



# Watershed Modeling for DWaRF

Using AGWA

The Automated Geospatial Watershed Assessment Tool

[www.tucson.ars.ag.gov/agwa](http://www.tucson.ars.ag.gov/agwa)

Shea Burns, Dave Goodrich, and Phil Guertin

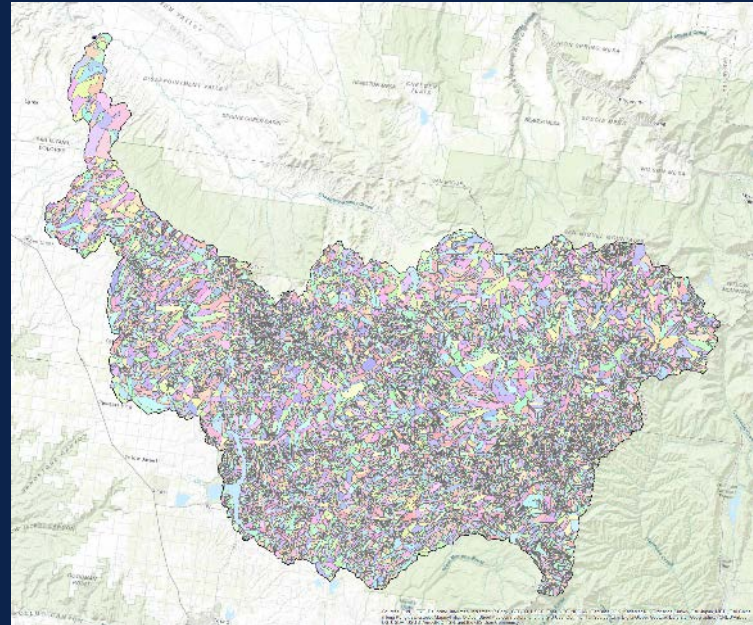




# Watershed Representation

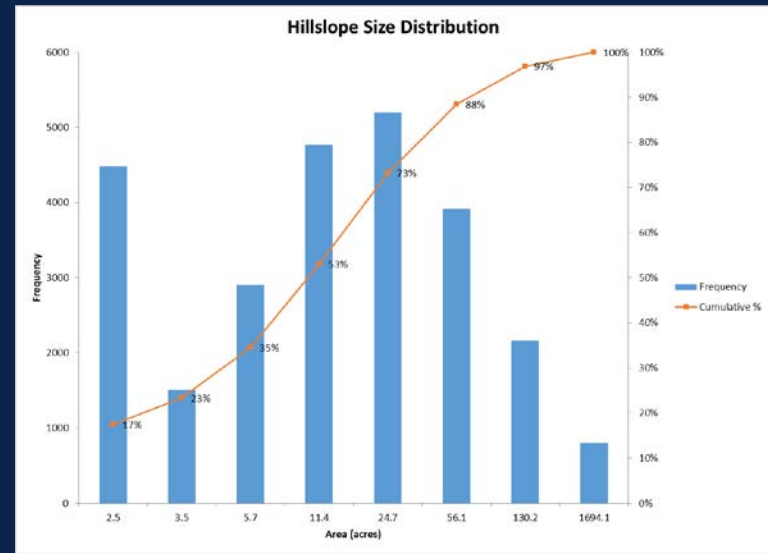


- ▶ Based on National Hydrography Dataset flowlines
- ▶ 25913 hillslope elements
- ▶ 10387 channel elements



# Watershed Representation

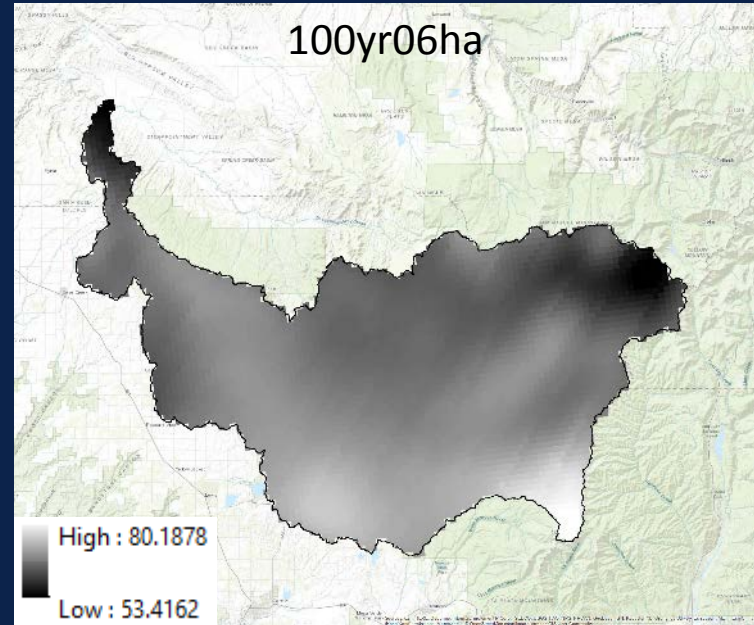
- ▶ Based on National Hydrography Dataset flowlines
- ▶ 25913 hillslope elements
- ▶ 10387 channel elements



# What drives change?

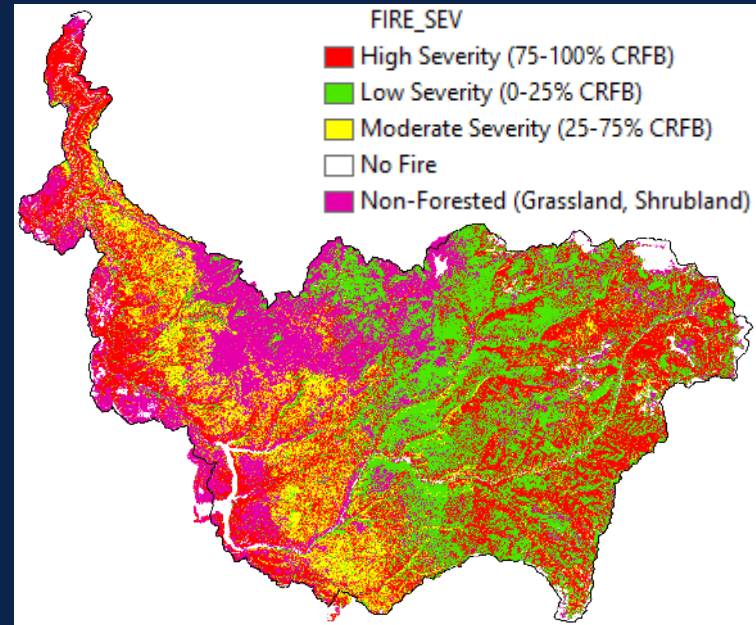
## ▶ Design Storms

- ▶ Obtained from NOAA Precipitation Frequency Data Server
  - ▶ <https://hdsc.nws.noaa.gov/hdsc/pfds>
- ▶ 1, 2, 5, 10, 25, 50, and 100 year return periods
- ▶ 5, 10, 15, 30, 60 minute and 2, 3, and 6 hour durations
- ▶ 1 year 5 minute event
  - ▶ Depth: 3.5mm to 5.4mm
- ▶ 100 year 6 hour event
  - ▶ Depth: 53.4mm to 80.2 mm



# What drives change?

- ▶ Burn severity
  - ▶ Reductions in canopy cover
    - ▶ Low severity: 14% reduction
    - ▶ Moderate severity: 32% reduction
    - ▶ High severity: 50% reduction
  - ▶ Reductions in hydraulic roughness
  - ▶ Reductions in hydraulic conductivity





# Simulations and Results

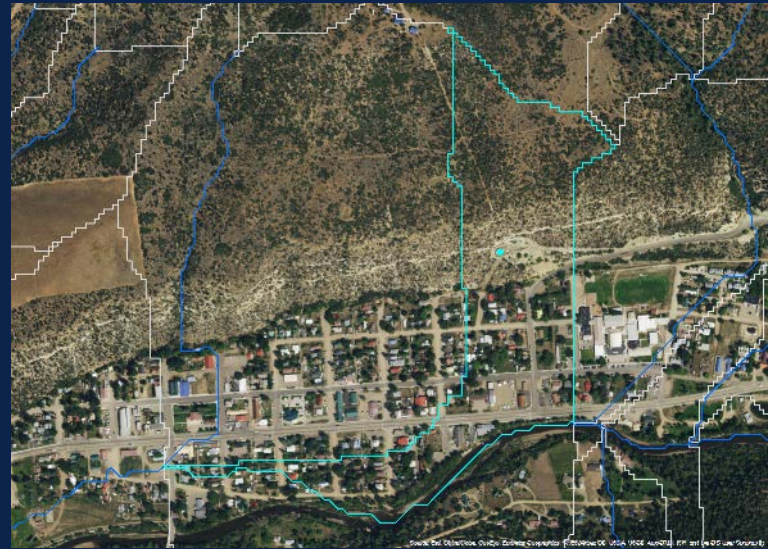


- ▶ 112 simulations
  - ▶ 56 prefire, 56 postfire
- ▶ 186 result files
  - ▶ 62 prefire
    - ▶ 56 hillslope files (all return periods, all durations)
    - ▶ 6 channels files (2, 10, and 25 year return periods, 60 minute and 6 hour durations)
  - ▶ 62 postfire
    - ▶ 56 hillslope files (all return periods, all durations)
    - ▶ 6 channels files (2, 10, and 25 year return periods, 60 minute and 6 hour durations)
  - ▶ 62 percent change from prefire to postfire
    - ▶ 56 hillslope files (all return periods, all durations)
    - ▶ 6 channel files (2, 10, and 25 year return periods, 60 minute and 6 hour durations)

## Simulations and Results

### ▶ Town of Dolores Watertank

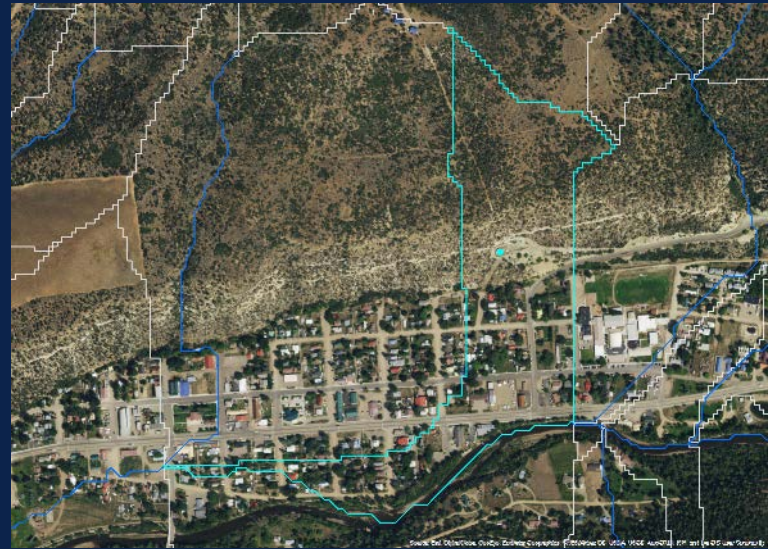
- ▶ 37°28'39.57"N  
108°29'48.34"W
- ▶ ~63 acre hillslope
- ▶ 2 year 60 minute event
  - ▶ Prefire peak runoff: 0.2" / hour
  - ▶ Postfire peak runoff: 1.3" / hour
  - ▶ Percent change: 550% increase



## Simulations and Results

### ▶ Town of Dolores Watertank

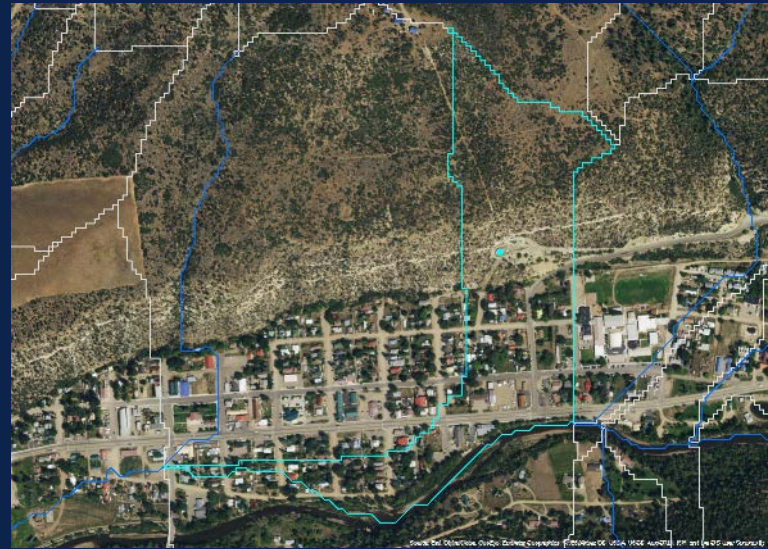
- ▶ 37°28'39.57"N  
108°29'48.34"W
- ▶ ~63 acre hillslope
- ▶ 10 year 60 minute event
  - ▶ Prefire peak runoff: 2.5" / hour
  - ▶ Postfire peak runoff: 2.6" / hour
  - ▶ Percent change: 4% increase





## Simulations and Results

- ▶ Town of Dolores Watertank
  - ▶ 37°28'39.57"N  
108°29'48.34"W
  - ▶ ~63 acre hillslope
  - ▶ 25 year 60 minute event
    - ▶ Prefire peak runoff: 3.55" / hour
    - ▶ Postfire peak runoff: 3.63" / hour
    - ▶ Percent change: 2.25% increase



## Simulations and Results

- ▶ Spruce Water Canyon and Road 36 stream/road intersection
  - ▶ 37°30'59.54"N  
108°22'54.09"W
  - ▶ 18 sq. mi. drainage area
  - ▶ 2 year 60 minute event
    - ▶ Prefire peak runoff: 86 cfs
    - ▶ Postfire peak runoff: 482 cfs
    - ▶ Percent change: 460% increase



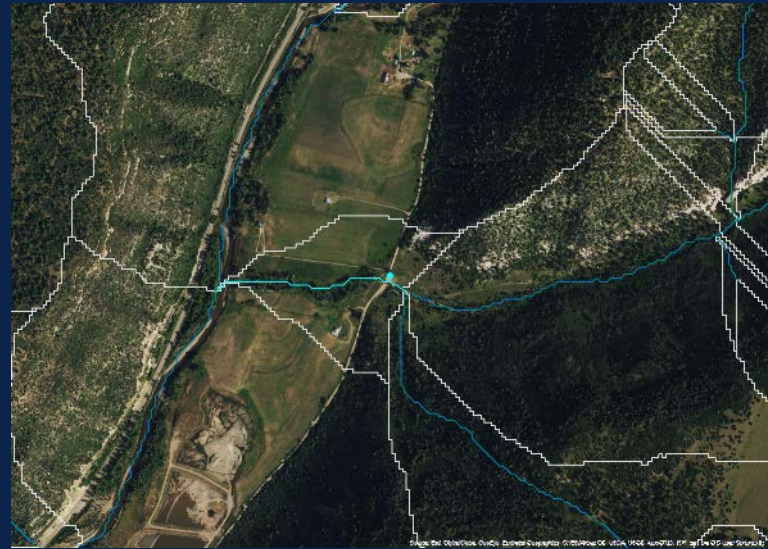
## Simulations and Results

- ▶ Spruce Water Canyon and Road 36 stream/road intersection
  - ▶ 37°30'59.54"N  
108°22'54.09"W
  - ▶ 18 sq. mi. drainage area
  - ▶ 10 year 60 minute event
    - ▶ Prefire peak runoff: 960 cfs
    - ▶ Postfire peak runoff: 2988 cfs
    - ▶ Percent change: 211% increase



## Simulations and Results

- ▶ Spruce Water Canyon and Road 36 stream/road intersection
  - ▶ 37°30'59.54"N  
108°22'54.09"W
  - ▶ 18 sq. mi. drainage area
  - ▶ 25 year 60 minute event
    - ▶ Prefire peak runoff: 2454 cfs
    - ▶ Postfire peak runoff: 6700 cfs
    - ▶ Percent change: 173% increase



## Simulations and Results

### ▶ Silver Creek - water intake for Rico

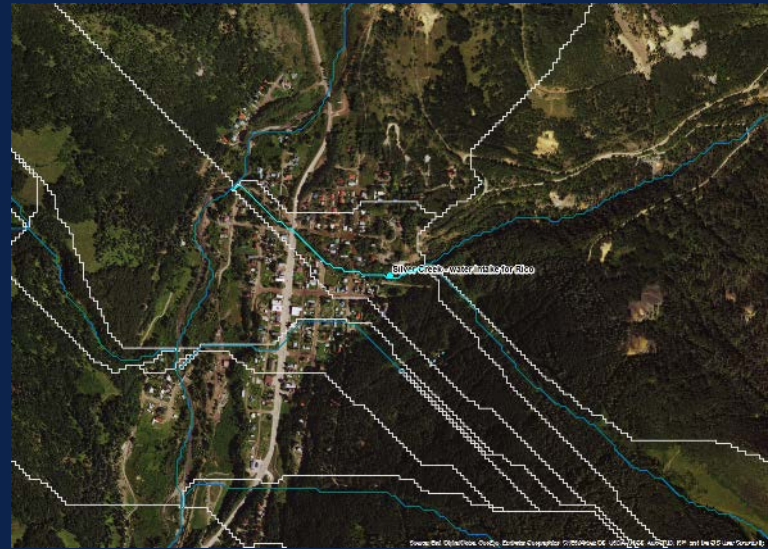
- ▶ 37°41'36.20"N  
108° 1'41.71"W
- ▶ 7.1 sq. mi. drainage area
- ▶ 2 year 60 minute event
  - ▶ Prefire peak runoff: 82 cfs
  - ▶ Postfire peak runoff: 222 cfs
  - ▶ Percent change: 171% increase



## Simulations and Results

### ▶ Silver Creek - water intake for Rico

- ▶ 37°41'36.20"N  
108° 1'41.71"W
- ▶ 7.1 sq. mi. drainage area
- ▶ 10 year 60 minute event
  - ▶ Prefire peak runoff: 490 cfs
  - ▶ Postfire peak runoff: 2546 cfs
  - ▶ Percent change: 420% increase



## Simulations and Results

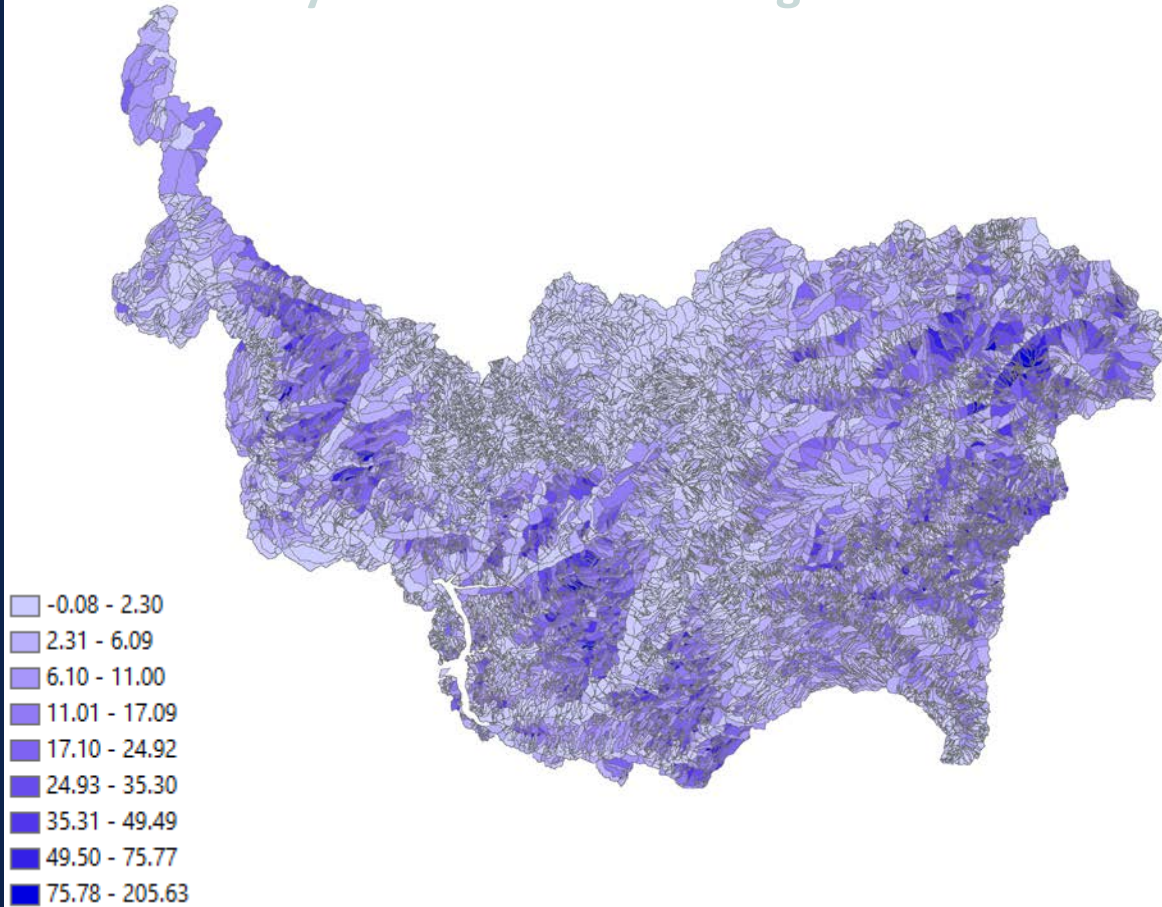
### ▶ Silver Creek - water intake for Rico

- ▶ 37°41'36.20"N  
108° 1'41.71"W
- ▶ 7.1 sq. mi. drainage area
- ▶ 25 year 60 minute event
  - ▶ Prefire peak runoff: 1603 cfs
  - ▶ Postfire peak runoff: 6420 cfs
  - ▶ Percent change: 300% increase



# Model Results

## 10yr60ma Percent Change in Runoff







## Additional Notes



- ▶ Model is driven by design storms, not observed data
- ▶ When viewing channel results, be aware an unrealistic volume of rainfall has been applied
- ▶ Simulations are not calibrated, so relative change is emphasized
- ▶ Results should be a starting point for asking more questions, especially if they are not intuitive
- ▶ As events get larger, rainfall tends to dominate other change



# Questions and Discussion

[www.tucson.ars.ag.gov/agwa](http://www.tucson.ars.ag.gov/agwa)

