Influence of Tillage Management on Soil Moisture and Temperature in the Pataha Creek Watershed

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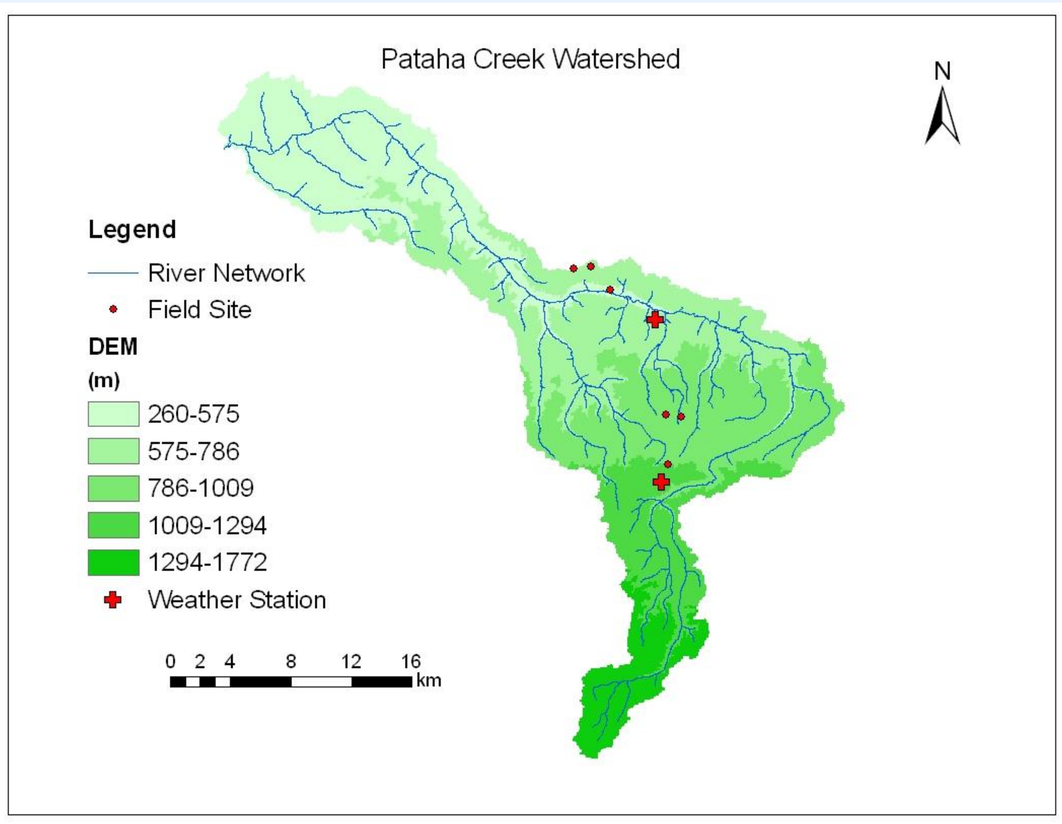
Introduction

Agricultural tillage management and weather conditions have been observed to affect soil water movement and heat transport; therefore, agricultural land use practices may have an impact on water availability for the summer time in-stream flow in the Pacific Northwest.

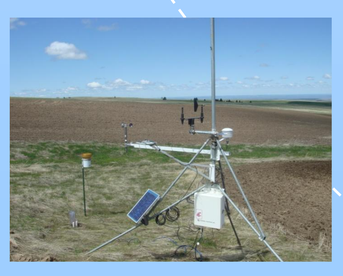
Study Area

The Pataha Creek Watershed drains an area of 478 km^2 stretching cross Garfield and Columbia County, WA. It is a main tributary of the Tucannon river located 18 km above the Tucannon's confluence with the Snake River.



Field Experiments

Two factors, tillage and precipitation, were considered in the field experiments. Conventional tillage (CT) and no-till (NT) management are practiced in this area and a low and a high precipitation zone are located in the northern and southern areas of the creek, respectively. Two replicated sites were randomly selected for each combination; thus, eight field sites were monitored in the experiment. At the beginning of the experiment, soil samples were collected to determine the bulk densities. Twice saturated hydraulic conductivities were measured using the Guelph permeameter. Soil moisture content and temperature at three depths (25, 50, and 120 cm) were simultaneously monitored by an EC-TM sensor at a time interval of 10 minutes. The data were recorded and stored in an EM-50R data-logger. Weather data from two weather stations located in the two precipitation zones were collected at 30-minute time intervals.



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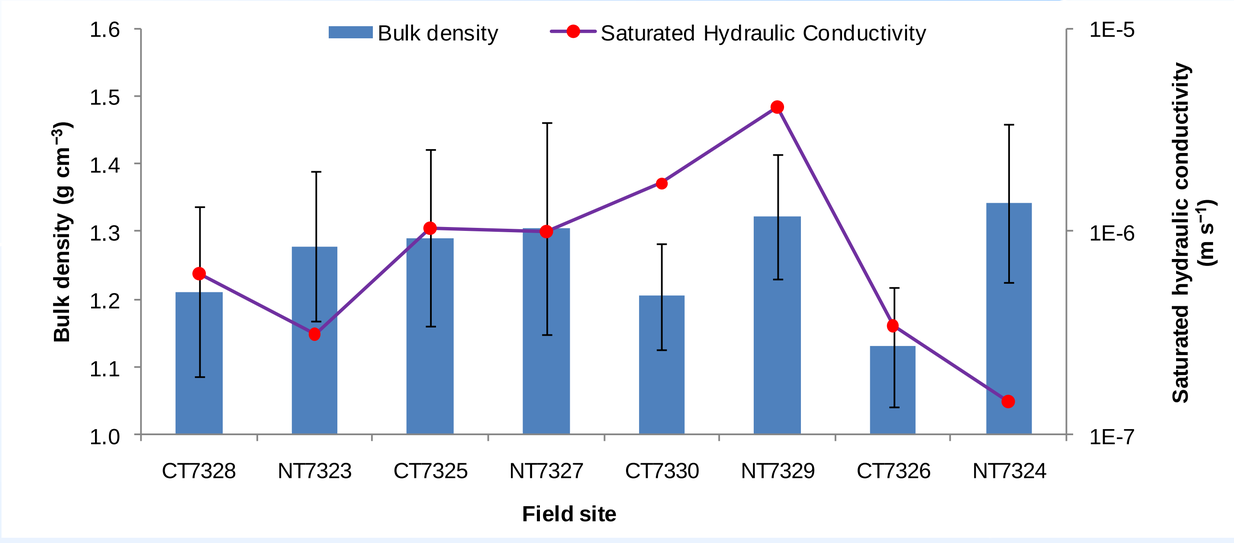
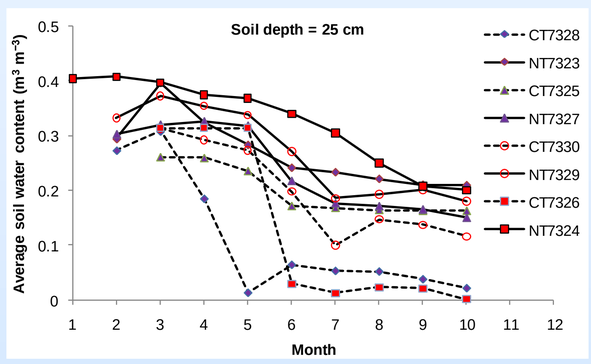
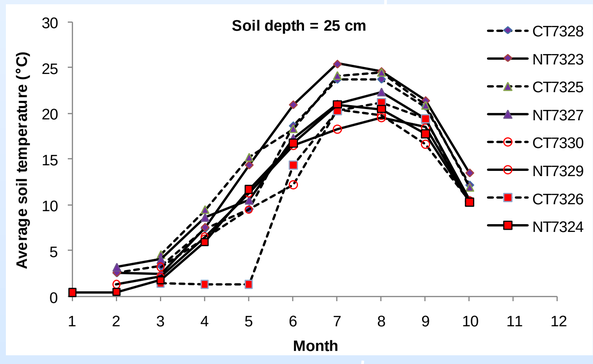
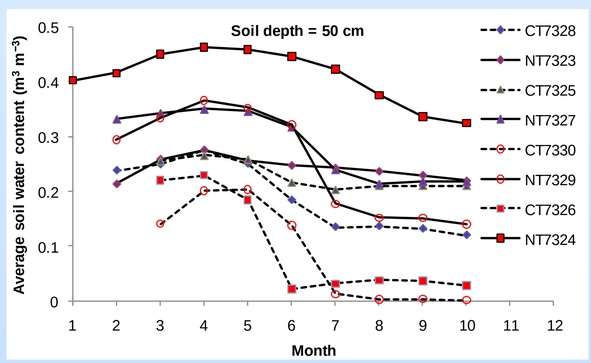
Bulk Density and Hydraulic Conductivity

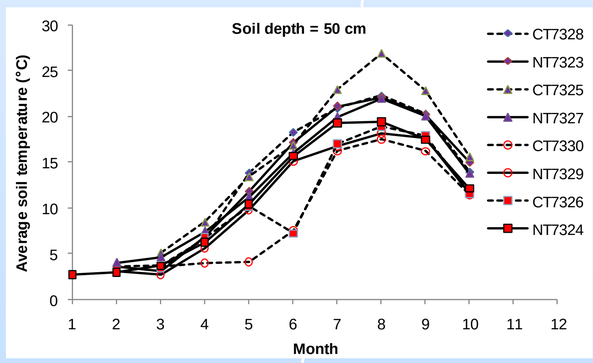


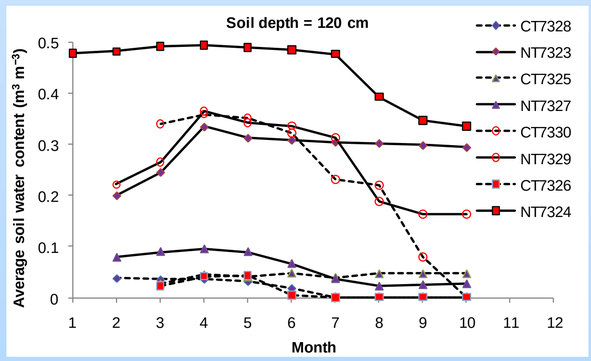
Monthly Average Water Content and Temperature

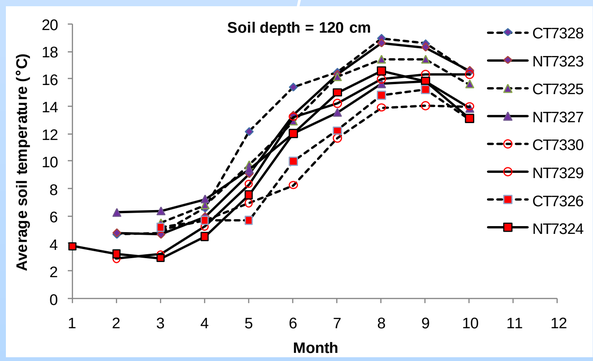












Statistical Conclusions

Response	Factor	p-value	Significant Difference?
Bulk density	Tillage	0.027	Yes (NT>CT)
Saturated hydraulic conductivity	Tillage	0.603	
Water content-25 cm	Tillage	<0.001	Yes (NT>CT)
	Precipitation	0.219	
Water content-50 cm	Tillage	<0.001	Yes (NT>CT)
	Precipitation	0.255	
Water content-120 cm	Tillage	<0.001	Yes (NT>CT)
	Precipitation	<0.001	Yes (High>Low)
Temperature-25 cm	Tillage	0.683	
	Precipitation	0.121	
Temperature-50 cm	Tillage	0.636	
	Precipitation	0.048	Yes (Low>High)
Temperature-120 cm	Tillage	0.613	
	Precipitation	0.087	

References

Azooz, R. H., and M. A. Arshad (1996), Soil infiltration and hydraulic conductivity under long-term no-tillage and conventional tillage systems, Canadian Journal of Soil Science, 76(2), 143 – 152.

Clausen, J. C., W. E. Jokela, F. I. Potter, and J. W. Williams (1996), Paired watershed comparison of tillage effects on runoff, sediment, and pesticide losses, Journal of Environmental Quality, 25(5), 1000 – 1007.