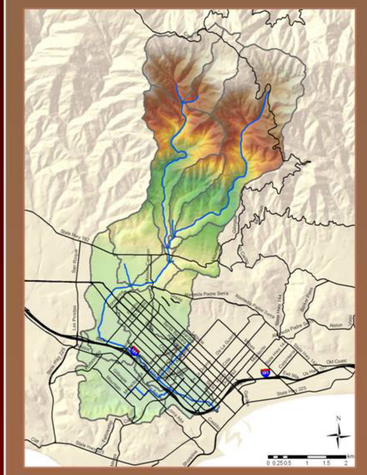
Post-Fire Sedimentation and Flood Risk Potential
in the Mission Creek Watershed of Santa Barbara

Mission Creek Watershed



Mission Creek drains water from the Los Padres National Forest to urbanized downtown Santa Barbara, Southern California. (Data Source: ESRI, SB County)

• Mission Creek flows through the urban area of downtown Santa Barbara, CA. Flooding occurs and damages property even in non-fire years.

• The steep and rocky upper watershed is part of the Los Padres National Forest. Fuel accumulation of chaparral vegetation creates a high risk of wildfire.

The 2008 Gap Fire burned 9,500 acres and 8 watersheds near Santa Barbara

Significance

The risk of damaging floods and sedimentation increases during post-fire years. Accurate predictions of the magnitude of risk using watershed analysis tools informs pre- and post-fire management actions. The recent, local 2008 Gap Fire refined our analysis.

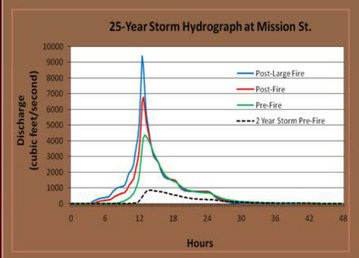
Objectives

1. Identify the physical changes in watershed properties after a fire.
2. Calculate the response of Mission Creek Watershed to wildfire based on the characteristics of the watershed, utilizing observations of the response of San Pedro Watershed to the 2008 Gap wildfire.
3. Assess risk and management implications of this analysis.

Observations of the San Pedro watershed after the Gap Fire improved our predictions

Hydrology Results

We used hydrologic modeling software to quantify the potential post-fire increases in peak discharge.

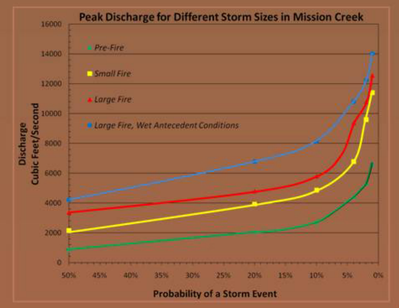


•24-hour design storms represent 2 - 100 year recurrence interval events

• A fire that burns 25% of the upper watershed increases peak discharge by 73% -155%

• A fire that burns 50% of the upper watershed increases peak discharge by 91%-300%

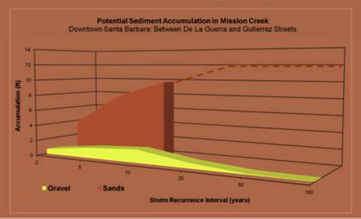
• Rainfall on wet soil (antecedent moisture) can further increase peak discharges by 12% - 25%



Synthesis of Results

• Using sediment transport calculations, we determined that gravel accumulation may reach 1 - 1 ½ feet

• Adding 1 foot of sediment to the lower channel would decrease capacity by ~10%



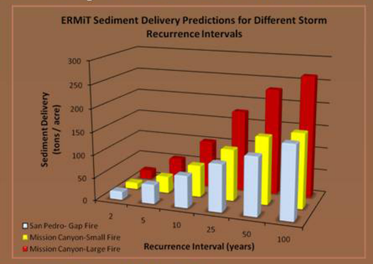
The FEMA 100-yr floodplain (light blue) is four times more likely to flood in first year after a fire.

Leslie Abramson **Milli Chennell** **Erica Eisch**
Alicia Glassco **Tom Holley**
Faculty Advisor: Tom Dunne

Donald Bren School of Environmental Science & Management

Sediment Results

We used an erosion prediction tool to calculate sediment delivery under different fire and storm scenarios.



• A small Fire in Mission Creek is comparable to the San Pedro Watershed after the Gap Fire

• A large fire could increase total sediment production by 385% after the 2-year storm

HYDROMULCH:

• This post-fire hillslope mitigation treatment may decrease sediment delivery to Mission Creek by 90%

• However, hydromulch is only effective for smaller storms and has unknown effects on hydrology

SEDIMENT BASINS:

• Existing sediment basins have a combined capacity of
  • Design = **24,200 yd³**
  • Current = **7,100 yd³**

• Estimated post-fire sediment production above basins:
  • Large fire + 2-yr storm = **51,977 yd³**

DEBRIS FLOWS:

• Unstable soils increase by 53% under post-fire conditions (pictured right)

• Greater risk in upper and middle watershed

Recommendations

Based on our analysis, we suggest that local agencies coordinate to:

1. **Clear sediment basins** to their maximum capacity to prepare for debris and sediment in flux after a fire
2. **Hydromulch** to reduce hillslope erosion
3. Increase Mission Creek flood capacity through **infrastructure improvements & channel clearing**
4. Incorporate post-fire risk into **city & county planning**
5. Improve **public information** to prepare for emergencies