

Chaparral Landscape Conversion After a Century of Global Change

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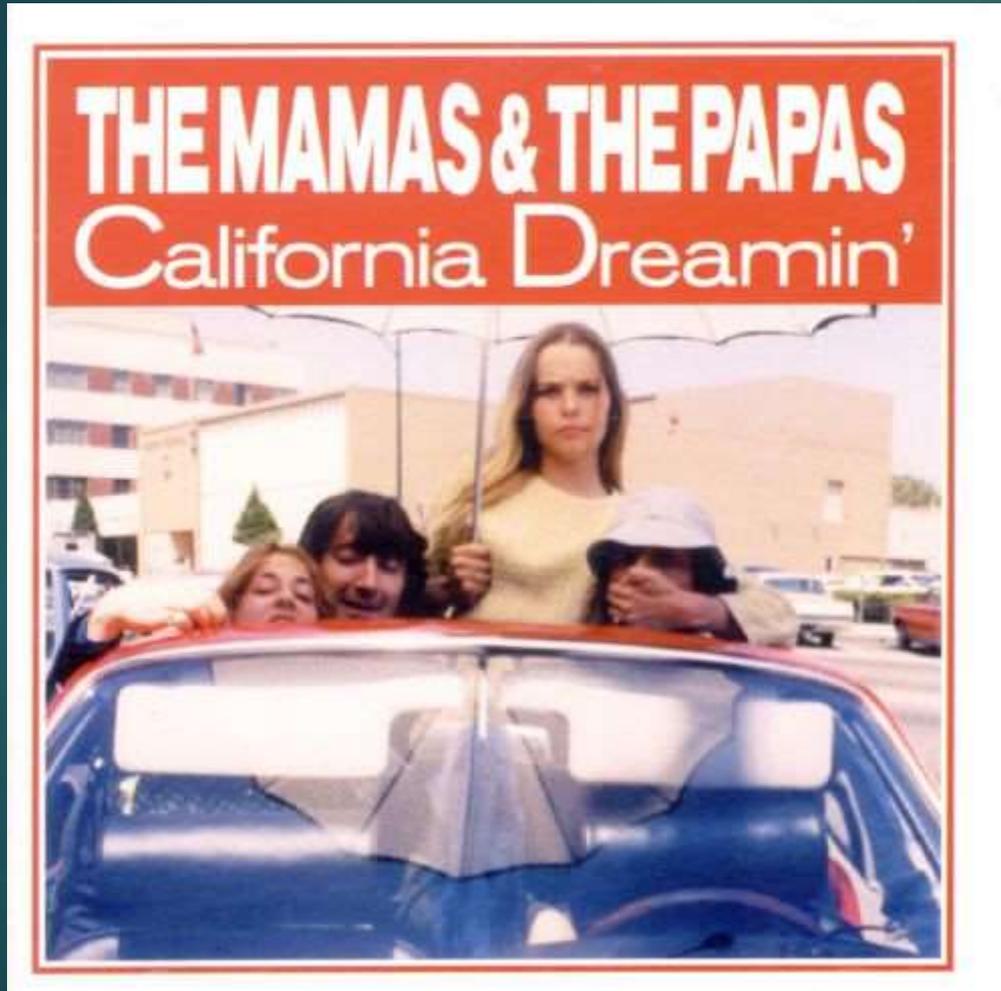
Natural Areas Conference, Davis, CA, October 2016

It's Story Time Again – Tom Waits

- ▶ More than a century of chaparral habitat conversion
 - ▶ Direct: Land development
 - ▶ Indirect: Fire and exotic grasses
- ▶ Possible resolution: Management considerations



California Dreamin'



*All the leaves are brown
And the sky is grey
I've been for a walk
On a winter's day
I'd be safe and warm
If I was in L.A.*

*California dreamin'
On such a winter's day*

California Dreamin'



Yes...sunshine, surf, palm trees, but...

California Dreamin'

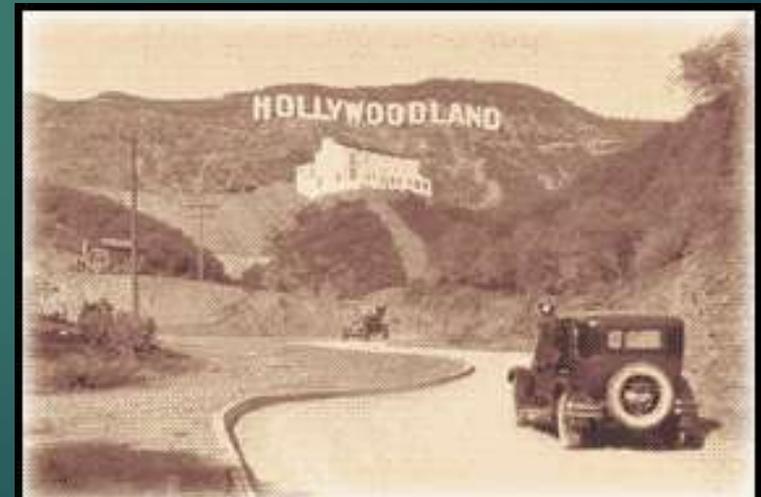
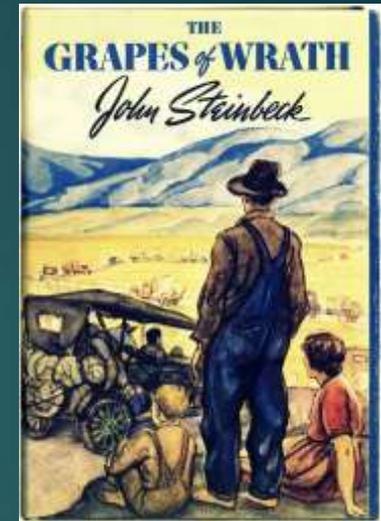
Wikipedia: The California Dream is the psychological motivation to gain fast wealth or fame in a new land

Long history of people flocking to the land of promise



Ongoing Opportunities & Reasons

- ▶ Gold Rush ~1850
- ▶ Oil ~ 1892
- ▶ 20th century: military, agriculture, aerospace, entertainment, technology....

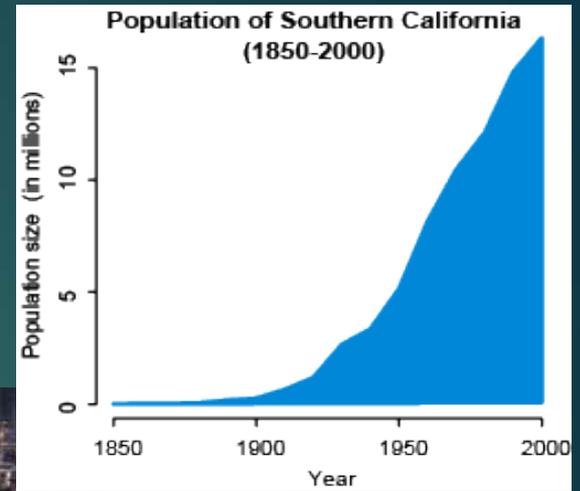


They Came in "Droves"

Covered wagon, Oregon Trail, 1850s



Transcontinental railroad
1867



Interstate Highways 1958



Cape Horn, 1850s

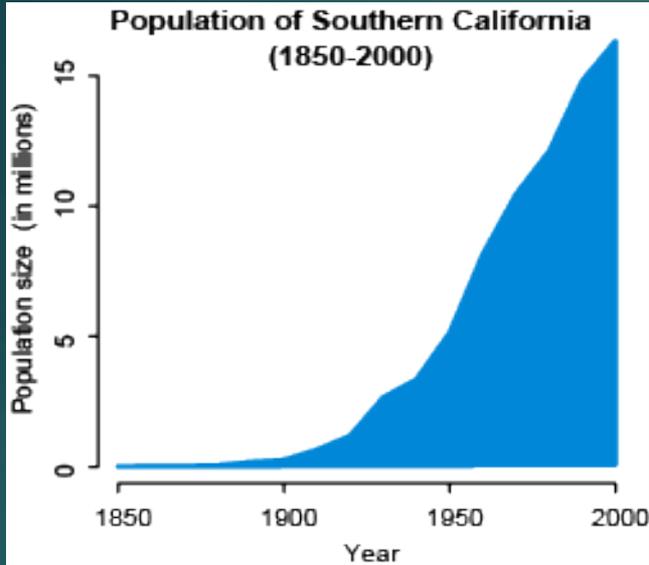


Automobile
Assembly line, 1913

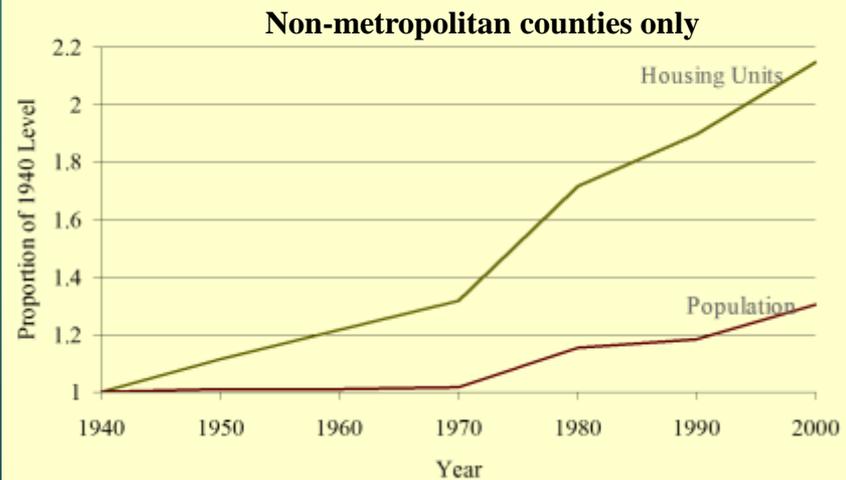
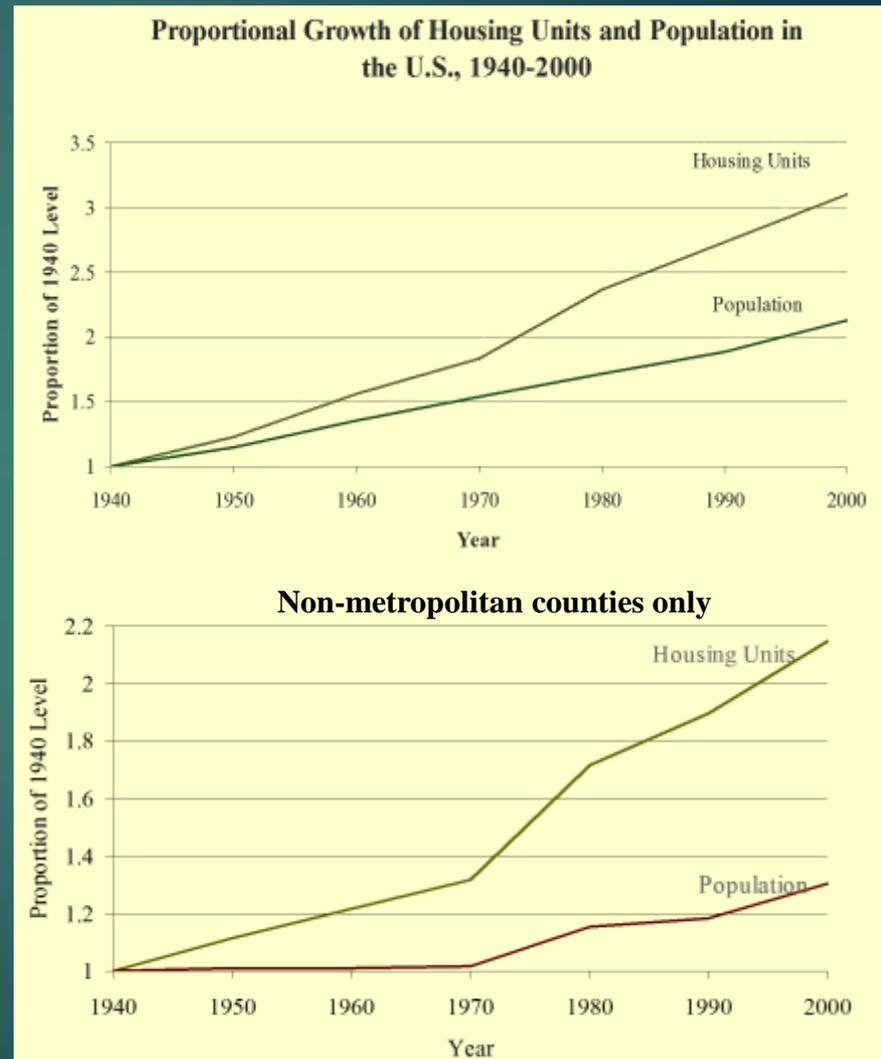


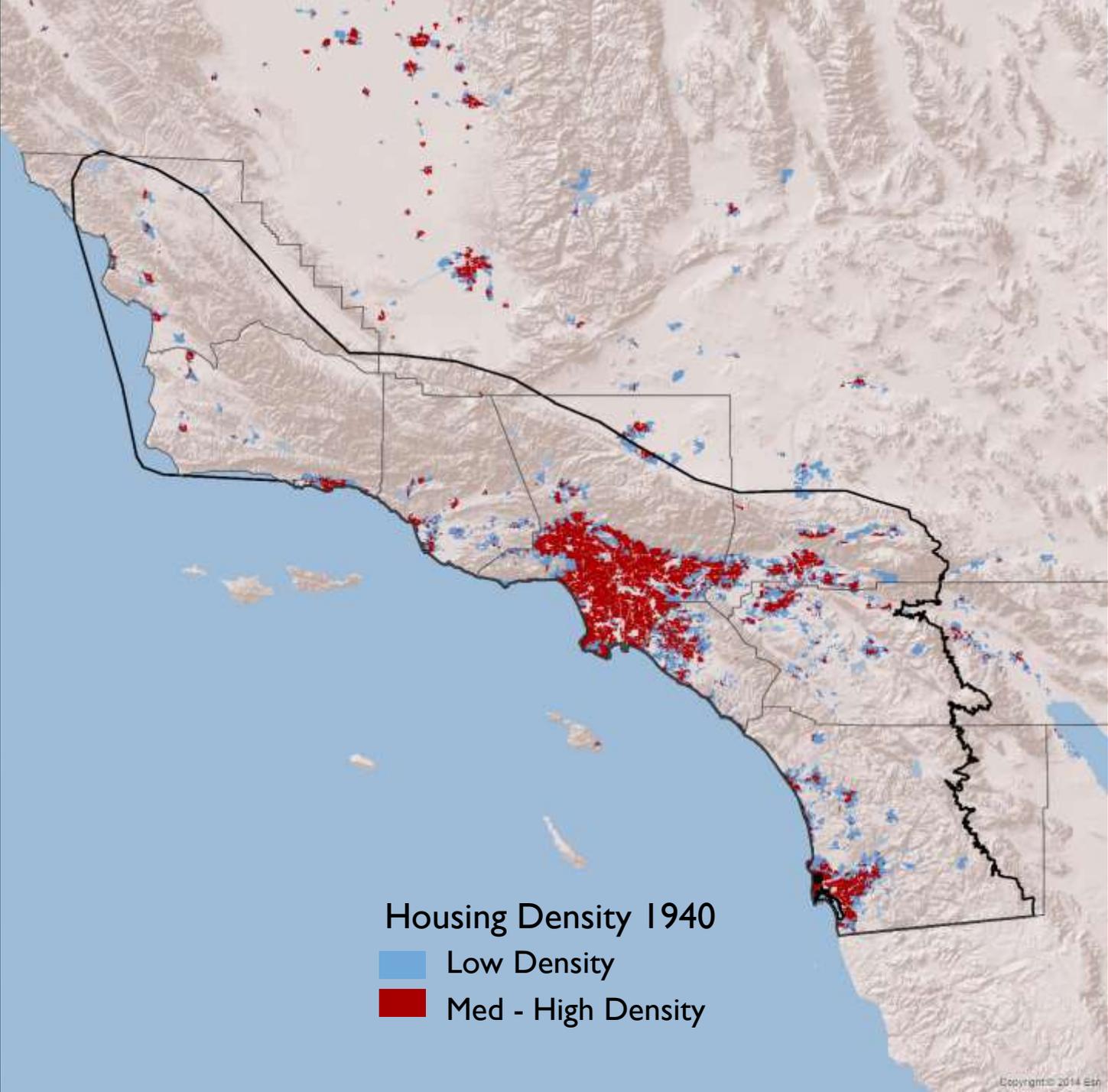
Post WWII, Suburban sprawl

With Population Comes ^{Lots of} Housing



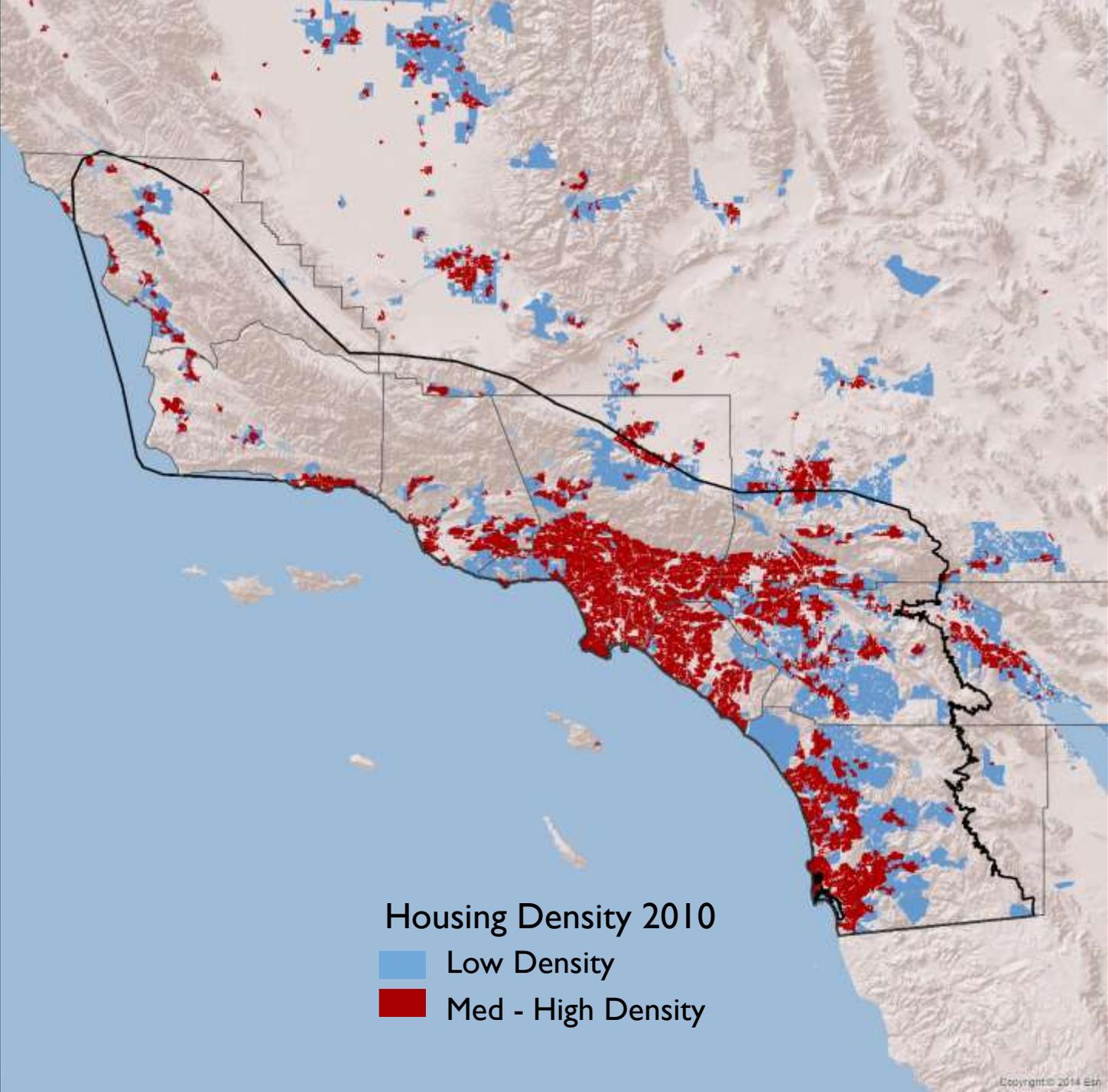
Higher rate of housing
Especially in rural areas





Housing Density 1940

- Low Density
- Med - High Density



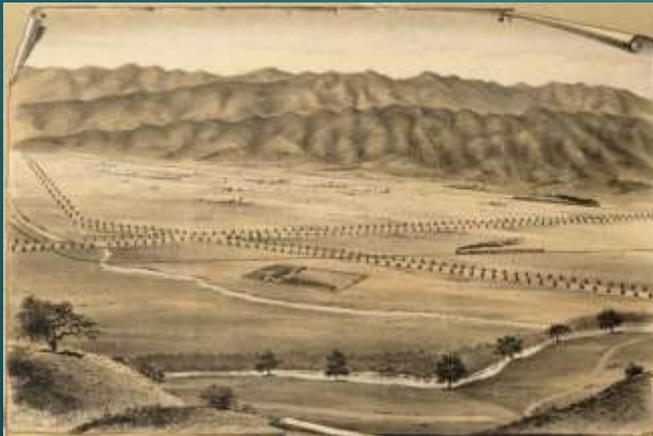
Housing Density 2010

- Low Density
- Med - High Density

The Result? Surplus → Sprawl

“Southern California, where the American Dream came too true.”
Lawrence Ferlinghetti

- ▶ Massive conversion and fragmentation
 - ▶ 30% intact chaparral remains
 - ▶ ~10% coastal sage scrub
- ▶ San Diego County – most T&E species in US



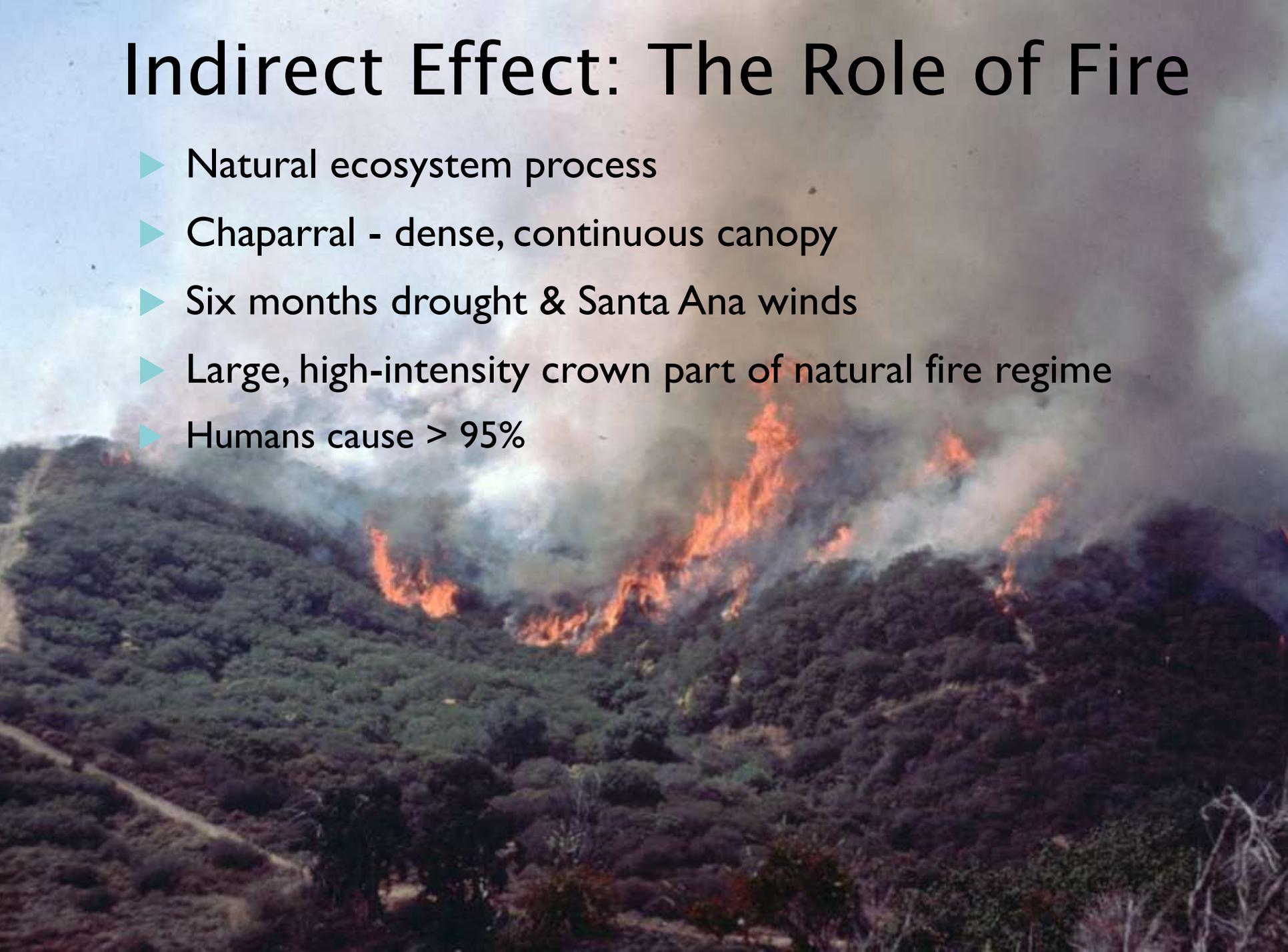
1890



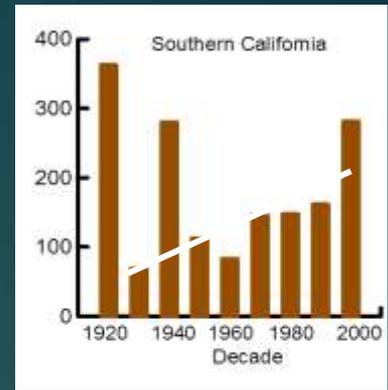
2016

Indirect Effect: The Role of Fire

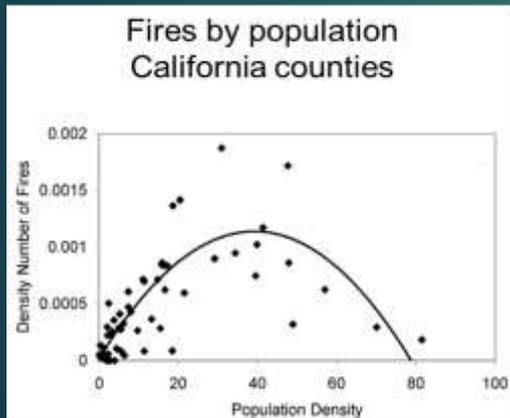
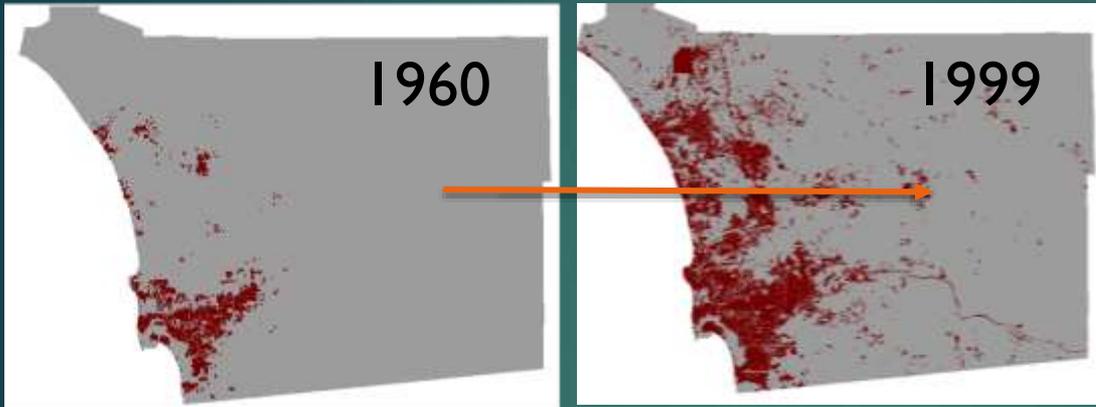
- ▶ Natural ecosystem process
- ▶ Chaparral - dense, continuous canopy
- ▶ Six months drought & Santa Ana winds
- ▶ Large, high-intensity crown part of natural fire regime
- ▶ Humans cause > 95%



Fires (and Big Fires) More Frequent, Extensive



Increased area burned



Syphard et al. 2007, 2009



Housing Pattern Matters

Ecological Consequences of Fire

Post-fire recovery of chaparral

Fire-cued seed germination
or resprouting

Resilient only to *periodic* wildfire

30 – 200 + years

Sensitive to short intervals

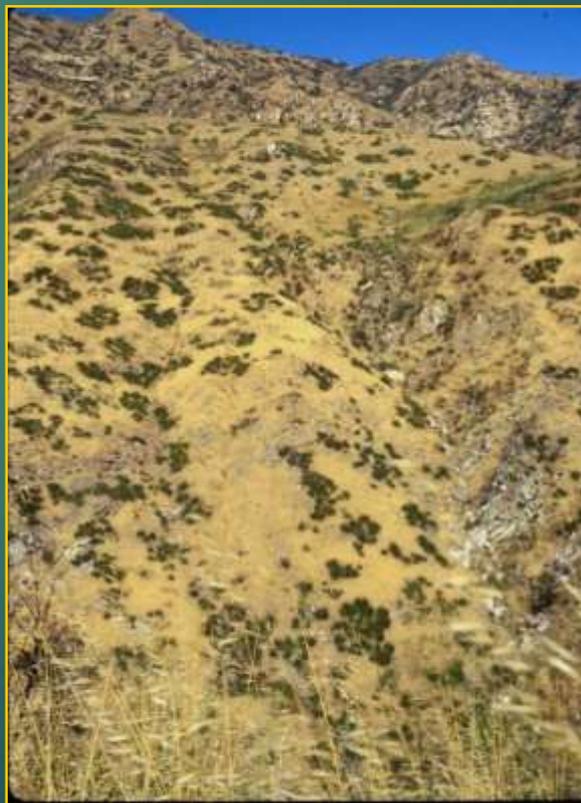
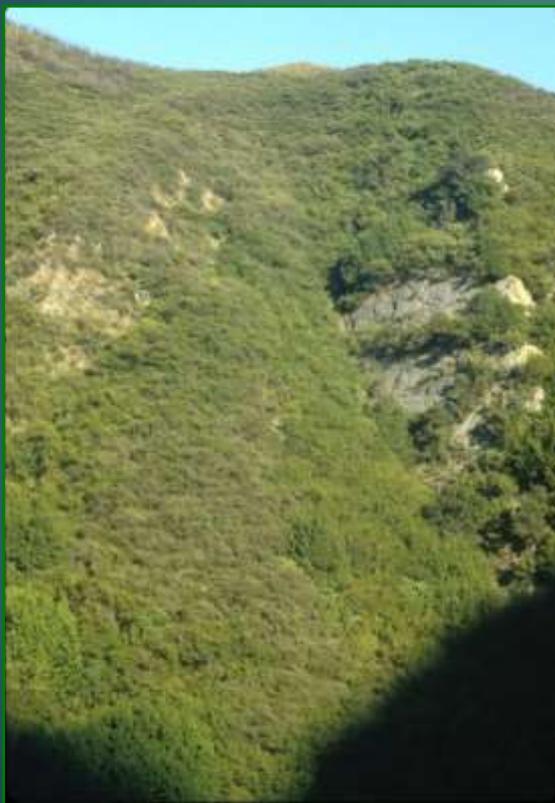
< ~ 5 -15 yrs

Need time to recover &
establish seed bank



Vegetation Type Conversion

- ▶ Extirpation opens canopy & allows annual grass invasion
- ▶ Annual grass -> more fire -> positive feedback
- ▶ Evidence documented in many case studies



Photos by
Anna
Jacobsen

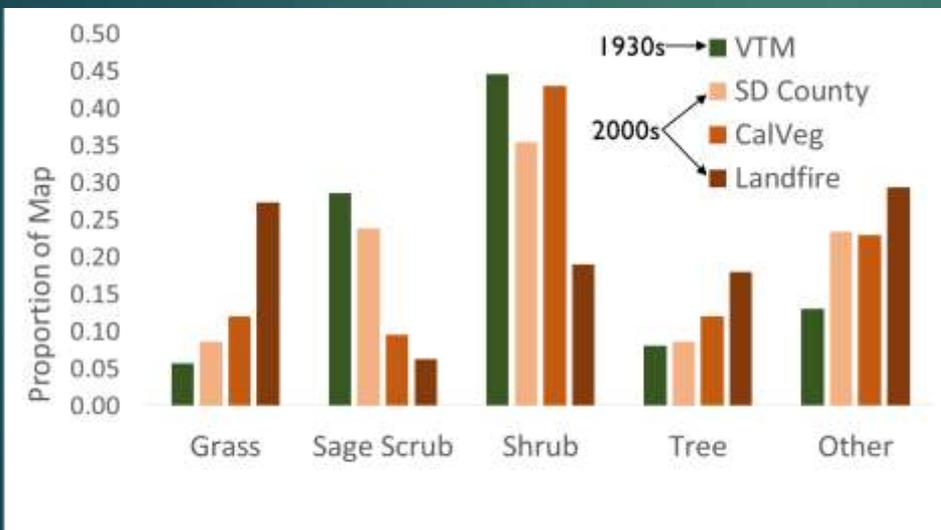
How Extensive Has It Been?

- ▶ Already widespread; invades rapidly (eg, development)
- ▶ “No evidence for extensive conversion” (*Meng et al. 2014; PLoS ONE*)
 - ▶ Some indication at lower elevations
 - ▶ Could not detect composition change or conversion before study period (1985 – 2010)

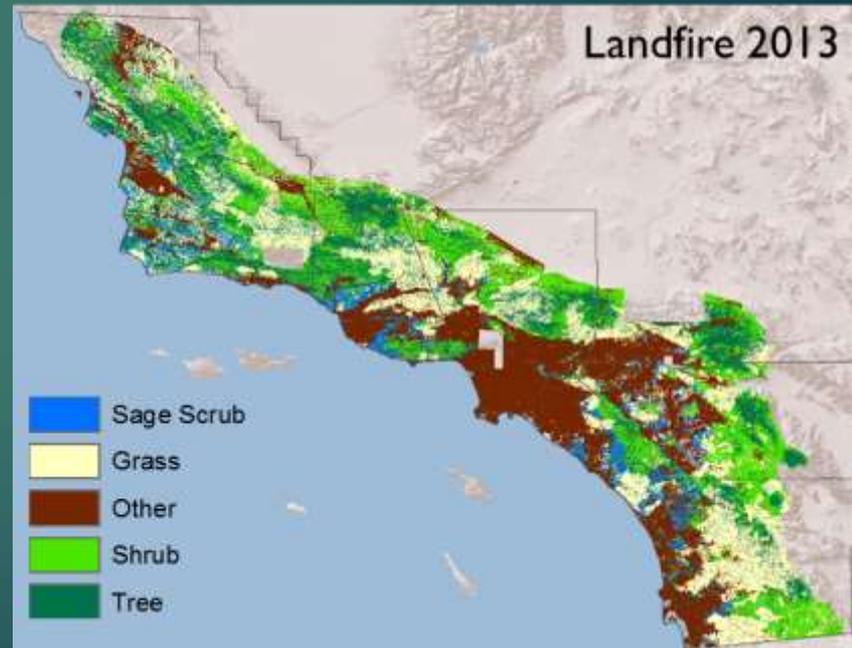
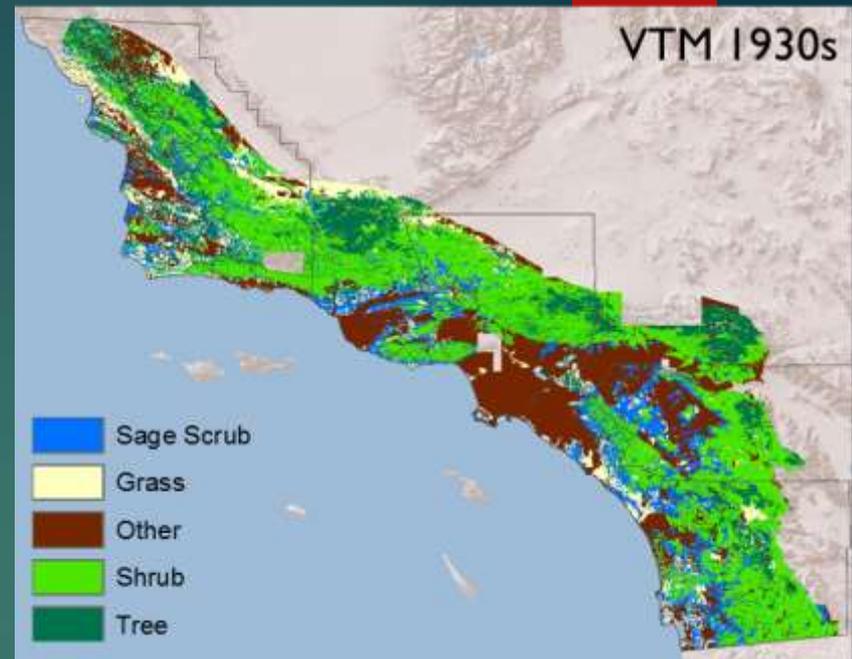


Simple Mapping Experiment

- ▶ Historical veg versus recent
- ▶ Less shrub, sage scrub
- ▶ More grass, tree, other

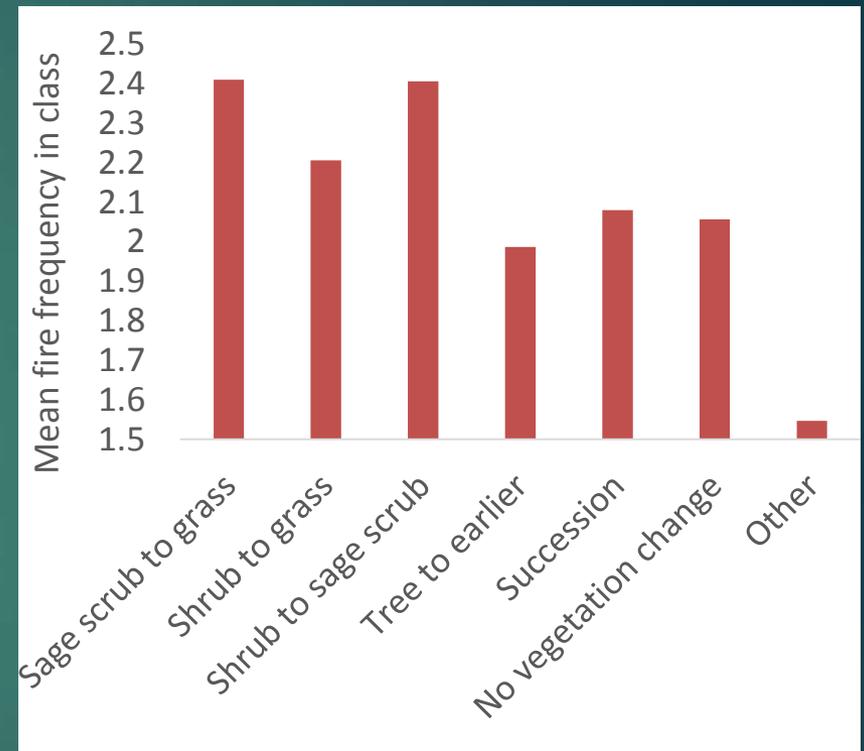
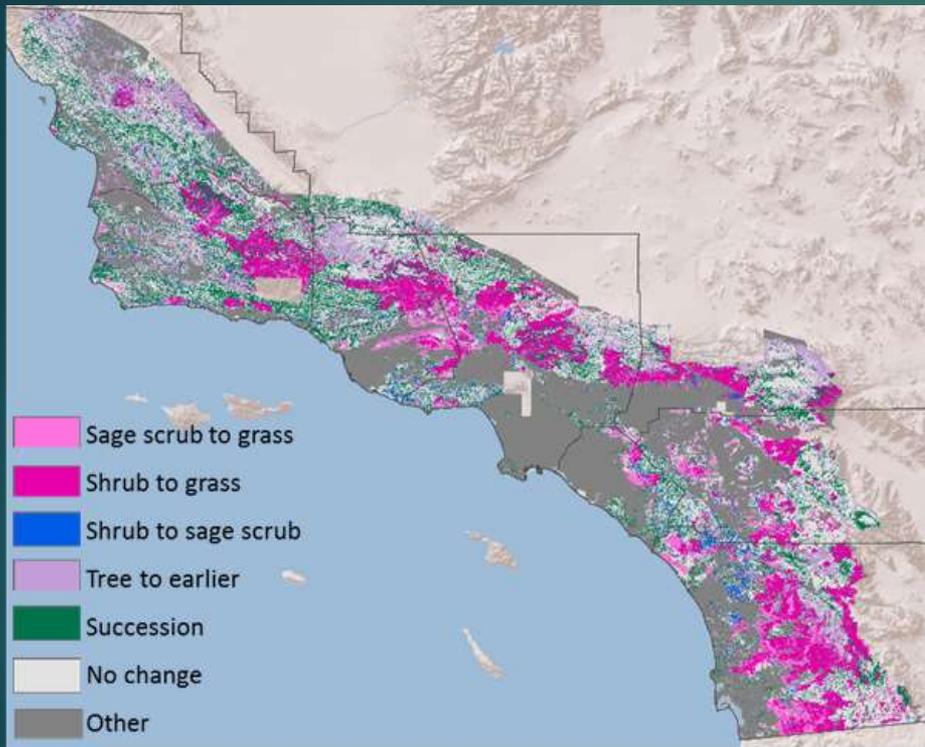


At least according to proportion cover in maps



***Must acknowledge map uncertainty

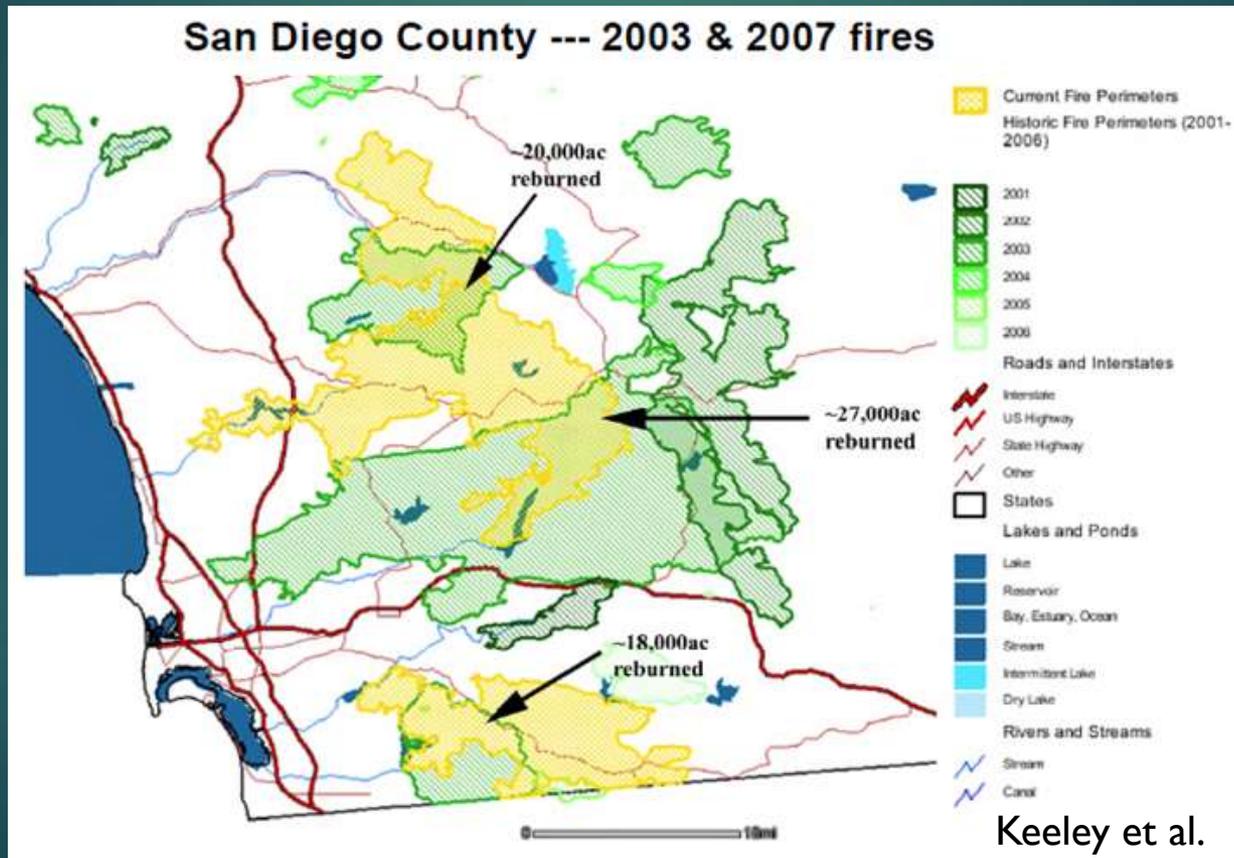
Does Fire Play a Role?



Strong trend: outweigh map uncertainty?

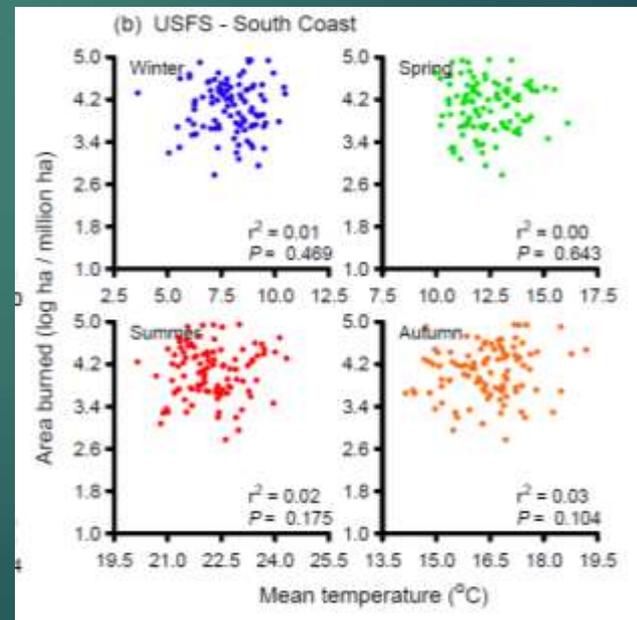
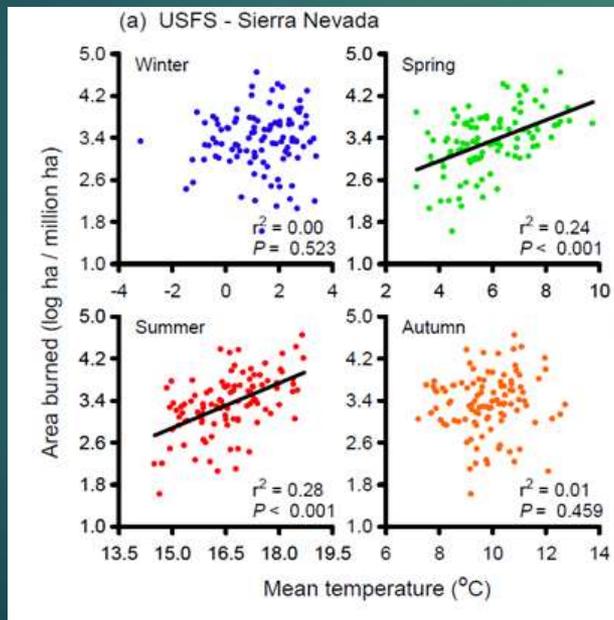
The Important Question: How Extensive Could It Be?

- ▶ Recent large fires across huge portions of landscape
 - ▶ Continued development in wildlands; climate change



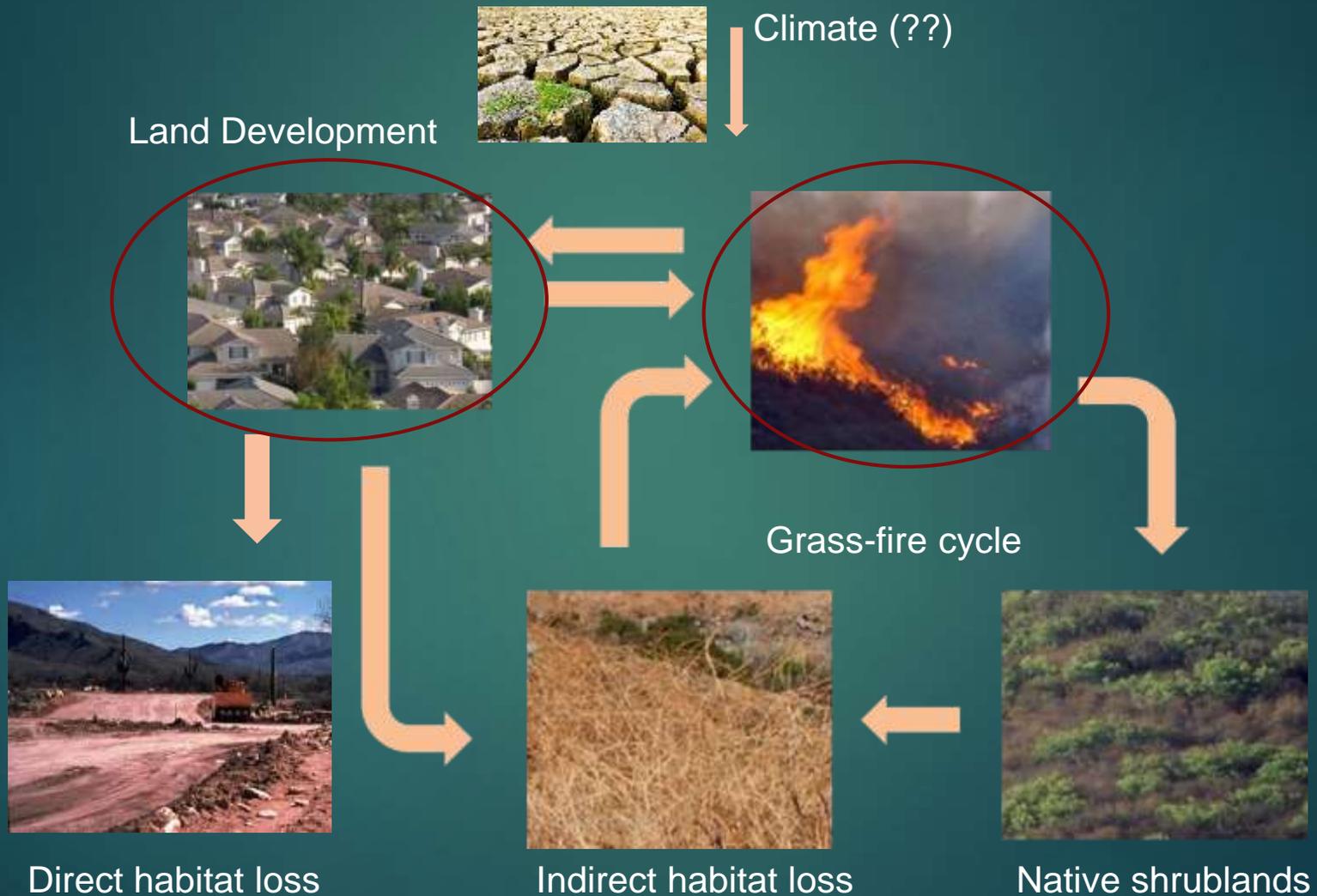
What About Climate?

- ▶ Not a major driver so far
- ▶ Potential species' range shifts, depending on species
 - ▶ Other threats may override (e.g., *Syphard et al. 2013, Franklin et al. 2014*)
- ▶ Historical fire-climate signal lacking in chaparral landscapes
 - ▶ Ignition-limited, land use may be more important



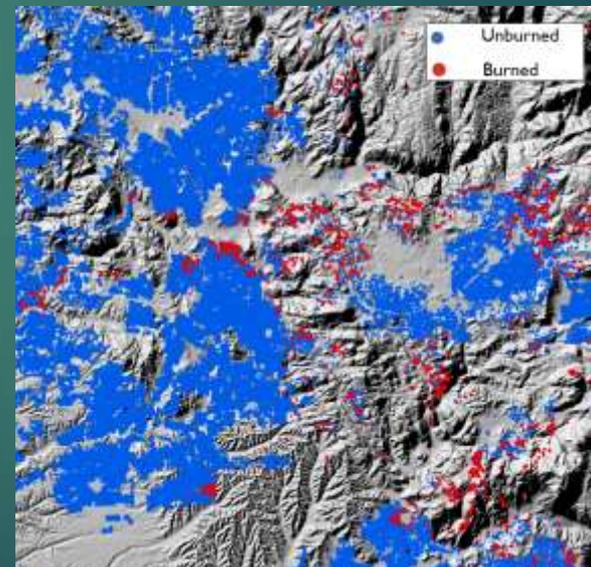
(Keeley and Syphard 2016)

Management Options



Fire Management

- ▶ To prevent conversion --> reduce fire
- ▶ Current management for community protection
 - ▶ Fires & house loss both highest at intermediate density
 - ▶ Mutual benefits



Syphard et al. 2011

Traditional Fire Management

- ▶ Fuels management and fire suppression
 - ▶ Fuel breaks, Rx fire don't passively stop wind-driven fires
- ▶ Could result in further chaparral conversion



Photo: RW Halsey



Syphard, Keeley, and Brennan 2011 a&b, Price et al. 2012

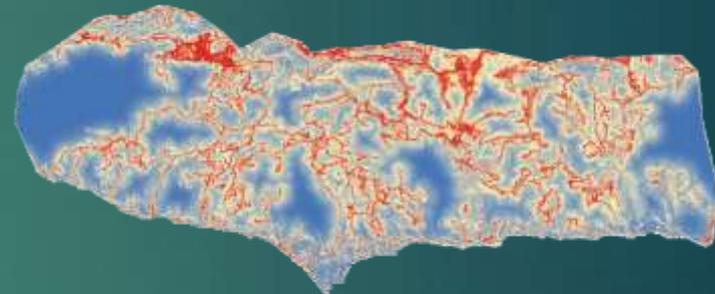
Ignition Prevention

- ▶ > 95% caused by humans
- ▶ Target different causes -> vary by timing, pattern, area burned

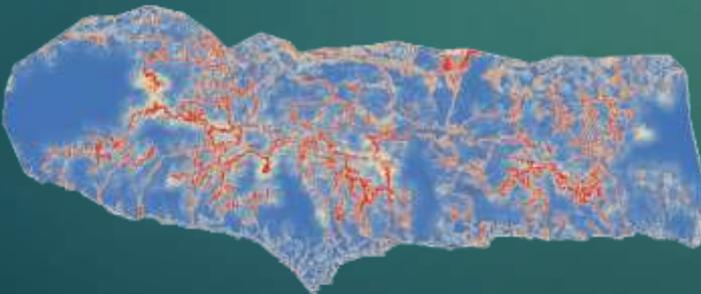
Equipment



Arson



Vehicle



Powerline



Syphard and Keeley 2015, IJWF

Land Use Decision-Making

- ▶ Can't change existing, but new growth anticipated

1) Zoning

- ▶ Directly regulate where houses are placed

2) Land acquisition for biodiversity protection

- ▶ Indirectly displace housing by restricting it

- ▶ Two studies simulating future development, 30 yrs

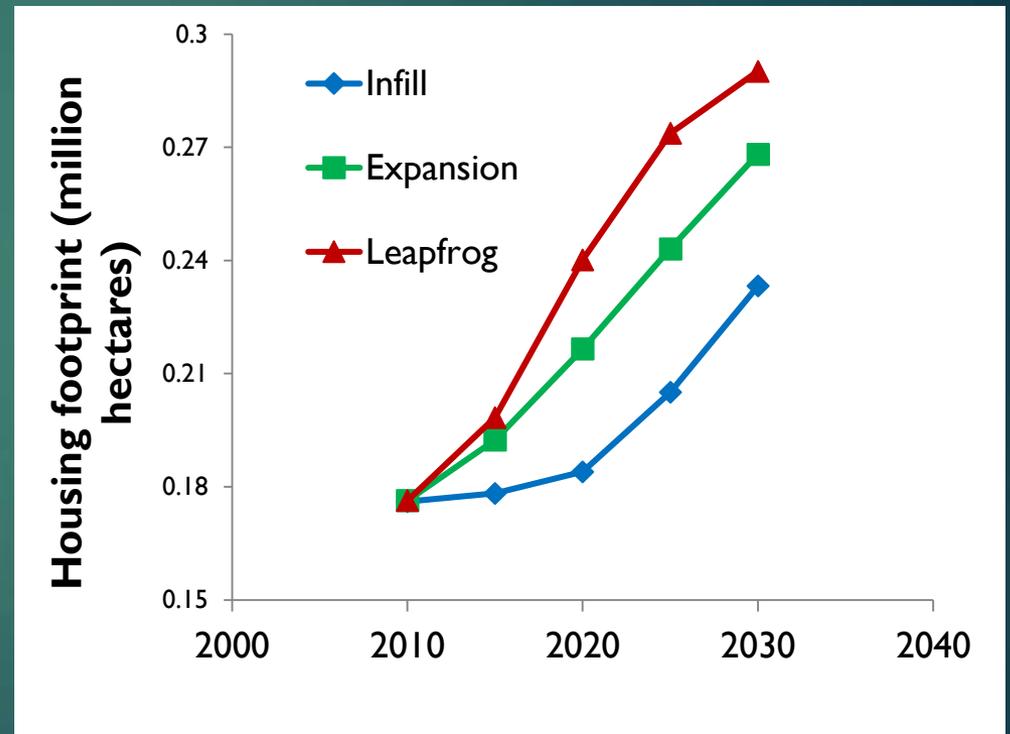
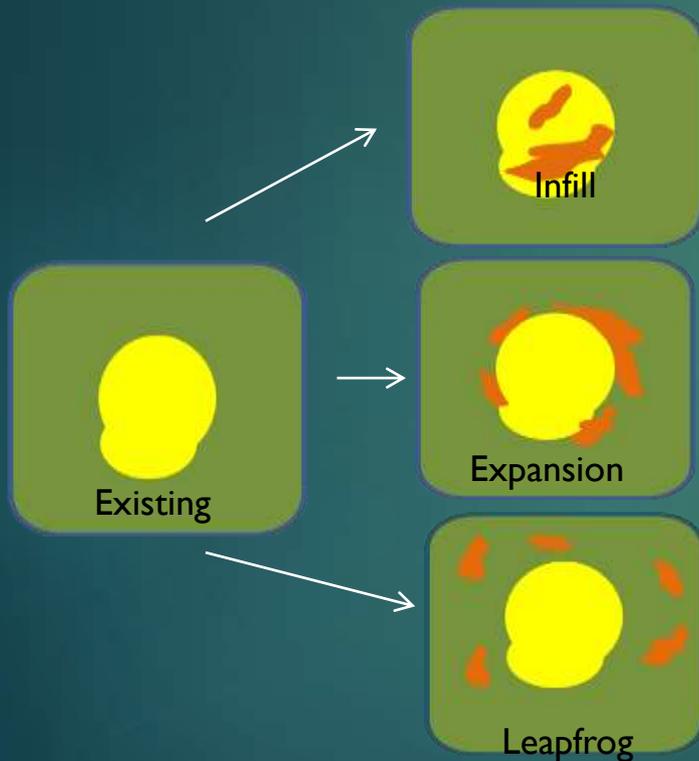
- ▶ Types of housing growth

- ▶ Method of selecting conservation lands

- ▶ Same number structures; different locations, configurations

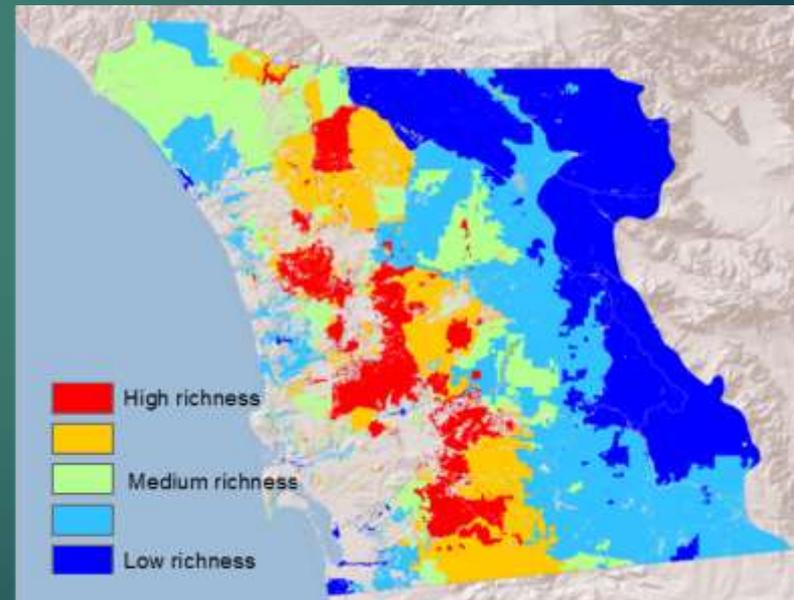
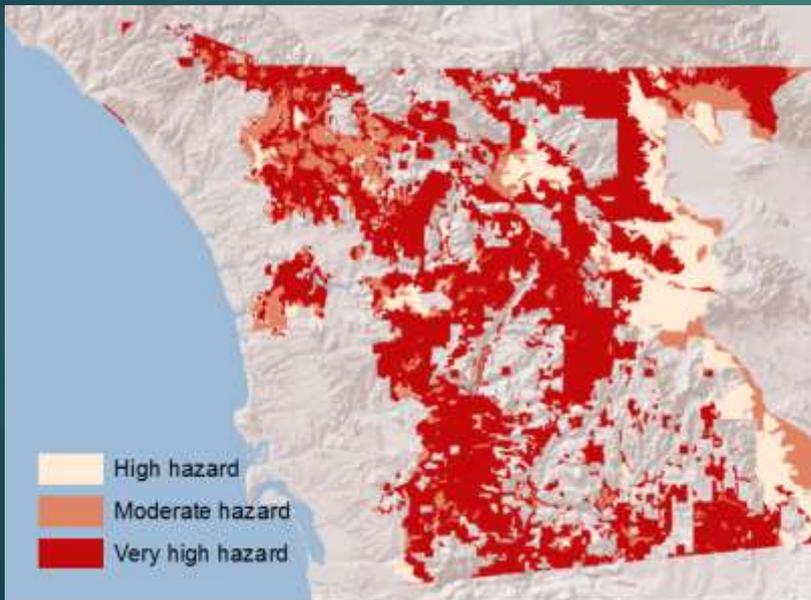
Planning Simulations via Zoning

- Infill development – lowest conversion, fragmentation, fire risk



Land Purchase for Conservation

- ▶ Lowest conversion/risk: protect land in high fire hazard OR species richness (areas overlap)
- ▶ Prevents development in sensitive lands, displaces new homes into higher-density developments



In Summary... On One Hand

Southern California, where the American Dream came too true.”

Lawrence Ferlinghetti

- ▶ Dramatic habitat loss after a century of global change
- ▶ Land use - primary driver
 - ▶ Direct loss & fragmentation; Indirect via fire & grass
- ▶ Climate change may exacerbate



In Summary... On The Other

“The future belongs to those who believe in the beauty of their dreams.” Eleanor Roosevelt

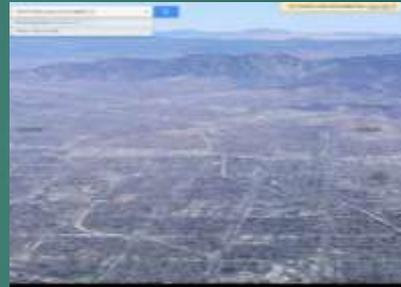
- ▶ Reducing fire could prevent type conversion
 - ▶ Preventing ignitions less costly than fuels management
- ▶ Land use planning (albeit more difficult)
 - ▶ Source of direct and indirect conversion
 - ▶ Smaller footprint, reduce fires, reduce corridors for invasives



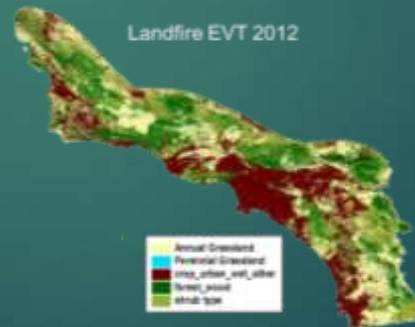
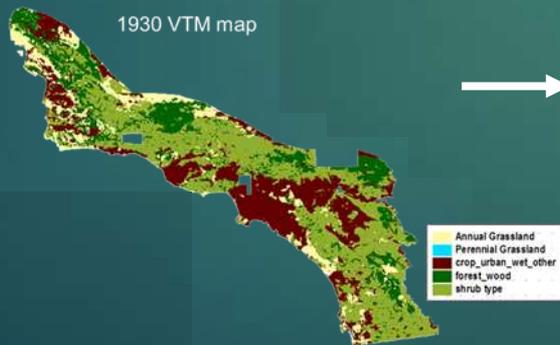
Photo Jeffery Turner

*“If you do not change direction,
you may end up where you are heading.”*

Lao Tzu



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Thank you

