EXTENDED OUTLINE FOR LECTURES

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Topic: Susceptibility of coarse-textured soils to soil erosion by water in the tropics

Introduction

- Acknowledging the bearing provided by lectures on spatial variability in the 1993 College on Soil Physics
- Explanation of terms
  Rainfall erosivity and soil erodibility will be defined. Implications of coarse texture will be discussed

Rainfall erosivity in the derived savanna and humid tropics of southern Nigeria

- Temporal variability evaluated with the regionalized variable and fractal theories
  Data spanning a period of 23 years have been used to fit variograms for a location each in the derived savanna and humid forest zones using the EI_{30} (two variants) and AI_m indices. Implications of the characteristics of these variograms (nugget, sill and range) will be examined. Calculated fractal dimensions will be discussed.

- Exceptional rainfall and return periods
  Rainfall intensities > 100 mm h^{-1} occur in the tropics although they are contributed by a minimal amount of the total rainfall. Return periods are essential to include these in conservation planning

- Magnitude of rainfall erosivity
  Daily, monthly and annual values

  - Which index for the tropics?
    At this stage, the concern for developing nations should be on soil conservation planning with available index. The readily available tool for this is RUSLE, implying that the EI_{30} is the appropriate index. Usefulness of other indices

  - How to get long-term estimates?

Emphasize that reliable equations based on long-term data can be used to evaluate rainfall erosivity from rainfall amounts given the little options

Highlight the need for stations with autoweather stations to be conscious of the resolutions of raingauges for future usefulness of data generated for soil conservation planning- Experience from Nigeria

Soil erodibility

- Particle size distribution
  LAC and impoverished soil.

- Aggregate stability
  Implication in terms of soil splash and soil erosion

  - Fractal theory in description of particle and aggregate size distribution

  The wet-sieving technique will be discussed and data will be shown for description of aggregate stability using mean-weight diameter, geometric mean diameter and fractal theory

- Water infiltration and hydraulic conductivity
  - Disc permeameter versus double-ring infiltrometer
    Water infiltration rates are high in the soils described but has traditionally been described using double-ring infiltrometers. Recent advances have made it possible to measure infiltration rates with tension infiltrometers which simulate water heads under rainfall better than with double ring infiltometers. Experiences using disc permeameter in southern Nigeria will be shared.

Soil loss

- Implications for soil and environmental quality
  Degradation of soil and water quality

Topic: Soil physical conditions in Nigerian savannas and biomass production

- The savannas of Nigeria and agricultural production
  The importance of the savannas will be highlighted in terms of agricultural production- crops and animals
- Soil physical properties
  - Derived savanna
  - Northern Guinean savanna
    Soil physical characteristics of profiles in the two agroecological zones will be discussed. This will include particle and gravel size distribution, bulk density and penetrometer resistance using a dynamic penetrometer

- Degradation of soil structure
  - Soil erosion
  - Hardsetting

  The potential soil losses will be highlighted and problem of hardsetting, different from soil compaction will be indicated. Laterisation will be discussed.

- Regeneration of soil structure
  - Vegetation and soil
    - Root growth and aboveground biomass
  - How long will it take?

  A case study of soil regeneration in the derived savanna will be given, with emphasis on soil structure

- Development of soil quality criteria with soil physical properties
  Attempts will be made to pinpoint criteria for knowing thresholds for soil degradation by setting soil quality parameters.

Figures and slides will be used for illustrations