Trees & Water Conservation: Objectives & Methods

- Objective:

  To determine the potential impact of trees on water conservation in the urban Front Range.

- Method:

  Gravimetric soil moisture measurements collected at paired treed and treeless sites.

- Research question:

  Will soil moisture under trees be different than soil moisture at adjacent treeless sites on irrigated turf plots?

Trees & Water Conservation: Objectives & Methods

- Independent variables:
  - Tree presence/characteristics (size, species)
  - Water input (precipitation, irrigation regime)
  - Soil texture
  - Weather (solar radiation, wind, humidity, temp)

Trees & Water Conservation: Plots

- Data were collected from 12 plots, once a day for 14 days
  - Species: green ash, cottonwood and hackberry
  - Locations: City of Golden Cemetery, Ulysses Park, Parfett Park, Lions Park and School of Mines

Trees & Water Conservation: Protocol

- Data collection began at 3 pm each day
- Rain gauges collected previous 24 hours' water input
- Four samples taken from treed and treeless sides of each plot from 6-8" depth
- Soil was weighed, dried and weighed again
- Weather data from Fossil Trace Golf Club
- Complementary data from EC probes
- *1344 soil samples analyzed*

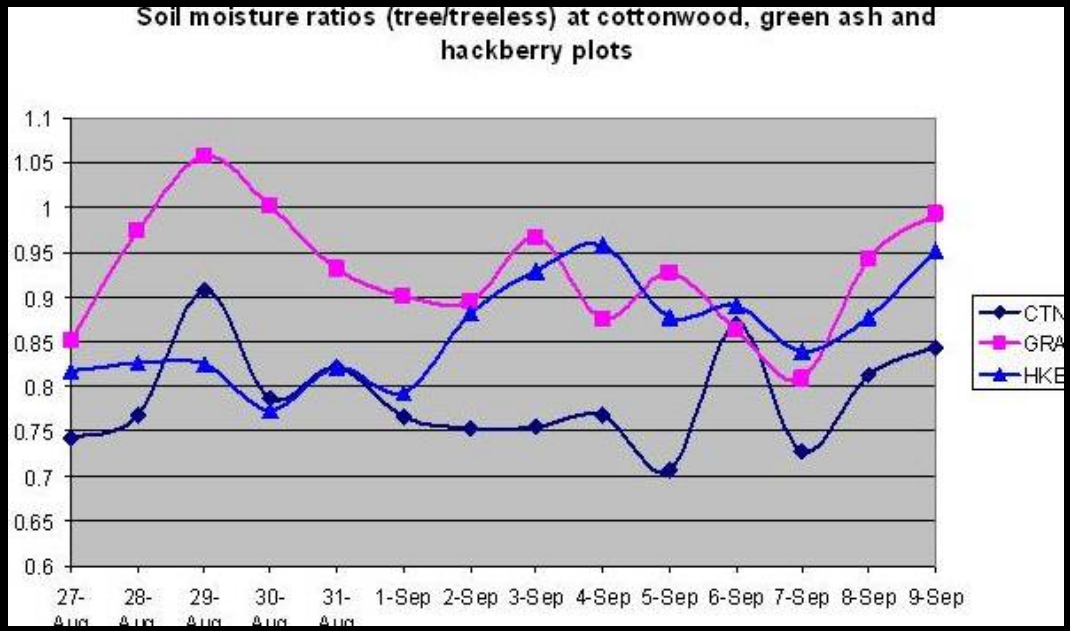
Trees & Water Conservation: Key Findings

- Overall, soil at treeless sites was more moist than soil beneath trees *(p*<0.001).
  - 13.4% ± 0.1%, 16.5% ± 0.2%
- Significant differences appear when the data were sorted by some independent variables.
  - Difference between treed and treeless soil moisture greater at plots with large trees than at plots with small trees.
    - Difference at sites with largest 6 trees: -4.7% ± 0.3%
    - Difference at sites with smallest 6 trees: -1.4% ± 0.4%

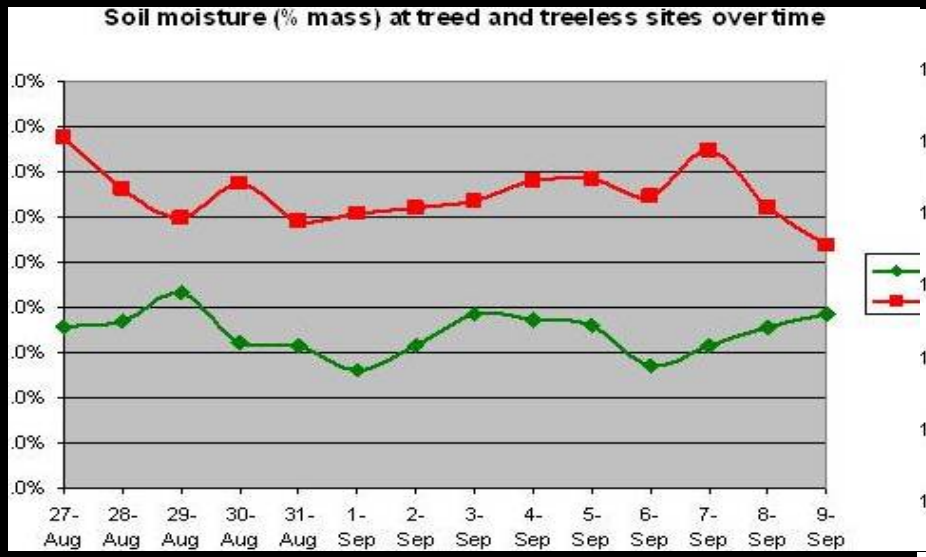
Trees & Water Conservation: Key Findings

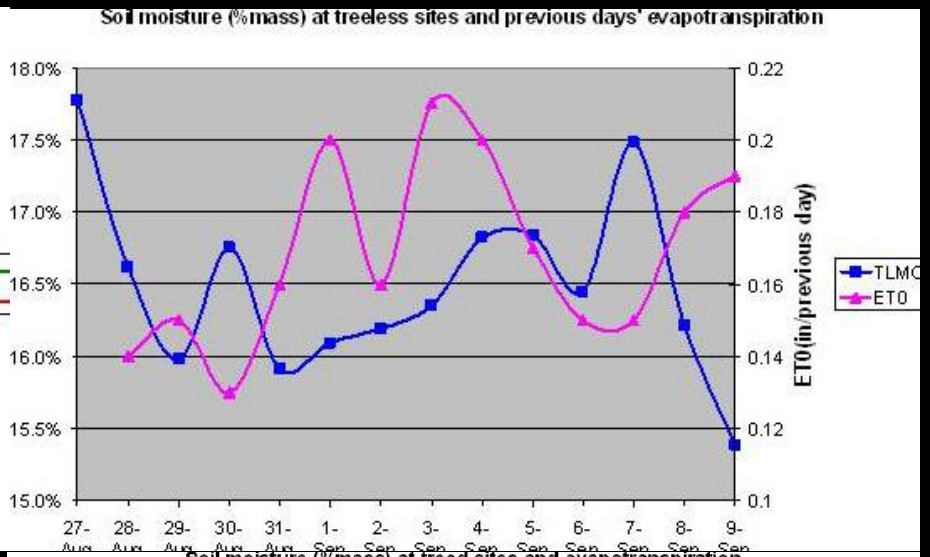
Tree species

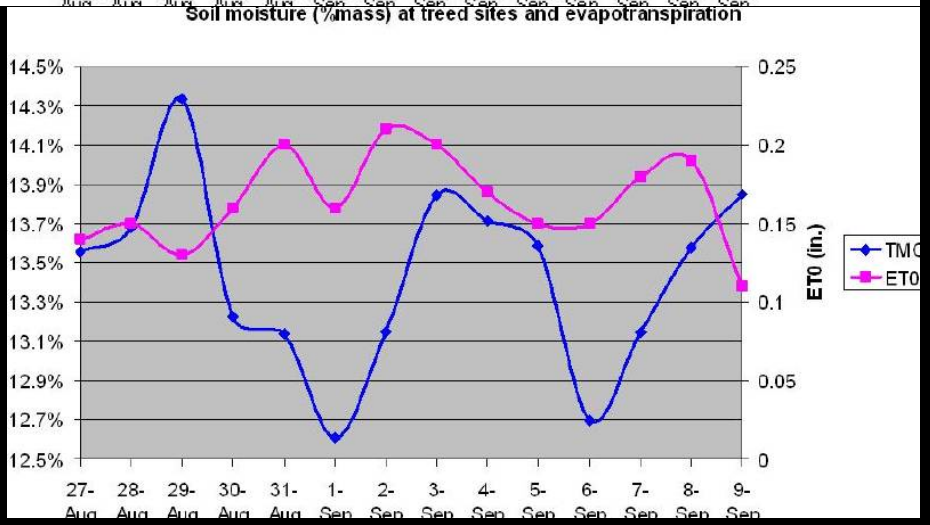
- The ratio of soil moisture beneath trees to soil moisture at adjacent treeless sites was greatest on green ash plots (but still less than 1) followed by hackberry plots then cottonwood plots.



Trees & Water Conservation: Key Findings







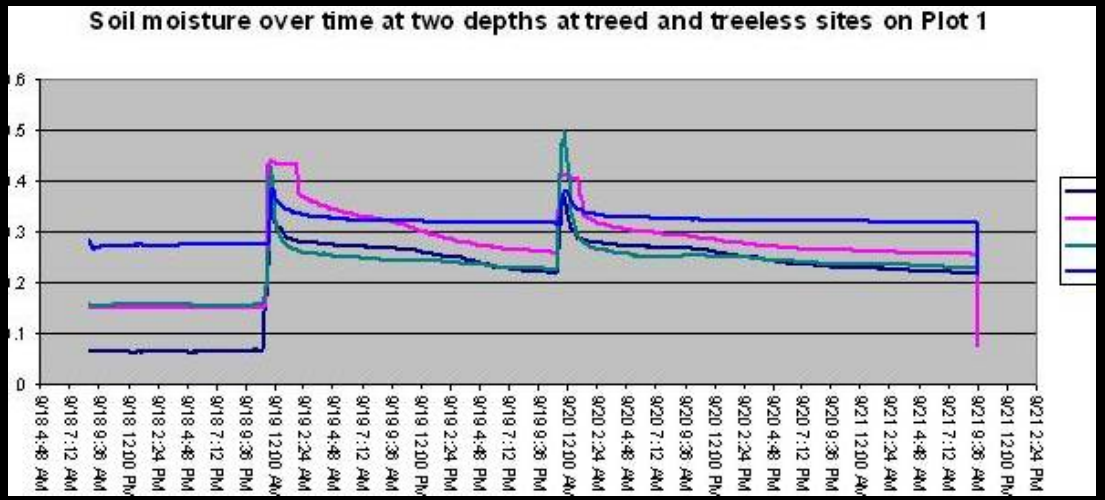
Soil moisture, water inputs and weather

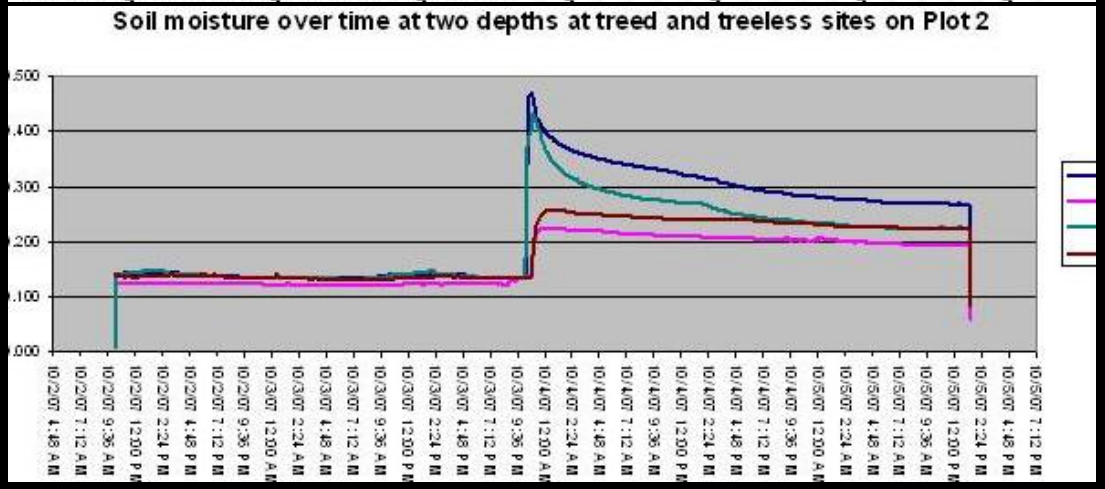
- Soil at treeless sites was drier when previous days' evapotranspiration (ET_0) was high (top right)
- Soil at treed sites was drier when same days' ET_0 was high (bottom right)

Trees & Water Conservation: Key Findings

EC probe data: response of soils at treed and treeless sites to watering

- Plot 1: Soil beneath tree dried more quickly than at treeless site (depth made no difference).
- Plot 2: Shallow soil at both sites dried more quickly than deep soil (tree presence made no difference).





Trees & Water Conservation: Summary

- For this study period and these species, tree presence did not conserve soil moisture.
- Gravimetric soil moisture methodology showed significant differences between treed and treeless sites and between other sub-groups (e.g., between species).
- EC probe data were inconclusive.

Trees & Water Conservation: Conclusion

- Observed overall differences in soil moisture between treed and treeless sites could be the result of many factors.
  - Soil compaction
  - Slope, aspect
  - Consumption by trees
  - Others?
- Treeless sites did not receive significantly greater water inputs than treed sites, overall.

Trees & Water Conservation:
Next Steps

- Important variables that need to be included in future research (or incorporated into this data *ex post*) are:
  - Soil compaction
  - Site slope and aspect
- EC probe data need to be expanded and trends therein investigated in more detail.
- Application to xeriscape research