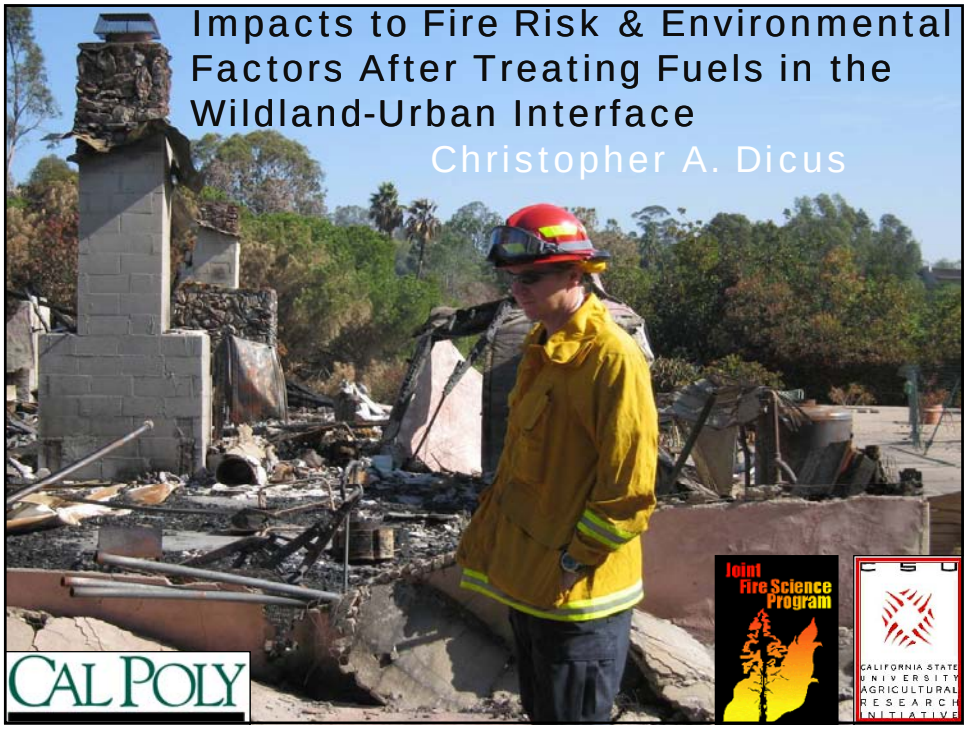


Three primary parts...

1. Monkeys in the zoo
   - Research efforts into tradeoffs of fuel treatment

2. If I ran the zoo...
   - Holistic approach to WUI management

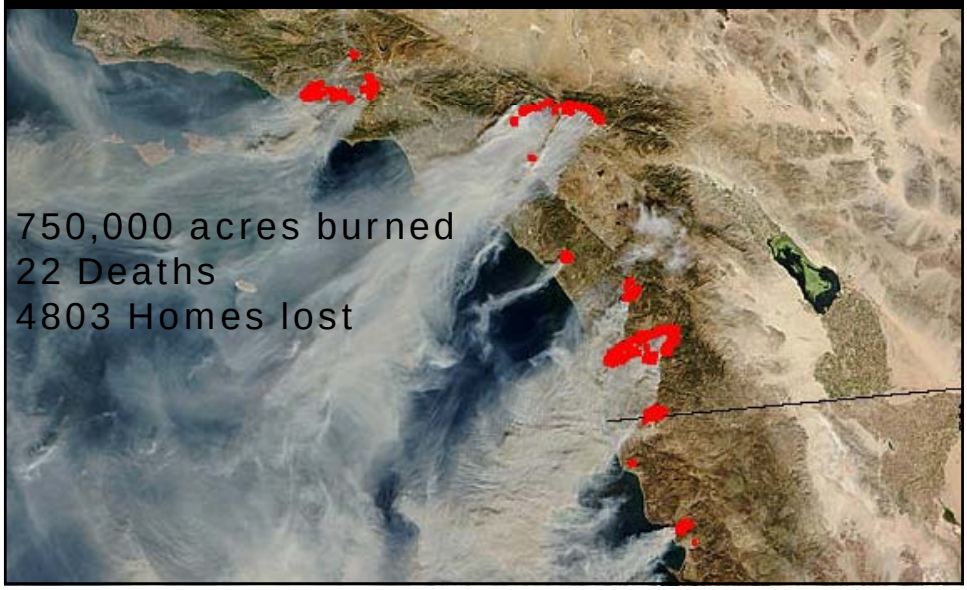
3. Zoo's gone wild...
   - When bad fires happen to good people

California dreamin'...

- Build it and they will come

California dreamin'...

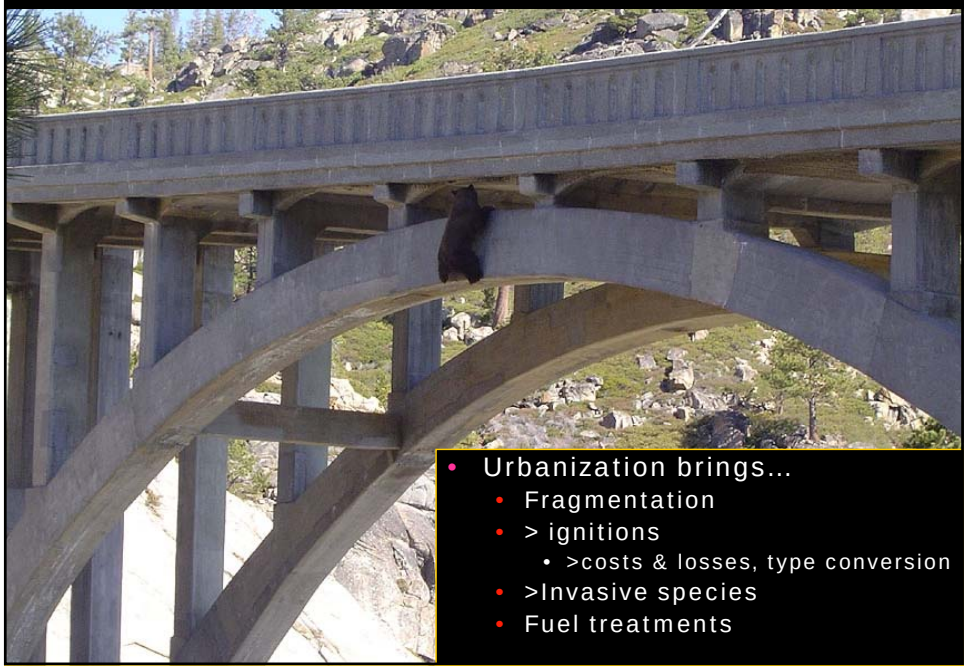
- Build it and they will <u>burn</u> (2003)



California dreamin'...

- Build it and they will burn (2007)

WUI: An insurmountable task???



- Urbanization brings…
  - Fragmentation
  - > ignitions
    - >costs & losses, type conversion
  - >Invasive species
  - Fuel treatments

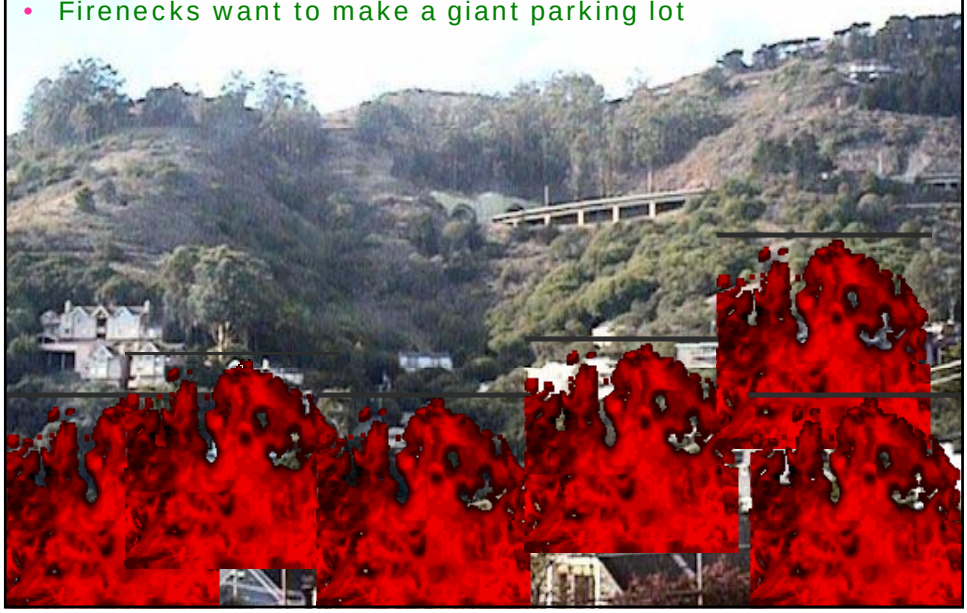
Hazards vs. benefits

- Vegetation provides benefits
  - Air pollution removal
  - Carbon sequestration
  - Soil stabilization
  - Home cooling costs
  - Stormwater retention
  - Wildlife habitat
  - Home value
  - And on and on…

Vegetation is more than fuel!!

The stereotypes…

- Hippies want more vegetative cover
- Firenecks want to make a giant parking lot



July 2003

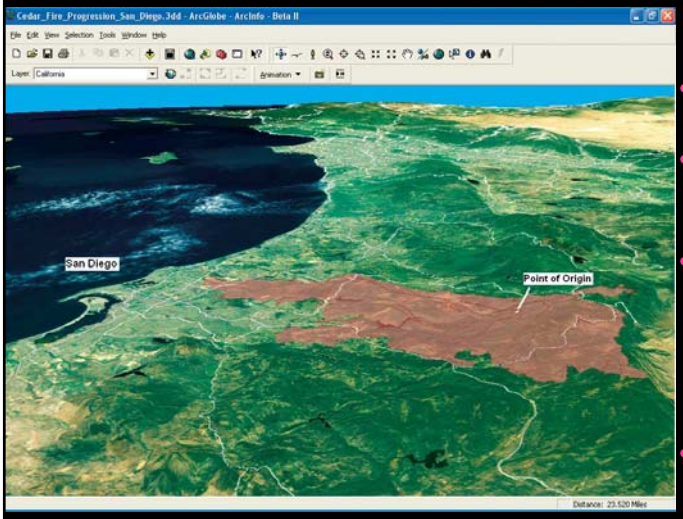
Urban Ecosystem Analysis
San Diego, California

Calculating the Value of Nature

Report Contents

AMERICAN FORESTS
americanforests.org

- The result???
  - Plant 100,000 trees



2003 Firestorm

- Acres
  - 749,401
- Homes lost
  - 4803
- Cedar Fire
  - 273,246 acres
  - 2820 homes
  - 14 fatalities
- The result???
  - Clear to 100'
  - A new grant

The objectives.... (originally)

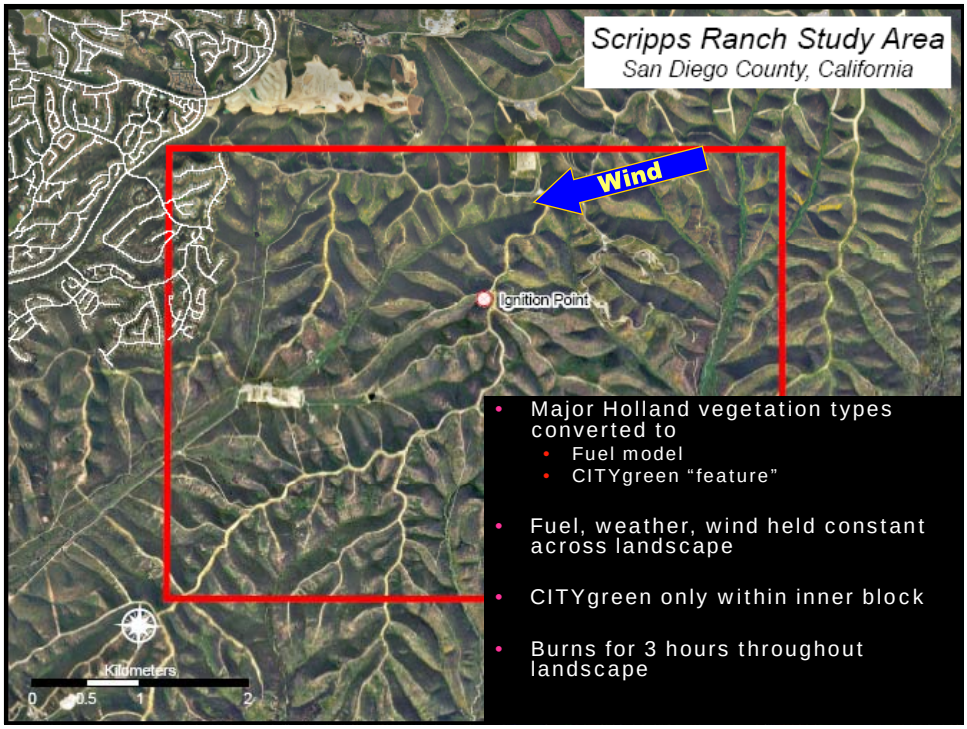
Determine...

1. Potential fire behavior for major grassland, shrubland, and woodland communities in San Diego
2. Community benefits for each of the communities above
3. Which best minimizes fire risk while maximizing benefits?

The tools...

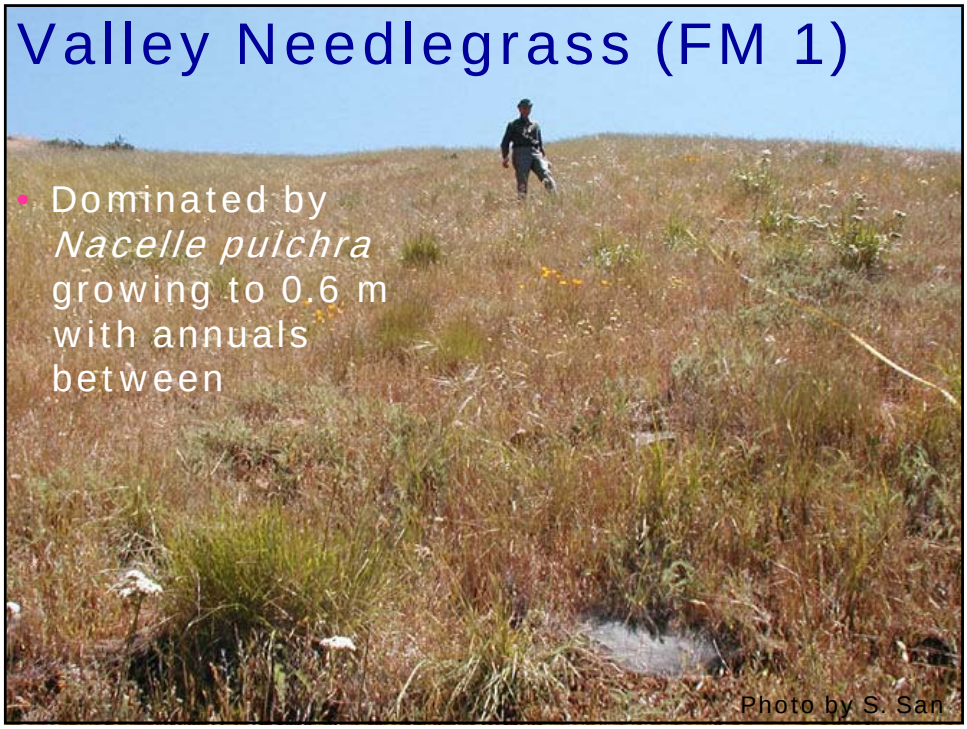
- FARSITE
  - Landscape simulations of fire behavior
    - Intensity
    - Rate of spread

- CITYgreen
  - Landscape planning tool for community planners
    - Air pollution removal
    - Carbon sequestration
    - Stormwater runoff



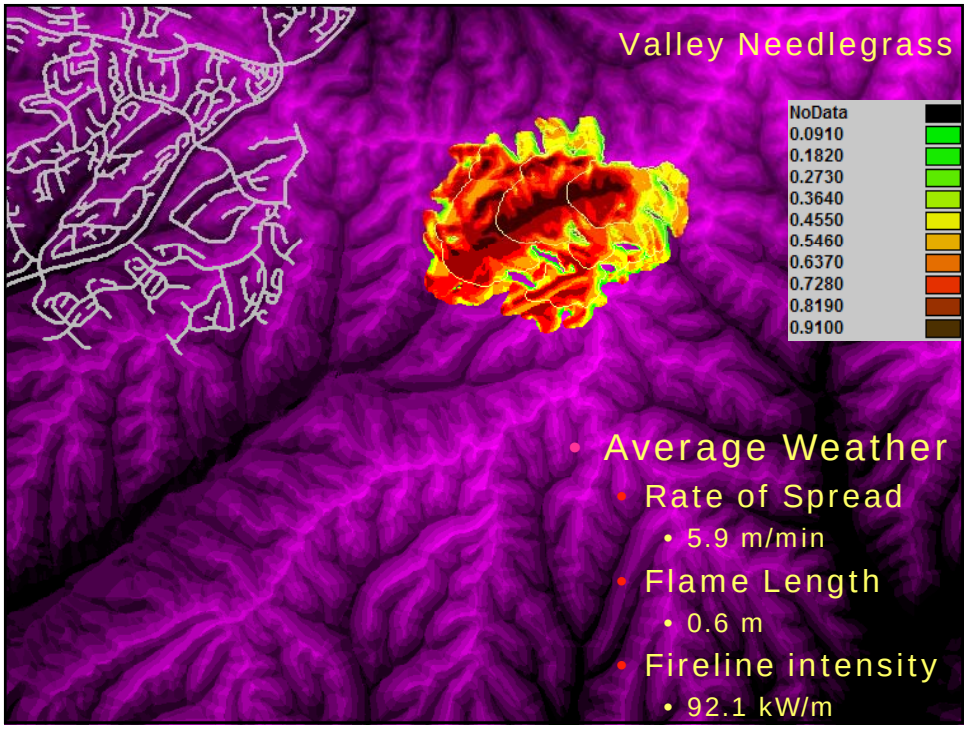
- Major Holland vegetation types converted to
  - Fuel model
  - CITYgreen "feature"
- Fuel, weather, wind held constant across landscape
- CITYgreen only within inner block
- Burns for 3 hours throughout landscape

Valley Needlegrass (FM 1)



- Dominated by *Nacelle pulchra* growing to 0.6 m with annuals between

Photo by S. San

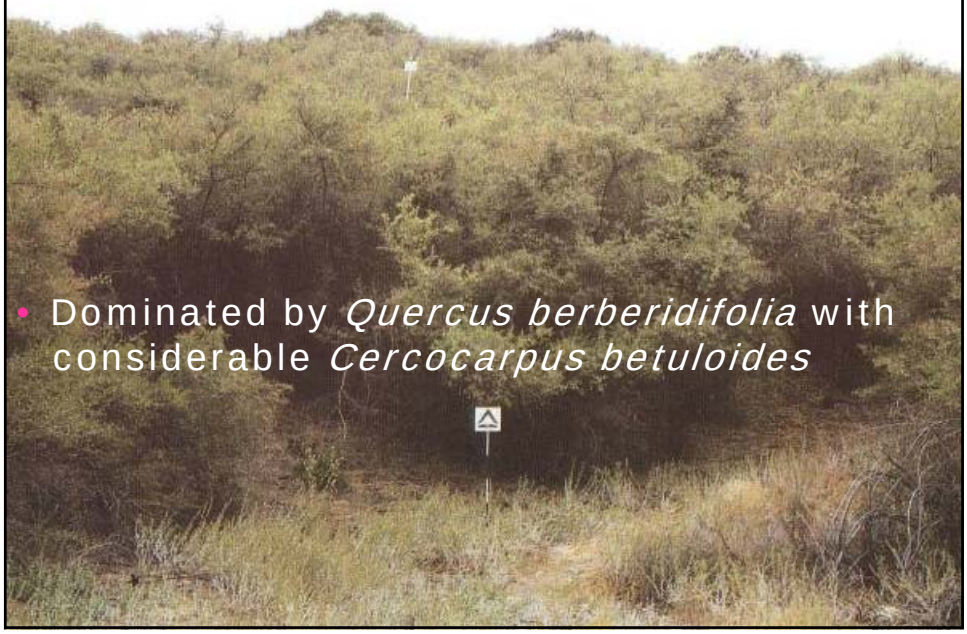


- Average Weather
  - Rate of Spread
    - 5.9 m/min
  - Flame Length
    - 0.6 m
  - Fireline intensity
    - 92.1 kW/m

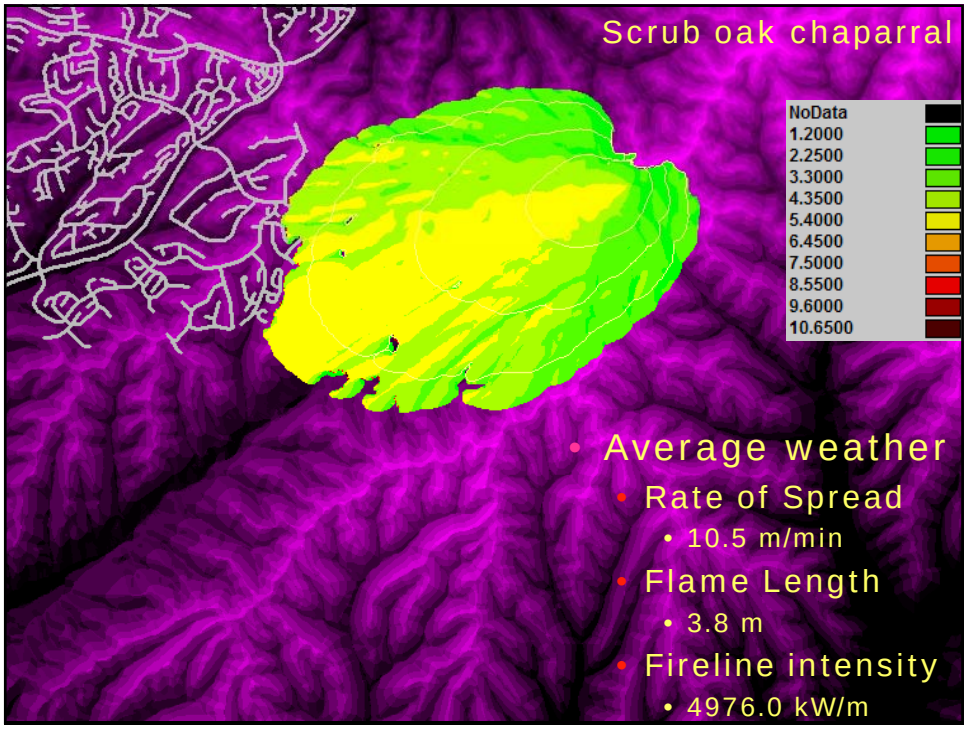
Benefits of needlegrass???

- Air pollution removed???
- Stormwater runoff stopped???
- Carbon sequestration???

Scrub oak chaparral (SH7)



- Dominated by *Quercus berberidifolia* with considerable *Cercocarpus betuloides*

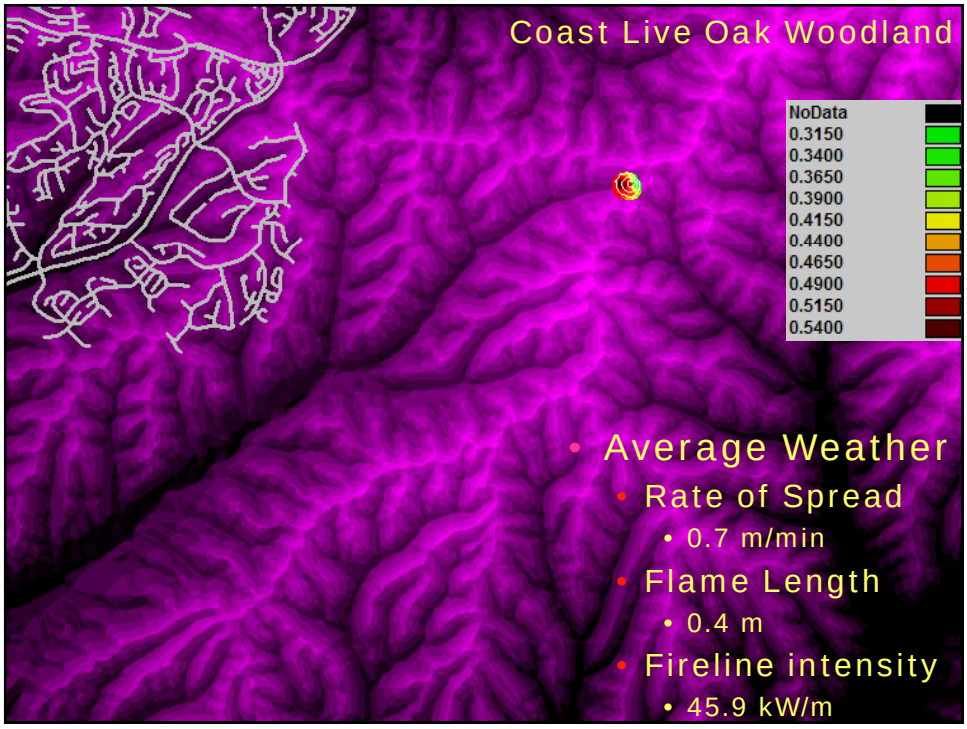


Benefits of scrub oak chaparral???

- Air pollution removed???
- Stormwater runoff stopped???
- Carbon sequestration???

Coast Live Oak Woodland (FM 9)

- Dominated by *Quercus agrifolia growing 10-25 m*

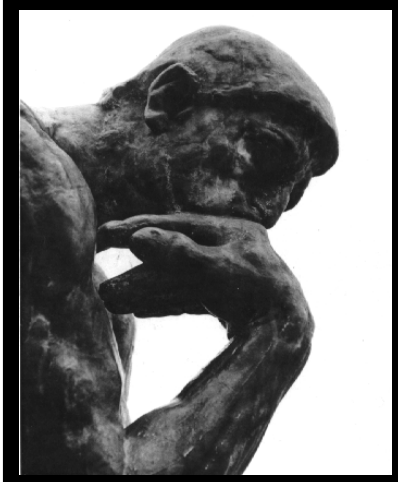


Benefits of coast live oak woodland???

- Air pollution removed???
  - 100.64 kg ha^{-1} yr^{-1}
- Stormwater runoff stopped???
  - 40.39 m^3 ha^{-1}
- Carbon sequestration???
  - 93386 kg ha^{-1}

Conclusions...

Politically-correct, please-don't-sue-me version

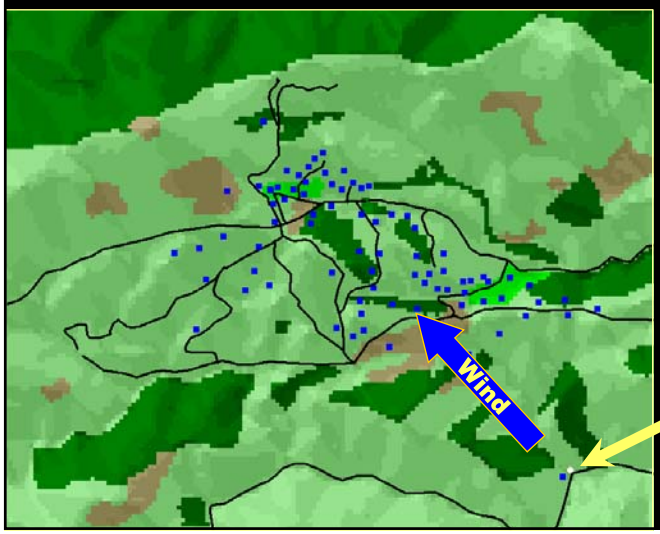


- When assessing canopy benefits...
  - Consider assumptions of CITYgreen model
- So what *if* just trees

Sierra mixed-conifer

Simulation	Stand ht (m)	Canopy Base ht (m)	Canopy bulk density (kg/m^3)
Untreated	34	2	0.101
Understory Removal	34	4	0.101
Thin to 50% BA	33	11	0.037

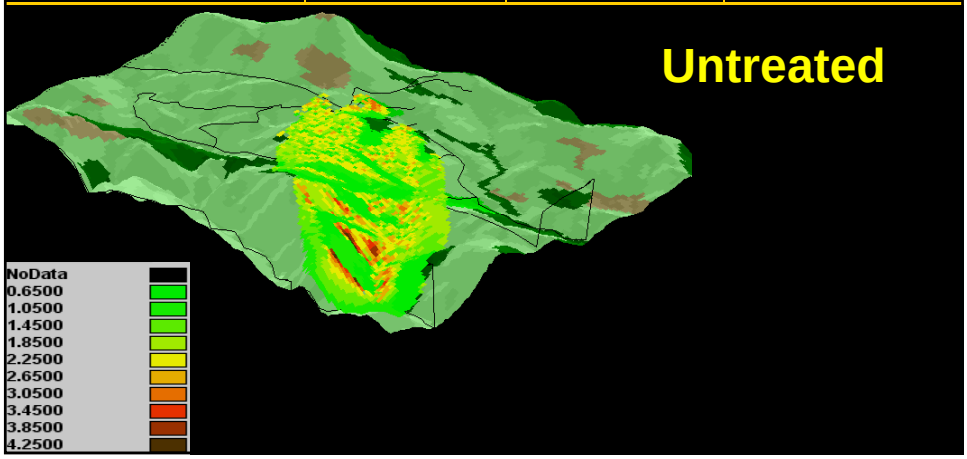
- Weather
  - Temp: 90°F (32°C)
  - RH: 30%
  - Wind: 22 mph (35 km/hr) from SE
- Slope: 15-30%
  - Aligned with wind



Fire ignites here

Burns 10 hours

	Untreated	Understory Removed	Thin to 50% BA
Stormwater runoff (m^3)	773,046	773,046	3.5
Air pollution (t)	371,045	371,045	3084
C sequestered (t)	1,288	1,288	11



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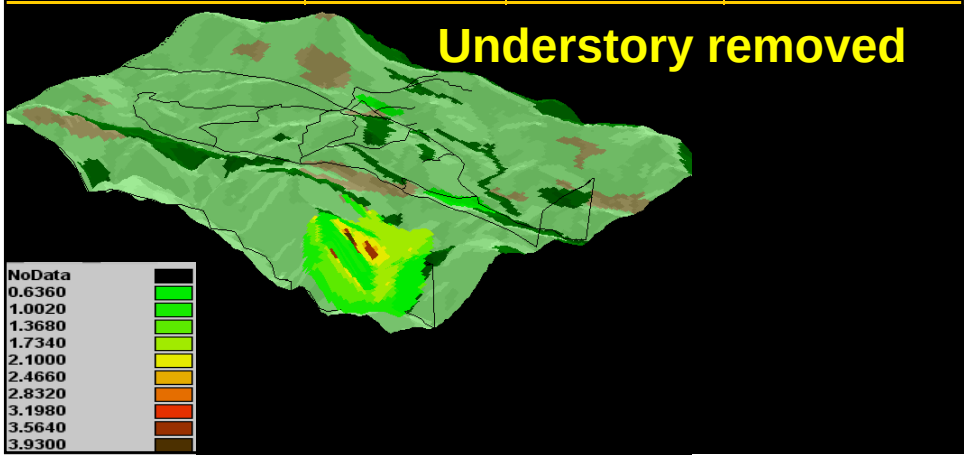

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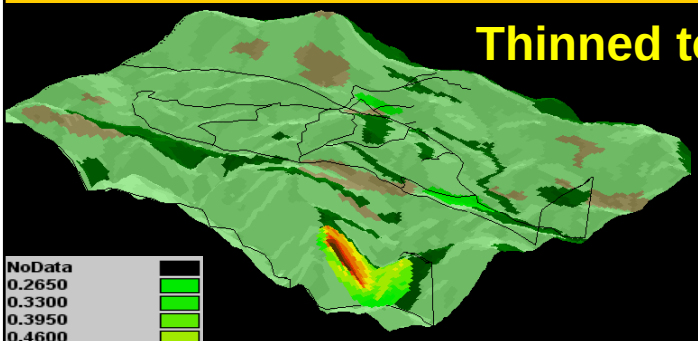


So did CITYgreen work???

Back to the drawing board...

i-Tree Software Suite v1.0

Tools for assessing and managing Community Forests

i-Tree

Forest Vegetation Simulator

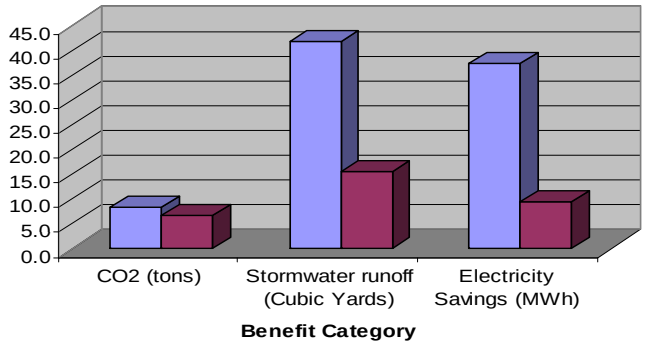
FVS

USDA Forest Service

- STRATUM
  - Part of I-Tree
- Fire & Fuels Extension
  - Forest Vegetation Simulator
- Both use same data
  - Species, height, dbh

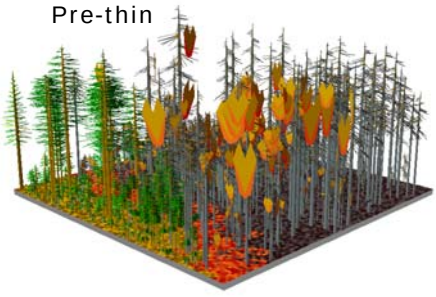
Mixed-conifer (Plumas NF)

	TPA	BA/Acre (ft)	QMD	Canopy Base Height (ft)	Canopy Bulk Density (kg/m^3)
Pre-thin	4617	314	3.5”	3’	0.105
Post-thin	617	289	9.3”	15’	0.103

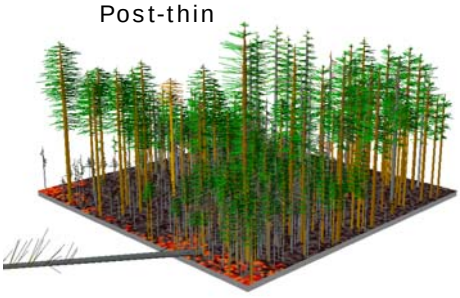


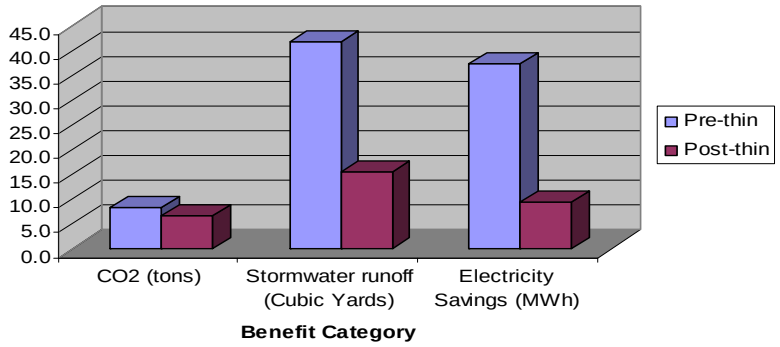
So did STRATUM work???

Pre-thin

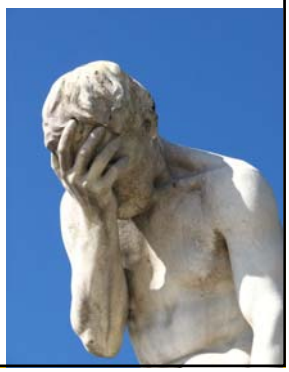


Post-thin





- Unfortunately
  - Designed for street trees
  - Shrubophobic



Another shot...

- Forest Vegetation Simulator not effective at landscape-level
- FARSITE not effective at fine-scale parcel-level analysis
- CITYgreen not effective at...
  - Anything non-trees
- Would I-tree work???
  - UFORE
    - (Urban Forest Effects Model)
    - Air pollution removal
    - C sequestration
    - Slew of other goodies

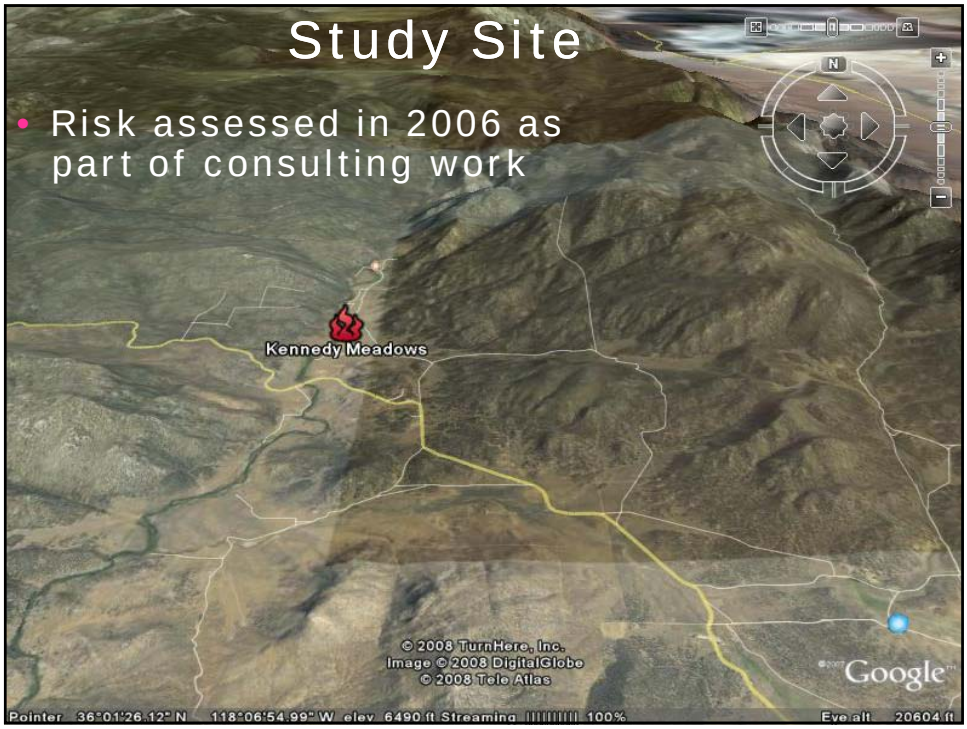
i-Tree Software Suite v1.0

Tools for assessing and managing Community Forests

i-Tree


The (new) objectives....
For major ecotypes in an E. Sierra, high-desert WUI community, determine ...
1. Potential fire behavior
2. Societal benefits
• Pollution removal
• C sequestration
3. If UFORE is going to work


Study Site
Nevada
San Francisco
San Jose
California
Kennedy Meadows
Los Angeles
San Diego
• Kennedy Meadows
• Eastern Sierras
• ~6500' between Sierra Crest and Mojave Desert



Pinyon

- Pinyon pine
  - *Pinus monophylla*
- Juniper (minor)
  - *Juniperus californica*
- Some litter, grass, and shrubs

Manter Fire (2000)

- Both burned...
  - Until the wind stopped

Burned

- Low annual grasses
  - (when it rains)
- Pinyon snags
- Very little regeneration

Fire Behavior

- Fuel per SSGIC
  - Pinyon = TU1
  - Sagebrush = GS2
  - Burned = GR1

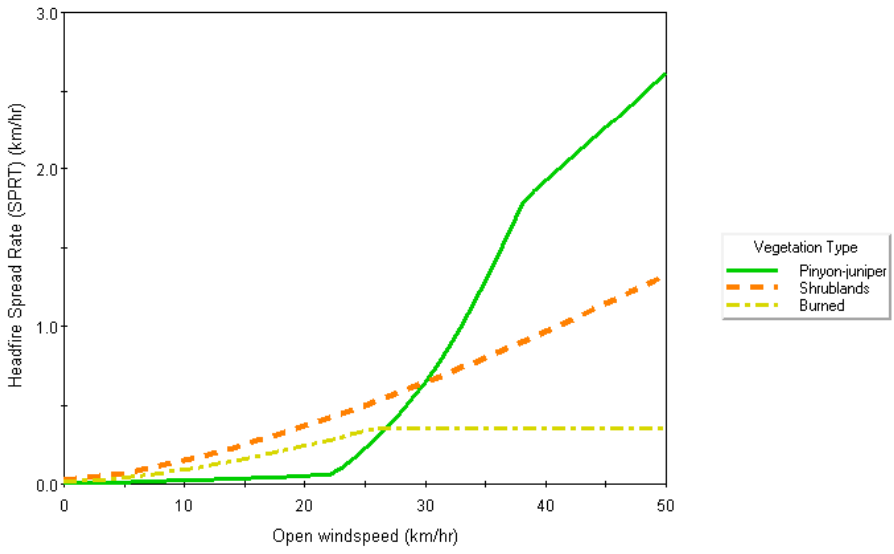
Southern Sierra Geographic Information Cooperative
Improving Public Safety & Protecting Resources

- Weather per Manter
  - Calibrated in FARSITE per Manter progression
  - Midflame Winds = 15 mph upslope
  - High Temp = 95°F
  - RH = 10%

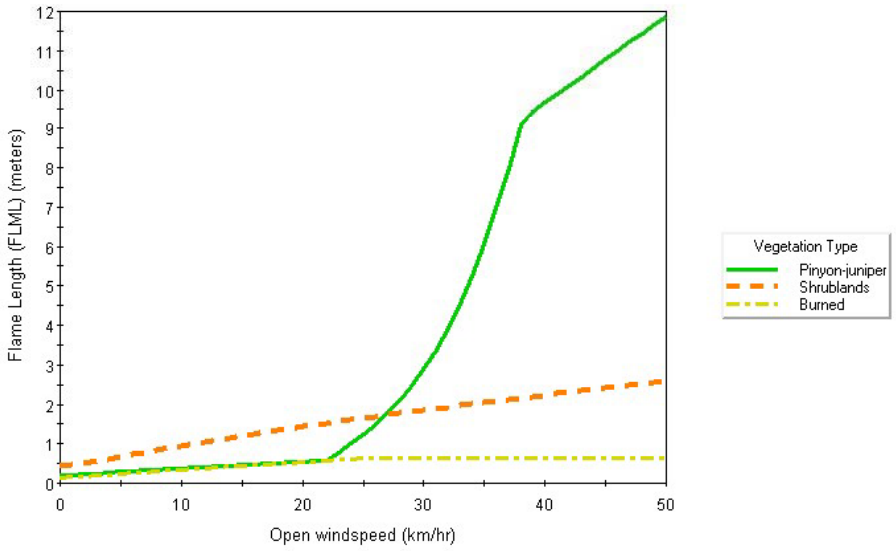
Societal benefits

- 3 plots per ecotype
  - Trees
    - Species, DBH, Ht, Crown Base Height and width
  - Shrubs
    - Species, Ht, Width, % Crown cover

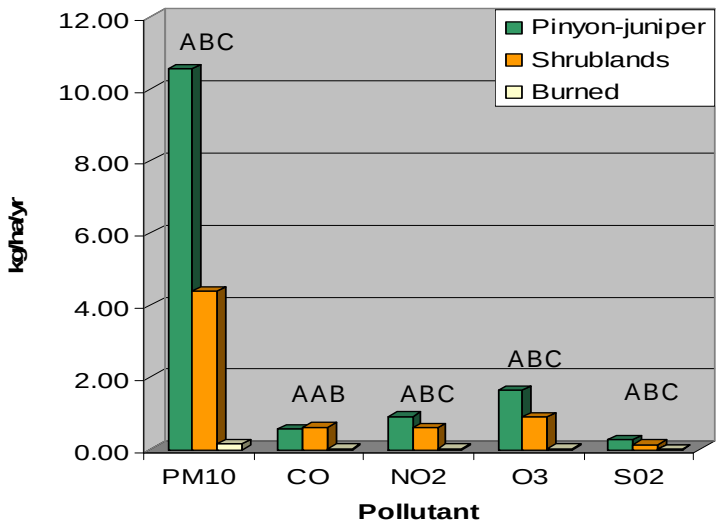
NEXUS simulations



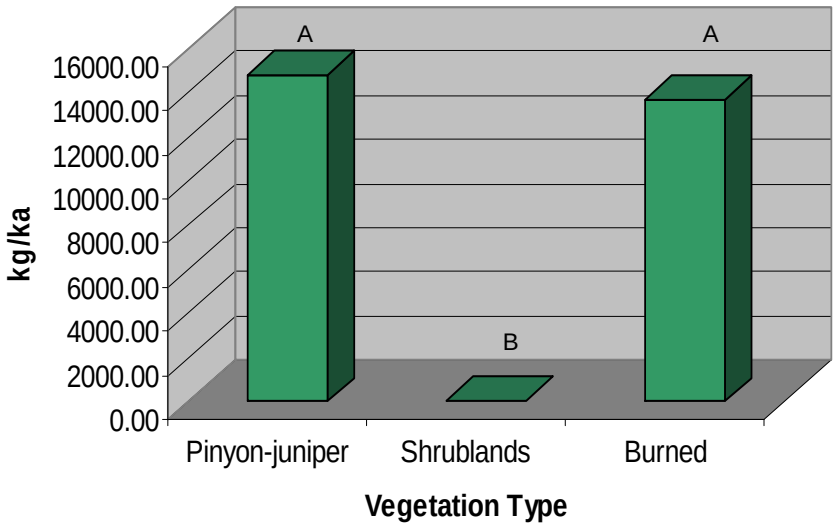
NEXUS simulations



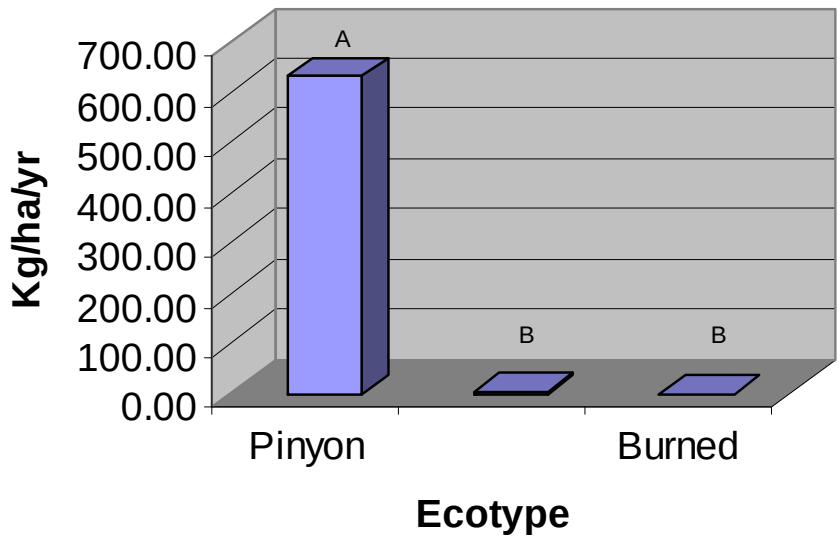
Air pollution removal

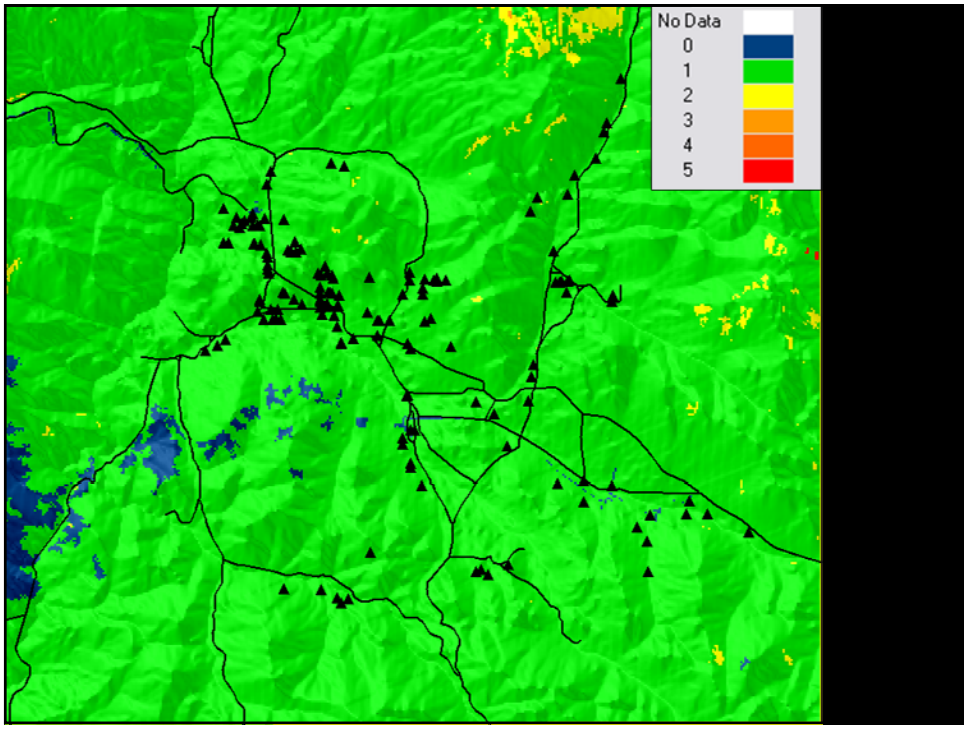


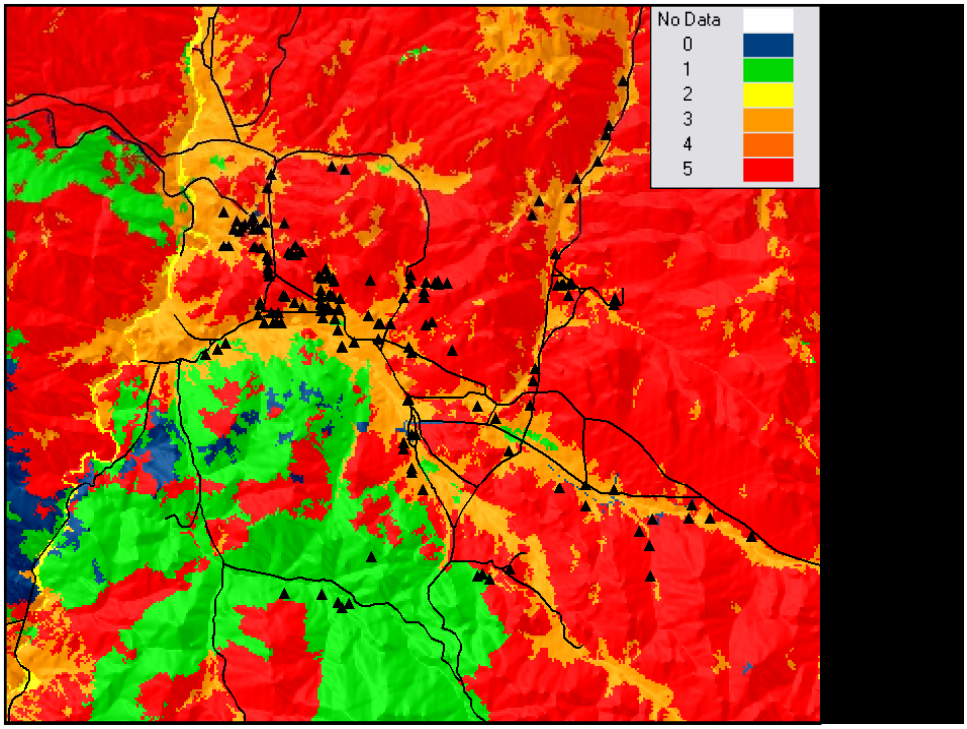
Carbon storage



C sequestration




No Data
0
1
2
3
4
5

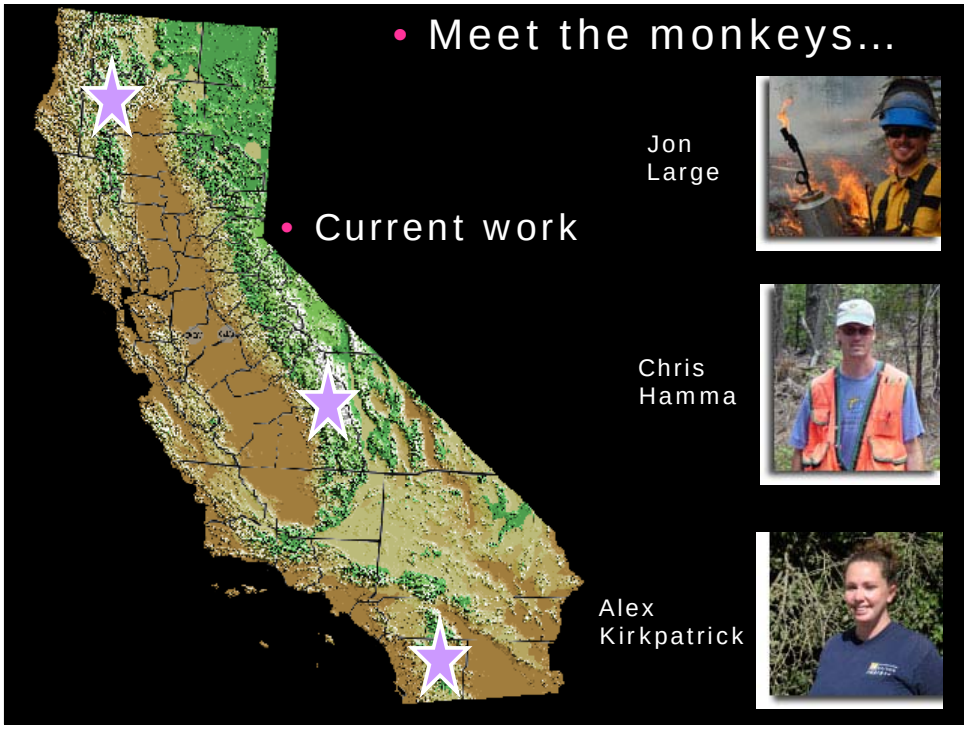

No Data
0
1
2
3
4
5

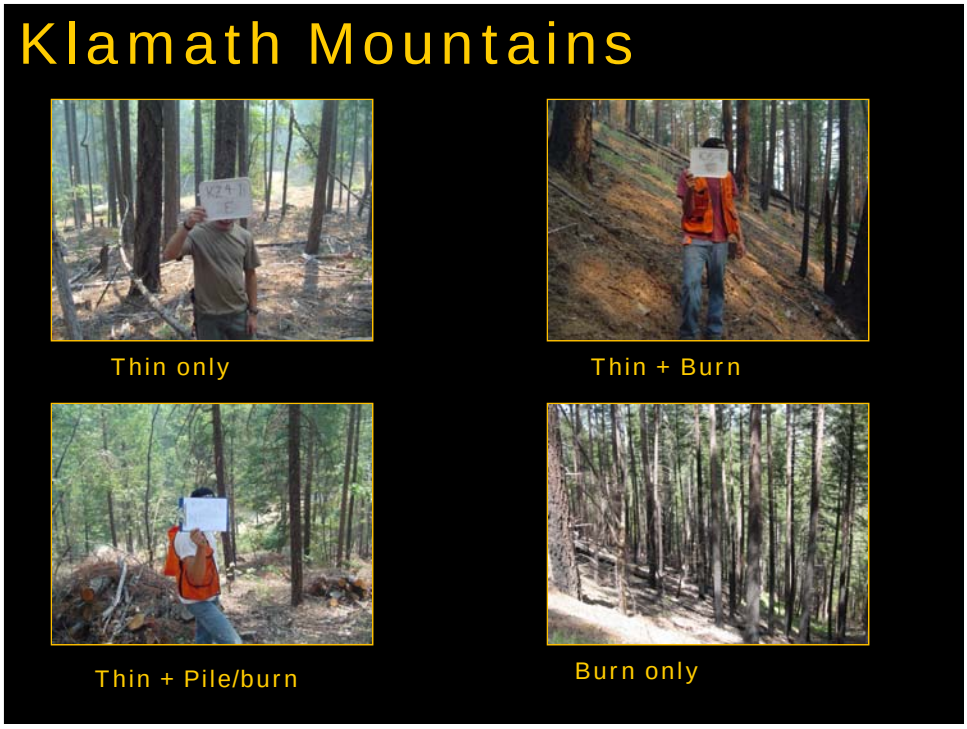
Landscape effects of defensible space

	Untreated	With 30' buffer	With 100' buffer
Pollutant	Capacity (t/yr)	Capacity lost (t/yr)	Capacity lost (t/yr)
PM_{10}	422.338	0.028	0.323
CO	26.304	0.003	0.028
NO_2	39.477	0.003	0.035
O_3	68.098	0.005	0.057
$S0_2$	11.349	0.001	0.009
Total	567.566	0.040	0.452

So what does it mean???

- Fire Behavior:
  - Stand-level
    - Shrubs>Pinyon>Burned until Pinyon began crowning
  - Landscape-level: Beware the near-structure variability!!!
  - Remember… Flames <1/2 your problem
- Benefits:
  - Pinyon greatest
  - Defensible space had few effects
    - Small population
  - UFORE needs tweaking
    - Had to send away data for analysis
    - I-Tree good, I-Shrub needed
      - Shrubs still the red-headed stepchild


• Meet the monkeys...
Jon Large
• Current work
Chris Hamma
Alex Kirkpatrick


Klamath Mountains
Thin only
Thin + Burn
Thin + Pile/burn
Burn only

Sierra Nevada Mountains

Thin only

Thin + Burn

Thin + Masticate

Thin + Pile/burn

Burn only

SoCal Chaparral

Burn only

Crush + Burn

Mastication

Goats

Part II

If I ran the zoo…

- Holistic approach to WUI management

It takes more than just fuel treatments to make communities sustainable

If I ran the (holistic) zoo…

Goal: Reduce costs and losses associated with wildfires in the wildland-urban interface

Focus Areas for Research & Policy Recommendations

Mitigation
- Existing communities
- Undeveloped communities

1. Fuels
   - Landscape-level
   - Landscaping standard
2. Construction
   - Materials
   - Assembly
   - Codes
3. Land-use planning
   - Community Design
   - Zoning
   - Critical Infrastructure
4. Education
   - Effectiveness

Preparedness, Response

1. Personal
2. Agency (suppression, law enforcement, etc.)
   - Mutual aid agreements
   - Number/staging of resources
   - Emergency coordination
3. Private business (utilities, insurance, medical, etc.)

Recovery

1. Secondary disaster mitigation
   - Environmental recovery
   - Infrastructure recovery
2. Economic recovery
   - Loans, grants, etc.
3. Social/Emotional recovery
4. Cost recovery

1. Identify effective management strategies
2. Determine sociopolitical/economic constraints
3. Provide potential solutions to overcome constraints
4. Monitor implementation of strategies and adjust

- Appropriate Suppression Resources
- Problem where small tax base
- Both agencies and private overemphasize




Even Superman had his kryptonite...

Atascadero 2006
- No time
- 2 minutes, 0.2 acres, 2 homes

We must prepare the battlefield!!!

Goal: Reduce costs and losses associated with wildfires in the wildland-urban interface

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4. Monitor implementation of strategies and adjust

•Appropriate Fuels Management

New Building Code for those in Very High Fire Hazard Severity Zones (effective 2008)

Chapter 7A [For SFM]

MATERIALS AND CONSTRUCTION METHODS FOR EXTERIOR WILDFIRE EXPOSURE

SECTION 701A — SCOPE, PURPOSE AND APPLICATION

701A.1 Scope. *This chapter applies to building materials, systems and or assemblies used in the exterior design and construction of new buildings located within a Wildland-Urban Interface Fire Area as defined in Section 702A.*

701A.2 Purpose. *The purpose of this chapter is to establish minimum standards for the protection of life and property by increasing the ability of a building located in any Fire Hazard Severity Zone within State Responsibility Areas or any Wildland-Urban Interface Fire Area to resist the intrusion of flame or burning embers projected by a vegetation fire and contributes to a systematic reduction in conflagration losses.*

701A.3 Application. *New buildings located in any Fire Hazard Severity Zone within State Responsibility Areas or any Wildland-Urban Interface Fire Area designated by the enforcing agency for which an application for a building permit is submitted on or after December 1, 2005, shall comply with the following sections:*

1. ***704A.1 — Roofing***
2. ***704A.2 — Attic Ventilation***

701A.3.1 Alternates for materials, design, tests and methods of construction. *The enforcing agency is permitted to modify the provisions of this chapter for site-specific conditions in accordance with Section 104.2.7. When required by the enforcing agency for the purposes of granting modifications, a fire protec-*

FIRE PROTECTION PLAN *is a document prepared for a specific project or development proposed for a Wildland-Urban Interface Fire Area. It describes ways to minimize and mitigate potential for loss from wildfire exposure.*

The Fire Protection Plan shall be in accordance with this chapter and the California Fire Code, Article 86A. When required by the enforcing agency for the purposes of granting modifications, a fire protection plan shall be submitted. Only locally adopted ordinances that have been filed with the California Building Standards Commission in accordance with Section 101.14 or the Department of Housing and Community Development in accordance with Section 101.15 shall apply.

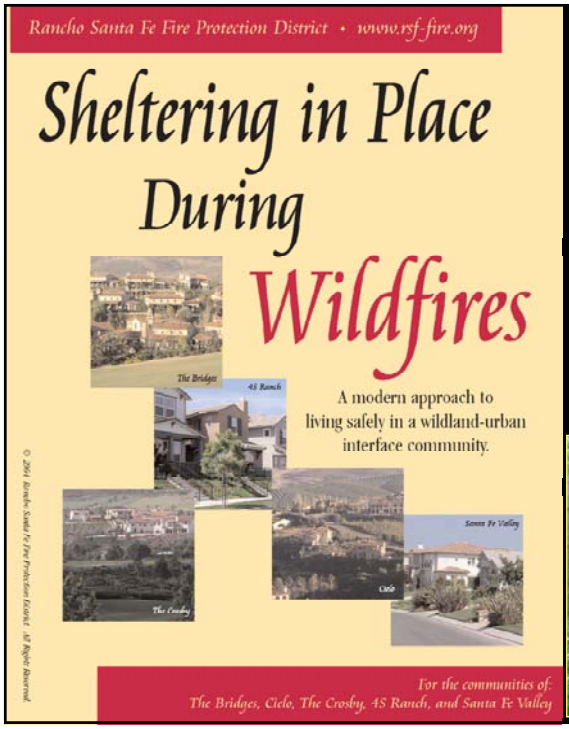
FIRE HAZARD SEVERITY ZONES *are geographical areas designated pursuant to California Public Resources Codes, Sections 4201 through 4204 and classified as Very High, High, or Moderate in State Responsibility Areas or as Local Agency Very High Fire Hazard Severity Zones designated pursuant to California Government Code Sections 51175 through 51189. See California Fire Code Article 86.*

The California Code of Regulations, Title 14, Section 1280 entitles the maps of these geographical areas as "Maps of the Fire Hazard Severity Zones in the State Responsibility Area of California."

IGNITION-RESISTANT MATERIAL *is any product which, when tested in accordance with UBC Standard 8-1 for a period of 30 minutes, shall have a flame spread of not over 25 and show no*

•Sound Land Use Planning

- San Diego way
  - Doesn't always work out so well...

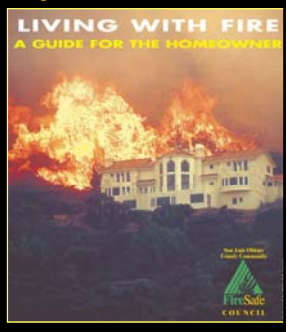


New paradigm???

- A commercial...
  - Shelter-in-Place special session
  - Association for Fire Ecology Conference
  - San Diego, Dec 1-4

•Community education and buy-in

♪… Taken' it to the streets…♫



LIVING ON THE EDGE
A Wildland Fire Management Tool

Collaboration is key!!!

♫ Kumbaya my Lord…

Goal: Reduce costs and losses associated with wildfires in the wildland-urban interface

Focus Areas for Research & Policy Recommendations

Mitigation
- **Existing communities**
- **Undeveloped communities**

1. Fuels
   - Landscape-level
   - Landscaping standard
2. Construction
   - Materials
   - Assembly
   - Codes
3. Land-use planning
   - Community Design
   - Zoning
   - Critical Infrastructure
4. Education
   - Effectiveness

Preparedness, Response

1. Personal
2. Agency (suppression, law enforcement, etc.)
   - Mutual aid agreements
   - Number/staging of resources
   - Emergency coordination
3. Private business (utilities, insurance, medical, etc.)

Recovery

1. Secondary disaster mitigation
   - Environmental recovery
   - Infrastructure recovery
2. Economic recovery
   - Loans, grants, etc.
3. Social/Emotional recovery
4. Cost recovery

1. Identify effective management strategies
2. Determine sociopolitical/economic constraints
3. Provide potential solutions to overcome constraints
4. Monitor implementation of strategies and adjust

Part III

Zoo's gone wild...

- When bad fires happen to good people

Zoo's gone wild

When bad fires happen to good people

100% survival

Evacuations ordered well in advance

- "But I thought this was shelter-in place"
- "True, but we don't know what YOU'RE gonna do when it hits the fan"

Some stayed behind...

Buyer beware...

- One company reported to have sold many contracts guaranteeing that they would spray gel on house during wildfire
- Turned back by law enforcement

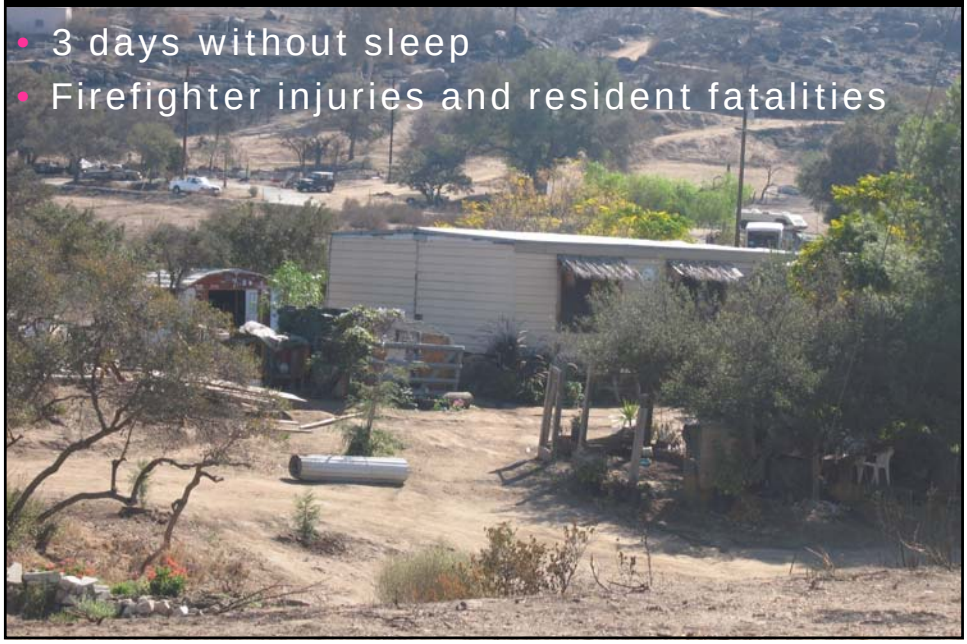
Timing is everything...

Harris Fire serendipity...

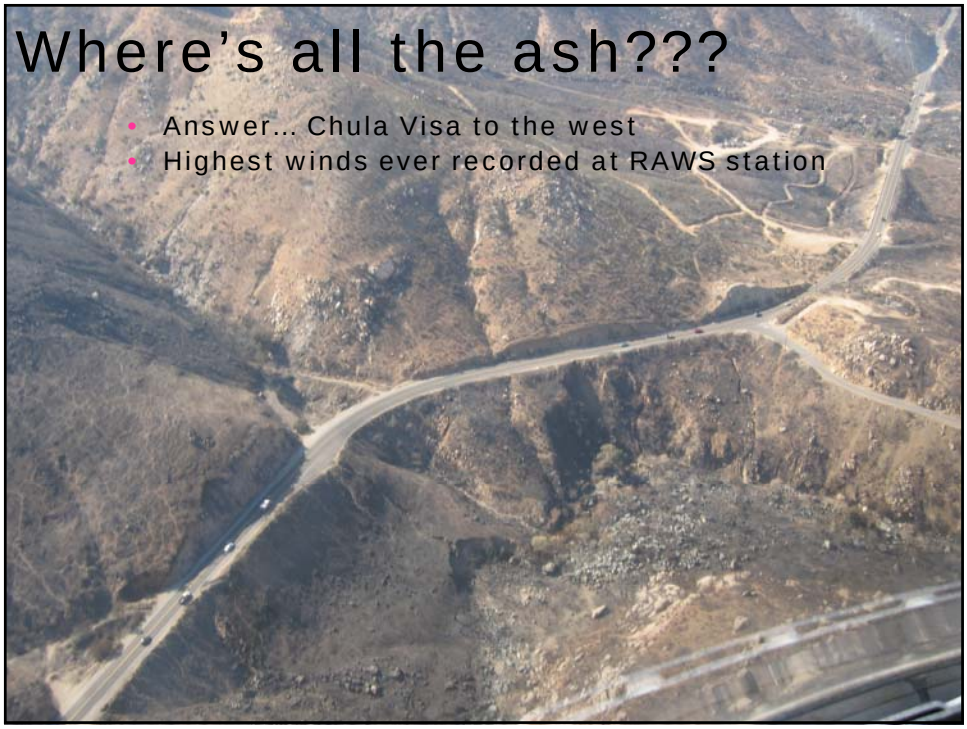
What fire camp is REALLY like...

Not quite Rancho Santa Fe...

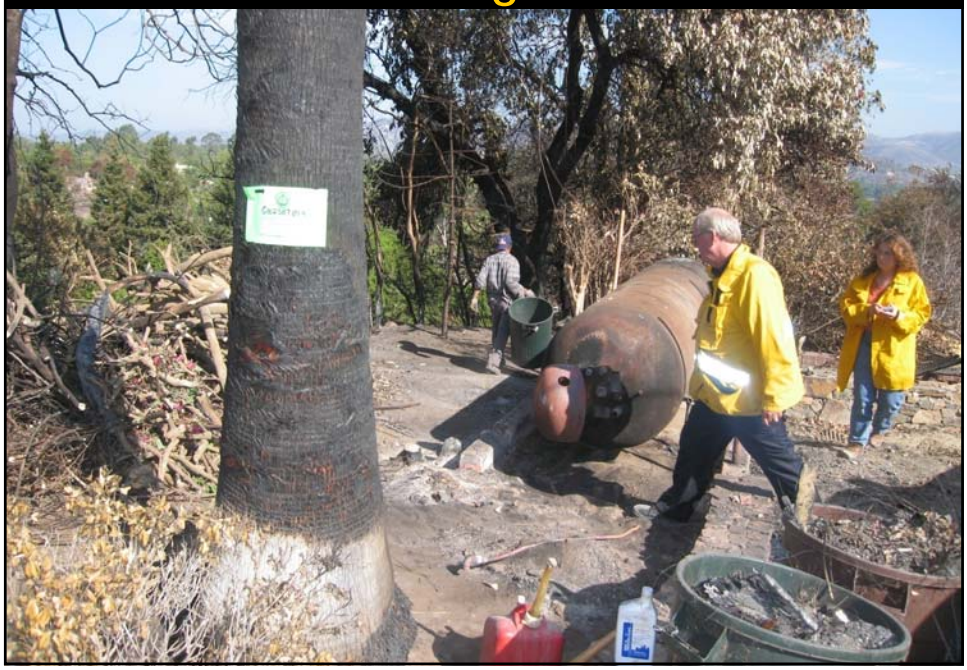
- 3 days without sleep
- Firefighter injuries and resident fatalities




Del Zura
Trailer Park


Where's all the ash???
Answer... Chula Visa to the west
Highest winds ever recorded at RAWS station

Witch Fire damage assessment

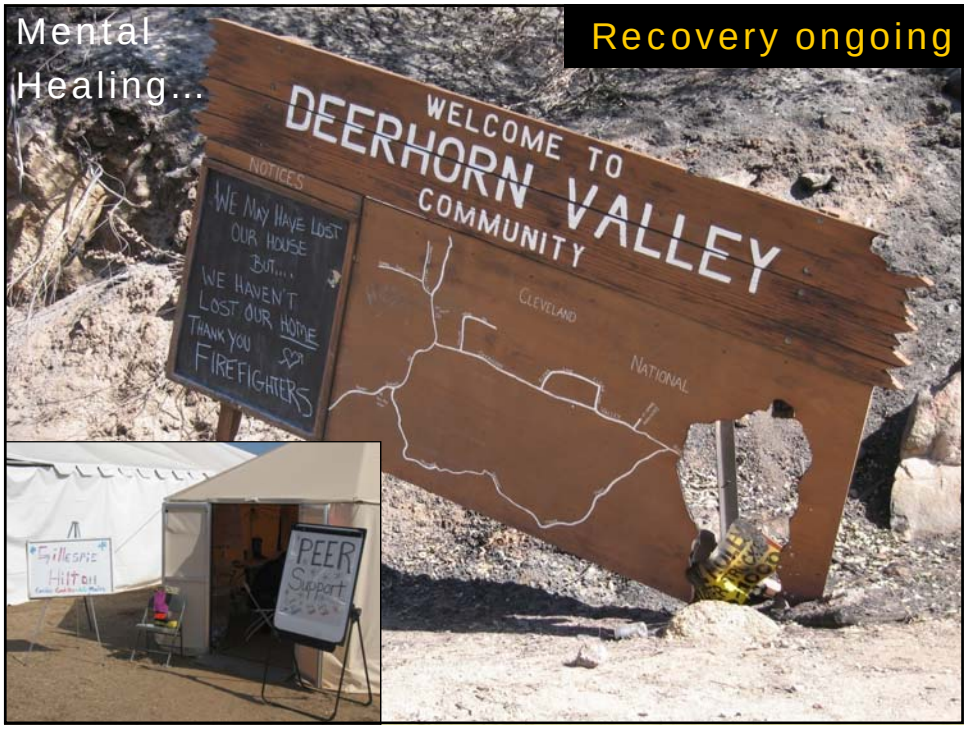



Yes (kinda)...
Double paned window sprayed with water just before fire arrived
Mulch almost ignited interior


No!
• Fire stopped 3 blocks back from house
• Asset-wealthy residents couldn't afford to change


"Thank you for not listening to me..."


Physical healing...
HOMEOWNER EROSION CONTROL ASSISTANCE CENTER 1-888-846-0800
Recovery ongoing
DISASTER
FEMA
Catastrophe Team


Mental Healing...
Recovery ongoing
WELCOME TO
DEERHORN VALLEY
COMMUNITY
NOTICES
WE MAY HAVE LOST OUR HOUSE BUT.... WE HAVEN'T LOST OUR HOME
THANK YOU
FIREFIGHTERS
CLEVELAND
NATIONAL
PEER Support


Pre-fire changes DID work...
• Construction
• Setbacks
• Landscaping
• Education