1. Describe two "ecosystem attributes" that differ between a tall grass prairie and an industrial cornfield.

20 points: Here should be a description of two ecosystem attributes (such as species diversity, trophic interactions, productivity, nutrient cycling, etc) and how they differ in a prairie and a cornfield. Note that soil characteristics like soil fertility and susceptibility to erosion are not ecosystem attributes. See your lecture notes from 9/18 and 9/23.

2. a). In terms of plant biology, what is the difference between a macronutrient and a micronutrient?

10 points: Macronutrients and micronutrients are both necessary for plant growth. However, macronutrients (H, C, O, N, P, K, Ca, S, Mg) are needed in large quantities, whereas micronutrients (B, Cl, Cu, Fe, Mn, Mo, Zn) are needed in much smaller amounts.

b). What three macronutrients are most limiting for plant growth in terrestrial environments?

10 points: Nitrogen (N), Phosphorus (P), and Potassium (K)

3. a). Using the soil triangle at right, identify a soil that is 30% sand, and 20% silt.

10 points Type: ___________ Clay ___________

b). How would this soil compare to a loam soil in terms of water retention, water drainage and ability to hold nutrients?

10 points

This soil has 30% sand, 20% silt and 50% clay.

Compared to a loam soil, a clay soil would have:
1) better water retention (due to increased surface area of soil particles b/c clay particles are so small);
2) poor water drainage (due to smaller pore sizes in soil b/c of lower sand content and higher clay content);
3) better nutrient retention (due to more negatively-charged clay particles).

Note that the "Clay" and "Loan" designations do not say anything about organic matter content. These names only describe the soil texture, i.e., the relative amounts of sand, silt and clay.
4. a). Draw and label the three principal horizons in agricultural soil.

b). What are the main characteristics of each horizon?

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I gave partial credit if you described the soil profile of a virgin nonagricultural soil.
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5. Define the term "organic matter" and describe two benefits of it in agricultural soils.

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10 points: Organic matter is the portion of soil composed of both living organisms and dead organisms at various stages of decomposition.

10 points: There are many benefits of organic matter, including:

1). Improved tilth
2). Improved soil drainage due to the creation of soil aggregates (mineral particles are glued together with organic matter to make larger particles).
3). Improved nutrient retention due to negatively-charged organic matter (more negatively-charged than clay)
4). Nutrient reservoir – Nutrients in organic molecules of organic matter are made available (mineralized) by soil microorganisms.
5). Increases population densities of soil microorganisms
6). Increases biological activity of soil (metabolic activity of soil microorganisms)
7). Reduces soil-borne diseases
8). pH buffering
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