Soil Science & Basin Restorations

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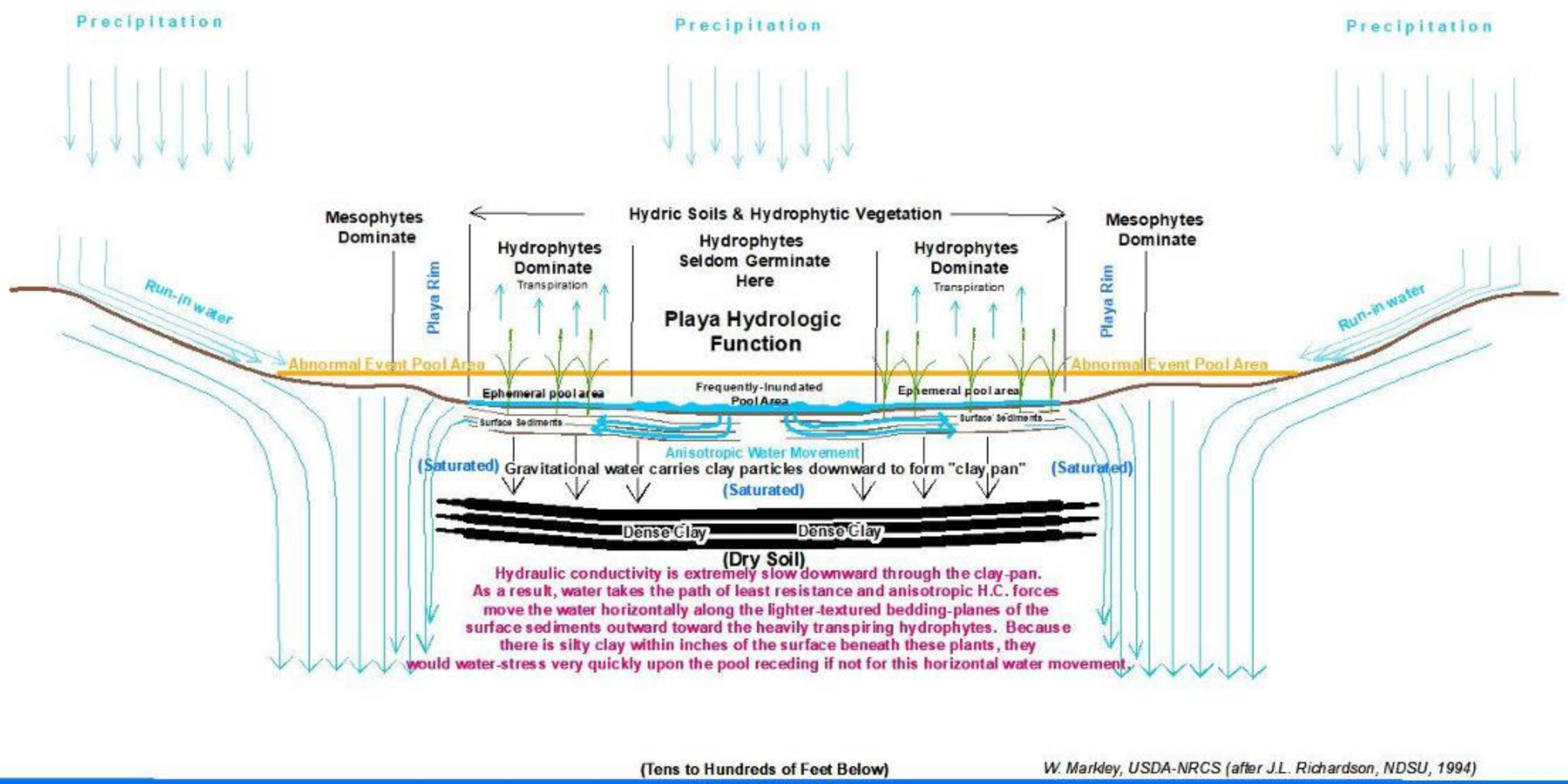
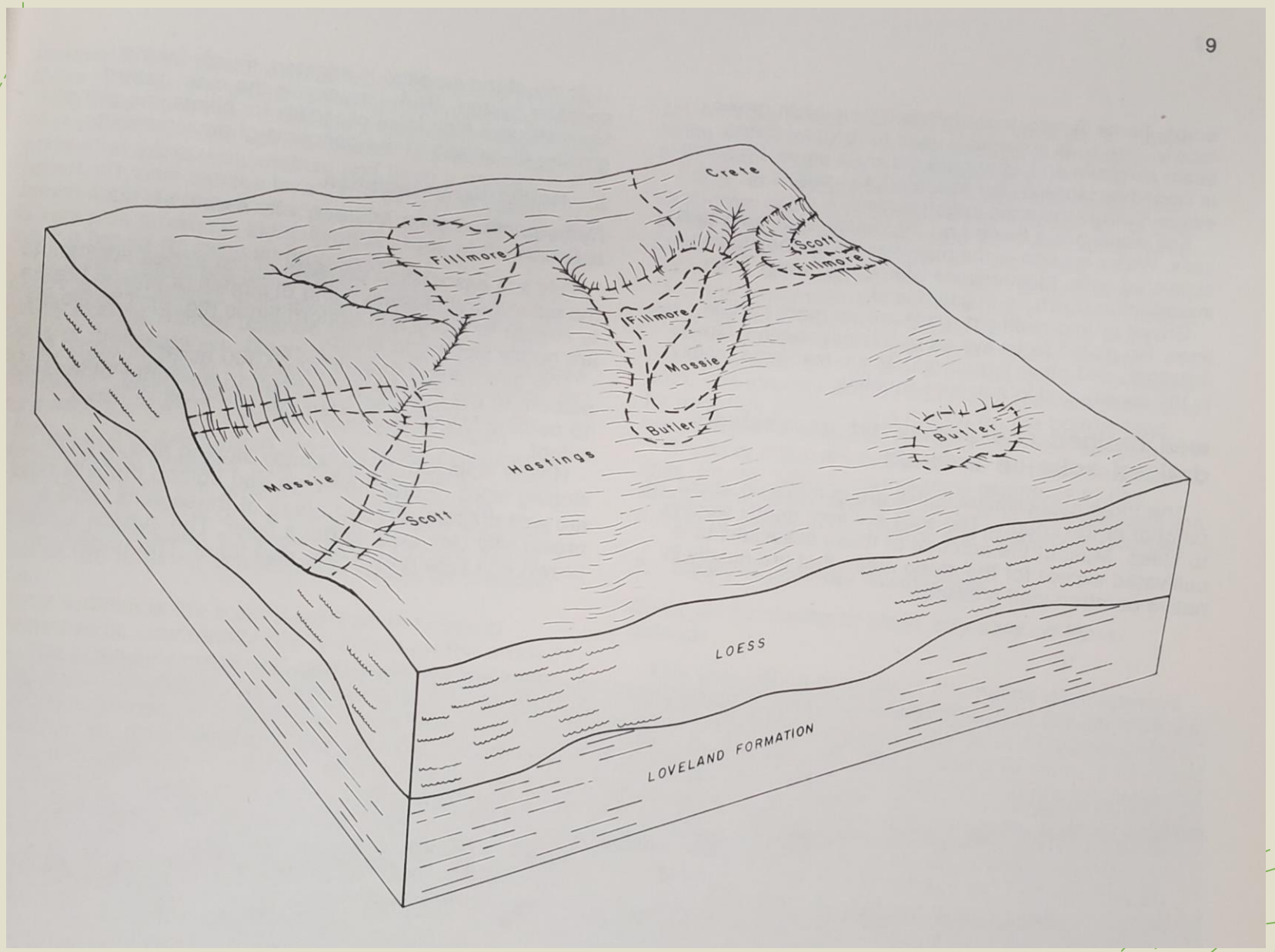
USDA-NRCS

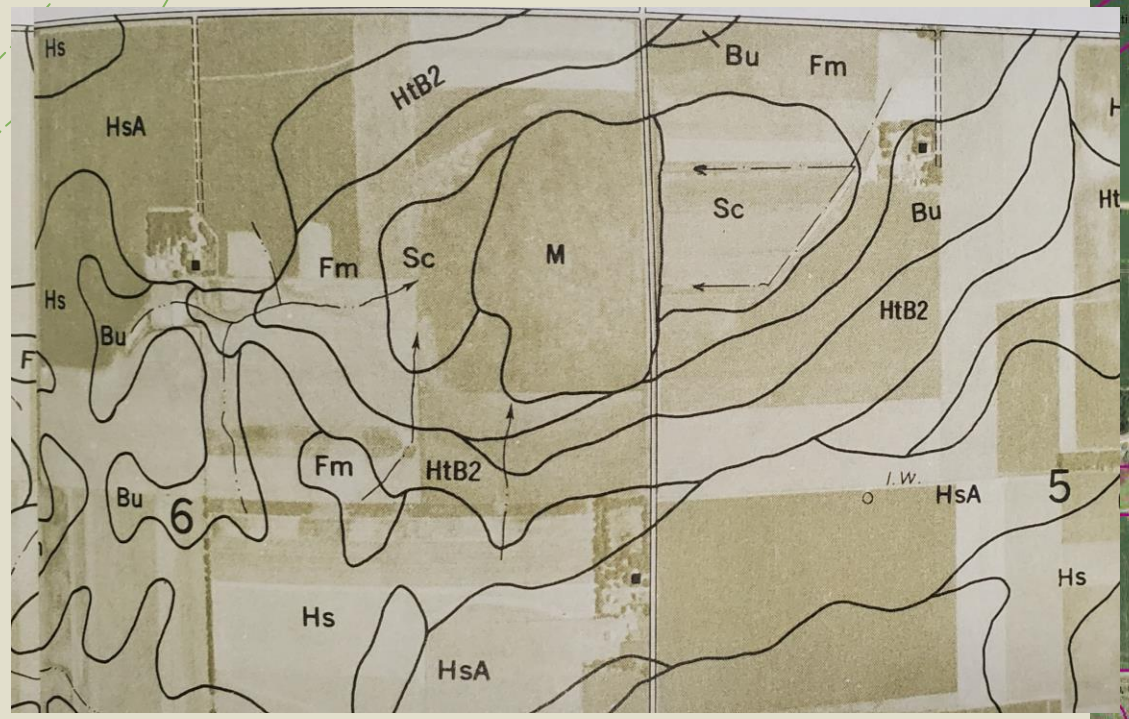
Introduction

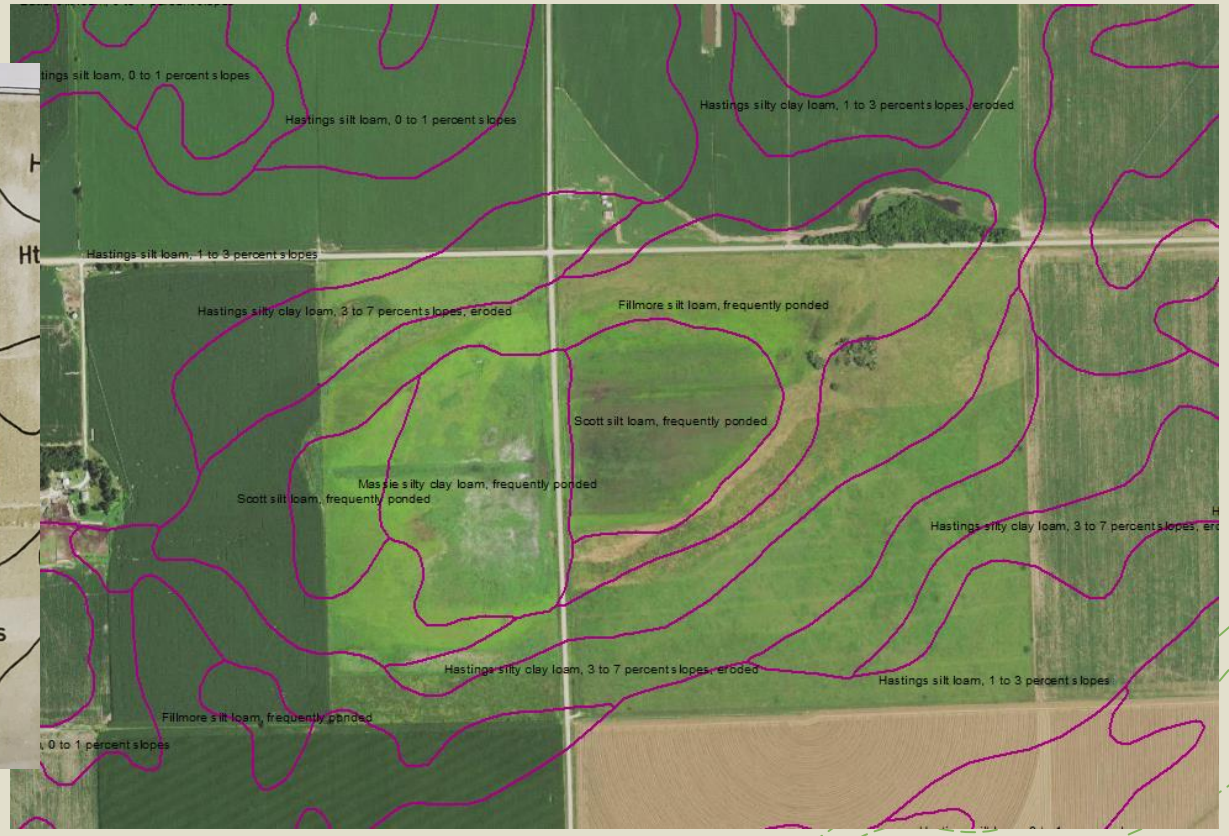
- No two basins are exactly the same
- Composite result is determined by all the inputs and impacts by nature and humans
- Soil scientists will study, predict and best explain the dynamic differences and expectations for each site
- Soil scientists review can impact eligibility, ranking and restoration potential


Precipitation
Precipitation
Precipitation
Mesophytes Dominate
Hydric Soils & Hydrophytic Vegetation
Mesophytes Dominate
Hydrophytes Dominate
Transpiration
Hydrophytes Seldom Germinate Here
Hydrophytes Dominate
Transpiration
Playa Rim
Playa Rim
Run-in water
Run-in water
Playa Hydrologic Function
Abnormal Event Pool Area
Abnormal Event Pool Area
Ephemeral pool area
Frequently-Inundated Pool Area
Ephemeral pool area
Surface Sediments
Surface Sediments
Anisotropic Water Movement
(Saturated)
Gravitational water carries clay particles downward to form "clay pan"
(Saturated)
(Saturated)
Dense Clay
Dense Clay
(Dry Soil)
Hydraulic conductivity is extremely slow downward through the clay-pan. As a result, water takes the path of least resistance and anisotropic H.C. forces move the water horizontally along the lighter-textured bedding-planes of the surface sediments outward toward the heavily transpiring hydrophytes. Because there is silty clay within inches of the surface beneath these plants, they would water-stress very quickly upon the pool receding if not for this horizontal water movement.
(Tens to Hundreds of Feet Below)
Ogallala Aquifer
W. Markley, USDA-NRCS (after J.L. Richardson, NDSU, 1994)


Crete
Fillmore
Scott
Fillmore
Fillmore
Massie
Butler
Butler
Hastings
Massie
Scott
LOESS
LOVELAND FORMATION

Soil Review – Historical & Current





OSD

SCOTT SERIES

The Scott series consists of very deep, poorly and very poorly drained soils that formed in loess. Scott soils are in closed depressions on loess uplands and stream terraces in the Central Loess Plains, MLRA 75. Slopes range from 0 to 1 percent. Mean annual precipitation is about 635 millimeters (25 inches) and the mean annual temperature is about 11 degrees C. (51 degrees F).

TAXONOMIC CLASS: Fine, smectitic, mesic Vertic Argialbolls

TYPICAL PEDON: Scott silt loam, on a concave, less than 1 percent slope in native rangeland at an elevation of 670 meters (2199 feet). (Colors are for moist soil unless otherwise stated.)

A--0 to 13 centimeters (0 to 5 inches); very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate medium granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary. (5 to 15 centimeters (2 to 6 inches) thick)

E--13 to 20 centimeters (5 to 8 inches); gray (10YR 5/1) silt loam, gray (10YR 6/1) dry; moderate thin and medium platy structure parting to moderate fine subangular blocky; slightly hard, friable; slightly acid; abrupt smooth boundary. (3 to 13 centimeters (1 to 5 inches) thick)

Bt1--20 to 51 centimeters (8 to 20 inches); very dark gray (N 3/0) silty clay, dark gray (N 4/0) dry; common medium prominent yellowish brown (10YR 5/4) iron masses; strong coarse prismatic structure parting to strong medium angular blocky; very hard, very firm, shiny surfaces on faces of most peds; many hard 1 to 2 mm, spherically shaped iron-manganese concretions; neutral; clear smooth boundary.

Bt2--51 to 86 centimeters (20 to 34 inches); very dark gray (N 3/0) clay, dark gray (N 4/0) dry; few fine prominent yellowish brown (10YR 5/4) iron masses; strong coarse prismatic structure parting to strong fine angular blocky; very hard, very firm; shiny surfaces on faces of most peds; many hard 1 to 2 mm, spherically shaped iron-manganese concretions; neutral; clear smooth boundary. (Combined thickness of the Bt horizon is 41 to 102 centimeters (16 to 40 inches) thick)

BC--86 to 117 centimeters (34 to 46 inches); dark grayish brown (2.5Y 4/2) silty clay loam, light brownish gray (2.5Y 6/2) dry; moderate medium subangular blocky structure; hard, firm; neutral; gradual smooth boundary. (13 to 36 centimeters (5 to 14 inches) thick)

C1--117 to 142 centimeters (46 to 56 inches); brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak coarse prismatic structure; slightly hard, friable; slightly alkaline; gradual smooth boundary. (20 to 51 centimeters (8 to 20 inches) thick)

C2--142 to 200 centimeters (56 to 80 inches); brown (10YR 4/3) silt loam, pale brown (10YR 6/3); moist; weak coarse prismatic structure; slightly hard, friable; carbonates disseminated throughout matrix; violent effervescence; slightly alkaline.

ESD

Ecological dynamics

These sites occur as depressions in an upland position and are subject to ponding. The vegetation communities evolved under a disturbance regime that included periods of sporadic but often intensive grazing by large transient herbivores, and occasional wildfires. They are often referred to as buffalo wallows.

Hydroperiods are the driving force that controls the type and extent of vegetation communities within the sites. Because hydroperiod can vary year to year, the boundaries between communities can fluctuate as hydroperiod fluctuates. Vegetation also shifts as a result of different grazing and disturbance regimes. In general, disturbance promotes annual communities, while lack of disturbance promotes perennial communities.

Additionally, not all playas contain all possible communities; they may contain as few as one vegetation community. Similarly, wetland-upland interfaces are transient due to variable hydroperiods. During periods of above average precipitation, the wetland will move into the upland, while in periods of below average precipitation, the wetland will constrict.

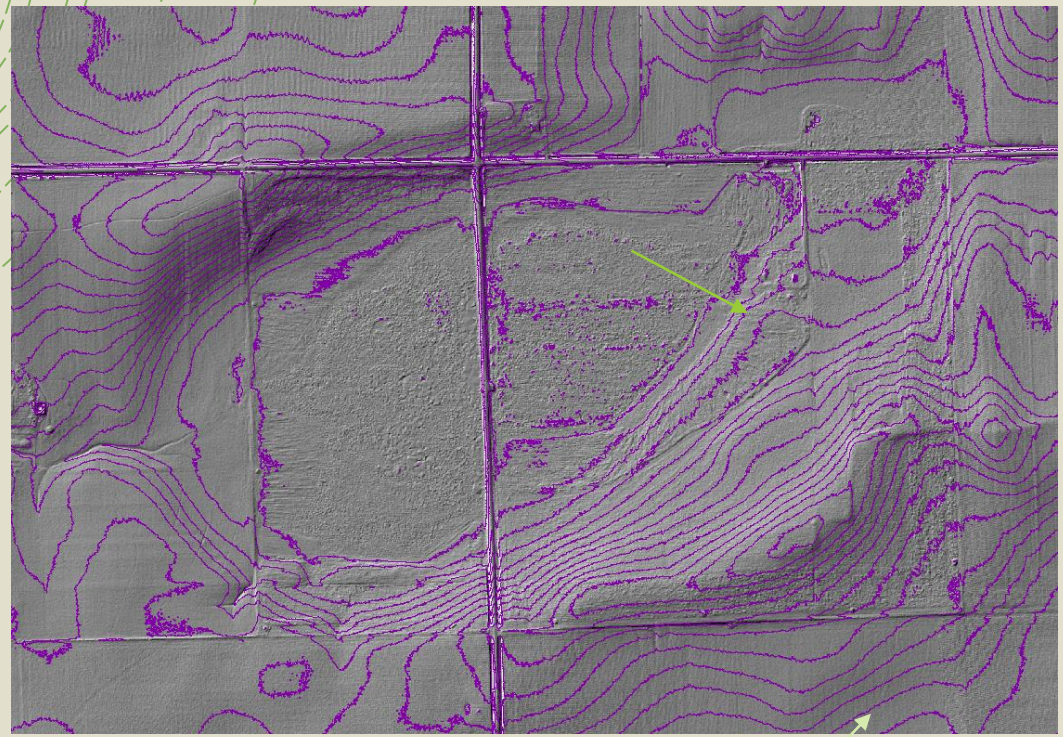
Photo Review

Climate & Photography

2010, wet

2012, dry

Lidar and Contours - Sedimentation

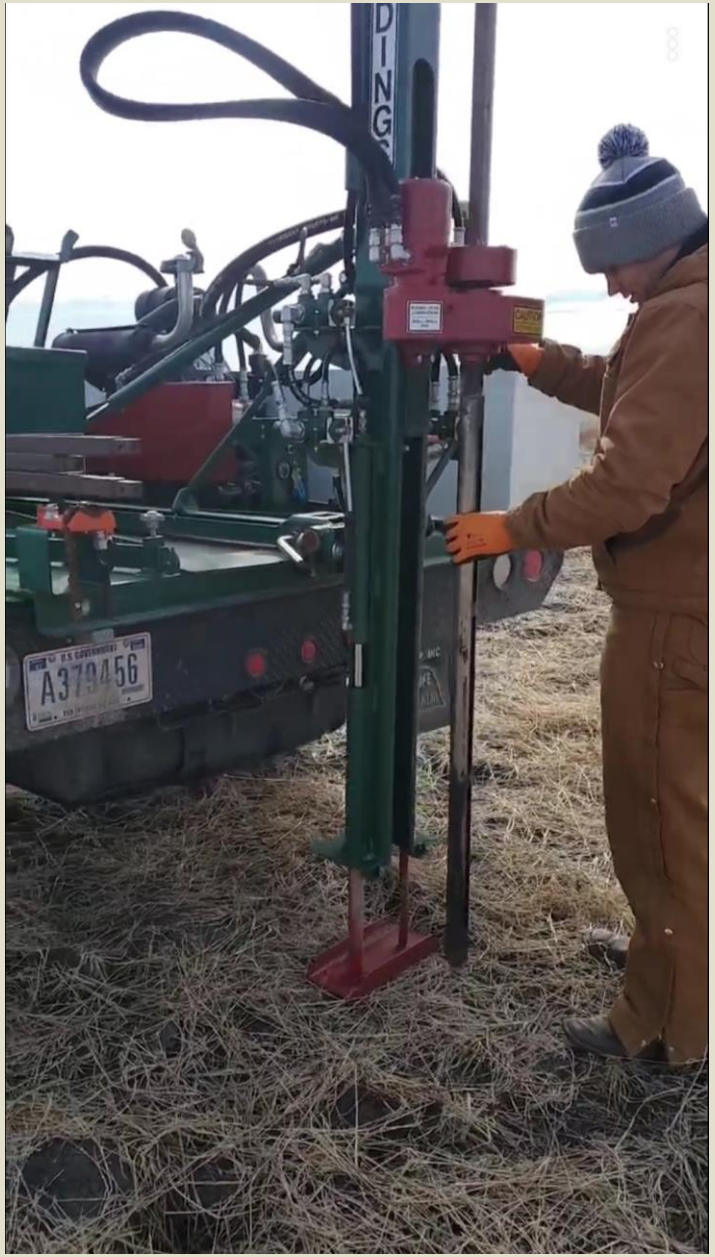


- Erosional deposition is almost always apparent around the outer rim of a playa with alluvial fans below incoming drains
- Human deposited fill is often spread around the playa floor

Soil Review

+ Utilizing offsite methodology, gain understanding of hydric boundary, wetland function, manipulations and potential sediment areas
+ Use offsite review to plan transect
+ Load boundaries and points into GPS
+ Field survey and update

Transect, Describe, Report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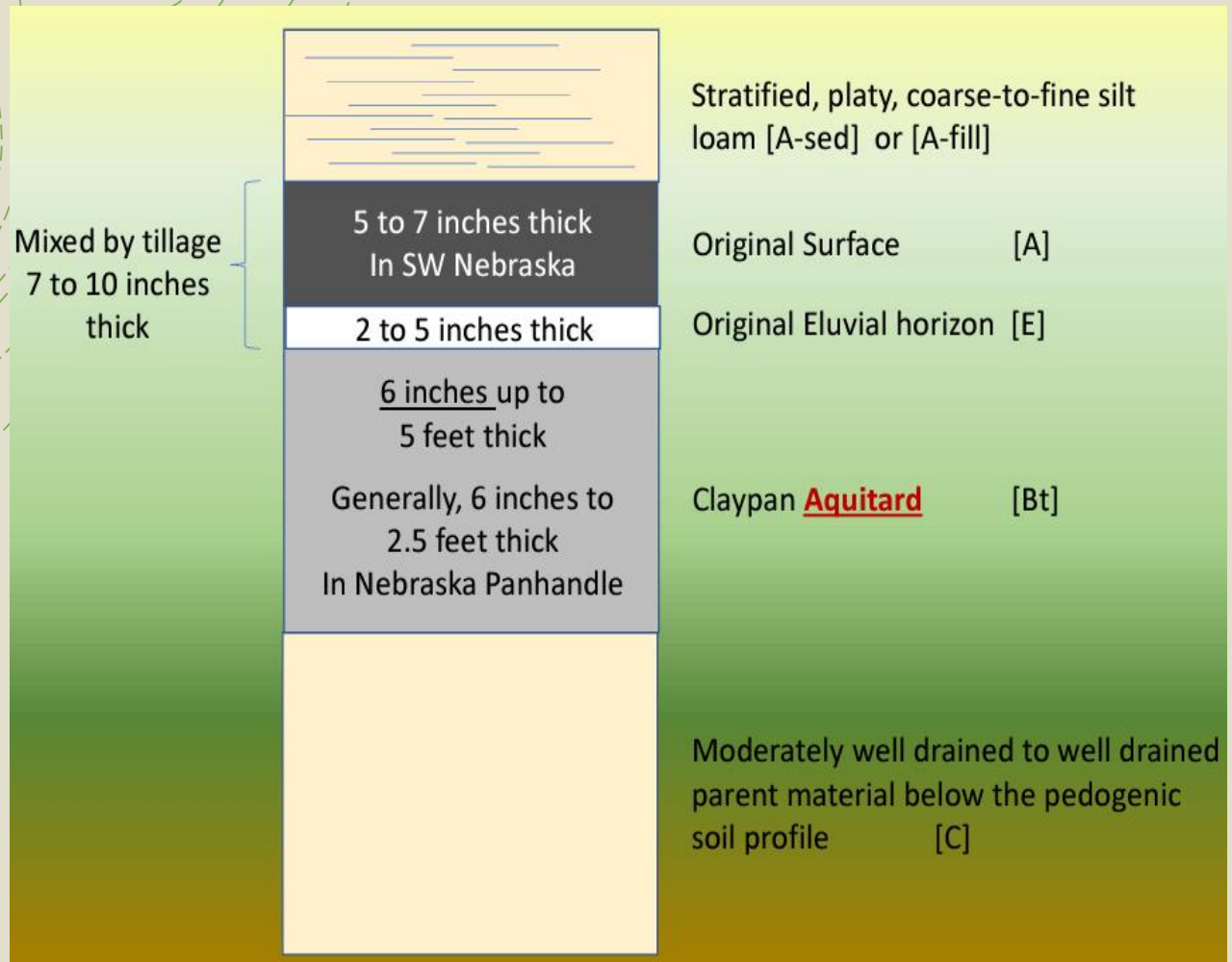
Stratified, platy, coarse-to-fine silt loam [A-sed] or [A-fill]
Mixed by tillage 7 to 10 inches thick
5 to 7 inches thick In SW Nebraska
Original Surface [A]
2 to 5 inches thick
Original Eluvial horizon [E]
6 inches up to 5 feet thick
Generally, 6 inches to 2.5 feet thick In Nebraska Panhandle
Claypan Aquitard [Bt]
Moderately well drained to well drained parent material below the pedogenic soil profile [C]

Soil Survey Report – Rolfes/Stuckey
Fillmore County

Survey Completed by: S. Cardenas, T. Durre, R. Hackbart, R. Hodges
11/2/21

This site is mapped as a Scott with a Hord boundary. Onsite soils investigation would suggest this site is more like a Fillmore soil type in most areas. First noted manipulation on this site was observed in 1958 by installation of reuse/drainage pit. This manipulation shrunk the wetland footprint by about 5.5 acres. Reuse/drainage pit was increased in size in 2010. This manipulation shrunk the existing wetland size by about .5 acre.

The soil survey concluded there is a normal A horizon and intact E horizon through the majority of the wetland footprint. Average depth of the A horizon was around 9-13”, some outliers being deeper. Most E horizons were 3-4” thick. Depth to the Bt1 horizon resembled a soil more typic of Fillmore, than Scott. There is approximately 1” of vegetative build up (organic matter) on top of the soil surface throughout the site. No excess sediment was found in the cores described. Lidar indicates a berm around the pit. No cores were sampled there. Combining the soils data with the topo survey should confirm enough borrow to fill the pit.

Hodges Recommendation: The ideal restoration on this site would include filling the pit and controlling the invasive species: reed canarygrass and cattail.

Stop #:	1				
HOR	DEPTH	COLOR	TEX/frag	Component Name:	Fillmore
A	6"	10YR 2/1	SIL	Note: top of Bt1 is at 6"	
Bt1	16"	10YR 3/1	SICL/SIC		
Bt2	16"+	10YR 3/2	SIC		

Stop #:	2				
HOR	DEPTH	COLOR	TEX/frag	Component Name:	Fillmore
A	4"	10YR 2/1	SIL / SICL (28%)		
E	7"	10YR 5/1	SIL		
Bt1	7"+	10YR 3/1	SICL (35%)		

Stop #:	3				
HOR	DEPTH	COLOR	TEX/frag	Component Name:	Fillmore
A	8"	10YR 2/1	SIL (26%)		
E	12"	10YR 5/1	SIL (20%)		
Bt1	12"+	10YR 3/1	SICL (34%)		

Stop #:	4				
HOR	DEPTH	COLOR	TEX/frag	Component Name:	Fillmore
A	9"	10YR 2/1	SIL (26%)		
E	13"	10YR 5/1	SIL (22%)		
Bt1	13"+	10YR 3/1	SICL (36%)		

Stop #:	5				
HOR	DEPTH	COLOR	TEX/frag	Component Name:	Fillmore
Sediment	2"	10YR 3/2	SIL/SICL mixed		
A	9"	10YR 2/2	SIL (25%)		
E	13"	10YR 5/1	SIL (19%)		
Bt1	13"+	10YR 3/1	SICL (34%)		

Conclusion + Questions?