

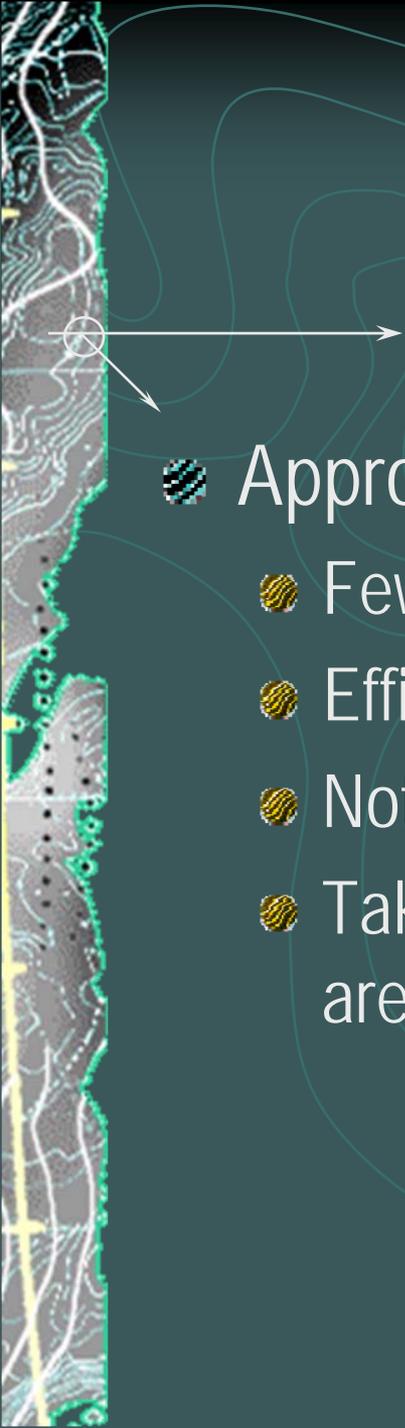
Renewable Energy Transmission

RETI Environmental Stakeholder Workshop
Los Angeles, California
April 23, 2008

Goal

- 
- Develop an approach for evaluating and expediting appropriately sited solar, wind, and geothermal resources in California, and the transmission capacity needed to bring these resources to market in a timeframe to both meet California's leadership goals and reduce greenhouse gas emissions from fossil sources nationally.

Appropriate Siting



● Appropriate siting means:

- Fewest environmental impacts possible
- Efficient use of existing infrastructure
- Not in any protected areas
- Takes into account priority areas not in protected areas

Agenda

- 
1. Overview of the situation
 2. Projects we are already engaged in
 3. Getting heard, participation needs
 4. Strategy for 2008
 5. Communications

Overview



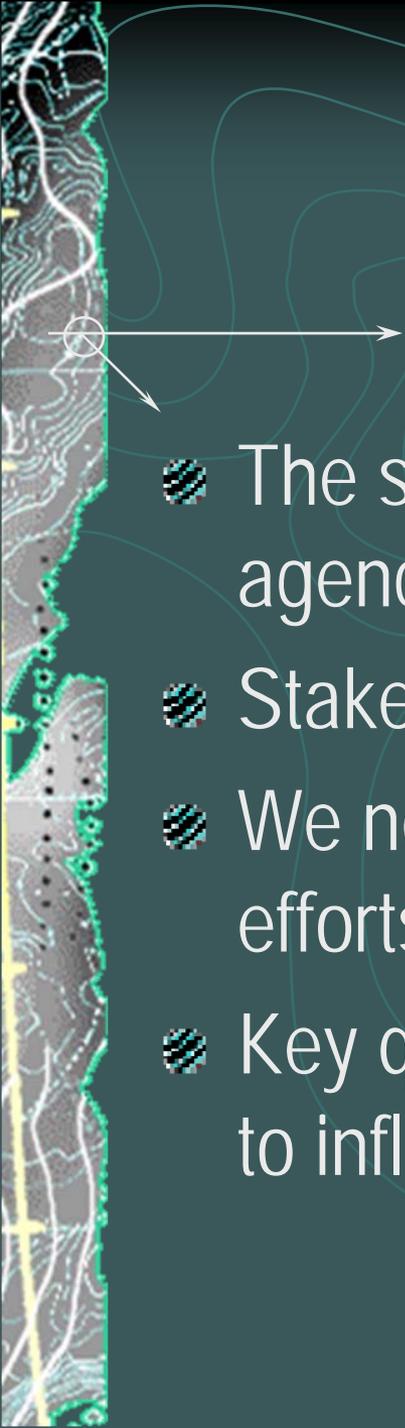
Global warming presents the greatest environmental challenge we have ever faced. It will displace millions of people, change the ecological landscape of the planet, make existing problems like pollution and resource competition worse, and cause mass extinctions. We can slow it down and diminish these effects or we can delay and make them worse.



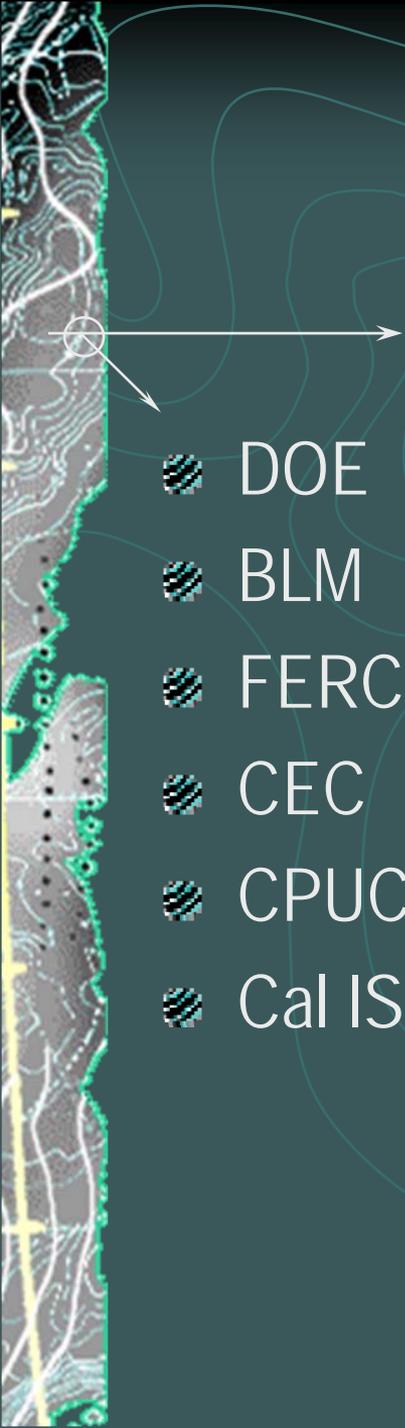
Overview

We have the tools necessary to cut greenhouse gas emissions. We have all the energy we need; it will just come from different sources. We will need to make some tough decisions in order to take advantage of them. We need to move quickly and carefully to make the progress we need in the time frame we need.

Overview

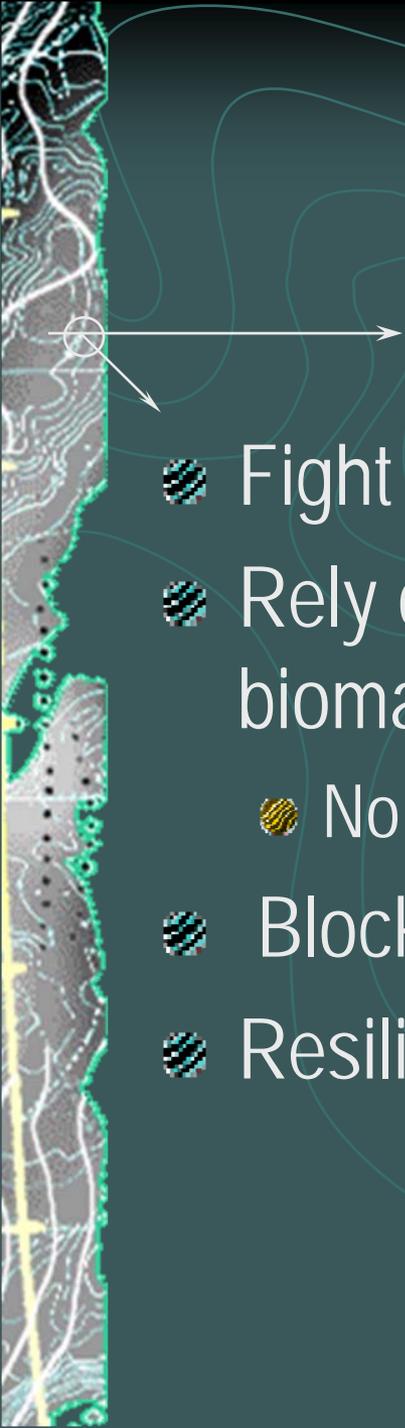
- 
- The situation is complicated with numerous agencies, siting and transmission proposals
 - Stakeholder participation is being taken seriously
 - We need to decide where to focus most of our efforts and prioritize
 - Key question: What gets us the best opportunity to influence final outcomes?

Players involved with Powerlines and Siting issues

- 
- DOE
 - BLM
 - FERC
 - CEC
 - CPUC
 - Cal ISO

- USFS
- USFWS (consultative)
- Utilities
- Generators
- Environmental Groups
- Communities

Environmental Goals

- 
- Fight Global Warming
 - Rely on efficiency, solar, wind, geothermal, biomass, biofuels, etc.
 - No Nuclear component
 - Block Coal Plants
 - Resilient Habitats

Stopping the Coal Rush



Coal-fired power plants produce about half of our electricity. There are plans on the drawing board to build over **150** new plants in the next few years. With new laws to fight global warming expected on the horizon, the coal industry is rushing to build as many new plants as possible before pollution safeguards are in place. In an industry motivated by the bottom line, it's not surprising that 85% of this "new generation" of proposed plants would use the same old technology of your grandparent's era—the same technology that creates the global warming pollution.



Overview: Consequences...

"If global emissions of carbon dioxide continue to rise at the rate of the past decade...there will be disastrous effects, including increasingly rapid sea level rise, increased frequency of droughts and floods, and increased stress on wildlife and plants due to rapidly shifting climate zones." --
James Hansen, one of America's leading climate scientists, NASA

A vertical strip on the left side of the slide shows a topographic map of a mountain range. A white circle is drawn on the map, with two white arrows pointing from it towards the text on the right. The background of the slide is a dark teal color with faint, light blue contour lines.

From NPCA "Unnatural Disasters"

"From melting glaciers at Glacier National Park to disappearing Joshua trees at Joshua Tree National Park, climate change threatens to radically alter our national parks."

From "Losing Ground" NRDC and RMC0 (2006)



"Projections of future warming by the end of the century range from, on the low end, 3 to 7 degrees Fahrenheit for the entire West to, on the high end, as much as a 14-degree Fahrenheit warming in the Southwest....In the arid and semi-arid West, changes of these magnitudes would fundamentally disrupt the region's ecosystems." ...

From "Losing Ground" NRDC and RMC0 (2006)



"I honestly believe that we are standing at the edge of a very, very large mass extinction, and top-of-mountain species are going to be the first to go."

DR. TERRY ROOT, STANFORD UNIVERSITY (2005)

Moving to cooler ground: Beloved fixtures of the Sierra may be forced up, or out, as the climate warms

— By Mark Grossi /The Fresno Bee
03/29/08 22:24:00



The 2,000-year-old giant sequoias east of Fresno have survived warm spells lasting centuries, but in just 100 years, global warming could snuff them out -- along with many Sierra Nevada species.

Why? The current episode of climate change is moving faster than any warm-up detected in the past 500,000 years, many scientists say. Many say car exhaust and other global-warming emissions from human activities may be the reason.

New Uranium Rush Threatens Deserts

Uranium Exploration Near Grand Canyon

By [FELICITY BARRINGER](#)

Published: February 7, 2008

With minimal public notice and no formal environmental review, the Forest Service has approved a permit allowing a British mining company to explore for uranium just outside Grand Canyon National Park, less than three miles from a popular lookout over the canyon's southern rim.





California Impacts

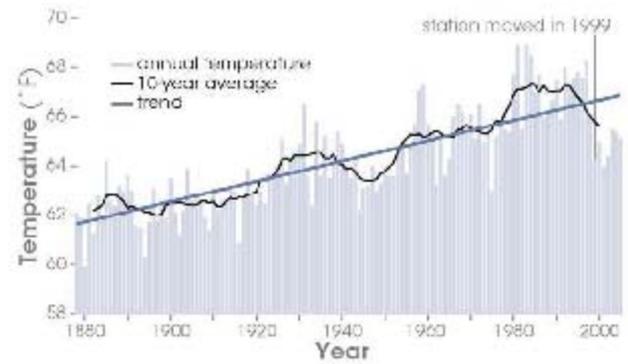
- Shifting ranges for flora and fauna
- Reduced snowpack
- Spring floods and summer droughts
- Changes in migratory behavior
- Increased extinctions
- Increased pest infestations and wildfires
- Sea level rise

KEY POINTS



- California's climate is already rapidly changing
- Expect greater stress on species and habitats
- Species/habitats will respond in different, perhaps surprising, ways
- We can take action now to help them adapt and survive

CALIFORNIA IS ALREADY WARMING 1950-2000

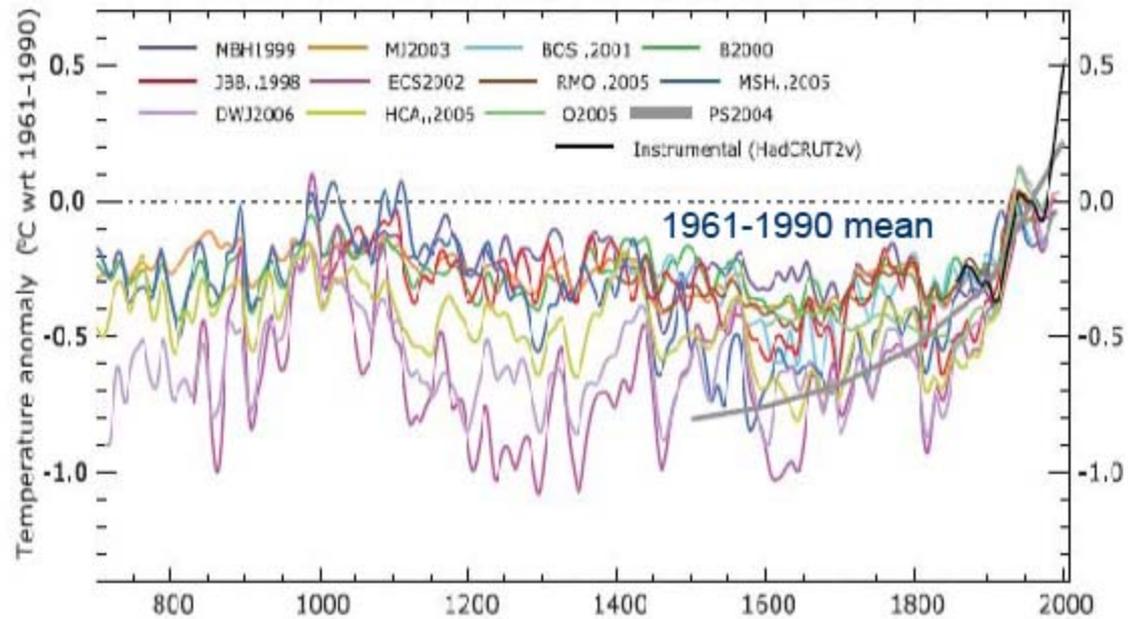


Los Angeles Temperature Trend
1880-2007

NORTHERN HEMISPHERE IS WARMER THAN PAST 1300 YEARS



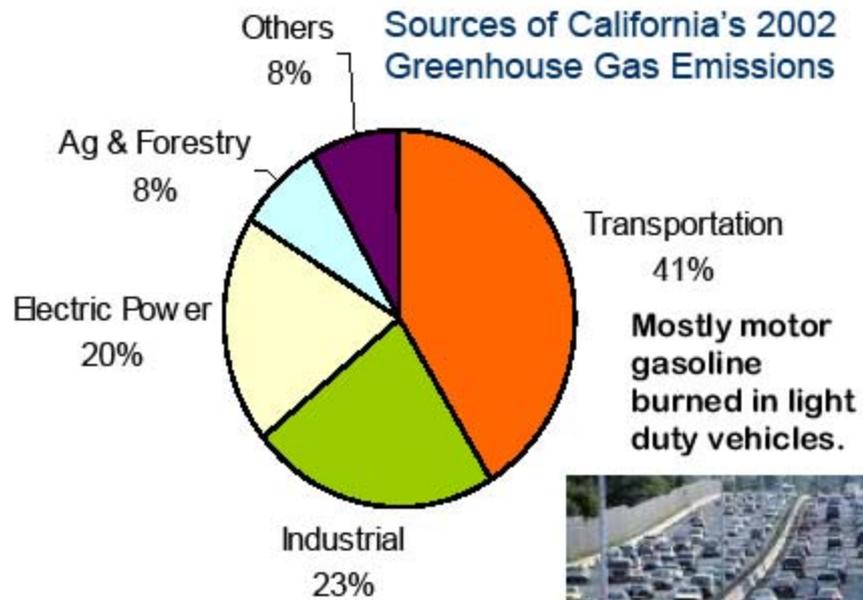
NORTHERN HEMISPHERE TEMPERATURE RECONSTRUCTIONS



WARMING IS DUE TO INCREASED GREENHOUSE GASES



Sources of California's 2002 Greenhouse Gas Emissions



Mostly motor gasoline burned in light duty vehicles.



CEC 2005



HOW WILL TEMPERATURE CHANGE IN THE FUTURE?

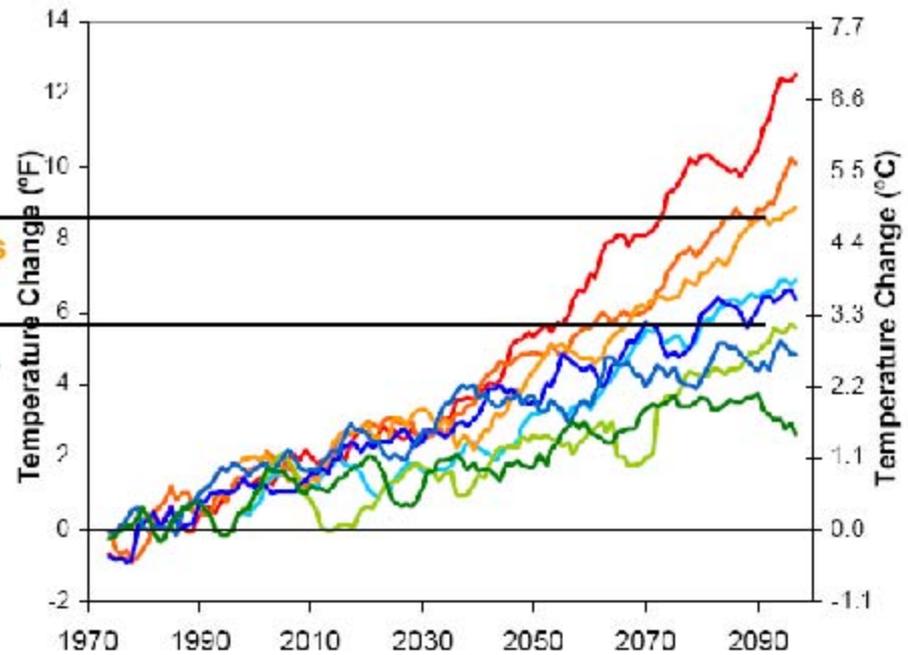
Depends on our choices

- **High emissions**
 - Rapid, fossil-fuel intensive growth
- **Moderate emissions**
 - Primarily fossil-fuel dependent growth
 - Some green technology
- **Lowest emissions**
 - Shift to service & information economy
 - Lots of green technology

HOW WILL TEMPERATURE CHANGE IN THE FUTURE?



- High Emissions**
+8.1 to 10.4 °F
- Medium Emissions**
+5.6 to 7.0 °F
- Lowest Emissions**
+3.0 to 4.7 °F





EXPECT THREE KEY PHYSICAL IMPACTS

- Greater seasonality in precipitation
 - Less winter snow in mountains
 - More summer drought
- Risk of large wildfires
- Sea level rise



PHYSICAL IMPACTS VARY WITH EMISSION LEVELS



	Temp Change	Sierra snowpack	Critically dry years	Large fire risk	Sea level rise
High Emissions	8-10.4°F	90% loss	2.5x	<i>not evaluated</i>	22-33"
Medium Emissions	5.5-7.9°F	78-80% loss	2-2.5x	55% increase	14-22"
Lower Emissions	3.0-5.4°F	30-60% loss	1-1.5x	10-35% increase	6-14"

Air Pollution Health Effects of Global Warming

- Higher temperature will increase the rate at which atmospheric chemical reactions proceed, thereby increasing concentrations of ozone and particulate matter (PM) precursors, ...more nitrate (a major component of PM_{2.5}) will volatilize.
- The number of days meteorologically conducive to pollution formation may rise by 75%–85% in the high ozone areas of Los Angeles (Riverside) and the San Joaquin Valley (Visalia) by the end of the century under a medium-high emissions/temperature scenario, but only 25%–35% under the lower emissions/temperature path.

Health effects continued...

- 
- Global background ozone (primarily formed from the greenhouse gas methane and nitrogen oxides from fuel combustion) is projected to increase by 4%–10% (low scenario) to 25% (high scenario) at 2100. If the latter were to occur, the ozone targets would be impossible to attain in much of California, even with near-zero local emissions.
 - It is clear that those living in poverty and in inner city areas will need greater assistance than other segments of the community in coping with various potential impacts associated with climate change. The particular vulnerabilities of environmental justice communities will require consideration in developing mitigation and adaptation actions.



AP: "Climate Change Brings Health Risks"

By H. JOSEF HEBERT – April 9, 2008

WASHINGTON (AP) — A top government health official said Wednesday that climate change is expected to have a significant impact on health in the next few decades, with certain regions of the country — and the elderly and children — most vulnerable to increased health problems.

Howard Frumkin, a senior official of the Centers for Disease Control and Prevention, gave a detailed summary on the likely health impacts of global warming at a congressional hearing...

Frumkin outlined the range of "major anticipated health" issues as a result of climate change. Among them, ...more heat waves that are of special danger to the elderly and the poor; more incidents of extreme weather posing a danger of drought in some areas and flooding in others; increase of food-borne and waterborne infectious diseases; more air pollution because of higher temperatures; and the migration into new areas of vector-borne and zoonotic diseases such as Lyme disease, West Nile virus, malaria or dengue fever as seasonal patterns change...



in Heat Related Deaths

....up to 6X

San Francisco Chronicle

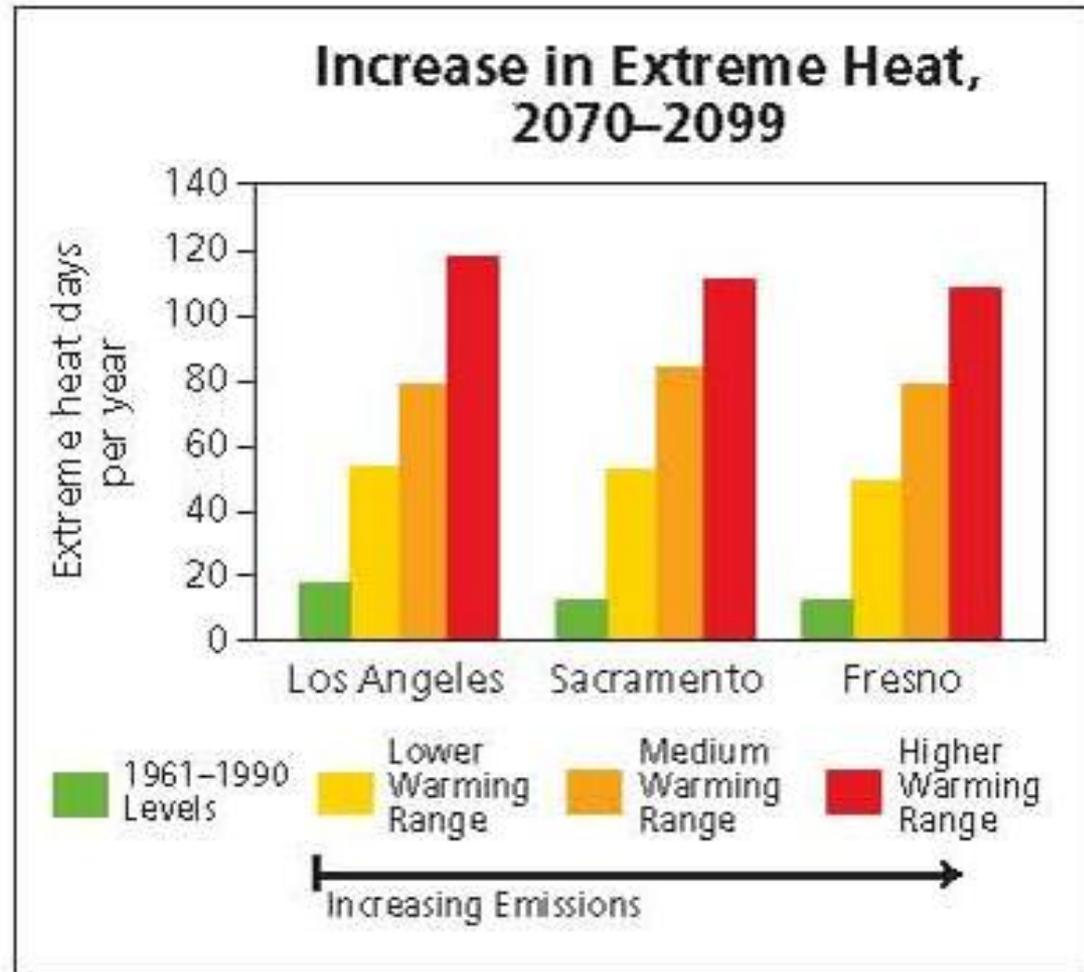
July 27, 2006

California Heat-related Deaths Reach
83

11 days of 100-degree temperatures

↑ Extreme Heat Days

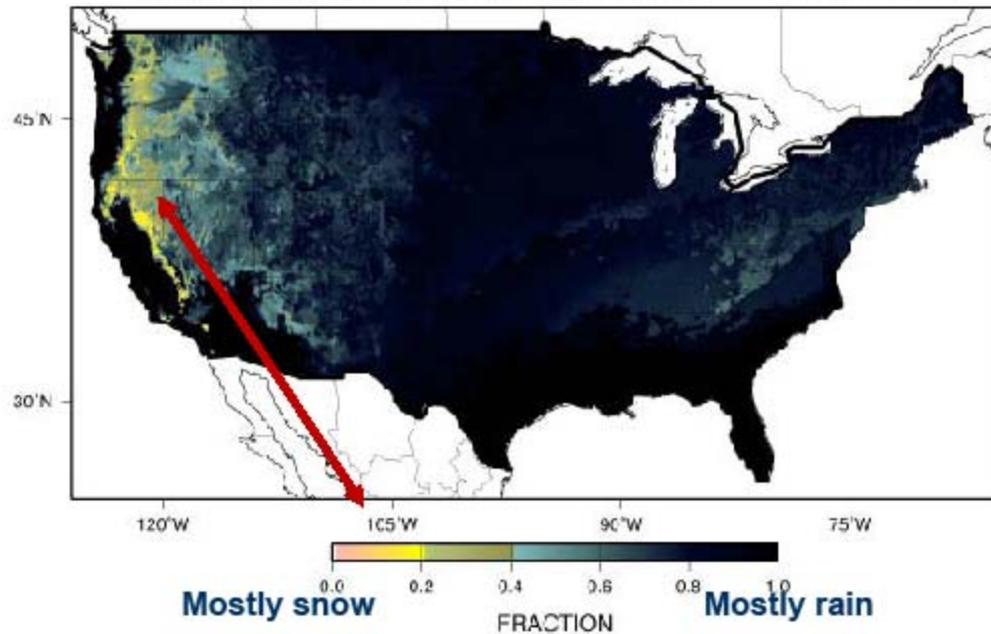
Up to 120
extreme
heat days
per year



MOST OF CALIFORNIA'S WATER DEPENDS ON SNOW



FRACTION OF ANNUAL PRECIPITATION THAT FALLS DURING MONTHS IN THE RANGE: $T_{MIN} > 0^{\circ}C$ or $T_{MIN} < -7^{\circ}C$



"Rain vs Snow"

Derived from OSU's PRISM monthly mean climatologies, 1971-2000

Dettinger, USGS

SNOWPACK ALREADY REDUCING IN SIERRA

Dana Glacier



1903 I.C. Russell



September 5, 2004 H. Basagic

Darwin Glacier



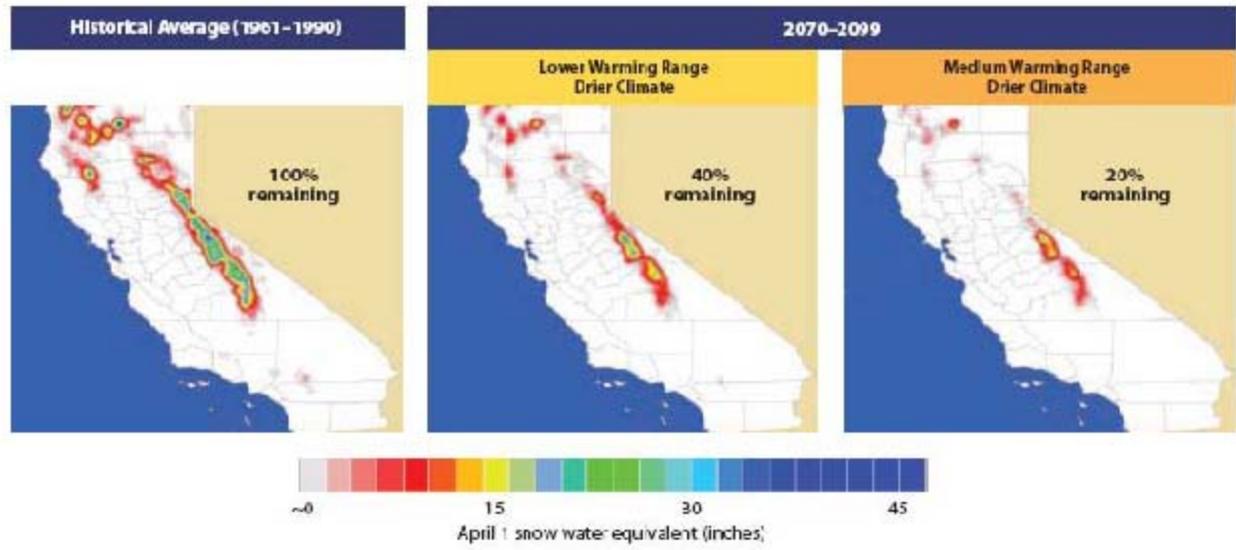
August 14, 1908 G.K. Gilbert



August 14, 2004 H. Basagic



SNOWPACK WILL CONTINUE TO SHRINK





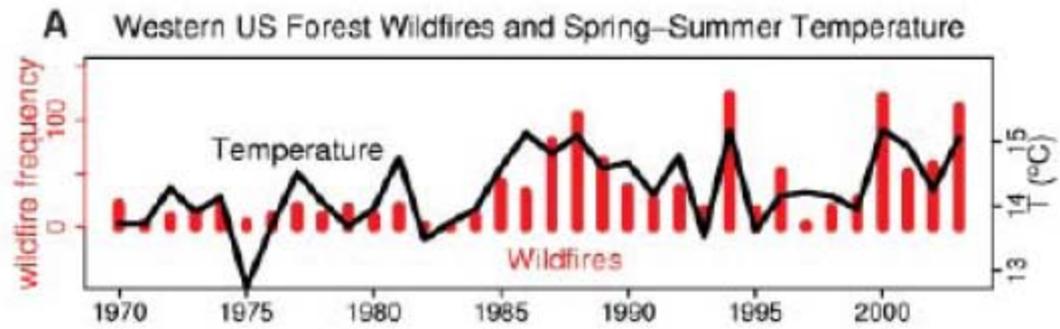
SNOWPACK – ECOLOGICAL LINKS



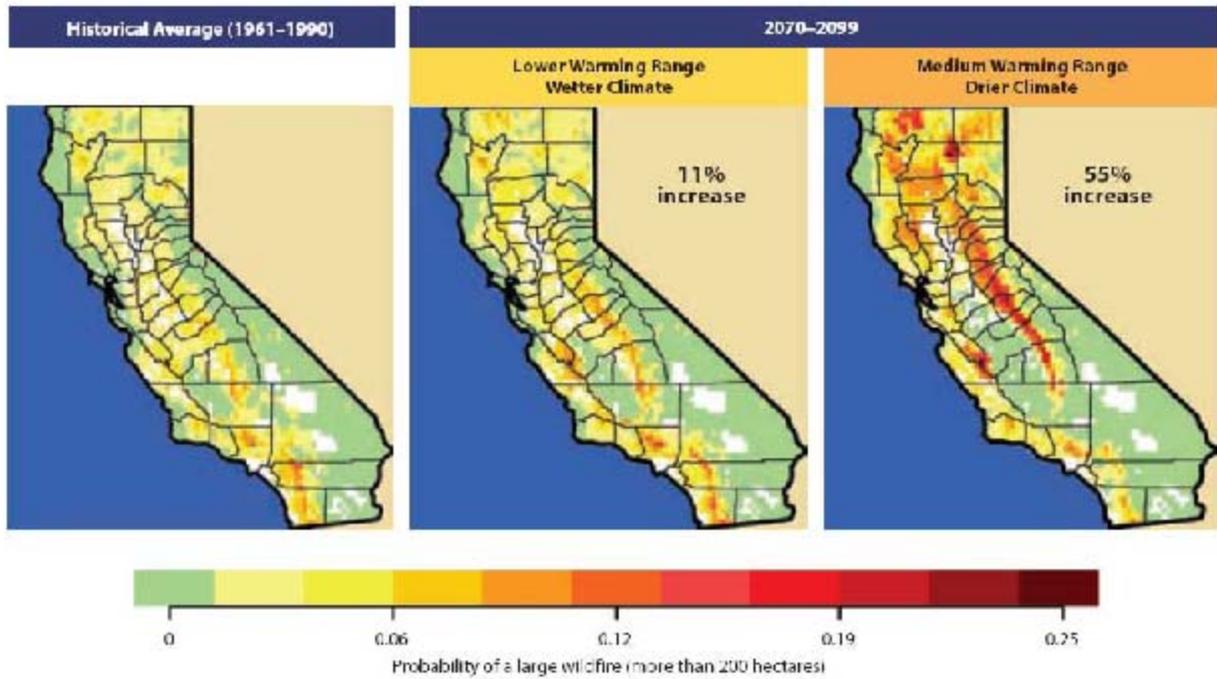
- Expect
 - More violent winter flooding
 - Increased riparian erosion
 - Calls for more water storage and flood control
 - Less water for species and water-dependent habitats (rivers, wetlands)
- Consider
 - Wider floodplains, meander belts
 - Creative water storage ideas

FIRE RISK IS ALREADY INCREASING

As temperatures increase, wildfire frequency increases



FIRE WILL CONTINUE TO INCREASE



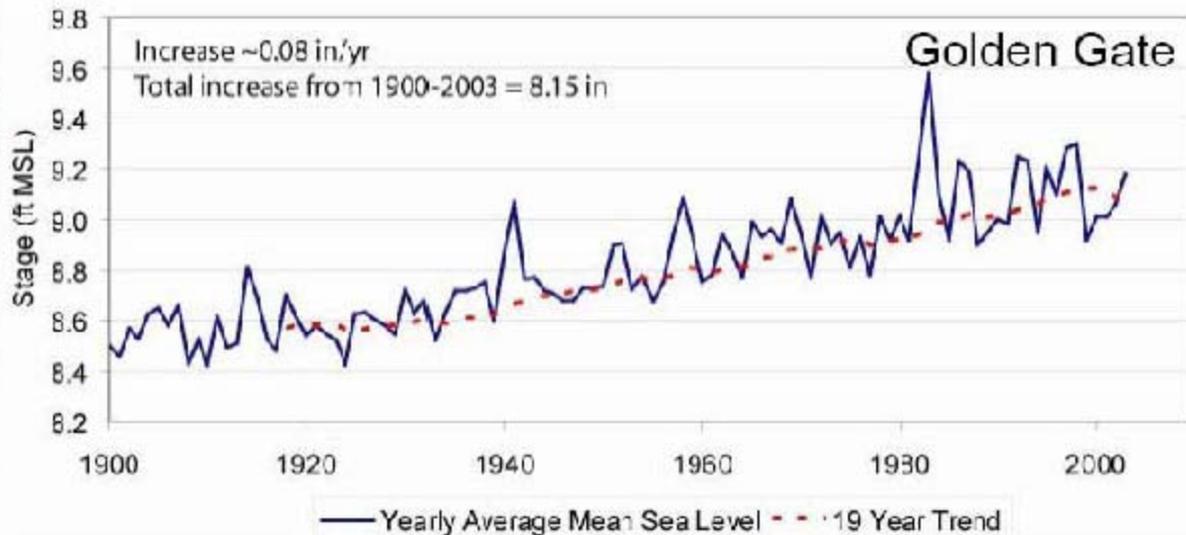
FIRE RISK – ECOLOGICAL LINKS



- **Expect:**
 - More frequent, large wildfires
 - Longer wildfire seasons
 - Changes in vegetation types and distribution
 - *More shrublands, less forest*
- **Consider:**
 - Reducing fuel loads
 - *Limits on prescribed burning, though*

SEA LEVEL IS ALREADY RISING

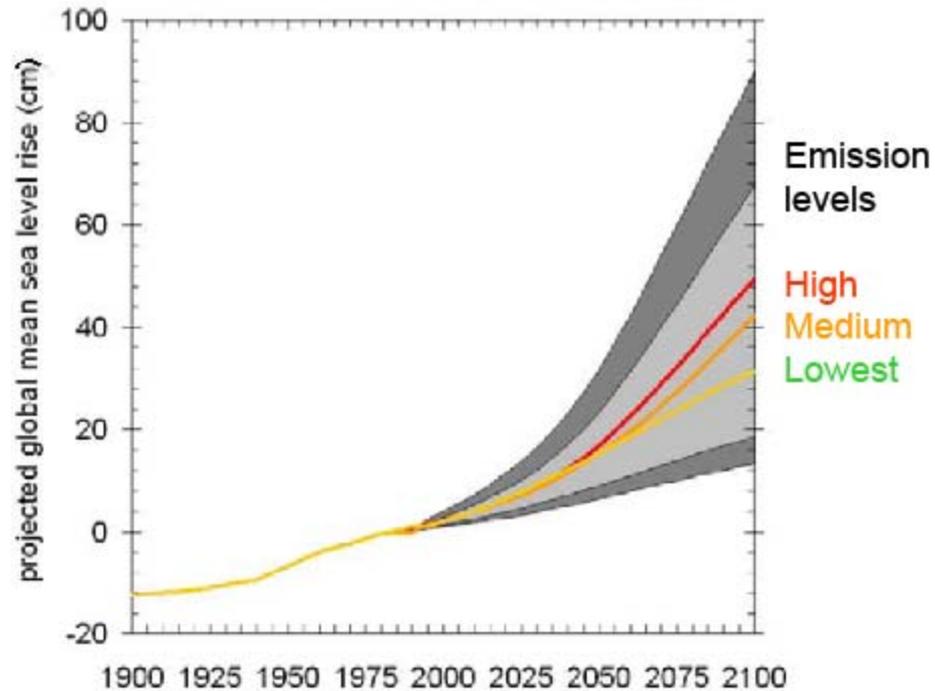
More than 8" rise at Golden Gate in last 100 years



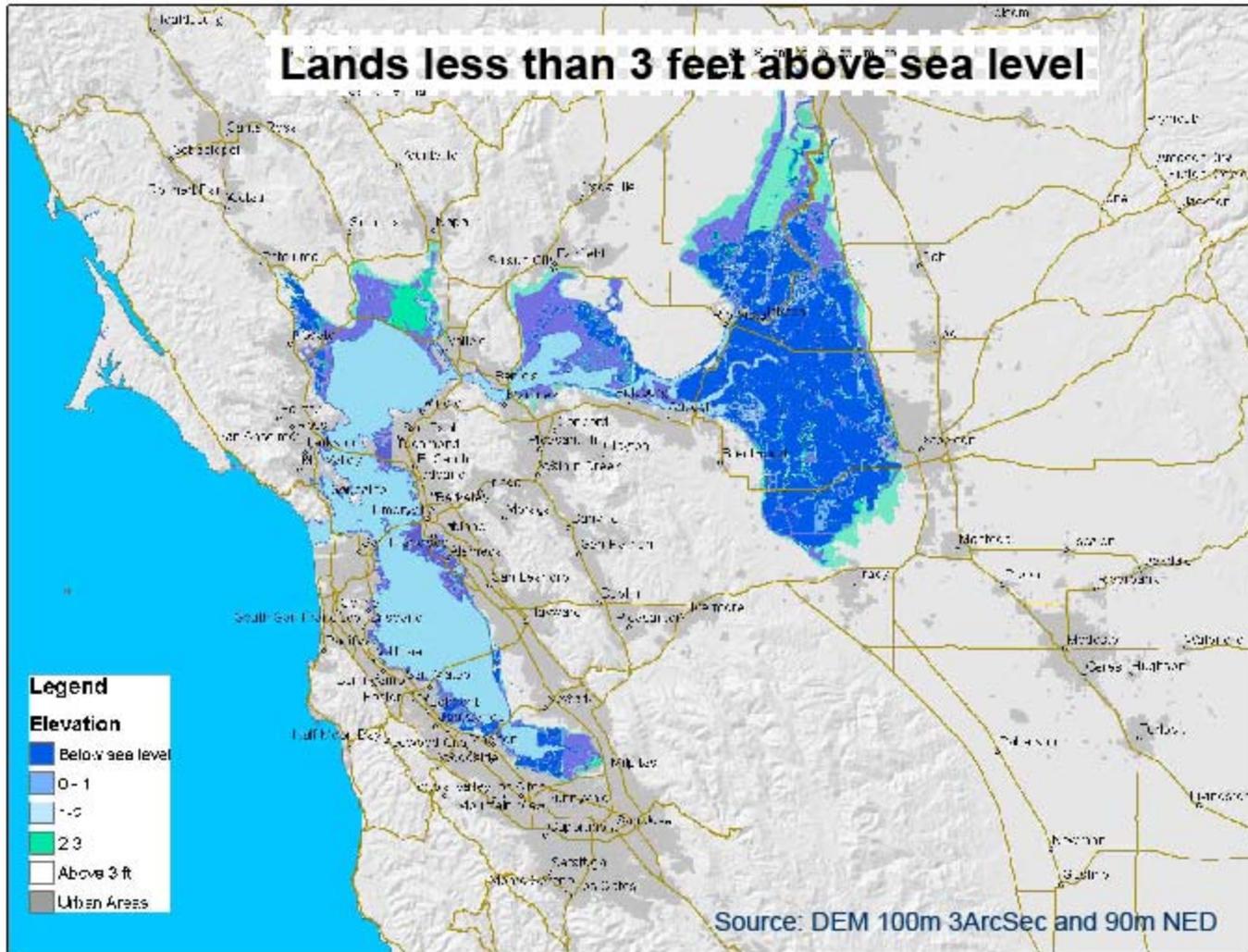
SEA LEVEL WILL CONTINUE TO RISE



12" to 36" rise expected by 2100



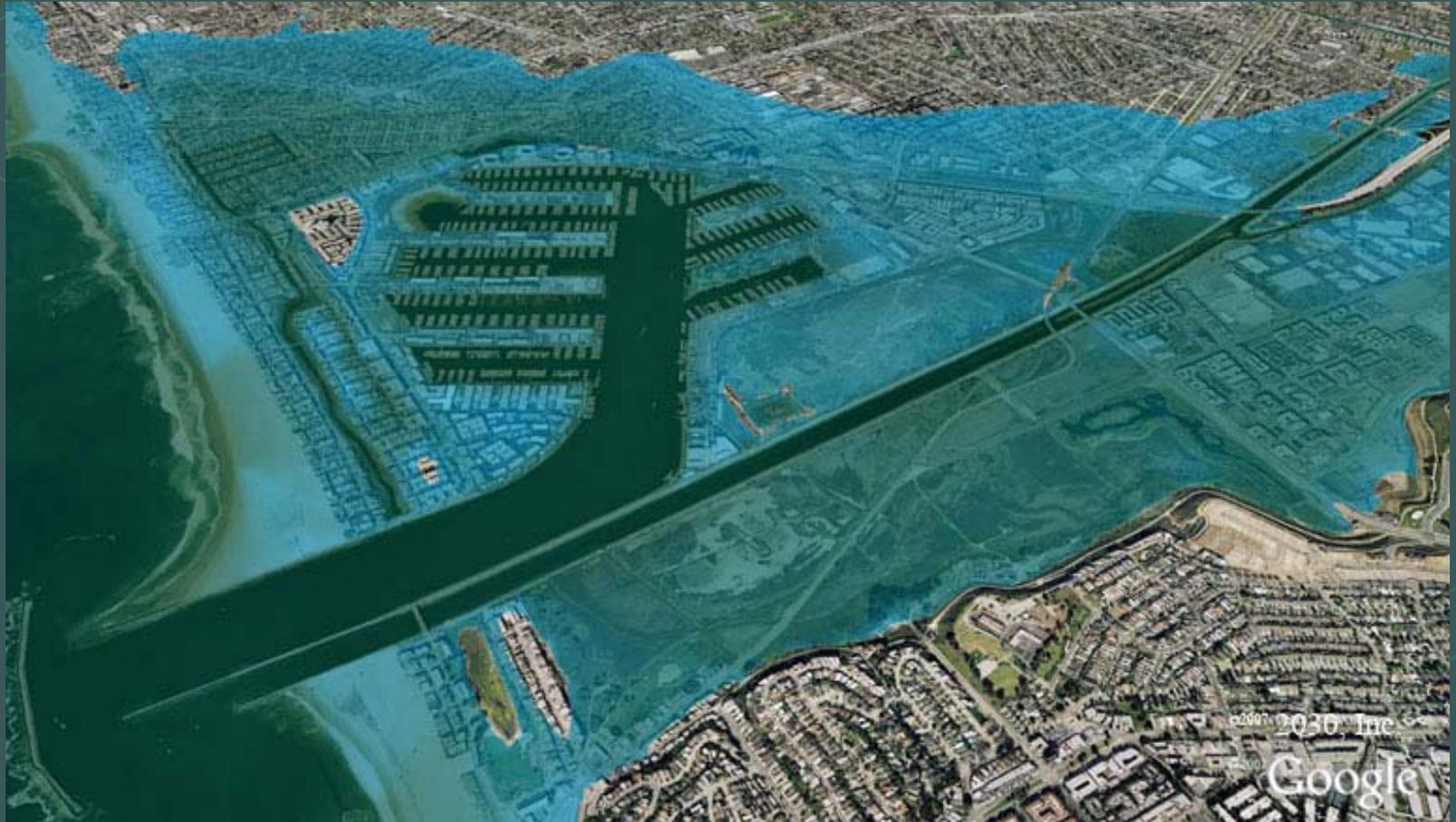
Lands less than 3 feet above sea level



San Diego at 5 meters sea level increase

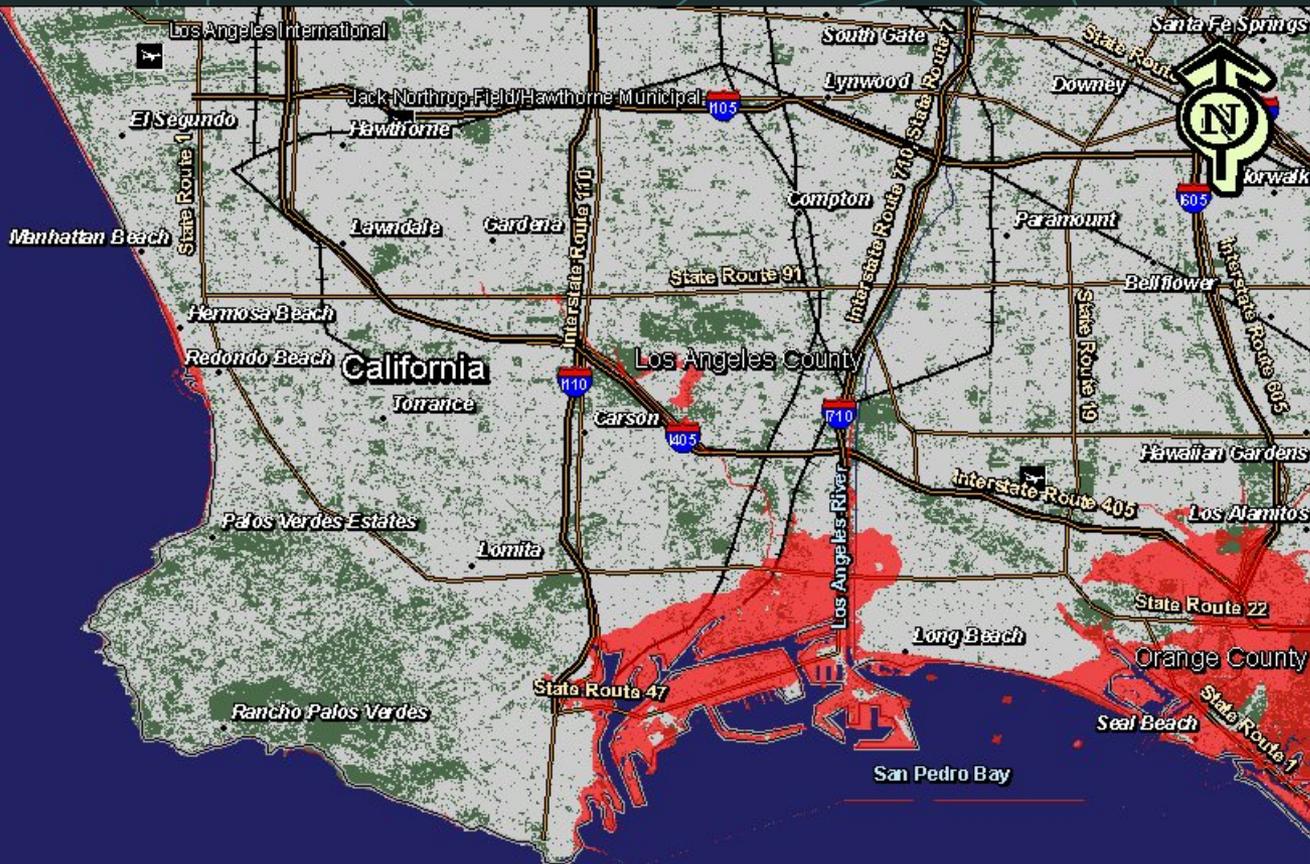


Marina Del Ray at 5 meters increase



Legend

- 5-meter rise
- airports
- cities
- interstates
- highways
- railroads
- states
- counties PR & VI
- counties US48
- waterways
- lakes & reservoirs
- land surface PR & VI
 - high population
 - low population
- land surface US east
 - urban
 - non-urban
- land surface US west
 - urban
 - non-urban
 - other countries

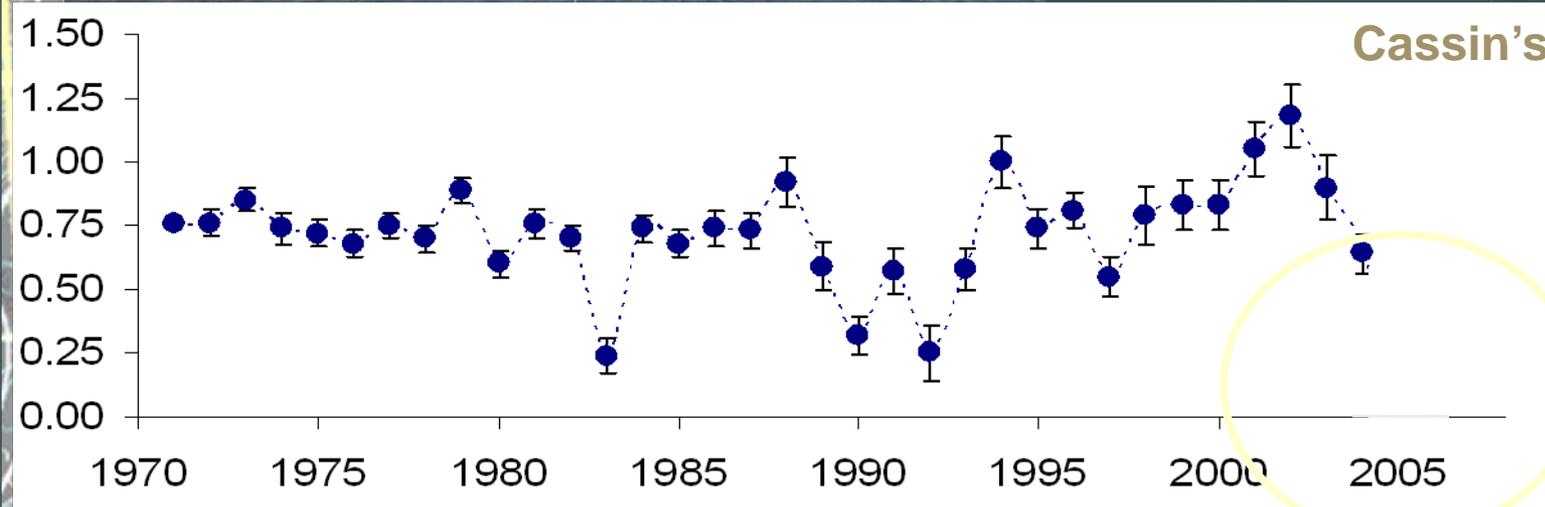


Susceptibility to Sea Level Rise

Weiss & Overpeck
The University of Arizona

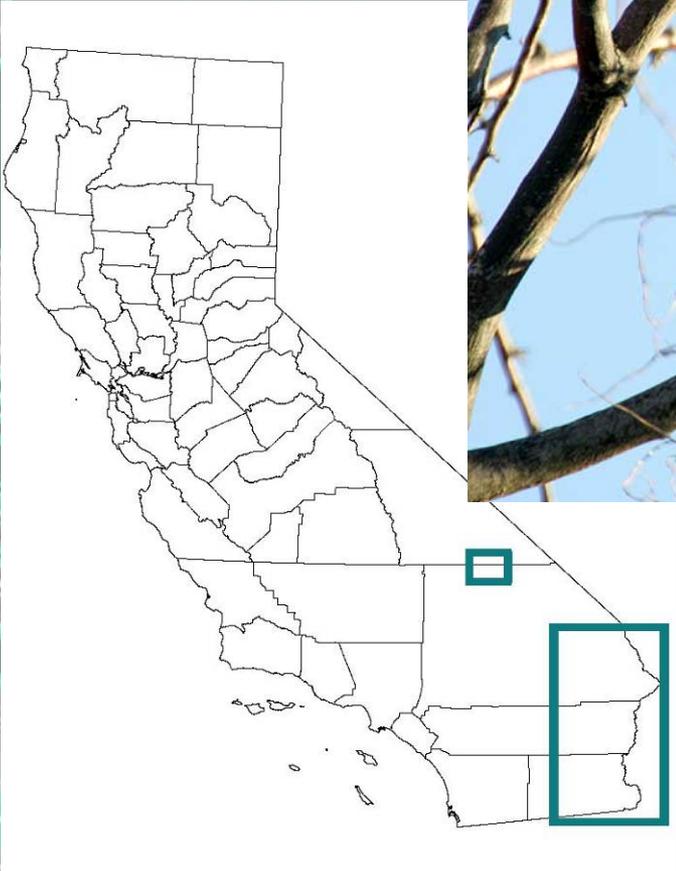


Seabird Breeding Failure



Cassin's Auklet

Drought = No Breeding



—*Sonoran Desert*

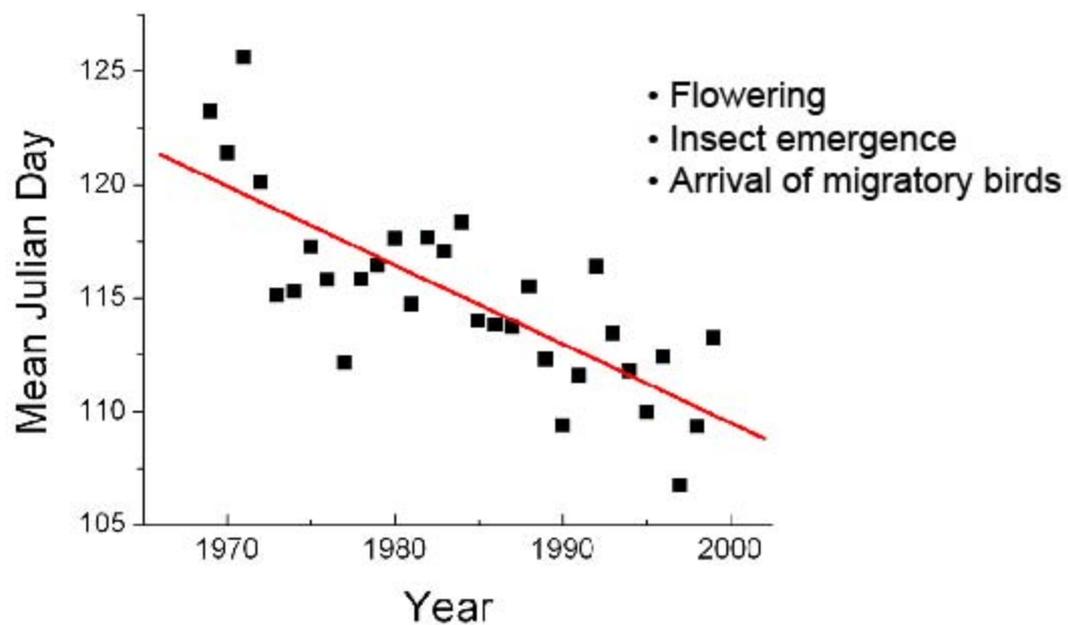
Changes in Arrival Dates



Ruby Crowned Kinglet
Fall arrival - 2 weeks later than 25 years ago

SPRING EVENTS ALREADY OCCURRING EARLIER

3.2 days earlier each decade



•Averages for 130 bird, plant, insect species

Root et al. (2005)

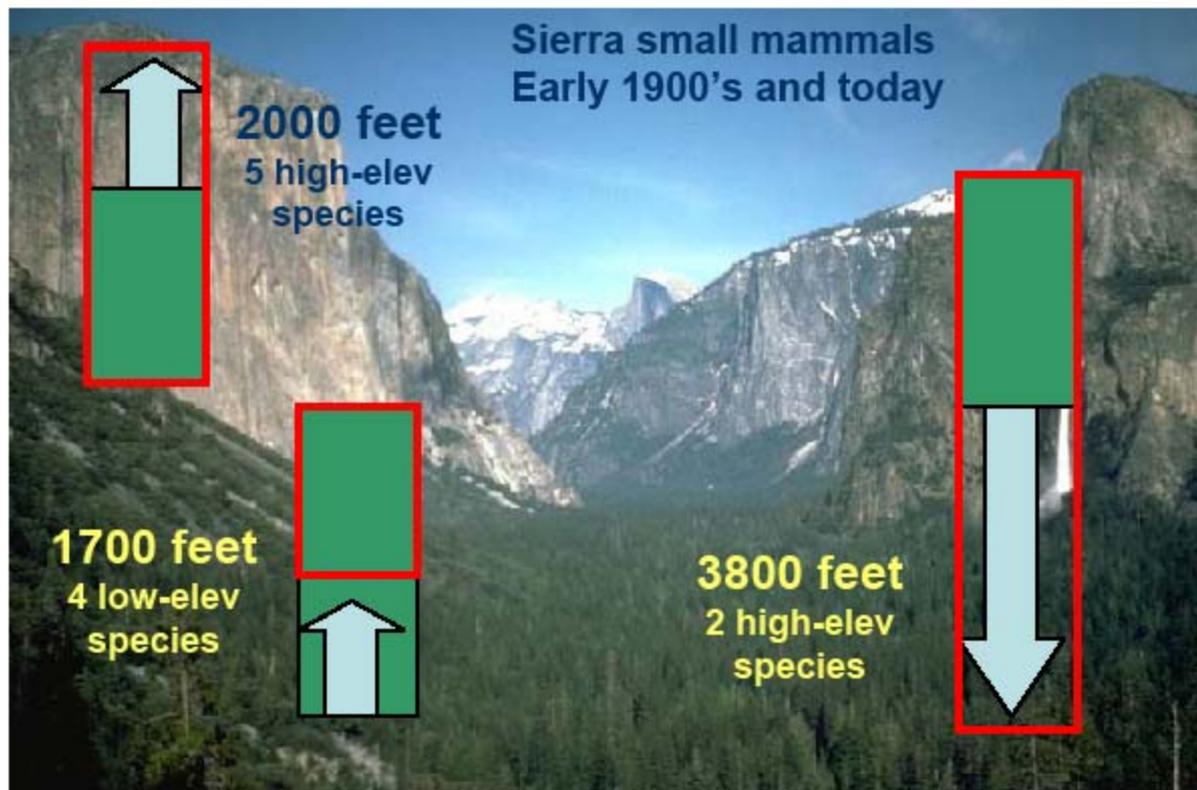


EARLIER SPRING EVENTS – CALIFORNIA EXAMPLES

- 12 of 22 bird species (55%) show change
- Different responses by species
 - 7 arrived earlier
 - 2 arrived later
- Four species with strong link to temp
 - Wilson's Warbler
 - Swainson's Thrush
 - Black-headed Grosbeak
 - Warbling Vireo



SPECIES SHIFTS TO COOLER AREAS



SPECIES SHIFTS – PINON MOUSE

Piñon mouse *Peromyscus truei*



habitat expansion
associated with elevational
increase in distribution

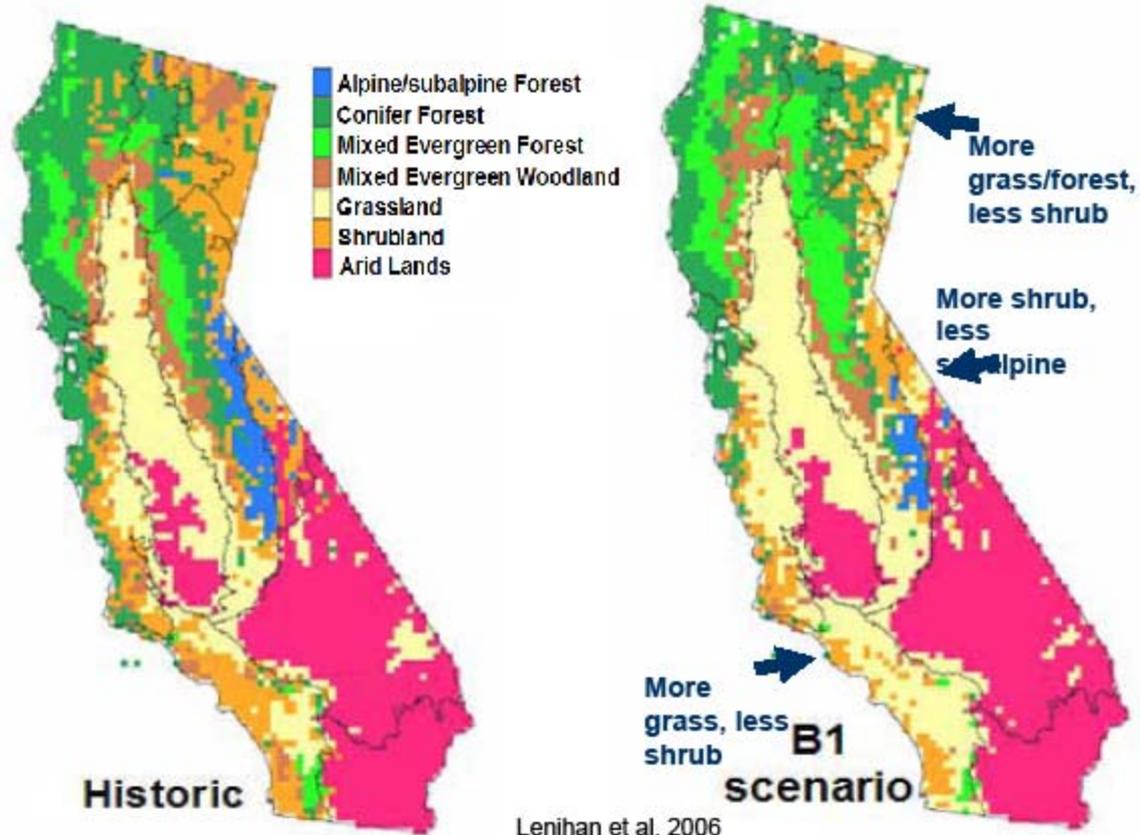


lodgepole - whitebark pine,
upper Lyell Canyon, 10,200 ft

piñon-juniper woodland, sage and
rabbitbrush understory, east slope
Sierra Nevada, 8000 ft



HABITAT SHIFTS IN AMOUNT AND LOCATION



Lenihan et al. 2006

DIFFERENT SPECIES, DIFFERENT RESPONSES



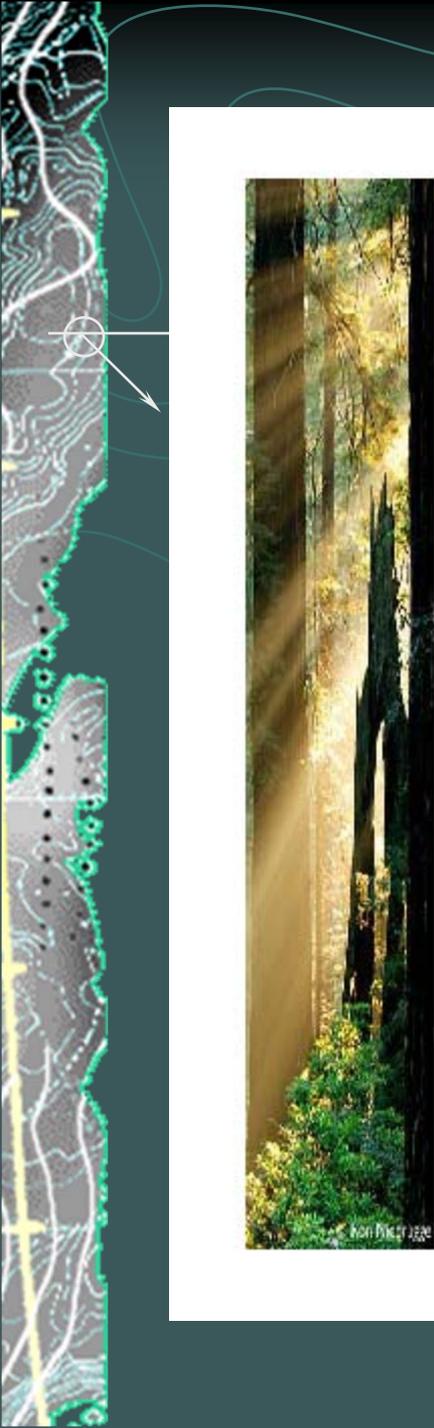
- More habitat generalists
 - invasive plants, insects and pathogens
- Greater survival of heat-tolerant species
- Mismatches in timing or distribution among species
 - Pollinators and flowers
 - Insectivores and hatching of insect prey
 - Migrating birds and mammals
- Changes in ecosystem functioning?



MOVING WILL BE DIFFICULT OR IMPOSSIBLE

- No room upslope (hilltop or mountaintop)
- Impassable migration routes
- Climate warming faster than trees can relocate
- New areas unsuitable for other reasons
 - Wrong soil type
 - No symbiotic species (fungi) for establishment
 - High competition from more hardy exotic species

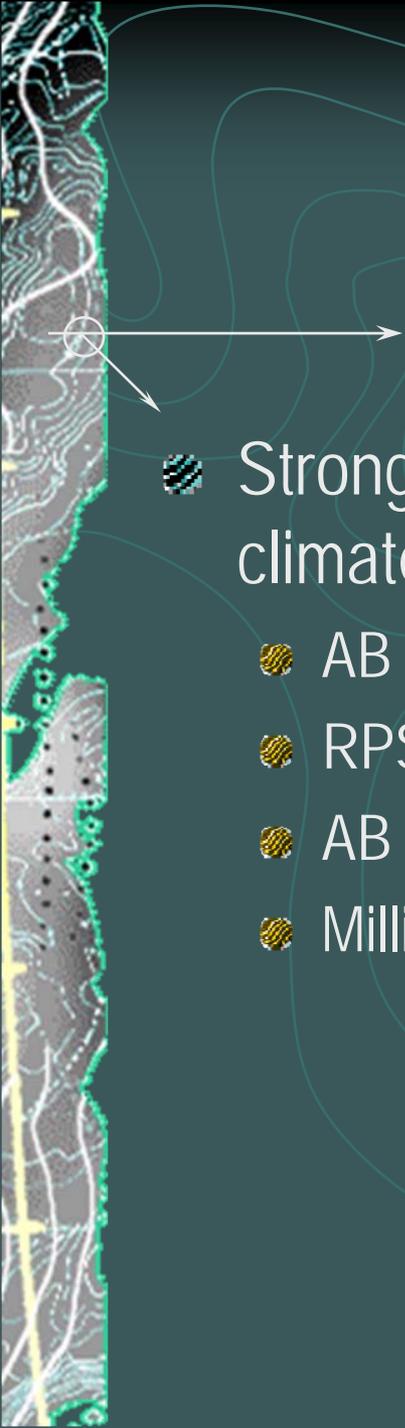




WHAT DO WE NEED TO DO?

- Most important action
 - Reduce greenhouse gas emissions
- Biological conservation actions
 - Reduce existing stressors on species
 - Buy time for species to adapt

California's challenge: Continue to lead

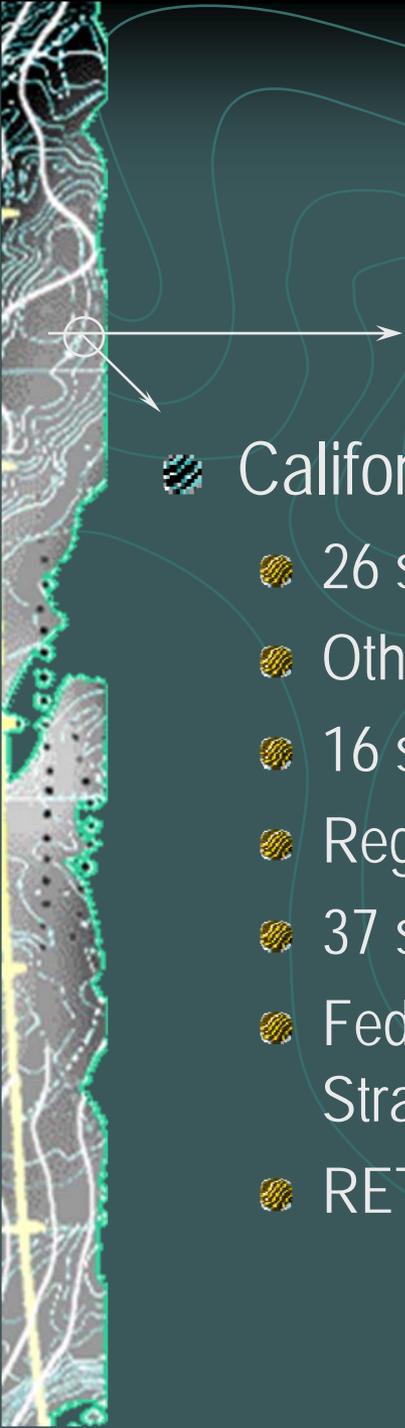


Strongest laws on climate change

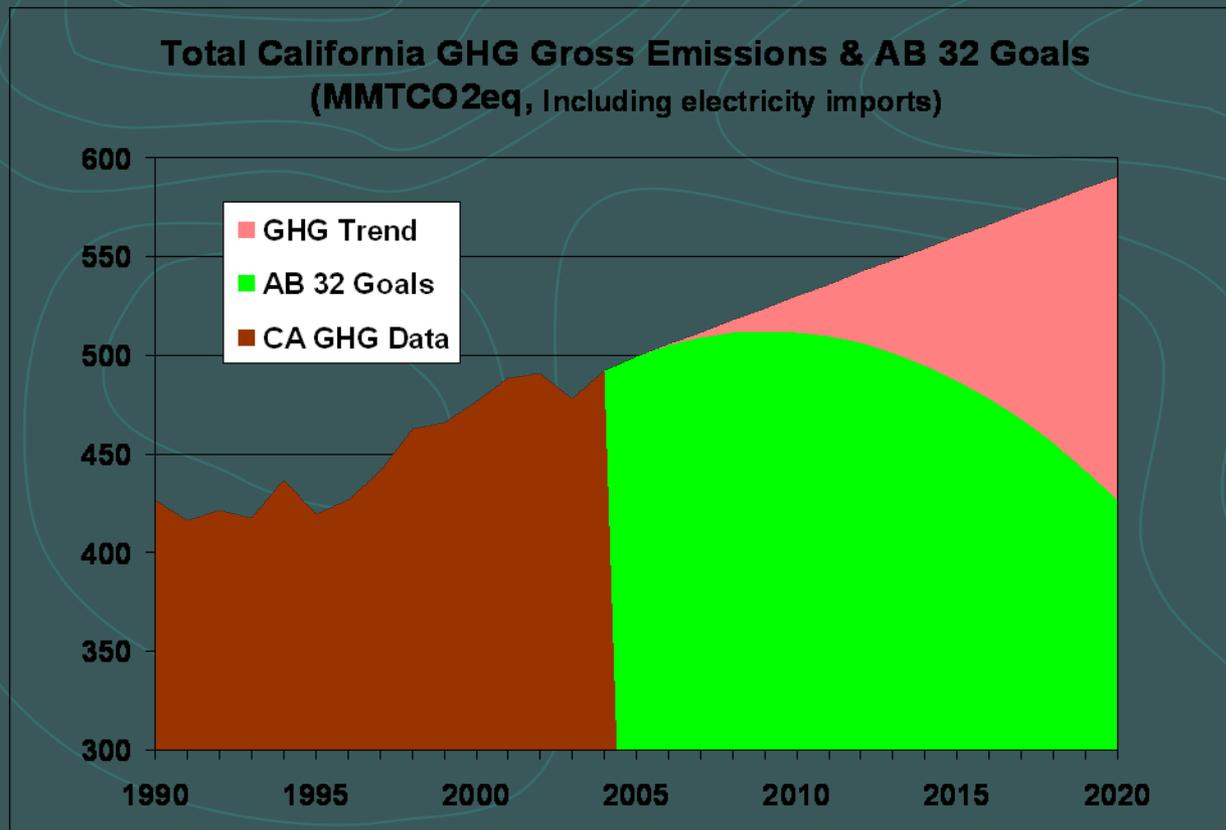
- AB 32
- RPS
- AB 1493 (Pavley)
- Million Solar Roofs

- Appliance and building efficiency standards
- Loading order
- Feed-in Tariffs?
- Executive Orders
- Climate Registry

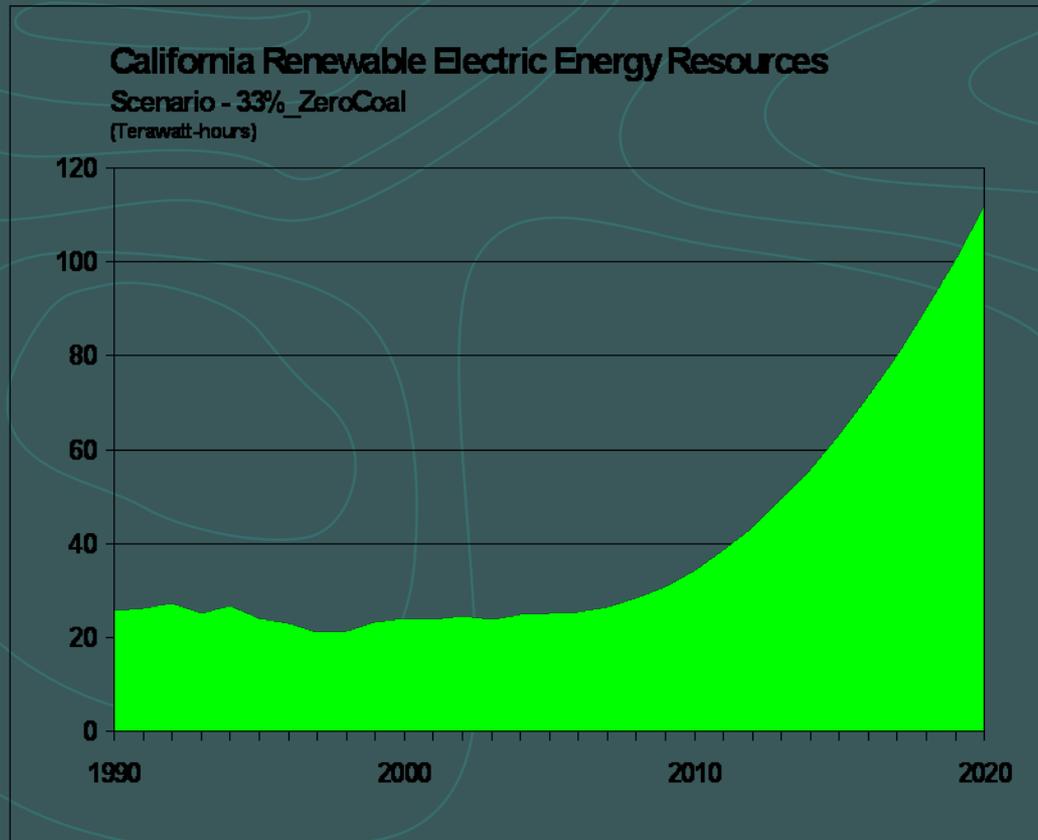
California's Challenge

- 
- California is a global leader
 - 26 states now with RPS
 - Other states adopting AB 32 (Hawaii in 2007)
 - 16 states adopted Pavley (40% of US auto market)
 - Regional Climate Initiatives, US and Canada
 - 37 states adopt common climate registry
 - Federal and state legislation patterned on California Strategies
 - RETI/WGA processes

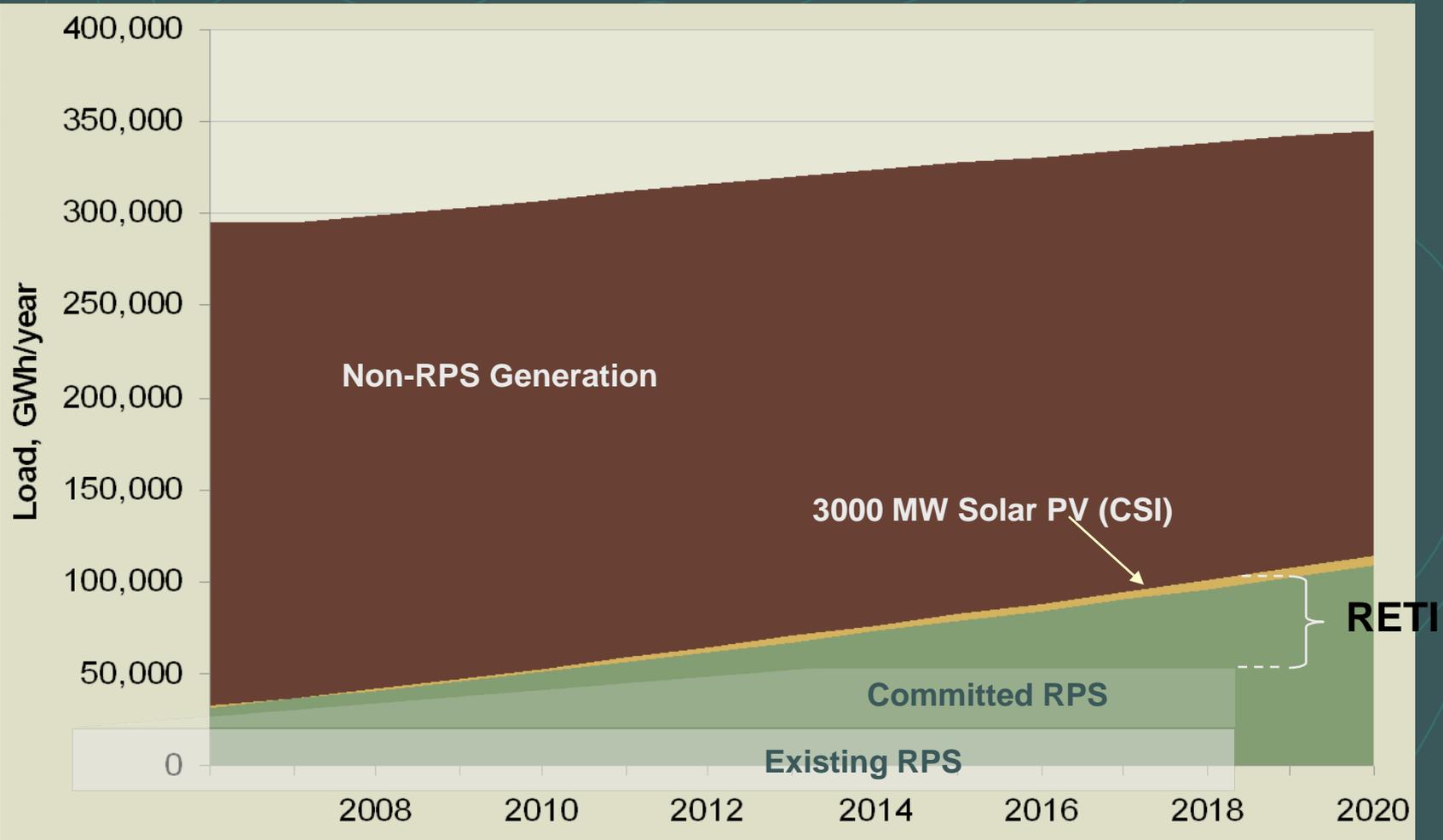
California policies will require large reductions in CO_2 emissions from the electricity sector.



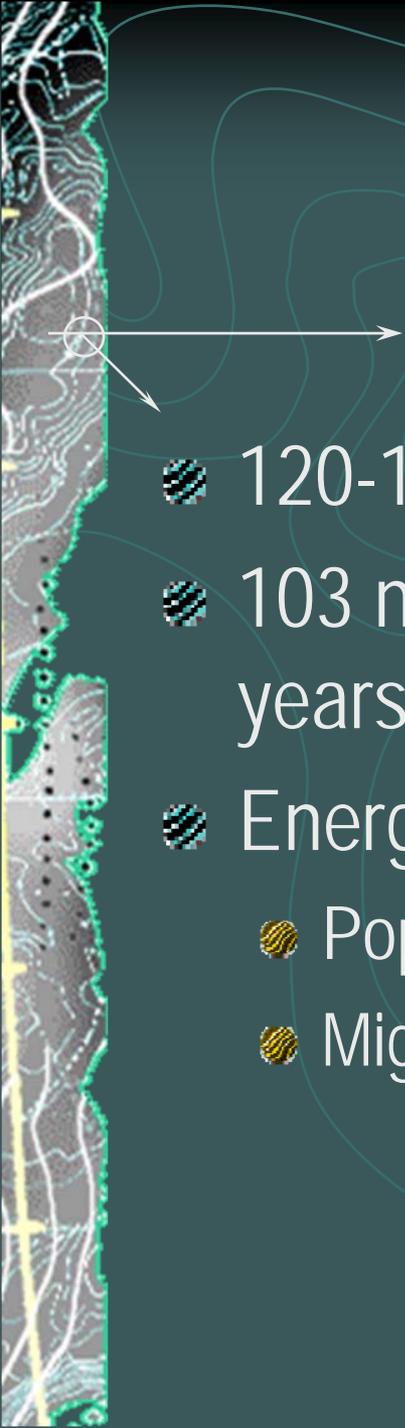
Large increases in renewable energy for electric generation will be required to meet state goals.



Total California Load (Nov. 2007 CEC Load Forecast)



We need it all

- 
- 120-150 new coal plants proposed
 - 103 nuclear plants, approaching or exceeding 30 years of age
 - Energy Demand growing
 - Population growth
 - Migration to warmer parts of California and US

We need it all

- 
- Global Warming is not a local supply issue
 - Need to build capacity to replace nuclear plants
 - Need to build capacity to block new coal plants
 - To do this:
 - We need all the efficiency we can get
 - We need all the distributed generation we can get
 - We need large-scale wind, solar and geothermal

We need it all -- No single tool is enough



● Roof top solar is still expensive and happening too slowly

- Statewide: 1,868 MW installed as of 2007

- CSI goal = 3,000 MW by 2017

Applications in IOU territories:

9817(Active) - 270 (withdrawn) = 249.3 MW in applications

- LADWP: 10.5 MW installed as of present

- In ~10 years, >\$150 million spent, 10.5 MW installed

- LADWP mandated by CSI to install 280 MW by 2017 using \$270 million rebate dollars—experience shows difficult to meet this goal. CSI needs adjustment? For POUs?

How to meet our energy needs using rooftop PV:

● Cover >100,430,000 roofs with PV (2kW ea)

● Californians use 272,385 MWh/day
(99,645,000,000 MWh/yr)

● 2 kW PV generates ~1,500 kWh/yr on average

● Install 1,500 MW of PV every year to meet CA load growth of 1%

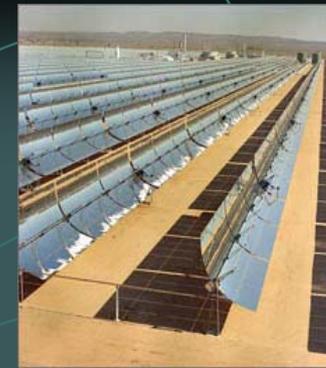
● Projected load growth ~3 terawatt-hours per year
(3,000 gigawatt-hours or 3 million megawatt-hours.)

1000 MW of PV gets ~2 TWh/year

How to meet our GHG goals using rooftop PV

- 3,000 MW = GHG reductions of ~3 million metric tonnes per year--about 3% of total current annual emissions from the electricity sector.
 - 20K MW "gap" = ~ 33 million rooftops
- California Solar Initiative
- Though early interest has been good...
 - Costs are high, dropouts have hurt and
 - Only half the 3,000 MW may materialize over the 10 years.
 - Incentives need improvement—FIT?

We Need it all...



- Concentrating solar can help, but will not be enough on its own.
 - 10,000 MW estimated for CA only half of what we need to meet our target
 - Transmission and siting hurdles could slow down progress
 - Tax policies must be extended for a longer term
 - We need to move quickly

We need it all...



- Wind Energy is picking up speed...
 - Largest project ever in development in CA
 - But best sites are elsewhere in the West
 - Like solar, siting, and transmission hurdles
 - Like solar, tax policies need improvement
 - Significant energy production but not enough by itself (4-8,000 MW)

We need it all ...

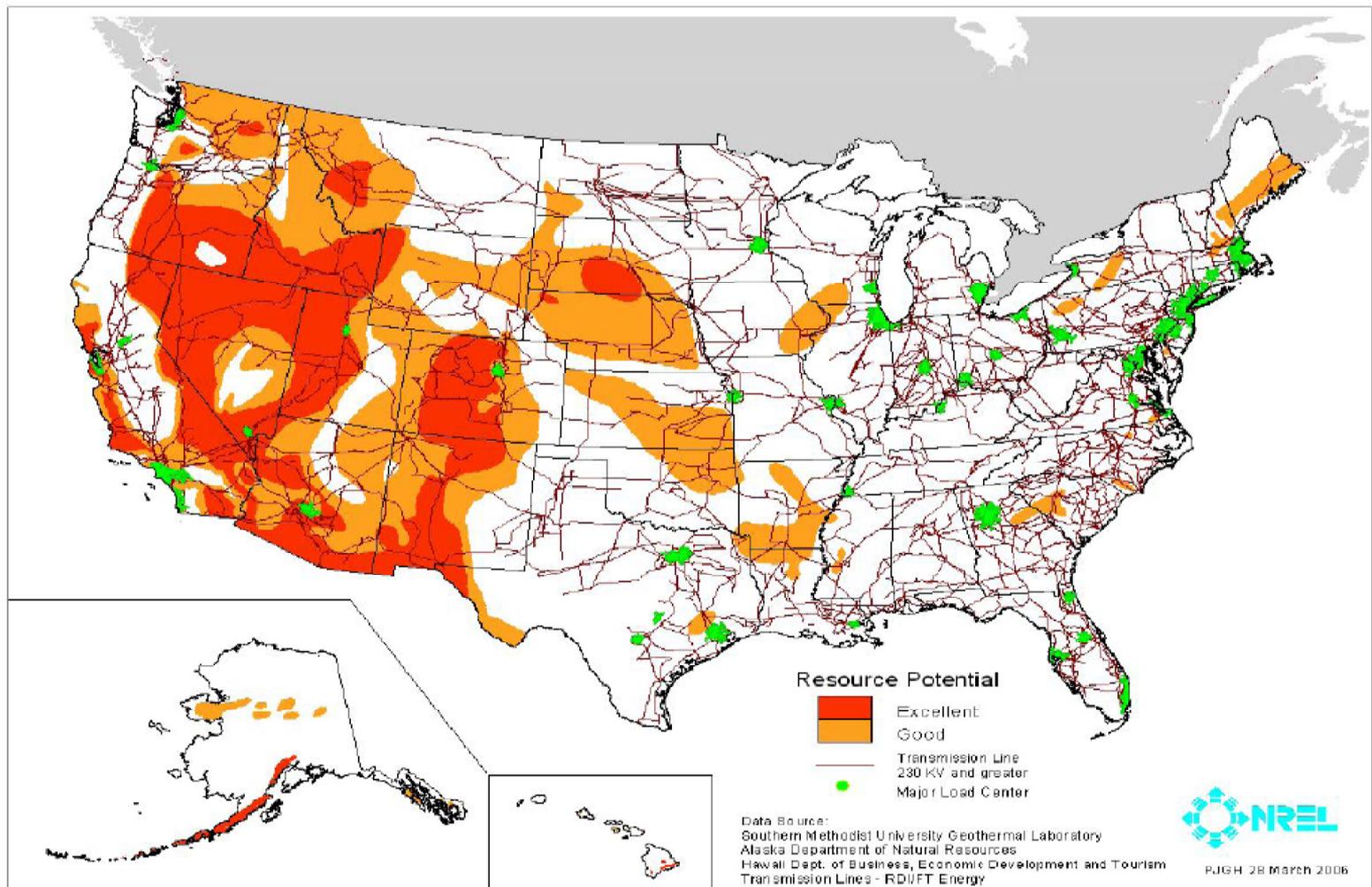


● Geothermal is limited but important

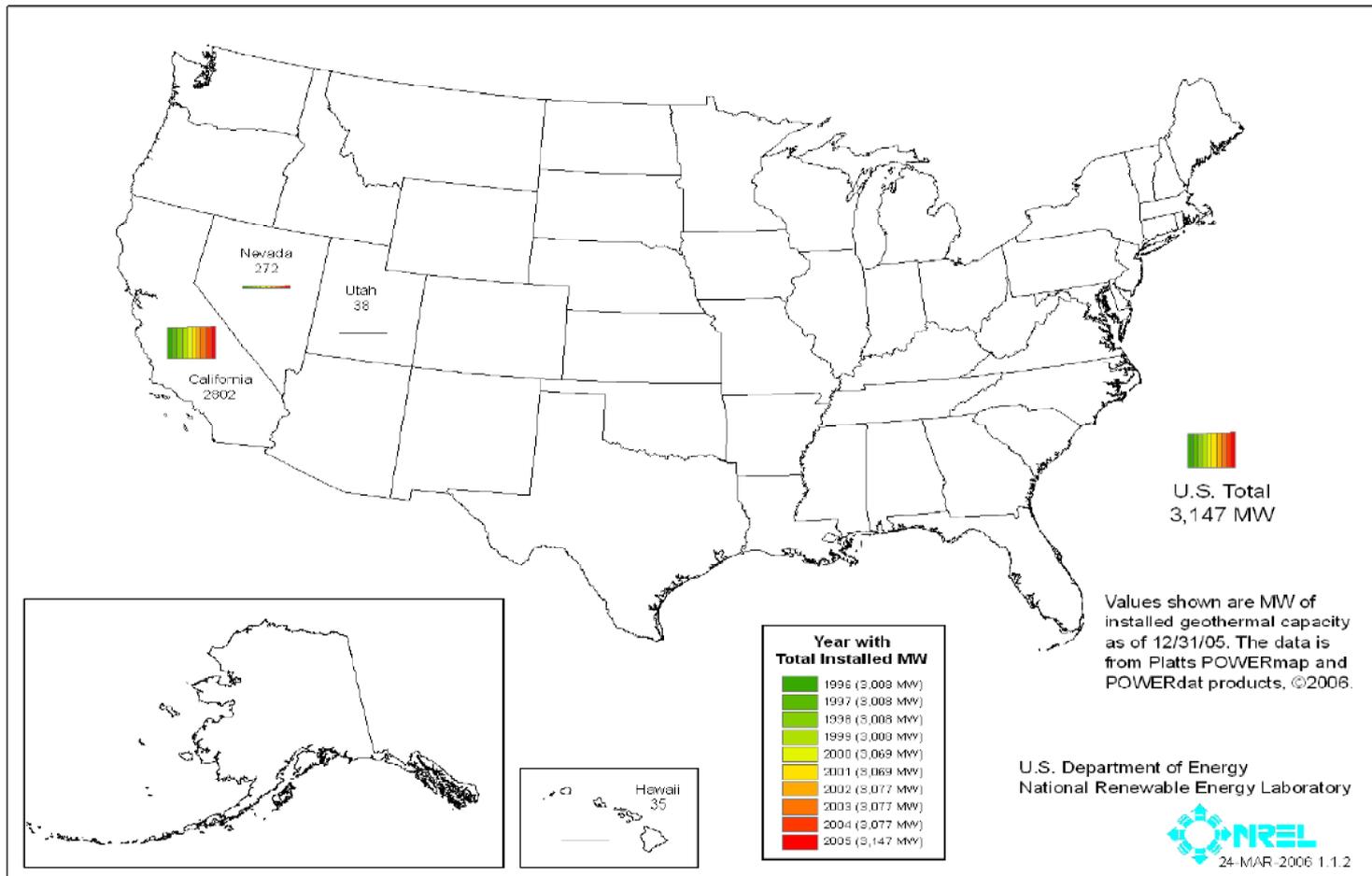
● Baseline power source

- Dispatchable so can balance intermittent renewables
- Remote locations have transmission issues
- Sites in NV could provide energy for California

Geothermal Resources and transmission



Installed Geothermal Energy



Energy Benefits

Southwest Solar Energy Potential

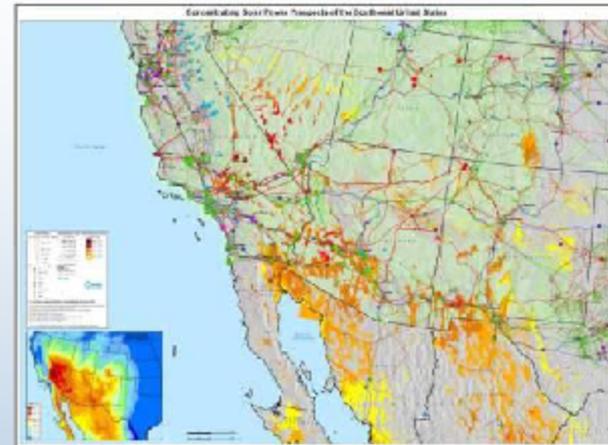
State	Land Area (mi ²)	Solar Capacity (MW)	Solar Generation Capacity GWh
AZ	19,279	2,467,663	5,836,517
CA	6,853	877,204	2,074,763
CO	2,124	271,903	643,105
NV	5,589	715,438	1,692,154
NM	15,156	1,939,970	4,588,417
TX	1,162	148,729	351,774
UT	3,564	456,147	1,078,879
Total	53,727	6,877,055	16,265,611

The table and map represent land that has no primary use today, exclude land with slope > 1%, and do not count sensitive lands.

Solar Energy Resource ≥ 6.75

Capacity assumes 5 acres/MW

Generation assumes 27% annual capacity factor



- Current total generation in the U.S. is 1,000GW w/ generation approximately 3,800 TWh

64 MWe Solargenix Solar Electric Plant: Boulder City, NV



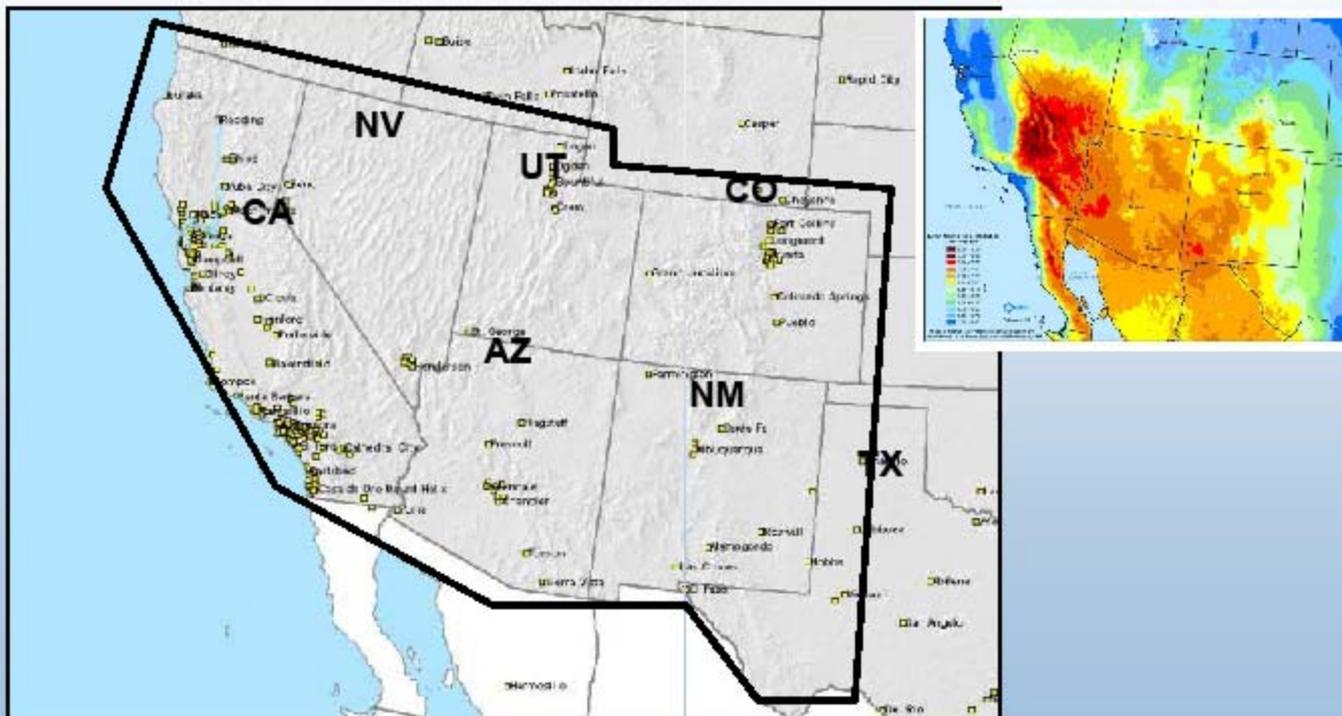




Solucar PS10 Sevilla, Spain



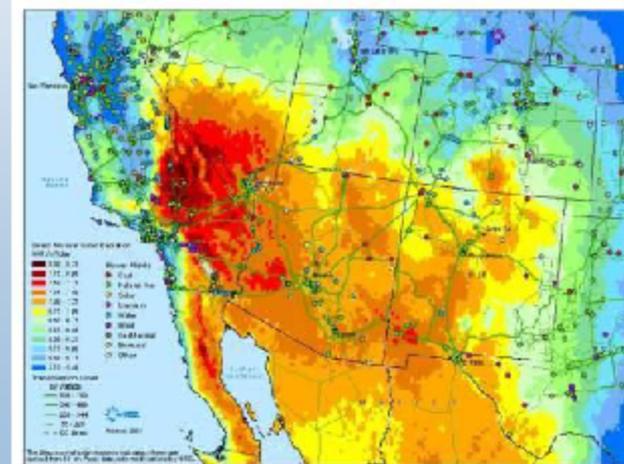
1000MW Analysis Focused on the Southwest Region



U.S. Southwest GIS Screening Analysis for CSP Generation

Screening Approach

- Initial GIS screening analysis used to identify regions most economically favorable to construction of large-scale CSP systems.
- GIS analysis used in conjunction with transmission and market analysis to identify favorable regions in four southwest states.



Southwest Solar Resources: Which Locations Are Suitable for CSP Development?

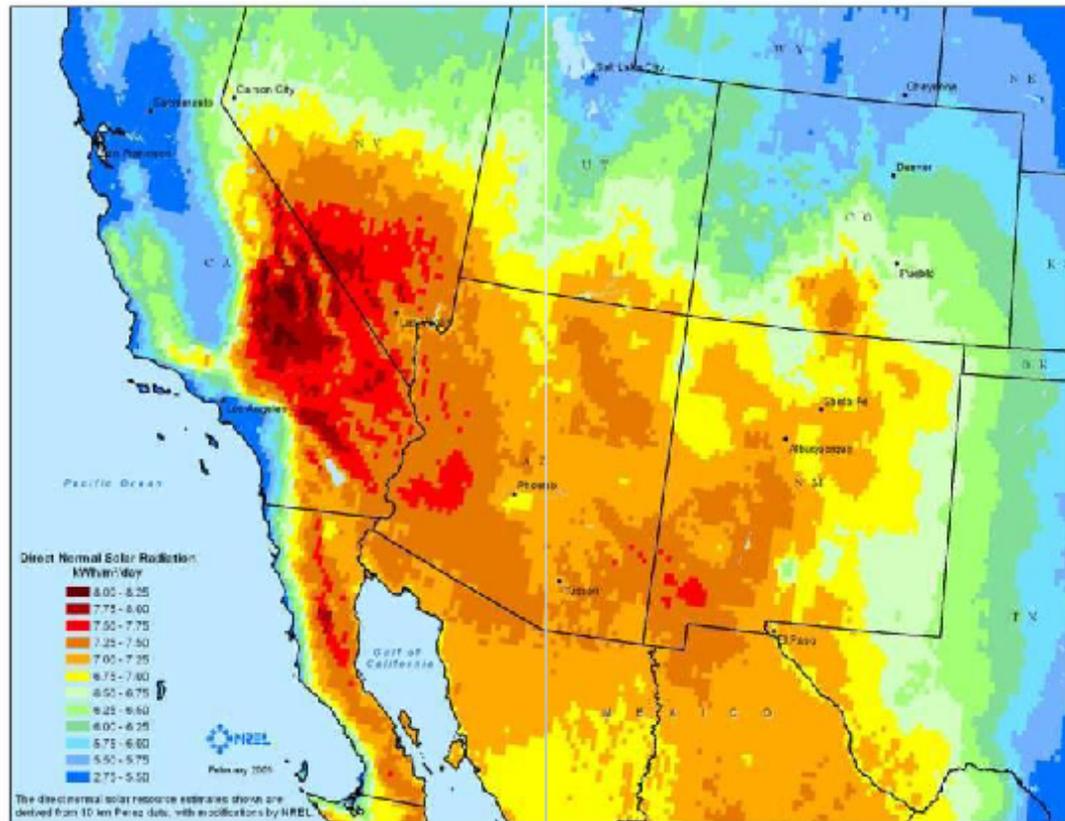
All Solar Resources



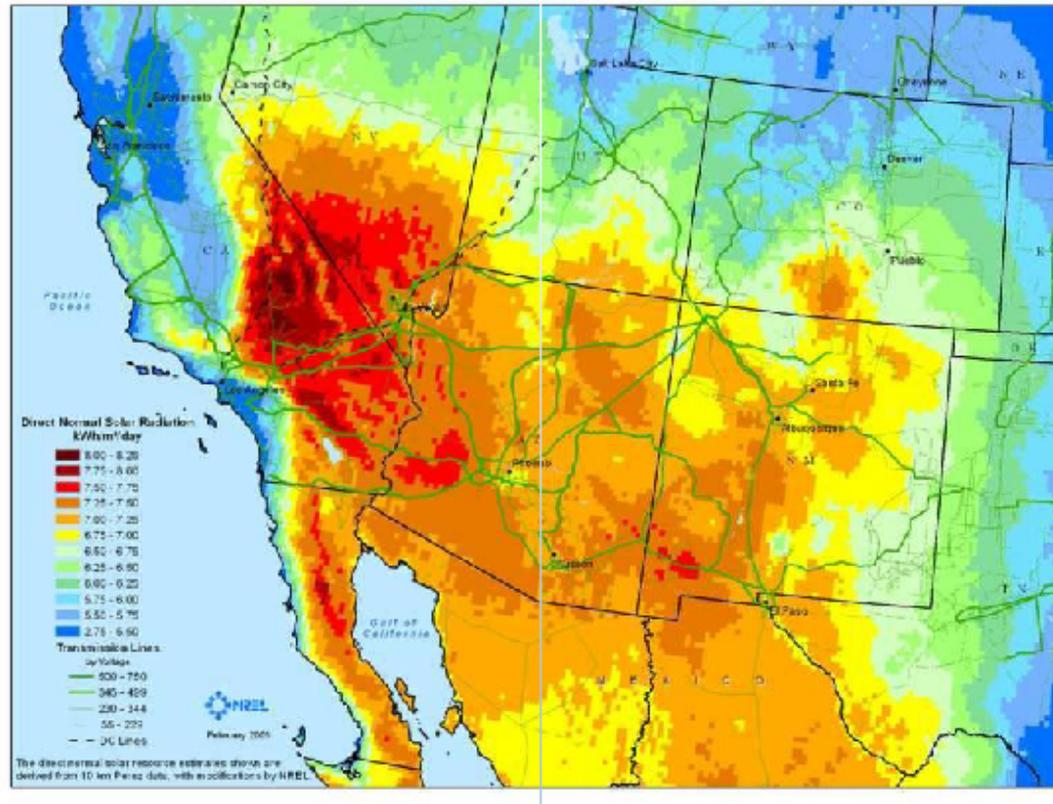
Locations Suitable for
Development

1. Start with direct normal solar resource estimates derived from 10 km satellite data.
2. Eliminate locations with less than 6.75 kwh/m²/day.
3. Exclude environmentally sensitive lands, major urban areas, and water features.
4. Remove land areas with greater than 1% (and 3%) average land slope.
5. Eliminate areas with a minimum contiguous area of less than 5 square kilometers.

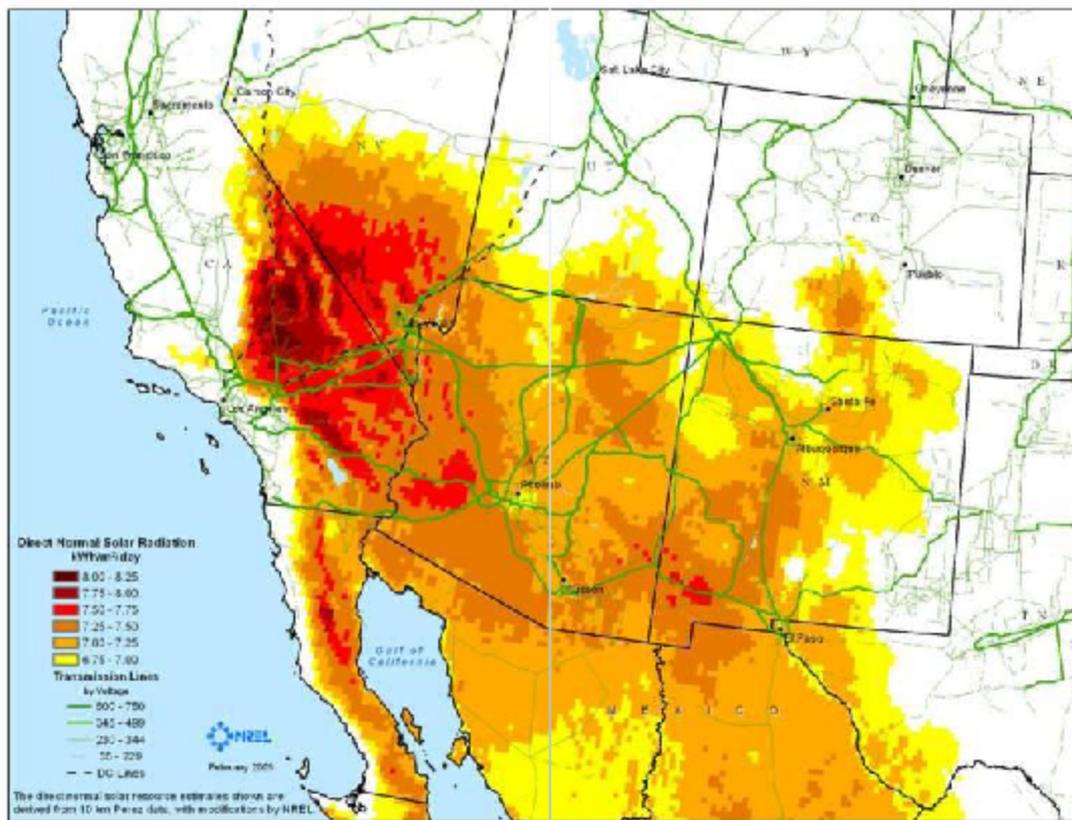
Southwest Solar Resources Unfiltered Data



Southwest Solar Resources Transmission Overlay

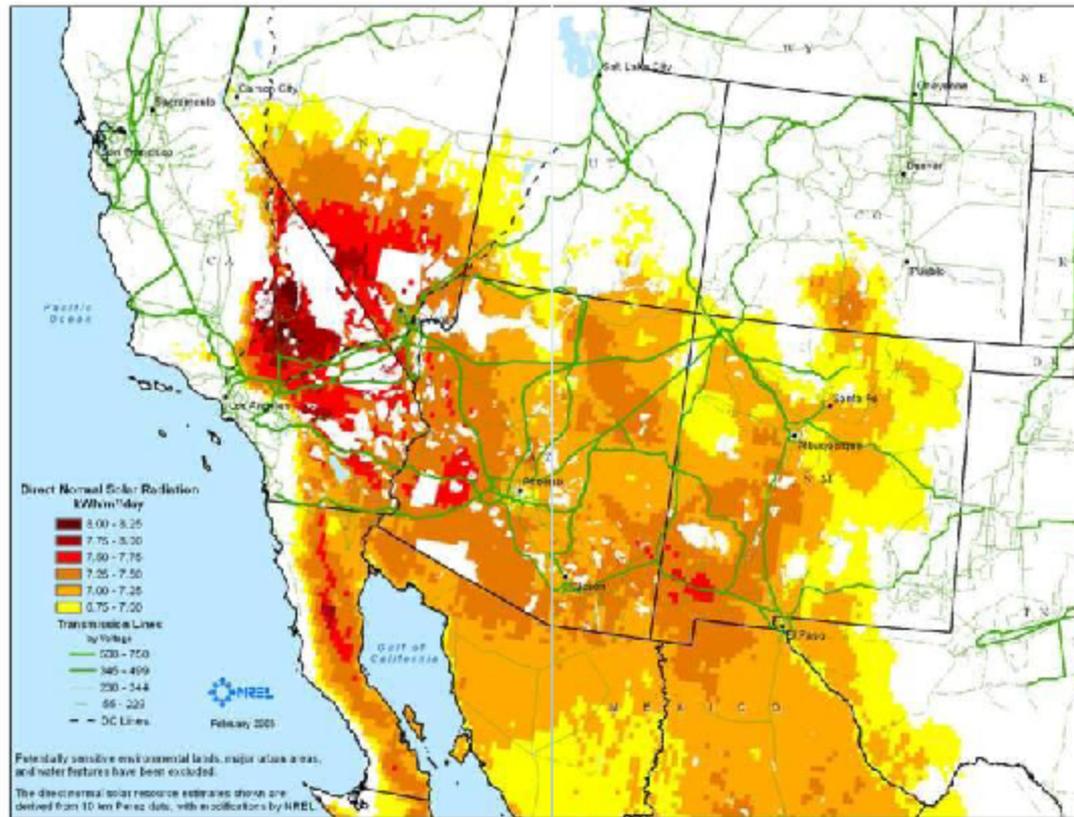


Southwest Solar Resources > 6.75 kWh/m²/day



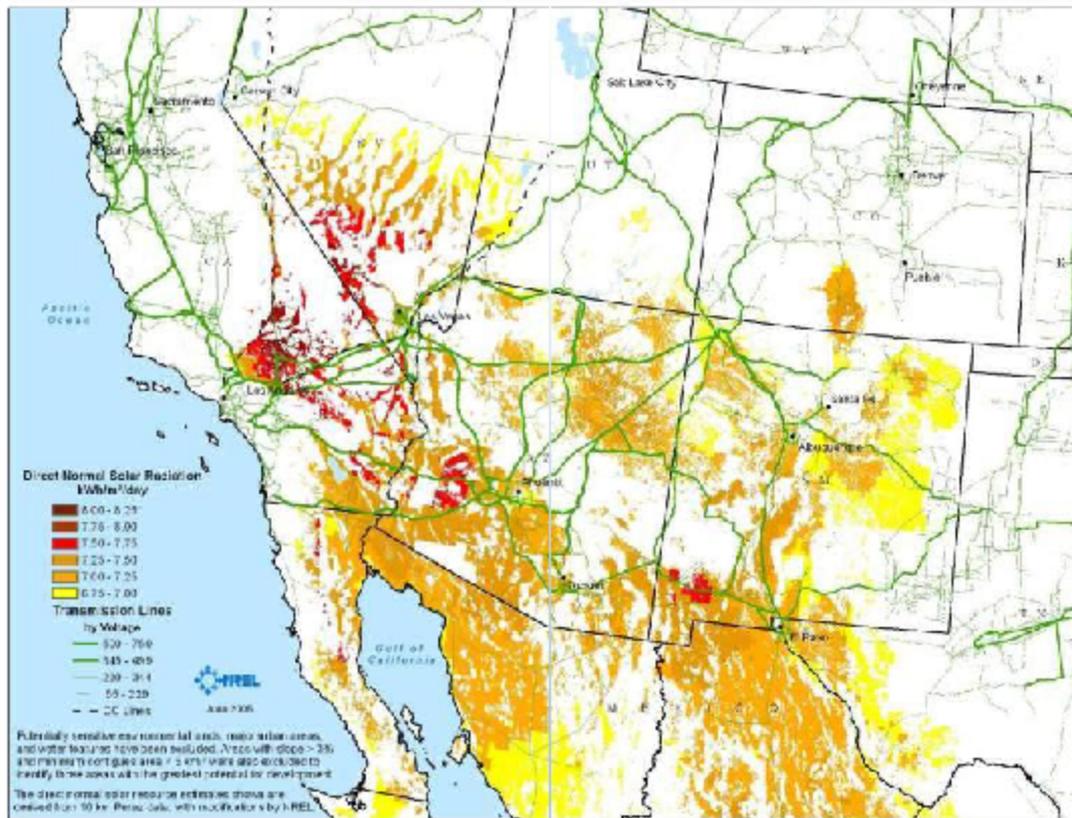
Southwest Solar Resources

Prior plus Environmental and Land Use Exclusions



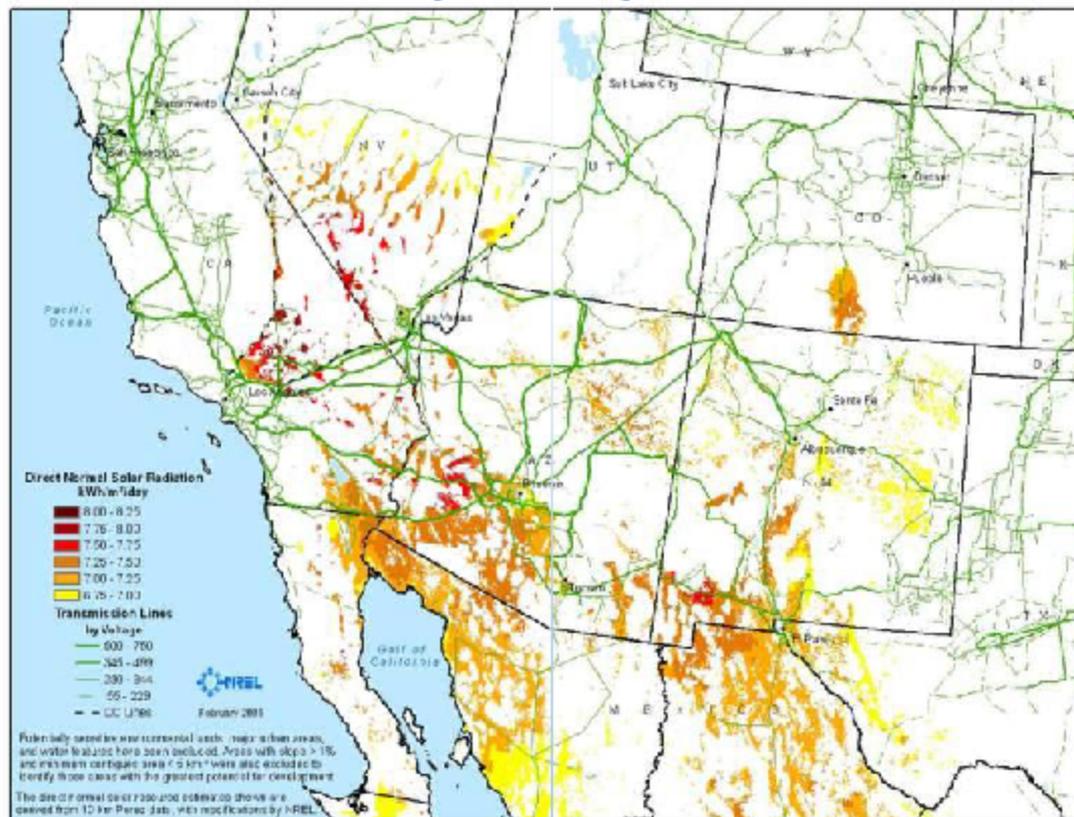
Southwest Solar Resources

Prior plus Slope < 3%



Southwest Solar Resources

Prior plus Slope < 1%

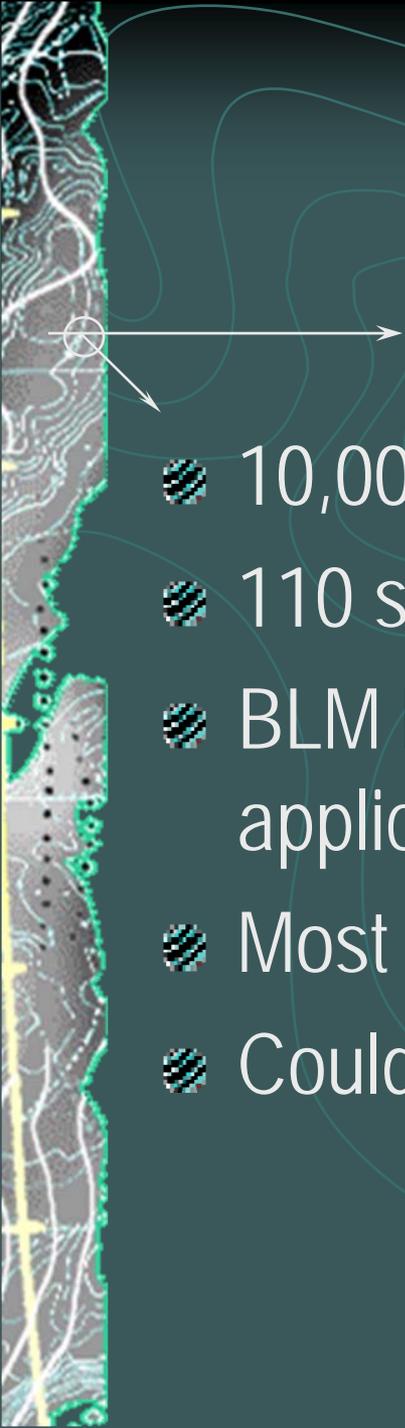


NREL Wind Potential

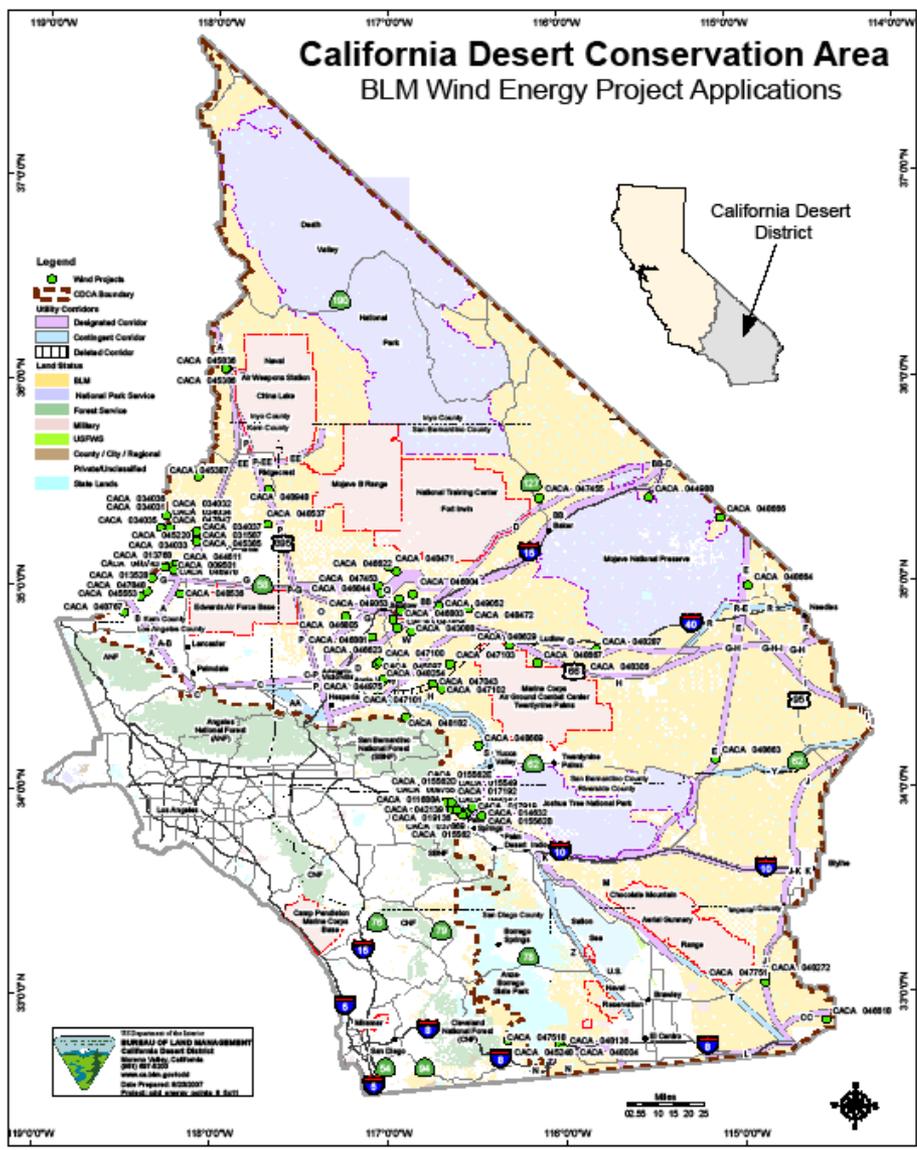
Developable Potential After Exclusions (50m hub height, in MW)

<i>State</i>	<i>Class 3</i>	<i>Class 4+</i>	<i>Class 5+</i>	<i>Class 6+</i>	<i>Class 4-6 Total</i>
<i>AZ</i>	22,250	2,310	660	200	3,170
<i>CA</i>	54,240	21,030	9,130	4,300	34,460
<i>CO</i>	288,130	73,130	7,570	4,060	84,760
<i>ID</i>	26,650	3,410	1,030	395	4,835
<i>MT</i>	899,460	291,510	54,480	15,620	361,610
<i>NV</i>	20,960	5,560	1,860	720	8,140
<i>NM</i>	312,140	73,040	10,780	1,800	85,620
<i>OR</i>	46,030	9,520	2,390	850	12,760
<i>UT</i>	15,740	3,490	1,180	410	5,080
<i>WA</i>	34,300	9,520	2,380	790	12,690
<i>WY</i>	534,410	257,650	116,670	57,040	431,360
	WECC (US) Totals	750,170	208,130	86,185	1,044,485
	~WECC Demand 2007	293,000			
	~US Demand, 2007	910,000			

BLM Estimates

- 
- 10,000 MW solar potential and applications
 - 110 square miles = 70,400 acres
 - BLM believes approximately 33% are viable applications, numerous denials already
 - Most near roads or existing infrastructure
 - Could be more or fewer applications

California Desert Conservation Area BLM Wind Energy Project Applications



Engaging on this issue



- Choose venue to maximize influence

- RETI

- WGA

- “Trump” FERC preemption

- Provide timely information

- Participate Directly

- Communicate and advocate for needed policies



Choose favorable venue

- Select processes that enable us to show progress on development of resources and lines
 - This makes it harder for FERC to designate lines under EP Act of 2005, NIETC or WWC
- Select Process with most ability to influence
 - Level as possible playing field with utilities, regulators and generators
- RETI provides these advantages



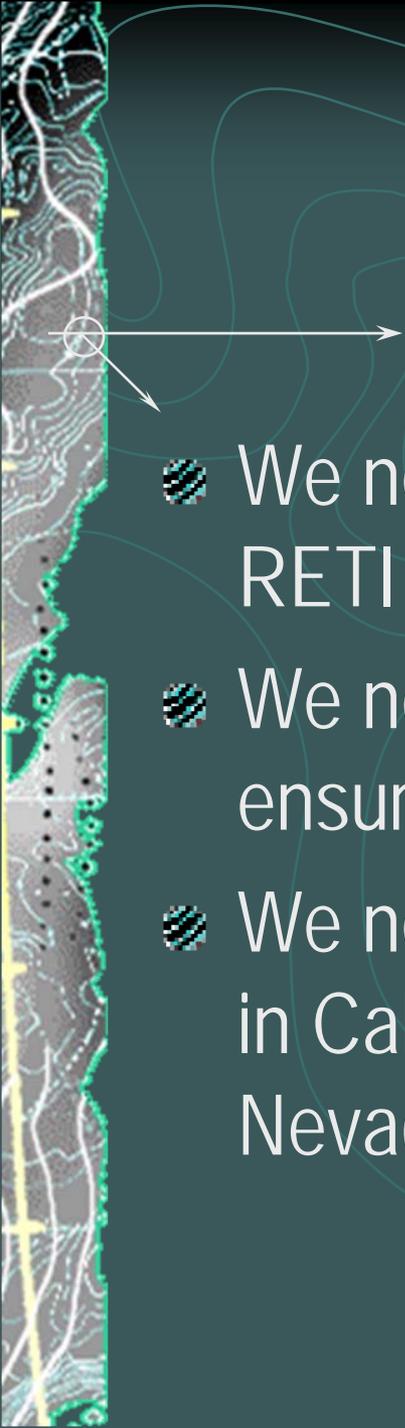
FERC will likely defer to States that
move forward ...

"I would be very reluctant to impose my judgment
over reasonable efforts made by states and
stakeholders."

-- *Marc Spitzer, FERC Commissioner, Speech to
the Energy Bar Association, Feb 15, 2008.*

"Tell us where not to go"

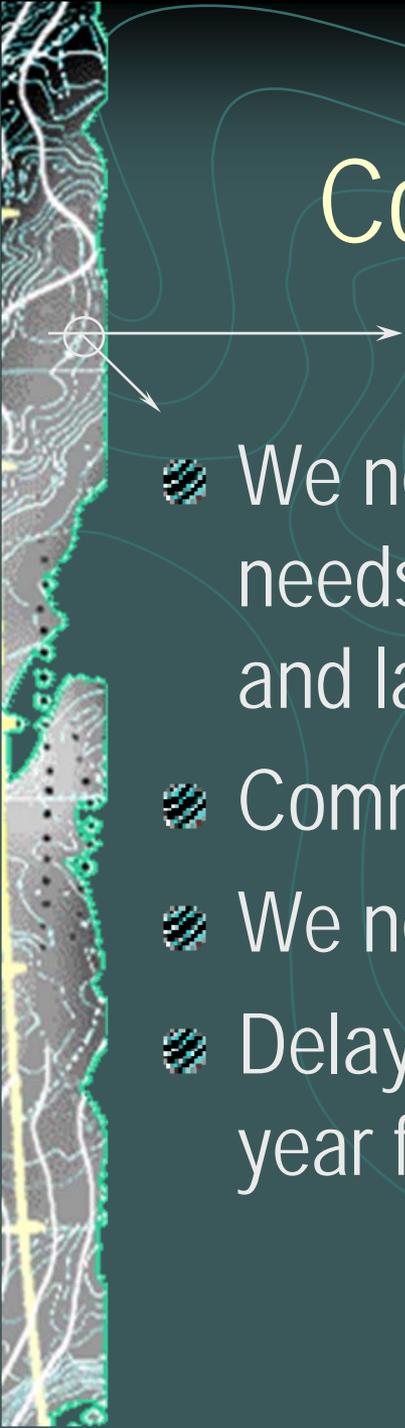
- 
- Timely provision of information about areas we want off limits is critical
 - Generators willing to work with us to avoid these areas
 - BLM is being diligent
 - We need to be seen as providing a solution to siting quandaries



Direct Participation Tasks

- We need to participate in the key meetings of RETI and WGA
- We need to engage in work assignments to ensure our perspective is included
- We need to communicate with other key players in California and in neighboring states especially Nevada

Communication and advocacy

- 
- We need to identify and communicate policy needs to representatives, regulators (FERC), and land management agencies
 - Communicate with stakeholders
 - We need to act as advocates for the best plans
 - Delay is not an option (FERC's clock runs for a year from a designation request)

Timeline

- 
- FERC can begin designating lines within a year if no progress is shown
 - First cut at energy zones this spring, 2008 (RETI)
 - WGA process begins, late spring to early summer 2008
 - Approximately 12-18 months to get to designating actual lines
 - 24- 60 months before solar projects begin construction
 - 60-72 months projects get electrified
 - Delay is not an option

For More Information



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● www.ucsususa.org

● www.californialung.org

● www.energy.ca.gov/reti/

● www.theclimateproject.org

● www.wecansolveit.org