Effects of Brush Management on the Hydrologic Budget and Water Quality in South-Central Texas

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What is Brush Management?

- Brush management refers to the selective removal of woody vegetation (in this case, ashe juniper) and allowing the native grasses to re-establish naturally in their place.

Reference Watershed (Untreated)

Photo: J. Ryan Banta

Reference Watershed (Untreated)

Photo: J. Ryan Banta

Treatment Watershed

Photo: J. Ryan Banta

Paired Watershed Study

- The goal of the project was to evaluate changes in the hydrologic budget of two adjacent study watersheds resulting from brush management

- Monitored hydrology pre- and post-treatment
  - Data-collection period from 2001–2010
  - Measured continuous rainfall, streamflow, and evapotranspiration
  - Storm runoff samples (ephemeral) collected for suspended-sediment, major ions and nutrients

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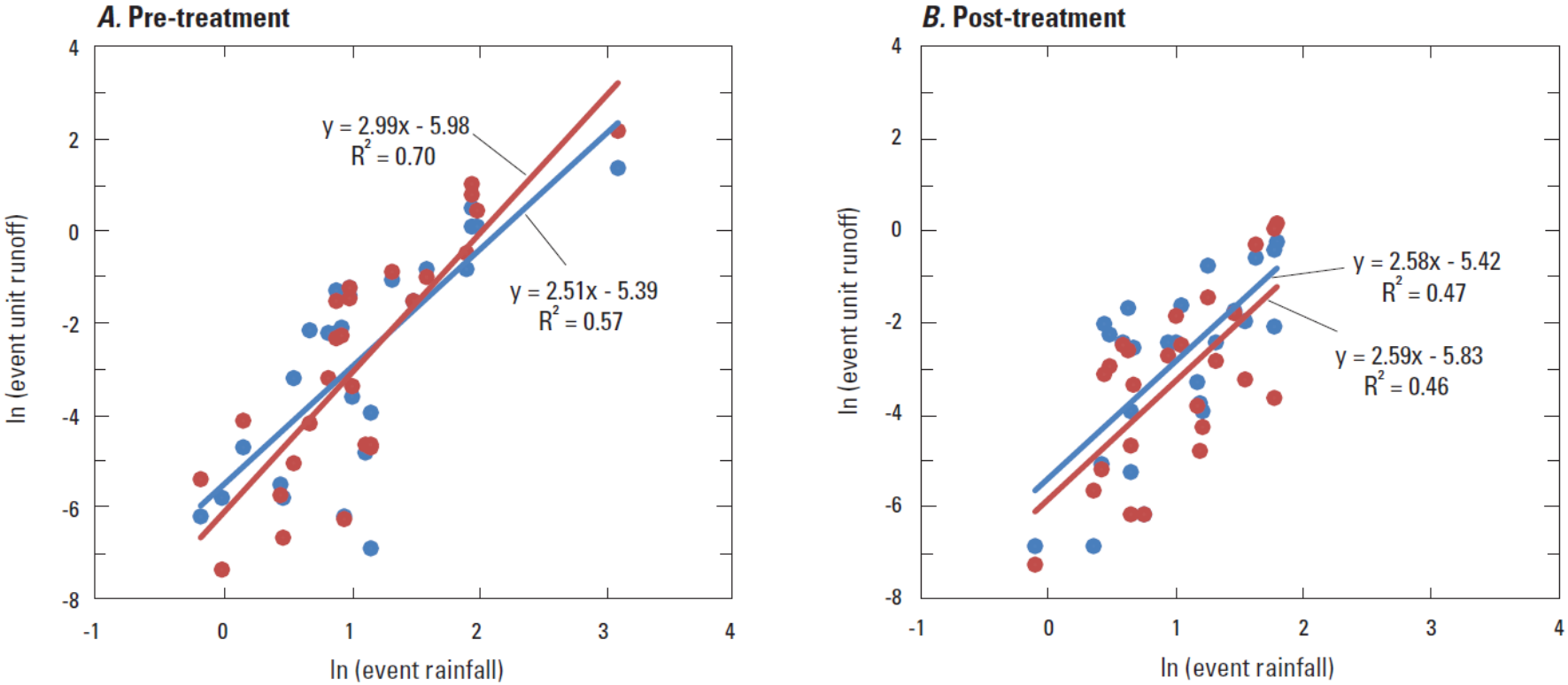
Photos: J. Ryan Banta, Richard N. Slattery

Streamflow vs. Rainfall

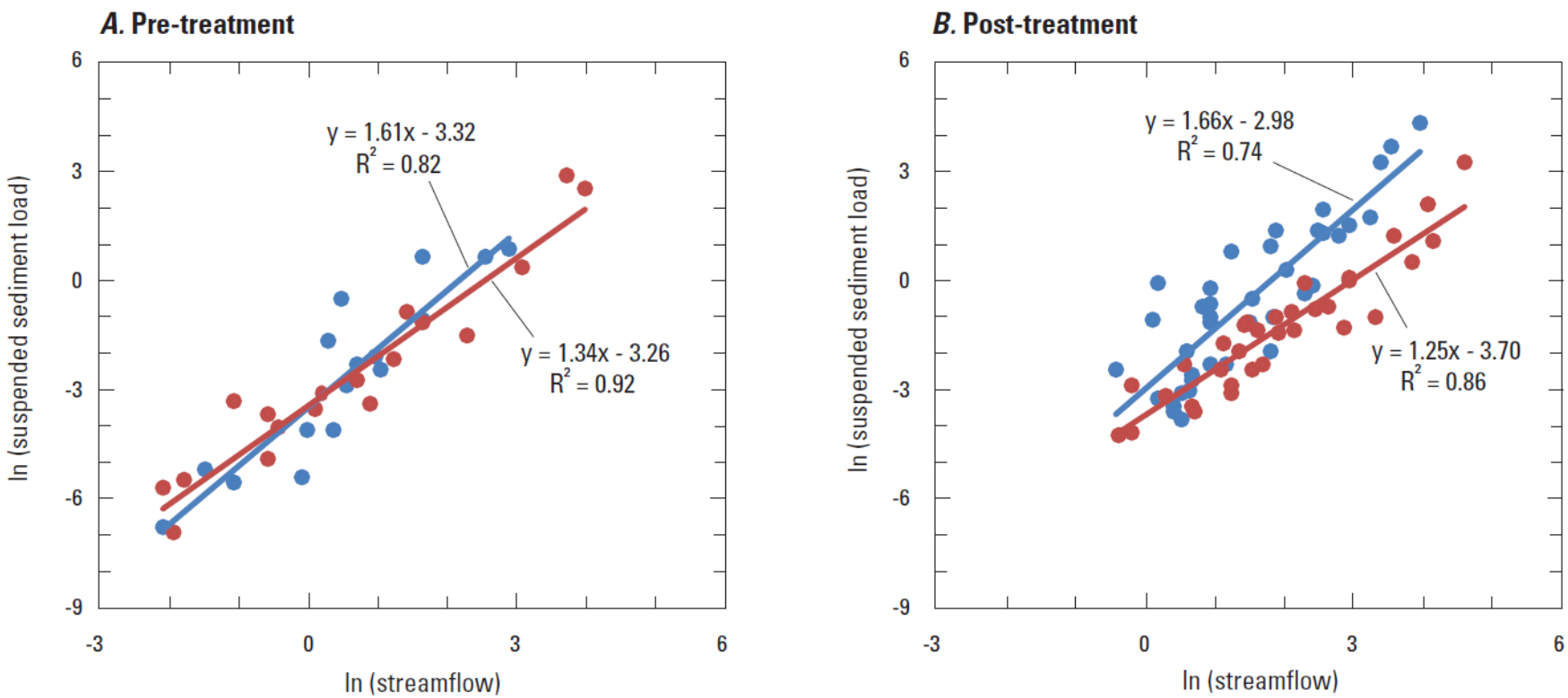


EXPLANATION

- Relation between event unit runoff and event rainfall at site 1C
- Relation between event unit runoff and event rainfall at site 2T
- Site 1C
- Site 2T
- y = ln (event unit runoff)
- x = ln (event rainfall)
- R^2 = Coefficient of determination

Source: Banta and Slattery, 2011

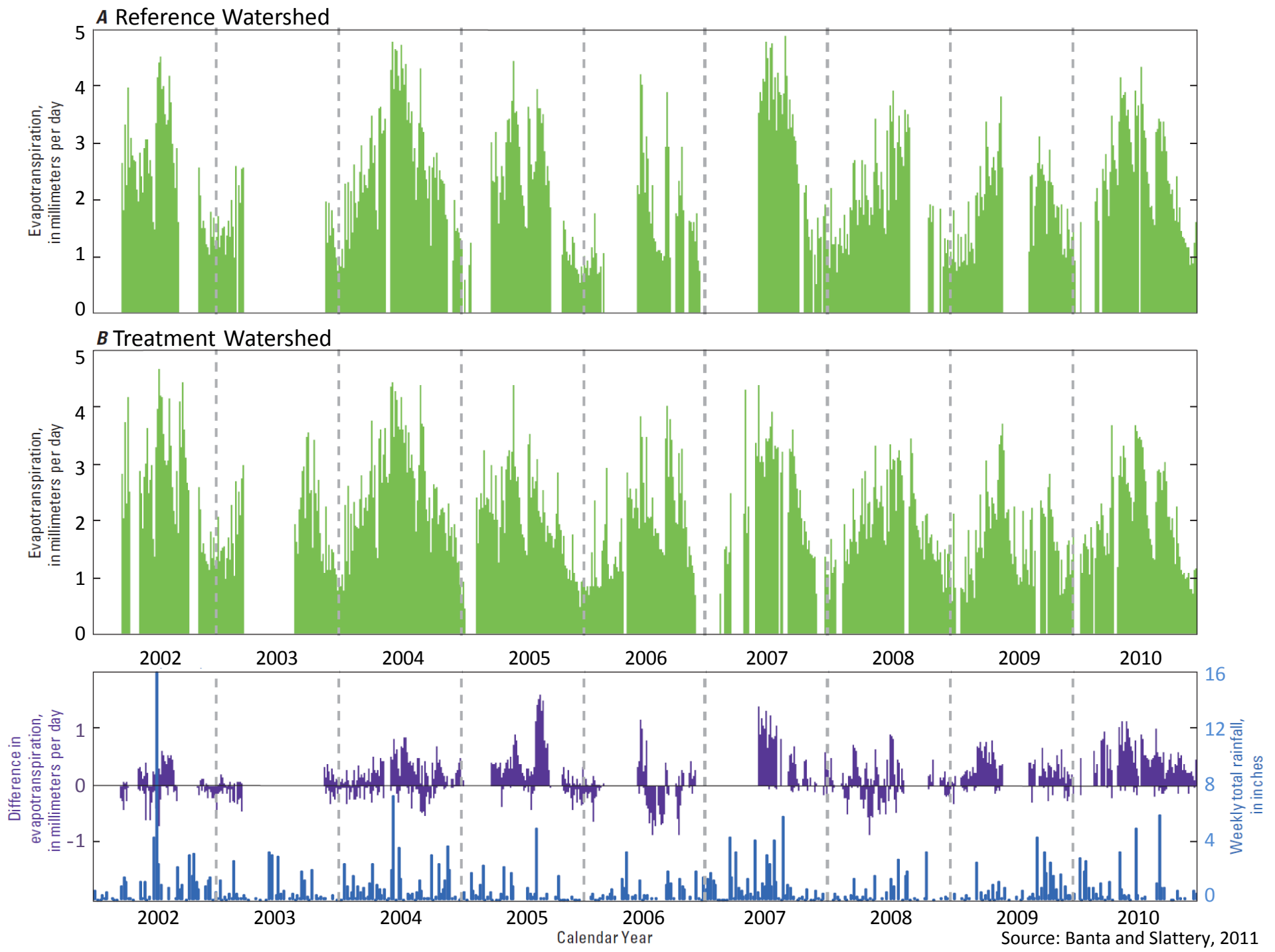
Suspended-Sediment Load vs. Streamflow



EXPLANATION

- Relation between suspended-sediment load and streamflow at site 1C
- Relation between suspended-sediment load and streamflow at site 2T
- Site 1C
- Site 2T
- y = ln (suspended-sediment load)
- x = ln (streamflow)
- R^2 = Coefficient of determination

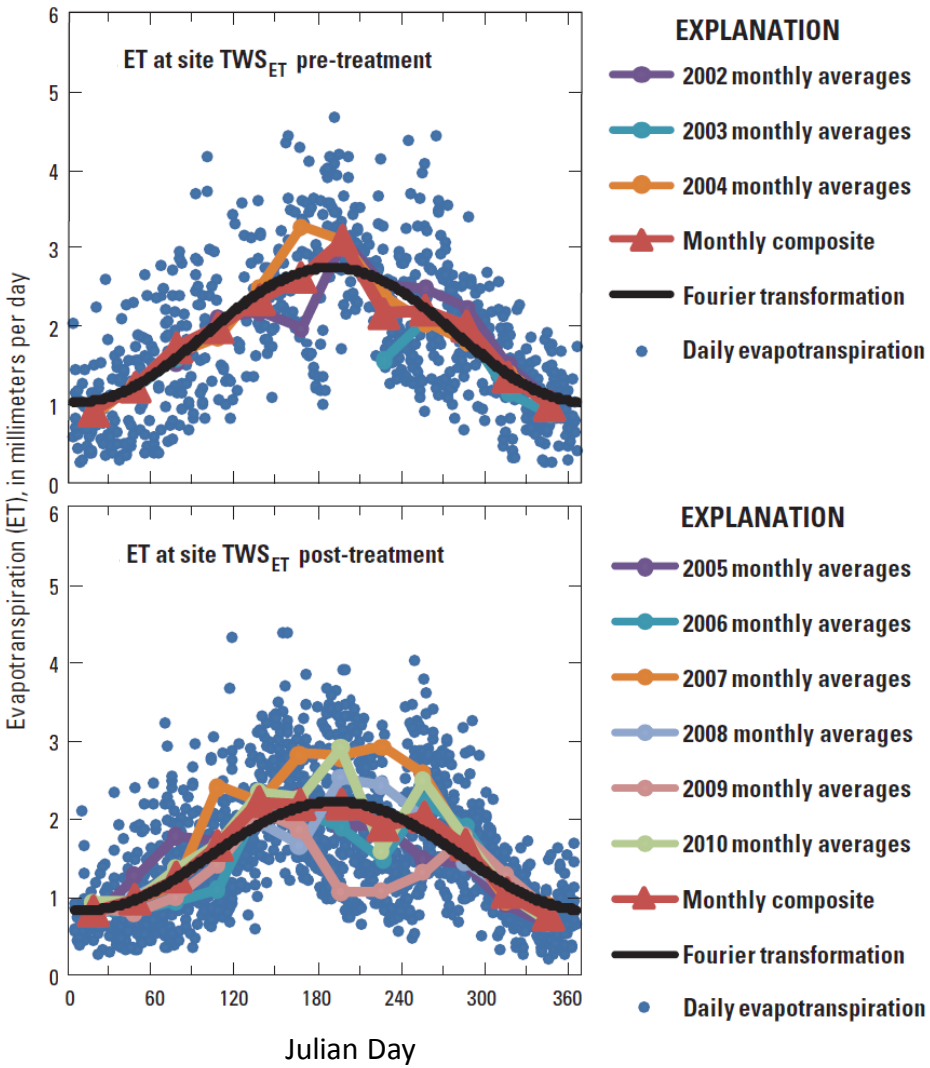
Source: Banta and Slattery, 2011



Source: Banta and Slattery, 2011

Balancing the hydrologic budget

- Rainfall
  - daily rainfall from network of gages
- Streamflow
  - daily discharge volume corrected for watershed area
- Estimated annual ET trends
  - calculated monthly averages
  - calculated Fourier transformation
- Potential groundwater recharge
  - calculated by mass balance approach to hydrologic budget



Source: Banta and Slattery, 2011

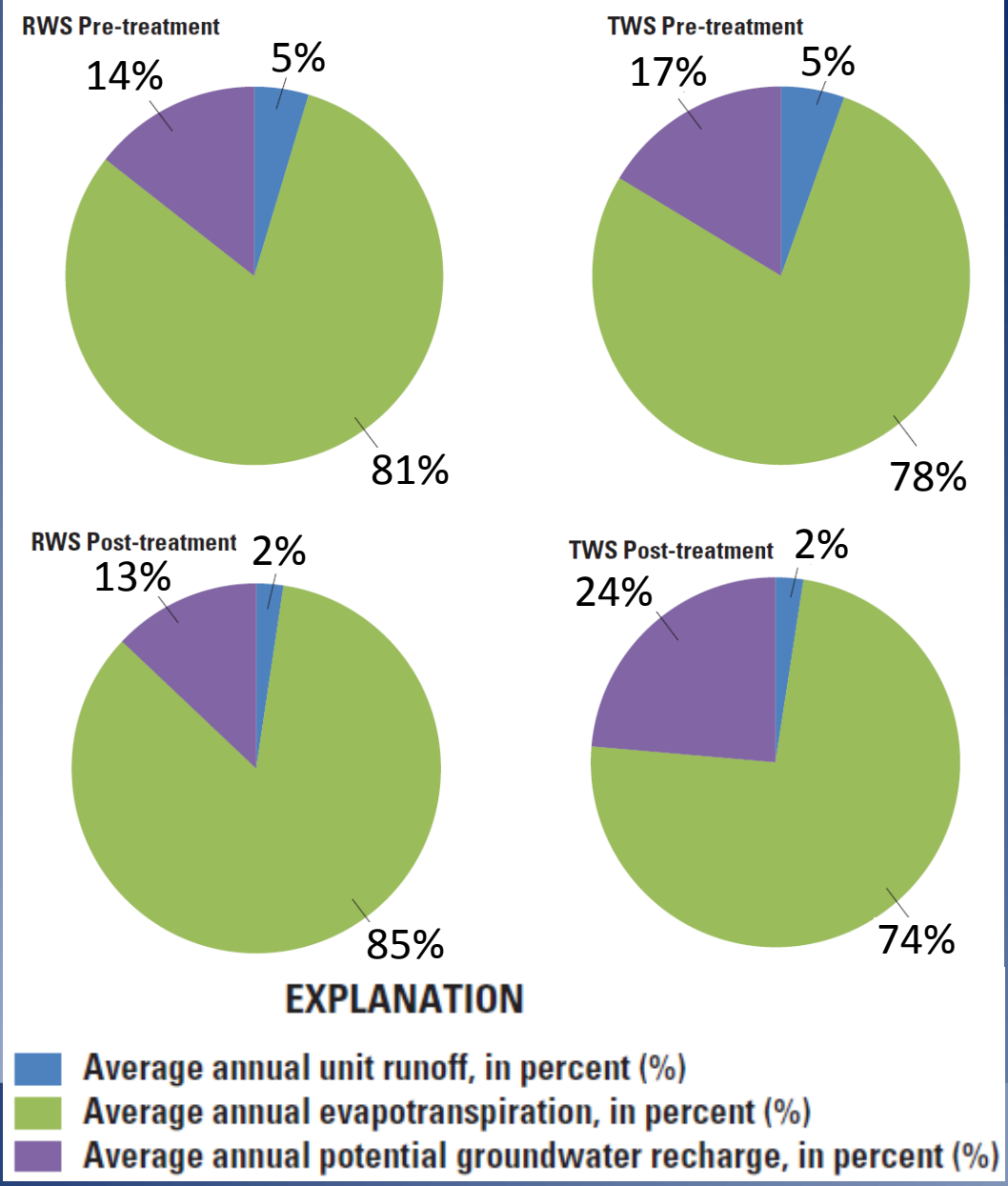
Hydrologic Budget - percent contributions

Reference Watershed (RWS) Pre-treatment

Treatment Watershed (TWS) Pre-treatment

RWS Post-treatment

TWS Post-treatment



USGS

Source:
Banta and Slattery, 2011

Honey Creek Study Conclusions

- Streamflow to rainfall relation did not change (pre- vs. post-treatment)
  - Antecedent conditions important
- Suspended sediment to streamflow relation *did* change (pre- vs. post-treatment)
  - Statistically significant
- Water quality did not change (pre- vs. post-treatment)
  - Graphical comparisons
- ET difference was statistically significant (pre- vs. post-treatment)
  - ET was linked in part to climate conditions
- Interpretive report and fact sheet available at pubs.usgs.gov
  - http://pubs.er.usgs.gov/publication/sir20115226
  - http://pubs.er.usgs.gov/publication/fs20123097

Next steps forward

- Continue monitoring the sites after a prescribed burn

Before

After

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Photos: Richard N. Slattery

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Photos: J. Ryan Banta

Questions?

Photo: J. Ryan Banta