

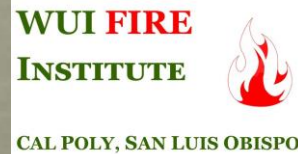
Fire Prevention in the Salinas River: A vegetation management project



Adriana Stagnaro



Dr. Chris Dicus



Chief Jay Enns

Battalion Chief for the City of Paso Robles Fire Department



- Other Partners

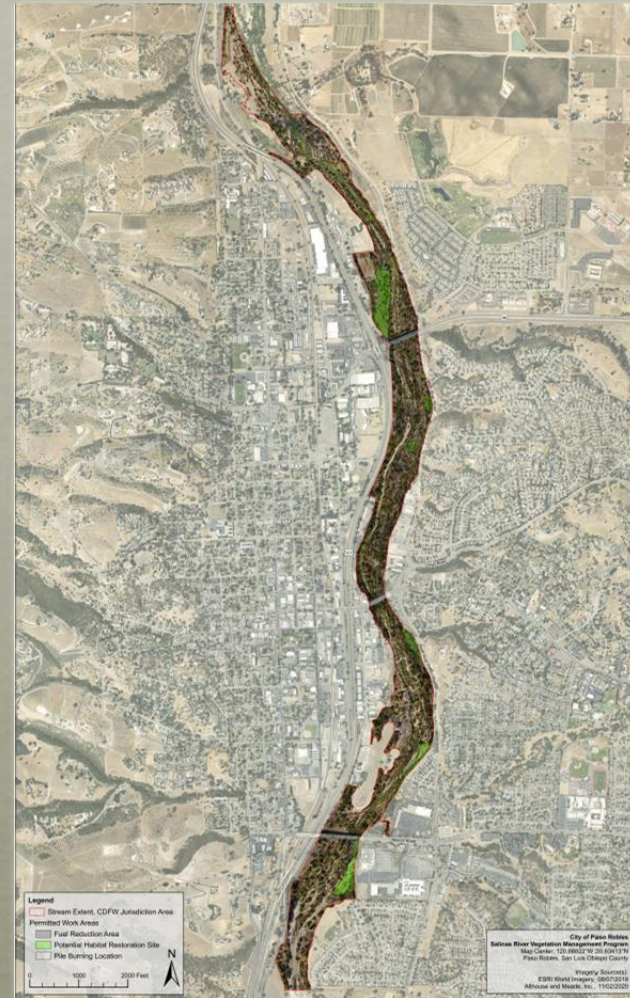
- Althouse & Meade
- Goat Girls
- Upper Salinas Las Tablas RCD



UPPER SALINAS-LAS TABLAS
RESOURCE
CONSERVATION DISTRICT

Site Description

- 3 miles bisecting Paso Robles
 - 430 acres
- Critical city infrastructure
- Steelhead habitat



Unhoused Population

2021

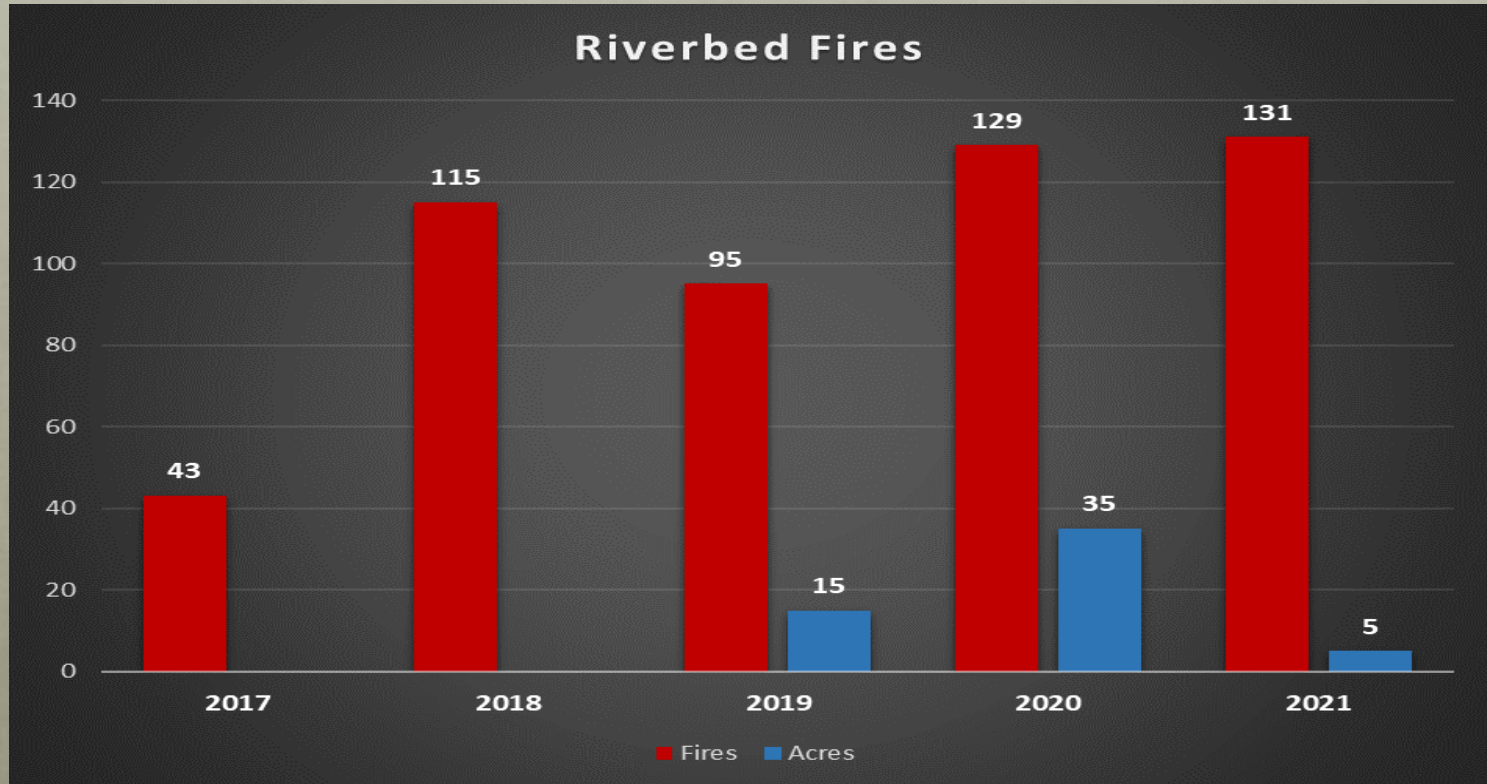
150-300 residents



245,040 pounds removed



Unintended Consequences



Not Confined to Riverbed



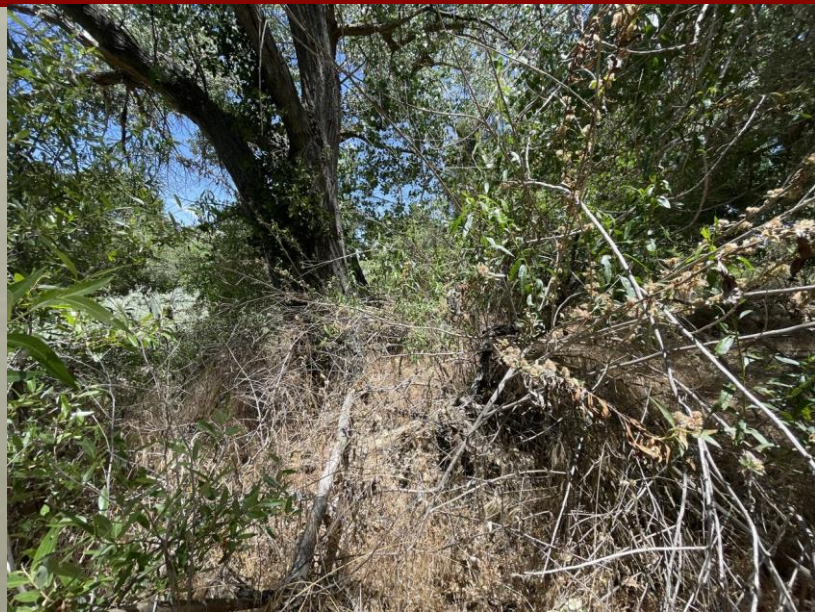
- 2020 River Fire
 - 2 homes destroyed
 - 82 households ordered to evacuate

Fixing the Problem

- City Manager declares emergency in 2019 and in 2020
- Veg management to reduce community risk, firefighter safety, and restoration
- Encompassed 227 acres in river channel and 38.7 acres of city maintained open space



Shaded fuel break

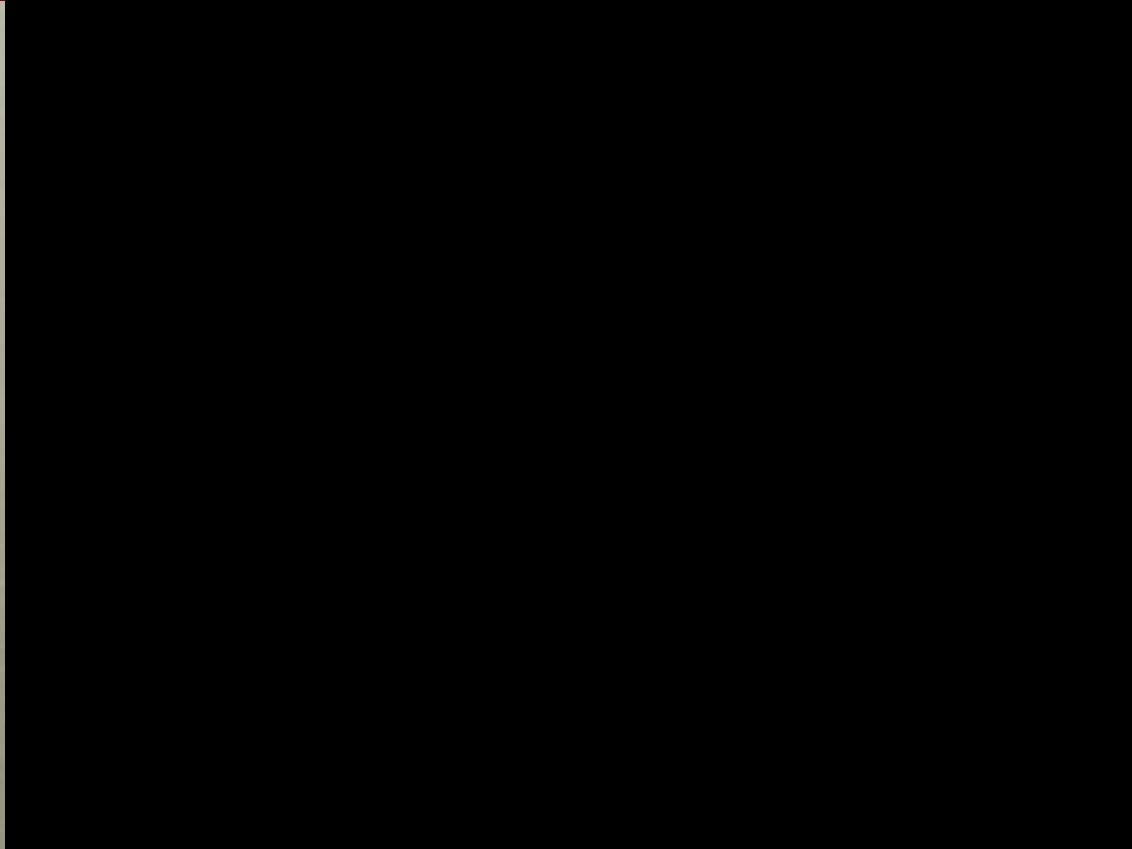


Before



After

Fire Goats Unite!



Follow-up Grazing

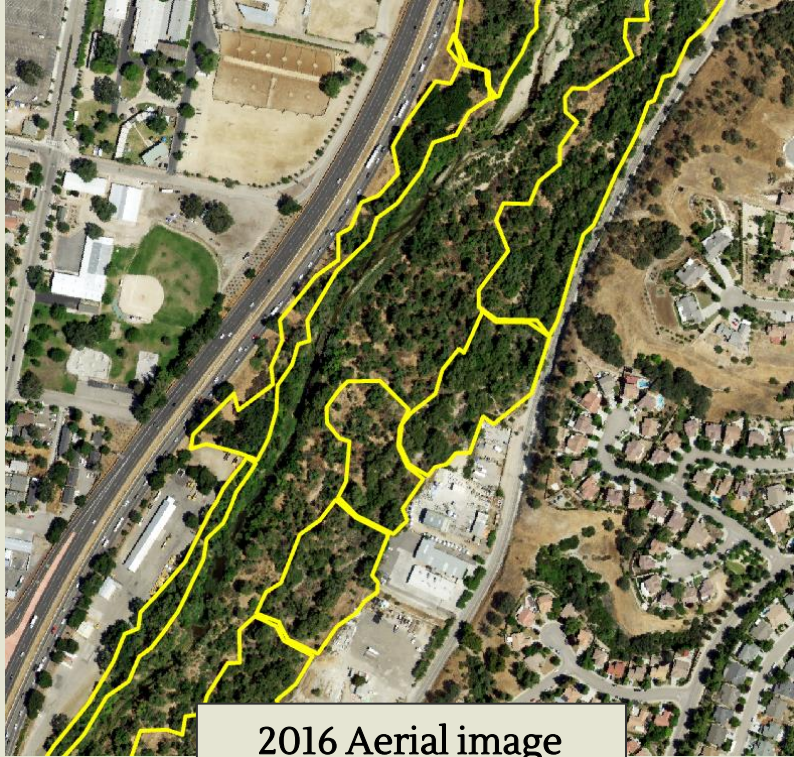


Before



After

Changes 2016-2022



2016 Aerial image



2022 Aerial Image

Research Questions

How do vegetative fuels differ between...

- Untreated
- Shaded fuel break only
- Shaded fuel break + grazing



In each of above, how does potential fire behavior differ by...

- Surface fire flame length
- Surface fire rate of spread

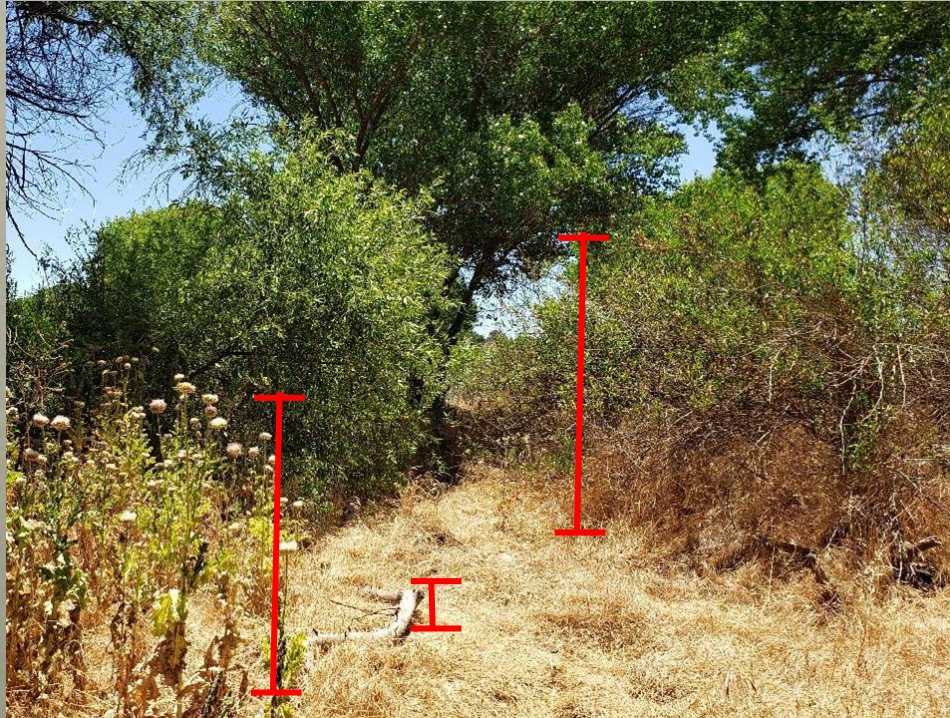
Inputs for Models



Down and Dead
Wood classified
by size (tons per acre)



Inputs for Models



Average depth of live and dead standing vegetation & leaf litter (inches)

This is what we call “fuel bed depth”

Inputs for Models



Herbaceous
fuel load

(tons per acre)

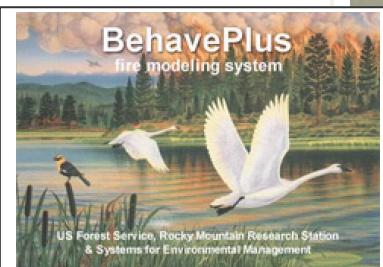
Vegetative Fuels

Model Name	Untreated Riparian	Mechanical Only	Mech + Grazing
Down and Dead Wood (<1/4")	1.1 tons/acre	0.4 tons/acre	1.2 tons/acre
Down and Dead Wood (1/4"-1")	7.0 tons/acre	3.7 tons/acre	10.6 tons/acre
Down and Dead Wood (1"-3")	4.5 tons/acre	3.9 tons/acre	3.5 tons/acre
Down and Dead Wood (>3")	1.4 tons/acre	4.0 tons/acre	3.4 tons/acre
Total Down and Dead Wood	14.1 tons/acre	12.0 tons/acre	18.8 tons/acre
Live Herbaceous Fuel Load	0.4 tons/acre	1.2 tons/acre	0.2 tons/acre
Live Woody Fuel Load	3.4 tons/acre	0.9 tons/acre	0.9 tons/acre
Fuel bed depth	6 feet	1.44 feet	0.17 feet
Canopy base height	4 feet	8.7 feet	9.6 feet

Custom “Fuel Models”

Fuel/Vegetation, Surface/Understory

			Initialize from a Fuel Model
Fuel Model Type		→	S
1-h Fuel Load	ton/ac	→	4.00
10-h Fuel Load	ton/ac	→	4.00
100-h Fuel Load	ton/ac	→	3.00
Live Herbaceous Fuel Load	ton/ac	→	0.00
Live Woody Fuel Load	ton/ac	→	3.00
1-h Surface Area/Vol Ratio	ft ² /ft ³	→	1500
Live Herb Surface Area/Vol Ratio	ft ² /ft ³	→	1800
Live Woody Surface Area/Vol Ratio	ft ² /ft ³	→	750
Fuel Bed Depth	ft	→	1.00
Dead Fuel Moisture of Extinction	%	→	25
Dead Fuel Heat Content	Btu/lb	→	8000
Live Fuel Heat Content	Btu/lb	→	8000



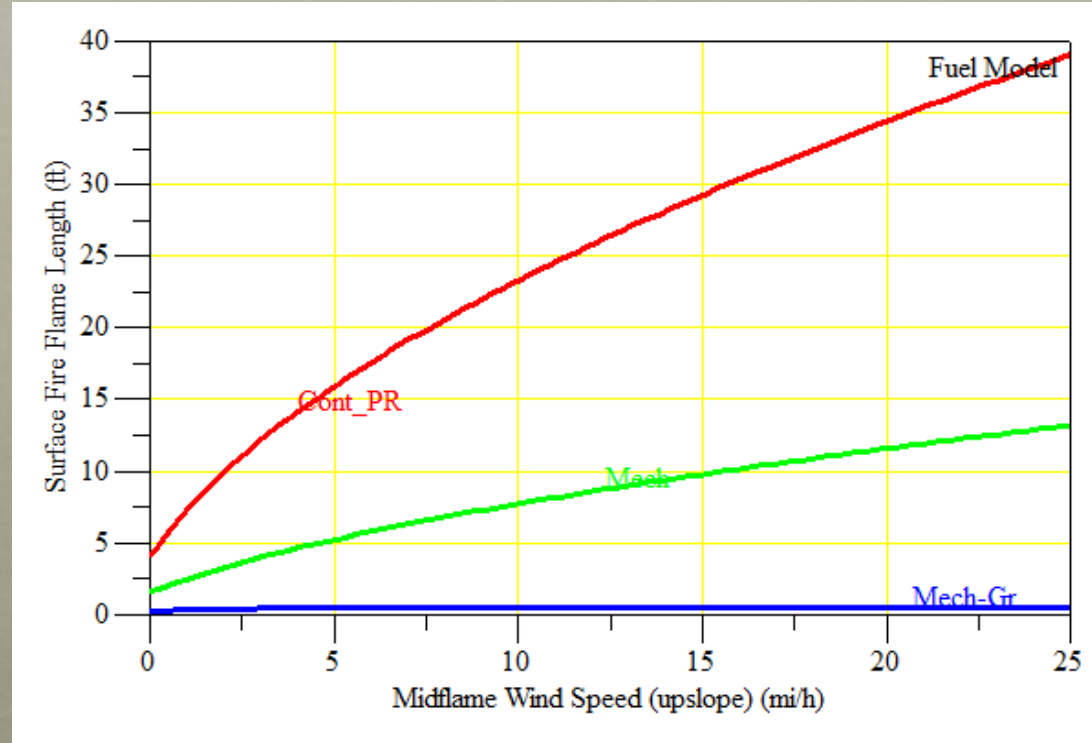
Differing Fire Behavior

Surface Fire Flame Length

Untreated Riparian

Mechanical Only

Mechanical + Grazing



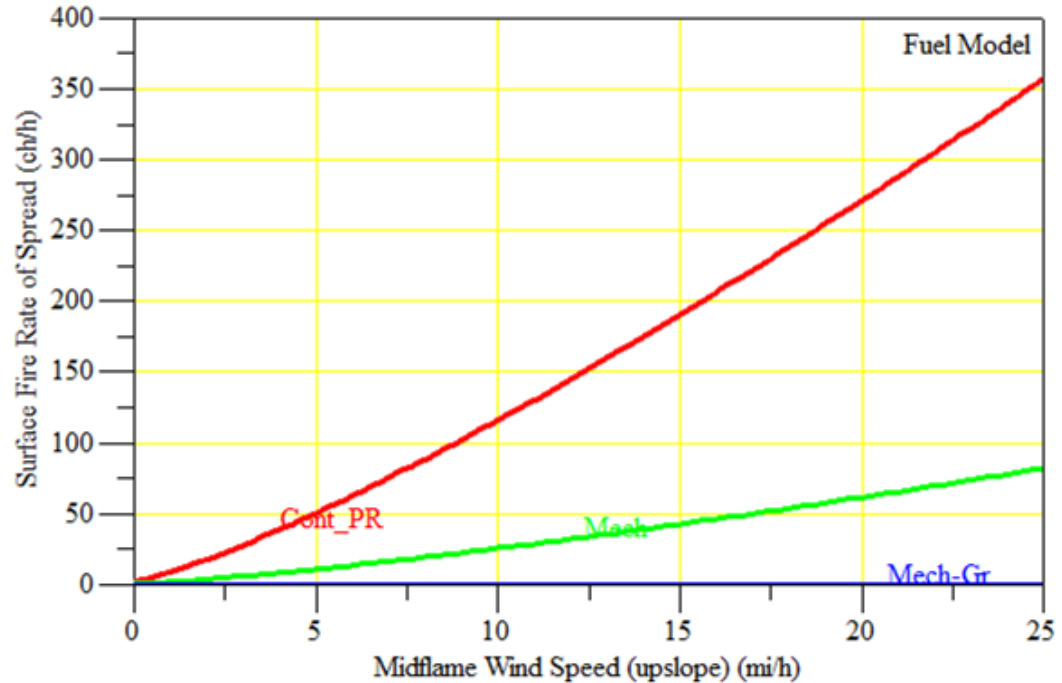
Differing Fire Behavior

Surface Fire Rate of Spread

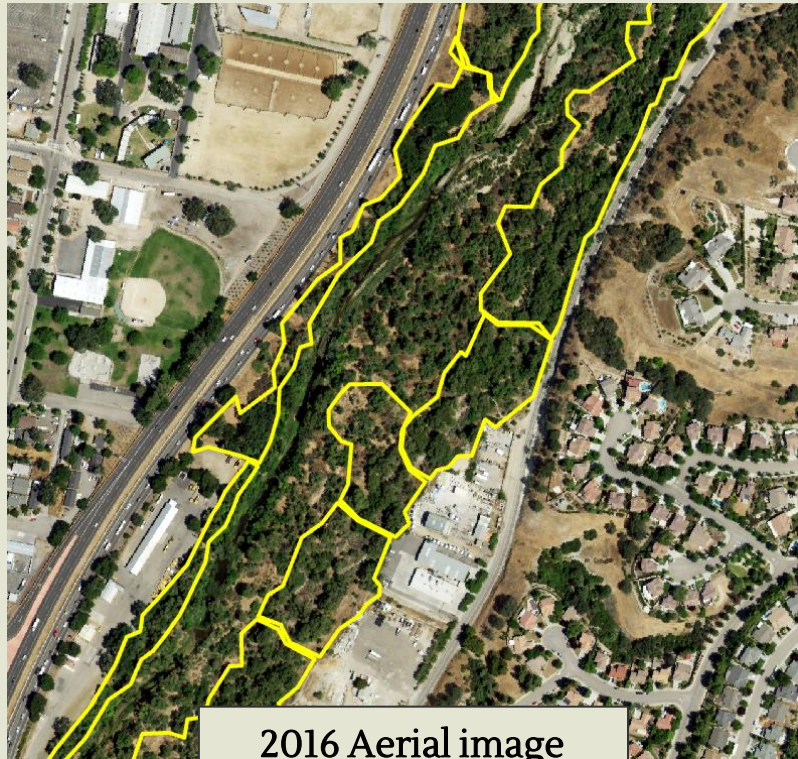
Untreated Riparian

Mechanical Only

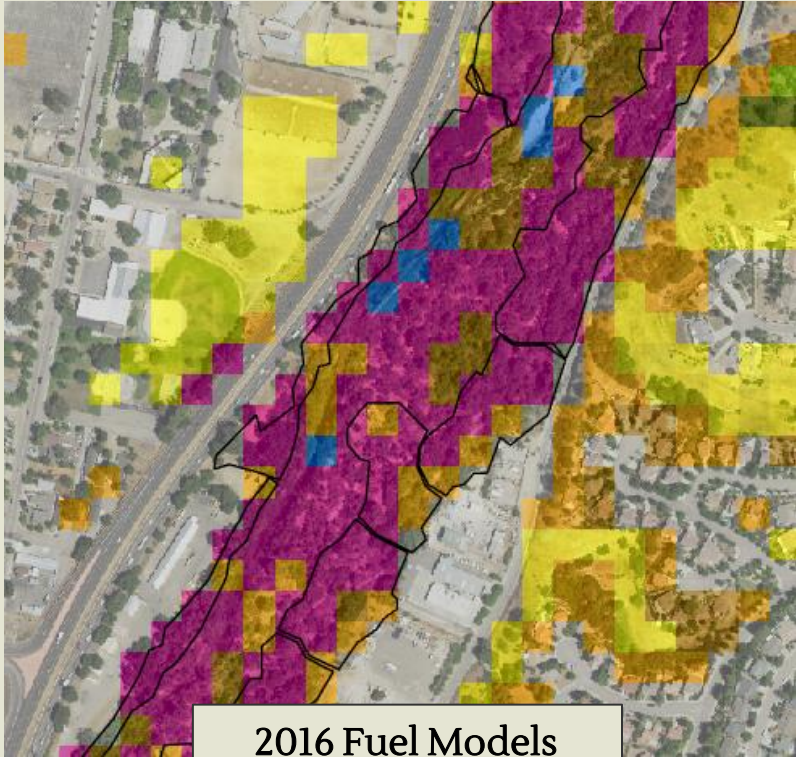
Mechanical + Grazing



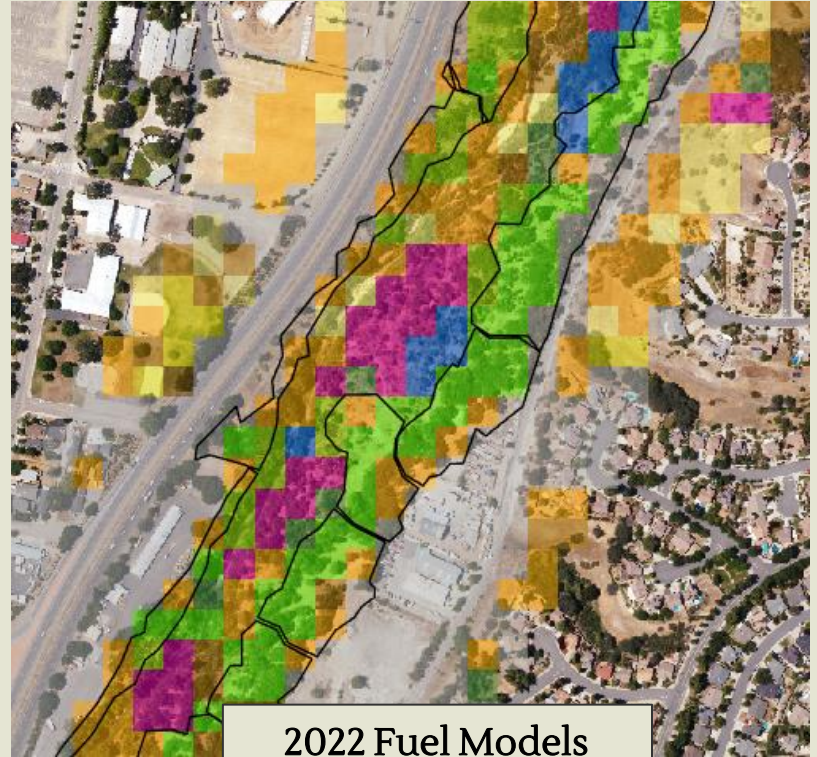
Modeling Across Project



Modeling Across Project

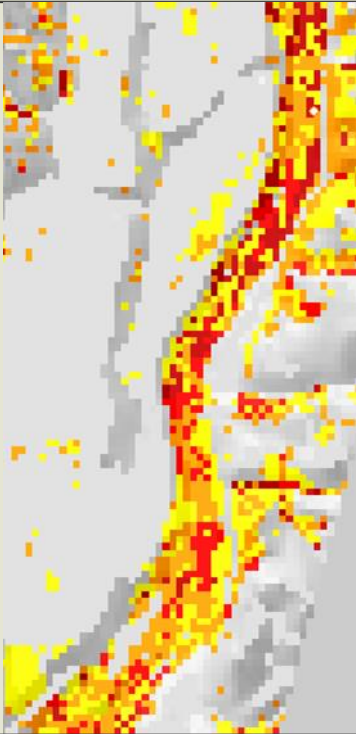


2016 Fuel Models

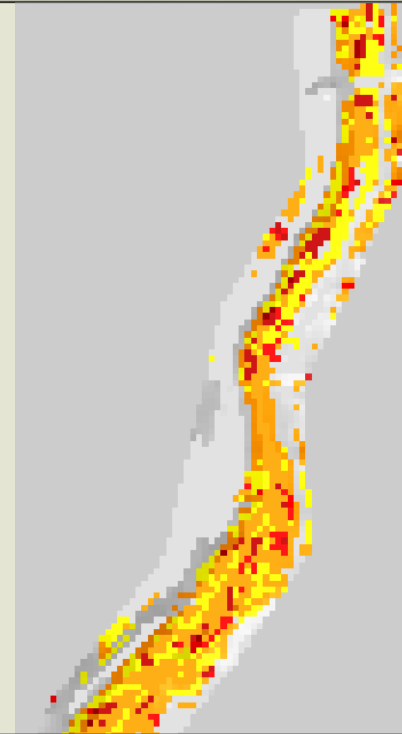
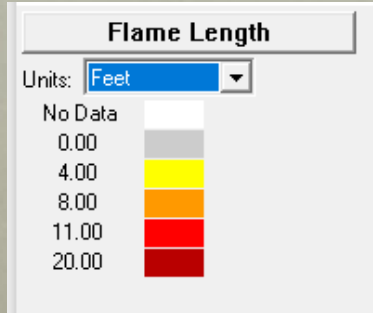


2022 Fuel Models

Modeling Across Project

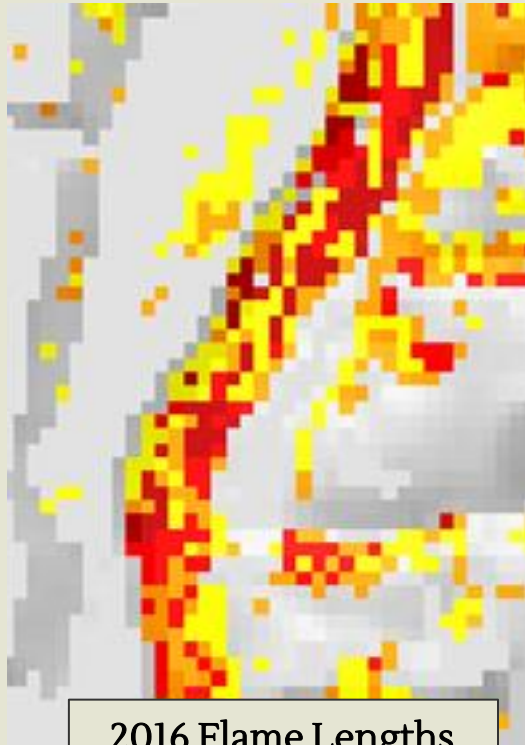


2016 Flame Lengths

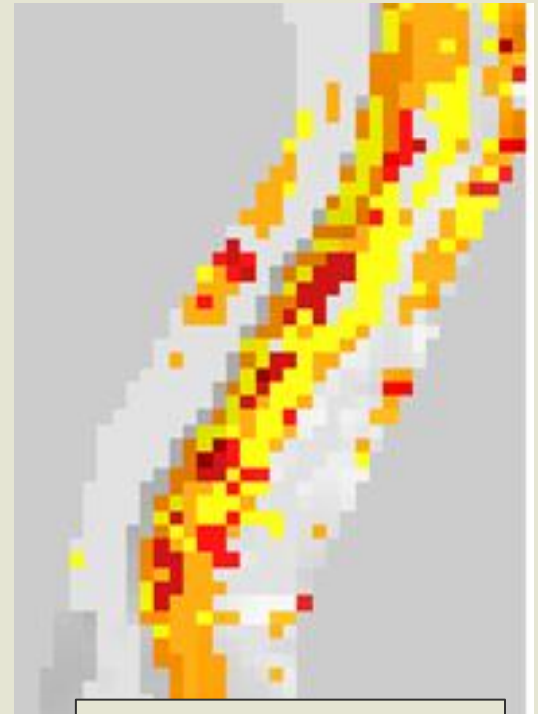
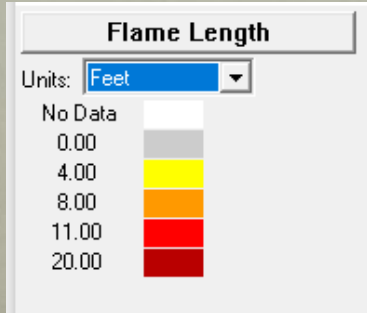


2022 Flame Lengths

Modeling Across Project

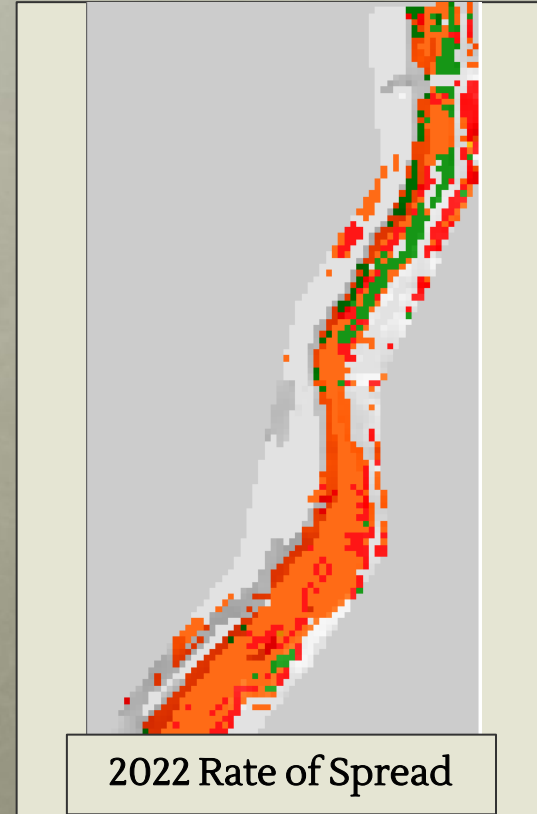
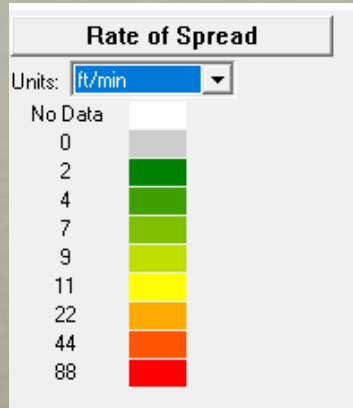
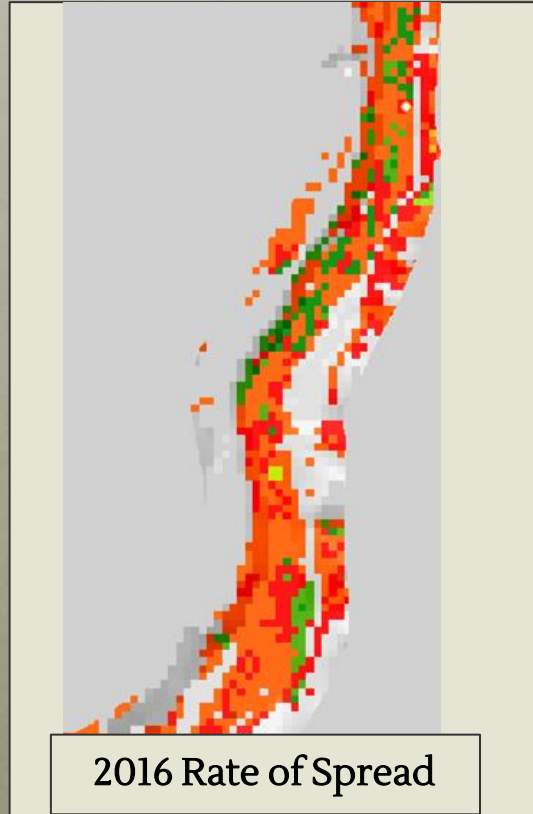


2016 Flame Lengths

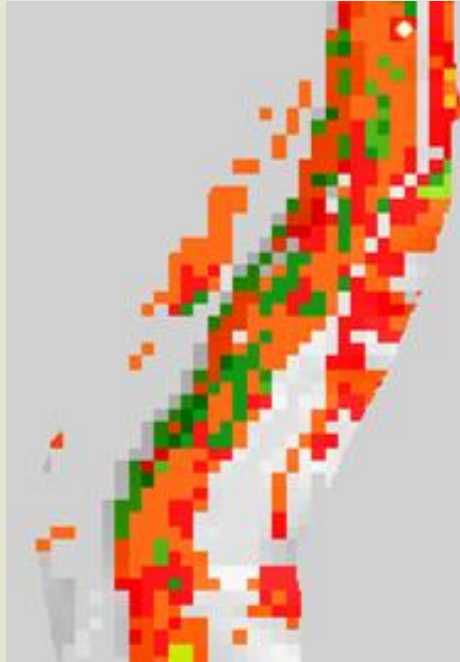


2022 Flame Lengths

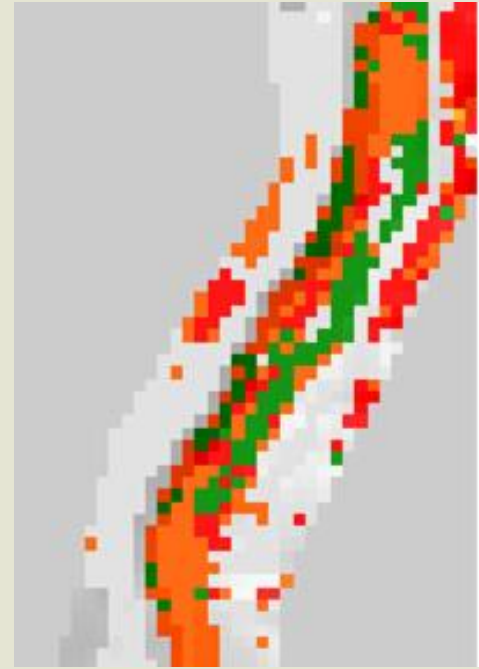
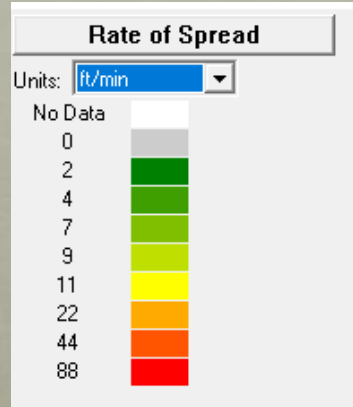
Modeling Across Project



Modeling Across Project



2016 Rate of Spread

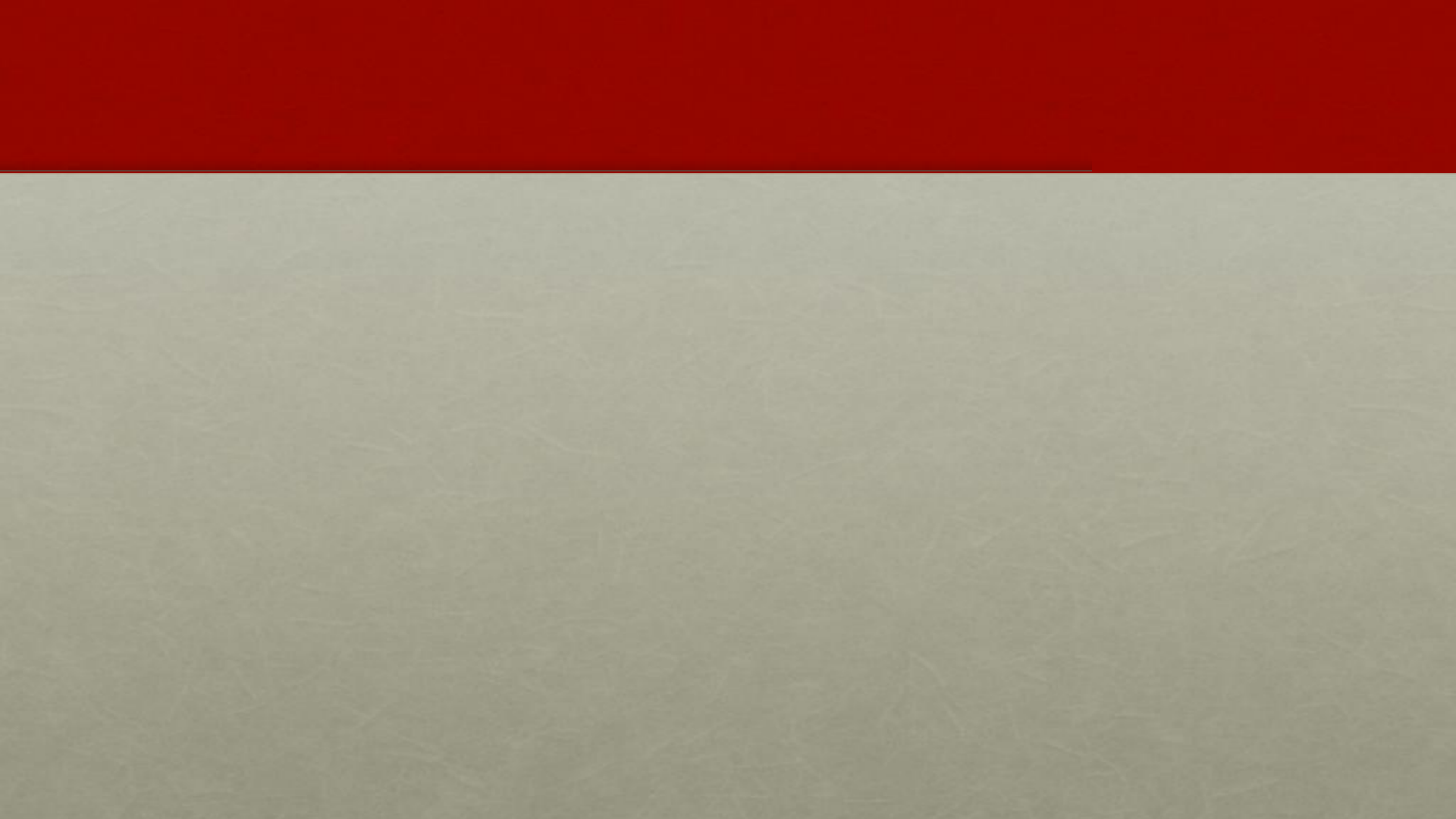


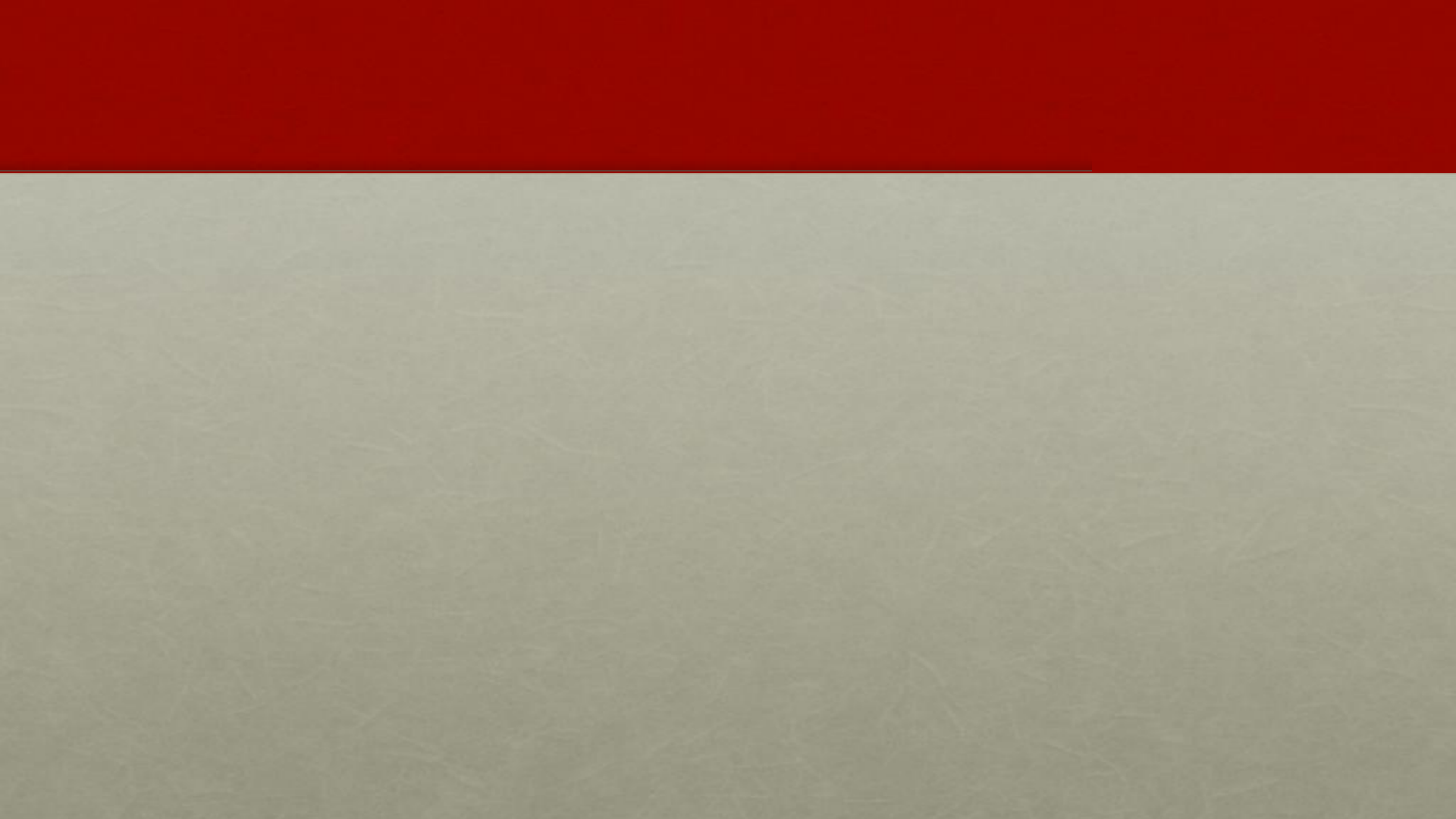
2022 Rate of Spread

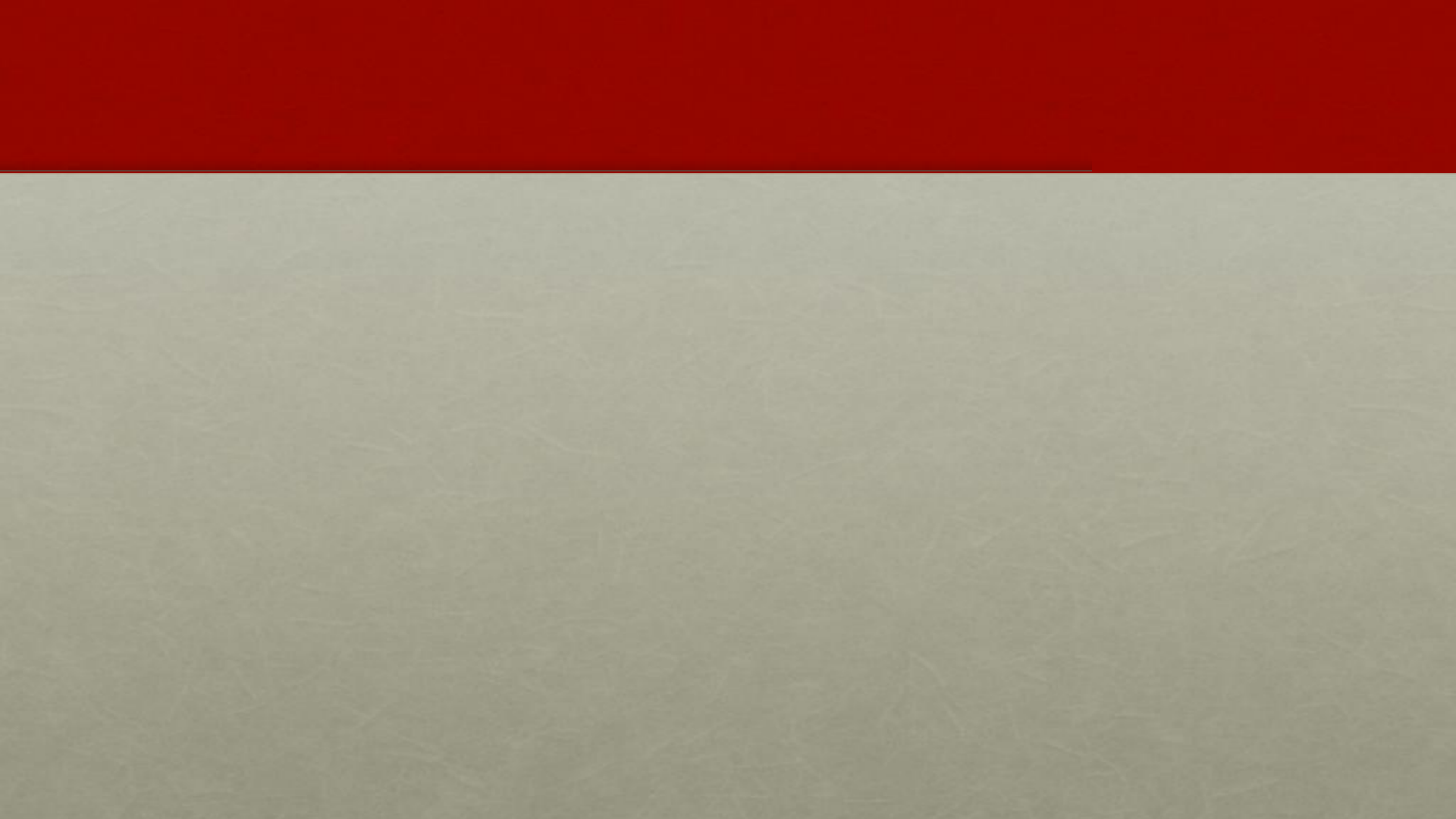
Conclusions



- Riverbed vegetation significantly altered, but in environmentally sound manner
- Fire behavior significantly reduced, increasing public safety
- Impacts of 2023 atmospheric rivers unknown at present







Fuel models help predict how a fire will burn



After grazing



Before grazing



After grazing



Before Crew



After crew



Before crew



After crew



Fire Prevention in the Salinas River: A vegetation management project



Dr. Chris Dicus
Cal Poly Professor and Coordinator
of Wildland Fire and Fuels
Management Program



Adriana Stagnaro
Cal Poly Master of Science student,
Environmental Sciences and
Management Program



Overview

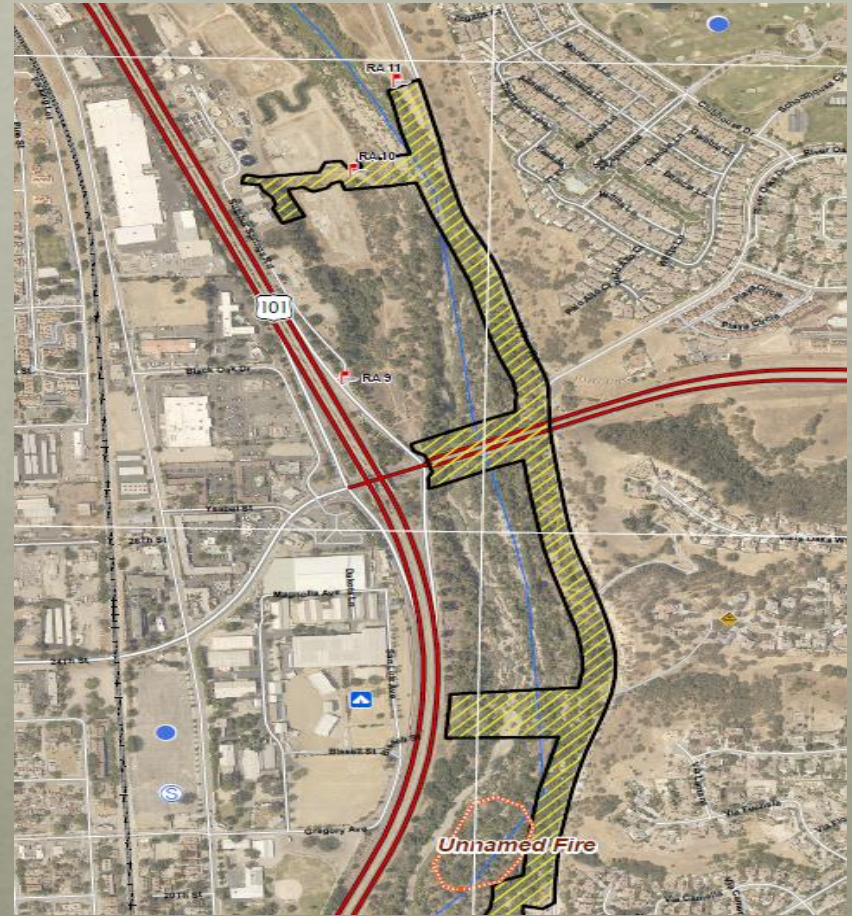
1. The vegetation management project (City of Paso Robles)
2. Fuel loading research (Cal Poly)
3. Potential fire behavior modeling before and after the veg management project (Cal Poly)

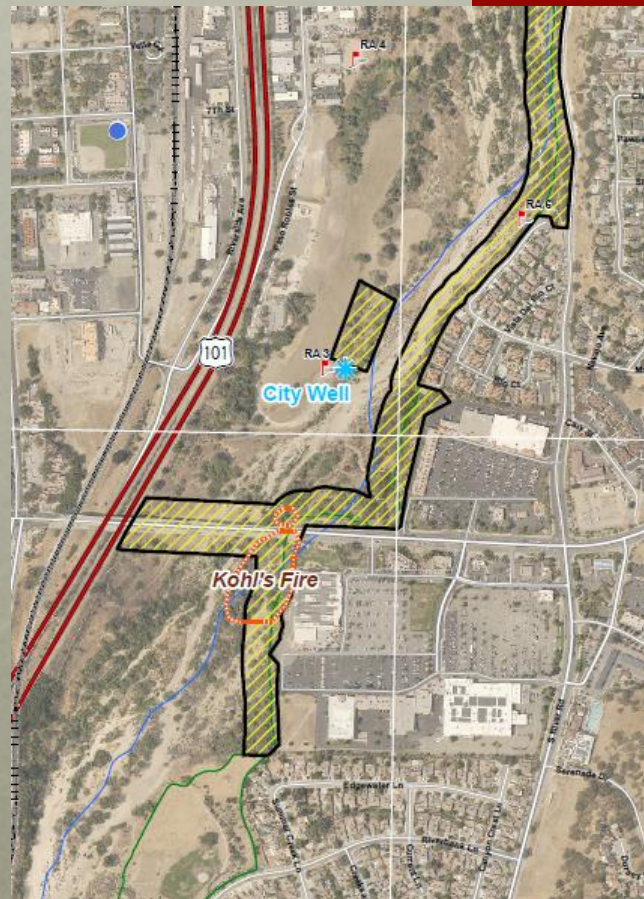
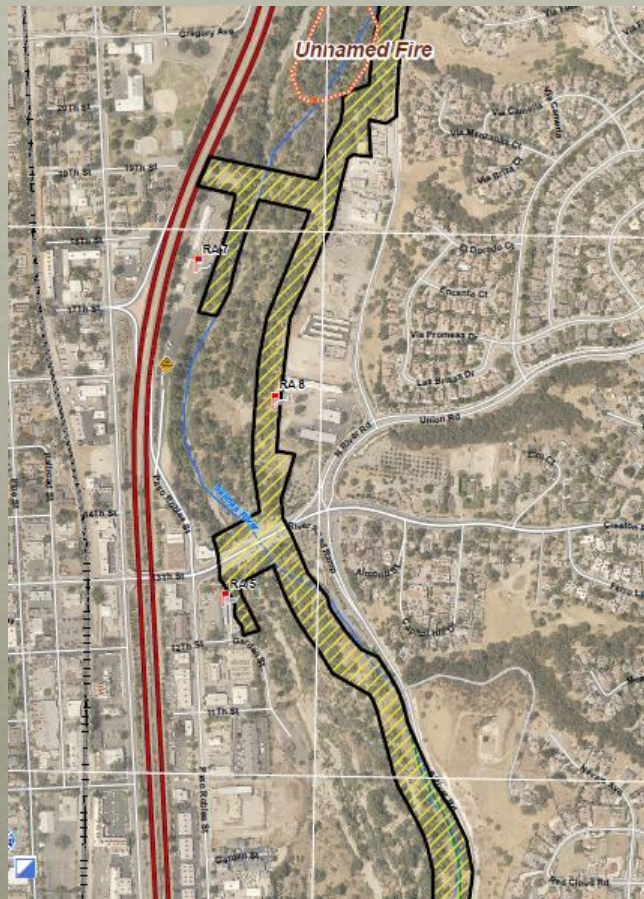
Unhoused Population

2021

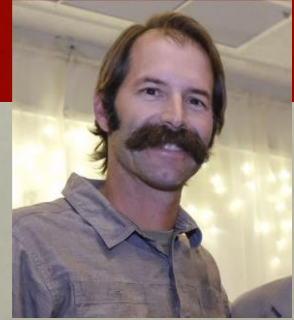


- Emergency Declared by City Manager in 2019
- Focused on protection of city infrastructure and community defense
- Encompassing 86 acres



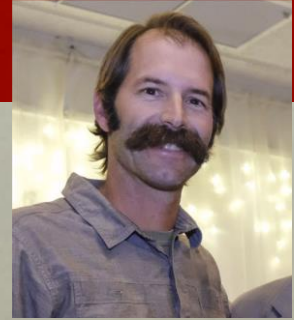


City of Paso Robles Accomplishments



- Expansion of primary design of the firebreak area in 2020
- Project approved by RWQCB spring 2021
- Approx. 80 acres grazed, and 25 acres of crew work completed in 2021
- Approx. 100 acres of grazing, 20 acres of understory crew work/fire scar clean-up, and five acres of Tree of Heaven removal completed in 2022
- A total of approx. 5 acres burned in 2021 in wildfires (down from 35 acres in 2020) (2022 data pending)
- LSAA approved by CDFW in spring 2022

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Research approach

Research goal:

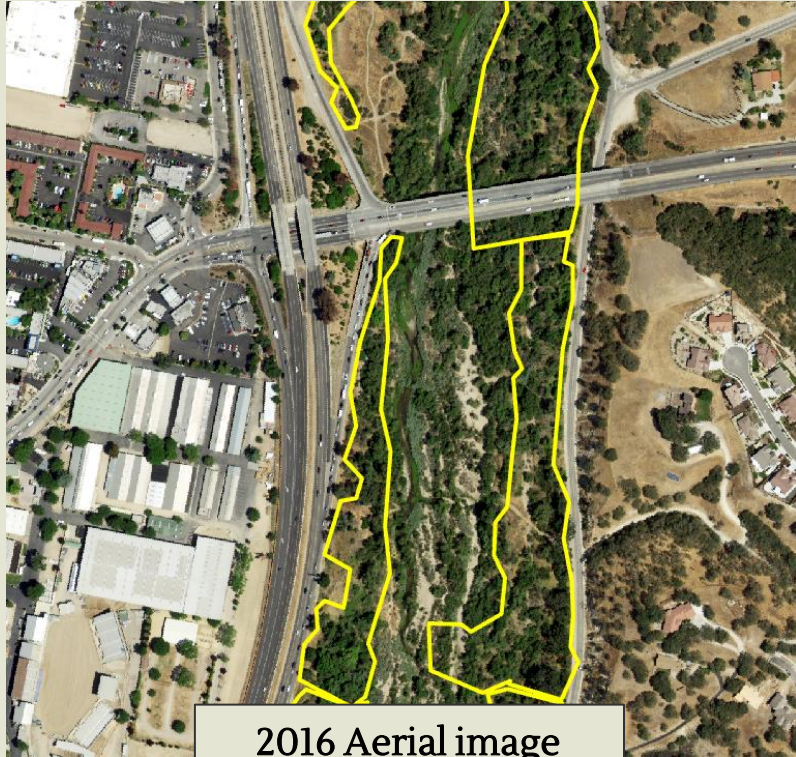
Assess the impact of the vegetation management project on reducing potential fire behavior in the project area.

Research approach

Fuel models:

Fuel models are a set of characteristics that describe a landscape's vegetation type, veg fuel load and veg fuel arrangement. The fuel model is used for predicting potential fire behavior on the landscape.

Changes 2016-2022



2016 Aerial image



2022 Aerial Image

Expected outcomes

In the peak of fire season, during a moderate wind event:

UNTREATED riparian forest:

→ Moderate flame lengths; moderate rate of spread; high crown fire potential

SHADED FUEL BREAK: Mechanical removal only:

→ Low flame lengths; high rate of spread; low crown fire potential

SHADED FUEL BREAK: Mechanical removal + grazing:

→ Low flame lengths; low rate of spread; low crown fire potential

Inputs for fuel models

- Fuel bed depth
- Canopy base height
- Dead fuel moisture of extinction
- Dead woody fuel load
- Live herbaceous fuel load
- Live woody fuel load

Research Questions

Develop three separate fuel models for:

1. UNTREATED: Original riparian forest
2. SHADED FUEL BREAK: Mechanical removal only
3. SHADED FUEL BREAK: Mechanical removal + grazing

Changes 2016-2022

2016 Fuel Models Raster Map
using custom model in the
control

Legend

2022 Fuel Models Raster Map
using custom models in the
control and in the treatment
area

Conclusion

We conclude that the City of Paso Robles vegetation management project has a measurable effect on reducing potential fire behavior!

Applications

Anyone can model fire behavior for their area of interest with the right tools. We recommend the following data sets and tools:

- **LandFire** 30x30 meter spatial data
- **FlamMap** fire modeling software
- Help from a firefighter or someone who knows fire management basics