The Natural Resources Conservation Service (NRCS) and other agencies have teamed up to declare 2015 the International Year of Soils. Healthy soils are the foundation of agriculture and NRCS will be showcasing the importance of soil with monthly themes. I have selected a few themes that are especially important to Weld County and asked Clark Harshbarger, Resource Soil Scientist, to write on those topics throughout the year. Below is the first installment in support of the International Year of Soils.

International Year of Soils: Soils Support Urban Life
Clark Harshbarger, Resource Soil Scientist, NRCS

Have you ever been to a child's baseball game and wondered how the groundkeeper's got such green grass to grow? What about walking through your neighborhood and noticing landscaped yards of some of the Rocky Mountain's most beautiful tree and shrub species? Have you ever driven over a nasty pothole or seen cracks in a foundation, and wondered "how did that happen"? The answer to these questions is determined by how we interact with our soils. Soils, both literally and figuratively, **support urban life**.

When we are young, what is one of the first places we are sent to play? The sand box. Why is this? For one, sand is not that sticky, and is easy to wash off. But let's think about that. What makes sand easier to wash off than silt or clay? Its size and shape! Sand is defined as a soil particle that is less than 2 mm in size but can range down to 0.05 mm. In the world of soil science, 2mm is all that separates a rock fragment from a soil particle. Sand particles are generally sub-rounded and when packed together form macro-pores. Sand has a very low electric charge, and it generally does not bond chemically with other sand particles. Unlike clay particles, which are flat and have a strong negative electrical charge, which enables them to bond to one another very tightly, creating micro-pores. Figure 1 compares the relative size of sand, silt and clay.

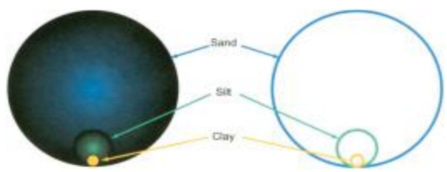

Figure 1: Relative sizes of sand, silt, and clay particles .(Urban Soil Primer, USDA).

Knowledge about soil properties is put to use in our urban life daily by professionals and homeowners alike. For instance, for a groundskeeper to know about how much water the outfield needs to support healthy plant growth, they need to know the soil texture, the depth of the soil profile that the plant species uses for root growth, and the estimated evapotranspiration rates of the local area. Most turf grass species need water when 50 percent of the management allowable depletion (MAD) is reached in the soil moisture profile. MAD is defined when plant available water is halfway between field capacity and permanent wilting point. The groundskeeper can bring the soil back to field capacity by calculating the available water holding capacity (AWC) of the portion of the profile that the roots use. Field capacity, is reached in a soil after a rain event, when gravimetric flow has left half water and half air in the soils pore spaces. The groundskeeper also needs to know how many gallons per minute the irrigation systems emits in order to determine the duration and frequency of watering events, in order to keep the soils from reaching permanent wilting point. All the while accounting for precipitation too! That is a lot to process but it starts with the understanding of how much water the soil can hold in each layer or horizon (AWC). AWC in your yard is best determined on site by determining your soil texture by horizon for the required plant root depth. The soil texture can be estimated by a soil scientist or sent to a soil lab for particle size analysis. For larger urban management areas, such as a park, the information is published via the USDA-NRCS Web Soil Survey http://websoilsurvey.nrcs.usda.gov/. To determine AWC, factors such as bulk density, structure, percent rock fragments, and organic matter content need to be accounted for.

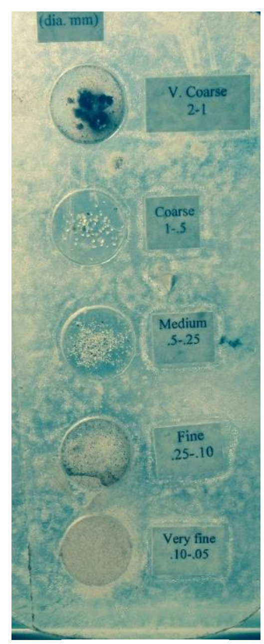

Figure 2: Sand fractions (USDA classification).

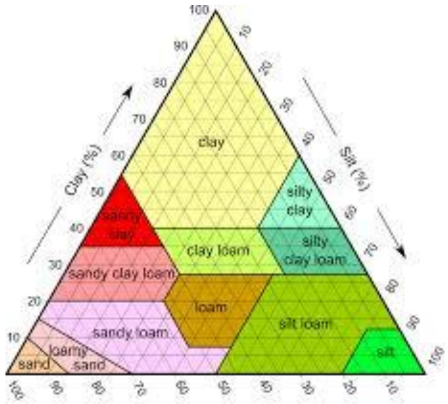

Figure 3: USDA classification systems textural triangle (Urban Soil Primer).

Soil texture is defined by the weight based proportion of sand, silt and clay particle sizes in a given sample. Figure 3 displays the texture triangle, which shows the unique soil textures by percent. Soil texture can be determined by the “texture by feel method” or by laboratory analysis. Each soil texture has unique properties that effect use and management of the soil. A sand texture, can hold about 0.35-0.75 inches of water per foot, because the particles cannot pack tightly and form macro pores. This property aids soil water drainage, but inhibits the soil’s water holding capacity. In comparison, clay loam textures can hold up to 2 inches of water per foot. Sand fractions vary in size, as seen in figure 2, and very fine sands behave more like silts than coarse and medium sized sands.

Knowing the difference in soil texture is critical for the design of common urban structures. Knowledge of soil types is needed by engineers to properly design road base, dam structures and foundations for building and home sites. There are three common texture classifications used in the United States by professionals who routinely work with soils. UNIFIED classification is used in construction designs, AASHTO classification is used in road base designs and the USDA classification is used in agricultural system designs. Each classification system aids the users planning and management decisions when working with soil. The main difference in the texture classification systems is the amount of emphasis placed on soil properties such as AWC, shrink swell potential, compactability and plasticity. How each texture class behaves when exposed to moisture and/or pressure determines its suitability for use. Without careful consideration of these properties, cracks in foundations and potholes can occur. We can attribute many years of success in our communities in the expression of parks, the landscapes in our subdivisions, and beautiful architectures of homes and buildings in our cities, to the understanding and ability to work with our soils. We recognize sometimes the inherent soil has too many limitations to overcome, so in some cases we bring in borrow to support a road base or a septic system leach field. On average, we need about 4 continuous feet of well-drained soil to allow microbial digestion to occur in order to treat septic effluent. Limitations in the soil can be overcome by design, but this can sometimes come at a significant cost. Each septic system has to function properly to protect ground water from effluent contamination. Groundwater recharges our drinking wells, rivers and reservoirs. Many times this will come at a high cost to the home owner, but we all can agree it is for the betterment of our health and safety.

We are learning more and more that the management of our lawns and our homes comes at a cost, financially and environmentally. We are in the “golden” age of conservation and have to keep asking ourselves critical questions to adapt to changing weather patterns and extreme fluctuations in moisture events. Does the prairie stay green all year long? No, it has evolved to have a blend of cool and warm season plants, each taking advantage of the changing seasonal fluctuations. Bio-mimicry of our prairies may be one way for us to help reduce our water usage as the demand along the Front Range increases in the future.

Sources

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