# EROSION PREDICTION

## WIND EROSION

Wind is an erosive agent. It detaches and transports soil particles, sorts the finer from the coarser particles, and deposits them unevenly. Loss of the fertile topsoil in eroded areas reduces the rooting depth and, in many places, reduces crop yield. Abrasion by airborne soil particles damages plants and structures. Drifting soil causes extensive damage also. Sand and dust in the air can harm animals, humans, and equipment.

Some wind erosion has always occurred as a natural land-forming process, but it has become detrimental as a result of human activities. This accelerated erosion is primarily caused by improper use and management of the land (Stallings 1951).

Wind erosion is difficult to measure. Wind moves across the land in a turbulent, erratic fashion. Soil may blow into, within, and out of a field in several directions in a single storm. The direction, velocity, duration, and variability of the wind all affect the erosion that occurs from a windstorm. Much of the soil eroding from a field bounces or creeps near the surface; however, some of the soil blown from a field may be high above the ground in a dust cloud by the time it reaches the edge of a field (Chepil 1963).

Assigning numerical values to the site conditions that govern wind erosion and expressing their relationships mathematically can develop estimates of wind erosion. This is the basis of the current Wind Erosion Equation (WEQ) that considers soil erodibility, ridge roughness, climate, unsheltered distance, and vegetative cover. Understanding the erosive forces of wind is essential to the correct use of the Wind Erosion Equation and interpretation of wind erosion data. NRCS predicts erosion rates, assesses potential damage, and plans control systems for wind erosion.

### WIND EROSION EQUATION

The Wind Erosion Equation (WEQ) is expressed as:

$E = f(IKCLV)$ where,

E = estimated average annual soil loss in tons per acre per year
$f$ = a function of
I = soil erodibility index
K = soil surface roughness factor
C = climatic factor
L = the unsheltered distance
V = the vegetative cover factor

I Factor

The I factor, expressed as the average annual soil loss in tons per acre per year from a field area, accounts for the inherent soil properties affecting erodibility. These properties include texture, organic matter, and calcium carbonate percentage. I is the potential annual wind erosion for a given soil under a given set of field conditions. The given set of field conditions for which I is referenced is that of an isolated, unsheltered, wide, bare, smooth, level, loose, and non-crusted soil surface, and at a location where the climatic factor (C) is equal to 100.

The soil erodibility or I factor has been determined based upon pre-dominant soil textural class and dry soil aggregates. These factors can be grouped into 8 wind erodibility groups as shown on pages II-2 and II-3 in the Florida Erosion Control Handbook (FLECH) and all of the I factors for Florida's soil series appear in the last column of Table 1, page A-1 thru 18 in the FLECH.

K Factor

The K factor is a measure of the effect of ridges and cloddiness made by tillage and planting implements. It is expressed as a decimal from 0.5 to 1.0. The ridge roughness table can be found on page A-92, Table 13 in the FLECH.

C Factor

The C factor for any given locality characterizes climatic erosivity, specifically windspeed and surface soil moisture. This factor is expressed as a percentage of the C factor for Garden City, Kansas, which has a value of 100.

The C factors for Florida can be found on page II-14 in the FLECH.

L Factor

The L factor considers the unprotected distance along the prevailing erosive wind direction across the area to be evaluated and the preponderance of the prevailing erosive winds.

V Factor

The V factor considers the kind, amount, and orientation of vegetation on the surface. The vegetative cover is expressed in pounds per acre of a flat small-grain residue equivalent.

The vegetative cover (V factor) can be determined by two methods. One method involves the collection and weighing of crop residue samples. It is more accurate than the second method, which uses visual estimates. The procedure for the first method is described on pages II-3 through II-4a and the second method is found on pages II-5 through II-7 in the FLECH.

## SOIL AND CROP TOLERANCE VALUES

Soil and crop tolerances (T) are expressed as average annual soil loss in tons per acre. Soils often have a higher tolerance to wind erosion than the crops that are planted. Soil loss tolerances for a named soil are recorded on the soil interpretation records.
The normal planning objective is to reduce soil loss by wind or water to T or lower. In situations where treatment for both wind and water erosion is needed, soil loss estimates using the WEQ and USLE or RUSLE are not added together to compare to T. Additional impacts of wind erosion that should be considered are potential offsite damages, such as air and water pollution and the deposition of soil particles.

Crop tolerance to soil blowing may also be an important consideration in wind erosion control. Wind or blowing soil, or both, can have an adverse effect on growing crops. Most crops are more susceptible to abrasion or other wind damage at certain growth stages than at others. Damage can result from desiccation and twisting of plants by the wind. Crop tolerance can be defined as the maximum wind erosion that a growing crop can tolerate, from crop emergence to field stabilization, without an economic loss to crop stand, crop yield, or crop quality. Some of the adverse effects of soil erosion and blowing soil on crops include:

- Excessive wind erosion that removes planted seeds, tubers, or seedlings.
- Exposure of plant root systems.
- Sand blasting and plant abrasion resulting in
  - crop injury
  - crop mortality
  - lower crop yields
  - lower crop quality
  - wind damage to seedlings, vegetables, and orchard crops.
- Burial of plants by drifting soil.

Estimated crop tolerance values can be found on page A-93, Table 14 in the FLECH.

## PRINCIPLES OF WIND EROSION CONTROL

Five principles of wind erosion control have been identified (Lyles and Swanson 1976; Woodruff et al. 1972; and Woodruff and Siddoway 1965). These are as follows:

- Establish and maintain adequate vegetation or other land cover.
- Reduce unsheltered distance along wind erosion direction.
- Produce and maintain stable clods or aggregates on the land surface.
- Roughen the land.
- Reshape the land to reduce erosion on knolls where converging windflow causes increased velocity and shear stress.

The cardinal rule of wind erosion control is to strive to keep the land covered with vegetation or crop residue at all times (Chepil 1956), and/or maintain enough soil moisture when farming organic soils like those in the Everglades Agricultural Area (EAA). This leads to several principles that should be paramount as alternative controls are considered:

- Return all land unsuited to cultivation to permanent cover.
- Maintain maximum possible cover on the surface during wind erosion periods.
- Maintain stable field borders or boundaries at all times.