

LAND CAPABILITY CLASSIFICATION

by

Conrad Neitsch, Micheal Golden, and L.R. Hossner

Abstract. Coal mining regulations require the reclamation plan to contain a detailed description of the proposed use of the land within the permit area. The affected areas must also be restored to a condition that is capable of supporting the uses which they were capable of supporting before mining, or to higher or better uses. The Land Capability Classification System proposed for classifying reclaimed minelands is based on the degree of limitation of the land. This classification system has been in use by the U. S. Department of Agriculture, Soil Conservation Service (now Natural Resources Conservation Service) for about 50 years. The grouping of soils is on the basis of their capability to produce common cultivated crops and pasture plants without deterioration over a long period of time. The change in land capability of the postmine lands can be evaluated by comparing premine and postmine surveys. The Land Capability Classification System proposed for minelands is compatible with existing Natural Resource Conservation Service programs.

Introduction

The Texas Coal Mining Regulations (1983) require the reclamation plan to "contain a detailed description of the proposed use, following reclamation of the land within the proposed permit area including a discussion of the utility and capacity of the land to support a variety of alternative uses, and the relationship of the proposed use to existing land use policies and plans" [780.147 (a)]. The Regulations also state that "the affected areas shall be restored... to conditions that are capable of supporting the uses which they were capable of supporting before any mining... or to higher or better uses.." [816.399(a)]

The Land Capability Classification System proposed for classifying reclaimed minelands is based on the Land Capability Classification as referenced in Agricultural Handbook No. 210 USDA-SCS which was issued September 1961 and was approved for reprinting in January 1973. The capability classification is one of a number of interpretive groupings made primarily for arable lands used for agricultural purposes and is also used for nonarable lands in permanent vegetation. The grouping of soils is on the basis of their capability to produce common cultivated crops and pasture plants without deterioration over a long period of time. The change in land capability of the postmine lands can be evaluated by comparing premine and postmine surveys. The use of this system does not substitute for the permanent program performance standards outlined in the Coal Mining Regulations. It is compatible with existing Natural Resource Conservation Service programs (Soil Survey Staff, 1975; 1994; United States Department of Agriculture, 1993; United States Department of Agriculture-Soil Conservation Service, 1973, 1992; United States Department of Agriculture-National Resource Conservation Service, 1995).

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²Conrad Neitsch is Soil Data Quality Specialist and Micheal Golden is MLRA Leader/State Soil Scientist, Natural Resource Conservation Service, 101 South Main Street, Temple, TX 76501; L.R. Hossner is Professor, Soil and Crop Sciences Department, Texas A&M University, College Station, TX 77843.

Land Capability Classification

The information on the soil map must be interpreted in a way that has meaning to the user. The capability classification is one of a number of interpretative groupings made primarily for agricultural purposes. As with all interpretative groupings the capability classification begins with the individual soil mapping units, which are building stones of the system.

Arable soils are grouped in this classification according to their potential for sustained production of the common cultivated crops that do not require specialized site conditions or site treatment. Nonarable soils are grouped according to their potential for the production of permanent vegetation and according to their risks of soil damage if mismanaged.

The capability grouping of soils is designed (1) to help land users and others use and interpret the soil maps, (2) to introduce users to the detail of the soil map itself, and (3) to make possible broad generalizations based on soil potentialities, limitations in use, and management problems. The grouping of soils is primarily on the basis of their capability to produce common cultivated crops and pasture plants without deterioration over a long period of time.

The capability classification provides three major categories of soil groupings: (1) capability class, (2) capability subclass, and (3) capability unit.

Capability classes are groups of capability subclasses or capability units that have the same relative degree of hazard or limitation. The risks of soil damage or limitation in use become progressively greater from class 1 to class 8. Class 1 land has few limitations that restrict their use. Class 2 land has some limitations that reduce choice of cropland plants, or require moderate conservation practices. Class 3 land has severe limitations that reduce choice of cropland plants, require special conservation practices, or both. Class 4 land has very severe land limitations that restrict choice of cropland plants or require very careful management. Class 5 land has little or no

erosion hazard but has other limitations, such as flooding, that are impractical to remove. Class 1 to 5 land is also used for pasture, rangeland, timber, or wildlife. Class 6 land has severe limitations that make them mostly unsuitable for cropland. It is used for pasture, range, timber, or wildlife. Class 7 land has very severe limitations that make it unsuitable for cropland. It is used for pasture, range, or wildlife. Class 8 land has limitations that preclude its use for commercial plant production. It is used for recreation, wildlife, water supply, or esthetic purposes. The classes show the general suitability of the soils for agricultural use. The various land capability classes (Class 1 to Class 8 land) as they may appear on a landscape are shown in Figure 1. The relation of land limitations and land-capability classes to safe land use is presented in Figure 2.

Capability subclasses are groups of capability units which have the same major conservation problem, such as erosion and runoff (E), excess water (W), root-zone limitations (S), and climatic limitations (C). The capability subclass provides information as to the kind of conservation problem or limitation involved. The class and subclass together provide information about both the degree of limitation and kind of problem involved for broad program planning, conservation need studies, and similar purposes.

Capability unit is a grouping of one or more individual soil mapping units having similar potentials and continuing limitations or hazards. The soils in a capability unit are sufficiently uniform to produce similar kinds of crops and pasture plants with similar management practices, require similar conservation treatment and management under the same kind and condition of vegetative cover, and have comparable potential productivity in specific region. This paper will not address capability unit in detail.

General Rules

The soil is placed in the capability class equal to the most limiting factor.

Subclass is assigned on the basis
E>W>S>C.

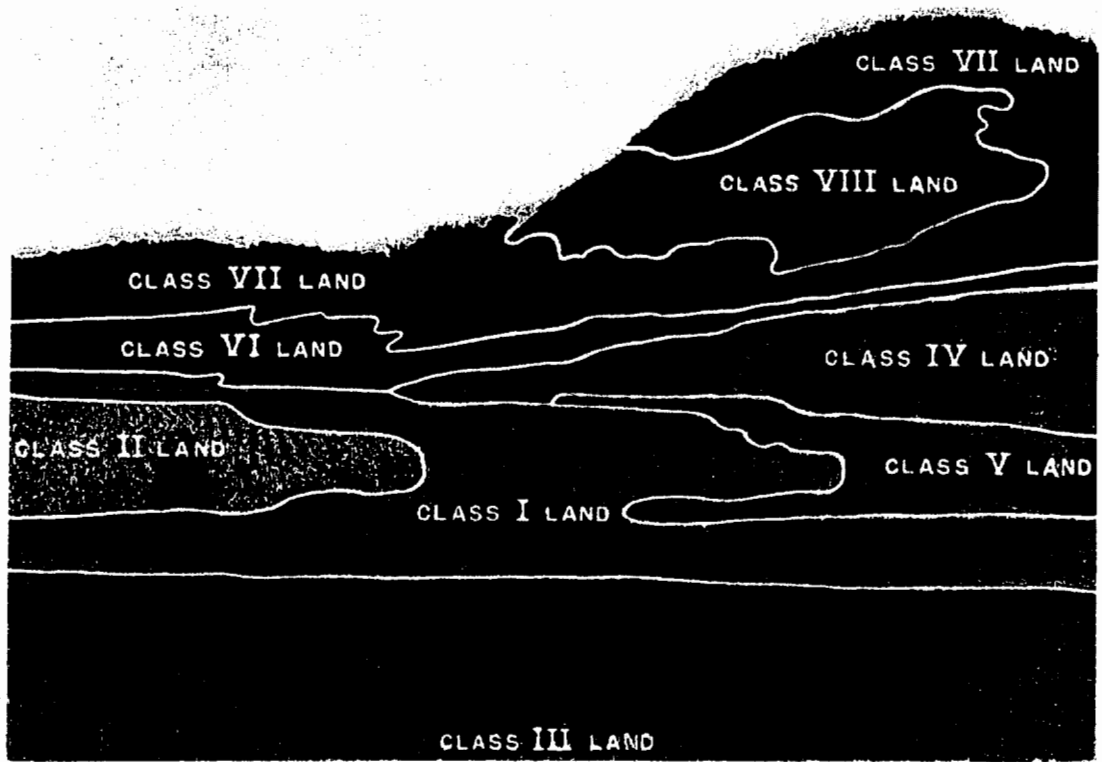


Figure 1. Land capability class distribution on a landscape (Source: USDA-SCS, 1973).

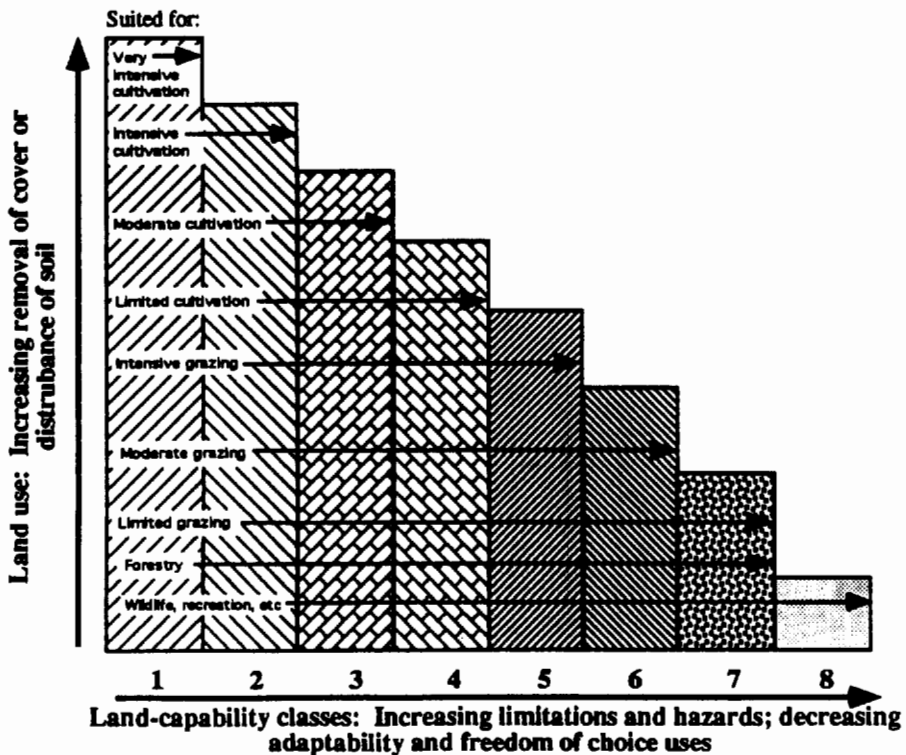


Figure 2. The relationship between land-capacity classes (land limitations) and safe land use (Source: USDA-SCS, 1973).

If 2 limiting factors are the same value then the capability class remains the same.

If 3 or more limiting factors are of the same magnitude then drop the capability one class.

Disregard if Depth and Available Water Content (AWC) are both limiting or Texture and AWC are both limiting or Salinity and AWC are both limiting.

Capability Class and Subclass

Criteria-Depth

Effective depth includes the total depth of the soil profile favorable for root development. In some soils this includes the C horizon; in a few only the A horizon is included. The shallowest depth to a lithic or paralithic contact and cemented pans is considered.

If depth is more than 40 inches the highest capability is 1.

If depth is 20 to 40 inches the highest capability subclass is 2S.

If depth is 10 to 20 inches check moisture regime:

If Aquic or Udic or is a Histisol the highest capability subclass is 3S.

If Ustic the highest capability subclass is 4S.

If Aridic the highest capability subclass is 6S.

If depth is less than 10 inches check moisture regime:

If Aquic or Udic or is a Histisol the highest capability subclass is 6S.

If Ustic or Torric or is an Aridisol the highest capability subclass is 7S.

The Limiting Factor is: DEPTH

Criteria-Reaction

Soil reaction, or soil pH, of less than 5.1 or more than 8.0 limits cropland production. Carbonatic mineralogy (calcium carbonate equivalent greater than 40 percent) limits

cropland production also. Soil pH to a depth of 20 inches and carbonatic mineralogy is considered.

The midpoint of pH of each layer to a depth of 20 inches is used. The most limiting pH is used if more than one layer is involved and check for carbonatic mineralogy.

If mineralogy is carbonatic then check classification:

If Mollisol the highest capability subclass is 2S.

If Ustic the highest capability subclass is 3S.

If mineralogy is NOT carbonatic check pH:

If pH is 5.1 - 8.0 the highest capability is 1.

If pH is 8.0 - 8.4 the highest capability subclass is 2S.

If pH is greater than 8.4 the highest capability subclass is 3S.

If pH is 4.5 - 5.1 the highest capability subclass is 2S.

If pH is 3.6 - 4.5 the highest capability subclass is 3S.

If pH is less than 3.6 the highest capability subclass is 6S.

The Limiting Factor is:

TOO ACID if pH < 5.1

TOO ALKALINE if pH > 8.0

EXCESS LIME if Carbonatic

Criteria-Texture

Soil texture and structure of the soil influences the environment of roots and influences soil permeability. Texture of the surface layer.

If texture is clay loam, coarse sandy loam, fine sandy loam, loam, sandy clay loam, silty clay loam, silt loam, sandy loam, or very fine sandy loam the highest capability is 1.

If texture is sandy clay or silty clay the highest capability subclass is 2S.

If texture is hemic material, mucky, mucky peat, muck, peat, peaty, or

sapric material the highest capability subclass is 3S.

If texture is gravel the highest capability subclass is 7S.

If texture is cemented, fragmental material, gravel (with no fine earth), gypsiferous material, unweathered bedrock, variable, weathered bedrock, or indurated the highest capability subclass is 8S.

If texture is clay check the midpoint percent of clay content:

If clay is less than 60% the highest capability subclass is 2S.

If clay is more than 60% the highest capability subclass is 3S.

If texture is fine sand, loamy coarse sand, very fine sand, loamy fine sand, or sand, check classification:

If psamments at subgroup level the highest capability subclass is 2S.

If psamm at Great Group level the highest capability subclass is 2S.

If Arenic, Grossarenic, Psamm at subgroup level the highest capability subclass is 2S.

If none of these occur the highest capability is 1.

Check for texture modifiers:

If gravely, very gravely, coarse gravely, or fine gravely the highest capability subclass is 2S.

If cobbly, angular cobbly, channery, cherty, very cherty, coarse cherty, or flaggy the highest capability subclass is 3S.

If very cobbly, very channery, very flaggy, very gravely, or very shaly the highest capability subclass is 4S.

If extremely cobbly, extremely channery, extremely cherty, extremely flaggy, extremely shaly, stony, or very stony the highest capability subclass is 6S.

If very bouldery, extremely bouldery, or extremely stony the highest capability subclass is 7S.

The Limiting Factor is:

TOO CLAYEY if clay, sandy clay, silty clay

TOO SANDY if fine sand, loamy coarse sand, loamy fine sand, loamy sand, loamy very fine sand, sand, very fine sand, coarse sand Psamments, Arenic, Grossarenic

EXCESS HUMUS if fibric material, hemic material, mucky, mucky-peat, muck, peat, peaty

SMALL STONES if cobbly, angular cobbly, channery, cherty, coarse cherty, flaggy, gravely, coarse gravely, fine gravely, slaty, very cobbly, very channery, very cherty, very flaggy, very gravely, very shaly, very slaty, extremely cobbly, extremely channery, extremely cherty, extremely flaggy, extremely gravely, extremely shaly, extremely slaty, or stony

LARGE STONES if bouldery, very stony, very bouldery, extremely bouldery, extremely stony

TEXTURE if miscellaneous textures

Criteria-Available Water Capacity (AWC)

Water-holding capacity is an important quality of soils. Soils that have limited moisture-holding capacity are likely to be droughty and have limitations in kinds of crops that can be grown. Total inches of available water to a depth of 40 inches in the Udic and Aquic regimes and to a depth of 60 inches in the Ustic and Aridic moisture regimes.

Check the taxonomic classification.

If the Order is Histisols, or Great Group is Aqu, Ud, or if Aquic or Udic Subgroup of Eutrochrepts or Quartzipsamments then the midpoint value of each layer is used.

The available water capacity for each layer is used to calculate the total inches of water to a depth of 40 inches or total depth if less than 40 inches.

If total water is 6 inches or more the highest capability is 1.

If total water is 4-6 inches the highest capability subclass is 2S.

If total water is 2-4 inches the highest capability subclass is 3S.

If total water is less than 2 the highest capability is 4S.

For the Great group Ust, or Subgroups other than Udic or Aquic, or Ustic Subgroups of Quartzipsamments, use the midpoint value of each layer for the available water capacity to a depth of 60 inches, or total depth if less than 60 inches.

If total water is 8 inches or more the highest capability is 1.

If total water is 5.5-8 inches the highest capability subclass is 2S.

If total water is 2.5-5.5 inches the highest capability subclass is 3S.

If total water is less than 2.5 the highest capability is 4S.

If the Order is Aridisols and has Aqu or Ust subgroups then the highest capability subclass is 6S.

All other Aridisols the highest capability is 7S.

The Limiting Factor is: DROUGHTY

Criteria-Permeability

Soil permeability is the quality of a soil horizon that enable water or air to move through it. The lowest value of permeability (units are inches/hour) to a depth of 20 inches is used.

If more than 0.2 the highest capability is 1.

If between 0.06 - 0.2 the highest capability is 2S.

If less than 0.06 look at taxonomy:

If Vertisol or Vertic Subgroups of Mollisols or Entisols the highest capability subclass is 2S.

All others the highest capability is 3S.

The Limiting Factor is: PERCS SLOW

Criteria-Wetness

Water on the soil or excess water in the soil presents a hazard to or limits its use. Depth to a water table and/or ponding that occurs during the first one third of the growing season. Temperature regimes and months that water table or ponding occurs is checked.

If the kind of water table is perched and moisture regime is Ustic the depth criteria is:

If 1.5 feet or more the highest capability is 1.

If 0.5 - 1.5 feet the highest capability subclass is 2W.

If less than 0.5 feet or (+) plus the highest capability subclass is 3W.

If the kind of water table is other than perched, check the temperature regime and water table months:

If Hyperthermic and any month listed except January.

If Thermic and March, April or May listed.

If Mesic and March or April listed.

If a water table or ponding occurs during any of the listed months for the temperature regime listed then consider depth criteria using midpoint values:

If 4 or more feet the highest capability is 1.

If 2.5 - 4 feet the highest capability subclass is 2W.

If 1.5 - 2.5 feet the highest capability subclass is 3W.

If 0.5 - 1.5 feet the highest capability subclass is 4W.

If less than 0.5 feet or (+) plus and has other class 2 limitations the highest capability subclass is 4W.

- If ponding occurs for very long duration during the growing season the highest capability subclass is 5W.
- If less than 0.5 feet or (+) plus and has other class 3 limitations the highest capability subclass is 6W.
- If less than 0.5 feet or (+) plus and has other class 4 limitations the highest capability subclass is 7W.
- If the soil has a classification of Fragiudalfs, Fragiudalfs, Fraglossudalfs, Fragiaquils or Fragiudults move the soil up one capability class, but not to 1.

The Limiting Factor is: WETNESS

Criteria-Flooding

Flooding is a continuing limitation or hazard that cannot feasibility be corrected or removed. Flooding frequency and duration during the growing season.

- If frequency of flooding is NONE the highest capability is 1.
- If HYPERTHERMIC and flooding month is January only or if THERMIC and flooding months are December, January, February only or if MESIC and flooding months are October through March the highest capability is 1.
- If HYPERTHERMIC and flooding month is any month except January or if THERMIC and flooding months are between March and November, or is MESIC and flooding months are April through September look at frequency and duration and the most severe condition is rated:
 - If Rare the highest capability is 1.
 - If Occas, brief or V brief the highest capability subclass is 2W.
 - If Occas, long or V long the highest capability subclass is 3W.

- If Freq, brief or V brief the highest capability subclass is 3W.
- If Freq, long the highest capability subclass is 4W.
- If Freq V long and no other limitations the highest capability subclass is 5W.
- If Freq V long and has 2 or 3 limitations the highest capability subclass is 6W.
- If Freq V long and has 4 or more limitations the highest capability subclass is 7W.

The Limiting Factor is: FLOODS

Criteria-Salinity

Presence of soluble salts or exchangeable sodium in amounts toxic to most plants can be a serious limiting factor in land use. The salinity (expressed as mhos/cm) for the surface layer or layers using the midpoint range.

- If dashed or less than 2.5 the highest capability is 1.
- If 2.5 - 4.5 the highest capability subclass is 2S.
- If 4.5 - 8.5 the highest capability subclass is 3S.
- If 8.5 - 16 the highest capability subclass is 4S.
- If 16 - 30 the highest capability subclass is 6S.
- If 30 - 40 the highest capability subclass is 7S.
- If the greater than 40 the highest capability subclass is 8S.

The Limiting Factor is: EXCESS SALT

Criteria-Frost Free Days

Growing season or Frost Free Days as interpreted from temperature regimes are not considered limiting factors in Texas.

All temperature regimes in Texas have the highest capability of 1.

Criteria-Precipitation Effectiveness

Precipitation effectiveness in arid and semiarid areas is a continuing limitation and hazard. This can be improved with a dependable irrigation supply. The effective precipitation is interpreted from taxonomic classification.

If the Great Group with Aqu, Ud or Histisols occur the highest capability is 1.

If the Great Group with Ust look at the subgroup modifier:

If Aqu or Ud the highest capability is 1.

If Fluventic, Mollic, Pachic or Cumulic the highest capability is 1.

If Aridic Mollisols the highest capability subclass is 2C.

If Aridic in other orders the highest capability subclass is 3C.

If any other subgroup the highest capability subclass is 2C.

If the Order is in Aridisols:

If Ust the highest capability is 6C.

If any other subgroup the highest capability is 7C.

If Great Group is in Quartzipsamments or Eutrochrepts and Ust subgroup the highest capability subclass is 2C.

If any other subgroup the highest capability is 1.

If Great Group is in Dystochrepts or Eutrochrepts the highest capability is 1.

The Limiting Factor is: **PRECIPITATION EFFECTIVENESS**

Criteria-Slope

The steepness of slope, length of slope and shape of slope all influence directly the soil and water losses from a field. Slopes are grouped according to "K" factors and "R" values. The "R" values have been determined for each Major Land Resource Areas (MLRA). Ignore slope if

the frequency of flooding is common, occasional, or frequent.

If Psamments, Psamm, Arenic, or Grossarenic classification occurs the slope groups are:

If slope is 0-8% the highest capability is 1.

If slope is 8-15% the highest capability subclass is 2E.

If slope is 15-35% the highest capability subclass is 3E.

If slope is more than 35 percent the highest capability subclass is 4E.

If MLRA is 42, 69, 70, 77, 81 and the "R" value is less than 150 and 125 was used to determine slope groups:

The "K" factor is less than .28:

If slope is 0-5% the highest capability is 1

If slope is 5-9% the highest capability subclass is 2E.

If slope is 9-16% the highest capability subclass is 3E.

If slope is 16-25% the highest capability subclass is 4E.

If slope is 25-35% the highest capability subclass is 6E.

If slope is more than 35% the highest capability subclass is 7E.

The "K" factor is .28 to .37:

If slope is 0-4% the highest capability is 1.

If slope is 4-7% the highest capability subclass is 2E.

If slope is 7-13% the highest capability subclass is 3E.

If slope is 13-20% the highest capability subclass is 4E.

If slope is 20-30% the highest capability subclass is 6E.

If slope is more than 30% the highest capability subclass is 7E.

The "K" factor is more than .37:

If slope is 0-3% the highest capability is 1.

If slope is 3-6% the highest capability subclass is 2E.

If slope is 6-10% the highest capability subclass is 3E.

If slope is 10-16% the highest capability subclass is 4E.

If slope is 16-24% the highest capability subclass is 6E.

If slope is more than 24% the highest capability subclass is 7E.

If MLRA is 78 or 79 and the "R" value is 150 to 200 and 175 was used to determine slope groups:

The "K" factor is less than .28:

If slope is 0-4% the highest capability is 1.

If slope is 4-7% the highest capability subclass is 2E.

If slope is 7-13% the highest capability subclass is 3E.

If slope is 13-20% the highest capability subclass is 4E.

If slope is 20-30% the highest capability subclass is 6E.

If slope is more than 30% the highest capability subclass is 7E.

The "K" factor is .28 to .37:

If slope is 0-3% the highest capability is 1

If slope is 3-5% the highest capability subclass is 2E.

If slope is 5-11% the highest capability subclass is 3E

If slope is 11-16% the highest capability subclass is 4E.

If slope is 16-24% the highest capability subclass is 6E.

If slope is more than 24% the highest capability subclass is 7E.

The "K" factor is more than .37:

If slope is 0-2% the highest capability is 1.

If slope is 2-4% the highest capability subclass is 2E.

If slope is 4-8% the highest capability subclass is 3E.

If slope is 8-12% the highest capability subclass is 4E.

If slope is 12-18% the highest capability subclass is 6E.

If slope is more than 18% the highest capability subclass is 7E.

If MLRA is 80A, 80B, 82, 83A, 83B, 83C, 83D, 84A, 84B, 84C or 85 and the "R" value 200 to 300 was used to determine slope groups:

The "K" factor is less than .28:

If slope is 0-3% the highest capability is 1.

If slope is 3-6% the highest capability subclass is 2E.

If slope is 6-10% the highest capability subclass is 3E.

If slope is 10-16% the highest capability subclass is 4E.

If slope is 16-25% the highest capability subclass is 6E.

If slope is more than 25% the highest capability subclass is 7E.

The "K" factor is .28 to .37"

If slope is 0-2% the highest capability is 1.

If slope is 2-4% the highest capability subclass is 2E.

If slope is 4-8% the highest capability subclass is 3E.

If slope is 8-12% the highest capability subclass is 4E.

If slope is 12-18% the highest capability subclass is 6E.

If slope is more than 18% the highest capability subclass is 7E.

The "K" factor is more than .37:

If slope is 0-1% the highest capability is 1.

If slope is 1-3% the highest capability subclass is 2E.

If slope is 3-5% the highest capability subclass is 3E.

If slope is 5-10% the highest capability subclass is 4E.

If slope is 10-15% the highest capability subclass is 6E.

If slope is more than 15% the highest capability subclass is 7E.

If MLRA is 86, 87, 133B, 150A, 150B, 151 or 152B and the "R" value is more than 300 and 350 was used to determine slope groups:

The "K" factor is less than .28:

If slope is 0-2% the highest capability is 1.

- If slope is 2-4% the highest capability subclass is 2E.
- If slope is 4-7% the highest capability subclass is 3E.
- If slope is 7-13% the highest capability subclass is 4E.
- If slope is 13-20% the highest capability subclass is 6E.
- If slope is more than 20% the highest capability subclass is 7E.

The "K" factor is .28 to .37:

- If slope is 0-1% the highest capability is 1.
- If slope is 1-3% the highest capability subclass is 2E.
- If slope is 3-5% the highest capability subclass is 3E.
- If slope is 5-10% the highest capability subclass is 4E.
- If slope is 10-15% the highest capability subclass is 6E.
- If slope is more than 15% the highest capability subclass is 7E.

The "K" factor is more than .37:

- If slope is 0-0.5% the highest capability is 1.
- If slope is 0.5-2% the highest capability subclass is 2E.
- If slope is 2-4% the highest capability subclass is 3E.
- If slope is 4-8% the highest capability subclass is 4E.
- If slope is 8-12% the highest capability subclass is 6E.
- If slope is more than 12% the highest capability subclass is 7E.

The Limiting Factor is: SLOPE

Criteria-Erosion

On some kinds of soil previous erosion reduces crop yields and the choice of crops significantly and on others the effect is not great.

If class phase SEVER occurs drop capability one class.

If class phase Gullied occurs drop capability two classes.

If Ustic or Aridic moisture regime use Wind Erodibility Groups:

If the Wind Erodibility Group (WEG) is 1, 2, 3, or 4L capability subclass is E except for class 1 soils.

If WEG is 1 or 2 drop capability one class.

The Limiting Factor is: EROSION

Criteria-Coated/Uncoated

On sandy soils the amount of silt and clay in the soil influences the wind erosion hazard. For Quartzipsamments that have 5% or less silt plus clay.

If uncoated, drop capability 1 class and assign subclass S.

Do not change if class equals 5W.

The Limiting Factor is: EROSION

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