Monitoring Effects of Wildfire Mitigation Treatments on Water Budget Components: A Paired-Basin Study in the Santa Fe River Watershed, New Mexico

Amy C. Lewis
Consultant to the New Mexico Interstate Stream Commission

GSA T104
From Pores to Mountains
September 28, 2016
Acknowledgements

The New Mexico Interstate Stream Commission has funded this investigation since 2008. ISC, City of Santa Fe, and USFS staff have also supported the investigation. Numerous individuals have assisted in field work. Doug Halm and John Moody, USGS, John Selker, OSU, and Fred Phillips, NM Tech and others have helped with the technical and conceptual approach.
Paired Basins Detail

- **Control Basin**
  - 153 ha
  - No Forest Treatments

- **Treated Basin**
  - 179 ha
  - Thinned & Burned

- **Flumes**
  - 23 & 76 cm flumes

- **Equipment**
  - Precipitation Station
  - Flumes

Map showing the boundaries and locations of the basins, with markers for different treatments and equipment.
Specific Questions

- Will the total surface runoff volume change following thinning?
- Will the total amount of groundwater recharge change following thinning?
- Will the rate and timing of surface runoff change?
Cross-Section of Treated Basin

- Land Surface
- Soil Surface
- Water Table

Precipitation

Lateral subsurface flow discharges to stream

Recharge to Regional Aquifer

ET
Average Flow by Water Year

- **Rx Begin**
- **Rx-maintenance**

![Chart showing average flow by water year with categories for Control and Treated.](chart.png)
Conceptual Pre- and Post-Treatment

![Graph showing treated flow vs. control flow](image-url)
Mean Monthly Flow: Before and After
Chloride Ratio: Treated Stream/Control Stream

R² = 0.43
Integration Periods-Control Basin
Integration Periods – Treated Basin
Cumulative Water Budget
Control Basin

Percent of Precipitation
Cumulative Water Budgets
Treated Basin

Percent of Precipitation

Evapotranspiration
Recharge or Interbasin Flow
Stream Flow
Precipitation

Volume of Water (1,000 m$^3$)

<table>
<thead>
<tr>
<th>Year</th>
<th>Evapotranspiration</th>
<th>Recharge or Interbasin Flow</th>
<th>Stream Flow</th>
<th>Precipitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>2.6 %</td>
<td>94%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>4.2 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>0.3 %</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Percentages are approximate and may vary.
Decreasing **Runoff** in Treated Basin as Compared to Control Basin
Increasing Recharge in Treated Basin as compared to Control Basin
June 2003 Storm Response

![Graph showing cumulative flow vs. cumulative precipitation.]
September 2013 Storm Response

The graph shows the cumulative flow (cm) against the cumulative precipitation (cm) for control and treated conditions. The control data is represented by blue dots, while the treated data is represented by red squares. The graph indicates a significant difference in cumulative flow between the control and treated conditions as the cumulative precipitation increases.
## Conclusions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Treated vs Control</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET</td>
<td>Decreasing</td>
<td>Chloride ratio appears to be declining</td>
</tr>
<tr>
<td>Runoff</td>
<td>Decreasing?</td>
<td>Flow in treated basin is progressively less with each of the dry integration periods, but a series of wet years are needed to confirm</td>
</tr>
<tr>
<td>Recharge</td>
<td>No change-Increasing?</td>
<td>Cross plot of T v C monthly recharge slightly higher</td>
</tr>
<tr>
<td>Storm Runoff</td>
<td>Intensity Decreasing</td>
<td>Based on storm response pre and post-treatment</td>
</tr>
</tbody>
</table>