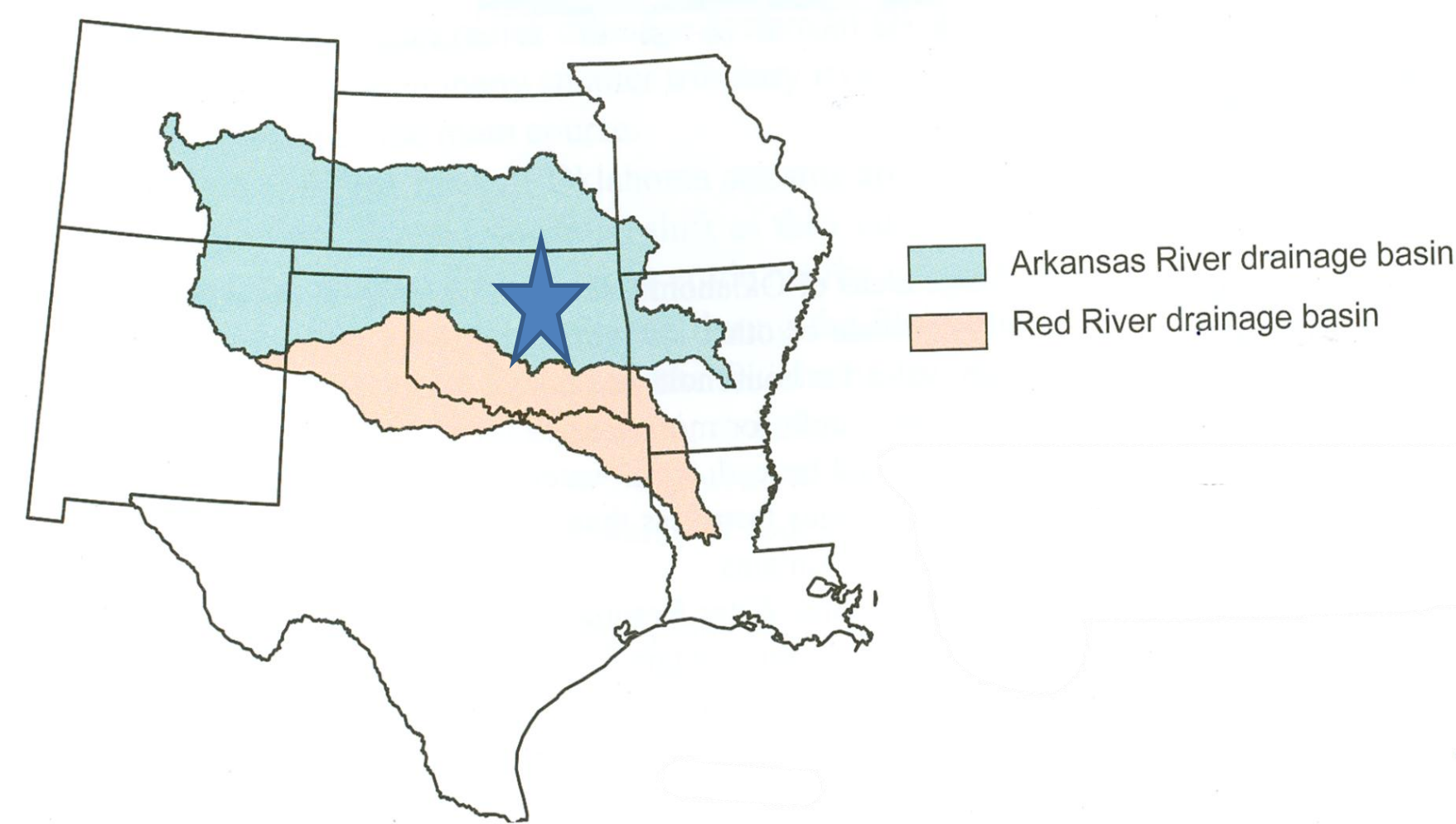




EFFECT OF SIMULATED ALLUVIAL BURIAL ON SOIL CARBON

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Floodplain stratigraphy commonly contains buried soils that are used as indicators of paleoclimatic conditions (landscape stability, ecology, etc.) (Figure 2). This study was conducted to evaluate the effects of rapid sedimentation on soil organic carbon; both in relative storage value/stability and discrimination of carbon isotope values ($\delta^{13}\text{C}$) currently used in paleoclimatic reconstruction. Soil carbon distribution throughout soil profiles are currently used to interpret stable environments of the past and are important to future greenhouse gas mitigation. While soil $\delta^{13}\text{C}$ values give an indication of past plant communities on the basis of cool season (C3) vs. warm season (C4) carbon uptake discrimination (^{13}C vs. ^{14}C) in their respective photosynthesis pathways and subsequent deposition into the soil organic matter pool. The more negative a value the more C3 while the more positive the value the more C4 dominated.

In spring of 2005, 12 plots were set up in a completely randomized experimental design on a Teller fine sandy loam (fine-loamy, mixed, active, thermic, Udic Argiustoll) located south of Stillwater, OK (Figure 3). Experiment consisted of 4 treatments of simulated alluvial burial (0, 8, 16, 24 cm in depth) by a fine sandy loam deposit. Native vegetation of the plots was dominated by tall prairie grasses and was in use as pasture for grazing animals. After seven years of burial, both the surface and buried A horizons were evaluated for changes in SOC and carbon isotopic values. All buried horizons significantly decreased in SOC compared to the control (Table 1). Control (unburied) averaged 1.60 % SOC while the buried horizons averaged 0.83 %; a 48 % drop in SOC. Significant changes in $\delta^{13}\text{C}$ values were observed between the control, buried, and new soil surface (Table 2). Buried A horizons $\delta^{13}\text{C}$ values were significantly more positive compared to the control, while the newly formed soil was more negative than the control. Burial/discontinuation of organic matter additions results in significant reductions in SOC and the alteration of $\delta^{13}\text{C}$ values highlighting the expedient loss of easily oxidizable carbon and discrediting the notion that burial does not significantly effect $\delta^{13}\text{C}$ values.

Table 2: Results of Simulated Alluvial Burial on $\delta^{13}\text{C}$ values after 7 Years of Burial

	Depth	Horizon	Thickness of Simulated Alluvial Sedimentation				
			0 cm (Control)	8 cm	16 cm	24cm	
				$\delta^{13}\text{C}$, ‰			
Forest Surface	0-5	A	-23.5 ef [§]	-	-	-	
Created* Surface	0-3	A	-	-24.7 f	-24.7 f	-25.4 f	
Pasture Surface (Original Surface)	0-5**		-21.8 e	-18.7 d	-19.3 d	-17.6 cd	
	5-15	Ap (b)	-17.6 cd	-17.4 cd	-16.1 bc	-15.9 abc	
	15-30		-15.1 ab	-14.2 ab	-15.7 abc	-14.0 a	

*Created Surface refers to simulated alluvial additions (circa 2005).
 **0-5, 5-15, and 15-30 refer to the depth from the surface of the original soil surface.
 § Values followed by the same letter are not significantly different (P=0.05) using Duncan's test.

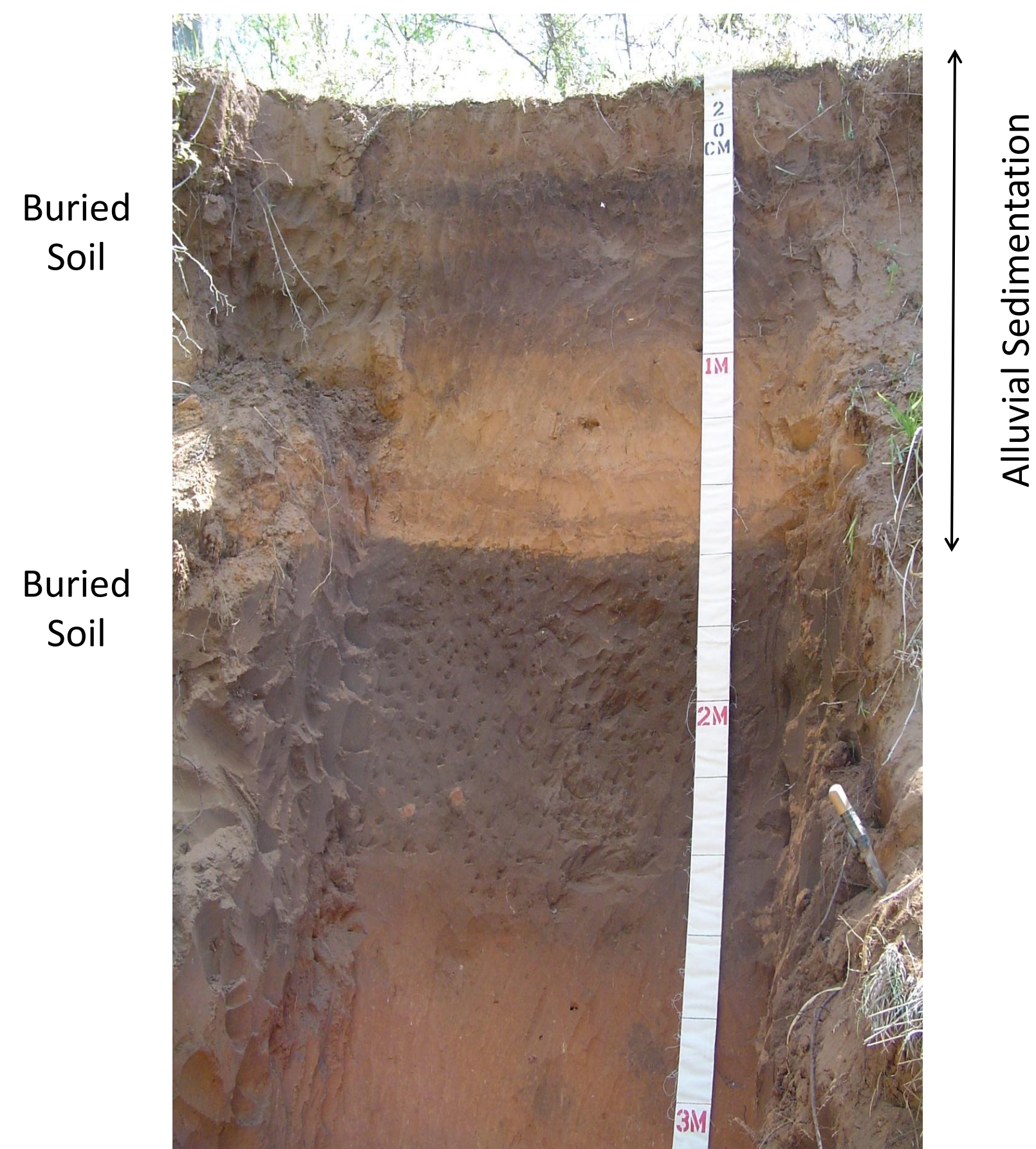


Figure 2: Example of typical buried soil sequence used in archeology and geoarchaeology as proxies for past climate change and landscape stability.



Figure 3: Photos of treatment plots prior to and after additions of simulated alluvial sediments. Starting from the top left and working clockwise. Plot prior to treatment, after treatment (16 cm burial) with sediment, control after 180 days, and 16 cm burial treatment after 180 days. Notice the difference in vegetation cover between the control and buried plot after 180 days after burial.

Table 1: Results of Simulated Alluvial Burial on Soil Carbon after 7 Years of Burial

Depth*	Horizon**	Simulated Alluvial Sedimentation				Adjacent Forest
		0 cm (Control)	8 cm	16 cm	24cm	-
		Total Carbon, %				
0-3	A	-	0.59 cdef	0.56d ef	0.29 gh	-
3-6	C	-	0.09 ih	0.04 i	0.06 ih	-
0-5		1.60 a [§]	0.92 b	0.80 cb	0.76 bcd	1.73 a
5-15	Ap(b)	0.73 bcde	0.57 cde	0.51 def	0.53 def	-
15-30		0.65 cde	0.61 cde	0.48 ef	0.61 cde	-

*0-3 and 3-6 depths refer to the burial material. 3-6 cm refers to the entire C horizon, not the actual horizon depth.
 0-5, 5-15, and 15-30 refer to the sampling depth from the surface of the original soil surface.
 **Buried horizon designation only applies to buried treatments as well as the plow layer doesn't apply to the forest.
 § Values followed by the same letter are not significantly different (P=0.05) using Duncan's test.