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based on

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by G. G. POHLMAN

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Land Classification in West Virginia Based on Use and Agricultural Value

by G. G. POHLMAN

THE CONSERVATION AND THE PROPER USE of natural resources have been emphasized repeatedly during the past few years. The farmer's ›rincipal natural resource is the land, which in turn is the source of the ıutrients necessary for growing plants. The plants thus fed are used lirectly by man or are fed to animals in order to transform them into ome other desired product. Regardless of the number of times the ›roducts of life may be changed before their ultimate use by man, the ninerals which they contain had their origin in the soil. The problem of onservation of soil resources therefore becomes a problem of how most fficiently to change the raw materials in the soil into products useful to nan. While many conditions enter in to determine the profit to be de-ived from the growth of crops, one factor which must be considered is he suitability of the land for a particular crop. Fortunately, nature has urnished plants which will grow under a wide variety of conditions. The ›roblem of proper land use, therefore, is the problem of selecting the type f plants which can be grown most profitably in a permanent system of griculture under a given set of conditions.

Farmers have long been aware of the fact that not all land is suited o the production of the same crops. Some of the land they found well uited to pasture, some to the growing of fruit crops, some to the pro-luction of vegetables, and some to field crops, while some of the land vas recognized as best suited for the production of trees. This nowledge came largely as a result of years of farming experience. No oncerted effort was made to classify soils according to their best ›ractical use. The soils in many areas have now been classified and lescribed in Soil Survey reports published by the United States Depart-nent of Agriculture and in some instances by various state agencies. In his classification the soils are divided into series on the basis of nature f soil profile, color, origin, drainage, fertility, and topography. The eries are further divided into types on the basis of texture.

ACKNOWLEDGMENT

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The technical information given in these soil reports needs careful study and interpretation in order to be of much value to the farmer. The practical information is based largely on the actual farm practices which were in use at the time the survey was made. As a result these reports have not been used as much as their value warrants. However, in recent years the classification of soils has been seriously considered in the evaluation of land. It has been used particularly in determining the value of land for farm loans and for taxation. The soil type has been used by the Soil Conservation Service as an aid in farm planning to reduce losses of soil by erosion. However, these efforts have been confined to rather limited areas, and have failed to meet all the demands for such service.

In order to help the farmer better to utilize his soil for the types of crops to which it is best adapted, and in order to get a better understanding of the agricultural problems in the state, a study was made of the soils of West Virginia and of the conditions affecting their value for agricultural purposes. The following objectives obtained:

(1) To evaluate the various factors which influence the use and value of the land for agricultural purposes.

(2) To prepare a state map showing the more important kinds of soil and the slope of the various soils found in the state.

(3) To establish a basis for the classification of land according to agricultural value.

(4) To make a map of the state showing areas of land of different agricultural value.

(5) To help the individual, through a better understanding of the factors involved in land use and classification, properly to use and evaluate land on individual farms.

Factors to Be Considered In the Classification of Land for Agricultural Purposes

The value of land for agricultural purposes is dependent upon a number of factors which may be classified as (1) soil factors, (2) climatic factors, and (3) economic and social factors. Each of these groups is of sufficient importance to warrant some discussion of the role which it plays in determining land use.

THE SOIL FACTOR IN LAND USE

Inasmuch as the soil is the medium on which plants grow and from which they derive the water and food they need, any property which affects the ability of the soil to furnish suitable conditions for plant growth is of the utmost importance.

(1) *Fertility and Productivity of the Soil* — The value of any soil for the production of crops is dependent upon its ability to furnish the necessary conditions for crop growth and upon the ease and practicability of improvement so that it will produce good yields. Some soils are naturally more fertile than others: *i.e.*, they are able to furnish a medium more suitable for growth. A large part of the difference is due to their

ability to furnish more available plant nutrients, particularly phosphorus, nitrogen, potassium, and calcium. By means of proper soil management such as the use of lime, fertilizers, and organic matter as needed, differences in fertility can be reduced and crop production profitably increased. However, these practices add to the cost of production, and consequently the less fertile soils do not have the same value as the more fertile soils.

(2) *Soil Moisture* — Although it is possible to grow crops under a wide range of moisture conditions, the crops which are most commonly grown and needed in the system of agriculture practiced in West Virginia require considerable moisture for their growth. The most valuable soils are able to furnish sufficient water during normal seasons so that the crops grown will not suffer. On the other hand the most valuable crops grow best on well-drained soils. Drainage is therefore an important factor in determining the value of land for agricultural purposes. By means of drainage systems excessive water may be removed. Wide differences in cost of drainage may account for considerable differences in the value of poorly-drained soils.

(3) *Ease of Cultivation* — Rock outcrops and stones interfere seriously with cultural practices. Steep slopes are more difficult to farm than more level areas. These features tend to increase the amount of hand labor necessary for crop production and consequently increase the cost of production. Soils which can be cultivated readily by means of machinery are therefore more valuable provided other features are the same.

(4) *Soil Texture* — The size of soil particles is of importance because of the effect on fertility, moisture, and ease of cultivation. Sandy soils, while easily cultivated, are more liable to drought. Clay soils are usually more difficult to till than lighter-texture soils and require more care in seedbed preparation. Extremely sandy or clayey soils are less fertile because of lack of plant food in the sandy soils and low rates of availability in the heavy soils. In general, loams and silt loams are the most favorable textures, although for early vegetable production sandy soils are preferred because these will warm up earlier and because the advantage of higher prices on the early market can be realized.

(5) *Depth of Soil* — The feeding zone of plant roots is dependent on the condition of the subsoil. Shallow soils will allow only a limited feeding zone for plant roots, and will not furnish as much plant food as deeper soils. In addition, such soils will not hold sufficient water to maintain good growth of plants during dry spells, and the plant roots, concentrated near the surface of the soil, will soon suffer from drought.

(6) *Erosion* — The most valuable part of the soil is found on the surface. When soil erosion is encouraged by improper cultural practices the value of the land is materially reduced. This has been true over a large section of West Virginia. Except in forested areas and bottomland soils, a considerable portion of the topsoil has been lost, and in a few areas the land has been rendered valueless for agriculture because of erosion. The danger of erosion in the future or the susceptibility of

the soil to erosion is also important in determining the value of land for agriculture.

(7) *Slope of the Land* — Although slope is not always considered as a feature of the soil it does influence the suitability of the land for cropping. In West Virginia land use is dependent to a considerabl extent upon slope. Its principal importance results from its relation- ship to erosion, although it does influence cultural practices also.

While an attempt has been made to separate the various factor which determine the value of soil, it is realized that these are so closel associated in actual farming practice that no one factor alone can b said to be the determining factor under any given set of conditions. Soi fertility is influenced by soil moisture, texture, depth of soil, and erosion Soil moisture is influenced by texture and depth of soil. Ease of culti vation is determined by texture and slope. Erosion is influenced b texture, slope, and the nature of the colloidal properties of the soil. Th largest crop yield may be expected where conditions are the most favor able for a particular crop, and the greatest profit where favorable condi tions can be obtained at the least expense.

Some of the factors listed above, such as texture, depth, and slope are an inherent part of the soil and cannot be changed. However, it i possible to increase the ability of soils to produce crops by the use o lime and fertilizer, to drain soils so that better crops can be grown, t decrease erosion by the use of proper cropping systems, and to add or ganic matter which will affect several of these factors. The value o soils for the purpose of crop production is dependent not only on thei present producing power but also on their potential value and the cos of changing the potential value to actual value.

THE CLIMATIC FACTOR IN LAND USE

The types of crops which may be grown and the yields which ma be expected from any one crop are dependent upon the climatic condi tions which obtain in any region. Inasmuch as both these influence th value of land for agricultural purposes, climate may be considered as on of the factors determining land use.

(1) *Length of Growing Season* — The number of days between th last frost in the spring and the first killing frost in the fall is called th growing season. This varies with the altitude and latitude. As show in Figure 1, the length of growing season in West Virginia varies fron less than 120 days in parts of Grant and Tucker counties to over 18 days in a few sections of the state. The eastern and northern panhandl sections have relatively long growing seasons because of their low alti tudes.

Crops vary widely even within species in the length of time require for maturity. Some crops require a longer growing season than is found in any section of West Virginia. Others such as corn can be grown ir many sections, but in a few areas with a very short growing season corn will usually not produce as high yields as corn having a longer season Length of growing season is also of importance in determining the numɔer of cuttings of some of the hay crops. Alfalfa will usually be cut three times in the areas with longer seasons in West Virginia, whereas no more than two cuttings may be expected in the areas having shorter seasons. It would be expected, then, that higher yields of such crops might be obtained in the regions of the state having the longer growing seasons.

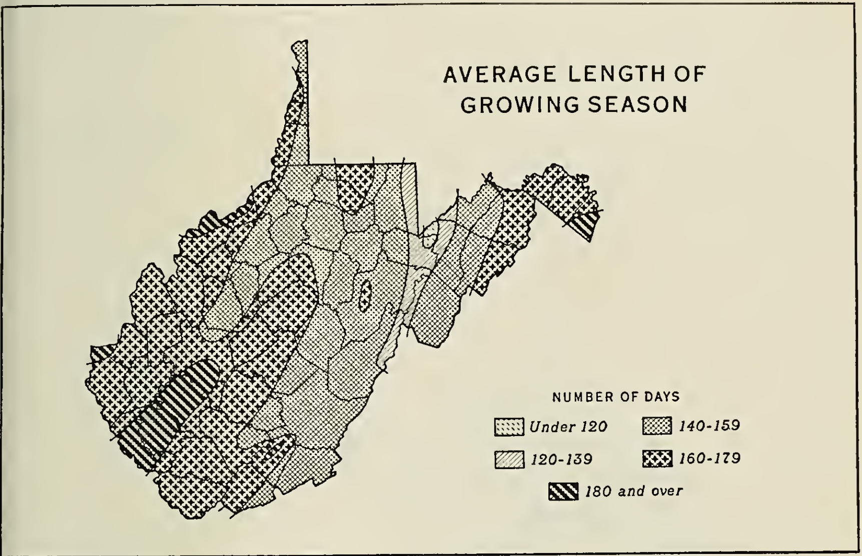

FIGURE 1 *(Courtesy U. S. Department of Agriculture)*

(2) *Temperature* — Temperature in its influence on the type of crops which may be grown can be separated into summer and winter temperatures. The temperature during the growing season is important in determining the length of season required; it is also a factor in determining the yield, since certain crops such as oats and buckwheat will give higher yields in relatively cool climates whereas corn requires hot weather for highest yields. Winter temperatures are important in determining the type of fruit, of other perennial plants, and of small grain which may be grown. This is particularly true with barley, which must be planted in the spring in those areas having the coldest winters, but preferably is seeded in fall in areas with milder winters.

The average annual temperature in West Virginia varies with altitude and latitude, the lowest average temperature being found in the high altitudes, and the highest temperature being in the southern part of the state at low altiudes.

(3) *Rainfall* — The total rainfall and its seasonal distribution will influence both type of crop and yield. An excess of rainfall may be harmful because of the increased infection by diseases which usually accompany. Rainfall may also influence the quality of crop. It has been reported in several of the eastern states that the yield and quality of

wheat are lower in seasons of high rainfall than in seasons of deficient moisture. Because of losses in curing during wet weather, rainfall may also affect the quality of hay produced. On the other hand, a deficiency of water may reduce the yield of certain crops. It is particularly noticeable in pastures which make very little growth during prolonged dry hot spells. The average annual rainfall in West Virginia is shown in Figure 2. Although no part of the state is very deficient in rainfall there is shown a variation of from less than 30 inches to more than 50 inches, the lowest rainfall being in parts of Grant and Pendleton counties and the highest in the central mountainous section of the state.

Although certain other climatic factors such as length of day, light intensity, and humidity are usually considered in a discussion of the relation of crop to climate, these are not sufficiently variable to be of much importance in this state.

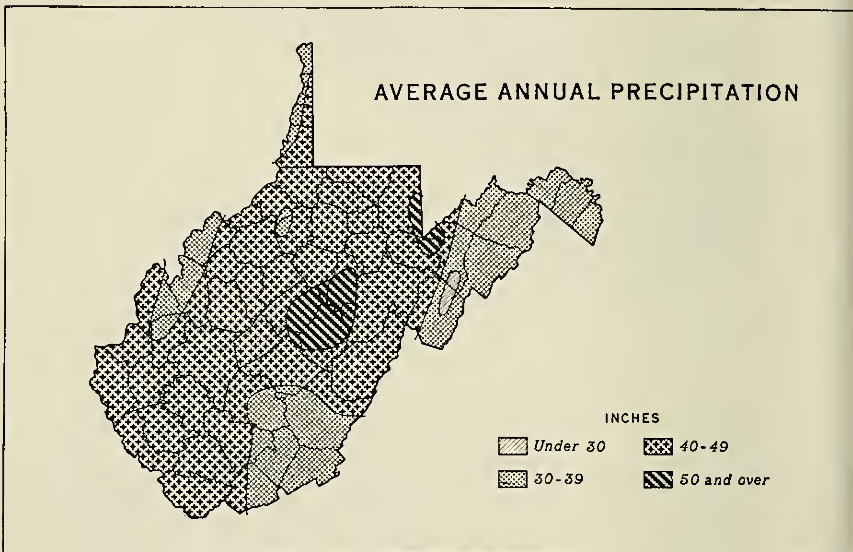

FIGURE 2 *(Courtesy U. S. Department of Agriculture)*

ECONOMIC AND SOIL FACTORS IN LAND USE

The soil and climatic factors discussed previously are related entirely to the production of crops. In order to make the best use of land it must not only be capable of producing good crops, but these crops must be produced at a profit. The economic factors are associated primarily with the cost of production per unit of crop and with the cost of marketing the crop. The cost of production will vary with certain of the soil and climatic factors already discussed. The cost of marketing is determined by distance to market and by cost of transportation per mile. These vary with the different crops and with the type of facilities available for transportation. The cost of maintenance of roads, schools, etc. is another factor to be considered.

From the standpoint of social welfare it is desirable to have communities which will help one to maintain a higher standard of living. Moreover, the cost of maintaining roads, schools, churches, etc. for isolated farms may be out of proportion to the value of the farms. Consequently many small, isolated areas which are desirable from the standpoint of soil, climate, and economic factors are certainly less desirable from the standpoint of the social welfare.

THE RELATIONSHIP OF THE SEVERAL FACTORS

Although a number of factors have been discussed separately, it is realized that these factors in many cases are so closely related that it is difficult to distinguish between them. A number of the soil relationships have already been mentioned. Climatic conditions have a very marked influence on the type and extent of weathering and consequently on the soil formed from rocks. Because of these conditions, all the soils in West Virginia are naturally acid, regardless of whether they are formed from limestone, sandstone, or shale. Both slope and rainfall are important in determining the extent of erosion. The amount and distribution of rainfall will govern to a large extent the moisture content of the soil and its effect on crop growth. Inasmuch as temperature is related to the rate of loss of water from the soil it will affect the same soil factors as will rainfall. It will also affect the rate at which plant food becomes available.

The cost of production is closely related to soil and climatic factors in so far as these affect the amounts of lime and fertilizer to apply and the ease of cultivation of the soil. The amount of lime needed over a long period of time depends upon the acidity of the soil, the ability of the soil to retain lime, and the climatic factors influencing the rate of loss. Fertilizer needs are governed by the same factors.

Evaluation of Physical Factors In Land Classification In West Virginia

The foregoing discussion emphasizes a number of factors which influence the value of land for agriculture. Certain of these factors, such as those dealing with social, climatic, and economic forces, are difficult to evaluate. However, the nature of the soil or the soil type, the extent of erosion, and the slope of the land can be evaluated fairly accurately and used in formulating a system of land classification. Information regarding these factors was available in published data, maps, and descriptions. This was supplemented with data obtained by field studies. The methods used together with the results are given under the discussion of each of the factors studied.

SLOPE

The soils of West Virginia were divided, on the basis of slope, into four classes as follows: (1) 0 to 12%, (2) 12 to 25%, (3) 25 to 40%, and (4) over 40% slope. By percent slope is meant the number of feet rise or fall in one hundred feet of horizontal distance. By means of con-

TABLE 1—*Distribution of slope classes by counties*

County	Prevailing Slope Class								Total acres
	0 to 12%		12 to 25%		25 to 40%		Over 40%		
	acres	%	acres	%	acres	%	acres	%	
Barbour	48,888	22.1	81,791	37.0	53,482	24.2	36,901	16.7	221,06
Berkeley	118,317	56.9	60,810	29.3	16,935	8.1	11,797	5.7	207,85
Boone	30,579	9.4	205	.1	32,851	10.2	260,205	80.3	323,84
Braxton	35,647	10.7	26,432	8.0	147,195	44.2	123,334	37.1	332,60
Brooke	14,747	24.9	9,649	16.3	30,601	51.7	4,203	7.1	59,20
Cabell	23,972	13.1	10,171	5.6	81,685	44.6	67,007	36.7	182,83
Calhoun	5,799	3.2	3,469	2.0	67,783	37.8	102,277	57.0	179,32
Clay	20,919	9.4	3,503	1.6	95,094	42.9	102,314	46.1	221,83
Doddridge	12,070	5.9	6.936	3.3	177,044	86.0	9,780	4.8	205,83
Fayette	59,891	14.0	100,485	23.6	122,873	28.8	143,311	33.6	426,56
Gilmer	10,533	4.8	3,288	1.5	108,596	49.6	96,719	44.1	219,13
Grant	93,114	30.4	90,455	29.6	72,623	23.7	49,728	16.3	305,92
Greenbrier	167,943	25.7	137,400	20.9	179,559	27.5	169,690	25.9	654,59
Hampshire	122,842	29.9	170,844	41.6	86,109	21.0	30,727	7.5	410,52
Hancock	6,959	12.3	34,792	61.4	11,215	19.8	3,706	6.5	56,67
Hardy	80,868	22.0	127,698	34.6	89,302	24.3	70,465	19.1	368,33
Harrison	35,809	13.4	47,785	18.6	176,300	65.9	5,530	2.1	267,42
Jackson	37,851	12.5	30,422	10.1	167,960	55.6	65,834	21.8	302,06
Jefferson	115,453	84.9	12,116	8.9	2,593	1.9	5,780	4.3	135,94
Kanawha	75,436	12.9	20,757	3.6	261,369	44.7	227,001	38.8	584,56
Lewis	22,680	9.1	27,977	11.1	146,388	58.5	53,419	21.3	250,46
Lincoln	21,566	7.7	7,844	2.8	177,553	63.4	72,915	26.1	279,87
Logan	24,318	8.3	5,777	2.0	37,362	12.8	224,268	76.9	291,72
McDowell	7,075	2.1	......	...	17,075	4.9	320,426	93.0	344,57
Marion	18,448	9.2	30,578	15.2	131,594	65.6	20,052	10.0	200,67
Marshall	16,970	8.4	51,829	25.7	75,988	37.7	56,979	28.2	201,76
Mason	64,495	22.6	92,981	32.6	85,487	30.0	42,317	14.8	285,28
Mercer	34,170	12.6	95.436	35.2	122,959	45.3	18,737	6.9	271,30
Mineral	54,175	25.7	87,357	41.3	38,905	18.4	30,763	14.6	211,20
Mingo	22,386	8.3	2,991	1.1	86,538	31.9	159,125	58.7	271,04
Monongalia	21,818	9.2	56,162	23.8	120,099	50.9	37,966	16.1	236,04
Monroe	78,970	26.0	76,137	25.2	82,835	27.3	65,290	21.5	303,23
Morgan	32,110	21.7	58,158	39.3	26,460	17.9	31,278	21.1	148,00
Nicholas	102,929	24.5	105,203	25.0	116,010	27.6	96,191	22.9	420,33
Ohio	4,603	6.6	29,900	42.9	24,358	34.9	10,899	15.6	69,76
Pendleton	43,993	9.9	92,506	20.7	179,279	40.2	130,225	29.2	446,00
Pleasants	9,975	11.6	16,113	18.7	39,968	46.4	20,120	23.3	86,17
Pocahontas	80,961	13.4	123,664	20.5	228,939	38.0	169,706	28.1	603,27
Preston	82,100	19.6	188,642	45.1	125,058	29.9	22,683	5.4	418,48
Putnam	48,997	21.8	15,094	6.8	120,088	53.5	40,186	17.9	224,36
Raleigh	64,803	16.6	89,691	23.0	139,767	35.8	96,235	24.6	390,49
Randolph	106,185	15.9	183,770	27.4	246,439	36.8	133,264	19.9	669,65
Ritchie	20,927	7.2	24,814	8.5	167,691	57.6	77,941	26.7	291,37
Roane	14,560	4.7	28,589	9.2	177,640	57.1	90,379	29.0	311,16
Summers	22,354	9.5	59,368	25.2	135,134	57.4	18,510	7.9	235,36
Taylor	13,406	11.8	34,155	30.1	65,841	58.1	......	...	113,40
Tucker	84,250	31.2	44,809	16.6	100,679	37.3	40,131	14.9	269,86
Tyler	22,118	13.3	14,791	8.9	114,566	68.8	15,002	9.0	166,47
Upshur	46,994	20.6	77,662	34.1	76,264	33.5	26,190	11.8	227,11
Wayne	32,305	9.8	29,123	8.8	169,215	51.0	100,800	30.4	331,44
Webster	26,951	7.5	57,373	16.1	129,678	36.2	143,502	40.1	357,50
Wetzel	16,366	7.1	1,821	0.7	80,942	35.1	131,572	57.1	230,70
Wirt	15,961	10.6	5,450	3.7	89,960	59.9	38,651	25.8	150,02
Wood	56,972	23.6	40,142	16.6	130,955	54.1	13,736	5.7	241,80
Wyoming	12,817	3.9	11,510	3.6	97,464	30.0	202,881	62.5	324,67
TOTAL	2,467,345	15.9	2,848,425	18.3	5,886,347	37.9	4,338,643	27.9	15,540,76

our maps obtained from the West Virginia Geological Survey the four lope classes were separated. The areas were then transferred to a tate map by means of a pantograph. The final map is shown in Bul-etin 285 of the Agricultural Experiment Station. Because of the scale f the map, many small areas were combined and classed according to he prevailing slope. Considerably more detail was possible in the east-rn mountainous section of the state, where long, high ridges occur, than 1 the rest of the state, where the hills are shorter and more variable in lope. The map, however, does indicate the prevailing slope in the vari-us areas in the state.

The areas in the four slope classes, determined by means of a plani-ieter, are given in Table 1 for the individual counties and for the state s a whole. These figures are only approximate because of the scale and he methods used. It is recognized that although no land with a slope of 2 to 25% is shown in McDowell county, some such areas exist in that ounty but were too small to be mapped. Likewise, parts of Taylor ounty having slopes greater than 40% were omitted because of their nall size. Although these are the only counties in which not all of the ope classes are mapped, there are other counties in which only a small ercentage of land has been shown in certain of the slope classes. In iese the errors will usually be larger than in counties where the various ope classes are more equally distributed. In the latter counties these rrors tend to counterbalance each other. The slopes given in Table 1 nd shown in Bulletin 285 are based on the prevailing slope in the reas.

Slope 0 to 12% (level to gently rolling; 2,467,345 acres or 15.9% f the area) —It will be noted that in the western part of the state the reas of relatively smooth topography occur largely along streams. In he eastern part of the state there are numerous level plateaus and some mestone valleys as well. The largest area is found in the limestone ections of Jefferson and Berkeley counties. A part of the level upland, articularly in Tucker and Grant counties, consists of rocky plateaus hich have little agricultural value. Some of the bottomlands are so arrow and subject to such frequent overflow that their value is limited.)espite these limitations the areas having a slope of less than 12% in-lude a considerable part of the area of the state land suitable for the rowing of cultivated crops. On land of this slope machinery can be sed and erosion is usually not a very serious problem, although on cer-ain soils and on slopes approaching 12%, strip cropping should be prac-iced to minimize soil losses by erosion.

Slope 12 to 25% (gently rolling to rolling; 2,848,425 acres or 18.3% f the area) — The areas having a slope of 12 to 25% are most abundant 1 the eastern part of the state. Much of this is upland of relatively ow productivity. However, a considerable part of it may be used for he production of field crops, principally hay and small grains, provided are is taken to prevent erosion. When cultivated crops are grown on ind having this slope the fields should be laid out in strips by alter-ating sod and cultivated crops. The land should never be without over during any season, cover crops being grown when the ordinary rotation does not maintain plant cover. Certain soils which are more subject to erosion should be kept in pasture even on this slope. While the ordinary farm machinery can be used, more labor is involved in the production of crops. The land is, therefore, somewhat less valuable for general crops than land having more level topography, but may be farmed provided long rotations having several years of sod are used.

Slope 25 to 40% (rolling to steep; 5,886,347 acres or 37.9% of the area) — Land in this slope class comprises over one-third of the area of the state. It occurs in abundance in the pasture areas in the northern and western parts of the state. It is too steep to be used for field crops because of the danger from erosion. The cost of production of crops is also high because of the limited extent to which machinery can be used. However, it is suitable for pastures provided a good sod can be maintained. Where this is not feasible, the land should be returned to forest as soon as possible. This will no doubt be the case with some of the less fertile and the more eroded soils.

Over 40% Slope (steep; 4,338,643 acres or 27.9% of the area) — Land having a slope of more than 40% should be in forest. Small steep breaks in less steep fields may be kept in pasture if good sod can be maintained, but usually it is not practical to maintain soil fertility by the use of lime and fertilizer on slopes of more than 40% A large part of the area in this slope class is already in forest and this should be carefully conserved.

The importance of slope in determining land use in West Virginia cannot be over-emphasized. More than any other factor, slope determines the suitability of land for agriculture. As the slope increases erosion becomes more severe, fertility is maintained with greater difficulty, and the cost of production increases.

EROSION

The soil erosion map shown in Figure 3 was derived from the map published by the Soil Conservation Service in 1935. Although the original map was made as a result of a reconnaissance survey which can be interpreted only in general terms, it does show that certain areas have been subjected to rather severe erosion. The data obtained in the survey are shown in Table 2.

TABLE 2—*Extent of erosion in West Virginia**

Extent of erosion	Surface soil remaining (percent)	Acreage
Destroyed	None	39,458
Severe	0 to 25	4,032,191
Moderate	25 to 75	9,736,325
Little or none	75 to 100	1,477,050

*Data from State Soil Conservation Program for West Virginia, Dec. 1936.

The acreage of land completely destroyed by erosion is small, yet it indicates the possibility in West Virginia of the complete destruction of agricultural land. A part of the eroded area occurs near industrial centers which may have been partly responsible for the circumstance.

Iowever, other areas apparently have come about through excessive rosion resulting from unwise cultural practice. Over 4 million acres of land have lost more than three-fourths of the top soil. A large part of this area having severe erosion occurs in the northern and western part of the state. This land was cropped for a time, then returned to pasture. A large loss of surface soil occurred during the cropping period. Unfortunately the change to pasture did not occur until the soil fertility had been partially depleted; today the stand of grass on most of the pastures is not sufficient to control erosion. On this area farming practices must be so modified as to control erosion; otherwise he land sooner or later must be returned to forest.

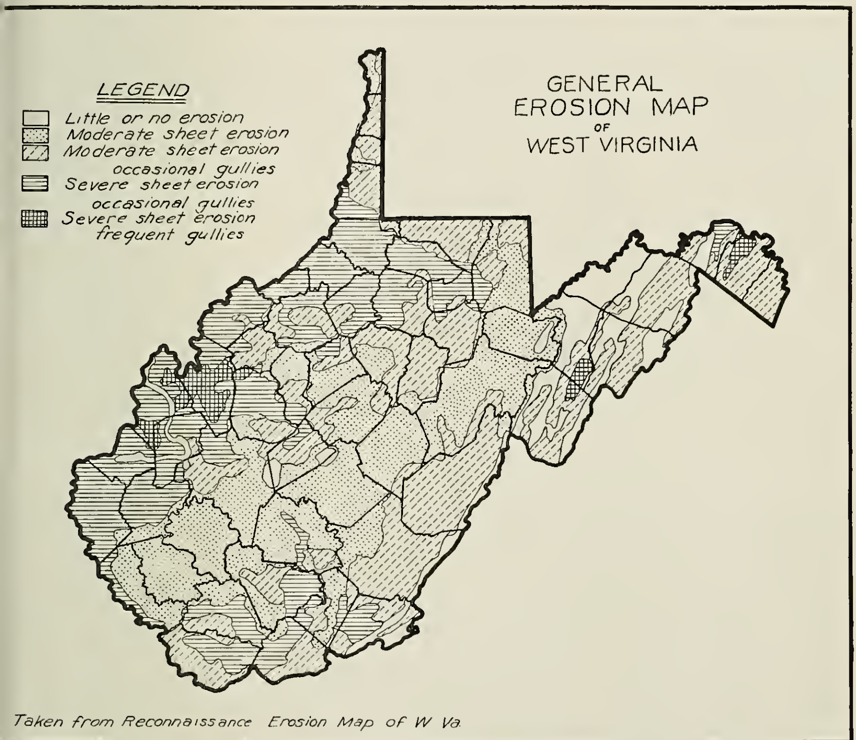

FIGURE 3

A large portion of the area of the state (9,736,325 acres) has lost between one-fourth and three-fourths of its surface soil. This is found in areas now largely in cut over land and in the more level upland agricultural sections. In much of this area the erosion has taken place as a result of improper logging practices, but the losses on the agricultural land must not be overlooked. Assuming ten inches of original soil, land in this erosion group now has only 2½ to 7½ inches of surface soil. Considerable subsoil must therefore be included in the land when plowed.

This materially reduces crop yields and shows need for a greater degre of erosion control.

Only about one-tenth of the area of the state (1,477,050 acres) ha had little or no erosion. This is found principally in bottomlands an in areas which have always had a good forest cover. However, th opinion has been expressed by a number of farmers that the bottom lands, which have been replenished by soil from the hills, are not as goo as they were formerly because the fresh deposits consist of subsoil. Th control of erosion is therefore necessary in order to maintain the pro ductivity of even the level bottomlands.

Soil Series and Types

Soil surveys have been made of 53 of the 55 counties of West Vi ginia and the results published in reports of the United States Depar ment of Agriculture. As has been stated previously, the soils ar separated into series and types on the basis of certain physical and chem ical properties. A brief description of the soil of each series mapped i given in Table 3. For a more detailed description the reader is referre to the soil survey reports published by the United States Departmen of Agriculture. The soils may be roughly classified on the basis o origin and method of formation as follows:

	Acres	*Percentage*
Bottomland	795,712	5.5
Terrace	335,744	2.3
Upland with limestone influence	1,545,088	10.8
Non-limestone upland	9,879,936	68.8
Rough stony land	1,732,288	12.0
Miscellaneous	78,080	0.6
Total mapped	14,366,848*	100.0

From the acreages given it is evident that the non-limestone up land soils are the most abundant, accounting for more than two-third of the area of the state thus far surveyed. These soils are derived fro sandstone and shale and are of relatively low fertility. Only 795,712 acre of bottomland and 335,744 acres of terrace or second bottom are mappe Some of these are so poorly drained that their value is greatly decrease The acreage of soils influenced by limestone, including Upshur, whic has in most cases been influenced only very little by limestone, is onl 1,545,088 or a little over 10% of the area of the state and is considerabl less than the acreage of rough, stony land.

DESCRIPTION AND GENERAL GROUPING OF SOIL SERIES

The next to the last column in Table 3 gives the grouping as seen o the state soil map (Bulletin 285). This grouping is a general one be cause of the reduction in scale and because of the fact that some of th older reports do not make as accurate separations as are made at present The soil map was prepared directly from individual county reports wit few changes. In the northern panhandle and in Wetzel and Tyler coun-

* These acreages do not include Greenbrier and Pocahontas counties, fo which soil survey reports are not available.

ties the steep, broken, and rough stony land was included with the prevailing soil type, and an area of Meigs mapped in Marshall county was changed to Westmoreland. The soils of Greenbrier and Pocahontas counties were classified with the aid of a geological survey map and in consultation with men who had worked on the soil surveys of these areas.*

The areas of bottomland in the state (Soil Group 1) are relatively small, being confined to narrow valleys along the principal streams. Smaller areas are found along almost every creek, but many of these are so narrow that they could not be shown. Most of these are fairly well drained, the largest areas of poorly drained bottomland occurring in the Canaan Valley and along Meadow River in Greenbrier county. In some instances narrow strips of bottomland have been widened on the map by the inclusion of strips of terrace; in others the terraces have been widened to include bottomland, depending upon the relative amounts of each. The bottomlands consist largely of Huntington, Pope, and Moshannon series, the differentiation being made on the origin of the parent material, as shown in Table 3.

Terrace soils (Group 2), sometimes called second bottoms, represent areas which were deposited by streams in the past but are no longer subject to overflow. The most important of these is the Wheeling soil found along the Ohio river. This is a fertile soil and well adapted to general or truck farming. Holston soils occupy a greater acreage but are not as fertile and generally occur in smaller areas. The Elk soils occur principally along the Monongahela river with smaller areas in the eastern limestone section. Monongahela soils are similar to Holston except that the drainage is not as good. They have been mapped principally in the eastern part of the state but are also found scattered in other areas. The poorly drained terrace soil (Tyler) is scattered over the state, the largest areas being along the Kanawha River and in the Teays Valley. In most places it is not present in sufficiently large areas to be separated.

Among the upland soils (Groups 3 and 4) Hagerstown is the most important from the standpoint of both acreage and fertility. About two-thirds of this soil occurs in Jefferson and Berkeley counties, where it is considered a very valuable soil. Frankstown is also important, particularly in eastern Jefferson county and also in Monroe, Greenbrier, Grant, and Mineral counties. The other limestone soils — Clarksville, Colbert, Elliber[1], Frederick, Lowell, Decatur, and Shelbyville — occur in scattered areas in the eastern counties. Of these Frederick and Elliber are usually gravelly or stony in texture.

Among the other upland soils having limestone influence (Group 5), Brooke soil, resulting from impure limestone, is found largely in the northern panhandle. Westmoreland has been influenced still less by

* The assistance of H. M. Fridley, West Virginia University, and A. J. Vessel, U. S. Department of Agriculture, is acknowledged.

[1] This soil has been classified in recent reports as being derived largely from sandstone and shale. Because of the fact that it was included with Frederick in the early reports and because it is closely associated with other limestone soils in areas where mapped, it is included with the limestone soils.

TABLE 3—*Description of the soils of West Virginia*

(1) Position	(2) Topography	(3) Parent material	(4) Surface
Bottomland	Level	Limestone and calcareous shales	Brown
Bottomland	Level	Limestone and calcareous shales	Light brown to brown
Bottomland	Level	Limestone and calcareous shales	Bluish gray
Bottomland	Level	Limestone and calcareous shales	Dark gray to b
Bottomland	Level	Sandstone and shale	Brown
Bottomland	Level	Sandstone and shale	Grayish brown
Bottomland	Level	Sandstone and shale	Grayish brown
Bottomland	Level	Red shale (calcareous)	Reddish brown
Bottomland	Level	Organic	Brown to black
Terrace	Level to undulating	Glaciated material	Brown
Terrace	Level to undulating	Limestone and calcareous shales	Yellowish brow brown
Terrace	Level to undulating	Sandstone and shale	Light brown to brown
Terrace	Level to undulating	Sandstone and shale	Grayish brown yellowish bro
Terrace	Level to undulating	Sandstone and shale	Gray to grayish
Terrace	Level to undulating	Sandstone and shale	Gray
Upland	Gently rolling	Limestone (pure)	Red to reddish
Upland	Gently rolling	Limestone	Brown
Upland	Gently rolling	Limestone (siliceous)	Yellowish brow
Upland	Gently rolling to steep	Limestone (cherty)	Brownish yello yellowish gra
Upland	Gently rolling to steep	Calcareous sandstone and shale	Gray to grayish
Upland	Gently rolling to steep	Limestone (cherty)	Brown
Upland	Gently rolling	Limestone (siliceous)	Yellow to yell brown
Upland	Rolling to hilly	Limestone (dolomitic)	Grayish brown yellowish bro
Upland	Level to rolling	Limestone (dolomitic cherty)	Light brown
Upland	Rolling to steep	Limestone and calcareous shales	Brown
Upland	Rolling to steep	Limestone shale and sandstone	Grayish brown yellowish bro
Upland	Rolling to steep	Calcareous shales (Indian red)	Dark reddish b
Upland	Rolling to steep	Limestone and Indian red shales	Red to yellow
Upland	Rolling to steep	Sandstone and shale (Indian red)	Dark reddish b
Upland	Rolling to steep	Sandstone and shale (red and yellow)	Red to yellowis
Upland	Rolling to steep	Sandstone and shale (dark)	Brown to yellow
Upland	Rolling to steep	Sandstone and shale	Yellowish brow brown
Upland	Rolling to steep	Sandstone and shale	Grayish brown
Upland	Level to gently rolling	Sandstone and shale	Gray to yellowis
Upland	Level to gently rolling	Sandstone and shale	Yellowish brow grayish brown
Upland	Rolling to steep	Sandstone and shale	Dark brown
Upland	Rolling to steep	Limestone, sandstone and shale	Mixed soils
Upland	Level to steep	Mixed	

[1]Refers to grouping on State soil map.

ABLE 3—*Description of the soils of West Virginia*

l	(6) Drainage	(7) Series	(8) Acreage[2]	(9) Group No.[1]	(10) Fertility rating
wish-brown	Good	Huntington	454,592	1A	1.0
(mottled)	Fair	Linside	5,376	1A	1.5
›ttled)	Poor	Holly	34,048	1B	2.5
›ttled)	Very poor	Dunning	4,224	1B	3.0
brown	Good	Pope	107,904	1A	1.5
)	Fair	Philo	8,896	1A	1.5
tled)	Poor	Atkins	34,816	1B	2.5
	Good	Moshannon	144,960	1A	1.0
:	Very poor	Muck	896	1B	3.0
n	Good	Wheeling	40,768	2A	1.0
wish brown	Good	Elk	36,928	2A	2.0
wish brown	Good	Holston	152,768	2A	2.0
v (mottled)	Fair	Monongahela	41,088	2A	2.0
›ttled)	Poor	Tyler	62,336	2B	2.5
	Very poor	Robertsville	1,856	2B	3.0
	Good	Decatur	4,992	3	1.5
n to red	Good	Hagerstown	195,072	3	1.5
	Good	Frankstown	98,432	4	1.5
brown	Good	Frederick	46,080	4	1.5
	Good	Elliber	37,952	4	2.0
d)	Fair	Shelbyville	2,112	4	2.0
d)	Poor	Colbert	960	4	2.5
h yellow	Good	Lowell	13,952	4	2.0
	Good	Clarksville	9,344	4	2.0
	Good	Brooke	47,232	5	2.5
w	Good	Westmoreland	291,712	5	2.5
	Good	Upshur	796,288	6	2.5
	Good	Belmont	960	6	2.5
	Good	Lehew	27,840	7	3.0
	Good	Meigs	3,200,704	7	3.0
n to yellow	Good	Berks	42,816	8	3.0
›w	Good	Dekalb	6,506,688	9	3.0
	Good	Leetonia	75,264	9	3.0
vn (mottled)	Fair	Tilsit	12,928	9	3.0
ed)	Poor	Lickdale	7,040	9	3.5
›w	Good	Summers	6,656	9	2.5
		Not differentiated	78,080		
		Rough stony land	1,732,288	10	5.0
			14,366,848		

[2]Does not include Greenbrier and Pocahontas counties.

limestone, the largest area being derived from calcareous shales and limestone in Harrison county, with smaller areas in Marshall, Monongalia, Marion, Hardy, Pendleton, and Monroe counties. In Group 6, Upshur, derived from Indian red calcareous shales and sandstones, is third in area of the various soils in the state. It is found principally in Braxton, Clay, Lewis, Gilmer, and Jackson counties. Only 960 acres of Belmont soil have been mapped and all of this is in Monroe county.

Among the non-limestone upland soils in Group 7, Meigs, a mixed soil, occurs in large areas in the western part of the state. Some of this probably has a little limestone influence. Smaller areas occur in Grant, Mineral, and Hampshire counties. In these it is closely associated with Lehew, the Indian red soil derived from non-calcareous sandstone and shale. Both are about the same in fertility as the Dekalb soils and are not as fertile as those having limestone influence. Berks soils (Group 8) are derived from dark-colored shales in eastern West Virginia. These are found in Jefferson, Berkeley, and Greenbrier counties. They are slightly more desirable than Dekalb soils in the same area.

Dekalb[2] (the principal soil in Group 9) is generally distributed, being mapped in every county in the state. It is somewhat less abundant in the northwestern part of the state. A wide strip in the central part of the state from Preston county in the north to Mingo county in the south has considerable soil of stony texture. Much of this is also very hilly and of little agricultural value. Farther east in Grant, Mineral, Pendleton, Hardy, Hampshire, and Monroe counties a part of the Dekalb soil is shaly and shallow. This shaly soil, because of its low water-holding capacity, has a low agricultural value. The other soils grouped with Dekalb have been mapped only in a few areas. Leetonia, a soil showing more weathering, has been mapped only in Randolph county. Lickdale is mapped in small areas in several of the eastern counties while Tilsit and Summers are mapped only in the southeastern counties.

The acreages for the individual soil series are given in Table 3. In some of the older maps not as many series were recognized, and the acreages given are somewhat in error. Several examples can be given. The differentiation of bottomland into limestone and non-limestone was first made in 1915 in West Virginia. Before this time all bottomland not derived from Indian red shales was mapped as either Huntington or Holly. Consequently these series undoubtedly include some soils which should be classified as Pope and Atkins. Only two separations on the basis of drainage of bottomland were made until 1925, when Linside was first mapped in West Virginia in Monroe county. This bottomland with moderately poor drainage was previously shown as either well drained (Pope or Huntington) or poorly drained (Atkins or Holly). Likewise, among the terrace soils Monongahela was not mapped in West Virginia until 1922. Previously it was grouped with Holston or Tyler, making the acreages given for these series higher than they should be.

In the upland soils the early maps did not show Westmoreland in Marshall county. Recent studies by the Soil Conservation Service show

[2] This series is mapped as Muskingum in some of the neighboring states.

that much of the soil mapped as Meigs in northern Marshall county is actually Westmoreland. Some areas shown in the earliest reports as Brooke are probably Westmoreland. Most of the upland shale and sandstone soils with no limestone influence have been called Dekalb. More recently they have been divided to give rise to Tilsit, Leetonia, Lickdale, and Summers.

Most of these changes have been made primarily on the basis of some physical differences which do not affect greatly the value of the maps for land classification.

FERTILITY RATING OF SOILS

It will be seen that most of the soils are naturally of relatively low fertility. However, since these soils are so abundant, they were taken as the average soil in determining the fertility rating given in the last column of Table 3. In this rating, given for soils of favorable texture (loams not stony, shaly, or gravelly), Dekalb soil shows a value of 3.0, which is intermediate between 1.0, given for the best soils, and 5.0, given for rough stony land. The limestone-derived soils are usually more fertile than those derived from sandstone and shale. These show fertility ratings of 1.5 to 2.5, depending upon the extent to which they have been influenced by limestone in their formation. Hagerstown, Decatur, Frankstown, and Frederick are usually derived from purer limestone than the other limestone soils and are considered to be more fertile. On the other hand Westmoreland, Brooke, Belmont, and Upshur, derived from rocks having much less limestone, are given ratings lower than for other soils derived partly from limestone. They are more fertile, however, than Dekalb and similar soils derived from sandstone and shale.

The effect of drainage on value may also be seen by comparing columns 6 and 10. In the bottomland soils, draining changes the fertility rating of washed-in, limestone-derived soil material from 1.0 for Huntington to 2.5 for Holly. Similar reduction in value occurs in the bottomlands and terraces from sandstone and shale soils. In making these reductions consideration was given to the present need for drainage and the cost of securing adequate drainage.

The effect of texture on value of land for agricultural purposes has been discussed. Soils deep, easy to cultivate, and having a high water-holding capacity are the most valuable. The slit loam usually combines these qualities in the most favorable proportion. In determining the value of the land the following changes were made from the fertility ratings given:

	Fertility rating
Sands and sandy loams	+0.0 to 0.5
Gravelly loams and gravelly silt loams	+0.5 to 1.0
Stony loams and stony silt loams	+1.0 to 1.5
Shaly loams and shaly silt loams	+1.0 to 1.5

In some areas the rating for sandy loams was the same as for loams. This is true for Tilsit sandy loam which, because of its imperfect drainage, holds water as well as the silt loams, and for Wheeling sandy loams which, because of their location, are valuable for the production of truck crops.

LAND CLASSES

By use of the information obtained in the evaluation of the physical factors, along with a general knowledge of the economic and social factors in various sections of the state, a general grouping of the areas in the state was possible. In this grouping the land was classified into eight classes on the basis of value and use. The relationship of soil type, erosion and slope to land class is shown in Table 4, wherein each land class represents a variety of conditions — soil, topographic, and erosion.

TABLE 4—*Relationship of fertility, slope, and erosion to land class and use*

Land class	Soil fertility index	Slope	Degree of erosion	Principle use
1	1.0-1.5	0-12	Moderate	Crop
2	1.0-1.5	0-12	Severe	Crop
	1.0-1.5	12-25	Moderate	Crop and pasture
	1.0-2.5	10-12	Moderate	Crop
3	1.0-1.5	25-40	Moderate	Pasture
	2.0-2.5	0-12	Severe	Crop
	2.0-2.5	12-25	Moderate	Crop and pasture
	3.0	0-12	Moderate	Crop
4	1.0-1.5	25-40	Severe	Pasture
	2.0-2.5	25-40	Moderate to severe	Pasture
	2.0-2.5	12-25	Severe	Crop and pasture
	3.0	12-25	Moderate	Crop and pasture
	3.0	0-12	Severe	Crop
	3.5	0-12	Moderate	Crop
5	3.0	25-40	Moderate to severe	Pasture
	3.5	25-40	Moderate	Pasture
	3.0	12-25	Severe	Crop and pasture
	3.5	12-25	Moderate to severe	Crop and pasture
	3.5	0-12	Severe	Crop
	4.0	0-12	Moderate	Crop and pasture
6	4.0	25-40	Moderate	Forest
	4.0	12-25	Moderate to severe	Forest
	4.0	0-12	Severe	Forest
	4.5	0-12	Moderate	Forest
7	3.5-5.0	25-40	Severe	Forest
	4.5-5.0	12-40	Moderate to severe	Forest
	4.5-5.0	0-12	Severe	Forest
	5.0	0-12	Severe	Forest
	1.0-5.0	Over 40%		Forest

With the ratings in Table 4 as a basis, the Land-Class map of the state was prepared (see Bulletin 285). In making general groupings it was often necessary to include in any one class land which more properly belongs in other classes. However, the map shows in general the areas of land belonging in each class. The acreages given in Table 5 show the approximate extent of the various land classes in the counties and in the state. A brief description follows:

Land Class I — Superior Crop Land

The land in this class is the best agricultural land in the state. It comprises 227,649 acres or 1.46% of the area of the state. The largest area shown is in Jefferson and Berkeley counties, where it consists of the level areas of limestone soil relatively free from rock outcrop. A level upland area of limestone soil in Greenbrier county is also included in this class. In other areas it consists of the fertile, well-drained bot-

A scene typical of Land Class I in Jefferson and Berkeley counties. The topography is level to gently undulating and the soil is a fertile limestone soil.

A level fertile terrace along the Ohio river. This is characteristic of a large part of the area in Land Class I in the western part of the state. The soil is well adapted to the production of truck crops or to general farming. In the background is seen an area of Land Class V.

tomland and along the Ohio River includes the more fertile level terraces as well. The land is all relatively level, having a slope of less than 12%, and the soils are naturally fertile. Practically all of the land is suitable for cultivation. It is used extensively for the production of fruits and grains in Jefferson and Berkeley counties. Along the Ohio River, where it is found on terraces and in the bottomland, it is used mostly for gen-

TABLE 5—*Distribution of land classes by counties*

County No.	County	Class I		Class II		Class III		Class IV	
		Acres	Per-cent	Acres	Per-cent	Acres	Per-cent	Acres	Per-cent
1	Barbour	......	....	......	....	4,395	1.99	53,548	24.22
2	Berkeley	57,803	27.81	11,309	5.44	23,875	11.49	49,007	23.57
3	Boone	......	....	......	....	......	....	......	....
4	Braxton	......	....	......	....	......	....	5,151	1.55
5	Brooke	......	....	......	....	13,686	23.12	11,094	18.74
6	Cabell	2,714	1.48	10,385	5.68	8,388	4.59	1,286	.71
7	Calhoun	......	....	......	....	......	....	......	....
8	Clay	......	....	......	....	......	....	......	....
9	Doddridge	......	....	......	....	1,686	.82	3,470	1.68
10	Fayette	......	....	......	....	724	.17	25,651	6.01
11	Gilmer	......	....	......	....	......	....	......	....
12	Grant	2,690	.88	4,138	1.35	517	.17	6,518	2.13
13	Greenbrier	9,724	1.49	35,824	5.47	67,348	10.29	31,013	4.73
14	Hampshire	3,182	.78	29,796	7.25	32,927	8.02	6,363	1.55
15	Hancock	2,500	4.41	......	....	......	....	22.502	39.71
16	Hardy	12,278	3.33	14,894	4.05	10,567	2.87	12,882	3.49
17	Harrison	......	....	11,579	4.33	14,874	5.56	136,157	50.92
18	Jackson	4,935	1.63	4,555	1.51	5,504	1.82	59,407	19.67
19	Jefferson	80,620	59.30	26,139	19.23	5,039	3.71	6,403	4.71
20	Kanawha	......	....	19,783	3.38	4,818	.83	8,918	1.52
21	Lewis	......	....	3,025	1.21	2,420	.96	19,359	7.73
22	Lincoln	......	....	398	.14	3,823	1.37	......	....
23	Logan	......	....	......	....	......	....	......	....
24	McDowell	......	....	......	....	410	.12	41	.01
25	Marion	......	....	......	....	10,008	4.99	26,825	13.36
26	Marshall	4,720	2.34	1,208	.60	21,187	10.59	77,172	38.15
27	Mason	21,558	7.56	16,322	5.72	22,995	8.06	8,007	2.81
28	Mercer	......	....	2,139	.79	23,432	8.64	94,034	34.66
29	Mineral	1,453	.69	12,036	5.70	986	.36	10,791	5.11
30	Mingo	......	....	......	....	......	....	......	....
31	Monongalia	......	....	3,656	1.55	3,047	1.29	36,463	15.45
32	Monroe	693	.23	25,748	8.49	34,661	11.43	49,911	16.46
33	Morgan	......	....	9,369	6.33	951	.64	23,027	15.56
34	Nicholas	......	....	......	....	26,242	6.24	59,604	14.18
35	Ohio	......	....	208	.30	14,243	20.32	24,224	34.72
36	Pendleton	......	....	19,316	4.33	......	....	54,967	12.33
37	Pleasants	4,436	5.15	......	....	2,746	3.18	6,759	7.85
38	Pocahontas	......	....	21,010	3.48	7,241	1.20	49,975	8.29
39	Preston	......	....	......	....	41,884	10.01	46,712	11.16
40	Putnam	......	....	21,182	9.44	411	.18	51,721	23.06
41	Raleigh	......	....	......	....	33,150	8.49	53,844	13.79
42	Randolph	......	....	25,830	3.86	......	....	38,612	5.76
43	Ritchie	......	....	......	....	......	....	16,165	5.55
44	Roane	......	....	......	....	806	.26	29,534	9.49
45	Summers	1,367	.58	3,417	1.45	19,038	8.09	31,808	13.52
46	Taylor	......	....	......	....	2,199	1.94	46,387	40.90
47	Tucker	......	....	7,661	2.84	18,177	6.73	4,888	1.82
48	Tyler	762	.46	......	....	19,381	11.64	6,642	3.99
49	Upshur	......	....	......	....	......	....	31,999	14.09
50	Wayne	4,006	1.21	5,634	1.70	7,237	2.08	3,533	1.07
51	Webster	......	....	......	....	......	....	13,943	3.90
52	Wetzel	309	.13	1,752	.76	1,959	.85	......	....
53	Wirt	......	....	4,839	3.23	2,521	1.68	1,512	1.00
54	Wood	11,899	4.92	7,346	3.04	5,173	2.14	57,632	23.83
55	Wyoming	......	....	......	....	153	.05	4,069	1.25
	TOTAL	227,649	1.46	360,498	2.32	520,829	3.36	1,419,530	9.13

ABLE 5—*Distribution of land classes by counties*

Class V		Class VI		Class VII		Class VIII		Total acres	County No.
Acres	Per-cent	Acres	Per-cent	Acres	Per-cent	Per-cent	Acres		
88,747	40.15	37,990	17.19	34,431	15.58	1,951	.87	221,062	1
29,844	14.36	14,241	6.85	19,896	9.57	1,884	.91	207,859	2
9,946	3.07	......	....	313,594	96.84	300	.09	323,840	3
113,623	34.16	179,426	53.95	33,339	10.02	1,069	.32	332,608	4
23,327	39.40	......	....	8,087	13.66	3,006	5.08	59,200	5
89,330	48.85	63,946	34.98	......	....	6,786	3.71	182,835	6
72,752	40.57	106,293	59.27	......	....	283	.16	179,328	7
27,257	12.29	72,860	32.84	121,399	54.73	314	.14	221,830	8
191,950	93.26	8,526	4.14	......	....	198	.10	205,830	9
134,463	31.53	71,886	16.85	186,285	43.67	7,551	1.77	426,560	10
109,619	50.02	109,006	49.75	......	....	511	.23	219,136	11
103,560	33.85	68,798	22.49	119,285	38.99	414	.14	305,920	12
98,156	15.00	81,678	11.38	328,035	50.11	2,814	.43	654,592	13
124,232	30.27	135,645	33.04	78,074	19.02	303	.07	410,522	14
26,878	47.42	......	....	3,438	6.07	1,354	2.39	56,672	15
93,392	25.36	58,671	15.93	165,146	44.83	503	.14	368,333	16
93,434	34.93	7,886	2.95	......	....	3,494	1.31	267,424	17
170,536	56.46	56,086	18.56	......	....	1,044	.35	302,067	18
3,674	2.70	6,718	4.94	5,039	3.71	2,310	1.70	135,942	19
164,002	28.06	114,596	19.60	255,943	43.79	16,503	2.82	584,563	20
163,346	65.22	58,179	23.23	3,529	1 41	606	.24	250,464	21
91,166	32.57	116,570	41.65	67,418	24.09	503	.18	279,878	22
......	....	......	....	291,325	99.86	400	.14	291,725	23
......	....	71,373	20.71	271,677	78.85	1,075	.31	344,576	24
137,633	68.59	21,873	10.90	1,238	.62	3,095	1.54	200,672	25
34,578	17.13	46,874	23.24	12,295	6.09	3,732	1.85	201,766	26
175,438	61.49	39,317	13.78	......	....	1,643	.58	285,280	27
57,561	21.21	66,323	24.45	23,228	8.56	4,585	1.69	271,302	28
26,355	12.48	127,103	60.18	31,543	14.94	933	.44	211,200	29
......	....	......	....	270,640	99.85	400	.15	271,040	30
111,421	47.20	47,026	19.92	30,268	12.83	4,164	1.76	236,045	31
91,999	30.34	27,630	9.11	71,798	23.68	792	.26	303,232	32
54,398	36.75	22,921	15.49	36,389	24.59	951	.64	148,006	33
62,351	14.84	49,840	11.85	220,567	52.48	1,729	.41	420,333	34
16,010	22.95	......	....	6,134	8.79	8,941	12.82	69,760	35
77,159	17.30	51,679	11.48	242,677	54.41	205	.05	446,003	36
57,662	66.91	13,729	15.93	......	....	844	.98	86,176	37
101,378	16.80	2,958	.49	419,892	69.60	816	.14	603,270	38
176,831	42.26	29,395	7.02	122,413	29.25	1,248	.30	418,483	39
111,925	49.88	39,074	17.42	......	....	52	.02	224,365	40
117,365	30.05	10,604	2.72	174,298	44.63	1,235	.32	390,496	41
79,383	11.86	197,450	29.48	325,534	48.61	2,849	.43	669,658	42
193,665	66.46	81,234	27.88	......	....	309	.11	291,373	43
154,828	49.76	125,395	40.30	......	....	605	.09	311,168	44
131,588	55.90	30,685	13.04	17,085	7.26	378	.16	235,366	45
59,790	52.73	......	....	3,246	2.86	1.780	1.57	113,402	46
54,327	20.13	81,350	30.14	103,064	38.19	402	.15	269,869	47
125,320	75.28	12,303	7.39	1,307	.78	762	.46	166,477	48
70,012	30.83	112,115	49.36	11,755	5.18	1,229	.54	227,110	49
104,512	31.53	140,583	42.42	63,745	19.23	2,193	.66	331,443	50
4,409	1.23	89,299	24.98	249,648	69.83	205	.06	357,504	51
82,570	35.79	141,740	61.44	309	.14	2,062	.89	230,701	52
96,486	64.32	43,656	29.10	......	....	1,008	.57	150,022	53
146,925	60.76	7,553	3.13	......	....	5,277	2.18	241,805	54
28,277	8.71	90,017	27.73	202,106	62.24	50	.02	324,672	55
4,765,390	30.66	3,190,100	20.53	4,947,119	31.83	109,650	.71	15,540,765	

eral farming but is very desirable land for the production of vegetables. In the areas where it occurs as strips of narrow bottomland it is the principal land on the farm suitable for cultivation and is used for the production of grain and hay for winter feed for livestock.

Land Class II — Good Crop Land

The area of land in this class is 360,498 acres or 2.32% of the total area. It differs from Land Class I, as shown in Table 4, in that the soils are somewhat poorer or more eroded, or the topography is less suitable for the production of general farm crops. A part of this area as mapped in the eastern part of the state consists of the limestone soils

An area of Land Class II along Mill Creek in Jackson county. The level terrace and bottomland are well suited to general farming. This is characteristic of much of the area in Land Class II in the State. The rolling land shown belongs in Land Class IV. (*Photo courtesy U. S. D. A.*)

having numerous rock outcrops. Consequently a somewhat smaller amount of the land can be cultivated. It also includes the level to gently-rolling limestone soils of Greenbrier, Pocahontas, and Monroe counties. In other sections it is largely terrace and bottomland. In some of these areas the fertility has been depleted because topography has rendered the land very well adapted to crop production. In others the natural drainage is inadequate and should be supplemented with drainage systems. However, with proper farm management practices this land can be brought back and maintained at a fairly high state of fertility. Most of the land is well suited to the production of general farm crops.

and Class III — Average Crop Land

Land in this class has an area of 520,829 acres, constituting 3.36% f the land area of the state. As shown in Table 4, this class varies conderably in erosion, slope, and soil fertility. In the upland soils a art consists of level to gently-rolling areas of soil derived from sandtone and shale. Under these conditions it may be considered to repreent average soil on land having relatively smooth topography. The reaainder of the upland soils mapped in this class is more fertile but has nore rolling topography. In most areas this land can be used for eneral farming provided erosion control practices are followed, al-

An area of Land Class III on the Arthurdale Homestead. This land is level to gently rolling and the soils belong to the Holly and Dekalb series.

though some of the areas, where the topography is relatively steep, are probably best adapted to pasture. The terrace and bottomland soils included in Class III generally need drainage. The soils are fairly fertile, but because of their poor drainage at present they do not have as high an agricultural value as the other land in this class. Most of these, however, can be drained, and when this is accomplished their value undoubtedly will rise above that of the other land in this class. Several such areas of poorly-drained land are included, particularly in a section of Greenbrier county along Meadow river and in the Canaan Valley in Tucker county. Some of the smaller narrow areas shown in Class III consist of relatively narrow bottomland soils which have been combined with some rolling to steep hilly land bordering them. Such areas are fairly common in many sections of the state.

Land Class IV — Below-Average Crop Land or Good Pasture Land

The area of land in this class comprises 1,419,530 acres or 9.13% of the total. As indicated in Table 4, the land in this class varies from fertile soils on relatively steep slopes (25 to 40%) to the less fertile upland soils (fertility rating 3.5) occurring in level areas. In the eastern mountainous section a considerable part of the area consists of rolling to steep limestone soils which can be maintained as good pasture if proper treatment is given. Other areas of similar nature occur along the Monongahela River. In the western part of the state most of the areas consist of rolling areas of Dekalb or Meigs soils. Much of this has been heavily cropped, but with proper management much of it can be built up to serve either as good pasture land or as land suitable for the production of crops. However, because of its rolling nature care must be taken to prevent soil erosion. Smaller amounts of land in this class consist of gravelly or slightly shaly or stony level uplands which may be used to some extent for either crop or pasture but which are naturally not fertile and cannot be built up to as high a state of fertility as other soils in this class having steeper slopes.

Land Class IV in Monongalia county. This is largely Dekalb silt loam soil having gently rolling to rolling topography. The area in the right approaches Land Class III.

Land Class V — Inferior Crop Land or Average Pasture Land

This class includes 4,765,390 acres or 30.66% of the area of the state. In the western part of the state it consists principally of land which is too steep for the production of crops, but most of it can be maintained as suitable pasture. At present the sod is poor but the soils respond to lime and fertilizer, and many of the pastures can be improved profitably except where erosion has been severe or where the topography is very broken. There are included in this area some small areas of bottomland and also some small, level hilltops and benches which can be used to grow crops for winter feed. In the eastern part of the state some land in Class V consists of the poor shaly soils having level to rolling topography. These soils are not well suited for pasture because of their shallow nature, which makes them particularly subject to drought. They can be used to a limited extent for the production of crops, especially in those areas where the soil is only moderately shaly. However, they can-

An area of Land Class V near Spencer. The topography is rolling to steep. The small benches and bottoms may be used for crop production, while the steeper areas should be kept in pasture. (*Photo courtesy U. S. D. A.*)

A submarginal area near Spencer. Land of this nature cannot be farmed profitably. The gullies shown can best be controlled by reforestation. This is typical of the area in Land Class VI in the western part of the state. (*U.S.D.A.*)

not be improved to the extent possible with the deeper soils free from shale. Some areas of stony soils are also included in this class. These are usually associated with some areas free from stone and in this combination sufficient tillable and pasture land is available for agricultural purposes.

Land Class VI — Submarginal Land

This class has an area of 3,190,100 acres and constitutes 20.53% of the area of the state. A small percentage of the land is suitable for agriculture. However, most of it is either too steep, too stony, or too shaly to be farmed with profit. The areas of land suitable for agriculture are small and scattered and the expense of maintaining roads and schools is greater than the land can afford to support. Agriculture on this type of land for the most part must be supplemented by some other source of income. Where this is not possible the land should be returned to forest.

The hill in the background is typical of part of Land Class VI in eastern West Virginia. The bare spots show the shale at the surface. Such soil is very droughty and has little agricultural value. The level area in the foreground is a terrace belonging to Land Class II. (*Photo courtesy U. S. D. A.*)

Land Class VII — Forest Land

Land in this class has an area of 4,947,119 acres or 31.83% of the area of the state. For the most part it is now in forest and differs from Class VI in that less of the land is suitable for agriculture. The soil is generally stony or very steep and the valleys are too narrow to furnish land for crop production. The best use under present conditions is for forests.

ınd Class VIII — Urban and Industrial Land

In this class are included the county seats, larger cities, and indus-ial areas. The total acreage of 109,650 acres shown is less than it ould be, but other towns were either too small or too scattered to be own on the map, hence were not included in the acreage.

A mountain scene in Morgan county. Most of the land is too steep to be used for agriculture and should be in forest (Land Class VII). A small amount of tillable land is shown in the foreground but this is usually too limited in extent to be farmed profitably.

Discussion

Although the division into the eight land classes has been shown on he map and in the tables as being a sharp division with measurements ıade to the nearest acre it must, of course, be recognized that such is ıot the case. In many cases the change is a gradual one due to increasing lopes or decreasing soil fertility. The division was made at the point vhere the average slope or fertility changed. This, therefore, indicates, s has previously been mentioned, that the Land Class groups apply only o an area as a whole and that within any one area exceptions can be bserved. It is further realized that since much of the information was btained from existing data — some of it rather old — there are in-tances where the borders are in error or areas wrongly classified. The ecuring of more detailed and accurate information will require a great leal of time and effort.

A few of the values used for soil and slope evaluation may be open o criticism. Soils which have been depleted of fertility but which can be restored have been given a better rating than soils which, while now as fertile, cannot be built up to as high a state of fertility. This is true of a good many of the terrace soils. Likewise, some soils having inadequate drainage may appear to be rated too high, but with adequate drainage, which is possible in most cases, the value would undoubtedly be higher than given. However, since the values given are intended to show potential as well as actual agricultural value, both present and future values must be considered in the scheme of classification.

The importance of social, economic, and climatic factors may appear to have been somewhat neglected. These are somewhat difficult to evaluate. The social factors have been taken care of largely by the elimination of small areas by the scale used in mapping. The importance of economic factors will vary with market conditions; therefore only large differences could be considered. The orchard land of the eastern panhandle and in some other areas in West Virginia, by reason of the value of the crop produced, has a high Land-Class rating. Some areas in Greenbrier county are about equal in soil and slope, but the land is not as valuable because of the type of farming practiced. The climate, although variable in the state, is usually favorable for the type of farming practiced. However, in certain sections it is a factor to be considered. The Canaan Valley has a somewhat lower rating than other areas of similar soil and topography because of the short growing season and also because of the poor marketing facilities. The same is true

Land Class VII on level topography. Many areas on the tops of the mountains are too rocky for agriculture.

: the area shown as Land Class V in western Grant county.

Despite these limitations the classification given agrees fairly well th values recognized by agricultural leaders. In a number of coun-s the values were checked with good agreement by county agents d others. Where the Land Class given seemed better than that recog-ized in the county, the reason was usually a depletion of fertility by st cropping methods, or lack of drainage as previously suggested. The neral principles developed and used in the classification are believed be sound and may be applied to smaller units and even to individual rms. The classification should prove useful in the readjustment of riculture which must result if farming in West Virginia is to be con-ued as a profitable enterprise.

SUMMARY

A brief discussion of the soil, climatic, economic, and social factors 'ecting the agricultural value and use of land is given. The land of e state is divided into four slope classes (0 to 12%, 12 to 25%, 25 to %, and over 40%) and the location of the various groups is given. A nplified map showing extent of erosion, copied from the map prepared · the Soil Conservation Service, is included. The soil series were ouped on the basis of origin and value and are shown on a map.

By means of a combination of the various factors, the soils are assified on the basis of agricultural value and use. The land classes e as follows:

I. Superior crop land
II. Good crop land
III. Average crop land
IV. Below-average crop land or good pasture land
V. Inferior crop land or average pasture land
VI. Submarginal land
VII. Forest land
VIII. Urban and industrial land

The location of these classes is shown in Bulletin 285 of the West irginia Agricultural Experiment Station.