FERTILITY CAPABILITY CLASSIFICATION -- METHODOLOGY

Problem soils have been defined as soils with inherent physical or chemical constraints to agricultural production. In these soils degradation hazards are more severe and adequate soil management measures are more difficult or costly to apply. Such soils, if improperly used or inadequately managed will degrade rapidly, sometimes irreversibly. As a result the land itself might go out of production (Dent, 1990).

The process of grouping land areas according to constraints to agricultural production is complex because:

1) In many cases tracts of land will exhibit a combination of a number of soil and agroclimatic constraints.

2) Environmental requirements of individual crops vary considerably so that what is a severe constraint for one crop may be less severe or no constraint for another crop.

3) The mapped soil data at 1:5 000 000 scale are presented as an association of a number of different soils, and each mapping unit may contain a variable proportion of no problem soils and soils with different constraints.

The Fertility Capability Soil Classification (FCC) was developed by Buol, Sanchez and co-workers (Buol, 1972; Buol et al, 1975, Sanchez et al, 1982) as a technical system for grouping soils according to the kind of problems they present for agronomic management of their chemical and physical properties. The system emphasizes quantifiable topsoil parameters as well as subsoil properties directly relevant to plant growth and yield performance.

3.1 The FCC System (quoted from Sanchez et al 1982)

The system consists of three categorical levels: type (topsoil texture), substrata type (subsoil texture), and 15 modifiers, including several changes from the original version (Buol et al, 1975) making the following, in effect the second approximation. The classes within each categorical level are defined below. Class designations from the three categorical levels are combined to form an FCC-unit.

Type. Texture of plow-layer or surface 20 cm, whichever is shallower: S = sandy topsoils: loamy sands and sands (by USDA definition);
L = loamy topsoils: <35% clay but not loamy sand or sand;
C = clayed topsoils: > 35% clay;
O = organic soils: >30% O.M. to a depth of 50 cm or more.

Substrata type (texture of subsoil). Used only if there is a marked textural change for the surface, of if a hard root-restricting layer is encountered within 50 cm:
S = sandy subsoil: texture as in type;
L = loamy subsoil: texture as in type;
C = clayey subsoil: texture as in type;
R = rock or other hard root-restricting layer.

Modifiers. Where more than one criterion is listed for each modifier, only one needs to be met. The criterion listed first is the most desirable one and should be used if data are available. Subsequent criteria are presented for use where data are limited.

g = (gley); soil or mottles <2 chroma within 60 cm of the soil surface and below all A horizons, or soil saturated with water for >60 days in most years; =hydromorphy

d = (dry): ustic, aridic or xeric soil moisture regimes (subsoil dry >90 cumulative days per year within 20-60 cm depth);

e = (low cation exchange capacity): applies only to plow layer or surface 20 cm, whichever is shallower: CEC <meq./100 g soil by Σ bases + KCI-extractable Al (effective CEC), or CEC <7 meq./100 g soil by Σ cations at pH 7, or CEC <10 Meq./100 g soil by Σ cations + Al H at pH 8.2;

a = (aluminum-toxicity): >60% Al-saturation of the effective CEC within 50 cm of the soil surface, or >67% acidity saturation of CEC by Σ cations at pH 7 within 50 cm of the soil surface, or >86% acidity saturation of CEC by Σ cations at pH 8.2 within 50 cm of the soil surface, or pH 5.0 in 1:1 $H^2 0$ within 50 cm, except in organic soils where pH must be less than 4.7;

h = (acid): 10-60% Al-saturation of the effective CEC within 50 cm of soil surface, or pH in 1:1 $H^2 0$ between 5.0 and 6.0%;

i = (high P-fixation by iron): % free $Fe^2 O^3$/% clay > 0.15 and more than 35% clay, or hues of 7.5 YR or redder and granular structure. This modifier is used only in clay (C) types; it applies only to plow-layer or surface 20 cm of soil surface, whichever is shallower;

x = X-ray amorphous): pH> 10 1n 1N NaF, or positive to field Naf test, or other indirect evidences of allophone dominance in the clay fraction;

v = (vertisol): very sticky plastic clay: > 35% clay and >50% of 2:1 expanding clays, or severe topsoil shrinking and swelling:

k = (low K reserves): <10% weatherable minerals in silt and sand fraction within 50 cm of the soil surface, or exchangeable K <0.20 meq./100 g, or K <2% of Σ bases; if bases < 10 meq./100 g;

b = (basic reaction): free $CaCO^3$ within 50 cm of the soil surface (effervescence with HCl), or pH> 7.3;

s = (salinity): > 4 dS/m of electrical conductivity of saturated extract at 25°C within 1 m of the soil surface;

n = (natric): > 15% Na-saturation of CEC within 50 cm of the soil surface;

c = (cat clay): pH in 1:1 H^20 is < 3.5 after drying, and jarosite mottles with hues of 2.5 Y or yellower and chromas 6 or more are present within 60 cm of the soil surface;

' = (gravel): a prime (') denotes 15-35% gravel or coarser (> 2 mm) particles by volume to any type or substrata type texture (example: S'L = gravelly,sand over loamy; SL' = sandy over gravelly loam); two prime marks(") denote more than 35% gravel or coarser particles (> 2 mm) by volume in any type or substrata type (example: LC" = loamy over clayey skeletal; L'C" = gravelly loam over clayey skeletal);

% = (slope): where it is desirable to show slope with the FCC, the slope range percentage can be placed in parentheses after the last condition modifier (example: Sb (0-8%) = uniformly sandy soil calcareous in reaction, 0-8% slope).

The soils are classified by determining whether the characteristic is present or not. Most of the quantitative limits are criteria present in the Legend of the Soil Map of the World (FAO/Unesco, 1974).

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