
Witch Fire October 2007 by Adam Johnson

INVESTIGATING RELATIONSHIPS BETWEEN FIRE SEVERITY, HABITAT TYPE, & LONG-TERM POST-FIRE RECOVERY OF THE 2007 WITCH CREEK FIRE

MGIS CANDIDATE: JONATHAN LEE

ADVISOR: ALAN TAYLOR

PennState

PRESENTATION OVERVIEW

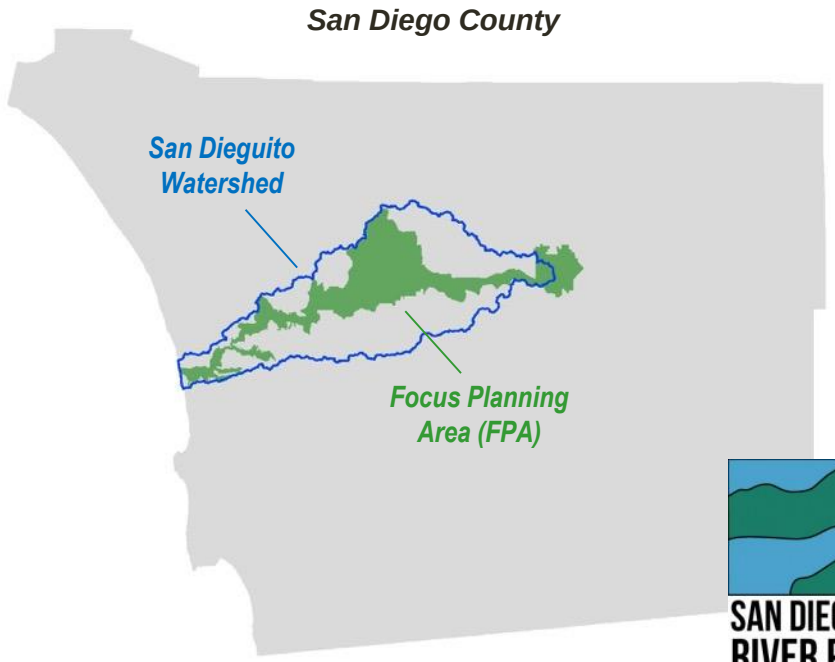
- About Me
- Background
- Goals and Objectives
- Proposed Methodology
- Initial Findings
- Project Timeline

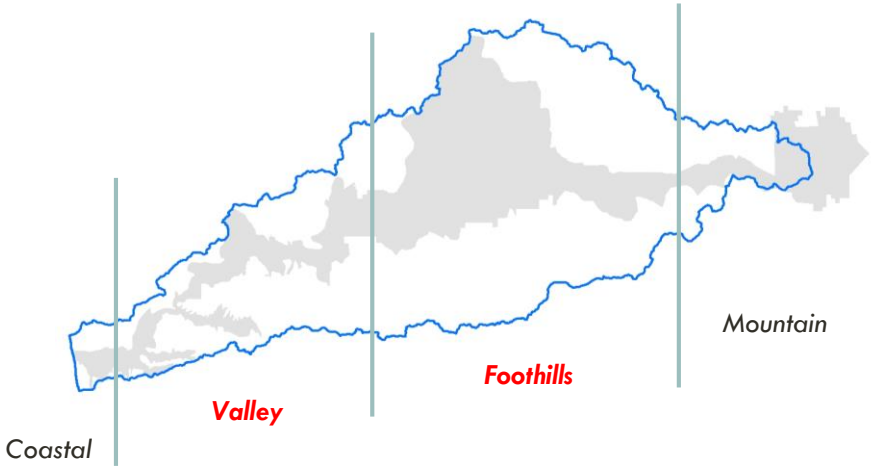
Jonathan Lee

Alan Taylor,
PSU Dept. of Geography

PROJECT MOTIVATION: SAN DIEGUITO RIVER PARK (SDRP)

- 55-mile long open space greenway located in northern San Diego County, CA
- Joint Powers Authority (SD County + 5 Cities)
- Focus Planning Area (FPA) = 37,000 ha
- More than half in public ownership






Riparian


Coastal Sage Scrub


Chaparral

WILDFIRES

- Destructive Force vs. Population Regulation/Growth
- Fire Management vs. Fire Regimes
  - Long-term suppression resulting in fire extremities (Harris & Taylor, 2015)
  - Controlled burns resulting in vulnerability to high severity fires (Thompson, Spies, and Ganio, 2007)
  - Increased frequencies resulting in alien plant invasion (Keeley and Brennan, 2012)
- What drives fire severity?
  (McKenzie, Miller, & Falk, 2007; Dillon et al, 2011)
  - Fuel (mass, spatial arrangement, moisture)
  - Weather (air temperature, wind, humidity)
  - Topography (slope, aspect, topographic position)

Devastated landscape after the Witch Fire

Fire poppy that only appears post-fire

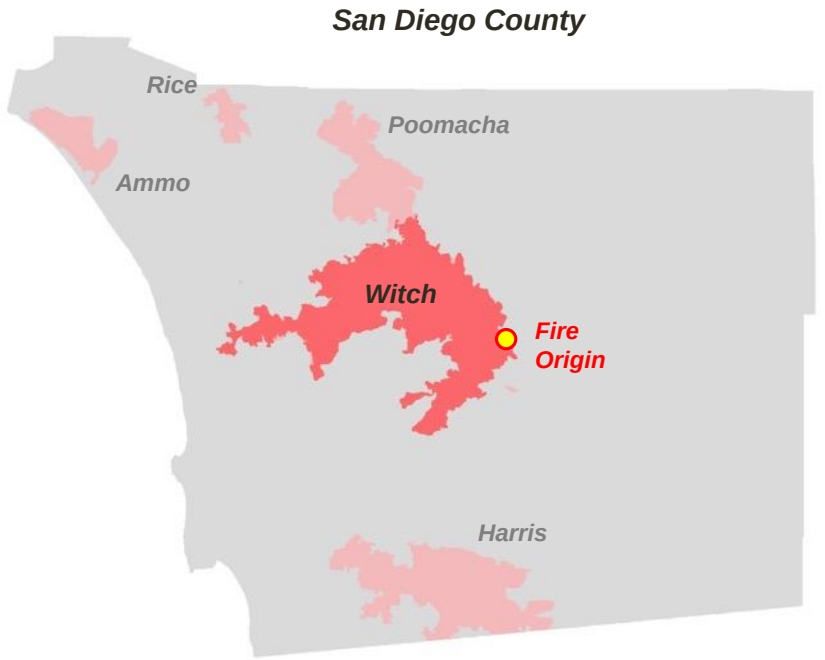
WILDFIRES (CONT.)

- What drives post-fire vegetation recovery? (Keeley, Fotheringham, and Baer-Keeley, 2005)
  - Event-dependent effects
  - Fire-interval effects
  - Internal density-dependent effects
  - External environmental effects

THE 2007 WITCH FIRE

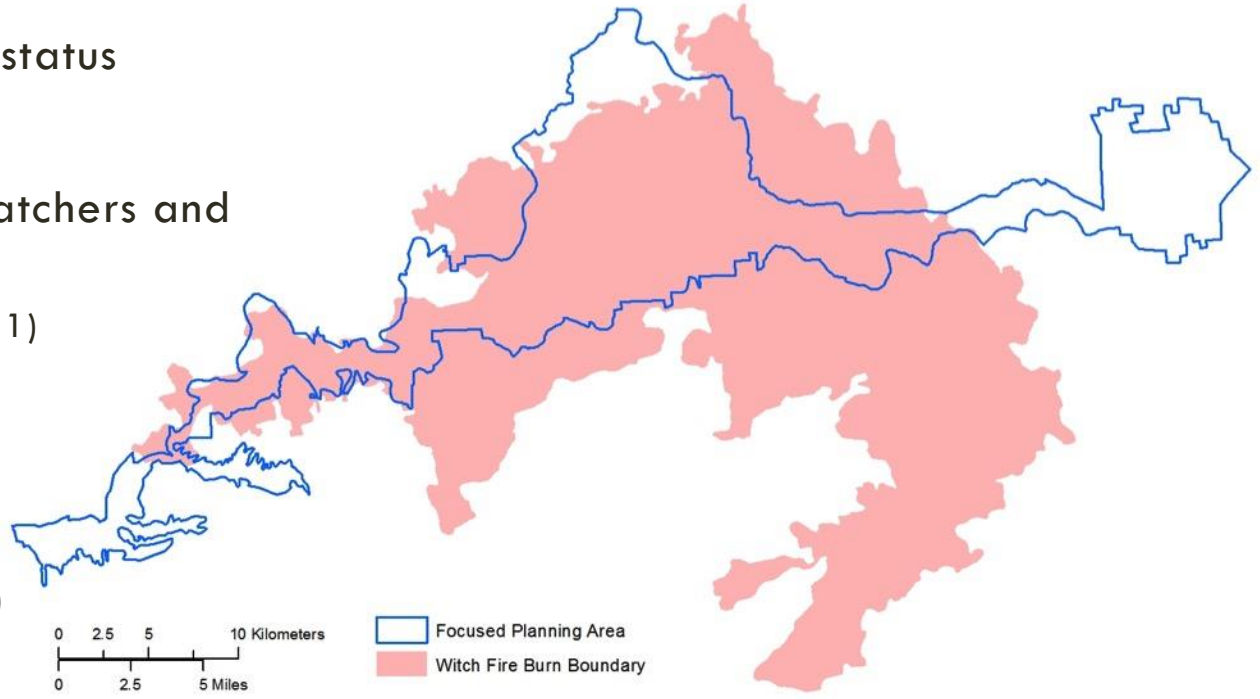
- 1 of 17 significant wildfires burning simultaneously between Santa Barbara and the Mexico border in October 2007
- Second largest of the 2007 California wildfire season
- Burned nearly 80,000-ha during a 10-day period
- Ignited by power lines
- Accelerated by Santa Ana wind conditions and prolonged severe drought

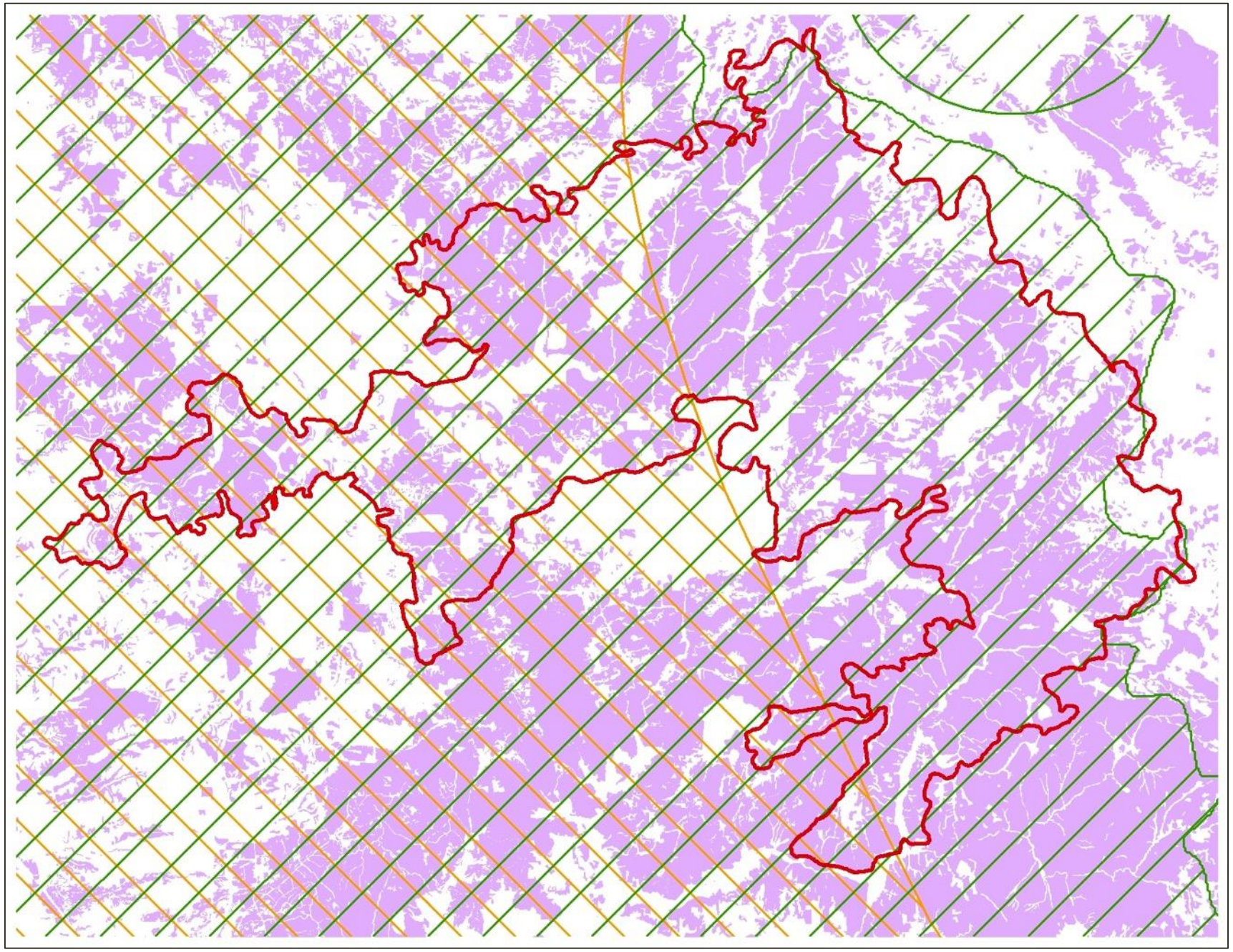
(CAL FIRE, 2009)



SO WHAT?

- Over 60% of SDRP's FPA was burned
- Major sensitive habitats that supported special status animal and plant species were impacted
- Critical to core populations of California gnatcatchers and cactus wrens (CBI, 2003)
  - Require shrubs that exceed 1 meter (Beyers & Wirtz, 2011)
  - Cactus (*Opuntia spp.*) can be slow-growing
- Burnt areas do not support insect fauna and nesting resources necessary for permanent residents (Stanton, 1986; Barr et al, 2015)





RANGE VS REALITY

- Fire Perimeter
- Cactus Wren Range
- CA Gnatcatcher Range
- Scrub and Chaparral

CWHR, 2000; SANDAG, 2012

Bernardo Bay, 2003

Bernardo Bay, 2007

Bernardo Bay, 2008

Santa Fe Valley, 2006

Santa Fe Valley, 2007

Santa Fe Valley, 2011

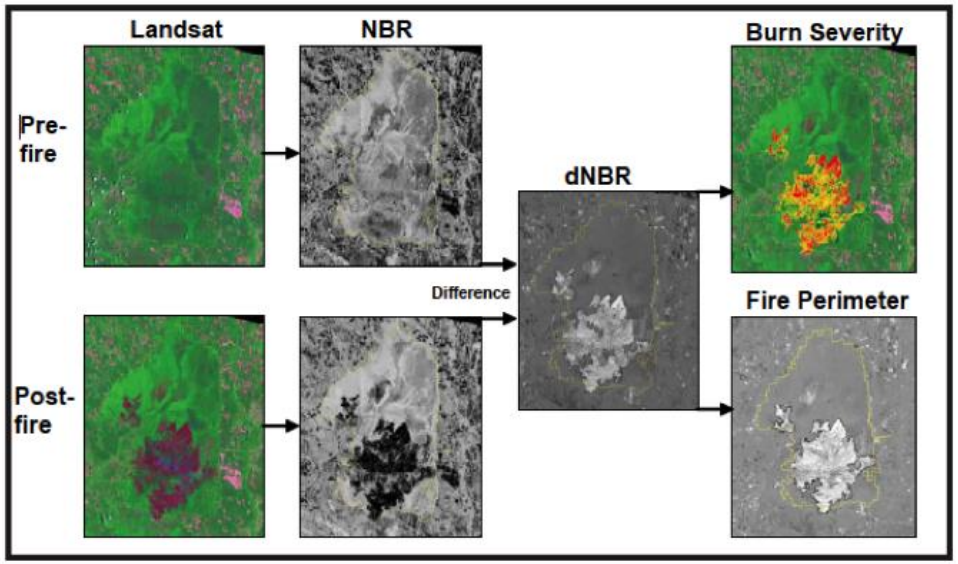
GOALS/OBJECTIVES

- To better understand impact of fire severity on long-term post-fire vegetation recovery
- Focus on areas that need active restoration efforts to expedite critical habitat recovery
- Identify associations among vegetation/fuels, topography, fire severity, and post-fire vegetation developments:
    1. Did certain vegetation types burn more severely than others?
    2. Did burn severity affect post-fire vegetation recovery?
    3. How did habitat type terrain variables impact fire severity and vegetation recovery?
        - Topographic position
        - Slope aspect
        - Solar radiation

METHODOLOGY: MEASURING FIRE SEVERITY

- Monitoring Trends in Burn Severity (MTBS) methodology using Landsat TM imagery
- "Fire Severity" = visible changes in aboveground biomass, fire products, and soil exposure
- Normalized Burn Ratio (NBR) index =
  (Band 4-Band 7)/(Band 4+Band 7) x 1000
  - Band 4 (near-IR) – vegetation greenness and soil moisture
  - Band 7 (mid-IR) – soil type and dryness level
- Differenced NBR (dNBR) = $NBR_{prefire} - NBR_{postfire}$

(Eidenshink et al, 2007)



METHODOLOGY: EXTENDED DNBR ASSESSMENT

1. *Did certain vegetation types burn more severely than others?*
2. *Did burn severity affect post-fire vegetation recovery?*

- Pre-Fire: May 19, 2006
- Post-Fire: April 22, 2008
- Conduct extended dNBR assessment
  - 2012
  - 2015

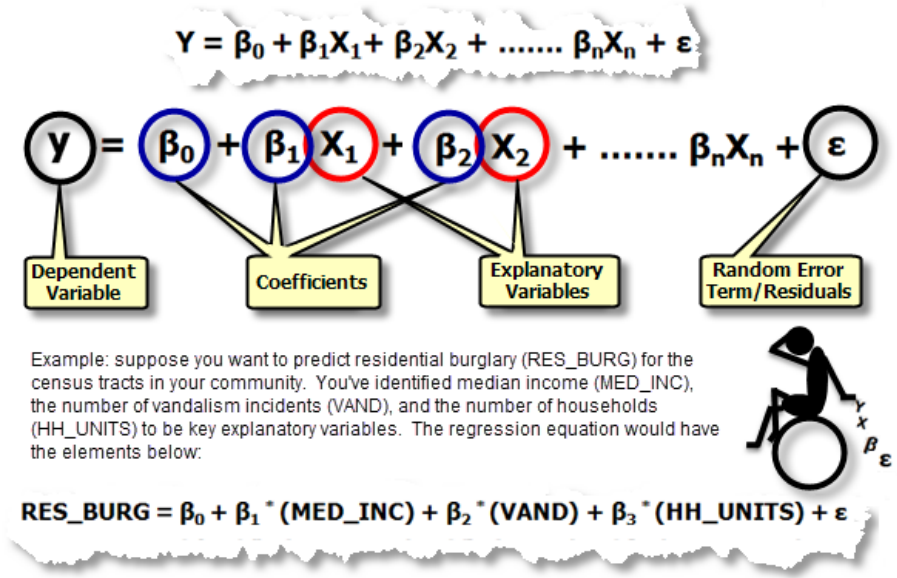
METHODOLOGY: PHYSICAL VARIABLES

3. *How did terrain variables impact fire severity and vegetation recovery?*

Variable	Description
Habitat Type	CSS, Chaparral, Grasslands, Forested, Riparian
Topographic Position Index	Relative measure of location's elevation with respect to its surroundings
Slope Aspect	Direction of the slope (ie. North/South-facing)
Solar Radiation	Amount of solar energy striking a surface which influences site temperature and moisture conditions

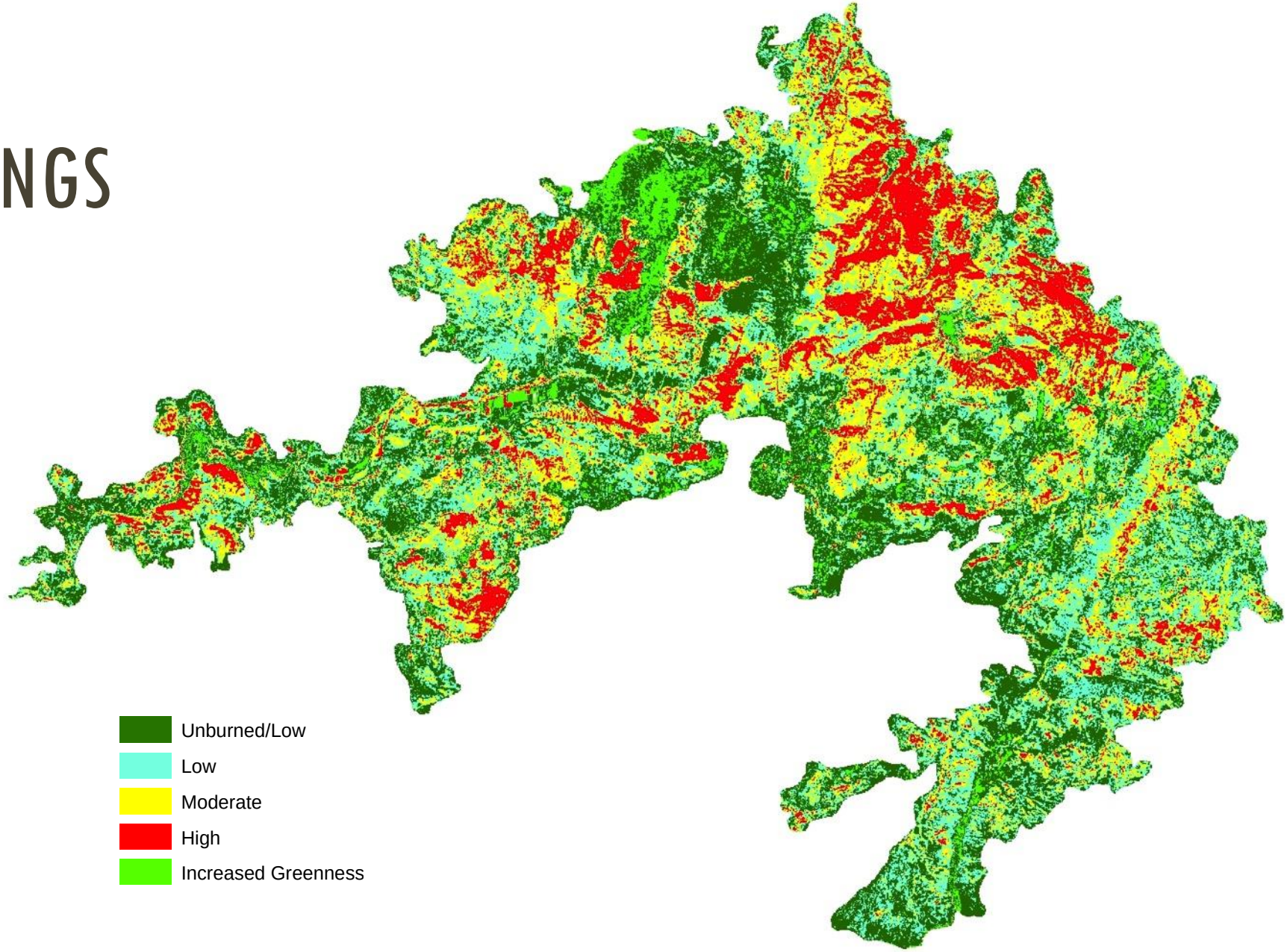
METHODOLOGY: REGRESSION ANALYSIS

- Ordinary Least Squares (OLS) regression using ArcGIS



(Esri Help)

INITIAL FINDINGS

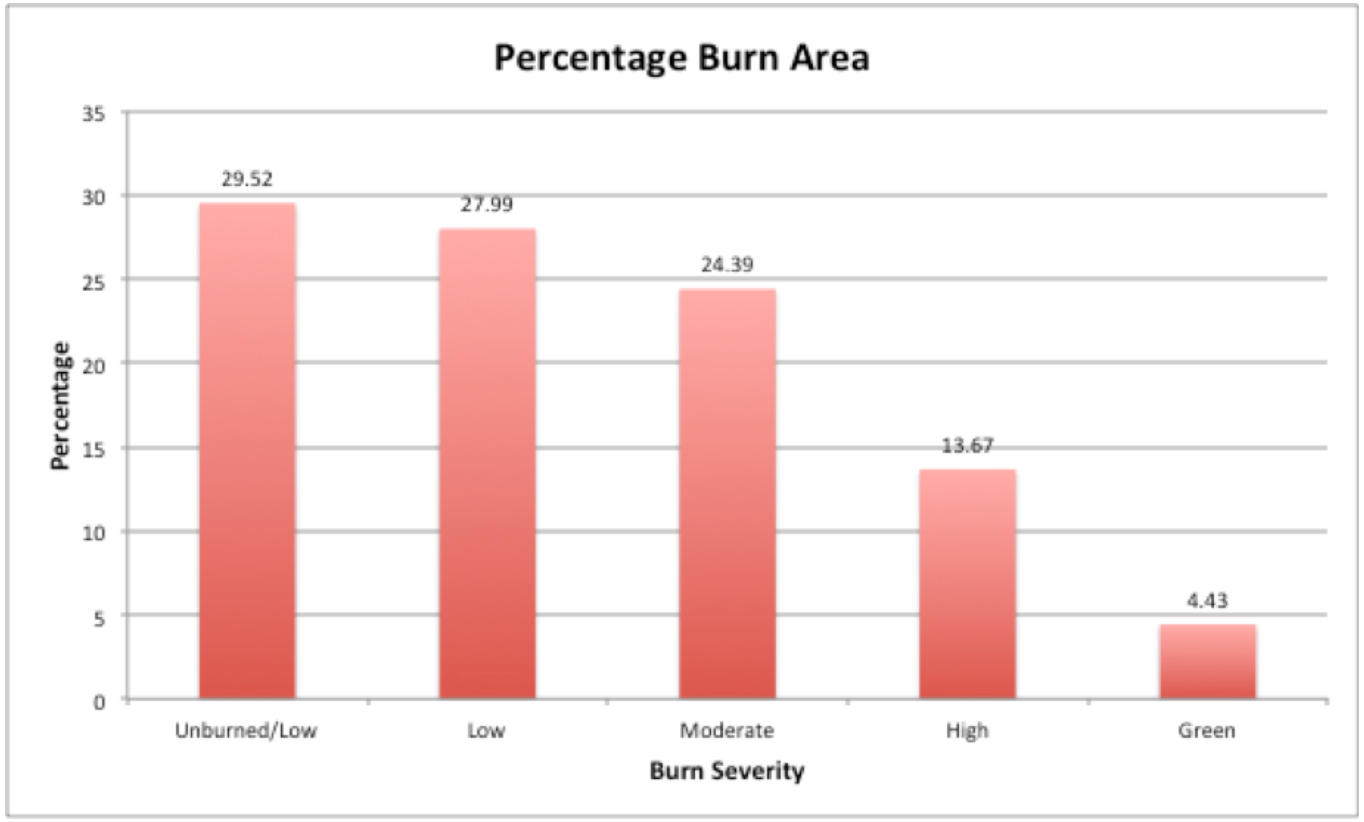


MTBS Assessment

- Fire: October 2007
- Pre-Fire: May 19, 2006
- Post-Fire: April 22, 2008

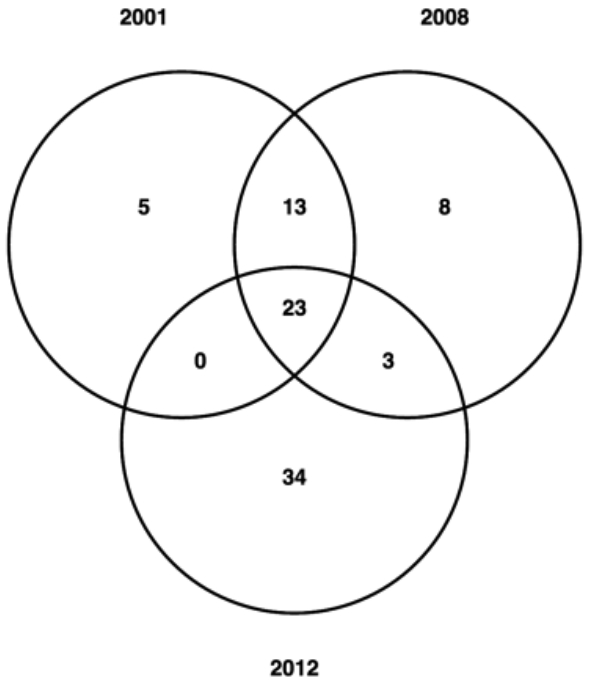
INITIAL FINDINGS

- Most burned low to moderate
- 4% increased greenness
  - Springtime growth
  - Post-fire vegetation response (sprouting, new establishment)



2001	2008	2012
Barren	Barren	Barren
California Annual Grassland	California Annual Grassland	California Annual Grassland
California Central Valley and Southern Coastal Grassland	California Central Valley and Southern Coastal Grassland	California Central Valley and Southern Coastal Grassland
California Coastal Live Oak Woodland and Savanna	California Coastal Live Oak Woodland and Savanna	California Coastal Live Oak Woodland and Savanna
California Mesic Chaparral	California Mesic Chaparral	California Mesic Chaparral
California Montane Riparian Systems	California Montane Riparian Systems	California Montane Riparian Systems
California Xeric Serpentine Chaparral	California Xeric Serpentine Chaparral	California Xeric Serpentine Chaparral
Central and Southern California Mixed Evergreen Woodland	Central and Southern California Mixed Evergreen Woodland	Central and Southern California Mixed Evergreen Woodland
Developed-High Intensity	Developed-High Intensity	Developed-High Intensity
Developed-Medium Intensity	Developed-Medium Intensity	Developed-Medium Intensity
Developed-Roads	Developed-Roads	Developed-Roads
Introduced Upland Vegetation-Annual and Biennial Forbland	Introduced Upland Vegetation-Annual and Biennial Forbland	Introduced Upland Vegetation-Annual and Biennial Forbland
Introduced Upland Vegetation-Annual Grassland	Introduced Upland Vegetation-Annual Grassland	Introduced Upland Vegetation-Annual Grassland
Introduced Upland Vegetation-Perennial Grassland and Forbland	Introduced Upland Vegetation-Perennial Grassland and Forbland	Introduced Upland Vegetation-Perennial Grassland and Forbland
Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland
Mediterranean California Mesic Serpentine Woodland and Chaparral	Mediterranean California Mesic Serpentine Woodland and Chaparral	Mediterranean California Mesic Serpentine Woodland and Chaparral
Mediterranean California Mixed Oak Woodland	Mediterranean California Mixed Oak Woodland	Mediterranean California Mixed Oak Woodland
Northern and Central California Dry-Mesic Chaparral	Northern and Central California Dry-Mesic Chaparral	Northern and Central California Dry-Mesic Chaparral
Open Water	Open Water	Open Water
Sonora-Mojave Semi-Desert Chaparral	Sonora-Mojave Semi-Desert Chaparral	Sonora-Mojave Semi-Desert Chaparral
Southern California Coastal Scrub	Southern California Coastal Scrub	Southern California Coastal Scrub
Southern California Dry-Mesic Chaparral	Southern California Dry-Mesic Chaparral	Southern California Dry-Mesic Chaparral
Southern California Oak Woodland and Savanna	Southern California Oak Woodland and Savanna	Southern California Oak Woodland and Savanna
Agriculture-Cultivated Crops and Irrigated Agriculture	Agriculture-Cultivated Crops and Irrigated Agriculture	California Mesic Serpentine Grassland
California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna	California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna	California Northern Coastal Grassland
Developed-Upland Deciduous Forest	Developed-Upland Deciduous Forest	North Pacific Montane Grassland
Developed-Upland Evergreen Forest	Developed-Upland Evergreen Forest	California Lower Montane Foothill Pine Woodland and Savanna
Developed-Upland Herbaceous	Developed-Upland Herbaceous	Developed-Low Intensity
Developed-Upland Mixed Forest	Developed-Upland Mixed Forest	Mediterranean California Sparsely Vegetated Systems II
Developed-Upland Shrubland	Developed-Upland Shrubland	North American Warm Desert Riparian Forest and Woodland
Mediterranean California Sparsely Vegetated Systems	Mediterranean California Sparsely Vegetated Systems	North American Warm Desert Riparian Herbaceous
NASS-Close Grown Crop	NASS-Close Grown Crop	North American Warm Desert Sparsely Vegetated Systems II
NASS-Fallow/Idle Cropland	NASS-Fallow/Idle Cropland	Western Cool Temperate Developed Ruderal Evergreen Forest
NASS-Row Crop	NASS-Row Crop	Western Cool Temperate Developed Ruderal Grassland
NASS-Row Crop-Close Grown Crop	NASS-Row Crop-Close Grown Crop	Western Cool Temperate Developed Ruderal Mixed Forest
North American Warm Desert Riparian Systems	North American Warm Desert Riparian Systems	Western Cool Temperate Fallow/Idle Cropland
Agriculture-Pasture and Hay	California Mesic Serpentine Grassland	Western Cool Temperate Orchard
California Montane Woodland and Chaparral	California Northern Coastal Grassland	Western Cool Temperate Pasture and Hayland
Herbaceous Wetlands	North Pacific Montane Grassland	Western Cool Temperate Row Crop
Mojave Mid-Elevation Mixed Desert Scrub	Recently Burned Herbaceous Wetlands	Western Cool Temperate Urban Deciduous Forest
Recently Disturbed Forest	Recently Disturbed Developed Upland Deciduous Forest	Western Cool Temperate Urban Evergreen Forest
	Recently Disturbed Developed Upland Evergreen Forest	Western Cool Temperate Urban Herbaceous
	Recently Disturbed Developed Upland Herbaceous	Western Cool Temperate Urban Mixed Forest
	Recently Disturbed Developed Upland Mixed Forest	Western Cool Temperate Urban Shrubland
	Recently Disturbed Developed Upland Shrubland	Western Cool Temperate Vineyard
	Recently Disturbed Orchard Vegetation	Western Warm Temperate Developed Ruderal Evergreen Forest
	Recently Disturbed Pasture and Hayland	Western Warm Temperate Developed Ruderal Grassland
		Western Warm Temperate Developed Ruderal Mixed Forest
		Western Warm Temperate Developed Ruderal Shrubland
		Western Warm Temperate Fallow/Idle Cropland
		Western Warm Temperate Orchard
		Western Warm Temperate Pasture and Hayland
		Western Warm Temperate Row Crop
		Western Warm Temperate Urban Deciduous Forest
		Western Warm Temperate Urban Evergreen Forest
		Western Warm Temperate Urban Herbaceous
		Western Warm Temperate Urban Mixed Forest
		Western Warm Temperate Urban Shrubland
		Western Warm Temperate Vineyard
		Western Warm Temperate Wheat

Common Classes in 2001, 2008, 2012
Common Classes in 2001, 2008
Common Classes in 2008, 2012
Exclusive Classes



Potentially reclassified to:

- Chaparral
- CSS
- Grasslands
- Forest
- Riparian

PROJECT TIMELINE

February 2016 – April 2016	*PROPOSAL REFINEMENT* • *Literature Review* • *Methodology Research* • *Initial Data Acquisition & Exploration*
May 11, 2016	*Peer Review Presentation*
May 2016	**ADDITIONAL DATA ACQUISITION** • Reclassify vegetation classification • Extended post-fire Landsat imagery (2008, 2012, 2015)
June 2016 – August 2016	**CONDUCT ANALYSIS**
June 2016	*Analysis I: Vegetation Type & Fire Severity*
July 2016	*Analysis II: Long-Term Post-Fire Recovery & Fire Severity*
August 2016	*Analysis III: Terrain Variables, Fire Severity, & Post-Fire Recovery*
September 2016	**Refine report**
Fall 2016	**Final presentation at San Diego Partners for Biodiversity Meeting** *Alternative: San Diego Regional GIS Council Meeting*

QUESTIONS/COMMENTS

Investigating Relationships Between Fire Severity, Habitat Type, & Long-term Post-fire Recovery of the 2007 Witch Creek Fire

Jonathan Lee
jkl178@psu.edu

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