola	20	20	20	15	20	5	23,000
LaPrairie	35	30	25	5	–	5	700
LaSa	(60)	(15)	(10)	(5)	–	(10)	
Lawson	(75)	(5)	–	(10)	(10)	–	
Lemond	60	15	15	5	–	5	15,500
Leota	50	15	10	15	–	10	35,800
Lerdal	35	15	35	15	–	–	5,800
Lester	45	10	15	10	10	10	664,600
LeSueur	50	13	14	8	6	9	260,000
Lilah	(20)	(20)	(20)	(20)	(15)	(5)	
Lindstrom	25	6	6	40	20	3	11,600
Lino	10	10	5	20	30	25	122,600
Lismore	60	15	15	1	–	9	15,900
Litchfield	60	15	10	5	–	10	28,800
Lobo	–	–	–	–	(100)	–	
Loxley	–	–	–	(5)	(95)	–	
Lura	75	5	5	5	–	10	41,600
McIntosh	10	70	15	5	–	–	173,400
Maddock	35	20	20	10	5	10	75,800
Madelia	70	15	5	–	–	10	15,600
Mahtowa	–	(5)	(5)	(10)	(80)	–	
Malachy	(45)	(40)	(5)	(5)	–	(5)	
Marcus	50	15	15	10	–	10	111,100
Marna	70	15	10	–	–	5	116,700
Marquette	5	5	5	15	65	5	173,100
Marshan	50	5	15	25	–	5	22,400
Marysland	(50)	(30)	(5)	(10)	–	(5)	
Mavie	–	20	25	10	35	10	74,500
Maxcreek	(60)	(25)	(5)	(5)	–	(5)	
Maxfield	(60)	(25)	(5)	(5)	–	(5)	
Mayer	50	10	5	25	–	10	27,400
Mazaska	(40)	(10)	(5)	(25)	(15)	(5)	
Medary	(45)	(10)	(10)	(15)	(15)	(5)	
Menahga	–	5	5	5	75	10	570,600
Meridian	20	30	25	10	10	5	2,500
Merton	(70)	(10)	(5)	(5)	–	(10)	
Merwin	–	–	–	(90)	(10)	–	
Metogga	(5)	–	(10)	(85)	–	–	
Milaca	20	20	20	15	15	10	323,600
Millerville	–	(5)	(5)	(90)	–	–	
Minneiska	60	–	10	15	10	5	13,100
Minneopa	(60)	(15)	(10)	(5)	–	(10)	
Minnetonka	(35)	(15)	–	(25)	(25)	–	
Moland	(70)	(10)	(10)	–	–	(10)	
Moody	55	15	15	5	–	10	179,700

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Table 8 (continued). Percentage distribution of cultivated, permanent pasture and forested land use on representative soils of Minnesota from analysis of conservation needs inventory data (11)

Soil series[1]	Corn and other row crops	Small grains	Rotation hay[2]	Permanent pasture[3]	Commercial and non-commercial forest	Other[4]	Estimated acreage of soil[5]
Mooselake	–[6]	–	–	(5)[7]	(95)	–	
Mora	5	5	15	15	50	10	360,200
Mosomo	–	–	–	(5)	(95)	–	
Mt. Carroll	45	20	20	5	–	10	94,600
Nebish	5	5	10	5	70	5	1,242,500
Nemadji	5	5	10	5	70	5	42,000
Nessel	35	20	20	10	5	10	39,800
Newfound	–	–	–	(5)	(95)	–	
Newglarus	(15)	(5)	(10)	(40)	(30)	–	
Newry	(65)	(10)	(5)	(10)	(10)	–	
Nicollet	70	15	5	–	–	10	986,300
Nokasippi	–	–	5	65	20	10	4,200
Nokay	5	–	10	15	60	10	206,300
Nordness	(15)	(5)	(10)	(40)	(30)	–	
Northcote	(15)	(55)	(15)	(5)	–	(10)	
Nowen	(20)	(20)	(20)	(15)	(15)	(10)	
Nutley	35	50	–	5	–	10	5,200
Nymore	30	15	20	15	10	10	93,800
Oak Lake	(60)	(15)	(15)	(2)	–	(8)	
Ocheyedan	(70)	(10)	(5)	(5)	–	(10)	
Ogilvie	(5)	(10)	(15)	(35)	(30)	(5)	
Oldham	25	15	15	40	–	5	18,800
Omega	5	5	15	10	60	5	74,400
Onamia	15	20	20	10	30	5	68,500
Ontonagon	–	–	5	15	80	–	44,300
Opole	20	20	20	20	15	5	1,100
Orion	(15)	–	(5)	(40)	(35)	(5)	
Osakis	–	45	25	20	10	–	10,800
Ostrander	50	20	15	5	5	10	149,600
Otterholt	(20)	(20)	(20)	(10)	(25)	(5)	
Paget	25	15	30	15	5	10	16,400
Palms	(5)	–	(10)	(85)	–	–	
Palsgrove	15	10	30	35	5	5	112,100
Parent	5	5	30	30	20	10	83,000
Parnell	25	20	10	40	–	5	313,700
Percy	(5)	(30)	(15)	(35)	(10)	(5)	
Plainfield	–	25	20	25	25	5	4,800
Poinsett	(60)	(15)	(15)	(2)	–	(8)	
Pomroy	5	5	15	5	70	–	37,900
Poppleton	5	30	30	10	15	10	49,800
Port Byron	50	20	20	5	–	5	47,500
Prebish							
Primghar	65	10	10	5	–	10	54,300
Quam	(30)	(15)	–	(55)	–	(5)	
Quetico	–	–	–	(5)	(95)	–	
Racine	45	20	25	5	–	5	99,000
Rasset	40	10	25	20	–	5	2,100
Rauville	(10)	–	–	(90)	–	–	
Readlyn	(50)	(20)	(10)	(10)	–	(10)	

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Table 8 (continued). Percentage distribution of cultivated, permanent pasture and forested land use on representative soils of Minnesota from analysis of conservation needs inventory data (11)

Soil series[1]	Corn and other row crops	Small grains	Rotation hay[2]	Permanent pasture[3]	Commercial and non-commercial forest	Other[4]	Estimated acreage of soil[5]
Redby	1	5	10	7	75	2	207,800
Renova	30	15	25	18	8	4	150,300
Renshaw	20	30	10	30	6	4	199,600
Rifle	(5)[7]	–[6]	–	(5)	(90)	–	
Rockton	25	15	30	20	2	8	52,200
Rockwell	20	30	10	30	5	5	5,100
Rockwood	20	18	25	6	25	6	60,500
Rolfe	(50)	(15)	(5)	(20)	(5)	(5)	
Roliss	5	40	20	14	17	4	277,000
Ronneby	–	–	10	15	65	10	232,800
Rothsay	70	10	5	5	–	10	45,600
Rushmore	(60)	(15)	(5)	(15)	–	(5)	
Salida	40	20	20	10	10	–	77,300
Santiago	(15)	(25)	(30)	(15)	(10)	(5)	
Sargeant	50	10	15	25	–	–	6,000
Sartell	15	5	20	10	50	–	24,500
Schapville	5	5	10	50	20	10	4,700
Seaton	35	20	30	10	–	5	132,300
Seelyeville	(5)	–	(10)	(50)	(30)	–	
Shakopee	(50)	(25)	(20)	(5)	–	–	132,300
Shible	55	10	–	30	–	5	3,000
Shields	55	10	20	00	5	10	2,400
Shooker	5	5	5	10	70	5	383,600
Shorewood	(50)	(25)	(10)	(5)	(5)	(5)	
Shullsburg	(10)	(20)	(30)	(35)	(5)	–	
Sigsbee	(50)	(15)	(20)	(5)	(5)	–	
Sinai	45	35	15	5	–	–	52,700
Sioux	5	25	25	20	15	10	158,800
Skyberg	50	20	15	5	–	10	54,800
Soderville	(65)	(5)	(5)	(10)	(10)	(5)	
Sparta	60	5	10	5	10	10	35,200
Spencer	(20)	(20)	(20)	(10)	(25)	(5)	
Spicer	60	15	15	–	–	10	18,400
Spooner	–	–	10	10	75	5	93,900
Spottswood	(30)	(25)	(35)	(5)	–	(5)	
Storden	(30)	(10)	(10)	(45)	–	(5)	
Strandquist	–	(30)	(20)	(30)	(15)	(5)	
Suamico	–	–	–	(5)	(95)	–	
Svea	(45)	(30)	(10)	(5)	–	(10)	
Sverdrup	55	30	5	–	–	10	124,300
Swenoda	60	10	5	5	–	10	4,200
Syrene	–	(5)	(10)	(85)	–	–	
Talcot	35	10	10	35	–	10	30,700
Tama	45	15	25	5	–	10	88,100
Taopi	(50)	(10)	(10)	(10)	(10)		
Tara	(65)	(15)	(10)	–	–	(10)	
Taylor	5	5	5	–	85	–	132,600
Tell	55	10	20	5	5	5	6,200
Terrill	50	15	15	10	–	10	64,300

1. Use is considered for all slope and erosion conditions.
2. Includes rotation hay and pasture.
3. Includes marshy and idle land.
4. Primarily roads, farmsteads, urban developments.
5. Estimated acreages are as of date of inventory (1967). Subsequent soil mapping may increase acreages.
6. – means "estimated to be less than 5 percent."
7. Numbers in parentheses are estimates on soil series descriptions and consideration of use on

Table 8 (continued). Percentage distribution of cultivated, permanent pasture and forested land use on representative soils of Minnesota from analysis of conservation needs inventory data (11)

Soil series[1]	Corn and other row crops	Small grains	Rotation hay[2]	Permanent pasture[3]	Commercial and non-commercial forest	Other[4]	Estimated acreage of soil[5]
Toivola	–[6]	–	–	(5)[7]	(95)	–	
Tonka	90	5	5	–	–	–	3,800
Torning	(35)	(40)	(10)	(10)	–	(5)	
Towner	–	35	30	30	–	5	400
Trent	(55)	(15)	(15)	(5)	–	(10)	
Trosky	55	10	25	5	–	5	5,500
Truman	70	5	10	5	–	10	40,100
Udolpho	35	15	–	20	20	10	4,900
Ulen	15	45	20	10	5	5	143,100
Urness	–	5	50	20	–	5	3,900
Vallers	50	30	10	5	–	5	400,200
Vasa	(50)	(10)	(15)	(10)	(10)	(5)	
Vienna	50	15	15	10	–	10	119,600
Viking	(5)	(50)	(20)	(15)	(5)	(5)	
Vlasaty	55	10	10	10	10	5	700
Wadena	55	20	15	5	–	5	81,600
Wahpeton	(10)	(10)	(10)	(55)	(10)	(5)	
Waldorf	(70)	(10)	(10)	(5)	–	(5)	
Warba	–	(5)	(10)	(10)	(70)	(5)	
Warman	–	5	5	30	50	10	54,300
Waubay	(40)	(30)	(10)	(10)	–	(10)	
Waukegan	50	20	15	5	–	5	114,600
Waukon	15	20	25	10	20	10	303,500
Webster	65	15	10	5	–	5	1,338,300
Whalan	30	5	15	20	30	–	26,700
Wheatville	(35)	(45)	(10)	(5)	–	(5)	
Whitewood	(25)	(20)	(15)	(35)	–	(5)	
Winger	15	55	15	5	–	10	164,000
Zimmerman	5	20	20	5	40	10	241,300
Zumbro	5	5	–	45	40	5	8,100

1. Use is considered for all slope and erosion conditions.
2. Includes rotation hay and pasture.
3. Includes marshy and idle land.
4. Primarily roads, farmsteads, urban developments.
5. Estimated acreages are as of date of inventory (1967). Subsequent soil mapping may increase acreages.
6. – means "estimated to be less than 5 percent."
7. Numbers in parentheses are estimates based on soil series descriptions and consideration of use on similar soils.

Table 9. Some physical and chemical properties of representative Minnesota soils

Soil series	Organic matter content[1]	Subsoil permeability[2]	Natural drainage condition	Available water capacity (in.)[3]	Soil reaction (surface horizon)	Common texture (surface horizon)
Aastad	High	Moderately slow	Moderately well	12.3	6.6-7.3	clay loam
Aazdahl	High	Moderately slow	Moderately well	12.3	6.6-7.3	clay loam
Adolph	High	Moderately slow	Very poor	7.2	6.1-7.3	silty clay loam
Afton	High	Moderately slow	Poor	13.9	6.6-7.3	silty clay loam

1. Organic matter content is considered as high if more than 5 percent; medium, 2 to 5 percent; and low, less than 2 percent.
2. Permeability is considered as follows: Rapid, more than 5 inches per hour; moderately rapid, 2.5 to 5; moderate, 0.8 to 2.5; moderately slow, 0.2 to 0.8, and slow, less than 0.2 inches per hour.
3. Available water capacity is calculated in inches to a depth of 5 feet or to a restricting layer. It should be noted that many poorly drained soils may have a water table at or near base of rooting zone.

Table 9 (continued). Some physical and chemical properties of representative Minnesota soils

Soil series	Organic matter content[1]	Subsoil permeability[2]	Natural drainage condition	Available water capacity (in.)[3]	Soil reaction (surface horizon)	Common texture (surface horizon)
Ahmeek	Medium	Moderately slow	Well	3.1	5.1-6.0	loam
Almena	Medium	Moderately slow	Moderately well to somewhat poor	11.3	5.1-.5.5	light silt loam
Alvin	Low	Moderately rapid	Well and moderately well	9.0	5.6-6.0	fine sandy loam
Amery	Medium	Rapid	Well and moderately well	3.1	4.5-5.5	sandy loam
Ankeny	High	Rapid	Well	9.2	6.1-6.5	sandy loam
Anoka	Medium	Moderate	Well	9.2	5.1-.6-1	very fine sand
Antigo	Medium	Moderate	Well	7.5	5.1-5.5	friable silt loam
Arcola	Medium	Moderately slow	Well	9.5	6.1-6.5	loam
Arenzville	Medium	Moderate	Well to moderately well	14.3	6.1-6.5	silt loam
Arland	Low	Moderate	Well	6.0	5.6-6.0	sandy loam
Arveson	High	Moderately rapid	Poor and very poor	9.1	7.4-7.8	fine sandy loam
Arvilla	High	Moderately rapid	Excessive	5.5	6.6-7.3	sandy loam
Athelwold	High	Moderate	Well	8.7	6.6-7.3	silty clay loam
Augsburg	High	Moderately rapid	Poor	15.0	7.9-8.4	loam
Badger	High	Moderately slow	Poor	11.3	7.4-7.8	loam
Barbert	High	Very slow	Poor	10.8	5.6-6.0	silt loam
Barnes	High	Moderate	Well	12.3	6.6-7.3	loam
Baroda	High	Very slow	Poor	10.8	5.1-7.3	silty clay loam
Barrows	High	Slow	Very poor	7.2	6.6-7.3	loam
Barto	Medium	Moderately rapid	Well	1.8	5.1-6.0	gravelly loam
Baudette	Medium	Moderate	Moderately well	10.8	6.1-7.3	loam
Bearden	High	Moderate	Poor	14.0	7.4-7.8	silty clay loam
Beauford	High	Slow	Poor	10.8	6.6-7.3	clay
Becker	High	Moderate	Moderately well	9.3	6.1-7.3	very fine sandy loam
Bellechester	High	Rapid	Excessively	2.7	6.1-7.8	sand
Beltrami	Medium	Moderate	Moderately well	11.8	6.6-7.3	sandy loam
Bena	Medium	Rapid	Well or moderately well	5.5	5.6-6.0	loamy fine sand
Benoit	High	Moderately rapid	Poor and very poor	8.4	7.4-8.4	loam
Beotia	High	Moderate	Well	14.0	6.6-7.3	silt loam
Bertrand	Medium	Moderate	Well	10.8	6.6-7.3	silt loam
Beseman	Medium	Rapid-Moderately slow	Very poorly	18.8	4.0-5.0	muck
Billett	Medium	Moderately rapid	Well	5.5	5.6-6.0	sandy loam
Biscay	High	Moderate and rapid	Poor	8.4	6.1-7.4	loam
Bixby	Medium	Moderate	Well	6.9	5.6-6.5	loam
Blackhoof	High	Very slow	Very poor	9.8	5.1-6.5	muck
Blomford	High	Moderately slow	Poor	8.5	5.1-6.5	loamy fine sand
Blooming	High	Moderate	Well	11.6	6.1-6.5	silt loam
Blue Earth	High	Moderately slow	Very poor	11.1	7.4-8.4	mucky silt loam
Bluffton	Medium	Moderately slow	Very poor	13.9	6.6-7.3	silty clay loam
Bold	Medium	Moderate	Excessive	14.3	7.4-7.8	silt
Boone	Low	Rapid	Excessive	5.7	5.6-6.0	fine sand
Borup	High	Moderately rapid	Poor	17.9	7.4-8.4	silt loam
Braham	Medium	Moderately rapid	Well and excessive	8.0	5.6-6.5	loamy fine sand
Brainerd	Medium	Moderately slow	Moderately well	3.1	4.5-6.0	sandy loam
Brickton	Moderate	Moderately slow	Poor	10.0	5.6-6.5	silt loam
Brodale	High	Moderate	Excessive	3.7	7.4-8.4	flaggy loam

1. Organic matter content is considered as high if more than 5 percent; medium, 2 to 5 percent; and low, less than 2 percent.
2. Permeability is considered as follows: Rapid, more than 5 inches per hour; moderately rapid, 2.5 to 5; moderate, 0.8 to 2.5; moderately slow, 0.2 to 0.8, and slow, less than 0.2 inches per hour.
3. Available water capacity is calculated in inches to a depth of 5 feet or to a restricting layer. It should be noted that many poorly drained soils may have a water table at or near base of rooting zone.

Table 9 (continued). Some physical and chemical properties of representative Minnesota soils

Soil series	Organic matter content[1]	Subsoil permeability[2]	Natural drainage condition	Available water capacity (in.)[3]	Soil reaction (surface horizon)	Common texture (surface horizon)
Brookings	High	Moderate	Moderately well	14.0	6.6-7.3	silty clay loam
Brophy	High	Rapid	Very poor	20.0	6.6-8.4	mucky peat
Brownton	High	Slow	Poor	10.8	7.4-7.8	silty clay loam
Burkhardt	High	Mod. rapid-rapid	Excessive	5.5	5.6-6.5	sandy loam
Burnsville	High	Moderately rapid	Excessive	5.5	5.6-6.0	sandy loam
Buse	High	Moderate	Well	12.3	7.4-7.8	loam
Calco	High	Moderately slow	Poor	13.9	7.4-7.8	silty clay loam
Campia	Medium	Moderate	Well	10.8	5.1-6.0	silt loam
Canisteo	High	Moderate	Poor	11.6	7.4-7.8	clay loam
Carlos	High	Moderately slow	Very poor	20.5	6.6-8.4	muck
Caron	High	Moderately slow	Very poor	20.	5.6-7.3	muck
Cashel	Low	Moderately slow	Poor	9.9	7.4-7.8	silty clay
Cathro	High	Rapid-slow	Very poor	18.3	5.6-7.8	muck
Chaseburg	Medium	Moderate	Well	14.3	6.6-7.3	silt loam
Chaska	High	Moderate	Poor	13.9	6.6-7.8	clay loam
Chelsea	Low		Excessive	5.5	6.1-6.5	loamy fine sand
Chetek	Low	Moderately rapid	Well	5.5	5.6-6.0	sandy loam
Chilgren	High	Slow	Poor	10.0	6.6-7.8	loam
Clarion	High	Moderate	Well	12.3	6.1-6.5	loam
Clontarf	High	Moderately rapid	Moderately well	5.5	6.1-7.8	sandy loam
Cloquet	Medium	Mod.-Upper rapid-lower	Excessive	5.5	4.5-6.0	fine sandy loam
Clyde	High	Moderate	Poor	13.9	6.6-7.3	silty clay loam
Collinwood	High	Moderately slow-slow	Poor	9.9	5.6-6.5	silty clay
Colo	High	Moderate	Poor	13.9	6.0-7.3	silty clay loam
Colvin	High	Mod. and mod. slow	Poor	13.9	7.4-9.0	silty clay loam
Comfrey	High	Moderate	Poor	13.9	6.6-7.8	clay loam
Copaston	High	Moderate	Well	5.5	6.1-7.3	sandy clay loam
Cordova	High	Moderately slow	Poor	11.3	6.1-7.3	silty clay loam
Cormant	High	Rapid	Poor and very poor	6.8	6.1-7.3	loamy fine sand
Crofton	Medium	Moderate	Well	14.0	7.4-7.8	silt loam
Cromwell	Medium	Moderately rapid	Excessive	5.5	5.1-6.0	sandy loam
Cushing	High	Mod. to mod. slow	Well	11.8	6.6-7.3	loam
Dakota	High	Moderately rapid	Well	8.3	5.6-6.5	loam
Dalbo	High	Moderately slow	Moderately well	9.5	6.1-7.3	silt loam
Darfur	High	Moderate	Poor	10.0	6.6-7.3	loam
Darnen	High	Moderately rapid	Moderately well	12.3	6.6-7.8	loam
Dassel	High	Moderately rapid	Poor	10.0	6.1-6.5	sandy loam
Dawson	High	Moderately rapid	Poor	15.2	4.0-5.0	muck
Deerwood	High	Moderately rapid	Very poor	6.8	7.4-7.8	muck
Derinda	Medium	Moderately well	Slow	9.5	6.1-6.5	silt loam
Dickinson	High	Moderate	Well to excessive	9.2	5.6-6.5	fine sandy loam
Dickman	High	Rapid	Excessive	5.5	6.1-6.5	sandy loam
Dodgeville	High	Moderately slow	Well	8.6	5.1-6.5	silt loam
Doland	High	Moderate	Well	12.3	6.6-7.3	silt loam
Dorchester	High	Moderately rapid	Moderately well	10.8	7.5-7.9	silt loam
Dorset	High	Moderately rapid	Excessive	5.5	6.1-7.3	sandy loam
Dovray	High	Moderately slow	Very poor	10.8	6.6-7.8	clay
Downs	Medium	Moderate	Well	10.8	5.1-6.0	silt loam

1. Organic matter content is considered as high if more than 5 percent; medium, 2 to 5 percent; and low, less than 2 percent.
2. Permeability is considered as follows: Rapid, more than 5 inches per hour; moderately rapid, 2.5 to 5; moderate, 0.8 to 2.5; moderately slow, 0.2 to 0.8, and slow, less than 0.2 inches per hour.
3. Available water capacity is calculated in inches to a depth of 5 feet or to a restricting layer. It should be noted that many poorly drained soils may have a water table at or near base of rooting zone.

Table 9 (continued). Some physical and chemical properties of representative Minnesota soils

Soil series	Organic matter content[1]	Subsoil permeability[2]	Natural drainage condition	Available water capacity (in.)[3]	Soil reaction (surface horizon)	Common texture (surface horizon)
Dubuque	High	Moderate-silty	Well	8.6	5.6-6.5	silt loam
Duelm	High	Rapid	Poor and mod. well	4.2	5.6-6.5	loamy coarse sand
Duluth	Medium	Slow	Well and mod. well	11.8	5.1-6.0	very fine sandy loam
Dunbarton	Medium	Moderately slow	Well	9.9	6.6-7.3	silt loam
Dundas	High	Moderately slow	Poor	11.3	5.6-6.5	silt loam
Dusler	High	Slow	Poor	7.2	5.0-5.5	silt loam
Edison	High	Moderate	Well	14.2	6.6-7.3	very fine sandy loam
Egeland	High	Moderate	Well	9.2	6.1-6.5	sandy loam
Eleva	Medium	Moderately rapid	Excessive	5.5	5.6-6.0	sandy loam
Embden	High	Moderate	Moderately well	9.2	6.6-7.3	fine sandy loam
Emmert	High	Very rapid	Excessive	1.7	5.1-6.5	gravelly coarse sandy loam
Enstrom	High	Rapid	Moderately well	8.0	6.6-7.8	fine sand
Erin	High	Moderately slow	Moderately well	9.5	6.1-6.5	silt loam
Estelline		Rapid	Well	8.7	6.6-7.3	silt loam
Estherville	High	Moderately rapid	Excessive	5.5	5.6-7.3	sandy loam
Etter	High	Moderate	Well	5.5	5.1-6.5	fine sandy loam
Everly	High	Moderate	Well	12.3	6.1-6.5	silt loam
Fairhaven	High	Moderately rapid	Well	8.3	5.6-6.5	silt loam
Fargo	High	Slow	Poor	10.8	6.6-7.3	silty clay
Farrar	High	Moderate to rapid	Well	12.3	6.1-6.5	fine sandy loam
Faxon	High	Moderate	Very poor	6.9	6.6-7.8	clay loam
Fayette	Low	Moderate	Well	10.8	5.1-6.0	silt loam
Fedji	High	Rapid to moderate	Excessive	8.0	6.1-6.5	loamy fine sand
Fieldon	High	Moderate	Poor	10.0	7.4-7.8	loam
Flak	High	Moderately slow	Well	3.1	5.1-6.0	fine sandy loam
Flaming	High	Rapid	Moderately well	5.7	5.6-7.3	loamy fine sand
Flandreau	High	Moderate	Well	8.3	6.6-7.3	loam
Flom	High	Moderate to slow	Poor	13.9	6.6-7.3	silty clay loam
Floyd	High	Moderate	Poor	12.3	6.6-7.3	loam
Foldahl	High	Rapid to moderate	Moderately well	8.0	6.1-7.8	sandy loam
Forada	High	Moderately rapid	Very poor	9.1	6.6-7.8	loam
Fordville	High	Moderate to rapid	Well	8.3	6.6-7.3	sandy loam
Forman	High	Moderate	Well	12.3	6.1-6.5	clay loam
Formdale	High	Moderately slow	Well	12.3	6.6-7.3	clay loam
Fossum	Medium	Very slow	Poor	6.8	7.4-7.8	sandy loam
Foxhome	High	Moderate	Moderately well	8.0	6.6-7.3	sandy loam
Fram	High	Moderate	Moderately well	10.0	7.4-7.8	loam
Freeon	Medium	Moderate	Moderately well	3.1	4.5-5.5	silt loam
Freer	High	Moderately slow	Poor	7.2	5.1-5.5	silt loam
Frontenac	High	Moderate	Well	10.3	6.1-6.5	silt loam
Fulda	High	Moderately slow to slow	Poor	10.8	6.6-7.3	silty clay loam
Gale	Low	Mod. to mod. rapid	Well	7.5	5.6-6.5	silt loam
Galva	High	Moderate	Well	14.0	6.1-6.5	medium silty clay loam

1. Organic matter content is considered as high if more than 5 percent; medium, 2 to 5 percent; and low, less than 2 percent.
2. Permeability is considered as follows: Rapid, more than 5 inches per hour; moderately rapid, 2.5 to 5; moderate, 0.8 to 2.5; moderately slow, 0.2 to 0.8, and slow, less than 0.2 inches per hour.
3. Available water capacity is calculated in inches to a depth of 5 feet or to a restricting layer. It should be noted that many poorly drained soils may have a water table at or near base of rooting zone.

Table 9 (continued). Some physical and chemical properties of representative Minnesota soils

Soil series	Organic matter content[1]	Subsoil permeability[2]	Natural drainage condition	Available water capacity (in.)[3]	Soil reaction (surface horizon)	Common texture (surface horizon)
Garnes	Medium	Moderate	Moderately well	11.8	6.6-7.8	loam
Garwin	High	Moderate	Poor	13.9	5.6-6.5	silty clay loam
Glencoe	High	Mod. to moderately slow	Very poor	13.9	6.6-7.3	clay loam
Glyndon	High	Moderate	Moderately well to somewhat poor	14.2	7.4-8.9	silt loam
Gonvick	High	Moderate	Moderately well	12.3	6.6-7.3	loam
Granby	High	Rapid	Poor to very poor	6.8	5.6-7.3	loamy sand
Grays	High	Moderate	Moderately well to well	10.8	6.1-6.5	silt loam
Grimstad	High	Moderate	Poor to moderate	8.0	7.4-7.8	sandy loam
Grogan	High	Moderately rapid	Well	14.2	5.6-7.3	silt loam
Growton	High	Moderate	Moderately well	9.2	5.6-6.5	fine sandy loam
Grygla	High	Rapid	Poor	8.5	6.1-7.3	loamy sand
Guckeen	High	Moderately slow	Moderately well	9.8	5.6-6.5	silty clay loam
Halder	Medium	Moderate	Somewhat poor	6.5	5.1-6.5	loam
Hamar	High	Moderately rapid	Poor	6.8	6.1-6.5	sandy loam
Hamel	High	Moderately slow	Poor	13.9	5.1-6.5	loam
Hamerly	High	Moderately slow	Somewhat poor	13.9	7.4-7.8	loam
Hangaard	High	Rapid	Poor	6.8	7.4-7.8	sandy loam
Hanska	High	Moderately rapid	Poor	9.1	6.1-7.3	loam
Hantho	High	Moderate	Moderately well	14.0	6.6-7.3	silt loam
Harps	High	Moderate	Poor	13.9	7.9-8.4	light clay loam
Hattie	High	Slow	Well to moderately well	9.9	7.4-8.4	clay
Haug	High	Moderately rapid	Very poor	10.0	6.6-7.3	muck
Havana	High	Moderately slow	Poor	11.3	5.6-6.5	silt loam
Hayden	Medium	Moderate	Well	11.8	5.6-6.5	loam
Hayfield	High	Moderate	Moderately well	6.9	5.6-6.5	silt loam
Hecla	Medium	Rapid to mod. rapid	Moderately well	5.7	6.6-7.3	loamy fine sand
Hegne	High	Very slow	Poor	10.8	7.4-8.4	silty clay
Heyder	High	Moderate	Well	9.2	6.1-6.5	fine sandy loam
Hibbing	Low	Slow	Well to moderately well	9.5	4.5-6.0	loam
Hillet	High	Moderate	Very poor	9.1	5.6-6.0	loam
Hiwood	Low	Rapid	Moderately well	5.7	4.5-6.0	fine sand
Hixton	Low	Moderately rapid	Well	6.9	5.6-6.0	friable loam
Holdingford	High	Moderately slow	Well	3.1	5.1-6.5	sandy loam
Hubbard	High	Rapid	Excessive	4.2	5.6-6.5	loamy coarse sand
Huntsville	High	Moderate	Moderately well	14.0	6.1-6.5	silt loam
Ihlen	High	Moderately rapid	Well	8.6	6.1-6.3	silty clay loam
Indus	Medium	Moderately slow	Poor	10.0	5.6-6.5	clay
Insula	Medium	Moderately rapid	Well	1.8	5.1-6.0	gravelly sandy loam
Isan	High	Rapid	Very poor	6.8	5.6-6.5	sandy loam
Isanti	High	Rapid (when drained)	Very poor	6.8	5.1-6.5	mucky loamy fine sand
Joy	High	Moderate	Well	14.0	6.1-6.5	silt loam
Judson	High	Moderate	Well to moderately well	14.0	6.1-6.5	silt loam
Kamrar	High	Moderately slow	Moderately well	9.9	6.1-7.3	clay loam

1. Organic matter content is considered as high if more than 5 percent; medium, 2 to 5 percent; and low, less than 2 percent.
2. Permeability is considered as follows: Rapid, more than 5 inches per hour; moderately rapid, 2.5 to 5; moderate, 0.8 to 2.5; moderately slow, 0.2 to 0.8, and slow, less than 0.2 inches per hour.
3. Available water capacity is calculated in inches to a depth of 5 feet or to a restricting layer. It should be noted that many poorly drained soils may have a water table at or near base of rooting zone.

Table 9 (continued). Some physical and chemical properties of representative Minnesota soils

Soil series	Organic matter content[1]	Subsoil permeability[2]	Natural drainage condition	Available water capacity (in.)[3]	Soil reaction (surface horizon)	Common texture (surface horizon)
Kanaranzi	High	Moderately rapid	Well to excessive	5.0	5.1-6.5	loam
Kasota	High	Moderate	Well	9.9	5.8-6.8	loam
Kasson	High	Moderately slow	Moderately well	11.8	6.1-6.5	silt loam
Kato	High	Moderate	Poor	8.4	6.6-7.3	silty clay loam
Kegonsa	High	Moderate	Well	7.5	6.1-7.3	silt loam
Kennebec	High	Moderate	Occasionally floods	14.0	6.1-6.5	silt loam
Kenyon	Medium	Moderate	Well	12.3	5.1-6.5	loam
Kilkenny	High	Moderately slow	Well to moderately well	9.5	5.6-6.5	clay loam
Kingsley	High	Mod. to moderately slow	Well	3.1	5.6-6.5	sandy loam
Kingston	High	Moderate	Moderately well to somewhat poor	14.0	6.1-7.3	silty clay loam
Kittson	High	Moderate	Moderately well to somewhat poor	10.7	6.6-7.3	loam
Klinger	High	Moderate	Somewhat poor	14.0	5.1-6.0	silty clay loam
Kranzburg	High	Moderate	Well	14.0	6.1-6.5	silt loam
Kratka	High	Moderately slow	Very poor to poor	8.5	7.4-7.8	loamy sand
Lamoure	High	Moderately slow	Very poor	13.9	7.4-7.8	silt loam
Langhei	Medium	Moderate	Excessive	11.8	6.6-8.4	loam
Langola	High	Rapid	Well to moderately well	3.1	5.6-6.5	loamy fine sand
LaPrairie	High	Moderate	Moderately well	14.0	7.4-7.8	silt loam
LaSa	High	Moderately rapid	Excessive	4.9	6.1-6.5	fine sand
Lawson	High	Moderate	Poor	14.0	6.6-7.3	silt loam
Lemond	High	Moderately rapid	Poor	9.1	7.4-7.8	loam
Leota	High	Moderately slow	Poor	12.0	6.1-6.5	silty clay loam
Lerdal	High	Slow	Poor to moderately well	10.8	5.1-6.0	silty clay loam
Lester	High	Moderate	Well	11.8	5.6-6.5	clay loam
LeSueur	High	Moderate	Mod. well to somewhat poor	12.3	6.6-7.3	clay loam
Lilah	Medium	Rapid	Excessive	3.5	5.1-6.0	sandy loam
Lindstrom	High	Moderate	Well	14.0	6.1-6.5	silt loam
Lino	Low	Rapid	Somewhat poor	6.8	5.6-6.0	loamy fine sand
Lismore	High	Moderate	Moderately well	12.3	6.6-7.3	silty clay loam
Litchfield	High	Moderately rapid	Mod. well to somewhat poor	5.0	6.1-6.5	loamy fine sand
Lobo	High	Rapid	Very poor	32.7	<4.5	peat
Loxley	High	Moderately rapid	Very poor	28.2	5.1-5.5	muck
Lura	High	Slow	Poor	10.8	6.1-7.3	silty clay
McIntosh	High	Mod. to moderately slow	Moderately well	14.0	7.9-8.4	silt loam
Maddock	High	Rapid	Well	5.7	6.1-6.5	light sandy loam
Madelia	High	Moderate	Poor	13.9	6.1-7.3	silty clay loam
Mahtowa	High	Slow	Poor to very poor	7.2	5.1-6.5	silt loam
Malachy	High	Moderately rapid	Moderately well to poor	5.5	7.4-7.8	sandy loam
Marcus	High	Moderately slow	Poor	13.9	6.1-7.3	silty clay loam
Marna	High	Slow	Poor	10.8	6.1-7.3	silty clay
Marquette	High	Moderately rapid	Excessive	2.6	5.6-7.3	loamy sand

1. Organic matter content is considered as high if more than 5 percent; medium, 2 to 5 percent; and low, less than 2 percent.
2. Permeability is considered as follows: Rapid, more than 5 inches per hour; moderately rapid, 2.5 to 5; moderate, 0.8 to 2.5; moderately slow, 0.2 to 0.8, and slow, less than 0.2 inches per hour.
3. Available water capacity is calculated in inches to a depth of 5 feet or to a restricting layer. It should be noted that many poorly drained soils may have a water table at or near base of rooting zone.

Table 9 (continued). Some physical and chemical properties of representative Minnesota soils

Soil series	Organic matter content[1]	Subsoil permeability[2]	Natural drainage condition	Available water capacity (in.)[3]	Soil reaction (surface horizon)	Common texture (surface horizon)
Marshan	High	Moderate	Very poor to poor	8.4	5.6-6.3	loam
Marysland	High	Moderate	Poor	8.4	7.4-7.8	loam
Mavie	High	Moderately slow	Poor	8.5	7.4-7.8	loam
Maxcreek	High	Moderate	Poor	13.9	6.6-7.8	silty clay loam
Maxfield	High	Moderate	Poor	13.9	6.6-7.8	silty clay loam
Mayer	High	Moderately rapid	Poor	8.4	7.4-7.8	loam
Mazaska	High	Moderately slow	Poor	10.8	6.1-7.3	silty clay loam
Medary	Light	Slow	Moderately well	9.5	5.1-6.0	silt loam
Menahga	Medium	Very rapid	Excessive	4.2	5.1-6.0	loamy sand
Meridian	High	Moderately rapid	Well	6.9	5.6-6.0	loam
Merton	High	Moderate	Moderately well to somewhat poor	12.3	5.6-6.5	silt loam
Merwin	Medium	Rapid	Very poor	18.3	4.0-5.0	mucky peat
Metogga	High	Rapid	Very poor	20.0	6.0-7.0	muck
Milaca	High	Moderately slow	Well	3.1	5.1-6.0	fine sandy loam
Millerville	High	Moderately slow	Very poor	20.0	5.6-7.3	mucky peat
Minneiska	High	Moderately rapid	Moderately well	9.2	6.6-7.3	silt loam
Minneopa	High	Moderately rapid	Moderately well	5.5	6.1-7.3	sandy loam
Minnetonka	High	Slow	Poor	10.8	5.6-7.3	silty clay loam
Moland	High	Moderate	Well	12.5	5.6-6.5	silt loam
Moody	Medium	Moderate	Well	14.0	6.1-7.3	silt loam
Mooselake	High	Rapid	Very poor	28.2	5.1-6.5	mucky peat
Mora	High	Moderately slow	Moderately well	3.1	5.1-6.5	loam
Mosomo	Low	Moderately rapid	Well to excessive	5.5	5.1-6.0	sandy loam
Mt. Carroll	High	Moderate	Well	14.0	6.1-6.5	silt loam
Nebish	High	Moderate	Well	11.8	6.6-7.3	loam
Nemadji	Medium	Rapid	Poor	5.7	4.5-6.0	fine sand
Nessel	Medium	Moderate	Moderately well	11.8	6.1-7.3	loam
Newfound	Low	Slow	Well	4.3	4.5-6.0	gravelly sandy loam
Newglarus	High	Mod. to moderately slow	Well	9.5	6.1-7.3	silt loam
Newry	High	Moderate	Moderately well	12.0	5.6-6.5	silt loam
Nicollet	High	Moderate	Moderately well to somewhat poor	12.3	6.1-6.5	clay loam
Nokasippi	High	Moderately slow	Very poor	7.2	5.1-5.5	mucky loamy fine sand
Nokay	Medium	Moderately slow	Poor	7.2	4.5-5.5	fine sandy loam
Nordness	Low	Moderate	Excessive	8.6	6.6-7.3	silt loam
Northcote	High	Slow	Poor	10.8	6.6-7.3	clay
Nowen	High	Moderate	Poor	10.0	6.1-7.3	sandy loam
Nutley	Medium	Slow	Well	9.9	7.4-8.4	silty clay
Nymore	High	Rapid	Excessive	4.2	5.1-6.0	loamy sand
Oak Lake	High	Moderate	Moderately well	12.3	6.6-7.3	friable silt loam
Ocheyedan	High	Moderate	Well	12.3	6.1-7.3	loam
Ogilvie	High	Moderate	Poor	8.4	4.5-6.0	silt loam
Oldham	High	Moderately slow	Somewhat poor	10.8	7.4-7.8	silty clay loam
Omega	Medium	Rapid	Excessive	5.7	4.5-5.5	loamy sand
Onamia	High	Moderately rapid	Well	6.9	5.1-6.5	sandy loam
Ontonagon	Low	Slow	Somewhat poor	9.5	5.6-6.0	silty clay loam
Opole	High	Moderately slow	Moderately well	3.1	5.6-6.5	fine sandy loam
Orion	Medium	Moderate	Poor	14.2	6.1-7.8	silt loam
Osakis	High	Moderately rapid	Moderately well	5.5	6.1-6.5	loam

1. Organic matter content is considered as high if more than 5 percent; medium, 2 to 5 percent; and low, less than 2 percent.
2. Permeability is considered as follows: Rapid, more than 5 inches per hour; moderately rapid, 2.5 to 5; moderate, 0.8 to 2.5; moderately slow, 0.2 to 0.8, and slow, less than 0.2 inches per hour.
3. Available water capacity is calculated in inches to a depth of 5 feet or to a restricting layer. It should be noted that many poorly drained soils may have a water table at or near base of rooting zone.

Table 9 (continued). Some physical and chemical properties of representative Minnesota soils

Soil series	Organic matter content[1]	Subsoil permeability[2]	Natural drainage condition	Available water capacity (in.)[3]	Soil reaction (surface horizon)	Common texture (surface horizon)
Ostrander	High	Moderate	Well	12.3	6.1-7.3	loam
Otterholt	Light	Moderate	Well	10.8	5.6-6.0	light silt loam
Paget	Medium	Moderately slow	Moderately well	3.1	5.1-6.5	silt loam
Palms	High	Moderately rapid	Very poor	18.3	6.1-6.5	muck
Palsgrove	Medium	Moderate	Well	8.6	5.6-7.3	silt loam
Parent	High	Moderately slow	Poor	7.2	5.6-7.3	loam
Parnell	High	Slow	Very poor	10.0	6.1-7.8	silty clay loam
Percy	High	Moderate	Poor	9.4	6.6-7.8	sandy clay loam
Plainfield	Light	Rapid	Excessive	4.2	5.6-6.0	loamy sand
Poinsett	High	Moderate	Well	14.0	6.1-6.5	silt loam
Pomroy	Medium	Moderately slow	Well	3.1	5.6-6.0	fine sand
Poppleton	High	Rapid	Moderately well	5.7	6.6-7.3	fine sand
Port Byron	High	Moderate	Well to moderately well	14.0	5.6-8.4	silt loam
Prebish	High	Moderately slow	Very poor	7.2	6.6-7.3	fine sandy loam
Primghar	High	Mod. to moderately slow	Somewhat poor	14.0	5.6-6.0	silty clay loam
Quam	High	Moderately slow	Very poor	13.9	6.6-7.3	mucky silty clay loam
Quetico	Medium	Moderate	Excessive	1.2	4.5-5.5	loam
Racine	High	Moderate	Well to moderately well	11.8	6.1-7.0	silt loam
Ransom	High	Moderate	Moderately well to poor	14.0	6.6-7.3	silty clay loam
Rasset	High	Moderately rapid	Excessive	5.5	6.1-6.5	loamy sand
Rauville	High	Moderate	Very poor	12.0	7.4-7.8	silt loam
Readlyn	High	Moderately slow	Somewhat poor	11.0	5.1-6.0	loam
Redby	Medium	Rapid	Somewhat poor	4.5	6.1-6.5	loamy fine sand
Renova	Medium	Moderate	Well	12.0	6.1-6.5	silt loam
Renshaw	High	Rapid	Excessive	4.0	6.6-7.3	sandy loam
Rifle	High	Moderately rapid	Very poor	15.0	6.6-7.3	mucky peat
Rockton	High	Moderate	Well	12.0	6.1-6.5	loam
Rockwell	High	Moderate	Poor	10.0	7.4-7.8	sandy clay loam
Rockwood	Low	Moderate	Well	6.5	5.6-6.0	loam
Rolfe	High	Slow	Very poor	9.5	5.1-5.5	heavy silt loam
Roliss	High	Moderately slow	Poor	10.8	6.6-7.3	sandy clay loam
Ronneby	High	Moderately slow	Poor	7.2	5.1-6.0	fine sandy loam
Rothsay	High	Moderately rapid	Well	14.2	6.6-7.3	silt loam
Rushmore	High	Moderate	Poor	13.9	6.6-7.8	silty clay loam
Salida	High	Very rapid	Excessive	1.7	6.6-7.3	gravelly sandy loam
Santiago	Medium	Moderate	Well	3.1	5.1-5.5	silt loam
Sargeant	Medium	Slow	Poor	11.3	5.1-6.5	silt loam
Sartell	High	Rapid	Excessive	5.7	5.1-6.0	fine sand
Schapville	High	Moderately slow	Moderately well	9.9	6.6-7.3	silt loam
Seaton	Medium	Moderate	Well	10.8	5.6-6.0	silt loam
Seelyeville	High	Moderately rapid	Very poor	28.2	5.6-7.3	muck
Shakopee	High	Slow	Poor	5.4	7.4-7.8	clay
Shible	High	Moderate	Well	5.5	6.6-7.3	fine sandy loam
Shields	High	Slow	Poor	10.0	5.6-6.0	silty clay loam
Shooker	High	Moderate	Poor	11.3	5.6-6.0	silt loam

1. Organic matter content is considered as high if more than 5 percent; medium, 2 to 5 percent; and low, less than 2 percent.
2. Permeability is considered as follows: Rapid, more than 5 inches per hour; moderately rapid, 2.5 to 5; moderate, 0.8 to 2.5; moderately slow, 0.2 to 0.8, and slow, less than 0.2 inches per hour.
3. Available water capacity is calculated in inches to a depth of 5 feet or to a restricting layer. It should be noted that many poorly drained soils may have a water table at or near base of rooting zone.

Table 9 (continued). Some physical and chemical properties of representative Minnesota soils

Soil series	Organic matter content[1]	Subsoil permeability[2]	Natural drainage condition	Available water capacity (in.)[3]	Soil reaction (surface horizon)	Common texture (surface horizon)
Shorewood	High	Moderately slow	Moderately well	9.6	5.6-7.3	silty clay loam
Shullsburg	High	Moderately slow	Poor	5.9	6.1-7.3	silt loam
Sigsbee	High	Slow	Poor	10.5	5.1-6.5	silty clay loam
Sinai	Medium	Slow	Moderately well	9.3	6.1-7.3	silty clay
Sioux	Medium	Rapid	Excessive	1.7	6.6-8.4	loam
Skyberg	High	Moderately slow	Poor	11.3	5.6-6.5	silt loam
Soderville	High	Rapid	Poor	5.5	4.5-5.0	fine sand
Sparta	High	Rapid	Excessive	5.7	5.6-6.0	loamy fine sand
Spencer	Medium	Moderate	Moderately well	10.8	5.1-6.0	silt loam
Spicer	High	Moderate	Poor	13.9	7.4-7.8	silty clay loam
Spooner	High	Moderate	Poor	11.3	6.1-7.8	very fine sandy loam
Spottswood	Medium	Moderate	Somewhat poor	8.3	6.1-7.8	loam
Storden	Medium	Moderate	Excessive	11.4	7.4-7.8	loam
Strandquist	High	Rapid	Poor	8.5	6.6-7.8	fine sandy loam
Suamico	High	Slow	Poor	18.3	6.1-6.5	muck
Svea	High	Moderate	Moderately well	12.3	6.6-7.3	loam
Sverdrup	High	Moderately rapid	Excessive	5.5	6.6-7.3	sandy loam
Swenoda	High	Moderately rapid	Moderately well	9.2	6.6-7.3	sandy loam
Syrene	High	Rapid	Poor	6.8	7.4-8.4	sandy loam
Talcot	High	Moderate	Very poor	8.4	7.4-7.8	silty clay loam
Tama	High	Moderate	Well	14.0	5.6-6.0	silt loam
Taopi	High	Very slow	Moderately well	11.8	6.1-6.5	silt loam
Tara	High	Mod. to mod. rapid	Moderately well	14.0	6.6-7.3	silt loam
Taylor	Low	Slow	Somewhat poor	9.5	6.1-6.5	silt loam
Tell	Low	Moderate	Well	7.5	5.6-6.5	silt loam
Terrill	Medium	Moderate	Moderately well	12.3	6.1-7.3	loam
Toivola	High	Very rapid	Excessive	1.7	5.1-6.5	gravelly coarse sandy loam
Tonka	High	Slow	Poor	10.8	6.1-6.5	silt loam
Torning	High	Mod. to mod. rapid	Excessive	9.2	6.6-7.3	loamy very fine sand
Trent	Medium	Moderate	Moderately well	14.0	5.6-6.5	silty clay loam
Trosky	High	Mod. to moderately slow	Poor	8.4	7.4-8.4	silty clay loam
Truman	High	Moderate	Well	14.0	6.1-7.3	silt loam
Udolpho	High	Moderate	Poor	8.4	5.6-6.5	silt loam
Ulen	High	Rapid	Moderately well	5.7	7.9-8.4	loamy fine sand
Urness	High	Mod. to moderately slow	Very poor	12.0	7.4-8.4	mucky silt loam
Vallers	High	Moderately slow	Poor	13.9	7.4-7.8	silty clay loam
Vasa	High	Moderate	Moderately well	10.8	5.6-7.3	silt loam
Vienna	High	Moderate	Well	12.3	6.6-6.5	silty clay loam
Viking	High	Very slow	Poor	10.8	7.4-7.8	sandy clay loam
Vlasaty	Moderate	Moderately slow	Moderately well	11.8	6.1-6.5	silt loam
Wadena	High	Moderately rapid	Well	8.3	6.1-7.3	loam
Wahpeton	High	Moderately slow	Moderately well	9.9	7.4-7.8	silty clay
Waldorf	High	Moderately slow	Poor	10.8	6.6-7.8	silty clay loam
Warba	Low	Moderately slow	Moderately well	11.8	5.1-6.5	very fine sandy loam
Warman	High	Moderate	Very poor	9.1	5.1-6.0	mucky loam
Waubay	High	Moderate	Moderately well	14.0	6.1-6.5	silt loam

1. Organic matter content is considered as high if more than 5 percent; medium, 2 to 5 percent; and low, less than 2 percent.
2. Permeability is considered as follows: Rapid, more than 5 inches per hour; moderately rapid, 2.5 to 5; moderate, 0.8 to 2.5; moderately slow, 0.2 to 0.8, and slow, less than 0.2 inches per hour.
3. Available water capacity is calculated in inches to a depth of 5 feet or to a restricting layer. It should be noted that many poorly drained soils may have a water table at or near base of rooting zone.

Table 9 (continued). Some physical and chemical properties of representative Minnesota soils

Soil series	Organic matter content[1]	Subsoil permeability[2]	Natural drainage condition	Available water capacity (in.)[3]	Soil reaction (surface horizon)	Common texture (surface horizon)
Waukegan	High	Moderate	Well	8.7	5.6-6.5	friable silt loam
Waukon	High	Moderate	Well	11.8	6.6-7.3	loam
Webster	High	Mod. to moderately slow	Poor	13.9	6.6-7.3	clay loam
Whalan	High	Moderate	Well	8.6	5.6-7.3	loam
Wheatville	High	Moderately rapid	Poor to moderately well	11.4	7.4-8.4	sandy clay loam
Whitewood	High	Moderately slow	Poor	13.9	6.1-7.8	silty clay loam
Winger	High	Mod. to moderately slow	Poor	13.9	7.4-8.4	silt loam
Zimmerman	Medium	Rapid	Excessive	5.5	5.1-6.0	loamy fine sand
Zumbro	High	Rapid	Moderately well	4.2	6.6-7.8	loamy sand

1. Organic matter content is considered as high if more than 5 percent; medium, 2 to 5 percent; and low, less than 2 percent.
2. Permeability is considered as follows: Rapid, more than 5 inches per hour; moderately rapid, 2.5 to 5; moderate, 0.8 to 2.5; moderately slow, 0.2 to 0.8, and slow, less than 0.2 inches per hour.
3. Available water capacity is calculated in inches to a depth of 5 feet or to a restricting layer. It should be noted that many poorly drained soils may have a water table at or near base of rooting zone.