Santa Fe Paired Basin Study

Amy Lewis, Hydrologist

Amy Lewis earned a master's degree in hydrology from New Mexico Tech in 1985 and has over 30 years of expertise evaluating water resource data, as both a public servant for the New Mexico Environment Department, Office of the State Engineer, and City of Santa Fe and as a private consultant, including her own hydrologic consulting business beginning in 2002. Amy developed an interest in forest restoration and the impacts on the hydrologic water budget while working as the City of Santa Fe Hydrologist. In 2008, she began managing the Santa Fe Paired Basin study funded by the New Mexico Interstate Stream Commission to monitor the changes in water budgets following forest thinning and maintenance burns.

The Santa Fe Watershed Paired Basin study, funded by NM Interstate Stream Commission, is monitoring the water budget components in response to ongoing forest treatments. Over the past eight years of the relatively dry period, stream flow and evapotranspiration appear to be decreasing in the treated basin with respect to an untreated basin but recharge may be increasing. A series of wet years, particularly in a significant snow pack, may show different results.

Figure 1. Introduction.

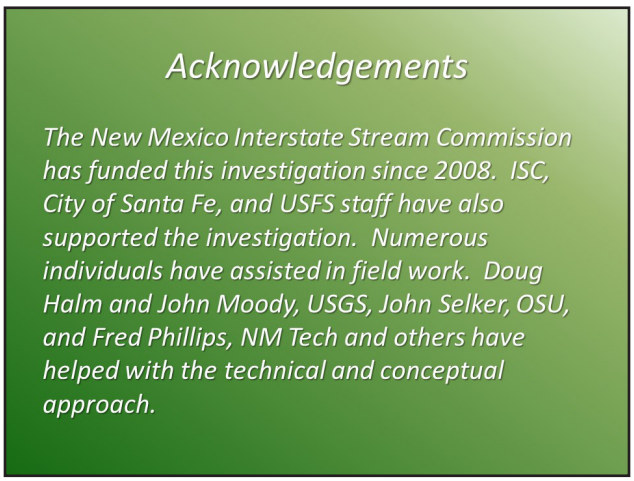

Figure 2. Acknowledgements.

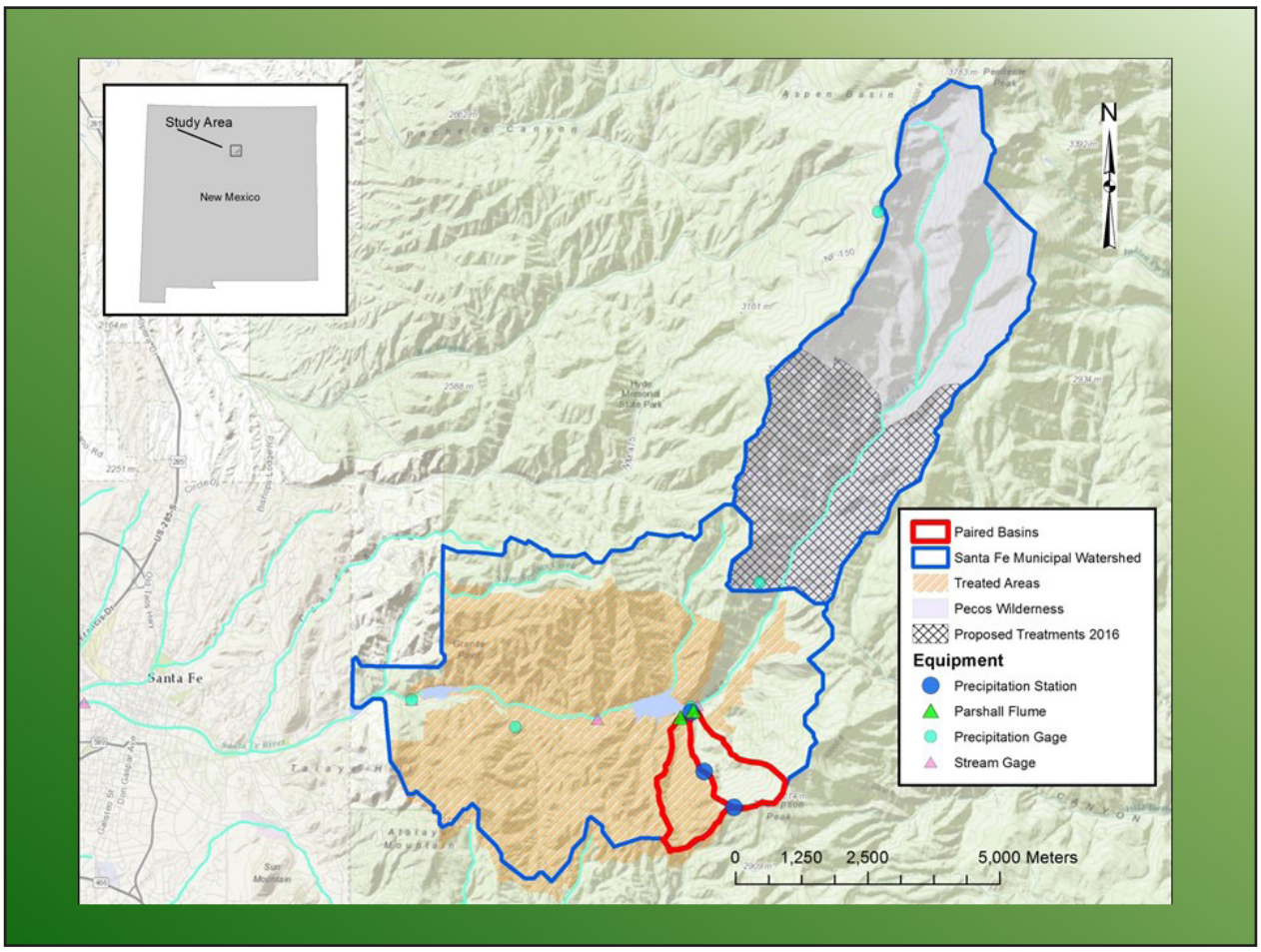

Figure 3. Santa Fe River supplies up to 40% of the City of Santa Fe's water supply, or about 5000 ac-ft/yr. The watershed is about 17,000 acres with the headwaters up at 12,000 feet. Water is stored in two reservoirs (McClure & Nichols-4,000 ac-ft of storage). The paired basins are each about 400 acres, one was treated in 2004 and 2010, and the other is untreated.

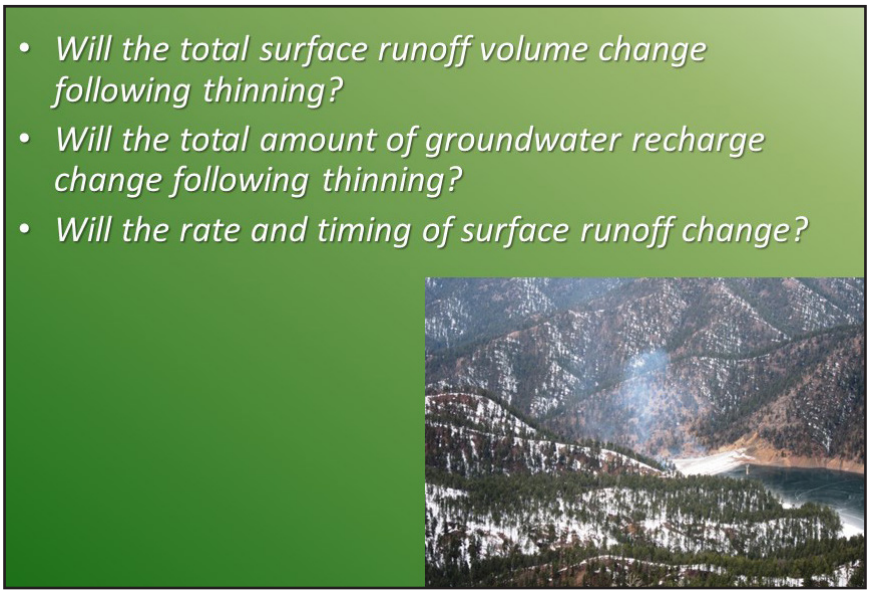

Figure 4. Specific questions.

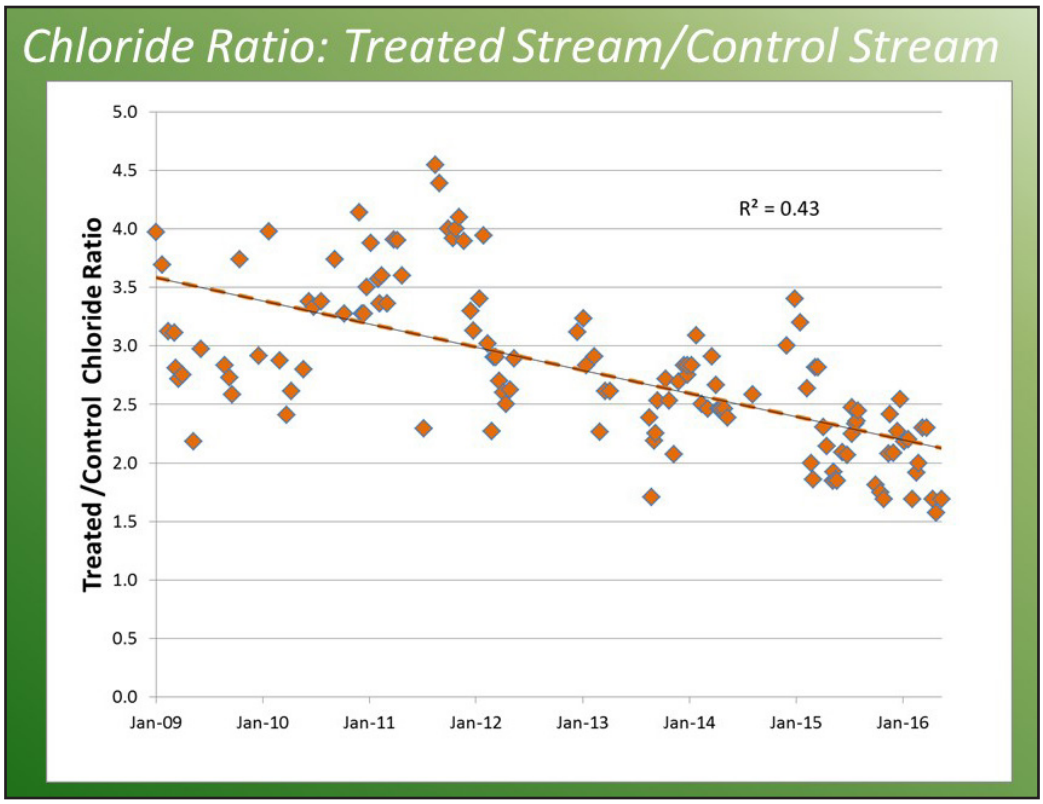

Figure 5. The chloride ratio was 3 to 1 from a sample collected in 1995, thus the forest treatments are not the cause of the higher ET in the treated basin. The historic higher ET may possibly be due to the greater area of west-facing slope in the treated basin. Although the R^2 is not impressive, the ratio appears to be declining, which would suggest a lower rate of ET in the treated basin as compared to the control.

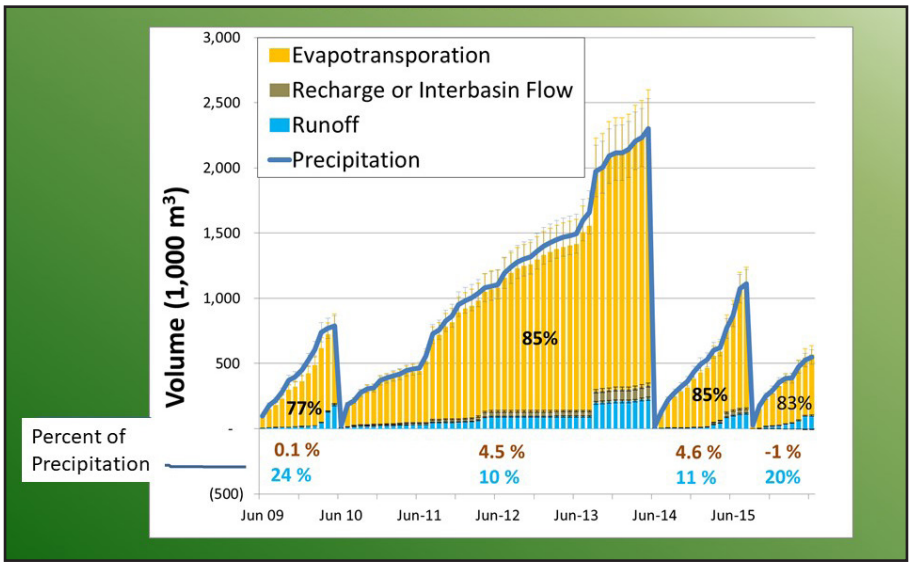

Figure 6. Cumulative water budget control basin. Now looking at the results of our water budgets based on the four integration periods defined by the chloride mass balance. The change in storage is not shown here, but it is less than 0.5%. ET ranges from 76 to 85% and runoff is 10 to 24% of precipitation. Recharge is between 0 and 5%. A value which is within the expected range for mountain front recharge.

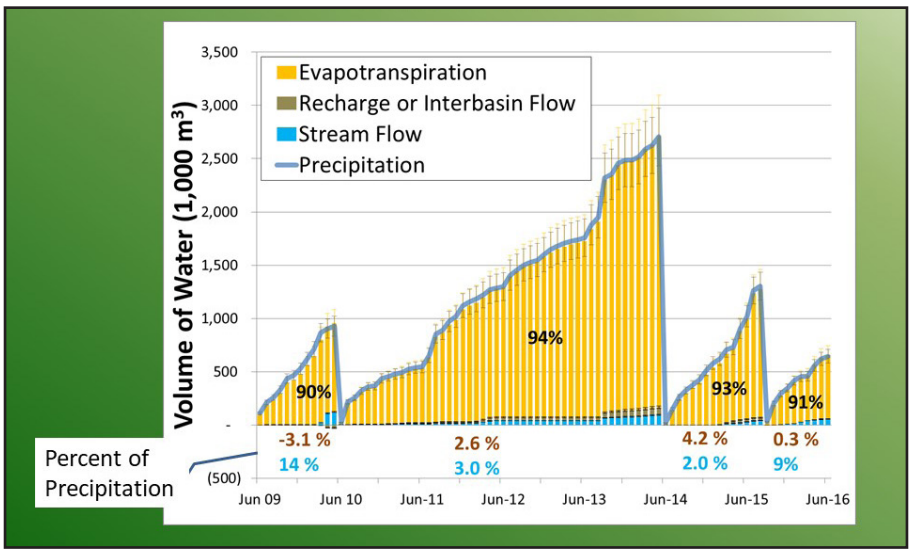

Figure 7. Cumulative water budget treated basin. ET is greater in the treated basin, ranging from 90 to 94%, with runoff between 2 and 14% of precipitation. Recharge estimates ranges from 0 to 4.7% of precipitation.

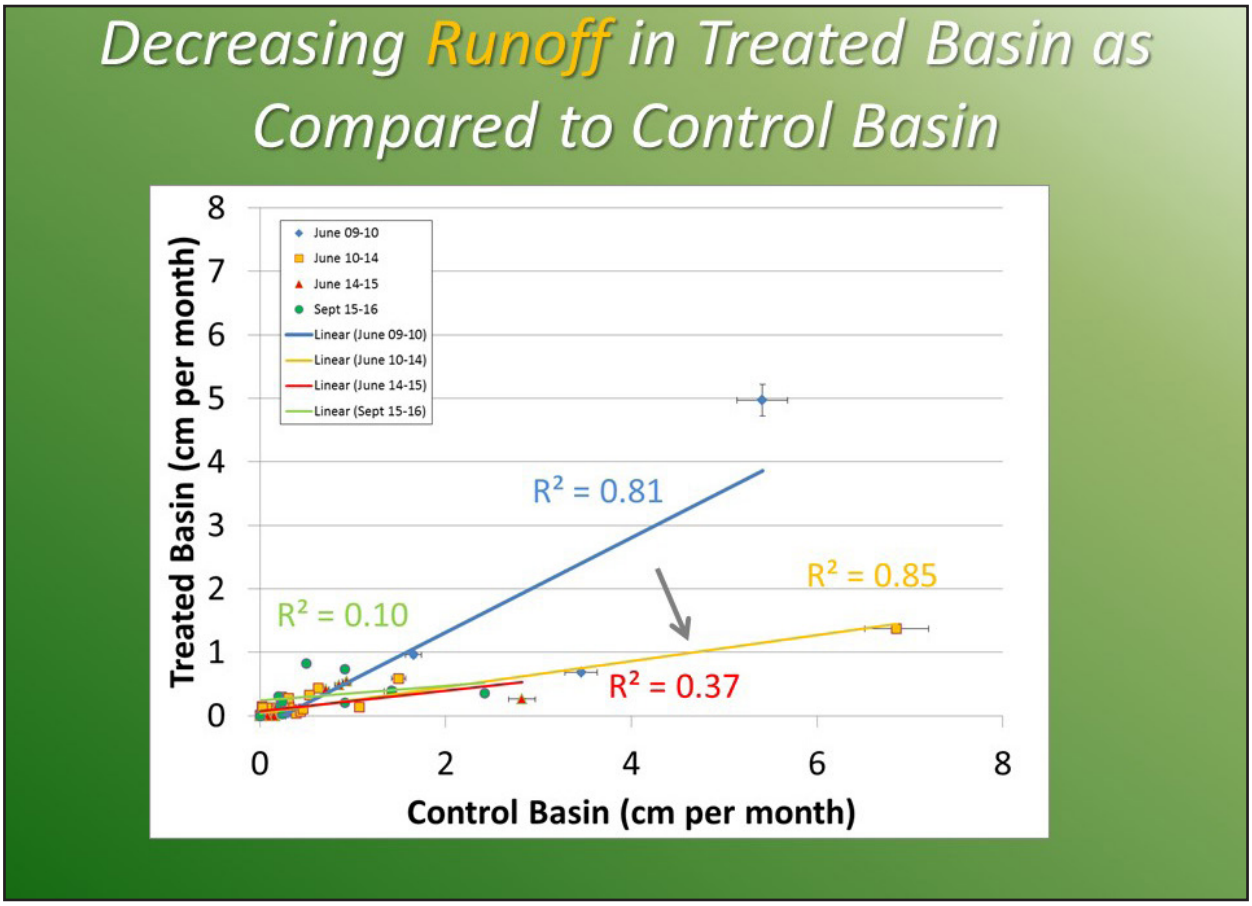

Figure 8. Looking at the monthly rate of stream flow based on the monthly water budget graphs, see how the monthly flows in the three periods compare. Stream flow appears to be trending downward from the first integration period to the last. This is consistent with our mean-monthly flow cross plot of before and after treatments.

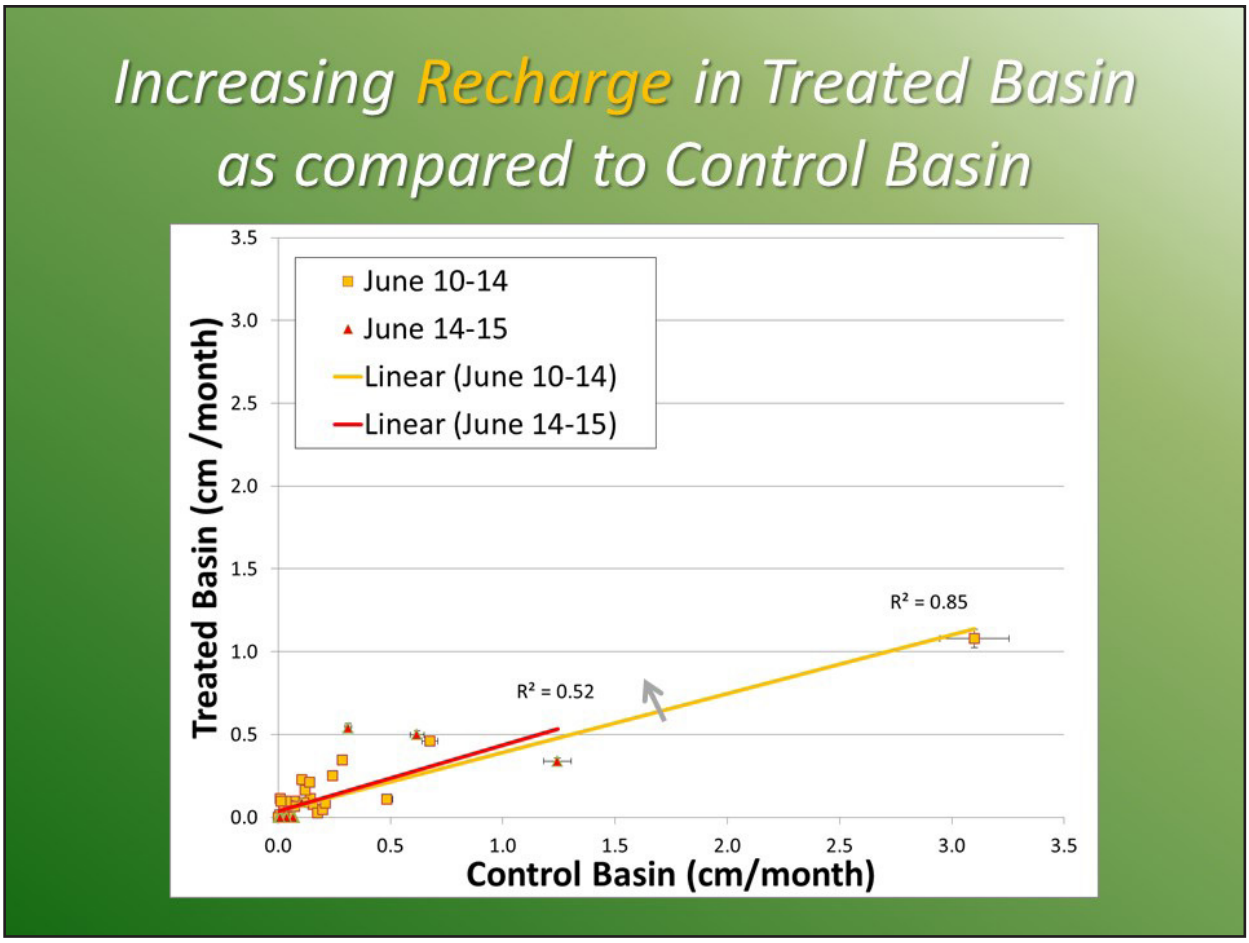

Figure 9. Preliminary results suggest that recharge appears to be doing the opposite, increasing with time in the treated basin as compared to the control basin. This is consistent with the conceptual understanding of increased groundcover - slower runoff, and increased time for recharge to occur.

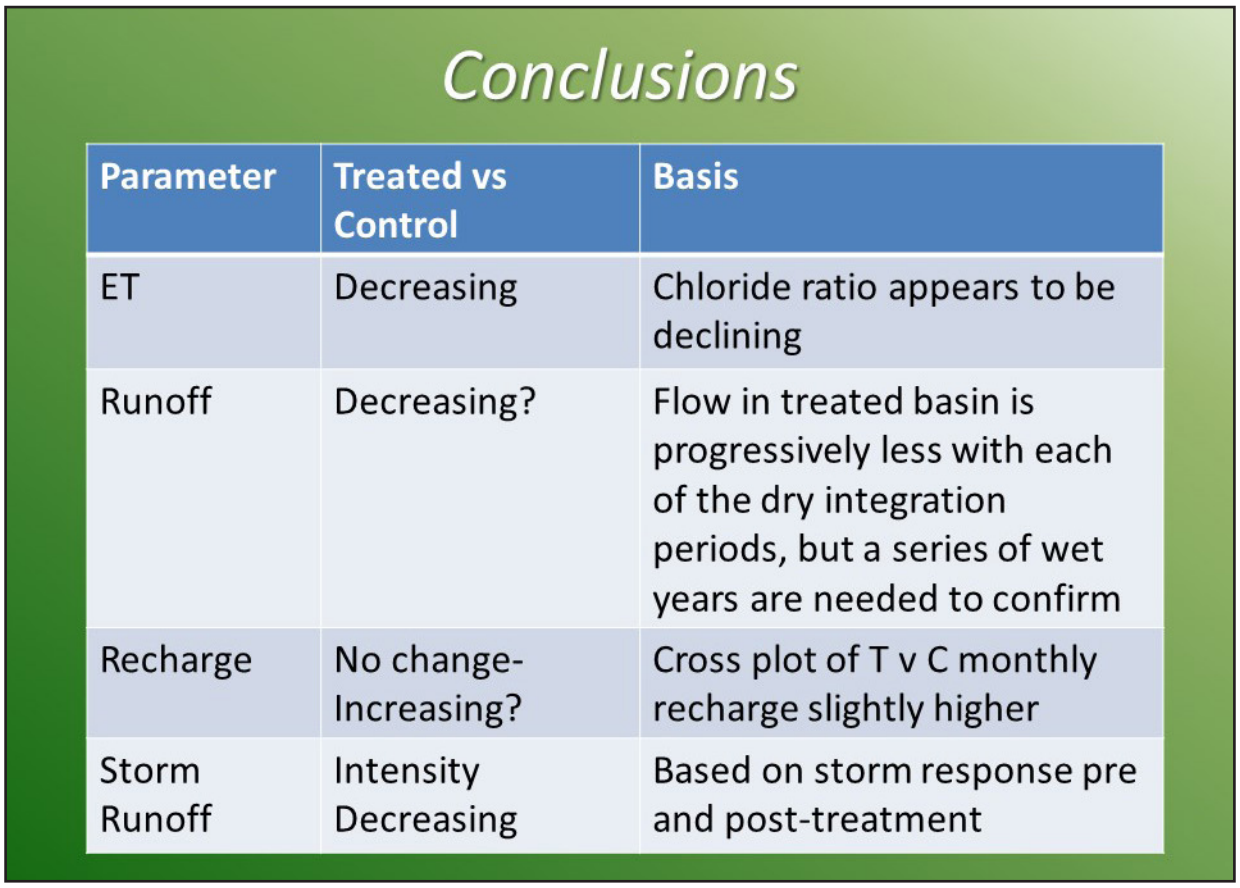

Figure 10. Conclusion. Surface runoff volume appears to decrease following thinning, but the period of investigation is a very dry period. Groundwater recharge appears to increase following thinning and maintenance burns with resulting increase in groundcover. The intensity of storm flows are reduced following thinning and increase in groundcover.