

REGIONAL AND GEOMORPHIC INFLUENCE ON
SOIL GENESIS AND OAK ECOSYSTEMS
IN THE CHARITON RIVER HILLS OF MISSOURI

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by

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The undersigned, appointed by the dean of the Graduate School, have examined the thesis entitled:

REGIONAL AND GEOMORPHIC INFLUENCE ON
SOIL GENESIS AND OAK ECOSYSTEMS IN
THE CHARITON RIVER HILLS OF MISSOURI

presented by Amber Marshaus Steele

A candidate for the degree of Master of Science,

and hereby certify that, in their opinion, it is worth of acceptance.

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Professor John M. Kabrick

Professor Fred J. Young

To the women in my family,
for teaching me to love and respect the earth,
and for paving the way for a world of possibility.
And, to Kyle, for your love, support, and faith in me.
You are my hero.

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ABSTRACT

Little is known about soil, geomorphic, and vegetation relationships in the moderately-dissected glaciated forests of the Chariton River Hills Ecological Subsection (CRHES). To gain a better understanding of these relationships for endeavors such as ecosystem classification and improved land management, sampling was done on two slope positions (upper and lower positions of backslopes with >15% slopes) of two slope aspects [north to northeast-facing (protected) and south to southwest-facing (exposed)] for a total of 48 plots along a gradient from central Missouri to the Missouri-Iowa border. Forty-eight soil pits were excavated at each plot to a depth of 205 cm, described, sampled, and analyzed. Soil physical properties such as particle size, bulk density, estimated available water capacity, and depths to diagnostic horizons were determined. To assess soil chemical property variation, samples were analyzed for extractable base cations, base saturation, cation exchange capacity, pH, and total organic carbon. Woody vegetation plots at each soil pit were established and inventoried, and site productivity data were collected. Vegetation data were used to determine site index, basal area, trees per hectare, percent stocking, and species richness. To assess the geomorphic effects of slope aspect and hillslope position, statistical analyses were performed on soil and vegetation parameters in a nested sampling design; and regional influences were determined using confidence intervals and regression analyses. Results indicated that influences from local geomorphic effects were more important than regional variation across the CRHES. Analyses demonstrated that clay in the argillic horizon was greater on upper hillslope positions, therefore decreasing the available water capacity. Upper exposed slopes had the least overall site productivity, but a greater abundance of white oak. On protected aspects, depth to the argillic horizon was greater, overall site productivity was greater, and there was an increase in abundance of red oak species.

1 INTRODUCTION, STUDY AREA, LITERATURE REVIEW, AND OBJECTIVES

1.1 INTRODUCTION

Managing land at an appropriate spatial scale is fundamental to the accomplishment of conservation objectives (Boyce and Haney, 1997). The purpose of delineating ecological units is to identify, describe, and map land and water areas at different levels of resolution that have similar capabilities and potential for land management (Cleland et al., 1997). The National Hierarchical Framework of Ecological Units is a systematic method for delineating these units (Cleland et al., 1997). Ecological units (Table 1.1) are designed to have similar associations of biotic and environmental factors, including climate, geology, topography, soils, hydrology, and vegetation. Units with the greatest level of detail, landtype (ELT) or landtype phase (ELTP) level, provide important delineations for management area planning and analysis.

The Missouri Department of Conservation (MDC) adopted the National Hierarchy of Ecological Units developed by the U.S. Forest Service for ecological land mapping and classification to describe ecological units to the level of landtype association (LTA) (Table 1.1; Nigh and Schroeder, 2002). Missouri's first attempt to describe and map the most detailed level of ecological units (i.e., ELTs), used geographic information systems and associated geospatial analyses as mapping tools. However, results from this method often lacked accuracy as well as important soils information. As a result, Missouri began using the U.S. Department of Agriculture (USDA) National Cooperative Soil Survey (NCSS) to map and describe ELTs. This work in Missouri coincides with a nationwide initiative by the USDA Natural Resources Conservation Service (NRCS) to develop Ecological Site Descriptions (ESDs). ESDs are based on a hierarchical ecological framework, similar to that of the U.S. Forest Service, and are guided by delineations made by the NCSS. Due to the many similarities, both in definition and approach, of ELTs and ESDs, the efforts to describe and map these units are occurring cooperatively and simultaneously in Missouri.

Table 1.1. Principle map unit design criteria of ecological units. Adapted from Cleland et al., 1997.

Ecological unit	Principal map unit design criteria
Domain	Broad climatic zones
Division	Regional climatic types Vegetational affinities Soil order
Province	Dominant potential natural vegetation Highlands or mountains with complex vertical climate-vegetation-soil zonation
Section	Geomorphic province, geologic age, stratigraphy, lithology Regional climatic data Phases of soil orders, suborders, or great groups Potential natural vegetation Potential natural communities (PNC)
Subsection	Geomorphic process, surficial geology, lithology Phases of soil orders, suborders, or great groups Subregional climatic data PNC – formation or series
Landtype association	Geomorphic process, geologic formation, surficial geology, and elevation Phases of soil subgroups, families, or series Local climate PNC- series, subseries, plant association
Landtype	Landform and topography (elevation, aspect, slope gradient, and position) Phases of soil subgroups, families, or series Rock type, geomorphic process PNC – plant associations
Landtype phase	Phases of soil families or series Landform and hillslope position PNC – plant associations or phases

Addressing ecologically distinct areas not delineated by original soil survey mapping efforts has been a challenge in the development of ELTs and ESDs in Missouri. For example, distinct soil map unit components were not commonly defined based on differences in slope aspect on steeply sloping backslopes. This often occurred because ecological effects from differences in slope aspect are better understood and easier to observe than differences in soil properties. This is a significant issue since only one ESD can be correlated to an individual soil map unit component (per national NRCS guidelines), not only for Missouri soil surveys, but for potentially all steeply sloping landscapes where ESD development is occurring. In Missouri,

initiatives are underway to provide clear evidence that soil properties and vegetation dynamics vary by slope aspect so that soil map units can be modified to include both exposed (south to southwest-facing) and protected (north to northeast-facing) components for soil map units on steeply sloping (>15%) landforms.

This study aims to specifically address variation in soil properties, site productivity, and species composition and structure on both regional and local geomorphic levels within an ecological subsection of Missouri. If significant soil or ecological differences exist within a single component of a soil map unit, the soil survey is not meeting the current needs of the NRCS and other current and potential users of the soil survey in Missouri.

1.2 STUDY AREA AND SITE SELECTION

1.2.1 Study Area

General Description

The Chariton River Hills Ecological Subsection (CRHES) lies within the Iowa and Missouri Heavy Till Plain Major Land Resource Area (MLRA 109; Fig. 1.1). This MLRA is characterized by moderately dissected glaciated till plains and covers a large portion of northern Missouri (Nigh and Schroeder, 2002). The CRHES has the greatest topographic relief of interior northern Missouri (up to 75 m). Study locations were confined to this area because of its extensive oak ecosystems. Despite the abundance of forest, timber resources in this region are largely unmanaged. However, the potential for oak ecosystem restoration and timber production for biofuels makes this region both ecologically and economically significant to Missouri.

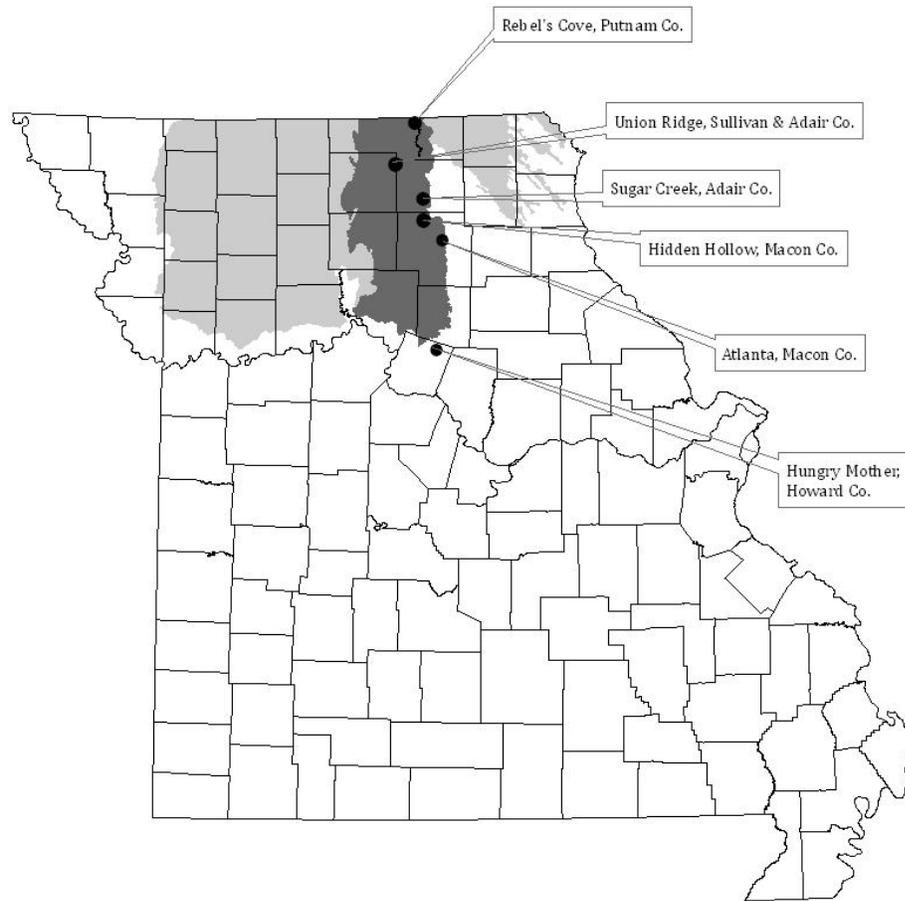


Figure 1.1. Iowa and Missouri Heavy Till Plain MLRA (light gray) in Missouri; Chariton River Hills Ecological Subsection (dark gray); filled black circles indicate project locations listed from south to north: Hungry Mother Conservation Area (CA), Atlanta Wildlife Area, Hidden Hollow CA, Sugar Creek CA, Union Ridge CA, and Rebel's Cove CA.

Geology

Knowledge of the landscape in which soils form is important to understanding pedogenic and vegetative differences. Prior to pre-Illinoian glaciations that occurred approximately 2.5 million to 500,000 years ago (ya), northern Missouri was a gently rolling landscape underlain by Pennsylvanian-aged limestones, sandstones, shales, and coal deposits (Thompson, 1995). During the Pleistocene, glaciers retreated and advanced several times. As the climate warmed and the glaciers retreated completely, till deposits ranging from 15-75 m thick remained (Thompson, 1995). These deposits have been studied and described and are thought to include at least five distinct till units (Rovey and Kean, 1996). In much of northern Missouri, Wisconsin-aged

(110,000 to 10,000 ya) loess overlies this till on gently sloping landforms (Thompson, 1995). Guccione (1983) and Woida and Thompson (1993) have observed that a welded solum, referred to as the Yarmouth-Sangamon paleosol, lies at the till-loess contact in stable upland positions of southern Iowa and northern Missouri (Rovey, 1997). During the Holocene, glacial melt, fluvial processes, and loess deposition carved and developed a river hills landscape in which few original surficial glacial features remain other than the till itself (Nigh and Schroeder, 2002).

Climate

The current climate of northern Missouri is characterized by warm, humid summers, and moderately cool winters. Mean annual air temperature for the study locations ranges between 9 to 13°C and mean annual precipitation ranges from 80 to 100 cm (Soil Survey Staff, 2011). The wettest months in the CRHES are May to September with 67% of the total precipitation occurring (Nigh and Schroeder, 2002). Annual snowfall ranges from 60 cm in the north to 50 cm in the south, and the growing season averages between 200-205 days (Nigh and Schroeder, 2002). The study area is considered to have a udic soil moisture regime and a mesic soil temperature regime (Soil Survey Staff, 2011).

Soils

Major soils in the CRHES include the Winnegan and Lindley soil series which are formed in Pre-Illinoian glacial till and occur on steeply sloping backslope positions. These soils are considered benchmark series due to their ecological significance and spatial extent. Differences between these soil series are slight. Winnegan soils are considered very deep, moderately well drained, fine, mixed, superactive mesic Oxyaquic Hapludalfs. Lindley soils are similar to Winnegan, but are well drained, fine-loamy, mixed, superactive, mesic Typic Hapludalfs. These alfisols are formed in glacial till that developed under humid climate conditions, they have well expressed argillic horizons and soft masses of calcium carbonate (CaCO₃) are commonly found in the lower part of their profile (Soil Survey Staff, 2011). Winnegan and Lindley soils support central hardwood species such as white oak (*Quercus alba* L.), northern red oak (*Quercus rubra* L.), black oak (*Quercus velutina* Lam.), and hickory species (*Carya* L. spp.).

Vegetation

Natural communities are distinct assemblages of native plants, animals, and microorganisms that occur in repeatable patterns across the landscape and through time (Nelson, 2010). The structure and composition of natural communities are influenced by geology, soils, topography, hydrology, and climate.

Forests, woodlands, savannas, and prairies comprise the majority of upland natural communities in northern Missouri. Forests are defined as communities dominated by trees that form a closed canopy (60-100% canopy coverage) and are interspersed with multilayered, shade-tolerant subcanopy trees, shrubs, vines, ferns, and herbaceous plants (Nelson, 2010). Woodlands differ from forests because they are fire-adapted ecosystems and usually have a less dense canopy (30-100% canopy coverage), sparse understory, and a dense ground flora rich in forbs, grasses, and sedges (Nelson, 2010). Savannas are a fire-adapted intergrade between woodlands and prairies and have widely spaced, open grown trees (<30% canopy coverage), the understory is usually absent, and ground flora consists of mixed grasses and forbs (Nelson, 2010). Prairie communities are also fire-adapted, have very few trees (<10% canopy coverage), and are dominated by perennial grasses and forbs (Nelson, 2010).

Pre-European settlement vegetation of the study area was largely woodlands, with forests on steeper slopes and narrower valleys (Nigh and Schroeder, 2002). Schroeder (1982) determined that an intricate pattern of prairie and forest in Missouri was a major factor for the extreme richness of wildlife in presettlement Missouri, and that the intricacy of the prairie-forest pattern was greatest in the Chariton River Hills. Conversion of uplands to agricultural production began in the late 1800s (Schroeder, 1982). Since that time, agricultural and developmental pressures have cleared forested slopes for grazing. The current overall landscape is mostly pasture with many tracts of second growth oak-hickory timber on the steepest areas (Nigh and Schroeder, 2002). The timbered areas that remain are an important remnant of a past landscape mosaic of woodland, prairie, and savanna.

1.2.2 Site Selection

Sites for this study were selected because of their geographic distribution, location, land condition, parent material, and land ownership type. Sites were selected based upon satisfying a number of criteria including (1) geographic location, (2) similarity of soils and topography, (3) accessibility, (4) lack of recent harvesting, burning, or other anthropogenic disturbances, and (5) high degree of ecological integrity. Final selection was decided from field assessment.

Consequently, all six sites were located on land owned by the MDC. All locations, with the exception of Hungry Mother Conservation Area, are located within the CRHES (Fig. 1.1; Nigh and Schroeder, 2002). All locations with the exception of Hungry Mother Conservation Area are within the CRHES. Hungry Mother Conservation Area was included as a site because its soils and physiography more closely resembled that of the CRHES.

To encompass forested portions of Winnegan and Lindley soils in the CRHES that would be affected by differences in slope aspect, sampling was done on two slope positions (upper and lower hillslope positions of backslopes (slopes >15%) of two slope aspects [protected (north to northeast-facing) and exposed (south to southwest-facing)] at two randomly-located sites within each of the six locations (Conservation Areas) for a total of 48 samples. Plots were not placed on neutral aspects (115 to 155° and 295 to 335°) (Fig.1.2).

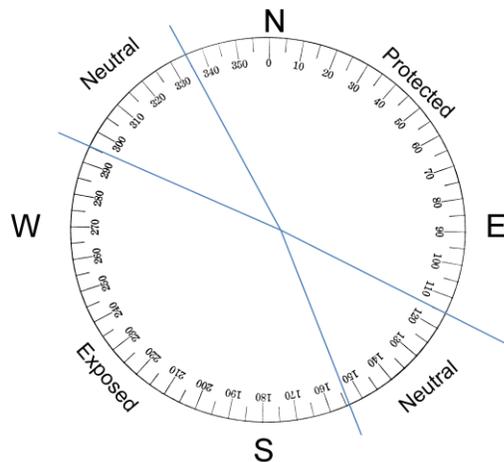


Figure 1.2. Topographic azimuth site selection criteria. Plots were not placed on neutral aspects (115 to 155° and 295 to 335°).

1.3 LITERATURE REVIEW

1.3.1 Soil Formation

Soil variability across a landscape is driven by soil formation. Factors influencing soil formation were first identified and discussed by Dokuchaev (Glinka, 1927) and Hilgard (Jenny, 1961). These were outlined in a well known equation that articulates the concept of soil development under the influence of climate and vegetation. This original equation is as follows:

$$s=f(p, cl, o)t$$

where s = soil, f = function, p = parent material, cl=climate, o=organisms, t=topography. This equation, though lacking specificity, laid out the premise that soils occur in predictable patterns. Jenny (1941) quantified this equation by designing transect experiments that determined how variation in soil properties directly correlate with changes in soil forming factors. Through these studies, Jenny redesigned the factors of pedogenesis assuming that soil forming factors are independent variables and produced the equation:

$$s=f(p, cl, r, o, t,...)$$

where s=soil, f = function, p=parent material, cl=external climate, r=topography, o=biotic potential, t=time, and ... = additional factors that are not yet known or are unique to a particular situation.

Jenny (1980) proposed a state-factor model, in which the distribution of a soil property is related to the five soil forming factors of climate, landscape position, biota, time, and parent material. On small spatial scales, some soil forming factors and processes, are assumed to be constant, allowing for study of a small subset of state factors, and as a result, the influence of a single factor can theoretically be observed and quantified. This type of observational study is known as a sequence (e.g., lithosequence, climosequence, toposequence, biosequence, chronosequence). In this study a toposequence is used to isolate slope aspect and hillslope position for observation of spatial variability in soil properties and/or forest dynamics.

Simonson (1958) elaborated on the work of Dokuchaev and Jenny by outlining the four processes of soil formation. These include: additions, losses, translocations, and transformations. Simonson argues that soil-genesis is a two-part process in which 1) soil-forming

factors move, change, and accumulate parent material to form soils and 2) soil-forming processes differentiate soil horizons. Simonson concluded that processes are of greater importance to soil scientists because of their role in horizon differentiation.

1.3.2 Soil-Landscapes and Spatial Variation

An understanding of the soil-landscape model requires knowledge of the concept of soil-landscape units (Hudson, 1990). Hudson (1992) defines these as, “natural terrains resulting from the interaction of the same five factors conventionally cited in the functional equation for soil formation. A soil-landscape unit has a recognizable form and shape of the surface of the earth.” To illustrate this Hudson uses an example that a slope is defined as a landform. However, a slope on a south-facing slope aspect and a slope on a north-facing slope aspect may be significantly different, and, in this case would require at least two soil-landscape units to be defined within a single landform. This example, has, in part, provided a framework for this study.

The field of soil genesis has benefitted greatly from the use of the soil-landscape model. Milne (1935), while working in East Africa, understood that soil profile development and related soil characteristics can change with respect to hillslope topography. From this work he developed the concept of a soil catena. Ruhe (1956; 1975) expanded on this idea and developed a soil-geomorphic model that integrated soil characteristics with hillslope models. Ruhe (1969) worked to quantify soil-landscape relationships in his book *Quaternary Landscapes of Iowa* by applying the concept of studying hillslopes in three dimensions, as well as through his contributions to the widely utilized five-unit hillslope classification model (Ruhe and Walker, 1968).

The incorporation of the hillslope model and geomorphologic principles to the soil-landscape model has provided an improved system for evaluating pedogenic and geomorphic processes. Daniels et al. (1971) used these concepts to determine that factors such as depth to water table and degree of dissection drives genesis of North Carolina coastal plain soils. In addition, Lepsch et al. (1977) used soil-landscape relationships to determine that oxisols are found on more stable upland slope positions, in comparison to younger soil orders in Brazil.

Applications and use of the soil-landscape model have evolved over time. Walker and Ruhe (1968) used the soil-landscape model to identify differences in the distribution of soil

properties such as surface horizon thickness, redox depletions, carbonates, and pH across an Iowa landscape. Young and Hammer (2000) performed a similar study, and were able to quantify soil-landform relationships using a large data set to provide statistically significant results of the degree of variation in soil properties such as clay, soil organic C, and nutrients in an upland landscape in central Missouri. In addition, McKenzie and Ryan (1999) used soil-landform relationships along with digital terrain analysis and gamma radiometric remote sensing techniques to quantify parent material differences in particle size and mineralogy in Australia.

Using soil-landform models and concepts, spatial variation of soil properties can often be explained by differences in soil forming factors such as slope aspect, landscape position, parent material, and vegetative communities. Chen et al. (1997) found that differences in slope aspect reflect variation in soil properties with average concentrations of exchangeable CEC and K greater on south-facing slope aspects in Taiwan. Chen also found that Ca, Mg, and pH increased on lower hillslope positions.

Interrelationships among soil chemical properties can be useful predictor of differences in plant community dynamics, Ollinger et al. (2002) found that in New Hampshire, patterns of net nitrification in soils were strongly related to rates of N mineralization and soil C:N ratios, and these relationships were also reflected in the forest canopy chemistry. In addition, Yimer et al. (2006) found that soil physical and chemical properties such as soil texture, bulk density, pH, P, CEC and base saturation varied with respect to vegetative communities and slope aspect in Ethiopia.

Soil properties change due to microclimatic differences that are induced by variation in slope aspect and landform. Topography affects the amount and daily cycle of solar radiation received at different times of the year, and has an influence on the microclimate, especially air and soil temperature, soil moisture, and humidity (Rosenberg et al., 1983; Desta et al., 2004). These microclimatic variables affect the development of soils as well as the type and quality of vegetation. Hutchins et al. (1976), while studying the Appalachian Mountains of eastern Kentucky, found differences in soil texture with slope aspect, with silt loam soils formed on northeast facing slopes, while sandy loam soils developed on southwest slopes, and that species

diversity was more mesic and diverse on northeast-facing slopes when compared to southwest-facing slopes. In addition, Ovales and Collins (1986), studying soil variability in two contrasting climatic environments in Florida, found that over 50% of variation in some soil properties could be explained by microclimatic effects of landscape position variation.

Sunlight with respect to latitude should also be considered when discussing the effects of slope aspect and landscape position on soil properties. The further the soil is from the equator the more it is affected by shading because solar radiation is received from angles both north and south of celestial zenith during the entire year (Schaetzl and Anderson, 2005). In addition, soils in the northern hemisphere may have north-facing slopes that retain snow accumulations for longer periods of time resulting in north-south slope differences in soil temperature and growing season length (Schaetzl and Anderson 2005). Finney et al. (1962) found that soils occurring on southwest-facing slopes have a thinner A (formerly A₁) horizon and more strongly developed E (formerly A₂) and B horizons than soils formed on northeast-facing slopes and attributed these differences to be caused by microclimatic variation in sunlight on slopes in the Allegheny Plateau of Ohio.

Soil moisture is an important factor in understanding how soils react to slope and slope aspect. For example, in mesic sites with an abundance of effective moisture, energy may be limiting for certain processes like weathering, causing pedogenic processes to be dependent on moisture instead of energy (Schaetzl and Anderson, 2005). However, in pedogenically dry sites, soil moisture may be the limiting factor and these slopes may contain deeper soils with greater expression of horizonation (Schaetzl and Anderson, 2005). Hanna et al. (1982) while studying soil available water by landscape position and slope aspect in Nebraska found soils formed on north-facing slope aspects had 20% more available water than soils on south-facing slope aspects. However, a study by Lee and Sypolt (1974) in West Virginia shows that available soil moisture is not always significantly different by slope aspect (Desta, 2004). Additionally, Hébrard et al. (2006) were not able to correlate soil surface moisture to local factors such as solar receipt, slope, slope aspect, or soil texture, and therefore attributed variation to local agricultural practices in a Mediterranean catchment.

In the northern Hemisphere, direct incidence of sunlight and associated radiant energy tend to be greater on south and south-west facing slopes causing these areas to be drier and warmer with greater potential evapotranspiration than north and northeast facing slopes which conversely tend to be relatively cooler and moister and have less potential evapotranspiration (Schaetzl and Anderson, 2005). Franzmeier et al. (1969) found that in the Cumberland Plateau of Tennessee, slope and slope aspect influences soil temperature and organic matter content. They specifically found that the lowest sites tend to be the coolest and have the greatest levels of exchangeable base cations, and soils formed on north-facing slopes are cooler than south-facing slopes while tending to have more soil organic matter throughout their solum. Interestingly, Hutchins et al. (1976) found that if slopes in eastern Kentucky received increased precipitation and also received greater amounts of radiation, increased temperatures, and greater evaporative demand resulted, therefore, differences in growth rates of vegetation could be related more to differences in energy exchange and thermal regimes than to differences in soil moisture (Desta, 2004).

Slopes that are drier and warmer are more likely to have decreased effective humidity than slopes which are cooler and wetter and have decreased potential evapotranspiration. Hutchins et al. (1976) also observed that air temperature, soil temperature, and the annual cycle of soil temperature fluctuations were greater on southwest-facing slopes when compared to northeast-facing slopes, and that relative humidity and available soil moisture were greater on northeast-facing slopes in eastern Kentucky.

1.3.3 Forest Soils

Forests are a valuable resource, both ecologically and economically. A comprehensive understanding of these ecosystems is vital to maintaining forest health and productivity. Soils, along with climate and topography, are of primary importance in determining the contemporary presence of forest ecosystems. Soils are also vital to understanding the biogeochemistry and productivity of forest ecosystems. Forest soils supply vital sources of water and nutrients for vegetation, including N, P, S, K, Na, Ca, Mg, and several micronutrients.

The growth, condition, and distribution of vegetation types in different hillslope positions are controlled by the bioavailability of soil nutrients. Application of the soil-landscape model is a useful tool in determining which soil properties are limiting factors in the forest ecosystem dynamics. Kabrick et al. (2011) found that oak (*Quercus* spp. L.) and hickory species common in the Missouri Ozarks were significantly more abundant on soils with smaller exchangeable Ca concentrations, and that less common species (e.g., chinkapin oak (*Quercus muehlenbergii* Engelm.)), were more abundant on soils with greater exchangeable Ca concentrations. Additional sources of potential spatial variation in vegetation can result from nutrients in falling litter from different types of vegetation, rates of microbial decomposition, soil mineralization, and nutrient recycling in the forest ecosystem (Finzi et al., 1998b).

Oaks are an important component of woodlands and forests in the eastern U.S. Oaks provide a valuable source of wildlife food (i.e., acorns) and are an important source of timber (e.g., fuel, charcoal, pulpwood, veneer, lumber). Expansion of these systems followed European settlement, however, oak regeneration and recruitment has more recently been on the decline in eastern North American forests (McShae and Healy, 2002). Oak decline has been attributed to factors such a decrease in disturbance phenomena (e.g., fire suppression), small mammal browsing and acorn predation, insects and diseases, and competition from more shade tolerant later successional species (Abrams and Nowacki, 1992; 1997; McShae and Healy, 2002). These declines have also led to increases in research designed to address oak ecosystem changes and reproduction strategies. According to Dey et al. (2009), oak regeneration can be best understood and modeled in an ecological context by using relatively small-scale plots within a multi-factor, hierarchical ecological classification system framework.

1.3.4 Forest Productivity

Slope aspect and slope gradient are correlated with site quality in most oak ecosystems. Due to relatively more mesic site conditions, sites with greater productivity usually occur on north to east-facing slope aspects and less productive sites on south to west-facing slope aspects in the northern hemisphere (Johnson et al., 2009). For example, Hannah (1968) found that site productivity (site index) was consistently greater on north-facing hillslope positions when

compared to south-facing slopes in Indiana. In addition, Hartung and Lloyd (1969) observed that the northeast-facing slope aspect (45°) was the most preferable slope aspect for white oak, black oak, scarlet oak, and shortleaf pine growth on very deep, cherty Ultisols in the Missouri Ozarks. Hillslope position and slope shape are also related to soil moisture. Lower slopes tend to have greater site productivity (site indices) due to increased subsurface water flow from upper slopes. Brown (2007) found variation among growth and site productivity (site index) of white pine in Ohio, and noted that lower hillslope positions were the most productive overall.

1.3.5 Forest Structure and Composition

The type and composition of plant communities, as well as types and rates of physical, chemical, and biological processes, are dramatically influenced by differences in pedogenic processes and soil properties (Dahlgren et al., 1997). Microclimatic variation, induced by slope aspect and hillslope position, is often an important factor when considering these differences over small scales.

Fu et al. (2004) found that topographic variability in terms of aspect and elevation had a great effect on soil organic matter. Their study concluded that south-facing slopes, upper hillslope positions, and gentle slope gradients were the most fertile positions for plant growth in China. In addition, Hutchins et al. (1976) found differences in plant communities with slope aspect. They concluded that in the Appalachian Mountains of eastern Kentucky, species richness was greater on the northeast-facing slopes and species tended to be more mesic (yellow poplar (*Liriodendron tulipifera* L.), basswood (*Tilia americana* L.), and cucumber magnolia (*Magnolia acuminata* L.)), while the southwest-facing slope had fewer species present and was dominated with dry and dry-mesic species (mixed oak and hickory species).

Slope aspect has long been known as a factor potentially significant in generating differences in structural ecosystem characteristics. Bale et al. (1998) found in eastern Australia vegetation on southeast-facing slope aspects had greater species richness, canopy cover, and canopy height than that of northwest-facing aspects. This relationship is opposite of what one might expect in the northern hemisphere, because Australia is in the southern hemisphere. Bale also found that eucalypt (*Eucalyptus* Sm. spp.) and rainforest species were segregated as a result

of slope aspect and differences in canopy species were influenced by microclimatic variations in light, heat, moisture, and edaphic conditions due to slope aspect.

Several quantitative studies on the relationships of forest structure and species composition to environmental features (e.g., elevation, hillslope position, slope aspect) have revealed that the floristic composition, community structure, and distribution of plant species vary with hillslope position and slope aspect, which in turn result in some variations of soil properties. Sardinero (2000) found that plant community structure differences are controlled primarily by temperature and precipitation, as well as hillslope position and soil moisture in New Hampshire. In northern California, Pinder et al. (1997) related the abundance of herbaceous communities to steeper slopes and valley bottoms, and attributed this distribution to differences in soil moisture. Although, some variation in soil properties can come from plants themselves. Van Breemen and Finzi (1998) point out examples such as, “dune formation by Marram grass, ‘islands’ of fertility’ in deserts, mull- and mor- forming temperate forest trees, and formation of peatbogs” as strong evidence for plants species causing variation in soil properties.

When considering ecological site descriptions in areas with oak woodland/forest potential, it is important to classify units by their reproduction potential. In the oak forests of the eastern U.S., the accumulation of oak reproduction generally increases with decreasing site quality and overstory density (Johnson et al., 2009). Because of their evolutionary adaptation to thrive in disturbance, oaks tend to accumulate more on drier sites and where overstory density is decreased (Johnson et al., 2009).

1.4 OBJECTIVES AND HYPOTHESES

1.4.1 Primary Research Objective

To understand the soil genesis and oak ecosystem dynamics of forested soils in the Chariton River Hills Ecological Subsection (CRHES) by evaluating variation of soil properties and forest productivity, composition, and structure that occur as a result of regional and/or local geomorphic effects.

1.4.2 Specific Research Objectives

1. To determine how soil genesis and the expression of soil properties vary across the CRHES and locally by hillslope position and slope aspect.
2. To determine how the productivity, composition, and structure of oak ecosystems varies across the CRHES and locally by hillslope position and slope aspect.
3. To evaluate occurrence and variation in diagnostic soil properties of two benchmark soil series (Winnegan and Lindley) across the CRHES.

1.4.3 Specific Research Hypotheses

1. Soil genesis, as quantified by differences among soil properties, will not vary greatly across the CRHES, but will show significant differences with slope aspect and hillslope position.
2. Productivity, composition, and structure of oak ecosystems will vary with slope aspect and hillslope position; regional differences will be a result of local management and site history.
3. Winnegan and Lindley soils are the same natural soil body and will not show significant differences in soil properties across the CRHES or be segregated to one portion of the region.

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2 REGIONAL AND GEOMORPHIC INFLUENCE ON SOIL GENESIS AND MORPHOLOGY RELATIVE TO VEGETATION IN THE CHARITON RIVER HILLS

2.1 ABSTRACT

Regional and geomorphic influences on soil property variation are poorly understood in forested regions of northern Missouri. Influences of slope aspect and hillslope position are important for understanding vegetation-site relationships. These relationships are especially important because vegetation is increasingly being used to indicate environmental conditions and forest productivity potential. Our objectives were to determine how soil genesis and expression of soil properties vary regionally across the Chariton River Hills Ecological Subsection and locally by slope aspect and hillslope position. A total of 48 soil pedons on two hillslope positions [upper and lower hillslope positions of backslopes (>15% slope)] of two slope aspects (north to northeast-facing and south to southwest-facing) along a gradient from central Missouri to the Missouri-Iowa border were excavated, described, and analyzed. Results show that local geomorphic effects such as slope aspect and hillslope position are more influential in soil property variation than regional effects, especially to physical soil properties. Average clay in the subsoil was significantly greater ($P=0.03$ to 0.07) on upper hillslope positions, estimated available water capacity was significantly greater ($P=0.01$) on soils formed on lower hillslope positions, and depth to the argillic horizon and clay maximum are greater on north to northeast-facing slope aspects. Differences in local geomorphic effects are reflected in vegetation through variation of species composition. Pedological influences may be causing variation from localized hillslope position effects to be more pronounced than slope aspect differences in soil properties related to genesis.

2.2 INTRODUCTION

Spatial variation of soil properties and vegetation follow patterns that are largely a function of landscape position, soil forming factors and processes, and local management practices (Beckett and Webster, 1971). Local geomorphic variation in slope aspect and hillslope position are important considerations when quantifying the spatial variation of soil properties

and vegetation (Milne, 1935; Pregitzer, 1983; Ovalles and Collins, 1986; Chen, 1997; Yimer, 2006); particularly in landscapes having steep slopes and a large degree of topographic relief. Understanding soil variability is a useful way to quantify pedogenic concepts and to better understand landscape evolution and vegetation-site relationships (Ruhe, 1956; Hutchins et al., 1976; Wilding and Drees, 1983).

The Chariton River Hills Ecological Subsection (CRHES) within the Iowa and Missouri Heavy Till Plain Major Land Resource Area (MLRA) is characterized by steep slopes and extensive oak forests covering a large portion of northern Missouri (Fig. 2.1). The CRHES is formed in Pre-Illinoian glacial till that has been dissected by fluvial processes leaving a present-day landscape that contains the greatest topographic relief of interior northern Missouri (up to 75 m) and is bordered on the east and west by more gently-sloping lands predominantly used for agriculture (Nigh and Schroeder, 2002). Forests in the CRHES are largely unmanaged and consequently, little is known about vegetation-site relationships in this region.

Interest is increasing in using landforms and soils to classify ecosystem components for ecological classification systems (ECS). The USDA Natural Resources Conservation Service (NRCS), in particular, is working to improve understanding of vegetation-site relationships to develop ecological site descriptions (ESDs) and for updating the National Cooperative Soil Survey. Ecological site descriptions are a level of ecological land classification analogous to ecological landtypes (ELTs) used by the U.S. Forest Service. Geomorphic factors are important site-level determinants of ecological dynamics used in both of these classification systems. Because of the important role of topography in variation of soil properties and vegetation, we designed a study to quantify its influence throughout a region and within localized geomorphic areas. The objectives of this study were to determine how soil genesis and expression of physical and chemical soil properties vary regionally across the CRHES and locally by slope aspect and hillslope position, and how these variations are reflected in the current vegetation.

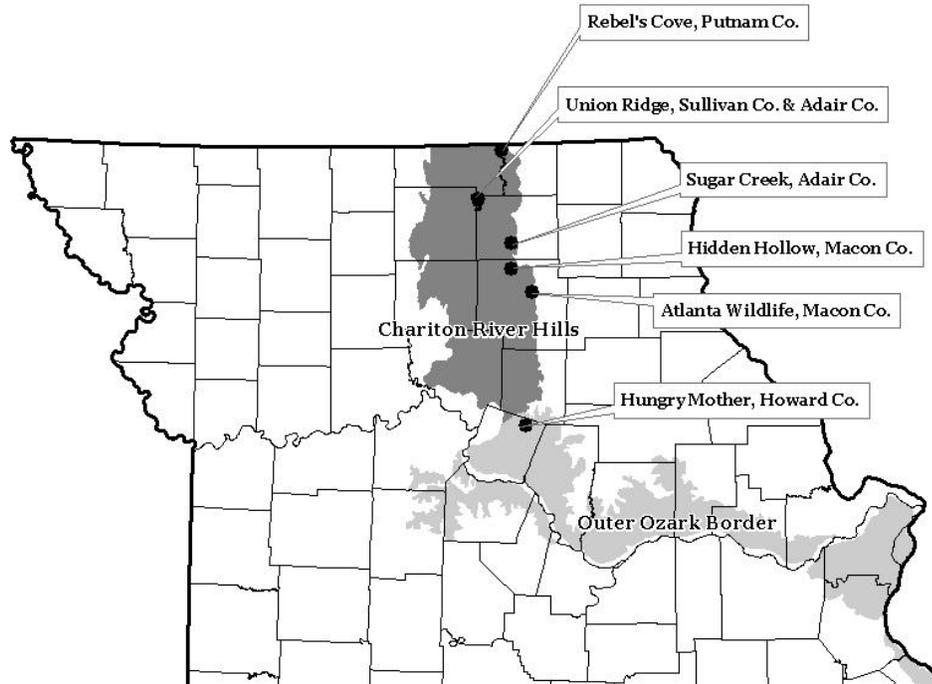


Figure 2.1 Chariton River Hills Ecological Subsection in Missouri (dark gray); Outer Ozark Border (light gray) in Missouri; filled black circles indicate project locations listed from south to north: Hungry Mother Conservation Area (CA), Atlanta Wildlife Area, Hidden Hollow CA, Sugar Creek CA, Union Ridge CA, and Rebel's Cove CA.

2.3 STUDY AREA

Prior to Pre-Illinoian glaciations (approximately 2.5 million to 500,000 years ago), northern Missouri was a gently rolling landscape underlain by Pennsylvanian-aged limestones, sandstones, shales, and coal deposits (Thompson, 1995). During the Pleistocene, glaciers retreated and advanced several times. As the climate warmed and the glaciers retreated completely, till deposits ranging from 15-75 meters thick were left behind (Thompson, 1995). These deposits have been studied and described and are thought to include at least five distinct till units (Rovey and Kean, 1996). In much of northern Missouri, Wisconsin-aged loess overlies till on gently sloping landforms (Thompson, 1995). Guccione (1983) and Woida and Thompson (1993) have observed that a welded solum, referred to as the Yarmouth-Sangamon paleosol, lies at the till-loess contact in stable upland positions of southern Iowa and northern Missouri (Rovey, 1997). During the Late Pleistocene, glacial melt, fluvial processes, and loess deposition carved and developed a river hills landscape in which few original surficial glacial features remain other

than the till itself (Nigh and Schroeder, 2002). Elevation ranges among study sites from approximately 195 to 285 m.

The present day climate of northern Missouri is characterized by warm, humid summers, and moderately cool winters. Mean annual air temperature for study locations ranges between 9 to 13°C and mean annual precipitation ranges from 80 to 100 cm (Soil Survey Staff, 2011). The wettest months in the CRHES are May to September with 67% of the total precipitation occurring during these months (Nigh and Schroeder, 2002). Annual snowfall ranges from 60 cm in the north to 50 cm in the south, and the growing season averages between 200-205 days (Nigh and Schroeder, 2002). The study area has a udic soil moisture regime and a mesic soil temperature regime. (Soil Survey Staff, 2011)

Soil series studied include Winnegan and Lindley. These soils are considered benchmark series due to their ecological significance and extensive spatial distribution. Winnegan and Lindley soils are formed in Pre-Illinoian glacial till, and developed under humid climate conditions. Distinguishing characteristics of these soils include a well-expressed argillic horizon with soft masses of calcium carbonate commonly found in the lower part of the profile (Soil Survey Staff, 2011). Differences between these soil series are slight. Winnegan soils are classified as moderately well drained, fine, Oxyaquic Hapludalfs, and Lindley soils are classified as well drained, fine-loamy, Typic Hapludalfs. These soils presently support central hardwood region species such as white oak (*Quercus alba* L.), black oak (*Quercus velutina* Lam.), northern red oak (*Quercus rubra* L.), and hickory species (*Carya* L. spp.).

Pre-European settlement vegetation of the study area was largely fire-adapted woodlands, with forests on steeper slopes and narrower valleys (Nigh and Schroeder, 2002). Schroeder (1982) found that the presence of an intricate pattern of prairies and forests in Missouri was a major factor in the richness of wildlife in presettlement Missouri, and that the CRHES had the most intricate prairie-forest pattern in the state. Conversion of uplands for agricultural production began in the late 1800s (Schroeder, 1982). Agricultural and developmental pressures have depleted much of the original forested structure in northern Missouri, and many originally forested slopes are now cleared for grazing. The current landscape

consists of extensive pasture with many tracts of second growth oak-hickory forest on the steepest areas (Nigh and Schroeder, 2002) which contain soil map units with either Winnegan or Lindley soil series as the dominant component.

2.4 MATERIALS AND METHODS

2.4.1 Site Selection

Six sites (Fig. 2.1) were selected along a gradient from central Missouri north to the Missouri-Iowa border. Sites were selected based upon satisfying a number of criteria including: (1) geographic location, (2) similarity of soils and topography, (3) accessibility, and (4) lack of recent harvesting, burning, or other anthropogenic disturbances. Consequently, all six sites were located on land owned by the Missouri Department of Conservation. All sites, except Hungry Mother Conservation Area are within the CRHES. The site at Hungry Mother Conservation Area was included because its soils and physiography were more similar to the CRHES.

To encompass forested portions of Winnegan and Lindley soils in the CRHES that would be affected by differences in slope aspect, sampling was done on two slope positions (upper and lower hillslope positions of backslopes (>15%) of two slope aspects [protected (north to northeast-facing) and exposed (south to southwest-facing)] at two randomly-located sites within each of the six locations (Conservation Areas) for a total of 48 samples. Plots were not placed on neutral aspects (115 to 155° and 295 to 335°).

2.4.2 Field Sampling and Site Descriptions

For sampling at each plot, a soil pit was excavated to a depth of 205 cm using a backhoe. Pits were centrally located on the chosen landform and the final location was chosen by determining, through hand probing, the area that most closely represented the mapped soil series (i.e., Winnegan or Lindley). The up-slope face of the soil pit was smoothed using hand tools to provide a natural, uniform appearance, and genetic horizons were delineated based on differences in color, texture, and structure. Each horizon was described in detail using standard NRCS Soil Survey methods (Schoeneberger et al., 2002; Soil Survey Division Staff, 1993). Depth, horizon designation, matrix color(s), roots, pores, texture, structure, redoximorphic features, ped surface

features, rock fragments, effervescence (reaction to 1N HCl-), and horizon boundary were recorded in detail, as well as any features unique to the horizon. One bulk soil sample (minimum 450 g) was collected for each soil horizon for laboratory analysis in the University of Missouri Soil Characterization Laboratory (Columbia, MO). Landscape, landform, and hillslope position information (e.g., percent slope, aspect, slope morphometry) were also recorded at each plot.

Bulk density samples were obtained by the core method (method 2.1.2.2, Grossman and Reinsch, 2002) with two bulk density samples per horizon. A sample ring was driven horizontally into the soil surface with a core apparatus. If strong resistance was met, either by rocks or large roots, the process was repeated in a new location within the middle of the horizon. The sample was carefully removed and placed into a pre-tared sampling tin which was covered, labeled, and transported to the laboratory for weighing and drying.

To quantify species composition, woody vegetation was inventoried in each slope position/aspect class/location combination within nested, concentrically-located vegetation plots. Trees 3.8 cm d.b.h. or greater (overstory) were inventoried in a circular 0.05-hectare plot. Trees less than 3.8 cm d.b.h. but greater than 0.5 m in height (large advance reproduction) were inventoried in a circular 0.005-hectare subplot. Trees up to 0.5 m in height (small advance reproduction) were inventoried in a 0.00125-hectare subplot. Species composition was quantified by calculating trees per hectare and basal area per hectare.

2.4.3 Analyses

Soil samples were analyzed in the Missouri Soil Characterization Laboratory (Columbia, MO) from procedures detailed in the USDA-NRCS Soil Survey Laboratory Methods Manual (Burt, 2004). Samples were air-dried, ground, and passed through a 2 mm mesh sieve prior to analysis. Particle size analysis was determined using pipette analysis with standard pretreatments, to remove organic matter and carbonates, and to disperse separates (method 3A1a1a, Burt, 2004). Particle size classes determined included: fine silt, coarse silt, very fine sand, fine sand, medium sand, coarse sand, very coarse sand and clay. Bulk density was determined by taking the oven-dry weight of samples (105 °C for 48 hours) divided by the volume of the sample ring (295 cm³) (bulk density method 3B, 3B6, 3B6a, Burt, 2004). Bulk density values were averaged for each horizon.

Estimated available water capacity (AWC) was determined using ranges of AWC in relation to soil texture and organic matter by horizon thickness (Soil Survey Division Staff, 1993).

Soil cation exchange capacity (CEC) and extractable cations, (Ca, Mg, K and Na) were determined using 1 M ammonium acetate ($\text{CH}_3\text{COONH}_4$) extraction, steam distillation, HCl-titration and atomic absorption spectrophotometry (CEC-7, method 4B1a1a1a1a1, Burt, 2004). These effective CEC values were used for statistical analysis and to calculate percent base saturation (BS). Cation exchange capacity was also determined by the summation of extractable bases plus the BaCl_2 -triethanolamine released extractable acidity (EA) (CEC-8.2, method 4B2alala1, Burt, 2004). Extractable Al of samples with large amounts of acidity was determined using 1 M KCl extraction and inductively coupled plasma-atomic emission spectrophotometry (ICP-AES, method 4B3a1a1a1, Burt, 2004). Soil pH was measured in 1:1 soil-to-water ratio and 1:2 soil-to-0.01 M CaCl_2 salt solution (methods 8C1a and 8C1e, respectively, Burt, 2004). Total organic carbon (TOC) was determined by dry combustion method 324H2a, modified to 927 °C using a LECO C-144 carbon analyzer.

Complete soil pedon descriptions and laboratory data were entered into the University of Missouri Center for Applied Research and Environmental Systems Cooperative Soil Survey Information System (<http://soils.missouri.edu>). Pedons were taxonomically certified to the series level (Soil Survey Staff, 1999; 2010), correlated, and reviewed by NRCS MLRA 109 Soil Survey staff.

To examine the effects of slope aspect and hillslope position, data were analyzed using the MIXED procedure (Statistical Analysis Software, SAS Version 9.2, Copyright © 2002-2008, SAS Institute Inc., Cary, NC, USA). Data were examined for normality prior to analysis and were transformed if necessary. The GLIMMIX procedure with specified data distribution was used for data that could not be normalized. Data that could not be normalized or fit were not analyzed. We used a hierarchical linear mixed model with aspect and hillslope position within aspect as nested fixed effects and location and site within locations as random effects. This model tested the effect of aspect using the aspect*location*site interaction and tested the effect of hillslope position within slope aspects using the hillslope position* location*site interaction. We also

examined the influence of soil properties to vegetative response variables (site index and stocking) using the REG procedure (Statistical Analysis Software, SAS Version 9.2, Copyright © 2002-2008, SAS Institute Inc., Cary, NC, USA) for variables including percent clay, percent silt, and percent base saturation averaged by profile area, and available water capacity, percent clay in the particle size control section, and total organic carbon by site. The REG procedure was also used to examine the interactions of clay in the particle size control section with depth to carbonates and depth to the carbonate maximum.

2.5 RESULTS AND DISCUSSION

2.5.1 Soil Physical Properties

The assessment of soil physical properties began with an evaluation of diagnostic soil properties. Determination of particle size (texture) is important for classifying soils to the family level (Soil Survey Division Staff, 2010). All study soils were alfisols with well expressed argillic horizons (Fig. 2.2-2.4) and classification at the family level was determined by the taking the weighted average of clay in the particle size control section (PSCS) (upper 50 cm of the argillic horizon; Soil Survey Division Staff, 2010).

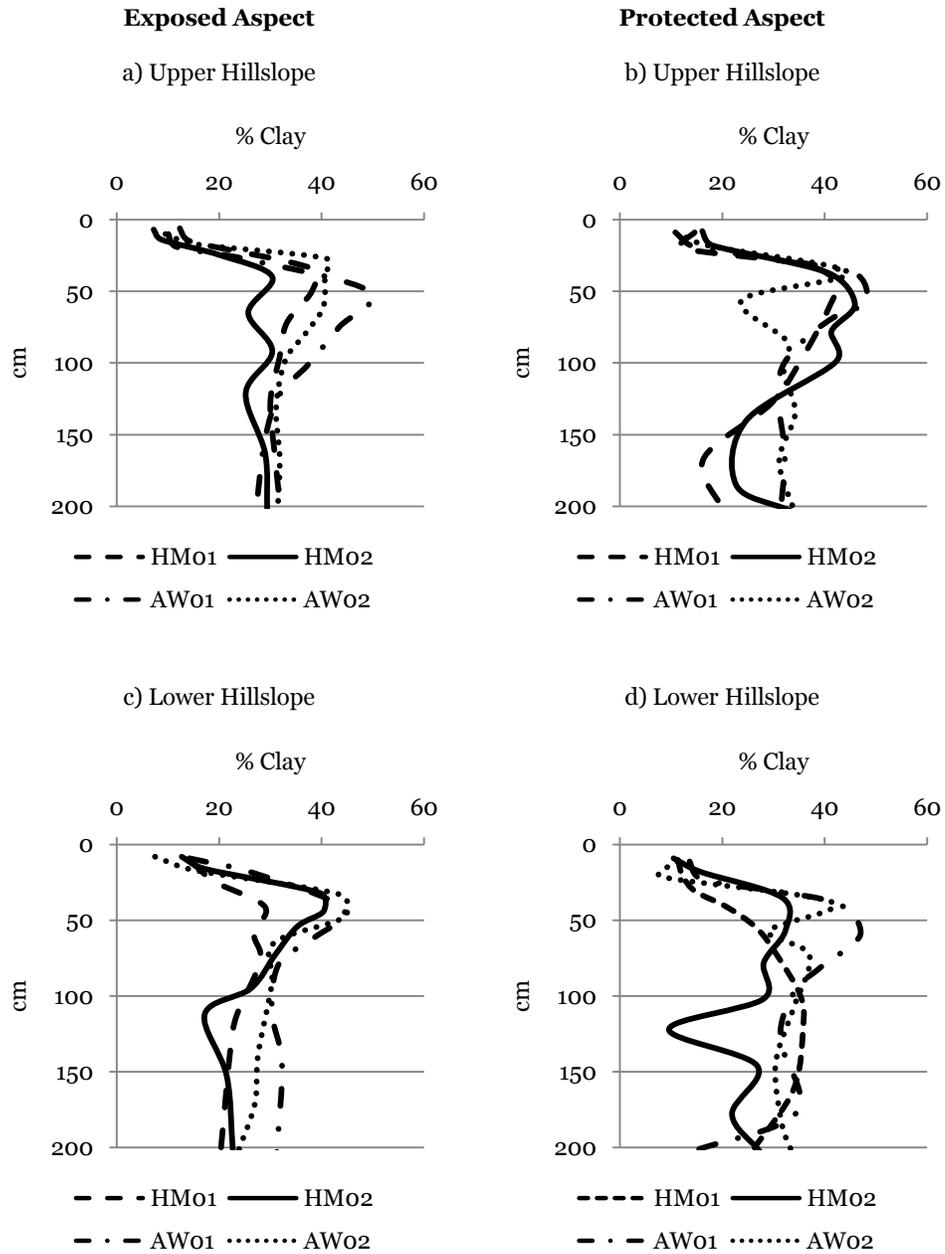


Figure 2.2 Depth distributions of percent clay for locations in the southern CRHES. Sites 1 and 2 of Hungry Mother Conservation Area (HM) and Atlanta Wildlife Area (AW) for a) exposed aspect, upper slope; b) protected aspect, upper slope; c) exposed aspect, lower slope; d) protected aspect, lower slope.

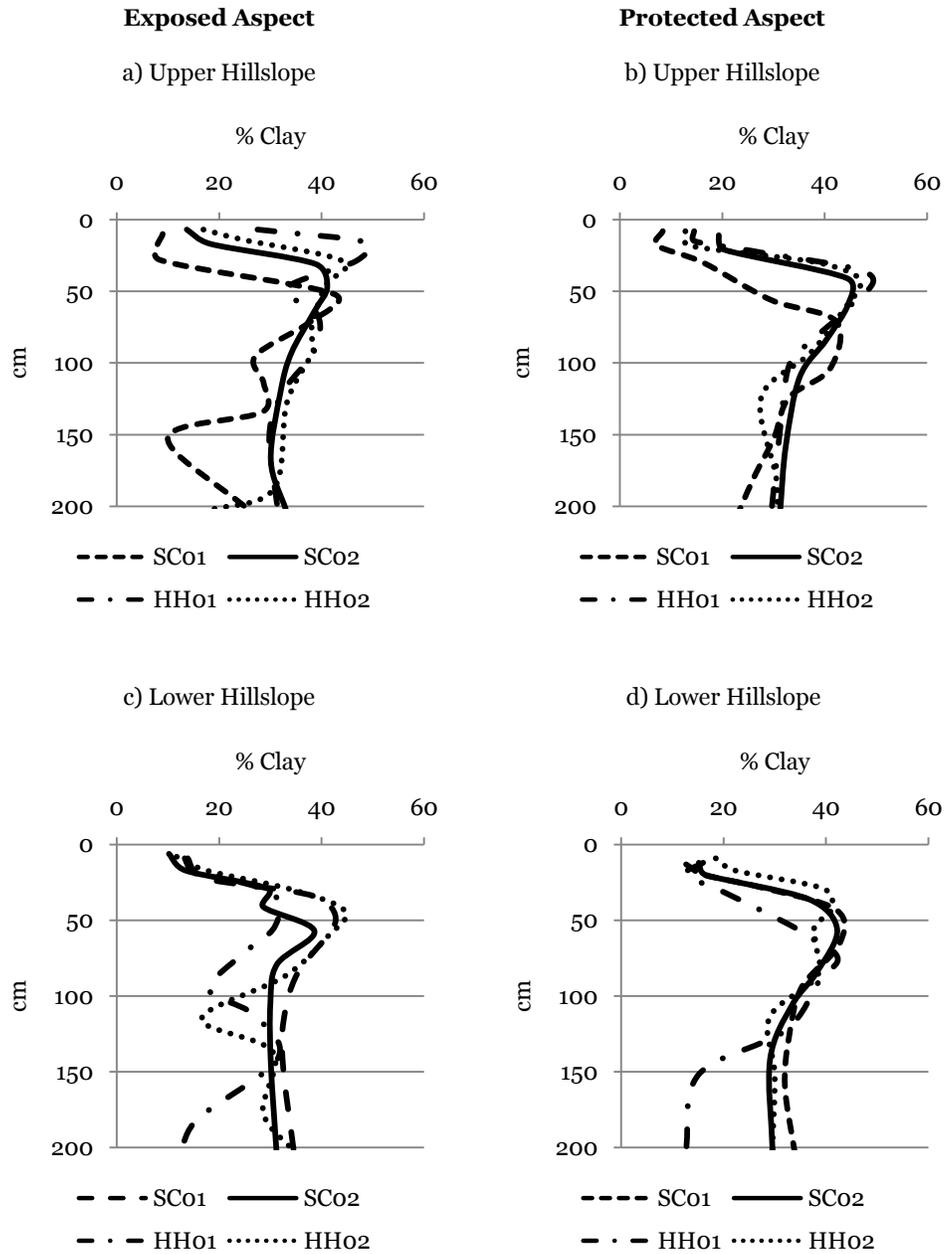


Figure 2.3 Depth distributions of percent clay for locations in the central CRHES. Sites 1 and 2 of Hidden Hollow Conservation Area (HH) and Sugar Creek Conservation Area (SC) for a) exposed aspect, upper slope; b) protected aspect, upper slope; c) exposed aspect, lower slope; d) protected aspect, lower slope.

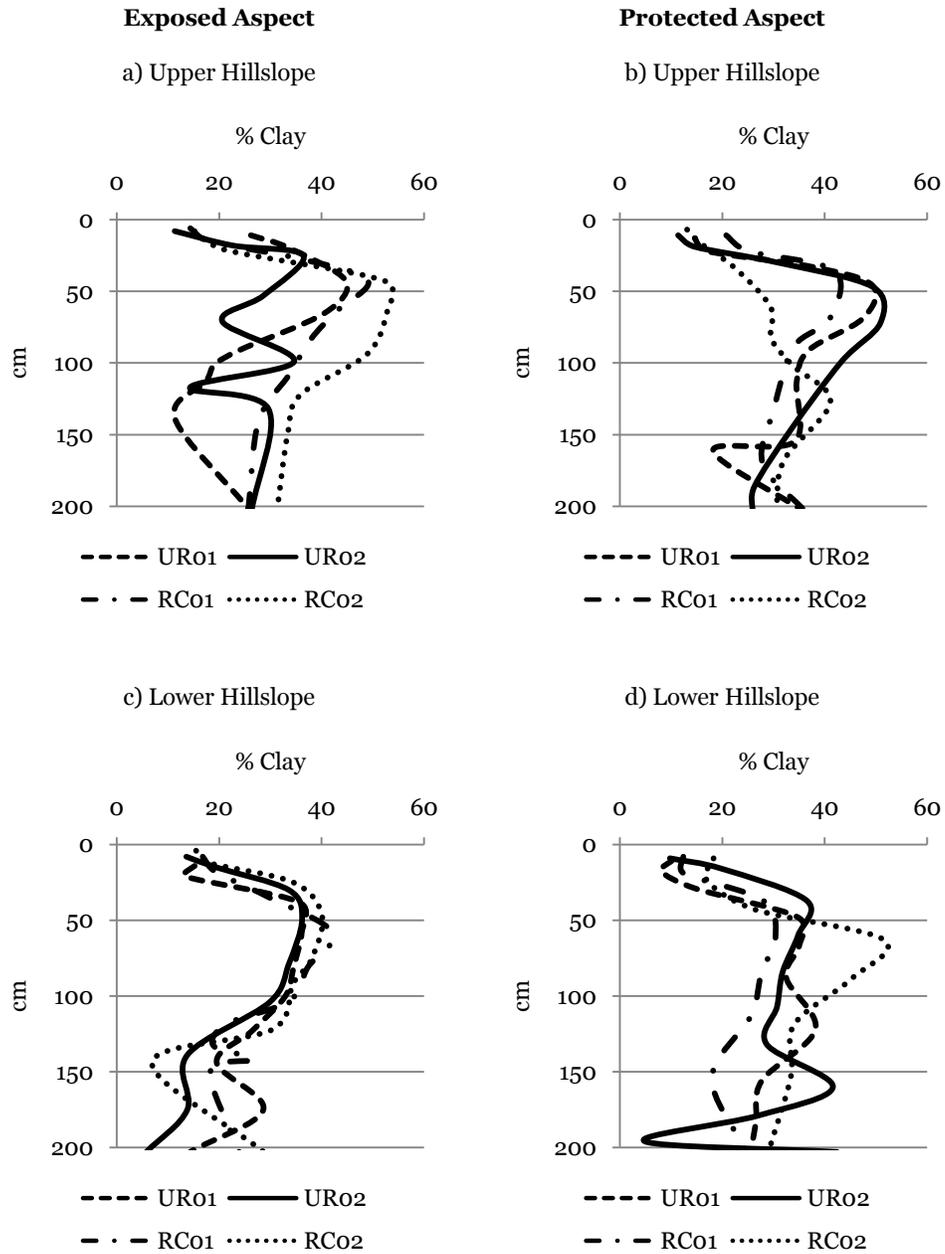


Figure 2.4 Depth distributions of percent clay for locations in the northern CRHES. Sites 1 and 2 of Union Ridge Conservation Area (UR) and Rebel’s Cove Conservation Area (RC) for a) exposed aspect, upper slope; b) protected aspect, upper slope; c) exposed aspect, lower slope; d) protected aspect, lower slope.

Five of the six sampling locations were mapped fine (>35% clay), however, nearly one-third of the sampled pedons taxonomically correlated as fine-loamy ($\leq 35\%$ clay). Regional trends in the distribution of fine-loamy soils were not clear among locations (Table 2.1).

Table 2.1 Taxonomic family distribution of soil pedons by sampling location (listed from south to north).

Taxonomic Family	Hungry Mother	Atlanta Wildlife	Hidden Hollow	Sugar Creek	Union Ridge	Rebel's Cove	Total
Fine	4	7	6	6	4	6	33
Fine-loamy	4	1	2	2	4	2	15

Average percent clay in the PSCS among locations was plotted among locations and demonstrated little variation as well, with the exception of Hungry Mother Conservation Area, which was mapped fine-loamy (Fig. 2.5). In addition, although Sugar Creek and Union Ridge demonstrate identical averages, the distribution of fine-loamy soils is more diverse at Union Ridge (Table 2.1). The average percent clay among pedons was 36 with a standard deviation of 5.4. Confidence intervals indicate that there are no significant differences for clay in the PSCS among locations, indicating that fine and fine-loamy soils co-exist in the CRHES and are not segregated to a particular area of the region.

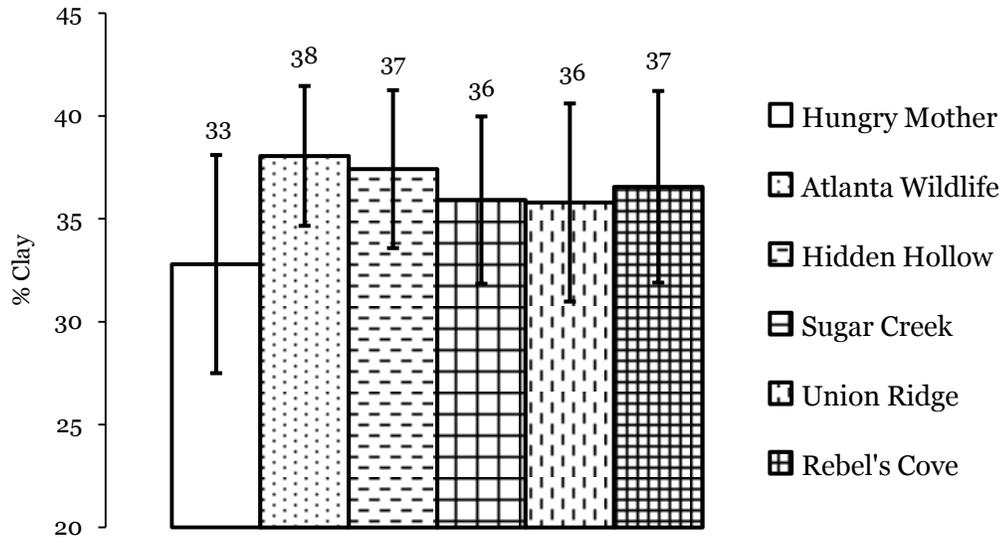


Figure 2.5 Average percent clay in the PSCS among locations (listed from south to north). Values represent means. Bars represent confidence intervals.

Despite a lack of clear regional trends, there was a distinct geomorphic effect on percent clay in the PSCS. Upper hillslope positions had marginally significant ($P=0.07$) increases in clay percentages when compared to lower hillslopes within each slope aspect (Fig. 2.6). These tendencies are confirmed by depth distributions of clay (Fig. 2.2- 2.4).

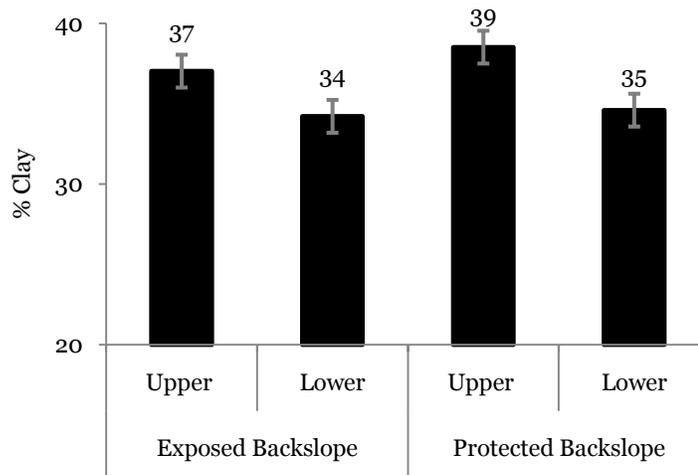


Figure 2.6 Average percent clay in the PSCS by landform position. The average percent clay is marginally significantly ($P=0.07$) greater on upper hillslope positions. Bars represent standard error.

The thickness of the epipedon (defined for communication as the A, E, and transitional horizons above the argillic horizon) appears greater on protected aspects (due to a bimodal distribution by slope aspect the model was not run) (Fig. 2.7 a). Analysis of the depth to the clay maximum showed a similar trend with significantly ($P=0.01$) greater depths on protected aspects (Fig. 2.7 b). These results are in agreement with topographic variation of soils in the Allegheny Plateau of Ohio (Finney et al., 1962).

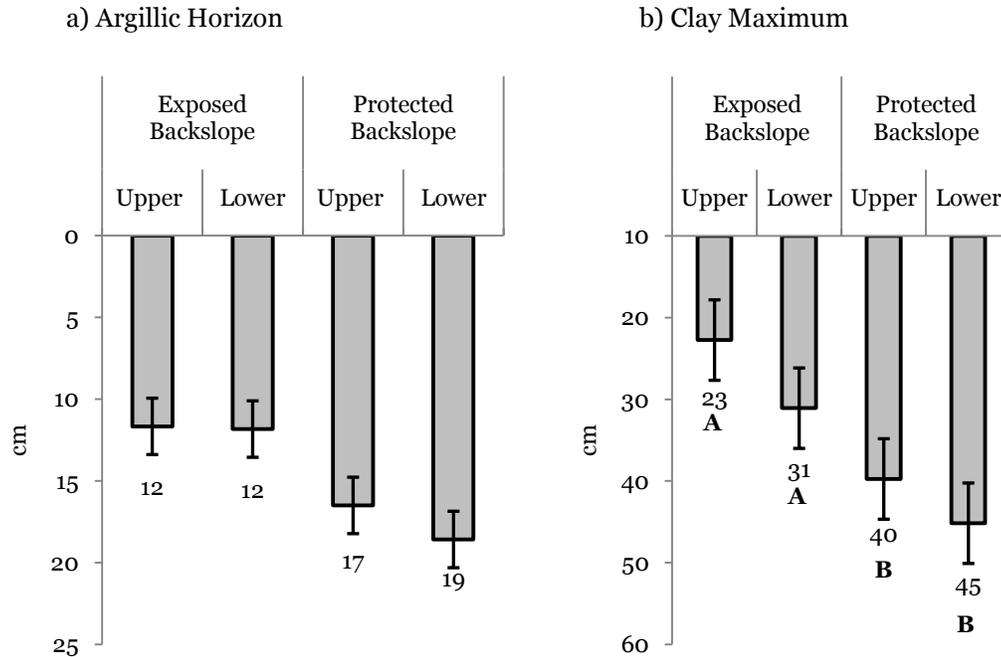


Figure 2.7 a) Average depth to the top of the argillic horizon and b) Average depth to the clay maximum by geomorphic position. The average depth to the argillic horizon was bimodally distributed by slope aspect and could not be modeled. The average depth to the clay maximum is significantly ($P=0.01$) deeper on protected aspects. Letters denote unique populations by slope aspect ($P<0.05$). Bars represent standard error.

The overall effect of slope aspect is dependent on the energy and moisture needs and limitations of the pedogenic processes on the slopes (Schaetzl and Anderson, 2005). Increased depths to the argillic and clay maximum may be influenced from increased water movement on protected aspects. To understand the distribution of clay throughout the profile, average clay percentages of three defined areas of the soil profile were analyzed (Fig. 2.8). These areas include: the epipedon (defined for communication as the surface to the top of the argillic

horizon), upper subsoil (top of the argillic horizon to its midpoint), and lower subsoil (midpoint of the argillic horizon to a depth of 205 cm). Results indicate that, overall, clay decreases in the lower subsoil (Fig. 2.2-2.4) and clay percentages do not vary significantly with aspect (Fig. 2.8 b, c). Increased radiation, soil temperature, and faunal (micro and macro) activity is producing a thinner epipedon on exposed aspects. On protected aspects, cooler temperatures and increased effective moisture are contributing to increased depths to the argillic and the clay maximum within the profile.

Results from clay distributions throughout various components of the profile (Fig. 2.8) demonstrate similar patterns to clay in the PSCS (Fig. 2.6) and reveal that there is significantly ($P=0.03$) more clay on upper hillslope positions in the upper subsoil due to variation in geomorphic effects (Fig. 2.8 b). Clay was also marginally significantly ($P=0.05$) greater in the lower subsoil on upper hillslope positions as well (Fig. 2.8 c).

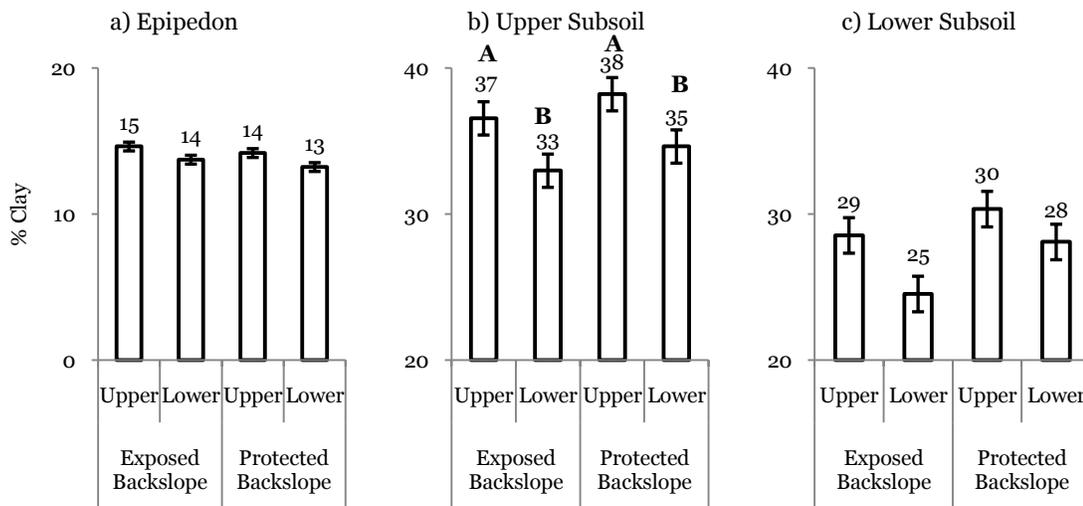


Figure 2.8 Weighted averages of clay fractions in the a) epipedon, b) upper subsoil, and c) lower subsoil in relation to slope aspect and hillslope position. In the upper subsoil clay is significantly ($P=0.03$) higher on upper hillslope positions. In the lower subsoil, clay is nominally ($P=0.05$) higher on upper hillslope positions. Bars represent standard error. Letters denote unique populations by hillslope position for a given aspect ($P<0.05$).

These results confirm that there was more clay in the argillic horizon on upper hillslope positions. One of the contributing factors to this phenomenon may be from influences of the Yarmouth-Sangamon (YS) paleosol. The YS paleosol is a thick welded solum present in stable

landscape positions of northern Missouri and southern Iowa (Ruhe, 1956; Guccione, 1983; Woida and Thompson, 1993). Morphologically, on uplands, this solum is characterized as a clay-rich, red-brown, oxidized B horizon on uplands (Frye et al., 1960 a; b). In the CRHES, soils on more gently sloping summit and shoulder landforms are formed in the YS paleosol (i.e., Gorin and Keswick; Soil Survey Staff, 2011). Therefore, it may be possible that as surfaces have eroded (Fig. 2.9), previous clay enrichment from the YS paleosol is influencing the amount of clay present in argillic horizons of upper hillslope positions (Fig. 2.6; 2.8), and providing evidence of greater stability over time (Fig. 2.9).

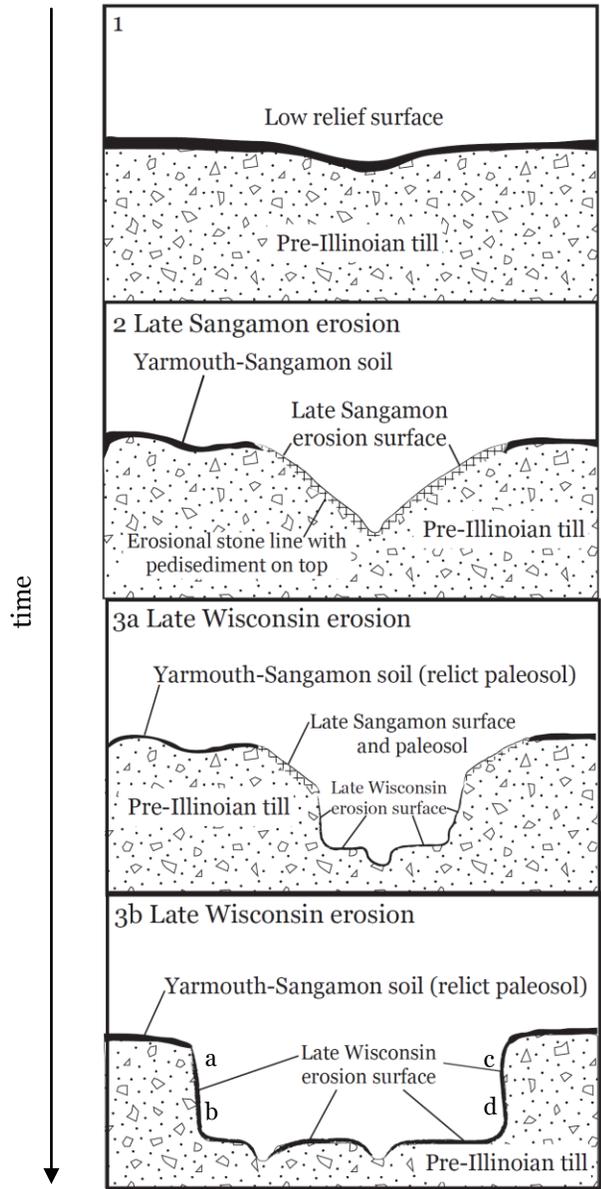


Figure 2.9 Diagrammatic representations of erosional surfaces of northern Missouri in cross section view. Attempt is made to show the evolution of these surfaces through time with window 1 being the oldest landscape configuration. Attempt is also made to depict idealized locations for study plots in window 3b: a) protected aspect, upper hillslope; b) protected aspect, lower hillslope; c) exposed aspect, upper hillslope; d) exposed aspect, lower hillslope. Adapted from Schaetzl and Anderson, 2005.

Additionally, increased effective moisture on lower hillslope positions may be causing clays to translocate at an increased rate on these positions. Decreased clay percentages in the lower subsoil when compared to the upper (Fig. 2.8 b, c) indicates that clays are either

translocating out of the landscape laterally or remaining somewhat stable. Due to the law of superposition we can conclude that upper hillslope positions are older than lower slope positions and clay translocation for longer periods. Clay stability over time on these positions may have been intensified by uptake of water by tree roots, thus plating clay in the soil profile.

A final hypothesis for variation in clay by hillslope position is differences in till stratigraphy. Rovey and Kean (1996) have described and named at least five distinct till formations in northern Missouri. Variation in glacial till formations can be quantified at times by differences in soil texture and clay mineralogy (Rovey and Kean, 1996), therefore, textural differences from upper to lower hillslope positions could be from dissection into a different till (Fig. 2.9). Further study of clay mineralogy and analysis of the coarse fraction may enable verification of the glacial till formation(s) in this study area.

One of the most limiting factors to tree growth is available water capacity (Fisher and Binkley, 2000). Soil moisture has been found to be significantly influenced by slope aspect and hillslope position (Whittaker, 1956; Hack and Goodlet, 1960; Hanna, 1982). Analysis of estimated total available water capacity (depths of 205 cm) demonstrated that lower hillslope positions had significantly ($P=0.03$) greater estimated available water for plant growth when compared to upper hillslope positions (Fig. 2.10). Because available water capacity is related to soil texture, decreased clay content on lower hillslope positions was contributing to this occurrence.

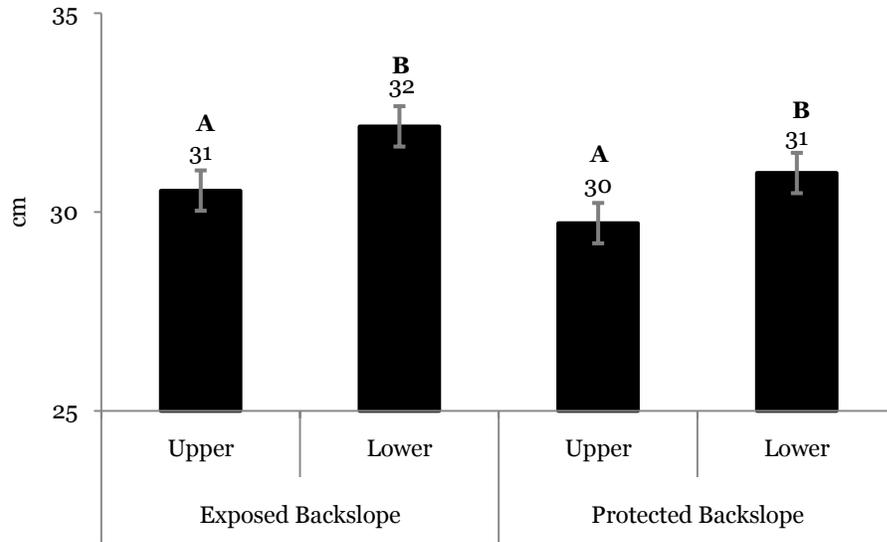


Figure 2.10 Estimated total available water capacity (cm) for pedons to a depth of 205 cm by geomorphic position. Bars represent standard error. Available water capacity is significantly greater ($P=0.02$) on lower hillslope positions. Letters denote unique populations by hillslope position for a given aspect ($P<0.05$).

2.5.2 Soil Chemical Properties

Analyses from this study demonstrate that most of the variations in soil properties were due to differences in local geomorphic effects, and that variability was expressed mostly in soil physical properties; however, differences in soil chemical properties occurred. Cation exchange capacity, which increases with clay, was significantly greater on upper hillslope positions both on upper and lower subsoil ($P=0.02$ and $P=0.04$, respectively; Fig. 2.11), which was in agreement with increased amounts of clay on upper hillslope positions for both the upper and lower subsoil (Fig. 2.8 b; c). Magnesium was greater on upper hillslope positions throughout the profile and was significantly ($P=0.04$) greater on upper hillslope positions in the upper subsoil (Table 2.2). This variation was most likely due to increased clay and CEC on upper hillslopes and was in agreement with positive correlations between CEC and Mg (Kabruck et al., 2011). Kabrick et al. (2011) also found similar relationships between CEC and Ca, however, our results did not match these trends. Correlations made in the study by Kabrick et al. (2011) were for pedologically older soils in the Missouri Ozarks with smaller nutrient supplies. Soils formed in glacial till of northern Missouri have a relatively greater nutrient status, and Ca levels were influenced more by the

presence of carbonates (CaCO_3) than by variation in clay (Table 2.2). Base saturation and hydrogen ion activity ($\{\text{H}^+\}$) were influenced similarly with nominally greater ($P=0.08$) percent BS on lower hillslope positions in the upper subsoil (Fig. 2.11), and decreased (becoming more basic) water and salt $\{\text{H}^+\}$ on lower hillslope positions of the upper subsoil ($P<0.01$ and $P=0.04$, respectively; Table 2.2).

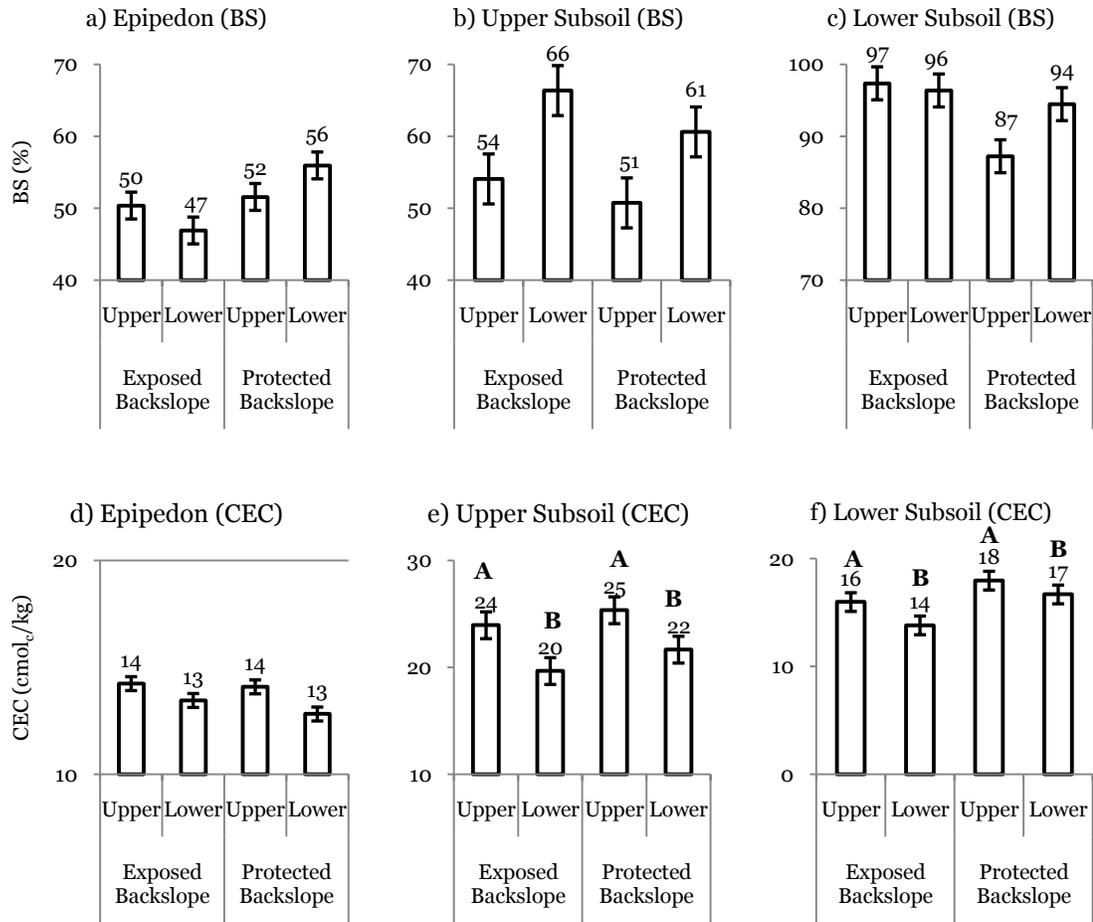


Figure 2.11 Weighted averages of base saturation (BS) (NH_4OAc) for the a) epipedon, b) upper subsoil, and c) lower subsoil and cation exchange capacity (CEC) (NH_4OAc) in the d) epipedon, e) upper subsoil, and f) lower subsoil by slope aspect and hillslope position. Letters denote unique populations by hillslope position for a given aspect ($P<0.05$). Bars represent standard error.

Table 2.2 Average values for select chemical and physical soil properties by geomorphic component.^{1, 2}

Soil Property		Exposed Backslope		Protected Backslope	
		Upper	Lower	Upper	Lower
Ca (cmol/kg)	Epipedon	6.56(±4.82)	5.57(±3.39)	6.50(±3.79)	6.47(±3.46)
	Upper	10.9(±7.93)	15.4(±8.85)	10.8(±7.61)	12.2(±6.27)
	Lower	34.2(±8.80)	35.9(±12.2)	28.5(±17.3)	32.2(±12.3)
Mg (cmol/kg)	Epipedon	1.35(±0.85)	0.93(±0.35)	1.19(±0.37)	1.13(±0.34)
	Upper	3.22(±1.21) A	2.07(±0.96) B	3.14(±1.11) A	2.35(±1.02) B
	Lower	4.19(±2.40)	3.26(±1.98)	4.00(±1.52)	3.50(±2.05)
K (cmol/kg)	Epipedon	0.29(±0.13)	0.26(±0.06)	0.23(±0.08)	0.22(±0.06)
	Upper	0.26(±0.07)	0.25(±0.08)	0.29(±0.07)	0.28(±0.05)
	Lower	0.18(±0.08)	0.16(±0.08)	0.20 (±0.07)	0.18(±0.07)
Na (cmol/kg)	Epipedon	0.01(±0.02)	0.01(±0.03)	0.01(±0.03)	0.01(±0.03)
	Upper	0.07(±0.04)	0.05(±0.05)	0.10(±0.03)	0.07(±0.05)
	Lower	0.29(±0.43)	0.14(±0.22)	0.29(±0.18)	0.17(±0.07)
{H ⁺ } (H ₂ O)	Epipedon	8.6x10 ⁻⁶	6.9x10 ⁻⁶	7.1x10 ⁻⁶	4.1 x10 ⁻⁶
		(±7.5x10 ⁻⁶)	(±5.0 x10 ⁻⁶)	(±5.7 x10 ⁻⁶)	(±5.3 x10 ⁻⁶)
	Upper	5.38 x10 ⁻⁶	3.12 x10 ⁻⁶	6.14 x10 ⁻⁶	3.44 x10 ⁻⁶
	subsoil	(±2.61 x10 ⁻⁶) A	(±1.98 x10 ⁻⁶) B	(±3.22 x10 ⁻⁶) A	(±1.31 x10 ⁻⁶) B
	Lower	1.65 x10 ⁻⁷	1.35 x10 ⁻⁷	9.02 x10 ⁻⁷	2.62 x10 ⁻⁷
	subsoil	(±2.87 x10 ⁻⁷)	(±3.74 x10 ⁻⁷)	(±1.45 x10 ⁻⁶)	(±4.67 x10 ⁻⁷)
{H ⁺ } (Salt)	Epipedon	2.45 x10 ⁻⁵	2.83 x10 ⁻⁵	2.17 x10 ⁻⁵	1.15 x10 ⁻⁵
		(±2.37 x10 ⁻⁵)	(±2.17 x10 ⁻⁵)	(±2.04 x10 ⁻⁵)	(±1.06 x10 ⁻⁵)
	Upper	2.32 x10 ⁻⁵	1.45 x10 ⁻⁵	2.72 x10 ⁻⁵	1.53 x10 ⁻⁵
	subsoil	(±1.30 x10 ⁻⁵) A	(±7.45 x10 ⁻⁶) B	(±1.38 x10 ⁻⁵) A	(±7.42 x10 ⁻⁶) B
	Lower	6.26 x10 ⁻⁷	6.17 x10 ⁻⁷	3.43 x10 ⁻⁶	1.09 x10 ⁻⁶
	subsoil	(±1.08 x10 ⁻⁶)	(±1.86 x10 ⁻⁶)	(±4.74 x10 ⁻⁶)	(±1.97 x10 ⁻⁶)
Db (g/cm ³)	Epipedon	1.22(±0.15) A	1.31(±0.10) B	1.18(±0.16) A	1.30(±0.23) B
	Upper	1.52(±0.08)	1.55(±0.06)	1.51(±0.07)	1.54(±0.08)
	Lower	1.72(±0.10)	1.67(±0.10)	1.69(±0.07)	1.67(±0.09)
Sand (%)	Epipedon	42(±11) A	47(±6) B	33(±12) A	43(±14) B
	Upper	32(±9)	35(±8)	29(±6)	33(±11)
	Lower	36(±8)	37(±9)	36(±8)	39(±12)
Silt (%)	Epipedon	43(±9)	39(±6)	53(±12)	44(±12)
	Upper	31(±6)	32(±6)	33(±3)	32(±9)
	Lower	36(±6)	39(±11)	33(±6)	33(±8)
TOC		90.4(±13.0)	109.1(±36.3)	96.2 (±15.7)	110.6(±34.8)

¹Standard deviation is given in parentheses.

²Letters denote unique populations by hillslope position for a given aspect (P<0.05).

Extractable cations such as Mg, Na, and especially Ca were greater in the lower subsoil (Table 2.2). These increases are reflected by percent BS which demonstrates averages reaching nearly 100% in the lower subsoil and by {H⁺} decreases (becomes more basic) in the lower subsoil (Fig. 2.11; Table 2.2). These results were in agreement with descriptions of carbonates in the lower parts of the profiles.

One of the most common forms of pedogenic (secondary) carbonates are finely disseminated films and threads (Rabenhorst et al., 1984; West et al., 1988). All pedons that reacted to 1N HCl (44 of 48 pedons) also had soft masses of carbonates described in their profiles, and half (22 of 44 pedons) of these, had finely disseminated carbonate threads described on ped faces that were dendritic in nature; these results, along with the presence of a udic soil moisture regime and mesic soil temperature regime, provide evidence that carbonates have leached through previously calcareous overlying material, precipitating into lower parts of the profile as finely disseminated threads and soft masses. Norton et al. (1983) came to a similar conclusion when studying Pre-Illinoian glaciation in Ohio.

Analyses of the depth to carbonates and were not significantly different by geomorphic component (Fig. 2.12). To determine if accumulations of secondary carbonates were related to clay in the argillic horizon, a regression analysis was performed to assess variation of clay in the PSCS with depth to carbonates and depth to the carbonate maximum. Results from these regressions were not significant, providing evidence that the leached-calcareous boundary was not related to clay distribution for soils in this study. In this case, the relatively increased water solubility of carbonates (in contrast to clay-sized particles) and the age and stability of the glacial till may be influential, as the average depth to carbonates was greater than average depths to the argillic horizon or to the clay maximum (Fig. 2.12; Fig. 2.8 a, b).

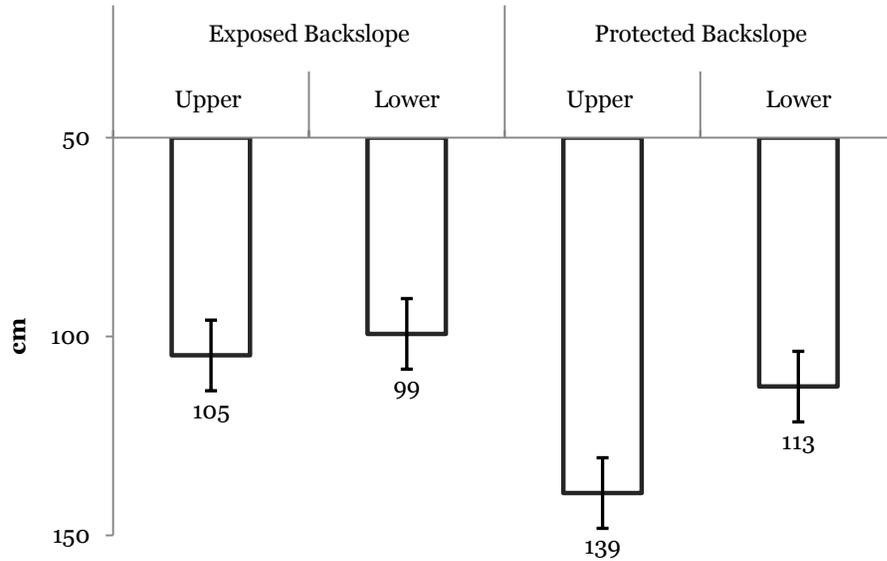


Figure 2.12 Average depths to carbonates by geomorphic component. Bars represent standard error.

2.5.3 Vegetation

Variation in soil properties from the influence of geomorphic effects is reflected by differences in species composition. Trees per hectare and basal area results provide support that local geomorphic effects are important to vegetation-site relationships in the CRHES (Table 2.3). Trees per hectare were significantly greater ($P=0.03$) on upper hillslope positions for white oak and marginally significantly increased ($P=0.08$) on exposed slope aspects (Table 2.3). Hickory species follow similar trends as white oak with a significantly greater ($P=0.04$) number of trees on upper hillslope positions. For red oak species, trees per hectare appear greater on lower hillslope positions and protected aspects (Table 2.3). Shade-tolerant oak competitor species such as white ash (*Fraxinus americana* L.) and eastern hophornbeam (*Ostrya virginiana* (Mill.) K. Koch)) showed similar trends to red oak species (Table 2.3). Basal area per hectare trends for species groups are similar to those found in the trees per hectare parameter (Table 2.3) with white oak species having significantly greater ($P=0.04$) basal area on exposed slope aspects.

Results follow silvicultural trends, with northern red oak reportedly more abundant in coves or lower north-facing slopes where the supply and through flow of water is generally greater (Sander, 1990; Johnson et al., 2009) and white oak tending to be more general in its distribution

with respect to site factors (Rogers, 1990). Species that are in competition with oaks (i.e., white ash, eastern hophornbeam, and other species groups) tend to be more abundant on lower hillslope positions and protected slope aspects.

Table 2.3 Average trees per hectare and basal area for species groups by geomorphic component.^{1,2}

Vegetation Parameter	Exposed Backslope		Protected Backslope	
	Upper	Lower	Upper	Lower
Trees per Hectare				
White Oak Spp.	443 (±248) A	380 (±190) B	358 (±197) A	210 (±138) B
Red Oak Spp.	48 (±42)	71 (±76)	84 (±77)	60 (±46)
Hickory Spp.	44 (±25) A	30(±21) B	58 (±38) A	43 (±39) B
White Ash	18 (±29)	30 (±30)	49 (±99)	57 (±85)
Eastern Hophornbeam	178 (±191)	229 (±201)	225 (±299)	313 (±245)
Other Spp.	26 (±31)	35 (±39)	35 (±22)	38 (±41)
Elm Spp. ³	5 (±17)	22(±32)	21 (±39)	21 (±29)
Basal Area (m²/hectare)				
White Oak Spp.	19.5 (±9.1) A	19.8 (±7.1) A	16.2 (±6.8) B	12.2 (±8.4) B
Red Oak Spp.	2.9 (±3.2)	5.4 (±5.4)	5.4 (±5.2)	6.6 (±6.0)
Hickory Spp.	0.7 (±0.9)	0.6 (±1.0)	1.1 (±1.3)	0.9 (±1.3)
White Ash	0.3 (±0.9)	0.2 (±0.2)	0.8 (±2.1)	1.1 (±2.2)
Eastern Hophornbeam	0.4 (±0.4)	0.5 (±0.4)	0.6 (±0.8)	0.7 (±0.6)
Other Spp.	0.2 (±0.4)	0.1 (±0.1)	0.3(±0.4)	0.4 (±1.0)
Elm Spp. ³	<0.1 (±0.1)	0.1 (±0.2)	0.1 (±0.2)	0.2 (±0.4)

¹ Standard deviation is given in parentheses.

² Letters denote unique populations by aspect or by hillslope position for a given aspect (P<0.05).

³ *Ulmus spp.* L.

It is unclear whether variation in species composition was related to variation in soil morphology and genesis or if it was influenced more by differences in geomorphic effects. A regression analysis of parameters such as trees per hectare and basal area per hectare for species groups (i.e., white oak species, red oak species, white ash, and eastern hophornbeam) with site variables such as percent clay, percent silt, base saturation, estimated available water capacity, and total organic carbon provided no significant results (Table 2.4); thus indicating that local geomorphic effects were likely more influential to variation in species composition than differences in soil properties.

Table 2.4 Regression coefficients for vegetation response variables with site variables¹ for the epipedon, upper subsoil, and lower subsoil.

Response Variables ¹	DF	F-Value	P-Value	R ²
Trees per Hectare				
White Oak Spp.				
Epipedon	(6-1)	0.9	0.5	-0.01
Upper subsoil	(6-1)	0.9	0.5	-0.02
Lower subsoil	(6-1)	1.0	0.4	-0.001
Red Oak Spp.				
Epipedon	(6-1)	0.8	0.6	-0.03
Upper subsoil	(6-1)	0.4	0.9	-0.09
Lower subsoil	(6-1)	0.3	1.0	-0.1
White Ash				
Epipedon	(6-1)	0.2	1.0	-0.1
Upper subsoil	(6-1)	0.2	1.0	-0.1
Lower subsoil	(6-1)	0.5	0.8	-0.07
Eastern Hophornbeam				
Epipedon	(6-1)	1.5	0.2	0.06
Upper subsoil	(6-1)	1.4	0.2	0.05
Lower subsoil	(6-1)	0.7	0.6	-0.03
Basal Area per Hectare (m ² /ha)				
White Oak Spp.				
Epipedon	(6-1)	0.5	0.8	-0.07
Upper subsoil	(6-1)	0.2	1.0	-0.1
Lower subsoil	(6-1)	0.3	1.0	-0.1
Red Oak Spp.				
Epipedon	(6-1)	0.6	0.7	-0.06
Upper subsoil	(6-1)	0.2	1.0	-0.1
Lower subsoil	(6-1)	0.4	0.9	-0.08
White Ash				
Epipedon	(6-1)	0.6	0.8	-0.06
Upper subsoil	(6-1)	0.5	0.8	-0.07
Lower subsoil	(6-1)	0.8	0.6	-0.03
Eastern Hophornbeam				
Epipedon	(6-1)	1.5	0.2	0.06
Upper subsoil	(6-1)	1.5	0.2	0.05
Lower subsoil	(6-1)	0.8	0.6	-0.03

¹Variables examined for each response variable include: total percent clay (epipedon, upper subsoil, lower subsoil), total percent silt (epipedon, upper subsoil, lower subsoil), percent base saturation (NH₄OAc) (epipedon, upper subsoil, lower subsoil), total available water capacity (cm), total organic carbon (MG/ha), and average percent clay in the PSCS for given species within a given parameter.

2.6 SUMMARY AND CONCLUSION

Microclimatic effects of slope aspect and hillslope position to soil property variability have been well documented (Franzmeier et al., 1960; Daniels et al., 1971; Hutchins et al., 1976; Lepsch et al., 1977; Desta et al., 2004). Varying geomorphic and pedological factors and processes have influenced the current landscape of the CRHES, and many of the soil physical and

chemical properties examined in this study exhibit differences related to slope aspect and hillslope position. Interestingly, most of the variation in soil properties was reflected in soil physical properties, and most were a result of differences in hillslope position. It is currently unclear why there is greater variation among hillslope positions; however, evidence supports that clay enrichment from the YS paleosol may have influenced increased clay on more stable upper hillslope positions. To address whether differences in glacial till formations exist, further study, including locating and verifying the YS paleosol and quantification of the clay mineralogy and the coarse fraction would be necessary.

Some effects of slope aspect were evident in soil properties; for example, stability of the soils formed on protected slope aspects was indicated by greater depths to the argillic, clay maximum, and carbonates on these positions. Results demonstrate that increased solar radiation (i.e., less erosion, decomposition, and bioturbation) was likely influencing this occurrence on exposed aspects. In contrast, increased depths to the argillic and clay maximum on protected aspects were likely caused by increased effective moisture and decreased soil temperatures.

Soil property variation by hillslope position and slope aspect were further reflected in the vegetation through species composition. However, regression analyses with vegetation and soil properties demonstrate that influences from local geomorphic components are more influential to variation of vegetation dynamics than differences in soil properties.

Regardless of the source of variation, significant differences exist in soil properties and vegetation in the CRHES of northern Missouri. Recognition of the role that local geomorphic factors play on vegetation-site relationships will remain an important consideration for refinements to the National Cooperative Soil Survey and other land classification systems, especially during the development of landform-scale management tools such as ESDs and ELTs. This study has also provided a useful study design and statistical model that will be well suited for future studies with goals of assessing spatial variability and vegetation-site relationships within a physiographic region. Future study of the glacial stratigraphy as well as determinations of the clay mineralogy and coarse fraction would help to determine variation in glacial till formation.

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3 REGIONAL AND GEOMORPHIC INFLUENCE ON THE PRODUCTIVITY, COMPOSITION, AND STRUCTURE OF OAK ECOSYSTEMS IN THE CHARITON RIVER HILLS

3.1 ABSTRACT

The steeply dissected glaciated landscapes of the Chariton River Hills Ecological Subsection (CRHES) in northern Missouri have extensive but largely unmanaged oak forests that are relatively under studied. There is increasing interest in these forests for oak ecosystem restoration, ecological site description, and the production of oak timber for biofuels. Our objectives were to determine how productivity, composition, and structure varied across the CRHES and locally by hillslope position and slope aspect. We inventoried vegetation and soils at 48 sites on upper and lower hillslope positions paired by northeast- and southwest-facing slope aspect classes on six minimally disturbed sites across the CRHES. Among locations, the site index of the two most abundant species ranged from 16-18 m (white oak) or 16-19 m (northern red oak) and was significantly greater ($P=0.01$ to 0.1) on north-facing aspects and lower hillslope positions. White oak stocking was greater ($P=0.01$) on southwest-facing slope aspects and on upper slopes ($P=0.2$). These oak species comprise the majority of the overstory; however ironwood, blackhaw, white ash, and other species comprise most of the understory and in particular the large advance reproduction layer. Meeting oak ecosystem restoration or oak regeneration objectives will require the application of prescribed fire or other disturbances to reduce the understory density to provide growing space for a variety of woodland ground flora and oak seedlings, particularly on lower northeast-facing slopes.

3.2 INTRODUCTION

Geomorphic factors such as the land surface shape, slope position, and slope aspect have long been recognized to influence soil properties as well as forest composition and productivity (Carmean, 1975; Pregitzer et al., 1983; Hicks and Frank, 1985; Fu et al., 2004) particularly in landscapes having steep slopes and a high degree of topographic relief. The Chariton River Hills Ecological Subsection (CRHES) within the Iowa and Missouri Heavy Till Plain Major Land

Resource Area (MLRA) is characterized by its steep slopes and extensive oak forests covering a large portion of northern Missouri (Fig. 3.1). The CRHES has the greatest topographic relief of interior northern Missouri (up to 75 m), and is bordered on the east and west by more gently-sloping lands predominantly used for agriculture. However, the forests in the CRHES are largely unmanaged and consequently little is known about their productivity, structure, and composition.

There is increasing interest in the forests of the CRHES by private land owners and public land management agencies for restoring oak forests and woodlands and for producing oak timber and biofuels. In addition, the USDA Natural Resources Conservation Service (NRCS) has an interest in improving the understanding of the vegetation-site relationships in this MLRA to develop ecological site descriptions (ESDs) and for updating the National Cooperative Soil Survey. Ecological site descriptions are a level of ecological land classification analogous to ecological landtypes (ELTs) used by the U.S. Forest Service. Geomorphic factors are important site-level determinants of site productivity and species composition used in both of these classification systems. Our study objectives were to determine how the productivity, composition, and structure of oak ecosystems vary regionally across the CRHES and locally by slope position and slope aspect.

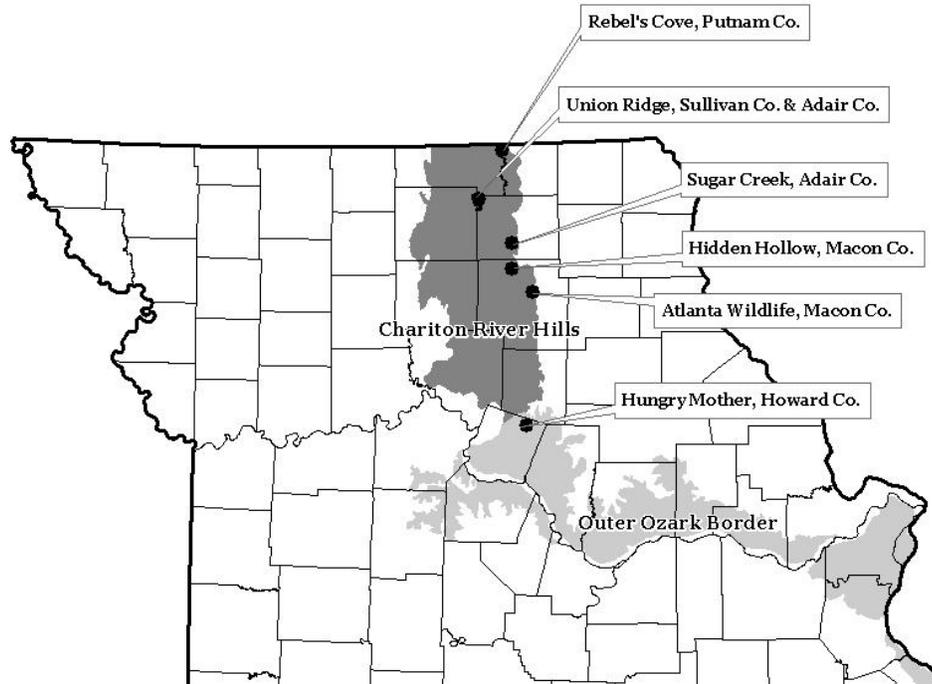


Figure 3.1 Chariton River Hills Ecological Subsection in Missouri (dark gray); Outer Ozark Border (light gray); filled black circles indicate project locations listed from south to north: Hungry Mother Conservation Area (CA), Atlanta Wildlife Area, Hidden Hollow CA, Sugar Creek CA, Union Ridge CA, and Rebel's Cove CA. (Nigh and Schroeder, 2002).

3.3 STUDY AREA

Six sites (Fig. 3.1) were selected from central Missouri north to the Missouri-Iowa border. Sites were selected based upon satisfying a number of criteria including (1) locality within or near the CRHES, (2) similarity of soils and topography, (3) accessibility, (4) a lack of recent harvesting, burning, or other anthropogenic disturbances, and (5) a high degree of ecological integrity. Consequently, all six sites were located on land owned by the Missouri Department of Conservation. All sites, except Hungry Mother Conservation Area were within the CRHES. The site at Hungry Mother Conservation Area was included because its soils and physiography more closely resembled that of the CRHES.

Study soils included the soil series Winnegan and Lindley. These soils were benchmark series due to their ecological significance and large mapping extent. Winnegan and Lindley soils are formed in calcareous Pre-Illinoian (2.5 million to 500,000 years ago) glacial till, and developed under humid climate conditions. Distinguishing characteristics of these soils include a

well-expressed argillic horizon and soft masses of calcium carbonate commonly found in the lower part of the profile (Soil Survey Staff, 2011). Differences between these soil series are slight. Winnegan soils are classified as very deep, moderately well drained, fine, Oxyaquic Hapludalfs, and Lindley soils are classified as well drained, fine-loamy, Typic Hapludalfs. These soils presently support central hardwood species such as white oak (*Quercus alba* L.), black oak (*Quercus velutina* Lam.), northern red oak (*Quercus rubra* L.), and species of hickory (*Carya* L. spp.).

Pre-European settlement vegetation of the study area was largely fire-adapted woodlands, with forests on steeper slopes and narrower valleys (Nigh and Schroeder, 2002). Schroeder (1982) found that the presence of an intricate pattern of prairie and forests in Missouri was a major factor in the richness of wildlife in presettlement Missouri, and that the CRHES had the most intricate prairie-forest pattern in the state. Conversion of uplands for agricultural production began in the late 1800s (Schroeder, 1982). Agricultural and developmental pressures have depleted much of the original forested structure in northern Missouri, and many once forested slopes are now cleared for grazing. The current landscape is mostly pasture with many tracts of second growth oak-hickory forest on the steepest areas (Nigh and Schroeder, 2002), which contain soil map units with either Winnegan or Lindley soil series as the dominant component.

3.4 METHODS

To encompass forested portions of the CRHES that were affected by differences in slope aspect, sampling was done on two slope positions (upper and lower hillslope positions of backslopes, (slopes >15%) two slope aspects [protected (north to northeast-facing) and exposed (south to southwest-facing)] at two randomly-located sites within each of the six locations (Conservation Areas) for a total of 48 samples. Plots were not placed on neutral aspects (115 to 155° and 295 to 335°).

Woody vegetation was inventoried in each slope position/aspect class/site combination within nested, concentrically-located vegetation plots. Trees 3.8 cm d.b.h. or greater were

inventoried in a circular 0.05-hectare plot and trees less than 3.8 m d.b.h but greater than 0.5 m tall were inventoried in a circular 0.005-hectare subplot by height classes: 0.5-0.9 m, 0.9-1.4 m, and >1.4 m. Trees up to 0.5 m tall were inventoried in a 0.00125-hectare subplot.

Site index data were collected on overstory plots by sampling up to three trees of each of the most abundant tree species present: white oak, or northern red oak. Trees selected were: 1) dominant or codominant, 2) having no indication of being open grown, and 3) no indications of suppression (Carmean et al., 1989). For selected trees, height was estimated using a clinometer and the age at d.b.h. was determined from a single core sampled with an increment borer 1.4 m above ground. Site index was computed using equations formulated for forest tree species in the eastern US (Carmean et al., 1989) and parameters from oak species in Missouri (McQuilkin, 1974; 1978). Trees per hectare and basal area per hectare were calculated and used to determine percent stocking (Gingrich, 1964; 1967).

To quantify site variables, a soil pit was excavated within each overstory plot to a depth of 205 cm; genetic horizons were then morphologically delineated and described in detail according to the NRCS Soil Survey standard methods (Schoeneberger et al., 2002; Soil Survey Division Staff, 1993). Soil samples were collected from each horizon for soil characterization analysis in the University of Missouri Soil Characterization Laboratory and some data are presented in Table 3.1. Data on the landscape and hillslope position information (e.g., percent slope, aspect, slope morphometry) were also recorded at each plot.

Table 3.1 Summary of average values for select site variables by diagnostic horizon for the epipedon (0 inches to the top of the argillic horizon), upper and lower subsurface horizons (divided at the midpoint from the top of the argillic horizon to a bottom depth of 205 inches).¹

Profile	Text.	Clay	Sand	AWC	CEC [†]	Ca [†]	Mg [†]	K [†]	BS	pH
Area	Class	(%)	(%)	(cm)					(%)	(H ₂ O)
Epipedon	Loam	14	41	2.8	14	6.3	1.2	0.25	51	5.2
		±4.2	±12	±1.3	±3.9	±3.8	±0.53	±0.09	±19	±0.52
Upper subsoil	Clay	36	33	11	23	12	2.7	0.27	58	5.2
	loam	±5.1	±8.6	±2.2	±4.1	±7.7	±1.2	±0.07	±16	±0.65
Lower subsoil	Clay	28	37	18	16	33	3.7	0.18	94	7.3
	loam	±4.9	±9.2	±2.0	±2.7	±13	±2.0	±0.08	±11	±0.91

¹ Standard deviation values are given below each average.

[†] Units are expressed in (cmol_c/kg).

To examine the effects of slope aspect and slope position, data were analyzed using the MIXED procedure (Statistical Analysis Software, SAS Version 9.2, Copyright © 2002-2008, SAS Institute Inc., Cary, NC, USA). Data were checked for normality prior to analysis and were transformed if necessary. Data that could not be normalized or fit were not analyzed. We used a hierarchical linear mixed model with aspect and slope position as nested, crossed, fixed effects and location and site within locations as random effects. This model tested the effect of aspect or slope position using the aspect*slope position*location interaction. We also examined regional differences in site index using the REG procedure (Statistical Analysis Software, SAS Version 9.2, Copyright © 2002-2008, SAS Institute Inc., Cary, NC, USA) by including variables percent clay, percent silt, available water capacity, cation exchange capacity, and percent base cation saturation averaged by site.

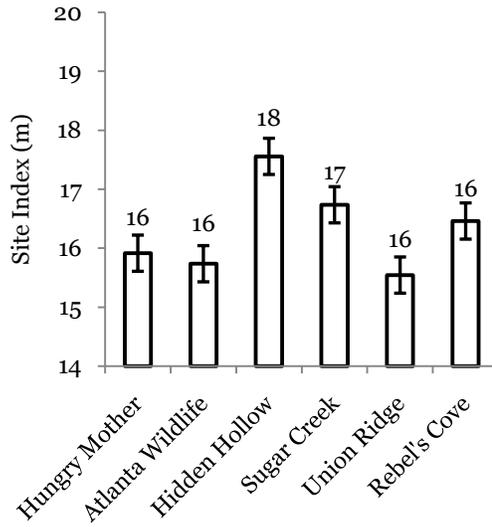
3.5 RESULTS

3.5.1 Site Productivity

Across the CRHES, white oak and northern red oak site index ranged from 16 to 18 m (white oak) and 16 to 19 m (northern red oak) (Fig. 3.2). The site index was slightly lower on the southern and northern-most locations but a regression analyses between site index and site

variables (percent clay, percent silt, available water capacity, cation exchange capacity, and percent base cation saturation) did not show significant relationships suggesting some other cause for regional differences. We observed that sites with lower site index values had older, slower-growing trees (particularly the white oaks) including Hungry Mother (average age 128 years), Atlanta Wildlife (average age 88 years), and Union Ridge (average age 85 years) suggesting that the site index may have been underestimated. Despite the lack of regional trends, there was a distinct geomorphic effect on the site index. Site indices for white oak were significantly greater on protected slope aspects ($P < 0.01$). On lower slope positions, site index values for white oak were nominally greater ($P = 0.1$). For northern red oak, site productivity appears greater on lower hillslope positions and protected aspects, but due to an imbalance in the dataset the model was not run. This imbalance was most likely a result of red oak species (northern red oak and black oak) not occurring on every plot. However, because northern red oak and black oak site index values were nearly equivalent (Johnson et al., 2009), the values of these species were averaged and results were significantly ($P < 0.01$) greater on lower hillslope positions. Results indicated slope position and aspect had a greater site-level influence on site productivity than regional factors and that the greatest productivity was on lower slope positions of protected aspects.

a) White Oak



b) Northern Red Oak

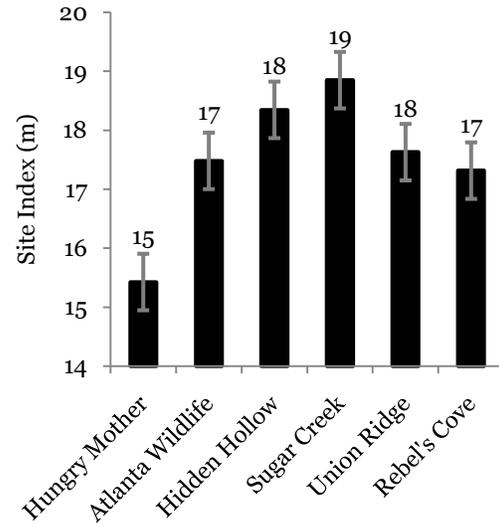
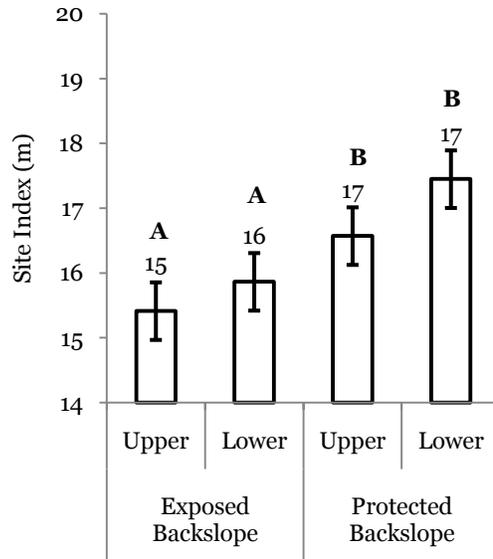


Figure 3.2 Average estimated site index (m) for a) white oak and b) northern red oak by site listed from south to north. Bars represent standard error.

a) White Oak



b) Northern Red Oak

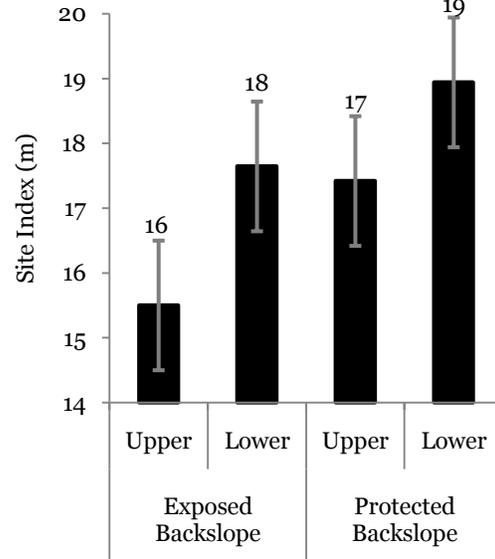


Figure 3.3 Average estimated site index for a) white oak and b) northern red oak by geomorphic component. Site index was significantly greater ($P < 0.01$) for a) white oak on protected slope aspects and nominally greater ($P = 0.1$) on lower hillslope positions. Letters denote unique populations by slope aspect ($P < 0.05$). Bars represent standard error.

3.5.2 Composition and Structure

All stands were in the understory reinitiation stage of stand development (Johnson et al., 2009) and were fully or over stocked (Gingrich, 1967). Stocking ranged from 78 to 112 percent (Table 3.2). On a stocking basis, white oaks (dominantly white oak) were the most abundant overstory species at every site, followed by red oak species (mainly northern red oak and some black oak), eastern hophornbeam (*Ostrya virginiana* (Mill.) K. Koch), hickories, and white ash (*Fraxinus americana* L.). Much like with productivity, we found aspect and slope position had a significant effect of the stocking of white oak and red oak species (Fig. 3.4). White oak stocking was significantly greater on exposed slope aspects ($P < 0.01$) and nominally greater on upper slope positions ($P = 0.1$). Red oak stocking was nominally greater on protected aspects and lower slope positions.

Table 3.2 Average percent stocking for overstory species (>3.8 cm d.b.h.) listed by location from the south to the north of the study area.

Species	Hungry	Atlanta	Hidden	Sugar	Union	Rebel's	Average
Group	Mother	Wildlife	Hollow	Creek	Ridge	Cove	Stocking
White oak spp.	53	83	47	60	51	88	63
Red oak spp.	12	20	25	16	21	8	18
Eastern hophornbeam	9	1	<1	4	7	4	4
Hickory spp.	7	5	3	3	2	2	4
White ash	<1	4	<1	<1	9	<1	3
Other Spp. ¹	1	<1	1	<1	0.0	<1	<1
Elm ²	2	<1	<1	<1	<1	1	1
Sugar maple ³	3	0.0	0.0	0.0	0.0	0.0	<1
Black cherry ⁴	<1	<1	<1	<1	1	<1	<1
Black walnut ⁵	1	0.0	0.0	0.0	0.0	<1	<1
Serviceberry ⁶	<1	0.0	<1	0.0	<1	<1	<1
Ohio buckeye ⁷	<1	0.0	0.0	0.0	<1	<1	<1
Total Stocking	89	112	78	84	92	105	94

¹ Mainly comprised of red mulberry (*Morus rubra* L.), Eastern redbud (*Cercis canadensis* L.), and hackberry (*Celtis occidentalis* L.).

² *Ulmus* spp. L.

³ *Acer saccarrinum* L.

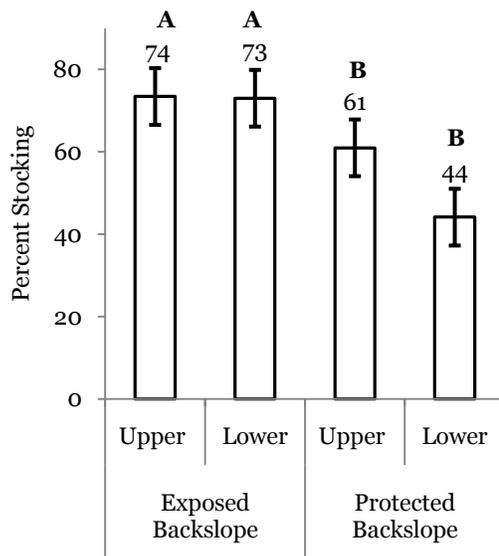
⁴ *Prunus serotina* Ehrh.

⁵ *Juglans nigra* L.

⁶ *Amelanchier arborea* Michx. f.

⁷ *Aesculus glabra* Willd.

a) White Oak Species



b) Red Oak Species

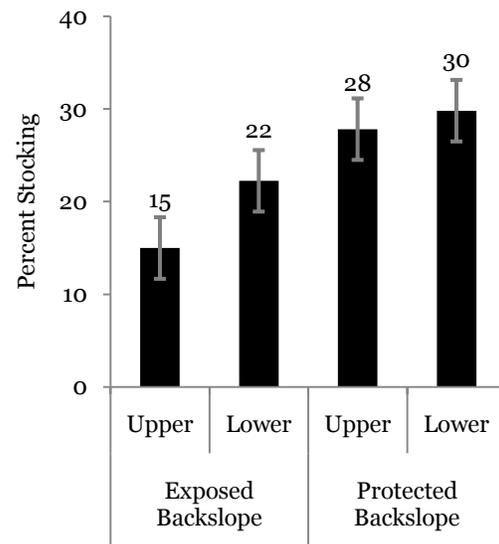


Figure 3.4 Average percent stocking for a) white oak species and b) red oak species groups by hillslope position. Stocking was significantly greater for white oak species on exposed slope aspects ($P < 0.01$) and nominally greater for upper hillslope positions ($P = 0.2$), and red oak species stocking was nominally greater on lower northeast-facing slopes. Letters represent unique populations by slope aspect ($P < 0.05$). Bars represent standard error.

The diameter distribution (Fig. 3.5) indicated that oaks exhibited a more normal or bell-shaped distribution with white oak species most abundant in the 20 to 25 cm diameter class and red oak species most abundant in the 25 to 35 cm diameter class. Other species demonstrated a reverse-J distribution, including: eastern hophornbeam, the category ‘other species’ (mainly elm, black cherry, and serviceberry), hickories, and white ash. Eastern hophornbeam was the most abundant species in the 5 to 10 cm diameter class, reaching an average distribution of 227 trees per hectare in this class. In the overstory, eastern hophornbeam stocking was significantly ($P = 0.03$) greater on lower hillslope positions, regardless of slope aspect (Fig. 3.6).

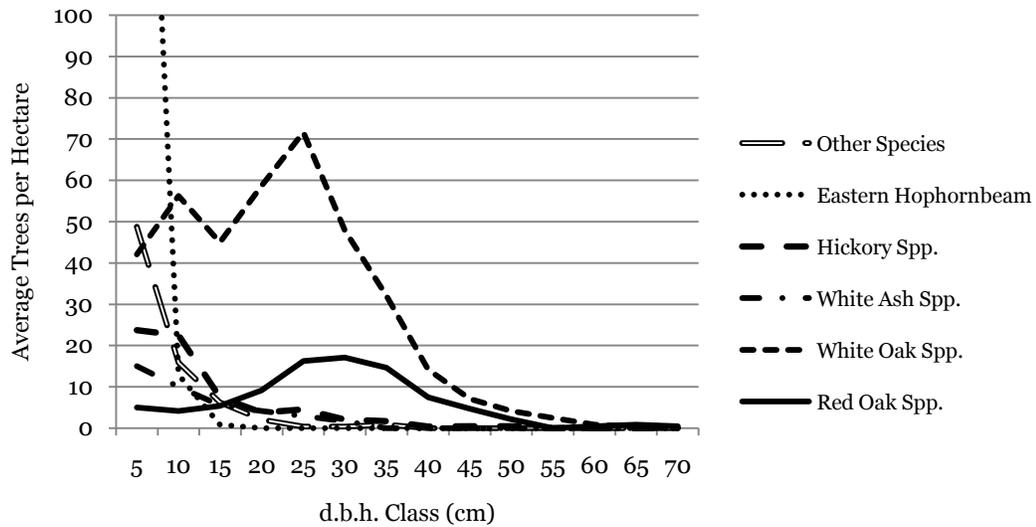


Figure 3.5 Average trees per hectare by diameter class for eastern hophornbeam, hickory species, white ash, white oak species, red oak species and the category other species. The y-axis has been adjusted to illustrate species less abundant than eastern hophornbeam, which is most abundant in the 5 to 10 cm diameter class with a total of 227 trees per hectare.

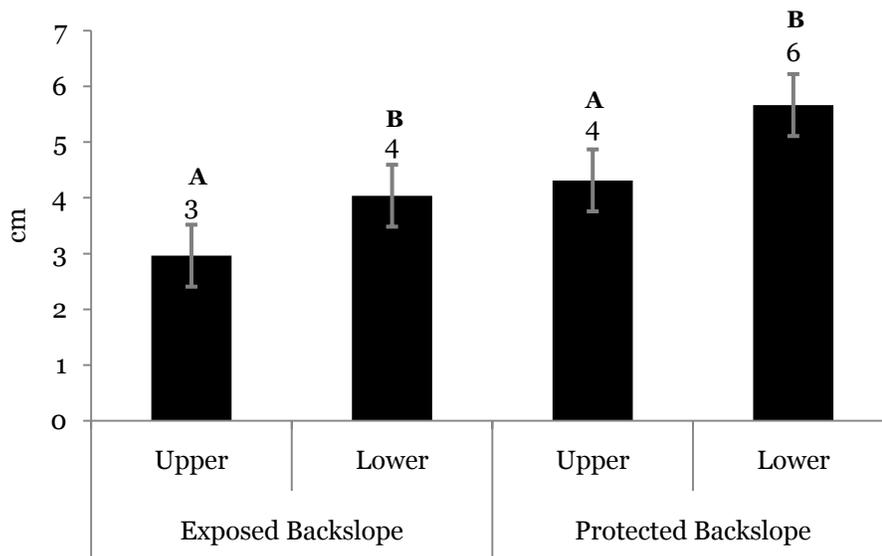


Figure 3.6 Average percent stocking of eastern hophornbeam by geomorphic component. Stocking is significantly ($P=0.03$) greater on lower slope positions. Letters denote unique populations by hillslope position for a given aspect ($P<0.05$). Bars represent standard error.

The large advance reproduction class (species >0.5 m tall and <3.8 cm d.b.h.) was mostly comprised of the category ‘other species’ (mainly blackhaw (*Viburnum prunifolium* L.), redbud, serviceberry, and elm species), white ash, and eastern hophornbeam (Table 3.3). White oak advance reproduction was highly variable from site to site and on sites with below average

amounts of white oak, eastern hophornbeam or the category ‘other species’ make up the majority of the advance reproduction class with smaller amounts of white ash.

Table 3.3 Average trees per hectare for the large advance reproduction layer (i.e., understory species <3.8 cm d.b.h. and >0.5 m in height) by species group for site locations listed in order from south to north.

Species	Hungry	Atlanta	Hidden	Sugar	Union	Rebel’s	Avg.
Group	Mother	Wildlife	Hollow	Creek	Ridge	Cove	TPH
Other Spp.	7625	1875	2426	4800	976	3900	3599
White ash	1000	3525	4901	2875	1275	2376	2658
Eastern hophornbeam	2176	1450	924	2801	3900	2250	2250
White oak spp.	25	2406	3226	3999	200	800	1741
Blackhaw	1250	2401	650	299	450	175	872
Hickory spp.	0	225	1524	0	49	126	321
Red oak spp.	99	49	114	74	74	25	72
Elm spp.	0	0	326	0	0	0	54
Total TPA	12175	11725	14089	14850	6926	9650	11570

¹ *Viburnum prunifolium* L.

In the large advance reproduction, variation by locations lacked clear trends; however, there are some differences by slope aspect and slope position for this class (Fig. 3.7). For example, white oak reproduction was greatest on exposed slope aspects and upper hillslope positions, the category ‘other species’ was more abundant on lower hillslope positions, and white ash was greater on upper hillslope positions.

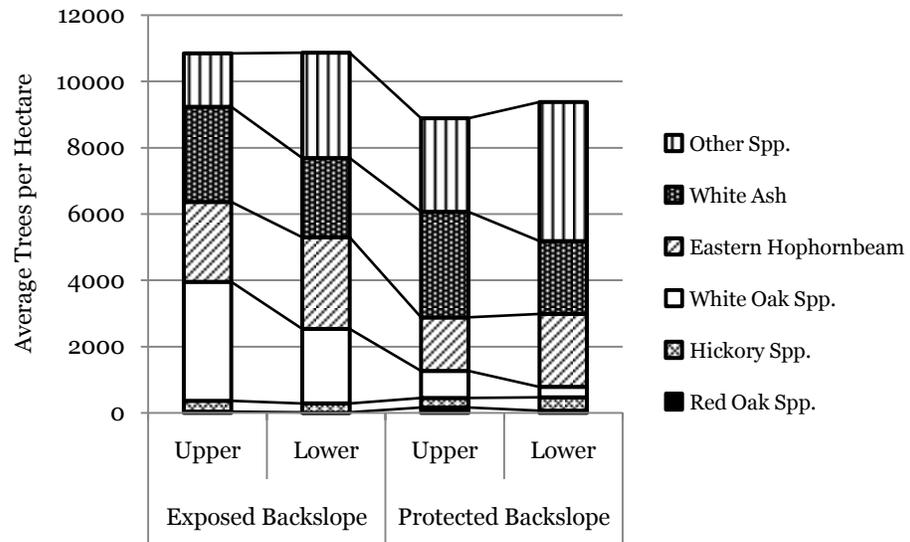


Figure 3.7 Average trees per hectare by hillslope position for the large advance reproduction class. Trees measured were greater than 0.5 m in height and less than 3.8 cm d.b.h.

In the small advance reproduction class (trees <0.5 m in height) (Fig. 3.8), white oak was the most abundant overall species and was greater on exposed aspects (due to an imbalance in the dataset the model was be run). White oak was followed by elm species [nominally greater (P=0.05) on protected aspects], white ash, and eastern hophornbeam.

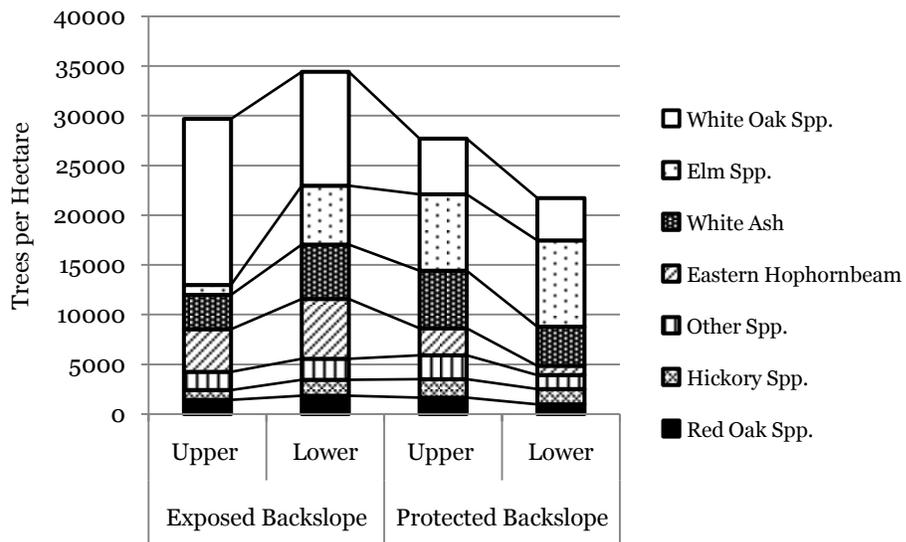


Figure 3.8 Average trees per hectare by hillslope position for the small advance reproduction class. This class includes all trees <0.5 m in height.

3.6 DISCUSSION

The oak forests of the CRHES exhibit small to moderate productivity as indicated by site index values ranging from 16 to 19 m across the region. These values are lower than oak site indices reported elsewhere in the Central Hardwood Region. For example, oak site index in West Virginia ranges from 20 to 25 m (Yawney, 1964), and in southern Indiana ranges from 14 to 24 m on slopes (Jose and Gillespie, 1997). Even in the nutrient-poor and droughty soils of the Missouri Ozarks, site index values for oaks equals (17 to 20 m; Hartung and Lloyd, 1969) or exceeds (18 to 21 feet; Kabrick et al., 2004) those observed in the CRHES. This was surprising considering the relatively large nutrient and water supply capacity of the glacially-derived soils of the CRHES (Table 3.1) compared to the highly-weathered and droughty soils of the Ozark Highlands (Kabrick, et al., 2008). This suggests that causes of the low to moderate site productivity of our study region are likely due to factors other than to soil properties such as seasonal rainfall patterns or other factors related to climate. Between 2001 and 2005 average annual rainfall in the study area averaged 10 m less than rainfall in the Missouri Ozarks (National Agricultural Statistics Service, 2011). Moreover, regression analyses indicated that regional site index patterns were not related to differences in soil properties or other site factors.

Our analysis demonstrated that locally, geomorphic factors play an important role in governing site productivity as we found that the range of average site index on different slope positions and slope aspects was as great as the average range among all sites across the CRHES. Correlations between slope aspect and slope gradient with site quality have been well documented (Hannah, 1968; Hartung and Lloyd, 1969; Brown, 2007) and in general north to east-facing slope aspects exhibit greater productivity than south to west-facing slope aspects in the northern hemisphere (Johnson et al., 2009). Our results were consistent with these trends and indicated that the most productive sites in the CRHES are found on lower slope positions of protected aspects.

Topographic differences in site productivity in the CRHES were reflected in the species composition. We found that red oak stocking was greater on lower, north-facing slopes and white oak stocking was greater on upper, south-facing slopes. Northern red oak is reportedly more

abundant in coves or lower north-facing slopes where water supply is generally greater than on other slopes (Sander, 1990; Johnson et al., 2009) and white oak is reportedly much broader in its distribution with respect to site factors (Rogers, 1990). Oaks in the CRHES also exhibited classic bell-shaped diameter distributions as they typically do in mesic natural mixed-oak stands in the Central Hardwood Region (Schnur, 1937; Roach and Gingrich, 1968). Commonly, more shade-tolerant species occupy smaller diameter size classes comprising the tail of the reverse-J-shaped diameter distribution that is observed when all species are included (Johnson et al., 2009). This was in contrast to drier oak ecosystems such as those of northern Lower Michigan (Johnson, 1992) or the Ozark Highlands (Loewenstein et al., 2000) where site conditions such as low nutrient status and water holding capacity (Kabrick et al., 2004) limit the number of shade tolerant species in the understory allowing moderately-tolerant white oaks to accumulate in the understory and develop a reverse-J distribution.

Despite their abundance in the present-day overstory, it appears uncertain whether oaks will be abundant in the future forests of the CRHES. Successful oak regeneration requires the accumulation of advance reproduction prior to recruitment following a canopy-removing disturbance (Johnson et al., 2009). Except for white oaks on upper, south-facing slopes, large oak advance reproduction was conspicuously declined. Prior to European settlement, fire was an important disturbance factor in the CRHES (Schroeder, 1982). With approximately 50 percent of the area in prairie and an intricate pattern of prairie and forest (Schroeder, 1982), it is likely that fire periodically spread to forested slopes of the CRHES. This likely favored the accumulation of oak seedlings by reducing the density of fire-sensitive oak competitors, positioning oaks to recruit into the overstory following larger, canopy-removing disturbances. Fire suppression, following European settlement and, especially, since the early 20th century (Nowacki and Abrams, 2008), has allowed shade-tolerant, fire-sensitive species to accumulate. Returning fire to these forests would likely reduce the density of fire-sensitive species and increase the density of oak advance reproduction and some of the forbs, legumes, sedges, and grasses characteristic of fire-dependent woodland ecosystems (Taft, 2009).

In the absence of fire, it is unclear what species would eventually recruit into the overstory of this region following a canopy-removing disturbance. For example, of the two most abundant species in the advance reproduction layer, eastern hophornbeam is not an overstory species and as such would not be a long-term competitor with overstory species and white ash is seldom abundant in the overstory of Central Hardwood forests (Schlesinger, 1990; Yaussy et al., 2003; Kabrick et al., 2004). In addition, white ash has an indeterminate future throughout North America because of the increasing spread of Emerald Ash Borer (*Agrilus planipennis* Fairmaire), which may eventually extirpate ash species in the Central Hardwood Region. Due to small quantities of oaks in the large advance reproduction and the limitations of oak regeneration from stump sprouting (Johnson et al., 2009), decreased oak stocking from current levels would be likely.

3.7 CONCLUSION

This study demonstrated that the geomorphic factors of slope aspect and slope position are important determinants of productivity, composition, and structure in the dissected glacial till plain forests of the CRHES. Recognition of the role that local geomorphic factors play on vegetation-site relationships will remain an important consideration for refinements to the National Cooperative Soil Survey and other land classification systems, especially during the development of landform-scale management tools such as ESDs and ELTs. These geomorphic differences are also important considerations for cost-effective land management decisions. For example, in the CRHES, management efforts (e.g., thinning, prescribed fire) may be most needed on protected aspects and lower slope positions to promote oak accumulation in the understory. Additionally, results from this study have provided baseline data for understanding the present-day composition, productivity, and regeneration potential for land managers and land owners seeking critical information about forests in an otherwise understudied region.

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4 OCCURANCE AND VARIATION OF DIAGNOSTIC SOIL PROPERTIES OF TWO BENCHMARK SOIL SERIES ACROSS AN ECOLOGICAL REGION

4.1 ABSTRACT

Soil scientists have long understood the limitations of using soil taxonomy as a basis for mapping soils. Spatial variability of soils cannot always be addressed through soil survey map unit delineations and descriptions. Limitations of levels of scale and detail often result in inclusions in soil map units that may or may not be included as a component. This study investigates the variability of two similar benchmark soil series (Winnegan and Lindley) using taxonomic classification and variation of diagnostic soil properties throughout an ecological region to provide additional documentation on Winnegan (Fine Oxyaquic Hapludalfs) and Lindley (Fine-loamy Typic Hapludalfs) benchmark soil series, with particular reference to localized geomorphic effects. Our results indicate that pedons correlated to Winnegan and Lindley soils are not segregated to one part of the region, and analysis of the distribution of average clay in the particle size control section (PSCS) shows a normal distribution with a mean of 36.1 % (± 5.38). However, when analyzing clay in the PSCS by slope aspect and hillslope position, we found that clay is nominally less ($P=0.07$) on lower hillslope positions. Our results indicate that Winnegan and Lindley are relicts of political boundary soil mapping and are the same natural body of soil.

4.2 INTRODUCTION

Soil Taxonomy (Soil Survey Staff, 1999) has provided a structured, hierarchical classification system to represent the essential features of world soils (Campbell and Edmonds, 1984). The nature of the soil survey is to consider geographic features of soil distributions, including sizes, shapes, internal variability, and arrangements of soil bodies on the landscape (Hole, 1978) using mapping concepts such as the soil-landscape model (Hudson, 1990). *Soil Taxonomy*, like other classification systems, imparts a human-constructed view of the soil landscape. The constraints of this view do not always allow for expression of spatial variation from regional and geomorphic effects within soil mapping units.

An understanding of soil classification requires distinctions to be made between various pedological units, including taxonomic, genetic, and mapping units. Taxonomic units are subdivisions within a specific classification system (e.g., order, suborder, great group, subgroup, family, and series). Genetic units exist in space and are tied to a distinctive size, shape, depth, topographic position, variability, relief, etc., and their boundaries are often complex and difficult to delineate. According to Campbell and Edmonds (1984) taxonomic units are creations of the human mind with regard to the landscape, while genetic units are created by nature. In soil mapping, soil map units apply the concepts of soil taxonomy to a geographic domain. Soil map units may correspond exactly to a taxonomic or genetic unit, or they may include combinations of both. This occurs largely due to the practical limitations of scale, detail, and cartographic representation.

Spatial variation of soil properties and vegetation follow patterns that are a function of landscape position, soil forming factors and processes, and local management practices (Beckett and Webster, 1971). Local geomorphic variation in slope aspect and hillslope position are important considerations when quantifying the spatial variation of soil properties and vegetation (Milne, 1935; Pregitzer, 1983; Ovalles and Collins, 1986; Chen, 1997; Yimer, 2006) particularly in landscapes having steep slopes and a large degree of topographic relief. Because of the important role of geomorphic effects in variation of soil properties and vegetation we determined to assess soil map unit variability throughout an ecologically distinct region. Our objectives were to evaluate the occurrence and variation in diagnostic soil properties of two benchmark soil series, Winnegan (Fine, mixed, superactive, mesic Oxyaquic Hapludalfs) and Lindley (Fine loamy, mixed superactive, mesic Typic Hapludalfs), across an ecologically distinct region. The Chariton River Hills Ecological Subsection (CRHES) within the Iowa and Missouri Heavy Till Plain Major Land Resource Area (MLRA) was chosen because of its steep slopes and extensive oak forests covering a large portion of northern Missouri (Fig. 4.1) and because little is understood about soil variability and plant-soil relationships in this region.

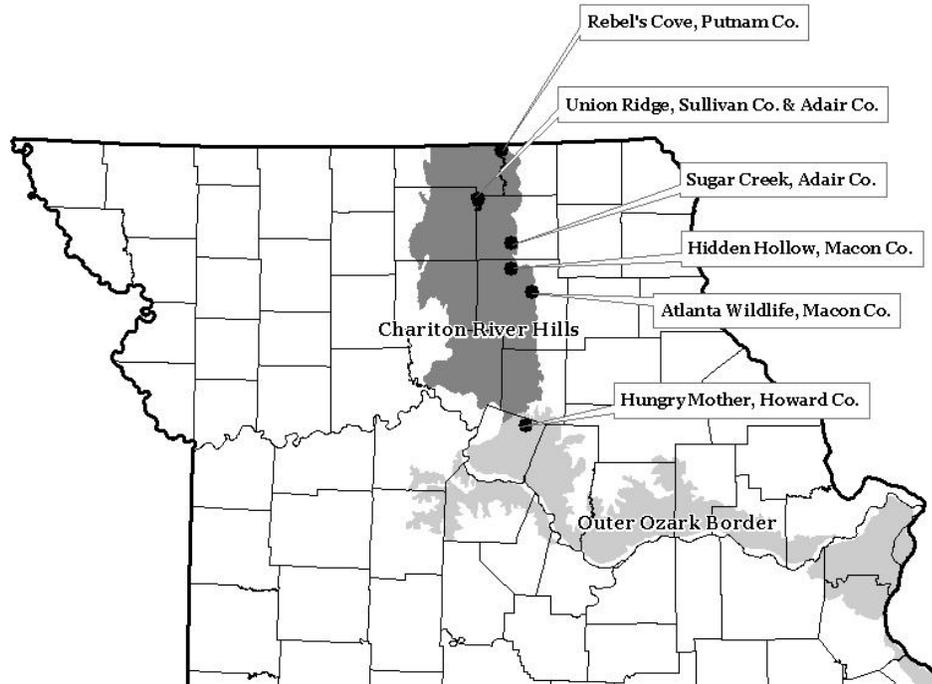


Figure 4.1 Chariton River Hills Ecological Subsection in Missouri (dark gray); Outer Ozark Border (light gray); filled black circles indicate project locations listed from south to north: Hungry Mother Conservation Area (CA), Atlanta Wildlife Area, Hidden Hollow CA, Sugar Creek CA, Union Ridge CA, and Rebel's Cove CA.

4.3 STUDY AREA

Prior to Pre-Illinoian (approximately 2.5 million to 500,000 years ago) glaciations, northern Missouri was a gently rolling landscape underlain by Pennsylvanian-aged limestones, sandstones, shales, and coal deposits (Thompson, 1995). During the Pleistocene, glaciers retreated and advanced several times. As the climate warmed and the glaciers retreated completely, till deposits ranging from 15-75 meters thick were left behind (Thompson, 1995). These deposits have been studied and described and are thought to include at least five distinct till units (Rovey and Kean, 1996). In much of northern Missouri, Wisconsin-aged loess overlies this till on gently sloping landforms (Thompson, 1995). Guccione (1983) and Woida and Thompson (1993) have observed that a welded solum, referred to as the Yarmouth-Sangamon paleosol, lies at the till-loess contact in stable upland positions of southern Iowa and northern Missouri (Rovey, 1997). During the Late Pleistocene, glacial melt, fluvial processes, and loess

deposition carved and developed a river hills landscape in which few original glacial features remain other than the till itself (Nigh and Schroeder, 2002).

The current climate of northern Missouri is characterized by warm, humid summers, and moderately cool winters. Mean annual air temperature for the study locations ranges between 9 to 13°C and mean annual precipitation ranges from 80 to 100 cm (Soil Survey Staff, 2011a). The wettest months in the CRHES are May to September with 67% of the total precipitation occurring during these months (Nigh and Schroeder, 2002). Annual snowfall ranges from 60 cm in the north to 50 cm in the south, and the growing season averages between 200-205 days (Nigh and Schroeder, 2002). Elevation ranges among study sites from approximately 195 to 285 m. The study area is considered to have a udic soil moisture regime and a mesic soil temperature regime. (Soil Survey Staff Division Staff, 2011a)

Soils studied in this project are the soil series Winnegan and Lindley. These soils are considered benchmark series due to their ecological significance and large spatial extent. Winnegan and Lindley soils are formed in calcareous Pre-Illinoian glacial till, and developed under humid climate conditions. Distinguishing characteristics of these soils include a well-expressed argillic horizon and soft masses of calcium carbonate commonly found in the lower part of the profile (Soil Survey Staff, 2011a). Differences between these soil series are slight. Winnegan soils are classified as very deep, moderately well drained, fine, Oxyaquic Hapludalfs, and Lindley soils are classified as well drained, fine-loamy, Typic Hapludalfs (Table 4.1; Soil Survey Staff, 2011a).

Table 4.1 Distinguishing characteristics between Winnegan and Lindley soil series (Soil Survey Staff, 2011a).¹

Soil Property	Winnegan	Lindley
Family	Fine (>35% clay in PSCS)	Fine-loamy (≤35% clay in PSCS)
Drainage Class	Moderately well (redox chroma 2 or less within 100 cm)	Well (redox chroma 2 or less at a depth > 100 cm)
Parent Material	Glacial till	Glacial till
Slope class	5-45%	5-60%

¹ Family is determined as a weighted average of clay in the particle size control section (PSCS) (top of the argillic horizon to a depth of 50 cm).

The Winnegan series was established in 1987 in Linn County, Missouri and the Lindley series was established in 1914 in Grundy County, Missouri (Soil Survey Staff, 2011). Figure 4.2 illustrates the similarities in landform, parent material, and associated soil series (Festervand, 1994 and Potter, 1989).

a) Winnegan

b) Lindley

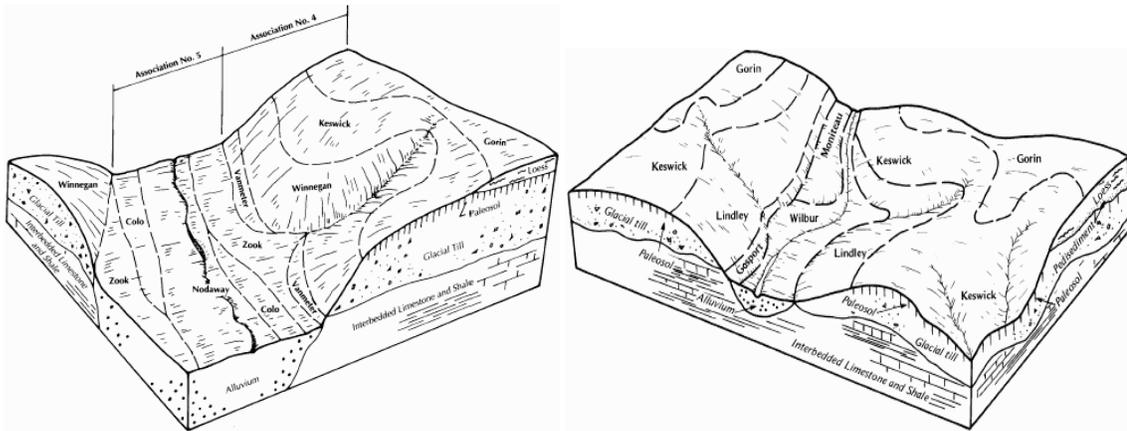


Figure 4.2 Typical patterns of soils and parent material in the: a) Winnegan-Keswick association (Festervand, 1994) and b) Keswick-Lindley-Gorin association (Potter, 1989).

Figure 4.3 demonstrates the current distribution of soil map units with Winnegan (black) and Lindley (gray) as the dominant components within MLRA boundaries that include Missouri (Soil Survey Staff, 2011a). From this figure it is evident that the distribution of Winnegan soils in northern Missouri is a relict of county soil mapping and state political boundaries and not due to variation in physiographic variation.

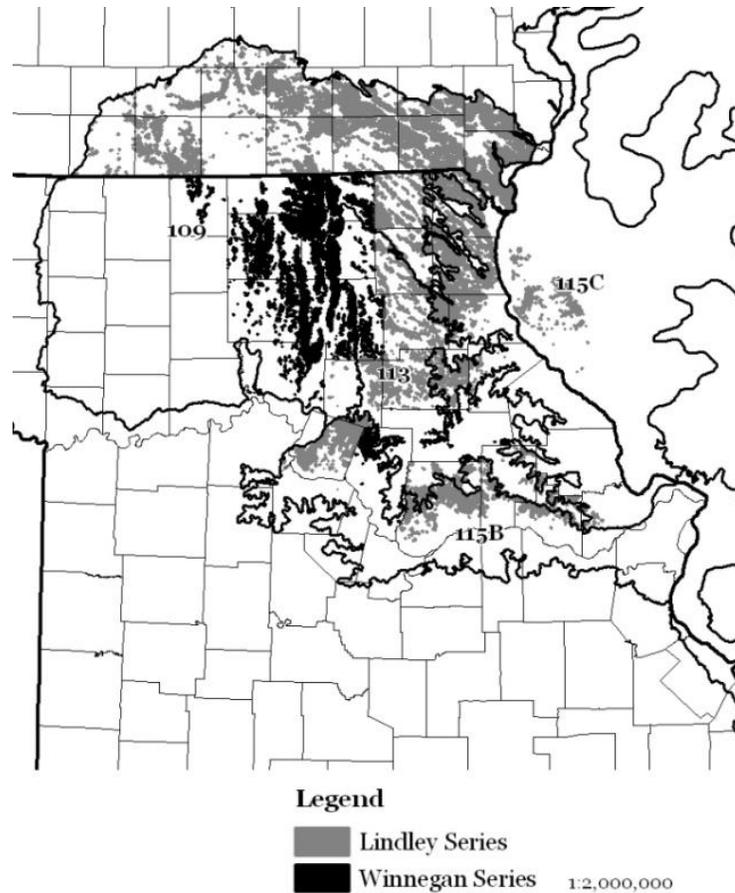


Figure 4.3 Distribution of Lindley and Winnegan Series in MLRAs (outlined in black) that include Missouri (109, 113, 115B, and 115C) (Soil Survey Staff, 2011b).

4.4 MATERIALS AND METHODS

4.4.1 Site Selection

Six sites (fig. 2.3.1) were selected along a gradient from central Missouri north to the Missouri-Iowa border. Sites were selected based upon satisfying a number of criteria including (1) geographic location, (2) similarity of soils and topography, (3) accessibility, and (4) lack of recent harvesting, burning, or other anthropogenic disturbances. Consequently, all six sites were located on land owned by the Missouri Department of Conservation. All sites, except Hungry Mother Conservation Area are within the CRHES. The site at Hungry Mother Conservation Area was included because its soils and physiography are similar to that of the CRHES.

To encompass potential sources of spatial variability in these soils of the CRHES, sampling was done on two slope positions (upper and lower hillslope positions of backslopes

(slopes >15%) two slope aspects [protected (north to northeast-facing) and exposed (south to southwest-facing)] at two randomly-located locations within each of the six sites (Conservation Areas) for a total of 48 samples. Plots were not placed on neutral aspects (115 to 155° and 295 to 335°).

4.4.2 Sampling

For soil sampling, at each plot, a soil pit was excavated to a depth of 205 cm. Pits were centrally located on the landform and the final location was chosen by determining, through hand probing, the area that most closely represented the soil series in question (i.e., Winnegan or Lindley). Landscape and hillslope position information was collected for each soil pedon (e.g., slope, aspect, slope morphometry). One face of the soil pit was smoothed using hand tools to provide a natural, uniform appearance, and genetic horizons were delineated based on differences in color, texture, and structure. Each horizon was described in detail using the NRCS Soil Survey standard methods (Schoeneberger et al., 2002; Soil Survey Division Staff, 1993). Depth, horizon name, matrix color(s), roots, pores, texture, structure, redoximorphic features, ped surface features, rock fragments, effervescence (reaction to 1N HCl-), and horizon boundary were recorded in detail, as well as any features unique to the horizon. One bulk soil sample (minimum 450 g) was collected for each soil horizon for laboratory analysis.

4.4.3 Analyses

Soil samples were analyzed in the Missouri Soil Characterization Laboratory (Columbia, MO) from procedures detailed in the USDA-NRCS Soil Survey Laboratory Methods Manual (Burt, 2004). Samples were air-dried, ground, and passed through a 2 mm mesh sieve prior to analysis. Particle size analysis was determined using pipette analysis with standard pretreatments and to disperse separates (method 3A1a1a, Burt, 2004). Particle size classes analyzed included: fine silt, coarse silt, very fine sand, fine sand, medium sand, coarse sand, very coarse sand and clay.

Complete soil pedon descriptions and laboratory data were entered into the University of Missouri Center for Applied Research and Environmental Systems Cooperative Soil Survey Information System (<http://soils.missouri.edu>). These data were taxonomically certified using Keys to Soil Taxonomy (Soil Survey Staff, 2010), correlated, and underwent review by NRCS

MLRA 109 Soil Survey staff and will be uploaded into the NRCS National Soils Information System (NASIS). Soil pedons were correlated to a soil series using Soil Taxonomy (2nd ed., Soil Survey Staff, 1999) and Keys to Soil Taxonomy (11th ed., Soil Survey Staff, 2010). Soil pedons that differed from the official series description by one characteristic (i.e., drainage class) were correlated as taxadjuncts.

To examine the effects of slope aspect and slope position, data were analyzed using the MIXED procedure (Statistical Analysis Software, SAS Version 9.2, Copyright © 2002-2008, SAS Institute Inc., Cary, NC, USA). Data were checked for normality prior to analysis and were transformed if necessary. We used a hierarchical linear mixed model with aspect and hillslope position within aspect as nested fixed effects and location and site within locations as random effects. This model tested the effect of aspect using the aspect*location*site interaction and tested the effect of hillslope position within slope aspects using the hillslope position* location*site interaction.

4.5 RESULTS

Distribution of soil pedons correlated to Winnegan and Lindley soil series and taxadjuncts by location reveals that variation in series among locations appears randomly distributed and not segregated to a particular location within the CRHES (Table 4.2). All locations were mapped as Winnegan with the exception of Hungry Mother which was mapped as Lindley, therefore it was expected that the majority of soils correlated to Winnegan, however, nearly one-third (15 of 48) of the soil pedons sampled were correlated as fine-loamy Lindley soils.

Table 4.2 Distribution of correlated soil pedons by sampling location (listed from south to north) and correlated name.

Correlated Name	Hungry Mother	Atlanta Wildlife	Hidden Hollow	Sugar Creek	Union Ridge	Rebel's Cove	TOTAL
Winnegan	4	7	3	5	3	6	28
Lindley taxadjunct	4	1	2	2	4	2	15
Winnegan taxadjunct	0	0	3	1	1	0	5

Interestingly, although all of the soils sampled were on steeply sloping backslope landforms (>15% slopes), nearly all pedons had redox depletions of chroma 2 or less described between depths of 45 and 100 cm. All fine-loamy soils (Lindley) were classified as being moderately well drained, and were correlated as Lindley taxadjuncts, and 5 of the 33 pedons correlated as fine (Winnegan) were somewhat poorly drained, and were correlated as Winnegan taxadjuncts.

Distribution of correlated soils lacked a clear trend when plotted by geomorphic component, although slightly more pedons classified as Lindley (fine-loamy) occurred on lower hillslope positions (Fig. 4.4).

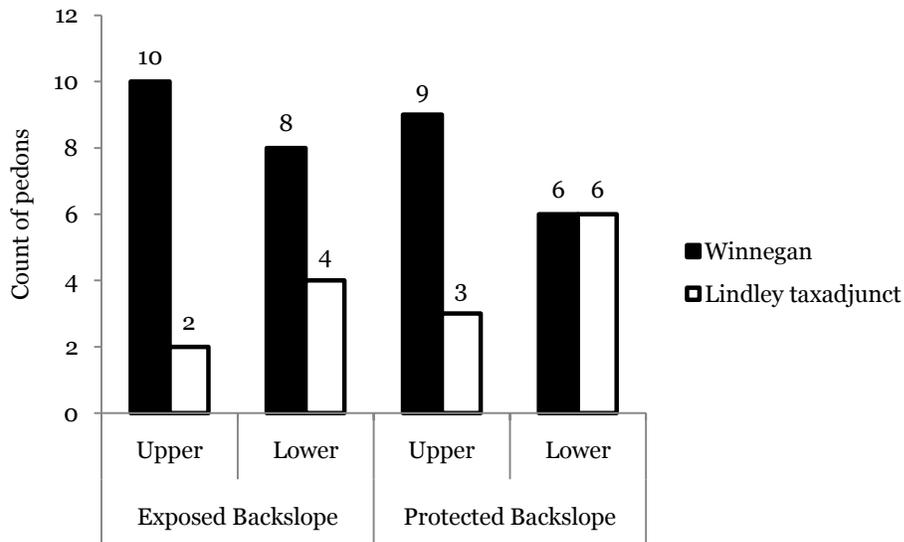


Figure 4.4 Count of correlated pedons by series for geomorphic components. Winnegan and Winnegan taxadjuncts were combined.

Percent clay in the particle size control section (PSCS) is an important taxonomic distinction between the fine-loamy texture family ($\leq 35\%$ clay and $>18\%$ sand) and the fine texture family ($>35\%$ clay). A histogram of percent clay in the particle size control section for all pedons demonstrated a normal distribution ($P=0.13$) indicating that these data fall into a single population (Fig. 4.5). The mean was 36.1% with a standard deviation of 5.38%, and clay in the PSCS ranged from 25 to 45% among the 48 pedons sampled.

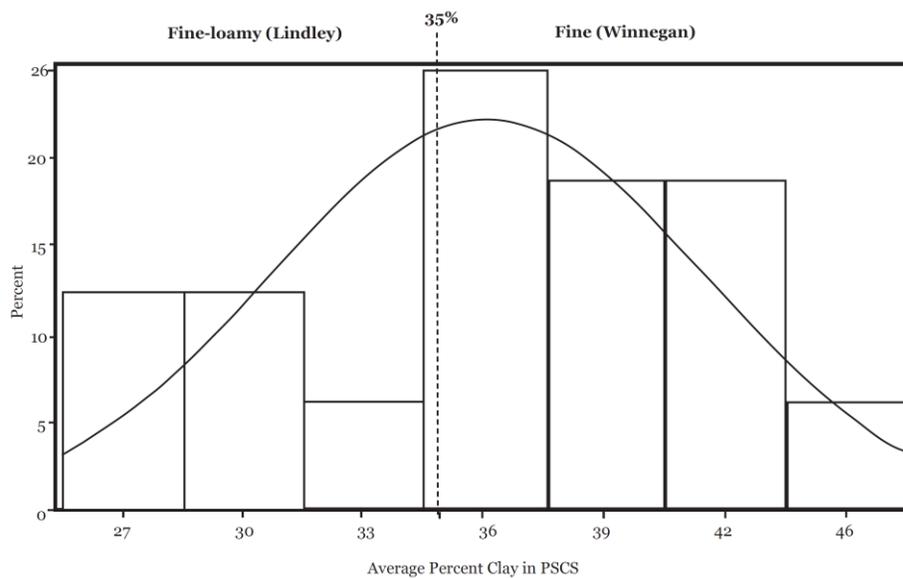


Figure 4.5 Histogram of percent clay in the PSCS for 48 pedons. Distribution is normal. The 35% line marks the distinction between fine and fine-loamy families.

Among locations, average clay in the PSCS ranged from 33 to 38% with no consistent trends in sites from south to north (Fig. 4.6), with the exception of a slight decrease at Hungry Mother, which was the only sampling location mapped as Lindley (fine-loamy). It is also noteworthy that although Sugar Creek and Union Ridge have the same average clay, Union Ridge had a greater number of pedons correlated as Lindley (Table 4.2).

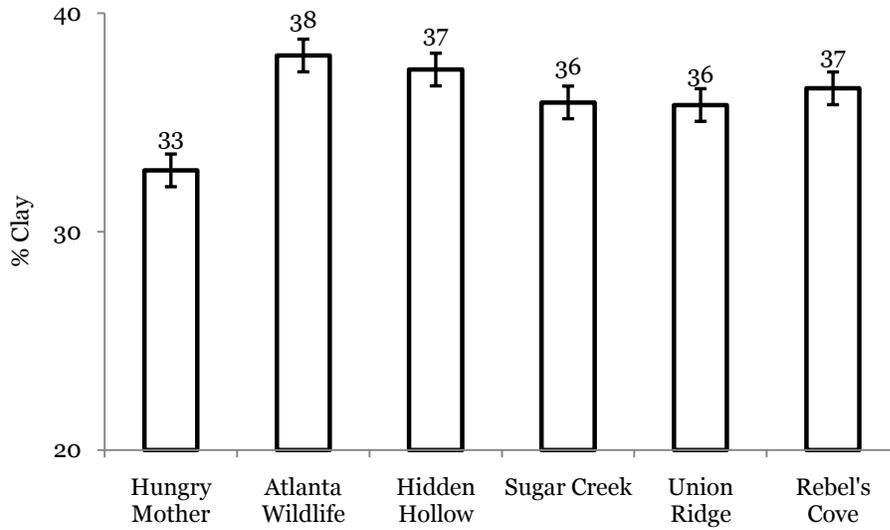


Figure 4.6 Weighted average percent clay in the PSCS among locations from south (Hungry Mother) to north (Rebel's Cove).

Despite a lack of regional trends, there was a distinct geomorphic effect on percent clay in the PSCS. Upper hillslope positions had marginally significant ($P=0.07$) increases in clay when compared to lower hillslopes regardless of aspect (Fig. 4.7).

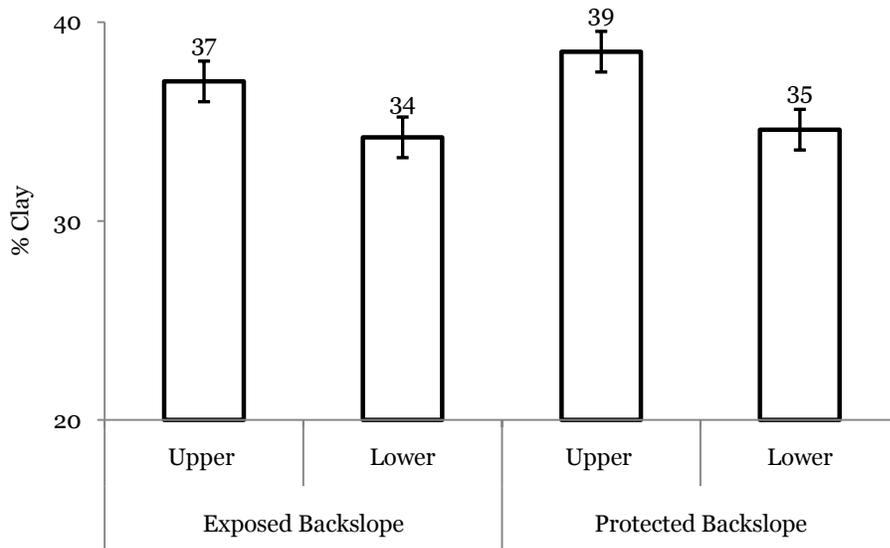


Figure 4.7 Average percent clay in the PSCS by landform position. The average percent clay is marginally significantly ($P=0.07$) higher on upper hillslope positions.

4.6 DISCUSSION

Due to the distribution, location, and taxonomic variation of Winnegan and Lindley soil series, we concluded that these series are the same natural soil body in the study area. A taxonomic break of 35% clay in the PSCS is not an appropriate family distinction for these soils which range in clay from 25-45% in the PSCS. Regional differences between these soils were not evident; however, geomorphic differences are affecting the distribution of clay. Potential hypotheses for this phenomenon include previous clay enrichment from the Yarmouth-Sangamon paleosol, which is present in soils formed stratigraphically higher in the landscape on less sloping (i.e., summit and shoulder) landforms, increased rates of water movement and clay translocation on lower hillslope positions, or the potential for till formation.

Nearly all soils sampled (43 of 48) were classified as having moderately well drainage (redox depletions chroma ≤ 2 between 45 and 100 cm). This is surprising because soils were located on steeply sloping backslope landforms (>15% slopes) and a water table was not observed in any of the soil pits throughout data collection (January to June 2009). The Winnegan series has been correlated as oxyaquic and interpreted as moderately well drained, and Lindley, although correlated as well drained, has been interpreted as moderately well drained for pedons in this study based on the depth to redox depletions; however, the soil morphology that we observed is that of a non-aquic soil. Convex slope shapes of the sampled soils, lack of a confining layer within a depth of 205 cm, and the steepness of slopes make it unlikely that a saturated zone would be present in the upper 100 cm of these soils for an extended period of time. The redox depletions that were described could be a result of extreme (rare) climatic events causing saturating conditions or relict mottling from saturating conditions prior to formation of the current erosional surface. Future study using piezometers is needed before final conclusions on the presence of a water table can be made.

4.7 CONCLUSION

In the CRHES, Winnegan and Lindley soil series are relicts of political-boundary soil mapping and are the same natural body of soil. A water table study to assess drainage patterns

on would help to quantify drainage class interpretations which are important to a variety of other applications (e.g., ecological site descriptions, timber management). Results from this study have provided complete soil pedon descriptions, bulk density, and laboratory data to serve as baseline data for the full extent of Winnegan and Lindley soil series in the CRHES of northern Missouri, and have provided a foundation for future pedological and vegetative studies in the region. Another important contribution of this study is the unique sampling design and subsequent statistical model developed to test spatial variation and soil-plant relationships, which is a particularly useful model for future soil survey update projects especially those that are occurring in concert with ecological site investigations.

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5 SUMMARY AND CONCLUSIONS

The overall objective of this study was to understand the soil genesis and oak ecosystem dynamics of forested soils in the Chariton River Hills Ecological Subsection (CRHES) by evaluating variation of soil properties and forest productivity, composition, and structure that occur as a result of regional and/or geomorphic differences. To meet this objective, soil properties and vegetation parameters were investigated for variation. Soil and vegetation was sampled and inventoried in a replicated design that elucidated the regional effects of an ecological subsection as well as the effects of slope aspect and hillslope position. Physical and chemical soil properties important to plant growth (particle size, bulk density, cation exchange capacity, base saturation, estimated available water capacity, pH, exchangeable cations, and total organic carbon) were determined and analyzed, and forest parameters useful for land management (site index, stocking, basal area, and trees per hectare) were determined.

Statistical analyses were performed on these properties, and the results provided evidence that significant differences in the soils and vegetation of the CHRES exist. We were able to further determine that local geomorphic influences were more important to variation than region-wide effects. Variation in soil physical properties were more apparent than variation in soil chemical properties, and many of the differences that we found were more affected by variation in hillslope position. Variation in soil properties is reflected by differences in the productivity, composition and structure of the vegetation; however, it was determined that microclimatic-induced topographic effects may be of greater importance to vegetation than variation in soil properties.

Within the CRHES, much of the variation is a result of differences in hillslope position. Evidence of previous clay enrichment from the Yarmouth-Sangamon paleosol on upper, more stable, hillslope positions is the most likely cause of this occurrence. Our analyses demonstrated that clay in the argillic horizon is greater on upper hillslope positions; therefore these sites had less available water, the poorest overall site productivity, and a greater abundance of more tolerant white oak in the overstory. Lower slopes in the CRHES tend to be just the opposite and have a greater abundance of mesophytic oak competitors such as eastern hophornbeam. Effects

from slope aspect are also evident in this region with greater depths to the argillic horizon, greater overall site productivity, and an increased abundance of red oak species in the overstory on protected aspects. Because sites in the CRHES tend to function structurally like more mesic regions to the east, oak regeneration will continue to be an important management concern. Assuming goals of oak ecosystem restoration or oak timber production, intervention, in the form of prescribed fire, thinning, and/or herbicide application will be necessary to remove shade tolerant mesophytic vegetation from the understory, and allow oak species to recruit. Management will be especially important on lower slopes of protected aspects.

The results of this study have also provided multi-faceted information that will assist in a number of applications. For example, these data will provide sound rationale for creating and developing ecological site descriptions in the CRHES. This study has also provided baseline vegetation data to assist in land management for an under studied, but ecologically and economically important region. Complete soil pedon data from this study will be useful for Soil Survey updates, as well as supporting data for additional projects. The unique design and associated statistical analyses from this study may be useful for future assessments of soil variability and soil-vegetation relationships within a physiographic region. This data would also support future study, including a more detailed assessment of the morphology and variability glacial till in this region, as well as collection and analysis of herbaceous vegetation layer data to provide a more complete determination of the variation of natural communities in this region.

APPENDIX A. SOIL PEDON DATA*

The following data is ordered alphabetically by site name.

Legend:

AW = Atlanta Wildlife Area

HH = Hidden Hollow Conservation Area

HM = Hungry Mother Conservation Area

RC = Rebel's Cove Conservation Area

SC = Sugar Creek Conservation Area

UR = Union Ridge Conservation Area

o1 = Replicate 1

o2 = Replicate 2

E = Exposed slope aspect

P = Protected slope aspect

U = Upper hillslope position

L = Lower hillslope position

MCL = Missouri Characterization Lab

*All pedon data is available online via the University of Missouri Center for Applied Research and Environmental Systems Cooperative Soil Survey Website (<http://soils.missouri.edu>).

A1. SITE ID: **AW01EL** MCL PEDON ID: **M0912151**

A --- (0-9 cm); 60% dark grayish brown (10YR 4/2, moist, broken face) , and 40% brown (10YR 5/3, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; many very fine, many fine pores; few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels; Note(s): not much o.m., Note(s): less than 1% vf gravel or coarse sand size cherts; clear smooth boundary.

Bt1 --- (9-19 cm); 80% yellowish brown (10YR 5/4, moist, broken face) , and 20% brown (10YR 5/3, moist, broken face) clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many very fine roots throughout, many fine roots throughout, and few coarse roots throughout; many very fine, many fine, few medium pores; few dark grayish brown (10YR 4/2, moist) prominent organoargillans on surfaces along root channels; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): gravels are mainly chert frags; clear smooth boundary.

Bt2 --- (19-42 cm); yellowish brown (10YR 5/6, moist, broken face) clay; moderate fine prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, common fine roots throughout, common very fine roots throughout, and few coarse roots throughout; common fine, common very fine pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): 1% 10YR 3/1 organoargillans (in root channels); abrupt smooth boundary.

Bt3 --- (42-62 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; weak medium prismatic parting to moderate medium subangular blocky structure; slightly effervescent (HCl, 1 normal); very firm; few fine roots throughout, few very fine roots throughout, few medium roots throughout, and few coarse roots throughout; common very fine pores; few dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light brownish gray (2.5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): CaCO₃ effervesces (in places), but not matrix, Note(s): possibly transitional horizon, Note(s): few gray dessimated SS pieces throughout; clear smooth boundary.

2Btk1 --- (62-78 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate medium prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; few coarse roots throughout, few fine roots throughout, and few medium roots throughout; common very fine pores; common light olive brown (2.5Y 5/3, moist) prominent clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries; 5% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

2Btk2 --- (78-110 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate fine prismatic parting to strong fine subangular blocky structure; violently effervescent (HCl, 1 normal); firm; few fine roots throughout, and few medium roots throughout; few very fine pores; few olive brown (2.5Y 4/3, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; many very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 5% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): 1% lignite frags; clear smooth boundary.

2Btk3 --- (110-145 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate fine prismatic parting to strong fine angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few very fine pores; few light olive brown (2.5Y 5/3, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 5% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): 1% lignite frags; gradual wavy boundary.

2Btk4 --- (145-205 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate coarse prismatic parting to moderate medium angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few fine roots throughout; few light olive brown (2.5Y 5/3, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common gray (5Y 6/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 6% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): moderately jointed.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm3)
AW01EL	MO91215101	0.0	3.5	A	14.2	39	46.8	20.3	18.7	13.9	17.8	7.3	4.8	3	L	1.53
AW01EL	MO91215102	3.5	7.5	Bt1	27	33.9	39.1	18.3	15.6	11.6	15.9	6.2	3.8	1.6	CL	1.56
AW01EL	MO91215103	7.5	16.5	Bt2	44.2	29.3	26.5	16.1	13.2	7.2	9.9	4.3	3.1	2	C	1.53
AW01EL	MO91215104	16.5	24.4	Bt3	38.4	31.2	30.4	18.5	12.7	7.5	10.4	4.7	3.8	4	CL	1.73
AW01EL	MO91215105	24.4	30.7	2Btk1	31.8	35.7	32.5	22.1	13.6	7.5	10.7	5.1	4.6	4.6	CL	1.69
AW01EL	MO91215106	30.7	43.3	2Btk2	30.3	35.2	34.5	22.4	12.8	8	10.9	5	4.5	6.1	CL	1.76
AW01EL	MO91215107	43.3	57.1	3Bck1	32.3	37	30.7	22.3	14.7	8.4	11.7	4.8	3.6	2.2	CL	1.67
AW01EL	MO91215108	57.1	80.7	3Bck2	31.3	36	32.7	22.4	13.6	8.7	11.2	5.1	3.9	3.8	CL	1.97

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CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH4OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH4OAcC)	% TOC	pH salt	pH H2O
AW01EL	MO91215101	1.2	0.4	0.1	0.1	1.8	10.5	5.5	12.3	10.6	7.3	75	15	17	1.1	3.8	4.4
AW01EL	MO91215102	3.1	1.2	0.0	0.2	4.5	14.9	10.2	19.4	17.3	14.7	69	23	26	0.8	3.6	4.3
AW01EL	MO91215103	10.6	2.8	0.1	0.4	13.9	17.4	8.8	31.3	27.1	22.7	39	44	51	0.5	3.8	4.3
AW01EL	MO91215104	17.0	2.8	0.1	0.4	20.3	7.7	0.4	28.0	24.7	20.7	2	72	82	0.3	5.0	5.4
AW01EL	MO91215105	49.5	3.2	0.1	0.2	53.0	1.1	0.0		19.3				100	0.2	7.3	7.7
AW01EL	MO91215106	46.4	3.6	0.1	0.2	50.3	0.0	0.0		16.5				100	0.1	7.4	7.9
AW01EL	MO91215107	45.4	6.9	0.4	0.2	52.9	0.0	0.0		16.8				100	0.1	7.5	8.0
AW01EL	MO91215108	39.0	8.5	0.9	0.3	48.7	0.0	0.0		15.5				100	0.0	7.6	7.9

A2. SITE ID: **AWo1EU** MCL PEDON ID: **Mo912150**

A --- (0-10 cm); 60% dark grayish brown (10YR 4/2, moist, broken face) , and 40% brown (10YR 5/3, moist, broken face) loam; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; many fine, many very fine pores; few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels; clear wavy boundary.

AB --- (10-19 cm); brown (10YR 5/3, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and few medium roots throughout; common very fine, common fine pores; few dark grayish brown (10YR 4/2, moist) distinct organoargillans on surfaces along root channels; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): contains fewer pores than other BEs (could be due to compaction?); clear wavy boundary.

Bt1 --- (19-28 cm); yellowish brown (10YR 5/4, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, and common very fine roots throughout; common very fine, common fine pores; few grayish brown (10YR 5/2, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; abrupt smooth boundary.

Bt2 --- (28-50 cm); strong brown (7.5YR 4/6, moist, broken face) clay; moderate fine prismatic parting to strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, common very fine roots throughout, and common medium roots throughout; common very fine pores; common brown (7.5YR 4/4, moist) prominent clay films on all faces of peds; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): no grays; clear smooth boundary.

Bt3 --- (50-75 cm); yellowish brown (10YR 5/6, moist, broken face) clay; moderate fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; many fine roots throughout, common very fine roots throughout, common medium roots throughout, and few coarse roots throughout; common very fine, few fine pores; few dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt4 --- (75-101 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; common very fine roots throughout, common roots throughout, and common medium roots throughout; common very fine, few fine, few medium pores; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt5 --- (101-122 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate coarse prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few very fine roots throughout, and few fine roots throughout; few very fine pores; few dark yellowish brown (10YR 4/6, moist) distinct clay films on all faces of peds; common light olive gray (5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; abrupt smooth boundary.

Bt6 --- (122-154 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium prismatic parting to strong medium angular blocky structure; very slightly effervescent (HCl, 1 normal); very firm; few very fine roots throughout, and few medium roots throughout; few light olive brown (2.5Y 5/3, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light olive gray (5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 5% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): jointed, Note(s): mnm increases towards base of horizon; clear wavy boundary.

Btk --- (154-205 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine prismatic parting to strong medium angular blocky structure; slightly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few light olive brown (2.5Y 5/3, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common olive gray (5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 3% rounded very strongly cemented cobble sized mixed rock fragments, 5% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): jointed.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
AW01EU	M091215001	0.0	3.9	A	10.1	41.8	48.1	22.8	19	9.1	16.8	8.8	8	5.4	L	1.38
AW01EU	M091215002	3.9	7.5	BE	11.7	41.4	46.9	22.6	18.8	9.6	16.7	9.1	7.7	3.8	L	1.33
AW01EU	M091215003	7.5	11.0	Bt1	25.9	36.2	37.9	19.9	16.3	7.8	13.2	6.8	5.8	4.3	L	1.21
AW01EU	M091215004	11.0	19.7	Bt2	49.3	24.5	26.2	12.5	12	5.1	7.5	4.3	4.5	4.8	C	1.33
AW01EU	M091215005	19.7	29.5	2Bt3	43.4	24.2	32.4	12.6	11.6	6.1	10.8	6.3	5.7	3.5	C	1.54
AW01EU	M091215006	29.5	39.8	2Bt4	37.4	27.6	35	14.9	12.7	8.2	12	6.9	5.3	2.6	CL	1.63
AW01EU	M091215007	39.8	48.0	2Bt5	31.8	29.9	38.3	16.6	13.3	7.8	13.7	7.3	5.7	3.8	CL	1.81
AW01EU	M091215008	48.0	60.6	3BC	28.9	29.8	41.3	16.7	13.1	8	13.9	8.3	7.1	4	CL	1.76
AW01EU	M091215009	60.6	79.9	3BCK	27.2	32.7	40.1	19.3	13.4	7.8	13.3	6.8	5.9	6.3	CL	1.93

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAcC)	% TOC	pH salt	pH H ₂ O
AW01EU	M091215001	1.4	0.4	0.0	0.2	2.0	9.9	2.9	11.9	10.2	4.9	59	17	20	1.9	4.1	4.8
AW01EU	M091215002	0.5	0.4	0.0	0.1	1.0	8.7	4.5	9.7	7.7	5.5	82	10	13	0.7	3.8	4.2
AW01EU	M091215003	0.5	0.8	0.0	0.1	1.4	17.3	12.3	18.7	15.4	13.7	90	7	9	0.6	3.6	4.3
AW01EU	M091215004	2.5	4.0	0.1	0.3	6.9	28.8	20.8	35.7	31.8	27.7	75	19	22	0.6	3.5	4.3
AW01EU	M091215005	5.3	5.6	0.1	0.3	11.3	21.6	13.4	32.9	29.4	24.7	54	34	38	0.3	3.8	4.5
AW01EU	M091215006	6.5	5.9	0.2	0.3	12.9	15.0	7.9	27.9	26.0	20.8	38	46	50	0.2	3.8	4.4
AW01EU	M091215007	7.9	6.3	0.2	0.3	14.7	9.6	3.5	24.3	23.1	18.2	19	61	64	0.1	4.2	4.7
AW01EU	M091215008	10.5	7.3	0.4	0.2	18.4	4.0	0.0	22.4	20.2	18.4	0	82	91	0.1	5.8	6.3
AW01EU	M091215009	36.6	6.0	0.4	0.2	43.2	1.4	0.0		16.0				100	0.1	7.3	7.7

A3. SITE ID: **AWo1PL** MCL PEDON ID: **Mo912152**

A --- (0-11 cm); 80% very dark grayish brown (10YR 3/2, moist, rubbed) , and 20% dark grayish brown (10YR 4/2, moist, broken face) loam; moderate very fine granular structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; common very fine, common fine pores; 1% subangular very strongly cemented fine gravel sized chert fragments; Note(s): more o.m. here; clear smooth boundary.

AB --- (11-23 cm); 60% dark grayish brown (10YR 4/2, moist, broken face) , and 40% brown (10YR 5/3, moist, broken face) loam; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; many very fine, many fine pores; few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): AE? or AB?, Note(s): no visible clfs, Note(s): has a lot of A colors, Note(s): check O.C. and texture, Note(s): mainly chert frags; abrupt smooth boundary.

Bt1 --- (23-38 cm); yellowish brown (10YR 5/6, moist, broken face) clay; moderate coarse prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, common very fine roots throughout, few medium roots throughout, and few coarse roots throughout; many very fine, common fine pores; few dark grayish brown (10YR 4/2, moist) prominent organoargillans on surfaces along root channels, few dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): mainly chert frags; clear smooth boundary.

Bt2 --- (38-59 cm); yellowish brown (10YR 5/6, moist, broken face) clay; moderate medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few very coarse roots throughout, few coarse roots throughout, and few very fine roots throughout; common very fine, common fine pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): lg gravel-sized cemented hematite frag nodule; clear smooth boundary.

Bt3 --- (59-81 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few fine roots throughout, few very fine roots throughout, and few medium roots throughout; few very fine, few fine pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 6% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): v. similar to horizon 6 without CaCO₃; clear smooth boundary.

2Btk1 --- (81-97 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate fine prismatic parting to moderate medium subangular blocky structure; slightly effervescent (HCl, 1 normal); very firm; few fine roots throughout; common very fine pores; common dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common gray (2.5Y 6/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 5% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): Abrupt smooth boundary based on CaCO₃ eff, not diagnostic features; abrupt smooth boundary.

2Btk2 --- (97-128 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate fine prismatic parting to strong fine subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; few fine roots throughout, and few very fine roots throughout; few fine, common very fine pores; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 5% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): evidence of jointing; clear smooth boundary.

2Btk3 --- (128-177 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine prismatic parting to moderate medium subangular blocky structure; violently effervescent (HCl, 1 normal); very firm; few fine roots throughout; few very fine pores; few dark yellowish brown (10YR 4/6, moist) distinct clay films on all faces of peds; common very dark grayish brown (10YR 3/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light olive gray (5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light olive brown (2.5Y 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 5% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): evidence of jointing, Note(s): gray dessimated sandstone frags; clear wavy boundary.

2Bck --- (177-205 cm); yellowish brown (10YR 5/6, moist, broken face) sandy loam; moderate medium prismatic parting to strong medium angular blocky structure; violently effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few very fine pores; few dark yellowish brown (10YR 4/6, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common very dark grayish brown (10YR 3/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common gray (2.5Y 6/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 6% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): evidence of jointing, Note(s): stratified with 10YR6/8 sand lens and 2.5y 6/1 vf sand layers, Note(s): clay lenses are jointed and redox and clay films occur mainly in these stratified clays.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm3)
AW01PL	M091215201	0.0	4.3	A	13.6	44	42.4	23	21	11	16.9	7.4	5	2.1	L	1.49
AW01PL	M091215202	4.3	9.1	AE	16.1	37.6	46.3	21.1	16.5	10.2	15.7	8.2	7.3	4.9	L	1.68
AW01PL	M091215203	9.1	15.0	Bt1	41.9	29.1	29	15.9	13.2	7.8	10.9	4.8	3.4	2.1	C	1.51
AW01PL	M091215204	15.0	23.2	Bt2	47	27.8	25.2	15.1	12.7	7.4	9.3	4.2	2.9	1.4	C	1.24
AW01PL	M091215205	23.2	31.9	Bt3	39.2	30.3	30.5	17	13.3	8.8	11.5	5.1	3.5	1.6	CL	1.72
AW01PL	M091215206	31.9	38.2	2Btk1	34.1	33.5	32.4	19.7	13.8	8.1	10.9	5.3	4.4	3.7	CL	1.77
AW01PL	M091215207	38.2	50.4	2Btk2	31.3	34	34.7	17.1	16.9	9.2	13.2	5.4	4.1	2.8	CL	1.83
AW01PL	M091215208	50.4	69.7	2BCK1	34.5	34.5	31	20.2	14.3	6.7	10.5	5.3	4.6	3.9	CL	1.85
AW01PL	M091215209	69.7	80.7	2BCK2	13.8	18.7	67.5	9.8	8.9	7	21	21.3	14.1	4.1	SL	1.59

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH4OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH4OAcC)	% TOC	pH salt	pH H2O
AW01PL	M091215201	8.1	1.6	0.0	0.2	9.9	6.4	0.0	16.3	13.6	9.9	0	61	73	1.9	5.9	6.1
AW01PL	M091215202	4.6	1.2	0.0	0.2	6.0	5.5	0.5	11.5	10.3	6.5	8	52	58	0.6	4.7	5.4
AW01PL	M091215203	15.1	3.3	0.1	0.3	18.8	10.2	1.4	29.0	27.1	20.2	7	65	69	0.5	4.5	4.9
AW01PL	M091215204	14.2	3.1	0.1	0.4	17.8	14.7	6.3	32.5	31.1	24.1	26	55	57	0.3	4.0	4.4
AW01PL	M091215205	14.2	2.8	0.1	0.3	17.4	9.2	2.2	26.6	25.2	19.6	11	65	69	0.2	4.4	4.8
AW01PL	M091215206	46.2	3.3	0.1	0.1	49.7	0.4	0.0		21.4				100	0.2	7.3	7.6
AW01PL	M091215207	24.5	4.0	0.2	0.1	28.8	1.4	0.0		20.3				100	0.1	7.4	7.8
AW01PL	M091215208	43.8	5.1	0.5	0.1	49.5	1.1	0.0		18.7				100	0.1	7.5	8.0
AW01PL	M091215209	33.6	2.9	0.5	0.1	37.1	0.4	0.0		9.5				100	0.0	7.5	8.0

A4. SITE ID: **AWo1PU** MCL PEDON ID: **Mo912153**

A --- (0-10 cm); 80% very dark grayish brown (10YR 3/2, moist, rubbed) , and 20% dark grayish brown (10YR 4/2, moist, broken face) loam; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, few medium roots throughout, and few medium roots throughout; many fine, many very fine, common medium pores; clear smooth boundary.

Bt1 --- (10-19 cm); 70% yellowish brown (10YR 5/4, moist, broken face) , and 30% dark grayish brown (10YR 4/2, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many very fine roots throughout, and common fine roots throughout; common very fine, common fine pores; very few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels, very few yellowish brown (10YR 5/4, moist) faint clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): lg root channel (macropore) , Note(s): heavy loam; clear smooth boundary.

Bt2 --- (19-37 cm); strong brown (7.5YR 5/6, moist, broken face) clay; weak medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, common fine roots throughout, common fine roots throughout, and common very fine roots throughout; many fine, common very fine pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds, very few dark grayish brown (10YR 4/2, moist) distinct organoargillans on surfaces along root channels; common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (37-57 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak coarse prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; many very fine roots throughout, common fine roots throughout, and few medium roots throughout; few very fine pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; abrupt smooth boundary.

Bt4 --- (57-67 cm); yellowish brown (10YR 5/6, moist, broken face) clay; moderate fine prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, and common very fine roots throughout; common fine, common very fine, few medium pores; few dark yellowish brown (10YR 4/6, moist) distinct clay films on all faces of peds; common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt5 --- (67-82 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, common medium roots throughout, and common very fine roots throughout; common fine, common very fine pores; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): matrix does not effervesce, but finely disseminated CaCO₃ threads have v. slight eff.; abrupt smooth boundary.

2Btk1 --- (82-102 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate coarse prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; common fine roots throughout, and few medium roots throughout; few very fine pores; few olive brown (2.5Y 4/3, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): 1% lignins, Note(s): secondary caco3 begins here; clear smooth boundary.

2Btk2 --- (102-125 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate medium prismatic parting to moderate medium subangular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few very fine pores; few olive brown (2.5Y 4/3, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries; 6% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): 1% lignins; clear smooth boundary.

2Btk3 --- (125-205 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate medium prismatic parting to moderate medium angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few olive brown (2.5Y 4/3, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, many very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 6% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): split sample! 09 (125-164 cm) 10 (164-205 cm), Note(s): only one bulk density sample (2 replicates) was taken from this horizon, Note(s): sample 10 may have slightly less caco₃, but otherwise v. similar in described properties (may decide to combine later), Note(s): horizon was split based on depth.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm3)
AW01PU	M091215301	0.0	3.9	A	11.2	47	41.8	25.5	21.5	10.9	16.5	7.8	4.8	1.8	L	1.34
AW01PU	M091215302	3.9	7.5	BE	14.7	40.6	44.7	22.2	18.4	9.7	16.1	7.6	6.6	4.7	L	1.31
AW01PU	M091215303	7.5	14.6	Bt1	45.5	29.3	25.2	15.4	13.9	7.2	8.5	4.4	3.2	1.9	C	1.52
AW01PU	M091215304	14.6	22.4	Bt2	48.2	26.6	25.2	14.1	12.5	6.3	8.8	4.4	3.8	1.9	C	1.51
AW01PU	M091215305	22.4	26.4	Bt3	42.3	29.8	27.9	16.6	13.2	8	9.7	4.9	3.5	1.8	C	1.60
AW01PU	M091215306	26.4	32.3	Bt4	36.5	31.2	32.3	16.6	14.6	8	11.5	5.5	4.5	2.8	CL	1.84
AW01PU	M091215307	32.3	40.2	2Btk1	31.8	34.5	33.7	21.1	13.4	7.7	10.5	5.1	4.9	5.5	CL	1.46
AW01PU	M091215308	40.2	49.2	2Btk2	30.9	36.3	32.8	22.2	14.1	8	10.1	4.7	4.7	5.3	CL	1.82
AW01PU	M091215309	49.2	64.6	2BCK1	32.2	36.5	31.3	22.2	14.3	8.2	11.3	5.4	3.9	2.5	CL	1.88
AW01PU	M091215310	64.6	80.7	2BCK1	31.4	34.3	34.3	20.5	13.8	7.8	11.8	5.9	5.1	3.7	CL	1.88

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH4OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH4OAc)	% TOC	pH salt	pH H2O
AW01PU	M091215301	7.2	1.2	0.0	0.3	8.7	7.4	0.0	16.1	13.4	8.7	0	54	65	2.6	5.0	5.3
AW01PU	M091215302	1.2	0.8	0.0	0.1	2.1	8.4	4.1	10.5	9.7	6.2	66	20	22	0.5	4.0	4.5
AW01PU	M091215303	5.8	2.8	0.0	0.3	8.9	22.4	14.7	31.3	30.3	23.6	62	28	29	0.6	3.7	4.2
AW01PU	M091215304	11.7	3.6	0.1	0.3	15.7	17.1	8.8	32.8	31.3	24.5	36	48	50	0.4	4.1	4.6
AW01PU	M091215305	11.7	3.3	0.1	0.3	15.4	12.4	4.4	27.8	27.0	19.8	22	55	57	0.4	4.2	4.7
AW01PU	M091215306	16.1	3.2	0.1	0.2	19.6	7.0	0.3	26.6	23.8	19.9	2	74	82	0.2	4.8	5.2
AW01PU	M091215307	41.5	3.2	0.1	0.1	44.9	0.0	0.0		18.8				100	0.1	7.4	7.7
AW01PU	M091215308	47.1	3.6	0.1	0.2	51.0	0.0	0.0		16.4				100	0.1	7.5	7.9
AW01PU	M091215309	45.7	6.4	0.4	0.2	52.7	0.0	0.0		15.2				100	0.1	7.6	8.0
AW01PU	M091215310	41.6	7.5	0.9	0.2	50.2	0.5	0.0		15.9				100	0.1	7.6	8.1

A5. SITE ID: **AWo2EL** MCL PEDON ID: **Mo912155**

A --- (0-8 cm); 60% very dark grayish brown (10YR 3/2, moist, rubbed) , and 40% dark grayish brown (10YR 4/2, moist, broken face) loam; weak very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; many very fine, many fine pores; Note(s): some 10yr5/3 and 10yr4/1 mixings less than 1 percent of total; clear smooth boundary.

Bt1 --- (8-17 cm); yellowish brown (10YR 5/4, moist, broken face) loam; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, common very fine roots throughout, few medium roots throughout, and few very coarse roots throughout; many very fine, many fine, few medium pores; very few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized chert fragments; Note(s): very coarse root penetrating through several horizons, Note(s): frags are less than one percent, but are present; clear smooth boundary.

Bt2 --- (17-33 cm); yellowish brown (10YR 5/6, moist, broken face) clay; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, few very coarse roots throughout, common fine roots throughout, common very fine roots throughout, and few medium roots throughout; common very fine, common fine pores; few dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (33-48 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few very coarse roots throughout, few coarse roots throughout, common medium roots throughout, and common fine roots throughout; common very fine, common fine pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): grays begin; clear smooth boundary.

Bt4 --- (48-65 cm); yellowish brown (10YR 5/6, moist, broken face) sandy clay loam; weak fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, common medium roots throughout, and few fine roots throughout; common very fine, common fine pores; few brown (10YR 5/3, moist) prominent clay films on all faces of peds; common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): no mnm, Note(s): transitional material starting to get sandier...much sandier from here down; clear wavy boundary.

Btg1 --- (65-92 cm); grayish brown (10YR 5/2, moist, broken face) clay loam; weak fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, common fine roots throughout, few very fine roots throughout, and few coarse roots throughout; common very fine, common fine pores; few dark grayish brown (10YR 4/2, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): no mm, Note(s): highly multi-colored; clear wavy boundary.

2Btg2 --- (92-139 cm); grayish brown (10YR 5/2, moist, broken face) gravelly sandy clay loam; weak fine prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, few coarse roots throughout, few fine roots throughout, and few very fine roots throughout; many very fine, many fine pores; few brown (7.5YR 4/2, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 16% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): lots of prominent colors, Note(s): matrix was difficult to define, Note(s): less than 1 percent lignites; gradual smooth boundary.

2Btg3 --- (139-171 cm); dark gray (7.5YR 4/1, moist, broken face) sandy clay loam; moderate medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few fine roots throughout; common very fine, common fine pores; few brown (7.5YR 4/2, moist) distinct clay films on all faces of peds; common dark reddish brown (5YR 3/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 5% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): denser material (roots restricted)...material is soft once out of place however, Note(s): some white disseminated sandstone material but no CaCO₃; gradual smooth boundary.

2Btg4 --- (171-205 cm); dark grayish brown (10YR 4/2, moist, broken face) sandy clay loam; moderate coarse prismatic parting to moderate medium angular blocky structure; noneffervescent (HCl, 1 normal); very firm; few very fine roots throughout; common very fine, common fine pores; few brown (7.5YR 4/2, moist) distinct clay films on all faces of peds; common brown (7.5YR 4/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 10% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): stratified vertically with sandy 7.5YR4/3 and 10YR5/6 clayey material.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
AWo2EL	Mo91215501	0.0	3.1	A	7.5	42.5	50	21.7	20.8	12	20.9	9.3	5.7	2.1	L	1.17
AWo2EL	Mo91215502	3.1	6.7	BE	15.3	39.1	45.6	19.8	19.3	10.7	18.2	8.5	5.7	2.5	L	1.46
AWo2EL	Mo91215503	6.7	13.0	Bt1	43.6	31.4	25	16.5	14.9	6.3	9.8	4.3	2.9	1.7	C	1.40
AWo2EL	Mo91215504	13.0	18.9	Bt2	44.4	33.8	21.8	17.8	16	5.8	8.6	3.6	2.1	1.7	C	1.45
AWo2EL	Mo91215505	18.9	25.6	2Bt3	30.7	23.9	45.4	11.8	12.1	9.5	23.5	8.2	3.1	1.1	SCL	1.42
AWo2EL	Mo91215506	25.6	36.2	2Btg1	30.3	29	40.7	14.4	14.6	7.7	16.1	7.4	5.6	3.9	CL	1.55
AWo2EL	Mo91215507	36.2	54.7	2Btg2	27.6	22.6	49.8	11.5	11.1	7.8	18.3	11	8.5	4.2	SCL	1.65
AWo2EL	Mo91215508	54.7	67.3	3BCg1	27	27.4	45.6	13.5	13.9	7.8	17	9.7	7.2	3.9	SCL	1.62
AWo2EL	Mo91215509	67.3	80.7	3BCg2	23.7	24.4	51.9	12.8	11.6	8.6	20.6	12.3	8	2.4	SCL	1.67

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
AWo2EL	Mo91215501	5.8	1.5	0.0	0.3	7.6	8.8	0.0	16.4	13.1	7.6	0	46	58	2.6	5.6	5.7
AWo2EL	Mo91215502	1.0	1.2	0.0	0.2	2.4	9.1	4.3	11.5	10.0	6.7	64	21	24	0.8	4.2	4.9
AWo2EL	Mo91215503	5.5	5.5	0.1	0.6	11.7	18.2	9.5	29.9	26.7	21.2	45	39	44	0.8	4.0	4.6
AWo2EL	Mo91215504	4.8	5.5	0.1	0.6	11.0	18.5	12.6	29.5	27.8	23.6	53	37	40	0.4	3.9	4.7
AWo2EL	Mo91215505	2.6	3.5	0.1	0.3	6.5	15.4	9.9	21.9	19.6	16.4	60	30	33	0.2	3.8	4.6
AWo2EL	Mo91215506	2.3	4.2	0.1	0.3	6.9	14.9	8.7	21.8	19.6	15.6	56	32	35	0.2	3.8	4.5
AWo2EL	Mo91215507	2.4	5.9	0.3	0.3	8.9	10.1	4.4	19.0	16.8	13.3	33	47	53	0.2	3.9	4.7
AWo2EL	Mo91215508	3.2	7.6	0.6	0.3	11.7	8.1	1.0	19.8	17.2	12.7	8	59	68	0.2	4.3	5.1
AWo2EL	Mo91215509	18.4	7.7	1.1	0.3	27.5	1.6	0.0		15.6				100	0.2	5.7	5.8

A6. SITE ID: **AWo2EU** MCL PEDON ID: **M0912154**

A --- (0-10 cm); 80% dark grayish brown (10YR 4/2, moist, broken face) , and 20% brown (10YR 5/3, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; many very fine, many fine, few medium pores; few very dark grayish brown (10YR 3/2, moist) distinct organoargillans on surfaces along root channels; common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt1 --- (10-17cm); yellowish brown (10YR 5/4, moist, broken face) loam; weak thick platy parting to moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common medium roots throughout, many fine roots throughout, and many very fine roots throughout; many very fine, many fine pores; very few dark grayish brown (10YR 4/2, moist) distinct organoargillans on surfaces along root channels; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): no clay films present; clear smooth boundary.

Bt2 --- (17-27cm); yellowish brown (10YR 5/6, moist, broken face) silty clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few medium roots throughout, many very fine roots throughout, and few fine roots throughout; common very fine, common fine pores; few yellowish brown (10YR 5/6, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): no peds seen; clear smooth boundary.

Bt3 --- (27-39 cm); yellowish brown (10YR 5/6, moist, broken face) silty clay; strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, common fine roots throughout, and many very fine roots throughout; few fine, common very fine pores; common yellowish brown (10YR 5/4, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt4 --- (39-61 cm); yellowish brown (10YR 5/6, moist, broken face) silty clay; weak medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, common fine roots throughout, and common very fine roots throughout; few very fine, few fine pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): redox depletions begin; clear smooth boundary.

Bt5 --- (61-80 cm; yellowish brown (10YR 5/6, moist, broken face) clay loam; weak medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, and common fine roots throughout; common very fine, common fine pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light olive gray (5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): lots of redox; clear smooth boundary.

Bt6 --- (80-98 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine prismatic parting to strong fine subangular blocky structure; very slightly effervescent (HCl, 1 normal); very firm; common medium roots throughout, and common fine roots throughout; few very fine, few fine pores; few dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light olive brown (2.5Y 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 6% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): cam masses increase towards base of horizon; abrupt wavy boundary.

Btk1 --- (98-131 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate fine angular blocky structure; strongly effervescent (HCl, 1 normal); extremely firm; few very fine roots throughout; few very fine pores; few dark yellowish brown (10YR 4/6, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light brownish gray (2.5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) medium prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates throughout with diffuse boundaries; 9% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): C-like in structure, Note(s): has clay films, Note(s): 1 percent lignite present; clear wavy boundary.

2Btk2 --- (131-166 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate medium prismatic parting to strong medium angular blocky structure; slightly effervescent (HCl, 1 normal); extremely firm; few fine roots throughout; few light olive brown (2.5Y 5/3, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light brownish gray (2.5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) medium prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries; 9% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): 1 percent lignite present, Note(s): maybe C material as well, Note(s): jointed; gradual smooth boundary.

2Btk3 --- (166-205 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate coarse prismatic parting to moderate medium subangular blocky structure; slightly effervescent (HCl, 1 normal); extremely firm; few very fine roots throughout; few light olive brown (2.5Y 5/3, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light brownish gray (2.5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries; 10% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): 1 percent lignite presentmore C-like change in texture and structure, Note(s): jointed, Note(s): no clay films.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm3)
AWo2EU	Mo91215401	0.0	3.9	A	9.5	43.2	47.3	22.5	20.7	12.2	18.7	8.3	5.5	2.6	L	1.13
AWo2EU	Mo91215402	3.9	6.7	BE	15.1	40	44.9	21.1	18.9	12.9	18.4	8	4.3	1.3	L	1.63
AWo2EU	Mo91215403	6.7	10.6	Bt1	40.8	30.1	29.1	16.5	13.6	6.6	9.8	4.8	4.1	3.8	C	1.35
AWo2EU	Mo91215404	10.6	15.4	Bt2	40.6	29.8	29.6	16.4	13.4	7.3	10.9	5.6	4.2	1.6	C	1.45
AWo2EU	Mo91215405	15.4	24.0	Bt3	40.3	30.2	29.5	15.8	14.4	7.3	10.7	5.1	4	2.4	C	1.55
AWo2EU	Mo91215406	24.0	31.5	Bt4	36.7	32	31.3	18.8	13.2	8.3	11.3	5.4	4.6	1.7	CL	1.62
AWo2EU	Mo91215407	31.5	38.6	2Bt5	32.9	31.8	35.3	17.8	14	9.3	12.6	5.4	4.9	3.1	CL	1.89
AWo2EU	Mo91215408	38.6	51.6	2Btk	31.1	34.6	34.3	17.9	16.7	7.9	10.6	5.6	5.7	4.5	CL	1.83
AWo2EU	Mo91215409	51.6	65.4	2Bck	31.8	35.5	32.7	21.9	13.6	8.5	11.1	5.1	4.3	3.7	CL	1.80
AWo2EU	Mo91215410	65.4	80.7	2Ck	31.4	35.6	33	20.8	14.8	8.3	11.2	4.8	4.5	4.2	CL	1.92

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH4OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH4OAc)	% TOC	pH salt	pH H2O
AWo2EU	Mo91215401	1.6	0.4	0.0	0.2	2.2	9.5	1.9	11.7	9.5	4.1	46	19	23	2.1	4.0	4.5
AWo2EU	Mo91215402	0.5	0.8	0.0	0.1	1.4	8.5	5.3	9.9	8.5	6.7	79	14	16	0.4	3.9	4.7
AWo2EU	Mo91215403	3.2	3.3	0.0	0.3	6.8	22.6	15.5	29.4	26.4	22.3	70	23	26	0.5	3.7	4.4
AWo2EU	Mo91215404	4.0	3.5	0.1	0.4	8.0	22.1	15.1	30.1	26.7	23.1	65	27	30	0.5	3.7	4.5
AWo2EU	Mo91215405	5.6	3.9	0.1	0.3	9.9	17.8	11.2	27.7	24.6	21.1	53	36	40	0.2	3.7	4.4
AWo2EU	Mo91215406	8.1	5.4	0.1	0.4	14.0	10.7	3.7	24.7	21.8	17.7	21	57	64	0.2	4.0	4.6
AWo2EU	Mo91215407	9.9	5.0	0.1	0.4	15.4	6.4	0.2	21.8	21.5	15.6	1	71	72	0.2	4.5	5.2
AWo2EU	Mo91215408	40.0	4.8	0.2	0.3	45.3	0.2	0.0		15.5				100	0.1	7.3	7.8
AWo2EU	Mo91215409	32.0	6.3	0.5	0.3	39.1	0.0	0.0		16.2				100	0.1	7.5	8.0
AWo2EU	Mo91215410	30.5	6.6	0.9	0.3	38.3	0.2	0.0		15.4				100	0.0	7.5	7.9

A7. SITE ID: **AWo2PL** MCL PEDON ID: **Mo912157**

A --- (0-11 cm); very dark grayish brown (10YR 3/2, moist, rubbed) loam; moderate very fine granular structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots, many medium roots throughout, and few coarse roots throughout; many fine, many very fine, common medium pores; 6% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): more organic matter present here than on exposed side, Note(s): good 3/2 colors throughout; clear wavy boundary.

E --- (11-21 cm); yellowish brown (10YR 5/4, moist, broken face) gravelly coarse sandy loam; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, common very fine roots throughout, and few medium roots throughout; many very fine, many fine, few medium pores; few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 16% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): mostly elluvial/colluvial material (frags), Note(s): no clfs present; clear smooth boundary.

Bt1 --- (21-38 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, common fine roots throughout, and few very fine roots throughout; few fine, common very fine pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subrounded very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt2 --- (38-57 cm); yellowish brown (10YR 5/6, moist, broken face) sandy clay loam; moderate fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, common medium roots throughout, common fine roots throughout, and few very fine roots throughout; many very fine, common fine pores; few dark yellowish brown (10YR 4/6, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subrounded very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (57-73 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, few medium roots throughout, and common fine roots throughout; common very fine, common fine pores; common yellowish brown (10YR 5/4, moist) prominent clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): frags are mostly grfs; abrupt smooth boundary.

2Btk1 --- (73-108 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine prismatic parting to strong fine subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; few medium roots throughout, few coarse roots throughout, and few fine roots throughout; few very fine, few fine pores; common light olive brown (2.5Y 5/4, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 5% subrounded very strongly cemented gravel sized mixed rock fragments; gradual smooth boundary.

2Btk2 --- (108-145 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate fine prismatic parting to strong fine subangular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few very fine pores; few light olive brown (2.5Y 5/4, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; many very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 8% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): dense; clear smooth boundary.

2Btk3 --- (145-184 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate fine prismatic parting to moderate fine angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few fine roots throughout; few light olive brown (2.5Y 5/4, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light brownish gray (2.5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate on vertical faces of peds with diffuse boundaries; 5% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): dense; clear smooth boundary.

2Btk4 --- (184-205 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; strong medium prismatic parting to strong fine angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few dark yellowish brown (10YR 4/6, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light olive gray (5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate on faces of peds with diffuse boundaries; 3% rounded very strongly cemented cobble sized mixed rock fragments, 8% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): dense, Note(s): jointed, Note(s): lignins present, Note(s): matrix color changes here is it a potential l.d.?

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
AWo2PL	M091215701	0.0	4.3	A	11.3	39.3	49.4	23	16.3	11.2	16.7	8.1	8.3	5.1	L	1.13
AWo2PL	M091215702	4.3	8.3	BE	8.1	27	64.9	15.9	11.1	8.5	13.1	8.1	14	21.2	COSL	1.43
AWo2PL	M091215703	8.3	15.0	Bt1	41.5	27.3	31.2	14.6	12.7	8.6	11	4.7	3.7	3.2	C	1.53
AWo2PL	M091215704	15.0	22.4	Bt2	29.1	16.4	54.5	6	10.4	15.6	22.7	8.7	5.2	2.3	SCL	1.60
AWo2PL	M091215705	22.4	28.7	Bt3	37	26.8	36.2	15.1	11.7	8.7	12.8	6.3	5.3	3.1	CL	1.61
AWo2PL	M091215706	28.7	42.5	2Btk1	33.9	35.6	30.5	23	12.6	7.7	10.2	5.1	4.5	3	CL	1.62
AWo2PL	M091215707	42.5	57.1	2BCK1	30.4	39.7	29.9	26.4	13.3	8.6	10	4.9	3.6	2.8	CL	1.73
AWo2PL	M091215708	57.1	72.4	2BCK2	31.6	35.5	32.9	22	13.5	7.8	10.6	5	5	4.5	CL	1.83
AWo2PL	M091215709	72.4	80.7	2BCK3	33.6	34.1	32.3	21.2	12.9	7.9	10.4	5.5	4.9	3.6	CL	1.94

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
AWo2PL	M091215701	14.7	1.9	0.0	0.3	16.9	7.8	0.0	24.7	21.7	16.9	0	69	78	4.9	5.5	5.8
AWo2PL	M091215702	1.4	0.4	0.0	0.1	1.9	4.7	1.0	6.6	6.4	2.9	34	29	30	0.4	4.4	4.9
AWo2PL	M091215703	8.9	2.6	0.1	0.3	11.9	13.6	5.0	25.5	25.2	16.9	30	47	47	0.5	4.2	5.0
AWo2PL	M091215704	7.3	2.0	0.1	0.3	9.7	11.1	0.8	20.8	19.2	10.5	8	47	50	0.3	4.1	4.7
AWo2PL	M091215705	12.4	2.7	0.1	0.3	15.5	10.5	0.9	26.0	25.3	16.4	5	60	61	0.3	4.6	5.2
AWo2PL	M091215706	48.3	3.4	0.1	0.3	52.1	0.0	0.0		21.6				100	0.2	7.3	7.9
AWo2PL	M091215707	39.5	5.0	0.1	0.3	44.9	1.2	0.0		18.9				100	0.1	7.5	8.0
AWo2PL	M091215708	39.2	8.7	0.5	0.3	48.7	0.0	0.0		20.1				100	0.1	7.6	8.2
AWo2PL	M091215709	36.6	9.6	1.1	0.3	47.6	1.4	0.0		20.4				100	0.1	7.7	8.1

A8. SITE ID: AWO2PU MCL PEDON ID: M0912156

A --- (0-9 cm); 80% very dark grayish brown (10YR 3/2, moist, rubbed) , and 20% dark grayish brown (10YR 4/2, moist, broken face) loam; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; many very fine, many fine, few medium pores; clear smooth boundary.

Bt1 --- (9-18 cm); yellowish brown (10YR 5/4, moist, broken face) loam; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common medium roots throughout, common fine roots throughout, and common very fine roots throughout; many very fine, many fine, few medium pores; few dark grayish brown (10YR 4/2, moist) prominent organoargillans on surfaces along root channels; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized chert fragments; clear smooth boundary.

Bt2 --- (18-37 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, common fine roots throughout, and many very fine roots throughout; few fine, common very fine pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): mostly grf (chert); clear smooth boundary.

Bt3 --- (37-56 cm); yellowish brown (10YR 5/4, moist, broken face) sandy clay loam; moderate medium prismatic parting to strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, common fine roots throughout, common very fine roots throughout, and common medium roots throughout; many fine, many very fine, few medium pores; common dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light brownish gray (10YR 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 6% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): sandier material, Note(s): gray redox; abrupt smooth boundary.

Btg --- (56-85 cm); grayish brown (10YR 5/2, moist, broken face) clay loam; moderate medium prismatic parting to strong medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; common fine roots throughout, and few medium roots throughout; common very fine, common fine pores; common grayish brown (10YR 5/2, moist) prominent clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light brownish gray (2.5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 7% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): structure easier to see because of sands, Note(s): breaks out nicely; abrupt smooth boundary.

Bt1' --- (85-107 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine prismatic parting to strong medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few coarse roots throughout, and few fine roots throughout; common very fine, common fine pores; common strong brown (7.5YR 4/6, moist) prominent clay films on all faces of peds; common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 6% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): desiccated white sandstone frags, but no CaCO₃; abrupt smooth boundary.

Btg' --- (107-135 cm); grayish brown (10YR 5/2, moist, broken face) clay loam; moderate medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); extremely firm; few very fine roots throughout; few very fine pores; common grayish brown (2.5Y 5/2, moist) distinct clay films on all faces of peds; common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 9% subrounded very strongly cemented gravel sized mixed rock fragments; abrupt wavy boundary.

Bt1'' --- (135-168 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; strong coarse prismatic parting to strong medium subangular blocky structure; noneffervescent (HCl, 1 normal); extremely firm; few very fine roots throughout; few very fine pores; few dark yellowish brown (10YR 4/6, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 7% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): majorly different horizon, Note(s): does not fit in well with rest of pedon, Note(s): looks jointed; abrupt wavy boundary.

2Btk --- (168-205 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate medium prismatic parting to strong medium angular blocky structure; strongly effervescent (HCl, 1 normal); extremely firm; few fine roots throughout; few very fine pores; few dark yellowish brown (10YR 4/6, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates throughout with diffuse boundaries; 10% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): 1% lignite, Note(s): somewhat jointed, Note(s): CAMs are crystalline and less massive - take longer to disappear under HCl-, Note(s): both horizon 8 and 9 are soft once out of situ, Note(s): this horizon would likely be a good one to run CaCO₃ Mg/Ca analysis on.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
AWo2PU	M091215601	0.0	3.5	A	10.8	43.2	46	22.8	20.4	11	18.7	8.5	5.8	2	L	1.40
AWo2PU	M091215602	3.5	7.1	BE	16.9	38.8	44.3	21.9	16.9	9.7	14.9	8.6	7.3	3.8	L	1.50
AWo2PU	M091215603	7.1	14.6	Bt1	44.6	29	26.4	14.9	14.1	5.5	9.2	5.3	4.4	2	C	1.45
AWo2PU	M091215604	14.6	22.0	Bt2	23.8	19	57.2	8.1	10.9	8.3	20.7	13.4	10.9	3.9	SCL	1.67
AWo2PU	M091215605	22.0	33.5	2Btg	32.6	28.8	38.6	16.2	12.6	8.4	13.8	8.1	5.9	2.4	CL	1.63
AWo2PU	M091215606	33.5	42.1	2Bt	32	31.4	36.6	18.7	12.7	9.5	12.2	6.6	5	3.3	CL	1.78
AWo2PU	M091215607	42.1	53.1	2Btg	34.2	32.5	33.3	18.2	14.3	9.4	12.8	5.5	3.7	1.9	CL	1.72
AWo2PU	M091215608	53.1	66.1	3BC	31.1	30.9	38	18.7	12.2	8.9	12.7	6.6	5.8	4	CL	1.71
AWo2PU	M091215609	66.1	80.7	4Bck	34	33.8	32.2	20.9	12.9	8.3	11.3	5.3	4.5	2.8	CL	1.73

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
AWo2PU	M091215601	5.7	1.2	0.0	0.2	7.1	8.0	0.1	15.1	12.3	7.2	1	47	58	2.4	4.5	4.7
AWo2PU	M091215602	1.7	1.2	0.0	0.1	3.0	8.4	3.4	11.4	9.2	6.4	53	26	33	0.5	4.0	4.8
AWo2PU	M091215603	6.9	4.5	0.1	0.4	11.9	20.0	12.5	31.9	28.4	24.4	51	37	42	0.4	3.9	4.5
AWo2PU	M091215604	3.8	2.4	0.1	0.2	6.5	12.0	7.1	18.5	16.2	13.6	52	35	40	0.2	4.0	4.7
AWo2PU	M091215605	5.9	4.3	0.1	0.3	10.6	13.2	7.9	23.8	23.2	18.5	43	45	46	0.1	3.8	4.4
AWo2PU	M091215606	6.5	5.0	0.2	0.3	12.0	10.6	3.4	22.6	22.1	15.4	22	53	54	0.1	3.9	4.8
AWo2PU	M091215607	8.8	5.9	0.2	0.4	15.3	7.0	1.2	22.3	22.2	16.5	7	69	69	0.1	4.4	5.0
AWo2PU	M091215608	8.8	5.6	0.3	0.3	15.0	5.7	0.0	20.7	19.0	15.0	0	72	79	0.1	5.5	6.1
AWo2PU	M091215609	45.0	5.4	0.5	0.3	51.2	1.1	0.0		18.2				100	0.1	7.3	7.4

A.9. SITE ID: **HH01EL** MCL PEDON ID: **M0912159**

A --- (0-9 cm); 90% dark grayish brown (10YR 4/2, moist, broken face) , and 10% brown (10YR 5/3, moist, broken face) fine sandy loam; moderate fine granular structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; many very fine, many fine, few medium pores; few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels; Note(s): organoargillans are along root channels and old pores; clear smooth boundary.

AB --- (9-17 cm); 80% dark grayish brown (10YR 4/2, moist, broken face) , and 20% yellowish brown (10YR 5/4, moist, broken face) fine sandy loam; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; few coarse roots throughout, common fine roots throughout, and common very fine roots throughout; common fine, many very fine, few medium pores; few very dark grayish brown (10YR 3/2, moist) distinct organoargillans on surfaces along root channels; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): zone of mixing (not like HH01EU) no clay films; clear smooth boundary.

Bt1 --- (17-32 cm); yellowish brown (10YR 5/6, moist, broken face) sandy clay loam; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common very fine roots throughout, and few fine roots throughout; common very fine, common fine pores; few dark grayish brown (10YR 4/2, moist) distinct organoargillans on surfaces along root channels, few yellowish brown (10YR 5/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): frags less than 1 percent , Note(s): clay films may not be as prominent due to sands?; clear smooth boundary.

Bt2 --- (32-54 cm); yellowish brown (10YR 5/6, moist, broken face) sandy clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, and common very fine roots throughout; common very fine, few fine pores; very few dark grayish brown (10YR 4/2, moist) distinct organoargillans on surfaces along root channels, few dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): few organoargillans in root channels , Note(s): what appears to be charcoal is present (less than 1%); clear smooth boundary.

Bt3 --- (54-73 cm); yellowish brown (10YR 5/6, moist, broken face) sandy clay loam; moderate fine prismatic parting to strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, common fine roots throughout, and common very fine roots throughout; few fine, common very fine pores; common dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt4 --- (73-96 cm); yellowish brown (10YR 5/6, moist, broken face) fine sandy loam; moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common coarse roots throughout, common fine roots throughout, and common very fine roots throughout; common very fine, common fine pores; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds, very few light yellowish brown (10YR 6/4, moist) distinct skeletons on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): sand skeletons are in places throughout horizon; clear smooth boundary.

Bt5 --- (96-112 cm); yellowish brown (10YR 5/6, moist, broken face) sandy clay loam; moderate fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout; few very fine, few fine pores; few dark yellowish brown (10YR 4/6, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): transitional horizon, Note(s): gray redox starts here; clear smooth boundary.

2Bt6 --- (112-141 cm); olive brown (2.5Y 4/3, moist, broken face) clay loam; strong medium prismatic parting to strong fine angular blocky structure; noneffervescent (HCl, 1 normal); very firm; few coarse roots throughout, common medium roots throughout, and few fine roots throughout; few very fine, few fine pores; common dark grayish brown (2.5Y 4/2, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): dense, fairly dark colored matrix; clear wavy boundary.

2Bt7 --- (141-181 cm); light olive brown (2.5Y 5/4, moist, broken face) fine sandy loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; few coarse roots throughout, few medium roots throughout, and few fine roots throughout; few fine, common very fine pores; few olive brown (2.5Y 4/3, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): lignins present, Note(s): sand lenses are structureless, Note(s): horizon is stratified with fine to coarse sands, Note(s): clay films only appear on clay lenses, Note(s): sand lenses are structureless and texture was challenging due to stratification (likely 2 distinct textures); abrupt irregular boundary.

2Bck --- (181-205 cm); light olive brown (2.5Y 5/4, moist, broken face) coarse sandy loam; weak medium angular blocky structure; strongly effervescent (HCl, 1 normal); friable; common fine roots throughout, and common very fine roots throughout; few fine, common very fine pores; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates throughout with diffuse boundaries; 5% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): lignins present, Note(s): stratified coarse sands and fine gravels with clays, Note(s): clays look like old root channels, Note(s): no clayfilms, Note(s): presence of clays made texture challenging.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
HH01EL	Mo91215901	0.0	3.5	A	13.3	33.1	53.6	16	17.1	11.1	25.4	9	5.2	2.9	FSL	1.27
HH01EL	Mo91215902	3.5	6.7	BE	15	28.4	56.6	13.6	14.8	10.5	27.3	9.4	5.7	3.7	FSL	1.50
HH01EL	Mo91215903	6.7	12.6	Bt1	30.3	21.7	48	9.2	12.5	9.8	27.2	6.9	2.6	1.5	SCL	1.42
HH01EL	Mo91215904	12.6	21.3	Bt2	30.9	15.2	53.9	5.5	9.7	10.7	35.2	6.1	1.3	0.6	SCL	1.56
HH01EL	Mo91215905	21.3	28.7	Bt3	24.3	13.2	62.5	3.9	9.3	13.7	41.8	6.3	0.5	0.2	SCL	1.51
HH01EL	Mo91215906	28.7	37.8	Bt4	18.1	12.6	69.3	3.3	9.3	11.7	49.9	7.7	0	0	FSL	1.66
HH01EL	Mo91215907	37.8	44.1	2Bt1	26.6	24.8	48.6	10.6	14.2	13.7	25.6	4.9	2.5	1.9	SCL	1.60
HH01EL	Mo91215908	44.1	55.5	2Bt2	31.5	33	35.5	16.7	16.3	8.4	12.3	5.7	5.4	3.7	CL	1.71
HH01EL	Mo91215909	55.5	71.3	2BC	15.9	20.9	63.2	10.5	10.4	7.3	38.4	14.2	2.1	1.2	FSL	1.47
HH01EL	Mo91215910	71.3	79.9	3BCK	12.4	20.8	66.8	11	9.8	4.5	11.1	12.5	19.6	19.1	COSL	1.61

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
HH01EL	Mo91215901	1.7	0.4	0.0	0.2	2.3	12.8	4.9	15.1	11.7	7.2	68	15	20	1.3	3.9	4.5
HH01EL	Mo91215902	3.7	0.8	0.0	0.2	4.7	7.9	1.7	12.6	10.4	6.4	27	37	45	0.5	4.4	5.2
HH01EL	Mo91215903	9.6	2.0	0.1	0.3	12.0	10.4	3.3	22.4	19.4	15.3	22	54	62	0.4	4.3	4.8
HH01EL	Mo91215904	10.2	2.0	0.1	0.3	12.6	9.1	2.5	21.7	19.2	15.1	17	58	66	0.3	4.3	5.0
HH01EL	Mo91215905	8.8	1.6	0.1	0.3	10.8	7.0	1.5	17.8	16.8	12.3	12	61	64	0.2	4.4	5.1
HH01EL	Mo91215906	8.6	1.2	0.1	0.2	10.1	6.6	0.6	16.7	13.4	10.7	6	60	75	0.1	4.5	5.1
HH01EL	Mo91215907	10.8	1.2	0.1	0.3	12.4	7.4	0.1	19.8	17.7	12.5	1	63	70	0.2	4.9	5.4
HH01EL	Mo91215908	15.9	1.6	0.1	0.4	18.0	7.7	0.0	25.7	22.0	18.0	0	70	82	0.2	5.3	5.8
HH01EL	Mo91215909	8.2	0.8	0.1	0.2	9.3	3.0	0.0	12.3	11.0	9.3	0	75	85	0.1	6.6	7.1
HH01EL	Mo91215910	39.2	1.2	0.1	0.2	40.7	0.0	0.0		8.5				100	0.1	7.4	7.8

A.10. SITE ID: **HH01EU** MCL PEDON ID: **M0912158**

A --- (0-7 cm); 80% very dark grayish brown (10YR 3/2, moist, rubbed) , and 20% dark grayish brown (10YR 4/2, moist, broken face) clay loam; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; many very fine, many fine, few medium pores; clear smooth boundary.

Bt1 --- (7-16 cm); brown (10YR 4/3, moist, broken face) clay; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many very fine roots throughout, common fine roots throughout, and few medium roots throughout; few very fine, few fine pores; common very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels, few dark grayish brown (10YR 4/2, moist) faint clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): border line "AB" horizon, but has clay films and significant clay increase from above; abrupt smooth boundary.

Bt2 --- (16-29 cm); yellowish brown (10YR 5/6, moist, broken face) clay; strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, common very fine roots throughout, and few coarse roots throughout; common very fine, common fine, few medium pores; common brown (10YR 5/3, moist) prominent clay films on all faces of peds, few dark grayish brown (10YR 4/2, moist) distinct organoargillans on surfaces along root channels; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 4/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subrounded very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (29-48 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, and common medium roots throughout; common very fine, common fine pores; common yellowish brown (10YR 5/4, moist) prominent clay films on all faces of peds; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt4 --- (48-67 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few coarse roots throughout, common medium roots throughout, and common fine roots throughout; few very fine, few fine pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt5 --- (67-92 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few medium roots throughout, and common fine roots throughout; few very fine, few fine pores; few dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; abrupt wavy boundary.

Btk1 --- (92-120 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate fine prismatic parting to strong fine subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; few coarse roots throughout, few medium roots throughout, and few very fine roots throughout; few very fine, few fine pores; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries; 6% subrounded very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

2Btk2 --- (120-151 cm); 60% dark yellowish brown (10YR 4/6, moist, broken face) , and 40% light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate medium prismatic parting to moderate fine angular blocky structure; violently effervescent (HCl, 1 normal); firm; few very fine roots throughout; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 8% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): denser and more brittle - good BC; gradual smooth boundary.

2Btk3 --- (151-205 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; strong coarse prismatic parting to strong medium angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few light olive brown (2.5Y 5/3, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; many very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 6% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): dense, Note(s): 1% lignins.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
HH01EU	M091215801	0.0	2.8	A	27.5	41.4	31.1	21.3	20.1	8.7	11.1	5.1	3.8	2.4	CL	1.15
HH01EU	M091215802	2.8	6.3	Bt1	48.8	26.3	24.9	18.3	8	6.4	9	4.5	3.5	1.5	C	1.29
HH01EU	M091215803	6.3	11.4	Bt2	46.7	31.5	21.8	15.6	15.9	5.4	7.2	3.4	3	2.8	C	1.32
HH01EU	M091215804	11.4	18.9	Bt3	33.1	42.4	24.5	17.5	24.9	6.6	8.9	4.3	3	1.7	CL	1.37
HH01EU	M091215805	18.9	26.4	Bt4	39.3	33	27.7	16.8	16.2	6.8	9.4	4.4	3.8	3.3	CL	1.62
HH01EU	M091215806	26.4	36.2	Bt5	38.5	33.6	27.9	18.1	15.5	7.1	9	4.6	3.8	3.4	CL	1.75
HH01EU	M091215807	36.2	47.2	2Btk	32.5	35.9	31.6	20.5	15.4	8.2	10.9	5.1	4.5	2.9	CL	1.73
HH01EU	M091215808	47.2	59.4	2Bck1	29.8	41.2	29	20.4	20.8	6.9	9.1	4.6	3.8	4.6	CL	1.64
HH01EU	M091215809	59.4	80.7	2Bck2	31.5	37.8	30.7	21.7	16.1	7.2	9.8	4.9	4.1	4.7	CL	1.76

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
HH01EU	M091215801	13.3	3.1	0.0	0.5	16.9	10.5	0.0	27.4	24.7	16.9	0	62	68	3.2	5.2	5.7
HH01EU	M091215802	11.2	3.5	0.0	0.4	15.1	12.7	2.8	27.8	27.3	17.9	16	54	55	1.2	4.4	4.9
HH01EU	M091215803	13.5	3.8	0.1	0.4	17.8	17.8	9.9	35.6	34.7	27.7	36	50	51	0.7	4.1	4.6
HH01EU	M091215804	11.7	3.0	0.1	0.4	15.2	20.7	12.2	35.9	32.0	27.4	45	42	47	0.3	3.9	4.6
HH01EU	M091215805	10.3	2.3	0.1	0.3	13.0	16.2	8.4	29.2	26.1	21.4	39	45	50	0.2	3.9	4.5
HH01EU	M091215806	12.9	2.3	0.1	0.3	15.6	10.6	3.8	26.2	25.4	19.4	20	60	61	0.1	4.0	4.6
HH01EU	M091215807	44.4	2.1	0.1	0.4	47.0	2.8	0.0		19.7				100	0.1	7.2	7.7
HH01EU	M091215808	48.5	2.1	0.1	0.3	51.0	2.0	0.0		18.1				100	0.1	7.4	7.9
HH01EU	M091215809	47.8	3.7	0.1	0.3	51.9	1.6	0.0		18.2				100	0.1	7.6	8.0

A.11. SITE ID: **HH01PL** MCL PEDON ID: **M0912161**

A --- (0-12 cm); very dark grayish brown (10YR 3/2, moist, rubbed) loam; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many very fine roots throughout, many fine roots throughout, and common medium roots throughout; many very fine, many fine, common medium pores; Note(s): few 10YR4/2 mixings from horizon below ; clear smooth boundary.

E --- (12-20 cm); brown (10YR 5/3, moist, broken face) loam; weak thin platy parting to moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many very fine roots throughout; many very fine, many fine pores; few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): E? no clayfilms present; clear smooth boundary.

Bt1 --- (20-32 cm); yellowish brown (10YR 5/4, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few medium roots throughout, common fine roots throughout, and common very fine roots throughout; common very fine, common fine pores; few brown (10YR 5/3, moist) faint clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 7% subangular very strongly cemented gravel sized mixed rock fragments; clear wavy boundary.

Bt2 --- (32-56 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; weak fine prismatic parting to strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, common very fine roots throughout, and few coarse roots throughout; common very fine, common fine, few medium pores; few dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (56-74 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay; weak medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few medium roots throughout, and common fine roots throughout; few very fine, few fine pores; common dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): grays begin; abrupt smooth boundary.

Bt4 --- (74-90 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few fine roots throughout; few very fine, few fine pores; few dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; abrupt smooth boundary.

Btk --- (90-123 cm); dark yellowish brown (10YR 4/4, moist, broken face) clay loam; strong fine prismatic parting to strong fine angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; common coarse roots throughout, common medium roots throughout, and common fine roots throughout; few very fine pores; few olive brown (2.5Y 4/3, moist) distinct clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; many very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): dense; abrupt smooth boundary.

2BC1 --- (123-152 cm); dark yellowish brown (10YR 4/6, moist, broken face) fine sandy loam; weak medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few fine roots throughout; common very fine pores; few dark yellowish brown (10YR 4/4, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; Note(s): outwash?, Note(s): some kind of film on vertical ped faces due to structure - not sure if really clay film though; gradual smooth boundary.

2BC2 --- (152-205 cm); yellowish brown (10YR 5/6, moist, broken face) fine sandy loam; weak medium angular blocky structure; very slightly effervescent (HCl, 1 normal); firm; few very fine roots throughout; common very fine pores; very few dark yellowish brown (10YR 4/4, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; few very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; Note(s): coarser sands, Note(s): some kind of film on vertical ped faces due to structure - not sure if really clay film though.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
HH01PL	M091216101	0.0	4.7	A	16	42.6	41.4	25.5	17.1	9.5	14.4	7.8	6.3	3.4	L	1.16
HH01PL	M091216102	4.7	7.9	BE	12.7	41.6	45.7	23	18.6	10.5	16	8.3	6.9	4	L	1.47
HH01PL	M091216103	7.9	12.6	Bt1	20.4	32.9	46.7	17.1	15.8	8.5	14.1	7.9	8.1	8.1	L	1.49
HH01PL	M091216104	12.6	22.0	Bt2	34.5	23.3	42.2	11.7	11.6	7.8	21.7	6.7	3.7	2.3	CL	1.50
HH01PL	M091216105	22.0	29.1	Bt3	42.2	30.1	27.7	16.5	13.6	6.9	9.9	5.3	4	1.6	C	1.56
HH01PL	M091216106	29.1	35.4	Bck	38.7	31.4	29.9	16.5	14.9	7.3	11.1	5.5	4.1	1.9	CL	1.78
HH01PL	M091216107	35.4	48.4	2Bck	32	36.4	31.6	23.5	12.9	6.4	10.8	6.3	4.9	3.2	CL	1.67
HH01PL	M091216108	48.4	59.8	3BC1	15.1	5.6	79.3	1.9	3.7	5.1	40.3	27.2	6.2	0.5	FSL	1.59
HH01PL	M091216109	59.8	80.7	3BC2	12.6	7.6	79.8	3	4.6	8.2	48.5	20.8	2.3	0	FSL	1.61

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
HH01PL	M091216101	16.9	2.4	0.0	0.3	19.6	10.9	0.0	30.5	26.5	19.6	0	64	74	4.6	5.6	5.8
HH01PL	M091216102	1.7	0.4	0.0	0.1	2.2	7.6	2.8	9.8	8.5	5.0	56	22	26	0.5	4.3	4.9
HH01PL	M091216103	2.4	0.8	0.0	0.2	3.4	12.4	7.4	15.8	13.4	10.8	69	21	25	0.4	4.2	4.9
HH01PL	M091216104	8.1	1.6	0.1	0.3	10.1	15.2	9.5	25.3	23.8	19.6	48	40	42	0.3	3.9	4.5
HH01PL	M091216105	13.6	2.4	0.1	0.4	16.5	13.8	5.6	30.3	27.9	22.1	25	55	59	0.3	4.1	4.4
HH01PL	M091216106	15.9	2.3	0.1	0.4	18.7	7.7	0.6	26.4	26.0	19.3	3	71	72	0.4	4.7	5.2
HH01PL	M091216107	49.4	1.6	0.1	0.3	51.4	0.1	0.0		18.8				100	0.2	7.5	7.8
HH01PL	M091216108	10.8	0.8	0.0	0.2	11.8	0.8	0.0	12.6	12.1	11.8	0	94	97	0.1	7.0	7.5
HH01PL	M091216109	8.6	0.8	0.0	0.2	9.6	1.3	0.0	10.9	10.1	9.6	0	88	95	0.1	6.6	6.8

A.12. SITE ID: **HH01PU** MCL PEDON ID: **Mo912160**

A --- (0-8 cm); 80% very dark grayish brown (10YR 3/2, moist, rubbed) , and 20% dark grayish brown (10YR 4/2, moist, broken face) silt loam; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; common fine, many very fine pores; clear smooth boundary.

AB --- (8-15 cm); brown (10YR 5/3, moist, broken face) clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, and common very fine roots throughout; few medium, many very fine, common fine pores; few dark grayish brown (10YR 4/2, moist) prominent organoargillans on surfaces along root channels; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): E? , Note(s): fragments are likely colluvial in nature; clear smooth boundary.

Bt1 --- (15-23 cm); yellowish brown (10YR 5/4, moist, broken face) clay; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, common fine roots throughout, and common very fine roots throughout; common fine, many very fine pores; very few yellowish brown (10YR 5/4, moist) faint clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): BE? , Note(s): check for precise clay increase, Note(s): clay films were difficult to determine; abrupt smooth boundary.

Bt2 --- (23-38 cm); yellowish brown (10YR 5/6, moist, broken face) clay; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, common medium roots throughout, and common very fine roots throughout; common very fine, few fine pores; few yellowish brown (10YR 5/4, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (38-62 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; weak fine prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few medium roots throughout, common fine roots throughout, and few fine roots throughout; common very fine pores; few yellowish brown (10YR 5/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt4 --- (62-85 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; weak medium prismatic parting to weak medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few medium roots throughout, and few fine roots throughout; few very fine, few fine pores; common dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of ped; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): significant grays start here; clear smooth boundary.

Bt5 --- (85-102 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; weak medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few fine roots throughout; few very fine pores; common olive brown (2.5Y 4/3, moist) prominent clay films on all faces of ped; common light olive gray (5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): dense , Note(s): start of second p.m. , Note(s): no free CaCO₃ , Note(s): clay min feels illitic?; abrupt smooth boundary.

2Btk1 --- (102-149 cm); yellowish brown (10YR 5/4, moist, broken face) clay loam; moderate medium prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of ped; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) medium prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of ped with diffuse boundaries; 7% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): dense , Note(s): 1% lignins present; gradual smooth boundary.

2Btk2 --- (149-205 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate medium angular blocky structure; violently effervescent (HCl, 1 normal); very firm; few fine roots throughout; few dark yellowish brown (10YR 4/4, moist) faint clay films on all faces of ped; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) medium prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) medium prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of ped with diffuse boundaries; 10% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): dense , Note(s): 1% lignins present.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
HH01PU	M091216001	0.0	3.1	A	14.5	60.1	25.4	36.9	23.2	6.2	9.1	4.8	4	1.3	SIL	1.17
HH01PU	M091216002	3.1	5.9	BE	14.6	60.7	24.7	37.7	23	5.7	8.4	4.6	3.6	2.4	SIL	1.47
HH01PU	M091216003	5.9	9.1	Bt1	27.7	49.2	23.1	29.4	19.8	5.7	8	4.2	3.2	2	CL	1.38
HH01PU	M091216004	9.1	15.0	Bt2	48.7	30.9	20.4	17.5	13.4	5.3	7	3.7	2.8	1.6	C	1.27
HH01PU	M091216005	15.0	24.4	Bt3	44.4	32	23.6	18.2	13.8	6.3	8.2	4	3.1	2	C	1.44
HH01PU	M091216006	24.4	33.5	Bt4	37.2	36.9	25.9	21.1	15.8	6.7	9.3	4.9	3.3	1.7	CL	1.56
HH01PU	M091216007	33.5	40.2	2Bt5	33	37.8	29.2	21.6	16.2	7.2	10.3	4.9	3.9	2.9	CL	1.76
HH01PU	M091216008	40.2	58.7	2Btk	31.2	39.5	29.3	23.9	15.6	7.3	10	5	4	3	CL	1.79
HH01PU	M091216009	58.7	80.7	2Bck	29.6	42.2	28.2	25.7	16.5	7.5	10	4.7	3.7	2.3	CL	1.79

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
HH01PU	M091216001	10.9	1.6	0.1	0.2	12.8	10.8	0.0	23.6	20.4	12.8	0	54	63	3.5	4.9	5.2
HH01PU	M091216002	2.5	0.8	0.1	0.1	3.5	8.3	3.7	11.8	10.5	7.2	51	30	33	0.6	4.2	4.8
HH01PU	M091216003	4.7	1.6	0.1	0.2	6.6	13.2	8.3	19.8	17.3	14.9	56	33	38	0.4	4.0	4.6
HH01PU	M091216004	11.1	3.6	0.1	0.5	15.3	22.2	15.2	37.5	34.2	30.5	50	41	45	0.4	3.9	4.4
HH01PU	M091216005	12.1	3.5	0.1	0.5	16.2	20.5	12.0	36.7	34.2	28.2	43	44	47	0.3	4.0	4.5
HH01PU	M091216006	12.3	2.8	0.1	0.4	15.6	12.4	6.0	28.0	26.9	21.6	28	56	58	0.2	4.0	4.6
HH01PU	M091216007	17.8	2.4	0.1	0.3	20.6	3.3	0.0	23.9	23.3	20.6	0	86	88	0.2	5.9	6.4
HH01PU	M091216008	48.5	2.0	0.1	0.3	50.9	0.3	0.0		19.6				100	0.1	7.3	7.7
HH01PU	M091216009	43.9	2.9	0.1	0.3	47.2	0.0	0.0		17.6				100	0.1	7.4	8.0

A.13. SITE ID: **HH02EL** MCL PEDON ID: **Mo912163**

A --- (0-8 cm); 90% dark grayish brown (10YR 4/2, moist, broken face) , and 10% very dark grayish brown (10YR 3/2, moist, broken face) sandy loam; weak very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and few medium roots throughout; many very fine, many fine, few medium pores; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; Note(s): very little o.m. , Note(s): not quite a true A horizon , Note(s): high in sands; abrupt smooth boundary.

Bt1 --- (8-17 cm); brown (10YR 5/3, moist, broken face) fine sandy loam; weak fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, and common very fine roots throughout; few medium, many very fine, common fine pores; few brown (10YR 5/3, moist) faint clay films on all faces of peds, few dark grayish brown (10YR 4/2, moist) faint organoargillans on surfaces along root channels; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): probably enough clay films and clay increase that this is a Bt, but check lab data to verify; clear smooth boundary.

Bt2 --- (17-30 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; weak medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few medium roots throughout, common very fine roots throughout, and few fine roots throughout; common very fine, common fine pores; few dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds, very few dark grayish brown (10YR 4/2, moist) faint organoargillans on surfaces along root channels; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): could have enough sands to make clay; clear smooth boundary.

Bt3 --- (30-44 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, common very fine roots throughout, and few medium roots throughout; few fine, common very fine pores; common dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt4 --- (44-61 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay; moderate medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, few fine roots throughout, and few very fine roots throughout; few fine, common very fine pores; common brown (10YR 4/3, moist) prominent clay films on all faces of ped; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): significant redox depletions start; clear smooth boundary.

Btk1 --- (61-87 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; weak fine prismatic parting to moderate fine subangular blocky structure; slightly effervescent (HCl, 1 normal); firm; few coarse roots throughout, few medium roots throughout, and few very fine roots throughout; few fine, common very fine pores; few olive brown (2.5Y 4/4, moist) prominent clay films on all faces of ped; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of ped with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries; 5% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

2Btk2 --- (87-115 cm); light olive brown (2.5Y 5/4, moist, broken face) silt loam; moderate medium prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; few fine roots throughout; few very fine pores; few olive brown (2.5Y 4/3, moist) distinct clay films on all faces of ped; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of ped with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries; 6% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): lignins present, Note(s): 1% fdc that are cylindrical and in pores almost like casts; abrupt wavy boundary.

2Btk3 --- (115-137 cm); light olive brown (2.5Y 5/6, moist, broken face) clay loam; weak fine prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; few very fine roots throughout; few fine pores; few olive brown (2.5Y 4/4, moist) faint clay films on all faces of ped; common brownish yellow (10YR 6/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light olive brown (2.5Y 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of ped with diffuse boundaries; Note(s): maybe more CaCO₃ than was described, but was mixed finely with matrix, Note(s): appears to be different material (silty and olive colored), Note(s): 1% fdc cylindrical & in pores almost like casts, Note(s): clf have line struct. & diff color, but do not have a lot of clay; abrupt wavy boundary.

2Btk4 --- (137-177 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate coarse prismatic parting to moderate medium subangular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few very fine pores; few gray (2.5Y 5/1, moist) faint clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 8% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): 1% lignins, Note(s): dense material; gradual smooth boundary.

2Btk5 --- (177-205 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate fine prismatic parting to moderate medium angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few grayish brown (2.5Y 5/2, moist) faint clay films on all faces of peds; common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light olive brown (2.5Y 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; many very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 6% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): 1% lignins, Note(s): dense material.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
HH02EL	M091216301	0.0	3.1	A	11.7	28	60.3	14.5	13.5	9.5	19.4	15.8	10.8	4.8	SL	1.28
HH02EL	M091216302	3.1	6.7	Bt1	17.4	26.2	56.4	13.6	12.6	9	18.7	13.7	9.6	5.4	FSL	1.71
HH02EL	M091216303	6.7	11.8	Bt2	34.5	26.9	38.6	14	12.9	6.9	13.2	9.2	6	3.3	CL	1.40
HH02EL	M091216304	11.8	17.3	Bt3	44.6	28.1	27.3	15.6	12.5	6.2	9.8	5.3	4	2	C	1.47
HH02EL	M091216305	17.3	24.0	Bt4	41.1	30	28.9	16.4	13.6	6.9	10	5.2	4	2.8	C	1.56
HH02EL	M091216306	24.0	34.3	2Btk1	32.8	34.7	32.5	20.1	14.6	7.2	11	5.2	4.7	4.4	CL	1.70
HH02EL	M091216307	34.3	45.3	2Btk2	16.6	56	27.4	24	32	17.1	7.9	1	0.9	0.5	SIL	1.79
HH02EL	M091216308	45.3	53.9	3Bck1	30.5	33.7	35.8	23.7	10	8.2	11.8	5.8	5	5	CL	1.65
HH02EL	M091216309	53.9	69.7	4Bck2	28.6	36.6	34.8	22.1	14.5	8.2	10.8	5.8	5.4	4.6	CL	1.80
HH02EL	M091216310	69.7	80.7	4Bck3	34.7	35.7	29.6	22.7	13	7.1	10.7	4.8	4	3	CL	1.76

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
HH02EL	M091216301	9.5	0.8	0.0	0.2	10.5	6.6	0.0	17.1	14.5	10.5	0	62	73	3.0	5.3	5.5
HH02EL	M091216302	2.9	0.8	0.0	0.2	3.9	7.4	4.5	11.3	11.1	8.4	54	34	35	0.6	4.0	4.9
HH02EL	M091216303	9.2	1.6	0.1	0.3	11.2	11.3	6.7	22.5	22.4	17.9	37	50	50	0.4	4.0	4.7
HH02EL	M091216304	15.5	2.3	0.1	0.4	18.3	11.1	3.2	29.4	28.8	21.5	15	62	64	0.4	4.1	4.9
HH02EL	M091216305	18.3	2.0	0.1	0.3	20.7	6.8	0.0	27.5	25.7	20.7	0	75	80	0.4	4.9	5.8
HH02EL	M091216306	40.5	1.9	0.1	0.2	42.7	2.4	0.0		20.0				100	0.3	7.2	7.8
HH02EL	M091216307	46.9	2.4	0.1	0.1	49.5	1.6	0.0		17.1				100	0.1	7.4	7.8
HH02EL	M091216308	32.2	1.6	0.0	0.1	33.9	1.7	0.0		10.8				100	0.1	7.4	7.9
HH02EL	M091216309	45.9	3.5	0.1	0.2	49.7	2.7	0.0		14.9				100	0.1	7.4	8.0
HH02EL	M091216310	44.9	5.5	0.2	0.2	50.8	1.8	0.0		16.8				100	0.1	7.4	8.0

A.14. SITE ID: **HH02EU** MCL PEDON ID: **Mo912162**

A --- (0-7 cm); 90% dark grayish brown (10YR 4/2, moist, broken face) , and 10% very dark grayish brown (10YR 3/2, moist, broken face) silt loam; weak very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; many fine, many very fine, common medium pores; Note(s): not much 10YR3/2 (less o.m.); abrupt smooth boundary.

Bt1 --- (7-14 cm); yellowish brown (10YR 5/4, moist, broken face) silt loam; weak fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, common very fine roots throughout, and few medium roots throughout; many very fine, common fine, common medium pores; few dark grayish brown (10YR 4/2, moist) distinct organoargillans on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; abrupt smooth boundary.

Bt2 --- (14-29 cm); yellowish brown (10YR 5/6, moist, broken face) silty clay; weak fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, common fine roots throughout, and few very fine roots throughout; common very fine, common fine pores; common dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (29-47 cm); yellowish brown (10YR 5/6, moist, broken face) silty clay; weak medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few medium roots throughout, common fine roots throughout, and common very fine roots throughout; common very fine, common fine pores; common dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): more redox and larger structure check clay percentage; clear smooth boundary.

Bt4 --- (47-78 cm); yellowish brown (10YR 5/6, moist, broken face) silty clay loam; moderate coarse prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, few medium roots throughout, and few fine roots throughout; common very fine, few fine pores; few brown (7.5YR 4/4, moist) prominent clay films on all faces of peds, few brown (10YR 5/3, moist) prominent clay films on all faces of peds; common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): two colors of clay films; clear smooth boundary.

Bt5 --- (78-91 cm); strong brown (7.5YR 5/6, moist, broken face) silty clay loam; moderate coarse prismatic parting to strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, few medium roots throughout, and common fine roots throughout; common very fine, few fine pores; common brown (7.5YR 4/4, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): redox depletions are significant; abrupt wavy boundary.

2Btk1 --- (91-128 cm); yellowish brown (10YR 5/6, moist, broken face) silty clay loam; moderate medium prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; common fine roots throughout, and few medium roots throughout; few very fine pores; few dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; many very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 5% subangular very strongly cemented gravel sized mixed rock fragments; gradual smooth boundary.

2Btk2 --- (128-188 cm); yellowish brown (10YR 5/6, moist, broken face) silty clay loam; moderate medium prismatic parting to moderate fine angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few very fine pores; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; many very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries; 7% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): vaguely jointed, Note(s): dense material; abrupt wavy boundary.

2Btk3 --- (188-205 cm); yellowish brown (10YR 5/6, moist, broken face) loam; moderate fine prismatic parting to strong fine angular blocky structure; strongly effervescent (HCl, 1 normal); firm; few very fine roots throughout; few very fine pores; very few yellowish brown (10YR 5/6, moist) distinct clay films on all faces of peds; common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) medium prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/3, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 8% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): stratified sands and clays, Note(s): sands are well sorted and sand lenses are structureless.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
HHo2EU	Mo91216201	0.0	2.8	A	16.9	46.3	36.8	21.6	24.7	9.1	14.1	6.8	4.6	2.2	L	1.28
HHo2EU	Mo91216202	2.8	5.5	BE	24.5	41.3	34.2	22.2	19.1	8.8	13.0	6.4	4.0	2.0	L	1.17
HHo2EU	Mo91216203	5.5	11.4	Bt1	44.1	32.6	23.3	18.4	14.2	6.0	8.0	4.1	3.2	2.0	C	1.27
HHo2EU	Mo91216204	11.4	18.5	Bt2	40.6	32.0	27.4	16.5	15.5	6.7	9.7	4.9	4.0	2.1	C	1.44
HHo2EU	Mo91216205	18.5	30.7	Bt3	37.9	34.7	27.4	20.0	14.7	6.9	9.8	4.9	3.7	2.1	CL	1.66
HHo2EU	Mo91216206	30.7	35.8	Bt4	38.4	32.8	28.8	18.8	14.0	7.0	9.8	5.4	4.3	2.3	CL	1.68
HHo2EU	Mo91216207	35.8	50.4	2Btk	33.2	37.2	29.6	22.3	14.9	7.7	10.3	5.4	4.2	2.0	CL	1.71
HHo2EU	Mo91216208	50.4	74.0	2Bck1	30.6	38.2	31.2	22.2	16.0	7.4	10.6	5.5	4.5	3.2	CL	1.76
HHo2EU	Mo91216209	74.0	80.7	2Bck2	17.6	20.8	61.6	11.8	9.0	8.4	25.6	14.3	9.7	3.6	FSL	1.79

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
HHo2EU	Mo91216201	6.5	1.5	0.0	0.3	8.3	11.1	1.6	19.4	18.1	10	16	43	46	3.4	4.1	4.6
HHo2EU	Mo91216202	3.1	1.6	0.0	0.3	5.0	15.2	9.6	20.2	18.0	15	66	25	28	1.1	3.7	4.3
HHo2EU	Mo91216203	6.0	2.4	0.1	0.3	8.8	24.2	16.6	33.0	32.0	25	65	27	28	0.7	3.6	4.5
HHo2EU	Mo91216204	7.7	2.0	0.1	0.3	10.1	19.3	15.0	29.4	27.8	25	60	34	36	0.4	3.7	4.3
HHo2EU	Mo91216205	9.3	1.9	0.1	0.3	11.6	15.5	10.2	27.1	25.4	22	47	43	46	0.2	3.8	4.4
HHo2EU	Mo91216206	14.0	2.0	0.1	0.3	16.4	10.3	3.0	26.7	25.2	19	15	61	65	0.2	4.1	4.7
HHo2EU	Mo91216207	42.7	1.2	0.1	0.2	44.2	2.2	0.0		20.2				100	0.1	7.0	7.7
HHo2EU	Mo91216208	48.3	3.2	0.1	0.3	51.9	1.9	0.0		17.0				100	0.1	7.4	7.9
HHo2EU	Mo91216209	43.6	3.2	0.2	0.1	47.1	0.0	0.0		9.8				100	0.1	7.5	8.0

A.15. SITE ID: **HH02PL** MCL PEDON ID: **M0912165**

A --- (0-9 cm); 60% very dark grayish brown (10YR 3/2, moist, rubbed) , and 40% dark grayish brown (10YR 4/2, moist, broken face) loam; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; many fine, many very fine, common medium pores; common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): fragments are likely colluvial; clear smooth boundary.

Bt1 --- (9-17 cm); yellowish brown (10YR 5/4, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; few coarse roots throughout, common fine roots throughout, and common very fine roots throughout; common fine, many very fine, few medium pores; few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): fragments are likely colluvial; clear smooth boundary.

Bt2 --- (17-29 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, and common very fine roots throughout; common fine, common very fine, few medium pores; very few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels, few dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): wet sample; clear smooth boundary.

Bt3 --- (29-42 cm); yellowish brown (10YR 5/6, moist, broken face) clay; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few fine roots throughout; many very fine, common fine pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt4 --- (42-57 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; weak medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout; common very fine, common fine pores; few dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): gray redox; abrupt smooth boundary.

Btk1 --- (57-86 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate medium subangular blocky structure; very slightly effervescent (HCl, 1 normal); firm; few very fine roots throughout, and few fine roots throughout; common very fine, common fine pores; common dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): very slight effervescence, Note(s): check Ca amounts from lab data, Note(s): may want to rethink k and 2 designations; clear smooth boundary.

2Btk2 --- (86-114 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate medium prismatic parting to strong fine subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; few fine roots throughout; few very fine, few fine pores; few light olive brown (2.5Y 5/4, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 8% subangular very strongly cemented gravel sized mixed rock fragments; gradual smooth boundary.

2Btk3 --- (114-152 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; few fine roots throughout; few very fine pores; few olive brown (2.5Y 4/4, moist) distinct clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; many very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 6% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): fairly similar to horizon above, Note(s): check lab data, but may want to consider combining; abrupt wavy boundary.

2Btk4 --- (152-205 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate coarse prismatic parting to moderate medium angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few fine roots throughout, and few very fine roots throughout; few very fine pores; few light olive brown (2.5Y 5/4, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; many very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 6% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): more sand therefore increase in pores, Note(s): 1% lignins.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
HH02PL	Mo91216501	0.0	3.5	A	18.5	37	44.5	19.6	17.4	13	16.3	8.3	5	1.9	L	1.64
HH02PL	Mo91216502	3.5	6.7	BE	22.2	33.2	44.6	17.7	15.5	11	17.2	8.3	5.6	2.5	L	1.51
HH02PL	Mo91216503	6.7	11.4	Bt1	39.5	28.4	32.1	15	13.4	8.8	10.8	5.8	4.4	2.3	CL	1.44
HH02PL	Mo91216504	11.4	16.5	Bt2	41.2	28.7	30.1	15.6	13.1	6.7	10.1	4.8	4.4	4.1	C	1.46
HH02PL	Mo91216505	16.5	22.4	Bt3	37.5	29.2	33.3	16.9	12.3	8.1	11.2	6	4.9	3.1	CL	1.53
HH02PL	Mo91216506	22.4	33.9	2Btk1	38.4	29.5	32.1	15.5	14	7.7	11.5	5.6	4.6	2.7	CL	1.67
HH02PL	Mo91216507	33.9	44.9	2Btk2	29	35.3	35.7	22.3	13	8.3	11.7	5.8	5.2	4.7	CL	1.75
HH02PL	Mo91216508	44.9	59.8	2Btk3	30	32.7	37.3	24.5	8.2	8.9	12.5	5.7	5.1	5.1	CL	1.81
HH02PL	Mo91216509	59.8	80.7	2BCK	29.5	30.4	40.1	19.9	10.5	7.7	15.3	8.4	4.8	3.9	CL	1.77

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
HH02PL	Mo91216501	13.9	1.2	0.0	0.2	15.3	4.3	0.0	19.6	18.6	15.3	0	78	82	2.5	6.6	6.8
HH02PL	Mo91216502	8.9	1.2	0.0	0.2	10.3	6.0	0.0	16.3	16.0	10.3	0	63	64	0.8	5.4	5.9
HH02PL	Mo91216503	12.2	1.6	0.0	0.4	14.2	13.0	4.6	27.2	24.1	18.8	24	52	59	0.4	4.1	5.0
HH02PL	Mo91216504	12.5	1.6	0.0	0.4	14.5	14.1	4.1	28.6	25.4	18.6	22	51	57	0.3	4.0	4.8
HH02PL	Mo91216505	16.1	1.2	0.0	0.3	17.6	8.1	0.3	25.7	24.2	17.9	2	69	73	0.3	4.7	5.5
HH02PL	Mo91216506	16.6	1.2	0.0	0.3	18.1	8.2	0.3	26.3	24.9	18.4	2	69	73	0.2	4.7	5.5
HH02PL	Mo91216507	44.6	1.6	0.0	0.1	46.3	0.0	0.0		16.8				100	0.2	7.2	7.7
HH02PL	Mo91216508	47.8	2.0	0.1	0.1	50.0	0.0	0.0		16.3				100	0.1	7.3	7.9
HH02PL	Mo91216509	44.8	2.8	0.0	0.1	47.7	0.0	0.0		15.3				100	0.1	7.2	8.0

A.16. SITE ID: **HH02PU** MCL PEDON ID: **Mo912164**

A --- (0-8 cm); dark grayish brown (10YR 4/2, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; many fine, many very fine, few medium pores; few very dark grayish brown (10YR 3/2, moist) faint organoargillans on surfaces along root channels; 1% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): frags are colluvial in nature; clear wavy boundary.

E --- (8-18 cm); 80% brown (10YR 5/3, moist, broken face) , and 20% dark grayish brown (10YR 4/2, moist, broken face) loam; weak thick platy parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many very fine roots throughout, and common fine roots throughout; many very fine, many fine, common medium pores; few very dark grayish brown (10YR 3/2, moist) faint organoargillans on surfaces along root channels, few pale brown (10YR 6/3, moist) faint silt coats on surfaces along root channels; common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): frags are colluvial in nature , Note(s): nice BE , Note(s): no clay films; clear smooth boundary.

Bt1 --- (18-30 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, few medium roots throughout, and many very fine roots throughout; common fine, many very fine, few medium pores; few dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds, very few dark grayish brown (10YR 4/2, moist) distinct organoargillans on surfaces along root channels; common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt2 --- (30-42 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, common very fine roots throughout, few coarse roots throughout, and common medium roots throughout; common fine, common very fine pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (42-64 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay; moderate fine prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, few medium roots throughout, common fine roots throughout, and common very fine roots throughout; common very fine, few fine pores; few dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): redox depletions start; abrupt smooth boundary.

2Btk1 --- (64-93 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate medium prismatic parting to strong fine subangular blocky structure; slightly effervescent (HCl, 1 normal); firm; few fine roots throughout, and few very fine roots throughout; common very fine, common fine pores; common dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented spherical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented threadlike finely disseminated carbonates on surfaces along root channels with diffuse boundaries; 6% subangular very strongly cemented gravel sized mixed rock fragments; abrupt wavy boundary.

2Btk2 --- (93-124 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; weak fine prismatic parting to strong fine subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; few medium roots throughout, few fine roots throughout, and few very fine roots throughout; common fine, common very fine pores; few olive brown (2.5Y 4/4, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented spherical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented threadlike finely disseminated carbonates on surfaces along root channels with diffuse boundaries; 6% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): stratified residuum sand lenses with 8&9-like material , Note(s): mnm is mainly in sands, Note(s): somewhat jointed; abrupt wavy boundary.

2Btk3 --- (124-179 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate medium prismatic parting to strong fine angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few fine roots throughout, and few very fine roots throughout; few very fine pores; few dark yellowish brown (10YR 4/6, moist) faint clay films on all faces of peds; common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; many very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented spherical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented threadlike finely disseminated carbonates on surfaces along root channels with diffuse boundaries; 8% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): stratified with sand materials , Note(s): lignins present , Note(s): dense; gradual smooth boundary.

2Btk4 --- (179-205 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate medium subangular blocky structure; violently effervescent (HCl, 1 normal); very firm; few fine roots throughout; few very fine pores; very few light olive brown (2.5Y 5/4, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; many very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented spherical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented threadlike finely disseminated carbonates on surfaces along root channels with diffuse boundaries; 6% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): dense.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
HHo2PU	Mo91216401	0.0	3.1	A	12.8	39.4	47.8	20	19.4	8.8	16.8	10.7	7.7	3.8	L	1.32
HHo2PU	Mo91216402	3.1	7.1	BE	13.4	38.4	48.2	19.7	18.7	10	17.5	10.5	6.8	3.4	L	1.33
HHo2PU	Mo91216403	7.1	11.8	Bt1	38.7	27.6	33.7	14.2	13.4	7.4	11.1	6.6	4.6	4	CL	1.48
HHo2PU	Mo91216404	11.8	16.5	Bt2	46.9	26.2	26.9	14.3	11.9	6	9	5.4	4.1	2.4	C	1.54
HHo2PU	Mo91216405	16.5	25.2	Bt3	43.5	27.1	29.4	15.9	11.2	6.5	9.8	5.5	4.8	2.8	C	1.69
HHo2PU	Mo91216406	25.2	36.6	2Btk	37.2	33.6	29.2	20	13.6	6.8	10.5	4.9	3.8	3.2	CL	1.77
HHo2PU	Mo91216407	36.6	48.8	2Bck1	27.6	27.5	44.9	14.3	13.2	5.4	15.6	13	7.5	3.4	CL	1.63
HHo2PU	Mo91216408	48.8	70.5	2Bck2	30.5	32	37.5	18.2	13.8	7	12.3	10.3	5.8	2.1	CL	1.76
HHo2PU	Mo91216409	70.5	80.7	2Bck3	30.8	31.2	38	18.4	12.8	6.6	11.7	7.4	6.2	6.1	CL	1.63

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
HHo2PU	Mo91216401	2.6	0.8	0.0	0.2	3.6	8.5	4.1	12.1	11.7	7.7	53	30	31	1.2	4.1	5.0
HHo2PU	Mo91216402	1.4	0.4	0.0	0.1	1.9	9.8	5.6	11.7	10.3	7.5	75	16	18	0.8	3.6	4.4
HHo2PU	Mo91216403	10.4	1.6	0.1	0.3	12.4	15.8	7.9	28.2	25.5	20.3	39	44	49	0.6	3.8	4.8
HHo2PU	Mo91216404	16.2	1.9	0.1	0.4	18.6	15.1	7.6	33.7	32.2	26.2	29	55	58	0.4	3.7	4.8
HHo2PU	Mo91216405	17.3	1.6	0.1	0.4	19.4	10.7	3.0	30.1	28.2	22.4	13	65	69	0.5	4.0	4.9
HHo2PU	Mo91216406	49.3	1.2	0.1	0.2	50.8	0.0	0.0		21.7				100	0.2	7.2	7.8
HHo2PU	Mo91216407	31.7	0.8	0.1	0.1	32.7	0.0	0.0		18.0				100	0.2	7.3	7.9
HHo2PU	Mo91216408	49.5	1.2	0.1	0.1	50.9	0.0	0.0		16.2				100	0.1	7.2	7.9
HHo2PU	Mo91216409	45.5	1.9	0.1	0.2	47.7	0.0	0.0		15.6				100	0.1	7.4	7.9

A.17. SITE ID: **HMo1EL** MCL PEDON ID: **Mo908951**

A --- (0-12 cm); 60% very dark grayish brown (10YR 3/2, moist, broken face) , and 40% brown (10YR 4/3, moist, broken face) loam; moderate very fine granular structure; noneffervescent (HCl, 1 normal); friable; many very fine roots throughout, common fine roots throughout, and few coarse roots throughout; few medium, many fine, many very fine pores; few very dark gray (10YR 3/1, moist) faint organoargillans on surfaces along root channels; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): frags less than 1% and are colluvial in nature; clear smooth boundary.

Bt1 --- (12-25 cm); yellowish brown (10YR 5/4, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, and common very fine roots throughout; few medium, common fine, common very fine pores; few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels, few dark yellowish brown (10YR 4/4, moist) faint clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 4/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subrounded very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt2 --- (25-41 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; strong very fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few very fine roots throughout, common fine roots throughout, and few medium roots throughout; few medium, common fine, common very fine pores; common dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; clear wavy boundary.

Bt3 --- (41-59 cm); yellowish brown (10YR 5/6, moist, broken face) loam; moderate fine prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, and common very fine roots throughout; few fine pores; common dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): 5% spherical decimated vf sand frags 5y6/2, Note(s): lignites present; clear smooth boundary.

Bt4 --- (59-77 cm); dark yellowish brown (10YR 4/4, moist, broken face) clay loam; moderate medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few medium roots throughout, and few fine roots throughout; few fine pores; common brown (10YR 4/3, moist) prominent clay films on all faces of peds; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light brownish gray (2.5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): lignites present; clear wavy boundary.

2Btk --- (77-113 cm); light olive brown (2.5Y 5/4, moist, broken face) loam; moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few medium roots throughout, and few very fine roots throughout; few very fine pores; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented cylindrical masses of carbonate throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): lignites present; clear irregular boundary.

2BCk1 --- (113-135 cm); light olive brown (2.5Y 5/4, moist, broken face) loam; weak coarse prismatic parting to moderate fine angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few dark grayish brown (2.5Y 4/2, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 5% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): lignites present, Note(s): basal till-like material, Note(s): 2% decimated gray sandstone frags; gradual smooth boundary.

2BCk2 --- (135-205 cm); olive brown (2.5Y 4/4, moist, broken face) loam; strong fine angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few dark grayish brown (2.5Y 4/2, moist) faint clay films on all faces of peds; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented cylindrical masses of carbonate throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 5% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): lignites present.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
HM001EL	Mo90895101	0.0	4.7	A	14.7	44.8	40.5	23.7	21.1	12.4	16.3	6.8	3.7	1.3	L	1.25
HM001EL	Mo90895102	4.7	9.8	Bt1	19.4	40.8	39.8	19.8	21.0	11.5	16.3	6.1	4.0	1.9	L	1.40
HM001EL	Mo90895103	9.8	16.1	Bt2	28.9	37.5	33.6	19.4	18.1	9.0	10.8	5.1	4.7	4.0	CL	1.55
HM001EL	Mo90895104	16.1	23.2	Bt3	26.8	42.4	30.8	22.7	19.7	9.4	10.2	4.3	4.2	2.7	L	1.50
HM001EL	Mo90895105	23.2	30.3	Bt4	28.0	44.2	27.8	25.8	18.4	9.2	9.4	3.9	3.2	2.1	CL	1.51
HM001EL	Mo90895106	30.3	44.5	2Btk	23.4	44.8	31.8	26.9	17.9	8.6	9.3	3.7	3.6	6.6	L	1.52
HM001EL	Mo90895107	44.5	53.1	2Bck1	22.2	45.8	32.0	26.8	19.0	8.4	9.7	4.6	4.4	4.9	L	1.51
HM001EL	Mo90895108	53.1	80.7	2Bck2	20.3	47.0	32.7	27.2	19.8	8.8	10.2	4.5	4.7	4.5	L	1.53

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
HM001EL	Mo90895101	11.0	0.8	0.0	0.3	12.1	12.3	0.1	24.4	20.3	12.2	1	50	60	3.9	4.5	4.9
HM001EL	Mo90895102	6.7	0.4	0.0	0.1	7.2	4.9	0.0	12.1	11.4	7.2	0	60	63	0.6	4.8	5.6
HM001EL	Mo90895103	11.9	0.8	0.0	0.2	12.9	5.0	0.0	17.9	17.2	12.9	0	72	75	0.6	4.9	5.8
HM001EL	Mo90895104	11.0	0.8	0.0	0.1	11.9	4.4	0.0	16.3	14.4	11.9	0	73	82	0.4	5.0	5.9
HM001EL	Mo90895105	15.2	0.8	0.0	0.1	16.1	4.3	0.0	20.4	17.6	16.1	0	79	91	0.5	6.4	7.0
HM001EL	Mo90895106	45.9	0.8	0.0	0.1	46.8	0.6	0.0		14.1				100	0.4	7.3	7.8
HM001EL	Mo90895107	34.9	0.8	0.0	0.1	35.8	0.0	0.0		12.8				100	0.4	7.3	8.0
HM001EL	Mo90895108	44.1	1.2	0.0	0.1	45.4	0.7	0.0		12.3				100	0.4	7.4	8.0

A.18. SITE ID: **HM01EU** MCL PEDON ID: **M0908950**

A --- (0-6 cm); 50% brown (10YR 5/3, moist, broken face) , 25% dark grayish brown (10YR 4/2, moist, broken face) , and 25% very dark grayish brown (10YR 3/2, moist, broken face) loam; weak very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many very fine roots throughout, common fine roots throughout, and common medium roots throughout; many fine, many very fine pores; 1% subangular very strongly cemented fine gravel sized chert fragments; clear smooth boundary.

BA --- (6-15 cm); yellowish brown (10YR 5/4, moist, broken face) loam; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common very fine roots throughout, and common fine roots throughout; common fine, common very fine pores; few very dark grayish brown (10YR 3/2, moist) distinct organoargillans on surfaces along root channels; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized chert fragments; Note(s): no visible clfs, Note(s): but does seem to have a clay pick up; abrupt smooth boundary.

Bt1 --- (15-34 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, and common fine roots throughout; common very fine pores; many strong brown (7.5YR 4/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt2 --- (34-50 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few fine roots throughout; common very fine pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (50-72 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, and few fine roots throughout; few medium pores; few strong brown (7.5YR 4/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common gray (10YR 6/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): clay increase; clear wavy boundary.

Bt4 --- (72-96 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, and few fine roots throughout; common fine pores; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common gray (2.5Y 6/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): gray redox, Note(s): has dendritic cylindrical shape (vf gray sands with different texture are deposited in old root channels); abrupt smooth boundary.

2Btk1 --- (96-127 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few coarse roots throughout, and few very coarse roots throughout; few very fine pores; few dark grayish brown (10YR 4/2, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; many very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented spherical masses of carbonate throughout with diffuse boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): illitic feel to clay minerology (mixings with PA shale?); abrupt wavy boundary.

2Btk2 --- (127-165 cm); 80% yellowish brown (10YR 5/6, moist, broken face) , and 20% light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate fine prismatic parting to strong fine angular blocky structure; slightly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few very fine pores; few light olive brown (2.5Y 5/3, moist) distinct clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented spherical masses of carbonate throughout with diffuse boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; gradual smooth boundary.

2Btk3 --- (165-205 cm); 60% yellowish brown (10YR 5/6, moist, broken face) , and 40% light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate fine prismatic parting to strong fine angular blocky structure; slightly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few grayish brown (2.5Y 5/2, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented spherical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): basal till-like material, Note(s): mixings with shales, Note(s): lignite present.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
HM01EU	Mo90895001	0.0	2.4	A	12.3	46.7	41.0	21.1	25.6	12.8	14.8	6.9	4.6	1.9	L	1.08
HM01EU	Mo90895002	2.4	5.9	BE	14.3	45.5	40.2	21.6	23.9	11.0	13.5	6.4	5.2	4.1	L	1.28
HM01EU	Mo90895003	5.9	13.4	Bt1	38.1	34.6	27.3	15.8	18.8	7.4	9.8	4.6	3.2	2.3	CL	1.32
HM01EU	Mo90895004	13.4	19.7	Bt2	38.1	34.8	27.1	15.4	19.4	7.5	9.5	4.3	3.5	2.3	CL	1.51
HM01EU	Mo90895005	19.7	28.3	Bt3	33.2	34.0	32.8	15.4	18.6	8.8	10.3	4.9	4.4	4.4	CL	1.53
HM01EU	Mo90895006	28.3	37.8	Bt4	31.8	36.0	32.2	16.8	19.2	9.1	10.9	5.1	4.0	3.1	CL	1.59
HM01EU	Mo90895007	37.8	50.0	2Btk1	30.0	41.6	28.4	22.9	18.7	7.2	9.1	4.2	3.5	4.4	CL	1.59
HM01EU	Mo90895008	50.0	65.0	2Btk2	30.9	38.6	30.5	21.2	17.4	7.2	9.9	4.8	4.4	4.2	CL	1.54
HM01EU	Mo90895009	65.0	80.7	2Bck	32.0	39.2	28.8	22.5	16.7	7.0	9.8	4.6	3.8	3.6	CL	1.68

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
HM01EU	Mo90895001	4.1	0.8	0.0	0.2	5.1	9.0	1.5	14.1	12.1	6.6	23	36	42	2.0	4.4	4.9
HM01EU	Mo90895002	0.7	0.4	0.0	0.1	1.2	9.9	6.5	11.1	8.6	7.7	84	11	14	0.5	3.8	4.5
HM01EU	Mo90895003	6.2	2.8	0.0	0.2	9.2	17.7	11.6	26.9	24.6	20.8	56	34	37	0.4	3.9	4.7
HM01EU	Mo90895004	8.0	2.3	0.0	0.2	10.5	15.7	8.8	26.2	24.2	19.3	46	40	43	0.4	4.0	4.7
HM01EU	Mo90895005	9.0	2.0	0.0	0.2	11.2	11.2	5.2	22.4	21.6	16.4	32	50	52	0.2	4.2	4.8
HM01EU	Mo90895006	12.6	1.6	0.0	0.2	14.4	9.6	1.2	24.0	21.0	15.6	8	60	68	0.2	4.5	5.2
HM01EU	Mo90895007	41.8	0.8	0.0	0.1	42.7	1.6	0.0		18.4				100	0.2	7.5	7.7
HM01EU	Mo90895008	43.9	1.2	0.0	0.1	45.2	0.6	0.0		16.5				100	0.1	7.5	7.8
HM01EU	Mo90895009	48.4	2.4	0.0	0.1	50.9	0.0	0.0		16.0				100	0.1	7.5	8.0

A.19. SITE ID: **HM01PL** MCL PEDON ID: **Mo908952**

A --- (0-10 cm); 60% dark grayish brown (10YR 4/2, moist, broken face) , 30% very dark grayish brown (10YR 3/2, moist, broken face) , and 10% brown (10YR 5/3, moist, broken face) silt loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, common very fine roots throughout, and few medium roots throughout; common fine, common very fine, few medium pores; abrupt wavy boundary.

AB --- (10-21 cm); 80% brown (10YR 5/3, moist, broken face) , and 20% dark grayish brown (10YR 4/2, moist, broken face) silt loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, common very fine roots throughout, and few medium roots throughout; common fine, common very fine pores; few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels; common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): frags could be colluvial, Note(s): possible E horizon - check clay content; clear smooth boundary.

BA --- (21-31 cm); yellowish brown (10YR 5/4, moist, broken face) silt loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout; many very fine, few fine pores; few yellowish brown (10YR 5/4, moist) faint clay films on all faces of peds, very few very dark grayish brown (10YR 3/2, moist) distinct organoargillans on surfaces along root channels; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): check lab data for clay increase, but may be a better B horizon rather than Bt; clear smooth boundary.

Bt1 --- (31-41 cm); yellowish brown (10YR 5/4, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, and few medium roots throughout; few fine pores; few brown (10YR 5/3, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt2 --- (41-55 cm); yellowish brown (10YR 5/6, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common very fine roots throughout, and few fine roots throughout; few fine pores; few yellowish brown (10YR 5/4, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): slightly illitic feel to clay min; clear smooth boundary.

Bt3 --- (55-73 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; weak fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few very fine roots throughout, and few fine roots throughout; few fine pores; few yellowish brown (10YR 5/6, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): few lignite masses, Note(s): few decimated vf sandston frags 2.5y6/4ish; clear smooth boundary.

Bt4 --- (73-100 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; weak fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few very fine roots throughout, and few fine roots throughout; few very fine pores; many yellowish brown (10YR 5/4, moist) prominent clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): few decimated vf sandstone frags 2.5y6/4, Note(s): few lignins; clear smooth boundary.

Bt5 --- (100-121 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate medium prismatic parting to strong medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few medium roots throughout, and few very fine roots throughout; few very fine pores; common olive brown (2.5Y 4/3, moist) prominent clay films on all faces of peds; common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): few lignins; clear smooth boundary.

2Btk1 --- (121-162 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate medium subangular blocky structure; very slightly effervescent (HCl, 1 normal); very firm; few fine roots throughout; few very fine pores; common olive brown (2.5Y 4/3, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented cylindrical masses of carbonate throughout with diffuse boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): took lignite sample here, Note(s): matrix had a very slight efferecense but where there is CaCO₃ it effereceses strongly; gradual smooth boundary.

2Btk2 --- (162-205 cm); dark yellowish brown (10YR 4/4, moist, broken face) loam; moderate medium prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few olive brown (2.5Y 4/3, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical throughout with clear boundaries; 5% subangular very strongly cemented gravel sized mixed rock fragments.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
HM01PL	Mo90895201	0.0	3.9	A	11.3	58.5	30.2	30.9	27.6	9.5	10.0	4.9	3.7	2.1	SIL	1.07
HM01PL	Mo90895202	3.9	8.3	BE	12.3	55.2	32.5	28.0	27.2	10.6	11.5	5.0	3.8	1.6	SIL	1.34
HM01PL	Mo90895203	8.3	12.2	Bt1	14.8	53.7	31.5	27.5	26.2	11.1	11.0	4.5	3.4	1.5	SIL	1.48
HM01PL	Mo90895204	12.2	16.1	Bt2	20.8	49.9	29.3	25.0	24.9	11.5	9.5	4.0	2.9	1.4	L	1.59
HM01PL	Mo90895205	16.1	21.7	Bt3	26.7	42.6	30.7	19.6	23.0	12.2	9.4	4.2	3.3	1.6	L	1.40
HM01PL	Mo90895206	21.7	28.7	Bt4	30.7	38.3	31.0	21.1	17.2	10.2	11.0	4.7	3.5	1.6	CL	1.43
HM01PL	Mo90895207	28.7	39.4	2Bt5	35.3	37.4	27.3	22.7	14.7	8.2	9.9	4.4	3.4	1.4	CL	1.49
HM01PL	Mo90895208	39.4	47.6	2Bt6	35.8	39.3	24.9	23.3	16.0	8.0	10.5	3.4	2.1	0.9	CL	1.57
HM01PL	Mo90895209	47.6	63.8	3BCK1	33.9	42.6	23.5	28.8	13.8	8.1	8.4	2.8	2.6	1.6	CL	1.67
HM01PL	Mo90895210	63.8	80.7	3BCK2	25.7	43.2	31.1	30.3	12.9	7.3	7.8	3.5	5.7	6.8	L	1.52

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
HM01PL	Mo90895201	12.1	1.6	0.0	0.4	14.1	7.4	0.0	21.5	18.0	14.1	0	66	78	3.2	5.7	6.0
HM01PL	Mo90895202	2.7	0.8	0.0	0.1	3.6	5.4	0.5	9.0	7.7	4.1	12	40	47	0.6	4.4	5.1
HM01PL	Mo90895203	2.4	0.8	0.0	0.1	3.3	5.1	2.2	8.4	8.1	5.5	40	39	41	0.3	4.0	4.9
HM01PL	Mo90895204	4.4	1.2	0.0	0.1	5.7	7.8	3.3	13.5	12.4	9.0	37	42	46	0.3	3.9	4.9
HM01PL	Mo90895205	5.4	1.6	0.0	0.1	7.1	9.8	4.5	16.9	15.8	11.6	39	42	45	0.3	4.0	5.0
HM01PL	Mo90895206	6.5	1.6	0.1	0.2	8.4	13.0	6.2	21.4	19.0	14.6	42	39	44	0.3	3.9	4.9
HM01PL	Mo90895207	8.9	1.6	0.1	0.2	10.8	12.2	5.5	23.0	22.0	16.3	34	47	49	0.2	3.8	4.7
HM01PL	Mo90895208	13.5	1.6	0.1	0.2	15.4	9.0	1.9	24.4	23.4	17.3	11	63	66	0.3	4.2	5.0
HM01PL	Mo90895209	43.1	1.2	0.1	0.1	44.5	4.2	0.0		19.9				100	0.3	7.0	7.4
HM01PL	Mo90895210	45.6	1.2	0.1	0.4	47.3	0.2	0.0		15.5				100	0.3	7.3	7.7

A.20. SITE ID: **HM01PU** MCL PEDON ID: **M0908953**

A --- (0-9 cm); 80% very dark grayish brown (10YR 3/2, moist, rubbed) , and 20% dark grayish brown (10YR 4/2, moist, rubbed) silt loam; moderate very fine granular structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and few medium roots throughout; many very fine, common fine pores; abrupt smooth boundary.

E --- (9-20 cm); brown (10YR 5/3, moist, broken face) silt loam; weak thick platy parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, common very fine roots throughout, few medium roots throughout, and few coarse roots throughout; common very fine, common fine pores; very few light gray (10YR 7/2, moist) faint silt coats on all faces of peds, few dark grayish brown (10YR 4/2, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; Note(s): oafs are mixings from A; clear wavy boundary.

Bt1 --- (20-31 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; many fine roots throughout, and common very fine roots throughout; few medium, common fine, common very fine pores; common dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): less than 1% grv; clear smooth boundary.

Bt2 --- (31-43 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, and common very fine roots throughout; common very fine pores; common dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (43-63 cm); yellowish brown (10YR 5/6, moist, broken face) clay; moderate fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, few fine roots throughout, and few very fine roots throughout; few very fine pores; common dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt4 --- (63-95 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, and few fine roots throughout; few very fine pores; common dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

2Bt5 --- (95-128 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few fine roots throughout; common dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light brownish gray (2.5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): change here? few white decimated rock frags but none fizz (no CaCO₃), Note(s): sands are 10yr6/8dry; abrupt wavy boundary.

2Bt6 --- (128-167 cm); dark yellowish brown (10YR 4/6, moist, broken face) fine sandy loam; moderate medium prismatic parting to moderate fine angular blocky structure; noneffervescent (HCl, 1 normal); very firm; few fine roots throughout; few very fine pores; few dark grayish brown (10YR 4/2, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light brownish gray (2.5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): composite sample, Note(s): stratified layers of clay, fine sand, and coarse sand, Note(s): sands are 10yr6/8dry; clear irregular boundary.

2Bt7 --- (167-205 cm); 70% dark yellowish brown (10YR 4/6, moist, broken face) , and 30% light olive brown (2.5Y 5/3, moist, broken face) loam; moderate medium prismatic parting to strong fine angular blocky structure; noneffervescent (HCl, 1 normal); very firm; few very fine roots throughout; few very fine pores; few light brownish gray (10YR 6/2, moist) faint skeletons on all faces of peds, few grayish brown (2.5Y 5/2, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light brownish gray (2.5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 6% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): matrix grades into different colors (2.5y), Note(s): very fine 10yr7/1 layers of sand.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
HM01PU	Mo90895301	0.0	3.5	A	14.6	58.8	26.6	32.0	26.8	7.3	9.6	4.6	3.2	1.9	SIL	1.23
HM01PU	Mo90895302	3.5	7.9	BE	12.2	59.0	28.8	30.3	28.7	7.1	11.3	5.8	3.5	1.1	SIL	1.26
HM01PU	Mo90895303	7.9	12.2	Bt1	35.6	38.7	25.7	17.9	20.8	7.3	9.5	4.0	3.1	1.8	CL	1.46
HM01PU	Mo90895304	12.2	16.9	Bt2	42.1	37.2	20.7	15.6	21.6	7.4	7.4	3.0	2.0	0.9	C	1.39
HM01PU	Mo90895305	16.9	24.8	Bt3	40.6	33.2	26.2	16.2	17.0	7.2	9.1	4.8	3.8	1.3	C	1.52
HM01PU	Mo90895306	24.8	37.4	Bt4	35.8	34.5	29.7	18.3	16.2	7.9	10.4	5.2	4.1	2.1	CL	1.66
HM01PU	Mo90895307	37.4	50.4	2Bt5	29.6	33.0	37.4	15.9	17.1	11.7	15.3	5.5	3.4	1.5	CL	1.69
HM01PU	Mo90895308	50.4	65.7	2BC	16.3	29.4	54.3	9.5	19.9	16.6	18.6	9.8	6.4	2.9	FSL	1.55
HM01PU	Mo90895309	65.7	80.7	2BC2	20.2	32.8	47.0	15.3	17.5	15.3	23.8	3.8	2.9	1.2	L	1.48

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
HM01PU	Mo90895301	14.3	1.5	0.0	0.3	16.1	7.8	0.0	23.9	22.4	16.1	0	67	72	3.4	5.6	5.7
HM01PU	Mo90895302	2.7	0.8	0.0	0.2	3.7	7.7	1.8	11.4	10.0	5.5	33	32	37	0.9	4.0	4.8
HM01PU	Mo90895303	6.1	2.8	0.0	1.0	9.9	17.8	10.0	27.7	25.4	19.9	50	36	39	0.7	3.6	4.6
HM01PU	Mo90895304	8.2	4.1	0.1	0.3	12.7	19.7	11.7	32.4	30.5	24.4	48	39	42	0.5	3.6	4.5
HM01PU	Mo90895305	9.6	4.5	0.1	0.3	14.5	15.1	8.0	29.6	28.7	22.5	36	49	50	0.3	3.7	4.7
HM01PU	Mo90895306	10.5	4.3	0.2	0.2	15.2	9.3	2.6	24.5	24.1	17.8	15	62	63	0.2	3.9	4.9
HM01PU	Mo90895307	10.2	4.2	0.3	0.2	14.9	6.4	0.4	21.3	19.4	15.3	3	70	77	0.2	4.4	5.3
HM01PU	Mo90895308	7.5	3.6	0.6	0.1	11.8	1.7	0.0	13.5	12.9	11.8	0	87	92	0.1	6.1	6.6
HM01PU	Mo90895309	8.2	5.2	1.1	0.1	14.6	2.9	0.0		14.0				100	0.1	7.0	7.3

A.21. SITE ID: **HMo2EL** MCL PEDON ID: **Mo908955**

A --- (0-8 cm); 60% dark grayish brown (10YR 4/2, moist, broken face) , and 40% very dark grayish brown (10YR 3/2, moist, broken face) loam; weak very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; many fine, many very fine, common medium pores; Note(s): somewhat e-like; clear wavy boundary.

Bt1 --- (8-16 cm); 50% brown (10YR 5/3, moist, broken face) , and 50% yellowish brown (10YR 5/4, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; few coarse roots throughout, common fine roots throughout, and common very fine roots throughout; many fine, many very fine pores; few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels, very few yellowish brown (10YR 5/6, moist) faint clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; clear smooth boundary.

Bt2 --- (16-32 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few very coarse roots throughout, common fine roots throughout, and common very fine roots throughout; common very fine, common fine, few medium pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): not just chert frags; clear smooth boundary.

Bt3 --- (32-44 cm); yellowish brown (10YR 5/6, moist, broken face) clay; strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, and common very fine roots throughout; common fine, common very fine pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): not just chert frags; clear wavy boundary.

Bt4 --- (44-54 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common coarse roots throughout, few medium roots throughout, and few fine roots throughout; few very fine, few fine pores; common dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 2% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): may have some very light rxn in lower part, Note(s): seems to be losing smectitic mineralogy; abrupt smooth boundary.

Btk1 --- (54-73 cm); dark yellowish brown (10YR 4/4, moist, broken face) clay loam; moderate fine prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, few fine roots throughout, and few very fine roots throughout; common very fine pores; common brown (10YR 4/3, moist) distinct clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on surfaces along root channels with diffuse boundaries; 3% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): less than 1% lignite frags; gradual smooth boundary.

2Btk2 --- (73-95 cm); light olive brown (2.5Y 5/4, moist, broken face) loam; moderate medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few medium roots throughout, and few fine roots throughout; few very fine pores; few grayish brown (2.5Y 5/2, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common gray (2.5Y 6/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent very weakly cemented spherical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on surfaces along root channels with diffuse boundaries; 5% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): 1% lignite frags; abrupt wavy boundary.

2Btk3 --- (95-112 cm); light olive brown (2.5Y 5/4, moist, broken face) gravelly loam; weak fine prismatic parting to strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few medium roots throughout, and few very fine roots throughout; few very fine pores; few grayish brown (2.5Y 5/2, moist) faint clay films on all faces of peds; common gray (2.5Y 6/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented spherical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on surfaces along root channels with diffuse boundaries; 8% subangular very strongly cemented gravel sized mixed rock fragments, 8% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): 2% lignite frags, Note(s): potential stoneline; abrupt smooth boundary.

2Btk4 --- (112-153 cm); light olive brown (2.5Y 5/4, moist, broken face) loam; strong fine prismatic parting to strong medium angular blocky structure; noneffervescent (HCl, 1 normal); extremely firm; few fine roots throughout; few olive brown (2.5Y 4/3, moist) faint clay films on all faces of peds; common gray (2.5Y 6/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries; 6% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): 3% lignite frags, Note(s): densic, Note(s): possibly basal till; gradual smooth boundary.

2Btk5 --- (153-205 cm); light olive brown (2.5Y 5/4, moist, broken face) loam; strong fine prismatic parting to strong fine angular blocky structure; noneffervescent (HCl, 1 normal); extremely firm; few fine roots throughout; few olive brown (2.5Y 4/3, moist) faint clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common gray (2.5Y 6/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brownish yellow (10YR 6/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented spherical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on surfaces along root channels with diffuse boundaries; 5% rounded very strongly cemented cobble sized limestone fragments, 4% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): 3% lignite frags, Note(s): densic, Note(s): possibly basal till.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
HM02EL	Mo90895501	0.0	3.1	A	12.7	40.9	46.4	18.9	22.0	14.4	16.9	6.2	5.5	3.4	L	1.22
HM02EL	Mo90895502	3.1	6.3	BE	17.2	38.4	44.4	18.8	19.6	14.8	19.3	5.8	3.5	1.0	L	1.50
HM02EL	Mo90895503	6.3	12.6	Bt1	39.7	31.5	28.8	16.0	15.5	7.5	10.0	4.8	3.7	2.8	CL	1.61
HM02EL	Mo90895504	12.6	17.3	Bt2	40.4	32.3	27.3	16.4	15.9	8.2	10.5	4.3	3.0	1.3	C	1.54
HM02EL	Mo90895505	17.3	21.3	2Bt3	35.3	33.8	30.9	17.9	15.9	8.4	11.7	5.2	3.7	1.9	CL	1.55
HM02EL	Mo90895506	21.3	28.7	2Btk1	30.9	34.9	34.2	19.2	15.7	8.6	12.3	6.1	4.7	2.5	CL	1.68
HM02EL	Mo90895507	28.7	37.4	3Btk2	26.2	40.8	33	24.1	16.7	8.8	11	5.3	4.6	3.3	L	1.71
HM02EL	Mo90895508	37.4	44.1	3Btk3	17.2	32.1	50.7	19.1	13	7	8.2	5.6	11.3	18.6	L	1.68
HM02EL	Mo90895509	44.1	60.2	4Bck1	21.5	44.6	33.9	26.5	18.1	9.9	12.3	5.7	4.3	1.7	L	1.70
HM02EL	Mo90895510	60.2	80.7	4Bck2	22.7	44.7	32.6	26.8	17.9	10	10.9	4.6	3.8	3.3	L	1.75

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
HM02EL	Mo90895501	10.7	1.2	0.0	0.3	12.2	8.1	0.0	20.3	17.0	12.2	0	60	72	3.1	5.2	5.5
HM02EL	Mo90895502	4.6	0.8	0.0	0.2	5.6	6.8	1.4	12.4	10.5	7.0	20	45	53	0.7	4.3	5.1
HM02EL	Mo90895503	13.6	1.6	0.0	0.4	15.6	10.0	2.7	25.6	22.8	18.3	15	61	69	0.3	4.2	5.1
HM02EL	Mo90895504	14.2	1.2	0.0	0.3	15.7	9.6	1.7	25.3	22.8	17.4	10	62	69	0.4	4.3	5.2
HM02EL	Mo90895505	17.6	1.2	0.0	0.2	19.0	4.3	0.0	23.3	21.1	19.0	0	81	90	0.4	6.3	6.6
HM02EL	Mo90895506	42.0	1.2	0.0	0.2	43.4	0.4	0.0		18.0				100	0.4	7.2	7.8
HM02EL	Mo90895507	48.1	1.2	0.0	0.1	49.4	0.4	0.0		15.6				100	0.4	7.3	8.0
HM02EL	Mo90895508	44.3	1.2	0.0	0.1	45.6	0.3	0.0		11.3				100	0.8	7.4	8.0
HM02EL	Mo90895509	46.1	1.6	0.0	0.1	47.8	0.9	0.0		12.6				100	0.5	7.2	8.0
HM02EL	Mo90895510	46.0	2.4	0.0	0.1	48.5	0.7	0.0		13.0				100	0.3	7.4	8.0

A.22. SITE ID: **HM02EU** MCL PEDON ID: **M0908954**

A --- (0-7 cm); 80% dark grayish brown (10YR 4/2, moist, broken face) , and 20% very dark grayish brown (10YR 3/2, moist, broken face) loam; weak fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; common fine, common very fine pores; abrupt wavy boundary.

E --- (7-14 cm); brown (10YR 5/3, moist, broken face) loam; weak fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, common very fine roots throughout, and few medium roots throughout; many fine, many very fine, few medium pores; few pale brown (10YR 6/3, moist) faint silt coats on all faces of peds; common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; clear wavy boundary.

Bt1 --- (14-25 cm); yellowish brown (10YR 5/4, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, common fine roots throughout, and common medium roots throughout; many fine, common very fine pores; few faint clay films, few pale brown (10YR 6/3, moist) faint silt coats on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): possibly BE (does not scream Bt but has slight evidence of clay films - check lab data); clear smooth boundary.

Bt2 --- (25-40 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, and few very fine roots throughout; common fine, common very fine pores; few yellowish brown (10YR 5/6, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): not much color variation; clear smooth boundary.

Bt3 --- (40-65 cm); yellowish brown (10YR 5/6, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, common fine roots throughout, and common very fine roots throughout; common fine pores; few yellowish brown (10YR 5/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light brownish gray (10YR 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt4 --- (65-92 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, common medium roots throughout, and few fine roots throughout; few very fine pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light olive brown (2.5Y 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light brownish gray (2.5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt5 --- (92-121 cm); yellowish brown (10YR 5/6, moist, broken face) silt loam; weak coarse prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few very fine roots throughout, few medium roots throughout, and few very fine roots throughout; few very fine pores; few dark yellowish brown (10YR 4/6, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments; gradual smooth boundary.

2Btk1 --- (121-163 cm); yellowish brown (10YR 5/4, moist, broken face) clay loam; moderate fine prismatic parting to strong medium angular blocky structure; slightly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; common light brownish gray (2.5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; few very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 5% subrounded very strongly cemented gravel sized mixed rock fragments; abrupt wavy boundary.

2Btk2 --- (163-205 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium prismatic parting to strong medium angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light olive brown (2.5Y 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented cylindrical masses of carbonate throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries; 4% subrounded very strongly cemented gravel sized mixed rock fragments.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
HMo2EU	Mo90895401	0.0	2.8	A	7.2	42.8	50.0	16.9	25.9	20.4	17.3	6.0	4.5	1.8	L	1.31
HMo2EU	Mo90895402	2.8	5.5	BE	8.7	45.6	45.7	17.7	27.9	21.8	15.7	4.8	2.6	0.8	L	1.47
HMo2EU	Mo90895403	5.5	9.8	Bt1	20.3	43.1	36.6	17.0	26.1	18.7	11.4	3.4	2.3	0.8	L	1.42
HMo2EU	Mo90895404	9.8	15.7	Bt2	30.4	39.5	30.1	13.5	26.0	19.4	8.6	1.0	0.7	0.4	CL	1.50
HMo2EU	Mo90895405	15.7	25.6	Bt3	25.7	33.3	41.0	11.9	21.4	15.8	17.7	4.7	2.2	0.6	L	1.52
HMo2EU	Mo90895406	25.6	36.2	Bt4	30.4	33.7	35.9	16.9	16.8	14.9	16.3	2.7	1.3	0.7	CL	1.55
HMo2EU	Mo90895407	36.2	47.6	Bt5	25.2	67.1	7.7	29.5	37.6	3.5	1.9	0.9	0.9	0.5	SIL	1.52
HMo2EU	Mo90895408	47.6	64.2	BCK1	29.0	43.0	28.0	21.5	21.5	8.8	10.1	4.8	2.9	1.4	CL	1.58
HMo2EU	Mo90895409	64.2	80.7	BCK2	29.4	42.8	27.8	24.0	18.8	8.1	9.3	4.5	3.5	2.4	CL	1.46

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
HMo2EU	Mo90895401	2.4	0.8	0.0	0.2	3.4	7.0	0.9	10.4	7.9	4.3	21	33	43	1.1	4.0	4.4
HMo2EU	Mo90895402	0.7	0.4	0.0	0.1	1.2	5.6	2.5	6.8	6.2	3.7	68	18	19	0.4	3.9	4.7
HMo2EU	Mo90895403	3.2	2.5	0.0	0.2	5.9	10.4	4.8	16.3	13.9	10.7	45	36	43	0.4	3.9	4.8
HMo2EU	Mo90895404	4.7	3.7	0.0	0.3	8.7	15.9	8.5	24.6	21.3	17.2	49	35	41	0.3	3.8	4.7
HMo2EU	Mo90895405	3.2	3.2	0.1	0.2	6.7	14.5	8.8	21.2	18.9	15.5	57	32	35	0.3	3.7	4.7
HMo2EU	Mo90895406	4.4	5.6	0.2	0.2	10.4	13.6	7.2	24.0	21.5	17.6	41	43	48	0.2	3.7	4.8
HMo2EU	Mo90895407	5.6	6.8	0.5	0.2	13.1	7.0	1.1	20.1	19.0	14.2	8	65	69	0.2	4.1	5.1
HMo2EU	Mo90895408	30.3	8.3	1.4	0.2	40.2	0.8	0.0		17.3				100	0.1	7.3	7.9
HMo2EU	Mo90895409	37.9	9.7	2.4	0.2	50.2	0.4	0.0		15.4				100	0.1	7.5	7.8

A.23. SITE ID: **HM02PL** MCL PEDON ID: **Mo908957**

A --- (0-9 cm); 60% very dark grayish brown (10YR 3/2, moist, rubbed) , 35% dark grayish brown (10YR 4/2, moist, rubbed) , and 5% brown (10YR 5/3, moist, rubbed) loam; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and few medium roots throughout; common fine, common very fine pores; clear smooth boundary.

Bt1 --- (9-18 cm); light olive brown (2.5Y 5/4, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; few medium roots throughout, common fine roots throughout, and common very fine roots throughout; many very fine, common fine pores; few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subrounded very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt2 --- (18-35 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, common medium roots throughout, and many fine roots throughout; many very fine, common fine pores; few yellowish brown (10YR 5/4, moist) faint clay films on all faces of peds; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; gradual smooth boundary.

Bt3 --- (35-57 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, few coarse roots throughout, and common fine roots throughout; common fine, common very fine pores; few dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light olive brown (2.5Y 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt4 --- (57-78 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, and common medium roots throughout; common very fine, few fine pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): 1 large gravel granite subrounded; clear wavy boundary.

Bt5 --- (78-102 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate medium subangular blocky structure; slightly effervescent (HCl, 1 normal); firm; few coarse roots throughout, and common fine roots throughout; few very fine, few fine pores; few dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented cylindrical masses of carbonate throughout with diffuse boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): few caco₃ cams effereceses slightly, but matrix does not; abrupt wavy boundary.

Bt6 --- (102-122 cm); yellowish brown (10YR 5/6, moist, broken face) loamy sand; weak fine subangular blocky structure; very slightly effervescent (HCl, 1 normal); firm; few medium roots throughout; many fine, many very fine pores; few dark yellowish brown (10YR 4/6, moist) faint clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented cylindrical masses of carbonate throughout with diffuse boundaries; 5% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): clay films present in clay masses, Note(s): sandy material somewhat thick here, but may just be lg sand pocket/lens, Note(s): eff is spotty, Note(s): small masses of clay throughout, Note(s): gravels are mainly coarse sands; abrupt wavy boundary.

2Btk1 --- (122-146 cm); light olive brown (2.5Y 5/4, moist, broken face) loam; moderate fine prismatic parting to moderate medium angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few medium roots throughout, and few fine roots throughout; few fine, few very fine pores; few dark yellowish brown (10YR 4/4, moist) faint clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 8% subangular very strongly cemented gravel sized mixed rock fragments, 1% subrounded very strongly cemented cobble sized mixed rock fragments; gradual irregular boundary.

2Btk2 --- (146-178 cm); dark yellowish brown (10YR 4/6, moist, broken face) loam; moderate medium prismatic parting to moderate fine angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few fine roots throughout; few dark yellowish brown (10YR 4/4, moist) faint clay films on all faces of peds; common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented threadlike finely disseminated carbonates throughout with diffuse boundaries; 8% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): has pockets of fine to coarse sand throughout, Note(s): sand lens is structureless; gradual irregular boundary.

2Btk3 --- (178-205 cm); olive brown (2.5Y 4/4, moist, broken face) gravelly clay loam; moderate medium prismatic parting to moderate fine angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few dark yellowish brown (10YR 4/4, moist) faint clay films on vertical faces of peds; common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented cylindrical masses of carbonate throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented threadlike finely disseminated carbonates throughout with diffuse boundaries; 16% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): not consistent across horizon but large pockets of coarse sand and gravel sized frags in places, Note(s): few masses of lignite.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
HM02PL	Mo90895701	0.0	3.5	A	10.5	47.4	42.1	24.1	23.3	10.5	13.4	7.7	6.5	4	L	1.41
HM02PL	Mo90895702	3.5	7.1	BE	15.8	44.9	39.3	22.9	22	10.4	13.2	7	5.9	2.8	L	1.59
HM02PL	Mo90895703	7.1	13.8	Bt1	31.7	36.6	31.7	18.3	18.3	8.2	10.6	5.6	4.6	2.7	CL	1.72
HM02PL	Mo90895704	13.8	22.4	Bt2	32.3	35.3	32.4	17.7	17.6	7.6	10.7	6.1	5	3	CL	1.41
HM02PL	Mo90895705	22.4	30.7	Bt3	28.1	36.2	35.7	18	18.2	10	12.7	6	4.1	2.9	CL	1.58
HM02PL	Mo90895706	30.7	40.2	2Bt	28	35.2	36.8	18.3	16.9	9.1	13.4	6.7	4.9	2.7	CL	1.68
HM02PL	Mo90895707	40.2	48.0	2BC	9.6	7.9	82.5	5.1	2.8	2.8	23.4	31.8	20.4	4.1	LS	1.51
HM02PL	Mo90895708	48.0	57.5	3BCK1	26.8	38.4	34.8	24.7	13.7	7.9	11.2	6.1	5.8	3.8	L	1.60
HM02PL	Mo90895709	57.5	70.1	3BCK2	21.9	28.2	49.9	18.6	9.6	5.6	8.7	8.5	14.9	12.2	L	1.72
HM02PL	Mo90895710	70.1	80.7	3BCK3	27.4	33.8	38.8	21.8	12	7.1	9	5.3	8.1	9.3	CL	1.31

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
HM02PL	Mo90895701	2.5	0.4	0.0	0.1	3.0	9.7	1.7	12.7	9.6	4.7	36	24	31	1.5	4.1	4.4
HM02PL	Mo90895702	2.7	0.4	0.0	0.1	3.2	7.1	3.3	10.3	9.4	6.5	51	31	34	0.4	4.1	4.7
HM02PL	Mo90895703	10.9	1.6	0.0	0.3	12.8	10.2	2.7	23.0	19.6	15.5	17	56	65	0.4	4.2	4.7
HM02PL	Mo90895704	11.3	1.2	0.0	0.3	12.8	9.9	2.8	22.7	20.1	15.6	18	57	64	0.2	4.1	4.7
HM02PL	Mo90895705	12.8	1.2	0.0	0.3	14.3	6.1	0.6	20.4	18.2	14.9	4	70	79	0.2	4.4	4.9
HM02PL	Mo90895706	35.5	0.8	0.0	0.2	36.5	2.5	0.0		17.7				100	0.2	7.1	7.4
HM02PL	Mo90895707	9.7	0.4	0.0	0.1	10.2	1.0	0.0		7.7				100	0.1	7.3	7.8
HM02PL	Mo90895708	44.9	0.8	0.0	0.2	45.9	0.4	0.0		15.6				100	0.1	7.4	7.9
HM02PL	Mo90895709	38.1	0.8	0.0	0.1	39.0	0.0	0.0		13.2				100	0.1	7.4	7.9
HM02PL	Mo90895710	50.9	2.0	0.1	0.2	53.2	0.0	0.0		14.7				100	0.1	7.4	7.9

A.24. SITE ID: **HM02PU** MCL PEDON ID: **M0908956**

A --- (0-8 cm); 70% dark grayish brown (10YR 4/2, moist, broken face) , 20% very dark grayish brown (10YR 3/2, moist, broken face) , and 10% brown (10YR 5/3, moist, broken face) silt loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; common fine, common very fine pores; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; clear smooth boundary.

AB --- (8-18 cm); brown (10YR 5/3, moist, broken face) silt loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, and many very fine roots throughout; many fine, common very fine, few medium pores; very few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels; common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subrounded very strongly cemented gravel sized chert fragments; Note(s): no clfs visible; clear smooth boundary.

Bt1 --- (18-37 cm); yellowish brown (10YR 5/4, moist, broken face) clay; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, and many fine roots throughout; common fine, common very fine pores; few brown (10YR 5/3, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt2 --- (37-59 cm); yellowish brown (10YR 5/6, moist, broken face) clay; moderate fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, common fine roots throughout, and few medium roots throughout; common fine, common very fine pores; common light olive brown (2.5Y 5/4, moist) prominent clay films on all faces of peds; common light olive brown (2.5Y 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (59-78 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, few fine roots throughout, and few very fine roots throughout; few fine, few very fine pores; common light olive brown (2.5Y 5/4, moist) prominent clay films on all faces of peds; common light brownish gray (2.5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; clear wavy boundary.

2Btg4 --- (78-99 cm); grayish brown (2.5Y 5/2, moist, broken face) clay; weak medium prismatic parting to weak medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few fine roots throughout; few very fine pores; few light olive brown (2.5Y 5/3, moist) distinct clay films on all faces of peds; common brownish yellow (10YR 6/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): dense horizon, Note(s): 45 degree angle boundary below (see photo); abrupt wavy boundary.

2BC1 --- (99-185 cm); dark yellowish brown (10YR 4/4, moist, broken face) very gravelly sandy clay loam; weak fine prismatic parting to weak medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few very fine roots throughout; few very fine pores; few dark brown (10YR 3/3, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark grayish brown (10YR 4/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark grayish brown (10YR 4/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 37% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): Horizon was split sampled due to depth (sample 07 99-140cm, sample 08 140-185cm); abrupt smooth boundary.

2BC2 --- (185-205 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate fine prismatic parting to strong fine angular blocky structure; noneffervescent (HCl, 1 normal); very firm; few very fine roots throughout; few light olive brown (2.5Y 5/3, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 6% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): sample number 09, Note(s): jointed.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm3)
HMo2PU	Mo90895601	0.0	3.1	A	16.1	78.3	5.6	44.9	33.4	2	1.7	0.8	0.7	0.4	SIL	1.16
HMo2PU	Mo90895602	3.1	7.1	BE	18.1	76.9	5	43.6	33.3	2	1.5	0.7	0.6	0.2	SIL	1.20
HMo2PU	Mo90895603	7.1	14.6	Bt1	40.6	47.7	11.7	25.9	21.8	2.5	3.8	2.2	2	1.2	SIC	1.22
HMo2PU	Mo90895604	14.6	23.2	Bt2	45.9	32.6	21.5	16.7	15.9	6.2	7.8	3.8	2.6	1.1	C	1.48
HMo2PU	Mo90895605	23.2	30.7	Bt3	41.3	33.7	25	16.7	17	6.6	10	4.8	2.8	0.8	C	1.59
HMo2PU	Mo90895606	30.7	39.0	Btg4	42.2	35.9	21.9	19.7	16.2	6.3	8.4	3.7	2.7	0.8	C	1.71
HMo2PU	Mo90895607	39.0	55.1	2BC1	24.7	18.1	57.2	9.3	8.8	5.5	8.5	8.9	17.6	16.7	SCL	1.49
HMo2PU	Mo90895608	55.1	72.8	2BC1	22.7	15.5	61.8	8.1	7.4	4.2	6	6	16.8	28.8	SCL	1.49
HMo2PU	Mo90895609	72.8	80.7	2BC	33.3	33.1	33.6	18.1	15	7.8	10.3	5.9	6.5	3.1	CL	1.82

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH4OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH4OAc)	% TOC	pH salt	pH H2O
HMo2PU	Mo90895601	4.2	1.2	0.0	0.3	5.7	13.1	1.2	18.8	15.9	6.9	17	30	36	1.8	4.4	4.8
HMo2PU	Mo90895602	1.2	0.8	0.0	0.1	2.1	12.0	6.5	14.1	12.2	8.6	76	15	17	0.5	3.7	4.2
HMo2PU	Mo90895603	5.4	4.8	0.1	0.3	10.6	23.5	16.3	34.1	30.9	26.9	61	31	34	0.4	3.6	4.2
HMo2PU	Mo90895604	5.9	6.1	0.1	0.3	12.4	23.5	17.3	35.9	32.5	29.7	58	35	38	0.3	3.5	4.2
HMo2PU	Mo90895605	5.2	5.3	0.2	0.3	11.0	20.9	15.8	31.9	29.0	26.8	59	34	38	0.2	3.4	4.2
HMo2PU	Mo90895606	5.9	6.0	0.2	0.3	12.4	20.2	17.3	32.6	31.6	29.7	58	38	39	0.2	3.4	4.2
HMo2PU	Mo90895607	3.0	2.9	0.2	0.2	6.3	12.5	7.2	18.8	16.1	13.5	53	33	39	0.1	3.6	4.1
HMo2PU	Mo90895608	4.7	2.8	0.3	0.1	7.9	9.2	3.0	17.1	15.8	10.9	28	46	50	0.1	3.8	4.5
HMo2PU	Mo90895609	12.3	6.4	0.8	0.2	19.7	4.2	0.1	23.9	23.4	19.8	1	82	84	0.1	4.7	5.1

A.25. SITE ID: **RC01EL** MCL PEDON ID: **Mo917157**

A --- (0-8 cm); 70% very dark grayish brown (10YR 3/2, moist, rubbed) , and 30% brown (10YR 4/3, moist, broken face) loam; moderate fine granular structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, and common very fine roots throughout; many very fine dendritic tubular low continuity, many fine dendritic tubular low continuity, few medium dendritic tubular low continuity pores; abrupt smooth boundary.

BA --- (8-18 cm); yellowish brown (10YR 5/4, moist, broken face) loam; weak medium subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, common very fine roots throughout, and few medium roots throughout; common very fine dendritic tubular low continuity pores; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt1 --- (18-34 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, and common very fine roots throughout; many very fine dendritic tubular low continuity, few medium dendritic tubular low continuity pores; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt2 --- (34-58 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common very fine roots throughout, common fine roots throughout, few medium roots throughout, and few coarse roots throughout; common very fine dendritic tubular low continuity pores; few yellowish brown (10YR 5/6, moist) prominent clay films on all faces of peds; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; clear wavy boundary.

Bt3 --- (58-81 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; common fine roots throughout, few medium roots throughout, and few coarse roots throughout; common very fine dendritic tubular low continuity pores; few yellowish brown (10YR 5/4, moist) prominent clay films on all faces of peds; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt4 --- (81-103 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; common fine roots throughout, and few medium roots throughout; common fine dendritic tubular low continuity, common fine dendritic tubular low continuity, common medium dendritic tubular low continuity pores; few yellowish brown (10YR 5/4, moist) distinct clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; clear wavy boundary.

Btk1 --- (103-117 cm); yellowish brown (10YR 5/6, moist, broken face) loam; weak medium prismatic parting to moderate fine subangular blocky structure; slightly effervescent (HCl, 1 normal); friable; common fine roots throughout, few medium roots throughout, and few coarse roots throughout; few fine dendritic tubular low continuity, few very fine dendritic tubular low continuity pores; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; clear wavy boundary.

Btk2 --- (117-126 cm); dark yellowish brown (10YR 4/6, moist, broken face) coarse sandy loam; moderate fine prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); friable; few medium roots throughout; common fine dendritic tubular low continuity, common very fine dendritic tubular low continuity, common medium dendritic tubular low continuity pores; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark grayish brown (2.5Y 4/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): horizons 8-11 interfinger some, Note(s): horizons 8 and 9 were not sampled separately for bulk density; abrupt wavy boundary.

2Btk3 --- (126-134 cm); yellowish brown (10YR 5/6, moist, broken face) silt loam; weak fine prismatic parting to moderate fine subangular blocky structure; slightly effervescent (HCl, 1 normal); friable; few fine roots throughout; few very fine dendritic tubular low continuity, few medium dendritic tubular low continuity pores; common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light brownish gray (2.5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; Note(s): slightly stratified ; abrupt wavy boundary.

2Btk4 --- (134-142 cm); dark yellowish brown (10YR 4/6, moist, broken face) loam; moderate fine prismatic parting to moderate medium subangular blocky structure; strongly effervescent (HCl, 1 normal); friable; few fine roots throughout, and common medium roots throughout; common medium dendritic tubular low continuity pores; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common black (10YR 2/1, moist) medium prominent extremely weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): horizons 10 and 11 were not sampled separately for bulk density; abrupt smooth boundary.

2Bck1 --- (142-150 cm); brownish yellow (10YR 6/8, moist, broken face) silt loam; weak fine prismatic parting to moderate fine subangular blocky structure; slightly effervescent (HCl, 1 normal); friable; common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common reddish gray (2.5YR 6/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common yellow (10YR 7/6, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; Note(s): slightly stratified; abrupt wavy boundary.

2Bck2 --- (150-205 cm); dark yellowish brown (10YR 4/4, moist, broken face) loam; moderate medium prismatic structure; strongly effervescent (HCl, 1 normal); very firm; common fine dendritic tubular low continuity pores; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light brownish gray (2.5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) medium prominent extremely weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): one sm piece of weathered lignin.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
RCo1EL	Mo91715701	0	8	A	16.8	40.6	42.6	20.8	19.8	11.5	16.5	7.3	5.4	1.9	L	1.08
RCo1EL	Mo91715702	8	18	BA	19.3	36.6	44.1	18.5	18.1	11.7	16.6	6.2	5.8	3.8	L	1.41
RCo1EL	Mo91715703	18	34	Bt1	29.2	35.7	35.1	19.7	16	9.2	12.9	6.2	4.2	2.6	CL	1.46
RCo1EL	Mo91715704	34	58	Bt2	42.1	30.7	27.2	16	14.7	8.4	7.5	3.7	4.1	3.5	C	1.38
RCo1EL	Mo91715705	58	81	Bt3	37.3	34	28.7	18.5	15.5	6.9	8.8	4.4	4.3	4.3	CL	1.52
RCo1EL	Mo91715706	81	103	Bt4	33.8	33.8	32.4	18.6	15.2	8.2	12.4	5	4.6	2.2	CL	1.56
RCo1EL	Mo91715707	103	117	Btk1	22.4	39.3	38.3	25.7	13.6	5.1	8.7	6	9.1	9.4	L	1.48
RCo1EL	Mo91715708	117	126	Btk2	19	20.4	60.6	11.7	8.7	4.3	10.5	8.9	19.7	17.2	COSL	1.42
RCo1EL	Mo91715709	126	134	2Btk3	19.3	72.9	7.8	51.8	21.1	1.6	1	0.8	2.4	2	SIL	1.47
RCo1EL	Mo91715710	134	142	2Btk4	26.5	45	28.5	31.3	13.7	6.1	8.3	4.7	5.3	4.1	L	1.52
RCo1EL	Mo91715711	142	150	2BCK1	18.3	58.5	23.2	32.9	25.6	9.4	5.6	1.9	3.8	2.5	SIL	1.52
RCo1EL	Mo91715712	150	203	2BCK2	23.9	37.3	38.8	21.4	15.9	7.4	10	4.8	7.5	9.1	L	1.52

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
RCo1EL	Mo91715701	10	2	0	0.4	12.4	7.4	0	19.8	16.8	12.4	0	63	74	3.1	5.1	5.4
RCo1EL	Mo91715702	2.7	1.2	0	0.2	4.1	8.1	4.7	12.2	11.1	8.8	53	34	37	0.7	3.8	4.7
RCo1EL	Mo91715703	7.5	2.4	0	0.2	10.1	9.8	3.3	19.9	17.2	13.4	25	51	59	0.5	4	4.8
RCo1EL	Mo91715704	12.6	3.6	0.1	0.3	16.6	12	4.4	28.6	26.5	21	21	58	63	0.3	4.1	5.1
RCo1EL	Mo91715705	13.2	3.6	0.1	0.3	17.2	8.9	2.2	26.1	23.7	19.4	11	66	73	0.2	4.1	5.1
RCo1EL	Mo91715706	13.9	3.2	0.1	0.2	17.4	3.7	0	21.1	19.6	17.4	0	82	89	0.2	5.3	6.1
RCo1EL	Mo91715707	36.3	2.9	0.1	0.1	39.4	0.3	0		14.1				100	0.2	7.5	7.9
RCo1EL	Mo91715708	28.2	2.3	0	0.1	30.6	0	0		12.1				100	0.2	7.6	8
RCo1EL	Mo91715709	38.2	3.6	0.1	0.2	42.1	1	0		11.3				100	0.1	7.6	8
RCo1EL	Mo91715710	50	2.8	0.1	0.2	53.1	0	0		13.3				100	0.1	7.6	8
RCo1EL	Mo91715711	23.1	2.4	0.1	0.1	25.7	0	0		9				100	0.1	7.6	8
RCo1EL	Mo91715712	45.7	3.9	0.1	0.2	49.9	0	0		13.5				100	0.1	7.6	8

A.26. SITE ID: **RC01EU** MCL PEDON ID: **Mo917150**

A --- (0-6 cm); 70% dark grayish brown (10YR 4/2, moist, rubbed) , and 30% brown (10YR 4/3, moist, rubbed) loam; weak very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many very fine roots throughout, common fine roots throughout, and few medium roots throughout; common very fine dendritic tubular moderate continuity, common fine dendritic tubular moderate continuity pores; common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; Note(s): horizon frozen at time of sampling; abrupt smooth boundary.

Bt1 --- (6-15 cm); yellowish brown (10YR 5/4, moist, broken face) loam; weak very fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; many medium roots throughout, few coarse roots throughout, and many fine roots throughout; few medium dendritic tubular moderate continuity, common very fine dendritic tubular moderate continuity, common fine dendritic tubular moderate continuity pores; very few brown (10YR 5/3, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; abrupt wavy boundary.

Bt2 --- (15-27 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, common coarse roots throughout, few fine roots throughout, and few very coarse roots throughout; few fine dendritic tubular moderate continuity, few medium dendritic tubular moderate continuity pores; few yellowish brown (10YR 5/6, moist) distinct clay films on all faces of peds; common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular indurated gravel sized mixed rock fragments; Note(s): 1 larger piece of gravel (2"); clear wavy boundary.

Bt3 --- (27-42 cm); strong brown (7.5YR 5/6, moist, broken face) clay; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, and common coarse roots throughout; few very fine dendritic tubular moderate continuity pores; common strong brown (7.5YR 4/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular indurated fine gravel sized mixed rock fragments; clear smooth boundary.

Bt4 --- (42-64 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak medium subangular blocky parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; many medium roots throughout, and few coarse roots throughout; few fine dendritic tubular moderate continuity pores; common strong brown (7.5YR 4/6, moist) prominent clay films on all faces of peds; common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular indurated fine gravel sized mixed rock fragments; clear smooth boundary.

Bt5 --- (64-83 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; weak medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout; few strong brown (7.5YR 4/6, moist) distinct clay films on all faces of peds; common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular indurated fine gravel sized mixed rock fragments; clear smooth boundary.

2Bt6 --- (83-108 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few fine roots throughout; few very fine dendritic tubular moderate continuity pores; common brown (10YR 4/3, moist) prominent clay films on all faces of peds; common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 5% subangular indurated fine gravel sized mixed rock fragments; Note(s): more densic for rest of pedon; clear smooth boundary.

2BCK1 --- (108-141 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; weak medium prismatic structure; strongly effervescent (HCl, 1 normal); very firm; few very fine dendritic tubular moderate continuity pores; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical masses of carbonate throughout with clear boundaries; 3% subangular indurated gravel sized mixed rock fragments; Note(s): 1 larger gravel (2"), Note(s): could be BC or C horizon?; gradual smooth boundary.

2BCK2 --- (141-204 cm); dark yellowish brown (10YR 4/6, moist, broken face) loam; weak medium prismatic structure; strongly effervescent (HCl, 1 normal); very firm; few very fine dendritic tubular moderate continuity, few medium dendritic tubular moderate continuity pores; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical masses of carbonate throughout with clear boundaries; 4% subangular indurated gravel sized mixed rock fragments; Note(s): 1 larger gravel (2"), Note(s): could be BC or C horizon?.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
RCo1EU	Mo91715001	0	6	A	14.4	46.3	39.3	24.4	21.9	10.8	15.8	6.9	4.3	1.5	L	1.07
RCo1EU	Mo91715002	6	15	Bt1	18	44	38	22.1	21.9	10.1	15.3	6.3	4.3	2	L	1.43
RCo1EU	Mo91715003	15	27	Bt2	35.4	31.8	32.8	16.3	15.5	8.4	13.1	5	4.3	2	CL	1.37
RCo1EU	Mo91715004	27	42	Bt3	49	28.3	22.7	15.4	12.9	5.8	8.5	3.3	3.2	1.9	C	1.42
RCo1EU	Mo91715005	42	64	Bt4	42.9	30.2	26.9	15.3	14.9	6.6	9.3	4.4	4.1	2.5	C	1.40
RCo1EU	Mo91715006	64	83	Bt5	38	32.4	29.6	17.8	14.6	7.2	10.7	4.3	4.6	2.8	CL	1.52
RCo1EU	Mo91715007	83	108	2Bt6	33.7	34.9	31.4	20	14.9	8.6	11.2	5.4	4.4	1.8	CL	1.68
RCo1EU	Mo91715008	108	141	2Bck1	27.7	37.7	34.6	17.8	19.9	8.8	12.4	4.9	5	3.5	CL	1.72
RCo1EU	Mo91715009	141	203	2Bck2	25.7	38.4	35.9	21.3	17.1	7.9	10.9	5.7	5.7	5.7	L	1.72

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
RCo1EU	Mo91715001	8.2	1.9	0	0.4	10.5	6.6	0	17.1	14.6	10.5	0	62	72	2.5	5.4	5.7
RCo1EU	Mo91715002	2.6	1.2	0	0.2	4	9.9	5.7	13.9	12.8	9.7	59	29	31	0.7	3.9	4.7
RCo1EU	Mo91715003	5.6	2.4	0.1	0.2	8.3	15	10	23.3	21.8	18.3	55	36	38	0.5	3.9	4.7
RCo1EU	Mo91715004	9.9	4.3	0.1	0.4	14.7	19.7	12.7	34.4	31.7	27.4	46	43	46	0.5	3.8	4.8
RCo1EU	Mo91715005	10.2	4.3	0.1	0.3	14.9	15.5	8.5	30.4	27.7	23.4	36	49	54	0.3	3.9	4.9
RCo1EU	Mo91715006	11.3	4	0.1	0.3	15.7	10.7	3.9	26.4	23.7	19.6	20	59	66	0.2	4	4.9
RCo1EU	Mo91715007	14.9	3.9	0.1	0.1	19	3.6	0	22.6	21.2	19	0	84	90	0.2	6.1	6.7
RCo1EU	Mo91715008	37.5	3.5	0.1	0.1	41.2	0.7	0		15.8				100	0.1	7.4	7.9
RCo1EU	Mo91715009	46	4.4	0.1	0.1	50.6	0	0		14.4				100	0.1	7.5	7.9

A.27. SITE ID: **RC01PL** MCL PEDON ID: **M0917152**

A --- (0-8 cm); very dark grayish brown (10YR 3/2, moist, rubbed) sandy loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, and many very fine roots throughout; many very fine dendritic tubular low continuity, common fine dendritic tubular low continuity pores; clear smooth boundary.

AB --- (8-19 cm); 70% yellowish brown (10YR 5/4, moist, broken face) , and 30% very dark grayish brown (10YR 3/2, moist, broken face) sandy loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; many very fine roots throughout, many fine roots throughout, and few coarse roots throughout; many fine dendritic tubular, many very fine dendritic tubular low continuity pores; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; abrupt wavy boundary.

Bt1 --- (19-37 cm); yellowish brown (10YR 5/6, moist, broken face) sandy clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, common very fine roots throughout, and few medium roots throughout; few fine dendritic tubular low continuity, few very fine dendritic tubular low continuity pores; few dark yellowish brown (10YR 4/6, moist) faint clay films on all faces of pedis; common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt2 --- (37-62 cm); yellowish brown (10YR 5/6, moist, broken face) sandy clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; many very fine roots throughout, many fine roots throughout, many medium roots throughout, and many coarse roots throughout; few very fine dendritic tubular low continuity pores; very few dark yellowish brown (10YR 4/6, moist) faint clay films on rock fragments; common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 8% subangular very strongly cemented gravel sized mixed rock fragments, 3% subrounded very strongly cemented cobble sized mixed rock fragments, 10% subrounded very strongly cemented stone sized mixed rock fragments; Note(s): very sandy, Note(s): nearly sandy clay?; clear smooth boundary.

Bt3 --- (62-84 cm); yellowish brown (10YR 5/6, moist, broken face) sandy clay loam; weak medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, and common medium roots throughout; very few dark yellowish brown (10YR 4/6, moist) faint clay films on rock fragments; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 8% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): dessimated glacial till (granites, chlorite schist), Note(s): base of this horizon appears to be some type of lag or stone line (see photo); abrupt smooth boundary.

Bt4 --- (84-113 cm); yellowish brown (10YR 5/6, moist, broken face) sandy clay loam; weak medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few fine roots throughout, and common medium roots throughout; very few dark yellowish brown (10YR 4/6, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 6% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): finer sands; abrupt smooth boundary.

Bt5 --- (113-154 cm); strong brown (7.5YR 5/6, moist, broken face) coarse sandy loam; weak fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few very fine roots throughout, and few coarse roots throughout; very few dark yellowish brown (10YR 4/6, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subrounded very strongly cemented cobble sized mixed rock fragments, 3% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): coarser sands; abrupt smooth boundary.

Bt6 --- (154-205 cm); dark yellowish brown (10YR 4/6, moist, broken face) loam; weak medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few fine roots throughout; very few dark yellowish brown (10YR 4/6, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (7.5YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): more dense material with much less sand.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
RCo1PL	Mo91715201	0	8	A	12.4	28.1	59.5	14.3	13.8	10.3	19.2	13.3	14.1	2.6	SL	1.18
RCo1PL	Mo91715202	8	19	AB	12.5	25.7	61.8	13.2	12.5	9.4	19.4	12.2	15.1	5.7	SL	1.53
RCo1PL	Mo91715203	19	37	Bt1	28	17	55	8.5	8.5	4.3	10.5	13.1	20.5	6.6	SCL	1.57
RCo1PL	Mo91715204	37	62	Bt2	30.4	7.4	62.2	3.8	3.6	2.3	5.8	10.6	28.9	14.6	SCL	1.65
RCo1PL	Mo91715205	62	84	Bt3	27.7	10.4	61.9	5.7	4.7	3.2	5.4	7.6	22.2	23.5	SCL	1.61
RCo1PL	Mo91715206	84	113	Bt4	25.6	16.9	57.5	7.4	9.5	10.4	23.4	10.4	8.5	4.8	SCL	1.59
RCo1PL	Mo91715207	113	154	Bt5	18	4.9	77.1	2.3	2.6	1.4	7.8	10.5	27.2	30.2	COSL	1.53
RCo1PL	Mo91715208	154	203	Bt6	24.7	38.9	36.4	22.7	16.2	9.5	13.2	5.1	5.1	3.5	L	1.53

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
RCo1PL	Mo91715201	9.5	1.2	0	0.4	11.1	3.3	0	14.4	12.4	11.1	0	77	89	2.1	6.2	6.3
RCo1PL	Mo91715202	6.1	1.2	0	0.2	7.5	3.5	0	11	9.5	7.5	0	68	79	1.2	5.7	5.9
RCo1PL	Mo91715203	6.6	2	0.1	0.3	9	11	4.9	20	17.1	13.9	35	45	53	0.4	4.1	5
RCo1PL	Mo91715204	8.5	2.8	0.1	0.3	11.7	8.7	2.5	20.4	18.3	14.2	18	57	64	0.3	4.2	4.9
RCo1PL	Mo91715205	8.7	2.4	0.1	0.2	11.4	8.7	2.1	20.1	17.3	13.5	16	57	66	0.2	4.3	5.1
RCo1PL	Mo91715206	9.6	2.8	0.1	0.2	12.7	7	0.8	19.7	16.8	13.5	6	65	76	0.1	4.3	5.2
RCo1PL	Mo91715207	6.1	1.6	0.1	0.1	7.9	5.3	0.1	13.2	10	8	1	60	79	0.1	4.7	5.5
RCo1PL	Mo91715208	13.1	2.8	0.3	0.1	16.3	5.3	0	21.6	18.2	16.3	0	75	90	0.1	6.3	6.9

A.28. SITE ID: **RCo1PU** MCL PEDON ID: **Mo917151**

A --- (0-11 cm); very dark grayish brown (10YR 3/2, moist, rubbed) loam; moderate very fine subangular blocky structure; friable; few medium roots throughout, many fine roots throughout, and many very fine roots throughout; many fine dendritic tubular low continuity, many very fine dendritic tubular low continuity pores; Note(s): frozen at time of sampling; clear wavy boundary.

Bt1 --- (11-22 cm); 60% yellowish brown (10YR 5/4, moist, broken face) , and 40% very dark grayish brown (10YR 3/2, moist, broken face) loam; moderate fine subangular blocky structure; firm; common medium roots throughout, common fine roots throughout, and few very fine roots throughout; common fine dendritic tubular low continuity, common very fine dendritic tubular low continuity, few medium dendritic tubular low continuity pores; very few dark yellowish brown (10YR 4/4, moist) faint clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): frozen at time of sampling; clear smooth boundary.

Bt2 --- (22-36 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak fine subangular blocky structure; firm; common fine roots throughout, few medium roots throughout, and few coarse roots throughout; few fine dendritic tubular low continuity, few very fine dendritic tubular low continuity pores; very few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels, few yellowish brown (10YR 5/6, moist) faint clay films on all faces of peds; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subrounded very strongly cemented fine gravel sized chert fragments; clear smooth boundary.

Bt3 --- (36-69 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak medium subangular blocky structure; firm; common fine roots throughout, few medium roots throughout, few coarse roots throughout, and few very coarse roots throughout; few very fine dendritic tubular low continuity, few fine dendritic tubular low continuity pores; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates throughout with diffuse boundaries; 1% rounded very strongly cemented fine gravel sized mixed rock fragments, 1% subrounded very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt4 --- (69-89 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; weak medium prismatic parting to moderate fine subangular blocky structure; firm; common fine roots throughout, common very fine roots throughout, and few medium roots throughout; few very fine dendritic tubular low continuity pores; few light olive brown (2.5Y 5/3, moist) prominent clay films on all faces of peds; common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 1% subrounded very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Btk1 --- (89-132 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; weak medium prismatic parting to moderate fine subangular blocky structure; very firm; few fine roots throughout; few light olive brown (2.5Y 5/3, moist) prominent clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; many light gray (10YR 7/1, moist) fine prominent weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 2% subrounded very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

2Btk2 --- (132-170 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate medium subangular blocky structure; very firm; few very fine roots throughout; few dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; many very pale brown (10YR 8/1, moist) coarse prominent weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments, 3% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): CaCO₃ nodules become larger and increase significantly in amount (maximum); clear smooth boundary.

2Bck --- (170-208 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate medium prismatic structure; very firm; few very fine roots throughout; few light olive brown (2.5Y 5/3, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; many very pale brown (10YR 8/1, moist) coarse prominent weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 4% subrounded very strongly cemented fine gravel sized mixed rock fragments.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
RCo1PU	Mo91715101	0	11	A	20.8	45.3	33.9	26	19.3	8.3	14.2	5.5	4.5	1.4	L	0.98
RCo1PU	Mo91715102	11	22	Bt1	25	41.7	33.3	23.7	18	8.5	12.8	6.2	4.3	1.5	L	1.37
RCo1PU	Mo91715103	22	36	Bt2	41.9	31.3	26.8	16.4	14.9	6	9.9	4.1	4.1	2.7	C	1.29
RCo1PU	Mo91715104	36	69	Bt3	41	29.8	29.2	14.9	14.9	6.3	9.3	5	4.8	3.8	C	1.54
RCo1PU	Mo91715105	69	89	Bt4	33.9	34.2	31.9	18.9	15.3	7.7	11.6	4.9	5	2.7	CL	1.66
RCo1PU	Mo91715106	89	132	Btk1	30.1	36.4	33.5	21.2	15.2	7	10.3	5.4	5.6	5.2	CL	1.67
RCo1PU	Mo91715107	132	170	2Btk2	27.9	36.5	35.6	23	13.5	6.8	9.9	4.4	5.7	8.8	CL	1.71
RCo1PU	Mo91715108	170	203	2Bck	36.1	31.4	32.5	17.8	13.6	7.2	10.7	5.1	5.1	4.4	CL	1.79

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
RCo1PU	Mo91715101	13.5	2	0	0.4	15.9	8	0	23.9	21.8	15.9	0	67	73	3.4	5.3	5.4
RCo1PU	Mo91715102	9.7	1.6	0	0.2	11.5	9.1	1.9	20.6	18.7	13.4	14	56	62	1	4.3	4.9
RCo1PU	Mo91715103	14.7	2.8	0.1	0.3	17.9	14.5	8	32.4	31.7	25.9	31	55	56	0.6	4	4.9
RCo1PU	Mo91715104	15.5	2.4	0.1	0.3	18.3	9.8	3	28.1	26.1	21.3	14	65	70	0.5	4.3	5.2
RCo1PU	Mo91715105	32.4	2.4	0.1	0.1	35	1.3	0		21.6				100	0.3	7.1	7.6
RCo1PU	Mo91715106	45.5	2.8	0.1	0.1	48.5	0.5	0		17.7				100	0.2	7.2	8
RCo1PU	Mo91715107	46.6	3.3	0.2	0.1	50.2	0.3	0		13.5				100	0.1	7.4	8
RCo1PU	Mo91715108	34	6.4	0.4	0.2	41	1	0		22.3				100	0.1	7.3	8

A.29. SITE ID: **RC02EL** MCL PEDON ID: **Mo917154**

A --- (0-4 cm); very dark grayish brown (10YR 3/2, moist, rubbed) loam; moderate medium granular structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, and many very fine roots throughout; many fine dendritic tubular low continuity, many very fine dendritic tubular low continuity, common medium dendritic tubular low continuity pores; abrupt smooth boundary.

BA --- (4-12 cm); yellowish brown (10YR 5/4, moist, broken face) loam; weak fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, and common very fine roots throughout; many very fine dendritic tubular low continuity, few fine dendritic tubular low continuity pores; very few brown (10YR 5/3, moist) faint clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subrounded very strongly cemented fine gravel sized mixed rock fragments; abrupt smooth boundary.

Bt1 --- (12-25 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, and common fine roots throughout; few very fine dendritic tubular low continuity pores; few yellowish brown (10YR 5/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subrounded very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt2 --- (25-47 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak fine prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few medium roots throughout, common fine roots throughout, and common very fine roots throughout; few yellowish brown (10YR 5/4, moist) prominent clay films on all faces of peds; common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; few light gray (10YR 7/1, moist) fine prominent noncemented threadlike finely disseminated carbonates throughout with diffuse boundaries; 1% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): very few CaCO₃, Note(s): matrix does not effervesce; clear smooth boundary.

Bt3 --- (47-76 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few very coarse roots throughout, few coarse roots throughout, common medium roots throughout, and many fine roots throughout; few yellowish brown (10YR 5/4, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common olive gray (5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subrounded very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Btk1 --- (76-92 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate medium subangular blocky structure; slightly effervescent (HCl, 1 normal); very firm; common medium roots throughout, and few fine roots throughout; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common light gray (10YR 7/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 2% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): CaCO₃ is present - not enough for Btk; gradual wavy boundary.

Btk2 --- (92-122 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); very firm; common coarse roots throughout, few medium roots throughout, and few fine roots throughout; few dark yellowish brown (10YR 4/4, moist) faint clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 2% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): densic, Note(s): CaCO₃ increases to 10 percent in base of horizon; abrupt wavy boundary.

Btk3 --- (122-144 cm); pale brown (10YR 6/3, moist, broken face) loamy very fine sand; weak medium subangular blocky structure; slightly effervescent (HCl, 1 normal); friable; few medium roots throughout; few yellowish brown (10YR 5/4, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brownish yellow (10YR 6/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light brownish gray (10YR 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common light gray (10YR 7/1, moist) fine distinct weakly cemented platy carbonate nodules along lamina or strata surfaces with diffuse boundaries; Note(s): very fine sand lense (see photo for orientation); abrupt wavy boundary.

Btk4 --- (144-205 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; strong medium prismatic structure moderate fine prismatic parting to moderate medium angular blocky structure; violently effervescent (HCl, 1 normal); firm; few medium roots throughout, and few fine roots throughout; few brown (10YR 4/3, moist) distinct clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) coarse prominent weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 2% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): densic.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm3)
RC02EL	Mo91715401	0	4	A	15.5	38.9	45.6	20.8	18.1	10.9	17.8	8.8	6	2.1	L	1.27
RC02EL	Mo91715402	4	12	BA	17.9	36.1	46	19.5	16.6	11.1	19.5	7.5	5.5	2.4	L	1.47
RC02EL	Mo91715403	12	25	Bt1	34.5	31.1	34.4	15.1	16	8.1	13.8	6	4.1	2.4	CL	1.44
RC02EL	Mo91715404	25	47	Bt2	40.1	28.8	31.1	16	12.8	7.1	12.4	4.8	4	2.8	C	1.58
RC02EL	Mo91715405	47	76	Bt3	38	30.5	31.5	16.5	14	7	11.6	5.6	4.5	2.8	CL	1.49
RC02EL	Mo91715406	76	92	Btk1	34.4	32.1	33.5	18	14.1	7.9	13	5	4.5	3.1	CL	1.61
RC02EL	Mo91715407	92	122	Btk2	30.5	34.2	35.3	20.6	13.6	7.5	12.3	5.9	4.9	4.7	CL	1.75
RC02EL	Mo91715408	122	144	Btk3	6.9	48.3	44.8	4.7	43.6	35.6	8.4	0.3	0.2	0.3	VFSL	1.60
RC02EL	Mo91715409	144	203	Btk4	28.7	35	36.3	20.5	14.5	8.4	12.8	5.9	5.2	4	CL	1.71

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH4OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH4OAcC)	% TOC	pH salt	pH H2O
RC02EL	Mo91715401	14.9	1.6	0	0.4	16.9	6.5	0	23.4	19.6	16.9	0	72	86	4.2	6.3	6.5
RC02EL	Mo91715402	2.2	0.4	0	0.2	2.8	9.8	5.1	12.6	11	7.9	65	22	26	0.8	3.8	4.7
RC02EL	Mo91715403	6.5	1.6	0.1	0.3	8.5	13.7	7.8	22.2	19.4	16.3	48	38	44	0.5	3.8	4.7
RC02EL	Mo91715404	10.2	2	0.1	0.3	12.6	13.2	5.8	25.8	23	18.4	32	49	55	0.4	4	4.9
RC02EL	Mo91715405	12.8	1.6	0.1	0.3	14.8	10.7	2.7	25.5	23	17.5	15	58	64	0.3	4.1	5
RC02EL	Mo91715406	32.6	1.2	0	0.1	33.9	1.3	0		19				100	0.3	7.1	7.5
RC02EL	Mo91715407	50.2	1.2	0	0.1	51.5	0	0		15.8				100	0.2	7.3	7.8
RC02EL	Mo91715408	22.4	2.4	0	0.1	24.9	0.1	0		5				100	0.1	7.5	8
RC02EL	Mo91715409	45	3.6	0.1	0.1	48.8	0	0		13.1				100	0.1	7.4	7.9

A.30. SITE ID: **RCo2EU** MCL PEDON ID: **Mo917153**

A --- (0-8 cm); 60% very dark grayish brown (10YR 3/2, moist, rubbed) , and 40% very dark grayish brown (10YR 3/2, moist, broken face) silt loam; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common very fine roots throughout, and common fine roots throughout; many fine dendritic tubular low continuity, many very fine dendritic tubular low continuity, common medium dendritic tubular low continuity, few coarse dendritic tubular low continuity pores; abrupt wavy boundary.

Bt1 --- (8-21 cm); yellowish brown (10YR 5/4, moist, broken face) silt loam; weak fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many medium roots throughout, common fine roots throughout, and common very fine roots throughout; common fine dendritic tubular low continuity, common very fine dendritic tubular low continuity, few medium dendritic tubular low continuity pores; very few yellowish brown (10YR 5/6, moist) faint clay films on all faces of peds; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt2 --- (21-43 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few very coarse roots throughout, common medium roots throughout, many fine roots throughout, and many very fine roots throughout; few very fine dendritic tubular low continuity, few fine dendritic tubular low continuity pores; few strong brown (7.5YR 4/6, moist) prominent clay films on all faces of peds; common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments, 1% subangular very strongly cemented coarse gravel sized mixed rock fragments; clear wavy boundary.

Bt3 --- (43-65 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak fine prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few very coarse roots throughout, few coarse roots throughout, common medium roots throughout, many fine roots throughout, and many very fine roots throughout; few very fine dendritic tubular low continuity, few fine dendritic tubular low continuity pores; few strong brown (7.5YR 4/6, moist) prominent clay films on all faces of peds; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt4 --- (65-94 cm); yellowish brown (10YR 5/6, moist, broken face) clay; moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, common medium roots throughout, and common fine roots throughout; few very fine dendritic tubular low continuity pores; few brown (10YR 5/3, moist) distinct clay films on surfaces along root channels; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common light gray (10YR 7/2, moist) fine prominent noncemented threadlike finely disseminated carbonates throughout with diffuse boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): CaCO₃ effervesces slightly in 1N HCl, but matrix does not; abrupt smooth boundary.

Bt5 --- (94-122 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate medium prismatic structure; noneffervescent (HCl, 1 normal); very firm; few coarse roots throughout, and few very fine roots throughout; few very fine dendritic tubular low continuity pores; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates throughout with diffuse boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): CaCO₃ effervesces slightly in 1N HCl, but matrix does not; gradual smooth boundary.

2BCK1 --- (122-149 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; weak medium prismatic structure; noneffervescent (HCl, 1 normal); very firm; few very fine roots throughout; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) medium prominent weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; gradual smooth boundary.

2BCK2 --- (149-205 cm); yellowish brown (10YR 5/4, moist, broken face) clay loam; weak medium prismatic structure; noneffervescent (HCl, 1 normal); very firm; few medium roots throughout; few dark yellowish brown (10YR 4/4, moist) faint clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) coarse prominent weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
RCo2EU	Mo91715301	0	8	A	15.2	67.1	17.7	39.7	27.4	3.6	6.6	3.7	3.2	0.6	SIL	1.04
RCo2EU	Mo91715302	8	21	Bt1	21.1	60.9	18	36.2	24.7	3.8	7	3.1	2.7	1.4	SIL	1.38
RCo2EU	Mo91715303	21	43	Bt2	52.5	29.6	17.9	16.3	13.3	3.8	6.3	3.1	2.9	1.8	C	1.35
RCo2EU	Mo91715304	43	65	Bt3	52.7	28.1	19.2	13.6	14.5	4.8	7	3	3	1.4	C	1.26
RCo2EU	Mo91715305	65	94	Bt4	48.8	26.7	24.5	13.2	13.5	5.4	9	5	3.7	1.4	C	1.49
RCo2EU	Mo91715306	94	122	Bt5	35.9	33.1	31	18.4	14.7	7.6	12.1	4.8	4.3	2.2	CL	1.72
RCo2EU	Mo91715307	122	149	2Bck1	33.4	35.3	31.3	19.2	16.1	7.7	11.7	5.4	4.5	2	CL	1.65
RCo2EU	Mo91715308	149	203	2Bck2	31.3	33.2	35.5	19	14.2	7.5	11.9	4.8	5	6.3	CL	1.82

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
RCo2EU	Mo91715301	8.6	2	0	0.4	11	9.9	0	20.9	17.3	11	0	53	64	3.5	5	5.5
RCo2EU	Mo91715302	2.4	1.2	0	0.2	3.8	11	5	14.8	12.4	8.8	57	26	31	0.7	3.8	4.6
RCo2EU	Mo91715303	6.3	5.6	0.1	0.4	12.4	23.9	16.7	36.3	34.6	29.1	57	34	36	0.6	3.9	4.5
RCo2EU	Mo91715304	7	6	0.1	0.3	13.4	23.4	15.5	36.8	33	28.9	54	36	41	0.4	3.9	4.5
RCo2EU	Mo91715305	10	6.3	0.2	0.3	16.8	16.7	8.6	33.5	30.9	25.4	34	50	54	0.3	4.2	4.8
RCo2EU	Mo91715306	12	6	0.3	0.3	18.6	8.8	2	27.4	24.2	20.6	10	68	77	0.2	4.7	5.2
RCo2EU	Mo91715307	37.3	4.7	0.4	0.1	42.5	0	0		19.1				100	0.1	7	7.4
RCo2EU	Mo91715308	31.6	5.6	0.4	0.1	37.7	2.4	0		16.4				100	0.1	7.2	7.9

A.31. SITE ID: **RC02PL** MCL PEDON ID: **Mo917156**

A --- (0-9 cm); very dark grayish brown (10YR 3/2, moist, rubbed) silt loam; moderate fine granular structure; noneffervescent (HCl, 1 normal); friable; common very fine roots throughout, and common fine roots throughout; many fine dendritic tubular low continuity, many fine dendritic tubular low continuity, common medium dendritic tubular low continuity pores; abrupt smooth boundary.

AB --- (9-24 cm); 70% brown (10YR 4/3, moist, broken face) , and 30% very dark grayish brown (10YR 3/2, moist, broken face) silt loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, common very fine roots throughout, and many medium roots throughout; common very fine dendritic tubular low continuity, few medium dendritic tubular low continuity pores; common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; clear smooth boundary.

Bt1 --- (24-43 cm); yellowish brown (10YR 5/4, moist, broken face) silt loam; weak medium subangular blocky parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; common very fine dendritic tubular low continuity, few medium dendritic tubular low continuity pores; very few grayish brown (10YR 5/2, moist) faint clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; Note(s): loess?; clear wavy boundary.

2Bt2 --- (43-63 cm); yellowish brown (10YR 5/4, moist, broken face) silty clay; weak coarse prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, common medium roots throughout, and few coarse roots throughout; common fine dendritic tubular low continuity, few medium dendritic tubular low continuity pores; few brown (10YR 5/3, moist) distinct clay films on all faces of peds; common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): loess?; abrupt wavy boundary.

2Bt3 --- (63-89 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak coarse prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few fine roots throughout, common very fine roots throughout, many medium roots throughout, and few very coarse roots throughout; common fine dendritic tubular low continuity pores; few brown (10YR 5/3, moist) distinct clay films on all faces of peds; common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

2Bt4 --- (89-119 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few fine roots throughout, few coarse roots throughout, and few medium roots throughout; few fine dendritic tubular low continuity, few very fine dendritic tubular low continuity pores; few dark yellowish brown (10YR 4/6, moist) distinct clay films on all faces of peds; common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments; abrupt smooth boundary.

2Btk1 --- (119-153 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; strong fine prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; common very fine roots throughout, and common fine roots throughout; common very fine dendritic tubular low continuity, few medium dendritic tubular low continuity pores; common brown (10YR 4/3, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common light gray (10YR 7/1, moist) fine prominent noncemented threadlike finely disseminated carbonates throughout with diffuse boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): CaCO₃ present, but matrix does not effervesce, Note(s): mnm increases at base of horizon; gradual smooth boundary.

2Btk2 --- (153-205 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; strong medium prismatic parting to moderate medium angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; common very fine dendritic tubular low continuity, few medium dendritic tubular low continuity pores; few brown (10YR 4/3, moist) prominent clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) medium prominent extremely weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
RCo2PL	Mo91715601	0	9	A	18.3	74.2	7.5	46.3	27.9	1.7	3	1.6	0.9	0.3	SIL	0.90
RCo2PL	Mo91715602	9	24	AB	17.1	75.6	7.3	46.6	29	1.7	2.8	1.4	1.2	0.2	SIL	1.20
RCo2PL	Mo91715603	24	43	Bt1	26.5	67.8	5.7	41.9	25.9	1.3	2	1.2	1	0.2	SIL	1.39
RCo2PL	Mo91715604	43	63	2Bt2	51.6	44.8	3.6	27.2	17.6	0.9	1.3	0.6	0.6	0.2	SIC	1.28
RCo2PL	Mo91715605	63	89	2Bt3	45.1	34.5	20.4	18.9	15.6	5	8.2	3.4	2.7	1.1	C	1.41
RCo2PL	Mo91715606	89	119	2Bt4	34	27.8	38.2	14.9	12.9	7	11.9	5.9	7.7	5.7	CL	1.66
RCo2PL	Mo91715607	119	153	2Btk1	33.4	32.3	34.3	16.7	15.6	7.8	12.4	5.9	4.8	3.4	CL	1.59
RCo2PL	Mo91715608	153	203	2Btk2	29	33.7	37.3	17.9	15.8	7.7	13.5	6.2	5.5	4.4	CL	1.70

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
RCo2PL	Mo91715601	10.9	2	0	0.4	13.3	7.6	0	20.9	18	13.3	0	64	74	3.1	5.4	5.7
RCo2PL	Mo91715602	5.9	1.2	0	0.2	7.3	6.3	0.2	13.6	11.9	7.5	3	54	61	1.1	4.7	5
RCo2PL	Mo91715603	4.5	1.9	0.1	0.2	6.7	11.6	5.8	18.3	16.8	12.5	46	37	40	0.4	3.9	4.7
RCo2PL	Mo91715604	9.5	5.6	0.2	0.5	15.8	22	14.7	37.8	36.9	30.5	48	42	43	0.4	3.7	4.6
RCo2PL	Mo91715605	8.8	6	0.2	0.4	15.4	18.6	11.9	34	31	27.3	44	45	50	0.3	3.7	4.6
RCo2PL	Mo91715606	6.8	4.4	0.2	0.2	11.6	11.4	6.9	23	22.1	18.5	37	51	52	0.2	3.8	4.7
RCo2PL	Mo91715607	10.2	5.6	0.4	0.2	16.4	4.6	0.6	21	20.1	17	4	78	82	0.1	4.6	5.2
RCo2PL	Mo91715608	32.9	5.6	0.5	0.1	39.1	0	0		15.3				100	0.1	7.3	7.7

A.32. SITE ID: **RC02PU** MCL PEDON ID: **Mo917155**

A --- (0-7 cm); very dark grayish brown (10YR 3/2, moist, rubbed) silt loam; moderate fine granular structure; noneffervescent (HCl, 1 normal); friable; few coarse roots throughout, common fine roots throughout, and common very fine roots throughout; many fine dendritic tubular low continuity, many very fine dendritic tubular low continuity, few medium dendritic tubular low continuity pores; abrupt smooth boundary.

BA --- (7-17 cm); yellowish brown (10YR 5/4, moist, broken face) silt loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, and common very fine roots throughout; many fine dendritic tubular low continuity, many very fine dendritic tubular low continuity, few medium dendritic tubular low continuity pores; very few dark grayish brown (10YR 4/2, moist) faint skeletal on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; clear smooth boundary.

Bt1 --- (17-34 cm); yellowish brown (10YR 5/4, moist, broken face) silt loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; few coarse roots throughout, few medium roots throughout, many fine roots throughout, and many very fine roots throughout; common fine dendritic tubular low continuity, common very fine dendritic tubular low continuity pores; very few dark yellowish brown (10YR 4/4, moist) faint clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; clear smooth boundary.

2Bt2 --- (34-61 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; weak medium prismatic parting to weak fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, common medium roots throughout, common fine roots throughout, and common very fine roots throughout; few very fine dendritic tubular low continuity pores; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized chert fragments; Note(s): looks like loess, but has a few small till fragments (less than 1 percent); clear smooth boundary.

2Bt3 --- (61-83 cm); yellowish brown (10YR 5/6, moist, broken face) sandy clay loam; weak fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, and common fine roots throughout; common fine dendritic tubular low continuity, common very fine dendritic tubular low continuity pores; few dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments, 1% subrounded very strongly cemented medium gravel sized mixed rock fragments; Note(s): paleosol? lots of sands, but larger subrounded till frags; clear smooth boundary.

2Bt4 --- (83-102 cm); yellowish brown (10YR 5/6, moist, broken face) sandy clay loam; weak medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few medium roots throughout, and common fine roots throughout; few very fine dendritic tubular low continuity pores; few dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): lots of sands; abrupt smooth boundary.

2Bt5 --- (102-127 cm); yellowish brown (10YR 5/6, moist, broken face) clay; moderate medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few fine roots throughout; few very fine dendritic tubular low continuity pores; few grayish brown (10YR 5/2, moist) prominent clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments; abrupt smooth boundary.

2Bt6 --- (127-168 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; strong medium prismatic parting to strong fine angular blocky structure; noneffervescent (HCl, 1 normal); very firm; few fine roots throughout; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical finely disseminated carbonates throughout with diffuse boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): major mnm increase, Note(s): finely disseminated carbonates present, but matrix does not effervesce; gradual smooth boundary.

2Btk --- (168-205 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; strong medium prismatic parting to strong fine angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few fine roots throughout; few dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
RCo2PU	Mo91715501	0	7	A	13.1	62.7	24.2	39	23.7	4.3	12.6	4.4	2.4	0.5	SIL	0.90
RCo2PU	Mo91715502	7	17	BA	15.9	61.5	22.6	39.1	22.4	3.7	11.1	5.4	2.2	0.2	SIL	1.26
RCo2PU	Mo91715503	17	34	Bt1	22.5	59.5	18	37.9	21.6	2.8	8.9	3.5	2.2	0.6	SIL	1.29
RCo2PU	Mo91715504	34	61	2Bt2	29.4	46.3	24.3	30.2	16.1	3.8	11.8	5.5	2.6	0.6	CL	1.59
RCo2PU	Mo91715505	61	83	2Bt3	29.6	24.7	45.7	13.3	11.4	8	23.7	7.8	4.3	1.9	SCL	1.42
RCo2PU	Mo91715506	83	102	2Bt4	33.8	15.7	50.5	6.6	9.1	7.3	24.6	10.6	5.1	2.9	SCL	1.47
RCo2PU	Mo91715507	102	127	2Bt5	41.1	27.7	31.2	13.3	14.4	7.8	13.8	4.8	3.7	1.1	C	1.59
RCo2PU	Mo91715508	127	168	2Bt6	32	35.7	32.3	19.2	16.5	8.1	12.2	5.7	4.4	1.9	CL	1.58
RCo2PU	Mo91715509	168	203	2Btk	30.5	35.5	34	19.9	15.6	8.5	13.6	5.1	4.4	2.4	CL	1.62

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAcC)	% TOC	pH salt	pH H ₂ O
RCo2PU	Mo91715501	7.5	1.6	0	0.3	9.4	7	0	16.4	13.5	9.4	0	57	70	2.4	5.2	5.8
RCo2PU	Mo91715502	1.7	0.8	0	0.1	2.6	8.2	3.5	10.8	9.6	6.1	57	24	27	0.7	3.9	4.3
RCo2PU	Mo91715503	1.2	1.6	0	0.2	3	11.8	7.3	14.8	14.1	10.3	71	20	21	0.4	3.6	4.1
RCo2PU	Mo91715504	2.2	3.3	0.1	0.2	5.8	14.1	9	19.9	18.9	14.8	61	29	31	0.4	3.8	4.3
RCo2PU	Mo91715505	4.2	3.7	0.2	0.2	8.3	12.4	7.7	20.7	19.8	16	48	40	42	0.2	3.8	4.7
RCo2PU	Mo91715506	6.6	4.8	0.3	0.2	11.9	11	5.7	22.9	20.2	17.6	32	52	59	0.1	3.9	4.8
RCo2PU	Mo91715507	11.3	6.7	0.4	0.3	18.7	10.8	4	29.5	27.1	22.7	18	63	69	0.2	3.9	4.3
RCo2PU	Mo91715508	11.3	6.1	0.5	0.1	18	4.1	0	22.1	19.9	18	0	81	90	0.1	5.3	5.7
RCo2PU	Mo91715509	27.1	6	0.4	0.1	33.6	0.4	0		16				100	0.1	7.2	7.7

A.33. SITE ID: **SC01EL** MCL PEDON ID: **M0900151**

A --- (0-9 cm); 60% very dark grayish brown (10YR 3/2, moist, rubbed) , and 40% very dark grayish brown (10YR 3/2, moist, broken face) loam; weak very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common very fine roots throughout, and common fine roots throughout; common fine dendritic tubular low continuity, common very fine dendritic tubular low continuity, common medium dendritic tubular low continuity pores; 1% subrounded very strongly cemented fine gravel sized mixed rock fragments; abrupt wavy boundary.

BA --- (9-22 cm); 80% yellowish brown (10YR 5/4, moist, broken face) , and 20% dark grayish brown (10YR 4/2, moist, broken face) loam; weak very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common medium roots throughout, common fine roots throughout, and common very fine roots throughout; common very fine dendritic tubular moderate continuity pores; very few dark yellowish brown (10YR 4/4, moist) faint clay films on all faces of ped; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): zone of mixing (A, E, & B); clear smooth boundary.

Bt1 --- (22-34 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium subangular blocky parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common very coarse roots throughout, common medium roots throughout, and common fine roots throughout; common very fine dendritic tubular moderate continuity pores; common yellowish brown (10YR 5/4, moist) prominent clay films on all faces of ped; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subrounded very strongly cemented fine gravel sized mixed rock fragments, 1% subrounded very strongly cemented medium gravel sized mixed rock fragments; clear smooth boundary.

Bt2 --- (34-51 cm); yellowish brown (10YR 5/6, moist, broken face) clay; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; common medium roots between peds, many fine roots between peds, and common coarse roots throughout; common very fine dendritic tubular moderate continuity pores; many yellowish brown (10YR 5/4, moist) prominent clay films on all faces of peds; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subrounded very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Btk1 --- (51-85 cm); 70% yellowish brown (10YR 5/6, moist, broken face) , and 30% light olive brown (2.5Y 5/4, moist, broken face) clay loam; weak medium prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; common very coarse roots between peds, common coarse roots between peds, common medium roots between peds, and common fine roots between peds; common very fine dendritic tubular low continuity pores; common dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented spherical masses of carbonate throughout with diffuse boundaries; 2% subrounded very strongly cemented fine gravel sized mixed rock fragments, 1% subrounded very strongly cemented medium gravel sized mixed rock fragments; Note(s): clays have a more illitic feel, Note(s): few lignins present; gradual smooth boundary.

Btk2 --- (85-116 cm); 70% yellowish brown (10YR 5/6, moist, broken face) , and 30% light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate fine prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; common very coarse roots between peds, common coarse roots between peds, and common medium roots between peds; common very fine dendritic tubular low continuity pores; common light olive brown (2.5Y 5/4, moist) distinct clay films on all faces of peds; common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries; 2% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): few lignins present; abrupt smooth boundary.

2Btk3 --- (116-147 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate medium prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); very firm; common fine roots between peds; common very fine dendritic tubular low continuity pores; few light olive brown (2.5Y 5/3, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries; 4% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): few lignins present; clear smooth boundary.

2Btk4 --- (147-205 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate medium prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); very firm; common fine roots between peds; common very fine dendritic tubular low continuity pores; common grayish brown (2.5Y 5/2, moist) distinct clay films on all faces of peds; common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries; 1% subrounded very strongly cemented medium gravel sized mixed rock fragments, 3% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): few lignins present.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm3)
SCo1EL	Mo90015101	0	9	A	13.9	37	49.1	19.1	17.9	11.8	21.7	8	5.8	1.8	L	1.19
SCo1EL	Mo90015102	9	22	BE	16.8	36.1	47.1	18.5	17.6	11.3	19.5	8.5	5.6	2.2	L	1.39
SCo1EL	Mo90015103	22	34	Bt1	38.5	29.7	31.8	16	13.7	7.9	12.3	4.7	4.1	2.8	CL	1.41
SCo1EL	Mo90015104	34	51	Bt2	42.7	29.8	27.5	15.6	14.2	6.9	10.3	4.7	3.3	2.3	C	1.49
SCo1EL	Mo90015105	51	85	Btk1	35.3	36.9	27.8	22.1	14.8	7.5	10.6	3.8	3.5	2.4	CL	1.58
SCo1EL	Mo90015106	85	116	Btk2	32.6	37.5	29.9	22.3	15.2	7.3	10.4	4.9	3.8	3.5	CL	1.77
SCo1EL	Mo90015107	116	147	2Btk3	32.5	37.3	30.2	22.2	15.1	7.7	11.8	4.1	3.6	3	CL	1.72
SCo1EL	Mo90015108	147	205	2Btk4	34.6	36	29.4	20.6	15.4	7.7	10.7	4.7	3.5	2.8	CL	1.71

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH4OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH4OAcC)	% TOC	pH salt	pH H2O
SCo1EL	Mo90015101	8.9	1.6	0	0.4	10.9	9.8	0	20.7	17.4	10.9	0	53	63	3.5	5.1	5.2
SCo1EL	Mo90015102	2.5	0.8	0	0.2	3.5	8.5	4	12	11	7.5	53	29	32	0.8	4	4.8
SCo1EL	Mo90015103	9.7	2	0.1	0.3	12.1	12	6.8	24.1	23	18.9	36	50	53	0.5	4.2	5
SCo1EL	Mo90015104	21.2	2.8	0.1	0.3	24.4	5	0	29.4	26.2	24.4	0	83	93	0.4	5.9	6.5
SCo1EL	Mo90015105	44.7	2.8	0.1	0.2	47.8	0	0		20				100	0.4	7.2	7.8
SCo1EL	Mo90015106	46.6	2.8	0.1	0.2	49.7	0	0		17.2				100	0.2	7.4	8
SCo1EL	Mo90015107	38	3.6	0.1	0.2	41.9	0.6	0		22.1				100	0.1	7.5	8
SCo1EL	Mo90015108	43.9	5.3	0.1	0.2	49.5	0	0		16.1				100	0.1	7.5	8

A.34. SITE ID: **SC01EU** MCL PEDON ID: **Mo900150**

A --- (0-10 cm); 60% very dark grayish brown (10YR 3/2, moist, rubbed) , and 40% dark grayish brown (10YR 4/2, moist, broken face) fine sandy loam; weak fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; common very fine dendritic tubular low continuity pores; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; abrupt wavy boundary.

E --- (10-28 cm); yellowish brown (10YR 5/4, moist, broken face) fine sandy loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, common medium roots throughout, and few coarse roots throughout; common fine dendritic tubular low continuity, few very fine dendritic tubular low continuity pores; very few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels; common dark grayish brown (10YR 4/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; clear wavy boundary.

Bt1 --- (28-52 cm); strong brown (7.5YR 5/6, moist, broken face) clay; weak medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; many fine roots throughout, common coarse roots throughout, and few very coarse roots throughout; few very fine dendritic tubular low continuity pores; few yellowish brown (10YR 5/6, moist) prominent clay films on all faces of peds; common yellowish red (5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments, 1% subangular very strongly cemented medium gravel sized mixed rock fragments; gradual smooth boundary.

Bt2 --- (52-71 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, few coarse roots throughout, and few very coarse roots throughout; few fine dendritic tubular low continuity, few very fine dendritic tubular low continuity pores; few yellowish brown (10YR 5/6, moist) prominent clay films on all faces of peds; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (71-95 cm); yellowish brown (10YR 5/6, moist, broken face) sandy clay loam; weak medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, and common very fine roots throughout; common very fine dendritic tubular low continuity pores; few light brownish gray (10YR 6/2, moist) distinct skeletans over cutans on all faces of peds, few dark yellowish brown (10YR 4/6, moist) distinct clay films on vertical faces of peds; common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): very fine sand skeletans , Note(s): pores are concentrated in the sandier, coarser gray mottles , Note(s): skeletans coat clay films; clear smooth boundary.

Bt4 --- (95-114 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; weak fine prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few fine roots throughout, and few medium roots throughout; common very fine dendritic tubular low continuity pores; few dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds, few light brownish gray (10YR 6/2, moist) distinct skeletalans over cutans on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): mnm is mainly in root channels and vertical ped faces, but throughout horizon, Note(s): vf sand skeletalans; abrupt smooth boundary.

Bt5 --- (114-134 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate coarse prismatic parting to moderate medium subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; common fine roots throughout; few very fine dendritic tubular low continuity pores; few brown (10YR 5/3, moist) prominent clay films on all faces of peds, few light brownish gray (10YR 6/2, moist) distinct skeletalans over cutans on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) medium prominent noncemented cylindrical masses of carbonate on vertical faces of peds with diffuse boundaries; 3% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): CaCO₃ increases in lower half of horizon , Note(s): vf sand skeletalans are coated with CaCO₃; abrupt smooth boundary.

Bt6 --- (134-152 cm); yellowish brown (10YR 5/6, moist, broken face) , and brownish yellow (10YR 6/8, dry, broken face) fine sandy loam; weak fine subangular blocky structure; slightly effervescent (HCl, 1 normal); friable; few fine roots throughout; few fine dendritic tubular low continuity, common very fine dendritic tubular low continuity pores; very few dark yellowish brown (10YR 4/6, moist) faint clay films on all faces of peds, very few gray (10YR 6/1, moist) faint clay films on surfaces along root channels; common dark yellowish brown (10YR 3/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light brownish gray (10YR 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) medium prominent extremely weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): sandy layer , Note(s): stratified with materials like horizon 9 , Note(s): 10yr5/4 CL; abrupt smooth boundary.

Bt7 --- (152-205 cm); dark yellowish brown (10YR 4/4, moist, broken face) loam; strong medium prismatic parting to strong fine angular blocky structure; strongly effervescent (HCl, 1 normal); extremely firm; few fine roots throughout; few very fine dendritic tubular low continuity pores; few olive brown (2.5Y 4/4, moist) prominent clay films on vertical faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) medium prominent extremely weakly cemented cylindrical carbonate nodules on vertical faces of peds with diffuse boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): rock-like structure.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
SCo1EU	Mo90015001	0	10	A	9	36.4	54.6	18.6	17.8	11.7	21.6	10.9	7.7	2.7	FSL	1.09
SCo1EU	Mo90015002	10	28	E	8.4	37.1	54.5	17.9	19.2	11.9	24.2	9.3	6.7	2.4	FSL	1.48
SCo1EU	Mo90015003	28	52	Bt1	42.5	23.4	34.1	11.3	12.1	6.8	11	6.2	5.8	4.3	C	1.47
SCo1EU	Mo90015004	52	71	Bt2	37.9	25.1	37	11.6	13.5	7.9	13.6	5.9	6	3.6	CL	1.50
SCo1EU	Mo90015005	71	95	Bt3	27.1	23.4	49.5	5.7	17.7	23.7	16.6	3.9	3.7	1.6	SCL	1.62
SCo1EU	Mo90015006	95	114	Bt4	28.7	28.5	42.8	13.6	14.9	10.9	18	6.5	5	2.4	CL	1.78
SCo1EU	Mo90015007	114	134	Bt5	28.5	29.9	41.6	15.2	14.7	8.8	15.1	8.1	6.3	3.3	CL	1.79
SCo1EU	Mo90015008	134	152	Bt6	10	24.5	65.5	7.7	16.8	14.1	41.4	8.1	1.5	0.4	FSL	1.62
SCo1EU	Mo90015009	152	203	Bt7	26	30.5	43.5	16.9	13.6	7.9	14.2	7.9	7.4	6.1	L	1.78

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAcC)	% TOC	pH salt	pH H ₂ O
SCo1EU	Mo90015001	5.2	1.2	0	0.4	6.8	10.7	0.4	17.5	15	7.2	6	39	45	3.5	4.4	4.6
SCo1EU	Mo90015002	0.7	0.4	0	0.1	1.2	5.3	2.6	6.5	5.8	3.8	68	19	21	0.4	4	4.3
SCo1EU	Mo90015003	8.7	4	0.1	0.3	13.1	18.1	11.9	31.2	28.3	25	48	42	46	0.4	3.9	4.5
SCo1EU	Mo90015004	8.3	3.6	0.1	0.3	12.3	15.6	10.2	27.9	25.2	22.5	45	44	49	0.3	3.9	4.6
SCo1EU	Mo90015005	6.6	3.2	0.1	0.2	10.1	10.1	5.3	20.2	18	15.4	34	50	56	0.2	4.1	4.8
SCo1EU	Mo90015006	9.6	3.7	0.1	0.2	13.6	5.5	0.6	19.1	17.5	14.2	4	71	78	0.2	4.7	5.2
SCo1EU	Mo90015007	19.4	3.7	0.1	0.2	23.4	1.8	0		16				100	0.1	7	7.4
SCo1EU	Mo90015008	24.6	2.1	0.1	0.1	26.9	0	0		6.6				100	0.1	7.5	7.8
SCo1EU	Mo90015009	34	5	0.2	0.2	39.4	0	0		12.5				100	0.1	7.7	7.9

A.35. SITE ID: **SC01PL** MCL PEDON ID: **Mo900153**

A --- (0-13 cm); very dark grayish brown (10YR 3/2, moist, rubbed) loam; weak very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and few medium roots throughout; few fine dendritic tubular low continuity, common very fine dendritic tubular low continuity pores; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; clear wavy boundary.

Bt1 --- (13-20 cm); brown (10YR 5/3, moist, broken face) loam; moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common medium roots throughout, and many fine roots throughout; few fine dendritic tubular low continuity, common very fine dendritic tubular low continuity pores; few very dark grayish brown (10YR 3/2, moist) distinct organoargillans on surfaces along root channels; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): AE/BA?; clear wavy boundary.

Bt2 --- (20-28 cm); yellowish brown (10YR 5/4, moist, broken face) clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; many medium roots throughout, few coarse roots throughout, and common very fine roots throughout; common fine dendritic tubular low continuity, common very fine dendritic tubular low continuity pores; common dark yellowish brown (10YR 4/4, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments, 1% subrounded very strongly cemented cobble sized mixed rock fragments; Note(s): 1 cobble (noted); clear smooth boundary.

Bt3 --- (28-43 cm); yellowish brown (10YR 5/6, moist, broken face) clay; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, common medium roots throughout, and common fine roots throughout; common very fine dendritic tubular low continuity pores; many yellowish brown (10YR 5/6, moist) prominent clay films on all faces of peds; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt4 --- (43-66 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak fine subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few medium roots throughout, and common fine roots throughout; few fine dendritic tubular low continuity, common very fine dendritic tubular low continuity pores; many yellowish brown (10YR 5/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Btk1 --- (66-94 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; weak coarse prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; few fine roots throughout, and few very fine roots throughout; few very fine dendritic tubular low continuity pores; many grayish brown (2.5Y 5/2, moist) prominent clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments; clear wavy boundary.

2Btk2 --- (94-127 cm); yellowish brown (10YR 5/4, moist, broken face) clay loam; weak fine prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; few medium roots throughout, common fine roots throughout, and few very fine roots throughout; few very fine dendritic tubular low continuity pores; common grayish brown (2.5Y 5/2, moist) prominent clay films on all faces of peds; common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 3% subangular very strongly cemented fine gravel sized mixed rock fragments, 1% subangular very strongly cemented medium gravel sized mixed rock fragments; Note(s): <1% lignins; gradual smooth boundary.

2Btk3 --- (127-160 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate medium prismatic parting to strong fine subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; few fine roots throughout; few very fine dendritic tubular low continuity pores; common yellowish brown (10YR 5/4, moist) distinct clay films on all faces of peds; common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brownish yellow (10YR 6/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light olive brown (2.5Y 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 3% subangular very strongly cemented fine gravel sized mixed rock fragments, 1% subangular very strongly cemented medium gravel sized mixed rock fragments; clear smooth boundary.

2Btk4 --- (160-205 cm); yellowish brown (10YR 5/8, moist, broken face) clay loam; moderate coarse prismatic parting to strong fine subangular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few fine roots throughout; few very fine dendritic tubular low continuity pores; common light olive brown (2.5Y 5/4, moist) distinct clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 4% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): rock-like structure.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
SCo1PL	Mo90015301	0	13	A	12.7	38.2	49.1	19.8	18.4	11.3	19	9.1	7.1	2.6	L	0.91
SCo1PL	Mo90015302	13	20	Bt1	16.2	35.7	48.1	19.2	16.5	11.8	20.1	7.5	6.1	2.6	L	1.47
SCo1PL	Mo90015303	20	28	Bt2	27	31.6	41.4	16.1	15.5	9.5	15.7	7.6	5.7	2.9	CL	1.51
SCo1PL	Mo90015304	28	43	Bt3	42	28.3	29.7	15.5	12.8	7.3	11.7	4.5	3.8	2.4	C	1.46
SCo1PL	Mo90015305	43	66	Bt4	42.6	29.5	27.9	16.1	13.4	7.2	10.1	4.9	3.9	1.8	C	1.58
SCo1PL	Mo90015306	66	94	Btk1	35.3	35	29.7	21.4	13.6	7.7	10.9	4.2	3.8	3.1	CL	1.59
SCo1PL	Mo90015307	94	127	2Btk2	32.8	36.8	30.4	22.3	14.5	7.3	10.2	5	4.1	3.8	CL	1.69
SCo1PL	Mo90015308	127	160	2Btk3	32	38.4	29.6	24.8	13.6	7.5	10.7	4	4	3.4	CL	1.73
SCo1PL	Mo90015309	160	203	2Btk4	33.9	36.8	29.3	22.6	14.2	7.4	10.3	5	3.8	2.8	CL	1.77

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAcC)	% TOC	pH salt	pH H ₂ O
SCo1PL	Mo90015301	5.4	1.2	0.1	0.2	6.9	8.4	0.2	15.3	12.8	7.1	3	45	54	2	4.9	5.4
SCo1PL	Mo90015302	4.9	1.1	0	0.2	6.2	6.1	1	12.3	11.8	7.2	14	50	53	0.6	4.8	5.4
SCo1PL	Mo90015303	8.6	1.6	0	0.2	10.4	7.8	2.9	18.2	16.3	13.3	22	57	64	0.5	4.5	5.1
SCo1PL	Mo90015304	14.6	2.3	0.1	0.3	17.3	11	4.4	28.3	26.9	21.7	20	61	64	0.4	4.3	4.8
SCo1PL	Mo90015305	19.3	2.5	0.1	0.3	22.2	7.4	0	29.6	25.6	22.2	0	75	87	0.4	5.8	6.5
SCo1PL	Mo90015306	45	2.8	0.1	0.1	48	0.2	0		18.7				100	0.2	7.2	7.8
SCo1PL	Mo90015307	44.6	3.6	0.1	0.1	48.4	0.4	0		17.4				100	0.1	7.3	7.9
SCo1PL	Mo90015308	43	4.7	0.1	0.2	48	0	0		16.3				100	0.1	7.3	8
SCo1PL	Mo90015309	36.4	7.9	0.2	0.2	44.7	0	0		16.2				100	0.1	7.6	8.2

A.36. SITE ID: **SCo1PU** MCL PEDON ID: **Mo900152**

A --- (0-8 cm); 80% very dark grayish brown (10YR 3/2, moist, rubbed) , and 20% dark grayish brown (10YR 4/2, moist, broken face) silt loam; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; common very fine dendritic tubular low continuity pores; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; abrupt smooth boundary.

E --- (8-18 cm); brown (10YR 5/3, moist, broken face) silt loam; noneffervescent (HCl, 1 normal); friable; common medium roots throughout, many fine roots throughout, and common very fine roots throughout; common fine dendritic tubular low continuity, common very fine dendritic tubular low continuity pores; very few black (10YR 2/1, moist) prominent organoargillans on surfaces along root channels, few light brownish gray (10YR 6/2, moist) distinct silt coats on all faces of peds; common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark grayish brown (10YR 4/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; clear wavy boundary.

Bt1 --- (18-30 cm); yellowish brown (10YR 5/4, moist, broken face) loam; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, and common very fine roots throughout; common very fine dendritic tubular low continuity pores; few black (10YR 2/1, moist) distinct organoargillans on surfaces along root channels, few yellowish brown (10YR 5/4, moist) faint silt coats on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; clear wavy boundary.

Bt2 --- (30-56 cm); 50% yellowish brown (10YR 5/4, moist, broken face) , and 50% yellowish brown (10YR 5/6, moist, broken face) clay loam; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, common fine roots throughout, and few very fine roots throughout; few very fine dendritic tubular low continuity pores; common yellowish brown (10YR 5/4, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments, 2% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (56-71 cm); yellowish brown (10YR 5/6, moist, broken face) clay; noneffervescent (HCl, 1 normal); firm; few medium roots throughout, few fine roots throughout, and few very fine roots throughout; few fine dendritic tubular low continuity, few very fine dendritic tubular low continuity pores; many gray (10YR 5/1, moist) prominent clay films on all faces of peds; common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

2Bt4 --- (71-104 cm); strong brown (7.5YR 5/6, moist, broken face) clay; noneffervescent (HCl, 1 normal); firm; common very fine roots throughout, and few fine roots throughout; common very fine dendritic tubular low continuity pores; common grayish brown (10YR 5/2, moist) prominent clay films on all faces of peds; common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented fine gravel sized mixed rock fragments; gradual smooth boundary.

2Bt5 --- (104-124 cm); strong brown (7.5YR 5/6, moist, broken face) clay loam; noneffervescent (HCl, 1 normal); very firm; few fine roots throughout, and few very fine roots throughout; few very fine dendritic tubular low continuity, few fine dendritic tubular low continuity pores; common grayish brown (10YR 5/2, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical finely disseminated carbonates throughout with diffuse boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

2Bt6 --- (124-152 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; noneffervescent (HCl, 1 normal); very firm; few very fine roots throughout, and few fine roots throughout; few very fine dendritic tubular low continuity pores; common grayish brown (10YR 5/2, moist) distinct clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): color difference, but similar texture to horizon 10, Note(s): manganese in old root channels; gradual smooth boundary.

2BC --- (152-178 cm); yellowish brown (10YR 5/6, moist, broken face) loam; noneffervescent (HCl, 1 normal); very firm; few very fine roots throughout; few fine dendritic tubular low continuity pores; many grayish brown (10YR 5/2, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; few very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical finely disseminated carbonates throughout with diffuse boundaries; 3% subangular very strongly cemented fine gravel sized mixed rock fragments, 2% subangular very strongly cemented medium gravel sized mixed rock fragments; clear smooth boundary.

2Bck --- (178-205 cm); dark yellowish brown (10YR 4/4, moist, broken face) loam; strongly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few fine dendritic tubular low continuity pores; common grayish brown (10YR 5/2, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) medium prominent extremely weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 3% subangular very strongly cemented fine gravel sized mixed rock fragments.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
SCo1PU	Mo90015201	0	8	A	8.4	73.1	18.5	29.2	43.9	7.8	3.1	0	5.3	2.3	SIL	0.94
SCo1PU	Mo90015202	8	18	E	7.3	50.2	42.5	19.2	31	8.5	18.2	7.4	5.7	2.7	SIL	1.34
SCo1PU	Mo90015203	18	30	Bt1	16.3	42.9	40.8	24.1	18.8	7.8	15.6	8.3	6	3.1	L	1.55
SCo1PU	Mo90015204	30	56	Bt2	29.5	32.6	37.9	16.7	15.9	7.6	14.2	6.7	5.6	3.8	CL	1.50
SCo1PU	Mo90015205	56	71	Bt3	42.2	26.6	31.2	12	14.6	6.3	12.2	6.3	4.4	2	C	1.37
SCo1PU	Mo90015206	71	104	2Bt4	41	23.6	35.4	11.9	11.7	6.2	14	6.4	5.5	3.3	C	1.48
SCo1PU	Mo90015207	104	124	2Bt5	33	28.3	38.7	15.4	12.9	7.6	14.2	7.3	6.1	3.5	CL	1.73
SCo1PU	Mo90015208	124	152	2Bt5	30.1	28.5	41.4	15.8	12.7	8.3	15.5	7.3	6.5	3.8	CL	1.76
SCo1PU	Mo90015209	152	178	2BC	26.4	29.7	43.9	16.5	13.2	8.5	15.3	8.5	7.5	4.1	L	1.74
SCo1PU	Mo90015210	178	203	2Bck	23.3	30	46.7	17.5	12.5	9	18.1	8.5	7.6	3.5	L	1.80

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
SCo1PU	Mo90015201	3.4	1.2	0.1	0.2	4.9	13.8	1.5	18.7	14.8	6.4	23	26	33	3.5	4.4	5.4
SCo1PU	Mo90015202	0.7	0.4	0	0.1	1.2	5.6	2.2	6.8	5.4	3.4	65	18	22	0.5	4.2	4.7
SCo1PU	Mo90015203	0.7	0.8	0	0.1	1.6	9.1	5.1	10.7	9.5	6.7	76	15	17	0.4	3.8	4.7
SCo1PU	Mo90015204	1.6	1.9	0.1	0.2	3.8	15.3	11.4	19.1	18	15.2	75	20	21	0.4	3.7	4.7
SCo1PU	Mo90015205	4.2	4.3	0.1	0.2	8.8	19.3	14.1	28.1	26.4	22.9	62	31	33	0.3	3.8	4.8
SCo1PU	Mo90015206	5.2	5	0.2	0.3	10.7	16.1	11	26.8	25.8	21.7	51	40	41	0.2	3.9	4.8
SCo1PU	Mo90015207	6.5	5.8	0.3	0.3	12.9	10.1	4.9	23	21.2	17.8	28	56	61	0.1	4	5.1
SCo1PU	Mo90015208	8.2	6	0.4	0.2	14.8	6.5	0.7	21.3	19.1	15.5	5	70	77	0.1	4.5	5.4
SCo1PU	Mo90015209	8.8	5.5	0.5	0.2	15	2.7	0	17.7	15.9	15	0	85	95	0.1	6.6	6.8
SCo1PU	Mo90015210	29.1	4.5	0.5	0.1	34.2	0	0		12.7				100	0.1	7.4	7.9

A.37. SITE ID: **SCo2EL** MCL PEDON ID: **Mo900155**

A --- (0-6 cm); 80% dark grayish brown (10YR 4/2, moist, broken face) , and 20% brown (10YR 5/3, moist, broken face) loam; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; many fine dendritic tubular low continuity, few medium dendritic tubular low continuity pores; few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): frags from above?, Note(s): organic material is from Oi; abrupt wavy boundary.

Bt1 --- (6-17 cm); yellowish brown (10YR 5/4, moist, broken face) fine sandy loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; few coarse roots throughout, common fine roots throughout, and common very fine roots throughout; common fine dendritic tubular low continuity, few medium dendritic tubular low continuity pores; very few dark grayish brown (10YR 4/2, moist) distinct organoargillans on surfaces along root channels; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): zone of mixing, Note(s): no clay films visible with hand lens; clear wavy boundary.

Bt2 --- (17-29 cm); yellowish brown (10YR 5/6, moist, broken face) sandy clay loam; weak medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few medium roots throughout, common fine roots throughout, and common very fine roots throughout; common very fine dendritic tubular low continuity, common fine dendritic tubular low continuity pores; few yellowish brown (10YR 5/6, moist) distinct clay films on all faces of peds; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): heavy CL; clear smooth boundary.

Bt3 --- (29-41 cm); yellowish brown (10YR 5/6, moist, broken face) sandy clay loam; weak medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, few very coarse roots throughout, common fine roots throughout, and common very fine roots throughout; common fine dendritic tubular low continuity, common medium dendritic tubular low continuity pores; few dark yellowish brown (10YR 4/6, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): lots of sand (nearing Sandy Clay?); abrupt smooth boundary.

Bt4 --- (41-57 cm); dark yellowish brown (10YR 4/6, moist, broken face) silty clay; weak coarse prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few very coarse roots throughout, common medium roots throughout, many fine roots throughout, and common very fine roots throughout; common fine dendritic tubular low continuity pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): grays look a little more like 2.5y colors; clear smooth boundary.

Btk1 --- (57-79 cm); dark yellowish brown (10YR 4/4, moist, broken face) clay loam; moderate coarse prismatic parting to strong medium subangular blocky structure; slightly effervescent (HCl, 1 normal); very firm; few very coarse roots throughout, few coarse roots throughout, common medium roots throughout, and many fine roots throughout; many fine dendritic tubular low continuity pores; few olive brown (2.5Y 4/4, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 3% subrounded very strongly cemented medium gravel sized mixed rock fragments, 1% subrounded very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Btk2 --- (79-105 cm); dark yellowish brown (10YR 4/4, moist, broken face) clay loam; strong coarse prismatic parting to strong fine subangular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few coarse roots throughout, common fine roots throughout, and few very fine roots throughout; common fine dendritic tubular low continuity pores; few olive brown (2.5Y 4/4, moist) distinct clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) medium prominent weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 2% subrounded very strongly cemented medium gravel sized mixed rock fragments, 3% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): dense; gradual smooth boundary.

Btk3 --- (105-145 cm); dark yellowish brown (10YR 4/4, moist, broken face) clay loam; strong medium prismatic parting to strong fine angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few medium roots throughout, and few fine roots throughout; few very fine dendritic tubular low continuity pores; few olive brown (2.5Y 4/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) medium prominent extremely weakly cemented cylindrical carbonate nodules on vertical faces of peds with diffuse boundaries; 3% subrounded very strongly cemented fine gravel sized mixed rock fragments, 1% subrounded very strongly cemented medium gravel sized mixed rock fragments; Note(s): dense, Note(s): carbonates are along vertical ped faces and along root channels; gradual smooth boundary.

Btk4 --- (145-205 cm); dark yellowish brown (10YR 4/4, moist, broken face) clay loam; strong medium prismatic parting to strong fine angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few medium roots throughout, and few fine roots throughout; few very fine dendritic tubular low continuity pores; very few olive brown (2.5Y 4/4, moist) faint clay films on all faces of peds; common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) medium prominent weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 4% subrounded very strongly cemented fine gravel sized mixed rock fragments, 1% subrounded very strongly cemented medium gravel sized mixed rock fragments; Note(s): dense, Note(s): redox depletions are along prisms (vertical ped faces).

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
SCo2EL	Mo90015501	0	6	A	10.2	40.6	49.2	19.9	20.7	10	17.5	9.2	9	3.5	L	1.37
SCo2EL	Mo90015502	6	17	Bt1	13.4	31.8	54.8	14.9	16.9	8.6	17.3	13.1	10.9	4.9	FSL	1.46
SCo2EL	Mo90015503	17	29	Bt2	29.5	21.1	49.4	9.2	11.9	5	13.9	13.2	13.1	4.2	SCL	1.42
SCo2EL	Mo90015504	29	41	Bt3	28.6	13.4	58	5.8	7.6	2.9	10.2	18.5	19.5	6.9	SCL	1.53
SCo2EL	Mo90015505	41	57	Bt4	38.6	32.4	29	15.6	16.8	6.8	10.9	4.7	4.4	2.2	CL	1.47
SCo2EL	Mo90015506	57	79	Btk1	31.3	35.8	32.9	20.1	15.7	7.2	11	5.1	4.8	4.8	CL	1.57
SCo2EL	Mo90015507	79	105	Btk2	30	36.1	33.9	20.1	16	7.6	12.1	4.8	5.3	4.1	CL	1.62
SCo2EL	Mo90015508	105	145	Btk3	30.1	35.7	34.2	18.9	16.8	7.8	11.8	5.2	4.6	4.8	CL	1.70
SCo2EL	Mo90015509	145	203	Btk4	31.2	36.4	32.4	20.4	16	7.7	12.1	4.6	4.3	3.7	CL	1.70

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAcC)	% TOC	pH salt	pH H ₂ O
SCo2EL	Mo90015501	4.3	0.8	0	0.3	5.4	7.7	0.7	13.1	10.8	6.1	11	41	50	2.2	4.7	5.4
SCo2EL	Mo90015502	2.7	0.8	0	0.1	3.6	6.5	2.4	10.1	8.4	6	40	36	43	0.5	4.6	5.2
SCo2EL	Mo90015503	4.8	1.2	0	0.2	6.2	13.6	8.6	19.8	17.2	14.8	58	31	36	0.4	4	4.7
SCo2EL	Mo90015504	5.5	1.2	0	0.2	6.9	11.8	7.7	18.7	17.1	14.6	53	37	40	0.2	4	4.9
SCo2EL	Mo90015505	13.5	2.1	0	0.2	15.8	9.4	2.8	25.2	22.5	18.6	15	63	70	0.4	4.4	5
SCo2EL	Mo90015506	42.2	2	0	0.1	44.3	0.9	0		16.6				100	0.3	7.4	7.7
SCo2EL	Mo90015507	44.6	2.4	0	0.1	47.1	0.9	0		16				100	0.2	7.4	7.9
SCo2EL	Mo90015508	39.1	3.6	0	0.1	42.8	2.3	0		15.2				100	0.1	7.5	7.9
SCo2EL	Mo90015509	36.9	4.9	0.1	0.2	42.1	0.6	0		14.9				100	0.1	7.5	7.9

A.38. SITE ID: **SCo2EU** MCL PEDON ID: **Mo900154**

A --- (0-7 cm); dark grayish brown (10YR 4/2, moist, broken face) fine sandy loam; moderate fine granular structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; common fine dendritic tubular low continuity pores; few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels; 1% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): not much actual A horizon, Note(s): organics are mixings from Oi; abrupt wavy boundary.

Bt1 --- (7-17 cm); brown (10YR 5/3, moist, broken face) fine sandy loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, and many very fine roots throughout; common fine dendritic tubular low continuity pores; very few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels; common brown (10YR 4/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subrounded very strongly cemented fine gravel sized mixed rock fragments, 1% subrounded very strongly cemented medium gravel sized mixed rock fragments; Note(s): no visible clay films!; clear smooth boundary.

Bt2 --- (17-31 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, many fine roots throughout, and common very fine roots throughout; few fine dendritic tubular low continuity pores; few brown (10YR 5/3, moist) distinct clay films on all faces of peds; common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subrounded very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (31-47 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; common fine roots throughout, common medium roots throughout, few coarse roots throughout, and few very coarse roots throughout; few very fine dendritic tubular low continuity pores; many yellowish brown (10YR 5/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subrounded very strongly cemented fine gravel sized mixed rock fragments, 1% subrounded very strongly cemented medium gravel sized mixed rock fragments; clear wavy boundary.

Btk4 --- (47-64 cm); yellowish brown (10YR 5/4, moist, broken face) clay loam; weak medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common coarse roots throughout, and common fine roots throughout; few fine dendritic tubular low continuity, few very fine dendritic tubular low continuity pores; common dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates throughout with diffuse boundaries; 2% subrounded very strongly cemented fine gravel sized mixed rock fragments, 1% subrounded very strongly cemented medium gravel sized mixed rock fragments; Note(s): few finely disseminated CaCO₃, Note(s): effervesces where present, but not in matrix; clear smooth boundary.

Btk1 --- (64-93 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; weak medium prismatic parting to strong fine subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; few very coarse roots throughout, common medium roots throughout, and common fine roots throughout; few fine dendritic tubular low continuity, common very fine dendritic tubular low continuity pores; few dark yellowish brown (10YR 3/4, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 2% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): structure is starting to get more angular - rock-like; clear smooth boundary.

Btk2 --- (93-120 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; strong medium prismatic parting to strong fine angular blocky structure; strongly effervescent (HCl, 1 normal); firm; few coarse roots throughout, few medium roots throughout, and few fine roots throughout; few very fine dendritic tubular low continuity pores; few olive brown (2.5Y 4/4, moist) distinct clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) medium prominent extremely weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 3% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): dense; clear wavy boundary.

Btk3 --- (120-168 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; strong coarse prismatic parting to strong fine angular blocky structure; violently effervescent (HCl, 1 normal); very firm; few fine roots throughout; few very fine dendritic tubular low continuity pores; few olive brown (2.5Y 4/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) coarse prominent weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 3% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): dense, rock-like structure, Note(s): <1% lignins present; gradual smooth boundary.

Btk4 --- (168-205 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; strong medium prismatic parting to strong fine angular blocky structure; strongly effervescent (HCl, 1 normal); extremely firm; few very fine roots throughout; few very fine dendritic tubular low continuity pores; few olive brown (2.5Y 4/4, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) medium prominent extremely weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 3% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): dense, very rock-like structure, Note(s): manganese is on vertical ped faces as well as along old root channels and around rocks, Note(s): grays are on vertical ped faces, Note(s): F3Ms are with the matrix inside peds.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
SCo2EU	Mo90015401	0	7	A	13.7	30.8	55.5	13.9	16.9	12.1	22.8	10.8	7.2	2.6	FSL	1.03
SCo2EU	Mo90015402	7	17	Bt1	18.3	29.1	52.6	13.2	15.9	11.1	22.3	9	6.5	3.7	FSL	1.53
SCo2EU	Mo90015403	17	31	Bt2	38.8	28.2	33	13.2	15	7.7	12.9	5.9	4.3	2.2	CL	1.51
SCo2EU	Mo90015404	31	47	Bt3	41.1	31.3	27.6	15.5	15.8	6.9	10.7	3.8	3.7	2.5	C	1.49
SCo2EU	Mo90015405	47	64	Bt4	38.6	33.8	27.6	17.4	16.4	7.1	10.3	4.6	3.5	2.1	CL	1.57
SCo2EU	Mo90015406	64	93	Btk1	34.1	36.7	29.2	22.1	14.6	7.4	10.9	4.2	3.8	2.9	CL	1.69
SCo2EU	Mo90015407	93	120	Btk2	32	37.8	30.2	22.4	15.4	7.1	10.2	4.4	4.1	4.4	CL	1.66
SCo2EU	Mo90015408	120	168	Btk3	30.1	38.8	31.1	22.2	16.6	7.7	11.8	4.2	4	3.4	CL	1.77
SCo2EU	Mo90015409	168	203	Btk4	33.1	38.6	28.3	22.2	16.4	7.2	10.4	4.7	3.7	2.3	CL	1.69

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAcC)	% TOC	pH salt	pH H ₂ O
SCo2EU	Mo90015401	7.7	1.2	0	0.3	9.2	6.8	0	16	12.9	9.2	0	58	71	2.1	5.7	5.8
SCo2EU	Mo90015402	5.2	1.2	0	0.1	6.5	7	0.9	13.5	12.2	7.4	12	48	53	0.7	5.1	5.3
SCo2EU	Mo90015403	11.9	2.9	0	0.2	15	9.7	3.4	24.7	22.6	18.4	18	61	66	0.5	4.5	4.8
SCo2EU	Mo90015404	14.7	3.1	0.1	0.2	18.1	8	2.5	26.1	25.4	20.6	12	69	71	0.3	4.6	4.9
SCo2EU	Mo90015405	24.3	3.3	0	0.1	27.7	2.6	0		23.5				100	0.3	7.1	7.4
SCo2EU	Mo90015406	40.1	3.1	0	0.1	43.3	0.3	0		18.4				100	0.3	7.6	7.8
SCo2EU	Mo90015407	45.3	4	0.1	0.1	49.5	0	0		16				100	0.2	7.6	7.9
SCo2EU	Mo90015408	39.5	5.7	0.1	0.1	45.4	0	0		15.1				100	0.1	7.6	8
SCo2EU	Mo90015409	39.2	9.5	0.2	0.1	49	0	0		15.2				100	0.1	7.7	8

A.39. SITE ID: **SCo2PL** MCL PEDON ID: **Mo900154**

A --- (0-12 cm); 60% very dark grayish brown (10YR 3/2, moist, rubbed) , and 40% dark grayish brown (10YR 4/2, moist, broken face) loam; moderate fine granular structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and few coarse roots throughout; many fine dendritic tubular pores; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): 1 1/2 inch macropore; abrupt wavy boundary.

BA --- (12-20 cm); 70% yellowish brown (10YR 5/4, moist, broken face) , and 30% dark grayish brown (10YR 4/2, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, common very fine roots throughout, few medium roots throughout, and few coarse roots throughout; common fine dendritic tubular, common very fine dendritic tubular pores; very few light gray (10YR 7/2, moist) faint silt coats on all faces of peds, few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): mixture of A, E, and B horizons; clear wavy boundary.

Bt1 --- (20-36 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; weak fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, common very fine roots throughout, and few coarse roots throughout; common fine dendritic tubular, few very fine dendritic tubular pores; few dark grayish brown (10YR 4/2, moist) distinct clay films on all faces of peds, few very dark grayish brown (10YR 3/2, moist) distinct organoargillans on surfaces along root channels; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subrounded very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt2 --- (36-56 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, common fine roots throughout, and few coarse roots throughout; few fine dendritic tubular, few very fine dendritic tubular pores; common yellowish brown (10YR 5/6, moist) prominent clay films on all faces of peds; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subrounded very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (56-84 cm); 70% yellowish brown (10YR 5/6, moist, broken face) , and 30% dark yellowish brown (10YR 4/4, moist, broken face) clay loam; moderate fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, common medium roots throughout, and few coarse roots throughout; few very fine dendritic tubular pores; many light olive brown (2.5Y 5/3, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brownish yellow (10YR 6/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subrounded very strongly cemented fine gravel sized mixed rock fragments, 1% subrounded very strongly cemented medium gravel sized mixed rock fragments; clear smooth boundary.

Btk --- (84-106 cm); olive brown (2.5Y 4/3, moist, broken face) clay loam; moderate medium prismatic parting to strong fine subangular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few fine roots throughout, and common coarse roots throughout; common very fine dendritic tubular pores; many dark grayish brown (2.5Y 4/2, moist) prominent clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 3% subrounded very strongly cemented fine gravel sized mixed rock fragments, 1% subrounded very strongly cemented medium gravel sized mixed rock fragments; Note(s): large clay film, 1% of horizon, 10YR 4/3, very coarse and horizontal in nature, Note(s): dense; gradual smooth boundary.

Bck1 --- (106-142 cm); olive brown (2.5Y 4/3, moist, broken face) clay loam; strong fine prismatic parting to strong fine subangular blocky structure; strongly effervescent (HCl, 1 normal); extremely firm; few fine roots throughout, and few very fine roots throughout; few very fine dendritic tubular, common very fine dendritic tubular low continuity pores; common dark grayish brown (2.5Y 4/2, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 3% subrounded very strongly cemented fine gravel sized mixed rock fragments, 1% subrounded very strongly cemented medium gravel sized mixed rock fragments; Note(s): dense; gradual smooth boundary.

Bck2 --- (142-205 cm); 60% olive brown (2.5Y 4/3, moist, broken face) , and 40% dark yellowish brown (10YR 4/4, moist, broken face) clay loam; strong medium prismatic parting to strong fine angular blocky structure; strongly effervescent (HCl, 1 normal); extremely firm; few fine roots throughout; few very fine dendritic tubular low continuity pores; few dark grayish brown (2.5Y 4/2, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; many very pale brown (10YR 8/1, moist) coarse prominent weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 4% subrounded very strongly cemented fine gravel sized mixed rock fragments, 2% subrounded very strongly cemented medium gravel sized mixed rock fragments; Note(s): dense.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
SCo2PL	Mo90015701	0	12	A	15.2	45.2	39.6	23.3	21.9	9.7	15.2	7.1	5.1	2.5	L	0.71
SCo2PL	Mo90015702	12	20	BA	16.5	44.6	38.9	21.4	23.2	10.3	16.5	6.1	4.4	1.6	L	1.39
SCo2PL	Mo90015703	20	36	Bt1	36.6	37.1	26.3	19.8	17.3	7.4	9.9	4.5	3	1.5	CL	1.32
SCo2PL	Mo90015704	36	56	Bt2	42.2	32.3	25.5	16	16.3	6.6	9.8	3.7	3.3	2.1	C	1.44
SCo2PL	Mo90015705	56	84	Bt3	38.3	36.3	25.4	18.7	17.6	7.2	9.5	4.1	3.1	1.5	CL	1.48
SCo2PL	Mo90015706	84	106	Btk	33.4	37.5	29.1	22	15.5	7	11.2	4.7	3.6	2.6	CL	1.63
SCo2PL	Mo90015707	106	142	BCK1	29.1	36.4	34.5	21.4	15	6.4	9.4	5	5.4	8.3	CL	1.73
SCo2PL	Mo90015708	142	203	BCK2	29.6	37.9	32.5	20.2	17.7	8.5	12.1	4.5	4.2	3.2	CL	1.81

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
SCo2PL	Mo90015701	4.3	1.2	0	0.3	5.8	11.9	1.7	17.7	14.4	7.5	23	33	40	2.6	4.4	5
SCo2PL	Mo90015702	2.6	0.8	0	0.1	3.5	9	4.2	12.5	10.8	7.7	55	28	32	0.8	4.1	5
SCo2PL	Mo90015703	7.1	1.6	0	0.2	8.9	14	9.8	22.9	23.1	18.7	52	39	39	0.5	4	4.8
SCo2PL	Mo90015704	11.4	2	0.1	0.3	13.8	13.8	8.8	27.6	26.7	22.6	39	50	52	0.3	4	4.8
SCo2PL	Mo90015705	20.8	2.4	0.1	0.3	23.6	5.2	0	28.8	24.8	23.6	0	82	95	0.3	6.7	7.1
SCo2PL	Mo90015706	51.7	2.4	0.1	0.2	54.4	0.6	0		19.6				100	0.2	7.3	7.9
SCo2PL	Mo90015707	47.8	2.8	0.1	0.2	50.9	0	0		16.4				100	0.2	7.5	8
SCo2PL	Mo90015708	41.6	4.5	0.1	0.2	46.4	0	0		17.2				100	0.1	7.5	7.9

A.40. SITE ID: **SCo2PU** MCL PEDON ID: **Mo900156**

A --- (0-11 cm); very dark grayish brown (10YR 3/2, moist, rubbed) loam; moderate fine granular structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; many very fine dendritic tubular low continuity pores; 1% subangular very strongly cemented fine gravel sized chert fragments; Note(s): mollic colors dominate in this A horizon (greater depth than most); abrupt smooth boundary.

BA --- (11-21 cm); yellowish brown (10YR 5/4, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, common very fine roots throughout, and few medium roots throughout; common very fine dendritic tubular low continuity pores; few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels, few dark grayish brown (10YR 4/2, moist) distinct organoargillans on surfaces along root channels; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized chert fragments; Note(s): no clay films visible with hand lens; clear smooth boundary.

Bt1 --- (21-41 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak fine prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few very fine roots throughout, few medium roots throughout, and common fine roots throughout; few very fine dendritic tubular low continuity pores; few yellowish brown (10YR 5/6, moist) prominent clay films on all faces of peds, very few very dark grayish brown (10YR 3/2, moist) distinct organoargillans on surfaces along root channels; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized chert fragments; Note(s): highly smectitic feel to clays; clear smooth boundary.

Bt2 --- (41-59 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; common medium roots throughout, common fine roots throughout, and few coarse roots throughout; few very fine dendritic tubular low continuity pores; few yellowish brown (10YR 5/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Btk3 --- (59-84 cm); yellowish brown (10YR 5/6, moist, broken face) clay; moderate medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, and few very fine roots throughout; few very fine dendritic tubular low continuity pores; few dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subrounded strongly cemented medium gravel sized , 2% subrounded very strongly cemented fine gravel sized mixed rock fragments; gradual smooth boundary.

Btk1 --- (84-110 cm); dark yellowish brown (10YR 4/4, moist, broken face) clay loam; moderate medium prismatic parting to strong fine subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; few medium roots throughout, and few fine roots throughout; few very fine dendritic tubular low continuity pores; few olive brown (2.5Y 4/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 3% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): 1 inch very fine sand lens in horizon, Note(s): few lignins in Clay Loam ; clear wavy boundary.

Btk2 --- (110-158 cm); 60% dark yellowish brown (10YR 4/6, moist, broken face) , and 40% dark yellowish brown (10YR 4/4, moist, broken face) clay loam; strong medium prismatic parting to strong medium subangular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few fine roots throughout; common very fine dendritic tubular low continuity pores; few olive brown (2.5Y 4/4, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) medium prominent extremely weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 3% subrounded very strongly cemented fine gravel sized mixed rock fragments, 1% subrounded very strongly cemented medium gravel sized mixed rock fragments; Note(s): dense; gradual smooth boundary.

Btk3 --- (158-205 cm); 60% dark yellowish brown (10YR 4/6, moist, broken face) , and 40% dark yellowish brown (10YR 4/4, moist, broken face) clay loam; strong medium prismatic parting to strong fine angular blocky structure; strongly effervescent (HCl, 1 normal); extremely firm; few fine roots throughout; few very fine dendritic tubular low continuity pores; few olive brown (2.5Y 4/4, moist) distinct clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 3% subrounded very strongly cemented fine gravel sized mixed rock fragments, 1% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): dense.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
SCo2PU	Mo90015601	0	11	A	19.3	38.8	41.9	21.2	17.6	10.3	17.4	7.5	4.8	1.9	L	0.90
SCo2PU	Mo90015602	11	21	BA	20.3	34.9	44.8	19.2	15.7	11.5	18.6	6.5	5.2	3	L	1.44
SCo2PU	Mo90015603	21	41	Bt1	44.4	28.9	26.7	14.7	14.2	6.5	9.8	4.6	3.5	2.3	C	1.39
SCo2PU	Mo90015604	41	59	Bt2	44.6	30.2	25.2	16.5	13.7	6.7	9.8	3.7	2.9	2.1	C	1.46
SCo2PU	Mo90015605	59	84	Bt3	40.3	35.1	24.6	19.8	15.3	6.6	9.2	4.1	3.1	1.6	C	1.55
SCo2PU	Mo90015606	84	110	Btk1	35.1	40.1	24.8	22.3	17.8	6.8	9.3	3.4	3.1	2.2	CL	1.58
SCo2PU	Mo90015607	110	158	Btk2	32.4	41.6	26	25.8	15.8	6.6	9	4.3	3.3	2.8	CL	1.55
SCo2PU	Mo90015608	158	203	Btk3	31.3	41.7	27	24.4	17.3	6.7	9.3	4.1	3.6	3.3	CL	1.70

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
SCo2PU	Mo90015601	18.7	2.1	0	0.3	21.1	6.5	0	27.6	25.3	21.1	0	76	83	3.7	6.3	6.4
SCo2PU	Mo90015602	6.7	1.2	0	0.1	8	7.9	1.6	15.9	14.2	9.6	17	50	56	0.7	4.8	5.5
SCo2PU	Mo90015603	16	2	0	0.3	18.3	12.2	2.7	30.5	27.7	21	13	60	66	0.7	4.7	5.3
SCo2PU	Mo90015604	17	2	0.1	0.4	19.5	11.8	3.4	31.3	30	22.9	15	62	65	0.3	4.4	5
SCo2PU	Mo90015605	17.1	1.6	0.1	0.3	19.1	7.8	1	26.9	25.4	20.1	5	71	75	0.2	4.7	5.2
SCo2PU	Mo90015606	50.9	1.6	0.1	0.2	52.8	1.8	0		21.1				100	0.2	7.3	7.7
SCo2PU	Mo90015607	49.7	2	0.1	0.2	52	1.6	0		18.7				100	0.2	7.4	7.9
SCo2PU	Mo90015608	49.2	3.2	0.1	0.2	52.7	0.2	0		18				100	0.1	7.5	8

A.41. SITE ID: **UR01EL** MCL PEDON ID: **Mo921153**

Oi --- (0-6 cm); very dark brown (10YR 2/2, moist, rubbed) silt loam; moderate very fine granular structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, common medium roots throughout, and few coarse roots throughout; many fine, many very fine, many medium pores; Note(s): reference Oi layer - not sure if necessary to sample - but now have one for reference; abrupt smooth boundary.

A --- (6-14 cm); brown (10YR 5/3, moist, broken face) loam; moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, common very fine roots throughout, and few very coarse roots throughout; few medium, many fine pores; few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels, very few light brownish gray (10YR 6/2, moist) faint silt coats on all faces of peds; common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): zone of mixing; clear wavy boundary.

Bt1 --- (14-21 cm); yellowish brown (10YR 5/4, moist, broken face) loam; moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common medium roots throughout, common fine roots throughout, and common very fine roots throughout; common fine, many very fine pores; very few dark grayish brown (10YR 4/2, moist) prominent organoargillans on surfaces along root channels, very few brown (10YR 5/3, moist) faint clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments, 1% subangular very strongly cemented medium gravel sized mixed rock fragments; Note(s): zone of mixing; clear smooth boundary.

Bt2 --- (21-38 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few very coarse roots throughout, common fine roots throughout, and common very fine roots throughout; common very fine pores; few yellowish brown (10YR 5/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (38-58 cm); yellowish brown (10YR 5/6, moist, broken face) clay; moderate fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, few medium roots throughout, and common fine roots throughout; common very fine, few fine pores; few yellowish brown (10YR 5/4, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments, 1% subangular very strongly cemented gravel sized sandstone fragments; clear smooth boundary.

Bt4 --- (58-81 cm); yellowish brown (10YR 5/6, moist, broken face) clay; moderate fine prismatic parting to strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few very coarse roots throughout, and common medium roots throughout; common very fine pores; common light olive brown (2.5Y 5/3, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): no CaCO₃ present (does not effervesce); clear smooth boundary.

Bt5 --- (81-100 cm); olive brown (2.5Y 4/4, moist, broken face) clay; moderate coarse prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; common fine roots throughout, and few very fine roots throughout; common very fine pores; common olive brown (2.5Y 4/3, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 6% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): few lignins present, Note(s): clay has an illitic feel (shales); clear wavy boundary.

2Bt6 --- (100-123 cm); olive brown (2.5Y 4/4, moist, broken face) clay; moderate medium prismatic parting to moderate fine subangular blocky structure; slightly effervescent (HCl, 1 normal); very firm; few coarse roots throughout, and few fine roots throughout; few fine, few very fine pores; few olive brown (2.5Y 4/3, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 10% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

2Bt7 --- (123-144 cm); olive brown (2.5Y 4/4, moist, broken face) gravelly clay; weak coarse prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few fine roots throughout; few fine, few very fine pores; few olive brown (2.5Y 4/3, moist) faint clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 30% subangular very strongly cemented gravel sized mixed rock fragments; abrupt wavy boundary.

2Bt8 --- (144-175 cm); olive brown (2.5Y 4/4, moist, broken face) clay; strong coarse prismatic parting to strong fine angular blocky structure; strongly effervescent (HCl, 1 normal); extremely firm; few fine roots throughout; few very fine pores; few olive brown (2.5Y 4/3, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 6% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): lignins present; abrupt irregular boundary.

2Bck --- (175-205 cm); olive brown (2.5Y 4/4, moist, broken face) very gravelly clay; weak medium subangular blocky structure; strongly effervescent (HCl, 1 normal); extremely firm; few fine roots throughout; common very fine pores; very few olive brown (2.5Y 4/3, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 40% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): mostly chert - still mixed rock fragments , Note(s): outwash of some kind?, Note(s): 5YR4/6 are disseminated Fe₃ nodules.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
UR01EL	Mo92115301	0	6	Oi	8	45	47	22.5	22.5	7.8	16.1	7.2	6.4	9.5	L	N/A
UR01EL	Mo92115302	6	14	A	15.2	40	44.8	22.9	17.1	10.4	17.9	8.3	5.8	2.4	L	1.29
UR01EL	Mo92115303	14	21	Bt1	13.4	41.5	45.1	22.7	18.8	10.9	17.5	7.3	5.9	3.5	L	1.48
UR01EL	Mo92115304	21	38	Bt2	35.6	31.9	32.5	17.5	14.4	7.9	12.5	5.9	4.4	1.8	CL	1.47
UR01EL	Mo92115305	38	58	Bt3	36.1	31.4	32.5	17.7	13.7	8.1	12.9	4.9	4.1	2.5	CL	1.50
UR01EL	Mo92115306	58	81	Bt4	34.5	32.1	33.4	18.5	13.6	8	12.8	6.1	4.2	2.3	CL	1.64
UR01EL	Mo92115307	81	100	Bt5	32.9	32.2	34.9	19.1	13.1	8.3	12.7	5.8	4.8	3.3	CL	1.67
UR01EL	Mo92115308	100	123	2Bt6	26.4	31.9	41.7	19.3	12.6	7.5	12.2	7.3	7.4	7.3	L	1.77
UR01EL	Mo92115309	123	144	2Bt7	19.5	24.9	55.6	14.8	10.1	6.4	11.7	7.6	13.3	16.6	COSL	1.77
UR01EL	Mo92115310	144	175	2Bt8	28.6	37.4	34	22.3	15.1	7.5	11.9	6	5.1	3.5	CL	1.75
UR01EL	Mo92115311	175	203	2Bck	14.3	22.9	62.8	13.7	9.2	5.9	12.3	7.9	14.3	22.4	COSL	1.80

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAcC)	% TOC	pH salt	pH H ₂ O
UR01EL	Mo92115301	27.5	3.6	0	1.4	32.5	40.1	0.1	72.6	69.9	32.6	0	45	46	22.7	4.3	4.7
UR01EL	Mo92115302	1.7	0.8	0	0.3	2.8	7.1	3	9.9	9.1	5.8	52	28	31	1.3	4	4.8
UR01EL	Mo92115303	1.4	0.4	0	0.2	2	9.2	2.5	11.2	9.3	4.5	56	18	22	0.7	4.2	5
UR01EL	Mo92115304	4.4	1.6	0	0.4	6.4	13.9	8.7	20.3	18.4	15.1	58	31	35	0.4	3.9	4.6
UR01EL	Mo92115305	4.7	1.6	0	0.3	6.6	14.4	9.1	21	20	15.7	58	31	33	0.4	3.9	4.6
UR01EL	Mo92115306	9.1	1.9	0	0.3	11.3	8.7	3.1	20	18.1	14.4	22	56	62	0.3	4.1	4.8
UR01EL	Mo92115307	13.3	2	0	0.2	15.5	3.7	0	19.2	17.8	15.5	0	81	87	0.2	5.6	6.5
UR01EL	Mo92115308	36.8	1.6	0	0.1	38.5	0	0		14.1				100	0.2	7.2	7.9
UR01EL	Mo92115309	41.9	1.6	0	0.1	43.6	0	0		10.4				100	0.2	7.2	8
UR01EL	Mo92115310	44.5	2.8	0	0.1	47.4	0	0		13				100	0.2	7.3	8
UR01EL	Mo92115311	36.6	1.6	0	0.1	38.3	0	0		7.7				100	0.2	7.4	8

A.42. SITE ID: **UR01EU** MCL PEDON ID: **Mo921152**

A --- (0-11 cm); 70% very dark grayish brown (10YR 3/2, moist, rubbed) , and 30% dark grayish brown (10YR 4/2, moist, broken face) loam; moderate fine granular structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, common coarse roots throughout, and few medium roots throughout; many fine, many very fine pores; common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): A depth greater than other exposed aspects, may be due to differences in microtopography; clear smooth boundary.

Bt1 --- (11-20 cm); brown (10YR 4/3, moist, broken face) clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; common fine, common very fine pores; few very dark grayish brown (10YR 3/2, moist) distinct organoargillans on surfaces along root channels, few dark brown (10YR 3/3, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt2 --- (20-43 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few very coarse roots throughout, common medium roots throughout, common fine roots throughout, and common very fine roots throughout; common fine, common very fine pores; few yellowish brown (10YR 5/6, moist) prominent clay films on all faces of peds; common light olive brown (2.5Y 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subrounded very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (43-65 cm); dark yellowish brown (10YR 4/4, moist, broken face) clay; weak medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few medium roots throughout, few fine roots throughout, common very fine roots throughout, and few coarse roots throughout; few fine, common very fine pores; few olive brown (2.5Y 4/4, moist) prominent clay films on all faces of peds; common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subrounded very strongly cemented gravel sized mixed rock fragments; abrupt irregular boundary.

Btk --- (65-91 cm); dark yellowish brown (10YR 4/4, moist, broken face) silt loam; moderate medium prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few coarse roots throughout, few medium roots throughout, and common fine roots throughout; common fine, common very fine pores; few olive brown (2.5Y 4/4, moist) distinct clay films on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; many very pale brown (10YR 8/1, moist) coarse prominent weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 1% subrounded very strongly cemented gravel sized mixed rock fragments; abrupt irregular boundary.

2Bt1 --- (91-101 cm); yellowish brown (10YR 5/4, moist, broken face) coarse sandy loam; weak medium subangular blocky structure; noneffervescent (HCl, 1 normal); friable; few fine roots throughout, and few medium roots throughout; many fine, few very fine pores; few olive brown (2.5Y 4/4, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; few very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 4% subrounded very strongly cemented gravel sized mixed rock fragments, 4% subrounded very strongly cemented stone sized mixed rock fragments; Note(s): clay bodies throughout, Note(s): many fine pores in sand and few very fine pores in clay, Note(s): very few carbonate masses effervescence very slightly; abrupt wavy boundary.

2Bt2 --- (101-113 cm); yellowish brown (10YR 5/6, moist, broken face) loam; moderate fine subangular blocky structure; very slightly effervescent (HCl, 1 normal); friable; few fine roots throughout, and few medium roots throughout; common very fine pores; few olive brown (2.5Y 4/4, moist) faint clay films on all faces of peds, few gray (2.5Y 5/1, moist) faint skeletons on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 3% subrounded very strongly cemented gravel sized mixed rock fragments; abrupt wavy boundary.

2Bt3 --- (113-139 cm); dark yellowish brown (10YR 4/6, moist, broken face) fine sandy loam; weak fine prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common medium roots throughout; common very fine pores; few dark yellowish brown (10YR 4/4, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subrounded very strongly cemented gravel sized mixed rock fragments; abrupt irregular boundary.

2Btk --- (139-205 cm); dark yellowish brown (10YR 4/4, moist, broken face) loam; strong medium prismatic parting to moderate fine angular blocky structure; strongly effervescent (HCl, 1 normal); extremely firm; common fine roots throughout, and common very fine roots throughout; few fine, few very fine pores; few olive brown (2.5Y 4/4, moist) faint clay films on all faces of peds, few brownish yellow (10YR 6/6, moist) faint skeletons on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 5% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): few lignins present.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
UR01EU	M092115201	0	11	A	26.2	36.2	37.6	18.9	17.3	9.5	14.5	7.2	4.5	1.9	L	1.14
UR01EU	M092115202	11	20	Bt1	33.7	32	34.3	17.4	14.6	8.4	13.6	5.7	4.3	2.3	CL	1.36
UR01EU	M092115203	20	43	Bt2	44.8	29.8	25.4	15.3	14.5	6.5	9	4.7	3.3	1.9	C	1.46
UR01EU	M092115204	43	65	Bt3	40.7	31.9	27.4	15.8	16.1	7.4	10.7	4.4	3.6	1.3	C	1.46
UR01EU	M092115205	65	91	Btk	24	58.8	17.2	46.9	11.9	3.9	5.6	3.3	2.7	1.7	SIL	1.61
UR01EU	M092115206	91	101	2Bt1	19.1	12.2	68.7	5.1	7.1	2.8	9	18.1	29	9.8	COSL	1.68
UR01EU	M092115207	101	113	2Bt2	17.4	32.2	50.4	13.7	18.5	12.3	18.2	9.4	7	3.5	L	1.68
UR01EU	M092115208	113	139	2Bt3	11.4	22.5	66.1	6.9	15.6	15.2	29	10.6	7.5	3.8	FSL	1.57
UR01EU	M092115209	139	203	2Btk	26.1	38.3	35.6	22.2	16.1	8.8	13.1	5.8	4.3	3.6	L	1.65

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAcC)	% TOC	pH salt	pH H ₂ O
UR01EU	M092115201	13.7	1.9	0	0.5	16.1	8	0	24.1	20.7	16.1	0	67	78	2.2	5.1	5.6
UR01EU	M092115202	15	1.6	0	0.4	17	8.6	0.4	25.6	22.9	17.4	2	66	74	1.1	4.6	5.1
UR01EU	M092115203	20.9	1.6	0.1	0.4	23	10	2	33	29.8	25	8	70	77	0.4	4.5	5
UR01EU	M092115204	22.3	1.2	0.1	0.2	23.8	5	0	28.8	25.3	23.8	0	83	94	0.3	5.7	6.1
UR01EU	M092115205	50.8	0.8	0	0.1	51.7	1.1	0		14.9				100	0.2	7.4	7.9
UR01EU	M092115206	13.6	0.4	0	0.1	14.1	2.9	0		12.8				100	0.1	7.3	7.9
UR01EU	M092115207	18.2	0.4	0	0.1	18.7	0.5	0		11.3				100	0.1	7.4	8
UR01EU	M092115208	7.4	0.4	0	0.1	7.9	0.7	0		7.2				100	0.1	7.2	7.8
UR01EU	M092115209	36.2	0.8	0	0.1	37.1	0	0		13.4				100	0.1	7.4	8

A.43. SITE ID: **UR01PL** MCL PEDON ID: **Mo921151**

A --- (0-10 cm); 70% dark grayish brown (10YR 4/2, moist, broken face) , and 30% very dark grayish brown (10YR 3/2, moist, rubbed) loam; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, common medium roots throughout, and few coarse roots throughout; common fine, few medium pores; 1% subangular very strongly cemented fine gravel sized chert fragments; abrupt smooth boundary.

E --- (10-18 cm); brown (10YR 5/3, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common medium roots throughout, common fine roots throughout, few very fine roots throughout, and few coarse roots throughout; many fine, few medium pores; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt1 --- (18-29 cm); yellowish brown (10YR 5/4, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, common fine roots throughout, and common very fine roots throughout; many fine, many very fine pores; few brown (10YR 5/3, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subrounded very strongly cemented gravel sized mixed rock fragments, 2% subrounded very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt2 --- (29-48 cm); yellowish brown (10YR 5/4, moist, broken face) clay loam; weak fine prismatic parting to strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, common medium roots throughout, and common fine roots throughout; common fine, common very fine pores; few yellowish brown (10YR 5/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subrounded very strongly cemented fine gravel sized mixed rock fragments, 5% rounded very strongly cemented cobble sized igneous rock fragments; Note(s): 5% cobbles were mainly chlorite schist type rocks; clear smooth boundary.

Bt3 --- (48-67 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; weak fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common very fine roots throughout, and few medium roots throughout; few medium, few fine pores; few brown (10YR 4/3, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subrounded very strongly cemented fine gravel sized mixed rock fragments; Note(s): medium to coarse sized igneous gravels; clear smooth boundary.

Bt4 --- (67-88 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; weak medium prismatic parting to strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, few medium roots throughout, common fine roots throughout, and common very fine roots throughout; common fine pores; few dark yellowish brown (10YR 4/4, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subrounded very strongly cemented fine gravel sized mixed rock fragments, 1% subrounded very strongly cemented gravel sized igneous rock fragments; abrupt smooth boundary.

Bt5 --- (88-122 cm); light olive brown (2.5Y 5/4, moist, broken face) silty clay loam; moderate coarse prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few very fine roots throughout; common fine pores; few olive brown (2.5Y 4/4, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subrounded very strongly cemented gravel sized mixed rock fragments; clear wavy boundary.

Bt6 --- (122-156 cm); dark yellowish brown (10YR 4/4, moist, broken face) clay loam; moderate medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few fine roots throughout; common fine pores; few yellow (10YR 7/8, moist) prominent skeletans on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): horizon 8 stratified w/ coarser sands (7.5YR5/8 and 10% mm) and gray (10YR6/1) vf sands/silt lenses, Note(s): sampled as part of composite as lenses were too small to break out; gradual smooth boundary.

Bt7 --- (156-183 cm); yellowish brown (10YR 5/4, moist, broken face) loam; moderate coarse prismatic parting to strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few very fine roots throughout; common fine pores; few olive brown (2.5Y 4/4, moist) distinct clay films on all faces of peds, few yellow (10YR 7/8, moist) prominent skeletans on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subrounded very strongly cemented gravel sized mixed rock fragments; abrupt smooth boundary.

2Bck --- (183-205 cm); olive brown (2.5Y 4/3, moist, broken face) loam; moderate coarse prismatic parting to strong fine subangular blocky structure; slightly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few fine pores; very few brownish yellow (10YR 6/8, moist) prominent skeletal on all faces of peds, few olive brown (2.5Y 4/4, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 6% subrounded very strongly cemented gravel sized mixed rock fragments; Note(s): CaCO₃ starts here.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
UR01PL	Mo92115101	0	10	A	10.3	42.3	47.4	22.4	19.9	8.5	17.7	11	7.5	2.7	L	0.88
UR01PL	Mo92115102	10	18	E	8.2	39.8	52	20.7	19.1	10	18.8	11.1	8.8	3.3	L	1.55
UR01PL	Mo92115103	18	29	Bt1	14.8	38.3	46.9	21.4	16.9	9	17.1	10.5	7.2	3.1	L	1.50
UR01PL	Mo92115104	29	48	Bt2	34.8	30.4	34.8	17	13.4	8.2	12.9	5.9	5	2.8	CL	1.49
UR01PL	Mo92115105	48	67	Bt3	35	33	32	16.6	16.4	7.7	12.4	6.2	4.4	1.3	CL	1.60
UR01PL	Mo92115106	67	88	Bt4	32.5	40	27.5	22.2	17.8	8.4	10	4.2	3.5	1.4	CL	1.51
UR01PL	Mo92115107	88	122	Bt5	38.2	51.5	10.3	39.2	12.3	2.8	3.2	2	1.6	0.7	SICL	1.56
UR01PL	Mo92115108	122	156	Bt6	27.7	38.7	33.6	20.9	17.8	10	13.4	4.8	3.6	1.8	CL	1.53
UR01PL	Mo92115109	156	183	Bt7	26.6	38	35.4	22.6	15.4	8.9	12.6	6.1	5	2.8	L	1.73
UR01PL	Mo92115110	183	203	2BCK	25.5	38	36.5	23.2	14.8	9.1	12.9	5.4	5.3	3.8	L	1.74

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAcC)	% TOC	pH salt	pH H ₂ O
UR01PL	Mo92115101	3.8	0.8	0	0.5	5.1	9.9	0.1	15	12.2	5.2	2	34	42	2.6	4.8	5.6
UR01PL	Mo92115102	1.2	0.4	0	0.1	1.7	4.8	0.8	6.5	4.8	2.5	32	26	36	0.5	4.7	5.4
UR01PL	Mo92115103	2.7	0.8	0	0.2	3.7	5.6	1.1	9.3	8	4.8	23	40	46	0.3	4.6	5.3
UR01PL	Mo92115104	5.5	1.6	0	0.3	7.4	14.5	7.7	21.9	18.3	15.1	51	34	40	0.4	4	4.7
UR01PL	Mo92115105	5.6	2	0	0.3	7.9	15.1	8.8	23	20.1	16.7	53	34	39	0.3	4	4.7
UR01PL	Mo92115106	5.8	2	0.1	0.3	8.2	14.7	7.2	22.9	19.5	15.4	47	36	42	0.3	4	4.7
UR01PL	Mo92115107	9.7	3.2	0.1	0.2	13.2	15.5	6.4	28.7	28.6	19.6	33	46	46	0.3	4.1	4.5
UR01PL	Mo92115108	10.4	2.7	0.1	0.1	13.3	4.7	0	18	15.4	13.3	0	74	86	0.2	5.5	6
UR01PL	Mo92115109	11.9	2	0.1	0.1	14.1	3.8	0	17.9	17.2	14.1	0	79	82	0.2	5.9	6.5
UR01PL	Mo92115110	37.4	2	0	0.1	39.5	0.8	0		13.2				100	0.1	7.3	7.9

A.44. SITE ID: **UR01PU** MCL PEDON ID: **M0921150**

A --- (0-13 cm); 80% very dark grayish brown (10YR 3/2, moist, rubbed) , and 20% dark grayish brown (10YR 4/2, moist, broken face) loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and few medium roots throughout; common fine, many very fine pores; 1% subangular very strongly cemented fine gravel sized chert fragments; abrupt smooth boundary.

BA --- (13-22 cm); brown (10YR 5/3, moist, broken face) loam; weak fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, and common very fine roots throughout; common fine, many very fine pores; very few pale brown (10YR 6/3, moist) faint silt coats on all faces of peds, few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels; common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized chert fragments; Note(s): no clay films; clear smooth boundary.

Bt1 --- (22-33 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; many medium roots throughout, common fine roots throughout, and few coarse roots throughout; common fine pores; few dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; abrupt smooth boundary.

Bt2 --- (33-46 cm); yellowish brown (10YR 5/6, moist, broken face) clay; moderate medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few coarse roots throughout, and common medium roots throughout; few fine pores; few yellowish brown (10YR 5/6, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments, 1% subangular very strongly cemented medium gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (46-69 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak fine prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common medium roots throughout, common fine roots throughout, and few coarse roots throughout; few fine pores; few brown (10YR 5/3, moist) distinct clay films on all faces of peds; common weak red (2.5YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented medium gravel sized mixed rock fragments, 2% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): iron nodule (3-5 mm diameter); clear smooth boundary.

Bt4 --- (69-91 cm); 50% dark yellowish brown (10YR 4/6, moist, broken face) , and 50% yellowish brown (10YR 5/6, moist, broken face) clay loam; weak fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout; few fine, few very fine pores; few brown (10YR 5/3, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented medium gravel sized mixed rock fragments, 2% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): increase in very fine sands; gradual smooth boundary.

Btk1 --- (91-113 cm); dark yellowish brown (10YR 4/4, moist, broken face) clay loam; moderate medium prismatic parting to strong fine subangular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few very fine pores; few olive brown (2.5Y 4/4, moist) distinct clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 2% subangular very strongly cemented medium gravel sized mixed rock fragments, 2% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): denser; clear wavy boundary.

Btk2 --- (113-155 cm); dark yellowish brown (10YR 4/4, moist, broken face) clay loam; strong medium prismatic parting to strong fine subangular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few fine roots throughout; few fine pores; few olive brown (2.5Y 4/4, moist) distinct clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) medium prominent weakly cemented cylindrical carbonate nodules throughout with clear boundaries; 3% subangular very strongly cemented fine gravel sized mixed rock fragments, 1% subangular very strongly cemented medium gravel sized mixed rock fragments; Note(s): 4 cm wide very fine sand layer at top of horizon (5Y7/2), Note(s): rest of horizon is dense; gradual wavy boundary.

2Btkg --- (155-161 cm); grayish brown (2.5Y 5/2, moist, broken face) loam; moderate medium prismatic parting to moderate fine subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; few medium roots throughout, and few fine roots throughout; few very fine pores; very few light gray (2.5Y 7/1, moist) faint silt coats on all faces of peds; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; Note(s): Bulk Density NOT sampled(similar to top of horizon 8); clear smooth boundary.

2Btk --- (161-205 cm); dark yellowish brown (10YR 4/4, moist, broken face) clay loam; strong medium prismatic parting to strong fine angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few fine roots throughout; few very fine pores; very few olive brown (2.5Y 4/4, moist) faint clay films on all faces of peds; common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent extremely weakly cemented cylindrical carbonate nodules throughout with diffuse boundaries; 5% subrounded very strongly cemented fine gravel sized mixed rock fragments, 1% subrounded very strongly cemented medium gravel sized mixed rock fragments; Note(s): some mixing with very fine sandy loam, Note(s): dense where CL exists.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
UR01PU	Mo92115001	0	13	A	14.6	45.2	40.2	25.9	19.3	6	10.6	7.9	10.6	5.1	L	0.87
UR01PU	Mo92115002	13	22	BA	16.9	45	38.1	24.8	20.2	7	11.9	6.5	8.3	4.4	L	1.41
UR01PU	Mo92115003	22	33	Bt1	37.5	32.5	30	16.2	16.3	5.2	8.5	5.1	6	5.2	CL	1.36
UR01PU	Mo92115004	33	46	Bt2	49.3	28.5	22.2	11.8	16.7	5.2	8.2	3.8	3.3	1.7	C	1.38
UR01PU	Mo92115005	46	69	Bt3	47.4	29.1	23.5	13.9	15.2	5.6	8.5	4.3	3.1	2	C	1.47
UR01PU	Mo92115006	69	91	Bt4	36.9	30.8	32.3	14.2	16.6	7.6	14.1	5.1	3.7	1.8	CL	1.64
UR01PU	Mo92115007	91	113	Btk1	34.5	35.5	30	18.8	16.7	6.6	10.6	5.6	4.3	2.9	CL	1.61
UR01PU	Mo92115008	113	155	Btk2	34	35.2	30.8	19.7	15.5	7.7	10	4.8	4.6	3.7	CL	1.73
UR01PU	Mo92115009	155	161	2Btgk	18.2	45.7	36.1	13.5	32.2	26.2	8.4	0.6	0.4	0.5	L	1.62
UR01PU	Mo92115010	161	203	2Btk	35.7	34.5	29.8	18.3	16.2	7.4	11.1	4.8	4.3	2.2	CL	0.87

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
UR01PU	Mo92115001	9.6	1.6	0	0.4	11.6	7.4	0	19	16.4	11.6	0	61	71	2.6	5.5	5.9
UR01PU	Mo92115002	3.4	0.8	0	0.1	4.3	7	3.3	11.3	10.3	7.6	43	38	42	0.4	4.1	4.6
UR01PU	Mo92115003	9.4	2.4	0.1	0.3	12.2	13.5	7.3	25.7	23.1	19.5	37	47	53	0.4	3.9	4.4
UR01PU	Mo92115004	14.7	4	0.1	0.4	19.2	15.7	5.8	34.9	32.1	25	23	55	60	0.4	4	4.5
UR01PU	Mo92115005	13.3	3.2	0.1	0.4	17	14.2	5	31.2	29.2	22	23	55	58	0.4	4.1	4.6
UR01PU	Mo92115006	14.9	2.8	0.1	0.3	18.1	6.2	0	24.3	23.6	18.1	0	75	77	0.2	5.6	6
UR01PU	Mo92115007	51	4.4	0.2	0.3	55.9	0.5	0		17.1				100	0.2	7.3	7.9
UR01PU	Mo92115008	51.6	4	0.2	0.3	56.1	2.3	0		17.5				100	0.1	7.3	8
UR01PU	Mo92115009	43.6	3.2	0.1	0.3	47.2	1.5	0		10.8				100	0.1	7.5	8.1
UR01PU	Mo92115010	37.8	4	0.2	0.3	42.3	0.4	0		17.8				100	0.1	7.5	8.1

A.45. SITE ID: **URo2EL** MCL PEDON ID: **Mo921160**

A --- (0-8 cm); 80% dark grayish brown (10YR 4/2, moist, broken face) , and 20% brown (10YR 5/3, moist, broken face) loam; weak very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, and many very fine roots throughout; many very fine, many fine, common medium pores; few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels; common yellowish brown (10YR 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): not much true A horizon (appears to have less O.M.), Note(s): gravels are colluvial in nature; clear smooth boundary.

Bt1 --- (8-15 cm); yellowish brown (10YR 5/4, moist, broken face) loam; weak thick platy parting to weak fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, common very fine roots throughout, and few medium roots throughout; many very fine, common fine, few medium pores; very few dark grayish brown (10YR 4/2, moist) prominent organoargillans on surfaces along root channels; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): true BE (no clfs), Note(s): softer, silty material, Note(s): gravels are colluvial; clear smooth boundary.

Bt2 --- (15-30 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few medium roots throughout, common very fine roots throughout, and few fine roots throughout; common fine, common very fine, few medium pores; few yellowish brown (10YR 5/6, moist) distinct clay films on all faces of peds; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (30-49 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few medium roots throughout, few fine roots throughout, and few very fine roots throughout; few medium, common fine, common very fine pores; few yellowish brown (10YR 5/6, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt4 --- (49-79 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine prismatic parting to strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few medium roots throughout, common fine roots throughout, and few very fine roots throughout; common very fine, common fine pores; few yellowish brown (10YR 5/4, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): gray redox begins here; clear smooth boundary.

Bt5 --- (79-104 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, common very fine roots throughout, and few medium roots throughout; few very fine, few fine pores; few yellowish brown (10YR 5/4, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; abrupt smooth boundary.

2BCK1 --- (104-139 cm); 50% dark yellowish brown (10YR 4/6, moist, broken face) , and 50% light olive brown (2.5Y 5/4, moist, broken face) silt loam; weak fine angular blocky structure; very slightly effervescent (HCl, 1 normal); friable; few very fine roots throughout; few very fine pores; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light olive brown (2.5Y 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): very fine sands and silts stratified with clays (matrix doesn't effervesce (only in places where carbs occur)), Note(s): see field sheet for diagram of boundaries, Note(s): no clay films; abrupt irregular boundary.

2BCK2 --- (139-175 cm); light olive brown (2.5Y 5/4, moist, broken face) silt loam; moderate medium prismatic parting to moderate fine angular blocky structure; strongly effervescent (HCl, 1 normal); firm; common fine roots throughout, and few very fine roots throughout; few very fine pores; few light olive brown (2.5Y 5/3, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common gray (2.5Y 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; many very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 1% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): stratified carbonates with clayey material between layers of silty C-like material, Note(s): clay films are present where there are clay lenses; abrupt irregular boundary.

2BCK3 --- (175-205 cm); light olive brown (2.5Y 5/4, moist, broken face) silt; moderate fine angular blocky structure; slightly effervescent (HCl, 1 normal); friable; few very fine roots throughout; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light olive brown (2.5Y 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; Note(s): silty material, structure is rock-like (siltstone?).

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm3)
UR02EL	Mo90016001	0	8	A	13.6	48.2	38.2	24	24.2	9.2	13.9	7	5.4	2.7	L	1.32
UR02EL	Mo90016002	8	15	Bt1	19.4	44.6	36	22.6	22	8.8	13	6.1	4.4	3.7	L	1.44
UR02EL	Mo90016003	15	30	Bt2	33.6	41.7	24.7	20.7	21	6.4	8.8	4.2	3.3	2	CL	1.56
UR02EL	Mo90016004	30	49	Bt3	36.2	33.2	30.6	19.2	14	7	11.7	5.1	4	2.8	CL	1.58
UR02EL	Mo90016005	49	79	Bt4	33.6	34.3	32.1	21.2	13.1	7.8	12.1	5.5	3.9	2.8	CL	1.70
UR02EL	Mo90016006	79	104	Bt5	29.9	33.8	36.3	19.6	14.2	9.9	13.7	5.7	4.3	2.7	CL	1.67
UR02EL	Mo90016007	104	139	2Bck1	13.8	50.8	35.4	13.5	37.3	22.6	8.6	1.5	1.2	1.5	SIL	1.51
UR02EL	Mo90016008	139	175	2Bck2	13.8	65.1	21.1	43.8	21.3	5	5.7	3.1	3.5	3.8	SIL	1.55
UR02EL	Mo90016009	175	203	2Bck3	5.8	90	4.2	67.4	22.6	1.1	1.2	0.6	0.7	0.6	SI	1.51

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH4OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH4OAcC)	% TOC	pH salt	pH H2O
UR02EL	Mo90016001	2.5	0.8	0	0.3	3.6	12.2	3.4	15.8	13.9	7	49	23	26	3.5	4.1	4.8
UR02EL	Mo90016002	0.7	0.4	0	0.1	1.2	9.5	5.9	10.7	10	7.1	83	11	12	0.5	3.9	4.7
UR02EL	Mo90016003	2.7	1.6	0	0.2	4.5	15.5	11.1	20	18.8	15.6	71	22	24	0.5	3.9	4.7
UR02EL	Mo90016004	4.4	2	0	0.2	6.6	13.5	9.1	20.1	19	15.7	58	33	35	0.3	4	4.8
UR02EL	Mo90016005	7.1	2.1	0	0.1	9.3	10	5	19.3	18.2	14.3	35	48	51	0.2	4.1	4.9
UR02EL	Mo90016006	9.8	1.6	0	0.1	11.5	6.3	1	17.8	17.2	12.5	8	65	67	0.2	4.5	5.1
UR02EL	Mo90016007	15	0.8	0	0	15.8	1.2	0		9.6				100	0.1	7.2	7.6
UR02EL	Mo90016008	40.5	2.1	0	0.1	42.7	0.5	0		8.8				100	0.2	7.4	8
UR02EL	Mo90016009	23.9	2.4	0	0	26.3	1.1	0		6.9				100	0.2	7.5	8.1

A.46. SITE ID: **UR02EU** MCL PEDON ID: **M0921159**

A --- (0-8 cm); 70% dark grayish brown (10YR 4/2, moist, broken face) , 20% very dark grayish brown (10YR 3/2, moist, broken face) , and 10% brown (10YR 5/3, moist, broken face) fine sandy loam; weak very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and few medium roots throughout; many very fine, many fine, few medium pores; abrupt smooth boundary.

Bt1 --- (8-18 cm); yellowish brown (10YR 5/6, moist, broken face) loam; weak thick platy parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, common very fine roots throughout, and few medium roots throughout; many very fine, many fine, few medium pores; few yellowish brown (10YR 5/4, moist) distinct clay films on all faces of peds; common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): enough clay films and clay increase to make an argillic horizon; clear wavy boundary.

Bt2 --- (18-25 cm); strong brown (7.5YR 4/6, moist, broken face) sandy clay; moderate medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; common fine roots throughout, and common very fine roots throughout; common very fine, common fine, common medium pores; few strong brown (7.5YR 4/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 6% subangular very strongly cemented gravel sized mixed rock fragments; clear smooth boundary.

Bt3 --- (25-53 cm); strong brown (7.5YR 4/6, moist, broken face) sandy clay loam; moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few coarse roots throughout, few medium roots throughout, common fine roots throughout, and common very fine roots throughout; common very fine, common fine pores; few strong brown (7.5YR 4/6, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 12% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): increase in sands cause clay films to be distinct; clear smooth boundary.

Bt4 --- (53-71 cm); strong brown (7.5YR 4/6, moist, broken face) sandy clay loam; moderate fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, common very fine roots throughout, and few medium roots throughout; many very fine, many fine, few coarse pores; few brown (7.5YR 4/4, moist) distinct clay films on all faces of peds; common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 8% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): increase in sands cause clay films to be distinct; clear smooth boundary.

2Bt5 --- (71-99 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine prismatic parting to strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few very fine roots throughout, common fine roots throughout, and few medium roots throughout; few very fine, few fine pores; common light olive brown (2.5Y 5/4, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brownish yellow (10YR 6/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light olive gray (5Y 6/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): 1% lignins (2 material) this and the following horizon are not out of order!; abrupt wavy boundary.

2BC --- (99-117 cm); dark yellowish brown (10YR 4/6, moist, broken face) gravelly coarse sandy loam; weak medium subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few very fine roots throughout; common fine, many very fine pores; few dark yellowish brown (10YR 4/6, moist) distinct clay films on all faces of peds; common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 17% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): no gray colors observed; abrupt wavy boundary.

2BCk1 --- (117-132 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate fine prismatic parting to moderate medium subangular blocky structure; very slightly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few very fine pores; few olive brown (2.5Y 4/3, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 8% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): effervescence very slight in places where there is CaCO₃ (not in matrix), Note(s): dense material; clear smooth boundary.

2BCk2 --- (132-206 cm); light olive brown (2.5Y 5/4, moist, broken face) loam; moderate medium prismatic parting to moderate fine angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few very fine roots throughout, and few fine roots throughout; few olive brown (2.5Y 4/3, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent weakly cemented spherical carbonate nodules throughout with diffuse boundaries, common very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 9% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): dense material, Note(s): 1% lignite, Note(s): texture gets more like clay loam toward the base of this horizon.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm3)
UR02EU	M090015901	0	8	A	11.3	35.9	52.8	17.2	18.7	12.4	18	9.3	8.4	4.7	FSL	1.29
UR02EU	M090015902	8	18	Bt1	22.6	32.7	44.7	17.5	15.2	10.5	15.9	8.4	6.8	3.1	L	1.38
UR02EU	M090015903	18	25	Bt2	36.4	13.8	49.8	5.4	8.4	3.1	5	5.6	15	21.1	SC	1.56
UR02EU	M090015904	25	53	Bt3	28.6	8.1	63.3	2.3	5.8	1.8	4.2	8	25.7	23.6	SCL	1.61
UR02EU	M090015905	53	71	Bt4	20.6	7.3	72.1	2.6	4.7	3	9.7	12.2	29.7	17.5	SCL	1.71
UR02EU	M090015906	71	99	2Bt5	34.6	31.4	34	16.2	15.2	6.9	11	6.2	6.1	3.8	CL	1.83
UR02EU	M090015907	99	117	2BC	14.3	4.3	81.4	1.4	2.9	0.8	2.3	9.2	37.4	31.7	COSL	1.61
UR02EU	M090015908	117	132	2Bck1	29.6	33.6	36.8	17.6	16	8	11.6	6.2	5.7	5.3	CL	1.74
UR02EU	M090015909	132	203	2Bck2	26.3	34.5	39.2	21	13.5	8.1	13.6	6.8	6.3	4.4	L	1.84

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH4OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH4OAcC)	% TOC	pH salt	pH H2O
UR02EU	M090015901	12.2	1.9	0	0.3	14.4	7.2	0	21.6	18	14.4	0	67	80	4.2	5.3	5.6
UR02EU	M090015902	3.4	1.2	0	0.2	4.8	8.8	4.7	13.6	12.8	9.5	49	35	38	0.6	4.1	4.6
UR02EU	M090015903	10.3	2.4	0	0.2	12.9	11.1	3.6	24	22.3	16.5	22	54	58	0.5	4.3	4.8
UR02EU	M090015904	10.2	2.4	0	0.2	12.8	8.4	2.3	21.2	18.7	15.1	15	60	68	0.3	4.4	5
UR02EU	M090015905	6.5	1.6	0	0.1	8.2	7.5	3.1	15.7	14.6	11.3	27	52	56	0.2	4.3	4.9
UR02EU	M090015906	12.6	2.9	0	0.2	15.7	7	1.1	22.7	21.2	16.8	7	69	74	0.2	4.5	5
UR02EU	M090015907	8.5	0.8	0	0.1	9.4	2.5	0	11.9	10.5	9.4	0	79	90	0.1	6.3	6.8
UR02EU	M090015908	38.9	2	0	0.1	41	1.4	0		16.8				100	0.1	7.5	7.7
UR02EU	M090015909	38.2	2	0	0.1	40.3	0.3	0		12.2				100	0.1	7.5	7.9

A.47. SITE ID: **UR02PL** MCL PEDON ID: **M0921162**

A --- (0-9 cm); 70% dark grayish brown (10YR 4/2, moist, broken face) , 20% very dark grayish brown (10YR 3/2, moist, broken face) , and 10% brown (10YR 5/3, moist, broken face) loam; weak fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common fine roots throughout; many very fine, many fine, common medium pores; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; Note(s): not a lot of o.m.; clear smooth boundary.

Bt1 --- (9-16 cm); yellowish brown (10YR 5/4, moist, broken face) loam; weak thick platy parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; few medium roots throughout, common very fine roots throughout, and common fine roots throughout; few medium, many very fine, many fine pores; few dark grayish brown (10YR 4/2, moist) distinct organoargillans on surfaces along root channels; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; clear smooth boundary.

Bt2 --- (16-37 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; weak medium prismatic parting to strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few medium roots throughout, common fine roots throughout, and common very fine roots throughout; common very fine, common fine pores; few yellowish brown (10YR 5/6, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): consistent color with no grays; clear smooth boundary.

Bt3 --- (37-60 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate fine prismatic parting to strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few medium roots throughout, common fine roots throughout, and common very fine roots throughout; many fine, common very fine, few medium pores; common yellowish brown (10YR 5/6, moist) distinct clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; gradual smooth boundary.

Bt4 --- (60-84 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; strong medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, and common very fine roots throughout; common fine, common very fine pores; common dark yellowish brown (10YR 4/6, moist) prominent clay films on all faces of peds; common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): originally had 3% cam here and 4% on horizon below, but when tubs were checked - nothing effervesced. Check Ca levels in lab data to compare with other horizons (removed cams from description); clear smooth boundary.

Bt5 --- (84-107 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few fine roots throughout, and common very fine roots throughout; few fine, common very fine pores; common olive brown (2.5Y 4/3, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): 1% lignite frags; clear wavy boundary.

2Btk1 --- (107-132 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate coarse prismatic parting to moderate medium subangular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few very fine pores; few olive brown (2.5Y 4/3, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries, few very pale brown (10YR 8/1, moist) fine prominent noncemented threadlike finely disseminated carbonates on vertical faces of peds with diffuse boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; abrupt wavy boundary.

2Btk2 --- (132-160 cm); 60% dark gray (2.5Y 4/1, moist, broken face) , and 40% very dark gray (2.5Y 3/1, moist, broken face) silty clay; moderate medium prismatic parting to moderate medium subangular blocky structure; slightly effervescent (HCl, 1 normal); firm; few fine roots throughout, and few medium roots throughout; common dark grayish brown (2.5Y 4/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light olive brown (2.5Y 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): coal layer, see photo , Note(s): 30% extremely weak coal fragments throughout (not sure whether to include in description) , Note(s): very mixed materials no clear patterns; abrupt wavy boundary.

2Btk3 --- (160-179 cm); light olive brown (2.5Y 5/4, moist, broken face) clay loam; moderate fine prismatic parting to moderate medium angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few fine roots throughout; common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark grayish brown (2.5Y 4/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): 1% lignite frags , Note(s): samples 9, 10, and 11 were taken separately, but only one Db was taken on horizon 9 (Db sample 9-2) and horizon 10 (Db sample 9-1) , Note(s): Horizon 11 should have similar Db to horizon 8 (coal like material); abrupt irregular boundary.

2BC --- (179-196 cm); light olive brown (2.5Y 5/4, moist, broken face) fine sand; weak fine angular blocky structure; noneffervescent (HCl, 1 normal); friable; few fine roots throughout, and few very fine roots throughout; many very fine pores; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brownish yellow (10YR 6/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): vf sands stratified with coal layers , Note(s): no effervescence; abrupt wavy boundary.

2Bck --- (196-205 cm); 60% very dark gray (2.5Y 3/1, moist, broken face) , and 40% dark gray (2.5Y 4/1, moist, broken face) silty clay; moderate medium subangular blocky structure; strongly effervescent (HCl, 1 normal); firm; few fine roots throughout; common dark grayish brown (2.5Y 4/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common light olive brown (2.5Y 5/4, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): coal like (very similar to horizon 8), Note(s): mixed up materials, Note(s): 40% coal frags extremely weak.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
UR02PL	Mo90016201	0	9	A	9.8	42.6	47.6	22	20.6	11.7	17.1	9.3	6.7	2.8	L	1.54
UR02PL	Mo90016202	9	16	Bt1	20	38.3	41.7	21.9	16.4	11.2	14.7	7.5	5.4	2.9	L	1.46
UR02PL	Mo90016203	16	37	Bt2	36.5	31.8	31.7	17.3	14.5	7.7	11.5	5.7	4.3	2.5	CL	1.57
UR02PL	Mo90016204	37	60	Bt3	34.8	32.6	32.6	18.2	14.4	8	12.2	5.6	4.4	2.4	CL	1.78
UR02PL	Mo90016205	60	84	Bt4	31.8	33.8	34.4	18.5	15.3	7.7	12	6.3	5	3.4	CL	1.67
UR02PL	Mo90016206	84	107	Bt5	30.7	36.3	33	19.4	16.9	11.8	10.3	4.8	3.7	2.4	CL	1.79
UR02PL	Mo90016207	107	132	2Btk1	28.7	35.9	35.4	20.9	15	8	12.8	6.4	4.9	3.3	CL	1.81
UR02PL	Mo90016208	132	160	2Btk2	41.6	42.1	16.3	36.4	5.7	3.3	5.7	1.7	2.6	3	SIC	1.61
UR02PL	Mo90016209	160	179	2Btk3	27	36.6	36.4	21.4	15.2	8.1	13.3	6.3	5	3.7	CL	1.74
UR02PL	Mo90016210	179	196	2BC	4.9	4.6	90.5	2.5	2.1	16.2	73.5	0.4	0.2	0.2	FS	1.68
UR02PL	Mo90016211	196	203	2Bck	42.4	46	11.6	38.6	7.4	3.4	3.7	1.4	1.6	1.5	SIC	1.17

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAc)	% TOC	pH salt	pH H ₂ O
UR02PL	Mo90016201	3.2	1.2	0	0.2	4.6	7.9	0.4	12.5	9.4	5	8	37	49	1.8	4.6	4.9
UR02PL	Mo90016202	1.2	1.2	0	0.2	2.6	8.9	5.2	11.5	10.7	7.8	67	23	24	0.4	4	4.8
UR02PL	Mo90016203	4.2	3.3	0	0.3	7.8	13	7.2	20.8	18	15	48	37	43	0.3	4	4.9
UR02PL	Mo90016204	6.1	4	0.1	0.3	10.5	10.4	4.4	20.9	17.7	14.9	30	50	59	0.2	4.1	4.8
UR02PL	Mo90016205	7.4	3.7	0.1	0.3	11.5	6.7	1.4	18.2	16.9	12.9	11	63	68	0.2	4.5	5.2
UR02PL	Mo90016206	10.4	4	0.1	0.3	14.8	3.5	0	18.3	16.3	14.8	0	81	91	0.2	5.7	6.3
UR02PL	Mo90016207	39.3	4	0.1	0.2	43.6	0.6	0		14.4				100	0.1	7.2	7.8
UR02PL	Mo90016208	49.6	10.5	0.1	0.4	60.6	1.6	0		26.3				100	2.6	7.4	8
UR02PL	Mo90016209	40.4	6.1	0.1	0.3	46.9	0	0		11.9				100	0.2	7.5	7.9
UR02PL	Mo90016210	1.9	1.2	0	0.1	3.2	0.6	0		3				100	0	7.4	7.9
UR02PL	Mo90016211	39	12.4	0.2	0.5	52.1	3	0		23.9				100	1.6	7.6	8

A.48. SITE ID: **URo2PU** MCL PEDON ID: **Mo921161**

A --- (0-11 cm); 70% very dark grayish brown (10YR 3/2, moist, rubbed) , 25% dark grayish brown (10YR 4/2, moist, broken face) , and 5% brown (10YR 5/3, moist, broken face) silt loam; moderate very fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; many fine roots throughout, many very fine roots throughout, and common medium roots throughout; many very fine, many fine, few medium pores; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): rock fragments are colluvial in nature; abrupt smooth boundary.

Bt1 --- (11-19 cm); 60% brown (10YR 5/3, moist, broken face) , 30% yellowish brown (10YR 5/4, moist, broken face) , and 10% dark grayish brown (10YR 4/2, moist, broken face) silt loam; weak thick platy parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); friable; common fine roots throughout, and many very fine roots throughout; common fine, many very fine, few medium pores; very few very dark grayish brown (10YR 3/2, moist) prominent organoargillans on surfaces along root channels, very few pale brown (10YR 6/3, moist) distinct silt coats on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 1% subangular very strongly cemented fine gravel sized mixed rock fragments; Note(s): less than 1 percent till frags (mainly small pieces of white chert); clear smooth boundary.

Bt2 --- (19-30 cm); dark yellowish brown (10YR 4/6, moist, broken face) clay loam; strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, and common very fine roots throughout; many very fine, common fine, few medium pores; few strong brown (7.5YR 4/6, moist) distinct clay films on all faces of peds, few pale brown (10YR 6/3, moist) distinct silt coats on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 5% subangular very strongly cemented gravel sized mixed rock fragments; abrupt smooth boundary.

Bt3 --- (30-47 cm); strong brown (7.5YR 4/6, moist, broken face) clay; strong fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few very coarse roots throughout, many very fine roots throughout, and common fine roots throughout; common very fine, few fine pores; common brown (7.5YR 4/4, moist) prominent clay films on all faces of peds; common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 4/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common dark yellowish brown (10YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): very red!; clear smooth boundary.

Bt4 --- (47-72 cm); strong brown (7.5YR 4/6, moist, broken face) clay; weak fine prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; common fine roots throughout, and common very fine roots throughout; common fine, common very fine pores; common yellowish brown (10YR 5/6, moist) prominent clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (10YR 5/3, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 2% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): redox depletions begin here; clear smooth boundary.

Bt5 --- (72-99 cm); yellowish brown (10YR 5/6, moist, broken face) clay; weak medium prismatic parting to moderate medium subangular blocky structure; noneffervescent (HCl, 1 normal); very firm; few medium roots throughout, common fine roots throughout, and common very fine roots throughout; common very fine, common fine, few medium pores; few dark yellowish brown (10YR 4/6, moist) distinct clay films on all faces of peds; common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 3% subangular very strongly cemented gravel sized mixed rock fragments; gradual smooth boundary.

Bt6 --- (99-146 cm); yellowish brown (10YR 5/6, moist, broken face) clay loam; moderate medium prismatic parting to moderate fine subangular blocky structure; noneffervescent (HCl, 1 normal); firm; few fine roots throughout, and few very fine roots throughout; few fine, few very fine pores; few dark yellowish brown (10YR 4/6, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (10YR 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brownish yellow (10YR 6/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): seems to contain more silt-stone(decomposed shales?) like material, Note(s): distinct l.d. here; clear wavy boundary.

Bt7 --- (146-186 cm); yellowish brown (10YR 5/6, moist, broken face) loam; moderate medium prismatic parting to strong medium subangular blocky structure; very slightly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few very fine pores; few dark yellowish brown (10YR 4/6, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common strong brown (7.5YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brownish yellow (10YR 6/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish red (5YR 4/6, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common brown (7.5YR 4/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common greenish gray (5G 5/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 5% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): lots of colors, Note(s): probably more mottling than redox features, Note(s): effervescence is very slight in places where CaCO₃ exists; gradual wavy boundary.

Btk --- (186-205 cm); dark yellowish brown (10YR 4/6, moist, broken face) loam; strong fine prismatic parting to strong medium angular blocky structure; strongly effervescent (HCl, 1 normal); very firm; few very fine roots throughout; few very fine pores; few dark yellowish brown (10YR 4/4, moist) faint clay films on all faces of peds; common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common black (10YR 2/1, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common grayish brown (2.5Y 5/2, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries, common yellowish brown (10YR 5/8, moist) fine prominent noncemented spherical masses of manganese accumulation throughout with sharp boundaries; common very pale brown (10YR 8/1, moist) fine prominent noncemented cylindrical masses of carbonate throughout with diffuse boundaries; 4% subangular very strongly cemented gravel sized mixed rock fragments; Note(s): 1% lignite, Note(s): jointed, Note(s): structure appears to be rock-like.

PHYSICAL:

Site ID	Sample No	Depth cm top	Depth cm bot	Horizon	Clay % tot	Silt % tot	Sand % tot	Fine % silt	Coarse % Silt	VF % Sand	F % Sand	M % Sand	C % Sand	VC % Sand	Textural Class	Moist Db (g/cm ³)
UR02PU	Mo90016101	0	11	A	11.4	55.9	32.7	32.6	23.3	7.6	12.8	5.6	4.4	2.3	SIL	0.83
UR02PU	Mo90016102	11	19	Bt1	14.6	54.5	30.9	31.4	23.1	7.4	11.9	5.3	3.8	2.5	SIL	1.43
UR02PU	Mo90016103	19	30	Bt2	30.8	42	27.2	24	18	5.9	9.2	4.4	3.4	4.3	CL	1.49
UR02PU	Mo90016104	30	47	Bt3	49.4	28	22.6	14.7	13.3	4.8	7.9	4.1	3.5	2.3	C	1.30
UR02PU	Mo90016105	47	72	Bt4	50.9	25.8	23.3	11.2	14.6	5.7	8.8	4.3	3	1.5	C	1.43
UR02PU	Mo90016106	72	99	Bt5	43.3	28.9	27.8	15	13.9	6.6	10.9	5	3.7	1.6	C	1.54
UR02PU	Mo90016107	99	146	Bt6	33.5	32.7	33.8	17	15.7	8.5	13.1	5.8	4.3	2.1	CL	1.76
UR02PU	Mo90016108	146	186	Bt7	26.3	38.8	34.9	21.2	17.6	7.9	12.5	6.4	4.6	3.5	L	1.78
UR02PU	Mo90016109	186	203	Btk	25.9	34.8	39.3	20.7	14.1	9.9	14.8	6.5	5	3.1	L	1.71

CHEMICAL:

Site ID	Sample No	Ca	Mg	Na	K	Sum Bases	Extract Acid	Extract Al	CEC Sum	CEC NH ₄ OAc	CEC Bases+Al	% Al Sat	% BS (Sum)	% BS (NH ₄ OAcC)	% TOC	pH salt	pH H ₂ O
UR02PU	Mo90016101	6.2	1.2	0	0.3	7.7	5.8	0	13.5	10.8	7.7	0	57	71	1.6	5.7	5.9
UR02PU	Mo90016102	1	0.8	0	0.2	2	8	4.6	10	9.2	6.6	70	20	22	0.5	4	4.7
UR02PU	Mo90016103	2.7	2	0	0.3	5	15.8	11.2	20.8	18.4	16.2	69	24	27	0.5	3.9	4.6
UR02PU	Mo90016104	5.3	4.4	0	0.3	10	23.8	18.2	33.8	31.4	28.2	65	30	32	0.5	3.9	4.7
UR02PU	Mo90016105	6.8	5.1	0.1	0.3	12.3	24.4	18.2	36.7	33	30.5	60	34	37	0.3	3.8	4.7
UR02PU	Mo90016106	6.4	4.5	0.1	0.3	11.3	20.4	14.3	31.7	28.3	25.6	56	36	40	0.2	3.8	4.7
UR02PU	Mo90016107	6.1	3.2	0.1	0.2	9.6	13.1	7.3	22.7	19.6	16.9	43	42	49	0.1	4	4.8
UR02PU	Mo90016108	8.2	3.3	0.1	0.2	11.8	7.4	1.8	19.2	16.9	13.6	13	61	70	0.5	4.5	5
UR02PU	Mo90016109	41.5	3.2	0.2	0.2	45.1	0.3	0		13.4				100	0.1	7	7.9

APPENDIX B. FIELD SAMPLING LOCATIONS

Legend:
 AW = Atlanta Wildlife Area
 HH = Hidden Hollow Conservation Area
 HM = Hungry Mother Conservation Area
 RC = Rebel's Cove Conservation Area
 SC = Sugar Creek Conservation Area
 UR = Union Ridge Conservation Area
 o1 = Replicate 1
 o2 = Replicate 2
 E = Exposed slope aspect
 P = Protected slope aspect
 U = Upper hillslope position
 L = Lower hillslope position
 MCL = Missouri Characterization Lab

Table B.1 Universal Transmencator System (UTM) (NAD83, Zone 15N) coordinates of sampling locations: Atlanta Wildlife, Hidden Hollow, and Hungry Mother.

SiteID	X SoilPit	Y SoilPit	X Overstory	Y Overstory	X Understory	Y Understory	X Regen	Y_Regen
AWo1EL	541375	4415258	541367	4415262	541357	4415261	541357	4415261
AWo1EU	541417	4415260	541402	4415251	541394	4415253	541394	4415253
AWo1PL	541526	4415367	541511	4415354	541523	4415369	541523	4415369
AWo1PU	541503	4415343	541477	4415328	541473	4415328	541473	4415328
AWo2EL	541172	4415035	541188	4415031	541183	4415026	541183	4415026
AWo2EU	541288	4415095	541294	4415085	541290	4415085	541290	4415085
AWo2PL	541320	4414069	541340	4414974	541343	4414976	541343	4414976
AWo2PU	541352	4414963	541369	4414948	541362	4414956	541362	4414956
HHo1EL	530725	4426834	530725	4426841	530735	4426834	530735	4426834
HHo1EU	530734	4426866	530730	4426858	530727	4426857	530727	4426857
HHo1PL	530723	4426920	530720	4426922	530710	4426931	530710	4426931
HHo1PU	530726	4426908	530725	4426902	530715	4426909	530715	4426909
HHo2EL	530937	4428004	530926	4428015	530927	4428019	530927	4428019
HHo2EU	530974	4428033	530971	4428033	530975	4428021	530975	4428021
HHo2PL	531107	4427991	531093	4427982	531098	4427987	531098	4427987
HHo2PU	531059	4426908	531064	4427985	531052	4427989	531052	4427989
HMo1EL	538824	4343650	538804	4343645	538814	4343636	538814	4343636
HMo1EU	538845	4343666	538823	4343661	538849	4343647	538849	4343647
HMo1PL	538865	4343735	538874	4343713	538887	4343703	538887	4343703
HMo1PU	538875	4343698	538854	4343702	538875	4343699	538875	4343699
HMo2EL	538693	4343464	538684	4343483	538689	4343464	538689	4343464
HMo2EU	538725	4343496	538705	4348705	538762	4343462	538762	4343462
HMo2PL	538817	4343536	538814	4343527	538819	4343532	538819	4343532
HMo2PU	538801	4343519	538799	4343505	538801	4343522	538801	4343522

Table B.2 Universal Transmercator System (UTM) (NAD83, Zone 15N) coordinates of sampling locations: Rebel’s Cove, Sugar Creek, and Union Ridge

SiteID	X SoilPit	Y SoilPit	X Overstory	Y Overstory	X Understory	Y Understory	X Regen	Y Regen
RCo1EL	523364	4489495	522941	4489366	522932	4489366	522932	4489366
RCo1EU	523389	4489491	523009	4489394	523013	4489385	523013	4489385
RCo1PL	538817	4489483	523246	4489520	523252	4489518	523252	4489518
RCo1PU	523430	4489491	523212	4489529	523219	4489529	523219	4489529
RCo2EL	522934	4489368	523362	4489493	523362	4489493	523362	4489493
RCo2EU	523010	4489397	523392	4489490	523396	4489488	523396	4489488
RCo2PL	523234	4489519	523478	4489488	523481	4489491	523481	4489491
RCo2PU	523197	4489534	523444	4489485	523456	4489476	523456	4489476
SCo1EL	530408	4439589	530394	4439602	530414	4439593	530414	4439593
SCo1EU	530438	4439598	530435	4439603	530416	4439606	530416	4439606
SCo1PL	530557	4439554	530540	4439554	530536	4439550	530536	4439550
SCo1PU	530527	4439216	530508	4439546	530510	4439561	530510	4439561
SCo2EL	532844	4439112	532834	4439115	532832	4439120	532832	4439120
SCo2EU	532885	4439177	532881	4439176	532887	4439165	532887	4439165
SCo2PL	532780	4439235	532786	4439236	532798	4439235	532798	4439235
SCo2PU	532807	4439216	532792	4439212	532796	4439210	532796	4439210
URo1EL	511081	4464388	511092	4464377	511086	4464375	511086	4464375
URo1EU	511071	4464427	511059	4464416	511062	4464422	511062	4464422
URo1PL	511018	4464614	511014	4464607	511012	4464620	511012	4464620
URo1PU	514794	4460332	511008	4464579	511005	4464584	511005	4464584
URo2EL	514644	4460348	514637	4460341	514629	4460349	514629	4460349
URo2EU	514671	4460337	514670	4460341	514674	4460341	514674	4460341
URo2PL	514794	4460332	514810	4460334	514826	446036	514826	446036
URo2PU	514743	4460329	514742	4460327	514742	4460339	514742	4460339