

Soil Resources of Afghanistan

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United States Department of Agriculture
Natural Resources Conservation Service

January 2018

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Properties of Soils in Alluvial Valleys in Farah and Kunar Provinces, Afghanistan

Ed Tallyn, Jason Nemecek, Moustafa Elrashidi,
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Abstract

To support the USDA's efforts to enhance agricultural development in Afghanistan, USDA-NRCS Soil Scientists in conjunction with USDA agricultural advisors described and sampled 14 pedons, eight in Farah Province and six in Kunar Province, to provide basic data on soil physical, chemical, and mineralogical properties of soils in the region to evaluate and better understand soil fertility and other soil management issues. In Farah Province, the drier of the two provinces, all pedons were alkaline, calcareous, had low amounts of organic C, and had inherently low nutrient levels. Six of the pedons had argillic horizons and calcic horizons were also common. No physical limitations for plant growth were observed. For six of the Farah pedons, Na contents were relatively high and water movement through the soils may be limited due to clay dispersion and structure degradation. The soils in the alluvial valley were non-saline and no evidence was observed that would suggest salt additions with irrigation water. In the Kunar Province, four of the six pedons were calcareous, but the carbonate content was considerably lower than was observed in the Farah Province. Generally, organic C contents in the soils of this province were higher than was observed in the Farah Province, and as a result, three of the pedons had mollic epipedons and were Mollisols. Four of the pedons had argillic horizons. Similarly to observations in Farah Province, soils evaluated in the Kunar Province had no physical limitations for plant growth. None of the pedons were saline, and all had low levels of Na in all horizons. Although relatively low, maximal EC was observed in the surface horizon of several of the pedons which suggests salts may be added with irrigation water and quality of irrigation water should be monitored. In both provinces, carbonates in surface and subjacent horizons may be fixing P in forms unavailable for plant growth. Thus, P fertilization in addition to N management will be critical for maximizing crop yields.

Introduction

With nearly 75% of the people of Afghanistan directly employed in agriculture, promoting the development of the agricultural sector is crucial to creating opportunity and hope for the people of Afghanistan. The rough terrain and arid climate of Afghanistan leaves little of the country's land arable. Prolonged drought, outdated farming methods, limited availability and use of improved seed, modern farming equipment, chemical fertilizers and pesticides provide additional obstacles to effective agricultural production. With a rapidly growing population and a finite land resource, conflict for resources particularly irrigation water and agricultural land is more rooted in economics than the ideology of the insurgency.

After 25 years of war, uncontrolled timber harvesting, overgrazing, destroyed infrastructure, and non-existent agricultural extension, the country is desperately poor and agricultural land is

unable to produce enough food to meet the needs of its population. Subsistence farming is the norm for the vast majority of the population, with wheat, goats, and sheep the most common agricultural commodities produced. Severe overgrazing, soil erosion, and poor irrigation management has had a profound impact on the soil resource, water quality, and agricultural production.

Across the country, yields for crops grown on irrigated land are incredibly low. Reasons for these low yields likely include low native soil fertility and poor fertilizer management. Thus, the USDA Provincial Reconstruction Team (PRT) in Afghanistan proposed a soil sampling plan for Farah and Kunar Provinces to evaluate fertility of the soils and identify other soil characteristics that might limit irrigated crop yields (Dubee, 2009). With no functioning laboratory facility nor sampling equipment, the PRT requested assistance from the USDA-NRCS to sample and analyze selected soils. Thus, the National Soil Survey Center, working in partnership with the USDA Foreign Agricultural Service (FAS), developed an agreement to sample and analyze selected soils; teach local nationals about soil and water conservation, soil sampling, and techniques for describing a soil; and promote capacity building of agricultural sector in Afghanistan (Dubee, 2009). Therefore, in January 2009, two NRCS Soil Scientists in conjunction with the two USDA agricultural advisors in Farah and Kunar provinces provided the technical expertise and assistance for describing, classifying, collecting, securing and shipping soil samples to the Kellogg Soil Survey Laboratory in Lincoln, Nebraska.

The objectives of the sampling project were to evaluate soil fertility, develop the field and laboratory capabilities of Afghan colleagues, and provide benchmark data for comparison with the results obtained from a University of Afghanistan laboratory being developed. The ultimate goal was use of data from the project to develop extension/outreach materials on soil and fertilizer management to help increase crop yields and conserve the soil resource.

Methods and Materials

Field Methods

Fourteen pedons were selected for sampling in Farah and Kunar Provinces, Afghanistan (Fig. 1). In Farah Province, six pedons were selected in the Farah-Rud alluvial valley, and two were located on alluvial fans and alluvial fan remnants to the west of Farah City (Fig. 2). In Kunar Province, six pedons were selected for sampling (Figs. 3 and 4). Three of pedons were on terraces associated with the Kunar River south of Asadabad and three pedons were in the alluvial valley of the Pech River west of Asadabad (Figs. 3 and 4). Sites were selected based on land use of currently being under irrigation or having the potential of being under gravity fed flood irrigation. Without irrigation, the possibility for crop production is severely limited in Kunar and Farah Provinces. Security concerns were also a major constraint for the sampling team.

Each pedon was described and sampled from a hand dug pit (Fig. 5). Descriptions (Appendices A and B) were made using standard terminology (Schoeneberger et al., 2012). Bulk samples were collected from each genetic horizon. All sampling was from one area of the pit considered to be



Figure 1. Afghanistan showing sampling areas in Farah and Kunar Provinces.

representative of conditions observed. An additional composite sample of the surface horizon was collected about 5 to 10 m from each pit to access variability of surface horizon chemical properties and nutrient content.

Laboratory Methods

Soil samples were air-dried and crushed to pass a 2 mm sieve. Coarse fragments between 2 and 75 mm were weighed to determine coarse fragment content. Laboratory methods for < 2mm soil material were those of the Kellogg Soil Survey Laboratory and are described in Soil Survey Staff (2014). Alphanumeric codes associated with each property on tables in Appendixes C and D represent specific methods described in Soil Survey Staff (2014a).

Briefly, particle-size analysis was by sieve and pipette. Bulk density was measured on saran-coated clods. Basic cations, Ca, Mg, Na, and K, were extracted with neutral, 1 M NH₄OAc. Cation exchange capacity (CEC) was measured by saturation with molar ammonium-acetate (NH₄OAc) buffered at pH 7.0. Total carbon (C) and nitrogen (N) concentration were determined by dry combustion, and CaCO₃ equivalent (CCE) was estimated by the electronic manometer



Figure 2. Pedon locations in Farah Province. Pedons S09AF006001 – 006006 are in the Farah Rud alluvial valley. Pedons S09AF006007 and 006008 are west of the alluvial valley in upland landscapes.

method. Organic C in soil was estimated from the difference in the total- and CaCO_3 -C. Soil pH was measured in water on a 1:1 soil:water suspension and in 0.01 M CaCl_2 for 1:2 soil:solution suspension. Soluble nitrate-N was extracted with 1.0 M KCl solution and measured with a flow injection, automated ion analyzer. Available phosphorus (P) was estimated in a sodium bicarbonate solution, Olsen method, and in a double acid extraction (Mehlich 3). Available iron, manganese, copper, and zinc were determined by the Mehlich3 method. Available boron (B) was measured in an equilibrium water extract. Electrical conductivity (EC) and water soluble cations and anions were measured on a saturated paste extract. Mineralogy of the clay separate was evaluated from oriented samples after Mg and K saturation, glycol solvation, and heat treatment. Sand/silt mineralogy was evaluated optically with a petrographic microscope. For specifics of these and other methods, refer to Soil Survey Staff (2014a).

Soil Fertility Capability Classification System (FCC)

The Soil Fertility Capability Classification System (FCC) (Smith, 1989) highlights major constraints to soil fertility and plant growth due to inherent properties of the soil. The

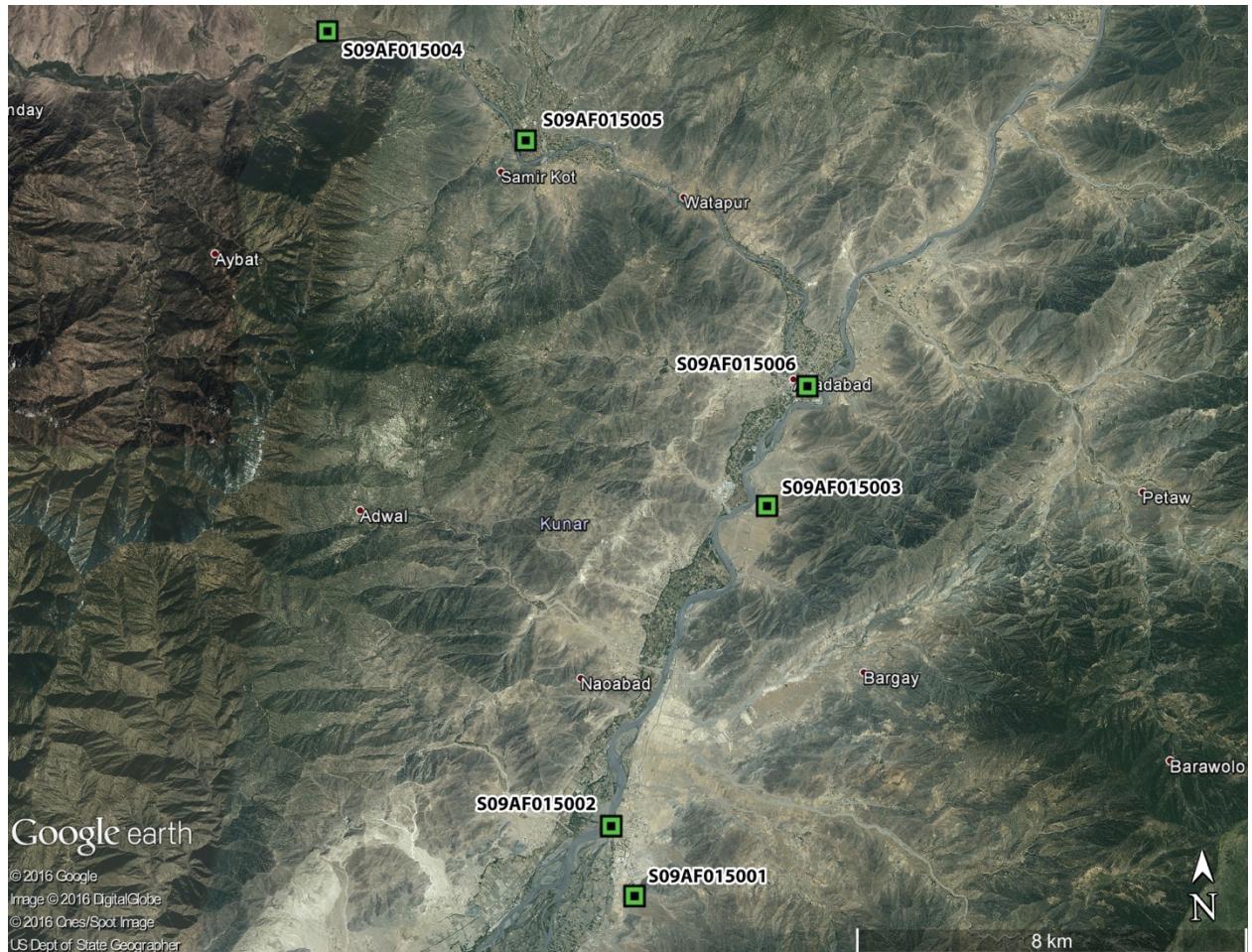


Figure 3. Pedon locations in Kunar Province. The Pech and Kunar Rivers join in Asadabad.

constraints have greater or lesser impact to management depending on related soil properties. Properties considered include:

Texture Type - texture of the 0 to 20 cm (and 20 to 50 cm depths if differing from the surface textural type)

- S – sandy (sand and loamy sand except for loamy fine and very fine sand)
- L – loamy (sandy loam, loam, silt, silt loam and clay loam with <35% clay)
- C – clayey (clay loam, silty clay loam and clay with $\geq 35\%$ clay)
 - Modifiers - coarse fragment content (gravel and cobbles) in the 0 to 20 cm and 20 to 50 cm depths (superscript placed after surface and subsurface texture types)
 - ‘ – 15 to 35%
 - “ – 35 to 60%

AI saturation of the 0 to 20 cm depth

- h – 10 to 60% of ECEC
- a – acid $>60\%$



Figure 4. Oblique view of location of pedons sampled in the Kunar Province. Note the greater relief than that observed in the Farah Province.

calcium carbonate within 50 cm of the surface

- b - free CaCO₃ (effervescence with HCl), or pH>7.3)

soil moisture regime

- d – xeric/ustic
- d+ – aridic

low cation exchange capacity in the 0 to 50 cm depth

- e - <4 cmol_c kg⁻¹ soil ECEC, or <7 cmol_c kg⁻¹ soil by sum of cations at pH 7, or <10 cmol_c kg⁻¹ soil by sum of cations + Al⁺³ + H⁺ at pH 8.2

high seasonal water table

- g – aquic soil moisture regime
- g+ – peraqueic soil moisture regime

P fixation in the 0 to 20 cm

- i – by crystalline Fe and Al oxides (dithionite citrate extractable free R₂O₃: clay ratio >0.2, or >4% citrate dithionite-extractable Fe, or Oxisols and oxic groups with C type, or hues redder than 5YR and granular structure)
- x – by non-crystalline Fe and Al oxides pH>10 (in 1 M NaF), or positive to field NaF test,

or Andisols and andic subgroups, except vitrands and vitric great groups and subgroups; other indirect evidences of allophane dominance in the clay size fraction, or >90% P retention (Blakemore et al., 1987)

- x - P retention between 30% and 90% by Blakemore et al. (1987)

low K supplying capacity in the 0 to 50 cm depth

- $k < 2 \text{ cmol (K}^+ \text{) kg}^{-1}$

Na levels within the 0 to 50 cm depth

- n - $> 15\%$ Na saturation of ECEC
- n - 6–15% Na saturation of ECEC (incipient alkalinity)

salinity

- s - $> 0.4 \text{ S m}^{-1}$ of saturated extract at 25 jC within 1 m; salids and salic groups;
- s - $0.2\text{--}0.4 \text{ S m}^{-1}$ of saturated extract at 25 jC within 1 m (incipient salinity)

high shrink-swell potential

- v - $> 35\%$ clay and $> 50\%$ of 2:1 expanding clays, or coefficient of linear expansibility > 0.09 or Vertisols and vertic groups

Combinations of factors may interact and modify management statements.

General Climate and Geology of Afghanistan

The climate of Afghanistan ranges from arid to semi-arid with cold winters and hot summers. Both temperature and precipitation are strongly influenced by elevation in this mountainous country and exhibit great seasonal and daily variation. Average winter temperatures range from about 7° C at low elevations in the southwest to about -16° C in the high mountains (UC Davis, 2016). Summer mean temperatures range from 6° C in high elevation areas to 33° C in southwestern deserts (UC Davis, 2016). Daily temperature fluctuation may be as much as 38° C . Most of the annual precipitation falls between the months of October and April. The deserts receive less than 100 mm of rain a year, whereas the mountains receive more than 1000 mm of precipitation, mostly as snow (UC Davis, 2016). Frontal winds from the west may bring large sandstorms during dry periods.

Afghanistan has some of the most complex and varied geology in the world. The oldest rocks are Archean, and they are succeeded by rocks from the Proterozoic and every more recent geologic system up to the present day. The country also has a long and complicated tectonic history, partly related to its position at the western end of the Himalaya (Afghanistan Geologic Survey, 2016a). The bedrock geology of Afghanistan can be thought of as a jigsaw of crustal



Figure 5. Describing and sampling with assistance from local population.

blocks separated by fault zones that have been put together by a series of tectonic events dating from the Jurassic.

A system of high mountains and deep valleys forms a backbone that extends across the country from the northeast to southwest. The highest elevations occur in the east-central and eastern region of the country, and the highest point is the peak of Naochak at 7485 m. Eastwards, these high relief mountains are contiguous with the Himalayan ranges. To the west, elevations decrease, and central and western ranges fan out into a series of foothills and eventually into desert plains in the west and southwest parts of the country (Afghanistan Geologic Survey, 2016b).

Climate and Geology of the Study Areas

Farah Province: Soils in river valleys in two provinces, Farah and Kunar, were selected for sampling (Fig. 1). In the western, more arid part of the country, eight pedons, S09AF006001 – S09AF006008, were sampled in Farah Province in the Farah Rud river valley near the town of Farah (Fig. 2). Pedons S09AF006001 – S09AF006006 were located in the river valley or at the edge of alluvial fans and fan remnants forming uplands to the south of the alluvial valley (Figs. 2 and 6). Pedons S09AF006007 and S09AF006008 were located west of the alluvial valley on alluvial fans descending from peaks in the area (Figs. 2 and 7).

Climate in the Farah region is arid with hot summers and cold winters. Mean annual temperature (1960 to 1983 period of record) is 20.7° C. The hottest month is July with mean monthly temperature of about 34° C, and the coldest mean monthly temperate, 7.2° C, occurs in January. Mean annual precipitation at Farah is about 75 mm. Most precipitation comes in winter and spring, and summers are dry (NOAA, 2016).

Sediments in the Farah Rud River alluvial valley are Holocene alluvium, Holocene and Pleistocene fan alluvium and colluvium, and late Pleistocene loess (Lidke, 2005; Doebrich and Wahl, 2006). Upland strata within the watershed of the Farah Rud River and that may have contributed sediments to the alluvial fans and stream floodplains and terraces include early Cretaceous limestone and sandstone, early Cretaceous sandstone and siltstone, early Cretaceous andesite lava, Oligocene and Eocene basaltic andesite and basalt, and Oligocene and Eocene rhyolite and dacite (Lidke, 2005; Doebrich and Wahl, 2006). Of these, the early Cretaceous limestone, sandstone, and siltstone are the most abundant.

Kunar Province: In the eastern part of the country, six pedons, S09AF015001 – S09AF015006, were sampled in Kunar Province near the town of Asadabad at the confluence of the Pech and Kunar Rivers (Figs. 3 and 4). In general, the alluvial valleys of these rivers are narrower and the uplands have greater relief than was the case with the landscapes in Farah (Figs. 2 and 6). Pedons S09AF015001, S09AF015002, and S09AF015003 were located in the Kunar River alluvial valley south of Asadabad (Fig. 3). Pedons S09AF015004 and S09AF015005 were west of Asadabad in the valley of the Pech River (Fig. 3). Pedon S09AF015006 was located in the town of Asadabad near the confluence of the Pech and Kunar Rivers (Fig. 3).

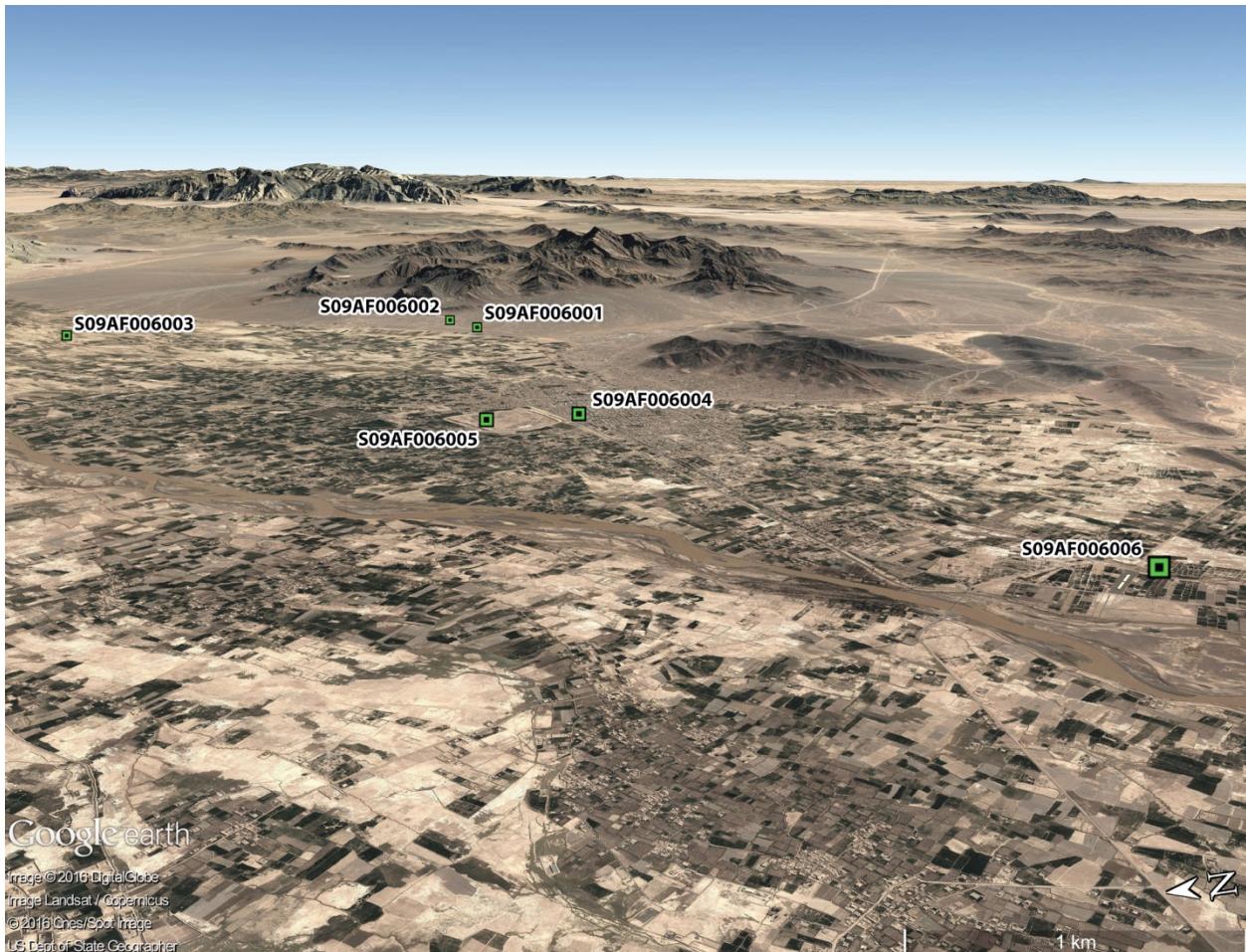


Figure 6. Location of pedons in the alluvial valley of the Farah Rud River.

The climate in the Kunar Province is moister and cooler than that in the Farah Province. Climate in the Asadabad region is semi-arid with hot summers and cold winters. Mean annual temperature is about 18° C. The hottest month is July with mean monthly temperature of about 31° C. The coldest month is January with a mean monthly temperature of about 7° C. Mean annual precipitation at Asadabad is about 200 mm. Most precipitation comes in winter and spring, and summers are dry (UC Davis, 2016; NOAA, 2016).

Sediments in the Pech and Kunar valleys are Holocene/late Pleistocene fan alluvium and colluvium, Holocene alluvium, and late Pleistocene loess. Upland rock types in the Pech River watershed include late Paleoproterozoic biotite and garnet biotite gneiss, mid Paleoproterozoic marble and biotite gneiss, and Oligocene granite. Biotite and garnet biotite gneiss is the most extensive unit. In the Kunar River watershed, upland strata include early Permian and Carboniferous sandstone and siltstone, Oligocene granite (isolated areas), early Carboniferous rhyolite and andesite, early Carboniferous limestone, and early Carboniferous rhyolite/andesite. In contrast to the rocks in the Farah Rud River watershed, limestone deposits



Figure 7. Location of pedons to the west and southwest of the Farah Rud River.

are less abundant in this part of Afghanistan (Bohannan and Turner, 2005; Doebrich and Wahl, 2006).

Soil Properties

General location, classification, and land cover for sampled pedons are given in Table 1.

Farah Province

Soils in the Farah Province reflect the climate and geology of the region. All pedons sampled were calcareous in all horizons, and the calcium carbonate equivalent (CCE) of pedons in the Farah Rud alluvial valley ranged from 26 to 51% (Tables 3-8). The carbonates were assumed to have been derived from the limestone rocks common in the watershed although carbonate deposition in dust may have added carbonates to the soils. The carbonate content in each pedon was relatively uniform with depth (Tables 3-8) suggesting that soil development had not resulted in appreciable redistribution and concentration of carbonates among the horizons. The uniform carbonate distribution in the pedons supports deposition with alluvial sediments as the

primary source of the carbonates. Appreciable deposition of carbonates at the soil surface by dust or wet infall would be expected to result in carbonate concentration in horizons near the normal depth of wetting.

Table 1. Sampling location, classification, and land cover for pedons sampled.

Pedon ID	Location (Town, Province)	Classification	Land Cover
S09AF006001	Gurgi1, Farah	coarse-loamy over sandy or sandy skeletal, mixed over carbonatic, hyperthermic Typic Haplocambids	Crop
S09AF006002	Gurgi2, Farah	loamy-skeletal, carbonatic, hyperthermic Typic Haplargids	Barren
S09AF006003	Mawran, Farah	coarse-loamy, mixed, semiactive, hyperthermic Typic Haplargids	Crop
S09AF006004	Farah City1, Farah	fine-silty, mixed, semiactive, hyperthermic Typic Calciargids	Crop
S09AF006005	Yazdi, Farah	fine, mixed, semiactive, hyperthermic Fluventic Aquicambids	Crop
S09AF006006	Farah City2, Farah	fine-silty, mixed, semiactive, hyperthermic Sodic Haplocambids	Crop
S09AF006007	Kohe Asya, Farah	coarse-loamy, mixed, active, hyperthermic Aquic Haplocalcids	Barren
S09AF006008	Karez Sofa, Farah	fine-loamy, mixed, semiactive, hyperthermic Typic Calciargids	Barren
S09AF015001	Sarkani1, Kunar	sandy-skeletal, mixed, thermic Xeric Haplocambids	Barren
S09AF015002	Sarkani2, Kunar	coarse-silty, mixed, active, thermic Oxyaquic Haploxerolls	Crop
S09AF015003	Marawara, Kunar	coarse-loamy, mixed, active, thermic Xeric Calciargids	Crop
S09AF015004	Mabogai, Kunar	coarse-loamy, micaeous, thermic Xeric Calciargids	Crop
S09AF015005	Watorpor, Kunar	fine-loamy, mixed, active, thermic Oxyaquic Haploxerolls	Crop
S09AF015006	Asadabad, Kunar	fine-loamy, mixed, active, thermic Aridic Argixerolls	Crop

Four of the pedons, S09AF006001, S09AF006002, S09AF006004, and S09AF006006, had pedogenic carbonate features, nodules and masses, and Bk horizons relatively deep in the

profile (Appendix A). The presence of these features deep in the soil and lack of a corresponding increase in carbonate content suggests they have formed by local redistribution of carbonates within a horizon rather than by movement of carbonates from overlying horizons. The depth to these Bk horizons is greater than the expected depth of leaching in the current arid environment. Because the pedogenic carbonates occurred deep in the profiles, they may be related to a paleosol formed during a time when these horizons were closer to the surface and were subsequently buried by alluvial and/or colluvial deposition. Lithologic discontinuities and buried soils are common in alluvial settings and were recognized in several pedons in this valley (Appendix A).

The two pedons outside the Farah Rud Valley, S09AF006007 and S09AF006008, had lower carbonate content than the pedons in the river valley (Tables 9 and 10) although both had Bk horizons with pedogenic carbonates (Appendix A). The lower carbonate content is assumed to be related to lower carbonate content in the alluvial/colluvial fan sediments in which these pedons developed. As was the case with the valley pedons, the pedogenic carbonate features appear to have formed by local carbonate redistribution rather than carbonate accumulation from overlying horizons. Six of the eight pedons sampled in the Farah Province had clay films in one or more subsoil horizons although only four of the six had the requisite clay increase to have an argillic horizon (Appendix A; Tables 3-10). The clay films indicate clay translocation has occurred. The depth at which the clay films occurred, however, is deeper than would be expected in the current arid climate. The clay films may be a product of local redistribution of clay within a horizon or alternatively, may have formed during a more pluvial paleoclimate. Relatively high Na concentrations in these soils (Tables 3-10) also may have enhanced clay dispersion and formation of the clay films.

Most of the pedons have loamy textured surface horizons (fine sandy loam, silt loam, silty clay loam, or loam) and estimated moderate infiltration rate. The exception is pedon S09AF006002 which has a gravelly loamy sand surface horizon texture and a high infiltration rate. A high proportion of the clay in the surface horizons is water dispersible (50 to 82% of the clay; Appendix C; Tables 3-10), however. The low organic C content of the surface horizons and high proportion of the clay that is dispersible in water suggest that aggregates would readily break down with raindrop impact, and the surface would be prone to formation of a surface crust. Surface crusting would reduce the infiltration rate, increase runoff and erosion, and may impede seedling emergence. Maintenance of residue on the soil surface is an effective and economical means of preventing crust formation and the detrimental effects associated with crusting.

Properties affecting plant production: All pedons in the Farah Province were calcareous in all horizons and water pH of all horizons was above 8.0 (Tables 3-10). Extractable P throughout each of the pedons sampled is low (Tables 3-10) and insufficient for maximum production of most agricultural crops. Additionally, high pH and high amounts of calcium carbonate in the soil would immobilize P and micronutrients and limit their plant availability (Lindsay, 1979). Thus, P fertilization is critical for maximum crop production because of low inherit P levels and moderately high fixation potential. Similarly, micronutrients may be fixed by carbonate

minerals and additions may be needed to maximize plant productivity. The high calcium carbonate levels also increase ammonia volatilization potential with use of urea or ammonium-N fertilizers. These N sources should be incorporated and kept moist until nitrification can occur (typically the first 2 to 3 days after application).

The cation exchange capacity (CEC) throughout all of the pedons is relatively low. Organic C contents are uniformly low (Tables 3-10) and thus, organic matter was not a major contributor to the CEC. Most of the CEC was from the phyllosilicate minerals in the clay separate which were dominantly mica and chlorite (Appendix C). The CEC is less than is typically found for soils with clays dominated by these minerals because of the dilution by calcite which was also a major component of the clays (Appendix C). Although the charge in these soils is relatively low, five of the seven pedons have sufficient CEC to retain positively charged nutrients without excessive leaching. Pedons S09AF006001 and S09AF006002 have CEC at pH7 of less than 7 cmol(+) kg⁻¹ within the upper 50 cm (FCC criteria for the e modifier).

With the exception of pedon S09AF006007, electrical conductivity of horizons sampled in the Farah Province was low, and the pedons were non- or slightly-saline (Tables 3-10). The exceptions to this statement were the 2Btn1 horizon from pedon S09AF006003 and the 2Bknq horizon of pedon S09AF006006 which had ECs of 5.31 and 4.38, respectively (Table 5 and 8). The EC of the surface horizons were similar to the subjacent horizons and did not suggest salt addition by poor quality irrigation water (Tables 3-8 and 10). Pedon S09AF006007 had extremely high EC in the upper two horizons. The high EC is attributed to salt concentration at the surface by evaporative pumping of salt laden shallow ground water instead of surface addition by irrigation water, however.

All pedons in the river valley had moderate or high Na contents with the exception of pedon S09AF006002 which had low Na (Tables 3-8). The Na content of these pedons is not exceptionally high and thus is not expected to be toxic to crops or other plants. The exchangeable sodium percentage (ESP) for one or more horizons in each pedon (pedon S09AF006002 is the exception) is greater than 4 cmol kg⁻¹, however, and may result in clay dispersion, structural degradation, and reduction in hydraulic conductivity (Northcote and Skene, 1972; McIntyre, 1979; Shainberg et al., 1989).

The two pedons outside the river valley, S09AF006007 and S09AF006008, had exceptionally high ESP that ranged from 50 to more than 10,000% (Tables 9 and 10). Associated Na contents may be toxic to crops and other plants, especially those sensitive to Na. It is assumed weathering of Na bearing minerals in the parent materials for these soils is the source of the Na in these soils although evaporative pumping appears to have resulted in Na redistribution from ground water and concentration at the surface in pedon S09AF006007 (Table 9).

Pedon S09AF006001

Classification: coarse-loamy over sandy or sandy skeletal, mixed over carbonatic, hyperthermic Typic Haplocambids

FCC designation: Lbd+e

This pedon is located about 7.3 km east of the Farah Rud River on a stream terrace that abuts an alluvial fan descending from peaks to the east of the site (Figs. 2, 6, 8, and 9). Slope at the site is about 1%. Parent material for the soil at this site was dominantly river alluvium. The increase in coarse fragment content at 53 cm, however, suggests that horizons below this depth may have had additions of colluvium from peaks to the east of the site. Alternatively, the parent material was entirely alluvium, and the coarse materials in which these horizons have developed were deposited during a period when the river channel was much nearer the site than its current location. Subsequent migration of the river resulted in deposition of sediments with lower coarse fragment content.



Figure 8. Oblique view of the landscape at the site of Pedon S09AF006001.



Figure 9. Pedon S09AF006001 profile and landscape. Photos by Ed Tallyn, Davis, CA.

Presence of an argillic and calcic horizon that developed in the sediments below 112 cm (Fig. 9) suggests the landscape was relatively stable for an extended period before the superjacent sediments were deposited. Weak development in the horizons above 112 cm, especially lack of carbonate redistribution to form pedogenic carbonate features, suggests the current period of soil development has been less than that during which the buried soil formed. The arid climate of the region would also limit soil development in the most recent sediments. The lack of evidence of redistribution of carbonates in the most recent sediments suggests the high amounts of carbonate minerals in these horizons were inherited from the parent materials which are assumed to be derived, at least partially, from limestone strata common in the watershed.

Horizon properties: The loamy textured Ap horizon indicates the infiltration rate for this soil is moderate. The soil's overall available water holding capacity (AWC) is relatively low (8 cm; Table 2) due to the sandy textures and high coarse fragment content below 53 cm (Table 3). Soil organic C is less than 0.75% in all horizons and has an irregular distribution through the upper three horizons (Table 3). The irregular depth distribution of organic C can be attributed to periodic sediment deposition and slow organic matter decomposition in the arid climate of the region.

Table 2. Available water holding capacity, maximum exchangeable Na percentage, and surface horizon and maximum electrical conductivity for the pedons sampled.

Pedon	Available Water		Maximum ESP		Electrical Conductivity	
	Holding Capacity cm water to 150 cm		ESP %	Depth cm	Surface Horizon dS m ⁻¹	Maximum dS m ⁻¹
<u>Farah</u>						
S09AF006001	8	10		112-200	<0.6	<0.6
S09AF006002	5	3		168-200	<0.6	<0.6
S09AF006003	16	25		49-67	0.9	5.3
S09AF006004	14	14		153-200	2.0	2.0
S09AF006005	20	14		14-49	1.6	1.6
S09AF006006	18	58		76-112	3.4	4.4
S09AF006007	N/A [†]	>400		0-11	194	194
S09AF006008	N/A	107		121-167	3.2	3.2
<u>Kunar</u>						
S09AF015001	N/A	6		0-20	0.3	0.3
S09AF015002	30	14		98-150	0.3	0.3
S09AF015003	23	5		0-20	0.9	0.9
S09AF015004	18 [‡]	2		116-142	<0.6	<0.6
S09AF015005	35 [‡]	6		0-7	0.7	0.7
S09AF015006	28	3		34-71	<0.6	0.8

[†] Water retention not measured because of high content of coarse fragments.

[‡] Lowest sampling depth was <150 cm; deepest horizon was extended to 150 cm to estimate WRD for the pedon.

Properties affecting plant production: Although the soil AWC is relatively low, AWC above 53 cm is medium which would potentially reduce frequency of irrigation needed for crop production. Bulk densities range from 1.55 to 1.87 Mg m⁻³ (Table 3) which, with exception of the deepest horizon (2Bt_{kb}), should not limit root growth nor water movement. The relatively high bulk density of the 2Bt_{kb} horizon, beginning at 112 cm, may limit root growth but because of the horizon's depth, should not be a major impediment to crop growth.

Table 3. Properties of Pedon S09AF006001.

Horizon	Depth	Particle Size Distribution										Coarse Frags.		
		Clay	Silt	Sand	Sand Separates					2-75	>2	Texture		
					VF	F	M	C	VC			mm	mm ⁺	Class
	cm	----- weight % -----										vol. %		
Ap	0	-	15	8.4	32.4	59.2	17.1	30.3	9.4	1.6	0.8	3	5	fsl
Bw1	15	-	31	12.1	45.6	42.3	12.7	20.0	5.5	2.2	1.9	5	3	I
Bw2	31	-	53	9.0	22.9	68.1	11.1	39.1	11.3	3.2	3.4	11	5	fsl
C1	53	-	68	3.6	5.1	91.3	9.2	53.8	15.4	4.9	8.0	24	40	vgrfs
C2	68	-	87	7.7	9.5	82.8	14.5	48.1	14.4	2.9	2.9	23	50	vgrlfs
C3	87	-	112	5.3	2.6	92.1	10.8	60.6	13.2	3.6	3.9	14	10	fs
2Bt knb	112	-	200	17.1	6.8	76.1	6.2	34.2	17.4	9.9	8.4	38	20	grfsl

† Volume estimates made in field at time of sampling.

Horizon	Depth	pH		Organic	Extractable Bases				CEC					
		CaCl ₂	H ₂ O		Ca [‡]	Mg	Na	K	Sum	pH 7	ESP	CaCO ₃		
		cm	%	----- cmol kg ⁻¹ -----										
Ap	0	-	15	7.8	8.4	0.41	40.7*	2.4	0.1	0.3	43.5	4.6	2.2	36
Bw1	15	-	31	7.9	8.5	0.29	41.8*	2.9	0.2	0.2	45.1	4.6	4.3	32
Bw2	31	-	53	8.0	8.6	0.73	42.2*	2.4	0.2	0.2	45.0	2.9	6.9	37
C1	53	-	68	8.1	8.7	0.02	39.7*	1.7	--	0.1	41.5	1.9	--	51
C2	68	-	87	8.1	8.8	0.00	42.7*	2.5	tr	0.1	45.3	2.4	--	48
C3	87	-	112	8.1	8.8	0.08	39.5*	1.8	0.1	0.1	41.5	1.9	5.3	50
2Bt knb	112	-	200	8.1	8.7	0.11	41.7*	3.2	0.4	0.3	45.6	4.1	9.8	50

† Organic C estimated from: % organic C = % total C – (% CaCO₃ * 0.12); values <0.00 assigned 0.00.

‡ May contain Ca from carbonate minerals or gypsum.

Horizon	Depth	Bulk Density				Water Retention				Phosphorus								
		Oven		33 kPa		COLE		33 kPa		1500 kPa		WRD [†]		EC		SAR	Olsen	Mehlich
		cm	Mg m ⁻³	Dry	---	Mg m ⁻³ ---	%	%	cm ³ cm ⁻³	ds m ⁻¹	----	mg kg ⁻¹ ----						
Ap	0	-	15	--	--	--	--	3.9	0.11	<0.60	--	1.7	11					
Bw1	15	-	31	1.53	1.55	0.004	14.1	4.7	0.14	1.02	3	1.5	9.1					
Bw2	31	-	53	1.63	1.66	0.006	11.2	3.9	0.11	<0.60	--	1.1	10.9					
C1	53	-	68	--	--	--	--	1.8	--	<0.60	--	0.8	0.2					
C2	68	-	87	1.58	1.60	0.004	6.2	3.6	0.03	<0.60	--	2.9	2.3					
C3	87	-	112	1.56	1.57	0.002	4.8	2.8	0.03	<0.60	--	0.4	0.2					
2Bt knb	112	-	200	1.81	1.87	0.008	7.5	6.8	0.01	0.79	4	0.4	1.2					

† Water retention difference.

The water pH ranges from 8.4 to 8.7, and the calcium carbonate equivalent (CCE) ranges from 36 to 50% in the pedon (Table 3). Extractable P throughout the profile is much lower than is needed for most agricultural crops. The high amounts of calcium carbonate in the soil would immobilize P and micronutrients and limit their plant availability. Thus, P fertilization is critical for optimum production because of low inherit P levels and moderately high fixation potential. Similarly, micronutrient additions may also be needed to maximize plant productivity. The CEC is relatively low to 53 cm and cations are subject to leaching if irrigation amounts are excessive.

Magnesium levels are marginally low and should be monitored. Salinity and Na content are low, and neither would be expected to limit plant growth. Electrical conductivity (EC) was 1 ds m⁻¹ or less in all horizons, and maximum exchangeable Na percentage (ESP), 9.8%, occurred in the 2Btcb horizon below 112 cm.

Pedon S09AF006002

Classification: loamy-skeletal, carbonatic, hyperthermic Typic Haplargids

FCC designation: S'S"bd+e



Figure 10. Oblique view of the landscape at the site of Pedon S09AF006002.

This pedon is located about 750 m east-northeast of Pedon S09AF006001 and about 7.4 km east of the Farah Rud River (Figs. 2, 6, 10, and 11). In contrast to a stream terrace position for Pedon S09AF006001, however, the landform for this soil is a fan apron. This site was chosen to evaluate potential for expansion of cropland by evaluating potential limitations, other than water, to crop production. In general, the properties of the soil at this site were similar to those for Pedon S09AF006001 and suggest that the parent materials were also similar, i.e. stream alluvium mixed with colluvium from peaks to the east. As was observed in Pedon S09AF006001, the soil has argillic and calcic horizons below 87 cm that have been buried by more recent sediment deposition (Fig. 11). The upper 87 cm of the pedon has only weak pedogenic development suggesting that the materials have been in place for a shorter period than the more developed horizons below 87 cm. More pluvial conditions during the period that the horizons below 87 cm were nearer the surface also may have contributed to the greater development of these horizons.

Horizon properties: Horizons above 87 cm had sand or loamy sand textures, and horizons below 87 cm had more clayey and loamy textures. All horizons from 11 to 168 cm had >40% coarse fragments (Appendix A). As was the case in Pedon S09AF006001, the deepest horizon (2Btk3; 168 to 200 cm) had appreciably fewer coarse fragments than the immediately superjacent horizons. The similar morphology of Pedons S09AF006001 and S09AF006002 suggests the soils



Table 4. Properties of Pedon S09AF006002.

Horizon	Depth	Particle Size Distribution										Coarse Frags. mm mm [†]	Texture Class		
		Clay	Silt	Sand	Sand Separates										
					VF	F	M	C	VC						
	cm				weight %							vol. %			
A1	0	-	11	5.0	17.3	77.7	5.0	12.3	19.5	30.9	13.5	47	25	grls	
A2	11	-	31	4.6	19.3	76.1	3.4	15.9	15.6	36.4	16.1	20	41	vgrlfs	
Bw1	31	-	59	5.8	8.2	86.0	3.4	4.8	5.6	32.3	21.3	46	70	exgrlcos	
Bw2	59	-	87	8.8	4.0	87.2	1.9	2.1	3.7	36.3	20.7	62	80	exgrlcos	
Btk1	87	-	134	19.9	6.4	73.7	3.4	3.0	10.0	32.6	17.0	61	60	vgrfsl	
Btk2	134	-	168	11.9	5.2	82.9	2.9	2.3	2.7	35.5	30.1	62	45	vgrls	
2Btk3	168	-	200	26.4	18.5	55.1	15.8	2.7	4.2	18.6	14.5	33	5	scl	

[†] Volume estimates made in field at time of sampling.

Horizon	Depth	pH		Organic C [†]	Extractable Bases				CEC pH 7	ESP	CaCO ₃			
		CaCl ₂	H ₂ O		Ca [‡]	Mg	Na	K						
	cm			%	cmol kg ⁻¹									
A1	0	-	11	7.9	8.5	0.10	39.3*	0.9	--	0.2	40.4	2.4	--	49
A2	11	-	31	8.0	8.5	0.03	37.5*	1.0	--	0.2	38.7	3.0	--	44
Bw1	31	-	59	8.0	8.6	0.00	39.1*	1.0	--	0.2	40.3	1.9	--	51
Bw2	59	-	87	8.0	8.6	0.00	39.7*	1.2	--	0.2	41.1	2.9	--	52
Btk1	87	-	134	7.9	8.5	0.00	39.9*	1.9	0.1	0.3	42.2	4.6	2.2	47
Btk2	134	-	168	7.9	8.5	0.07	38.7*	1.6	tr	0.2	40.5	2.9	--	52
2Btk3	168	-	200	8.2	8.5	0.00	39.3*	2.2	0.1	0.3	41.9	3.8	2.6	55

[†] Organic C estimated from: % organic C = % total C - (% CaCO₃ * 0.12); values <0.00 assigned 0.00.

[‡] May contain Ca from carbonate minerals or gypsum.

Horizon	Depth	Bulk Density		Oven Dry	Water Retention				EC	SAR	Phosphorus		
		33 kPa	33 kPa		COLE	33 kPa	1500 kPa	WRD [†]			Olsen	Mehlich	
		cm	---	Mg m ⁻³	%	%	cm ³ cm ⁻³	ds m ⁻¹			mg kg ⁻¹	----	
A1	0	-	11	--	--	--	2.9	--	<0.60	--	4.1	2.4	
A2	11	-	31	1.47	1.48	0.002	6.1	2.7	0.04	<0.60	--	2.2	
Bw1	31	-	59	--	--	--	2.7	--	<0.60	--	1.3	4	
Bw2	59	-	87	1.7	1.74	0.004	6.5	3.5	0.02	<0.60	--	1.1	0.1
Btk1	87	-	134	1.49	1.59	0.011	16.2	8.3	0.06	<0.60	--	0.8	0.2
Btk2	134	-	168	1.66	1.73	0.007	12.1	6.1	0.05	<0.60	--	0.6	0.5
2Btk3	168	-	200	1.44	1.55	0.019	21.9	13.5	0.1	<0.60	--	0.6	--

[†] Water retention difference.

have developed along a similar pathway as would be expected because of the close proximity of the two pedons. Organic C is <0.10% throughout the profile and has an irregular distribution similar to that observed in Pedon S09AF006001 (Table 4).

Properties affecting plant production: The sandy textures and high coarse fragment contents severely limit the soil's water holding capacity (5 cm; Table 2). If the site is irrigated, timing and amount would require careful management. No physical impediment to root growth was observed, and bulk density of all horizons suggest root growth would not be limited.

Chemically, this pedon is similar to Pedon S09AF006001. The pH and CCE were high which enhance P and micronutrient fixation and limits availability of these essential nutrients (Table 4). This pedon, like Pedon S09AF006001, also has a low CEC and there is an elevated risk of cation leaching if irrigated. Electrical conductivity and ESP have maxima of $<0.6 \text{ ds m}^{-1}$ and 2.6%, respectively, and are not expected to limit crop production.

Pedon S09AF006003

Classification: coarse-loamy, mixed, semiactive, hyperthermic Typic Haplargids

FCC designation: Lbd+s-n

This pedon is located 4.4 km southeast of the Farah Rud River and lies on a stream terrace about half way between the stream channel to the west and an alluvial fan to the east (Figs. 2, 6, 12, and 13). The lower coarse fragment content of this soil as compared to Pedons S09AF006001 and S09AF006002 (Tables 3, 4, and 5) reflects the distance from the alluvial fan from peaks to the east and the minor contribution of the colluvium to the parent materials. The deepest horizon observed (2C horizon; 141 to 200 cm; Fig. 13) had about 70% coarse fragments, however, which may reflect early contribution of colluvium from the peaks to the east or closer proximity to the stream channel at the time the materials were deposited.

Horizons between 49 and 141 cm had clay films (Appendix A), but the clay increase between the Bw and 2Bt1 horizons was insufficient for these horizons to meet argillic horizon criteria. A change in parent material at 49 cm, however, was identified morphologically (Appendix A) and was supported by clay-free sand and silt separate distribution (Fig. 14) (Kellogg, 1962). For pedons with a parent material discontinuity, a clay increase between eluvial and illuvial horizons is not required for the illuvial horizons to be considered an argillic horizon (Soil Survey Staff, 2014b). The low sand and coarse fragment content and high silt content of the upper two horizons (Table 5) suggest these horizons may be developed in loess common in the alluvial valley (Lidke, 2005).

Horizon properties: CCE was relatively high throughout the profile (Table 5), but pedogenic carbonates were not identified in any horizon. The uniform abundance of carbonates in all horizons is assumed to be inherited from the parent sediments and limestone deposits common in the watershed. The presence of clay films in the 2Bt horizons suggests the soil has undergone sufficient development for carbonate redistribution and formation of a calcic horizon. It is possible that the argillic horizon formed during a more pluvial period, and the



Figure 12. Oblique view of the landscape at the site of Pedon S09AF006003.

carbonates were subsequently added to the soil in dust, through wet infall of Ca, or through Ca additions from throughflow of water from upslope sources. Any of these mechanisms of carbonate addition, however, would be expected to result in one or more horizons in which carbonates had accumulated during soil development. Soil organic C is less than 0.50% in all horizons (Table 5).

Properties affecting plant production: The Ap horizon has silt loam texture and is interpreted to have a moderate infiltration rate. Surface crusting would reduce the infiltration rate, and silty soils are often prone to crust formation if the soil is bare during rainfall events. Organic C in the surface horizon is relatively low (0.50%; Table 5) which would enhance propensity for crust formation.

Bulk density was <1.7 Mg m⁻³ in all horizons (Table 5). Thus, root growth would not be limited, and no other impediment to root proliferation was observed in the profile. The soil's water holding capacity is 16 cm in the upper 150 cm of the profile (Table 2). This soil's ability to retain water is attributed to its silty textures and low amounts of coarse fragments.



Figure 13. Pedon S09AF006003 profile and landscape. Photos by Ed Tallyn, Davis, CA.

The water pH ranges from 8.4 to 8.9, and the CCE ranges from 27 to 34% (Table 5). The high amounts of calcium carbonate in the soil would immobilize P and micronutrients and limit their plant availability. Moderately high fixation potential and low inherit P amounts (Table 5) indicates that P fertilization is critical for maximum crop production. Similarly, micronutrient additions also may be needed to maximize plant productivity.

Electrical conductivity (EC) is relatively low in the Ap horizon but increases in subjacent horizons and reaches saline levels (5.31 ds m^{-1}) in the 2Bt1 horizon (49 to 67 cm) (Table 5). EC decreases in deeper horizons. The maximum EC in the 2Bt1 horizon may be due to addition of salts with irrigation water that have been subsequently leached below the surface horizon. The salinity in the 2Bt1 horizon may not limit crop growth due to its depth.

Table 5. Properties of Pedon S09AF006003.

Horizon	Depth	Particle Size Distribution											Texture Class	
		Clay	Silt	Sand	Sand Separates					2-75 mm	>2 mm [†]			
					VF	F	M	C	VC					
	cm				weight %							vol. %		
Ap	0	-	18	21.1	68.4	10.5	6.9	2.3	0.7	0.2	0.4	2	-- sil	
Bn	18	-	49	24.3	59.5	16.2	7.9	4.9	1.9	0.8	0.7	9	10 sil	
2Bn1	49	-	67	21.7	48.4	29.9	12.0	9.5	4.5	1.9	2.0	44	30 grl	
2Bn2	67	-	114	11.5	18.4	70.1	17.6	33.9	11.9	3.7	3.0	3	6 fsl	
2Bn3	114	-	141	22.8	35.0	42.2	14.4	14.2	7.5	2.0	4.1	50	40 vgrl	
2Cn	141	-	200	8.5	22.0	69.5	12.5	21.6	20.2	7.7	7.5	64	70 exgrsl	

† Volume estimates made in field at time of sampling.

Horizon	Depth	pH		Organic C [†]	Extractable Bases					CEC				
		CaCl ₂	H ₂ O		Ca [‡]	Mg	Na	K	Sum	pH 7	ESP	CaCO ₃		
		cm			%	cmol kg ⁻¹					%	%		
Ap	0	-	18	7.9	8.4	0.50	119.4*	6.4	0.2	0.4	126.4	8.8	2.3	27
Bn	18	-	49	8.0	8.4	0.31	42.7*	6.3	1.3	0.3	50.6	7.9	16.5	29
2Bn1	49	-	67	8.1	8.3	0.08	42.7*	6.5	1.6	0.2	51.0	6.4	25.0	32
2Bn2	67	-	114	8.2	8.6	0.17	36.9*	5.6	1.3	0.2	44.0	5.7	22.8	31
2Bn3	114	-	141	8.3	8.9	0.07	41.1*	7.0	1.2	0.2	49.5	4.8	25.0	34
2Cn	141	-	200	8.2	8.8	0.03	38.3*	6.4	0.7	0.1	45.5	3.9	17.9	33

† Organic C estimated from: % organic C = % total C - (% CaCO₃ * 0.12); values <0.00 assigned 0.00.

‡ May contain Ca from carbonate minerals or gypsum.

Horizon	Depth	Bulk Density											Phosphorus Olsen	Phosphorus Mehlich		
		Oven		Water Retention												
		33 kPa	Dry	COLE	33 kPa	1500 kPa	WRD [†]	EC	SAR	ds m ⁻¹	mg kg ⁻¹					
	cm	---- Mg m ⁻³ ---			%	%	cm ³ cm ⁻³	ds m ⁻¹								
Ap	0	-	18	1.38	1.43	0.012	22.4	8.9	0.18	0.94	2	2.5	0.9			
Bn	18	-	49	1.43	1.48	0.011	20.8	9.4	0.16	2.86	4	0.8	0.5			
2Bn1	49	-	67	1.39	1.46	0.012	20.7	8.7	0.12	5.31	5	1.1	0.4			
2Bn2	67	-	114	1.56	1.62	0.012	16.9	8.4	0.13	2.28	7	0.7	0.2			
2Bn3	114	-	141	1.62	1.69	0.009	11	10.1	0.01	1.74	7	0.8	0.4			
2Cn	141	-	200	--	--	--	--	--	--	1.54	5	1.2	0.8			

† Water retention difference.

The ESP of all horizons below 18 cm was greater than 16% (Table 5). The SAR, however, does not exceed 7 in any horizon. Unless a plant species was sensitive to high Na levels, the ESP is not expected to limit crop growth. High ESP can result in clay dispersion and degradation of soil physical properties, especially hydraulic conductivity. The relatively high EC in these horizons is expected to result in a relatively high ionic strength in the soil solution which would enhance flocculation of the clays and help maintain structure, aggregation, and other physical properties (Shainberg et al., 1989). Clay dispersion and physical property degradation may occur, however, if the soil is irrigated with water with low EC (ionic strength).

S09AF006004

Classification: fine-silty, mixed, semiactive, hyperthermic Typic Calciargids

FCC designation: LCbd+n-

This pedon is located 2.7 km southeast of the Farah Rud River on a stream terrace (Figs. 2, 6, 15, and 16). This soil has less than 1% coarse fragments and less than 25% sand in all horizons (Table 6). The silty textures of horizons in this pedon suggest the parent material is loess that has been identified in the alluvial valley of the Farah Rud River (Lidke, 2005). Alternately, the parent material may be silty alluvium that may or may not be reworked loess. Sand and silt separate distribution suggests this soil is developed in a texturally uniform parent material (Table 6).

Horizons below 29 cm (Bt1 horizon) had abundant clay films (Appendix A), and there was an appreciable clay increase at the upper boundary of the Bt1 horizon (Table 6; Fig. 16). Thus, the soil is interpreted as having an argillic horizon. The presence of an argillic horizon suggests the surface on which this pedon is located has been stable for an extended period with limited additions of new sediments. The loess in the alluvial valley was identified as late Pleistocene (Lidke, 2005). The argillic horizon in this soil would agree with a late Pleistocene surface age.

Horizon properties: The Ap horizon has silt loam texture and a moderate infiltration rate. As discussed above, soils with silt loam texture are prone to form surface crusts under raindrop impact (bare surface). Organic C is less than 0.55% in all horizons (Table 6), and low organic C in

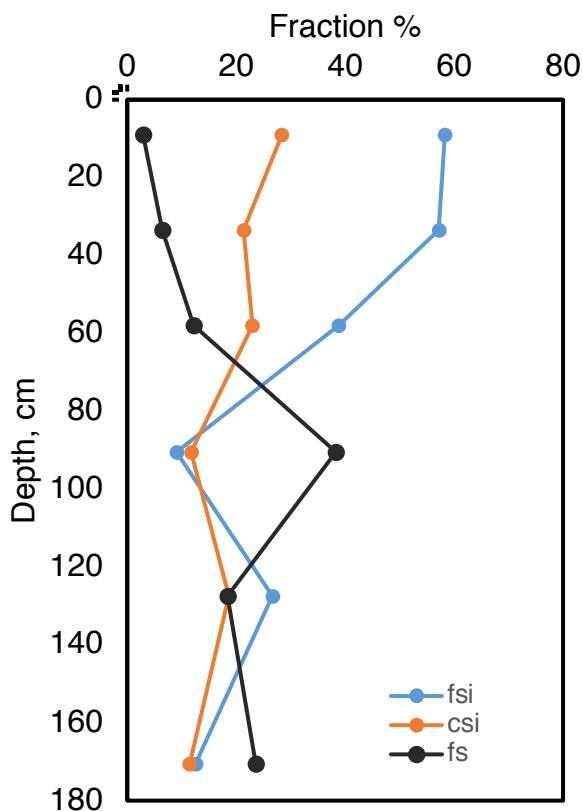


Figure 14. Depth distribution of clay-free particle size separates for Pedon S2009AF006003.

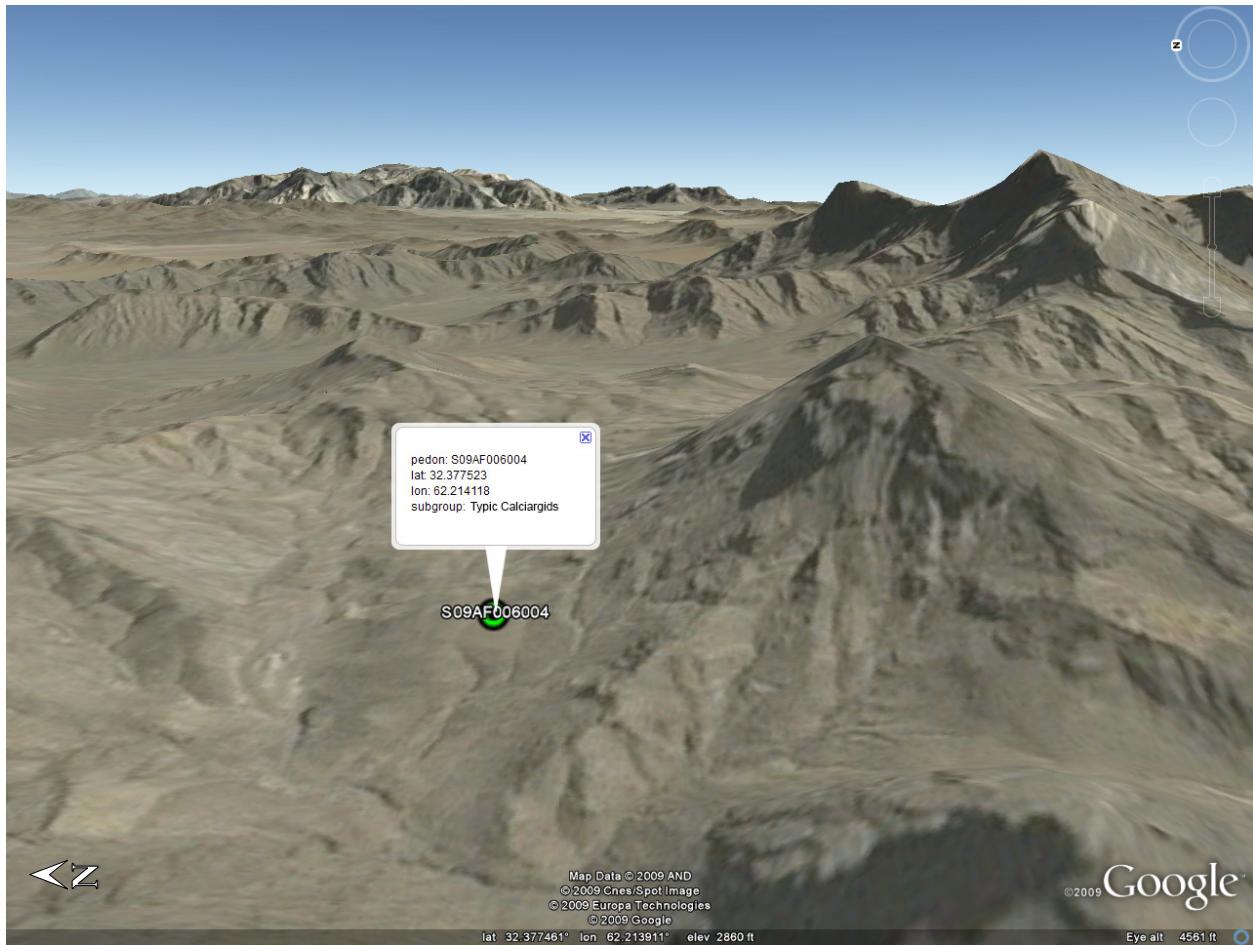


Figure 15. Oblique view of the landscape at the site of Pedon S09AF006004.

the surface horizon which would limit aggregation and enhance propensity for crust formation. Additionally, ESP in the surface horizon is 8.3% (Table 6) which may enhance clay dispersion, aggregation breakdown, and crust formation. The electrical conductivity of the surface horizon, however, is 1.98 ds m^{-1} , and the soil solution ionic strength would encourage flocculation of clay and aggregate formation which would tend to limit surface crust formation (Shainberg et al., 1989). Without evaluation of crusting propensity of these soils, it is unclear if the soils will form crusts under raindrop impact. Maintaining residue cover on the soil surface, however, will limit surface crusting, help maintain infiltration rates, and reduce soil erosion.

The CCE was relatively uniform throughout the profile (Table 6). The Btk1 horizon had about 6% carbonate nodules and masses and thus, met requirements for a calcic horizon. The depth of the identifiable pedogenic carbonates in this arid environment suggests the pedogenic carbonates may have formed by dissolution and reprecipitation within the horizon instead of translocation from overlying horizons.



Figure 16. Pedon S09AF006004 profile and landscape. Photos by Ed Tallyn, Davis, CA.

Properties affecting plant production: Bulk density in all horizons of this pedon was $<1.7 \text{ Mg m}^{-3}$ and would not be expected to limit root growth (Table 6). Water holding capacity for the upper 150 cm is about 14 cm which is typical for soils with silt loam and silty clay loam textured horizons (Table 2).

The water pH ranges from 8.2 to 8.7, and the CCE ranged from 27 to 38%. The CCE was relatively uniform among the horizons (Table 6). As was the case with other pedons in this valley, the high amounts of calcium carbonate in the soil would immobilize P and micronutrients and limit their plant availability. Moderately high fixation potential and low inherit P amounts (Table 6) indicates that P fertilization is critical for maximum crop production. Similarly, micronutrient additions may also be needed to maximize plant productivity.

Electrical conductivity is about 1.9 ds m^{-1} in the surface horizon and is less than 1.0 ds m^{-1} in deeper horizons (Table 6). These levels of salinity should not limit crop production although the highest EC in the surface horizon suggests salts may have been added with irrigation water. Increased salinity from continued salt additions may become a limitation for agricultural production and should be monitored.

Table 6. Properties of Pedon S09AF006004.

Horizon	Depth	Particle Size Distribution											Texture Class	
		Clay	Silt	Sand	Sand Separates					2-75 mm	>2 mm [†]			
					VF	F	M	C	VC					
	cm				weight %							vol. %		
Ap	0	-	12	22.7	63.8	13.5	10.8	2.4	0.2	tr	0.1	tr	1 sil	
Bk	12	-	29	25.6	61.1	13.3	9.8	2.8	0.6	0.1	tr	--	1 sil	
Bt1	29	-	57	35.6	56.2	8.2	5.9	1.8	0.3	0.1	0.1	tr	1 sicl	
Bt2	57	-	122	29.6	54.7	15.7	10.1	5.2	0.2	0.1	0.1	1	1 sicl	
Btkn1	122	-	153	21.3	56.7	22.0	16.9	4.3	0.6	0.1	0.1	1	1 sil	
Btkn2	153	-	200	19.7	57.7	22.6	14.7	6.7	1.1	0.1	tr	tr	1 sil	

† Volume estimates made in field at time of sampling.

Horizon	Depth	pH		C [†] %	Extractable Bases					CEC				
		CaCl ₂	H ₂ O		Ca [‡]	Mg	Na	K	Sum	pH 7	ESP	CaCO ₃		
		cm				cmol kg ⁻¹					%	%		
Ap	0	-	12	7.9	8.2	0.48	43.7*	5.7	0.6	0.5	50.5	7.2	8.3	29
Bw	12	-	29	8.0	8.6	0.52	46.5*	5.7	0.5	0.4	53.1	7.7	6.5	28
Bt1	29	-	57	8.1	8.6	0.3	44.9*	6.9	0.5	0.6	52.9	9.0	5.6	27
Bt2	57	-	122	8.0	8.7	0.29	42.5*	6.2	0.5	0.7	49.9	7.4	6.8	30
Btkn1	122	-	153	8.0	8.7	0.16	37.7*	5.5	0.6	0.8	44.6	5.1	11.8	36
Btkn2	153	-	200	8.1	8.7	0.00	39.4*	6.8	0.7	0.8	47.7	5.0	14.0	38

† Organic C estimated from: % organic C = % total C - (% CaCO₃ * 0.12); values <0.00 assigned 0.00.

‡ May contain Ca from carbonate minerals or gypsum.

Horizon	Depth	Bulk Density											Phosphorus Olsen Mehlich
		Oven		Water Retention									
		33 kPa	Dry	COLE	33 kPa	1500 kPa	WRD [†]	EC	SAR	ds m ⁻¹	mg kg ⁻¹		
	cm	---- Mg m ⁻³ ---			%	%	cm ³ cm ⁻³	ds m ⁻¹		---- mg kg ⁻¹ ----			
Ap	0	-	12	1.46	1.52	0.013	18.8	9.8	0.13	1.98	2	3.6	2.7
Bk	12	-	29	1.56	1.61	0.011	17.8	10.1	0.12	0.64	2	2.1	2.7
Bt1	29	-	57	1.55	1.62	0.015	18.6	13.9	0.07	0.59	2	2.8	1.8
Bt2	57	-	122	1.57	1.65	0.017	17.8	11.6	0.10	0.63	3	2.8	3.0
Btkn1	122	-	153	1.65	1.7	0.01	14.9	9.4	0.09	0.72	5	0.9	0.4
Btkn2	153	-	200	1.61	1.67	0.012	15.8	9.2	0.11	0.95	5	0.7	0.3

† Water retention difference.

The ESP ranges from about 6 to 14%. These levels are lower than critical levels recognized in Soil Taxonomy. They are sufficient, however, to potentially result in degradation of soil physical properties and reduction of hydraulic conductivity (Northcote and Skene, 1972; McIntyre, 1979). The low EC and associated low solution ionic strength in this soil would not mitigate the effects of Na on clay dispersion and associated degradation of hydraulic conductivity.

S09AF006005

Classification: fine, mixed, semiactive, hyperthermic Fluventic Aquicambids

FCC designation: Cbd+n-

This pedon is located about 2 km southeast of the Farah Rud River on a stream terrace (Figs. 2, 6, 17, and 18). This soil has less than 1% coarse fragments and less than 7% sand in all horizons (Table 7; Fig. 19). As was discussed for the nearby pedon S09AF006004, the silty textures of horizons in this pedon suggest the parent material is loess. Sand and silt separate distribution suggests this soil is developed in a texturally uniform parent material (Fig. 19).



Figure 17. Oblique view of the landscape at the site of Pedon S09AF006005.



Figure 18. Pedon S09AF006005 profile and landscape. Photos by Ed Tallyn, Davis, CA.

Horizons below the Ap horizon (14 cm) had clay films (Appendix A), and there was an appreciable clay increase between the Ap and Bt1 horizons (Table 7). Thus, the soil has an argillic horizon and the geomorphic surface on which this pedon is located has been stable for a substantial period with limited addition of sediment.

The CCE was relatively uniform in all horizons although there was a slight increase between the Bt1 and Bt2 horizons (Table 7). No pedogenic carbonates, however, were identified in any horizon, and calcic horizon criteria were not met. The uniform carbonate distribution and lack of pedogenic carbonate features suggest the soil is weakly developed. The argillic horizon, however, suggests more advanced soil development. The argillic horizon may have formed during an earlier more pluvial climate with carbonate addition in a more arid climate. The uniform carbonate distribution suggests, however, that the carbonates were deposited with the alluvial parent material and redistribution has not been sufficient to form a calcic horizon.

Horizon properties: This pedon had redoximorphic features and colors with chroma ≤ 2 that suggest seasonal saturation (Appendix A). Common redox concentrations occurred between 49 and 99 cm, and horizons below 99 cm had a matrix color with chroma ≤ 2 . It is assumed the alluvial aquifer is deeper than 2 m, and landscape features did not suggest that water ponded at the soil surface. Thus, the seasonal saturation that resulted in formation of redox features in this soil is related either to seasonal ground water from throughflow from upslope sources coming near the surface during the rainy season or alternately, to slow movement of water

through the clayey Bt horizons allowing development of reducing conditions and redoximorphic features.

Organic matter in the surface horizon is about 0.8% and remains relatively high to 49 cm (Table 7). The ESP ranged from 12.9 to 14.0 throughout the Bt horizons which may be high enough to result in clay dispersion which would reduce the rate of water movement through the soil. Low hydraulic conductivity may have contributed to saturation and reduction to form redox features in these horizons.

The water pH ranges from 8.6 to 8.8, and the CCE ranged from 27 to 38% (Table 7). Similar to other pedons in the alluvial valley, the CCE was relatively uniform among the horizons (Table 7), and carbonate redistribution was insufficient to recognize a calcic horizon. Bulk density in all horizons of this pedon was $<1.7 \text{ Mg m}^{-3}$ and would not be expected to limit root growth (Table 5). Water holding capacity for the upper 150 cm is about 20 cm (Table 2).

Properties affecting plant production: The Ap horizon has a silty clay loam texture and a moderately low infiltration rate. Although this soil is subject to surface crusting if bare during rainfall events, the high clay content of the surface horizon (39%; Table 7) may reduce the tendency of this soil to form a crust. The Ap horizon had an ESP of 12.7% which would promote clay dispersion, aggregate breakdown, and crust formation. The EC in this horizon, however, was 1.6 ds m^{-1} , and the ionic strength of the soil solution would enhance flocculation of the clays and mitigate the effect of the high ESP.

The high amounts of calcium carbonate in the soil would immobilize P and micronutrients and limit their plant availability. Moderately high fixation potential and low inherit P amounts (Table 7) indicates that P fertilization is critical for maximum crop production. Similarly, micronutrient additions may also be needed to maximize plant productivity.

Electrical conductivity was about 1.6 ds m^{-1} in the surface horizon and was greater than 1.0 ds m^{-1} to a depth of 140 cm (Table 7). Although the EC was higher than was observed in other pedons, these levels of salinity should not limit crop production and do not suggest the soil has

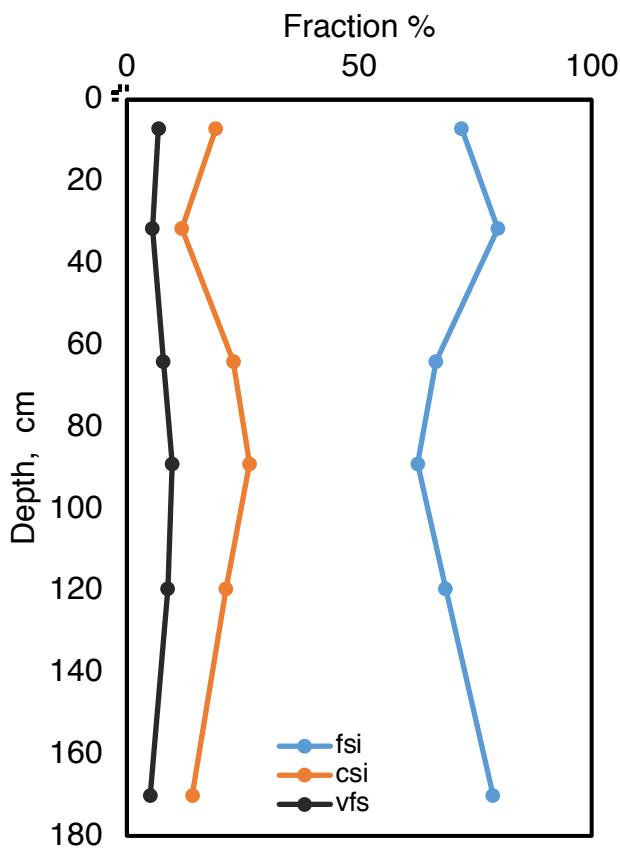


Figure 19. Depth distribution of clay-free particle size separates for Pedon S2009AF006005.

been degraded by irrigation with poor quality water. Irrigation water quality should be routinely monitored, however.

Table 7. Properties of Pedon S09AF006005.

Horizon	Depth	Particle Size Distribution										Texture Class	
		Clay	Silt	Sand	Sand Separates					2-75 mm	>2 mm [†]		
					VF	F	M	C	VC				
	cm				weight %							vol. %	
Anp	0	-	14	39.4	55.2	5.4	4.1	0.7	0.4	0.1	0.1	tr	sicl
Btn1	14	-	49	45.1	50.3	4.6	3	1.1	0.4	0.1	--	tr	sic
Btn2	49	-	79	42.4	51.5	6.1	4.5	1.2	0.3	0.1	tr	tr	6 sic
Btng	79	-	99	40.5	52.9	6.6	5.8	0.6	0.1	0.1	--	--	1 sic
Bg1	99	-	140	41.9	52.2	5.9	5.1	0.5	0.2	0.1	tr	tr	1 sic
Bg2	140	-	200	40.3	55.4	4.3	3	0.9	0.3	0.1	--	8	1 sic

[†] Volume estimates made in field at time of sampling.

Horizon	Depth	pH		Organic C [†]	Extractable Bases				CEC					
		CaCl ₂	H ₂ O		Ca [‡]	Mg	Na	K	Sum	pH 7	ESP	CaCO ₃		
		cm	%		cmol kg ⁻¹					%	%			
Anp	0	-	14	8.2	8.6	0.78	47.6*	11.4	1.6	0.5	61.1	12.6	12.7	27
Btn1	14	-	49	8.2	8.6	0.71	48.3*	13.1	1.8	0.6	63.8	12.9	14.0	26
Btn2	49	-	79	8.3	8.6	0.32	45.1*	13.8	1.4	0.8	61.1	11.3	12.4	31
Btng	79	-	99	8.3	8.7	0.10	43.3*	17.3	1.1	0.9	62.6	8.5	12.9	32
Bg1	99	-	140	8.3	8.8	0.28	40.4*	18.2	1.0	1.0	60.6	10.2	9.8	33
Bg2	140	-	200	8.2	8.7	0.19	40.5*	13.8	0.8	1.0	56.1	9.8	8.2	34

*Organic C estimated from: % organic C = % total C - (% CaCO₃ * 0.12); values <0.00 assigned 0.00.

[†]May contain Ca from carbonate minerals or gypsum.

Horizon	Depth	Bulk Density										Phosphorus Olsen	Phosphorus Mehlich	
		Oven		Water Retention						EC	SAR			
		33 kPa	Dry	COLE	33 kPa	1500 kPa	WRD [†]	cm ³ cm ⁻³	ds m ⁻¹		mg kg ⁻¹			
	cm	---- Mg m ⁻³ ---			%	%								
Anp	0	-	14	1.37	1.5	0.031	25.7	17.9	0.11	1.57	4	5.9	6.8	
Btn1	14	-	49	1.49	1.61	0.026	23.7	17.2	0.10	1.40	5	9.6	13.1	
Btn2	49	-	79	1.53	1.65	0.025	22.2	15.9	0.10	1.47	4	12.8	5.0	
Btng	79	-	99	1.61	1.70	0.018	20.5	15.8	0.08	1.26	4	11.1	4.8	
Bg1	99	-	140	1.47	1.59	0.026	26.2	10.0	0.24	1.01	3	5.7	0.1	
Bg2	140	-	200	1.53	1.63	0.02	24.3	15.8	0.12	0.86	3	3.9	--	

[†] Water retention difference.

S09AF006006

Classification: fine-silty, mixed, semiactive, hyperthermic Sodic Haplocambids

FCC designation: Lbd+n-s-

This pedon is about 0.5 km from the Farah Rud River, and is the closest pedon to the river channel (Figs. 2, 6, 20 and 21). The pedon has silty textures and low sand content between 12 and 167 cm suggesting the parent material for these horizons may be loess or was influenced by loess. The surface horizon has higher sand than subjacent horizons and both morphology (Appendix A) and clay-free particle size distribution (Fig. 22) suggest a lithologic discontinuity at the base of the Bw1 horizon (32 cm). The deepest horizon, 2Bkq, also has higher sand content than overlying horizons suggested this horizon may have developed in sandier alluvial deposits. Alternately, the parent materials may simply be alluvial sediments of varying texture.

Horizon properties: Although there is a clay increase at the surface of the Bw horizon, no clay films were present in the pedon, and the differences in clay content among the horizons are assumed to be depositional. A few pedogenic carbonate masses were present in the 2Bkn1 and



Figure 20. Oblique view of the landscape at the site of Pedon S09AF006006.



Figure 21. Pedon S09AF006006 profile and landscape. Photos by Ed Tallyn, Davis, CA.

2Bkn2 horizons and the 2Bknq horizon (Appendix A), but the quantity was insufficient to qualify these horizons as calcic horizons. The spherical durinodes in the 2Bknq horizon (Appendix A) were assumed to have developed elsewhere in the watershed and transported to the site as part of alluvial sediments.

Properties affecting plant production: The Anp horizon has a silt loam texture and a moderate infiltration rate. As with other soils in this valley, this soil is subject to surface crusting if the surface is bare during rainfall events. The ESP in the Anp horizon was 22.9% which would promote clay dispersion, aggregate breakdown, and crust formation (Table 8). The EC in the surface horizon was higher than other pedons in the valley (3.41 ds m^{-1}) which would be expected to induce high soil solution ionic strength and would potentially mitigate clay dispersion, aggregate breakdown, and surface crust formation. Crusting characteristics of this and other pedons in this alluvial valley cannot be ascertained with certainty without additional evaluations of surface crusting dynamics. As a precaution, residue should be maintained on the surface to limit crust formation, potential reduction in infiltration rates, and impediment of seedling emergence. Salinity and sodium levels in irrigation water and the soil should be monitored routinely.

The pH in water ranges from 8.1 to 8.6, and the CCE ranged from 26 to 34% (Table 8). The CCE was relatively uniform among the horizons. Similar to other pedons sampled in this river valley, high amounts of calcium carbonate would be expected to immobilize P and micronutrients and

Table 8. Properties of Pedon S09AF006006.

Horizon	Depth	Particle Size Distribution											Texture Class	
		Clay	Silt	Sand	Sand Separates					2-75 mm	>2 mm [†]			
					VF	F	M	C	VC					
	cm				weight %							vol. %		
Anp	0	-	12	11.3	52.5	36.2	26.5	9.2	0.4	0.1	tr	--	-- sil	
Bwn1	12	-	32	19.4	61.9	18.7	16.8	1.8	0.1	tr	--	--	-- sil	
2Bwn2	32	-	76	24.3	62.9	12.8	11.5	1.1	0.2	tr	--	1	-- sil	
2Bkn1	76	-	112	22.6	60.7	16.7	13.4	2.8	0.4	0.1	tr	1	-- sil	
2Bkn2	112	-	167	17.9	64.1	18.0	13.5	3.6	0.5	0.3	0.1	1	-- sil	
2Bknq	167	-	200	13.3	59.6	27.1	18.3	7.7	0.7	0.4	tr	--	-- sil	

† Volume estimates made in field at time of sampling.

Horizon	Depth	pH		Organic C [†]	Extractable Bases					CEC			
		CaCl ₂	H ₂ O		Ca [‡]	Mg	Na	K	Sum	pH 7	ESP	CaCO ₃	
		cm		%	cmol kg ⁻¹						%	%	
Anp	0	-	12	8.1	8.4	0.18	45.8*	5.5	1.1	0.4	52.8	4.8	22.9 31
Bw1	12	-	32	8.0	8.1	0.05	71.3*	5.1	1.2	0.5	78.1	6.1	19.7 26
2Bn	32	-	76	8.1	8.2	0.17	44.7*	9.3	1.7	0.7	56.4	7.1	23.9 29
2Bkn1	76	-	112	8.1	8.4	0.05	43.2*	7.8	1.8	0.9	53.7	3.1	58.1 29
2Bkn2	112	-	167	8.2	8.6	0.00	40.6*	10.9	1.6	0.6	53.7	5.8	27.6 34
2Bknq	167	-	200	8.1	8.5	0.06	38.8*	10.7	2.5	0.7	52.7	5.1	49.0 37

*Organic C estimated from: % organic C = % total C - (% CaCO₃ * 0.12); values <0.00 assigned 0.00.

†May contain Ca from carbonate minerals or gypsum.

Horizon	Depth	Bulk Density											Phosphorus Olsen Mehlich
		Oven		Water Retention									
		33 kPa	Dry	COLE	33 kPa	1500 kPa	WRD [†]	EC	SAR	ds m ⁻¹	mg kg ⁻¹		
	cm	---- Mg m ⁻³ ---			%	%	cm ³ cm ⁻³	ds m ⁻¹		----	----		
Anp	0	-	12	1.43	1.46	0.007	15.1	5.5	0.14	3.41	4	5.8	7.8
Bw1	12	-	32	1.55	1.57	0.004	16.2	8.1	0.13	3.82	3	5.7	23.7
2Bn	32	-	76	1.40	1.48	0.019	19.6	12.0	0.11	3.35	5	2.0	0.5
2Bkn1	76	-	112	1.47	1.52	0.011	18.7	11.1	0.11	2.31	6	1.0	0.8
2Bkn2	112	-	167	1.50	1.54	0.009	19.4	9.6	0.15	2.38	6	0.6	3.8
2Bknq	167	-	200	1.44	1.49	0.011	18.5	8.5	0.14	4.38	11	1.1	--

† Water retention difference.

limit their plant availability. Moderately high fixation potential and low inherit P amounts (Table 8) indicate that P fertilization is critical for maximum crop production. Micronutrient additions may also be needed to maximize plant productivity.

Water holding capacity for the upper 150 cm is about 18 cm (Table 9). Bulk density in all horizons of this pedon was <1.6 Mg m⁻³ (Table 2) and would not be expected to limit root growth. Organic carbon in the surface horizon is very low (0.18%; Table 8) which is likely due to the sediments in which the horizon has developed having been only recently deposited. The ESP ranged from 23 to 58% through the profile (Table 8), and clay dispersion and degraded physical properties may limit water movement through the soil. The EC ranged from 2.3 to 4.4 through the pedon which should help to maintain clay in a flocculated state and aid drainage in this soil. The salt distribution through the pedon is irregular which suggests the salts were deposited with the alluvial sediments and not due to irrigation with poor quality water.

S09AF006007

Classification: coarse-loamy, mixed, active, hyperthermic Aquic Haplocalcids

FCC designation: Lbd+ns

This pedon is located about 11 km west north-west of the Farah Rud River and is outside of the true alluvial valley (Figs. 2 and 7). It is, however, located immediately adjacent to a braided stream draining across an alluvial fan (Figs. 2, 7, 23, and 24). Thus, parent material for the soil is alluvium derived from local fan deposits. The surface is relatively stable as indicated by the presence of clay films in the Btnz and Btknz horizons (Appendix A). Clay content is relatively low and is irregular with depth which precludes presence of an argillic horizon (Table 9). The CCE increases between the Ayz and Btnz horizons and remains constant with depth. The Btknz

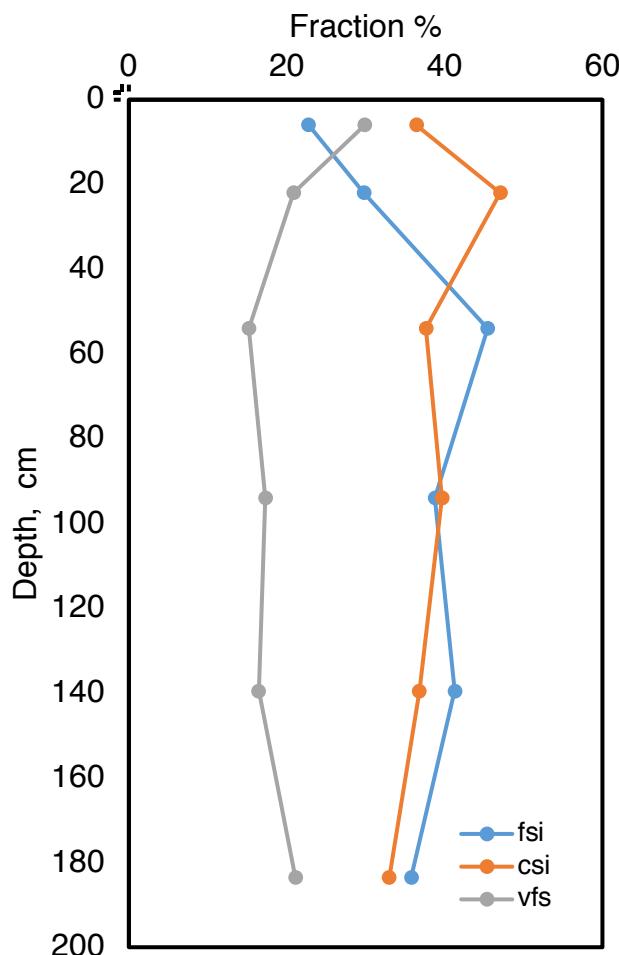


Figure 22. Depth distribution of clay-free particle size separates for Pedon S2009AF006006.



Figure 23. Oblique view of the landscape at the site of Pedon S09AF006007.

horizon, however, contained sufficient pedogenic carbonates for the horizon to meet calcic horizon criteria.

Horizon properties: The most striking features of this soil were the extremely high EC and ESP, especially in the upper two horizons, and the present of a 5 to 10 mm thick salt crust at the soil surface (Appendix A; Table 9, Figs. 24 and 25). EC in the Ayz horizon was 194 ds m^{-1} and the ESP was 10,677%. Both salt content and ESP decreased with depth which suggests the salts, much of which were Na salts, were derived from groundwater and were concentrated in near surface horizons as the water moved upward to the surface by evaporative wicking. A seasonal groundwater table within the soil was supported by presence of redox depletions in the Btknz horizon (Appendix A). Salts in the groundwater were probably derived from water soluble minerals in the fan deposits upslope from the pedon. Soil pH in water ranges from 8.3 to 8.7, and soil organic C is very low because of limited



Figure 24. Salt crust on surface of Pedon S09AF006007.

organic matter inputs from sparse vegetation at the site (Table 9). Clay content is relatively low (<20%), and bulk density would not limit root growth (Table 9).



Figure 25. Pedon S09AF006007 profile and landscape. Photos by Ed Tallyn, Davis, CA.

Properties affecting plant production: The overriding factor influencing plant production on this soil was the high salt content of the near surface horizons. Surface horizon salt content is high enough that only salt tolerant species are likely to grow at the site. Although salts and Na can be leached from the soil by over irrigation, conditions at this site, especially high groundwater salt content preclude its use for crop production. As with the soils in the alluvial valley, high carbonate content and high pH would be expected to limit availability of P and micronutrients although salt content throughout the profile is the major factor limiting production at this site.

Table 9. Properties of Pedon S09AF006007.

Horizon	Depth	Particle Size Distribution										Texture Class	
		Clay	Silt	Sand	Sand Separates					2-75 mm	>2 mm [†]		
					VF	F	M	C	VC				
	cm				weight %							vol. %	
Ayz	0 - 11	20.7	49.9	29.4	17.2	9.8	2.3	tr	0.1	--	--	I	
Btnz	11 - 49	17.3	63.6	19.1	13.8	5	0.3	tr	--	1	--	sil	
Btknz	49 - 83	11.7	54.9	33.4	19.2	13.6	0.4	0.1	0.1	tr	--	sil	
Bknz	83 - 100	10.7	52	37.3	17.2	19.8	0.2	tr	0.1	--	--	sil	

[†] Volume estimates made in field at time of sampling.

Horizon	Depth	pH		Organic C [†]	Extractable Bases				CEC			
		CaCl ₂	H ₂ O		Ca [‡]	Mg	Na [‡]	K	Sum	pH 7	ESP	CaCO ₃
		cm	%		cmol kg ⁻¹						%	%
Ayz	0 - 11	8.6	8.3	0.55	134.2*	20.9	512.5	4.4	672	4.8	10677.1	9
Btnz	11 - 49	8.6	8.7	0.23	40.8*	8.2	26.5	0.6	76.1	7.0	378.6	27
Btknz	49 - 83	8.2	8.7	0.00	40.1*	3.8	5.5	0.3	49.7	5.3	103.8	24
Bknz	83 - 100	8.1	8.5	0.00	39.2*	3.5	4.4	0.2	47.3	5.4	81.5	20

*Organic C estimated from: % organic C = % total C - (% CaCO₃ * 0.12); values <0.00 assigned 0.00.

[†]May contain Ca from carbonate minerals or gypsum; contains Na from or Na chloride and sulfate salts.

Horizon	Depth	Bulk Density										Phosphorus Olsen mg kg ⁻¹	
		Oven		Water Retention					EC SAR				
		33 kPa	Dry	COLE	33 kPa	1500 kPa	WRD [†]	ds m ⁻¹					
	cm	---- Mg m ⁻³ ---			%	%	cm ³ cm ⁻³	ds m ⁻¹			---- mg kg ⁻¹ ----		
Ayz	0 - 11	--	--	--	--	9.3	--	194	679	12	27.3		
Btnz	11 - 49	--	--	--	--	10.4	--	27	89	1.9	0.3		
Btknz	49 - 83	--	--	--	--	1.5	--	5.2	35	0.5	--		
Bknz	83 - 100	--	--	--	--	1.3	--	5.3	22	0.6	0.9		

[†] Water retention difference.

S09AF006008

Classification: fine-loamy, mixed, semiactive, hyperthermic Typic Calciargids

FCC designation: Lbd+ens-

Like Pedon S09AF006007 this pedon was not within the alluvial valley of the Farah Rud River. It lies on a nearly level alluvial fan about 20 km west south-west of Pedon S09AF006006 (Figs. 2, 6, 26, and 27). Parent materials were colluvial sediments comprising the alluvial fan on which the pedon is located.



Figure 26. Oblique view of the landscape at the site of Pedon S09AF006008.

Horizon properties: The pedon had about 80% coarse fragments on the soil surface and appreciable coarse fragments in most horizons which are assumed to have been derived from upslope sources (Appendix A; Table 10). The soil had an appreciable increase in clay between



Figure 27. Pedon S09AF006008 profile and landscape. Photos by Ed Tallyn, Davis, CA.

the An and Btkn1 horizons (Table 10), and clay films were present in horizons between 15 and 121 cm (Appendix A). Thus, the soil had an argillic horizon which suggests that the surface on which the pedon occurs is relatively stable and not actively eroding. Although carbonate content was relatively uniform throughout the pedon (Table 10), horizons below 15 cm had pedogenic carbonates (Appendix A) and met criteria for a calcic horizon. The Ap horizon has a loam texture and a moderate infiltration rate. There was no evidence of physical root restriction by any horizon. Available water holding capacity of this soil would be expected to be low because of the high content of coarse fragments throughout the soil.

ESP was 40 to 50% in the upper two horizons and increased to 80 to 100% in horizons below 39 cm (Table 10). An ESP of this magnitude may result in Na toxicity to Na sensitive plants. The water pH in the horizons with ESP of 80+ % and SAR greater than 100 is above 9.0 which suggests that Na carbonate minerals were present in these horizons. SAR and ESP distribution suggests that the Na is present in the parent material and that limited leaching of Na has occurred during soil development. Arid conditions and high Na levels have limited plant growth and residue additions to the soil. Thus, soil organic C amounts are very low (<0.14%; Table 10).

Properties affecting plant production: Similar to Pedon S09AF006007, the greatest impediment to plant production, assuming irrigation water is available, is the Na content of the soil. Assuming Na tolerant crops are being grown, the high pH and presence of carbonates will fix P

and micronutrients. The moderately high fixation coupled with low inherit P amounts will require P fertilization and potentially micronutrient additions for maximum crop yield.

Table 10. Properties of Pedon S09AF006008.

Horizon	Depth	Particle Size Distribution										Texture	
		Clay	Silt	Sand	Sand Separates					2-75 mm	>2 mm [†]		
					VF	F	M	C	VC				
	cm				weight %					vol. %			
An	0	-	15	14.7	37.7	47.6	17.6	19.1	7.3	2.0	1.6	22	3 I
Btkn1	15	-	39	22.0	19.8	58.2	15.9	28.3	8.4	2.9	2.7	18	20 grscl
Btkn2	39	-	86	27.8	25.8	46.4	15.7	23.3	6.2	0.8	0.4	2	2 scl
2Btkn3	86	-	121	26.6	6.2	67.2	1.5	16.4	29.0	8.3	12.0	62	70 exgrscl
2Ckn	121	-	167	5.8	4.9	89.3	2.9	28.5	40.0	6.5	11.4	59	80 exgrs

[†] Volume estimates made in field at time of sampling.

Horizon	Depth	pH		Organic C [†]	Extractable Bases					CEC			
		CaCl ₂	H ₂ O		Ca [‡]	Mg	Na [‡]	K	Sum	pH 7	ESP	CaCO ₃	
		cm			%	cmol kg ⁻¹					%	%	
An	0	-	15	8.1	8.8	0.14	38.8*	2.1	2.3	0.2	43.4	4.4	52.3 16
Btkn1	15	-	39	8.1	8.7	0.00	39.9*	3.5	2.9	0.4	46.7	6.8	42.6 17
Btkn2	39	-	86	8.4	9.2	0.01	39.5*	2.6	5.8	0.9	48.8	7.1	81.7 18
2Btkn3	86	-	121	8.7	9.4	0.00	37.9*	1.7	7.3	0.7	47.6	7.8	93.6 12
2Ckn	121	-	167	8.2	9.8	0.00	36.1*	0.7	3.1	0.1	40.0	2.9	106.9 14

*Organic C estimated from: % organic C = % total C – (% CaCO₃ * 0.12); values <0.00 assigned 0.00.

[†]May contain Ca from carbonate minerals or gypsum; contains Na from or Na chloride and sulfate salts.

Horizon	Depth	Bulk Density										Olsen P mg kg ⁻¹	Mehlrich P mg kg ⁻¹		
		Oven Dry		Water Retention					Phosphorus						
		33 kPa	Mg m ⁻³	COLE	33 kPa	1500 kPa	WRD [†]	EC	SAR						
	cm	---		%					cm ³ cm ⁻³			ds m ⁻¹			
An	0	-	15	--	--	--	4.2	--	3.17	30	6.7	28.1			
Btkn1	15	-	39	--	--	--	6.9	--	2.11	23	0.8	8.4			
Btkn2	39	-	86	--	--	--	9.6	--	1.51	--	1.5	7.7			
2Btkn3	86	-	121	--	--	--	10.5	--	1.75	246	1.9	6.6			
2Ckn	121	-	167	--	--	--	3.0	--	1.83	412	0.9	1.0			

[†] Water retention difference.

Kunar Province

Among the differences in properties of soils in the Farah and Kunar provinces is the carbonate content. Horizons in all pedons evaluated in the Farah Province except S09AF006008 contained more than 25% carbonates (Tables 3-10). In contrast, most horizons evaluated from pedons in the Kunar province had a CCE of less than 15%, and all horizons from two of the pedons, S09AF015005 and S09AF015006, were non-calcareous (Tables 11-16). In contrast to the Farah Rud River watershed with abundant limestones, rock types in uplands in the Kunar and Pech River watersheds are dominantly gneiss, granite, sandstone, and siltstone with limited amounts of limestone (Bohanan and Turner, 2005). Thus, carbonate additions to the alluvial and colluvial sediments in the Pech and Kunar alluvial valleys would be limited.

As was observed in the Farah Province, pedons in the Kunar Province had relatively uniform carbonate depth distribution suggesting the carbonates were deposited with the alluvial sediments. Two of the pedons, S09AF015003 and S09AF015004, had horizons with pedogenic carbonates that had apparently formed by local redistribution of the carbonates (Appendix B), and these pedons had calcic horizons.

The other major difference in the soils in the two provinces is the amount of precipitation and mean annual temperature. The area in the Kunar Province from which the soils were sampled receives about three times as much precipitation as falls in the Farah Province (200 vs. 75 mm), and the mean annual temperature is about 3° C cooler (18 vs. 21° C). Thus, the soils in the Kunar Province have a soil moisture regime on the border between aridic and ustic (aridic-ustic) and a thermic soil temperature regime as compared to an aridic moisture regime and hyperthermic temperature regime in the Farah Province (Soil Survey Staff, 2014b). Because the soils in the Kunar Province are more moist than those observed in the Farah Province, increased vegetative growth and biomass additions to the soil resulted in three of the six pedons evaluated having a mollic epipedon and placing as Mollisols (Table 1; Appendix B).

Five of the six pedons evaluated in the Kunar Province had clay films in one or more subsoil horizons although only three of the six had the requisite clay increase to have an argillic horizon (Appendix B; Tables 11-16). The clay films in pedons with uniform clay distribution with depth may be a product of local redistribution of clay within a horizon.

The pedons evaluated have loamy textured surface horizons (sandy loam, fine sandy loam, silt loam, or loam) and estimated moderate infiltration rate (Tables 11-16). In general, the surface horizons of the Kunar pedons had greater organic C contents and lower ESP than pedons evaluated in the Farah Province. This combination of properties may enhance aggregation in the surface horizon and increase the soils' resistance to crust formation as compared to soils in the Farah Province. Without specific studies of crust formation in Afghani soils, however, propensity for crusting cannot be predicted with certainty. Residue cover should be maintained on the soils to prevent crusting, increase soil organic C, enhance soil health, and reduce runoff.

Several horizons in the Kunar pedons were described with visible mica minerals (sand sized), and grain counts of fine sand separates from horizons indicated that muscovite and biotite comprised up to 70% of the separate. In fact, Pedon S09AF015004 placed in a micaeous family mineralogy class. In general, pedons in the Pech River alluvial valley had higher mica contents than those in the Kunar River valley south of the confluence of the two rivers (Appendix D). The abundance of mica minerals in the Pech River valley is apparently because of the abundance of biotite gneiss in upland rocks within the Pech River watershed (Bohannan and Turner, 2005).

Properties affecting plant production: Although carbonate contents were less than those observed in soils from the Farah Province, the water pH of all horizons evaluated was greater than 7.5 (Tables 11-16). Extractable P throughout each of the pedons sampled was low (Tables 11-16) and insufficient for maximum production of most agricultural crops. In addition, the high pH and presence of carbonates in surface horizons would immobilize P and micronutrients and limit their plant availability. Thus, P fertilization is critical for maximum crop production because of low inherit P levels and moderate fixation potential. Similarly, micronutrient additions may also be needed to maximize plant productivity. The calcium carbonate levels in most pedons also increase ammonia volatalization potential with use of urea or ammonium-N fertilizers. These N sources should be incorporated and kept moist until nitrification can occur (typically the first 2 to 3 days after application).

The cation exchange capacity (CEC) throughout the Kunar pedons ranges from 3.8 to 10.6 cmol kg⁻¹ (Tables 11-16), and the clays in the Kunar Province were more active than those in the soils from Farah (Appendix C and D). Dominant minerals in the clay separate were mica and chlorite which is similar to the mineralogy of soils in the Farah Province. Most of the Kunar pedons, however, had minor amounts of smectite minerals which would increase the CEC. Additionally, organic C was higher in the Kunar pedons as compared to the pedons from Farah which would also tend to result in higher CECs.

In general, the EC of horizons in pedons evaluated in the Kunar Province is low, and the soils were non-saline (Tables 11-16). In several of the pedons, however, the maximum EC was observed in the surface horizon which suggests salts are being added to the soils by irrigation with low quality water. Surface horizon EC should be monitored and corrective action taken if the soils become saline.

None of the pedons evaluated in the Kunar Province had excessive Na. The ESP of all horizons shallower than 1 m was less than 10% (Tables 11-16). Only pedon S09AF015002 had an ESP that exceeded 6%, and horizons in this pedon with ESP more than 6% were deeper than 50 cm (Table 12).

S09AF015001

Classification: sandy-skeletal, mixed, thermic Xeric Haplocambids

FCC designation: L"S"bde

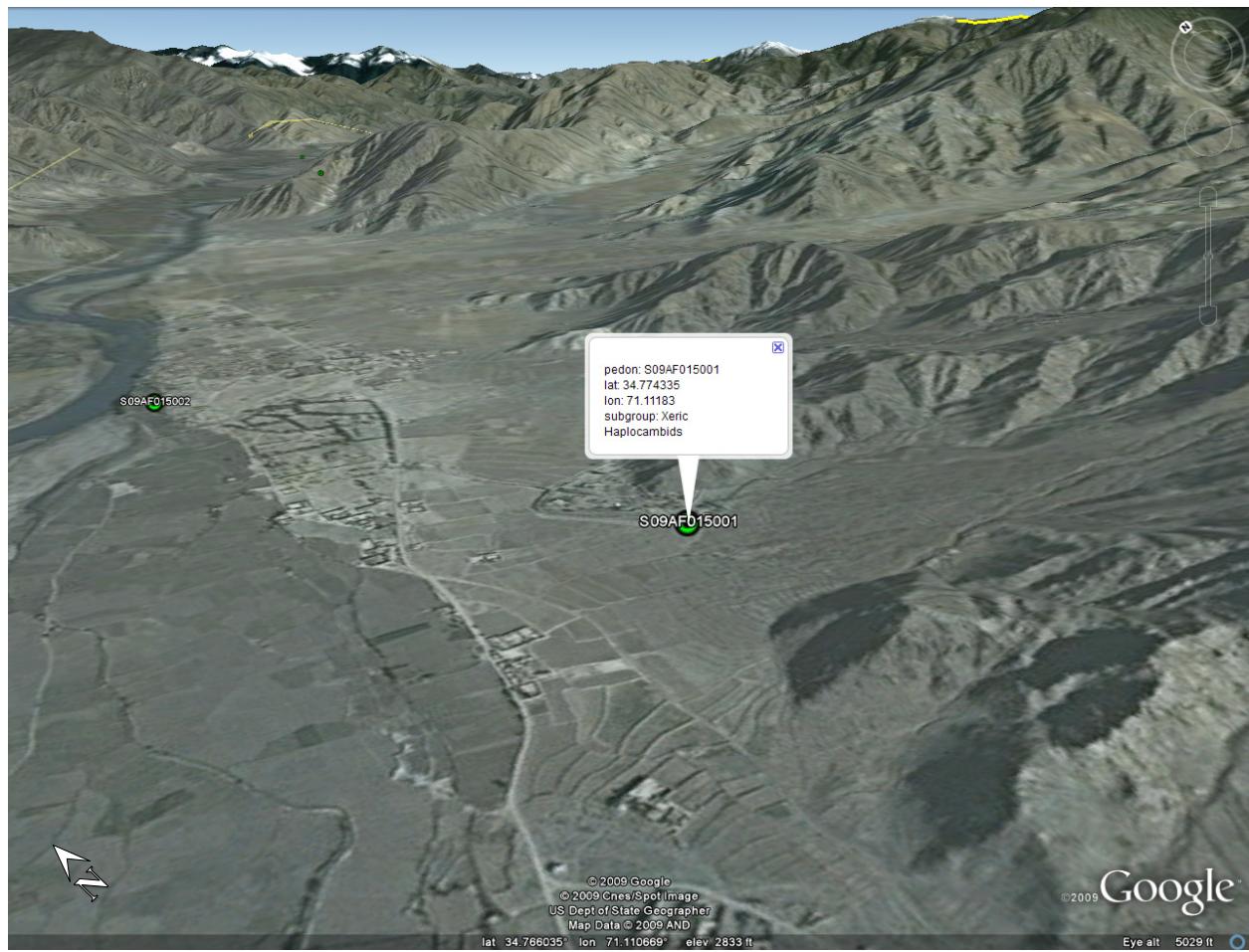


Figure 28. Oblique view of the landscape at the site of Pedon S09AF015001.

This pedon is about 1.5 km east of the Kunar River and lies on an alluvial fan apron descending from mountains to the east (Figs. 3, 4, 28, and 29). Parent material is colluvium and mixed alluvium.

Horizon properties: The Ap horizon has a sandy loam texture and a moderately-high infiltration rate. The pedon has about 5% fragments on the surface, and the horizons from 20 to 97 cm contain 35 to 70% coarse fragments (Table 11). Clay content throughout the profile was less than 9%, and the soil had no indication of clay translocation. Pedogenic carbonates were observed in the Bk1 and Bk2 horizons (Appendix B). However, the CCE of all horizons was less than 8% which is too low to meet calcic horizon criteria (Table 11). In contrast to the pedons in the Farah area, limestone is a very minor component of the upland landscape (Bohannan and Turner, 2005). Although rare, limestone strata were probably the source of the sparse carbonates in this pedon. Dust deposition is an alternant source for at least a portion of the carbonates.

Properties affecting plant production: Organic C content of the Ap horizon is very low, 0.19% (Table 11) which may be the result of erosion and loss of surficial material. Residues should be



Figure 29. Pedon S09AF015001 profile and landscape. Photos by Ed Tallyn, Davis, CA. maximized to reduce potential crusting, slow runoff, reduce erosion, and potentially increase soil organic matter in the surface horizon.

Bulk density of horizons that were evaluated ranged from 1.63 to 1.86 Mg m⁻³ (Table 11). Horizons with bulk density greater than about 1.65 to 1.8 Mg m⁻³ (sandy and loamy soils, respectively) may limit root growth although no feature was observed in the soil that would suggest root limitation. The elevated bulk density may be related to the low clay and relatively high sand content of these horizons. Water holding capacity could not be evaluated below 77 cm because of lack of bulk density data from gravelly horizons. However, extrapolation from horizons with bulk density and water retention data suggest the water holding capacity for this soil would be about 10 to 15 cm in the upper 150 cm of soil.

The pH in water ranged from 8.0 to 8.6, and all horizons contained calcium carbonate. As was discussed for the pedons in the Farah Province, the carbonates and high pH of this soil would be expected to result in ammonia volatilization and fixation of P and micronutrients. Fixation capacity may be less than the pedons in Farah since the CCE is considerably less. P and micronutrient availability remains a concern, however, and P fertilizer should be used to promote maximum plant growth and yield. Magnesium contents are low throughout the profile and measurement should be included in soil analysis.

Table 11. Properties of Pedon S09AF015001.

Horizon	Depth	Particle Size Distribution												
		Clay	Silt	Sand	Sand Separates					Coarse Frags.		2-75 mm	>2 mm [†]	
					VF	F	M	C	VC					
	cm				weight %							vol. %		
Ap	0	-	20	8.6	36.9	54.5	8.8	12.1	12	11.3	10.3	38	5	sl
Bw1	20	-	60	5.1	17.5	77.4	5.7	17.3	16.7	21.8	15.9	52	45	vgrlcos
Bw2	60	-	77	6.9	26.1	67	9.1	10.4	16.5	17.1	13.9	47	35	vcbcosl
Bk1	77	-	97	1.6	7.9	90.5	2.6	9.1	24	28.6	26.2	54	70	excbcos
Bk2	97	-	117	4.6	19	76.4	7.9	15.2	19.2	17.0	17.1	51	--	lcos
C1	117	-	137	4.8	17.1	78.1	5.8	11.3	18.8	20.1	22.1	58	--	lcos
C2	137	-	163	3.8	15.1	81.1	8.5	21.3	25.5	16.2	9.6	43	--	lcos

[†] Volume estimates made in field at time of sampling.

Horizon	Depth	pH		Organic C [†]	Extractable Bases					CEC				
		CaCl ₂	H ₂ O		Ca [‡]	Mg	Na	K	Sum	pH 7	ESP	CaCO ₃		
		cm		%	cmol kg ⁻¹						%	%		
Ap	0	-	20	7.6	8.0	0.19	25.3*	0.9	0.3	0.3	26.8	5.5	5.5	2
Bw1	20	-	60	7.8	8.1	0.15	33.3*	0.6	0.1	0.4	34.4	3.6	2.8	6
Bw2	60	-	77	7.7	8.1	0.01	25.9*	0.8	0.1	0.3	27.1	4.4	2.3	3
Bk1	77	-	97	7.9	8.6	0.00	30.7*	0.5	0.1	0.1	31.4	2.7	3.7	5
Bk2	97	-	117	7.8	8.4	0.11	39.3*	0.8	0.1	0.2	40.4	4.4	2.3	6
C1	117	-	137	7.8	8.5	0.05	36.4*	0.7	0.1	0.2	37.4	3.7	2.7	7
C2	137	-	163	7.8	8.5	0.00	37.8*	0.7	0.1	0.1	38.7	3.4	2.9	8

[†] Organic C estimated from: % organic C = % total C - (% CaCO₃ * 0.12); values <0.00 assigned 0.00.

[‡] May contain Ca from carbonate minerals or gypsum.

Horizon	Depth	Bulk Density											
		Oven		Water Retention									
		33 kPa	Dry	COLE	33 kPa	1500 kPa	WRD [†]	EC	SAR	Olsen	Mehlrich		
	cm	---- Mg m ⁻³ ---			%	%	cm ³ cm ⁻³	ds m ⁻¹		---- mg kg ⁻¹ ----			
Ap	0	-	20	1.63	1.65	0.003	12.0	2.3	0.11	1.77	2	5.3	39.6
Bw1	20	-	60	1.73	1.73	--	10.4	1.3	0.09	<0.6	--	3.0	17.6
Bw2	60	-	77	1.85	1.86	0.001	8.7	0.9	0.09	<0.6	--	2.3	37.8
Bk1	77	-	97	--	--	--	0.4	--	<0.6	--	2.2	25.2	
Bk2	97	-	117	--	--	--	0.8	--	<0.6	--	2.8	13.9	
C1	117	-	137	--	--	--	1	--	<0.6	--	4.3	17.1	
C2	137	-	163	--	--	--	1.9	--	<0.6	--	5.2	11.9	

[†] Water retention difference.

The ESP ranged from 2.7 to 5.5% and was irregular with depth. Salt content was low throughout the pedon, and the maximum EC was 1.8 ds m⁻¹ in the Ap horizon (Table 11). The maximum EC and ESP were in the surface horizon which suggests salts, especially those containing Na may have been added with irrigation water. Neither salts nor Na is expected to limit plant growth or be detrimental to soil physical properties at this time but may be detrimental if low quality irrigation water is used. Monitoring irrigation water quality is recommended.

S09AF015002

Classification: coarse-silty, mixed active, thermic Oxyaeric Haploixerolls

FCC designation: Lbd

This pedon was located about 0.75 km east of the Kabul River on a nearly level stream terrace (Figs. 3, 4, 30, and 31). Soil parent material is mixed alluvium. In contrast, to the pedons observed in the Farah River valley and to pedon S209AF015001 located on an alluvial fan a short distance southeast of this soil, this pedon has a dark colored near surface horizons that



Figure 30. Oblique view of the landscape at the site of Pedon S09AF015002.



Figure 31. Pedon S09AF015002 profile and landscape. Photos by Ed Tallyn, Davis, CA.

meet mollic epipedon criteria. This and other pertinent properties result in the pedon placing as a Mollisol although the climate is quite dry.

Horizon properties: Although clay films were present in the Bt horizon (9 to 42 cm; Appendix B), there was no related clay increase between the Ap and Bt horizons (Table 12), and argillic horizon criteria were not met. The soil had Fe-Mn masses in all horizons below 9 cm (Appendix B) suggesting the soil has a seasonal water table at a relatively shallow depth during periods of the year. Lack of redox depletions in these horizons suggests that the duration of seasonal saturation is too short to deplete Fe and Mn from areas large enough to be identifiable. The seasonal water table may be the result of throughflow from upslope parts of the landscape. Periodic anoxic conditions associated with saturated soil may have induced a reduced rate of organic matter decomposition and formation of the dark colored mollic epipedon.

Table 12. Properties of Pedon S09AF015002.

Horizon	Depth	Particle Size Distribution										Texture Class	
		Clay	Silt	Sand	Sand Separates					2-75 mm	>2 mm [†]		
					VF	F	M	C	VC				
	cm				weight %							vol. %	
Ap	0 -	9	15	55.1	29.9	11.8	9.3	5	2.7	1.1	2	-- sil	
Bt	9 -	42	14.7	55.2	30.1	12.2	11.7	2.6	2.7	0.9	4	-- sil	
Bw1	42 -	68	8.6	50.9	40.5	28.8	9.0	1.9	0.5	0.3	2	-- sil	
Bw2	68 -	75	1.8	27.7	70.5	41.0	27.7	1.5	0.2	0.1	--	-- vflsl	
Bw3	75 -	98	6.7	71.7	21.6	16.5	3.3	1.0	0.6	0.2	1	1 sil	
C	98 -	150	1.8	54.7	43.5	30.6	12.6	0.2	0.1	tr	tr	50 vblldsil	

† Volume estimates made in field at time of sampling.

Horizon	Depth	pH		Organic C [†]	Extractable Bases				CEC			Texture Class
		CaCl ₂	H ₂ O		Ca [‡]	Mg	Na	K	Sum	pH 7	ESP	
		cm			%	cmol kg ⁻¹					%	
Ap	0 -	9	7.8	8.3	0.98	41.4*	4.8	0.3	0.6	47.1	7.5	4.0 7
Bt	9 -	42	7.8	8.5	0.55	41.0*	4.4	0.3	0.5	46.2	6.9	4.3 7
Bw1	42 -	68	7.8	8.4	0.35	39.2*	2.9	0.2	0.3	42.6	3.7	5.4 10
Bw2	68	75	7.8	8.4	0.17	34.5*	1.8	0.1	0.1	36.5	1.0	10.0 11
Bw3	75	98	7.8	8.3	0.31	36.8*	2.8	0.2	1.2	41.0	2.3	8.7 11
C	98 -	150	7.8	8.3	0.15	35.0*	2.4	0.2	0.1	37.7	1.4	14.3 12

† Organic C estimated from: % organic C = % total C - (% CaCO₃ * 0.12); values <0.00 assigned 0.00.

‡ May contain Ca from carbonate minerals or gypsum.

Horizon	Depth	Bulk Density										Phosphorus	
		Oven		Water Retention						EC			
		33 kPa	Dry	COLE	33 kPa	1500 kPa	WRD [†]	cm ³ cm ⁻³	ds m ⁻¹	Olsen	Mehlich		
	cm	--- Mg m ⁻³ ---			%	%				---- mg kg ⁻¹ ----			
Ap	0 -	9	--	--	--	6.7	--	0.34	1	18.6	55.8		
Bt	9 -	42	1.54	1.59	0.010	21.6	5.9	0.24	0.18	1	13.8	45.9	
Bw1	42 -	68	1.41	1.45	0.009	21.6	3.5	0.25	<0.6	--	6.9	20.1	
Bw2	68	75	--	--	--	1.3	--	<0.6	--	2.5	0.8		
Bw3	75	98	1.37	1.40	0.007	22.9	2.7	0.28	<0.6	--	3.0	4.2	
C	98 -	150	1.30	1.33	0.008	17.5	1.2	0.21	<0.6	--	1.4	0.6	

† Water retention difference.

The Ap horizon has a silt loam texture, and the soil is mostly fragment free above the very bouldery C horizon at 98 cm (Appendix B). As would be expected for a dark colored surface

horizon, soil organic C in the Ap horizon was 0.98% and the underlying Bt horizon with similar color had 0.55% organic C (Table 12; Appendix C). Soil pH in water ranged from 8.3 to 9.5 and the CCE ranged from 7 to 12% (Table 12). The ESP ranged from 4.0 to 14.3% and was irregular with depth. It is unlikely these levels of Na would result in degradation of physical properties since the clay content is low in horizons with high Na. The infiltration rate and hydraulic conductivity are moderate. The water holding capacity of this pedon is about 30 cm which is high. Thus, the soil has the ability to store appreciable amounts of rainfall and irrigation water for later use by plants.

Properties affecting plant production: The silt loam texture and an ESP of 4% in the Ap horizon suggest this soil is subject to surface crusting and the soil surface should have a vegetative or residue cover whenever possible to maintain infiltration. Bulk density was less than 1.6 Mg m^{-3} throughout the pedon (Table 12), and no indication of a root restrictive horizon was observed.

The high pH and the presence of carbonates would serve to fix P and micronutrients similar to other soils in the region. Thus, ammonia volatilization, and P and micronutrient availability is a concern and fertilizer programs should be planned accordingly. Magnesium content is relatively low and should be included in soil analysis. Salt content was low throughout the pedon and is not a limitation for crop growth and yield

S09AF015003

Classification: coarse-loamy, mixed, active, thermic Xeric Calciargids

FCC designation: Lbd

This pedon is located about 0.3 km east of the Kubul River on the apron of an alluvial fan descending from mountains to the east (Figs. 3, 4, 32 and 33). The soil had clay films in the Btk1 and Btk2 horizons, and the clay increase between the Bk and Btk1 horizons was sufficient to meet argillic horizon criteria (Appendix B; Table 13). Additionally, the soil had pedogenic carbonate nodules and masses in all horizons below 27 cm. Horizons below 47 cm had sufficient amounts of carbonates for a calcic horizon. The abrupt increase in the CCE at 47 cm may be due to difference in colluvial/alluvial parent materials or may reflect leaching of carbonates from horizons above 47 cm. The degree of development suggests the site has been stable for an appreciable period time even though it may be subject to flooding from the Kubul River.

Horizon properties: The Ap horizon has a fine sandy loam texture, and the soil is mostly fragment free. The infiltration rate and hydraulic conductivity were moderate. The surface horizon was relatively thick and dark. The Ap horizon had 0.55% organic C, and organic C was above 0.2% to a depth of 104 cm (Table 13). The pH in water ranged from 7.9 to 8.4. This soil has a high water holding capacity (about 30 cm of water in the upper 150 cm) (Table 9), and the soil should store appreciable precipitation and irrigation water for crops.



Figure 32. Oblique view of the landscape at the site of Pedon S09AF015003.

Properties affecting plant production: This soil would be expected to be subject to surface crusting because of the loamy texture and ESP of 5% in the Ap horizon (Table 13). Thus, the soil surface should have a vegetative or residue cover whenever possible to maintain infiltration. Bulk density was less than 1.5 Mg m^{-3} throughout the pedon (Table 13), and no indication of a root restrictive horizon was observed.



Figure 33. Pedon S09AF015003 profile and landscape. Photos by Ed Tallyn, Davis, CA.

The upper two horizons (0 to 27 cm) had only trace amounts of calcium carbonate (Table 13). Thus, P and micronutrient fixation may be relatively less than that expected in soils in the Farah Province, but additional evaluations would be needed to effectively evaluate P and micronutrient dynamics. Only the Ap horizon had measurable water soluble salts, and this horizon had the highest ESP measured in the pedon (Table 13). The Na content in the surface horizon should not be high enough to limit plant growth but may reduce the infiltration rate due to clay dispersion and surface crusting if the soils are bare. The fact that EC and ESP in the surface horizon were higher than was observed in subjacent horizons suggests that Na salts may have been added through irrigation with poor quality water. Although, the salts and Na are not expected to be a problem at present, continued use of low quality irrigation water may degrade the soil and limit crop production. Magnesium content is low and soil tests should include magnesium.

Table 13. Properties of Pedon S09AF015003.

Horizon	Depth	Particle Size Distribution												
		Clay	Silt	Sand	Sand Separates					Coarse Frags.		2-75 mm	>2 mm [†]	
					VF	F	M	C	VC					
	cm				weight %							vol. %		
Ap	0	-	11	11.0	30.6	58.4	23.4	27.2	5.7	1.1	1.0	5	10	fsl
Bk	11	-	27	9.7	45.9	44.4	23.7	13.2	4.6	1.4	1.5	3	--	I
Btk1	27	-	47	13.8	48.4	37.8	21.0	11.5	3.4	1.1	0.8	5	--	I
Btk2	47	-	72	22.3	62.4	15.3	8.2	4.8	1.5	0.5	0.3	20	--	sil
B'k1	72	-	104	19.9	60.2	19.9	12.8	5.3	1.6	0.1	0.1	8	--	sil
B'k2	104	-	150	15.0	50.1	34.9	20.7	11.8	2.0	0.2	0.2	5	--	sil

[†] Volume estimates made in field at time of sampling.

Horizon	Depth	pH		Organic C [†]	Extractable Bases				CEC					
		CaCl ₂	H ₂ O		Ca [‡]	Mg	Na	K	Sum	pH 7	ESP	CaCO ₃		
		cm		%	cmol kg ⁻¹					%	%			
Ap	0	-	11	7.4	7.9	0.55	16.5*	1.8	0.3	0.3	18.9	6.5	4.6	tr
Bk	11	-	27	7.6	8.1	0.36	13.2*	1.4	0.1	0.2	14.9	7.2	1.4	tr
Btk1	27	-	47	7.7	8.1	0.20	40.6*	2.0	0.1	0.2	42.9	8.4	1.2	3
Btk2	47	72	7.7	8.1	0.23	47.9*	2.8	0.2	0.2	51.1	9.7	2.1	20	
B'k1	72	104	7.7	8.3	0.20	43.1*	3.3	0.2	0.2	46.8	7.9	2.5	19	
B'k2	104	-	150	7.8	8.4	0.14	42.3*	3.3	0.2	0.1	45.9	4.6	4.3	19

*Organic C estimated from: % organic C = % total C - (% CaCO₃ * 0.12); values <0.00 assigned 0.00.

[†]May contain Ca from carbonate minerals or gypsum.

Horizon	Depth	Bulk Density											
		Oven		Water Retention				Phosphorus					
		33 kPa	Dry	COLE	33 kPa	1500 kPa	WRD [‡]	EC	SAR	Olsen	Mehlich		
	cm	--- Mg m ⁻³ ---			%	%	cm ³ cm ⁻³	ds m ⁻¹		mg kg ⁻¹			
Ap	0	-	11	--	--	--	4.8	--	0.85	tr	11.8	31.7	
Bk	11	-	27	1.41	1.44	0.007	14.1	4.8	0.13	<0.6	--	1.9	41.7
Btk1	27	-	47	1.47	1.50	0.007	13.7	6.5	0.10	<0.6	--	1.4	7.1
Btk2	47	72	1.34	1.42	0.017	23.2	8.5	0.17	<0.6	--	2.3	1.8	
B'k1	72	104	1.34	1.39	0.012	19.9	8.1	0.15	<0.6	--	2.6	3.4	
B'k2	104	-	150	1.42	1.46	0.009	17.6	5.9	0.16	<0.6	--	2.4	0.7

[‡] Water retention difference.

S09AF015004

Classification: coarse-loamy, micaeous, thermic Xeric Calcic Argids

FCC designation: Lbde

This pedon is located in the Pech River valley about 15 km upstream of the confluence of the Pech and Kabul Rivers in Asadabad (Figs. 3, 4, 34, and 35). The pedon is on a fan apron that descends from mountains north of the stream. The stream valley is about 400 m wide, and the pedon is about 200 m north of the stream.

Horizon properties: This soil has sandy loam and loam textures throughout, and maximum clay content is 18%. Clay films were present in horizons below 87 cm (Appendix B), and there is a sufficient clay increase between the Bk2 and Btk1 horizons for the soil to have an argillic horizon (Table 14). Surface horizons are dark and the upper horizons meet color and organic C criteria for a mollic epipedon. Organic C contents in the Ap and Bk1 horizons were 1.12 and 0.55%, respectively (Table 14). Pedogenic carbonates were present in all subsoil horizons and the CCE was sufficient to qualify as a calcic horizon.



Figure 34. Oblique view of the landscape at the site of Pedon S09AF015004.

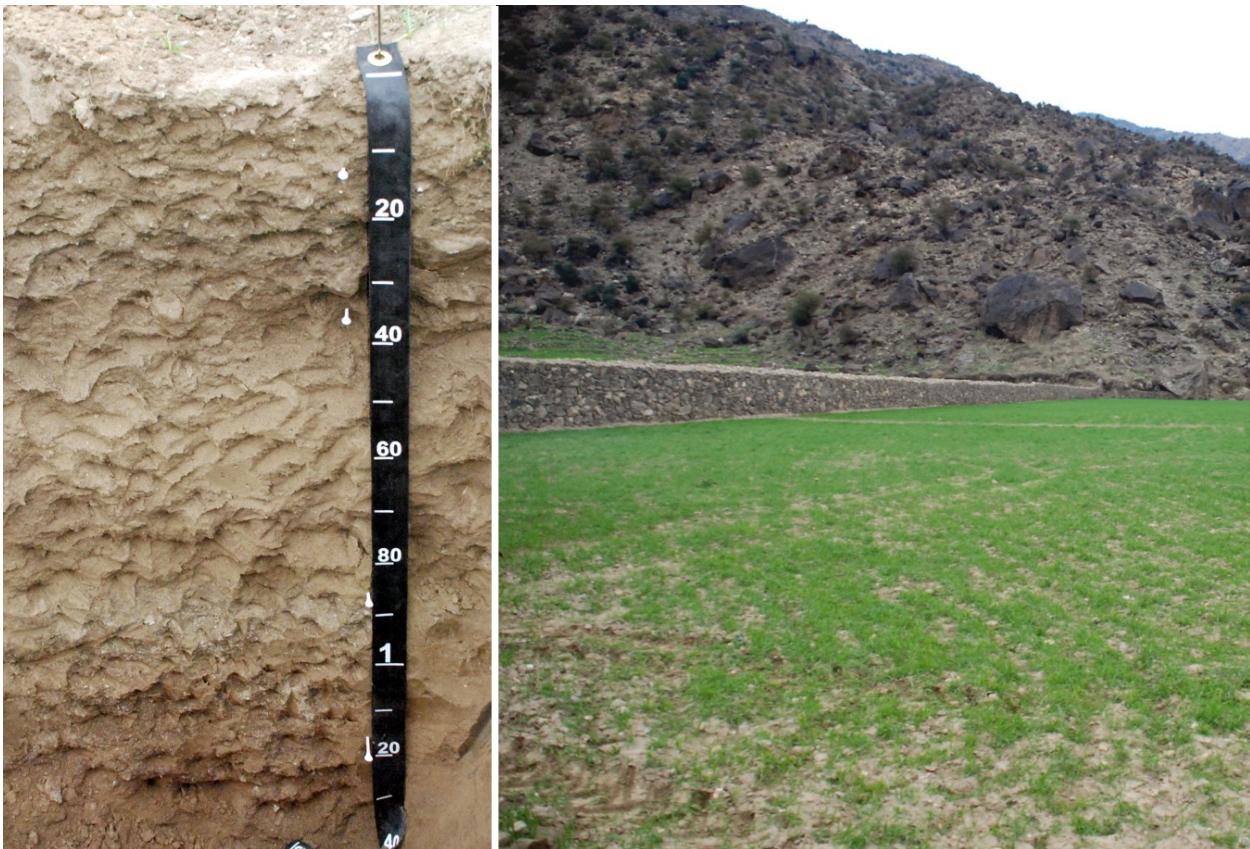


Figure 35. Pedon S09AF015004 profile and landscape. Photos by Ed Tallyn, Davis, CA.

Common mica flakes were described in all subsoil horizons, and grain counts indicated that the Bk2 and Btk2 horizons had 48 and 70% biotite plus muscovite, respectively, in the fine sand separate (Appendix D). It is assumed that biotite gneiss which is a major rock type in the watershed upslope from this pedon was the source of the mica minerals.

The Ap horizon had a sandy loam texture, and the soil is mostly fragment free. The infiltration rate and hydraulic conductivity were moderate. Water holding capacity for this pedon was estimated to be about 18 cm which is lower than other soils in the area (Table 14).

Properties affecting plant production: Propensity of this soil for surface crusting may be less than other soils in the area because of the low Na contents in upper horizons (only a trace of extractable Na in the Ap horizon; Table 14). Even though Na was low, because of the texture and low EC, the surface may crust if bare during rainfall events. Bulk density was less than 1.7 Mg m⁻³ throughout the pedon (Table 14), and no indication of a root restrictive horizon was observed.

The pH in water was uniform and ranged from 8.2 to 8.3. The CCE was low, and the maximum was 6% in the Btk1 horizon (Table 14). Similar to other pedons in the Kabul region, fixation of P and micronutrients may be less than would be expected for soils in the Farah region because of lower amounts of calcium carbonate although ammonia volatilization may be a concern. P

fertilization, however, is needed to maximize plant production and crop yields because of the low amounts of P measured for this pedon (Table 14). The EC was less than 0.6 ds m⁻¹ throughout the pedon, and the data indicate Na amounts are low and inconsequential (Table 14).

Table 14. Properties of Pedon S09AF015004.

Horizon	Depth	Particle Size Distribution										Texture	
		Clay	Silt	Sand	Sand Separates				2-75 mm	>2 mm [†]			
					VF	F	M	C					
	cm				weight %						vol. %		
Ap	0	-	12	10.3	27.7	62.0	9.7	20.2	17.9	9.8	4.4	15	1 sl
Bk1	12	-	38	6.4	21.0	72.6	12.0	28.1	18.0	9.8	4.7	11	1 sl
Bk2	38	-	87	6.6	20.6	72.8	14.2	29.7	17.9	7.8	3.2	6	3 fsl
Btk1	87	-	116	18.1	38.0	43.9	10.1	16.1	10.6	5.2	1.9	4	-- I
Btk2	116	-	142	12.0	22.7	65.3	10.8	21.5	19.4	10.7	2.9	11	-- sl

† Volume estimates made in field at time of sampling.

Horizon	Depth	pH		Organic C [†]	Extractable Bases				CEC				
		CaCl ₂	H ₂ O		Ca [‡]	Mg	Na	K	Sum	pH 7	ESP	CaCO ₃	
		cm	%		cmol kg ⁻¹					%	%		
Ap	0	-	12	7.6	8.2	1.12	38.1*	1.2	tr	0.7	40.0	7.1	-- 4
Bk1	12	-	38	7.6	8.2	0.55	23.5*	0.7	tr	0.3	24.5	4.4	-- 1
Bk2	38	-	87	7.7	8.3	0.38	32.4*	0.6	tr	0.2	33.2	3.7	-- 2
Btk1	87	-	116	7.6	8.2	0.38	47.1*	1.2	0.1	0.3	48.7	8.9	1.1 6
Btk2	116	-	142	7.7	8.3	0.35	37.3*	1.0	0.1	0.2	38.6	6.3	1.6 2

*Organic C estimated from: % organic C = % total C - (% CaCO₃ * 0.12); values <0.00 assigned 0.00.

†May contain Ca from carbonate minerals or gypsum.

Horizon	Depth	Bulk Density										Phosphorus	
		Oven		Water Retention				EC					
		33 kPa	Dry	COLE	33 kPa	1500 kPa	WRD [‡]	ds m ⁻¹	SAR	Olsen	Mehlich		
	cm	---- Mg m ⁻³ ----			%	%	cm ³ cm ⁻³			----- mg kg ⁻¹ -----			
Ap	0	-	12	--	--	--	3.5	--	<0.6	--	9.0	41.1	
Bk1	12	-	38	1.66	1.66	--	8.0	0.7	0.11	<0.6	--	1.7	
Bk2	38	-	87	1.50	1.51	0.002	8.9	0.9	0.12	<0.6	--	1.2	
Btk1	87	-	116	1.60	1.65	0.010	17.4	8.2	0.14	<0.6	--	2.6	
Btk2	116	-	142	1.61	1.65	0.008	12.1	5.1	0.11	<0.6	--	1.4	

‡ Water retention difference.

S09AF015005

Classification: fine-loamy, mixed, active, thermic Oxyaqua Haploxerolls

FCC designation: Ld

This pedon is located downstream of Pedon S09AF015004 and is about 10 km northwest of Asadabad (Figs. 3, 4, 36, and 37). As was the case for Pedon S09AF015004, the stream valley is only about 400 m wide. The pedon is on a terrace, is about 250 m north of the main stream, and is about 400 m west of a smaller stream flowing from the north (Fig3. 3, 4, and 36).

Horizon properties: This soil has loam and silt loam textures throughout, and maximum clay content is about 23%. Clay films were present in horizons all subsoil horizons (Appendix B). The clay content, however, is relatively uniform throughout the pedon, and the soil does not have an argillic horizon (Table 15). The upper two horizons to a depth of 42 cm had colors sufficiently dark to meet mollic horizon criteria (Appendix B), and organic C contents of the Ap and Bt1 horizons were 1.64 and 1.43%, respectively (Table 15). This soil lacked carbonate minerals. Mica



Figure 36. Oblique view of the landscape at the site of Pedon S09AF015001.



Figure 37. Pedon S09AF015005 profile and landscape. Photos by Ed Tallyn, Davis, CA.

flakes were present in all horizons (Appendix B), and mica minerals, biotite and muscovite, comprised about 35 to 40% of the coarse silt separate (Appendix D).

The Ap horizon had a loam texture, and the soil is essentially fragment free. The infiltration rate is moderate and the hydraulic conductivity for all horizons would also be moderate. Water holding capacity for this pedon was high (about 35 cm; estimated by extending properties of Bt3 horizon to 150 cm; Table 9). Bulk density was less than 1.7 Mg m^{-3} throughout the pedon (Table 15), and no indication of a root restrictive horizon was observed.

Properties affecting plant production: The ESP of the Ap horizon was 5.9% (Table 15) which may enhance clay dispersion and surface crusting. The Ap horizon had the highest ESP among the horizons which suggests Na is being added to the soil with irrigation water. The added Na does not appear to be a problem currently but should be monitored to avoid further degradation of soil physical properties. The EC of the Ap horizon is also maximal in the pedon and supports salt additions with irrigation.

The pH in water was uniform and ranged from 7.6 to 8.2 (Table 15). Similar to other pedons in the Kabul region, fixation of P and micronutrients may be less than would be expected for soils in the Farah region because of low amounts of calcium carbonate. P fertilization, however, is needed to maximize plant production and crop yields because of the low amounts of P

measured for this pedon (Table 15). Magnesium content is low. Soil tests should include magnesium.

Table 15. Properties of Pedon S09AF015005.

Horizon	Depth	Particle Size Distribution										Texture Class	
		Clay	Silt	Sand	Sand Separates					2-75 mm	>2 mm [†]		
					VF	F	M	C	VC				
	cm				weight %							vol. %	
Ap	0 - 7	19.9	46.5	33.6	10.8	12.9	6.8	2.4	0.7	1	1	I	
Bt1	7 - 42	19.8	47.9	32.3	10.8	12.5	6.5	1.9	0.6	4	1	I	
Bt2	42 - 62	20.2	44.5	35.3	11.1	13.3	7.6	2.6	0.7	1	1	I	
Bt3	62 - 100	23.3	52.3	24.4	8.6	8.8	4.2	2.0	0.8	8	1	sil	

[†] Volume estimates made in field at time of sampling.

Horizon	Depth	pH		Organic C [†]	Extractable Bases				CEC			
		CaCl ₂	H ₂ O		Ca [‡]	Mg	Na	K	Sum	pH 7	ESP	CaCO ₃
		cm			%	cmol kg ⁻¹					%	%
Ap	0 - 7	7.4	7.9	1.64	17.5*	1.5	0.7	0.4	20.1	11.8	5.9	--
Bt1	7 - 42	6.9	7.6	1.43	12.7*	1.4	0.2	0.2	14.5	11.6	1.7	--
Bt2	42 - 62	7.1	8.0	0.94	8.7*	1.0	0.2	0.2	10.1	8.8	2.3	--
Bt3	62 - 100	7.4	8.2	0.75	11.3*	1.5	0.3	0.2	13.3	10	3.0	--

*Organic C estimated from: % organic C = % total C – (% CaCO₃ * 0.12); values <0.00 assigned 0.00.

[†]May contain Ca from carbonate minerals or gypsum.

Horizon	Depth	Bulk Density				Water Retention				Phosphorus		
		Oven		COLE	33 kPa	1500 kPa	WRD [†]	EC	SAR	Olsen	Mehlich	
		33 kPa	Dry		%	%	cm ³ cm ⁻³	ds m ⁻¹	mg kg ⁻¹			
	cm	---- Mg m ⁻³ ---										
Ap	0 - 7	1.53	1.59	0.013	24.5	9.3	0.23	0.72	tr	19.2	32.2	
Bt1	7 - 42	1.47	1.54	0.015	24.0	8.3	0.23	<0.6	--	2.1	4.6	
Bt2	42 - 62	1.52	1.59	0.015	21.4	2.6	0.28	<0.6	--	2.2	0.8	
Bt3	62 - 100	1.55	1.62	0.014	21.9	7.4	0.21	<0.6	--	2.7	1.6	

[†] Water retention difference.

S09AF015006

Classification: fine-loamy, mixed, active, thermic Aridic Argixerolls

FCC designation: Ld

This pedon is located on a low terrace at the confluence of the Pech and Kubul Rivers in Asadabad (Figs. 3, 4, 38 and 39). The pedon lies about 30 m south of the main channel of the tributary and about 280 m west of the Kabul River channel.

Horizon properties: This soil has loam and silt loam textures throughout, and maximum clay content is about 24%. Clay films were present in all subsoil horizons (Appendix B), and the clay increase between the Ap and 2Bt1 horizons, 3.7%, was marginally sufficient to qualify as an argillic horizon (Table 16). The upper two horizons to a depth of 42 cm had colors sufficiently dark to meet mollic horizon criteria, and the soil places as a Mollisol. Organic C contents of the Ap and 2Bt1 horizons were 1.64 and 0.87%, respectively, and organic C is more than 0.4% to 150 cm (Table 16). All horizons were non-calcareous. Mica flakes were present in all horizons (Appendix B). The sum of biotite and muscovite was 69% in the coarse silt separate in the Ap

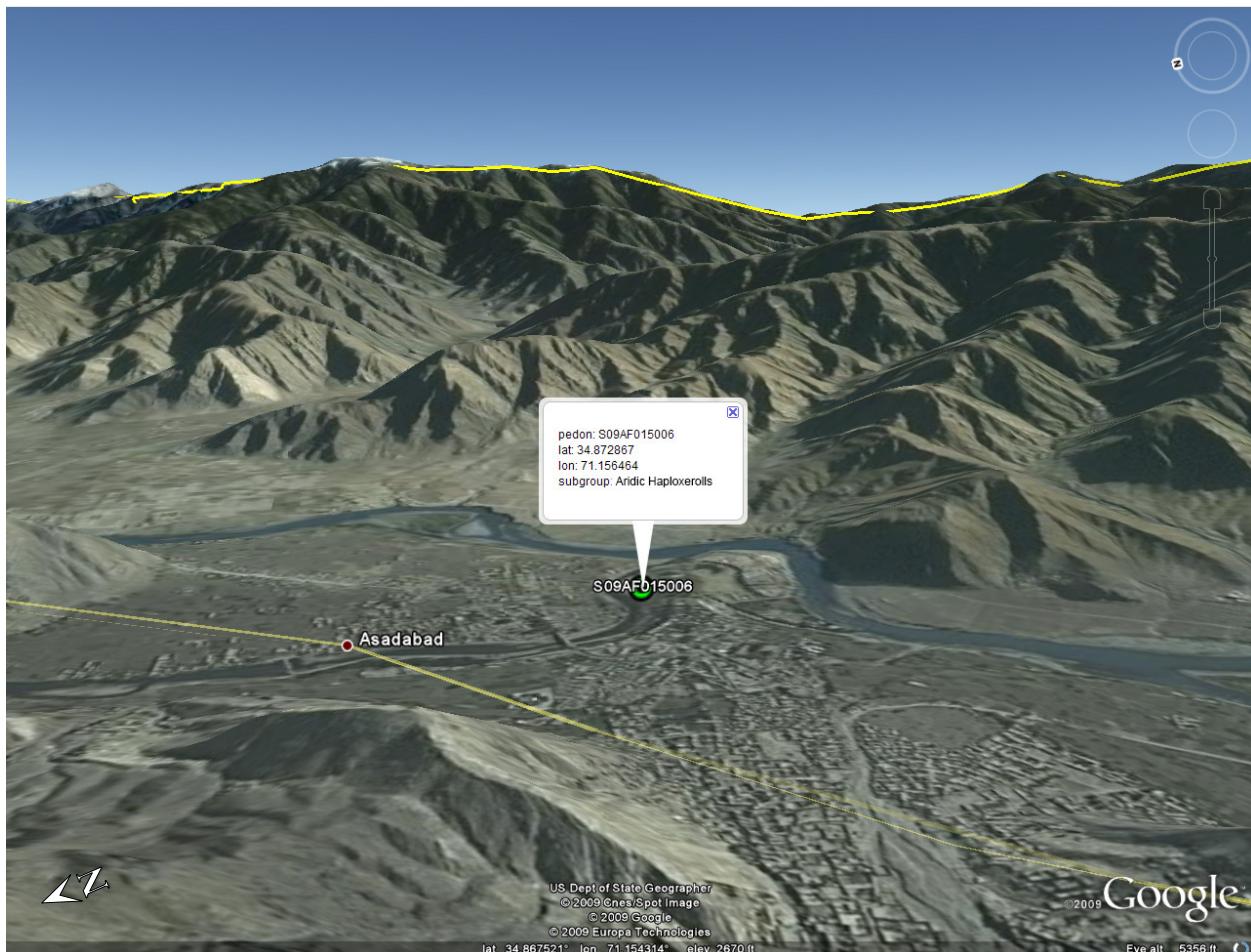


Figure 38. Oblique view of the landscape at the site of Pedon S09AF015006.



Figure 39. Pedon S09AF015006 profile and landscape. Photos by Ed Tallyn, Davis, CA.

horizon, and was comprised about 35 to 40% of this separate in the 2Bt1 and 2Bt3 horizons (Appendix D). Redox concentrations were observed in horizons below 71 cm which is likely the result of seasonal saturation related to the pedon's low position and proximity to the stream channel.

The Ap horizon had a loam texture, and the soil is essentially fragment free. The infiltration rate is moderate and the hydraulic conductivity for all horizons would also be moderate. Water holding capacity for this pedon was 28 cm (Table 2).

Properties affecting plant production: The ESP of all horizons was less than 3% (Table 16) although the soil may be subject to surface crusting if bare during rainfall events. Only the 2Bt4 horizon had EC greater than 0.6 ds m^{-1} which suggests irrigation water quality is acceptable or the surface has been irrigated for an insufficient period for salts to accumulate. Bulk density was less than 1.6 Mg m^{-3} throughout the pedon (Table 16), and no indication of a root restrictive horizon was observed.

The pH in water was uniform and ranged from 7.0 to 8.0 (Table 16). Similar to other pedons in the Kabul region, fixation of P and micronutrients may be less than would be expected for soils in the Farah region because carbonates are not present in the soil. P fertilization, however, is needed to maximize plant production and crop yields because of the low amounts of P

measured for this pedon (Table 15). Magnesium content is low. Soil tests should include magnesium.

Table 16. Properties of Pedon S09AF015006.

Horizon	Depth	Particle Size Distribution										Texture Class	
		Clay	Silt	Sand	Sand Separates					2-75 mm	>2 mm [†]		
					VF	F	M	C	VC				
	cm				weight %							vol. %	
Ap	0	-	15	16.8	45.0	38.2	16.6	17.2	3.5	0.7	0.2	1	1 I
2Bt1	15	-	34	20.5	46.2	33.3	14.2	15.4	2.7	0.6	0.4	2	1 I
2Bt2	34	-	71	17.5	44.9	37.6	17.7	15.4	3.7	0.6	0.2	tr	1 I
2Bt3	71	-	110	22.9	52.2	24.9	12.3	9.4	2.6	0.5	0.1	--	1 sil
2Bt4	110	-	150	23.7	57.2	19.1	10.5	6.8	1.3	0.3	0.2	tr	1 sil

[†] Volume estimates made in field at time of sampling.

Horizon	Depth	pH		Organic C [†] %	Extractable Bases				CEC					
		CaCl ₂	H ₂ O		Ca [‡]	Mg	Na	K	Sum	pH 7	ESP	CaCO ₃		
		cm							cmol kg ⁻¹		%	%		
Ap	0	-	15	7.2	8.0	1.64	15.4*	1.4	0.1	1.1	18.0	11.5	0.9	--
2Bt1	15	-	34	7.1	7.9	0.87	11.8*	1.2	0.1	0.2	13.3	10.2	1.0	--
2Bt2	34	-	71	6.9	7.8	0.49	8.0*	0.9	0.2	0.3	9.4	7.7	2.6	--
2Bt3	71	-	110	6.6	7.1	0.43	9.9*	1.2	0.2	0.2	11.5	10.0	2.0	--
2Bt4	110	-	150	6.5	7.0	0.51	13.0*	1.6	0.2	0.3	15.1	11.8	1.7	--

*Organic C estimated from: % organic C = % total C - (% CaCO₃ * 0.12); values <0.00 assigned 0.00.

[†]May contain Ca from carbonate minerals or gypsum.

Horizon	Depth	Bulk Density										Olsen P mg kg ⁻¹	Mehlich P mg kg ⁻¹		
		Oven Dry		Water Retention				Phosphorus							
		33 kPa	ds m ⁻¹	COLE	33 kPa	1500 kPa	WRD [†]	EC	SAR						
	cm	---	Mg m ⁻³ ---			%	%	cm ³ cm ⁻³	ds m ⁻¹			-----	-----		
Ap	0	-	15	--	--	--	2.5	--	<0.6	--	9.1	26.7			
2Bt1	15	-	34	1.45	1.50	0.011	20.0	9.1	0.16	<0.6	--	5.2	8.9		
2Bt2	34	-	71	1.54	1.60	0.013	19.1	8.1	0.17	<0.6	--	3.3	4.2		
2Bt3	71	-	110	1.49	1.57	0.018	21.5	10.1	0.17	<0.6	--	4.7	3.7		
2Bt4	110	-	150	1.40	1.48	0.019	25.3	10.0	0.21	0.82	1	7.0	5.0		

[†] Water retention difference.

Overview of nutrient contents

Total nitrogen (N) content was negligible in most soils, ranging between 10 and 1640 mg/kg with an average of 631 mg/kg (Appendix C and D). The concentration of nitrate-N was generally low (≤ 32 mg/kg) in most soils. The Ap horizons from three pedons, S09AF006004, S09AF015001, and S09AF015005) had moderate nitrate-N concentration that ranged between 43 and 47 mg kg $^{-1}$. The surface horizon of pedon S09AF006007 had an extremely high nitrate-N concentration of 382 mg kg $^{-1}$ (Appendix C and D). Source of the nitrate is unknown since this pedon is used for rangeland and nitrate additions from fertilizer would not be expected. Evaporative wicking may have concentrated nitrate in ground water in the surface horizon. Evaporative wicking may have concentrated nitrate in ground water in the surface horizon. Where calcium carbonate is present in surface layers, there is an increased potential to volatilize ammonium and urea nitrogen, especially if applied on the surface without incorporation and the soil dries before nitrification can occur.

Phosphorus (P) extracted with sodium bicarbonate solution (Olsen P) is a good index for the availability of this essential nutrient in calcareous soils (Olsen et al., 1954; Elrashidi, 2001). The data indicated that the P concentration was within the low range of availability (≤ 14 mg/kg) for most soils tested (Tables 2-16). The Ap horizons from pedons S09AF015002 and S09AF015005 in Kunar Province had moderate P concentrations of 18.6 and 19.2 mg kg $^{-1}$, respectively.

Most surface horizons had relatively low K concentration (≤ 300 mg/kg) (Appendix C and D). Exceptions were pedon S09AF015006 in Kunar Province (moderate K concentration of 430 mg/kg) and the saline pedon S09AF006007 with a very high K concentration of 1681 mg kg $^{-1}$.

The Mehlich 3 extraction was used to measure the concentrations of plant available Fe, Mn, Cu, and Zn (Elrashidi et al., 2003). The data indicated that Fe concentration in surface horizons was relatively low, ranging from 35 to 177 mg kg $^{-1}$. The Ap horizons from pedons S09AF015002 and S09AF015005, however, had adequate amounts of available Fe; 300 and 265 mg kg $^{-1}$, respectively (Appendix C and D). In general, both Cu and Zn concentrations were low in all soils especially for those samples with high CaCO₃ content (Appendix C and D). Most soils had B concentrations that were considered to be deficient (≤ 4.0 mg/kg) (Appendix C and D). Exceptions were the Az horizon from pedon S09AF006007 and the A, Btk1, and Btk2 horizons from pedon S09AF006008. Distribution of B in these pedons suggests the B was inherit in the parent material and has been redistributed during soil development, especially concentration in the surface by evaporative pumping in pedon S09AF006007.

Additional Considerations

Crop yields produced in dry land are usually low compared with those of the humid and sub-humid regions unless irrigated. Approximately 60% of the world's dry land is in developing countries such as Afghanistan. Many of the soils investigated were coarse-textured, inherently low in fertility, organic matter, and water-holding capacity. These properties suggest that the

soils are susceptible to wind erosion, nutrient/organic matter depletion, and the subsequent loss of soil productivity. Soil and water conservation practices must be applied to counteract further degradation. The application of organic wastes such as animal manures and municipal wastes and maintenance of crop residues or the soil surface offer the best possible means

of improving the physical properties, tilth, fertility, and restoring the productivity of these soils. Although current socioeconomic conditions in Afghanistan may limit use of organic wastes and crop residues to improve the soils, it is important to promote policies that encourage conservation practices. Further, sound water management practices should be applied to enhance water-use efficiency by crops. It is generally recognized that selection of major crops and cultivars grown are an important water management practice that will also help to produce a satisfactory yield. Increasing water availability through irrigation and management practices is futile, however, unless soil fertility deficiencies are corrected to ensure plant nutrition is adequate to take advantage of the increased water supply.

Generally, the quantity of a nutrient taken up by a crop over the growth period serves as a guideline in assessing the appropriate rate of nutrient application. For example, typical crops of barley, oats, wheat, and corn remove 40, 55, 56, and 150 kg N ha^{-1} ; 8, 10, 13, and 27 kg P ha^{-1} ; and 10, 14, 14, and 37 kg K ha^{-1} , respectively (Mengel and Kirkby, 1982). These data provide a rough working basis for nutrient requirements to produce acceptable yields. Fertilizers added for crop production should compensate for these nutrient losses.

Fates of nutrients in addition to crop uptake must be considered in determining the amount and form of fertilizer nutrients applied. These include ammonia volatilization from ammonium and urea-based N fertilizers, leaching of nitrate and other mobile nutrients, and fixation of P. Soils with high pH such as was observed in the soils from Farah and Kunar Provinces fix considerable amounts of P. Further, alkaline calcareous soils are generally deficient in iron and other micronutrients because of fixation by carbonates (Lindsay, 1979). Therefore, additions of iron and manganese along with boron, copper and zinc should be considered along with the major nutrients (N, P, and K) to ensure good crop growth.

Another process that may deplete plant nutrients and organic C is soil erosion by both wind and water. Relative soil erodibility for water erosion can be shown using the K factor in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE2) (Renard et al., 1997). Values ranged from 0.24 to 0.64 (Table 17). Potential erodibility of the soil increases as the K factor increases, and a K factor value of greater than about 0.3 should be considered as potentially highly erodible. In general, soils with silt loam and loam texture and low organic C in the surface horizon are most erodible, and soils with surface horizons that have sandy textures and/or high organic C are least erodible by water. Thus, pedons S09AF006003 and S09AF006004 with a silt loam surface horizon texture and relatively low organic C had a high K factor are easily eroded (Tables 5, 6, and 17). In contrast, pedon S09AF006002 had a gravelly loamy sand texture in the surface horizon and pedon S09AF015004 with a sandy loam texture and relatively high organic C in the surface horizon were the least erodible of the

pedons evaluated (Tables 2, 13, and 17). In addition to soil erodibility, amount of slope, length of slope, and rainfall erosivity are also factors that strongly influence soil erosion by water (Renard et al., 1997). Crop grown, tillage system, and crop rotation as well as engineering practices such as terrace construction also influence soil loss and are parameters than can be modified by management. For furrow irrigated systems, a major consideration is slope of the furrow, i.e. if the K factor and furrow gradient are high, erosion potential is high. To the extent possible, irrigated fields should be designed to minimize slope of the run of the furrow.

Amount of wind erosion can be estimated by use of the Wind Erosion Equation (WEQ). Factors in this equation include a soil erodibility index, soil roughness, a climate factor, unsheltered distance across the field along the prevailing wind erosion direction, and equivalent vegetative cover (Woodruff and Siddoway, 1965). The soil erodibility index is based on aggregate size at the soil surface and a wind erodibility group (WEG) which is assigned based on texture of the surface horizon and presence or absence of carbonates in the surface (L = carbonates (lime) present in the surface horizon). As the WEG increases, susceptibility of the soil to wind erosion decreases. For the pedons evaluated in Farah and Kunar Provinces, the WEG ranged from 2 to 5 (Table 17). Pedon S09AF006002 with a calcareous, loamy sand surface horizon was most susceptible to wind erosion (WEG = 2) and pedons S09AF015005 and S09AF015006 with non-calcareous loam surface horizons were least prone to blowing. Wind breaks and surface cover with residue are effective in reducing wind erosion.

Table 17. Soil erodibility factors.

Pedon	K Factor	WEG†
S09AF006001	0.43	3
S09AF006002	0.28	2
S09AF006003	0.64	4L
S09AF006004	0.64	4L
S09AF006005	0.55	4L
S09AF006006	0.64	4L
S09AF006007	0.55	4L
S09AF006008	0.55	4L
S09AF015001	0.32	3
S09AF015002	0.43	4L
S09AF015003	0.49	3
S09AF015004	0.24	3
S09AF015005	0.37	5
S09AF015006	0.32	5

† - Wind erodibility group.

Summary

Fourteen pedons, eight in Farah Province and six in Kunar Province, were sampled and analyzed to better understand properties of soils and potential limitations for crop production in these regions. In the Farah Province, six of the pedons evaluated were in the Farah Rud alluvial valley. The other two pedons were outside the valley on alluvial fans southwest of Farah City. All pedons evaluated in the Farah Province were alkaline, calcareous, had low amounts of organic C, and had inherently low nutrient levels. Textures ranged from sandy to clayey, and gravel content, although low over most of the area, was high in pedons located near the boundary between the alluvial valley and alluvial fans surrounding the valley.

Soil development in the Farah Province varied considerably. Six of the pedons had argillic horizons and calcic horizons were also common. Two of the pedons were more weakly developed with only cambic horizons. The degree of development suggests that the terraces on which the soils lie are relatively stable, and addition of fresh sediment with flood events is rare.

No physical limitations for plant growth were observed in the Farah pedons evaluated. For six of the pedons evaluated, Na contents were relatively high and water movement through the soils may be limited due to clay dispersion and structure degradation. The soils in the alluvial valley were non-saline and no evidence was observed that would suggest salt additions with irrigation water. One pedon on an alluvial fan was exceptionally saline with electrical conductivity in excess of 180 ds m^{-1} in the surface horizon. Depth distribution of the salinity suggests salts in the surface horizon originated shallow groundwater and had concentrated at the surface through evaporative wicking.

In the Kunar Province, the six pedons were in the alluvial valleys of the Kunar and Pech Rivers which join in Asadabad. Precipitation in this region is higher than that observed the area studied in the Farah Province. Four of the six pedons were calcareous, but the carbonate content was considerably lower than was observed in the Farah Province. The soils were alkaline in reaction, however. Textures were dominantly loamy. Generally, organic C contents in the soils evaluated were higher than was observed in the Farah Province, and as a result, three of the pedons had mollic epipedons and were Mollisols.

Similar to soils in the Farah Province, soil development varied but was, in general, moderately advanced. Four of the pedons had argillic horizons. Degree of development and presence of argillic horizons suggests addition of fresh sediments with flooding of the rivers is relatively rare.

No physical limitations for plant growth were observed in the pedons evaluated in Kunar Province. In contrast to the Farah pedons, however, none of the pedons were saline and all had low levels of Na in all horizons. Low Na in these soils coupled with relatively high organic C in surface horizons suggests infiltration and water movement would not be impeded in these soils. Although relatively low, maximal EC was observed in the surface horizon of several of the pedons which suggests salts may be added with irrigation water. The amount of salt addition is

not an issue for plant growth at this time, but quality of irrigation water should be regularly evaluated.

References

- Afghanistan Geologic Survey. 2016a. Geology of Afghanistan.
<http://www.bgs.ac.uk/afghanminerals/geology.htm>.
- Afghanistan Geologic Survey. 2016b. Afghanistan: its geography, peoples and history.
<https://www.bgs.ac.uk/AfghanMinerals/environs.htm>.
- Blakemore, L.C., P.L. Searle, and B.K. Daly. 1987. Methods for chemical analysis of soils. 43 p. N. Z. Bur. Sci. Rep. 80, N. Z. Soil Bur. Lower Hutt, New Zealand.
- Bohannon, Robert G. and Turner, Kenzie J. 2005. Geologic Map of Quadrangle 3470 and the Northern Edge Of Quadrangle 3370, Jalal-Abad (511), Chaghasaray (512), and Northernmost Jaji-Maydan (517) Quadrangles, Afghanistan. U.S. Geological Survey Open-file Report 2005-1108-A.
- Doebrich, J.L. and R.R. Wahl. 2006. Geologic and mineral resource map of Afghanistan. U.S. Geol. Survey Open File Rep. 2006-1038.
- Dubee, Bruce. 2009. Proposal to Conduct a Comprehensive Soil Characterization Study in Farah, Kunar, and Nangahar Provinces, Afghanistan. USDA-FAS.
- Elrashidi, M.A. 2001. Selection of appropriate phosphorus test for soils. USDA/NRCS, National Soil Survey Center.
- Elrashidi, M.A., M.D. Mays, and C.W. Lee. 2003. Assessment of Mehlich3 and ammonium bicarbonate-DTPA extraction for simultaneous measurement of fifteen elements in soils. Commun. Soil Sci. Plant Anal. 34:2817-2003.
- Kellogg, C.E. 1962. The place of the laboratory and soil classification and interpretation. USDA-Soil Conservation Service, Washington, D.C.
- Lidke, David J. 2005. Geologic Map of Quadrangle 3262, Farah (421) and Hokumat-E-Pur-Chaman (422) Quadrangles, Afghanistan. U.S. Geological Survey Open-file Report 2005-1108-A.
- Lindsay, W.L. 1979. Chemical equilibria in soils. John Wiley & Sons, New York.
- McIntyre, D.S. 1979. Exchangeable sodium, subplasticity and hydraulic conductivity of some Australian soils. Aust. J. Soil Res. 17:115-120.
- Mengel, K., and E.A. Kirkby. 1982. Principles of plant nutrition. International Potash Institute,

Olsen, S.R., C.V. Cole, F.S. Watanabe, and L.A. Dean. 1954. Estimation of available phosphorus in soils by extraction with sodium bicarbonate. U.S. Dep. of Agric. Circ. 939.

Olsen, S.R., C.V. Cole, F.S. Watanabe, and L.A. Dean. 1954. Estimation of available phosphorus in soils by extraction with sodium bicarbonate. Circular 939. USDA-Agricultural Research Service.

NOAA. 2016. Surface climate summary stations – Afghanistan. National Climatic Data Center. <http://www.ncdc.noaa.gov/oa/climate/afghan/data/surfaceafghanistan.html>.

Northcote, K.H., and J.K.M. Skene. 1972. Australian soils with saline and sodic properties. CSIRO Aust. Div. Soils. Publ. 27.

Renard, K.G., G.R. Foster, G.A. Weesies, K.K. McCool, and D.C. Yoder, coordinators. 1997. Predicting soil erosion by water : a guide to conservation planning with the revised universal soil loss equation. U.S. Department of Agriculture, Agriculture Handbook no. 703, 404 pp.

Schoeneberger, P.J., D.A. Wysocki, E.C. Benham, and Soil Survey Staff. 2012. Field book for describing and sampling soils, Version 3.0. Natural Resources Conservation Service, National Soil Survey Center, Lincoln, NE.

Shainberg, I., M.E. Sumner, W.P. Miller, M.P. W. Farina, M.A. Pavan, and M.Y. Fey. 1989. Use of Gypsum on Soils: A Review. p. 1-111 IN Stewart, B.A. (ed.) Advances in Soil Sci., vol. 9. Springer-Verlag, New York.

Smith, C.W., 1989. The Fertility Capability Classification System (FCC) – 3rd Approximation: A Technical Soil Classification System Relating Pedon Characterization Data to Inherent Fertility Characteristics. Ph.D. Dissertation. North Carolina State University, Raleigh, North Carolina.

Soil Survey Staff. 2014a. Kellogg Soil Survey Laboratory Methods Manual. Soil Survey Investigations Report No. 42, Version 5.0. R. Burt and Soil Survey Staff (ed.). U.S. Department of Agriculture, Natural Resources Conservation Service.

Soil Survey Staff. 2014b. Keys to Soil Taxonomy, 12th ed. USDA-Natural Resources Conservation Service, Washington, DC.

UC Davis International Programs. 2016. e-Afghan Ag Maps: Climate.
<http://afghanag.ucdavis.edu/country-info/e-afghan-ag-maps-1/e-afghan-ag-maps#climate>

Woodruff, N.P. and F.H. Siddoway. 1965. A wind erosion equation. Soil Sci Soc Am J.1965; 29: 602-608.

APPENDIX A

Farah Province Pedon Descriptions

PEDON DESCRIPTION

Print Date: Jun 7 2017

Description Date: Jan 21 2009

Describer: Jason Nemecek, Ed Tallyn

Site ID: S09AF006001

Site Note: Surface irrigated cropland - modified boarder irrigation: winter wheat; About 4 inches of rain annually during winter month. Irrigation water in Farah Province comes from both surface water (for part of the year, until the rivers dry up) and groundwater (karez).

Pedon ID: S09AF006001

Pedon Note: These soils have loamy surface and subsurface layers. Infiltration rates are moderate. Available water holding capacity is low. Base cation content is high although magnesium content is low. Calcium carbonate in the surface layer may lead to micronutrient deficiencies. Apply micronutrients foliar if deficiency symptoms appear. High calcium carbonate levels in the surface layer may require higher phosphorous fertilization rates than typically recommended. Irrigated crops, winter wheat. Management concerns: Low water holding capacity/coarse textures/high gravel content above 87 cm, Reaction strongly alkaline within 40 inches. Irrigation water management- timing and amounts (over irrigating).

Lab Source ID: SSL

Lab Pedon #: 09N0392

User Transect ID:

Soil Name as Described/Sampled: SND

Classification: coarse-loamy over sandy or sandy-skeletal, mixed over carbonatic, hyperthermic Typic Haplocambids

Soil Name as Correlated: Haplocambids

Classification: Coarse-loamy over sandy or sandy-skeletal, mixed over carbonatic, semiaactive, hyperthermic Typic Haplocambids

Pedon Type: undefined observation

Pedon Purpose: full pedon description

Taxon Kind: family

Associated Soils:

Physiographic Division:

Physiographic Province:

Physiographic Section:

State Physiographic Area:

Local Physiographic Area:

Geomorphic Setting: on tread of stream terrace on tread of conservation terrace on tread of river valley

Upslope Shape: linear

Cross Slope Shape: linear

Country: Afghanistan

State:

County:

MLRA:

Soil Survey Area:

Map Unit:

Quad Name:

Std Latitude: 32.3831667

Std Longitude: 62.1624167

Primary Earth Cover: Barren land

Secondary Earth Cover: Culturally induced barren

Vegetation:

Parent Material: mixed alluvium

Bedrock Kind:

Bedrock Depth:

Bedrock Hardness:

Bedrock Fracture Interval:

Particle Size Control Section: 25 to 100 cm.

Surface Fragments: 5.0 percent nonflat subangular indurated 2- to 75-millimeter Mixed rock fragments

Description origin: PedonPC

Description database: MLRA02_Davis

Diagnostic Features: ochric epipedon 0 to 53 cm.
cambic horizon 15 to 53 cm.
strongly contrasting particle size class 53 to cm.
lithologic discontinuity 112 to cm.
argillic horizon 112 to 200 cm.
secondary carbonates 112 to 200 cm.
strongly contrasting particle size class 112 to cm.

Top Depth (cm)		Bottom Depth (cm)		Restriction Kind					Restriction Hardness		
53				strongly contrasting textural stratification					Noncemented		
112				strongly contrasting textural stratification					Noncemented		
Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)	
1.0	666.0	0	21.0			75		well			

Ap--0 to 15 centimeters (0.0 to 5.9 inches); light olive brown (2.5Y 5/4) fine sandy loam, olive brown (2.5Y 4/4), moist; 59 percent sand; 32 percent silt; 8 percent clay; weak thin platy structure; soft, very friable, nonsticky, nonplastic; many very fine roots throughout and common medium roots throughout and common coarse roots throughout; many very fine low-continuity vesicular and common medium low-continuity vesicular and many fine low-continuity vesicular pores; 5 percent nonflat subrounded indurated 2 to 75-millimeter Mixed rock fragments; violent effervescence, by HCl, 1 normal; moderately alkaline, pH 8.4, pH meter; gradual wavy boundary. Lab sample # 09N02073

Bw1--15 to 31 centimeters (5.9 to 12.2 inches); light olive brown (2.5Y 5/4) loam, olive brown (2.5Y 4/4), moist; 42 percent sand; 46 percent silt; 12 percent clay; weak thick platy structure; soft, very friable, slightly sticky, slightly plastic; common coarse roots throughout; many very fine low-continuity vesicular and common medium low-continuity vesicular and many fine low-continuity vesicular pores; 3 percent nonflat subrounded indurated 2 to 75-millimeter Mixed rock fragments; sodium adsorption ratio of 3.0; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.5, pH meter; gradual wavy boundary. Lab sample # 09N02074

Bw2--31 to 53 centimeters (12.2 to 20.9 inches); light olive brown (2.5Y 5/4) fine sandy loam, olive brown (2.5Y 4/4), moist; 68 percent sand; 23 percent silt; 9 percent clay; weak coarse subangular blocky structure; slightly hard, friable, nonsticky, nonplastic; common medium roots throughout and common fine roots throughout; many very coarse low-continuity tubular and many fine low-continuity tubular and common coarse low-continuity tubular pores; 5 percent nonflat subrounded indurated 2 to 75-millimeter Mixed rock fragments; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.6, pH meter; gradual wavy boundary. Lab sample # 09N02075

C1--53 to 68 centimeters (20.9 to 26.8 inches); light olive brown (2.5Y 5/4) very gravelly fine sand, olive brown (2.5Y 4/4), moist; 91 percent sand; 5 percent silt; 4 percent clay; weak coarse subangular blocky structure; loose, loose, nonsticky, nonplastic; common medium roots throughout and common coarse roots throughout; common very fine low-continuity tubular pores; 40 percent nonflat subrounded indurated 2 to 75-millimeter Mixed rock fragments; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.7, pH meter; clear wavy boundary. Lab sample # 09N02076

C2--68 to 87 centimeters (26.8 to 34.3 inches); light yellowish brown (2.5Y 6/4) very gravelly loamy fine sand, olive brown (2.5Y 4/4), moist; 83 percent sand; 10 percent silt; 8 percent clay; weak coarse subangular blocky structure; loose, loose, nonsticky, nonplastic; common very fine low-continuity tubular pores; 50 percent nonflat subrounded indurated 2 to 75-millimeter Mixed rock fragments; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.8, pH meter; clear smooth boundary. Lab sample # 09N02077

C3--87 to 112 centimeters (34.3 to 44.1 inches); dark yellowish brown (10YR 4/6) fine sand, dark yellowish brown (10YR 3/6), moist; 92 percent sand; 3 percent silt; 5 percent clay; structureless massive; loose, loose, nonsticky, nonplastic; 10 percent nonflat subrounded indurated 2 to 75-millimeter Mixed rock fragments; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.8, pH meter; abrupt smooth boundary. Lab sample # 09N02078

2Btknb--112 to 200 centimeters (44.1 to 78.7 inches); dark yellowish brown (10YR 4/4) fine sandy loam, dark yellowish brown (10YR 4/4), moist; 76 percent sand; 7 percent silt; 17 percent clay; structureless massive; extremely hard, very firm, moderately sticky, moderately plastic; common very coarse roots throughout; 30 percent prominent clay films on all faces of peds; 5 percent fine distinct irregular extremely weakly cemented 10YR 8/1), dry, carbonate masses with diffuse boundaries throughout; 20 percent nonflat subrounded indurated 2 to 75-millimeter Mixed rock fragments; sodium adsorption ratio of 4.0; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.7, pH meter. Lab sample # 09N02079

PEDON DESCRIPTION

Print Date: Jun 7 2017

Description Date: Jan 21 2009

Describer: Jason Nemecek, Ed Tallyn

Site ID: S09AF006002

Site Note: Range (non-irrigated); About 4 inches of rain annually during winter month. The water in Farah Province comes from both surface water (for part of the year, until the rivers dry up) and groundwater (karez).

Pedon ID: S09AF006002

Pedon Note: Low holding capacity in surface. Management concerns: Slow soil infiltration rates below surface horizon, Low water holding capacity. Coarse textures/high gravel content below 53 cm, strongly alkaline within 100 cm, Contrasting particle size within 100 cm, irrigation water management timing and amounts (over irrigating); This soil has a sandy surface and subsurface layer, is gravelly in the upper 20 cm, and very gravelly in the subsurface layer. Gravel content increases to over 60 percent below 50 cm. The soil has very low available water holding capacity and irrigation must be very frequent. The soil is highly calcareous and micronutrient deficiencies are probable without foliar applications. Cation exchange capacity and exchangeable magnesium is low. Saturated hydraulic conductivity is high and nutrient leaching is likely. Small, frequent fertilizer applications are recommended. High Calcium carbonate levels in the surface layer may require higher phosphorous fertilization rates than typically recommended.

Lab Source ID:

Lab Pedon #: 09N0393

User Transect ID:

Soil Name as Described/Sampled: SND

Classification: Loamy-skeletal, carbonatic, hyperthermic Typic Haplargids

Soil Name as Correlated: Haplargids

Classification: Loamy-skeletal, carbonatic, hyperthermic Typic Haplargids

Pedon Type:

Pedon Purpose: full pedon description

Taxon Kind: family

Associated Soils:

Physiographic Division:

Physiographic Province:

Physiographic Section:

State Physiographic Area:

Local Physiographic Area:

Geomorphic Setting: on tread of fan apron on tread of fan piedmont

Country: Afghanistan

State:

County:

MLRA:

Soil Survey Area:

Map Unit:

Quad Name:

Std Latitude: 32.3861111

Std Longitude: 62.1697222

Primary Earth Cover: Barren land

Secondary Earth Cover: Savanna rangeland

Vegetation:

Parent Material: mixed alluvium

Bedrock Kind:

Bedrock Depth:

Upslope Shape: linear

Cross Slope Shape: linear

Particle Size Control Section: 87 to 137 cm.

Bedrock Hardness:

Bedrock Fracture Interval:

Surface Fragments: subangular indurated and 40.0 percent nonflat subangular 2- to 75-millimeter Mixed rock fragments and 30.0 percent nonflat subangular indurated 75- to 250-millimeter Mixed rock fragments

Description origin: PedonPC

Description

database: MLRA02_Davis

Diagnostic Features: ochric epipedon 0 to 87 cm.
argillic horizon 87 to 200 cm.
secondary carbonates 87 to 200 cm.
strongly contrasting particle size class 168 to cm.
lithologic discontinuity 168 to cm.

Top Depth (cm)	Bottom Depth (cm)	Restriction Kind	Restriction Hardness
168		strongly contrasting textural stratification	Noncemented

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
1.0	665.0	0	21.0			75		well		

A1--0 to 11 centimeters (0.0 to 4.3 inches); light yellowish brown (10YR 6/4) gravelly loamy sand, dark yellowish brown (10YR 4/4), moist; 78 percent sand; 17 percent silt; 4 percent clay; structureless single grain; loose, loose, nonsticky, nonplastic; few fine roots around fragments; few very fine low-continuity vesicular pores; 10 percent nonflat subangular indurated 75 to 250-millimeter Mixed rock fragments and 15 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.5, pH meter; clear smooth boundary. Lab sample # 09N02081

A2--11 to 31 centimeters (4.3 to 12.2 inches); light yellowish brown (10YR 6/4) very gravelly loamy fine sand, dark yellowish brown (10YR 4/4), moist; 76 percent sand; 19 percent silt; 5 percent clay; weak thick platy structure; soft, very friable, nonsticky, nonplastic; few very fine roots around fragments; few very fine low-continuity vesicular pores; 11 percent nonflat subangular indurated 75 to 250-millimeter Mixed rock fragments and 30 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.5, pH meter; clear smooth boundary. Lab sample # 09N02082

Bw1--31 to 59 centimeters (12.2 to 23.2 inches); light yellowish brown (10YR 6/4) extremely cobbly loamy coarse sand, 10YR 2/4 (10YR 2/4), moist; 86 percent sand; 8 percent silt; 6 percent clay; weak coarse subangular blocky structure; soft, very friable, nonsticky, nonplastic; common very fine roots around fragments; many very fine low-continuity vesicular and many fine low-continuity vesicular pores; 30 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments and 40 percent nonflat subangular indurated 75 to 250-millimeter Mixed rock fragments; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.6, pH meter; gradual smooth boundary. Lab sample # 09N02083

Bw2--59 to 87 centimeters (23.2 to 34.3 inches); light brown (7.5YR 6/3) extremely cobbly loamy coarse sand, brown (7.5YR 4/4), moist; 87 percent sand; 4 percent silt; 9 percent clay; weak coarse subangular blocky structure; soft, very friable, nonsticky, nonplastic; very few very fine roots around fragments; many

very fine low-continuity vesicular and few fine low-continuity vesicular pores; 40 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments and 40 percent nonflat subangular indurated 75 to 250-millimeter Mixed rock fragments; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.6, pH meter; gradual smooth boundary. Lab sample # 09N02084

Btk1--87 to 134 centimeters (34.3 to 52.8 inches); brown (7.5YR 5/4) extremely cobbly fine sandy loam, strong brown (7.5YR 4/6), moist; 74 percent sand; 6 percent silt; 20 percent clay; moderate medium subangular blocky structure; soft, very friable, nonsticky, nonplastic; very few very fine roots around fragments; common very fine low-continuity vesicular and common fine low-continuity vesicular pores; 25 percent prominent clay films on rock fragments; 5 percent fine distinct irregular extremely weakly cemented 10YR 8/1), dry, carbonate masses with clear boundaries throughout; 30 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments and 30 percent nonflat subangular indurated 75 to 250-millimeter Mixed rock fragments; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.5, pH meter; abrupt smooth boundary. Lab sample # 09N0285

Btk2--134 to 168 centimeters (52.8 to 66.1 inches); yellowish brown (10YR 5/4) very gravelly loamy sand, dark yellowish brown (10YR 4/6), moist; 83 percent sand; 5 percent silt; 12 percent clay; moderate coarse subangular blocky structure; soft, very friable, nonsticky, nonplastic; very few very fine roots around fragments; common very fine low-continuity vesicular pores; 35 percent prominent clay films on rock fragments; 5 percent fine distinct irregular extremely weakly cemented 10YR 8/1), dry, carbonate masses with clear boundaries throughout; 15 percent nonflat subangular indurated 75 to 250-millimeter Mixed rock fragments and 30 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.5, pH meter; abrupt smooth boundary. Lab sample # 09N0286

2Btk3--168 to 200 centimeters (66.1 to 78.7 inches); light brown (7.5YR 6/4) sandy clay loam, strong brown (7.5YR 4/6), moist; 55 percent sand; 19 percent silt; 26 percent clay; moderate coarse subangular blocky structure; extremely hard, friable, nonsticky, moderately plastic; very few very fine roots around fragments; common very fine low-continuity vesicular pores; 15 percent prominent clay films on rock fragments; 15 percent fine distinct irregular extremely weakly cemented 10YR 8/1), moist, carbonate masses with clear boundaries throughout; 5 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.5, pH meter. Lab sample # 09N0287

PEDON DESCRIPTION

Print Date: Jun 7 2017

Description Date: Jan 21 2009

Describer: Jason Nemecek, Ed Tallyn

Site ID: S09AF006003

Site Note: Surface irrigated cropland - modified boarder irrigation: winter wheat; About 4 inches of rain annually during winter month. The water in Farah Province comes from both surface water (for part of the year, until the rivers dry up) and groundwater (karez).

Pedon ID: S09AF006003

Pedon Note: Lab data by horizon; calcium carbonate % is: 27, 29, 32, 31, 24, and 33. Exch. Na %: 1,9,10,12,14, 12. SAR 2, 4 ,5, 7 ,7, 5. Management concerns: Moderate soil infiltration rates in the surface horizon, pH above 8.4 within 100 cm. Elevated sodium/EC for salt sensitive plants. Irrigation water management- timing and amounts (over irrigating); This soil has a loamy surface and subsurface layer. Infiltration rates are moderate. Available water holding capacity is moderate. Base cation content is high. Calcium carbonate in the surface layer may lead to micronutrient deficiencies. Apply micronutrients foliar if deficiency symptoms appear. High calcium carbonate levels in the surface layer may require higher phosphorous fertilization rates than typically recommended. The upper 50 cm are slightly saline. Salinity increases below this depth. Use of poor quality irrigation water and/or not including a periodic leaching of accumulated salts may lead to further salinization. Salinity monitoring is recommended.

Lab Source ID: SSL

Lab Pedon #: 09N0394

User Transect ID:

Soil Name as Described/Sampled: SND

Classification: Fine-loamy, mixed, superactive, hyperthermic
Typic Haplargids

Soil Name as Correlated: Haplargids

Classification: Coarse-loamy, mixed, semiactive, hyperthermic
Typic Haplargids

Pedon Type:

Pedon Purpose: full pedon description

Taxon Kind: family

Associated Soils:

Physiographic Division:

Physiographic Province:

Physiographic Section:

State Physiographic Area:

Local Physiographic Area:

Country: Afghanistan

State:

County:

MLRA:

Soil Survey Area:

Map Unit:

Quad Name:

Std Latitude: 32.4265833

Std Longitude: 62.1632222

Primary Earth Cover: Barren land

Secondary Earth Cover: Culturally induced barren

Vegetation:

Parent Material: mixed alluvium

Bedrock Kind:

Geomorphic Setting: on tread of stream terrace
on tread of river valley
on tread of conservation terrace

Upslope Shape: linear

Cross Slope Shape: linear

Particle Size Control Section: 25 to 100 cm.

Description origin: PedonPC

Diagnostic Features: ochric epipedon 0 to 49 cm.
cambic horizon 18 to 49 cm.
argillic horizon 49 to 67 cm.
lithologic discontinuity 49 to cm.

Bedrock Depth:

Bedrock Hardness:

Bedrock Fracture Interval:

Surface Fragments: 2.0 percent
nonflat subrounded indurated 2- to
75-millimeter Mixed rock fragments

Description database: MLRA02_Davis

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
1.0	671.0	0	21.0			75		well		

Ap--0 to 18 centimeters (0.0 to 7.1 inches); light yellowish brown (2.5Y 6/3) silt loam, light olive brown (2.5Y 5/4), moist; 11 percent sand; 68 percent silt; 21 percent clay; weak very coarse columnar structure; extremely hard, very firm, very sticky, very plastic; common very fine roots in cracks and common medium roots in cracks and common coarse roots in cracks; many very fine low-continuity vesicular and many fine low-continuity vesicular pores; sodium adsorption ratio of 2.0; strong effervescence, by HCl, 1 normal; moderately alkaline, pH 8.4, pH meter; gradual smooth boundary. Lab sample # 09N02088

Bn--18 to 49 centimeters (7.1 to 19.3 inches); pale yellow (2.5Y 7/3) silt loam, light olive brown (2.5Y 5/3), moist; 16 percent sand; 60 percent silt; 24 percent clay; weak coarse prismatic parts to weak coarse subangular blocky structure; extremely hard, very firm, very sticky, very plastic; few very fine roots in cracks and few fine roots in cracks; many very fine low-continuity vesicular and many fine low-continuity vesicular pores; 10 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments; sodium adsorption ratio of 4.0; strong effervescence, by HCl, 1 normal; moderately alkaline, pH 8.4, pH meter; clear wavy boundary. Lab sample # 09N02089

2Btn1--49 to 67 centimeters (19.3 to 26.4 inches); pale yellow (2.5Y 7/3) loam, light olive brown (2.5Y 5/3), moist; 30 percent sand; 48 percent silt; 22 percent clay; weak coarse prismatic parts to weak coarse subangular blocky structure; extremely hard, very firm, slightly sticky, very plastic; very few very coarse roots in cracks; many very fine low-continuity vesicular and many fine low-continuity vesicular pores; 5 percent distinct clay films on rock fragments; 30 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments; sodium adsorption ratio of 5.0; strong effervescence, by HCl, 1 normal; moderately alkaline, pH 8.3, pH meter; clear wavy boundary. Lab sample # 09N02090

2Btn2--67 to 114 centimeters (26.4 to 44.9 inches); light yellowish brown (2.5Y 6/3) fine sandy loam, light olive brown (2.5Y 5/4), moist; 70 percent sand; 18 percent silt; 12 percent clay; weak medium prismatic parts to weak coarse subangular blocky structure; extremely hard, very firm, very sticky, moderately plastic; common very coarse roots in cracks and common coarse roots in cracks; many very fine low-continuity vesicular and many fine low-continuity vesicular pores; 5 percent faint clay films on rock fragments; 3 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments and 3 percent nonflat subangular indurated 75 to 250-millimeter Mixed rock fragments; sodium adsorption ratio of 7.0; strong effervescence, by HCl, 1 normal; strongly alkaline, pH 8.6, pH meter; clear wavy boundary. Lab

sample # 09N02091

2Btn3--114 to 141 centimeters (44.9 to 55.5 inches); pale yellow (2.5Y 7/3) loam, light olive brown (2.5Y 5/4), moist; 42 percent sand; 35 percent silt; 23 percent clay; structureless massive; extremely hard, very firm, very sticky, very plastic; common very coarse roots in cracks and common coarse roots in cracks; many very fine low-continuity vesicular and many fine low-continuity vesicular pores; 25 percent prominent clay films on rock fragments; 20 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments and 20 percent nonflat subangular indurated 75 to 250-millimeter Mixed rock fragments; sodium adsorption ratio of 7.0; strong effervescence, by HCl, 1 normal; strongly alkaline, pH 8.9, pH meter; clear smooth boundary. Lab sample # 09N02092

2Cn--141 to 200 centimeters (55.5 to 78.7 inches); light brownish gray (2.5Y 6/2) sandy loam, light yellowish brown (2.5Y 6/4), moist; 70 percent sand; 22 percent silt; 9 percent clay; structureless massive; extremely hard, very firm, nonsticky, nonplastic; 35 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments and 35 percent nonflat subangular indurated 75 to 250-millimeter Mixed rock fragments; sodium adsorption ratio of 5.0; strong effervescence, by HCl, 1 normal; strongly alkaline, pH 8.8, pH meter. Lab sample # 09N02093

PEDON DESCRIPTION

Print Date: Jun 7 2017

Description Date: Jan 22 2009

Describer: Jason Nemecek, Ed Tallyn

Site ID: S09AF006004

Site Note: Surface irrigated cropland - modified boarder irrigation: currently fallow but previous crop was winter wheat. About 4 inches of rain annually during winter month. The water in Farah Province comes from both surface water (for part of the year, until the rivers dry up) and groundwater (karez).

Pedon ID: S09AF006004

Pedon Note: Lab by horizon: CaCo3 % 29, 28,27, 30, 36, 38, good dispersion, Exchange NA 5,5,4,5,8,9; SAR 2,2,2,3,5,5. Very high water holding capacity, Management concerns: Strongly alkaline within 100 cm. Elevated EC/sodium for salt sensitive plants. Irrigation water management- timing and amounts (over irrigating). Modified boarder, Irrigated crops, winter wheat.

Columnnar Structure. This soil has a loamy surface and subsurface layers. Infiltration rates are moderate in the surface layer and saturated hydraulic conductivity is moderate in the subsurface layer. Available water holding capacity is moderate. Base cation content is high. Calcium carbonate in the surface layer may lead to micronutrient deficiencies. Apply micronutrients foliar if deficiency symptoms appear. High calcium carbonate levels in the surface layer may require higher phosphorous fertilization rates than typically recommended.

Lab Source ID:

Lab Pedon #: 09N0395

User Transect ID:

Soil Name as Described/Sampled: SND

Classification: Fine, mixed, superactive, hyperthermic Typic Calciargids

Soil Name as Correlated: Calciargids

Classification: Fine-silty, mixed, semiactive, hyperthermic Typic Calciargids

Pedon Type:

Pedon Purpose: full pedon description

Taxon Kind: family

Associated Soils:

Physiographic Division:

Physiographic Province:

Physiographic Section:

State Physiographic Area:

Local Physiographic Area:

Geomorphic Setting: on tread of stream terrace
on tread of conservation terrace
on tread of river valley

Country: Afghanistan

State:

County:

MLRA:

Soil Survey Area:

Map Unit:

Quad Name:

Std Latitude: 32.3768056

Std Longitude: 62.1078333

Primary Earth Cover: Crop cover

Secondary Earth Cover: Row crop

Vegetation:

Parent Material: mixed alluvium

Bedrock Kind:

Bedrock Depth:

Upslope Shape: linear
Cross Slope Shape: linear
Particle Size Control Section: 29 to 79 cm.

Description origin: PedonPC

Diagnostic Features: ochric epipedon 0 to 29 cm.
 argillic horizon 29 to 200 cm.
 secondary carbonates 122 to 200 cm.
 calcic horizon 122 to 200 cm.

Bedrock Hardness:
Bedrock Fracture Interval:
Surface Fragments: 1.0 percent nonflat subangular indurated 2- to 75-millimeter Mixed rock fragments
Description database: MLRA02_Davis

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
1.0	636.0	0	21.0			75		well		

Ap--0 to 12 centimeters (0.0 to 4.7 inches); light gray (2.5Y 7/2) silt loam, light olive brown (2.5Y 5/4), moist; 14 percent sand; 64 percent silt; 23 percent clay; strong coarse columnar parts to moderate medium subangular blocky structure; extremely hard, very firm, slightly sticky, moderately plastic; common medium roots throughout and common fine roots throughout; many very fine low-continuity vesicular and many fine low-continuity vesicular pores; 1 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments; sodium adsorption ratio of 2.0; strong effervescence, by HCl, 1 normal; slightly alkaline, pH 7.8, pH meter; gradual smooth boundary. Lab sample # 09N02095

Bw-12 to 29 centimeters (4.7 to 11.4 inches); pale yellow (2.5Y 7/3) silt loam, light olive brown (2.5Y 5/4), moist; 13 percent sand; 61 percent silt; 26 percent clay; weak coarse subangular blocky structure; extremely hard, very firm, slightly sticky, moderately plastic; common medium roots throughout and common fine roots throughout; many very fine low-continuity vesicular and common medium low-continuity vesicular pores; 1 percent nonflat subangular indurated 2 to 76-millimeter Mixed rock fragments; sodium adsorption ratio of 2.0; strong effervescence, by HCl, 1 normal; moderately alkaline, pH 8.1, pH meter; gradual smooth boundary. Lab sample # 09N02096

Bt1--29 to 57 centimeters (11.4 to 22.4 inches); very pale brown (10YR 7/3) silty clay loam, yellowish brown (10YR 5/4), moist; 8 percent sand; 56 percent silt; 36 percent clay; weak coarse prismatic parts to moderate medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; common medium roots throughout and common coarse roots throughout; many very fine low-continuity vesicular and common coarse low-continuity vesicular pores; 10 percent prominent clay films on vertical faces of ped; 1 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments; sodium adsorption ratio of 2.0; violent effervescence, by HCl, 1 normal; moderately alkaline, pH 8.3, pH meter; clear smooth boundary. Lab sample # 09N02097

Bt2--57 to 122 centimeters (22.4 to 48.0 inches); very pale brown (10YR 7/3) silty clay loam, brown (10YR 4/3), moist; 16 percent sand; 55 percent silt; 30 percent clay; moderate coarse prismatic parts to weak medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; common medium roots throughout and common fine roots throughout and common coarse roots throughout; many very fine low-continuity vesicular and common medium low-continuity vesicular and many fine low-continuity vesicular pores; 40 percent prominent clay films on all faces of ped; 1 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments; sodium adsorption ratio of 3.0; violent effervescence, by HCl, 1 normal; moderately alkaline, pH 8.3, pH meter; clear smooth boundary. Lab sample # 09N02098

Bt kn1--122 to 153 centimeters (48.0 to 60.2 inches); pale brown (10YR 6/3) silt loam, brown (10YR 5/3), moist; 22 percent sand; 57 percent silt; 21 percent clay; moderate coarse subangular blocky parts to moderate medium subangular blocky structure; extremely hard, very firm, very sticky, moderately plastic; common medium roots throughout; many medium low-continuity vesicular and many fine low-continuity vesicular pores; 40 percent prominent clay films on all faces of ped; 2 percent fine prominent irregular weakly cemented 10YR 8/1), dry, carbonate nodules with clear boundaries throughout and 4 percent medium prominent irregular extremely weakly cemented 10YR 8/1), dry, carbonate masses with clear boundaries throughout; 1 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments; sodium adsorption ratio of 5.0; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.5, pH meter; gradual smooth boundary. Lab sample # 09N02099

Bt kn2--153 to 200 centimeters (60.2 to 78.7 inches); light yellowish brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4), moist; 23 percent sand; 58 percent silt; 20 percent clay; moderate coarse subangular blocky parts to moderate medium subangular blocky structure; extremely hard, very firm, very sticky, moderately plastic; common medium roots throughout; many medium low-continuity vesicular and common fine low-continuity vesicular pores; 40 percent prominent clay films on all faces of ped; 4 percent medium prominent irregular extremely weakly cemented 10YR 8/1), dry, carbonate masses with clear boundaries throughout; 1 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments; sodium adsorption ratio of 5.0; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.5, pH meter. Lab sample # 09N02100

PEDON DESCRIPTION

Print Date: Jun 7 2017

Description Date: Jan 25 2009

Describer: Jason Nemecek, Ed Tallyn

Site ID: S09AF006005

Site Note: Surface irrigated cropland - modified boarder irrigation; About 4 inches of rain annually during winter month. The water in Farah Province comes from both surface water (for part of the year, until the rivers dry up) and groundwater (karez).

Pedon ID: S09AF006005

Pedon Note: Management concerns: High water table (49 cm) irrigation water management- timing and amounts (over irrigating) Lab data: CaCo₃ %, 27, 26, 31, 32, 33, 34; strongly alkaline within 100 cm. Elevated EC/sodium for salt sensitive plants. Exchange Na % 8, 9, 8, 9, 6, 5 SAR; 4, 5, 4, 4, 3, 3, Columnar Structure. "n" suffix. These soils have loamy surface and clayey subsurface layers. Infiltration rates are moderate. Available water holding capacity is high. Base cation content is high although magnesium content is low. Calcium carbonate in the surface layer may lead to micronutrient deficiencies. Apply micronutrients foliar if deficiency symptoms appear. High calcium carbonate levels in the surface layer may require higher phosphorous fertilization rates than typically recommended.

Lab Source ID:

Lab Pedon #: 09N0396

User Transect ID:

Soil Name as Described/Sampled: SND

Classification: Fine, mixed, superactive, hyperthermic Aquic Haplargids

Soil Name as Correlated: Aquicambids

Classification: Fine, mixed, semiactive, hyperthermic Fluventic Aquicambids

Pedon Type:

Pedon Purpose: full pedon description

Taxon Kind: family

Associated Soils:

Physiographic Division:

Physiographic Province:

Physiographic Section:

State Physiographic Area:

Local Physiographic Area:

Geomorphic Setting: on tread of stream terrace
on tread of river valley
on tread of conservation terrace

Upslope Shape: linear

Cross Slope Shape: linear

Country: Afghanistan

State:

County:

MLRA:

Soil Survey Area:

Map Unit:

Quad Name:

Std Latitude: 32.3837222

Std Longitude: 62.1066667

Primary Earth Cover: Crop cover

Secondary Earth Cover: Row crop

Vegetation:

Parent Material: mixed alluvium

Bedrock Kind:

Bedrock Depth:

Bedrock Hardness:

Bedrock Fracture Interval:

Particle Size Control Section: 25 to 100 cm.

Description origin: PedonPC

Surface Fragments:

Description

database: MLRA02_Davis

Diagnostic Features: ochric epipedon 0 to 14 cm.

cambic horizon 49 to 99 cm.

redox concentrations 49 to 200 cm.

anthric saturation 49 to 200 cm.

redox depletions with chroma 2 or less 99 to 200 cm.

reduced matrix 99 to 200 cm.

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
1.0	658.0	0	21.0			75		well		

Anp--0 to 14 centimeters (0.0 to 5.5 inches); pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3), moist; 5 percent sand; 55 percent silt; 39 percent clay; moderate coarse columnar structure; very hard, very firm, very sticky, moderately plastic; many medium roots throughout; many very fine low-continuity vesicular pores; sodium adsorption ratio of 4.0; strong effervescence, by HCl, 1 normal; strongly alkaline, pH 8.6, pH meter; clear wavy boundary. Lab sample # 09N02102

Btn1--14 to 49 centimeters (5.5 to 19.3 inches); pale brown (10YR 6/3) silty clay, brown (10YR 5/3), moist; 5 percent sand; 50 percent silt; 45 percent clay; moderate coarse subangular blocky structure; very hard, very firm, very sticky, moderately plastic; common very fine roots throughout and common medium roots throughout and common fine roots throughout; many very fine low-continuity vesicular and many fine low-continuity vesicular pores; 15 percent prominent clay films on all faces of peds; sodium adsorption ratio of 5.0; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.6, pH meter; clear wavy boundary. Lab sample # 09N02103

Btn2--49 to 79 centimeters (19.3 to 31.1 inches); pale brown (10YR 6/3) silty clay, pale brown (10YR 6/3), moist; 6 percent sand; 52 percent silt; 42 percent clay; moderate coarse subangular blocky structure; very hard, very firm, very sticky, moderately plastic; common medium roots throughout; many very fine low-continuity vesicular and many fine low-continuity vesicular pores; 5 percent prominent clay films on all faces of peds and 5 percent prominent 10YR 2.5/1), moist, organic stains on all faces of peds; 3 percent fine distinct irregular extremely weakly cemented 10YR 6/8), dry, masses of reduced iron with clear boundaries Throughout; 3 percent nonflat rounded extremely weakly cemented 2 to 75-millimeter Charcoal fragments; 3 percent irregular 2 to 19 millimeter brick; sodium adsorption ratio of 4.0; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.6, pH meter; clear wavy boundary. Lab sample # 09N02104

Btng--79 to 99 centimeters (31.1 to 39.0 inches); pale brown (10YR 6/3) silty clay, light yellowish brown (10YR 6/4), moist; 7 percent sand; 53 percent silt; 41 percent clay; structureless massive; very hard, very firm, very sticky, moderately plastic; common medium roots throughout; many medium low-continuity vesicular pores; 5 percent prominent clay films on vertical faces of peds; 3 percent fine distinct irregular extremely weakly cemented 10YR 6/8), dry, masses of reduced iron with clear boundaries Throughout and 5 percent extremely coarse distinct irregular extremely weakly cemented clay depletions with clear boundaries Throughout; 1 percent nonflat rounded indurated 2-millimeter Mixed rock fragments and 1 percent nonflat rounded weakly cemented 2 to 4-millimeter Shell fragments; sodium adsorption ratio of 4.0; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.7, pH meter; clear smooth boundary. Lab sample # 09N02105

Bg1--99 to 140 centimeters (39.0 to 55.1 inches); light gray (10YR 7/2) silty clay, light gray (10YR 7/2),

moist; 6 percent sand; 52 percent silt; 42 percent clay; structureless massive; very hard, very firm, very sticky, slightly plastic; common medium roots throughout; many medium low-continuity vesicular pores; 3 percent fine distinct irregular extremely weakly cemented 10YR 6/8), dry, masses of reduced iron with clear boundaries Throughout and 20 percent extremely coarse distinct irregular extremely weakly cemented 10YR 6/2), dry, clay depletions with diffuse boundaries Throughout; 1 percent nonflat rounded indurated 2 to 75-millimeter Mixed rock fragments and 1 percent nonflat rounded weakly cemented 2 to 4-millimeter Shell fragments; sodium adsorption ratio of 3.0; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.8, pH meter; clear smooth boundary. Lab sample # 09N02106

Bg2--140 to 200 centimeters (55.1 to 78.7 inches); light gray (10YR 7/2) silty clay, light gray (10YR 7/2), moist; 4 percent sand; 55 percent silt; 40 percent clay; structureless massive; very hard, very firm, very sticky, moderately plastic; common medium roots throughout; many medium low-continuity vesicular pores; 3 percent fine distinct irregular extremely weakly cemented 10YR 6/8), dry, masses of reduced iron with clear boundaries Throughout and 20 percent extremely coarse distinct irregular extremely weakly cemented clay depletions with clear boundaries Throughout; 1 percent nonflat rounded indurated 2 to 75-millimeter Mixed rock fragments and 1 percent nonflat rounded weakly cemented 2 to 4-millimeter Shell fragments; sodium adsorption ratio of 3.0; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.7, pH meter. Lab sample # 09N02107

PEDON DESCRIPTION

Print Date: Jun 7 2017

Description Date: Jan 22 2009

Describer: Jason Nemecek, Ed Tallyn

Site ID: S09AF006006

Site Note: Surface irrigated cropland - modified boarder irrigation: winter wheat and orchards; About 4 inches of rain annually during winter month. The water in Farah Province comes from both surface water (for part of the year, until the rivers dry up) and groundwater (karez).

Pedon ID: S09AF006006

Pedon Note: Would be considered Prime farmland in U.S. if there is a dependable irrigation water supply (Climatic factor?).

Management concerns: Slow saturated hydraulic conductivity in the subsurface horizons. High EC/Sodium for salt sensitive plants. Irrigation water management- timing and amounts (over irrigating), Surface irrigated, winter wheat and orchards. Lab data by horizon: CaCo3; 31,26,29,29,34,37; Exch. Na: 11,11,12,35,15,23; SAR; 4,3,5,6,6,11. (horizon from 12 to 32 cm has fine stratification or rock structure evidence of recent flooding); This soil has a loamy surface and subsurface layer. Infiltration rates are moderate. Available water holding capacity is high. Base cation content is high. Calcium carbonate in the surface layer may lead to micronutrient deficiencies. Apply micronutrients foliar if deficiency symptoms appear. High calcium carbonate levels in the surface layer may require higher phosphorous fertilization rates than typically recommended. The soil is slightly saline and sodic. Salinity and sodicity increase in horizons below 50 cm. Use of poor quality irrigation water and/or not including a periodic leaching of accumulated salts may lead to further salinization. Salinity monitoring is recommended.

Lab Source ID:

Lab Pedon #: 09N0397

User Transect ID:

Soil Name as Described/Sampled: SND

Classification: Fine, mixed, superactive, hyperthermic Typic Haplocambids

Soil Name as Correlated: Haplocambids

Classification: Fine-silty, mixed, semiactive, hyperthermic Sodic Haplocambids

Pedon Type:

Pedon Purpose: full pedon description

Taxon Kind: family

Associated Soils:

Physiographic Division:

Country: Afghanistan

State:

County:

MLRA:

Soil Survey Area:

Map Unit:

Quad Name:

Std Latitude: 32.3531944

Std Longitude: 62.0631944

Physiographic Province:

Primary Earth Cover: Crop cover

Physiographic Section:

Secondary Earth Cover: Row crop

State Physiographic Area:

Vegetation:

Parent Material: mixed alluvium

Local Physiographic Area:

Geomorphic Setting: conservation terrace
river valley
stream terrace

Upslope Shape: linear

Cross Slope Shape: linear

Particle Size Control Section: 25 to 100 cm.

Description origin: PedonPC

Bedrock Kind:

Bedrock Depth:

Bedrock Hardness:

Bedrock Fracture Interval:

Surface Fragments:

Description database: MLRA02_Davis

Diagnostic Features: ochric epipedon 0 to 12 cm.
cambic horizon 32 to 76 cm.
lithologic discontinuity 32 to cm.
salt accumulations 76 to 112 cm.
secondary carbonates 76 to 200 cm.
durinodes 167 to 200 cm.

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
0.0	665.0	0	21.0			75		well		

Anp--0 to 12 centimeters (0.0 to 4.7 inches); pale brown (10YR 6/3) silt loam, brown (10YR 4/3), moist; 36 percent sand; 53 percent silt; 11 percent clay; weak medium subangular blocky structure; soft, friable, nonsticky, nonplastic; many medium roots throughout and common fine roots throughout; many fine vesicular pores; sodium adsorption ratio of 4.0; strong effervescence, by HCl, 1 normal; moderately alkaline, pH 8.4, pH meter; clear smooth boundary. Lab sample # 09N02109

Bwn1--12 to 32 centimeters (4.7 to 12.6 inches); light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4), moist; 19 percent sand; 62 percent silt; 19 percent clay; moderate thin platy parts to weak coarse subangular blocky structure; slightly hard, firm, very sticky, slightly plastic; many very fine roots throughout and many fine roots throughout; common fine vesicular and common coarse tubular pores; sodium adsorption ratio of 3.0; strong effervescence, by HCl, 1 normal; moderately alkaline, pH 8.1, pH meter; clear smooth boundary. Lab sample # 09N02110

2Bwn2--32 to 76 centimeters (12.6 to 29.9 inches); light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4), moist; 13 percent sand; 63 percent silt; 24 percent clay; weak medium angular blocky structure; slightly hard, firm, very sticky, moderately plastic; common medium roots throughout and common fine roots throughout; common coarse high-continuity tubular pores; sodium adsorption ratio of 5.0; violent effervescence, by HCl, 1 normal; moderately alkaline, pH 8.2, pH meter; gradual smooth boundary. Lab sample # 09N02111

2Bkn1--76 to 112 centimeters (29.9 to 44.1 inches); very pale brown (10YR 7/3) silt loam, dark yellowish brown (10YR 4/4), moist; 17 percent sand; 61 percent silt; 23 percent clay; weak coarse angular blocky structure; slightly hard, friable, very sticky, moderately plastic; few fine roots throughout; common very fine tubular and few very coarse tubular pores; 1 percent fine irregular carbonate masses on faces of peds; sodium adsorption ratio of 6.0; violent effervescence, by HCl, 1 normal; moderately alkaline, pH 8.4, pH meter; gradual smooth boundary. Lab sample # 09N02112

2Bkn2--112 to 167 centimeters (44.1 to 65.7 inches); pale brown (10YR 6/3) silt loam, yellowish brown (10YR 5/4), moist; 18 percent sand; 64 percent silt; 18 percent clay; weak coarse angular blocky structure; slightly hard, firm, very sticky, moderately plastic; few medium roots throughout; many very fine

vesicular and many fine vesicular pores; 1 percent fine irregular carbonate masses throughout and 1 percent medium spherical carbonate nodules throughout; sodium adsorption ratio of 6.0; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.6, pH meter; gradual smooth boundary. Lab sample # 09N02113

2Bknq--167 to 200 centimeters (65.7 to 78.7 inches); light yellowish brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4), moist; 27 percent sand; 60 percent silt; 13 percent clay; weak thin platy parts to weak coarse angular blocky structure; slightly hard, firm, very sticky, moderately plastic; many very fine vesicular and many fine vesicular pores; 1 percent fine irregular carbonate masses throughout and 5 percent medium spherical strongly cemented durinodes throughout; sodium adsorption ratio of 11.0; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.5, pH meter. Lab sample # 09N02114

PEDON DESCRIPTION

Print Date: Jun 7 2017

Description Date: Jan 24 2009

Describer: Jason Nemecek, Ed Tallyn

Site ID: S09AF006007

Site Note: Rangeland - salt crust on surface; About 4 inches of rain annually during winter month. The water in Farah Province comes from both surface water (for part of the year, until the rivers dry up) and groundwater (karez).

Pedon ID: S09AF006007

Pedon Note: High pH within the surface, High water table (49 cm), Slow saturated hydraulic conductivity in the subsurface horizons. High water table (49 cm). Poor dispersion in last two horizons. Lab data by horizon: CaCo3; 9,27,24,20; Exch. Na 100,100, 53, 45, EC 141.3, 8.99, 1.61,1.61 SAR; 679,89,35,22. Natric horizon needs prismatic structure or illuvial material with uncoated sand or silt grains. Also, not enough clay increase. Not enough clay increase for an argillic horizon. This soil has loamy surface and subsurface layers. The soil is extremely saline and extremely sodic and must be reclaimed to be used for agriculture. Calcium sulfate is present, but water quality will dictate if gypsum application is needed to aid leaching of salts and sodium. Salinity and sodium monitoring is recommended thereafter. Infiltration rates are interpreted from these data to be moderate but sealing can occur during reclamation if insufficient soluble calcium is present. Available water is increased if salt content is lowered. Base cation content is high. Calcium carbonate in the surface layer may lead to micronutrient deficiencies. Apply micronutrients foliar if deficiency symptoms appear. High calcium carbonate levels in the surface layer may require higher phosphorous fertilization rates than typically recommended.

Lab Source ID:

Lab Pedon #: 09N0398

User Transect ID:

Soil Name as Described/Sampled: SND

Classification: Fine-loamy, mixed, superactive, hyperthermic Aquic Haplalgids

Soil Name as Correlated: Haplocalcids

Classification: Coarse-loamy, mixed, active, hyperthermic Aquic Haplocalcids

Pedon Type:

Pedon Purpose: full pedon description

Taxon Kind: family

Associated Soils:

Physiographic Division:

Physiographic Province:

Country: Afghanistan

State:

County:

MLRA:

Soil Survey Area:

Map Unit:

Quad Name:

Std Latitude: 32.3811111

Std Longitude: 61.9480278

Primary Earth

Cover: Grass/herbaceous cover

Secondary Earth Cover: Grassland rangeland

Physiographic Section:
State Physiographic Area:
Local Physiographic Area:
Geomorphic Setting: on summit of tread of fan skirt on summit of tread of fan piedmont
Upslope Shape: linear
Cross Slope Shape: linear
Particle Size Control Section: 25 to 100 cm.
Description origin: PedonPC

Vegetation:
Parent Material: mixed alluvium
Bedrock Kind:
Bedrock Depth:
Bedrock Hardness:
Bedrock Fracture Interval:
Surface Fragments:
Description database: MLRA02_Davis

Diagnostic Features: ochric epipedon 0 to 11 cm.
 calcic horizon 11 to 83 cm.
 aquic conditions 49 to 100 cm.
 redox concentrations 49 to 100 cm.
 secondary carbonates 49 to 100 cm.

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
1.0	647.0	210	21.0			75		well		

Ayz--0 to 11 centimeters (0.0 to 4.3 inches); light olive brown (2.5Y 5/4) loam, olive brown (2.5Y 4/4), moist; 29 percent sand; 50 percent silt; 21 percent clay; weak coarse subangular blocky structure; slightly hard, friable, nonsticky, nonplastic; common medium roots throughout and common coarse roots throughout; 10 percent coarse irregular 10YR 8/1, dry, salt masses at top of horizon and 2 percent fine irregular salt, finely disseminated; sodium adsorption ratio of 679.0; strong effervescence, by HCl, 1 normal; moderately alkaline, pH 8.3, pH meter; abrupt smooth boundary. Lab sample # 09N02115

Btnz--11 to 49 centimeters (4.3 to 19.3 inches); light olive brown (2.5Y 5/4) silt loam, olive brown (2.5Y 4/4), moist; 19 percent sand; 64 percent silt; 17 percent clay; weak medium subangular blocky structure; moderately hard, friable, very sticky, moderately plastic; common medium roots throughout and common coarse roots throughout; many very fine high-continuity dendritic tubular and common coarse high-continuity dendritic tubular pores; 5 percent prominent clay films on all faces of peds; 1 percent fine irregular salt masses throughout; sodium adsorption ratio of 89.0; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.7, pH meter; clear smooth boundary. Lab sample # 09N02116

Btknz--49 to 83 centimeters (19.3 to 32.7 inches); light olive brown (2.5Y 5/4) silt loam, olive brown (2.5Y 4/4), moist; 33 percent sand; 55 percent silt; 12 percent clay; weak medium subangular blocky structure; extremely hard, extremely firm by carbonates, nonsticky, nonplastic; common medium roots throughout and common coarse roots throughout; few medium high-continuity dendritic tubular and common coarse high-continuity dendritic tubular pores; 20 percent prominent clay films on all faces of peds; 5 percent fine irregular masses of reduced iron; 5 percent fine threadlike silica masses throughout and 4 percent fine threadlike carbonate masses throughout and 1 percent fine salt masses throughout and 2 percent medium irregular moderately cemented carbonate nodules throughout; sodium adsorption ratio of 35.0; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.7, pH meter; clear smooth boundary. Lab sample # 09N02117

Bknz--83 to 100 centimeters (32.7 to 39.4 inches); light yellowish brown (2.5Y 6/3) silt loam, light olive brown (2.5Y 5/4), moist; 37 percent sand; 52 percent silt; 11 percent clay; weak medium subangular blocky structure; moderately hard, friable, slightly sticky, slightly plastic; very few medium roots

throughout and common coarse roots throughout; common coarse high-continuity dendritic tubular pores; 2 percent fine irregular salt, finely disseminated throughout; sodium adsorption ratio of 22.0; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.5, pH meter. Lab sample # 09N02118

PEDON DESCRIPTION

Print Date: Jun 7 2017

Description Date: Jan 25 2009

Describer: Jason Nemecek, Ed Tallyn

Site ID: S09AF006008

Site Note: Range - Located on flat desert pavement covered with closely packed rounded rock fragments; About 4 inches of rain annually during winter month. The water in Farah Province comes from both surface water (for part of the year, until the rivers dry up) and groundwater (karez).

Pedon ID: S09AF006008

Pedon Note: Management concerns: High gravel content at 86 cm, High gravel content/sandy textures below 121 cm. Lab data by horizon; CaCo3, 16,17,18,12,14, Exch. Na; 36,34,74,83,92; SAR; 30,23,246,412. poor dispersion in all except second to last horizon. Does not have the structure for natric horizon. This soil has a gravelly loamy surface and subsurface layer. Infiltration rates are moderate. Available water holding capacity is medium. Base cation content is high. Calcium carbonate in the surface layer may lead to micronutrient deficiencies. Apply micronutrients foliar if deficiency symptoms appear. High calcium carbonate levels in the surface layer may require higher phosphorous fertilization rates than typically recommended. Cation exchange capacity is low. Although calcium content is high, soil testing should be frequent and include magnesium and potassium in the analysis. The soil is sodic and slightly saline. Water quality may dictate if gypsum is needed to leach salts and sodium. Salinity and sodium monitoring is recommended.

Lab Source ID:

Lab Pedon #: 09N0399

User Transect ID:

Soil Name as Described/Sampled: SND

Classification: Fine-loamy, mixed, superactive, hyperthermic Typic Haplargids

Soil Name as Correlated: Calciargids

Classification: Fine-loamy, mixed, semiactive, hyperthermic Typic Calciargids

Pedon Type:

Pedon Purpose: full pedon description

Taxon Kind: family

Associated Soils:

Physiographic Division:

Physiographic Province:

Physiographic Section:

State Physiographic Area:

Local Physiographic Area:

Country: Afghanistan

State:

County:

MLRA:

Soil Survey Area:

Map Unit:

Quad Name:

Std Latitude: 32.2913611

Std Longitude: 61.7653611

Primary Earth Cover: Barren land

Secondary Earth

Cover: Culturally induced barren

Vegetation:

Parent Material: mixed alluvium

Bedrock Kind:

Geomorphic Setting: on talus fan remnant on talus fan piedmont	Bedrock Depth:
Upslope Shape: linear	Bedrock Hardness:
Cross Slope Shape: linear	Bedrock Fracture Interval:
Particle Size Control Section: 15 to 65 cm.	Surface Fragments: 70.0 percent nonflat rounded indurated 2- to 75-millimeter Mixed rock fragments and 10.0 percent nonflat rounded indurated 75- to 250-millimeter Mixed rock fragments
Description origin: PedonPC	Description database: MLRA02_Davis
Diagnostic Features: ochric epipedon 0 to 15 cm. argillic horizon 15 to 121 cm. secondary carbonates 15 to 200 cm. calcic horizon 39 to 86 cm. lithologic discontinuity 86 to cm.	

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
1.0	617.0	0	21.0			75		well		

An--0 to 15 centimeters (0.0 to 5.9 inches); yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 4/4), moist; 25 percent sand; 56 percent silt; 19 percent clay; weak medium subangular blocky structure; hard, firm, nonsticky, nonplastic; 3 percent nonflat rounded indurated 2 to 75-millimeter Mixed rock fragments; sodium adsorption ratio of 30.0; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.8, pH meter; clear smooth boundary. Lab sample # 09N02119

Btkn1--15 to 39 centimeters (5.9 to 15.4 inches); light yellowish brown (10YR 6/4) gravelly sandy clay loam, dark yellowish brown (10YR 4/4), moist; 58 percent sand; 19 percent silt; 22 percent clay; weak medium subangular blocky structure; extremely hard, very firm, moderately sticky, moderately plastic; very few medium roots in cracks; many very fine low-continuity vesicular and common very coarse high-continuity dendritic tubular pores; 5 percent prominent clay films on all faces of peds; 5 percent medium distinct irregular extremely weakly cemented 10YR 8/1), dry, carbonate masses with clear boundaries throughout; 20 percent nonflat rounded indurated 2 to 75-millimeter Mixed rock fragments; sodium adsorption ratio of 23.0; strong effervescence, by HCl, 1 normal; strongly alkaline, pH 8.7, pH meter; clear smooth boundary. Lab sample # 09N02120

Btkn2--39 to 86 centimeters (15.4 to 33.9 inches); pale brown (10YR 6/3) sandy clay loam, dark yellowish brown (10YR 4/4), moist; 46 percent sand; 26 percent silt; 28 percent clay; moderate medium subangular blocky structure; extremely hard, very firm, moderately sticky, moderately plastic; few medium roots in cracks; many very fine low-continuity vesicular and common very coarse high-continuity dendritic tubular pores; 25 percent distinct clay films on all faces of peds; 10 percent fine distinct irregular extremely weakly cemented carbonate masses with clear boundaries throughout; 2 percent nonflat rounded indurated 2 to 75-millimeter Mixed rock fragments; strong effervescence, by HCl, 1 normal; very strongly alkaline, pH 9.2, pH meter; abrupt smooth boundary. Lab sample # 09N02121

2Btkn3--86 to 121 centimeters (33.9 to 47.6 inches); brown (7.5YR 4/4) extremely gravelly sandy clay loam, strong brown (7.5YR 4/6), moist; 67 percent sand; 6 percent silt; 27 percent clay; structureless massive; loose, loose, moderately sticky, moderately plastic; 5 percent distinct clay films on bottom faces of peds and 15 percent distinct clay bridges on rock fragments; 5 percent fine faint irregular extremely

weakly cemented carbonate concretions with clear boundaries around rock fragments; 10 percent nonflat rounded indurated 75 to 250-millimeter Mixed rock fragments and 60 percent nonflat rounded indurated 2 to 75-millimeter Mixed rock fragments; sodium adsorption ratio of 246.0; violent effervescence, by HCl, 1 normal; very strongly alkaline, pH 9.4, pH meter; abrupt smooth boundary. Lab sample # 09N02122

2Ckn--121 to 200 centimeters (47.6 to 78.7 inches); pale brown (10YR 6/3) extremely gravelly sand, dark brown (10YR 3/3), moist; 89 percent sand; 5 percent silt; 6 percent clay; structureless massive; loose, loose, nonsticky, nonplastic; 5 percent fine distinct irregular extremely weakly cemented carbonate concretions with clear boundaries around rock fragments; 10 percent nonflat rounded indurated 75 to 250-millimeter Mixed rock fragments and 70 percent nonflat rounded indurated 2 to 75-millimeter Mixed rock fragments; sodium adsorption ratio of 412.0; violent effervescence, by HCl, 1 normal; very strongly alkaline, pH 9.8, pH meter. Lab sample # 09N02123

APPENDIX B

Kunar Province Pedon Descriptions

PEDON DESCRIPTION

Print Date: Jun 7 2017

Description Date: Jan 11 2009

Describer: Jason Nemecek, Ed Tallyn

Site ID: S09AF015001

Site Note: Dry land crops, currently fallow; About 8 inches of rain annually during winter months. The source of water (available year round) in Kunar Province is snowmelt from the Hindu Kush Mountain. Most (99%) of the irrigation in this area is via surface canals, where small diversions are placed in the rivers and water is diverted into a canal for irrigation.

Pedon ID: S09AF015001

Pedon Note: Management concerns: High volume of coarse fragments. Low water holding capacity/coarse textures below 77 cm, Contrasting particle size within 100 cm, Slightly elevated pH, Irrigation water management- timing and amounts (over irrigating) Lab data by horizon; CaCo₃; 2,6,3,5,6,7,8; Exch. Na; 4,2,2,3,3,2,2; Organic Carbon calculated by 0.12 (CaCo₃) = inorganic C; Then Total Carbon - inorganic C = organic C; OC = .19, .15, .01, 0,.11,.05, 0; OM =.33, .26, .02, 0, .19, .09, 0 Note: 1500kpa/clay 25 or less from 0 to 137; This soil has a very gravelly loamy surface and very gravelly sandy subsurface layer. Infiltration rates are moderately rapid. Available water holding capacity is low. Base cation content is high but magnesium levels are low. Calcium carbonate in the surface layer may lead to micronutrient deficiencies. Apply micronutrients foliar if deficiency symptoms appear. Cation exchange capacity is low. Although calcium content is high, soil testing should be frequent and include magnesium and potassium in the analysis. High calcium carbonate levels in the surface layer may require higher phosphorous fertilization rates than typically recommended.

Lab Source ID:

Lab Pedon #: 09N0400

User Transect ID:

Soil Name as Described/Sampled: SND

Classification: Sandy-skeletal, mixed, thermic Xeric Haplocambids

Soil Name as Correlated: Haplocambids

Classification: Sandy-skeletal, mixed, thermic Xeric Haplocambids

Pedon Type:

Pedon Purpose: full pedon description

Taxon Kind: family

Associated Soils:

Physiographic Division:

Physiographic Province:

Physiographic Section:

State Physiographic Area:

Country: Afghanistan

State:

County:

MLRA:

Soil Survey Area:

Map Unit:

Quad Name:

Std Latitude: 34.7743333

Std Longitude: 71.1118333

Primary Earth Cover: Crop cover

Secondary Earth Cover: Row crop

Vegetation:

Parent Material: mixed alluvium

Local Physiographic Area:

Geomorphic Setting: on summit of tread of fan apron on summit of tread of fan piedmont

Upslope Shape: linear

Cross Slope Shape: linear

Particle Size Control Section: 25 to 100 cm.

Description origin: PedonPC

Diagnostic Features: ochric epipedon 0 to 77 cm.
cambic horizon 60 to 77 cm.
secondary carbonates 77 to 117 cm.

Bedrock Kind:

Bedrock Depth:

Bedrock Hardness:

Bedrock Fracture Interval:

Surface Fragments: 5.0 percent nonflat subrounded indurated 2- to 75-millimeter Mixed rock fragments

Description database: MLRA02_Davis

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
2.0	798.0	280	18.0			203		well		

Ap--0 to 20 centimeters (0.0 to 7.9 inches); light yellowish brown (2.5Y 6/3) sandy loam, olive brown (2.5Y 4/3), moist; 55 percent sand; 37 percent silt; 9 percent clay; moderate medium subangular blocky structure; soft, friable, nonsticky, nonplastic; few fine roots in cracks; few very fine low-continuity vesicular and common fine low-continuity vesicular pores; 5 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments; sodium adsorption ratio of 2.0; violent effervescence, by HCl, 1 normal; moderately alkaline, pH 8.0, pH meter; clear smooth boundary. Lab sample # 09N02124

Bw1--20 to 60 centimeters (7.9 to 23.6 inches); light olive brown (2.5Y 5/3) very gravelly loamy coarse sand, dark olive brown (2.5Y 3/3), moist; 77 percent sand; 18 percent silt; 5 percent clay; weak fine subangular blocky structure; soft, friable, nonsticky, nonplastic; few very fine roots throughout; few fine low-continuity vesicular pores; 45 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments; slight effervescence, by HCl, 1 normal; moderately alkaline, pH 8.1, pH meter; clear wavy boundary. Lab sample # 09N02125

Bw2--60 to 77 centimeters (23.6 to 30.3 inches); light olive brown (2.5Y 5/4) very cobbly coarse sandy loam, olive brown (2.5Y 4/4), moist; 67 percent sand; 26 percent silt; 7 percent clay; weak fine subangular blocky structure; soft, friable, nonsticky, nonplastic; few very fine roots throughout and very few medium roots throughout; few fine low-continuity vesicular pores; 15 percent nonflat subangular indurated 75 to 250-millimeter Mixed rock fragments and 20 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments; violent effervescence, by HCl, 1 normal; moderately alkaline, pH 8.1, pH meter; clear wavy boundary. Lab sample # 09N02126

Bk1--77 to 97 centimeters (30.3 to 38.2 inches); light olive brown (2.5Y 5/3) very cobbly coarse sand, dark olive brown (2.5Y 3/3), moist; 91 percent sand; 8 percent silt; 2 percent clay; structureless single grain; soft, friable, nonsticky, nonplastic; 5 percent medium distinct irregular weakly cemented 10YR 8/2), dry, carbonate masses with sharp boundaries around rock fragments; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.6, pH meter; clear wavy boundary. Lab sample # 09N02127

Bk2--97 to 117 centimeters (38.2 to 46.1 inches); light olive brown (2.5Y 5/4) loamy coarse sand, olive brown (2.5Y 4/4), moist; 76 percent sand; 19 percent silt; 5 percent clay; structureless single grain; soft, friable, nonsticky, nonplastic; 5 percent fine distinct irregular weakly cemented 10YR 8/2), dry, carbonate masses with sharp boundaries around rock fragments; violent effervescence, by HCl, 1 normal;

moderately alkaline, pH 8.4, pH meter; clear wavy boundary. Lab sample # 09N02128

C1--117 to 137 centimeters (46.1 to 53.9 inches); light olive brown (2.5Y 5/4) loamy coarse sand, olive brown (2.5Y 4/4), moist; 78 percent sand; 17 percent silt; 5 percent clay; structureless single grain; soft, friable, nonsticky, nonplastic; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.5, pH meter; clear wavy boundary. Lab sample # 09N02129

C2--137 to 163 centimeters (53.9 to 64.2 inches); light olive brown (2.5Y 5/4) loamy coarse sand, olive brown (2.5Y 4/4), moist; 81 percent sand; 15 percent silt; 4 percent clay; structureless single grain; soft, friable, nonsticky, nonplastic; violent effervescence, by HCl, 1 normal; strongly alkaline, pH 8.5, pH meter. Lab sample # 09N02130

PEDON DESCRIPTION

Print Date: Jun 7 2017

Description Date: Jan 11 2009

Describer: Jason Nemecek, Ed Tallyn

Site ID: S09AF015002

Site Note: These soils are on anthropogenic terraces that were farmed for the last several hundred to a thousand years. Surface irrigated cropland - modified boarder irrigation: winter wheat, almonds; Most (99%) of the irrigation in this area is via surface canals, where small diversions are placed in the rivers and water is diverted into a canal for irrigation.

Pedon ID: S09AF015002

Pedon Note: Management concerns: Contrasting particle size within 100 cm; Stones within 100 cm; Slightly elevated pH. Irrigation water management- timing and amounts (over irrigating); Organic Carbon calculated by 0.12 (CaCo₃) = inorganic C; Then Total Carbon - inorganic C = organic C; by horizon; OC; 0.98, 0.55, 0.35, 0.17, 0.31, 0.15; OM; 1.69, 0.95, 0.60, 0.29, 0.53, 0.26; poor dispersion in C and Bw2 horizon, Exch. Na; 2,3, 5, 11, 8, 13; CaCo₃; 7,7, 10, 11, 11, 12.; These soils have loamy surface and subsurface layers. Infiltration rates are moderate. Available water holding capacity is high. Base cation content is high although magnesium content is low. Calcium carbonate in the surface layer may lead to micronutrient deficiencies. Apply micronutrients foliar if deficiency symptoms appear. High calcium carbonate levels in the surface layer may require higher phosphorous fertilization rates than typically recommended.

Lab Source ID:

Lab Pedon #: 09N0401

User Transect ID:

Soil Name as Described/Sampled: SND

Classification: Fine-loamy, mixed, superactive, thermic Aridic Argixerolls

Soil Name as Correlated: Haploixerolls

Classification: Coarse-silty, mixed, active, thermic Oxyaquic Haploixerolls

Pedon Type:

Pedon Purpose: full pedon description

Taxon Kind: family

Associated Soils:

Physiographic Division:

Physiographic Province:

Physiographic Section:

State Physiographic Area:

Local Physiographic Area:

Country: Afghanistan

State:

County:

MLRA:

Soil Survey Area:

Map Unit:

Quad Name:

Std Latitude: 34.787722

Std Longitude: 71.1066667

Primary Earth Cover: Crop cover

Secondary Earth Cover: Row crop

Vegetation:

Parent Material: mixed alluvium

Bedrock Kind:

Geomorphic Setting: on tread of stream terrace on tread of conservation terrace on tread of river valley

Upslope Shape: linear

Cross Slope Shape: linear

Particle Size Control Section: 25 to 100 cm.

Description origin: PedonPC

Bedrock Depth:

Bedrock Hardness:

Bedrock Fracture Interval:

Surface Fragments:

Description

database: MLRA02_Davis

Diagnostic Features: mollic epipedon 0 to 42 cm.
aquic conditions 9 to 150 cm.
redox concentrations 9 to 150 cm.
anthric saturation 9 to 150 cm.
cambic horizon 42 to 98 cm.

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
1.0	788.0	280	18.0			203		well		

Ap--0 to 9 centimeters (0.0 to 3.5 inches); grayish brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2), moist; 30 percent sand; 55 percent silt; 15 percent clay; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common medium roots throughout and common fine roots throughout and common coarse roots throughout; common medium low-continuity dendritic tubular and common fine low-continuity dendritic tubular pores; sodium adsorption ratio of 1.0; strong effervescence, by HCl, 1 normal; moderately alkaline, pH 8.3, pH meter; clear smooth boundary. Lab sample # 09N02131

Bt--9 to 42 centimeters (3.5 to 16.5 inches); grayish brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2), moist; 30 percent sand; 55 percent silt; 15 percent clay; weak coarse subangular blocky structure; hard, friable, slightly sticky, moderately plastic; common coarse roots throughout; common fine low-continuity vesicular and common coarse low-continuity vesicular pores; 25 percent prominent clay films on all faces of peds; 1 percent fine distinct irregular extremely weakly cemented 2.5Y 6/4), dry, iron-manganese masses with diffuse boundaries On surfaces along root channels; sodium adsorption ratio of 1.0; strong effervescence, by HCl, 1 normal; strongly alkaline, pH 8.5, pH meter; clear smooth boundary. Lab sample # 09N02132

Bw1--42 to 68 centimeters (16.5 to 26.8 inches); grayish brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2), moist; 41 percent sand; 51 percent silt; 9 percent clay; weak fine subangular blocky structure; soft, very friable, nonsticky, nonplastic; few medium roots throughout and few coarse roots throughout; few very fine low-continuity interstitial and few fine low-continuity interstitial pores; 5 percent medium distinct irregular extremely weakly cemented 2.5Y 6/4), dry, iron-manganese masses with diffuse boundaries On surfaces along root channels; very slight effervescence, by HCl, 1 normal; moderately alkaline, pH 8.4, pH meter; clear smooth boundary. Lab sample # 09N02133

Bw2--68 to 75 centimeters (26.8 to 29.5 inches); light brownish gray (2.5Y 6/2) very fine sandy loam, dark grayish brown (2.5Y 4/2), moist; 71 percent sand; 28 percent silt; 2 percent clay; weak fine subangular blocky structure; soft, very friable, nonsticky, nonplastic; few very coarse roots throughout and few very coarse roots throughout; few very fine low-continuity interstitial and few fine low-continuity interstitial pores; 15 percent medium distinct irregular extremely weakly cemented 2.5Y 6/4), dry, iron-manganese masses with diffuse boundaries On surfaces along root channels; strong effervescence, by HCl, 1 normal; moderately alkaline, pH 8.4, pH meter; clear smooth boundary. Lab sample # 09N02134

Bw3--75 to 98 centimeters (29.5 to 38.6 inches); grayish brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2), moist; 22 percent sand; 72 percent silt; 7 percent clay; weak fine subangular blocky structure; slightly hard, friable, moderately sticky, moderately plastic; 15 percent medium distinct irregular extremely weakly cemented 2.5Y 6/4), moist, iron-manganese masses with diffuse boundaries On surfaces along root channels; 1 percent nonflat subrounded indurated 75 to 250-millimeter Mixed rock fragments; violent effervescence, by HCl, 1 normal; moderately alkaline, pH 8.3, pH meter; diffuse broken boundary. Lab sample # 09N02135

C--98 to 150 centimeters (38.6 to 59.1 inches); grayish brown (2.5Y 5/2) very bouldery silt loam, dark grayish brown (2.5Y 4/2), moist; 44 percent sand; 55 percent silt; 2 percent clay; structureless massive; slightly hard, very friable, nonsticky, nonplastic; 3 percent fine distinct irregular extremely weakly cemented 2.5Y 7/6), dry, iron depletions with diffuse boundaries Throughout and 10 percent medium distinct irregular extremely weakly cemented 2.5Y 6/4), dry, iron-manganese masses with diffuse boundaries Throughout; 50 percent nonflat subrounded indurated 600 to 1000-millimeter Mixed rock fragments; strong effervescence, by HCl, 1 normal; moderately alkaline, pH 8.3, pH meter. Lab sample # 09N02136

PEDON DESCRIPTION

Print Date: Jun 7 2017

Description Date: Jan 12 2009

Describer: Jason Nemecek, Ed Tallyn

Site ID: S09AF015003

Site Note: These soils are on anthropogenic terraces that were farmed for the last several hundred to a thousand years.; Non-irrigated cropland, winter wheat; Most (99%) of the irrigation in this area is via surface canals, where small diversions are placed in the rivers and water is diverted into a canal for irrigation.

Pedon ID: S09AF015003

Pedon Note: Organic Carbon calculated by $0.12 (\text{CaCO}_3) = \text{inorganic C}$; Then Total Carbon - inorganic C = organic C; by horizon; OC: 0.55, 0.36, 0.20, 0.23, 0.20, 0.14; OM: 0.95, 0.62, 0.34, 0.40, 0.34, 0.20; Exch Na: 4, 1, 1, 2, 3, 3 CaCO₃; tr, tr, 3, 20, 19, 19 Poor dispersion in first three horizons below 0.25. Would be considered Prime farmland in U.S. if there is a dependable irrigation water supply. Very high water holding capacity. Management concerns: Slightly elevated pH; Irrigation water management- timing and amounts (over irrigating). Does not meet Mollic horizon criteria based **Quad Name:** on OC, too thin. These soils have loamy surface and subsurface layers. Infiltration rates are moderate. Available water holding capacity is high. Base cation content is high although magnesium content is low. Calcium carbonate in the surface layer may lead to micronutrient deficiencies. Apply micronutrients foliar if deficiency symptoms appear. High calcium carbonate levels in the surface layer may require higher phosphorous fertilization rates than typically recommended.

Lab Source ID:

Std Latitude: 34.8493333

Lab Pedon #: 09N0402

Std Longitude: 71.1458611

User Transect ID:

Soil Name as Described/Sampled: SND

Classification: Fine-loamy, mixed, superactive, thermic Aridic Calcixerolls

Soil Name as Correlated: Calciargids

Classification: Coarse-loamy, mixed, active, thermic Xeric Calciargids

Pedon Type:

Pedon Purpose: full pedon description

Taxon Kind: family

Associated Soils:

Physiographic Division:

Primary Earth Cover: Crop cover

Physiographic Province:

Secondary Earth Cover: Row crop

Physiographic Section:

Vegetation:

State Physiographic Area:

Parent Material: mixed alluvium

Local Physiographic Area:

Bedrock Kind:

Geomorphic Setting: on tread of fan apron on tread of hillslope terrace on tread of river valley

Upslope Shape: linear

Cross Slope Shape: linear

Particle Size Control Section: 27 to 72 cm.

Description origin: PedonPC

Diagnostic Features: ochric epipedon 0 to 11 cm.
 secondary carbonates 27 to 130 cm.
 argillic horizon 27 to 72 cm.
 calcic horizon 47 to 72 cm.

Bedrock Depth:

Bedrock Hardness:

Bedrock Fracture Interval:

Surface Fragments: 10.0 percent nonflat subrounded indurated 75- to 250-millimeter Mixed rock fragments

Description database: MLRA02_Davis

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
1.0	780.0	0	18.0			203		well		

Ap--0 to 11 centimeters (0.0 to 4.3 inches); light olive brown (2.5Y 5/3) fine sandy loam, dark olive brown (2.5Y 3/3), moist; 45 percent sand; 46 percent silt; 9 percent clay; moderate medium subangular blocky structure; soft, very friable, slightly sticky, slightly plastic; common medium roots throughout and common fine roots throughout and common coarse roots throughout; few medium low-continuity vesicular and few fine low-continuity vesicular and few coarse low-continuity vesicular pores; 5 percent fine prominent irregular extremely weakly cemented mica flakes, unspecified with sharp boundaries throughout; 10 percent nonflat subangular indurated 75 to 250-millimeter Mixed rock fragments; sodium adsorption ratio of 0.0; slight effervescence, by HCl, 1 normal; moderately alkaline, pH 7.9, pH meter; clear smooth boundary. Lab sample # 09N02138

Bk--11 to 27 centimeters (4.3 to 10.6 inches); light olive brown (2.5Y 5/4) loam, dark olive brown (2.5Y 3/3), moist; 44 percent sand; 47 percent silt; 10 percent clay; weak very coarse subangular blocky structure; slightly hard, friable, slightly sticky, moderately plastic; common very coarse roots throughout and common medium roots throughout and common fine roots throughout; common very coarse low-continuity tubular and common medium low-continuity tubular and common fine low-continuity tubular pores; 5 percent fine prominent irregular extremely weakly cemented mica flakes, unspecified with sharp boundaries throughout and 1 percent fine prominent irregular extremely weakly cemented 10YR 8/1), dry, carbonate masses with sharp boundaries on surfaces along pores; very slight effervescence, by HCl, 1 normal; moderately alkaline, pH 8.1, pH meter; gradual smooth boundary. Lab sample # 09N02139

Btk1--27 to 47 centimeters (10.6 to 18.5 inches); light olive brown (2.5Y 5/4) loam, 2.5Y 3/6 (2.5Y 3/6), moist; 33 percent sand; 49 percent silt; 14 percent clay; weak coarse subangular blocky structure; moderately hard, friable, slightly sticky, moderately plastic; common very fine roots throughout and common fine roots throughout; common very fine low-continuity tubular and common medium low-continuity tubular and common fine low-continuity tubular pores; 4 percent distinct skeletans on bottom faces of peds and 5 percent prominent clay films on all faces of peds; 5 percent fine prominent irregular extremely weakly cemented mica flakes, unspecified with sharp boundaries throughout and 8 percent fine prominent irregular extremely weakly cemented carbonate, finely disseminated with sharp boundaries on surfaces along root channels and 5 percent fine prominent irregular extremely weakly cemented 10YR 8/1), dry, carbonate masses with sharp boundaries on surfaces along pores; very slight effervescence, by HCl, 1 normal; moderately alkaline, pH 8.1, pH meter; clear smooth boundary. Lab sample # 09N02140

Btk2--47 to 72 centimeters (18.5 to 28.3 inches); light yellowish brown (2.5Y 6/4) silt loam, olive brown (2.5Y 4/3), moist; 15 percent sand; 62 percent silt; 22 percent clay; strong medium subangular blocky structure; moderately hard, friable, slightly sticky, moderately plastic; many very fine low-continuity tubular and common medium low-continuity tubular and common fine low-continuity tubular pores; 5 percent prominent clay films on all faces of ped; 5 percent fine prominent irregular extremely weakly cemented mica flakes, unspecified with sharp boundaries throughout and 5 percent medium prominent spherical extremely weakly cemented 10YR 8/1), dry, carbonate nodules with sharp boundaries throughout and 35 percent medium prominent irregular moderately cemented 10YR 8/1), dry, carbonate masses with sharp boundaries throughout; violent effervescence, by HCl, 1 normal; moderately alkaline, pH 8.1, pH meter; gradual smooth boundary. Lab sample # 09N02141

B'k1--72 to 104 centimeters (28.3 to 40.9 inches); light yellowish brown (2.5Y 6/4) silt loam, olive brown (2.5Y 4/3), moist; 20 percent sand; 60 percent silt; 20 percent clay; moderate medium subangular blocky structure; moderately hard, friable, moderately sticky, moderately plastic; common very coarse high-continuity tubular and few medium low-continuity tubular pores; 5 percent fine prominent irregular extremely weakly cemented mica flakes, unspecified with sharp boundaries throughout and 5 percent medium prominent spherical moderately cemented 10YR 8/1), moist, carbonate nodules with sharp boundaries throughout and 5 percent medium prominent irregular extremely weakly cemented 10B 8/1), moist, carbonate masses with sharp boundaries throughout; 3 to 5 percent krotovinas (volume percent); 3 to 5 percent krotovinas (lateral area percent); violent effervescence, by HCl, 1 normal; moderately alkaline, pH 8.3, pH meter; gradual smooth boundary. Lab sample # 09N02142

B'k2--104 to 130 centimeters (40.9 to 51.2 inches); light yellowish brown (2.5Y 6/3) silt loam, olive brown (2.5Y 4/3), moist; 35 percent sand; 50 percent silt; 15 percent clay; structureless massive; moderately hard, friable, moderately sticky, very plastic; 5 percent fine prominent irregular extremely weakly cemented mica flakes, unspecified with sharp boundaries throughout and 5 percent medium prominent spherical moderately cemented carbonate nodules with sharp boundaries throughout and 5 percent medium prominent irregular extremely weakly cemented carbonate masses with sharp boundaries throughout; violent effervescence, by HCl, 1 normal; moderately alkaline, pH 8.4, pH meter. Lab sample # 09N02143

PEDON DESCRIPTION

Print Date: Jun 7 2017

Description Date: Jan 13 2009

Describer: Jason Nemecek, Ed Tallyn

Site ID: S09AF015004

Site Note: These soils are on anthropogenic terraces that were farmed for the last several hundred to a thousand years.; Surface irrigated cropland - modified boarder irrigation: winter wheat, almonds; Most (99%) of the irrigation in this area is via surface canals, where small diversions are placed in the rivers and water is diverted into a canal for irrigation.

Pedon ID: S09AF015004

Pedon Note: Organic Carbon calculated by 0.12 (CaCo₃) = inorganic C; Then Total Carbon - inorganic C = organic C; by horizon; OC; 1.12, 0.6 0.38, 0.38, 0.35; OM; 1.93, 0.95, 0.65, 0.65, 0.60; CaCo₃; 4, 1, 2, 6, 2; Would be considered Prime farmland in U.S. if there is a dependable irrigation water supply. Management concerns: Slightly elevated pH; Irrigation water management- timing and amounts (over irrigating). These soils have loamy surface and subsurface layers. Infiltration rates are moderate. Available water holding capacity is high. Base cation content is high although magnesium content is low. Calcium carbonate in the surface layer may lead to micronutrient deficiencies. Apply micronutrients foliar if deficiency symptoms appear. High calcium carbonate levels in the surface layer may require higher phosphorous fertilization rates than typically recommended.

Lab Source ID:

Lab Pedon #: 09N0403

User Transect ID:

Soil Name as Described/Sampled: SND

Classification: Fine-loamy, mixed, superactive, thermic Aridic Calcixerolls

Soil Name as Correlated: Calciargids

Classification: Coarse-loamy, micaceous, thermic Xeric Calciargids

Pedon Type:

Pedon Purpose: full pedon description

Taxon Kind: family

Associated Soils:

Physiographic Division:

Physiographic Province:

Physiographic Section:

State Physiographic Area:

Local Physiographic Area:

Geomorphic Setting: on tread of fan apron on tread of fan piedmont on tread of hillslope terrace

Country: Afghanistan

State:

County:

MLRA:

Soil Survey Area:

Map Unit:

Quad Name:

Std Latitude: 34.9464722

Std Longitude: 71.0417222

Primary Earth Cover: Crop cover

Secondary Earth Cover: Row crop

Vegetation:

Parent Material: mixed alluvium

Bedrock Kind:

Bedrock Depth:

Upslope Shape: linear

Cross Slope Shape: linear

Particle Size Control Section: 87 to 137 cm.

Description origin: PedonPC

Diagnostic Features: ochric epipedon 0 to 38 cm.
secondary carbonates 12 to 142 cm.
argillic horizon 87 to 142 cm.
calcic horizon 87 to 116 cm.

Bedrock Hardness:

Bedrock Fracture Interval:

Surface Fragments: 5.0 percent nonflat subrounded indurated 2- to 75-millimeter Mixed rock fragments

Description database: MLRA02_Davis

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
1.0	780.0	0	18.0			203		well		

Ap--0 to 12 centimeters (0.0 to 4.7 inches); light olive brown (2.5Y 5/3) sandy loam, dark olive brown (2.5Y 3/3), moist; 62 percent sand; 28 percent silt; 10 percent clay; weak fine subangular blocky structure; hard, very friable, slightly sticky, moderately plastic; common very fine roots throughout and common medium roots throughout and common fine roots throughout; common very fine low-continuity dendritic tubular and common medium low-continuity dendritic tubular and common fine low-continuity dendritic tubular pores; 5 percent fine distinct irregular extremely weakly cemented mica flakes, unspecified with sharp boundaries throughout; 1 percent nonflat subrounded indurated 2 to 75-millimeter Mixed rock fragments; slight effervescence, by HCl, 1 normal; moderately alkaline, pH 8.2, pH meter; gradual wavy boundary. Lab sample # 09N02144

Bk1--12 to 38 centimeters (4.7 to 15.0 inches); grayish brown (2.5Y 5/2) sandy loam, very dark grayish brown (2.5Y 3/2), moist; 73 percent sand; 21 percent silt; 6 percent clay; moderate medium subangular blocky structure; soft, friable, nonsticky, slightly plastic; common medium roots throughout and few coarse roots throughout; common very fine low-continuity tubular pores; 5 percent fine distinct irregular extremely weakly cemented mica flakes, unspecified with sharp boundaries throughout and 3 percent fine distinct irregular extremely weakly cemented carbonate masses with sharp boundaries throughout; 1 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments; slight effervescence, by HCl, 1 normal; moderately alkaline, pH 8.2, pH meter; gradual wavy boundary. Lab sample # 09N02145

Bk2--38 to 87 centimeters (15.0 to 34.3 inches); light olive brown (2.5Y 5/3) fine sandy loam, dark grayish brown (2.5Y 4/2), moist; 73 percent sand; 21 percent silt; 7 percent clay; weak coarse subangular blocky structure; soft, very friable, nonsticky, slightly plastic; common fine roots throughout; common very fine low-continuity tubular pores; 5 percent fine distinct irregular extremely weakly cemented mica flakes, unspecified with sharp boundaries throughout and 5 percent fine distinct irregular extremely weakly cemented carbonate masses with sharp boundaries throughout; 3 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments; strong effervescence, by HCl, 1 normal; moderately alkaline, pH 8.3, pH meter; gradual wavy boundary. Lab sample # 09N02146

Btk1--87 to 116 centimeters (34.3 to 45.7 inches); light yellowish brown (2.5Y 6/3) loam, dark grayish brown (2.5Y 4/2), moist; 44 percent sand; 38 percent silt; 18 percent clay; strong coarse prismatic structure; slightly hard, friable, slightly sticky, moderately plastic; common very fine low-continuity tubular pores; 2 percent distinct clay bridges between sand grains and 25 percent prominent clay films on all faces of ped; 5 percent fine distinct irregular extremely weakly cemented mica flakes, unspecified with sharp boundaries throughout and 25 percent medium distinct irregular extremely weakly cemented

carbonate masses with sharp boundaries throughout; very slight effervescence, by HCl, 1 normal; moderately alkaline, pH 8.2, pH meter; gradual wavy boundary. Lab sample # 09N02147

Btk2--116 to 142 centimeters (45.7 to 55.9 inches); light olive brown (2.5Y 5/3) sandy loam, 2.5Y 3/4 (2.5Y 3/4), moist; 65 percent sand; 23 percent silt; 12 percent clay; strong coarse prismatic structure; slightly hard, slightly rigid, slightly sticky, moderately plastic; common very fine low-continuity tubular pores; 2 percent prominent clay bridges between sand grains and 20 percent prominent clay films on all faces of ped; 5 percent fine distinct irregular extremely weakly cemented mica flakes, unspecified with sharp boundaries throughout and 15 percent fine distinct irregular extremely weakly cemented carbonate masses with sharp boundaries throughout; strong effervescence, by HCl, 1 normal; moderately alkaline, pH 8.3, pH meter. Lab sample # 09N02148

PEDON DESCRIPTION

Print Date: Jun 7 2017

Description Date: Jan 13 2009

Describer: Jason Nemecek, Ed Tallyn

Site ID: S09AF015005

Site Note: These soils are on anthropogenic terraces that were farmed for the last several hundred to a thousand years. Surface irrigated cropland - modified boarder irrigation: winter wheat. Most (99%) of the irrigation in this area is via surface canals, where small diversions are placed in the rivers and water is diverted into a canal for irrigation.

Pedon ID: S09AF015005

Pedon Note: Organic Carbon calculated by 0.12 (CaCO₃) = inorganic C; Then Total Carbon - inorganic C = organic C; by horizon; OC 1.64, 1.43, 0.94, 0.75; OM; 2.82, 2.46, 1.62, 1.29; poor dispersion in third horizon below 0.25; Exch. Na; 5,2,2,3; CaCO₃. Would be considered Prime farmland in U.S. if there is a dependable irrigation water supply. Management concerns: Irrigation water management- timing and amounts (over irrigating). These soils have loamy surface and subsurface layers. Infiltration rates are moderate. Available water holding capacity is very high. Base cation content is high although magnesium is low. There are no major limitations to plant growth if adequate water supply is present. Use of poor quality irrigation water and/or not including a periodic leaching of accumulated salts may lead to salinization.

Lab Source ID:

Lab Pedon #: 09N0404

User Transect ID:

Soil Name as Described/Sampled: SND

Classification: Fine, mixed, superactive, thermic Aridic Argixerolls

Soil Name as Correlated: Haploixerolls

Classification: Fine-loamy, mixed, active, thermic Oxyaeric Haploixerolls

Pedon Type:

Pedon Purpose: full pedon description

Taxon Kind: family

Associated Soils:

Physiographic Division:

Physiographic Province:

Physiographic Section:

State Physiographic Area:

Local Physiographic Area:

Geomorphic Setting: on tread of stream terrace on tread of conservation terrace on tread of river valley

Upslope Shape: linear

Cross Slope Shape: linear

Country: Afghanistan

State:

County:

MLRA:

Soil Survey Area:

Map Unit:

Quad Name:

Std Latitude: 34.9235556

Std Longitude: 71.0896667

Primary Earth Cover: Crop cover

Secondary Earth Cover: Row crop

Vegetation:

Parent Material: mixed alluvium

Bedrock Kind:

Bedrock Depth:

Bedrock Hardness:

Bedrock Fracture Interval:

Particle Size Control Section: 25 to 100 cm.

Surface Fragments: 1.0 percent nonflat subrounded indurated 2- to 75-millimeter Mixed rock fragments

Description origin: PedonPC

Description database: MLRA02_Davis

Diagnostic Features: mollic epipedon 0 to 100 cm.
cambic horizon 7 to 100 cm.
anthric saturation 62 to 100 cm.
aquic conditions 62 to 100 cm.
redox concentrations 62 to 100 cm.

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
1.0	875.0	1	18.0			203		well		

Ap--0 to 7 centimeters (0.0 to 2.8 inches); grayish brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2), moist; 34 percent sand; 47 percent silt; 20 percent clay; moderate medium subangular blocky structure; slightly hard, friable, nonsticky, slightly plastic; common medium roots throughout and many fine roots throughout and common coarse roots throughout; common very fine low-continuity vesicular pores; 10 percent fine prominent irregular extremely weakly cemented mica flakes, unspecified with sharp boundaries throughout and 5 percent medium distinct irregular extremely weakly cemented worm casts with clear boundaries throughout; 1 percent nonflat subrounded indurated 2 to 75-millimeter Mixed rock fragments; sodium adsorption ratio of 0.0; noneffervescent, by HCl, 1 normal; moderately alkaline, pH 7.9, pH meter; clear smooth boundary. Lab sample # 09N02149

Bt1--7 to 42 centimeters (2.8 to 16.5 inches); grayish brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2), moist; 32 percent sand; 48 percent silt; 20 percent clay; moderate coarse subangular blocky structure; slightly hard, friable, moderately sticky, moderately plastic; common medium roots throughout and common fine roots throughout; many very fine low-continuity vesicular and common medium low-continuity vesicular pores; 25 percent prominent clay films on all faces of ped; 10 percent fine prominent irregular extremely weakly cemented mica flakes, unspecified with sharp boundaries throughout and 5 percent medium distinct irregular extremely weakly cemented worm casts with diffuse boundaries throughout; 1 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments; noneffervescent, by HCl, 1 normal; slightly alkaline, pH 7.6, pH meter; clear smooth boundary. Lab sample # 09N02150

Bt2--42 to 62 centimeters (16.5 to 24.4 inches); light olive brown (2.5Y 5/3) loam, dark grayish brown (2.5Y 4/2), moist; 35 percent sand; 45 percent silt; 20 percent clay; moderate coarse prismatic structure; hard, firm, very sticky, very plastic; common very fine roots throughout; many very fine low-continuity vesicular pores; 35 percent prominent clay films on all faces of ped; 10 percent fine prominent irregular extremely weakly cemented mica flakes, unspecified with sharp boundaries throughout; 1 percent nonflat subangular indurated 2 to 75-millimeter Mixed rock fragments; noneffervescent, by HCl, 1 normal; moderately alkaline, pH 8.0, pH meter; clear smooth boundary. Lab sample # 09N02151

Bt3--62 to 100 centimeters (24.4 to 39.4 inches); light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2), moist; 24 percent sand; 52 percent silt; 23 percent clay; moderate coarse prismatic structure; hard, firm, very sticky, very plastic; few very fine roots throughout; common very fine low-continuity irregular and common fine low-continuity interstitial pores; 45 percent prominent clay films on all faces of ped; 2 percent fine distinct irregular very weakly cemented 10YR 5/6), dry, iron-manganese masses with clear boundaries Throughout; 1 percent fine prominent irregular extremely weakly cemented mica flakes, unspecified with sharp boundaries throughout; 1 percent nonflat subangular indurated 2 to

75-millimeter Mixed rock fragments; noneffervescent, by HCl, 1 normal; moderately alkaline, pH 8.2, pH meter. Lab sample # 09N02152

PEDON DESCRIPTION

Print Date: Jun 7 2017

Description Date: Jan 16 2009

Describer: Jason Nemecek

Site ID: S09AF015006

Site Note: Surface irrigated - modified boarder irrigation: citrus, pine, ornamentals. Most (99%) of the irrigation in this area is via surface canals, where small diversions are placed in the rivers and water is diverted into a canal for irrigation.

Pedon ID: S09AF015006

Pedon Note:

Lab Source ID: SSL

Lab Pedon #: 09N0405

User Transect ID:

Soil Name as Described/Sampled: SND

Classification:

Soil Name as Correlated:

Classification: fine-loamy, mixed, active, thermic Aridic Argixerolls

Pedon Type:

Pedon Purpose: full pedon description

Taxon Kind:

Associated Soils:

Physiographic Division:

Physiographic Province:

Physiographic Section:

State Physiographic Area:

Local Physiographic Area:

Geomorphic Setting: on tread of stream terrace on tread of conservation terrace on tread of river valley

Upslope Shape: linear

Cross Slope Shape: linear

Particle Size Control Section: 34 to 84 cm.

Description origin: PedonPC

Diagnostic Features: anthric saturation to cm.

mollic epipedon 0 to 34 cm.

argillic horizon 34 to 150 cm.

lithologic discontinuity 71 to cm.

redox concentrations 71 to 150 cm.

aquic conditions 71 to 150 cm.

Country: Afghanistan

State:

County:

MLRA:

Soil Survey Area:

Map Unit:

Quad Name:

Std Latitude: 34.8728611

Std Longitude: 71.1564722

Primary Earth Cover: Crop cover

Secondary Earth Cover: Row crop

Vegetation:

Parent Material: mixed alluvium

Bedrock Kind:

Bedrock Depth:

Bedrock Hardness:

Bedrock Fracture Interval:

Surface Fragments: 1.0 percent nonflat subangular indurated 2- to 75-millimeter Mixed rock fragments

Description database: KSSL

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
1.0	809.0	0	18.0			203		well		

Ap--0 to 15 centimeters (0.0 to 5.9 inches); light olive brown (2.5Y 5/3) clay loam, very dark grayish brown (2.5Y 3/2), moist; 30 percent clay; moderate medium subangular blocky structure; soft, friable, slightly sticky, moderately plastic; many very fine roots throughout and many medium roots throughout and many fine roots throughout; many very fine low-continuity tubular and common medium low-continuity tubular pores; 1 percent nonflat rounded indurated 75 to 250-millimeter Mixed rock fragments; noneffervescent, by HCl, 1 normal; neutral, pH 7.0, Hellige-Truog; abrupt smooth boundary. Lab sample # 09N02153

2Bt1--15 to 34 centimeters (5.9 to 13.4 inches); light olive brown (2.5Y 5/3) clay loam, very dark grayish brown (2.5Y 3/2), moist; 32 percent clay; strong coarse prismatic structure; hard, firm, moderately sticky, moderately plastic; many very fine roots between pedes and common medium roots between pedes and many fine roots between pedes; many very fine low-continuity tubular pores; 20 percent prominent clay films on vertical faces of pedes; 1 percent fine distinct irregular extremely weakly cemented mica flakes, unspecified with sharp boundaries throughout; 1 percent nonflat rounded indurated 75 to 350-millimeter Mixed rock fragments; noneffervescent, by HCl, 1 normal; moderately alkaline, pH 8.0, Hellige-Truog; clear wavy boundary. Lab sample # 09N02154

2Bt2--34 to 71 centimeters (13.4 to 28.0 inches); light olive brown (2.5Y 5/3) clay, olive brown (2.5Y 4/3), moist; 41 percent clay; strong very coarse prismatic structure; extremely hard, very firm, slightly sticky, very plastic; common very coarse roots between pedes and common medium roots between pedes and common coarse roots between pedes; many very fine low-continuity tubular and common medium low-continuity tubular and many fine low-continuity tubular pores; 40 percent prominent clay films on vertical faces of pedes; 2 percent fine distinct irregular extremely weakly cemented mica flakes, unspecified with sharp boundaries throughout; 1 percent nonflat rounded indurated 2 to 75-millimeter Mixed rock fragments; noneffervescent, by HCl, 1 normal; moderately alkaline, pH 8.0, Hellige-Truog; abrupt smooth boundary. Lab sample # 09N02155

2Bt3--71 to 110 centimeters (28.0 to 43.3 inches); light olive brown (2.5Y 5/3) clay loam, olive brown (2.5Y 4/3), moist; 39 percent clay; strong very coarse prismatic structure; extremely hard, very firm, moderately sticky, very plastic; common very coarse roots between pedes and common coarse roots between pedes and ; common medium low-continuity tubular and many fine low-continuity tubular pores; 50 percent prominent clay films on vertical faces of pedes; 10 percent medium distinct irregular extremely weakly cemented 10YR 4/8), dry, masses of reduced iron with clear boundaries Throughout; 5 percent fine distinct irregular extremely weakly cemented mica flakes, unspecified with sharp boundaries throughout; 1 percent nonflat rounded indurated 75 to 250-millimeter Mixed rock fragments; noneffervescent, by HCl, 1 normal; neutral, pH 7.0, Hellige-Truog; gradual smooth boundary. Lab sample # 09N02156

2Bt4--110 to 150 centimeters (43.3 to 59.1 inches); olive brown (2.5Y 4/3) clay loam, olive brown (2.5Y 4/3), moist; 37 percent clay; strong coarse prismatic structure; extremely hard, very firm, slightly sticky, moderately plastic; few very fine roots between pedes; many very fine low-continuity tubular and common medium high-continuity tubular and many fine low-continuity tubular and common coarse high-continuity tubular pores; 40 percent prominent clay films on vertical faces of pedes; 10 percent medium distinct irregular extremely weakly cemented 10YR 4/8), dry, masses of reduced iron with clear boundaries Throughout; 1 percent fine distinct irregular extremely weakly cemented mica flakes, unspecified with sharp boundaries throughout; 1 percent nonflat rounded indurated 75 to 250-millimeter Mixed rock fragments; noneffervescent, by HCl, 1 normal; neutral, pH 7.0, Hellige-Truog. Lab sample # 09N02157

APPENDIX C

Farah Province Pedon Data

S09AF006001-S09AF006008

***** Primary Characterization Data *****

Pedon ID: S09AF006001

(Farah, Afghanistan)

Print Date: Jun 7 2017 2:52PM

Sampled as on Jan 19, 2009: SND ; Fine-loamy over sandy or sandy-skeletal, mixed, superactive, hyperthermic Typic Haplocambids

Revised to correlated on Jan 9, 2017: Haplocambids ; Coarse-loamy over sandy or sandy-skeletal, mixed over carbonatic, semiactive, hyperthermic Typic Haplocambids

SSL - Project C2009AF06067 Afghanistan

- Site ID S09AF006001 Lat: 32° 22' 59.40" north Long: 62° 9' 44.70" east

- Pedon No. 09N0392

- General Methods 1B1A, 2A1, 2B

United States Department of Agriculture

Natural Resources Conservation Service

National Soil Survey Center

Kellogg Soil Survey Laboratory

Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
09N02073	Ap	Ap	0-15	S09AF006001-1				FSL
09N02074	Bw1	Bw1	15-31	S09AF006001-2				L
09N02075	Bw2	Bw2	31-53	S09AF006001-3				FSL
09N02076	C1	C1	53-68	S09AF006001-4				FS
09N02077	C2	C2	68-87	S09AF006001-5				LFS
09N02078	C3	C3	87-112	S09AF006001-6				FS
09N02079	2Btgb	2Btgb	112-200	S09AF006001-7				FSL
09N02080	ApFertility	Ap Fertility	0-15	S09AF006001-A				

Pedon Calculations				Result	Units of Measure	
Calculation Name						
Weighted Particles, 0.1-75mm, 75 mm Base				72	% wt	
Volume, >2mm, Weighted Average				11	% vol	
Clay, total, Weighted Average				7	% wt	
Clay, carbonate free, Weighted Average				6	% wt	
CEC Activity, CEC7/Clay, Weighted Average, CECd, Set 1				0.37	(NA)	

Weighted averages based on control section: 25-100 cm

PSDA & Rock Fragments			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	
					(----- Total -----)		(-- Clay --)		(--- Silt ---)		(----- Sand -----)		(Rock Fragments (mm))								
					Lab Clay	Silt	Sand	Fine CO ₃	Fine	Coarse	VF	F	M	C	VC	(----- Weight -----)		>2 mm			
					<	.002	.05	<	<	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	
					Text-ure <	.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75
					Depth (cm)		Horz		Prep		%		% of <2mm Mineral Soil				(----- % of <75mm -----)		wt % whole soil		
					Layer		3A1a1a		3A1a1a		3A1a1a		3A1a1a		3A1a1a		3A1a1a				
09N02073	0-15	Ap	S	fsl	8.4	32.4	59.2	3.2	0.7	12.2	20.2	17.1	30.3	9.4	1.6	0.8	1	2	--	44	3
09N02074	15-31	Bw1	S	I	12.1	45.6	42.3	3.6	1.8	23.6	22.0	12.7	20.0	5.5	2.2	1.9	2	3	--	33	5
09N02075	31-53	Bw2	S	fsl	9.0	22.9	68.1	3.7	1.5	12.1	10.8	11.1	39.1	11.3	3.2	3.4	5	5	1	62	11
09N02076	53-68	C1	S	fs	3.6	5.1	91.3	1.4	1.0	3.0	2.1	9.2	53.8	15.4	4.9	8.0	10	11	3	86	24
09N02077	68-87	C2	S	lfs	7.7	9.5	82.8	3.8	1.3	5.0	4.5	14.5	48.1	14.4	2.9	2.9	7	14	2	76	23
09N02078	87-112	C3	S	fs	5.3	2.6	92.1	2.8	1.0	1.1	1.5	10.8	60.6	13.2	3.6	3.9	6	8	--	84	14
09N02079	112-200	2Btgb	S	fsl	17.1	6.8	76.1	8.8	1.8	3.8	3.0	6.2	34.2	17.4	9.9	8.4	16	20	2	81	38
09N02080	0-15	ApFertility	S													8	1	--	--	9	

***** Primary Characterization Data *****

Pedon ID: S09AF006001

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Print Date: Jun 7 2017 2:52PM

Fine-loamy over sandy or sandy-skeletal, mixed, superactive, hyperthermic Typic Haplocambids

; Pedon No. 09N0392

Water Dispersible PSDA

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(- - - Water Dispersible - - -)

(- - - Total - - -) (- - Clay - - -) (- - Silt - - -) (- - Sand - - -)

Clay F CO₃ F C VF F M C VC

< .002 .05 < .002 .02 .05 .10 .25 .5 1

.002 -.05 -.2 .0002 .002 -.02 -.05 -.10 -.25 -.50 -.1 -.2

(- - - % of <2mm - - -)

3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a

09N02073	0-15	Ap	S	5.8	33.8	60.4	1.5	14.8	19.0	14.9	32.3	11.3	1.4	0.5
09N02074	15-31	Bw1	S	9.2	48.4	42.4	2.1	26.2	22.2	12.6	20.3	5.6	1.9	2.0

Bulk Density & Moisture

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13-

(Bulk Density)

33 Cole Water Content

kPa Whole 6 10 33 1500 1500 kPa Ratio

kPa Dry kPa kPa kPa kPa

(- - - % of < 2mm - - -)

DbWR1 DbWR1 DbWR1 3C2a1a 3D1

(- - - % of < 2mm - - -)

3F1a1a

WRD WRD Aggst Aggst

Whole Soil Stabl 2-0.5mm 2-0.5mm

cm³ cm³ % CEC7 1500 kPa

09N02073	0-15	Ap	S					3.9	1.006		6	0.55	0.46	
09N02074	15-31	Bw1	S	1.53	1.55	0.004		14.1	4.7	1.007	0.14	3	0.38	0.39
09N02075	31-53	Bw2	S	1.63	1.66	0.006		11.2	3.9	1.005	0.11		0.32	0.43
09N02076	53-68	C1	S					1.8		1.003			0.53	0.50
09N02077	68-87	C2	S	1.58	1.60	0.004		6.2	3.6	1.005	0.03		0.31	0.47
09N02078	87-112	C3	S	1.56	1.57	0.002		4.8	2.8	1.003	0.03		0.36	0.53
09N02079	112-200	2Btkb	S	1.81	1.87	0.008		7.5	6.8	1.008	0.01		0.24	0.40
09N02080	0-15	ApFertility	S						1.007					

Water Content

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13-

(- - Atterberg - -)

(- - Limits - -)

Field Recon Field Recon Water Content

Recon 33 6 10 33 Sieved Samples

33 kPa kPa kPa kPa 100

kPa kPa kPa kPa 200

kPa kPa kPa kPa 500

(- - % of < 2mm - - -)

3B2

09N02073	0-15	Ap	S		NP		1.66	1.68	13.8				
09N02074	15-31	Bw1	S				1.56	1.58	15.6				
09N02075	31-53	Bw2	S		NP								
09N02077	68-87	C2	S		NP								
09N02079	112-200	2Btkb	S	23	10								

***** Primary Characterization Data *****

Pedon ID: S09AF006001

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Print Date: Jun 7 2017 2:52PM

Fine-loamy over sandy or sandy-skeletal, mixed, superactive, hyperthermic Typic Haplocambids

; Pedon No. 09N0392

Carbon & Extractions				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-
Layer	Depth (cm)	Horz	Prep	(---- Total ----)			Est OC (WB)	C/N Ratio	(--- Dith-Cit Ext ---)			(----- Ammonium Oxalate Extraction -----)			(--- Na Pyro-Phosphate ---)							
				C C	N N	S S			Fe	Al	Mn	Al+½Fe ODOE	Fe	Al	Si	Mn	C C	Fe Fe	Al Al	Mn Mn		
				(----- % of <2 mm -----)			(----- % of <2mm -----)			(----- % of <2mm -----)			(----- mg kg⁻¹ -----)			(----- % of <2mm -----)						
				4H2a	4H2a	4H2a			4G1	4G1	4G1											
09N02073	0-15	Ap	S	4.73	0.12	0.02	0.4		3	0.5	--	tr										
09N02074	15-31	Bw1	S	4.13	0.03	--	0.2		9	0.6	--	tr										
09N02075	31-53	Bw2	S	5.17	0.01	tr	0.7		61	0.5	--	tr										
09N02076	53-68	C1	S	6.14	0.04	--	tr		1	0.4	--	--										
09N02077	68-87	C2	S	5.75	0.02	--	tr		1	0.5	--	tr										
09N02078	87-112	C3	S	6.08	0.02	tr	tr		1	0.4	--	tr										
09N02079	112-200	2Btkb	S	6.11	0.03	tr	0.1		3	0.5	--	tr										

CEC & Bases				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-				
Layer	Depth (cm)	Horz	Prep	(----- NH₄OAC Extractable Bases -----)								Sum Bases	Acid- ity	Extr AI	KCl	Sum Mn	NH₄ OAC	(--- Base ---)			
				Ca	Mg	Na	K		cmol(+) kg⁻¹	mg kg⁻¹	(----- cmol(+) kg⁻¹ -----)	4B1a1a	Sum Cats	+AI	4B1a1a	4B1a1a	4B1a1a	(- Saturation -)			
				(----- cmol(+) kg⁻¹ -----)														(----- % -----)			
09N02073	0-15	Ap	S	40.7*	2.4	0.1	0.3	43.5								4.6			100		
09N02074	15-31	Bw1	S	41.8*	2.9	0.2	0.2	45.1								4.6			100		
09N02075	31-53	Bw2	S	42.2*	2.4	0.2	0.2	45.0								2.9			100		
09N02076	53-68	C1	S	39.7*	1.7	--	0.1	41.5								1.9			100		
09N02077	68-87	C2	S	42.7*	2.5	tr	0.1	45.3								2.4			100		
09N02078	87-112	C3	S	39.5*	1.8	0.1	0.1	41.5								1.9			100		
09N02079	112-200	2Btkb	S	41.7*	3.2	0.4	0.3	45.6								4.1			100		

*Extractable Ca may contain Ca from calcium carbonate or gypsum., CEC7 base saturation set to 100.

*** Primary Characterization Data ***

Pedon ID: S09AF006001

ND

Sampled As : SND
USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Print Date: Jun 7 2017 2:52PM

Fine-loamy over sandy or sandy-skeletal, mixed, superactive, hyperthermic Typic Haplocambids

***** Primary Characterization Data *****

Pedon ID: S09AF006001

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

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Fine-loamy over sandy or sandy-skeletal, mixed, superactive, hyperthermic Typic Haplocambids

; Pedon No. 09N0392

Phosphorous			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	
Layer	Depth (cm)	Horz	Prep	Melanic Index	Oxal %	Anion Available	Exch Capacity	Phosphorous				H ₂ O	Citric Acid	Mehlich III	KCl NO ₃
								Bray 1	Bray 2	Olsen	KCl mg kg ⁻¹				
								4D1a1a1a	4D5a1	4D2a1b1	4D6a1				4D9a1a
09N02073	0-15	Ap	S			5.5	9.6			1.7	0.1		11.0	6.75	
09N02074	15-31	Bw1	S			5.5	8.3			1.5	0.1		9.1	6.42	
09N02075	31-53	Bw2	S			6.9	10.0			1.1	0.1		10.9	3.07	
09N02076	53-68	C1	S							0.8	0.1		0.2		
09N02077	68-87	C2	S							2.9	tr		2.3		
09N02078	87-112	C3	S							0.4	tr		0.2		
09N02079	112-200	2Btkb	S							0.4	--		1.2		
09N02080	0-15	ApFertility	S											1.25	

Phosphorous			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	
Layer	Depth (cm)	Horz	Prep	Melanic Index	Oxal %	Anion Available	Exch Capacity	Phosphorous				H ₂ O	Citric Acid	Mehlich III	KCl NO ₃
								Bray 1	Bray 2	Olsen	KCl mg kg ⁻¹				4D6b
								4D1a1a1a	4D5a1	4D2a1b1	4D6a1				
09N02073	0-15	Ap	S										9.7		
09N02074	15-31	Bw1	S										7.9		
09N02075	31-53	Bw2	S										4.0		
09N02080	0-15	ApFertility	S										5.6		

Trace Elements Tier 1			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Ag mg/kg	As mg/kg	Ba mg/kg	Be mg/kg	Cd mg/kg	Co mg/kg	Cr mg/kg	Cu mg/kg	Mn mg/kg	Mo mg/kg	Hg ug/kg
				4H1a										
09N02080	0-15	ApFertility	HM	0.01	10.04	122.68	0.78	0.16	8.08	30.79	15.51	456.81	0.53	30

***** Primary Characterization Data *****

Pedon ID: S09AF006001

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

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Fine-loamy over sandy or sandy-skeletal, mixed, superactive, hyperthermic Typic Haplocambids

; Pedon No. 09N0392

Trace Elements Tier 2				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-
-----------------------	--	--	--	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------

Layer	Depth (cm)	Horz	Prep	Ni mg/kg 4H1a	P mg/kg 4H1a	Pb mg/kg 4H1a	Sb mg/kg 4H1a	Se ug/kg 4H1a	Sn mg/kg 4H1a	Sr mg/kg 4H1a	Tl mg/kg	V mg/kg 4H1a	W mg/kg 4H1a	Zn mg/kg 4H1a
09N02080	0-15	ApFertility	HM	31.31	449.92	14.21	0.47	422.80	0.52	299.02		40.04	0.04	51.23

Major Elements				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
----------------	--	--	--	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------

Layer	Depth (cm)	Horz	Prep	Al mg/kg 4H1b	Ca mg/kg 4H1b	Fe mg/kg 4H1b	K mg/kg 4H1b	Mg mg/kg 4H1b	Mn mg/kg 4H1b	Na mg/kg 4H1b	P mg/kg 4H1b	Si mg/kg 4H1b	Sr mg/kg 4H1b	Ti mg/kg 4H1b	Zr mg/kg 4H1b
09N02073	0-15	Ap	HM	39492	150482	23820	11168	12347	519	7960	453	202620	375	2763	74
09N02074	15-31	Bw1	HM	36661	109953	20854	10357	11267	462	7045	359	181085	299	2407	65
09N02075	31-53	Bw2	HM	35345	174833	22118	10342	10753	487	7526	319	191968	401	2484	80
09N02076	53-68	C1	HM	27153	212045	18149	8190	7800	405	6967	306	171696	422	1979	67
09N02077	68-87	C2	HM	30579	194526	20376	9137	8915	441	6817	235	185120	400	2301	77
09N02078	87-112	C3	HM	27895	205110	19549	8493	7713	430	6923	397	179783	394	2184	71
09N02079	112-200	2Btgb	HM	33780	211854	21631	10443	11742	484	5769	354	168458	449	2024	71
09N02080	0-15	ApFertility	HM	45193	130914	25427	12944	13949	558	8484	481	220098	365	2910	79

***** Primary Characterization Data *****

Pedon ID: S09AF006001

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

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Fine-loamy over sandy or sandy-skeletal, mixed, superactive, hyperthermic Typic Haplocambids

; Pedon No. 09N0392

Clay Mineralogy (<.002 mm)			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
			X-Ray						Thermal						Elemental				EGME	Inter preta tion
Layer	Depth (cm)	Horz	Fract ion	7A1a1						SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	Na ₂ O	Retn			
09N02073	0.0-15.0	Ap	tcly	MI 3	CL 2	CA 2												mg g ⁻¹	CMIX	
09N02075	31.0-53.0	Bw2	tcly	MI 3	CL 3	CA 2													CMIX	
09N02077	68.0-87.0	C2	tcly	MI 4	CL 3	CA 1													CMIX	
09N02079	112.0-200.0	2Btcb	tcly	MI 4	CL 3	CA 1													CMIX	

FRACTION INTERPRETATION:

tcly - Total Clay <0.002 mm

MINERAL INTERPRETATION:

CA Calcite

CL Chlorite

MI Mica

RELATIVE PEAK SIZE:

5 Very Large

4 Large

3 Medium

2 Small

1 Very Small

6 No Peaks

INTERPRETATION (BY HORIZON):

CMIX - Mixed Clay

***** Primary Characterization Data *****

Pedon ID: S09AF006001

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Print Date: Jun 7 2017 2:52PM

Fine-loamy over sandy or sandy-skeletal, mixed, superactive, hyperthermic Typic Haplocambids

; Pedon No. 09N0392

Sand - Silt Mineralogy (2.0-0.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
				X-Ray				Thermal				Optical				EGME		Inter			
Depth		Fract										Grain Count									
Layer	(cm)	Horz	Fract	(----- peak size -----)				(----- % -----)				(----- % -----)				mg g ⁻¹					
09N02073	0.0-15.0	Ap	fs									27	CB 53	QZ 20	CA 11	FE 6	FK 4	AR 4		SMIX	
													CD 1	PR 1	BT tr	FP tr	MS tr				
09N02075	31.0-53.0	Bw2	fs									31	CB 49	QZ 17	FE 11	CA 9	AR 7	FK 4		SMIX	
													CD 2	OP 1	PR tr	FP tr	BT tr				
09N02077	68.0-87.0	C2	fs									32	CB 48	QZ 20	CA 10	FE 10	AR 6	FK 3		SMIX	
													BT 1	CD 1	OP 1	PR tr	FP tr	HN tr			
09N02079	112.0-200.0	2Btgb	fs									33	CB 42	QZ 20	CA 12	FE 9	AR 7	FK 6		SMIX	
													CD 3	OP 1	PR 1	CL tr	BT tr	FP tr			
													FZ tr	GN tr	HN tr	MS tr					

FRACTION INTERPRETATION:

fs - Fine Sand 0.1-0.25 mm

MINERAL INTERPRETATION:

AR Weatherable Aggregates	BT Biotite	CA Calcite	CB Carbonate Aggregates	CD Chert (Chalcedony)
CL Chlorite	FE Iron Oxides (Goethite)	FK Potassium Feldspar	FP Plagioclase Feldspar	FZ Feldspathoids
GN Garnet	HN Hornblende	MS Muscovite	OP Opaques	PR Pyroxene
QZ Quartz				

*** Primary Characterization Data ***

Pedon ID: S09AF006001
Sampled As : SND
USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)
Fine-loamy over sandy or sandy-skeletal, mixed, superactive, hyperthermic Typic Haplocambids
; Pedon No. 09N0392

Print Date: Jun 7 2017 2:52PM

INTERPRETATION (BY HORIZON):

SMIX - Mixed Sand

***** Primary Characterization Data *****

Pedon ID: S09AF006002

(Farah, Afghanistan)

Print Date: Jun 7 2017 2:52PM

Sampled as on Jan 19, 2009: SND ; Loamy-skeletal, mixed, superactive, hyperthermic Typic Haplargids
 Revised to correlated on Jan 9, 2017: Haplargids ; Loamy-skeletal, carbonatic, hyperthermic Typic Haplargids

SSL - Project C2009AF06067 Afghanistan
 - Site ID S09AF006002 Lat: 32° 23' 10.00" north Long: 62° 10' 11.00" east
 - Pedon No. 09N0393
 - General Methods 1B1A, 2A1, 2B

United States Department of Agriculture
 Natural Resources Conservation Service
 National Soil Survey Center
 Kellogg Soil Survey Laboratory
 Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
09N02081	A1	A1	0-11	S09AF006002-1				LS
09N02082	A2	A2	11-31	S09AF006002-2				LFS
09N02083	Bw1	Bw1	31-59	S09AF006002-3				LCOS
09N02084	Bw2	Bw2	59-87	S09AF006002-4				LCOS
09N02085	Btk1	Btk1	87-134	S09AF006002-5				FSL
09N02086	Btk2	Btk2	134-168	S09AF006002-6				LS
09N02087	2Btcb	2Btcb	168-200	S09AF006002-7				SCL

Pedon Calculations			Result	Units of Measure	
Calculation Name					
Weighted Particles, 0.1-75mm, 75 mm Base			86	% wt	
Volume, >2mm, Weighted Average			47	% vol	
Clay, total, Weighted Average			19	% wt	
Clay, carbonate free, Weighted Average			18	% wt	
CEC Activity, CEC7/Clay, Weighted Average, CECd, Set 1			0.23	(NA)	

Weighted averages based on control section: 87-137 cm

PSDA & Rock Fragments				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	
				Lab Text- ure	(----- Total -----)				(- Clay - - -)				(- - Silt - - -)				(- - - Sand - - -)				(Rock Fragments (mm))	
					Clay	Silt	Sand	Fine	CO ₃	Fine	Coarse	VF	F	M	C	VC	(----- Weight -----)				>2 mm	
					<	.002	.05	<	<	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	wt %	
					.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	whole soil	
Layer	Depth (cm)	Horz	Prep		(----- % of <2mm Mineral Soil -----)				3A1a1a 3A1a1a 3A1a1a 3A1a1a				3A1a1a 3A1a1a 3A1a1a 3A1a1a				(----- % of <75mm -----)					
					3A1a1a																	
09N02081	0-11	A1	S	ls	5.0	17.3	77.7	2.1	1.0	5.0	12.3	19.5	30.9	13.5	4.6	9.2	14	29	4	78	47	
09N02082	11-31	A2	S	lfs	4.6	19.3	76.1	1.5	1.0	3.4	15.9	15.6	36.4	16.1	4.3	3.7	6	11	3	68	20	
09N02083	31-59	Bw1	S	lcos	5.8	8.2	86.0	1.9	1.0	3.4	4.8	5.6	32.3	21.3	11.0	15.8	17	29	--	89	46	
09N02084	59-87	Bw2	S	lcos	8.8	4.0	87.2	3.8	1.3	1.9	2.1	3.7	36.3	20.7	10.4	16.1	15	39	8	94	62	
09N02085	87-134	Btk1	S	fsl	19.9	6.4	73.7	9.3	1.5	3.4	3.0	10.0	32.6	17.0	7.1	7.0	14	35	12	86	61	
09N02086	134-168	Btk2	S	ls	11.9	5.2	82.9	6.1	0.7	2.9	2.3	2.7	35.5	30.1	5.9	8.7	16	39	7	92	62	
09N02087	168-200	2Btcb	S	scl	26.4	18.5	55.1	15.2	1.3	15.8	2.7	4.2	18.6	14.5	10.1	7.7	15	17	1	67	33	

***** Primary Characterization Data *****

Pedon ID: S09AF006002

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Loamy-skeletal, mixed, superactive, hyperthermic Typic Haplargids

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; Pedon No. 09N0393

Water Dispersible PSDA

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(----- Water Dispersible -----)

(--- Total ---) (--- Clay ---) (--- Silt ---) (--- Sand ---)

Clay Silt Sand F CO₃ F C VF F M C VC

< .002 .05 < < .002 .02 .05 .10 .25 .5 1

.002 -.05 -2 .0002 .002 -.02 -.05 -.10 -.25 -.50 -.1 -2

(----- % of <2mm -----)

3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a

09N02081	0-11	A1	S	2.5	17.8	79.7	1.0	6.3	11.5	12.9	35.4	14.4	6.6	10.4
09N02082	11-31	A2	S	2.1	19.9	78.0	1.0	6.0	13.9	16.5	38.4	15.7	3.6	3.8

Bulk Density & Moisture

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13-

(Bulk Density) Cole Water Content WRD Aggst

33 Oven 6 10 33 1500 1500 kPa Ratio

kPa Dry kPa kPa kPa kPa AD/OD

(--- g cm⁻³ ---) DbWR1 DbWR1

(----- % of < 2mm -----)

DbWR1 3C2a1a 3D1

WRD Whole Aggst

Soil Stabl 2-0.5mm (- Ratio/Clay -)

cm³ cm³ % CEC7 1500 kPa

09N02081	0-11	A1	S	1.47	1.48	0.002			2.9	1.004		0.48	0.58
09N02082	11-31	A2	S					6.1	2.7	1.004	0.04	0.65	0.59
09N02083	31-59	Bw1	S						2.7	1.004		0.33	0.47
09N02084	59-87	Bw2	S	1.70	1.74	0.004		6.5	3.5	1.005	0.02	0.33	0.40
09N02085	87-134	Btk1	S	1.49	1.59	0.011		16.2	8.3	1.009	0.06	0.23	0.42
09N02086	134-168	Btk2	S	1.66	1.73	0.007		12.1	6.1	1.007	0.05	0.24	0.51
09N02087	168-200	2Btgb	S	1.44	1.55	0.019		21.9	13.5	1.015	0.10	0.14	0.51

Water Content

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13-

(-- Atterberg --) (--- Bulk Density ---) (--- Water Content ---)

(-- Limits --) Field Recon Recon Field Recon Sieved Samples

LL PI 33 10 33 100 200 500

kPa Dry kPa kPa kPa kPa kPa

(----- g cm⁻³ -----) (----- % of < 2mm -----)

3B2 3B2 3B2

Field Recon Recon Sieved Samples

33 10 33 100 200 500

kPa Dry kPa kPa kPa kPa

09N02081	0-11	A1	S			NP	1.71	1.73	6.2				
09N02082	11-31	A2	S			NP	1.66	1.67	6.0				
09N02083	31-59	Bw1	S										
09N02085	87-134	Btk1	S	27	13								
09N02087	168-200	2Btgb	S	53	25								

***** Primary Characterization Data *****

Pedon ID: S09AF006002

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Loamy-skeletal, mixed, superactive, hyperthermic Typic Haplargids

Print Date: Jun 7 2017 2:52PM

; Pedon No. 09N0393

Carbon & Extractions				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-
Layer	Depth (cm)	Horz	Prep	(---- Total ----)			Est OC (WB)	C/N Ratio	(--- Dith-Cit Ext ---)			(----- Ammonium Oxalate Extraction -----)			(--- Na Pyro-Phosphate ---)							
				C C	N N	S S			Fe	Al	Mn	Al+1/2Fe ODOE	Fe	Al	Si	Mn	C C	Fe Fe	Al Al	Mn Mn		
				(----- % of <2 mm -----)			(----- % of <2mm -----)			(----- % of <2mm -----)			(----- mg kg ⁻¹ -----)			(----- % of <2mm -----)						
				4H2a	4H2a	4H2a			4G1	4G1	4G1											
09N02081	0-11	A1	S	5.98	0.04	tr	0.1		2	0.4	--	tr										
09N02082	11-31	A2	S	5.31	0.06	--	tr		1	0.4	--	tr										
09N02083	31-59	Bw1	S	6.11	0.02	--	tr		3	0.4	--	tr										
09N02084	59-87	Bw2	S	6.16	0.03	--	--			0.4	--	tr										
09N02085	87-134	Btk1	S	5.62	0.06	--	--			0.5	--	tr										
09N02086	134-168	Btk2	S	6.31	0.03	--	tr		1	0.4	--	tr										
09N02087	168-200	2Btgb	S	6.48	--	--	--			0.4	--	tr										

CEC & Bases				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-				
Layer	Depth (cm)	Horz	Prep	(----- NH ₄ OAC Extractable Bases -----)								Sum Bases	Acid- ity	Extr AI	KCl	Sum Mn	NH ₄ OAC	Bases +AI	(--- Base ---)		
				Ca	Mg	Na	K		cmol(+) kg ⁻¹	mg kg ⁻¹	(----- cmol(+) kg ⁻¹ -----)	4B1a1a		4B1a1a		4B1a1a	(----- % -----)	Sum Cats	+AI	Sat	Sum NH ₄ OAC
				4B1a1a	4B1a1a	4B1a1a	4B1a1a														
09N02081	0-11	A1	S	39.3*	0.9	--	0.2	40.4								2.4			100		
09N02082	11-31	A2	S	37.5*	1.0	--	0.2	38.7								3.0			100		
09N02083	31-59	Bw1	S	39.1*	1.0	--	0.2	40.3								1.9			100		
09N02084	59-87	Bw2	S	39.7*	1.2	--	0.2	41.1								2.9			100		
09N02085	87-134	Btk1	S	39.9*	1.9	0.1	0.3	42.2								4.6			100		
09N02086	134-168	Btk2	S	38.7*	1.6	tr	0.2	40.5								2.9			100		
09N02087	168-200	2Btgb	S	39.3*	2.2	0.1	0.3	41.9								3.8			100		

*Extractable Ca may contain Ca from calcium carbonate or gypsum., CEC7 base saturation set to 100.

***** Primary Characterization Data *****

Pedon ID: S09AF006002

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Loamy-skeletal, mixed, superactive, hyperthermic Typic Haplargids

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; Pedon No. 09N0393

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
				(- - - - - Water Extracted From Saturated Paste - - - - -)															1:2 Total Salts	Elec Cond	Elec Cond	Exch Na	SAR
Layer	Depth (cm)	Horz	Prep	Ca (---- mmol(+) L ⁻¹ -----)	Mg	Na	K	CO ₃	HCO ₃	F	Cl	PO ₄	Br	OAC	SO ₄	NO ₂	NO ₃	H ₂ O (---- % -----)	(-- dS m ⁻¹ --)	4F1a1a1	%		
09N02081	0-11	A1	S																0.14	--			
09N02082	11-31	A2	S																0.11	--			
09N02083	31-59	Bw1	S																0.11	--			
09N02084	59-87	Bw2	S																0.12	--			
09N02085	87-134	Btk1	S																0.17	2			
09N02086	134-168	Btk2	S																0.17	1			
09N02087	168-200	2Btcb	S																0.22	3			

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-
				(- - - - - pH - - - - -)				(- - Carbonate -- -)		(- - Gypsum ---)				
Layer	Depth (cm)	Horz	Prep	CaCl ₂	0.01M	H ₂ O	Sat			As CaCO ₃	As CaSO ₄ *2H ₂ O	Resist		
				4C1a2a	1:2	1:1	Paste	Oxid	NaF	(---- % -----)			ohms	
					4C1a2a	4C1a2a			4C1a1a14E1a1a1a1				cm ⁻¹	
09N02081	0-11	A1	S		7.9	8.5			10.1	49				
09N02082	11-31	A2	S		8.0	8.5			10.1	44				
09N02083	31-59	Bw1	S		8.0	8.6			10.0	51				
09N02084	59-87	Bw2	S		8.0	8.6			10.0	52				
09N02085	87-134	Btk1	S		7.9	8.5			10.1	47				
09N02086	134-168	Btk2	S		7.9	8.5			9.9	52				
09N02087	168-200	2Btcb	S		8.2	8.5			10.0	55				

***** Primary Characterization Data *****

Pedon ID: S09AF006002

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Loamy-skeletal, mixed, superactive, hyperthermic Typic Haplargids

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; Pedon No. 09N0393

Phosphorous			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Melanic Index	NZ Oxal	Anion Available	Phosphorous				H ₂ O	Citric Acid	Mehlich III	KCl NO ₃
							Bray Capacity 1	Bray 2	Olsen	mg kg ⁻¹				
							4D1a1a1a	4D5a1	4D2a1b1	4D6a1				4D9a1a
09N02081	0-11	A1	S			6.7	12.8		4.1	0.1		2.4	5.27	
09N02082	11-31	A2	S			5.2	9.7		2.2	0.1		1.3	4.48	
09N02083	31-59	Bw1	S			4.9	8.3		1.3	0.1		4.0	4.58	
09N02084	59-87	Bw2	S						1.1	tr		0.1		
09N02085	87-134	Btk1	S						0.8	--		0.2		
09N02086	134-168	Btk2	S						0.6	--		0.5		
09N02087	168-200	2Btkb	S						0.6	--		tr		

Phosphorous			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Melanic Index	NZ Oxal	Anion Available	Phosphorous				H ₂ O	Citric Acid	Mehlich III	KCl NO ₃
							Bray Capacity 1	Bray 2	Olsen	mg kg ⁻¹				
							4D1a1a1a	4D5a1	4D2a1b1	4D6b				
09N02081	0-11	A1	S								3.8			
09N02082	11-31	A2	S								2.9			
09N02083	31-59	Bw1	S								3.6			

Major Elements			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Al	Ca	Fe	K	Mg	Mn	Na	P	Si	Sr	Ti
				mg/kg 4H1b										
09N02081	0-11	A1	HM	31118	196175	23612	8666	12278	506	6621	390	188278	445	2802
09N02082	11-31	A2	HM	33540	175188	22263	9624	12001	500	7583	499	196882	411	2582
09N02083	31-59	Bw1	HM	28945	210194	22571	8669	9222	449	6482	308	173804	425	2350
09N02084	59-87	Bw2	HM	30073	211315	23118	9548	9564	459	6546	119	171787	410	2301
09N02085	87-134	Btk1	HM	35906	189463	24486	11134	12504	493	5563	342	176906	353	2306
09N02086	134-168	Btk2	HM	30330	208276	23413	10198	9080	457	5626	313	168442	376	2293
09N02087	168-200	2Btkb	HM	34196	201923	21308	10133	17253	387	3306	124	162100	322	1745

***** Primary Characterization Data *****

(Farah, Afghanistan)

Loamy-skeletal, mixed, superactive, hyperthermic Typic Haplargids

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Pedon ID: S09AF006002

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

; Pedon No. 09N0393

Clay Mineralogy (<.002 mm)			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
			X-Ray						Thermal						Elemental				EGME	Inter preta tion
Layer	Depth (cm)	Horz	Fract ion	7A1a1						SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	Na ₂ O	Retn			
				(----- peak size -----)						(----- % -----)	(----- % -----)	(----- % -----)	(----- % -----)	(----- % -----)	(----- % -----)	(----- % -----)	(----- % -----)	mg g ⁻¹		
09N02081	0.0-11.0	A1	tcly	MI 3	CL 3	CA 2													CMIX	
09N02083	31.0-59.0	Bw1	tcly	MI 3	CL 3	CA 1													CMIX	
09N02085	87.0-134.0	Btk1	tcly	MI 2	CL 2	CA 1	MT 1												CMIX	
09N02087	168.0-200.0	2Btcb	tcly	MI 4	CL 3														CMIX	

FRACTION INTERPRETATION:

tcly - Total Clay <0.002 mm

MINERAL INTERPRETATION:

CA Calcite

CL Chlorite

MI Mica

MT Montmorillonite

RELATIVE PEAK SIZE:

5 Very Large

4 Large

3 Medium

2 Small

1 Very Small

6 No Peaks

INTERPRETATION (BY HORIZON):

CMIX - Mixed Clay

***** Primary Characterization Data *****

(Farah, Afghanistan)

Loamy-skeletal, mixed, superactive, hyperthermic Typic Haplargids

Print Date: Jun 7 2017 2:52PM

Pedon ID: S09AF006002

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

; Pedon No. 09N0393

Sand - Silt Mineralogy (2.0-0.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
				X-Ray				Thermal				Optical								EGME	Inter
Depth		Fract										Grain Count								Retn	preta
Layer	(cm)	Horz	Fract	(----- peak size -----)				(----- % -----)				(----- % -----)								mg g ⁻¹	
09N02081	0.0-11.0	A1	fs									29	CB 43	QZ 16	AR 13	FE 11	CA 10	FK 5			SMIX
													BT 1	CD 1	OP 1	PR tr	CL tr	FP tr			
													HN tr								
09N02083	31.0-59.0	Bw1	fs									33	CB 43	QZ 23	CA 10	FE 8	AR 7	FK 5			SMIX
													FP 1	BT 1	CD 1	OP 1	PR 1	CL tr			
													GN tr				HN tr				
09N02085	87.0-134.0	Btk1	fs									30	CB 44	QZ 19	FE 9	FK 8	CA 8	AR 7			SMIX
													CD 2	PR 2	FP 1	HN tr	OP tr	BT tr			
09N02087	168.0-200.0	2Btgb	fs									26	CB 52	QZ 20	CA 9	AR 8	FE 4	FK 3			SMIX
													CD 2	PR 1	FP tr	OP tr					

FRACTION INTERPRETATION:

fs - Fine Sand 0.1-0.25 mm

MINERAL INTERPRETATION:

AR Weatherable Aggregates	BT Biotite	CA Calcite	CB Carbonate Aggregates	CD Chert (Chalcedony)
CL Chlorite	FE Iron Oxides (Goethite)	FK Potassium Feldspar	FP Plagioclase Feldspar	GN Garnet
HN Hornblende	OP Opaques	PR Pyroxene	QZ Quartz	

*** Primary Characterization Data ***

Pedon ID: S09AF006002
Sampled As : SND
USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)
Loamy-skeletal, mixed, superactive, hyperthermic Typic Haplargids
; Pedon No. 09N0393

Print Date: Jun 7 2017 2:52PM

INTERPRETATION (BY HORIZON):

SMIX - Mixed Sand

***** Primary Characterization Data *****

Pedon ID: S09AF006003

(Farah, Afghanistan)

Print Date: Jun 7 2017 2:52PM

Sampled as on Jan 19, 2009: SND ; Fine-loamy, mixed, superactive, hyperthermic Typic Haplargids
 Revised to correlated on Jan 9, 2017: Haplargids ; Coarse-loamy, mixed, semiactive, hyperthermic Typic Haplargids

SSL - Project C2009AF006067 Afghanistan
 - Site ID S09AF006003 Lat: 32° 25' 35.70" north Long: 62° 9' 47.60" east
 - Pedon No. 09N0394
 - General Methods 1B1A, 2A1, 2B

United States Department of Agriculture
 Natural Resources Conservation Service
 National Soil Survey Center
 Kellogg Soil Survey Laboratory
 Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
09N02088	Ap	Ap	0-18	S09AF006003-1				SIL
09N02089	Bw	Bw	18-49	S09AF006003-2				SIL
09N02090	2Bt1	2Bt1	49-67	S09AF006003-3				L
09N02091	2Bt2	2Bt2	67-114	S09AF006003-4				FSL
09N02092	2Bt3	2Bt3	114-141	S09AF006003-5				L
09N02093	2C	2C	141-200	S09AF006003-6				SL
09N02094	ApFertility	Ap Fertility	0-18	S09AF006003-A				

Pedon Calculations				Result		Units of Measure	
Calculation Name				54	% wt		
Weighted Particles, 0.1-75mm, 75 mm Base				12	% vol		
Volume, >2mm, Weighted Average				15	% wt		
Clay, total, Weighted Average				12	% wt		
Clay, carbonate free, Weighted Average				0.42	(NA)		
CEC Activity, CEC7/Clay, Weighted Average, CECd, Set 1				1	cm/m		
LE, Whole Soil, Summed to 1m							

Weighted averages based on control section: 49-99 cm

PSDA & Rock Fragments				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
				Lab	(----- Total -----)			(- - - Clay - - -)		(- - - Silt - - -)		(- - - - Sand - - - -)				(Rock Fragments (mm))		>2 mm			
				Text-ure	Clay	Silt	Sand	Fine	CO ₃	Fine	Coarse	VF	F	M	C	VC	(----- Weight -----)		wt %		
				Layer	<	.002	.05	<	<	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	
				Depth (cm)	.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-.1	-2	-5	-20	-75	75	
				Horz	Prep				% of <2mm Mineral Soil				3A1a1a				3A1a1a 3A1a1a 3A1a1a 3A1a1a				
				3A1a1a									3A1a1a 3A1a1a 3A1a1a 3A1a1a				3A1a1a 3A1a1a 3A1a1a 3A1a1a				
09N02088	0-18	Ap	S	sil	21.1	68.4	10.5	5.5	3.7	46.0	22.4	6.9	2.3	0.7	0.2	0.4	1	1	--	6	2
09N02089	18-49	Bw	S	sil	24.3	59.5	16.2	5.5	5.3	43.3	16.2	7.9	4.9	1.9	0.8	0.7	2	5	2	17	9
09N02090	49-67	2Bt1	S	I	21.7	48.4	29.9	6.3	4.5	30.4	18.0	12.0	9.5	4.5	1.9	2.0	7	29	8	54	44
09N02091	67-114	2Bt2	S	fsl	11.5	18.4	70.1	3.0	1.8	8.0	10.4	17.6	33.9	11.9	3.7	3.0	1	2	--	54	3
09N02092	114-141	2Bt3	S	I	22.8	35.0	42.2	8.1	3.7	20.6	14.4	14.4	14.2	7.5	2.0	4.1	10	26	14	64	50
09N02093	141-200	2C	S	sl	8.5	22.0	69.5	2.8	1.8	11.5	10.5	12.5	21.6	20.2	7.7	7.5	14	47	3	85	64
09N02094	0-18	ApFertility	S													tr	1	--	--	--	1

*** Primary Characterization Data ***

Pedon ID: S09AF006003

Sampled As : SND
USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)
Fine-loamy, mixed, superactive, hyperthermic Typic Haplalgids
Pedon No. 09N0394

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Water Dispersible PSDA				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	
Layer	Depth (cm)	Horz	Prep	(- - - - - Water Dispersible - - - - -)												
				(- - - - - Total - - - - -)			(- - - - - Clay - - - - -)			(- - - - - Silt - - - - -)			(- - - - - Sand - - - - -)			
				Clay	Silt	Sand	F	CO ₃	F	C	VF	F	M	C	VC	
09N02088	0-18	Ap	S	< .002	.002	.05	<	<	.002	.02	.05	.10	.25	.5	1	
				.002	.05	-2	.0002	.002	.02	.05	.10	.25	.50	-1	-2	
				(- - - - - % of <2mm - - - - -)												
				3A1a6a				3A1a6a 3A1a6a				3A1a6a 3A1a6a 3A1a6a 3A1a6a				
Bulk Density & Moisture				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-
Layer	Depth (cm)	Horz	Prep	(Bulk Density)				Cole	(- - - - - Water Content - - - - -)				WRD	Aggst		
				33	Oven	Whole	6	10	33	1500	1500 kPa	Ratio	Whole	Stabl	(- Ratio/Clay - -)	
				kPa	Dry	Soil	kPa	kPa	kPa	kPa	Moist	AD/OD	Soil	2-0.5mm	CEC7	1500 kPa
09N02088	0-18	Ap	S	1.38	1.43	0.012			22.4	8.9		1.012	0.18	3	0.42	0.42
09N02089	18-49	Bw	S	1.43	1.48	0.011			20.8	9.4		1.012	0.16		0.33	0.39
09N02090	49-67	2Bt1	S	1.39	1.46	0.012			20.7	8.7		1.011	0.12		0.29	0.40
09N02091	67-114	2Bt2	S	1.56	1.62	0.012			16.9	8.4		1.010	0.13		0.50	0.73
09N02092	114-141	2Bt3	S	1.62	1.69	0.009			11.0	10.1		1.013	0.01		0.21	0.44
09N02093	141-200	2C	S							5.0			1.007			
09N02094	0-18	ApFertility		S								1.012				
Water Content				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-
Layer	Depth (cm)	Horz	Prep	(- - - - - Atterberg - - - - -)				(- - - - - Bulk Density - - - - -)				(- - - - - Water Content - - - - -)				
				(- - - - - LL - - - - -)	Field	Recon	Recon	Field	Recon	(- - - - - Sieved Samples - - - - -)						
				(- - - - - PI - - - - -)		33	Oven		33	6	10	33	100	200	500	
09N02088	0-18	Ap	S	27	8			1.51	1.52		24.8					
09N02090	49-67	2Bt1	S	25	9											
09N02092	114-141	2Bt3	S	34	14											
				pct <0.4mm		(- - - - - g cm ⁻³ - - - - -)			3B2				(- - - - - % of <2mm - - - - -)			
				3H	3H								3B2			

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Pedon ID: S09AF006003

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USDA-NRCS-NSSC-Soil Survey Laboratory

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Fine-loamy, mixed, superactive, hyperthermic Typic Haplargids

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Carbon & Extractions				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-
Layer	Depth (cm)	Horz	Prep	(- - - - - Total C N S % of < 2 mm - - - - -)			Est OC (WB)	C/N Ratio	(- - - Dith-Cit Ext Fe Al Mn - - - - -)			(- - - Ammonium Oxalate Extraction Al+1/2Fe ODOE Fe Al Si Mn - - - - -)			(- - - Na Pyro-Phosphate C Fe Al Mn - - - - -)							
				4H2a	4H2a	4H2a	4G1	4G1	4G1	(- - - - - % of < 2mm - - - - -)			mg kg ⁻¹ (- - - - - % of < 2mm - - - - -)									
				4H2a	4H2a	4H2a																
09N02088	0-18	Ap	S	3.74	0.09	tr	0.5	5	0.9	tr	tr											
09N02089	18-49	Bw	S	3.79	0.08	tr	0.3	4	0.8	--	tr											
09N02090	49-67	2Bt1	S	3.92	0.05	0.03	0.1	2	0.8	--	tr											
09N02091	67-114	2Bt2	S	3.89	0.05	0.01	0.2	3	0.8	--	tr											
09N02092	114-141	2Bt3	S	4.15	0.07	0.03	0.1	1	0.7	--	tr											
09N02093	141-200	2C	S	3.99	0.05	0.01	0.1	1	0.6	--	tr											

CEC & Bases				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-				
Layer	Depth (cm)	Horz	Prep	(- - - NH ₄ OAC Extractable Bases - - - - -)								CEC8	CEC7	ECEC	(- - - Base - - - - -)						
				Ca	Mg	Na	K	Sum Bases	Acid-ity	Extr Al	KCl Mn	Sum Cats	NH ₄ OAC	Bases +Al	AI Sat	Sum	NH ₄ OAC				
				(- - - cmol(+) kg ⁻¹ - - - - -)				mg kg ⁻¹ (- - - cmol(+) kg ⁻¹ - - - - -)				4B1a1a				(- - - % - - - - -)					
09N02088	0-18	Ap	S	119.4*	6.4	0.2	0.4	126.4							8.8				100		
09N02089	18-49	Bw	S	42.7*	6.3	1.3	0.3	50.6							7.9				100		
09N02090	49-67	2Bt1	S	42.7*	6.5	1.6	0.2	51.0							6.4				100		
09N02091	67-114	2Bt2	S	36.9*	5.6	1.3	0.2	44.0							5.7				100		
09N02092	114-141	2Bt3	S	41.1*	7.0	1.2	0.2	49.5							4.8				100		
09N02093	141-200	2C	S	38.3*	6.4	0.7	0.1	45.5							3.9				100		

*Extractable Ca may contain Ca from calcium carbonate or gypsum., CEC7 base saturation set to 100.

Salt				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
Layer	Depth (cm)	Horz	Prep	(- - - - - Water Extracted From Saturated Paste - - - - -)															1:2	SAR			
				Ca	Mg	Na	K	CO ₃	HCO ₃	F	Cl	PO ₄	Br	OAC	SO ₄	NO ₂	NO ₃	H ₂ O	Total Salts	Elec Cond	Elec Cond	Exch Na	
				(- - - mmol(+) L ⁻¹ - - - - -)	(- - - 4F2	(- - - 4F2	(- - - 4F2	(- - - 4F2	(- - - 4F2	(- - - 4F2	(- - - 4F2	(- - - 4F2	(- - - 4F2	(- - - 4F2	(- - - 4F2	(- - - 4F2	(- - - 4F1a1a1						
09N02088	0-18	Ap	S	3.5	2.7	3.0	0.1	--	3.0	tr	2.3	--	--	3.5	tr	0.5	42.1	tr	0.94	0.35	1	2	
09N02089	18-49	Bw	S	8.2	9.9	13.5	tr	--	1.6	--	6.5	--	--	23.2	0.1	1.5	42.3	0.1	2.86	0.81	9	4	
09N02090	49-67	2Bt1	S	19.3	26.4	23.1	--	--	1.1	--	15.0	--	--	51.2	0.1	2.9	40.2	0.2	5.31	1.29	10	5	
09N02091	67-114	2Bt2	S	2.6	5.7	14.7	--	--	1.7	--	5.1	--	--	16.5	tr	0.6	44.3	0.1	2.28	0.75	12	7	
09N02092	114-141	2Bt3	S	1.0	4.1	11.2	0.2	--	2.2	tr	4.4	--	--	10.2	tr	0.4	47.3	0.1	1.74	0.57	14	7	
09N02093	141-200	2C	S	1.2	5.2	9.1	--	--	2.2	tr	2.5	--	--	10.9	tr	0.2	28.5	tr	1.54	0.39	12	5	

***** Primary Characterization Data *****

Pedon ID: S09AF006003

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine-loamy, mixed, superactive, hyperthermic Typic Haplargids

Print Date: Jun 7 2017 2:52PM

; Pedon No. 09N0394

pH & Carbonates

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11-

(----- pH -----)										(- - Carbonate --)	(- - Gypsum --)			
										As CaCO ₃	As CaSO ₄ ·2H ₂ O			
										<2mm	<20mm	<2mm	<20mm	Resist
Layer	Depth (cm)	Horz	Prep	KCl	0.01M	H ₂ O	Sat	Oxid	NaF	(----- % -----)			ohms	
					1:2 4C1a2a	1:1 4C1a2a	4F2		4C1a1a14E1a1a1a1					4E2a1a1a1

09N02088	0-18	Ap	S		7.9	8.4	8.0		10.4	27		
09N02089	18-49	Bw	S		8.0	8.4	7.9		10.3	29	tr	
09N02090	49-67	2Bt1	S		8.1	8.3	7.9		10.2	32	--	
09N02091	67-114	2Bt2	S		8.2	8.6	8.2		10.2	31	tr	
09N02092	114-141	2Bt3	S		8.3	8.9	8.5		9.9	34	tr	
09N02093	141-200	2C	S		8.2	8.8	8.4		9.6	33		

Phosphorous

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(----- Phosphorous -----)										KCl										
										Oxal	Acid	Anion Exch	Resin	Bray 1	Bray 2	Olsen	H ₂ O	Citric Acid	Mehlrich III	Extr NO ₃
Layer	Depth (cm)	Horz	Prep	Index	Melanic	NZ	Available	Capacity	1	mg kg ⁻¹			4D1a1a1a	4D5a1	4D2a1b1	4D6a1	4D9a1a			
					%	(-----	4D1a1a1a				4D5a1	4D2a1b1								

09N02088	0-18	Ap	S			6.0	10.3			2.5	0.1	0.9	15.71
09N02089	18-49	Bw	S			3.5	6.1			0.8	tr	0.5	15.21
09N02090	49-67	2Bt1	S			3.5	5.7			1.1	--	0.4	
09N02091	67-114	2Bt2	S							0.7	--	0.2	
09N02092	114-141	2Bt3	S							0.8	--	0.4	
09N02093	141-200	2C	S							1.2	tr	0.8	

¹ Analyzed size fraction = <2 mm

Phosphorous

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(----- Phosphorous -----)										KCl										
										Oxal	Acid	Anion Exch	Resin	Bray 1	Bray 2	Olsen	H ₂ O	Citric Acid	Mehlrich III	Extr NO ₃
Layer	Depth (cm)	Horz	Prep	Index	Melanic	NZ	Available	Capacity	1	mg kg ⁻¹			4D6b							
					%	(-----	4D6b													

09N02088	0-18	Ap	S									12.1
09N02089	18-49	Bw	S									4.9
09N02090	49-67	2Bt1	S									1.8

¹ Analyzed size fraction = <2 mm

***** Primary Characterization Data *****

Pedon ID: S09AF006003

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(Farah, Afghanistan)

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Trace Elements Tier 1				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Ag mg/kg 4H1a	As mg/kg 4H1a	Ba mg/kg 4H1a	Be mg/kg 4H1a	Cd mg/kg 4H1a	Co mg/kg 4H1a	Cr mg/kg 4H1a	Cu mg/kg 4H1a	Mn mg/kg 4H1a	Mo mg/kg 4H1a	Hg ug/kg 4H1a	
09N02094	0-18	ApFertility	HM	0.02	11.13	115.90	1.05	0.13	10.12	37.06	19.61	566.69	0.47	33	
Trace Elements Tier 2				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	
Layer	Depth (cm)	Horz	Prep	Ni mg/kg 4H1a	P mg/kg 4H1a	Pb mg/kg 4H1a	Sb mg/kg 4H1a	Se ug/kg 4H1a	Sn mg/kg 4H1a	Sr mg/kg 4H1a	Tl mg/kg	V mg/kg 4H1a	W mg/kg 4H1a	Zn mg/kg 4H1a	
09N02094	0-18	ApFertility	HM	53.01	481.75	14.82	0.44	401.49	0.62	270.72		44.45	0.03	60.40	
Major Elements				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Al mg/kg 4H1b	Ca mg/kg 4H1b	Fe mg/kg 4H1b	K mg/kg 4H1b	Mg mg/kg 4H1b	Mn mg/kg 4H1b	Na mg/kg 4H1b	P mg/kg 4H1b	Si mg/kg 4H1b	Sr mg/kg 4H1b	Ti mg/kg 4H1b	Zr mg/kg 4H1b
09N02088	0-18	Ap	HM	54758	107175	29488	15456	16763	682	7344	581	222842	319	3229	88
09N02089	18-49	Bw	HM	53233	118807	28391	15704	15896	629	6900	489	219621	342	3081	91
09N02090	49-67	2Bt1	HM	47517	127774	26362	12548	15873	563	6962	482	223233	359	2983	93
09N02091	67-114	2Bt2	HM	48717	122678	25758	11436	15139	594	6912	487	220841	340	2934	84
09N02092	114-141	2Bt3	HM	43896	122990	22742	7295	14208	529	6103	224	200077	174	2475	87
09N02093	141-200	2C	HM	38865	101676	16117	3739	8457	468	6900	115	175322	32	1858	93
09N02094	0-18	ApFertility	HM	56311	80712	19830	4281	10071	732	5356	400	163536	23	2230	72

***** Primary Characterization Data *****

Pedon ID: S09AF006003

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine-loamy, mixed, superactive, hyperthermic Typic Haplargids

Print Date: Jun 7 2017 2:52PM

; Pedon No. 09N0394

Clay Mineralogy (<.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
				X-Ray				Thermal				Elemental				EGME		Inter			
Layer	Depth (cm)	Horz	Fract	7A1a1												Retn	preta				
			ion	(----- peak size -----)				(- - - - % - - - -)				(- - - - % - - - -)						mg g ⁻¹			
09N02088	0.0-18.0	Ap	tcly	MI 3	CL 3	CA 2														CMIX	
09N02090	49.0-67.0	2Bt1	toly	MI 3	CL 3	CA 2														CMIX	

FRACTION INTERPRETATION:

tcly - Total Clay <0.002 mm

MINERAL INTERPRETATION:

CA Calcite

CL Chlorite

MI Mica

RELATIVE PEAK SIZE:

5 Very Large

4 Large

3 Medium

2 Small

1 Very Small

6 No Peaks

INTERPRETATION (BY HORIZON):

CMIX - Mixed Clay

***** Primary Characterization Data *****

Pedon ID: S09AF006003

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine-loamy, mixed, superactive, hyperthermic Typic Haplargids

Print Date: Jun 7 2017 2:52PM

; Pedon No. 09N0394

Sand - Silt Mineralogy (2.0-0.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	
				X-Ray				Thermal				Optical						EGME	Inter			
Depth		Fract										Tot Re				Grain Count				Retn	preta	
Layer	(cm)	Horz	Fract	(----- peak size -----)				(- ----- % -----)				(- ----- % -----)				7B1a2						
09N02088	0.0-18.0	Ap	csi									51	QZ 49	CA 22	FK 9	BT 7	AR 4	FE 2			mg g ⁻¹	SMIX
													MS 2	HN 1	PR 1	CB 1	CD tr	BY tr				
													FP tr	GC tr	GN tr	GS tr	ZR tr	OP tr				
09N02090	49.0-67.0	2Bt1	csi									42	QZ 39	CA 31	BT 12	FK 5	AR 3	CB 3				SMIX
													MS 3	FE 2	CD 1	HN 1	PR 1	OP tr				
													ZR tr	BY tr	FP tr	GN tr						
09N02092	114.0-141.0	2Bt3	csi									40	QZ 37	CA 25	BT 11	CB 8	FK 8	AR 4				SMIX
													FE 2	MS 2	PR 2	CD 1	BY tr	FP tr				
													GN tr	HN tr	RU tr	ZR tr	OP tr					

FRACTION INTERPRETATION:

csi - Coarse Silt 0.02-0.05 mm

MINERAL INTERPRETATION:

AR Weatherable Aggregates	BT Biotite	BY Beryl	CA Calcite	CB Carbonate Aggregates
CD Chert (Chalcedony)	FE Iron Oxides (Goethite)	FK Potassium Feldspar	FP Plagioclase Feldspar	GC Glass Coated Grain
GN Garnet	GS Glass	HN Hornblende	MS Muscovite	OP Opaques
PR Pyroxene	QZ Quartz	RU Rutile	ZR Zircon	

*** Primary Characterization Data ***

Pedon ID: S09AF006003
Sampled As : SND
USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)
Fine-loamy, mixed, superactive, hyperthermic Typic Haplargids
; Pedon No. 09N0394

Print Date: Jun 7 2017 2:52PM

INTERPRETATION (BY HORIZON):

SMIX - Mixed Sand

***** Primary Characterization Data *****

Pedon ID: S09AF006004

(Farah, Afghanistan)

Print Date: Jun 7 2017 2:52PM

Sampled as on Jan 20, 2009: SND ; Fine, mixed, superactive, hyperthermic Typic Calciargids
 Revised to correlated on Jan 9, 2017: Calciargids ; Fine-silty, mixed, semiactive, hyperthermic Typic Calciargids

SSL - Project C2009AF006067 Afghanistan
 - Site ID S09AF006004 Lat: 32° 22' 36.50" north Long: 62° 6' 28.20" east
 - Pedon No. 09N0395
 - General Methods 1B1A, 2A1, 2B

United States Department of Agriculture
 Natural Resources Conservation Service
 National Soil Survey Center
 Kellogg Soil Survey Laboratory
 Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
09N02095	Ap	Ap	0-12	S09AF006004-1				SIL
09N02096	Bw	Bw	12-29	S09AF006004-2				SIL
09N02097	Bt1	Bt1	29-57	S09AF006004-3				SICL
09N02098	Bt2	Bt2	57-122	S09AF006004-4				SICL
09N02099	Btk1	Btk1	122-153	S09AF006004-5				SIL
09N02100	Btk2	Btk2	153-200	S09AF006004-6				SIL
09N02101	ApFertility	Ap Fertility	0-12	S09AF006004-A				

Pedon Calculations				Result	Units of Measure
Weighted Particles, 0.1-75mm, 75 mm Base				4	% wt
Volume, >2mm, Weighted Average				0	% vol
Clay, total, Weighted Average				33	% wt
Clay, carbonate free, Weighted Average				27	% wt
CEC Activity, CEC7/Clay, Weighted Average, CECd, Set 1				0.25	(NA)
LE, Whole Soil, Summed to 1m				2	cm/m

Weighted averages based on control section: 29-79 cm

PSDA & Rock Fragments				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
Depth				Lab	(----- Total -----)			(-- Clay --)		(--- Silt ---)		(----- Sand -----)				(Rock Fragments (mm))		>2 mm			
Layer	(cm)	Horz	Prep		Clay	Silt	Sand	Fine	CO ₃	Fine	Coarse	VF	F	M	C	VC	(----- Weight -----)	wt %			
			Text-ure	<	.002	.05	<	<	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-		
					.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	
					% of <2mm Mineral Soil				3A1a1a 3A1a1a 3A1a1a 3A1a1a				3A1a1a 3A1a1a 3A1a1a 3A1a1a				% of <75mm				
09N02095	0-12	Ap	S	sil	22.7	63.8	13.5	6.0	4.0	37.5	26.3	10.8	2.4	0.2	tr	0.1	--	tr	--	3	tr
09N02096	12-29	Bw	S	sil	25.6	61.1	13.3	6.5	4.3	38.9	22.2	9.8	2.8	0.6	0.1	tr	--	--	--	4	--
09N02097	29-57	Bt1	S	sicl	35.6	56.2	8.2	10.4	5.7	37.4	18.8	5.9	1.8	0.3	0.1	0.1	--	tr	--	2	tr
09N02098	57-122	Bt2	S	sicl	29.6	54.7	15.7	9.6	5.4	32.3	22.4	10.1	5.2	0.2	0.1	0.1	tr	1	--	7	1
09N02099	122-153	Btk1	S	sil	21.3	56.7	22.0	7.3	5.1	32.8	23.9	16.9	4.3	0.6	0.1	0.1	tr	1	--	6	1
09N02100	153-200	Btk2	S	sil	19.7	57.7	22.6	7.0	4.2	33.7	24.0	14.7	6.7	1.1	0.1	tr	--	tr	--	8	tr
09N02101	0-12	ApFertility	S													--	--	--	--	--	

*** Primary Characterization Data ***

Pedon ID: S09AF006004

Sampled As : SND
USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)
Fine, mixed, superactive, hyperthermic Typic Calciargids
Pedon No. 09N0395

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***** Primary Characterization Data *****

Pedon ID: S09AF006004

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

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Print Date: Jun 7 2017 2:52PM

; Pedon No. 09N0395

Carbon & Extractions				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-
Layer	Depth (cm)	Horz	Prep	(- - - - - Total C N S % of < 2 mm - - - - -)			Est OC (WB)	C/N Ratio	(- - Dith-Cit Ext Fe Al Mn)			(- - - - - Ammonium Oxalate Extraction Al+½Fe ODOE Fe Al Si Mn)			(- - Na Pyro-Phosphate C Fe Al Mn mg kg⁻¹)							
				4H2a	4H2a	4H2a	4G1	4G1	4G1	(- - - - - % of < 2mm - - - - -)			(- - - - - % of < 2mm - - - - -)			(- - - - - % of < 2mm - - - - -)						
				4.95	0.02	--	tr	2	0.6	(- - - - - % of < 2mm - - - - -)			(- - - - - % of < 2mm - - - - -)			(- - - - - % of < 2mm - - - - -)						
09N02095	0-12	Ap	S	3.96	0.11	0.01	0.5	5	0.9	--	tr											
09N02096	12-29	Bw	S	3.88	0.11	tr	0.6	5	0.9	--	tr											
09N02097	29-57	Bt1	S	3.54	0.09	tr	0.3	3	0.9	--	tr											
09N02098	57-122	Bt2	S	3.89	0.08	tr	0.3	4	0.7	--	tr											
09N02099	122-153	Btk1	S	4.48	0.07	0.01	0.1	2	0.7	--	tr											
09N02100	153-200	Btk2	S	4.55	0.02	--	tr	2	0.6	--	tr											

CEC & Bases				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	(- - - - - NH₄OAC Extractable Bases - - - - -)			
Layer	Depth (cm)	Horz	Prep	Ca Mg Na K cmol(+) kg⁻¹				Sum Bases	Acid-ity	Extr AI	KCl Mn	CEC8 Sum NH₄ Bases	CEC7 Sum OAC +AI	ECEC Al Sat	(- - - - - Base - - - - -)	(- - - - - Saturation - - - - -)	(- - - - - NH₄OAC Sum - - - - -)				
				4B1a1a	4B1a1a	4B1a1a	4B1a1a	4B1a1a	mg kg⁻¹	4B1a1a	cmol(+) kg⁻¹	4B1a1a	cmol(+) kg⁻¹	4B1a1a	%	(- - - - - % - - - - -)					
				4.37*	5.7	0.6	0.5	50.5				7.2			100						
09N02095	0-12	Ap	S	43.7*	5.7	0.6	0.5	50.5				7.2			100						
09N02096	12-29	Bw	S	46.5*	5.7	0.5	0.4	53.1				7.7			100						
09N02097	29-57	Bt1	S	44.9*	6.9	0.5	0.6	52.9				9.0			100						
09N02098	57-122	Bt2	S	42.5*	6.2	0.5	0.7	49.9				7.4			100						
09N02099	122-153	Btk1	S	37.7*	5.5	0.6	0.8	44.6				5.1			100						
09N02100	153-200	Btk2	S	39.4*	6.8	0.7	0.8	47.7				5.0			100						

*Extractable Ca may contain Ca from calcium carbonate or gypsum., CEC7 base saturation set to 100.

Salt				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
Layer	Depth (cm)	Horz	Prep	(- - - - - Water Extracted From Saturated Paste - - - - -)																1:2	Exch	SAR	
				Ca	Mg	Na	K	CO ₃	HCO ₃	F	Cl	PO ₄	Br	OAC	SO ₄	NO ₂	NO ₃	H ₂ O	Total Salts	Elec Cond	Elec Cond	Na	
				(- - - - - mmol(+) L⁻¹ - - - - -)	(- - - - - mmol(+) L⁻¹ - - - - -)	(- - - - - mmol(+) L⁻¹ - - - - -)	(- - - - - mmol(+) L⁻¹ - - - - -)	(- - - - - mmol(+) L⁻¹ - - - - -)	(- - - - - mmol(+) L⁻¹ - - - - -)	(- - - - - mmol(+) L⁻¹ - - - - -)	(- - - - - mmol(+) L⁻¹ - - - - -)	(- - - - - mmol(+) L⁻¹ - - - - -)	(- - - - - mmol(+) L⁻¹ - - - - -)	(- - - - - mmol(+) L⁻¹ - - - - -)	(- - - - - mmol(+) L⁻¹ - - - - -)	(- - - - - mmol(+) L⁻¹ - - - - -)	(- - - - - mmol(+) L⁻¹ - - - - -)	(- - - - - mmol(+) L⁻¹ - - - - -)	(- - - - - dS m⁻¹ - - - - -)	(- - - - - dS m⁻¹ - - - - -)	(- - - - - % - - - - -)	(- - - - - % - - - - -)	
09N02095	0-12	Ap	S	8.0	6.9	6.2	--	--	4.5	--	3.0	--	--	--	12.8	0.2	1.8	47.1	0.1	1.98	0.73	5	2
09N02096	12-29	Bw	S	1.9	1.9	2.5	--	--	3.5	tr	0.6	--	--	--	2.5	tr	tr	45.8	tr	0.64	0.29	5	2
09N02097	29-57	Bt1	S	1.3	1.8	2.4	0.2	--	2.9	tr	0.7	--	--	--	2.2	0.1	tr	61.5	tr	0.59	0.29	4	2
09N02098	57-122	Bt2	S	0.9	1.6	3.0	0.4	--	3.0	tr	0.6	--	--	--	2.6	tr	0.1	50.9	tr	0.63	0.26	5	3
09N02099	122-153	Btk1	S	0.5	1.2	4.1	0.6	--	2.7	tr	0.8	--	--	--	3.4	tr	tr	50.2	tr	0.72	0.30	8	5
09N02100	153-200	Btk2	S	0.6	1.8	5.3	0.8	--	2.4	tr	1.3	--	--	--	5.5	tr	tr	54.8	tr	0.95	0.40	9	5

***** Primary Characterization Data *****

Pedon ID: S09AF006004

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine, mixed, superactive, hyperthermic Typic Calciargids

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; Pedon No. 09N0395

pH & Carbonates

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11-

(----- pH -----) (- - Carbonate --) (- - Gypsum --)
CaCl₂ As CaCO₃ As CaSO₄·2H₂O Resist
0.01M H₂O Sat <2mm <20mm <2mm <20mm ohms
Layer Depth Horz Prep KCl 1:2 1:1 Paste Oxid NaF (%) cm⁻¹
(cm) 4C1a2a 4C1a2a 4F2 4C1a1a14E1a1a1a1 4E2a1a1a1

09N02095	0-12	Ap	S	7.9	8.2	7.8	10.4	29	--
09N02096	12-29	Bw	S	8.0	8.6	8.1	10.4	28	
09N02097	29-57	Bt1	S	8.1	8.6	8.3	10.4	27	
09N02098	57-122	Bt2	S	8.0	8.7	8.3	10.4	30	
09N02099	122-153	Btk1	S	8.0	8.7	8.5	10.2	36	
09N02100	153-200	Btk2	S	8.1	8.7	8.5	10.1	38	

Phosphorous

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(----- Phosphorous -----) KCl
Melanic NZ Acid Anion Exch Resin Bray Bray Olsen H₂O Citric Mehlich Extr
Index Oxal Available Capacity 1 2 Acid III NO₃
Layer Depth Horz Prep % (----- mg kg⁻¹ -----)
(cm) 4D1a1a1a 4D5a1 4D2a1b1 4D6a1 4D9a1a

09N02095	0-12	Ap	S	9.7	16.7	3.6	0.1	2.7	44.04
09N02096	12-29	Bw	S	8.6	16.0	2.1	0.2	2.7	5.65
09N02097	29-57	Bt1	S	9.3	15.9	2.8	0.2	1.8	2.16
09N02098	57-122	Bt2	S			2.8	0.3	3.0	
09N02099	122-153	Btk1	S			0.9	0.1	0.4	
09N02100	153-200	Btk2	S			0.7	tr	0.3	
09N02101	0-12	ApFertility	S						106.82

Phosphorous

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(----- Phosphorous -----) KCl
Melanic NZ Acid Anion Exch Resin Bray Bray Olsen H₂O Citric Mehlich Extr
Index Oxal Available Capacity 1 2 Acid III NO₃
Layer Depth Horz Prep % (----- mg kg⁻¹ -----)
(cm) 4D6b

09N02095	0-12	Ap	S						7.6
09N02096	12-29	Bw	S						5.5
09N02097	29-57	Bt1	S						6.5
09N02101	0-12	ApFertility	S						9.5

***** Primary Characterization Data *****

Pedon ID: S09AF006004

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine, mixed, superactive, hyperthermic Typic Calciargids

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; Pedon No. 09N0395

Trace Elements Tier 1				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Ag mg/kg 4H1a	As mg/kg 4H1a	Ba mg/kg 4H1a	Be mg/kg 4H1a	Cd mg/kg 4H1a	Co mg/kg 4H1a	Cr mg/kg 4H1a	Cu mg/kg 4H1a	Mn mg/kg 4H1a	Mo mg/kg 4H1a	Hg ug/kg 4H1a	

09N02101	0-12	ApFertility	HM	0.04	11.12	117.46	1.03	0.16	9.32	34.98	19.62	518.52	0.54	62
----------	------	-------------	----	------	-------	--------	------	------	------	-------	-------	--------	------	----

Trace Elements Tier 2				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-
Layer	Depth (cm)	Horz	Prep	Ni mg/kg 4H1a	P mg/kg 4H1a	Pb mg/kg 4H1a	Sb mg/kg 4H1a	Se ug/kg 4H1a	Sn mg/kg 4H1a	Sr mg/kg 4H1a	Tl mg/kg	V mg/kg 4H1a	W mg/kg 4H1a	Zn mg/kg 4H1a

09N02101	0-12	ApFertility	HM	52.00	594.07	15.37	0.54	512.97	0.73	305.42		43.94	0.03	61.95
----------	------	-------------	----	-------	--------	-------	------	--------	------	--------	--	-------	------	-------

Major Elements				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Al mg/kg 4H1b	Ca mg/kg 4H1b	Fe mg/kg 4H1b	K mg/kg 4H1b	Mg mg/kg 4H1b	Mn mg/kg 4H1b	Na mg/kg 4H1b	P mg/kg 4H1b	Si mg/kg 4H1b	Sr mg/kg 4H1b	Ti mg/kg 4H1b	Zr mg/kg 4H1b

09N02095	0-12	Ap	HM	52809	85015	19885	5235	10380	667	6275	414	175568	42	2324	71
09N02096	12-29	Bw	HM	53635	88282	21690	7111	11486	668	6172	554	185886	80	2468	71
09N02097	29-57	Bt1	HM	58997	92257	25595	10640	14318	699	5876	647	196966	155	2661	77
09N02098	57-122	Bt2	HM	51039	109567	23654	11163	14331	579	6838	626	204532	276	2632	75
09N02099	122-153	Btk1	HM	43740	126786	22241	10608	17886	534	7063	316	205285	448	2535	67
09N02100	153-200	Btk2	HM	42670	125506	22309	10979	22167	566	6997	419	207075	572	2551	67

***** Primary Characterization Data *****

Pedon ID: S09AF006004

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine, mixed, superactive, hyperthermic Typic Calciargids

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; Pedon No. 09N0395

Clay Mineralogy (<.002 mm)			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
			X-Ray						Thermal						Elemental				EGME	Inter preta tion
Layer	Depth (cm)	Horz	Fract ion	7A1a1						SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	Na ₂ O	Retn			
09N02096	12.0-29.0	Bw	tcly	MI 4	CL 3	CA 2												mg g ⁻¹	CMIX	
09N02098	57.0-122.0	Bt2	tcly	MI 4	CL 3	CA 2													CMIX	
09N02100	153.0-200.0	Btk2	tcly	MI 4	CL 3	CA 2													CMIX	

FRACTION INTERPRETATION:

tcly - Total Clay <0.002 mm

MINERAL INTERPRETATION:

CA Calcite

CL Chlorite

MI Mica

RELATIVE PEAK SIZE:

5 Very Large

4 Large

3 Medium

2 Small

1 Very Small

6 No Peaks

INTERPRETATION (BY HORIZON):

CMIX - Mixed Clay

***** Primary Characterization Data *****

Pedon ID: S09AF006004

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine, mixed, superactive, hyperthermic Typic Calciargids

Print Date: Jun 7 2017 2:52PM

; Pedon No. 09N0395

Sand - Silt Mineralogy (2.0-0.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
				X-Ray				Thermal				Optical								EGME	Inter
Depth		Fract										Grain Count								Retn	preta
Layer	(cm)	Horz	Fract	(----- peak size -----)				(----- % -----)				(----- % -----)								mg g ⁻¹	
09N02096	12.0-29.0	Bw	csi									44	QZ 42	CA 19	BT 8	FK 8	MS 8	CB 6			SMIX
													AR 4	FE 2	PR 2	RU tr	ZR tr	OP tr			
													PO tr	CD tr	BY tr	FP tr	GN tr	GS tr			
													HN tr								
09N02098	57.0-122.0	Bt2	csi									52	QZ 49	CA 19	BT 8	FK 5	MS 5	CB 4			SMIX
													AR 3	PR 2	CD 2	FE 1	HN 1	MG tr			
													OP tr	PO tr	SS tr	ZR tr	FP tr	GN tr			
													BY tr								
09N02100	153.0-200.0	Btk2	csi									47	QZ 43	CA 28	FK 6	BT 6	MS 4	AR 3			SMIX
													CB 2	CD 2	FE 1	FP 1	OP 1	PR 1			
													BY tr	TM tr	ZR tr	GN tr	HN tr				

FRACTION INTERPRETATION:

csi - Coarse Silt 0.02-0.05 mm

MINERAL INTERPRETATION:

AR Weatherable Aggregates

BT Biotite

BY Beryl

CA Calcite

CB Carbonate Aggregates

*** Primary Characterization Data ***

(Farah, Afghanistan)

Fine, mixed, superactive, hyperthermic Typic Calciargids

Print Date: Jun 7 2017 2:52PM

Pedon ID: S09AF006004

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

; Pedon No. 09N0395

MINERAL INTERPRETATION:

CD Chert (Chalcedony)

FE Iron Oxides (Goethite)

FK Potassium Feldspar

FP Plagioclase Feldspar

GN Garnet

GS Glass

HN Hornblende

MG Magnetite

MS Muscovite

OP Opaques

PO Plant Opal

PR Pyroxene

QZ Quartz

RU Rutile

SS Sponge Spicule

TM Tourmaline

ZR Zircon

INTERPRETATION (BY HORIZON):

SMIX - Mixed Sand

***** Primary Characterization Data *****

Pedon ID: S09AF006005

(Farah, Afghanistan)

Print Date: Jun 7 2017 2:52PM

Sampled as on Jan 23, 2009:

SND ; Fine, mixed, superactive, hyperthermic Aquic Haplargids
 Revised to : ; Fine, mixed, semiactive, hyperthermic Fluventic Aquicambids

SSL - Project C2009AF06067 Afghanistan
 - Site ID S09AF006005 Lat: 32° 23' 1.40" north Long: 62° 6' 24.00" east
 - Pedon No. 09N0396
 - General Methods 1B1A, 2A1, 2B

United States Department of Agriculture
 Natural Resources Conservation Service
 National Soil Survey Center
 Kellogg Soil Survey Laboratory
 Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
09N02102	Ap	Ap	0-14	S09AF006005-1				SICL
09N02103	Bt1	Bt1	14-49	S09AF006005-2				SIC
09N02104	Bt2	Bt2	49-79	S09AF006005-3				SIC
09N02105	Btg	Btg	79-99	S09AF006005-4				SIC
09N02106	Bg1	Bg1	99-140	S09AF006005-5				SIC
09N02107	Bg2	Bg2	140-200	S09AF006005-6				SIC
09N02108	ApFertility	Ap Fertility	0-14	S09AF006005-A				

Pedon Calculations

Calculation Name	Result	Units of Measure
Weighted Particles, 0.1-75mm, 75 mm Base	2	% wt
Volume, >2mm, Weighted Average	0	% vol
Clay, total, Weighted Average	44	% wt
Clay, carbonate free, Weighted Average	36	% wt
CEC Activity, CEC7/Clay, Weighted Average, CECd, Set 1	0.28	(NA)
LE, Whole Soil, Summed to 1m	3	cm/m

Weighted averages based on control section: 14-64 cm

PSDA & Rock Fragments				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
Layer	Depth (cm)	Horz	Prep																		
09N02102	0-14	Ap	S	scl	39.4	55.2	5.4	9.8	6.5	43.6	11.6	4.1	0.7	0.4	0.1	0.1	tr	tr	--	1	tr
09N02103	14-49	Bt1	S	sic	45.1	50.3	4.6	10.8	7.9	43.8	6.5	3.0	1.1	0.4	0.1	--	--	tr	--	2	tr
09N02104	49-79	Bt2	S	sic	42.4	51.5	6.1	10.6	8.7	38.3	13.2	4.5	1.2	0.3	0.1	tr	tr	tr	--	2	tr
09N02105	79-99	Btg	S	sic	40.5	52.9	6.6	10.3	8.3	37.2	15.7	5.8	0.6	0.1	--	--	--	--	--	1	--
09N02106	99-140	Bg1	S	sic	41.9	52.2	5.9	9.8	9.2	39.8	12.4	5.1	0.5	0.2	0.1	tr	--	--	--	1	tr
09N02107	140-200	Bg2	S	sic	40.3	55.4	4.3	9.6	7.8	47.0	8.4	3.0	0.9	0.3	0.1	--	5	1	2	9	8
09N02108	0-14	ApFertility	S													tr	tr	--	--	tr	

*** Primary Characterization Data ***

Pedon ID: S09AF006005

Sampled As : SND
USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)
Fine, mixed, superactive, hyperthermic Aquic Haplalgids
Pedon No. 09N0396

Print Date: Jun 7 2017 2:52PM

***** Primary Characterization Data *****

Pedon ID: S09AF006005

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine, mixed, superactive, hyperthermic Aquic Haplargids

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Carbon & Extractions				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-
Layer	Depth (cm)	Horz	Prep	(- - - - - Total - - - - -)			Est OC (WB)	C/N Ratio	(- - - Dith-Cit Ext - - -)			(- - - Ammonium Oxalate Extraction - - -)			(- - - Na Pyro-Phosphate - - -)							
				(- - - % of < 2 mm - - -)	(- - -)	(- - -)			(- - - % of < 2mm - - - - -)	(- - -)	(- - - % of < 2mm - - - - -)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)			
				4H2a	4H2a	4H2a			4G1	4G1	4G1											
09N02102	0-14	Ap	S	4.02	0.11	0.03	0.8		7	0.6	tr	tr										
09N02103	14-49	Bt1	S	3.83	0.15	0.01	0.7		5	0.9	tr	tr										
09N02104	49-79	Bt2	S	4.04	0.05	0.03	0.3		6	0.8	tr	tr										
09N02105	79-99	Btg	S	3.94	0.05	0.01	0.2		3	0.7	tr	tr										
09N02106	99-140	Bg1	S	4.24	0.09	tr	0.2		2	0.6	--	tr										
09N02107	140-200	Bg2	S	4.27	0.06	tr	0.1		2	0.7	--	tr										

CEC & Bases				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	(- - - Base - - -)			
Layer	Depth (cm)	Horz	Prep	(- - - NH ₄ OAC Extractable Bases - - -)								Sum Bases	Acid- ity	Extr AI	KCl Mn	Sum NH ₄ OAC +AI	Bases Sat	Al Sum	(- Saturation -)	NH ₄ OAC	
				Ca	Mg	Na	K	cmol(+) kg ⁻¹	cmol(+) kg ⁻¹	cmol(+) kg ⁻¹	cmol(+) kg ⁻¹										
				4B1a1a	4B1a1a	4B1a1a	4B1a1a					mg kg ⁻¹	(- - - cmol(+) kg ⁻¹ - - -)	(- - - % - - -)	4B1a1a						
09N02102	0-14	Ap	S	47.6*	11.4	1.6	0.5	61.1								12.6			100		
09N02103	14-49	Bt1	S	48.3*	13.1	1.8	0.6	63.8								12.9			100		
09N02104	49-79	Bt2	S	45.1*	13.8	1.4	0.8	61.1								11.3			100		
09N02105	79-99	Btg	S	43.3*	17.3	1.1	0.9	62.6								8.5			100		
09N02106	99-140	Bg1	S	40.4*	18.2	1.0	1.0	60.6								10.2			100		
09N02107	140-200	Bg2	S	40.5*	13.8	0.8	1.0	56.1								9.8			100		

*Extractable Ca may contain Ca from calcium carbonate or gypsum., CEC7 base saturation set to 100.

Salt				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
Layer	Depth (cm)	Horz	Prep	(- - - Water Extracted From Saturated Paste - - -)															Total Salts	1:2 Elec Cond	Exch Na	SAR	
				Ca	Mg	Na	K	CO ₃	HCO ₃	F	Cl	PO ₄	Br	OAC	SO ₄	NO ₂	NO ₃	H ₂ O	(- - - % - - -)	(- - - dS m ⁻¹ - - -)	(- - - % - - -)		
				4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F1a1a1	4F2	4F1a1a1	%
09N02102	0-14	Ap	S	2.6	5.2	8.4	0.1	--	4.3	tr	2.8	--	--	10.5	0.1	0.1	74.2	0.1	1.57	0.80	8	4	
09N02103	14-49	Bt1	S	1.7	4.6	8.4	0.2	--	4.0	tr	2.1	--	--	8.9	tr	tr	74.9	0.1	1.40	0.75	9	5	
09N02104	49-79	Bt2	S	1.2	5.3	7.8	0.4	--	3.3	--	2.3	--	--	10.0	0.1	0.1	70.3	0.1	1.47	0.71	8	4	
09N02105	79-99	Btg	S	0.9	4.5	6.3	0.4	--	3.2	tr	1.9	--	--	8.2	tr	0.1	66.9	tr	1.26	0.62	9	4	
09N02106	99-140	Bg1	S	0.3	4.0	4.7	0.5	--	2.7	0.1	1.8	--	--	5.7	tr	0.1	80.6	tr	1.01	0.57	6	3	
09N02107	140-200	Bg2	S	0.2	3.0	3.9	0.6	--	2.8	0.1	1.4	--	--	4.1	tr	0.3	76.1	tr	0.86	0.46	5	3	

***** Primary Characterization Data *****

Pedon ID: S09AF006005

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine, mixed, superactive, hyperthermic Aquic Haplargids

Print Date: Jun 7 2017 2:52PM

pH & Carbonates

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11-

(----- pH -----) (- - Carbonate --) (- - Gypsum --)
CaCl₂ As CaCO₃ As CaSO₄·2H₂O Resist
0.01M H₂O Sat <2mm <20mm <2mm <20mm ohms
Layer Depth Horz Prep KCl 1:2 1:1 Paste Oxid NaF (%) cm⁻¹
(cm) 4C1a2a 4C1a2a 4F2 4C1a1a14E1a1a1a1 4E2a1a1a1

09N02102	0-14	Ap	S	8.2	8.6	8.2	10.3	27	--
09N02103	14-49	Bt1	S	8.2	8.6	8.3	10.3	26	--
09N02104	49-79	Bt2	S	8.3	8.6	8.5	10.0	31	--
09N02105	79-99	Btg	S	8.3	8.7	8.5	9.9	32	--
09N02106	99-140	Bg1	S	8.3	8.8	8.6	10.0	33	--
09N02107	140-200	Bg2	S	8.2	8.7	8.6	10.2	34	--

Phosphorous

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(----- Phosphorous -----) KCl
Melanic NZ Acid Anion Exch Resin Bray Bray Olsen H₂O Citric Mehlich Extr
Index Oxal Available Capacity 1 2 Acid III NO₃
Layer Depth Horz Prep % (----- mg kg⁻¹ -----)
(cm) 4D1a1a1a 4D5a1 4D2a1b1 4D6a1 4D9a1a

09N02102	0-14	Ap	S	23.9	44.0	5.9	0.2	6.8	13.40
09N02103	14-49	Bt1	S	40.5	75.1	9.6	0.3	13.1	5.44
09N02104	49-79	Bt2	S	43.8	79.5	12.8	0.1	5.0	
09N02105	79-99	Btg	S			11.1	0.1	4.8	
09N02106	99-140	Bg1	S			5.7	tr	0.1	
09N02107	140-200	Bg2	S			3.9	tr	--	
09N02108	0-14	ApFertility	S					13.71	

Phosphorous

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(----- Phosphorous -----) KCl
Melanic NZ Acid Anion Exch Resin Bray Bray Olsen H₂O Citric Mehlich Extr
Index Oxal Available Capacity 1 2 Acid III NO₃
Layer Depth Horz Prep % (----- mg kg⁻¹ -----)
(cm) 4D6b

09N02102	0-14	Ap	S				26.9		
09N02103	14-49	Bt1	S				57.0		
09N02104	49-79	Bt2	S				7.1		
09N02108	0-14	ApFertility	S				5.4		

***** Primary Characterization Data *****

Pedon ID: S09AF006005

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine, mixed, superactive, hyperthermic Aquic Haplargids

Print Date: Jun 7 2017 2:52PM

Trace Elements Tier 1				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Ag mg/kg 4H1a	As mg/kg 4H1a	Ba mg/kg 4H1a	Be mg/kg 4H1a	Cd mg/kg 4H1a	Co mg/kg 4H1a	Cr mg/kg 4H1a	Cu mg/kg 4H1a	Mn mg/kg 4H1a	Mo mg/kg 4H1a	Hg ug/kg 4H1a	
09N02108	0-14	ApFertility	HM	0.10	10.67	141.30	1.25	0.17	10.47	41.58	23.07	541.69	0.37	48	
Trace Elements Tier 2				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	
Layer	Depth (cm)	Horz	Prep	Ni mg/kg 4H1a	P mg/kg 4H1a	Pb mg/kg 4H1a	Sb mg/kg 4H1a	Se ug/kg 4H1a	Sn mg/kg 4H1a	Sr mg/kg 4H1a	Tl mg/kg	V mg/kg 4H1a	W mg/kg 4H1a	Zn mg/kg 4H1a	
09N02108	0-14	ApFertility	HM	41.22	709.94	17.42	0.45	543.31	1.06	406.14		50.42	0.02	71.16	
Major Elements				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Al mg/kg 4H1b	Ca mg/kg 4H1b	Fe mg/kg 4H1b	K mg/kg 4H1b	Mg mg/kg 4H1b	Mn mg/kg 4H1b	Na mg/kg 4H1b	P mg/kg 4H1b	Si mg/kg 4H1b	Sr mg/kg 4H1b	Ti mg/kg 4H1b	Zr mg/kg 4H1b
09N02102	0-14	Ap	HM	62547	102587	31948	17877	20752	690	5857	760	215286	390	3097	87
09N02103	14-49	Bt1	HM	63450	103186	32453	18525	22498	706	5647	834	213981	407	3104	93
09N02104	49-79	Bt2	HM	57627	118014	29563	17223	22328	654	5453	978	210055	529	2941	81
09N02105	79-99	Btg	HM	56918	112313	29716	16892	22171	647	5264	673	214479	522	2941	85
09N02106	99-140	Bg1	HM	39662	56763	24938	17610	21381	543	4693	516	209427	377	2949	59
09N02107	140-200	Bg2	HM	40818	61917	26123	17167	21359	560	4734	456	213021	402	3041	65
09N02108	0-14	ApFertility	HM	59851	107939	30792	17597	21614	660	5702	856	219149	453	3053	85

***** Primary Characterization Data *****

(Farah, Afghanistan)

Pedon ID: S09AF006005

Print Date: Jun 7 2017 2:52PM

Sampled As : SND

Fine, mixed, superactive, hyperthermic Aquic Haplargids

USDA-NRCS-NSSC-Soil Survey Laboratory

; Pedon No. 09N0396

Clay Mineralogy (<.002 mm)			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
			X-Ray						Thermal						Elemental				EGME	Inter preta tion
Layer	Depth (cm)	Horz	Fract ion	7A1a1						SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	Na ₂ O	Retn			
09N02102	0.0-14.0	Ap	tcly	MI 4	CL 3	CA 2												mg g ⁻¹	CMIX	
09N02103	14.0-49.0	Bt1	tcly	MI 4	CL 3	CA 1													CMIX	
09N02105	79.0-99.0	Btg	tcly	MI 3	CL 3	CA 2													CMIX	
09N02107	140.0-200.0	Bg2	tcly	MI 4	CL 3	CA 2	MT 1												CMIX	

FRACTION INTERPRETATION:

tcly - Total Clay <0.002 mm

MINERAL INTERPRETATION:

CA Calcite

CL Chlorite

MI Mica

MT Montmorillonite

RELATIVE PEAK SIZE:

5 Very Large

4 Large

3 Medium

2 Small

1 Very Small

6 No Peaks

INTERPRETATION (BY HORIZON):

CMIX - Mixed Clay

***** Primary Characterization Data *****

Pedon ID: S09AF006005

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine, mixed, superactive, hyperthermic Aquic Haplargids

Print Date: Jun 7 2017 2:52PM

; Pedon No. 09N0396

Sand - Silt Mineralogy (2.0-0.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
				X-Ray				Thermal				Optical								EGME	Inter
Depth		Fract										Tot Re				Grain Count				Retn	preta
Layer	(cm)	Horz	Fract	(----- peak size -----)				(----- % -----)				(----- % -----)				7B1a2				mg g ⁻¹	tion
09N02102	0.0-14.0	Ap	csi									47	QZ 44	CA 25	BT 13	AR 4	MS 3	CB 3			SMIX
													FK 3	CD 2	HN 2	FE 1	PR 1	FP tr			
													GN tr	GS tr	BY tr	OP tr	PO tr	ZR tr			
09N02103	14.0-49.0	Bt1	csi									51	QZ 47	CA 25	BT 8	FK 4	AR 4	MS 2			SMIX
													PR 2	CB 2	CD 2	FE 2	HN 1	OP tr			
													PO tr	RU tr	FP tr	GN tr	BY tr				
09N02105	79.0-99.0	Btg	csi									44	QZ 40	CA 25	BT 14	CB 6	FK 5	MS 2			SMIX
													AR 2	PR 2	OP 1	BY 1	CD 1	FE 1			
													FP tr	GN tr	HN tr	RU tr					
09N02107	140.0-200.0	Bg2	csi									43	QZ 42	CA 27	BT 9	CB 6	FK 6	AR 3			SMIX
													MS 3	PR 2	HN 1	CD 1	FE tr	FP tr			
													GN tr	GS tr	BY tr	OP tr	TM tr				

FRACTION INTERPRETATION:

csi - Coarse Silt 0.02-0.05 mm

***** Primary Characterization Data *****

(Farah, Afghanistan)

Pedon ID: S09AF006005

Print Date: Jun 7 2017 2:52PM

Sampled As : SND
USDA-NRCS-NSSC-Soil Survey LaboratoryFine, mixed, superactive, hyperthermic Aquic Haplargids
; Pedon No. 09N0396**MINERAL INTERPRETATION:**

AR Weatherable Aggregates	BT Biotite	BY Beryl	CA Calcite	CB Carbonate Aggregates
CD Chert (Chalcedony)	FE Iron Oxides (Goethite)	FK Potassium Feldspar	FP Plagioclase Feldspar	GN Garnet
GS Glass	HN Hornblende	MS Muscovite	OP Opaques	PO Plant Opal
PR Pyroxene	QZ Quartz	RU Rutile	TM Tourmaline	ZR Zircon

INTERPRETATION (BY HORIZON):

SMIX - Mixed Sand

***** Primary Characterization Data *****

Pedon ID: S09AF006006

(Farah, Afghanistan)

Print Date: Jun 7 2017 2:52PM

Sampled as on Jan 20, 2009: SND ; Fine, mixed, superactive, hyperthermic Typic Haplocambids
 Revised to correlated on Jan 9, 2017: Haplocambids ; Fine-silty, mixed, semiactive, hyperthermic Sodic Haplocambids

SSL - Project C2009AF006067 Afghanistan
 - Site ID S09AF006006 Lat: 32° 21' 11.50" north Long: 62° 3' 47.50" east
 - Pedon No. 09N0397
 - General Methods 1B1A, 2A1, 2B

United States Department of Agriculture
 Natural Resources Conservation Service
 National Soil Survey Center
 Kellogg Soil Survey Laboratory
 Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
09N02109	Ap	Ap	0-12	S09AF006006-1				SIL
09N02110	Bw1	Bw1	12-32	S09AF006006-2				SIL
09N02111	2Bw2	2Bw2	32-76	S09AF006006-3				SIL
09N02112	2Bk1	2Bk1	76-112	S09AF006006-4				SIL
09N02113	2Bk2	2Bk2	112-167	S09AF006006-5				SIL
09N02114	2Bkq	2Bkq	167-200	S09AF006006-6				SIL
09N02158	ApFertility	Ap Fertility	0-12	S09AF006006-A				

Pedon Calculations				Result	Units of Measure
Weighted Particles, 0.1-75mm, 75 mm Base				3	% wt
Volume, >2mm, Weighted Average				1	% vol
Clay, total, Weighted Average				23	% wt
Clay, carbonate free, Weighted Average				19	% wt
CEC Activity, CEC7/Clay, Weighted Average, CECd, Set 1				0.24	(NA)
LE, Whole Soil, Summed to 1m				1	cm/m

Weighted averages based on control section: 25-100 cm

PSDA & Rock Fragments				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
				Lab	(----- Total -----)			(- - - Clay - - -)		(- - - Silt - - -)		(- - - - Sand - - - -)				(Rock Fragments (mm))		(< 2 mm weight % whole soil)			
				Text-ure	Clay	Silt	Sand	Fine	CO ₃	Fine	Coarse	VF	F	M	C	VC	(----- Weight -----)	>2 mm	wt % whole soil		
				Layer	<	.002	.05	<	<	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-75	
				Depth (cm)	.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	
				Horz	Prep				(% of <2mm Mineral Soil)				3A1a1a				3A1a1a 3A1a1a 3A1a1a 3A1a1a				
					3A1a1a				3A1a1a 3A1a1a 3A1a1a 3A1a1a				3A1a1a 3A1a1a 3A1a1a 3A1a1a				3A1a1a 3A1a1a 3A1a1a 3A1a1a				
09N02109	0-12	Ap	S	sil	11.3	52.5	36.2	3.8	1.8	20.2	32.3	26.5	9.2	0.4	0.1	tr	--	--	--	10	--
09N02110	12-32	Bw1	S	sil	19.4	61.9	18.7	6.8	1.3	24.0	37.9	16.8	1.8	0.1	tr	--	--	--	--	2	--
09N02111	32-76	2Bw2	S	sil	24.3	62.9	12.8	6.4	5.1	34.4	28.5	11.5	1.1	0.2	tr	--	1	tr	--	2	1
09N02112	76-112	2Bk1	S	sil	22.6	60.7	16.7	7.2	4.0	30.0	30.7	13.4	2.8	0.4	0.1	tr	1	tr	1	5	2
09N02113	112-167	2Bk2	S	sil	17.9	64.1	18.0	5.2	4.0	33.9	30.2	13.5	3.6	0.5	0.3	0.1	1	--	--	5	1
09N02114	167-200	2Bkq	S	sil	13.3	59.6	27.1	2.6	3.7	31.0	28.6	18.3	7.7	0.7	0.4	tr	--	--	--	9	--
09N02158	0-12	ApFertility	S													tr	tr	--	--	tr	

*** Primary Characterization Data ***

Pedon ID: S09AF006006

Sampled As : SND
USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)
Fine, mixed, superactive, hyperthermic Typic Haplacambids
Pedon No. 09N0397

Print Date: Jun 7 2017 2:52PM

***** Primary Characterization Data *****

Pedon ID: S09AF006006

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine, mixed, superactive, hyperthermic Typic Haplomabids

Print Date: Jun 7 2017 2:52PM

; Pedon No. 09N0397

Carbon & Extractions				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-
Layer	Depth (cm)	Horz	Prep	(- - - - Total - - - -)			Est OC (WB)	C/N Ratio	(- - Dith-Cit Ext - - - -)			(- - - Ammonium Oxalate Extraction - - - -)			(- - Na Pyro-Phosphate - - - -)							
				C	N	S			Fe	Al	Mn	Al+1/2Fe	ODOE	Fe	Al	Si	Mn	C	Fe	Al	Mn	
				(- - - - % of < 2 mm - - - -)					(- - - - % of < 2mm - - - - -)			(- - - - % of < 2mm - - - - -)			mg kg ⁻¹ (- - - - % of < 2mm - - - -)							
				4H2a	4H2a	4H2a			4G1	4G1	4G1											
09N02109	0-12	Ap	S	3.90	0.07	0.01	0.2		3	0.8	--	tr										
09N02110	12-32	Bw1	S	3.17	0.02	0.32	0.1		4	0.7	--	tr										
09N02111	32-76	2Bw2	S	3.65	0.02	0.05	0.1		8	0.7	--	tr										
09N02112	76-112	2Bk1	S	3.53	0.02	0.01	tr		2	0.7	--	tr										
09N02113	112-167	2Bk2	S	4.07	0.03	0.01	tr		1	0.8	--	tr										
09N02114	167-200	2Bkq	S	4.50	0.01	0.02	--		0.7	--	tr											

CEC & Bases				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-			
Layer	Depth (cm)	Horz	Prep	(- - - NH ₄ OAC Extractable Bases - - - -)								CEC8	CEC7	ECEC	(- - - Base - - - -)					
				Ca	Mg	Na	K	Sum Bases	Acid- ity	Extr	KCl				Al	(- Saturation -)				
				(- - - cmol(+) kg ⁻¹ - - - -)				mg kg ⁻¹ (- - - cmol(+) kg ⁻¹ - - - -)						(- - - % - - - -)						
09N02109	0-12	Ap	S	45.8*	5.5	1.1	0.4	52.8							4.8			100		
09N02110	12-32	Bw1	S	71.3*	5.1	1.2	0.5	78.1							6.1			100		
09N02111	32-76	2Bw2	S	44.7*	9.3	1.7	0.7	56.4							7.1			100		
09N02112	76-112	2Bk1	S	43.2*	7.8	1.8	0.9	53.7							3.1			100		
09N02113	112-167	2Bk2	S	40.6*	10.9	1.6	0.6	53.7							5.8			100		
09N02114	167-200	2Bkq	S	38.8*	10.7	2.5	0.7	52.7							5.1			100		

*Extractable Ca may contain Ca from calcium carbonate or gypsum., CEC7 base saturation set to 100.

Salt				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
Layer	Depth (cm)	Horz	Prep	(- - - - Water Extracted From Saturated Paste - - - -)															1:2 Total Elect Cond Exch Na SAR				
				Ca	Mg	Na	K	CO ₃	HCO ₃	F	Cl	PO ₄	Br	OAC	SO ₄	NO ₂	NO ₃	H ₂ O	Total Salts	Elect Cond	Exch Cond	Na	SAR
				(- - - mmol(+) L ⁻¹ - - - -)	(- - - mmol(+) L ⁻¹ - - - -)	(- - - mmol(+) L ⁻¹ - - - -)	(- - - mmol(+) L ⁻¹ - - - -)	(- - - mmol(+) L ⁻¹ - - - -)	(- - - mmol(+) L ⁻¹ - - - -)	(- - - mmol(+) L ⁻¹ - - - -)	(- - - mmol(+) L ⁻¹ - - - -)	(- - - mmol(+) L ⁻¹ - - - -)	(- - - mmol(+) L ⁻¹ - - - -)	(- - - mmol(+) L ⁻¹ - - - -)	(- - - mmol(+) L ⁻¹ - - - -)	(- - - mmol(+) L ⁻¹ - - - -)	(- - - mmol(+) L ⁻¹ - - - -)	(- - - % - - - -)	(- - dS m ⁻¹ - - - -)	(- - - - -)	(- - - - -)	(- - - - -)	(- - - - -)
09N02109	0-12	Ap	S	14.0	14.1	13.7	0.5	--	2.6	--	6.5	--	--	--	34.3	0.2	1.1	39.7	0.1	3.41	0.97	11	4
09N02110	12-32	Bw1	S	25.7	11.4	13.5	0.8	--	1.5	--	3.9	--	--	--	48.1	0.1	0.2	41.6	0.1	3.82	2.61	11	3
09N02111	32-76	2Bw2	S	12.8	10.9	16.2	1.3	--	1.4	--	3.6	--	--	--	35.8	0.1	--	52.0	0.1	3.35	1.20	12	5
09N02112	76-112	2Bk1	S	3.7	4.4	12.7	1.0	--	1.7	--	3.8	--	--	--	16.8	tr	--	55.3	0.1	2.31	0.90	35	6
09N02113	112-167	2Bk2	S	2.5	7.5	13.7	1.3	--	1.9	--	5.3	--	--	--	17.9	tr	--	51.7	0.1	2.38	0.90	15	6
09N02114	167-200	2Bkq	S	2.7	13.7	30.6	2.5	--	1.8	--	13.0	--	--	--	34.0	--	--	43.0	0.1	4.38	1.31	23	11

***** Primary Characterization Data *****

Pedon ID: S09AF006006

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine, mixed, superactive, hyperthermic Typic Haplomabids

Print Date: Jun 7 2017 2:52PM

; Pedon No. 09N0397

pH & Carbonates

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11-

(----- pH -----) (- - Carbonate --) (- - Gypsum --)
CaCl₂ As CaCO₃ As CaSO₄·2H₂O Resist
0.01M H₂O Sat <2mm <20mm <2mm <20mm ohms
Layer Depth Horz Prep KCl 1:2 1:1 Paste Oxid NaF (%) cm⁻¹
(cm) 4C1a2a 4C1a2a 4F2 4C1a1a14E1a1a1a1 4E2a1a1a1

09N02109	0-12	Ap	S	8.1	8.4	8.0	10.2	31	--
09N02110	12-32	Bw1	S	8.0	8.1	7.9	10.2	26	2
09N02111	32-76	2Bw2	S	8.1	8.2	8.0	10.2	29	--
09N02112	76-112	2Bk1	S	8.1	8.4	8.2	10.0	29	--
09N02113	112-167	2Bk2	S	8.2	8.6	8.3	9.9	34	--
09N02114	167-200	2Bkq	S	8.1	8.5	8.3	9.9	37	--

Phosphorous

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(----- Phosphorous -----) KCl
Melanic NZ Acid Anion Exch Resin Bray Bray Olsen H₂O Citric Mehlich Extr
Depth Index Oxal Available Capacity 1 2 Acid III NO₃
Layer (cm) Horz Prep % (----- mg kg⁻¹ -----)
4D1a1a1a 4D5a1 4D2a1b1 4D6a1 4D9a1a

09N02109	0-12	Ap	S	18.6	41.3	5.8	tr	7.8	15.02
09N02110	12-32	Bw1	S	7.3	34.5	5.7	tr	23.7	1.88
09N02111	32-76	2Bw2	S	8.2	14.2	2.0	--	0.5	1.68
09N02112	76-112	2Bk1	S			1.0	tr	0.8	
09N02113	112-167	2Bk2	S			0.6	--	3.8	
09N02114	167-200	2Bkq	S			1.1	tr	--	

Phosphorous

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(----- Phosphorous -----) KCl
Melanic NZ Acid Anion Exch Resin Bray Bray Olsen H₂O Citric Mehlich Extr
Depth Index Oxal Available Capacity 1 2 Acid III NO₃
Layer (cm) Horz Prep % (----- mg kg⁻¹ -----)
4D6b

09N02109	0-12	Ap	S			4.0			
09N02110	12-32	Bw1	S			14.0			
09N02111	32-76	2Bw2	S			3.2			
09N02158	0-12	ApFertility	S			7.7			

***** Primary Characterization Data *****

Pedon ID: S09AF006006

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine, mixed, superactive, hyperthermic Typic Haplombids

Print Date: Jun 7 2017 2:52PM

Trace Elements Tier 1				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Ag mg/kg 4H1a	As mg/kg 4H1a	Ba mg/kg 4H1a	Be mg/kg 4H1a	Cd mg/kg 4H1a	Co mg/kg 4H1a	Cr mg/kg 4H1a	Cu mg/kg 4H1a	Mn mg/kg 4H1a	Mo mg/kg 4H1a	Hg ug/kg 4H1a	
09N02158	0-12	ApFertility	HM	0.02	9.07	79.51	0.75	0.11	7.31	27.32	36.52	418.81	0.56	33	
Trace Elements Tier 2				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	
Layer	Depth (cm)	Horz	Prep	Ni mg/kg 4H1a	P mg/kg 4H1a	Pb mg/kg 4H1a	Sb mg/kg 4H1a	Se ug/kg 4H1a	Sn mg/kg 4H1a	Sr mg/kg 4H1a	Tl mg/kg	V mg/kg 4H1a	W mg/kg 4H1a	Zn mg/kg 4H1a	
09N02158	0-12	ApFertility	HM	30.77	531.19	11.28	0.45	425.78	0.47	293.39		37.04	0.03	57.84	
Major Elements				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Al mg/kg 4H1b	Ca mg/kg 4H1b	Fe mg/kg 4H1b	K mg/kg 4H1b	Mg mg/kg 4H1b	Mn mg/kg 4H1b	Na mg/kg 4H1b	P mg/kg 4H1b	Si mg/kg 4H1b	Sr mg/kg 4H1b	Ti mg/kg 4H1b	Zr mg/kg 4H1b
09N02109	0-12	Ap	HM	40631	119776	23910	10386	14061	510	8261	560	243869	340	3077	88
09N02110	12-32	Bw1	HM	44453	103550	24802	12001	18355	546	8663	700	246222	334	3143	89
09N02111	32-76	2Bw2	HM	48001	109764	25332	13803	21709	565	7425	562	238180	385	2980	81
09N02112	76-112	2Bk1	HM	47849	107752	25280	13715	21179	555	8125	429	249517	417	2988	77
09N02113	112-167	2Bk2	HM	43485	115477	23801	12200	24073	516	7535	488	234838	615	2902	82
09N02114	167-200	2Bkq	HM	40128	134966	23083	11025	21849	490	7348	453	230165	775	2877	83

***** Primary Characterization Data *****

(Farah, Afghanistan)

Pedon ID: S09AF006006

Print Date: Jun 7 2017 2:52PM

Sampled As : SND

Fine, mixed, superactive, hyperthermic Typic Haplombids

USDA-NRCS-NSSC-Soil Survey Laboratory

; Pedon No. 09N0397

Clay Mineralogy (<.002 mm)			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	
			X-Ray						Thermal						Elemental				EGME	Inter preta tion	
Layer	Depth (cm)	Horz	Fract ion	7A1a1												Retn					
				(----- peak size -----)			(- - - - % - - - - -)			(- - - - - % - - - - -)			SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	Na ₂ O		
09N02109	0.0-12.0	Ap	tcly	MI 4	CL 3	CA 2															CMIX
09N02111	32.0-76.0	2Bw2	tcly	MI 4	CL 3	CA 2															CMIX
09N02112	76.0-112.0	2Bk1	tcly	MI 4	CL 3	CA 2															CMIX
09N02114	167.0-200.0	2Bkq	tcly	MI 3	CL 3	CA 2															CMIX

FRACTION INTERPRETATION:

tcly - Total Clay <0.002 mm

MINERAL INTERPRETATION:

CA Calcite

CL Chlorite

MI Mica

RELATIVE PEAK SIZE:

5 Very Large

4 Large

3 Medium

2 Small

1 Very Small

6 No Peaks

INTERPRETATION (BY HORIZON):

CMIX - Mixed Clay

***** Primary Characterization Data *****

(Farah, Afghanistan)

Fine, mixed, superactive, hyperthermic Typic Haplocambids

Print Date: Jun 7 2017 2:52PM

Pedon ID: S09AF006006

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

; Pedon No. 09N0397

Sand - Silt Mineralogy (2.0-0.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
				X-Ray				Thermal				Optical						EGME	Inter		
Depth		Fract										Grain Count						Retn	preta		
Layer	(cm)	Horz	ion	(----- peak size -----)				(----- % -----)				(----- % -----)						mg g ⁻¹			
09N02109	0.0-12.0	Ap	csi					44	QZ 42	CA 22	CB 8	FK 8	BT 6	MS 6						SMIX	
									AR 3	PR 2	FE 1	OP 1	FP 1	GN tr							
									GS tr	HN tr	BY tr	CD tr	PO tr	ZR tr							
09N02111	32.0-76.0	2Bw2	csi					46	QZ 41	CA 27	FK 6	BT 6	MS 4	AR 4						SMIX	
									CB 3	CD 3	FE 2	PR 2	RU tr	ZR tr							
									OP tr	BY tr	FP tr	GN tr	HN tr								
09N02112	76.0-112.0	2Bk1	csi					48	QZ 44	CA 20	CB 9	BT 9	FK 5	MS 4						SMIX	
									AR 3	CD 2	FE 1	HN 1	OP 1	PR 1							
									RU tr	ZR tr	FP tr	GN tr	BY tr								
09N02114	167.0-200.0	2Bkq	csi					42	QZ 39	CA 21	CB 13	BT 10	AR 4	MS 4						SMIX	
									FK 3	PR 2	GN 1	CD 1	FE 1	FP tr							
									BY tr	GS tr	HN tr	OP tr	TM tr								

FRACTION INTERPRETATION:

csi - Coarse Silt 0.02-0.05 mm

***** Primary Characterization Data *****

(Farah, Afghanistan)

Pedon ID: S09AF006006

Print Date: Jun 7 2017 2:52PM

Sampled As : SND
USDA-NRCS-NSSC-Soil Survey LaboratoryFine, mixed, superactive, hyperthermic Typic Haplocambids
; Pedon No. 09N0397**MINERAL INTERPRETATION:**

AR Weatherable Aggregates	BT Biotite	BY Beryl	CA Calcite	CB Carbonate Aggregates
CD Chert (Chalcedony)	FE Iron Oxides (Goethite)	FK Potassium Feldspar	FP Plagioclase Feldspar	GN Garnet
GS Glass	HN Hornblende	MS Muscovite	OP Opaques	PO Plant Opal
PR Pyroxene	QZ Quartz	RU Rutile	TM Tourmaline	ZR Zircon

INTERPRETATION (BY HORIZON):

SMIX - Mixed Sand

***** Primary Characterization Data *****

Pedon ID: S09AF006007

(Farah, Afghanistan)

Print Date: Jun 7 2017 2:52PM

Sampled as on Jan 22, 2009: SND ; Fine-loamy, mixed, superactive, hyperthermic Aquic Haplargids
 Revised to correlated on Jan 9, 2017: Haplocalcids ; Coarse-loamy, mixed, active, hyperthermic Aquic Haplocalcids

SSL - Project C2009AF006067 Afghanistan
 - Site ID S09AF006007 Lat: 32° 22' 52.00" north Long: 61° 56' 52.90" east
 - Pedon No. 09N0398
 - General Methods 1B1A, 2A1, 2B

United States Department of Agriculture
 Natural Resources Conservation Service
 National Soil Survey Center
 Kellogg Soil Survey Laboratory
 Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
09N02115	Az	Az	0-11	S09AF006007-1				L
09N02116	Btz	Btz	11-49	S09AF006007-2				SIL
09N02117	Btkz	Btkz	49-83	S09AF006007-3				SIL
09N02118	Bkz	Bkz	83-100	S09AF006007-4				SIL

Calculation Name	Pedon Calculations			Result	Units of Measure
Weighted Particles, 0.1-75mm, 75 mm Base				10	% wt
Volume, >2mm, Weighted Average				0	% vol
Clay, total, Weighted Average				15	% wt
Clay, carbonate free, Weighted Average				13	% wt
CEC Activity, CEC7/Clay, Weighted Average, CECd, Set 1				0.43	(NA)

Weighted averages based on control section: 11-83 cm

PSDA & Rock Fragments				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-

***** Primary Characterization Data *****

Pedon ID: S09AF006007

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine-loamy, mixed, superactive, hyperthermic Aquic Haplargids

Print Date: Jun 7 2017 2:52PM

Water Dispersible PSDA

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(----- Water Dispersible -----)

(--- Total ---) (--- Clay ---) (--- Silt ---) (--- Sand ---)

Clay F CO₃ F C VF F M C VC

< .002 < .002 .05 < .002 .002 .02 .05 .10 .25 .5 1

.002 -.05 -.2 .0002 .002 -.02 -.05 -.10 -.25 -.50 -.1 -.2

(----- % of <2mm -----)

Layer Depth (cm) Horz Prep 3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a

09N02115 0-11 Az S 41.0 41.3 17.7 -- 24.8 16.5 10.7 5.8 1.0 0.1 0.1

Bulk Density & Moisture

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13-

(Bulk Density) Cole Water Content

33 10 33 1500 1500 kPa kPa kPa kPa kPa kPa AD/OD Ratio

Oven Dry Whole Soil

kPa kPa kPa kPa kPa kPa cm³ cm⁻³ %

(----- % of <2mm -----)

Layer Depth (cm) Horz Prep 3C2a1a 3D1 3F1a1a

09N02115 0-11 Az S 9.2 1.012 1 0.23 0.44

09N02116 11-49 Btz S 10.4 1.011 0.40 0.60

09N02117 49-83 Btkz S 1.5 1.007 0.45 0.13

09N02118 83-100 Bkz S 1.3 1.007 0.50 0.12

Water Content

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13-

(- Atterberg -) (- Bulk Density -) (- Water Content -)

(- Limits -) Field Recon Recon Field Recon (- Sieved Samples -)

LL PI 33 10 33 100 200 500

kPa kPa kPa kPa kPa kPa kPa

(----- g cm⁻³ -----) (----- % of <2mm -----)

Layer Depth (cm) Horz Prep pct <0.4mm 3B2 3B2 3B2

3H 3H

09N02115 0-11 Az S 28 10 1.42 1.40 27.8

09N02116 11-49 Btz S 22 10

09N02118 83-100 Bkz S NP

*** Primary Characterization Data ***

Pedon ID: S09AF006007

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine-loamy, mixed, superactive, hyperthermic Aquic Haplargids

Print Date: Jun 7 2017 2:52PM

; Pedon No. 09N0398

Carbon & Extractions				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-
Layer	Depth (cm)	Horz	Prep	(- - - - - Total C N S % of <2 mm - - - - -)			Est OC (WB)	C/N Ratio	(- - Dith-Cit Ext Fe Al Mn)			(- - - - - Ammonium Oxalate Extraction Al+½Fe ODOE Fe Al Si Mn)			(- - Na Pyro-Phosphate C Fe Al Mn mg kg⁻¹ % of <2mm - - - - -)							
				4H2a	4H2a	4H2a			4G1	4G1	4G1											
09N02115	0-11	Az	S	1.63	0.06	3.42	0.5		9	0.3	--	tr										
09N02116	11-49	Btz	S	3.47	0.06	0.12	0.2		3	0.5	--	tr										
09N02117	49-83	Btkz	S	2.86	0.03	0.03	--			0.8	tr	tr										
09N02118	83-100	Bkz	S	2.34	tr	0.03	--			0.8	tr	tr										

CEC & Bases				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	
Layer	Depth (cm)	Horz	Prep	(- - - NH₄OAC Extractable Bases - - - - -)								CEC8	CEC7	ECEC	(- - - Base - - -)			
				Ca	Mg	Na	K	Sum Bases	Acid- ity	Extr Al	KCl Mn	Sum Cats	NH₄ OAC	Bases +Al	Al Sat	Sum	NH₄OAC	
				(- - - - - cmol(+) kg⁻¹ - - - - -)								mg kg⁻¹	(- - - cmol(+) kg⁻¹ - - - - -)		(- - - % - - - - -)			
09N02115	0-11	Az	S	134.0*	20.9	512.0	4.4	671.3								4.8		100
09N02116	11-49	Btz	S	40.8*	8.2	26.5	0.6	76.1								7.0		100
09N02117	49-83	Btkz	S	40.1*	3.8	5.5	0.3	49.7								5.3		100
09N02118	83-100	Bkz	S	39.2*	3.5	4.4	0.2	47.3								5.4		100

*Extractable Ca may contain Ca from calcium carbonate or gypsum., CEC7 base saturation set to 100.

Salt				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
Layer	Depth (cm)	Horz	Prep	(- - - - - Water Extracted From Saturated Paste - - - - -)													1:2						
				Ca	Mg	Na	K	CO ₃	HCO ₃	F	Cl	PO ₄	Br	OAC	SO ₄	NO ₂	NO ₃	H ₂ O	Total Salts	Elec Cond	Elec Cond	Exch Na	SAR
				(- - - mmol(+) L⁻¹ - - - - -)	(- - - 4F2 - - - - -)	(- - - 4F2 - - - - -)	(- - - 4F2 - - - - -)	(- - - 4F2 - - - - -)	(- - - 4F2 - - - - -)	(- - - 4F2 - - - - -)	(- - - 4F2 - - - - -)	(- - - 4F2 - - - - -)	(- - - 4F2 - - - - -)	(- - - 4F2 - - - - -)	(- - - 4F2 - - - - -)	(- - - 4F2 - - - - -)	(- - - 4F2 - - - - -)	(- - - % - - - - -)	(- - dS m⁻¹ - - - - -)	(- - - 4F2 - - - - -)	(- - - 4F1a1a1 - - - - -)	(- - - % - - - - -)	
09N02115	0-11	Az	S	13.1	128.0	5700.0	74.8	--	3.7	--	4961.8	--	2.8	--	740.5	--	32.8	44.5	6.7	194.00	141.30	100*	679
09N02116	11-49	Btz	S	9.1	11.1	281.5	2.4	--	1.3	--	219.4	--	--	--	93.8	--	1.8	56.5	1.3	27.00	8.99	100*	89
09N02117	49-83	Btkz	S	2.3	2.6	54.9	0.2	--	1.6	0.1	16.3	--	--	--	36.4	--	0.3	48.6	0.2	5.20	1.61	53	35
09N02118	83-100	Bkz	S	4.6	4.6	47.3	0.1	--	1.3	0.1	15.8	--	--	--	39.9	--	0.5	42.3	0.2	5.30	1.61	45	22

*ESP set to 100, Na exceeds measured exchange capacity.

***** Primary Characterization Data *****

Pedon ID: S09AF006007

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine-loamy, mixed, superactive, hyperthermic Aquic Haplargids

Print Date: Jun 7 2017 2:52PM

; Pedon No. 09N0398

pH & Carbonates

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11-

(----- pH -----) (- - Carbonate --) (- Gypsum --)
CaCl₂ As CaCO₃ As CaSO₄·2H₂O Resist
0.01M H₂O Sat <2mm <20mm <2mm <20mm ohms
1:2 1:1 Paste Oxid (%) cm⁻¹
4C1a2a 4C1a2a 4F2 NaF (-----)
4C1a1a14E1a1a1a1 4E2a1a1a1

09N02115	0-11	Az	S	8.6	8.3	8.1	9.9	9	9
09N02116	11-49	Btz	S	8.6	8.7	8.6	9.9	27	--
09N02117	49-83	Btkz	S	8.2	8.7	8.5	10.1	24	--
09N02118	83-100	Bkz	S	8.1	8.5	8.3	10.0	20	--

Phosphorous

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(----- Phosphorous -----) KCl
Melanic NZ Acid Anion Exch Resin Bray Bray Olsen H₂O Citric Mehlich Extr
Index Oxal Available Capacity 1 2 Acid III NO₃
% (----- mg kg⁻¹ -----)
4D1a1a1a 4D5a1 4D2a1b1 4D6a1 4D9a1a

09N02115	0-11	Az	S	3.5	9.5	12.0	0.1	27.3	381.21
09N02116	11-49	Btz	S	5.6	8.6	1.9	tr	0.3	20.01
09N02117	49-83	Btkz	S	0.6	1.1	0.5	0.1	--	
09N02118	83-100	Bkz	S			0.6	tr	0.9	

Phosphorous

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(----- Phosphorous -----) KCl
Melanic NZ Acid Anion Exch Resin Bray Bray Olsen H₂O Citric Mehlich Extr
Index Oxal Available Capacity 1 2 Acid III NO₃
% (----- mg kg⁻¹ -----)
4D6b

09N02115	0-11	Az	S					18.1	
09N02116	11-49	Btz	S					1.3	
09N02117	49-83	Btkz	S					--	

***** Primary Characterization Data *****

(Farah, Afghanistan)

Pedon ID: S09AF006007

Print Date: Jun 7 2017 2:52PM

Sampled As : SND
USDA-NRCS-NSSC-Soil Survey Laboratory

Fine-loamy, mixed, superactive, hyperthermic Aquic Haplargids
; Pedon No. 09N0398

Major Elements				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Al mg/kg 4H1b	Ca mg/kg 4H1b	Fe mg/kg 4H1b	K mg/kg 4H1b	Mg mg/kg 4H1b	Mn mg/kg 4H1b	Na mg/kg 4H1b	P mg/kg 4H1b	Si mg/kg 4H1b	Sr mg/kg 4H1b	Ti mg/kg 4H1b	Zr mg/kg 4H1b
09N02115	0-11	Az	HM	25721	52332	12912	8945	22444	337	113541	284	171754	805	1781	48
09N02116	11-49	Btz	HM	44880	104145	22508	13626	23345	554	15309	520	248845	600	2681	65
09N02117	49-83	Btkz	HM	46156	91856	23089	14182	12491	605	11724	474	271367	539	2904	79
09N02118	83-100	Bkz	HM	47777	76106	23606	14827	10643	543	12273	419	282477	504	2930	77

*** Primary Characterization Data ***

Pedon ID: S09AF006007

Sampled As : SND
USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)
Fine-loamy, mixed, superactive, hyperthermic Aquic Haplargids
Pedon No. 09N0398

Print Date: Jun 7 2017 2:52PM

FRACTION INTERPRETATION:

tcly - Total Clay <0.002 mm

MINERAL INTERPRETATION:

CA Calcite

CL Chlorite

MI Mica

MT Montmorillonite

RELATIVE PEAK SIZE:

5 Very Large

4 Large

2 Small

INTERPRETATION (BY)

CMIX - Mixed Clay

***** Primary Characterization Data *****

Pedon ID: S09AF006007

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine-loamy, mixed, superactive, hyperthermic Aquic Haplargids

Print Date: Jun 7 2017 2:52PM

; Pedon No. 09N0398

Sand - Silt Mineralogy (2.0-0.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
				X-Ray				Thermal				Optical								EGME	Inter
Depth		Fract										Tot Re				Grain Count				Retn	preta
Layer	(cm)	Horz	Fract	(----- peak size -----)				(- ----- % -----)				(- ----- % -----)				7B1a2					
09N02115	0.0-11.0	Az	csi									44	QZ 41	CA 16	FK 15	MS 7	BT 5	PR 3			SMIX
													AR 3	HN 3	CD 2	FE 1	CB 1	BY tr			
													FP tr	GC tr	GN tr	GS tr	OP tr	PO tr			
09N02116	11.0-49.0	Btz	csi									47	QZ 45	CA 21	FK 10	BT 8	MS 6	CB 4			SMIX
													CD 1	FE 1	AR 1	HN 1	PR 1	BY tr			
													OP tr	PO tr	RU tr	ZR tr	FP tr	GN tr			
													GS tr								
09N02118	83.0-100.0	Bkz	csi									47	QZ 46	CA 21	BT 12	FK 8	MS 4	AR 2			SMIX
													HN 2	PR 2	CB 2	FE 1	OP tr	RU tr			
													ZR tr	CD tr	BY tr	FP tr	GN tr	GS tr			

FRACTION INTERPRETATION:

csi - Coarse Silt 0.02-0.05 mm

MINERAL INTERPRETATION:

AR Weatherable Aggregates	BT Biotite	BY Beryl	CA Calcite	CB Carbonate Aggregates
CD Chert (Chalcedony)	FE Iron Oxides (Goethite)	FK Potassium Feldspar	FP Plagioclase Feldspar	GC Glass Coated Grain

*** Primary Characterization Data ***

Pedon ID: S09AF006007
Sampled As : SND
USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)
Fine-loamy, mixed, superactive, hyperthermic Aquic Haplargids
; Pedon No. 09N0398

Print Date: Jun 7 2017 2:52PM

MINERAL INTERPRETATION:

GN Garnet	GS Glass	HN Hornblende	MS Muscovite	OP Opaques
PO Plant Opal	PR Pyroxene	QZ Quartz	RU Rutile	ZR Zircon

INTERPRETATION (BY HORIZON):

SMIX - Mixed Sand

***** Primary Characterization Data *****

Pedon ID: S09AF006008

(Farah, Afghanistan)

Print Date: Jun 7 2017 2:52PM

Sampled as on Jan 23, 2009: SND ; Fine-loamy, mixed, superactive, hyperthermic Typic Haplargids
 Revised to correlated on Jan 10, 2017: Calciargids ; Fine-loamy, mixed, semiactive, hyperthermic Typic Calciargids

SSL - Project C2009AF006067 Afghanistan
 - Site ID S09AF006008 Lat: 32° 17' 28.90" north Long: 61° 45' 55.30" east
 - Pedon No. 09N0399
 - General Methods 1B1A, 2A1, 2B

United States Department of Agriculture
 Natural Resources Conservation Service
 National Soil Survey Center
 Kellogg Soil Survey Laboratory
 Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
09N02119	A	A	0-15	S09AF006008-1				L
09N02120	Btk1	Btk1	15-39	S09AF006008-2				SCL
09N02121	Btk2	Btk2	39-86	S09AF006008-3				SCL
09N02122	2Btk3	2Btk3	86-121	S09AF006008-4				SCL
09N02123	Ck	Ck	121-167	S09AF006008-5				S

Pedon Calculations

Calculation Name	Result	Units of Measure
Weighted Particles, 0.1-75mm, 75 mm Base	42	% wt
Volume, >2mm, Weighted Average	6	% vol
Clay, total, Weighted Average	25	% wt
Clay, carbonate free, Weighted Average	22	% wt
CEC Activity, CEC7/Clay, Weighted Average, CECd, Set 1	0.28	(NA)

Weighted averages based on control section: 15-65 cm

PSDA & Rock Fragments				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-

*** Primary Characterization Data ***

Pedon ID: S09AF006008

Sampled As : SND
USDA-NRCS-NSSC-Soil Survey Laboratory

Farah, Afghanistan)
Fine-loamy, mixed, superactive, hyperthermic Typic Haplalgids
Pedon No. 09N0399

Print Date: Jun 7 2017 2:52PM

***** Primary Characterization Data *****

Pedon ID: S09AF006008

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine-loamy, mixed, superactive, hyperthermic Typic Haplargids

Print Date: Jun 7 2017 2:52PM

; Pedon No. 09N0399

CEC & Bases				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-
Layer	Depth (cm)	Horz	Prep	(----- NH ₄ OAC Extractable Bases -----)								CEC8	CEC7	ECEC	(---- Base ----)		
				Ca	Mg	Na	K	Sum Bases	Acid- ity	Extr Al	KCl	Sum NH ₄ OAC	Bases +Al	Al	(- Saturation -)		
				(----- cmol(+) kg ⁻¹ -----)	(----- 4B1a1a -----)	(----- 4B1a1a -----)	(----- 4B1a1a -----)	(----- 4B1a1a -----)	(----- Al -----)	(----- mg kg ⁻¹ -----)	(----- 4B1a1a -----)	(----- cmol(+) kg ⁻¹ -----)	(----- 4B1a1a -----)	(----- % -----)			
09N02119	0-15	A	S	38.8*	2.1	2.3	0.2	43.4				4.4				100	
09N02120	15-39	Btk1	S	39.9*	3.5	2.9	0.4	46.7				6.8				100	
09N02121	39-86	Btk2	S	39.5*	2.6	5.8	0.9	48.8				7.1				100	
09N02122	86-121	2Btk3	S	37.9*	1.7	7.3	0.7	47.6				7.8				100	
09N02123	121-167	Ck	S	36.1*	0.7	3.1	0.1	40.0				2.9				100	

* Extractable Ca may contain Ca from calcium carbonate or gypsum., CEC7 base saturation set to 100.

Salt				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
Layer	Depth (cm)	Horz	Prep	(----- Water Extracted From Saturated Paste -----)															1:2	Elec	Elec	Exch	
				Ca	Mg	Na	K	CO ₃	HCO ₃	F	Cl	PO ₄	Br	OAC	SO ₄	NO ₂	NO ₃	H ₂ O	Total Salts	Elec Cond	Elec Cond	Na	SAR
				(----- mmol(+) L ⁻¹ -----)	(----- 4F2 -----)	(----- 4F2 -----)	(----- 4F2 -----)	(----- 4F2 -----)	(----- 4F2 -----)	(----- 4F2 -----)	(----- 4F2 -----)	(----- 4F2 -----)	(----- 4F2 -----)	(----- 4F2 -----)	(----- 4F2 -----)	(----- 4F2 -----)	(----- 4F2 -----)	(----- % -----)	(----- dS m ⁻¹ -----)	(----- 4F2 -----)	(----- 4F1a1a1 -----)		
09N02119	0-15	A	S	1.9	--	28.9	0.3	--	3.5	--	8.7	--	--	--	18.6	0.2	1.0	23.7	0.1	3.17	0.62	36	30
09N02120	15-39	Btk1	S	0.6	0.7	18.7	0.2	--	2.8	--	6.4	--	--	--	10.1	0.1	1.0	32.1	tr	2.11	0.58	34	23
09N02121	39-86	Btk2	S	--	--	15.0	0.1	--	6.9	0.3	1.6	--	--	--	6.4	tr	0.2	42.2	tr	1.51	0.75	74	
09N02122	86-121	2Btk3	S	--	--	17.4	0.1	--	7.5	0.5	2.8	--	--	--	7.0	0.1	0.2	44.8	tr	1.75	0.87	83	246
09N02123	121-167	Ck	S	--	--	17.7	0.1	--	5.4	0.5	5.8	--	--	--	7.4	0.1	0.2	26.3	tr	1.83	0.63	92	412

pH & Carbonates				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	
Layer	Depth (cm)	Horz	Prep	(----- pH -----)				(----- Carbonate -----)				(----- Gypsum -----)			
				CaCl ₂	0.01M	H ₂ O	Sat	As CaCO ₃	<2mm	<20mm	<2mm	<20mm	As CaSO ₄ ·2H ₂ O	Resist	
				1:2	1:1	Paste	Oxid	NaF	(----- % -----)	(----- % -----)	(----- % -----)	(----- % -----)	4E2a1a1	cm ⁻¹	
09N02119	0-15	A	S	8.1	8.8	8.4		10.1	16		--				
09N02120	15-39	Btk1	S	8.1	8.7	8.4		10.0	17		--				
09N02121	39-86	Btk2	S	8.4	9.2	9.2		9.8	18		--				
09N02122	86-121	2Btk3	S	8.7	9.4	9.3		9.7	12		tr				
09N02123	121-167	Ck	S	8.2	9.8	9.5		9.6	14		--				

***** Primary Characterization Data *****

Pedon ID: S09AF006008

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine-loamy, mixed, superactive, hyperthermic Typic Haplargids

Print Date: Jun 7 2017 2:52PM

; Pedon No. 09N0399

Phosphorous -1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

Layer	Depth (cm)	Horz	Prep	Melanic Index	(- - - - - Phosphorous - - - - -) KCl									
					Acid Oxal	Anion Available	Exch Capacity	Bray 1	Bray 2	Olsen	H ₂ O	Citric Acid	Mehlich III	Extr NO ₃
					%	(- - - - - mg kg ⁻¹ - - - - -)	4D1a1a1a	4D5a1	4D2a1b1	4D6a1	4D9a1a			
09N02119	0-15	A	S			17.6	31.0			6.7	0.4	28.1	6.76	
09N02120	15-39	Btk1	S			6.0	9.0			0.8	0.1	8.4	7.44	
09N02121	39-86	Btk2	S			5.0	7.8			1.5	0.2	7.7	2.04	
09N02122	86-121	2Btk3	S							1.9	0.2	6.6		
09N02123	121-167	Ck	S							0.9	0.1	1.0		

Phosphorous -1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

Layer	Depth (cm)	Horz	Prep	Melanic Index	(- - - - - Phosphorous - - - - -) KCl									
					Acid Oxal	Anion Available	Exch Capacity	Bray 1	Bray 2	Olsen	H ₂ O	Citric Acid	Mehlich III	Extr NO ₃
					%	(- - - - - mg kg ⁻¹ - - - - -)	4D6b							
09N02119	0-15	A	S									29.9		
09N02120	15-39	Btk1	S									11.5		
09N02121	39-86	Btk2	S									11.4		

Major Elements -1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

Layer	Depth (cm)	Horz	Prep	Al mg/kg 4H1b	Ca mg/kg 4H1b	Fe mg/kg 4H1b	K mg/kg 4H1b	Mg mg/kg 4H1b	Mn mg/kg 4H1b	Na mg/kg 4H1b	P mg/kg 4H1b	Si mg/kg 4H1b	Sr mg/kg 4H1b	Ti mg/kg 4H1b	Zr mg/kg 4H1b
09N02119	0-15	A	HM	43746	66749	21074	17728	10397	440	10670	402	295690	264	2736	99
09N02120	15-39	Btk1	HM	50204	69324	25635	18868	14562	532	9764	445	283225	246	2759	91
09N02121	39-86	Btk2	HM	51889	73084	26191	18394	14265	519	10060	380	276442	244	2672	88
09N02122	86-121	2Btk3	HM	55158	48977	25171	24309	12289	370	9944	257	303319	187	2089	116
09N02123	121-167	Ck	HM	42340	55104	16227	21744	4639	266	11219	199	318338	153	1961	101

***** Primary Characterization Data *****

Pedon ID: S09AF006008

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine-loamy, mixed, superactive, hyperthermic Typic Haplargids

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; Pedon No. 09N0399

Clay Mineralogy (<.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
				X-Ray				Thermal				Elemental				EGME		Inter			
Layer	Depth (cm)	Horz	Fract ion	7A1a1								SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	Na ₂ O	Retn	preta	
09N02119	0.0-15.0	A	tclay	MI 3	CL 3	CA 1						(-)	(-)	(-)	(-)	(-)	(-)	(-)	mg g ⁻¹	CMIX	
09N02121	39.0-86.0	Btk2	tclay	MI 3	CL 3	CA 1														CMIX	
09N02123	121.0-167.0	Ck	tclay	MI 4	CL 3	MT 2	CA 1													CMIX	

FRACTION INTERPRETATION:

tclay - Total Clay <0.002 mm

MINERAL INTERPRETATION:

CA Calcite

CL Chlorite

MI Mica

MT Montmorillonite

RELATIVE PEAK SIZE:

5 Very Large

4 Large

3 Medium

2 Small

1 Very Small

6 No Peaks

INTERPRETATION (BY HORIZON):

CMIX - Mixed Clay

***** Primary Characterization Data *****

Pedon ID: S09AF006008

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)

Fine-loamy, mixed, superactive, hyperthermic Typic Haplargids

Print Date: Jun 7 2017 2:52PM

; Pedon No. 09N0399

Sand - Silt Mineralogy (2.0-0.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
				X-Ray				Thermal				Optical						EGME	Inter		
Layer	Depth (cm)	Horz	Fract ion	(----- peak size -----)				(----- % -----)				(----- % -----)				7B1a2		Retn	interpre tation		
				45	QZ 44	CA 18	BT 12	CB 10	FK 6	MS 6		mg g ⁻¹									
09N02119	0.0-15.0	A	csi		AR 2	FE 1	FP 1	HN 1	PR 1	OP tr									SMIX		
					RU tr	ZR tr	GN tr	CD tr	BY tr												
09N02121	39.0-86.0	Btk2	fs		52	QZ 46	FK 19	CB 12	AR 8	CA 6	FE 4								SMIX		
					BT 2	CD 1	OP 1	PR tr	FP tr	HN tr											
09N02123	121.0-167.0	Ck	fs			49	QZ 42	FK 17	AR 14	CB 12	CA 5	FE 4							SMIX		
					OP 2	PR 1	CD 1	BT 1	FP tr	GN tr											
					HN tr	MS tr															

FRACTION INTERPRETATION:

csi - Coarse Silt 0.02-0.05 mm fs - Fine Sand 0.1-0.25 mm

MINERAL INTERPRETATION:

AR Weatherable Aggregates	BT Biotite	BY Beryl	CA Calcite	CB Carbonate Aggregates
CD Chert (Chalcedony)	FE Iron Oxides (Goethite)	FK Potassium Feldspar	FP Plagioclase Feldspar	GN Garnet
HN Hornblende	MS Muscovite	OP Opaques	PR Pyroxene	QZ Quartz
RU Rutile	ZR Zircon			

*** Primary Characterization Data ***

Pedon ID: S09AF006008
Sampled As : SND
USDA-NRCS-NSSC-Soil Survey Laboratory

(Farah, Afghanistan)
Fine-loamy, mixed, superactive, hyperthermic Typic Haplargids
; Pedon No. 09N0399

Print Date: Jun 7 2017 2:52PM

INTERPRETATION (BY HORIZON):

SMIX - Mixed Sand

APPENDIX D

Kunar Province Pedon Data

S09AF015001-S09AF015006

*** Primary Characterization Data ***

Pedon ID: S09AF015001

(Konar, Afghanistan)

Print Date: Jun 7 2017 2:52PM

Sampled as on Jan 9, 2009: SND ; Sandy-skeletal, mixed, thermic Xeric Haplocambids
Revised to correlated on Jan 10, 2017: Haplocambids ; Sandy-skeletal, mixed, thermic Xeric Haplocambids

SSL - Project C2009AF06067 Afghanistan
- Site ID S09AF015001 Lat: 34° 46' 27.60" north Long: 71° 6' 42.60" east
- Pedon No. 09N0400
- General Methods 1R1A 2A1 2B

United States Department of Agriculture
Natural Resources Conservation Service
National Soil Survey Center
Kellogg Soil Survey Laboratory
Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
09N02124	Ap	Ap	0-20	S09AF015001-1			SL	
09N02125	Bw1	Bw1	20-60	S09AF015001-2			LCOS	
09N02126	Bw2	Bw2	60-77	S09AF015001-3			COSL	
09N02127	Bk1	Bk1	77-97	S09AF015001-4			COS	
09N02128	Bk2	Bk2	97-117	S09AF015001-5			LCOS	
09N02129	C1	C1	117-137	S09AF015001-6			LCOS	
09N02130	C2	C2	137-163	S09AF015001-7			LCOS	

Calculation Name	Pedon Calculations	Result	Units of Measure
Weighted Particles, 0.1-75mm, 75 mm Base	87	% wt	
Volume, >2mm, Weighted Average	41	% vol	
Clay, total, Weighted Average	5	% wt	
Clay, carbonate free, Weighted Average	4	% wt	
CEC Activity, CEC7/Clay, Weighted Average, CECd, Set 1	0.96	(NA)	

Weighted averages based on control section: 25-100 cm

PSDA & Rock Fragments				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
Layer	Depth (cm)	Horz	Prep	Lab Text- ure	(- - - - - Total - - - - -)		(- - Clay - - -)		(- - Silt - - -)		(- - - - - Sand - - - - -)		(Rock Fragments (mm))				(- - - - - Weight - - - - -)			>2 mm wt % whole soil	
					Clay	Silt	Sand	Fine	CO ₃	Fine	Coarse	VF	F	M	C	VC					
					<.002	.002	.05	<	<	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	
09N02124	0-20	Ap	S	sl	8.6	36.9	54.5	2.5	0.7	22.0	14.9	8.8	12.1	12.0	11.3	10.3	9	12	17	66	38
09N02125	20-60	Bw1	S	Icos	5.1	17.5	77.4	1.5	1.0	10.3	7.2	5.7	17.3	16.7	21.8	15.9	14	23	15	86	52
09N02126	60-77	Bw2	S	cosl	6.9	26.1	67.0	1.9	1.0	13.4	12.7	9.1	10.4	16.5	17.1	13.9	13	23	11	78	47
09N02127	77-97	Bk1	S	cos	1.6	7.9	90.5	0.6	--	5.6	2.3	2.6	9.1	24.0	28.6	26.2	21	25	8	94	54
09N02128	97-117	Bk2	S	Icos	4.6	19.0	76.4	1.2	--	10.3	8.7	7.9	15.2	19.2	17.0	17.1	14	21	16	85	51
09N02129	117-137	C1	S	Icos	4.8	17.1	78.1	1.1	--	10.4	6.7	5.8	11.3	18.8	20.1	22.1	18	25	15	88	58
09N02130	137-163	C2	S	Icos	3.8	15.1	81.1	1.5	--	8.6	6.5	8.5	21.3	25.5	16.2	9.6	15	15	13	84	43

***** Primary Characterization Data *****

Pedon ID: S09AF015001

Sampled As : SND

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Water Dispersible PSDA

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(----- Water Dispersible -----)

(--- Total ---) (--- Clay ---) (--- Silt ---) (--- Sand ---)

Clay Silt Sand F CO₃ F C VF F M C VC

< .002 .05 < < .002 .02 .05 .10 .25 .5 1

.002 -.05 -.2 .0002 .002 -.02 -.05 -.10 -.25 -.50 -.1 -.2

(----- % of <2mm -----)

Layer Depth (cm) Horz Prep 3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a

09N02124 0-20 Ap S 7.3 37.3 55.4 1.0 22.3 15.0 8.3 14.3 9.1 11.6 12.1

Bulk Density & Moisture

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13-

(Bulk Density) Cole Water Content

33 10 33 1500 1500 kPa kPa kPa kPa kPa kPa

kPa Dry Whole Soil

(----- % of < 2mm -----)

Depth (cm) Horz Prep 3DbWR1 3C2a1a 3D1

(----- cm³ cm⁻³ % -----)

WRD Aggst (- Ratio/Clay -)

Whole Stabl 2-0.5mm CEC7 1500 kPa

(----- cm³ cm⁻³ % -----)

09N02124	0-20	Ap	S	1.63	1.65	0.003	12.0	2.3	1.007	0.11	0.64	0.27
09N02125	20-60	Bw1	S	1.73	1.73	--	10.4	1.3	1.004	0.09	0.71	0.25
09N02126	60-77	Bw2	S	1.85	1.86	0.001	8.7	0.9	1.005	0.09	0.64	0.13
09N02127	77-97	Bk1	S				0.4		1.003		1.69	0.25
09N02128	97-117	Bk2	S				0.8		1.005		0.96	0.17
09N02129	117-137	C1	S				1.0		1.005		0.77	0.21
09N02130	137-163	C2	S				1.9		1.004		0.89	0.50

Water Content

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13-

(-- Atterberg --) (---- Bulk Density ----)

(-- Limits --) Field Recon Recon Field Recon Sieved Samples

LL PI 33 6 10 33 100 200 500

kPa Oven Dry kPa kPa kPa kPa kPa

(----- g cm⁻³ -----) (----- % of < 2mm -----)

Depth (cm) Horz Prep 3H 3B2 3B2 3B2

(----- cm³ cm⁻³ % -----)

09N02124	0-20	Ap	S	18	3		1.72	1.70	17.5			
09N02126	60-77	Bw2	S		NP							
09N02128	97-117	Bk2	S		NP							
09N02130	137-163	C2	S		NP							

(Konar, Afghanistan)
Sandy-skeletal, mixed, thermic Xeric Haplocambids
; Pedon No. 09N0400

Print Date: Jun 7 2017 2:52PM

***** Primary Characterization Data *****

Pedon ID: S09AF015001

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Konar, Afghanistan)

Sandy-skeletal, mixed, thermic Xeric Haplocambids

Print Date: Jun 7 2017 2:52PM

; Pedon No. 09N0400

Carbon & Extractions				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-
Layer	Depth (cm)	Horz	Prep	(---- Total ----) C N S			Est OC	OC (WB)	C/N Ratio	(--- Dith-Cit Ext ---) Fe Al Mn			(---- Ammonium Oxalate Extraction ----) Al+½Fe ODOE Fe Al Si Mn			(--- Na Pyro-Phosphate ---) C Fe Al Mn						
				(% of <2 mm -----)			(% of <2 mm -----)			(% of <2 mm -----)			mg kg⁻¹ (% of <2mm -----)									
				4H2a	4H2a	4H2a				4G1	4G1	4G1										
09N02124	0-20	Ap	S	0.43	0.05	tr	0.2		4	0.5	tr	tr										
09N02125	20-60	Bw1	S	0.87	0.02	0.01	0.1		4	0.3	--	tr										
09N02126	60-77	Bw2	S	0.37	tr	--	tr		22	0.4	--	tr										
09N02127	77-97	Bk1	S	0.54	--	--	--			0.2	--	tr										
09N02128	97-117	Bk2	S	0.83	--	tr	0.1			0.3	--	tr										
09N02129	117-137	C1	S	0.89	0.03	--	tr		1	0.3	--	tr										
09N02130	137-163	C2	S	0.89	0.04	--	--			0.3	--	tr										

CEC & Bases				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	(- - - Base - - -)		
Layer	Depth (cm)	Horz	Prep	(- - - NH₄OAC Extractable Bases - - -)						Sum Bases cmol(+) kg⁻¹	Acid-ity Al	Extr Mn	KCl Mn Cats	NH₄OAC +Al	Bases Sat	Al Sat	Sum NH₄OAC	(- - - Base - - -)		
				Ca	Mg	Na	K											(- - - cmol(+) kg⁻¹ - - -)	(- - - cmol(+) kg⁻¹ - - -)	(- - - % - - -)
				4B1a1a	4B1a1a	4B1a1a	4B1a1a											4B1a1a		
09N02124	0-20	Ap	S	25.3*	0.9	0.3	0.3	26.8							5.5				100	
09N02125	20-60	Bw1	S	33.3*	0.6	0.1	0.4	34.4							3.6				100	
09N02126	60-77	Bw2	S	25.9*	0.8	0.1	0.3	27.1							4.4				100	
09N02127	77-97	Bk1	S	30.7*	0.5	0.1	0.1	31.4							2.7				100	
09N02128	97-117	Bk2	S	39.3*	0.8	0.1	0.2	40.4							4.4				100	
09N02129	117-137	C1	S	36.4*	0.7	0.1	0.2	37.4							3.7				100	
09N02130	137-163	C2	S	37.8*	0.7	0.1	0.1	38.7							3.4				100	

*Extractable Ca may contain Ca from calcium carbonate or gypsum., CEC7 base saturation set to 100.

***** Primary Characterization Data *****

(Konar, Afghanistan)

Pedon ID: S09AF015001

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Sandy-skeletal, mixed, thermic Xeric Haplocambids

USDA-NRCS-NSSC-Soil Survey Laboratory

; Pedon No. 09N0400

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-	
				(----- Water Extracted From Saturated Paste -----)																1:2 Elec Cond	Elec Cond	Exch Na	SAR	
Layer	Depth (cm)	Horz	Prep	Ca (---- mmol(+) L ⁻¹) 4F2	Mg 4F2	Na 4F2	K 4F2	CO ₃ (----) 4F2	HCO ₃ 4F2	F 4F2	Cl 4F2	PO ₄ 4F2	Br 4F2	OAC 4F2	SO ₄ 4F2	NO ₂ 4F2	NO ₃ 4F2	H ₂ O (---- % ----) 4F2	Total Salts 4F2	Cond 4F2	1:2 Elec Cond 4F1a1a1	%		
09N02124	0-20	Ap	S	10.8	1.4	4.4	0.6	--	2.4	--	5.5	--	--	--	2.4	0.3	7.2	25.7	tr	1.77	0.34	4	2	
09N02125	20-60	Bw1	S																		0.18		2	
09N02126	60-77	Bw2	S																		0.25		2	
09N02127	77-97	Bk1	S																		0.09		3	
09N02128	97-117	Bk2	S																		0.11		3	
09N02129	117-137	C1	S																		0.10		2	
09N02130	137-163	C2	S																		0.09		2	

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	
				(----- pH -----)				(-- Carbonate --)				(-- Gypsum --)			
Layer	Depth (cm)	Horz	Prep	CaCl ₂ 0.01M 1:2 4C1a2a	H ₂ O 1:1 4C1a2a	Sat Paste 4F2	Oxid	As CaCO ₃ <2mm 4C1a1a14E1a1a1a1	As CaSO ₄ *2H ₂ O <20mm 4C1a1a14E1a1a1a1	Resist <2mm 4C1a1a14E1a1a1a1	ohms <20mm 4C1a1a14E1a1a1a1				
09N02124	0-20	Ap	S	7.6	8.0	7.6		9.5	2						
09N02125	20-60	Bw1	S	7.8	8.1			10.0	6						
09N02126	60-77	Bw2	S	7.7	8.1			9.5	3						
09N02127	77-97	Bk1	S	7.9	8.6			9.5	5						
09N02128	97-117	Bk2	S	7.8	8.4			9.8	6						
09N02129	117-137	C1	S	7.8	8.5			9.9	7						
09N02130	137-163	C2	S	7.8	8.5			9.8	8						

***** Primary Characterization Data *****

Pedon ID: S09AF015001

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

Phosphorous

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

Layer	Depth (cm)	Horz	Prep	Melanic Index	NZ Oxal Available Capacity	Bray 1 2	Olsen H ₂ O	Citric Acid III	Mehlich Extr NO ₃	KCl	
										(- - - - -) mg kg ⁻¹	
										4D1a1a1a	4D5a1 4D2a1b1 4D6a1 4D9a1a
09N02124	0-20	Ap	S			12.4	27.9		5.3	0.3	39.6 43.20
09N02125	20-60	Bw1	S			5.8	10.5		3.0	0.2	17.6 17.40
09N02126	60-77	Bw2	S			6.7	13.8		2.3	0.2	37.8
09N02127	77-97	Bk1	S						2.2	0.1	25.2
09N02128	97-117	Bk2	S						2.8	0.2	13.9
09N02129	117-137	C1	S						4.3	0.2	17.1
09N02130	137-163	C2	S						5.2	0.3	11.9

Phosphorous

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

Layer	Depth (cm)	Horz	Prep	Melanic Index	NZ Oxal Available Capacity	Bray 1 2	Olsen H ₂ O	Citric Acid III	Mehlich Extr NO ₃	KCl	
										(- - - - -) mg kg ⁻¹	
										4D6b	
09N02124	0-20	Ap	S							68.8	
09N02125	20-60	Bw1	S							18.1	

Major Elements

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

Layer	Depth (cm)	Horz	Prep	Al	Ca	Fe	K	Mg	Mn	Na	P	Si	Sr	Ti	Zr
				mg/kg 4H1b											
09N02124	0-20	Ap	HM	72851	24517	43036	13205	16207	973	17641	923	293227	167	4079	36
09N02125	20-60	Bw1	HM	68111	42978	38672	9725	13159	850	18584	628	292685	184	3346	15
09N02126	60-77	Bw2	HM	70913	27959	40202	10944	13764	901	18836	750	301527	182	3585	24
09N02127	77-97	Bk1	HM	66866	36024	38050	8529	11783	832	18698	486	315227	184	2987	11
09N02128	97-117	Bk2	HM	68282	44530	39694	9537	13559	911	18407	698	288942	189	3482	16
09N02129	117-137	C1	HM	67553	47449	39876	9364	13293	888	18387	779	290270	191	3401	19
09N02130	137-163	C2	HM	66351	45514	38164	9116	13083	862	18871	726	295743	175	3200	14

***** Primary Characterization Data *****

(Konar, Afghanistan)

Sandy-skeletal, mixed, thermic Xeric Haplocambids

Print Date: Jun 7 2017 2:52PM

Pedon ID: S09AF015001

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

; Pedon No. 09N0400

Clay Mineralogy (<.002 mm)			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-										
			X-Ray						Thermal						Elemental				EGME	Inter preta tion										
Layer	Depth (cm)	Horz	Fract ion	7A1a1												SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	Na ₂ O	Retn							
				(----- peak size -----)												(----- % -----)	(----- % -----)				mg g ⁻¹									
09N02124	0.0-20.0	Ap	tcly	CL 3	MI 3																CMIX									
09N02126	60.0-77.0	Bw2	tcly	CL 4	MI 3	MT 2															CMIX									
09N02128	97.0-117.0	Bk2	tcly	KK 3	CL 3	MT 2	CA 1														CMIX									
09N02130	137.0-163.0	C2	tcly	CL 3	MI 3	MT 2	CA 1														CMIX									

FRACTION INTERPRETATION:

tcly - Total Clay <0.002 mm

MINERAL INTERPRETATION:

CA Calcite	CL Chlorite	KK Kaolinite	MI Mica	MT Montmorillonite
------------	-------------	--------------	---------	--------------------

RELATIVE PEAK SIZE:	5 Very Large	4 Large	3 Medium	2 Small	1 Very Small	6 No Peaks
---------------------	--------------	---------	----------	---------	--------------	------------

INTERPRETATION (BY HORIZON):

CMIX - Mixed Clay

*** Primary Characterization Data ***

Pedon ID: S09AF015001

Sampled As : SND
USDA-NRCS-NSSC-Soil Survey Laboratory

(Konar, Afghanistan)
Sandy-skeletal, mixed, thermic Xeric Hapludicents
; Pedon No. 09N0400

Print Date: Jun 7 2017 2:52PM

Sand - Silt Mineralogy (2.0-0.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
Layer	Depth (cm)	Horz	Fract ion	X-Ray				Thermal				Optical				EGME		Inter preta tion			
				(----- peak size -----)				(- - - % - - - - -)				Tot Re		Grain Count				Retn			
09N02124	0.0-20.0	Ap	csi																mg g ⁻¹	SMIX	
													44	QZ 43	BT 20	FK 10	HN 7	MS 7	PR 6		
														AR 3	CA 2	OP 1	PO tr	MZ tr	LA tr		
														BY tr	CB tr	CD tr	FE tr	FP tr	GN tr		
														GS tr	RU tr	ZR tr					
09N02126	60.0-77.0	Bw2	csi										50	QZ 47	BT 18	FK 10	MS 8	PR 5	HN 4		SMIX
														AR 2	CA 2	FE 1	OP 1	GN 1	GS tr		
														MZ tr	PO tr	FP tr	CD tr	BY tr	TM tr		
															ZR tr						
09N02128	97.0-117.0	Bk2	fs										38	QZ 32	AR 16	FK 16	CB 12	BT 7	FE 6		SMIX
														CA 5	CL 2	MS 2	PR 2	HN 1	OP tr		
														ZR tr	FP tr	CD tr					
09N02130	137.0-163.0	C2	fs										24	AR 29	QZ 21	FK 20	CB 13	BT 7	CA 4		SMIX
														FE 2	FP 1	CD 1	CL 1				

*** Primary Characterization Data ***

(Konar, Afghanistan)

Sandy-skeletal, mixed, thermic Xeric Haplocambids

Print Date: Jun 7 2017 2:52PM

Pedon ID: S09AF015001

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

; Pedon No. 09N0400

FRACTION INTERPRETATION:

csi - Coarse Silt 0.02-0.05 mm fs - Fine Sand 0.1-0.25 mm

MINERAL INTERPRETATION:

AR Weatherable Aggregates	BT Biotite	BY Beryl	CA Calcite	CB Carbonate Aggregates
CD Chert (Chalcedony)	CL Chlorite	FE Iron Oxides (Goethite)	FK Potassium Feldspar	FP Plagioclase Feldspar
GN Garnet	GS Glass	HN Hornblende	LA Lamprobolite	MS Muscovite
MZ Monazite	OP Opaques	PO Plant Opal	PR Pyroxene	QZ Quartz
RU Rutile	TM Tourmaline	ZR Zircon		

INTERPRETATION (BY HORIZON):

SMIX - Mixed Sand

***** Primary Characterization Data *****

(Konar, Afghanistan)

Pedon ID: S09AF015002

Print Date: Jun 7 2017 2:52PM

Sampled as on Jan 9, 2009: SND ; Fine-loamy, mixed, superactive, thermic Aridic Argixerolls
 Revised to correlated on Jan 10, 2017: Haploxerolls ; Coarse-silty, mixed, active, thermic Oxyaeric Haploxerolls

SSL - Project C2009AF06067 Afghanistan
 - Site ID S09AF015002 Lat: 34° 47' 15.80" north Long: 71° 6' 24.00" east
 - Pedon No. 09N0401
 - General Methods 1B1A, 2A1, 2B

United States Department of Agriculture
 Natural Resources Conservation Service
 National Soil Survey Center
 Kellogg Soil Survey Laboratory
 Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
09N02131	Ap	Ap	0-9	S09AF015002-1				SIL
09N02132	Bt	Bt	9-42	S09AF015002-2				SIL
09N02133	Bw1	Bw1	42-68	S09AF015002-3				SIL
09N02134	Bw2	Bw2	68-75	S09AF015002-4				VFSL
09N02135	Bw3	Bw3	75-98	S09AF015002-5				SIL
09N02136	C	C	98-150	S09AF015002-6				SIL
09N02137	ApFertility	Ap Fertility	0-9	S09AF015002-A				

Pedon Calculations				Result	Units of Measure
Weighted Particles, 0.1-75mm, 75 mm Base				21	% wt
Volume, >2mm, Weighted Average				3	% vol
Clay, total, Weighted Average				15	% wt
Clay, carbonate free, Weighted Average				14	% wt
CEC Activity, CEC/Clay, Weighted Average, CECd, Set 1				0.47	(NA)

Weighted averages based on control section: 7-42 cm

PSDA & Rock Fragments				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
				Lab	(----- Total -----)			(- Clay - - -)		(- Silt - - -)		(- - - Sand - - -)		(Rock Fragments (mm))				>2 mm			
				Text-	Clay	Silt	Sand	Fine	CO ₃	Fine	Coarse	VF	F	M	C	VC	(----- Weight -----)		wt %		
				ure	<	.002	.05	<	<	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	whole soil
				Depth (cm)	<.002		<.05	<2	.0002	.002	<.02	<.05	<.10	<.25	<.50	<1	<2	<5	<20	<.1-	
				Horz	Prep		(----- % of <2mm Mineral Soil -----)		3A1a1a		3A1a1a 3A1a1a 3A1a1a		3A1a1a 3A1a1a 3A1a1a		3A1a1a 3A1a1a 3A1a1a		(----- % of <75mm -----)				
				Layer	3A1a1a		3A1a1a 3A1a1a 3A1a1a		3A1a1a 3A1a1a 3A1a1a		3A1a1a 3A1a1a 3A1a1a		3A1a1a 3A1a1a 3A1a1a		3A1a1a 3A1a1a 3A1a1a						
09N02131	0-9	Ap	S	sil	15.0	55.1	29.9	4.0	--	35.1	20.0	11.8	9.3	5.0	2.7	1.1	1	1	--	20	2
09N02132	9-42	Bt	S	sil	14.7	55.2	30.1	3.4	0.7	33.7	21.5	12.2	11.7	2.6	2.7	0.9	3	1	--	21	4
09N02133	42-68	Bw1	S	sil	8.6	50.9	40.5	1.6	--	23.6	27.3	28.8	9.0	1.9	0.5	0.3	tr	2	--	13	2
09N02134	68-75	Bw2	S	vfsl	1.8	27.7	70.5	0.6	--	8.5	19.2	41.0	27.7	1.5	0.2	0.1	--	--	--	30	--
09N02135	75-98	Bw3	S	sil	6.7	71.7	21.6	1.3	--	34.2	37.5	16.5	3.3	1.0	0.6	0.2	tr	1	--	6	1
09N02136	98-150	C	S	sil	1.8	54.7	43.5	0.4	--	18.3	36.4	30.6	12.6	0.2	0.1	tr	--	tr	--	13	tr
09N02137	0-9	ApFertility	S														1	1	1	--	3

***** Primary Characterization Data *****

(Konar, Afghanistan)

Pedon ID: S09AF015002

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Sampled As : SND

Fine-loamy, mixed, superactive, thermic Aridic Argixerolls

USDA-NRCS-NSSC-Soil Survey Laboratory

; Pedon No. 09N0401

Water Dispersible PSDA

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(- - - Water Dispersible - - -)

(- - - Total - - -) (- - Clay - - -) (- - - Silt - - -) (- - - Sand - - -)

Clay Silt Sand F CO₃ F C VF F M C VC

< .002 .05 < < .002 .02 .05 .10 .25 .5 1

.002 -.05 -2 .0002 .002 -.02 -.05 -.10 -.25 -.50 -1 -2

(- - - % of <2mm - - -)

3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a

Layer	Depth (cm)	Horz	Prep	9.9	58.5	31.6	1.5	38.4	20.1	12.9	9.3	5.8	1.8	1.8
-------	------------	------	------	-----	------	------	-----	------	------	------	-----	-----	-----	-----

Bulk Density & Moisture

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13-

(Bulk Density)

33 Oven Cole (- - - Water Content - - -)

kPa Dry Whole 6 10 33 1500 1500 kPa Ratio

(- - - % of < 2mm - - -)

DbWR1 DbWR1 kPa kPa kPa Mois AD/OD

(- - - g cm⁻³ - - -)

DbWR1 DbWR1 DbWR1 3C2a1a 3D1

3F1a1a

09N02131	0-9	Ap	S	9.9	58.5	31.6	1.5	38.4	20.1	12.9	9.3	5.8	1.8	1.8	
09N02132	9-42	Bt	S	1.54	1.59	0.010				21.6	5.9	1.009	5	0.50	0.45
09N02133	42-68	Bw1	S	1.41	1.45	0.009				21.6	3.5	1.008	0.24	0.47	0.40
09N02134	68-75	Bw2	S							1.3	1.005	0.25	0.43	0.41	
09N02135	75-98	Bw3	S	1.37	1.40	0.007				22.9	2.7	1.002	0.56	0.72	
09N02136	98-150	C	S	1.30	1.33	0.008				17.5	1.2	1.004	0.28	0.34	0.40
09N02137	0-9	ApFertility	S								1.011	0.21	0.78	0.67	

Water Content

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13-

(- - Atterberg - -)

(- - - Limits - - -)

LL PI Field Recon Recon (- - - Water Content - - -)

kPa kPa Field Recon Sieved Samples

33 6 33 10 100 200 500

(- - - % of < 2mm - - -)

3B2 3B2 3B2

Layer	Depth (cm)	Horz	Prep	pct <0.4mm									
09N02131	0-9	Ap	S	31	6								
09N02132	9-42	Bt	S	28	9								
09N02134	68-75	Bw2	S		NP								
09N02136	98-150	C	S		NP								

***** Primary Characterization Data *****

Pedon ID: S09AF015002

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Konar, Afghanistan)

Fine-loamy, mixed, superactive, thermic Aridic Argixerolls

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Carbon & Extractions				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-
Layer	Depth (cm)	Horz	Prep	(---- Total ----)			Est OC (WB)	C/N Ratio	(--- Dith-Cit Ext ---)			(----- Ammonium Oxalate Extraction -----)			(--- Na Pyro-Phosphate ---)							
				C	N	S			Fe	Al	Mn	Al+½Fe ODOE	Fe	Al	Si	Mn	C	Fe	Al	Mn		
				(---- % of <2 mm ----)			(---- % of <2 mm ----)			(---- % of <2 mm ----)			(---- % of <2 mm ----)			mg kg ⁻¹ (---- % of <2mm ----)						
				4H2a	4H2a	4H2a			4G1	4G1	4G1											
09N02131	0-9	Ap	S	1.82	0.10	0.02	1.0		10	0.7	tr	tr										
09N02132	9-42	Bt	S	1.39	0.05	0.01	0.5		11	0.7	tr	tr										
09N02133	42-68	Bw1	S	1.55	0.07	tr	0.3		5	0.7	tr	tr										
09N02134	68-75	Bw2	S	1.49	0.01	--	0.1		12	0.6	--	--										
09N02135	75-98	Bw3	S	1.63	2.93	--	0.3			0.8	tr	tr										
09N02136	98-150	C	S	1.59	0.04	--	0.2		5	0.6	--	tr										

CEC & Bases				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-				
Layer	Depth (cm)	Horz	Prep	(---- NH ₄ OAC Extractable Bases ----)								CEC8	CEC7	ECEC							
				Ca	Mg	Na	K	Sum Bases	Acid- ity	Extr	KCl	Sum Mn	NH ₄ OAC	Bases +Al	Al	(- Saturation -)	Sum	NH ₄ OAC			
				(---- cmol(+) kg ⁻¹ ----)				4B1a1a		4B1a1a		4B1a1a		4B1a1a		(---- cmol(+) kg ⁻¹ ----)					
09N02131	0-9	Ap	S	41.4*	4.8	0.3	0.6	47.1							7.5				100		
09N02132	9-42	Bt	S	41.0*	4.4	0.3	0.5	46.2							6.9				100		
09N02133	42-68	Bw1	S	39.2*	2.9	0.2	0.3	42.6							3.7				100		
09N02134	68-75	Bw2	S	34.5*	1.8	0.1	0.1	36.5							1.0				100		
09N02135	75-98	Bw3	S	36.8*	2.8	0.2	1.2	41.0							2.3				100		
09N02136	98-150	C	S	35.0*	2.4	0.2	0.1	37.7							1.4				100		

*Extractable Ca may contain Ca from calcium carbonate or gypsum., CEC7 base saturation set to 100.

Salt				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
Layer	Depth (cm)	Horz	Prep	(---- Water Extracted From Saturated Paste ----)															1:2 Total Salts	Elec Cond	Elec Cond	Exch Na	SAR
				Ca	Mg	Na	K	CO ₃	HCO ₃	F	Cl	PO ₄	Br	OAC	SO ₄	NO ₂	NO ₃	H ₂ O	(-- % --)	(-- dS m ⁻¹ --)	4F2	4F1a1a1	
				(---- mmol(+) L ⁻¹ ----)	(---- mmol(+) L ⁻¹ ----)	(---- mmol(+) L ⁻¹ ----)	(---- mmol(+) L ⁻¹ ----)	(---- mmol(+) L ⁻¹ ----)	(---- mmol(+) L ⁻¹ ----)	(---- mmol(+) L ⁻¹ ----)	(---- mmol(+) L ⁻¹ ----)	(---- mmol(+) L ⁻¹ ----)	(---- mmol(+) L ⁻¹ ----)	(---- mmol(+) L ⁻¹ ----)	(---- mmol(+) L ⁻¹ ----)	(---- mmol(+) L ⁻¹ ----)	(---- mmol(+) L ⁻¹ ----)	(---- % ----)	(---- dS m ⁻¹ ----)	4F2	4F1a1a1		
09N02131	0-9	Ap	S	3.6	2.9	1.8	0.7	--	5.5	tr	0.9	--	--	--	3.0	tr	tr	49.6	tr	0.85	0.35	2	1
09N02132	9-42	Bt	S	2.6	2.0	1.7	0.4	--	3.8	tr	0.7	--	--	--	2.5	0.1	tr	45.3	tr	0.65	0.28	3	1
09N02133	42-68	Bw1	S																	0.21	5		
09N02134	68-75	Bw2	S																	0.14	11		
09N02135	75-98	Bw3	S																	0.20	8		
09N02136	98-150	C	S																	0.20	13		

***** Primary Characterization Data *****

Pedon ID: S09AF015002

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Konar, Afghanistan)

Fine-loamy, mixed, superactive, thermic Aridic Argixerolls

Print Date: Jun 7 2017 2:52PM

; Pedon No. 09N0401

pH & Carbonates

		-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-
Layer	Depth (cm)	Horz	Prep	(----- pH -----)				(- - - Carbonate - - -)		(- - - Gypsum - - -)		
				CaCl ₂	0.01M	H ₂ O	Sat	As CaCO ₃	As CaSO ₄ ·2H ₂ O	Resist		
				1:2	1:1	Paste	Oxid	NaF	<2mm	<20mm	<2mm	ohms
				4C1a2a	4C1a2a	4F2		4C1a1a14E1a1a1a1				cm ⁻¹
09N02131	0-9	Ap	S		7.8	8.3	8.0		9.8	7		
09N02132	9-42	Bt	S		7.8	8.5	8.0		9.9	7		
09N02133	42-68	Bw1	S		7.8	8.4			9.9	10		
09N02134	68-75	Bw2	S		7.8	8.4			9.5	11		
09N02135	75-98	Bw3	S		7.8	8.3			9.8	11		
09N02136	98-150	C	S		7.8	8.3			9.7	12		

Phosphorous

		-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	(----- Phosphorous -----)				KCl					
				Melanic Index	NZ Oxal	Acid Available	Anion Capacity	Exch 1	Bray 2	Olsen H ₂ O	Citric Acid	Mehlich III	Extr NO ₃
								mg kg ⁻¹					
								4D1a1a1a	4D5a1	4D2a1b1	4D6a1	4D9a1a	
09N02131	0-9	Ap	S			23.7	59.7		18.6	0.3	55.8	22.79	
09N02132	9-42	Bt	S			19.9	47.8		13.8	0.3	45.9	10.69	
09N02133	42-68	Bw1	S			6.7	16.0		6.9	0.1	20.1	5.05	
09N02134	68-75	Bw2	S						2.5	0.1	0.8		
09N02135	75-98	Bw3	S						3.0	0.1	4.2		
09N02136	98-150	C	S						1.4	tr	0.6		
09N02137	0-9	ApFertility	S									4.49	

Phosphorous

		-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	(----- Phosphorous -----)				KCl					
				Melanic Index	NZ Oxal	Acid Available	Anion Capacity	Bray 1	Bray 2	Olsen H ₂ O	Citric Acid	Mehlich III	Extr NO ₃
								mg kg ⁻¹					
								4D6b					
09N02131	0-9	Ap	S								112.0		
09N02132	9-42	Bt	S								91.8		
09N02133	42-68	Bw1	S								22.2		
09N02137	0-9	ApFertility	S								90.2		

***** Primary Characterization Data *****

Pedon ID: S09AF015002

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Konar, Afghanistan)

Fine-loamy, mixed, superactive, thermic Aridic Argixerolls

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Trace Elements Tier 1				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Ag mg/kg 4H1a	As mg/kg 4H1a	Ba mg/kg 4H1a	Be mg/kg 4H1a	Cd mg/kg 4H1a	Co mg/kg 4H1a	Cr mg/kg 4H1a	Cu mg/kg 4H1a	Mn mg/kg 4H1a	Mo mg/kg 4H1a	Hg ug/kg 4H1a	
09N02137	0-9	ApFertility	HM	0.10	12.51	187.06	1.09	0.13	12.25	49.98	35.38	614.70	0.50	29	
Trace Elements Tier 2				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	
Layer	Depth (cm)	Horz	Prep	Ni mg/kg 4H1a	P mg/kg 4H1a	Pb mg/kg 4H1a	Sb mg/kg 4H1a	Se ug/kg 4H1a	Sn mg/kg 4H1a	Sr mg/kg 4H1a	Tl mg/kg	V mg/kg 4H1a	W mg/kg 4H1a	Zn mg/kg 4H1a	
09N02137	0-9	ApFertility	HM	44.54	1207.99	15.91	0.52	595.53	2.23	130.38		64.17	0.17	93.38	
Major Elements				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Al mg/kg 4H1b	Ca mg/kg 4H1b	Fe mg/kg 4H1b	K mg/kg 4H1b	Mg mg/kg 4H1b	Mn mg/kg 4H1b	Na mg/kg 4H1b	P mg/kg 4H1b	Si mg/kg 4H1b	Sr mg/kg 4H1b	Ti mg/kg 4H1b	Zr mg/kg 4H1b
09N02131	0-9	Ap	HM	70928	39460	38569	18072	17777	852	14056	1299	281566	209	3927	39
09N02132	9-42	Bt	HM	71575	39574	38675	18117	17458	810	13798	1262	281679	205	3926	41
09N02133	42-68	Bw1	HM	67153	44299	33287	18812	16157	630	14754	1090	280671	208	3680	33
09N02134	68-75	Bw2	HM	57928	43338	25880	18569	13524	553	15299	823	248271	199	3145	26
09N02135	75-98	Bw3	HM	61875	44054	30025	20649	14711	630	14129	836	240884	188	3292	28
09N02136	98-150	C	HM	57902	44625	28104	18060	14611	616	14995	887	251724	197	3320	28
09N02137	0-9	ApFertility	HM	66902	20284	34723	19921	12253	865	16491	730	254055	237	4737	34

***** Primary Characterization Data *****

(Konar, Afghanistan)

Pedon ID: S09AF015002

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Sampled As : SND

Fine-loamy, mixed, superactive, thermic Aridic Argixerolls

USDA-NRCS-NSSC-Soil Survey Laboratory

; Pedon No. 09N0401

Clay Mineralogy (<.002 mm)			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
			X-Ray						Thermal						Elemental				EGME	Inter preta tion
Layer	Depth (cm)	Horz	Fract ion	7A1a1						SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	Na ₂ O	Retn			
09N02131	0.0-9.0	Ap	tcly	MI 3	CL 3	CA 1												mg g ⁻¹	CMIX	
09N02132	9.0-42.0	Bt	tcly	MI 3	CL 3	CA 1													CMIX	
09N02134	68.0-75.0	Bw2	tcly	MI 3	CL 3														CMIX	
09N02136	98.0-150.0	C	tcly	MI 2	CL 2														CMIX	

FRACTION INTERPRETATION:

tcly - Total Clay <0.002 mm

MINERAL INTERPRETATION:

CA Calcite

CL Chlorite

MI Mica

RELATIVE PEAK SIZE:

5 Very Large

4 Large

3 Medium

2 Small

1 Very Small

6 No Peaks

INTERPRETATION (BY HORIZON):

CMIX - Mixed Clay

***** Primary Characterization Data *****

(Konar, Afghanistan)

Pedon ID: S09AF015002

Print Date: Jun 7 2017 2:52PM

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Fine-loamy, mixed, superactive, thermic Aridic Argixerolls

USDA-NRCS-NSSC-Soil Survey Laboratory

; Pedon No. 09N0401

Sand - Silt Mineralogy (2.0-0.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
				X-Ray				Thermal				Optical								EGME	Inter
Depth		Fract										Tot Re				Grain Count				Retn	preta
Layer	(cm)	Horz	Fract	(----- peak size -----)				(----- % -----)				(----- % -----)				7B1a2				mg g ⁻¹	tion
09N02131	0.0-9.0	Ap	csi									49	QZ 43	MS 19	FK 13	BT 8	HN 4	CD 3		SMIX	
													PR 3	AR 2	OP 1	PO 1	FE 1	FP 1			
													GN tr	LA tr	BY tr	MZ tr	TM tr	ZR tr			
09N02132	9.0-42.0	Bt	csi									35	QZ 31	CA 16	FK 13	BT 11	MS 11	HN 6		SMIX	
													AR 4	CD 3	CB 2	PR 2	OP 1	FP 1			
													FE tr	PO tr	ZR tr						
09N02134	68.0-75.0	Bw2	vfs									40	QZ 38	FK 23	CA 11	AR 8	BT 8	CB 4		SMIX	
													HN 3	MS 2	PR 2	OP 1	FP 1	GN 1			
													FE tr	TM tr							
09N02136	98.0-150.0	C	csi									42	QZ 39	CA 17	FK 12	AR 9	MS 6	BT 5		SMIX	
													HN 4	CB 3	CD 2	OP 1	PR 1	LA tr			
													TM tr	AP tr	FE tr	BY tr	GN tr				

FRACTION INTERPRETATION:

csi - Coarse Silt 0.02-0.05 mm

vfs - Very Fine Sand 0.05-0.1 mm

*** Primary Characterization Data ***

(Konar, Afghanistan)

Fine-loamy, mixed, superactive, thermic Aridic Argixerolls

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Pedon ID: S09AF015002

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

; Pedon No. 09N0401

MINERAL INTERPRETATION:

AP Apatite	AR Weatherable Aggregates	BT Biotite	BY Beryl	CA Calcite
CB Carbonate Aggregates	CD Chert (Chalcedony)	FE Iron Oxides (Goethite)	FK Potassium Feldspar	FP Plagioclase Feldspar
GN Garnet	HN Hornblende	LA Lamprobolite	MS Muscovite	MZ Monazite
OP Opaques	PO Plant Opal	PR Pyroxene	QZ Quartz	TM Tourmaline
ZR Zircon				

INTERPRETATION (BY HORIZON):

SMIX - Mixed Sand

***** Primary Characterization Data *****

(Konar, Afghanistan)

Pedon ID: S09AF015003

Print Date: Jun 7 2017 2:53PM

Sampled as on Jan 10, 2009: SND ; Fine-loamy, mixed, superactive, thermic Aridic Calcixerolls
 Revised to correlated on Jan 10, 2017: Calciargids ; Coarse-loamy, mixed, active, thermic Xeric Calciargids

SSL - Project C2009AF06067 Afghanistan
 - Site ID S09AF015003 Lat: 34° 50' 57.60" north Long: 71° 8' 45.10" east
 - Pedon No. 09N0402
 - General Methods 1B1A, 2A1, 2B

United States Department of Agriculture
 Natural Resources Conservation Service
 National Soil Survey Center
 Kellogg Soil Survey Laboratory
 Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
09N02138	Ap	Ap	0-11	S09AF015003-1				FSL
09N02139	Bk	Bk	11-27	S09AF015003-2				L
09N02140	Btk1	Btk1	27-47	S09AF015003-3				L
09N02141	Btk2	Btk2	47-72	S09AF015003-4				SIL
09N02142	B'k1	B'k1	72-104	S09AF015003-5				SIL
09N02143	B'k2	B'k2	104-150	S09AF015003-6				SIL

Pedon Calculations

Calculation Name	Result	Units of Measure
Weighted Particles, 0.1-75mm, 75 mm Base	24	% wt
Volume, >2mm, Weighted Average	7	% vol
Clay, total, Weighted Average	18	% wt
Clay, carbonate free, Weighted Average	16	% wt
CEC Activity, CEC7/Clay, Weighted Average, CECd, Set 1	0.51	(NA)

Weighted averages based on control section: 27-72 cm

PSDA & Rock Fragments				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	
				Lab Texture Layer Depth (cm)	(----- Total -----)	(-- Clay --)	(--- Silt ---)	(----- Sand -----)	(Rock Fragments (mm))													
					Clay	Silt	Sand	Fine	CO ₃	Fine	Coarse	VF	F	M	C	VC	(----- Weight -----)					
					<	.002	.05	<	<	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-		
					.002	-.05	-2	.0002	.002	.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75		
				(----- % of <2mm Mineral Soil -----)				(----- % of <75mm -----)														
				3A1a1a				3A1a1a 3A1a1a 3A1a1a				3A1a1a 3A1a1a 3A1a1a 3A1a1a										
09N02138	0-11	Ap	S	fsl	11.0	30.6	58.4	4.0	--	14.0	16.6	23.4	27.2	5.7	1.1	1.0	2	3	--	38	5	
09N02139	11-27	Bk	S	I	9.7	45.9	44.4	3.0	0.7	21.3	24.6	23.7	13.2	4.6	1.4	1.5	2	1	--	23	3	
09N02140	27-47	Btk1	S	I	13.8	48.4	37.8	4.4	0.6	24.7	23.7	21.0	11.5	3.4	1.1	0.8	4	1	--	21	5	
09N02141	47-72	Btk2	S	sil	22.3	62.4	15.3	6.0	4.8	40.1	22.3	8.2	4.8	1.5	0.5	0.3	15	5	--	26	20	
09N02142	72-104	B'k1	S	sil	19.9	60.2	19.9	4.6	4.5	37.4	22.8	12.8	5.3	1.6	0.1	0.1	3	5	--	15	8	
09N02143	104-150	B'k2	S	sil	15.0	50.1	34.9	3.2	4.5	32.8	17.3	20.7	11.8	2.0	0.2	0.2	1	4	--	18	5	

***** Primary Characterization Data *****

Pedon ID: S09AF015003

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Konar, Afghanistan)

Fine-loamy, mixed, superactive, thermic Aridic Calcixerolls

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; Pedon No. 09N0402

Water Dispersible PSDA

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(- - - Water Dispersible - - -)

(- - - Total - - -) (- - Clay - - -) (- - - Silt - - -) (- - - Sand - - -)

Clay F CO₃ F C VF F M C VC

< .002 .05 < < .002 .02 .05 .10 .25 .5 1

.002 -.05 -2 .0002 .002 -.02 -.05 -.10 -.25 -.50 -.1 -2

Layer	Depth (cm)	Horz	Prep	(- - - % of <2mm - - -)											
				3A1a6a			3A1a6a			3A1a6a			3A1a6a		

09N02138	0-11	Ap	S	3.2	50.0	46.8	27.1	22.9	24.3	14.1	5.0	1.8	1.6
----------	------	----	---	-----	------	------	------	------	------	------	-----	-----	-----

Bulk Density & Moisture

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13-

(Bulk Density) Cole Water Content WRD Aggst

33 10 33 1500 kPa Ratio

kPa kPa kPa AD/OD

kPa kPa kPa cm³ cm⁻³ %

Dry Whole Soil Stabl 2-0.5mm (- - Ratio/Clay - -)

Oven 6 1500 kPa CEC7 1500 kPa

Soil cm³ cm⁻³ %

(- - g cm⁻³ - - -) DbWR1 DbWR1 3F1a1a

(- - - % of < 2mm - - -) DbWR1 3C2a1a 3D1

09N02138	0-11	Ap	S	1.41	1.44	0.007	14.1	4.8	1.008	4	0.59	0.44
09N02139	11-27	Bk	S	1.47	1.50	0.007	13.7	6.5	1.010	0.13	0.74	0.49
09N02140	27-47	Btk1	S	1.34	1.42	0.017	23.2	8.5	1.014	0.10	0.61	0.47
09N02141	47-72	Btk2	S	1.34	1.39	0.012	19.9	8.1	1.016	0.17	0.43	0.38
09N02142	72-104	B'k1	S	1.42	1.46	0.009	17.6	5.9	1.014	0.15	0.40	0.41
09N02143	104-150	B'k2	S						1.009	0.16	0.31	0.39

Water Content

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13-

(- - Atterberg - - -) (- - - Bulk Density - - -) (- - - Water Content - - -)

(- - - Limits - - -) Field Recon Recon Field Recon (- - - Sieved Samples - - -)

LL PI 33 6 33 10 33 100 200 500

kPa kPa kPa kPa kPa kPa kPa kPa kPa

Layer	Depth (cm)	Horz	Prep	(- - - pct <0.4mm - - -)		(- - - g cm ⁻³ - - -)		(- - - % of < 2mm - - -)	
				3H	3H	3B2	3B2	3B2	

09N02138	0-11	Ap	S	NP	1.58	1.53	22.2
----------	------	----	---	----	------	------	------

09N02140	27-47	Btk1	S	23	7		
----------	-------	------	---	----	---	--	--

09N02141	47-72	Btk2	S	34	15		
----------	-------	------	---	----	----	--	--

09N02143	104-150	B'k2	S	22	5		
----------	---------	------	---	----	---	--	--

***** Primary Characterization Data *****

Pedon ID: S09AF015003

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(Konar, Afghanistan)

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; Pedon No. 09N0402

Carbon & Extractions				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-
Layer	Depth (cm)	Horz	Prep	(---- Total ----) C N S			Est OC	OC (WB)	C/N Ratio	(--- Dith-Cit Ext ---) Fe Al Mn			(---- Ammonium Oxalate Extraction ----) Al+½Fe ODOE Fe Al Si Mn			(--- Na Pyro-Phosphate ---) C Fe Al Mn						
				(% of <2 mm -----)			(% of <2 mm -----)			(% of <2 mm -----)			mg kg⁻¹ (% of <2mm -----)									
				4H2a	4H2a	4H2a				4G1	4G1	4G1										
09N02138	0-11	Ap	S	0.55	0.11	--	0.5		5	0.6	tr	tr										
09N02139	11-27	Bk	S	0.36	0.03	--	0.3		11	0.6	tr	tr										
09N02140	27-47	Btk1	S	0.56	0.03	--	0.3		10	0.7	tr	tr										
09N02141	47-72	Btk2	S	2.63	0.07	tr	0.3		4	0.7	tr	tr										
09N02142	72-104	B'k1	S	2.48	0.03	tr	0.2		7	0.8	tr	tr										
09N02143	104-150	B'k2	S	2.42	0.02	0.03	0.2		9	0.8	tr	tr										

CEC & Bases				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-				
Layer	Depth (cm)	Horz	Prep	(---- NH₄OAC Extractable Bases ----)								CEC8	CEC7	ECEC	(---- Base ----)						
				Ca	Mg	Na	K	Sum Bases	Acid-ity	Extr Al	KCl Mn	Sum Cats	NH₄OAC +Al	Bases Sat	Al Sum	(- Saturation -) NH₄OAC					
				(---- cmol(+) kg⁻¹ ----)	(---- 4B1a1a ----)	(---- 4B1a1a ----)	(---- 4B1a1a ----)	(---- 4B1a1a ----)	(---- cmol(+) kg⁻¹ ----)	(---- 4B2b1a1 ----)	(---- mg kg⁻¹ ----)	(---- cmol(+) kg⁻¹ ----)	(---- 4B1a1a ----)	(---- % ----)	(---- % ----)						
09N02138	0-11	Ap	S	16.5*	1.8	0.3	0.3	18.9	0.5					6.5					100		
09N02139	11-27	Bk	S	13.2*	1.4	0.1	0.2	14.9						7.2					100		
09N02140	27-47	Btk1	S	40.6*	2.0	0.1	0.2	42.9						8.4					100		
09N02141	47-72	Btk2	S	47.9*	2.8	0.2	0.2	51.1						9.7					100		
09N02142	72-104	B'k1	S	43.1*	3.3	0.2	0.2	46.8						7.9					100		
09N02143	104-150	B'k2	S	42.3*	3.3	0.2	0.1	45.9						4.6					100		

*Extractable Ca may contain Ca from calcium carbonate or gypsum., CEC7 base saturation set to 100.

Salt				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
Layer	Depth (cm)	Horz	Prep	(---- Water Extracted From Saturated Paste ----)															1:2 Total Elect Cond Exch Na SAR				
				Ca	Mg	Na	K	CO ₃	HCO ₃	F	Cl	PO ₄	Br	OAC	SO ₄	NO ₂	NO ₃	H ₂ O	Total Salts	Elect Cond	Exch Cond	Na	SAR
				(---- mmol(+) L⁻¹ ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- % ----)	(---- dS m⁻¹ ----)	(---- 4F2 ----)	(---- 4F1a1a1 ----)	%	
09N02138	0-11	Ap	S	5.8	1.6	0.3	0.3	--	3.2	tr	0.4	--	--	--	5.2	0.2	--	34.0	tr	0.85	0.27	4	tr
09N02139	11-27	Bk	S																	0.19	1		
09N02140	27-47	Btk1	S																	0.18	1		
09N02141	47-72	Btk2	S																	0.21	2		
09N02142	72-104	B'k1	S																	0.17	3		
09N02143	104-150	B'k2	S																	0.17	3		

***** Primary Characterization Data *****

Pedon ID: S09AF015003

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Konar, Afghanistan)

Fine-loamy, mixed, superactive, thermic Aridic Calcixerolls

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; Pedon No. 09N0402

pH & Carbonates

		-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-
Layer	Depth (cm)			(----- pH -----)				(- - Carbonate --) As CaCO ₃		(- - Gypsum --) As CaSO ₄ ·2H ₂ O		Resist ohms cm ⁻¹
		Horz	Prep	KCl	0.01M	H ₂ O	Sat	Oxid	NaF	(----- % -----)		
09N02138	0-11	Ap	S		7.4	7.9	7.3		9.4	tr		
09N02139	11-27	Bk	S		7.6	8.1			9.4	tr		
09N02140	27-47	Btk1	S		7.7	8.1			9.9	3		
09N02141	47-72	Btk2	S		7.7	8.1			10.4	20		
09N02142	72-104	B'k1	S		7.7	8.3			10.4	19		
09N02143	104-150	B'k2	S		7.8	8.4			10.4	19		

Phosphorous

		-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)			(- - Phosphorous -----)				KCl				Extr NO ₃	
		Melanic Index	NZ	Acid Oxal	Anion Available	Exch Capacity	Bray 1	Bray 2	Olsen H ₂ O	Citric Acid	Mehlrich III		
09N02138	0-11	Ap	S		11.5	18.8			11.8	0.4	31.7	32.52	
09N02139	11-27	Bk	S		6.2	19.6			1.9	0.1	41.7	26.79	
09N02140	27-47	Btk1	S		2.8	4.9			1.4	0.1	7.1	22.16	
09N02141	47-72	Btk2	S		4.0	7.7			2.3	tr	1.8		
09N02142	72-104	B'k1	S						2.6	0.1	3.4		
09N02143	104-150	B'k2	S						2.4	tr	0.7		

Phosphorous

		-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)			(- - Phosphorous -----)				KCl				Extr NO ₃	
		Melanic Index	NZ	Acid Oxal	Anion Available	Exch Capacity	Bray 1	Bray 2	Olsen H ₂ O	Citric Acid	Mehlrich III		
09N02138	0-11	Ap	S								28.7		
09N02139	11-27	Bk	S								36.7		
09N02140	27-47	Btk1	S								9.4		

***** Primary Characterization Data *****

Pedon ID: S09AF015003

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Konar, Afghanistan)

Fine-loamy, mixed, superactive, thermic Aridic Calcixerolls

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Major Elements				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Al mg/kg 4H1b	Ca mg/kg 4H1b	Fe mg/kg 4H1b	K mg/kg 4H1b	Mg mg/kg 4H1b	Mn mg/kg 4H1b	Na mg/kg 4H1b	P mg/kg 4H1b	Si mg/kg 4H1b	Sr mg/kg 4H1b	Ti mg/kg 4H1b	Zr mg/kg 4H1b
09N02138	0-11	Ap	HM	67969	27168	36387	18135	13378	875	14905	700	256675	230	4719	32
09N02139	11-27	Bk	HM	69297	42744	38391	20103	18061	910	13090	1329	241297	216	3770	36
09N02140	27-47	Btk1	HM	58148	79596	33147	17053	15973	749	8590	708	213304	174	3619	40
09N02141	47-72	Btk2	HM	59817	73830	33495	16860	17187	703	8778	690	218739	202	3548	43
09N02142	72-104	B'k1	HM	69165	21943	36758	20803	12916	904	17179	842	275930	254	5085	33
09N02143	104-150	B'k2	HM	58819	68867	30974	16659	16770	640	10106	642	223951	236	3289	30

***** Primary Characterization Data *****

Pedon ID: S09AF015003

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Konar, Afghanistan)

Fine-loamy, mixed, superactive, thermic Aridic Calcixerolls

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; Pedon No. 09N0402

Clay Mineralogy (<.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
				X-Ray				Thermal				Elemental				EGME		Inter			
Layer	Depth (cm)	Horz	Fract	7A1a1												Retn	preta				
			ion	(----- peak size -----)				(- - - - % - - - -)				(- - - - % - - - -)								mg g ⁻¹	
09N02138	0.0-11.0	Ap	tcl	MI 3	CL 3																CMIX
09N02140	27.0-47.0	Btk1	tcl	MI 3	CL 2	MT 2	CA 1														CMIX
09N02141	47.0-72.0	Btk2	tcl	MI 3	CL 3	CA 3	MT 2														CMIX
09N02143	104.0-150.0	B'k2	tcl	CA 3	MI 3	KK 3	VR 1														CMIX

FRACTION INTERPRETATION:

tcl - Total Clay <0.002 mm

MINERAL INTERPRETATION:

CA Calcite	CL Chlorite	KK Kaolinite	MI Mica	MT Montmorillonite
VR Vermiculite				

RELATIVE PEAK SIZE: 5 Very Large 4 Large 3 Medium 2 Small 1 Very Small 6 No Peaks

INTERPRETATION (BY HORIZON):

CMIX - Mixed Clay

***** Primary Characterization Data *****

Pedon ID: S09AF015003

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Konar, Afghanistan)

Fine-loamy, mixed, superactive, thermic Aridic Calcixerolls

Print Date: Jun 7 2017 2:53PM

; Pedon No. 09N0402

Sand - Silt Mineralogy (2.0-0.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
				X-Ray				Thermal				Optical								EGME	Inter
Depth		Fract										Grain Count								Retn	preta
Layer	(cm)	Horz	Fract	(----- peak size -----)				(----- % -----)				(----- % -----)				7B1a2				mg g ⁻¹	
09N02138	0.0-11.0	Ap	csi									52	QZ 49	FK 16	BT 12	MS 8	PR 7	HN 4			SMIX
													AR 2	GN 1	BY 1	CD 1	CL tr	FE tr			
													CA tr	MZ tr	OP tr	PO tr	TM tr	VM tr			
													ZR tr								
09N02140	27.0-47.0	Btk1	csi									48	QZ 47	BT 15	MS 12	FK 9	HN 4	PR 4			SMIX
													AR 2	CA 2	CB 2	FE 1	FP 1	GN tr			
													CL tr	BY tr	MZ tr	OP tr	PI tr	TM tr			
													VM tr	ZR tr							
09N02141	47.0-72.0	Btk2	csi									40	QZ 37	MS 13	CB 10	BT 8	CA 8	FK 7			SMIX
													HN 5	PR 5	FE 2	AR 2	FP 1	CD 1			
													CL tr	GN tr	BY tr	TM tr	LA tr	MZ tr			
													PO tr								
09N02143	104.0-150.0	B'k2	vfs									41	QZ 36	CA 12	FK 10	MS 10	AR 9	BT 8			SMIX

***** Primary Characterization Data *****

Pedon ID: S09AF015003

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USDA-NRCS-NSSC-Soil Survey Laboratory

(Konar, Afghanistan)

Fine-loamy, mixed, superactive, thermic Aridic Calcixerolls

Print Date: Jun 7 2017 2:53PM

; Pedon No. 09N0402

Sand - Silt Mineralogy (2.0-0.002 mm)			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-				
Layer	Depth (cm)	Horz Fract ion	X-Ray						Thermal						Optical						EGME	Inter pretation Retn		
															Grain Count									
															7B1a2									
			(----- peak size -----)						(- ----- % -----)						(- ----- % -----)						mg g ⁻¹			
															CB 5	HN 3	PR 2	CD 2	FE 2	FP 1				
															OP 1	PI tr	MZ tr	GN tr	BY tr					

FRACTION INTERPRETATION:

csi - Coarse Silt 0.02-0.05 mm vfs - Very Fine Sand 0.05-0.1 mm

MINERAL INTERPRETATION:

AR Weatherable Aggregates	BT Biotite	BY Beryl	CA Calcite	CB Carbonate Aggregates
CD Chert (Chalcedony)	CL Chlorite	FE Iron Oxides (Goethite)	FK Potassium Feldspar	FP Plagioclase Feldspar
GN Garnet	HN Hornblende	LA Lamprobolite	MS Muscovite	MZ Monazite
OP Opaques	PI Pyrite	PO Plant Opal	PR Pyroxene	QZ Quartz
TM Tourmaline	VM Vermiculite-Mica	ZR Zircon		

INTERPRETATION (BY HORIZON):

SMIX - Mixed Sand

***** Primary Characterization Data *****

(Konar, Afghanistan)

Pedon ID: S09AF015004

Print Date: Jun 7 2017 2:53PM

Sampled as on Jan 11, 2009: SND ; Fine-loamy, mixed, superactive, thermic Aridic Calcixerolls
 Revised to correlated on Jul 5, 2014: Calcixerolls ; Coarse-loamy, paramicaceous, active, thermic Aridic Calcixerolls

SSL - Project C2009AF06067 Afghanistan
 - Site ID S09AF015004 Lat: 34° 56' 47.30" north Long: 71° 2' 30.20" east
 - Pedon No. 09N0403
 - General Methods 1B1A, 2A1, 2B

United States Department of Agriculture
 Natural Resources Conservation Service
 National Soil Survey Center
 Kellogg Soil Survey Laboratory
 Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
09N02144	Ap	Ap	0-12	S09AF015004-1				SL
09N02145	Bk1	Bk1	12-38	S09AF015004-2				SL
09N02146	Bk2	Bk2	38-87	S09AF015004-3				FSL
09N02147	Btk1	Btk1	87-116	S09AF015004-4				L
09N02148	Btk2	Btk2	116-142	S09AF015004-5				SL

Pedon Calculations

Calculation Name	Result	Units of Measure
Weighted Particles, 0.1-75mm, 75 mm Base	62	% wt
Volume, >2mm, Weighted Average	4	% vol
Clay, total, Weighted Average	7	% wt
Clay, carbonate free, Weighted Average	7	% wt
CEC Activity, CEC7/Clay, Weighted Average, CECd, Set 1	0.59	(NA)

Weighted averages based on control section: 27-72 cm

PSDA & Rock Fragments				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-

***** Primary Characterization Data *****

Pedon ID: S09AF015004

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

Water Dispersible PSDA

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(----- Water Dispersible -----)

(--- Total ---) (--- Clay ---) (--- Silt ---) (--- Sand ---)

Clay Silt Sand F CO₃ F C VF F M C VC

< .002 .05 < < .002 .02 .05 .10 .25 .5 1

.002 -.05 -.2 .0002 .002 -.02 -.05 -.10 -.25 -.50 -.1 -.2

(--- % of <2mm ---)

3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a

Layer Depth (cm) Horz Prep 09N02144 0-12 Ap S 7.6 30.7 61.7 21.9 8.8 10.0 20.6 16.4 9.7 5.0

Bulk Density & Moisture -1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13-

(Bulk Density) Cole Water Content WRD Aggst (- Ratio/Clay -)

33 10 33 1500 1500 kPa kPa kPa kPa AD/OD cm³ cm⁻³ %

Dry Whole Soil (--- % of < 2mm ---)

kPa kPa DbWR1 3C2a1a 3D1 3F1a1a

(--- g cm⁻³ ---) (--- % of < 2mm ---)

DbWR1 DbWR1

09N02144 0-12 Ap S 1.66 1.66 -- 8.0 3.5 1.008 14 0.69 0.34
 09N02145 12-38 Bk1 S 1.66 1.66 0.002 8.9 0.7 1.005 0.11 0.69 0.11
 09N02146 38-87 Bk2 S 1.50 1.51 0.002 8.9 0.9 1.005 0.12 0.56 0.14
 09N02147 87-116 Btk1 S 1.60 1.65 0.010 17.4 8.2 1.014 0.14 0.49 0.45
 09N02148 116-142 Btk2 S 1.61 1.65 0.008 12.1 5.1 1.010 0.11 0.53 0.43

Water Content -1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13-

(-- Atterberg --) (--- Bulk Density ---) (--- Water Content ---)

(-- Limits --) Field Recon Recon Field Recon Sieved Samples

LL PI 33 10 33 10 33 100 200 500

kPa kPa kPa kPa kPa kPa kPa kPa

Layer Depth (cm) Horz Prep 09N02144 0-12 Ap S NP 1.41 1.45 20.2
 09N02146 38-87 Bk2 S NP
 09N02148 116-142 Btk2 S NP

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***** Primary Characterization Data *****

Pedon ID: S09AF015004

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Konar, Afghanistan)

Fine-loamy, mixed, superactive, thermic Aridic Calcixerolls

Print Date: Jun 7 2017 2:53PM

; Pedon No. 09N0403

Carbon & Extractions				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-
Layer	Depth (cm)	Horz	Prep	(---- Total ----) C N S			Est OC	OC (WB)	C/N Ratio	(--- Dith-Cit Ext ---) Fe Al Mn			(---- Ammonium Oxalate Extraction ----) Al+½Fe ODOE Fe Al Si Mn			(--- Na Pyro-Phosphate ---) C Fe Al Mn						
				(% of <2 mm -----)			(% of <2 mm -----)			(% of <2 mm -----)			mg kg⁻¹ (% of <2mm -----)									
				4H2a	4H2a	4H2a				4G1	4G1	4G1										
09N02144	0-12	Ap	S	1.60	0.14	0.01	1.2		9	0.4	tr	tr										
09N02145	12-38	Bk1	S	0.67	0.05	tr	0.5		10	0.3	--	--										
09N02146	38-87	Bk2	S	0.62	0.02	tr	0.4		18	0.3	tr	--										
09N02147	87-116	Btk1	S	1.10	0.07	tr	0.4		6	0.9	0.1	0.1										
09N02148	116-142	Btk2	S	0.59	0.01	tr	0.4		45	0.6	tr	tr										

CEC & Bases				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-				
Layer	Depth (cm)	Horz	Prep	(---- NH₄OAC Extractable Bases ----)								CEC8	CEC7	ECEC	(---- Base ----)						
				Ca	Mg	Na	K	Sum Bases	Acid-ity	Extr Al	KCl Mn	Sum Cats	NH₄OAC	Bases +Al	Al Sat	Sum	NH₄OAC	(- Saturation -)			
				(----- cmol(+) kg⁻¹ -----)	4B1a1a	4B1a1a	4B1a1a	4B1a1a	(----- cmol(+) kg⁻¹ -----)	4B2b1a1	mg kg⁻¹	(----- cmol(+) kg⁻¹ -----)	4B1a1a	(----- % -----)	(----- % -----)						
09N02144	0-12	Ap	S	38.1*	1.2	tr	0.7	40.0	0.5					7.1					100		
09N02145	12-38	Bk1	S	23.5*	0.7	tr	0.3	24.5						4.4					100		
09N02146	38-87	Bk2	S	32.4*	0.6	tr	0.2	33.2						3.7					100		
09N02147	87-116	Btk1	S	47.1*	1.2	0.1	0.3	48.7						8.9					100		
09N02148	116-142	Btk2	S	37.3*	1.0	0.1	0.2	38.6						6.3					100		

*Extractable Ca may contain Ca from calcium carbonate or gypsum., CEC7 base saturation set to 100.

Salt				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
Layer	Depth (cm)	Horz	Prep	(---- Water Extracted From Saturated Paste -----)															1:2				
				Ca	Mg	Na	K	CO ₃	HCO ₃	F	Cl	PO ₄	Br	OAC	SO ₄	NO ₂	NO ₃	H ₂ O	Total Salts	Elec Cond	Elec Cond	Exch Na	SAR
				(----- mmol(+) L⁻¹ -----)	(----- mmol(+) L⁻¹ -----)	(----- mmol(+) L⁻¹ -----)	(----- mmol(+) L⁻¹ -----)	(----- mmol(+) L⁻¹ -----)	(----- mmol(+) L⁻¹ -----)	(----- mmol(+) L⁻¹ -----)	(----- mmol(+) L⁻¹ -----)	(----- mmol(+) L⁻¹ -----)	(----- mmol(+) L⁻¹ -----)	(----- mmol(+) L⁻¹ -----)	(----- mmol(+) L⁻¹ -----)	(----- mmol(+) L⁻¹ -----)	(----- % -----)	(----- dS m⁻¹ -----)	(----- % -----)		4F1a1a1		
09N02144	0-12	Ap	S																0.22	1			
09N02145	12-38	Bk1	S																0.17	1			
09N02146	38-87	Bk2	S																0.12	1			
09N02147	87-116	Btk1	S																0.19	1			
09N02148	116-142	Btk2	S																0.12	1			

***** Primary Characterization Data *****

Pedon ID: S09AF015004

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Konar, Afghanistan)

Fine-loamy, mixed, superactive, thermic Aridic Calcixerolls

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; Pedon No. 09N0403

pH & Carbonates

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11-

(----- pH -----) (-- Carbonate --) (-- Gypsum --)
CaCl₂ As CaCO₃ As CaSO₄·2H₂O Resist
0.01M H₂O Sat <2mm <20mm <2mm <20mm ohms
Layer Depth Horz Prep KCl 1:2 1:1 Paste Oxid NaF (%) cm⁻¹
(cm) 4C1a2a 4C1a2a 4C1a1a14E1a1a1a1

09N02144	0-12	Ap	S	7.6	8.2		9.9	4
09N02145	12-38	Bk1	S	7.6	8.2		9.5	1
09N02146	38-87	Bk2	S	7.7	8.3		9.9	2
09N02147	87-116	Btk1	S	7.6	8.2		10.2	6
09N02148	116-142	Btk2	S	7.7	8.3		9.5	2

Phosphorous

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(----- Phosphorous -----) KCl
Melanic NZ Acid Anion Exch Resin Bray Bray Olsen H₂O Citric Mehlich Extr
Index Oxal Available Capacity 1 2 Acid III NO₃
Layer Depth Horz Prep % (-) mg kg⁻¹ (-)
(cm) 4D1a1a1a 4D5a1 4D2a1b1 4D6a1 4D9a1a

09N02144	0-12	Ap	S	12.8	23.4	9.0	0.3	41.1	18.31
09N02145	12-38	Bk1	S	2.7	6.2	1.7	0.2	32.6	21.42
09N02146	38-87	Bk2	S	3.1	5.5	1.2	0.2	12.4	8.07
09N02147	87-116	Btk1	S	2.5	5.3	2.6	0.1	2.4	
09N02148	116-142	Btk2	S	2.4	5.6	1.4	0.1	3.6	

Phosphorous

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(----- Phosphorous -----) KCl
Melanic NZ Acid Anion Exch Resin Bray Bray Olsen H₂O Citric Mehlich Extr
Index Oxal Available Capacity 1 2 Acid III NO₃
Layer Depth Horz Prep % (-) mg kg⁻¹ (-)
(cm) 4D6b

09N02144	0-12	Ap	S				46.4		
09N02145	12-38	Bk1	S				30.7		
09N02146	38-87	Bk2	S				13.7		

***** Primary Characterization Data *****

(Konar, Afghanistan)

Pedon ID: S09AF015004

Print Date: Jun 7 2017 2:53PM

Sampled As : SND

Fine-loamy, mixed, superactive, thermic Aridic Calcixerolls

USDA-NRCS-NSSC-Soil Survey Laboratory

; Pedon No. 09N0403

Major Elements				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Al mg/kg 4H1b	Ca mg/kg 4H1b	Fe mg/kg 4H1b	K mg/kg 4H1b	Mg mg/kg 4H1b	Mn mg/kg 4H1b	Na mg/kg 4H1b	P mg/kg 4H1b	Si mg/kg 4H1b	Sr mg/kg 4H1b	Ti mg/kg 4H1b	Zr mg/kg 4H1b
09N02144	0-12	Ap	HM	65638	20629	33354	19681	11402	849	14210	991	267248	161	3829	22
09N02145	12-38	Bk1	HM	65961	14521	30935	19142	10564	786	16397	924	276487	164	3771	19
09N02146	38-87	Bk2	HM	66872	16488	31048	19423	10581	789	17149	902	286410	171	3895	20
09N02147	87-116	Btk1	HM	72029	25694	42364	23099	13258	1241	12287	808	256087	151	4502	27
09N02148	116-142	Btk2	HM	68357	14329	35317	20231	11098	867	14574	747	278901	160	4140	26

Pedon ID: S09AF015004

Sampled As : SND
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*** Primary Characterization Data ***

(Konar, Afghanistan)

Fine-loamy, mixed, superactive, thermic Aridic Calcixerolls

Print Date: Jun 7 2017 2:53PM

FRACTION INTERPRETATION:

tcly - Total Clay <0.002 mm

MINERAL INTERPRETATION:

CA Calcite CL Chlorite KK Kaolinite MI Mica VR Vermiculite

RELATIVE PEAK SIZE: 5 Very Large 4 Large 3 Medium 2 Small 1 Very Small 6 No Peaks

INTERPRETATION (BY HORIZON):

CMIX - Mixed Clay

*** Primary Characterization Data ***

Pedon ID: S09AF015004

Sampled As : SND
USDA-NRCS-NSSC-Soil Survey Laboratory

(Konar, Afghanistan)
Fine-loamy, mixed, superactive, thermic Aridic Calcixerolls
; Pedon No. 09N0403

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Sand - Silt Mineralogy (2.0-0.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-		
				X-Ray				Thermal				Optical				EGME		Interpretation					
Depth		Fract		Tot Re												Grain Count				Retn			
Layer	(cm)	Horz	Fract	(-----peak size-----)	(-----% -----)</th <th>(-----)</th> <th>mg g⁻¹</th> <th>MICA</th>	(-----)	(-----)	(-----)	(-----)	(-----)	(-----)	(-----)	(-----)	(-----)	(-----)	(-----)	(-----)	(-----)	(-----)	mg g ⁻¹	MICA		
09N02144	0.0-12.0	Ap	fs													13	BT 61	MS 12	QZ 11	FK 10	PR 3	OP 1	
																FE 1	FP tr	GN tr	HN tr	AR tr	TM tr		
09N02146	38.0-87.0	Bk2	fs													29	BT 31	QZ 28	FK 19	MS 17	PR 3	FE 1	PMIC
																OP tr	GN tr	CB tr	TM tr				
09N02148	116.0-142.0	Btk2	fs													17	BT 54	MS 16	QZ 16	FK 10	PR 2	GN 1	PMIC
																OP tr	TM tr	VM tr					

FRACTION INTERPRETATION:

fs - Fine Sand 0.1-0.25 mm

MINERAL INTERPRETATION:

AR Weatherable Aggregates	BT Biotite	CB Carbonate Aggregates	FE Iron Oxides (Goethite)	FK Potassium Feldspar
FP Plagioclase Feldspar	GN Garnet	HN Hornblende	MS Muscovite	OP Opaques
PR Pyroxene	QZ Quartz	TM Tourmaline	VM Vermiculite-Mica	

INTERPRETATION (BY HORIZON):

MICA - Micaceous

***** Primary Characterization Data *****

(Konar, Afghanistan)

Pedon ID: S09AF015005

Print Date: Jun 7 2017 2:53PM

Sampled as on Jan 11, 2009: SND ; Fine, mixed, superactive, thermic Aridic Argixerolls
 Revised to correlated on Jan 16, 2017: Haploxerolls ; Fine-loamy, mixed, active, thermic Oxyaqua Haploxerolls

SSL - Project C2009AF06067 Afghanistan
 - Site ID S09AF015005 Lat: 34° 55' 24.80" north Long: 71° 5' 22.80" east
 - Pedon No. 09N0404
 - General Methods 1B1A, 2A1, 2B

United States Department of Agriculture
 Natural Resources Conservation Service
 National Soil Survey Center
 Kellogg Soil Survey Laboratory
 Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
09N02149	Ap	Ap	0-7	S09AF015005-1				L
09N02150	Bt1	Bt1	7-42	S09AF015005-2				L
09N02151	Bt2	Bt2	42-62	S09AF015005-3				L
09N02152	Bt3	Bt3	62-100	S09AF015005-4				SIL

Calculation Name	Pedon Calculations			Result	Units of Measure
Weighted Particles, 0.1-75mm, 75 mm Base		25		% wt	
Volume, >2mm, Weighted Average		2		% vol	
Clay, total, Weighted Average		20		% wt	
Clay, carbonate free, Weighted Average		20		% wt	
CEC Activity, CEC7/Clay, Weighted Average, CECd, Set 1		0.54		(NA)	
LE, Whole Soil, Summed to 1m		1		cm/m	

Weighted averages based on control section: 7-57 cm

PSDA & Rock Fragments				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
				Lab Text- ure	(- - - - Total - - - -)			(- - Clay - - - -)			(- - - Silt - - - -)			(- - - - Sand - - - -)			(- - - Rock Fragments (mm) - - - -)				
					Clay	Silt	Sand	Fine	CO ₃	Fine	Coarse	VF	F	M	C	VC	(- - - - Weight - - - -)				
					<	.002	.05	<	<	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	
					.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	
Layer	Depth (cm)	Horz	Prep					(- - - - % of <2mm Mineral Soil - - - -)				(- - - - % of <75mm - - - -)				(- - - - % of <75mm - - - -)					
								3A1a1a				3A1a1a 3A1a1a 3A1a1a				3A1a1a 3A1a1a 3A1a1a 3A1a1a					
09N02149	0-7	Ap	S	I	19.9	46.5	33.6	7.9	0.2	33.3	13.2	10.8	12.9	6.8	2.4	0.7	1	tr	--	24	1
09N02150	7-42	Bt1	S	I	19.8	47.9	32.3	7.3	--	34.9	13.0	10.8	12.5	6.5	1.9	0.6	3	1	--	25	4
09N02151	42-62	Bt2	S	I	20.2	44.5	35.3	7.3		33.2	11.3	11.1	13.3	7.6	2.6	0.7	1	tr	--	25	1
09N02152	62-100	Bt3	S	sil	23.3	52.3	24.4	8.5		38.4	13.9	8.6	8.8	4.2	2.0	0.8	8	--	--	23	8

***** Primary Characterization Data *****

(Konar, Afghanistan)

Pedon ID: S09AF015005

Print Date: Jun 7 2017 2:53PM

Sampled As : SND

Fine, mixed, superactive, thermic Aridic Argixerolls

USDA-NRCS-NSSC-Soil Survey Laboratory

; Pedon No. 09N0404

Water Dispersible PSDA

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(- - - Water Dispersible - - -)

(- - - Total - - -) (- - Clay - - -) (- - - Silt - - -) (- - - Sand - - -)

Clay Silt Sand F CO₃ F C VF F M C VC

< .002 .05 < < .002 .02 .05 .10 .25 .5 1

.002 -.05 -2 .0002 .002 -.02 -.05 -.10 -.25 -.50 -1 -2

Layer	Depth (cm)	Horz	Prep	(- - - % of <2mm - - -)											
				3A1a6a			3A1a6a			3A1a6a			3A1a6a		

09N02149	0-7	Ap	S	11.9	53.9	34.2	40.7	13.2	10.6	12.9	6.9	2.9	0.9
----------	-----	----	---	------	------	------	------	------	------	------	-----	-----	-----

Bulk Density & Moisture

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13-

(Bulk Density) Cole (- - - Water Content - - -)

33 10 33 1500 1500 kPa Ratio

kPa kPa kPa kPa AD/OD

(- - - g cm⁻³ - - -) % of < 2mm (- - - % of < 2mm - - -)

DbWR1 DbWR1 DbWR1 3C2a1a 3D1

(- - - cm³ cm⁻³ % - - -) 3F1a1a

09N02149	0-7	Ap	S	1.53	1.59	0.013	24.5	9.3	1.013	0.23	1	0.59	0.47
09N02150	7-42	Bt1	S	1.47	1.54	0.015	24.0	8.3	1.015	0.23		0.59	0.42
09N02151	42-62	Bt2	S	1.52	1.59	0.015	21.4	2.6	1.012	0.28		0.44	0.13
09N02152	62-100	Bt3	S	1.55	1.62	0.014	21.9	7.4	1.015	0.21		0.43	0.32

Water Content

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13-

(- - Atterberg - -) (- - - Bulk Density - - -) (- - - Water Content - - -)

(- - - Limits - -) Field Recon Recon Field Recon (- - - Sieved Samples - - -)

LL PI 33 Oven 33 10 33 100 200 500

kPa kPa Dry kPa kPa kPa kPa kPa kPa

(- - - g cm⁻³ - - -) (- - - % of < 2mm - - -)

3B2 3B2 3B2

09N02149	0-7	Ap	S	38	14	1.32	1.41	28.3					
09N02150	7-42	Bt1	S	38	15								
09N02152	62-100	Bt3	S	34	13								

***** Primary Characterization Data *****

Pedon ID: S09AF015005

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Konar, Afghanistan)

Fine, mixed, superactive, thermic Aridic Argixerolls

Print Date: Jun 7 2017 2:53PM

; Pedon No. 09N0404

Carbon & Extractions				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-		
Depth				(----- Total -----)	C	N	S	Est OC	OC (WB)	C/N Ratio	(--- Dith-Cit Ext ---)	Fe	Al	Mn	(---- Ammonium Oxalate Extraction ----)	Al+1/2Fe ODOE Fe	Al	Si	Mn	(--- Na Pyro-Phosphate ---)	C	Fe	Al	Mn
Layer	Depth (cm)	Horz	Prep	(----- % of <2 mm -----)	(----- % of <2 mm -----)	(----- % of <2 mm -----)	(----- % of <2 mm -----)	mg kg ⁻¹	(----- % of <2 mm -----)	(----- % of <2 mm -----)	(----- % of <2 mm -----)													
09N02149	0-7	Ap	S	1.64	0.16	0.01	1.6	10	0.9	0.1	tr													
09N02150	7-42	Bt1	S	1.43	0.09	tr	1.4	16	0.9	0.1	tr													
09N02151	42-62	Bt2	S	0.94	0.05	--	1.0	18	1.1	0.1	tr													
09N02152	62-100	Bt3	S	0.75	0.04	tr	0.8	18	1.2	0.1	tr													

CEC & Bases				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-							
Depth				(----- NH ₄ OAC Extractable Bases -----)												CEC8 CEC7 ECEC				(----- Base -----)				
Layer	Depth (cm)	Horz	Prep	Ca	Mg	Na	K	Sum Bases	Acid-ity	Extr Al	KCl Mn	Sum NH ₄ Bases	OAC +Al	Al Sat	Sum NH ₄ OAC	(----- cmol(+) kg ⁻¹ -----)	(----- cmol(+) kg ⁻¹ -----)	(----- % -----)	(----- % -----)	(----- cmol(+) kg ⁻¹ -----)	(----- % -----)	(----- cmol(+) kg ⁻¹ -----)	(----- % -----)	
09N02149	0-7	Ap	S	17.5*	1.5	0.7	0.4	20.1	2.2							11.8							100	
09N02150	7-42	Bt1	S	12.7*	1.4	0.2	0.2	14.5	3.0							17.5	11.6						83	100
09N02151	42-62	Bt2	S	8.7*	1.0	0.2	0.2	10.1	2.2							12.3	8.8						82	100
09N02152	62-100	Bt3	S	11.3*	1.5	0.3	0.2	13.3	2.3							15.6	10.0						85	100

*Extractable Ca may contain Ca from calcium carbonate or gypsum., CEC7 base saturation set to 100.

Salt				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
Depth				(----- Water Extracted From Saturated Paste -----)																		1:2	
Layer	Depth (cm)	Horz	Prep	Ca	Mg	Na	K	CO ₃	HCO ₃	F	Cl	PO ₄	Br	OAC	SO ₄	NO ₂	NO ₃	H ₂ O	Total Salts	Elec Cond	Elec Cond	Exch Na	SAR
09N02149	0-7	Ap	S	5.2	0.8	0.7	0.2	--	3.1	0.1	0.9	--	--	--	1.5	0.6	1.9	60.3	tr	0.72	0.37	5	tr
09N02150	7-42	Bt1	S																	0.20	2		
09N02151	42-62	Bt2	S																	0.09	2		
09N02152	62-100	Bt3	S																	0.08	3		

***** Primary Characterization Data *****

Pedon ID: S09AF015005

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Konar, Afghanistan)

Fine, mixed, superactive, thermic Aridic Argixerolls

Print Date: Jun 7 2017 2:53PM

; Pedon No. 09N0404

pH & Carbonates			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-
Layer	Depth (cm)	Horz	(----- pH -----)							(- - - Carbonate - - -) As CaCO ₃		(- - - Gypsum - - -) As CaSO ₄ ·2H ₂ O Resist	
			Prep	KCl	CaCl ₂	0.01M	H ₂ O	Sat	Oxid	NaF	<2mm	<20mm	ohms
					1:2	1:1	Paste			4C1a1a14E1a1a1a1	(----- % -----)	cm ⁻¹	
09N02149	0-7	Ap	S		7.4	7.9	7.5			9.0	tr		
09N02150	7-42	Bt1	S		6.9	7.6				8.7			
09N02151	42-62	Bt2	S		7.1	8.0				8.9	--		
09N02152	62-100	Bt3	S		7.4	8.2				9.4	--		

Phosphorous			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-		
Layer	Depth (cm)	Horz	(----- Phosphorous -----)											KCl		
			Prep	Melanic	NZ	Acid	Anion	Exch	Resin	Bray	Bray	Olsen	H ₂ O	Citric	Mehllich	Extr
				Index		Oxal	Available	Capacity	1	2			Acid	III	NO ₃	
09N02149	0-7	Ap	S			15.3	37.5			19.2	0.2		32.2	47.12		
09N02150	7-42	Bt1	S			2.3	11.1			2.1	tr		4.6	26.61		
09N02151	42-62	Bt2	S			1.1	2.5			2.2	0.1		0.8	5.09		
09N02152	62-100	Bt3	S							2.7	0.1		1.6			

Phosphorous			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-		
Layer	Depth (cm)	Horz	(----- Phosphorous -----)											KCl		
			Prep	Melanic	NZ	Acid	Anion	Exch	Resin	Bray	Bray	Olsen	H ₂ O	Citric	Mehllich	Extr
				Index		Oxal	Available	Capacity	1	2			Acid	III	NO ₃	
09N02149	0-7	Ap	S										37.5			
09N02150	7-42	Bt1	S										8.0			
09N02151	42-62	Bt2	S										1.8			

***** Primary Characterization Data *****

(Konar, Afghanistan)

Pedon ID: S09AF015005

Print Date: Jun 7 2017 2:53PM

Sampled As : SND

Fine, mixed, superactive, thermic Aridic Argixerolls

USDA-NRCS-NSSC-Soil Survey Laboratory

; Pedon No. 09N0404

Major Elements				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Al mg/kg 4H1b	Ca mg/kg 4H1b	Fe mg/kg 4H1b	K mg/kg 4H1b	Mg mg/kg 4H1b	Mn mg/kg 4H1b	Na mg/kg 4H1b	P mg/kg 4H1b	Si mg/kg 4H1b	Sr mg/kg 4H1b	Ti mg/kg 4H1b	Zr mg/kg 4H1b
09N02149	0-7	Ap	HM	77938	7936	43474	24706	12498	646	9857	580	258888	102	4765	28
09N02150	7-42	Bt1	HM	76058	6561	43623	24209	12232	650	9739	487	253126	91	4844	30
09N02151	42-62	Bt2	HM	78136	5812	44614	23016	12053	731	10091	399	262040	92	4750	23
09N02152	62-100	Bt3	HM	80645	6068	45677	23497	12921	782	9046	426	254902	89	4931	39

*** Primary Characterization Data ***

Pedon ID: S09AF015005

Sampled As : SND
USDA-NRCS-NSSC-Soil Survey Laboratory

(Konar, Afghanistan)
Fine, mixed, superactive, thermic Aridic Argixerolls
Pedon No. 09N0404

Print Date: Jun 7 2017 2:53PM

Clay Mineralogy (<.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-							
				X-Ray								Thermal								Elemental		EGME		Interpretation				
																				SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	Na ₂ O	Retn	
Depth				Fract				7A1a1				7A2a																
Layer	(cm)	Horz		ion	(----- peak size -----)				(- - - - % - - - - -)				(- - - - % - - - - -)				mg g ⁻¹											
09N02149	0.0-7.0	Ap		tcly	MI 4	KK 3	VR 2					KK 68										CMIX						
09N02150	7.0-42.0	Bt1		tcly	MI 4	KK 3	VR 2					KK 30										CMIX						
09N02152	62.0-100.0	Bt3		tcly	MI 3	KK 3	VR 2					KK 27										CMIX						

FRACTION INTERPRETATION:

tcly - Total Clay <0.002 mm

MINERAL INTERPRETATION:

KK Kaolinite MI Mica

VR Vermiculite

RELATIVE PEAK SIZE:

INTERPRETATION

5 Very Large

3 Medium

INTERPRETATION (BY HORIZON)

CMI λ - Mixed Clay

***** Primary Characterization Data *****

(Konar, Afghanistan)

Pedon ID: S09AF015005

Print Date: Jun 7 2017 2:53PM

Sampled As : SND
USDA-NRCS-NSSC-Soil Survey Laboratory

Fine, mixed, superactive, thermic Aridic Argixerolls
; Pedon No. 09N0404

Sand - Silt Mineralogy (2.0-0.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
				X-Ray				Thermal				Optical								EGME	Inter
Depth		Fract										Grain Count								Retn	preta
Layer	(cm)	Horz	Fract	(----- peak size -----)				(----- % -----)				(----- % -----)				7B1a2				mg g ⁻¹	
09N02149	0.0-7.0	Ap	csi									30	BT 22	QZ 22	HN 19	MS 18	FK 7	OP 4			SMIX
													AR 3	PO 2	PR 2	FE 1	GN 1	ZR tr			
													BY tr								
09N02150	7.0-42.0	Bt1	csi									29	QZ 26	BT 19	MS 17	HN 16	FK 13	AR 2			SMIX
													PO 2	PR 2	OP 1	GN tr	FE tr	SS tr			
													ZE tr								
09N02152	62.0-100.0	Bt3	csi									30	QZ 27	BT 25	MS 18	HN 16	FK 7	AR 2			SMIX
													PR 2	OP 2	FE 1	FP 1	GN tr	GS tr			
													BY tr				ZR tr				

FRACTION INTERPRETATION:

csi - Coarse Silt 0.02-0.05 mm

MINERAL INTERPRETATION:

AR Weatherable Aggregates	BT Biotite	BY Beryl	FE Iron Oxides (Goethite)	FK Potassium Feldspar
FP Plagioclase Feldspar	GN Garnet	GS Glass	HN Hornblende	MS Muscovite
OP Opaques	PO Plant Opal	PR Pyroxene	QZ Quartz	SS Sponge Spicule
ZE Zeolite	ZR Zircon			

*** Primary Characterization Data ***

Pedon ID: S09AF015005
Sampled As : SND
USDA-NRCS-NSSC-Soil Survey Laboratory

(Konar, Afghanistan)
Fine, mixed, superactive, thermic Aridic Argixerolls
; Pedon No. 09N0404

Print Date: Jun 7 2017 2:53PM

INTERPRETATION (BY HORIZON):

SMIX - Mixed Sand

***** Primary Characterization Data *****

(Konar, Afghanistan)

Pedon ID: S09AF015006

Print Date: Jun 7 2017 2:53PM

Sampled as on Jan 14, 2009: SND ; Fine, mixed, superactive, thermic Vertic Argixerolls
 Revised to correlated on Jan 16, 2017: Argixerolls ; Fine-loamy, mixed, active, thermic Oxyaquaic Argixerolls

SSL - Project C2009AF06067 Afghanistan
 - Site ID S09AF015006 Lat: 34° 52' 22.30" north Long: 71° 9' 23.30" east
 - Pedon No. 09N0405
 - General Methods 1B1A, 2A1, 2B

United States Department of Agriculture
 Natural Resources Conservation Service
 National Soil Survey Center
 Kellogg Soil Survey Laboratory
 Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
09N02153	Ap	Ap	0-15	S09AF015006-1				L
09N02154	2Bt1	2Bt1	15-34	S09AF015006-2				L
09N02155	2Bt2	2Bt2	34-71	S09AF015006-3				L
09N02156	2Bt3	2Bt3	71-110	S09AF015006-4				SIL
09N02157	2Bt4	2Bt4	110-150	S09AF015006-5				SIL

Pedon Calculations

Calculation Name	Result	Units of Measure
Weighted Particles, 0.1-75mm, 75 mm Base	18	% wt
Volume, >2mm, Weighted Average	0	% vol
Clay, total, Weighted Average	19	% wt
Clay, carbonate free, Weighted Average	19	% wt
CEC Activity, CEC7/Clay, Weighted Average, CECd, Set 1	0.44	(NA)

Weighted averages based on control section: 34-84 cm

PSDA & Rock Fragments			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-			
Depth (cm)			Horz			Lab Text-ure			(----- Total -----)			(- Clay - - -)			(- - Silt - - -)			(- - - Sand - - -)			(Rock Fragments (mm))		
Layer			Prep			Clay Silt Sand			Fine CO ₃			Fine			Coarse VF			F M C VC			(- - - Weight - - -)		
																					>2 mm		
																					wt % whole soil		

***** Primary Characterization Data *****

Pedon ID: S09AF015006

Sampled As : SND

USDA-NRCS-NSSC-Soil Survey Laboratory

(Konar, Afghanistan)

Fine, mixed, superactive, thermic Vertic Argixerolls

Print Date: Jun 7 2017 2:53PM

Water Dispersible PSDA

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12-

(- - - Water Dispersible - - -)

(- - - Total - - -) (- - Clay - - -) (- - Silt - - -) (- - Sand - - -)

Clay F C VF F M C VC

< .002 .05 < < .002 .02 .05 .10 .25 .5 1

.002 -.05 -.2 .0002 .002 -.02 -.05 -.10 -.25 -.50 -.1 -.2

(- - - % of <2mm - - -)

3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a 3A1a6a

Layer Depth (cm) Horz Prep

09N02153 0-15 Ap S 8.5 51.2 40.3 33.1 18.1 20.3 15.4 3.3 0.8 0.5

Bulk Density & Moisture

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13-

(Bulk Density) Cole Water Content

33 10 33 1500 1500 kPa kPa kPa kPa kPa kPa

kPa kPa kPa kPa kPa kPa

(- - - % of < 2mm - - -)

DbWR1 3C2a1a 3D1

WRD Whole Aggst Stabl (- - Ratio/Clay - -)

kPa cm³ cm⁻³ % 2-0.5mm CEC7 1500 kPa

(- - g cm⁻³ - - -) DbWR1

(- - - % of < 2mm - - -)

3F1a1a

Layer Depth (cm) Horz Prep

09N02153 0-15 Ap S 1.45 1.50 0.011 20.0 2.5 1.014 13 0.68 0.15
09N02154 15-34 2Bt1 S 1.54 1.60 0.013 19.1 9.1 1.015 0.16 0.50 0.44
09N02155 34-71 2Bt2 S 1.49 1.57 0.018 21.5 10.1 1.013 0.17 0.44 0.46
09N02156 71-110 2Bt3 S 1.40 1.48 0.019 25.3 10.0 1.015 0.17 0.44 0.44
09N02157 110-150 2Bt4 S 34 11 1.20 1.25 28.2 0.21 0.50 0.42

Water Content

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13-

(- - Atterberg - - -) (- - Bulk Density - - -) (- - Water Content - - -)

(- - - Limits - - -) Field Recon Recon Field Recon Sieved Samples

LL PI 33 6 33 10 33 100

kPa kPa kPa kPa kPa kPa

(- - - g cm⁻³ - - -)

3B2 3B2 3B2

(- - - % of < 2mm - - -)

Layer Depth (cm) Horz Prep

09N02153 0-15 Ap S 34 11 1.20 1.25 28.2
09N02154 15-34 2Bt1 S 32 12
09N02156 71-110 2Bt3 S 32 12

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Carbon & Extractions				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-
Layer	Depth (cm)	Horz	Prep	(---- Total ----) C N S			Est OC	OC (WB)	C/N Ratio	(--- Dith-Cit Ext ---) Fe Al Mn			(---- Ammonium Oxalate Extraction ----) Al+1/2Fe ODOE Fe Al Si Mn			(--- Na Pyro-Phosphate ---) C Fe Al Mn						
				(% of <2 mm -----)			(% of <2 mm -----)			(% of <2 mm -----)			mg kg ⁻¹ (% of <2mm -----)									
				4H2a	4H2a	4H2a				4G1	4G1	4G1										
09N02153	0-15	Ap	S	1.64	0.16	0.01	1.6		10	0.9	0.1	tr										
09N02154	15-34	2Bt1	S	0.87	0.05	tr	0.9		15	1.1	0.1	tr										
09N02155	34-71	2Bt2	S	0.49	0.02	--	0.5		22	1.0	0.1	tr										
09N02156	71-110	2Bt3	S	0.43	0.02	tr	0.4		23	1.3	0.1	tr										
09N02157	110-150	2Bt4	S	0.51	0.03	0.01	0.5		19	1.4	0.1	tr										

CEC & Bases				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-
Layer	Depth (cm)	Horz	Prep	(---- NH ₄ OAC Extractable Bases ----)								CEC8	CEC7	ECEC	(---- Base ----)		
				Ca	Mg	Na	K	Sum Bases	Acid-ity	Extr Al	KCl Mn	Sum NH ₄ OAC	Bases +Al	Al Sat	Sum NH ₄ OAC	(- Saturation -)	
				(---- cmol(+) kg ⁻¹ ----)	(---- 4B1a1a ----)	(---- 4B1a1a ----)	(---- 4B1a1a ----)	(---- 4B2b1a1 ----)	(---- mg kg ⁻¹ ----)	(---- 4B2b1a1 ----)	(---- cmol(+) kg ⁻¹ ----)	(---- 4B1a1a ----)	(---- % ----)	(---- % ----)	(---- % ----)		
09N02153	0-15	Ap	S	15.4*	1.4	0.1	1.1	18.0	2.9			11.5				100	
09N02154	15-34	2Bt1	S	11.8*	1.2	0.1	0.2	13.3	2.6			10.2				100	
09N02155	34-71	2Bt2	S	8.0*	0.9	0.2	0.3	9.4	2.8			12.2	7.7			77	100
09N02156	71-110	2Bt3	S	9.9*	1.2	0.2	0.2	11.5	3.2			14.7	10.0			78	100
09N02157	110-150	2Bt4	S	13.0*	1.6	0.2	0.3	15.1	4.2			19.3	11.8			78	100

*Extractable Ca may contain Ca from calcium carbonate or gypsum., CEC7 base saturation set to 100.

Salt				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
Layer	Depth (cm)	Horz	Prep	(---- Water Extracted From Saturated Paste ----)													1:2	Exch Na SAR					
				Ca	Mg	Na	K	CO ₃	HCO ₃	F	Cl	PO ₄	Br	OAC	SO ₄	NO ₂	NO ₃	H ₂ O	Total Salts	Elec Cond	Elec Cond		
				(---- mmol(+) L ⁻¹ ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- 4F2 ----)	(---- % ----)	(---- dS m ⁻¹ ----)	(---- 4F2 ----)	(---- 4F1a1a1 ----)	%	
09N02153	0-15	Ap	S																	0.20	1		
09N02154	15-34	2Bt1	S																	0.11	1		
09N02155	34-71	2Bt2	S																	0.06	2		
09N02156	71-110	2Bt3	S																	0.24	2		
09N02157	110-150	2Bt4	S	5.4	1.0	1.2	0.2	--	tr	--	3.0	tr	--	--	4.4	--	tr	60.9	tr	0.82	0.33	1	1

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pH & Carbonates				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-
Layer	Depth (cm)	Horz	Prep	(----- pH -----)				(- - - Carbonate - - -)		(- - - Gypsum - - -)		Resist ohms		
				CaCl ₂	0.01M	H ₂ O	Sat	As CaCO ₃	As CaSO ₄ ·2H ₂ O					
				1:2	1:1	Paste	Oxid	<2mm	<20mm	<2mm	<20mm		cm ⁻¹	
09N02153	0-15	Ap	S	7.2	8.0			9.1	tr					
09N02154	15-34	2Bt1	S	7.1	7.9			9.1	tr					
09N02155	34-71	2Bt2	S	6.9	7.8			9.3						
09N02156	71-110	2Bt3	S	6.6	7.1			9.3						
09N02157	110-150	2Bt4	S	6.5	7.0	6.5		9.2						

Phosphorous				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	(----- Phosphorous -----)				(----- Phosphorous -----)				KCl			
				Melanic Index	NZ	Acid Oxal	Anion Available	Exch Capacity	Bray 1	Bray 2	Olsen	H ₂ O	Citric Acid	Mehlich III	Extr NO ₃
				%	(-----	mg kg ⁻¹	(-----	mg kg ⁻¹	4D1a1a1a	4D5a1	4D2a1b1	4D6a1	4D9a1a)	
09N02153	0-15	Ap	S			12.7	30.8		9.1	0.1		26.7	3.59		
09N02154	15-34	2Bt1	S			4.7	13.3		5.2	0.1		8.9	3.04		
09N02155	34-71	2Bt2	S			2.0	6.3		3.3	0.1		4.2	1.57		
09N02156	71-110	2Bt3	S						4.7	tr		3.7	0.52		
09N02157	110-150	2Bt4	S						7.0	tr		5.0			

Phosphorous				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	(----- Phosphorous -----)				(----- Phosphorous -----)				KCl			
				Melanic Index	NZ	Acid Oxal	Anion Available	Exch Capacity	Bray 1	Bray 2	Olsen	H ₂ O	Citric Acid	Mehlich III	Extr NO ₃
				%	(-----	mg kg ⁻¹	(-----	mg kg ⁻¹	4D6b)
09N02153	0-15	Ap	S									29.8			
09N02154	15-34	2Bt1	S									10.6			
09N02155	34-71	2Bt2	S									5.8			

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Major Elements				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Al mg/kg 4H1b	Ca mg/kg 4H1b	Fe mg/kg 4H1b	K mg/kg 4H1b	Mg mg/kg 4H1b	Mn mg/kg 4H1b	Na mg/kg 4H1b	P mg/kg 4H1b	Si mg/kg 4H1b	Sr mg/kg 4H1b	Ti mg/kg 4H1b	Zr mg/kg 4H1b
09N02153	0-15	Ap	HM	75846	13227	41499	22233	13171	824	11300	702	255857	126	4543	27
09N02154	15-34	2Bt1	HM	79178	11410	42618	22113	13099	823	10730	568	255606	116	4507	28
09N02155	34-71	2Bt2	HM	78661	10829	42487	22114	13148	674	10846	538	258066	115	4649	30
09N02156	71-110	2Bt3	HM	79312	9512	44818	22587	13493	782	9791	417	253618	107	4717	39
09N02157	110-150	2Bt4	HM	81640	8862	45677	24435	13934	773	9297	534	248659	103	4720	42

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Clay Mineralogy (<.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
				X-Ray				Thermal				Elemental						EGME	Inter		
												SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	Na ₂ O	Retn	preta	
Depth				Fract				7A1a1				7A2a									
Layer	(cm)	Horz	ion	(----- peak size -----)				(- - - - % - - - -)				(- - - - % - - - -)				mg g ⁻¹					
09N02154	15.0-34.0	2Bt1	tclv	VR 3	KK 3							KK 43							CMIX		
09N02156	71.0-110.0	2Bt3	tclv	MI 3	VR 2	KK 2						KK 34							CMIX		

FRACTION INTERPRETATION:

tcly - Total Clay <0.002 mm

MINERAL INTERPRETATION:

KK Kaolinite MI Mica

VR Vermiculite

RELATIVE PEAK SIZE:

INTERPRETATION (BY)

CMIX - Mixed Clay

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Sand - Silt Mineralogy (2.0-0.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
				X-Ray				Thermal				Optical								EGME	Inter
Depth		Fract										Grain Count								Retn	preta
Layer	(cm)	Horz	ion	(----- peak size -----)				(----- % -----)				(----- % -----)								mg g ⁻¹	
09N02153	0.0-15.0	Ap	fs									18	BT 40	MS 29	QZ 17	FK 6	AR 2	HN 2			PMIC
													PR 2	OP 1	FP 1	BY tr	FE tr	TM tr			
													ZE tr								
09N02154	15.0-34.0	2Bt1	csi									35	QZ 34	MS 26	BT 14	HN 11	FK 10	AR 4			SMIX
													FE 1	PR 1	FP tr	GN tr	ZR tr	BY tr			
													MZ tr	OP tr	PO tr						
09N02156	71.0-110.0	2Bt3	csi									37	QZ 34	BT 18	MS 16	FK 13	HN 12	AR 2			SMIX
													FE 1	FP 1	GN 1	OP 1	PR 1	BY tr			
													RU tr	TM tr	ZR tr						

FRACTION INTERPRETATION:

csi - Coarse Silt 0.02-0.05 mm fs - Fine Sand 0.1-0.25 mm

MINERAL INTERPRETATION:

AR Weatherable Aggregates	BT Biotite	BY Beryl	FE Iron Oxides (Goethite)	FK Potassium Feldspar
FP Plagioclase Feldspar	GN Garnet	HN Hornblende	MS Muscovite	MZ Monazite
OP Opaques	PO Plant Opal	PR Pyroxene	QZ Quartz	RU Rutile
TM Tourmaline	ZE Zeolite	ZR Zircon		

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INTERPRETATION (BY HORIZON):

PMIC - Paramicaceous SMIX - Mixed Sand