Small-scale variation in soil moisture content under one-seed juniper trees

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THE STORY IN BRIEF:

We conducted a pilot study in July 2004 to determine variation in superficial soil moisture content under canopies of dead and live one-seed juniper trees in 3 grazing exclosures on the ranch.

We found no small-scale variation in gravimetric water content under tree canopies. Distance away from the main stem along either the long or short axis of the tree canopy projection had no influence on soil moisture content. Plots in exclosures with highest basal cover of herbaceous vegetation tended to have drier topsoils. Soil samples collected under live juniper trees had more moisture than soils under dead trees. Cooler temperatures and less herbaceous understory under the canopy of live trees may have been associated with less short-term evapotranspiration losses from superficial soil layers and could account for the differences we observed.

THE PROBLEM:

Much research has been conducted on controlling one-seed juniper (*Juniperus monosperma*) woodlands for increased forage yield, however, little is known about the influence of tree killing on soil water dynamics. It is often assumed that juniper clearing is associated with the release of moisture that should result in a measurable increase in groundwater recharge. However, the fate of water otherwise used by juniper trees could vary considerably depending on overall rainfall, soil texture, depth to caliche layer, and herbaceous understory cover among other factors. This pilot study is part of a longer-term project designed to address questions associated with the influence of juniper control on soil water dynamics.

OBJECTIVE:

To determine the influence of tree control and understory defoliation on soil water infiltration dynamics.

EXPECTED OUTCOMES**:**

Determine soil water movement above the caliche layer under dead and living juniper trees with either heavy or no defoliation of the herbaceous understory.

This study will provide critical information to understand small scale soil moisture dynamics in relation to juniper control and understory defoliation regime.

DURATION:

July 2004 – August 2006

APPROACH:

Six trees were selected in each of 3 cattle-grazing exclosures located in juniper woodlands in July 2004. Half the area in each exclosure had been treated with Tebuthiuron in 1995. Three dead tree snags and 3 living trees were selected in each exclosure and soil samples were taken at 1/3,

2/3, and 3/3 of the longest and shortest axis of tree canopies to determine soil texture and small-scale variation in gravimetric water content of topsoils beneath trees. Soil samples were collected using a 1" diameter soil core to a depth of about 1'. Samples were placed in sealed plastic bags, weighed shortly after collection, and dried in an oven until constant weight. Gravimetric moisture content was determined by subtracting dry weight from the initial sample weight. Soil texture was determined using a Beckman Coulter Particle Size Analyzer that calculated percentages of sand-, silt- and clay-sized particles. The soil texture triangle was then used to determine each sample's soil texture class.

RESULTS:

Soils were mostly sandy loams. We found no small-scale variation in gravimetric water content of topsoils under tree canopies. Distance away from main tree stem along either the long or short axis of the tree canopy projection had no influence on superficial soil moisture content (Figs. 1 and 2). However, there was a significant difference in gravimetric water content among exclosures. Plots in exclosures with highest basal cover of herbaceous vegetation tended to have drier topsoils. We also detected a significant difference in gravimetric water content under dead and live juniper trees (Fig. 3). Topsoils under live juniper trees had more moisture (10.02%) than soils under dead trees (8.83%). Cooler temperatures and less herbaceous understory under the canopy of live trees may have been associated with less evapotranspiration losses from superficial soil layers and could account for the differences we observed.

POTENTIAL APPLICATION:

The information form this pilot study was used to install CS-615 & CS-616 soil moisture probes at different depths to monitor moisture moving through the soil profile under dead and live juniper trees. In addition, we imposed understory defoliation treatments (no defoliation or heavy defoliation) under monitored juniper trees. This study began in early summer of 2005 and will provide detailed information about soil moisture movement after each rain event during 2 growing seasons. Upon finalizing this study we should have a better idea of how soil moisture is partitioned as a result of juniper kill and understory defoliation.

EDUCATIONAL PLAN:

Results from this study will be made available to the general public as an Agricultural Experiment Station bulletin. A press release with the most relevant results will be distributed statewide through the Agricultural Communications Department of the College of Agriculture and Home Economics

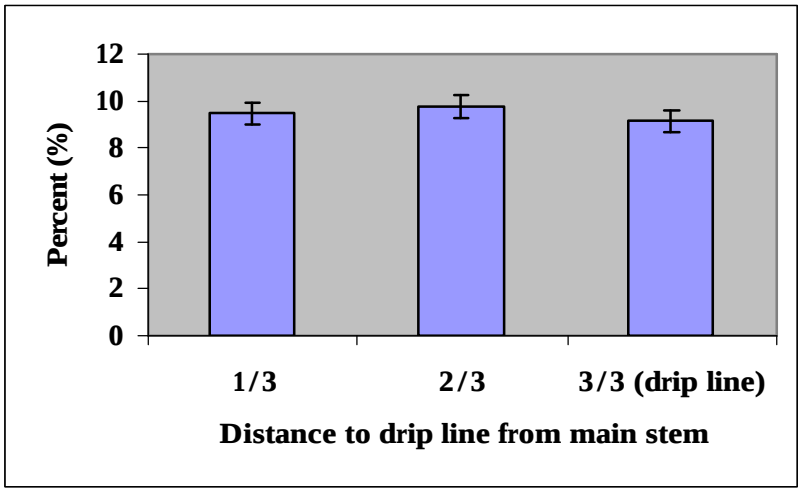

Fig. 1: Influence of distance from main stem on topsoil moisture content

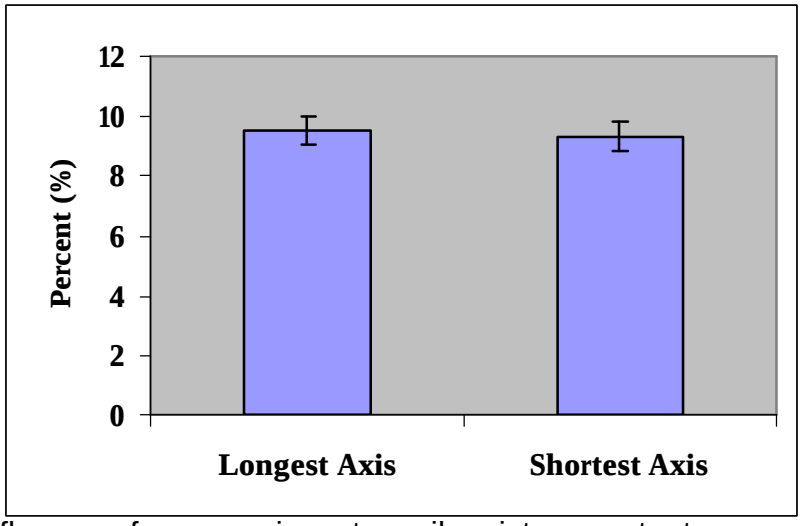

Fig. 2: Influence of crown axis on topsoil moisture content

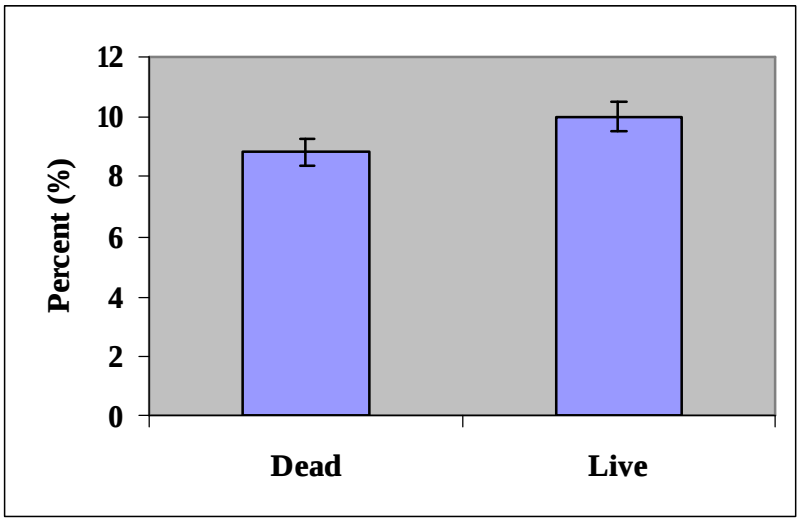

Fig. 3: Topsoil moisture content under dead and live juniper trees