Page 87 Lascano et al 2007, text book

ET from Reference Crop

$$Et_o = \frac{0.408\Delta(R_n - G) + \gamma \frac{C_n}{T_a + 273} \mu (e_s - e_a)}{\Delta + \gamma(1 + C_d \mu)}$$

- ET0=reference ET (Tall or Short)
- Rn=net radiation (MJ m-2 d-1)
- G=Soil heat flux density (MJ m-2 d-1)
- Ta=daily air temp (°C)
- μ=Daily wind speed (m s-1) at 2 m
- e_s=saturated vapor pressure (kPa)
- e_a=actural vapor pressure (kPa)
- Δ=the slope of the saturation vapor pressure-temperauture curve ((kPa $^oC^{-1}$)
- γ=the psychrometric constant (kPa °C-1)
- C_n=numeric constant that changes with reference crop
- C_d=denominator constant that changes with reference crop

ET from Reference Crop

$$Et_o = \frac{0.408\Delta(R_n - G) + \gamma \dfrac{C_n}{T_a + 273} \mu (e_s - e_a)}{\Delta + \gamma(1 + C_d \mu)}$$

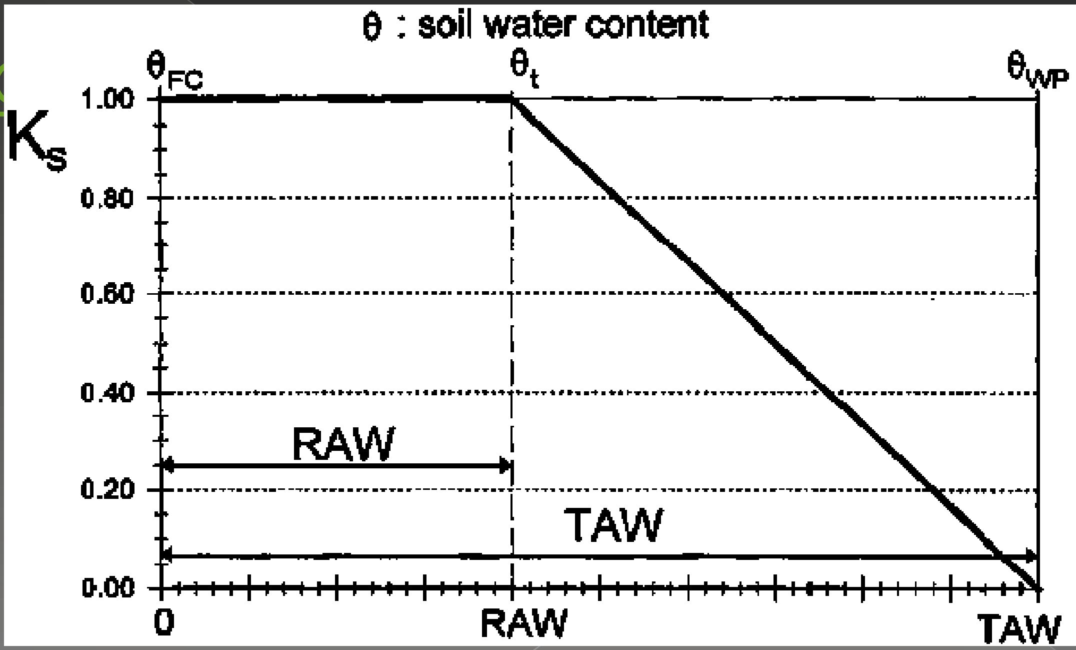
- **Step by Step Calculation of the Penman-Monteith Evapotranspiration (FAO-56 Method)**
- http://edis.ifas.ufl.edu/ae459

Crop Coefficients (kc)

- Kc will vary based on:
  - Crop growth stage, row spacing geometry, and “maybe” variety of crop
- Link to factsheet containing crop coefficients
  - http://www.ianrpubs.unl.edu/epublic/pages/publicationD.jsp?publicationId=1237

Impacts of water stress on ET

- ET is only affected by Water stress when readily available water (RAW) is depleted
- Grow it is restricted, we want to avoid this if possible
- http://www.fao.o... 0e0e.htm



Additional adjustments to Kc

-
- http://www.fao.org/docrep/x0490e/x0490e0b.htm

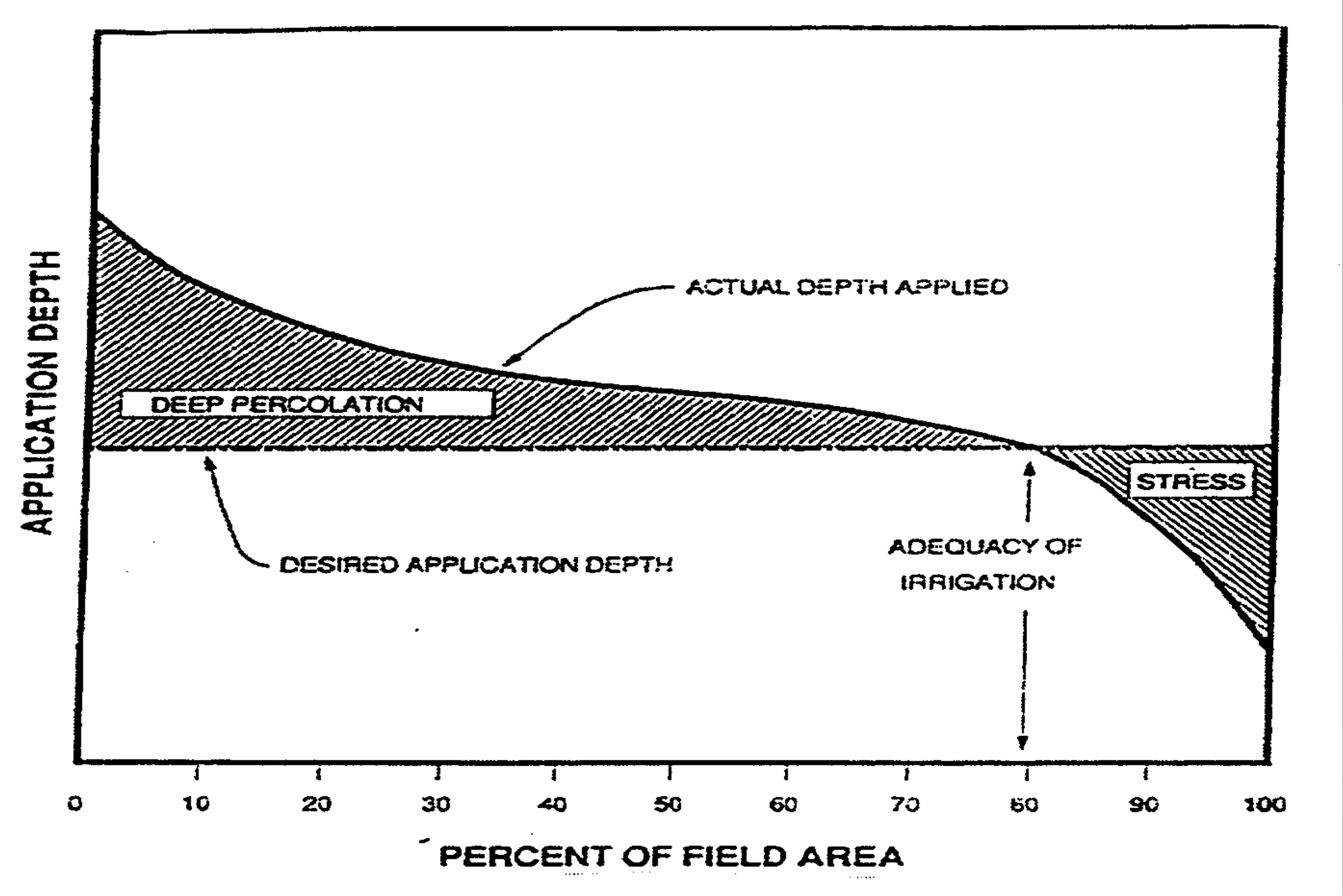
Efficiencies and Uniformities

- Application efficiency (E_a)

$$E_a = \frac{d_n}{d_g}$$

  - d_n = net irrigation depth
  - d_g = gross irrigation depth
  - fraction or percentage
- Water losses
  - Evaporation
  - Drift
  - Runoff
  - Deep percolation

Water Losses



Application Uniformity

- Distribution uniformity (DU)

$$DU = 100\left[\frac{d_{LQ}}{d_Z}\right]$$

  - d_{LQ} = average low-quarter depth of water received
  - d_Z = average depth applied
- Popular parameter for surface irrigation systems in particular

Application Uniformity Cont'd…

- Christiansen's Coefficient of Uniformity (CU)

$$CU = 100\left[1 - \sum_{i=1}^{n} \frac{|d_z - d_i|}{n d_z}\right]$$

  - n = number of observations (each representing the same size area)
  - d_z = average depth for all observations
  - d_i = depth for observation i
- Popular parameter for sprinkler and microirrigation systems in particular
- For relatively high uniformities (CU > 70%), Eq. 5.4 and 5.5 relate CU to DU

Turf Sprinkler Uniformity Test

(catch cans placed on a 5 ft x 5 ft grid)