BAE 452/552
Problem set 6

Please make sure you state any assumptions that you make.

1. (**BAE 452/552**) Determine the runoff hydrograph for the following rainstorm using the CN method. You may assume CN = 80, and AMC conditions II.

Time hours	Rainfall cm	Time hours	Rainfall cm
0	0.00	14	0.71
2	0.23	16	0.48
4	0.48	18	0.48
6	0.71	20	0.36
8	0.94	22	0.36
10	9.17	24	0.23
12	1.88		

2. (**BAE 452/552**) Determine the soil loss (t ha^{-1}) using RUSLE for the different rainfall zones and associated crop rotations using the data tables below. (Round your soil loss results to even integers.) Describe the effect of crop rotation, tillage practice and precipitation on the soil loss estimation.*

Rainfall Zone	Crop Rotation		Seeding	C factor
High P	ww/sf	conventional tillage	late seed	0.155
High P	sw	no tillage	late seed	0.0052
High P	ww/b/f	no tillage	late seed	0.022
High P	sw	reduced tillage	late seed	0.0206
High P	ww/b/f	reduced tillage	late seed	0.1114
Int. Dry Zone	ww/sf	conventional tillage	late seed	0.15
Int. Dry Zone	w/b/f	no tillage	late seed	0.0309
Int. Dry Zone	w/b/f	reduced tillage	late seed	0.0997
Int. Wet Zone	ww/sf	conventional tillage	late seed	0.159
Int. Wet Zone	w/b/f	no tillage	late seed	0.0289
Int. Wet Zone	w/b/f	reduced tillage	late seed	0.1566
Low P	ww/sf	conventional tillage	early seed	0.1155
Low P	ww/sf	no tillage	early seed	0.019
Low P	ww/sf	reduced tillage	early seed	0.0982

	Precip (in)	Slope (%)	Soil Type	OM%	Horizontal Slope Length (ft)
High P	22	17.4	Loamy Very Fine Sand	2	71.5
Int. Wet Zone	20	17.4	Loamy Very Fine Sand	2	71.5
Int. Dry Zone	16	18.3	Silt Loam	2	71.4
Low P	15	11.2	Silt Loam	2	248.4

*Data for Pataha Watershed in Eastern Washington State (courtesy Dr. Don McCool, USDA-ARS)

ww= winter wheat, sw = spring wheat, w = wheat, b = barley, f = fallow, sf = summer fallow
reduced tillage leaves some residue on the surface

3. (**BAE 452/552**) In this problem, you are asked to determine the total loading of nitrogen (N) as a result of a 2 cm rainstorm that produced 0.5 cm of runoff and 2,000 Kg/ha of soil loss from a Palouse silt loam soil. Prior to the storm, the soil was at a volumetric moisture content (θ, m^3/m^3) of 20%. The total nitrogen in this silt loam soil consists of 75% organic N and 25% NH_4^+-N. The bulk density (ρ) of the Palouse silt loam is 1,350 Kg/m^3 and the porosity is 50%.

The Freundlich relationship for NH_4^+-N is $(C_s) = 7.43*C_d^{0.76}$ providing C_s ($\mu g\ g^{-1}$ of soil) and C_d ($mg\ L^{-1}$). Total NH_4^+-N ($mg\ L^{-1}$) in the silt loam soil is 506.25 mg/L, and C_d = 159.80 mg/L

a. Assuming that the rain water saturates the surface soil, and the rain water completely mixed with 0.5 cm of surface soil, determine the concentration of NH_4^+-N (mg/L) in the runoff.
b. Determine the total N loading (Kg/ha) as the sum of solid-phase and dissolved-phase loading.

4. (**BAE 452/552**) The pesticide Simazine is used at planting of a cash crop. The application rate is always 1500 g/ha. One application is made on May 3, one on May 6, and one on May 9. On May 9 (after the pesticide application), a 3 cm storm hits the area producing 0.5 cm of runoff and 1.0 t/ha of sediment. The soil is a sandy loam with 2% organic matter.

Determine the runoff losses of Simazine due to the storm event.

5. (**BAE 552**) Show the steps to arrive the equations presented in Session 17 on slide 10:

$$A_t = \left[\frac{1}{1 + w / K_d \rho_{dry}}\right] P_t$$

$$D_t = \left[\frac{1}{1 + K_d \rho_{dry} / w}\right] P_t$$