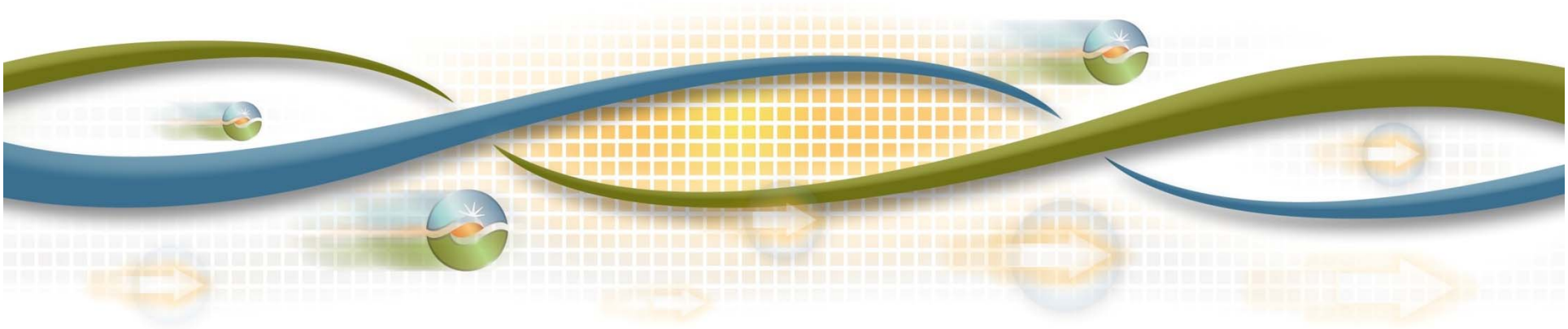
Clean Energy and Pollution Reduction Act Senate Bill 350 Study: *Preliminary Results*

May 25, 2016



Recap of Day 1

- Overall benefits to California Ratepayers
  - **$1 - $1.5 Billion in 2030**
- California CO_2 emissions reduced from **64 million metric tons/year** in 2020 to **44 – 45 million metric tons/year** in 2030 which is far below EPA's CPP requirements for California
- Expanded region by 2030 decreases electric sector NOx, SO_2 and $PM_{2.5}$ emission WECC-wide and within California
- Regional market creates **9,900 – 19,400** jobs
- Disadvantaged communities benefit both economically and environmentally
- Regionalization lowers costs to maintain system reliability and improves integration

Economic Assessment for SB350

Preliminary Results

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Berkeley Economic Advising and Research

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Berkeley Economic Advising and Research
www.bearecon.com

Income and Job Dynamics

Three main economic drivers in the SB350/CAISO RPS scenarios:

1. Power capacity investment
2. Infrastructure investment
3. Income/expenditure effects of electricity rate reductions

Estimating Impacts

- Direct Effects: Increased economic activity in response to direct spending (investment or consumption).
- Indirect effects: Economic activity in enterprises linked by supply chains to directly affected sectors (e.g., suppliers of input components and raw materials).
- Induced effects: Demand from rising household income (e.g. spending by employees of directly and indirectly affected firms).

Previous California Studies

California Advanced Energy Employment Survey (2014)

- 431,800 jobs in advanced energy, with majority (70%) in energy efficiency.
- 94,837 jobs in “advanced electricity generation”, majority in solar (72,986)
  - Apples and Oranges: No distinction between utility-scale and rooftop
  - Wind: 3,270

Phillips (2014)

- Considers employment effects of 4,250 MW utility-scale solar built from 2010-2014.
- 10,200 construction, 136 operations jobs, 1,600 supply chain, and 3,700 induced jobs (~15k total).

Jones et al. (2015)

- Forecasts 878,000 – 1,067,000 total jobs with 50% RPS (JEDI model estimates).
- Concedes that their analysis overestimates job growth, and is best used for comparisons between scenarios/technology.

Assessment Scenarios

	Scenario 1a	Scenario 2	Scenario 3
CAISO simultaneous export limit	2,000	8,000	8,000
Procurement	Current practice	Current practice	WECC-wide
Operations	CAISO	WECC-wide	WECC-wide
Portfolio Composition (GWh)			
California Solar	21,482	22,147	9,827
California Wind	8,480	5,596	5,596
California Geothermal	3,942	3,942	3,942
Northwest Wind, Existing Transmission	4,056	1,574	891
Northwest Wind RECs	2,803	2,803	0
Utah Wind, Existing Transmission	1,693	1,693	1,177
Wyoming Wind, Existing Transmission	1,708	1,708	1,708
Wyoming Wind, New Transmission	0	0	8,037
Southwest Solar, Existing Transmission	0	1,489	1,489
Southwest Solar RECs	2,978	2,978	2,978
New Mexico Wind, Existing Transmission	3,416	3,416	3,416
New Mexico Wind, New Transmission	0	0	7,905
Total CA Resources	33,904	31,685	19,365
Total Out-of-State Resources	16,654	15,661	27,601
Total Renewable Resources	**50,558**	**47,346**	**46,966**

- * Note: table lists *available* GWh; delivered GWh is the same in all scenarios; differences in total GWh due to changes in renewable curtailment

Macroeconomic Impacts

Percent change from Reference* in 2030

	Full Capacity Build-out	Build-out with Partial Trade	Build-out with Regionalism
	S1a	S2	S3
Gross State Product ($B)	0.32%	0.37%	0.35%
Real Output	0.35%	0.40%	0.39%
Employment (,000)	0.29%	0.35%	0.32%
Real Income	0.48%	0.53%	0.61%
State Revenue	0.21%	0.33%	0.34%

*Differences are estimated with respect to a reference scenario assuming no additional RPS investment ("Build-out") from 2020.

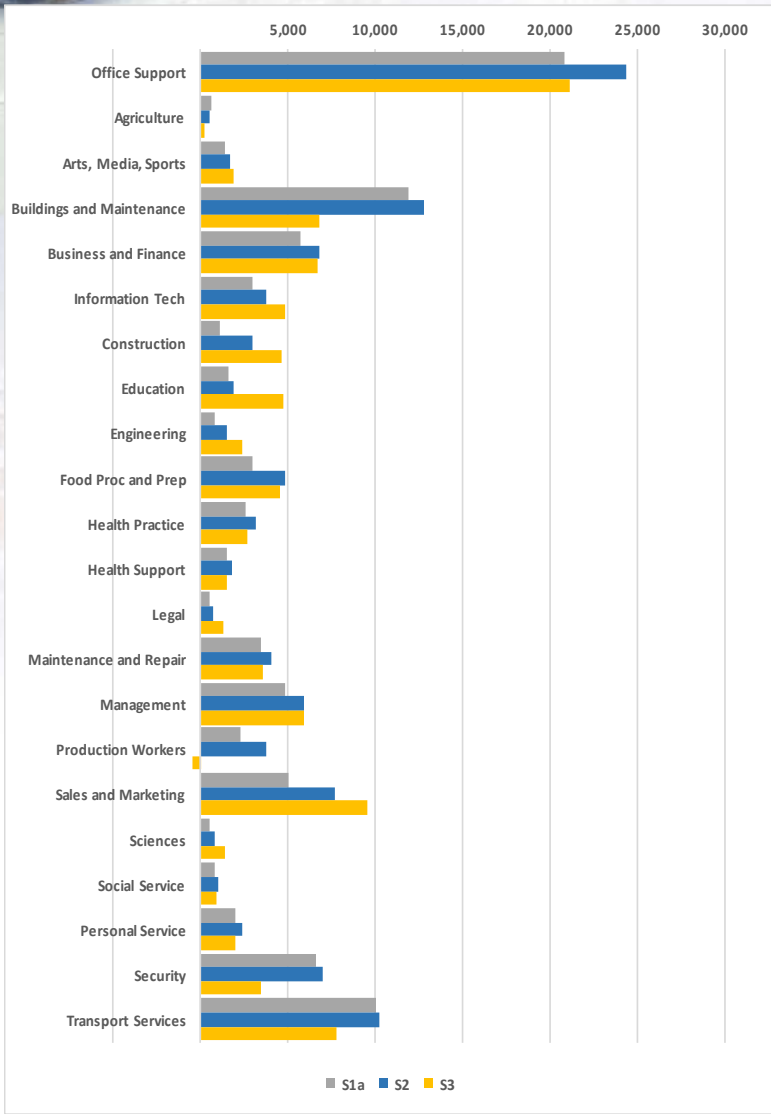
Difference from Reference in 2030
2015 $ Billions unless noted

	Full Capacity Build-out	Build-out with Partial Trade	Build-out with Regionalism
	S1a	S2	S3
Gross State Product ($B)	11.298	12.987	12.467
Real Output	18.289	21.027	20.564
Employment (,000)	90.330	109.678	100.247
Real Income	26.853	30.970	34.747
State Revenue	6.082	6.669	7.663

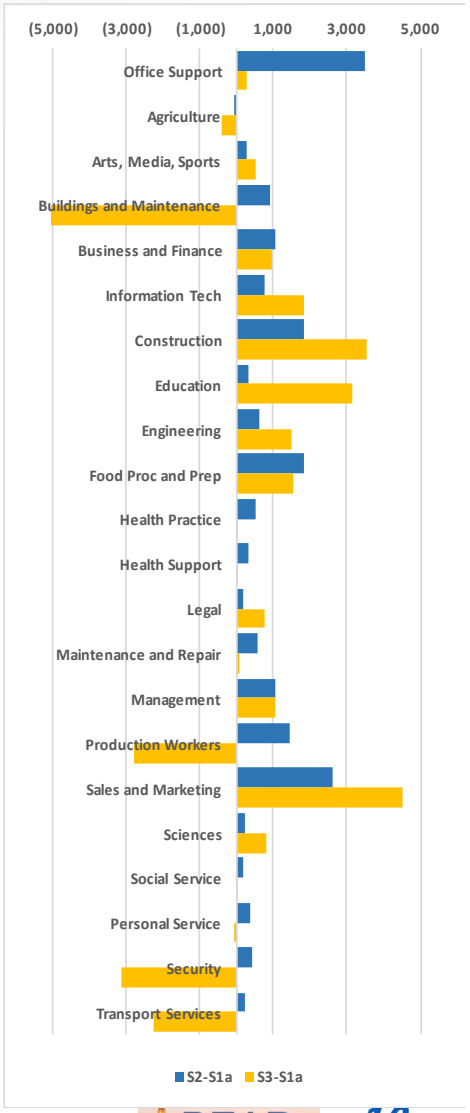
Measuring Jobs

- Jobs estimates measure **changes in the aggregate California labor force in Full-Time Equivalent (FTE) employees** relative to a non-SB350 (33% RPS) scenario.
- Jobs from the renewable buildout include short-term construction jobs and long-term O&M jobs
- Indirect jobs from ratepayer savings generally more permanent changes in employment.

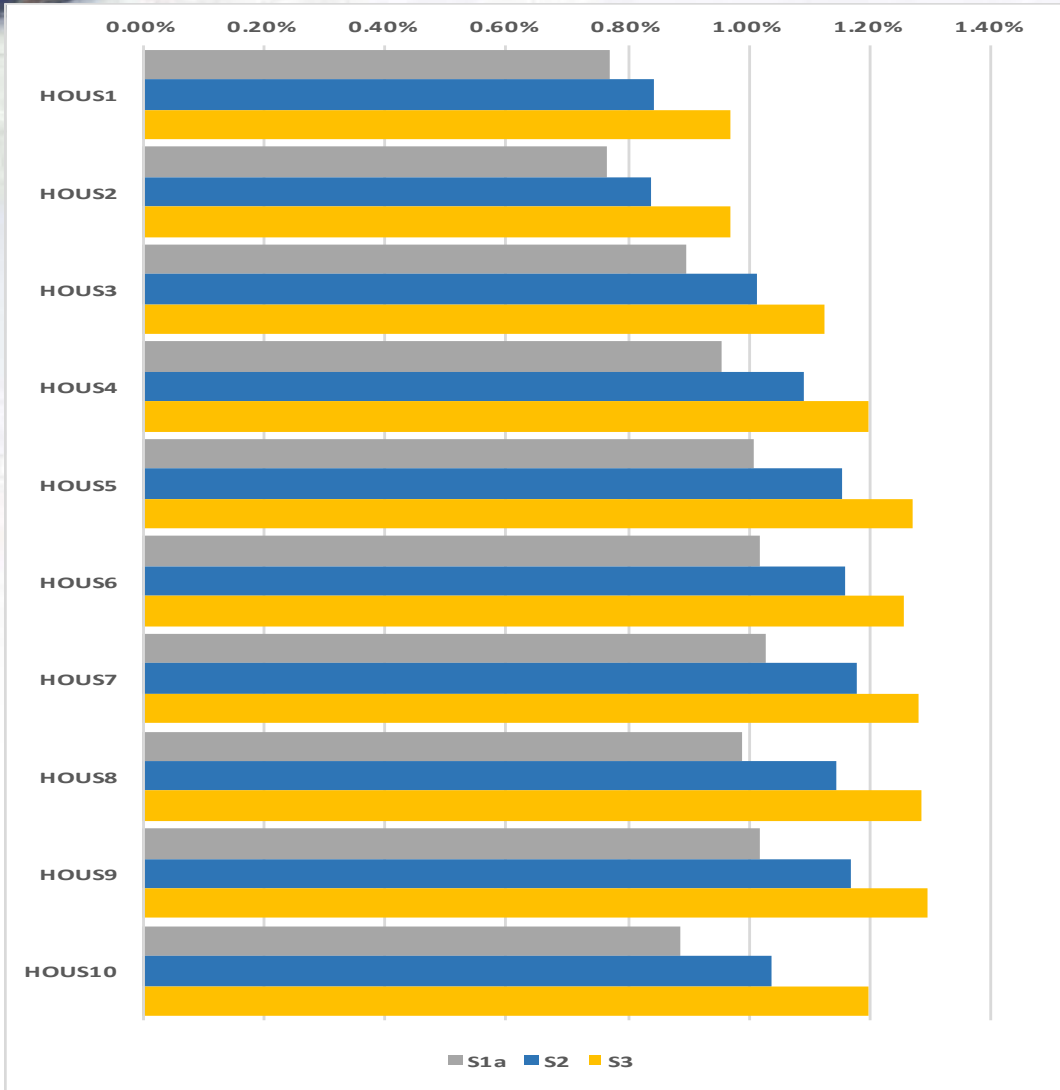
Employment Impacts by Occupation
(FTE Change from Reference in 2030)



- All scenarios stimulate job creation in California.
- Power sector investments create both temporary and long term jobs.
- More affordable energy creates more diverse long term jobs.
- Combining the power sector and power source diversification yields the most FTE jobs.

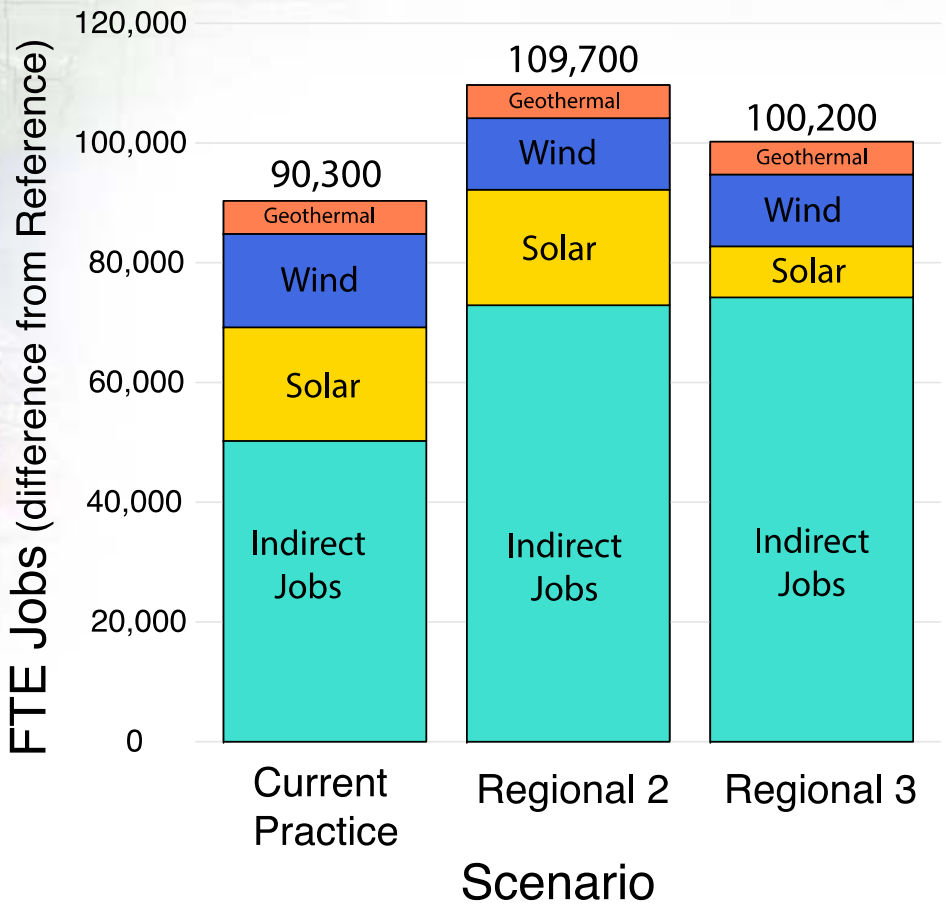


Household Real Income Impact by Decile
(percent change from Reference in 2030)



- Household income rises for every scenario and every decile.
- Households benefit most from more affordable energy.

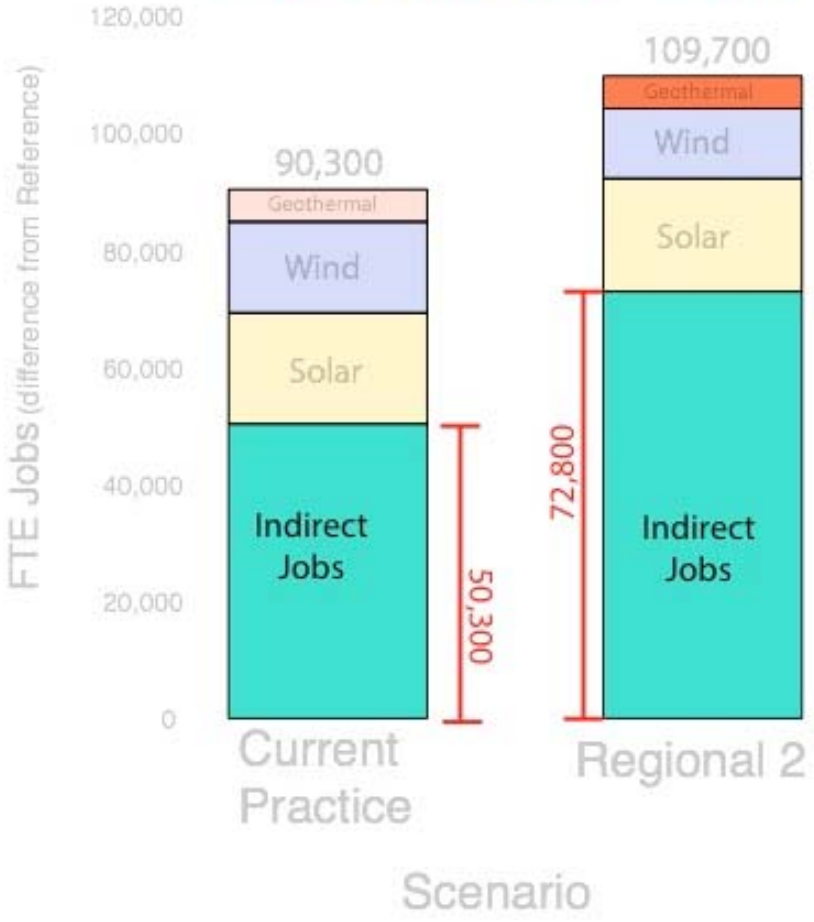
Statewide Jobs Created by 2030, by Scenario



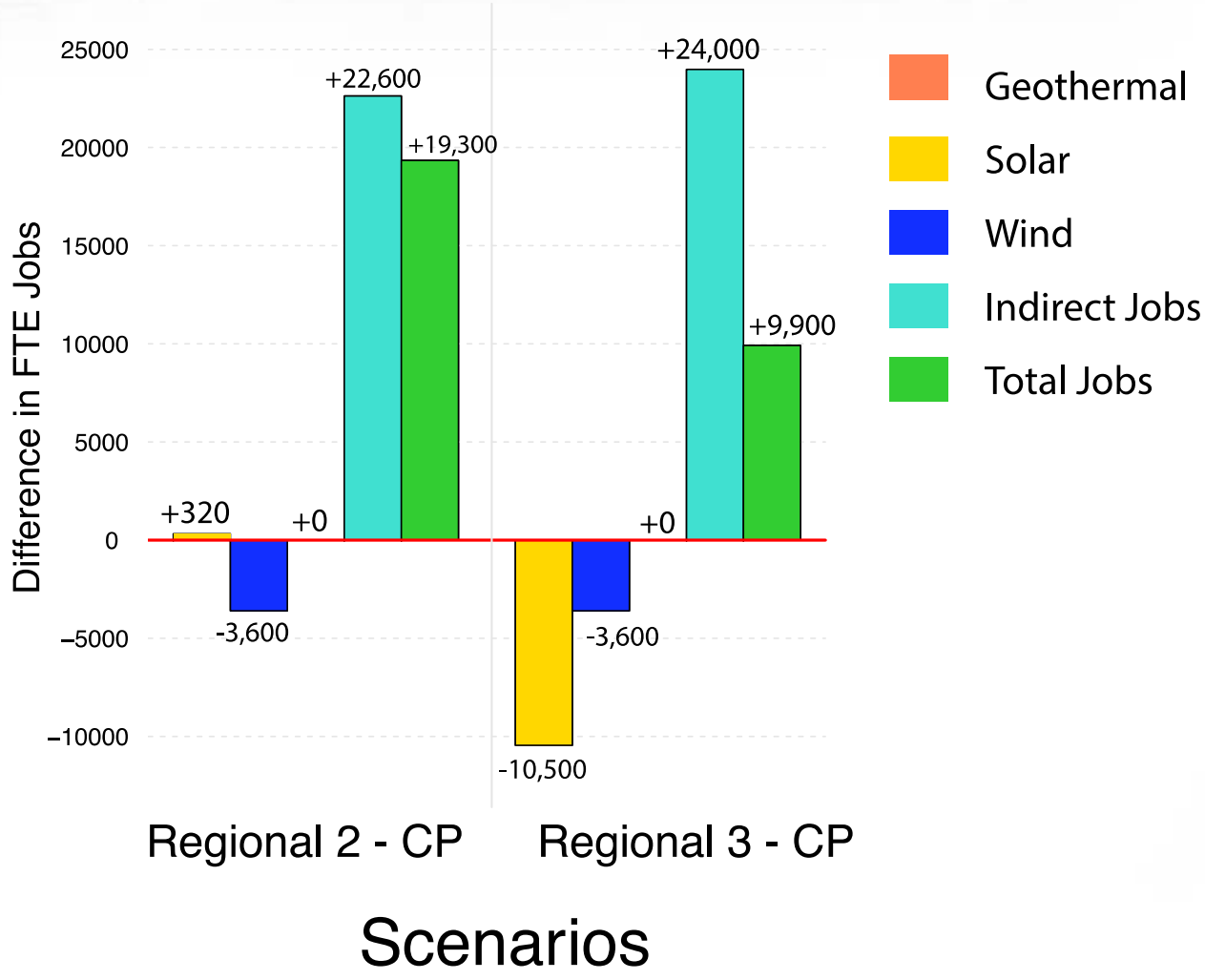
- Direct jobs contain both estimates short term construction jobs and long term operations
- Job estimates calculated using data from:
  - Solar – Phillips (2014)
  - Wind and Geothermal – Kaman & El Alami (2015)

Calculating Differences in Statewide Jobs Created

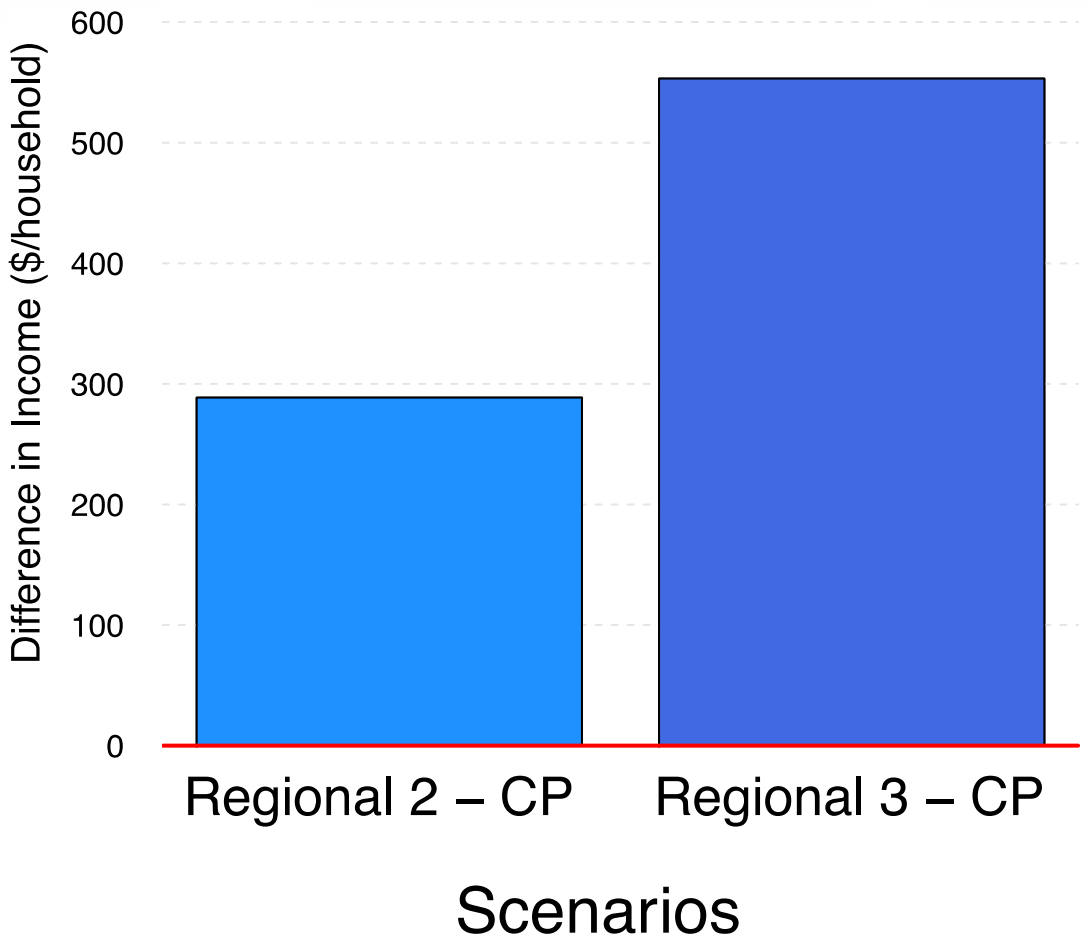
Change in Indirect Jobs S2 - S1A =
72,800 - 50,300 Jobs = +22,500



Difference in Statewide Jobs Created by 2030

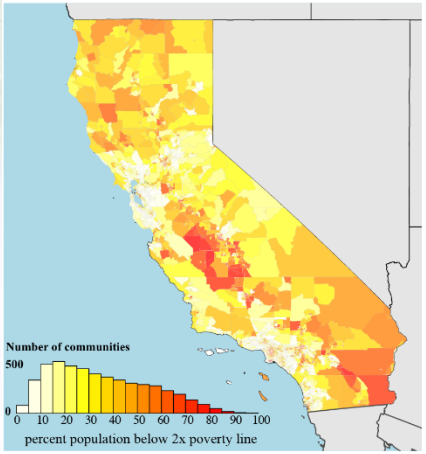


Difference in Statewide Income in 2030



Identifying Disadvantaged Communities (DCs) with CalEnviroScreen 2.0

Poverty



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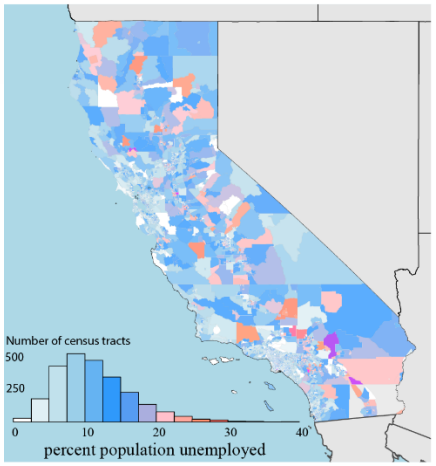
Unemployment

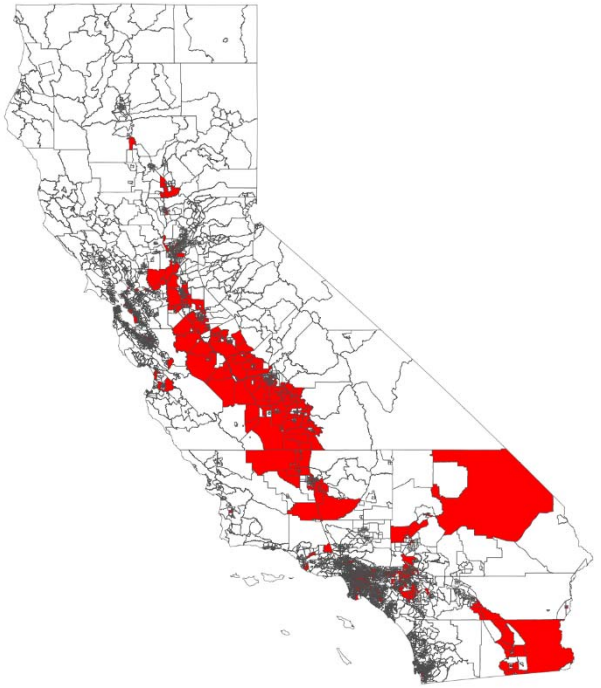


+ Environmental factors
+ Health factors
+ Other socioeconomic factors

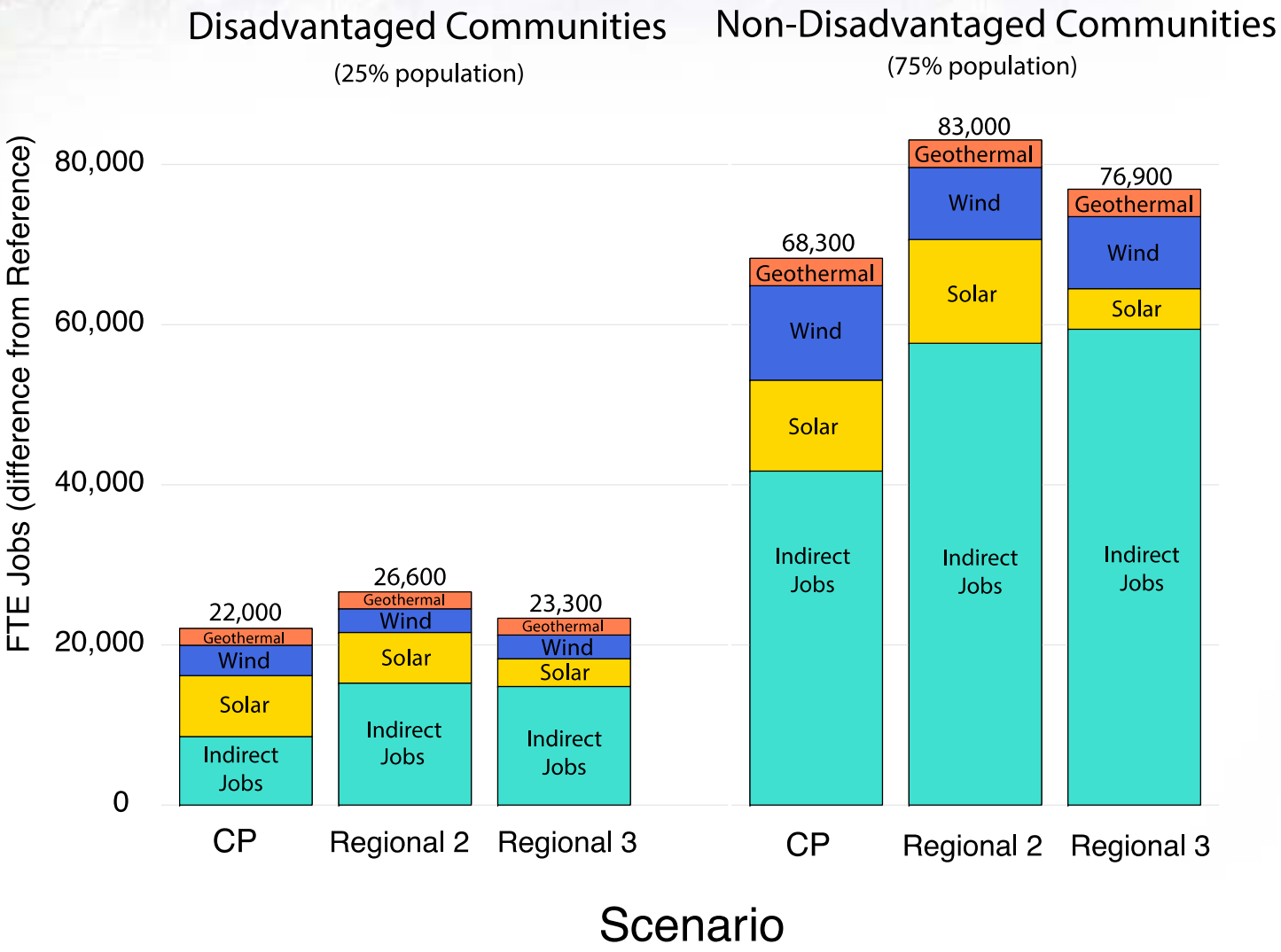
➔

CES Score

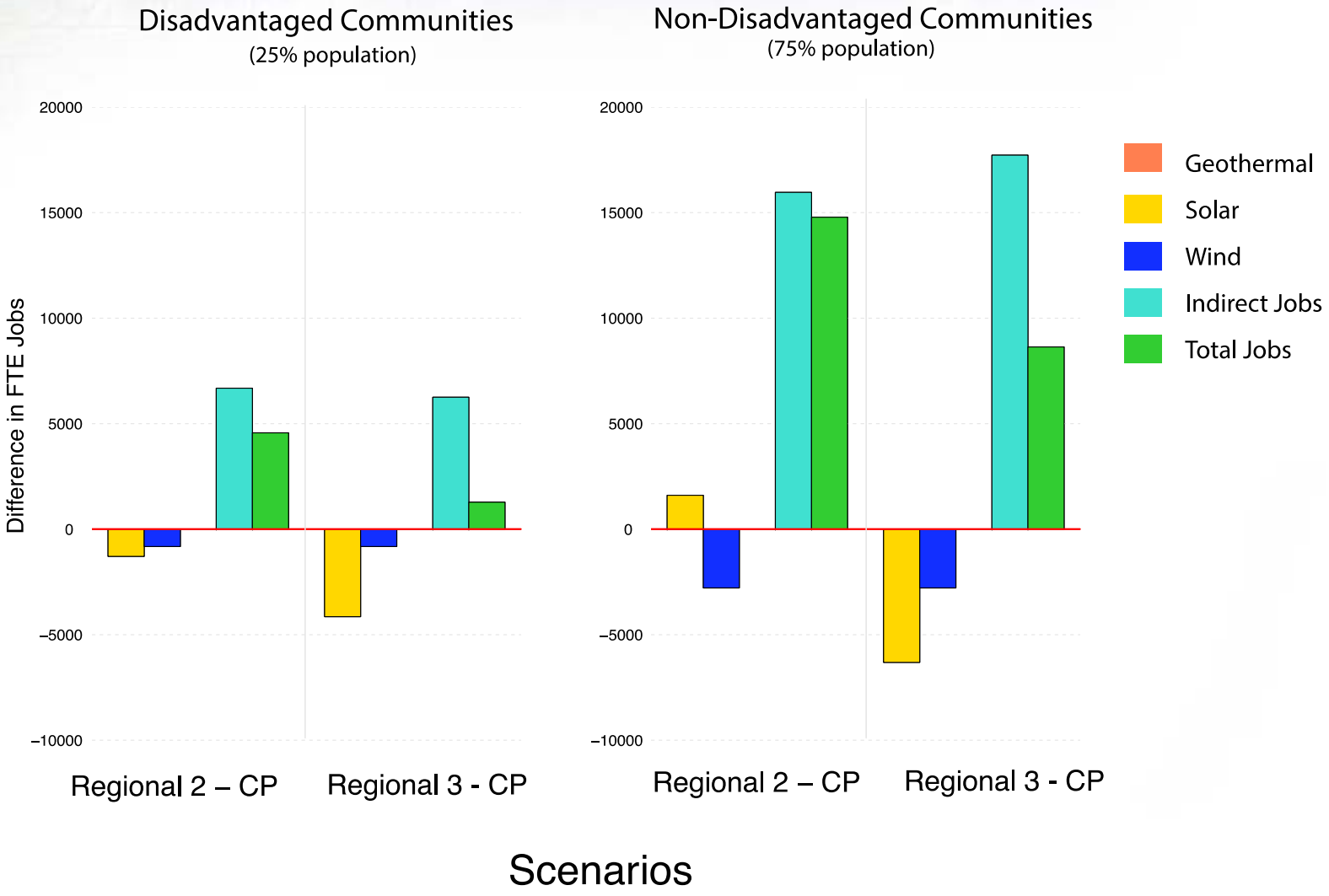
Top 25 percentile of CES Scores Designated as disadvantaged communities



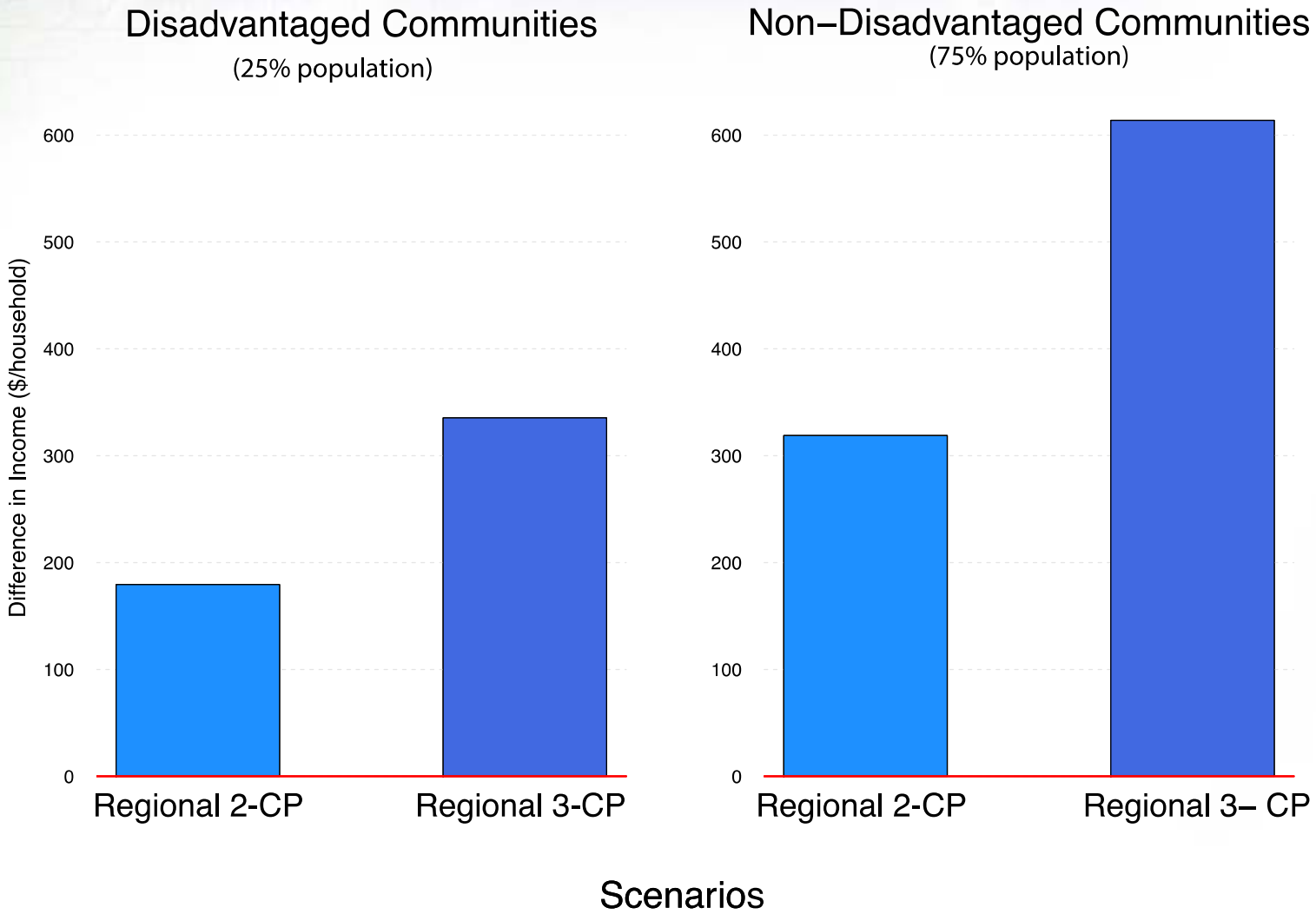
Job Creation Across Scenarios in DCs vs Non-DCs



Difference in Job Creation Across Scenarios in DCs versus Non-DCs

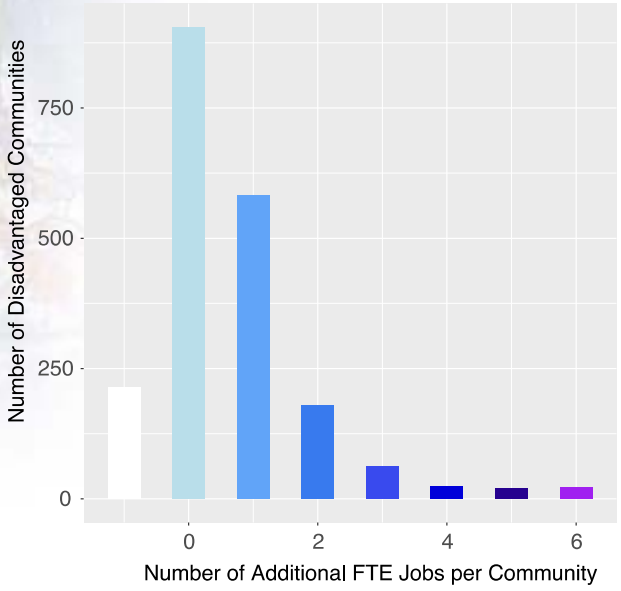


Difference in Real Income Across Scenarios in DCs versus Non-DCs



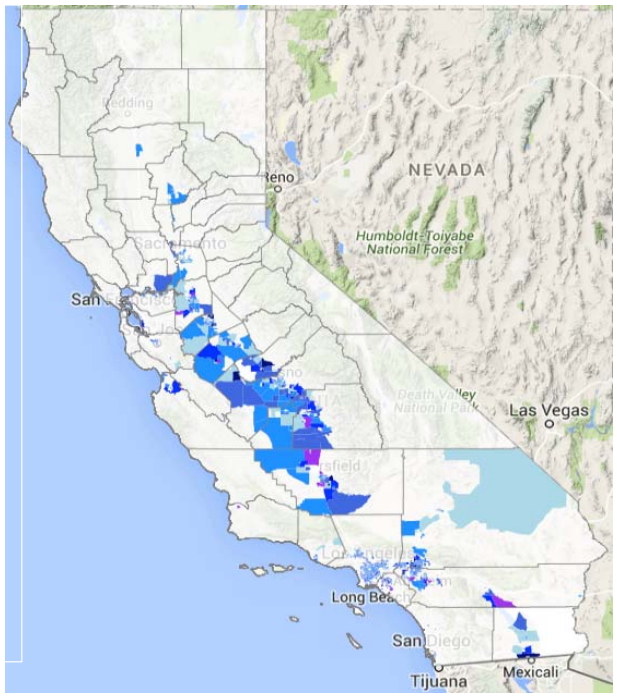
DC Difference in FTE Jobs

Distribution of Job Creation Differences

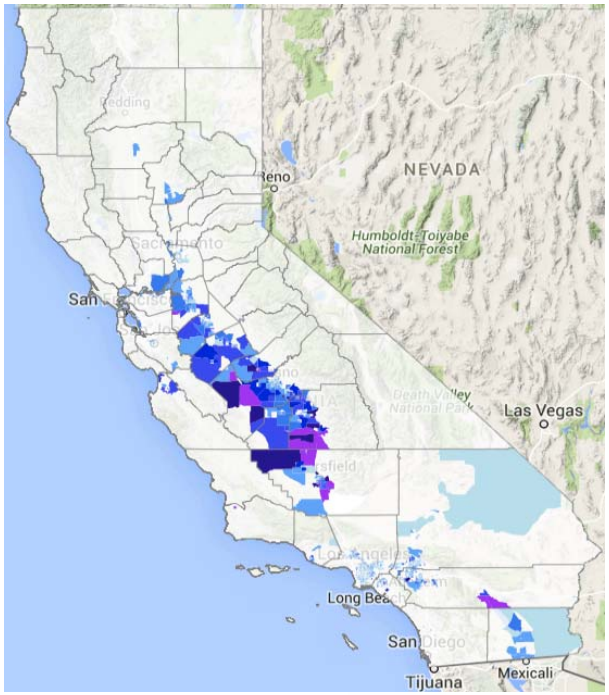


Location of Job Creation Differences

Regional 2 – CP

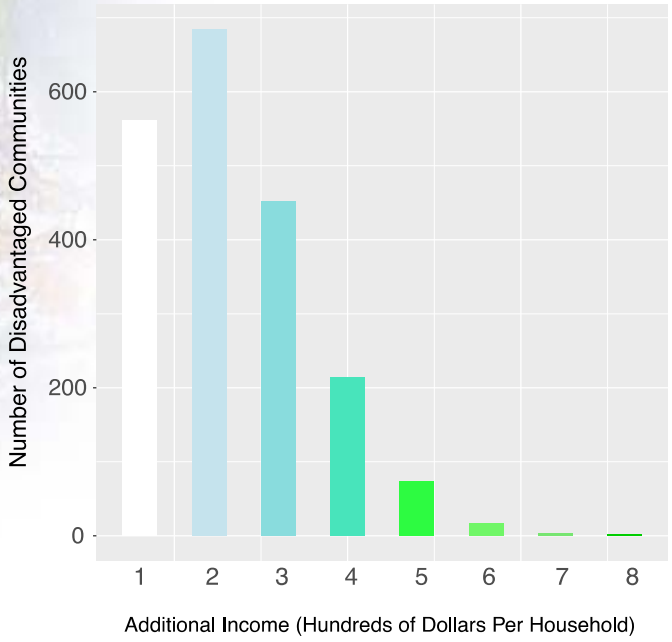


Regional 3 – CP



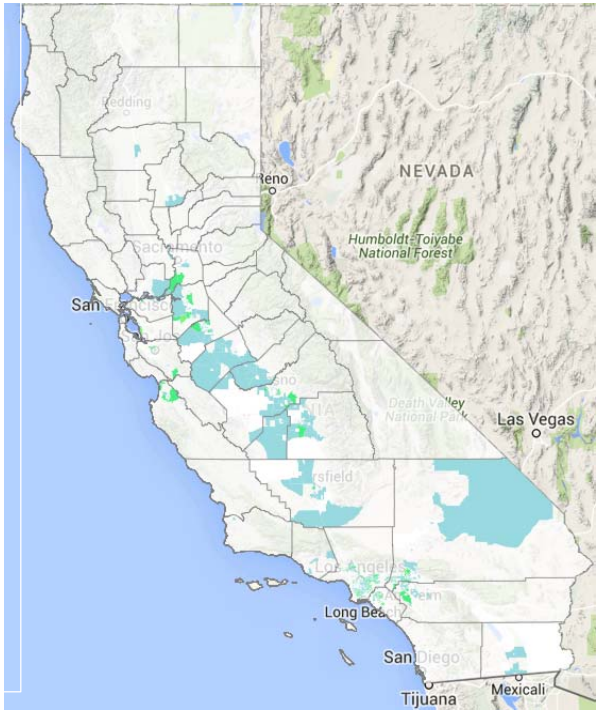
DC Differences in Income ($/hh)

Distribution of Income Difference

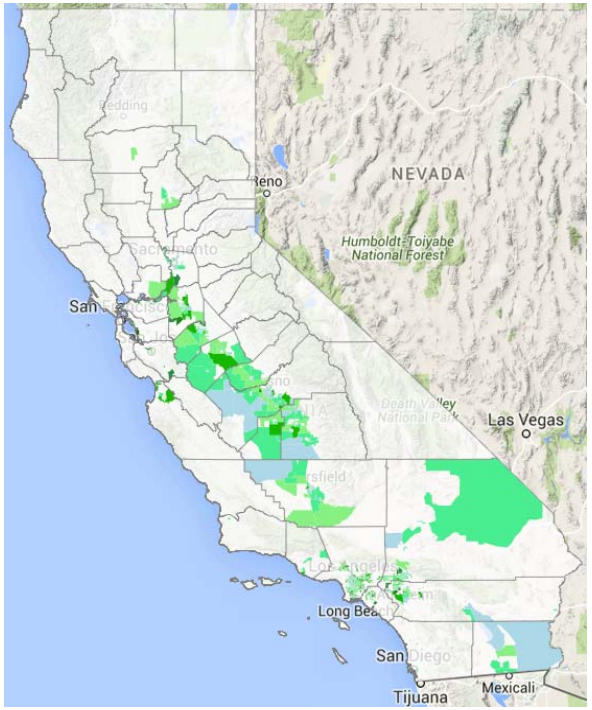


Location of Income Differences

Regional 2 – CP



Regional 3 – CP



DC Regions Studied in Detail

Regions	Counties within Region	% of DC's
San Diego and Imperial	San Diego, Imperial	2%
Inland Valley	San Bernardino, Riverside	13%
Los Angeles	Los Angeles, Ventura, Orange	56%
Central Coast	Monterey, San Luis Obispo, Santa Barbara, Santa Cruz, San Benito	<1%
Bay Area	San Francisco, Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, San Mateo	4%
Sacramento	El Dorado, Placer, Sacramento, Yolo, Sutter, Yuba	2.5%
North State	Del Norte, Siskiyou, Modoc, Humboldt, Trinity, Shasta, Lassen, Tehama, Plumas, Sierra, Nevada, Butte, Glenn, Colusa, Lake, Mendocino	<1%
Central Valley	San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, Kern, Mariposa, Tuolumne, Calaveras, Amador	22%
Southern Sierra	Alpine, Mono, Inyo	None

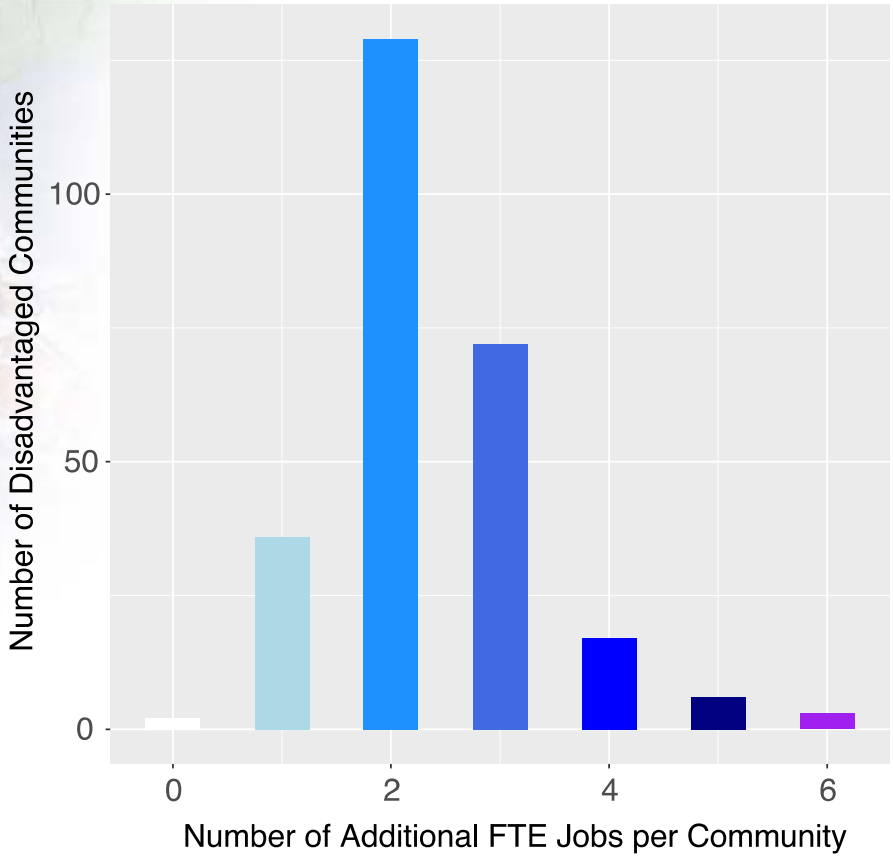
Inland Valley

- 11.4% of state population
- 6.6% unemployment rate
- Average household Income = $71,867
- 265 disadvantaged communities (13% of state total)

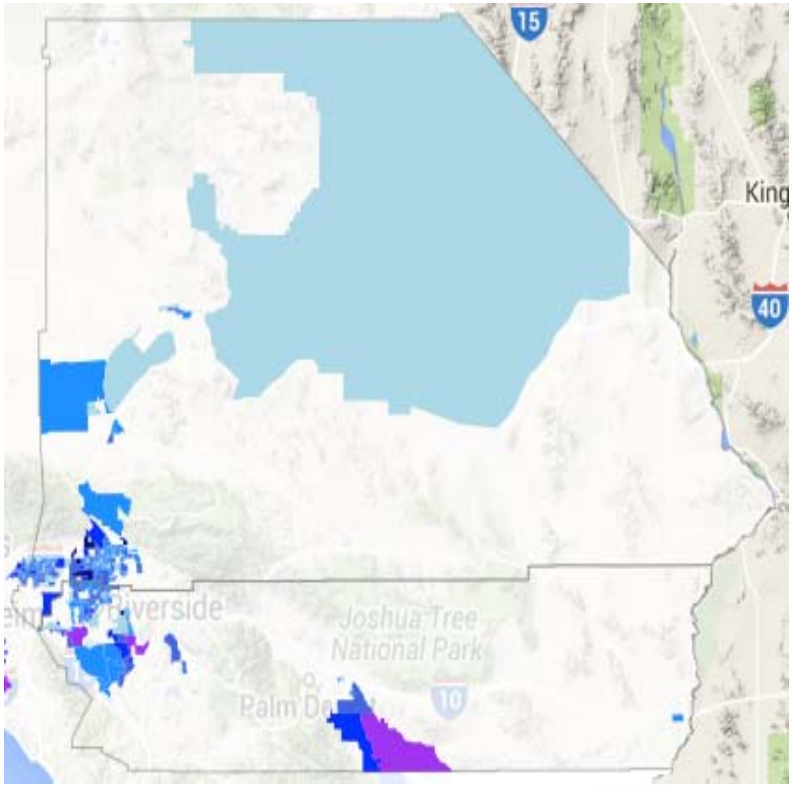
Inland Valley

Difference in Jobs Created, (R2-CP)

Distribution of Job Creation Differences



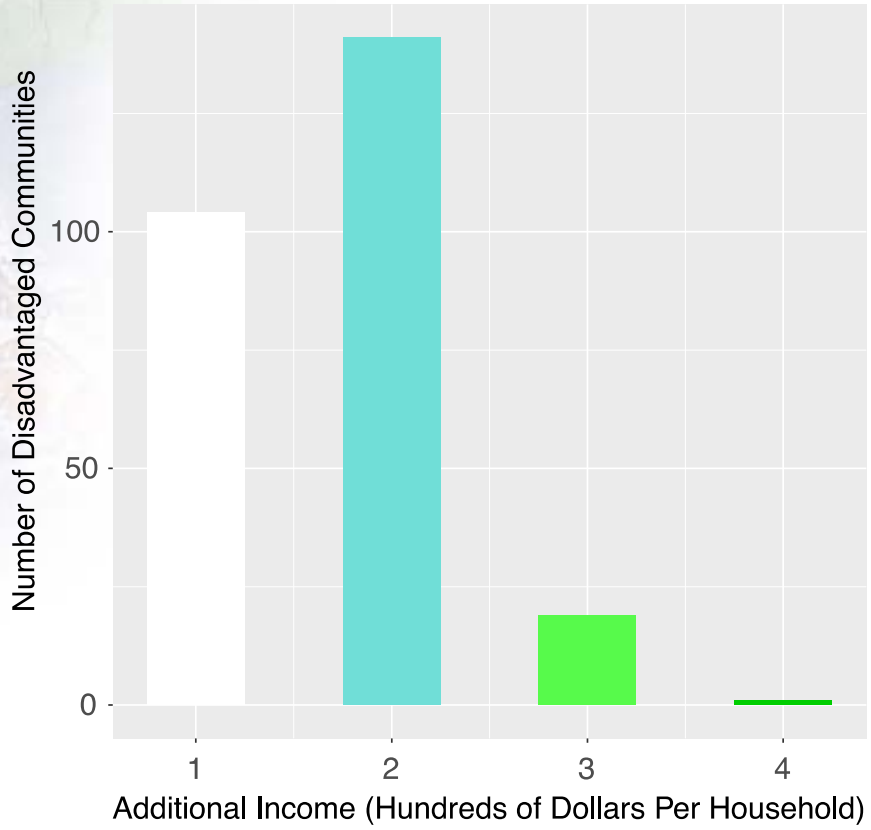
Location of Job Creation Differences



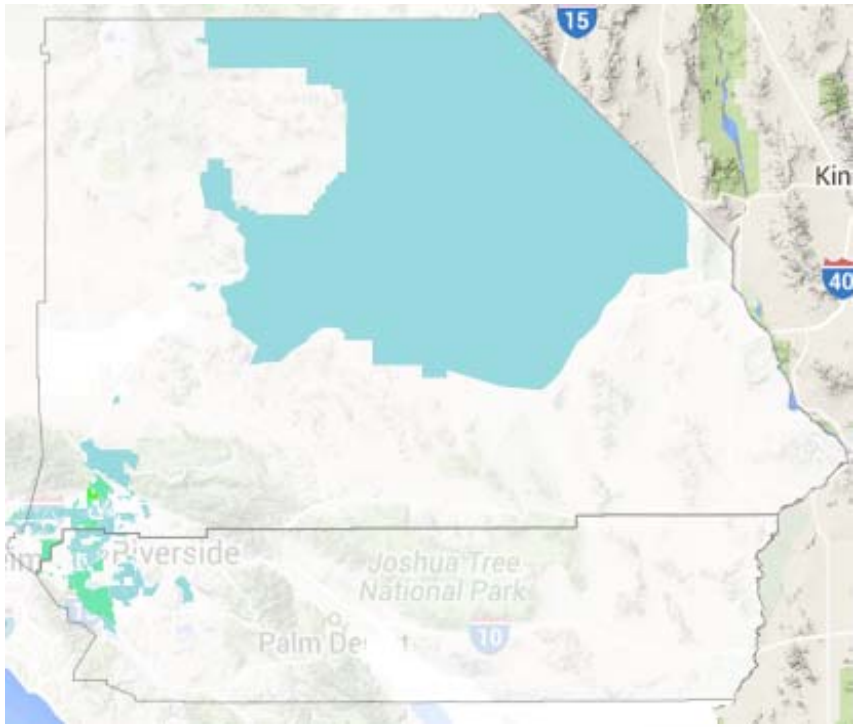
Inland Valley

Difference in Income ($/hh), (R2-CP)

Distribution of Income Difference



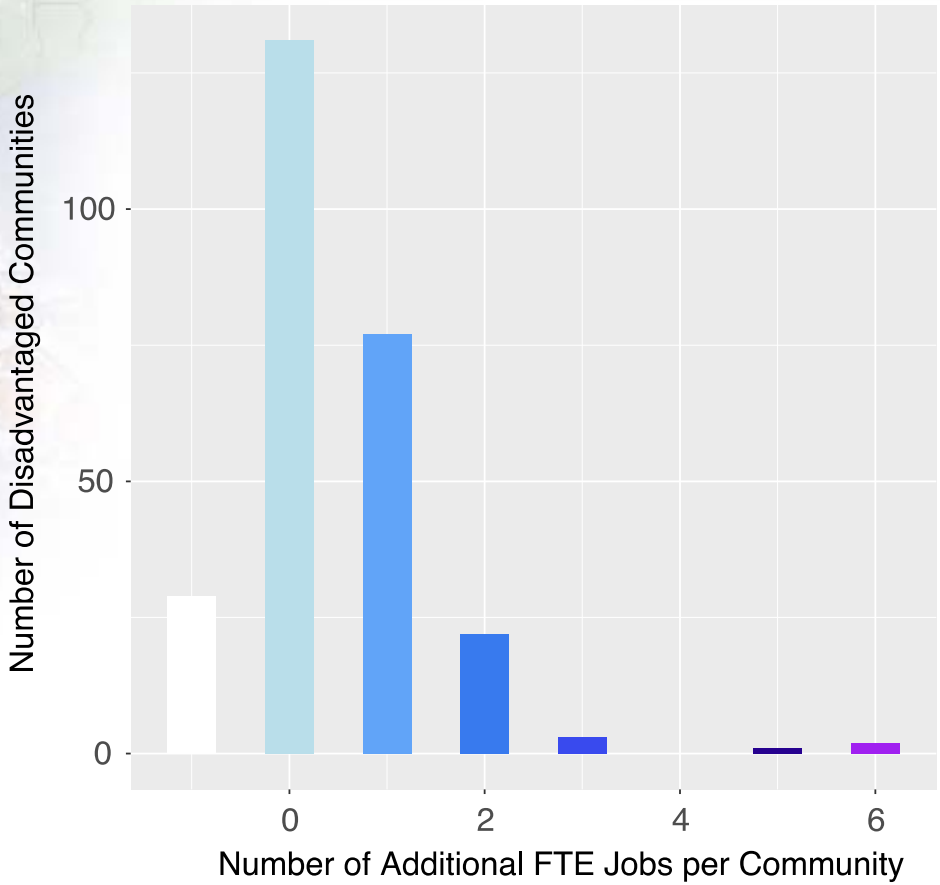
Location of Income Differences



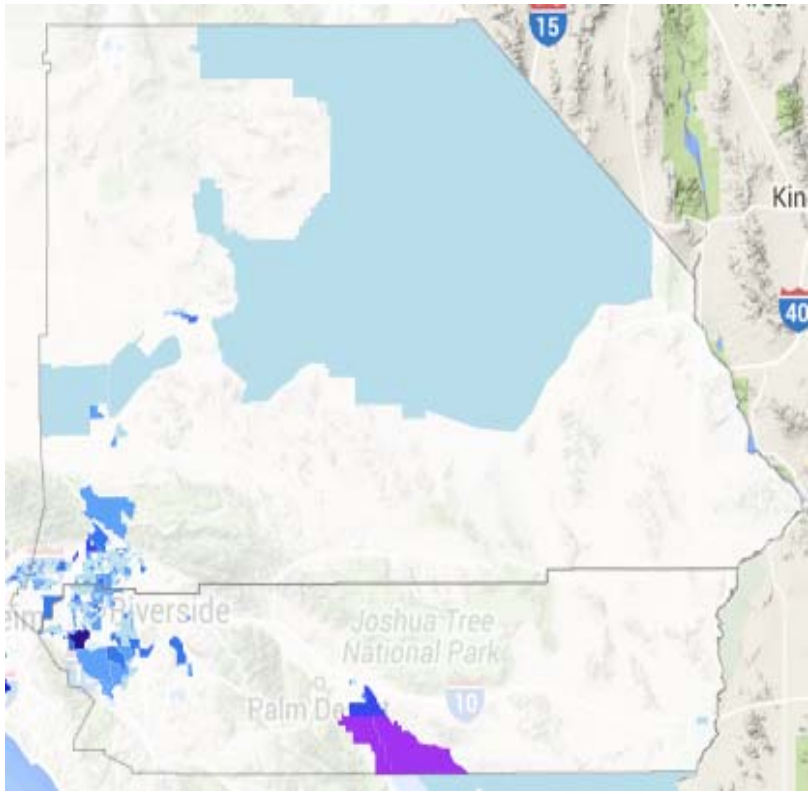
Inland Valley

Difference in Jobs Created, (R3-CP)

Distribution of Job Creation Differences



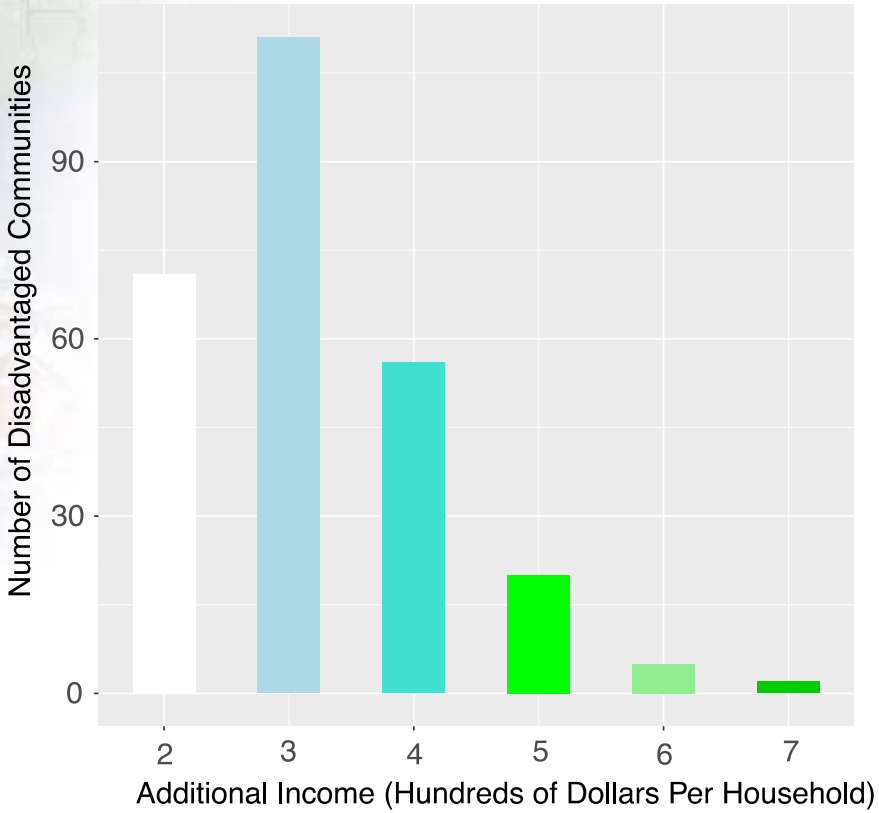
Location of Job Creation Differences



Inland Valley

Difference in Income ($/hh), (R3-CP)

Distribution of Income Differences



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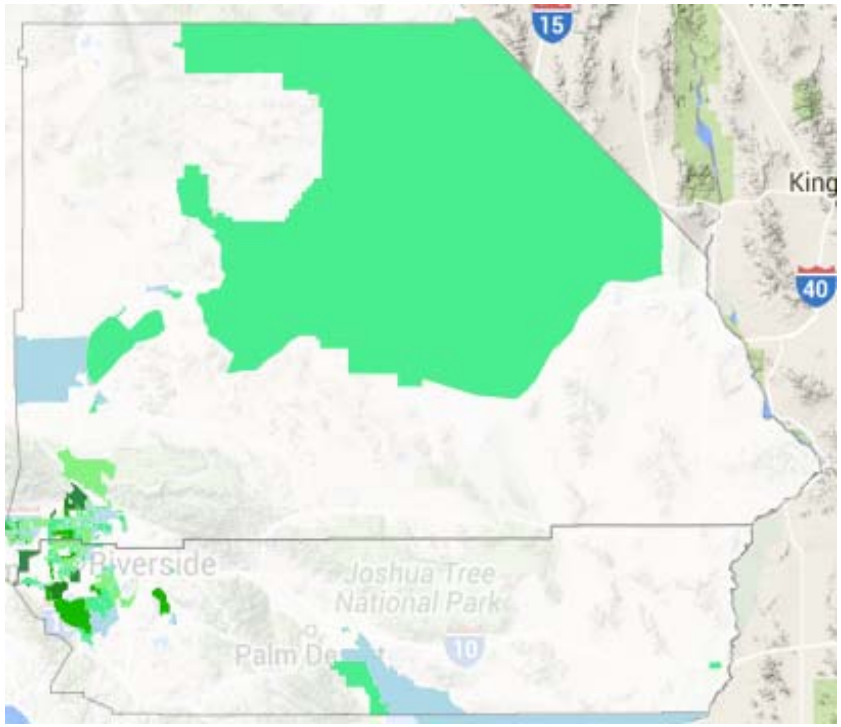


Greater Los Angeles Area

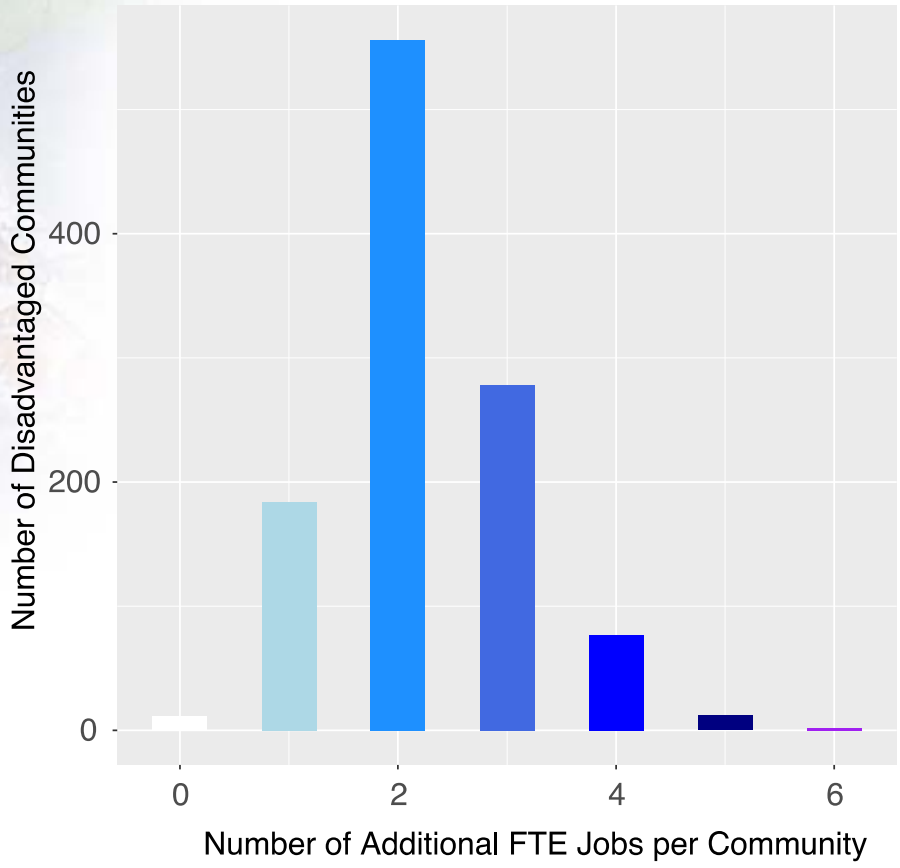
- 36.5% of state population
- 6.1% unemployment rate
- Average household Income = $87,728
- 1120 disadvantaged communities

  (56% of state total)

Greater Los Angeles Area

Difference in Jobs Created, (R2-CP)

Distribution of Job Creation Differences



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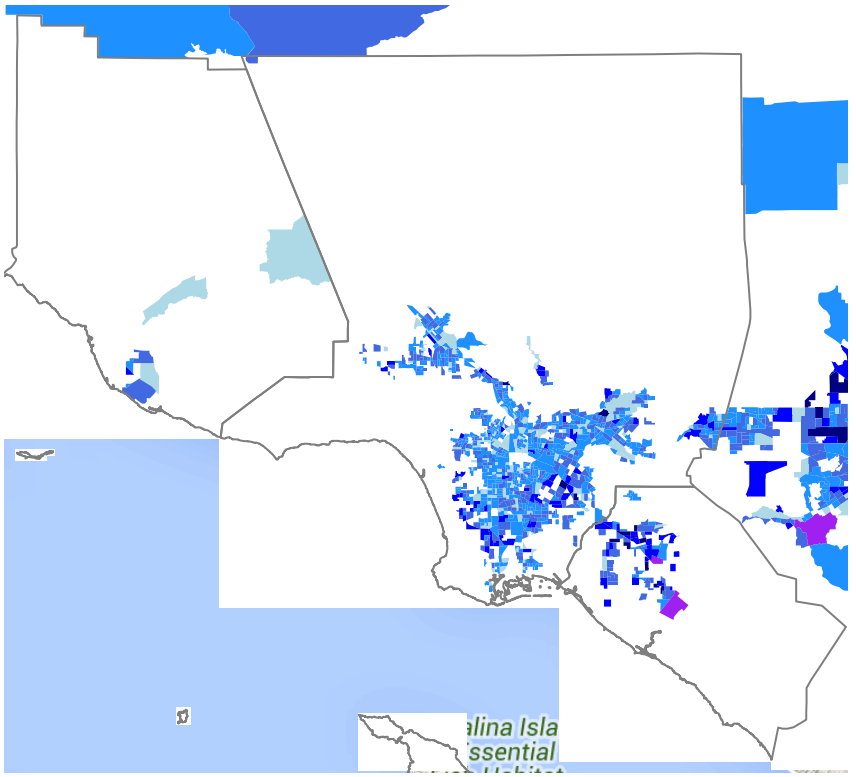
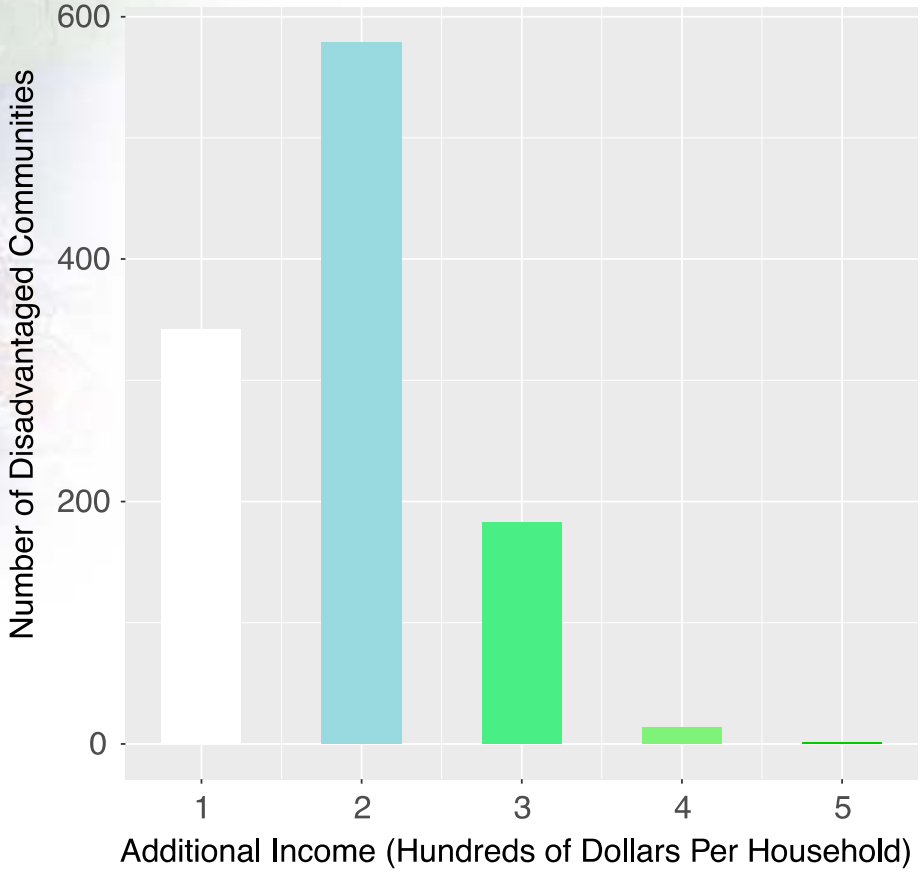


Greater Los Angeles Area

Difference in Income ($/hh), (R2-CP)

Distribution of Income Differences



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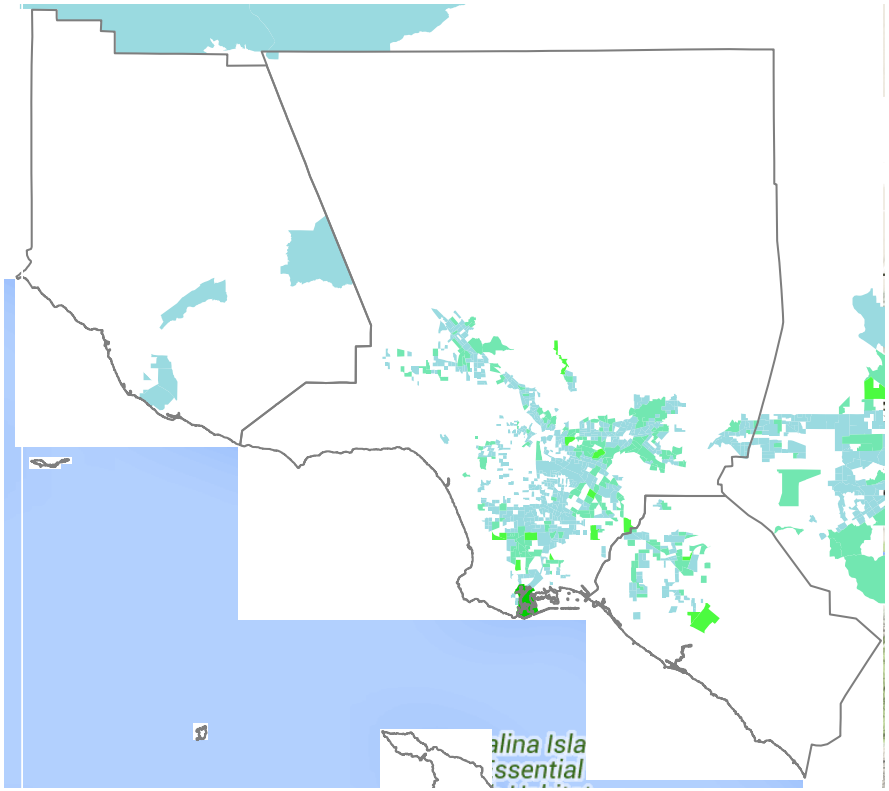
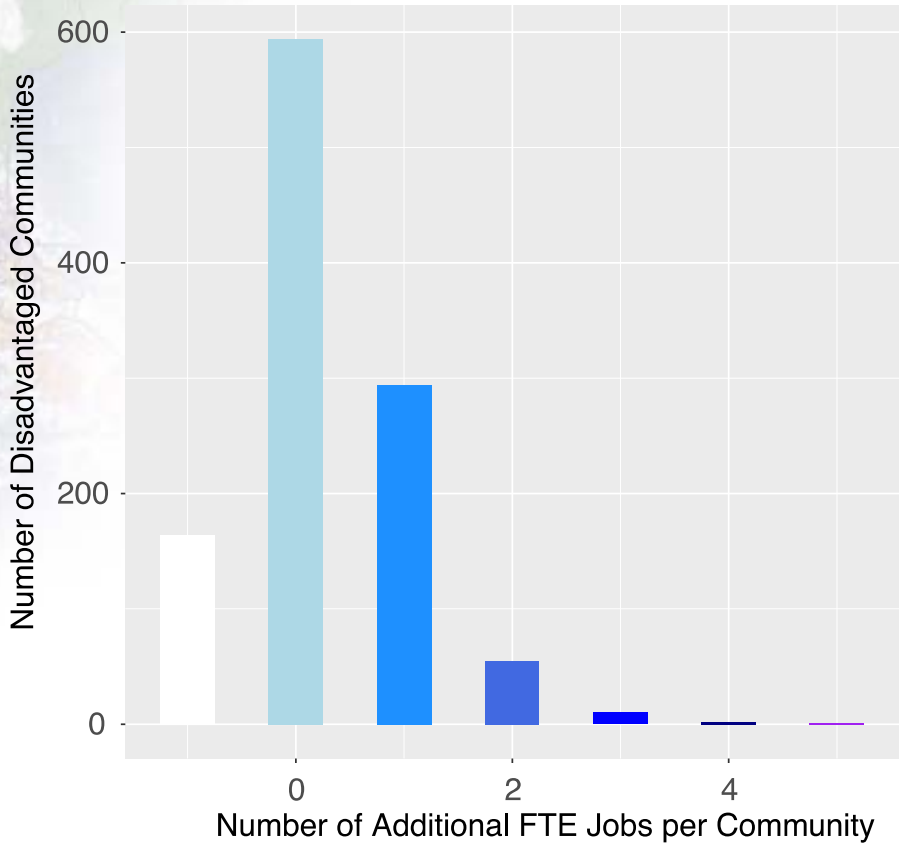


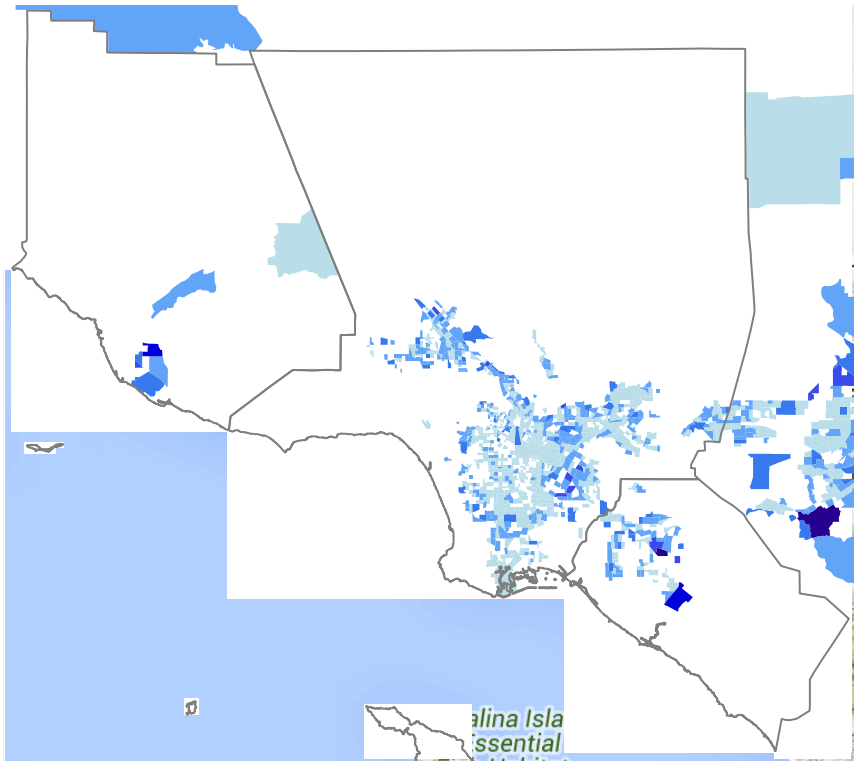
Greater Los Angeles Area

Difference in Jobs Created, (R3-CP)

Distribution of Job Creation Differences



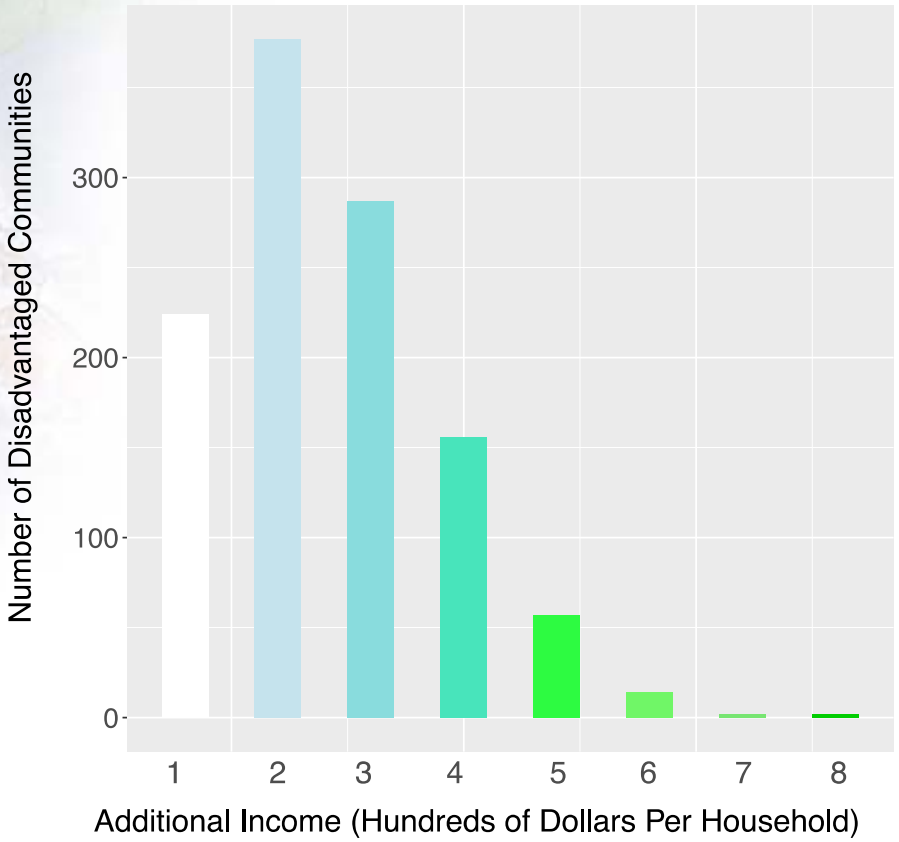
Location of Job Creation Differences



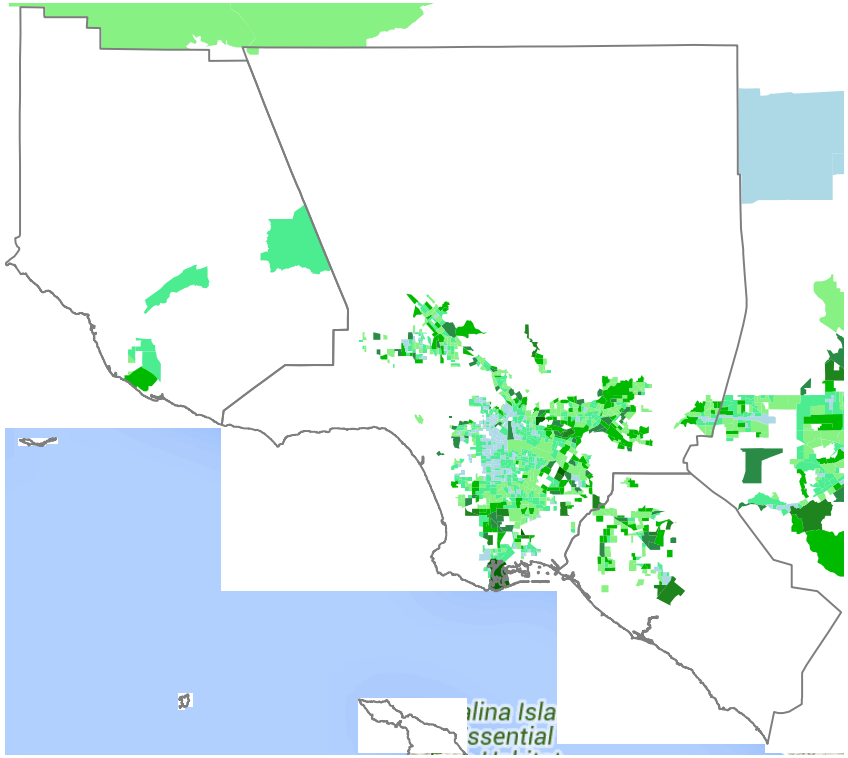
Greater Los Angeles Area

Difference in Income ($/hh), (R3-CP)

Distribution of Income Differences

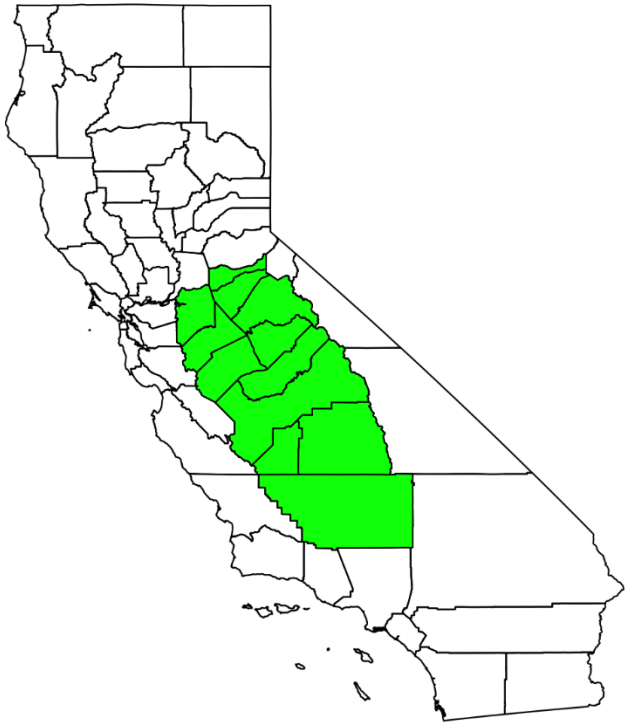


Location of Income Differences



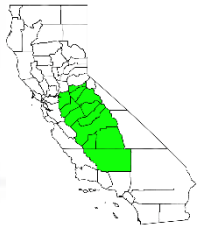
Central Valley

- 10.6% of state population
- 10% unemployment rate
- Average household Income = $64,756
- 433 disadvantaged communities (22% of state total)

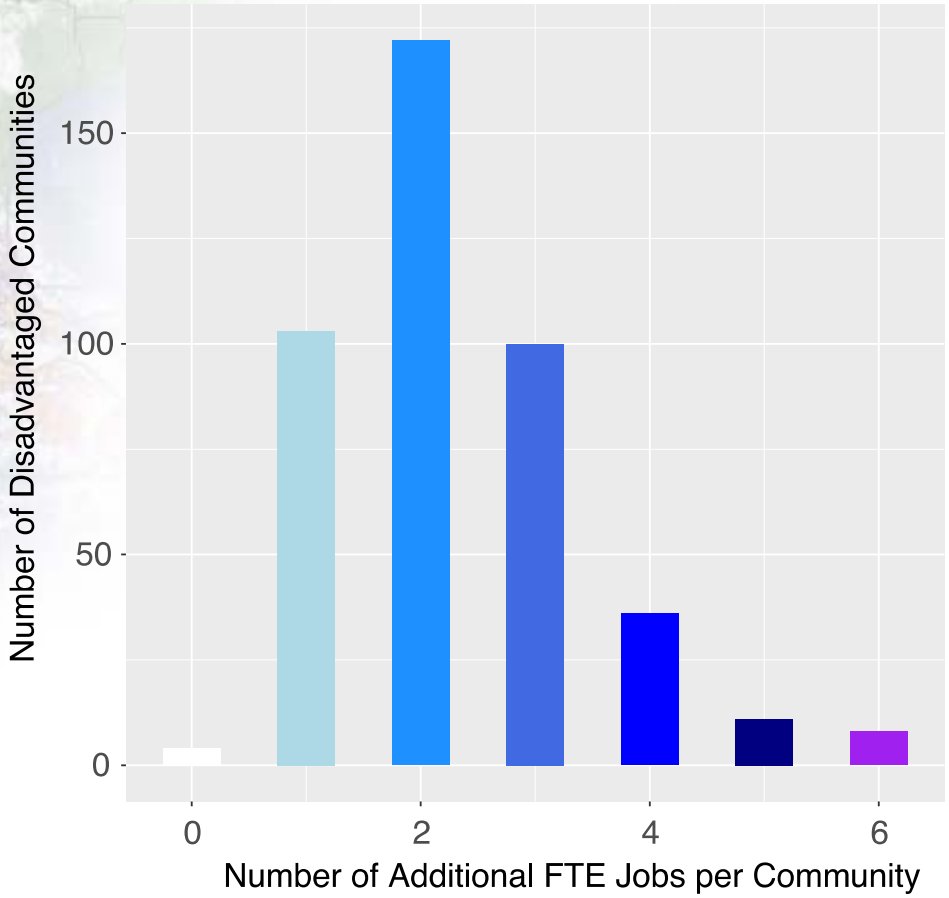


Central Valley

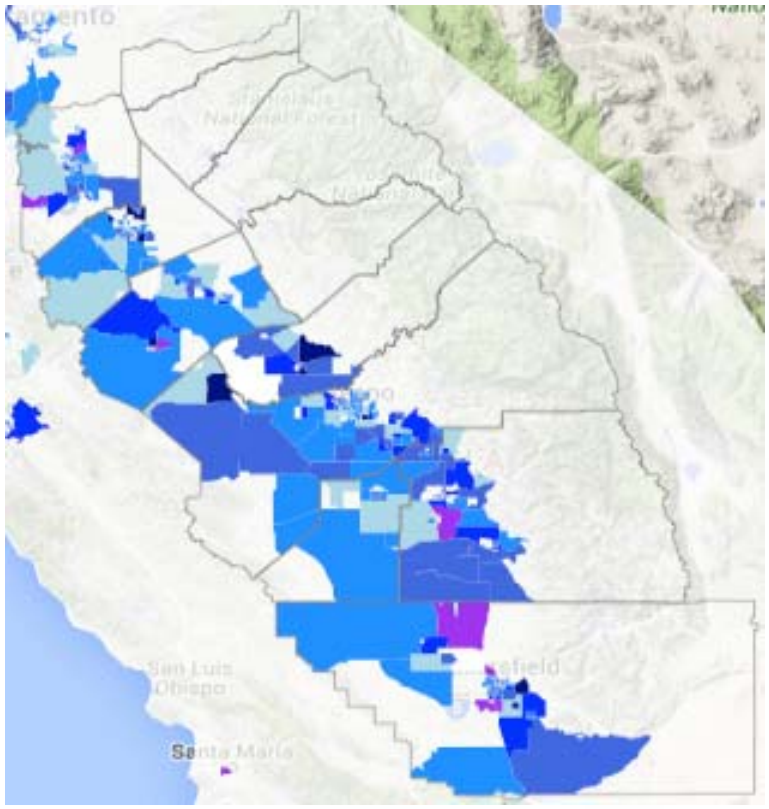
Difference in Jobs Created, (R2-CP)



Distribution of Job Creation Differences

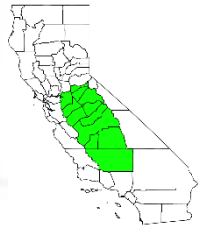


Location of Job Creation Differences

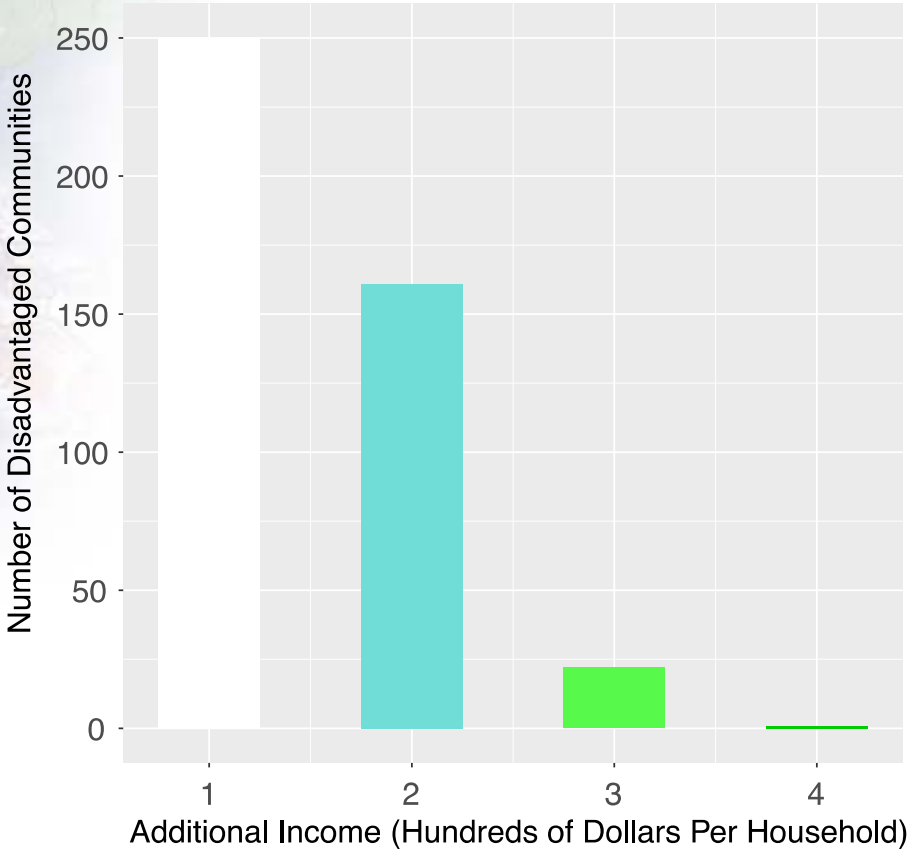


Central Valley

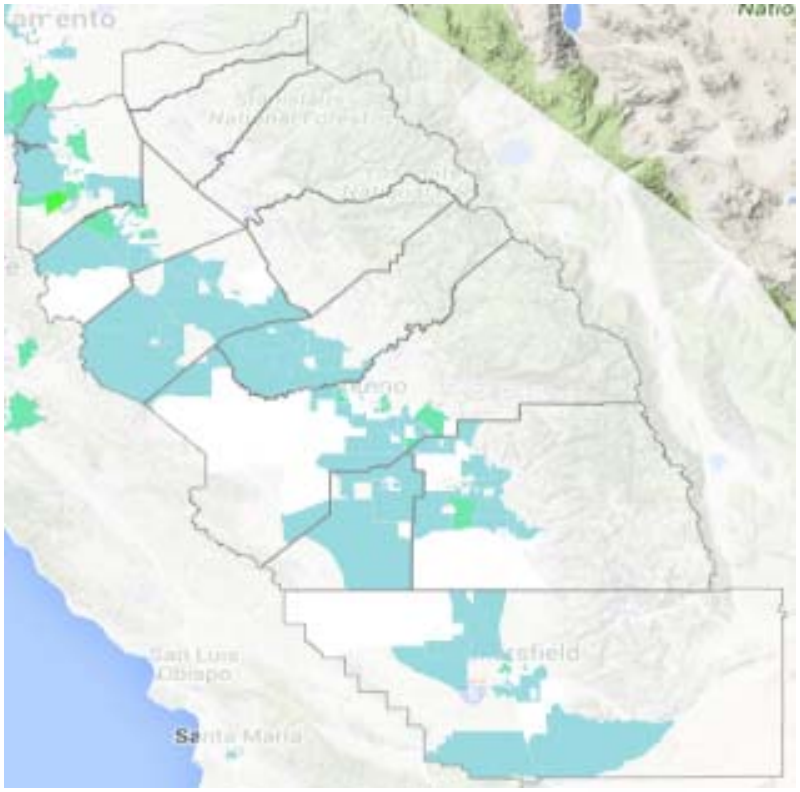
Difference in Income ($/hh), (R2-CP)



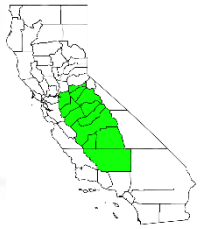
Distribution of Income Differences



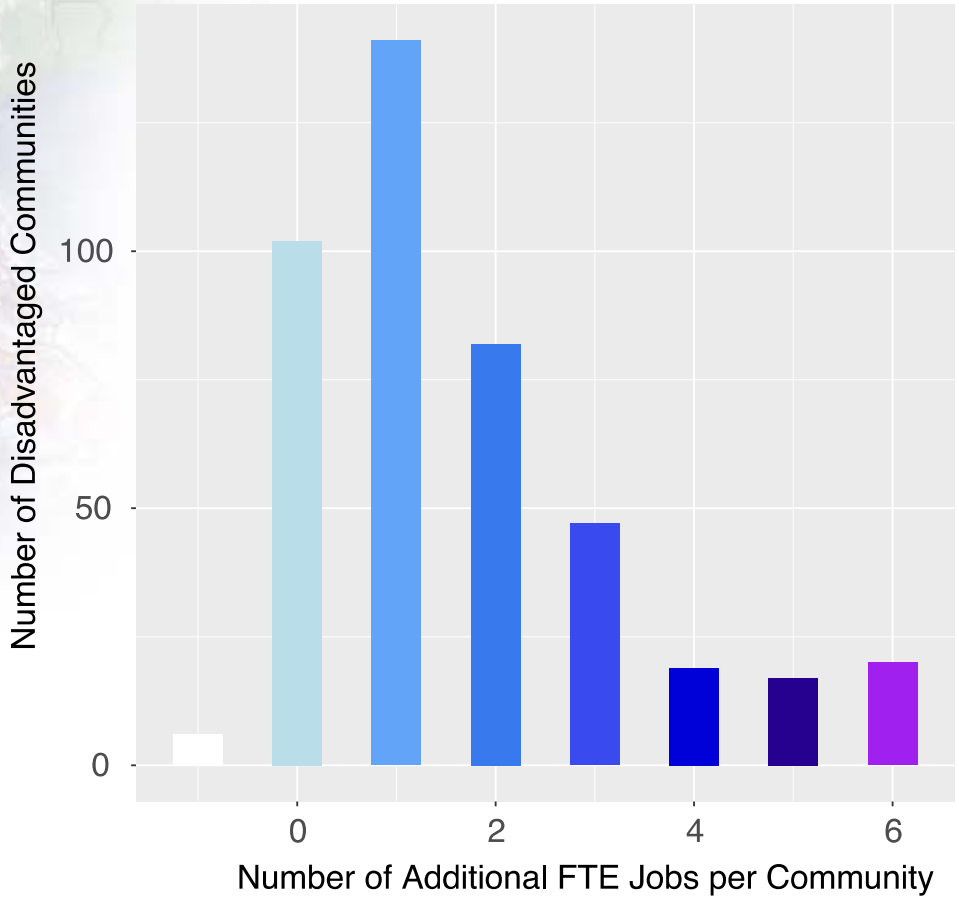
Location of Income Differences



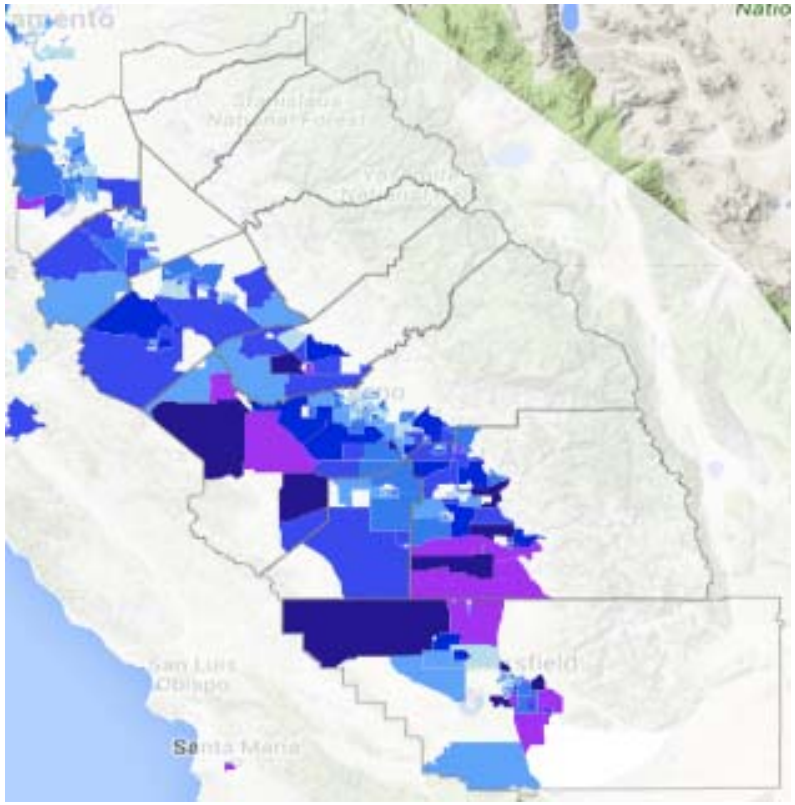
Central Valley
Difference in Jobs Created, (R3-CP)



Distribution of Job Creation Differences

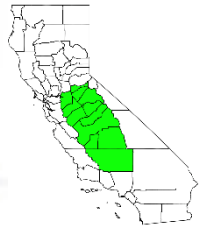


Location of Job Creation Differences

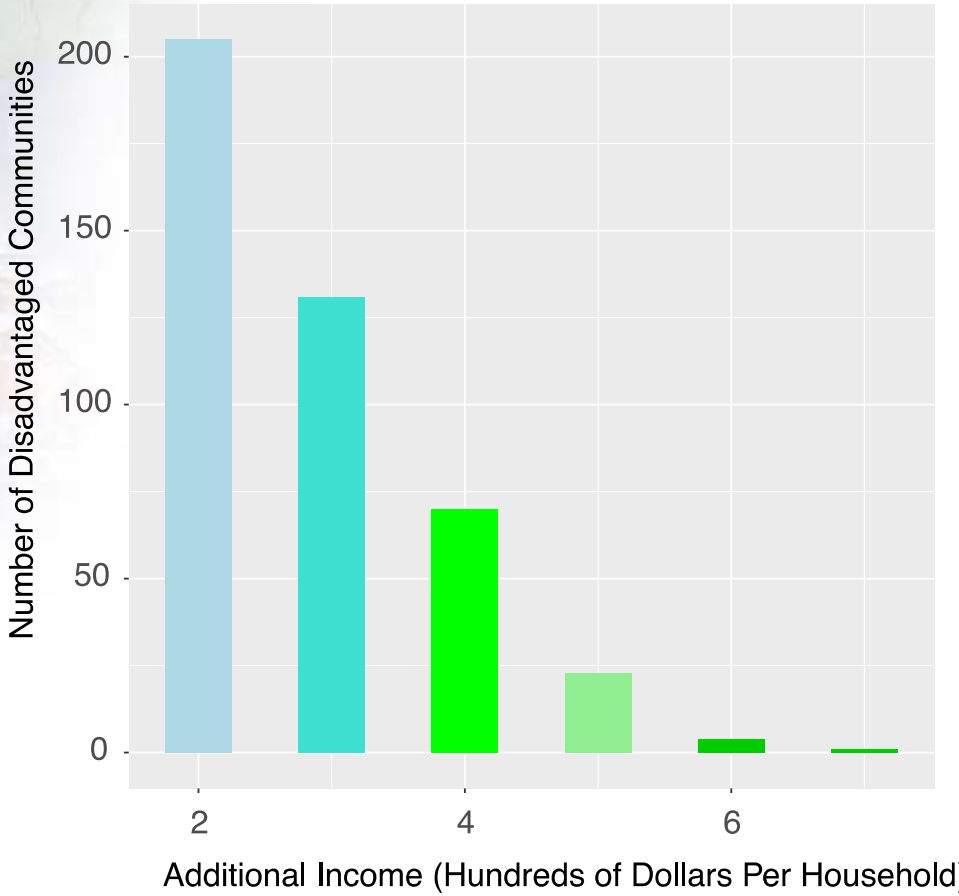


Central Valley

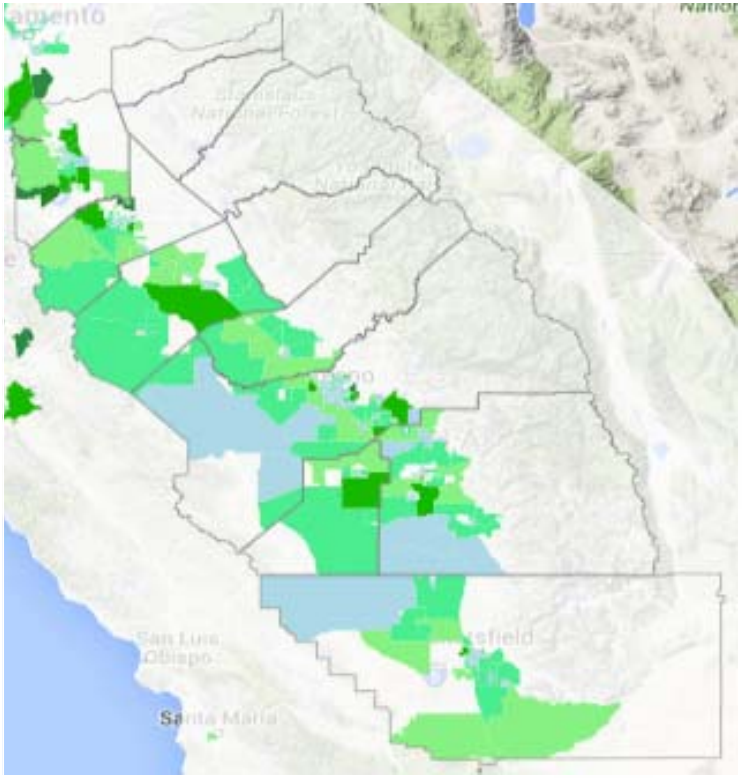
Difference in Income ($/hh), (R3-CP)



Distribution of Income Differences



Location of Income Differences



Conclusions

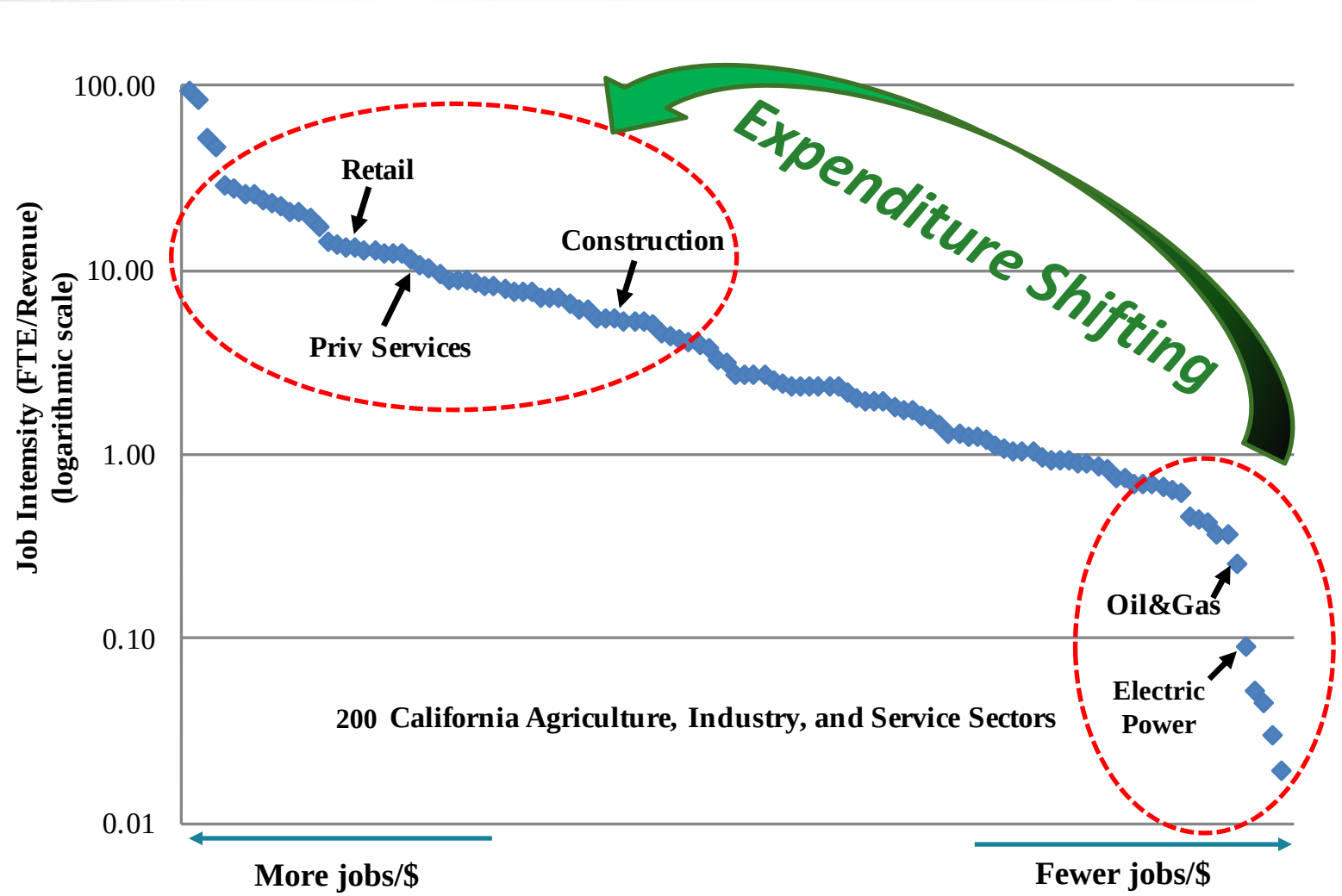
- All three RPS scenarios offer stimulus to the California economy.
- The regionalization scenarios (Regional 2 and Regional 3)
  - Create more numerous and diverse jobs due to greater rate-payer savings
  - Deliver the most extensive economic benefits to California households and enterprises.

Discussion

A Few Economic Principles

1. Infrastructure investment creates short-term employment.
2. Capacity investment creates short and long term jobs, depending on import content of renewable technology and O&M budgets.
3. Expenditure Shifting: Demand funded by energy savings is a potent and pervasive source of long term, diverse job creation. These jobs are more likely to be for instate services that cannot be outsourced

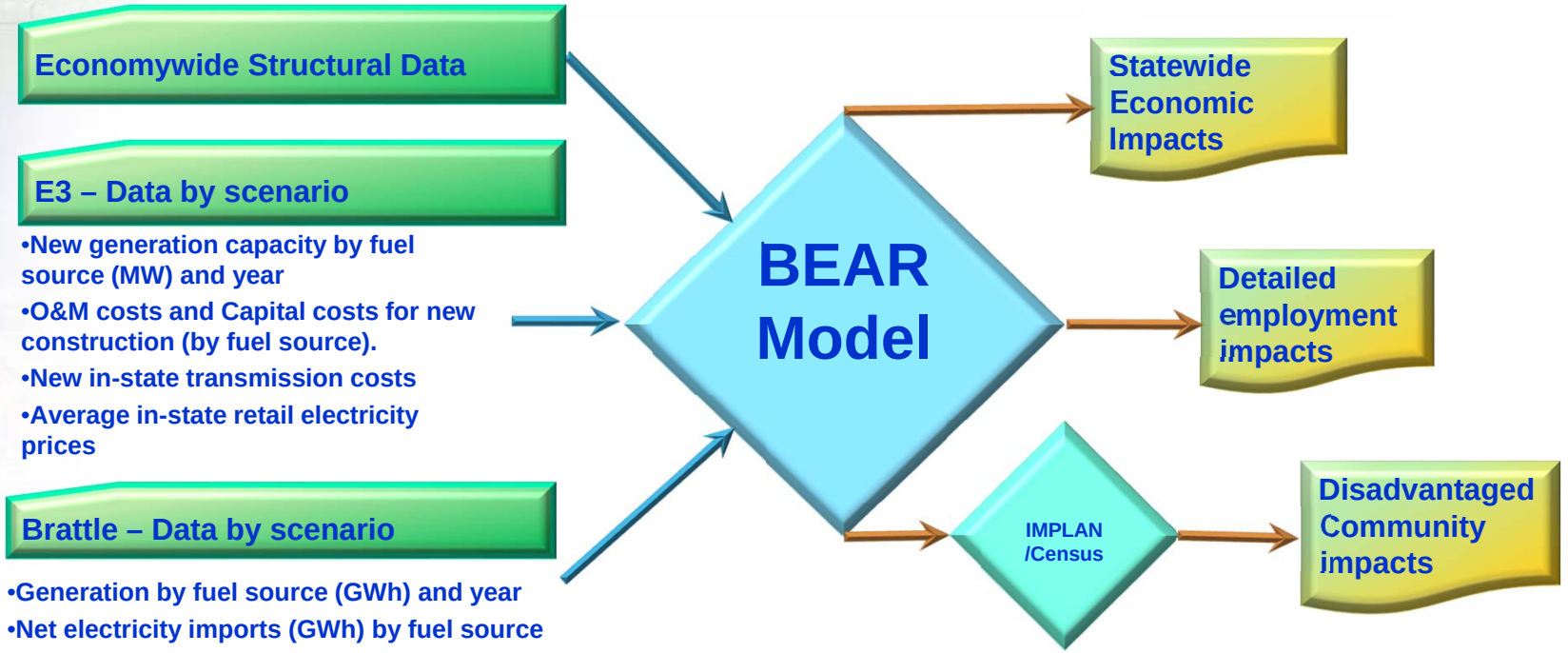
How Energy Savings Create Jobs



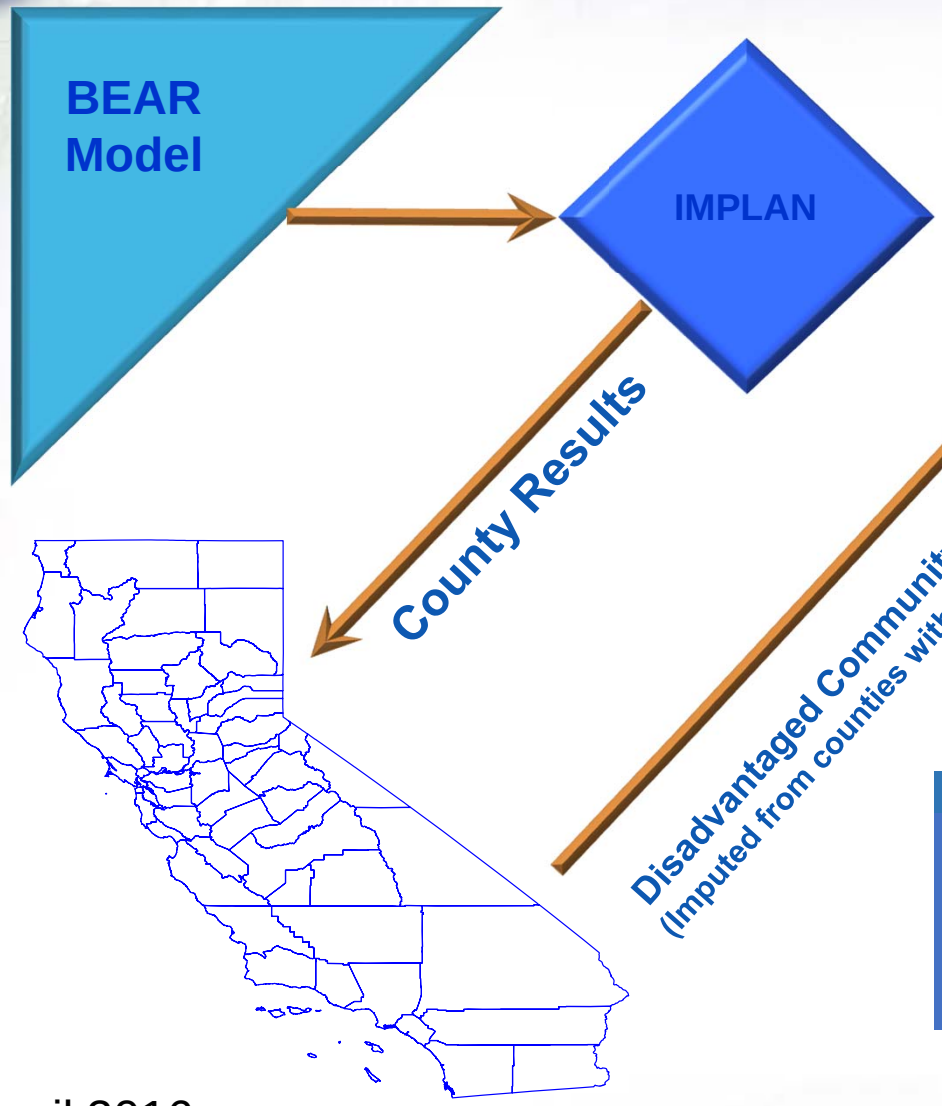
Forecasting Model: General Features

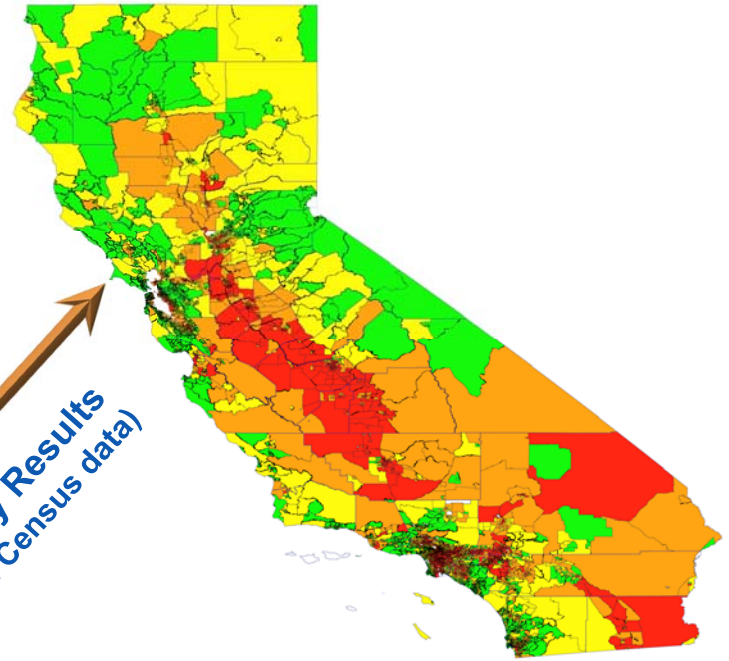
- A state economy model
  - California's economic structure is unique
  - Our stakeholders need clear information on the adjustment process
  - National and regional assessments can mask extensive interstate and regional spillovers and trade-offs
- A dynamic general equilibrium model
  - Traces pathways of growth and job creation
  - Captures detailed interactions and linkages across markets and between institutions
  - Captures extensive direct, indirect, and induced impacts
  - Evaluates policies ex ante, identifying benefits and adjustment needs to facilitate dialog and implementation

Economic Assessment Framework



Detailed Livelihoods Impacts





	Impacts in Disadvantaged Communities
1	Employment
2	Wages
3	Real Household Incomes
4	Real Household Consumption
5	Household Energy Cost

Economic Data for California, 2013

- 200 production activities
- 200 commodities (includes trade and transport margins)
- 24 factors of production
  - 22 labor categories
  - Capital
  - Land
- 10 Household income groups
- Enterprises
- Federal Government (7 fiscal accounts)
- State Government (27 fiscal accounts)
- Local Government (11 fiscal accounts)
- Consolidated capital account
- External Trade Accounts
  - Rest of United States
  - Rest of the World

Detailed Occupational Analysis

The BEAR Model tracks employment by sector (200) and by 9, 22, or 95 occupations

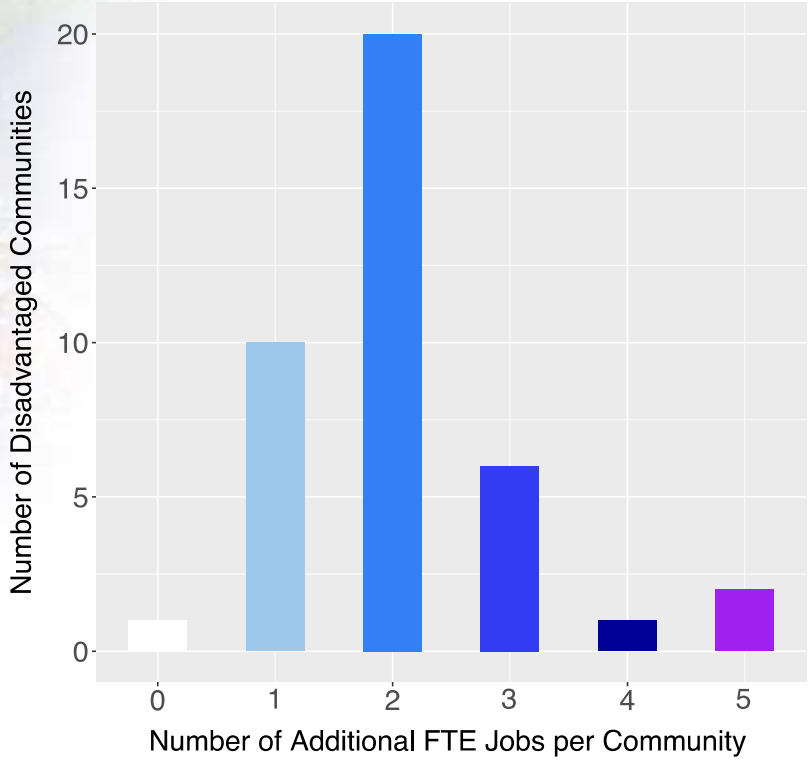
1. **Management occupations**
2. **Business and financial operations occupations**
3. **Computer and mathematical science occupations**
4. **Architecture and engineering occupations**
5. **Life, physical, and social science occupations**
6. **Community and social services occupations**
7. **Legal occupations**
8. **Education, training, and library occupations**
9. **Arts, design, entertainment, sports, and media occupations**
10. **Healthcare practitioners and technical occupations**
11. **Healthcare support occupations**
12. **Protective service occupations**
13. **Food preparation and serving related occupations**
14. **Building and grounds cleaning and maintenance occupations**
15. **Personal care and service occupations**
16. **Sales and related occupations**
17. **Office and administrative support occupations**
18. **Farming, fishing, and forestry occupations**
19. **Construction and extraction occupations**
20. **Installation, maintenance, and repair occupations**
21. **Production occupations**
22. **Transportation and material moving occupations**

San Diego and Imperial

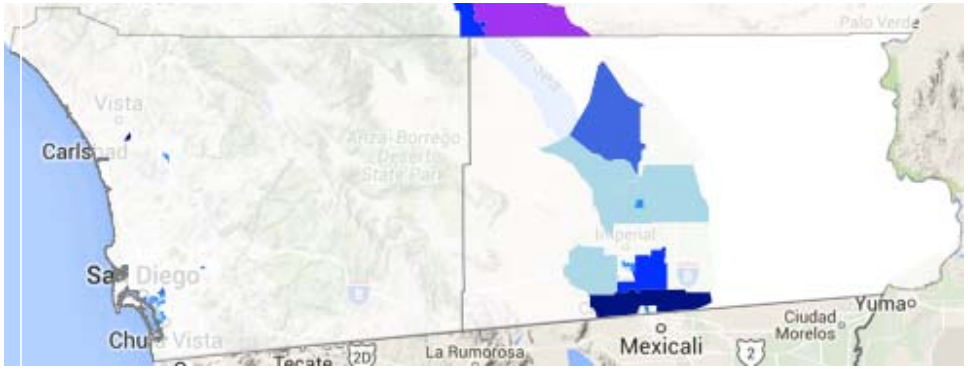
- 8.8% of state population
- 6.1% average unemployment rate
- Average household Income = $85,193
- 40 disadvantaged communities (2% of state total)

San Diego and Imperial
Difference in Jobs Created, (R2-CP)

Distribution of Job Creation Differences



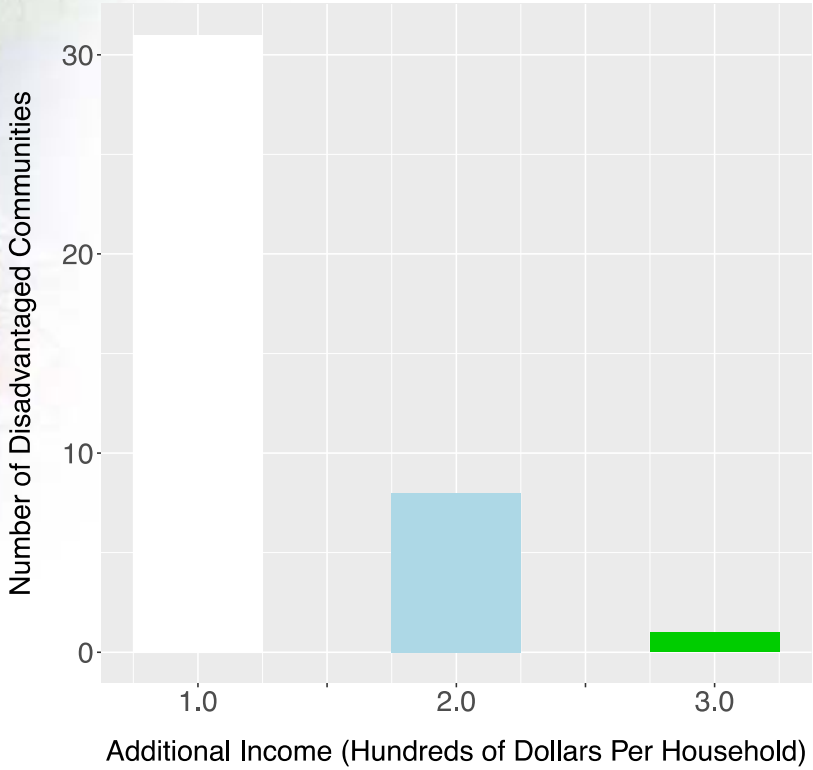
Location of Job Creation Differences



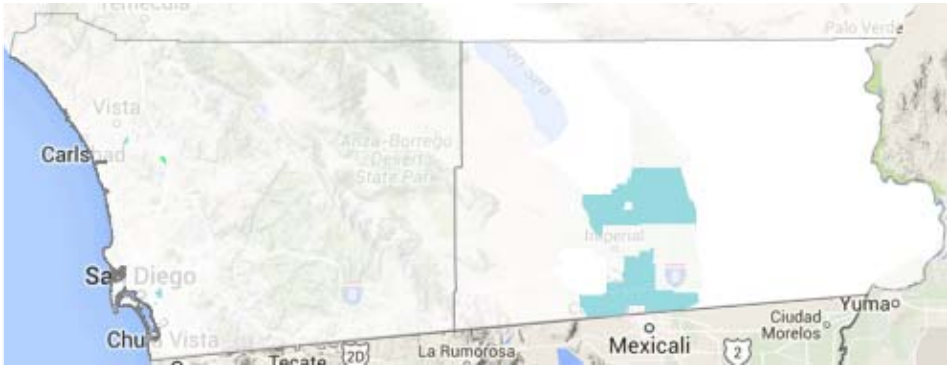
San Diego and Imperial

Difference in Income ($/hh), (R2-CP)

Distribution of Income Differences



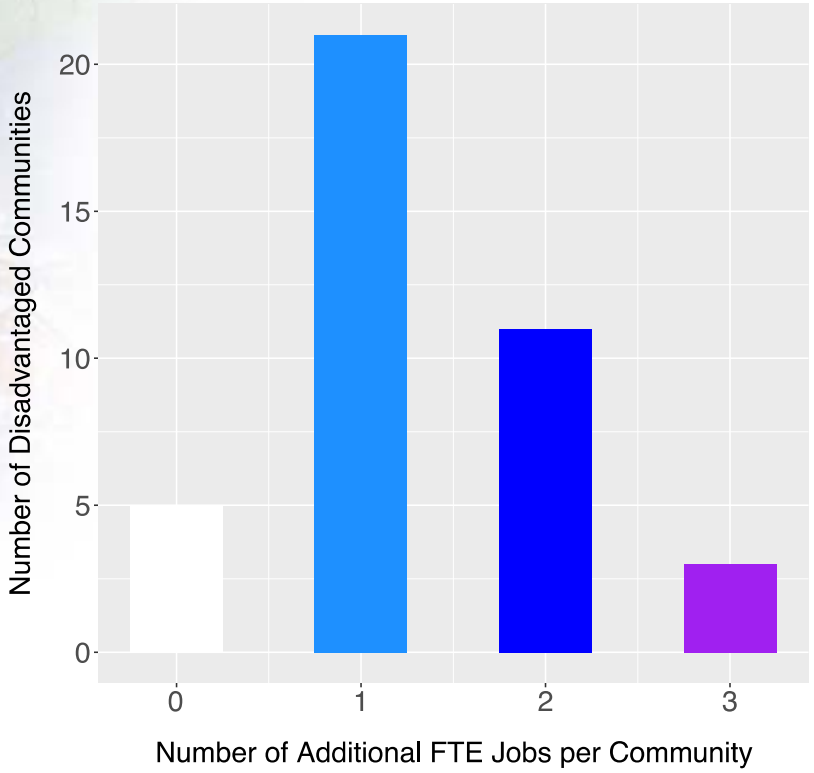
Location of Income Differences



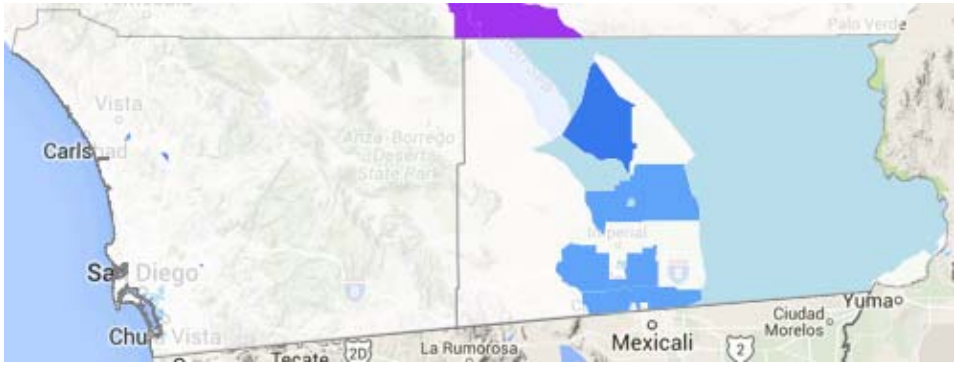
San Diego and Imperial

Difference in Jobs Created, (R3-CP)

Distribution of Job Creation Differences



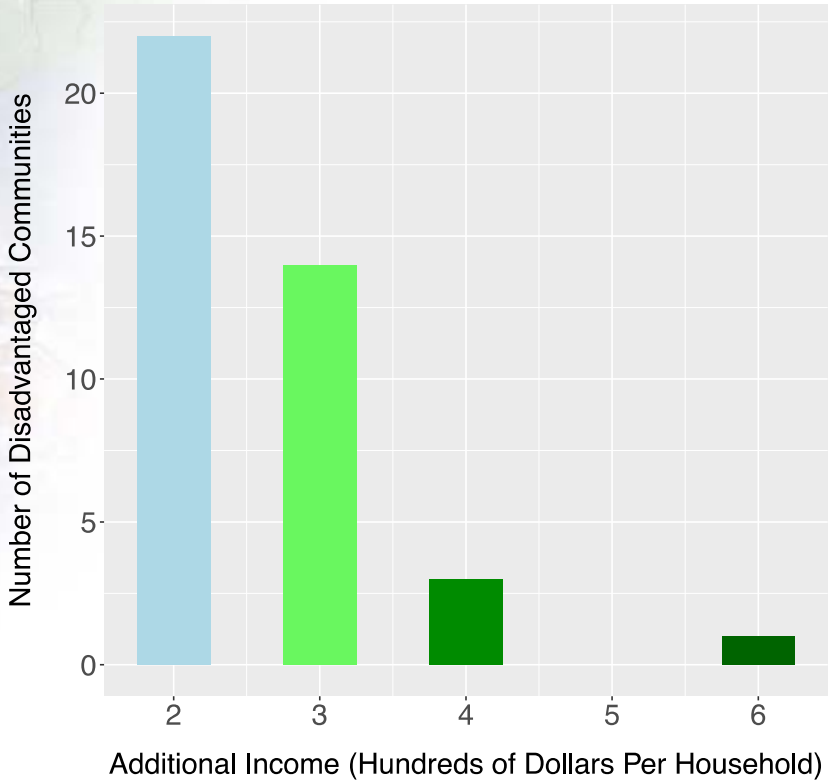
Location of Job Creation Differences



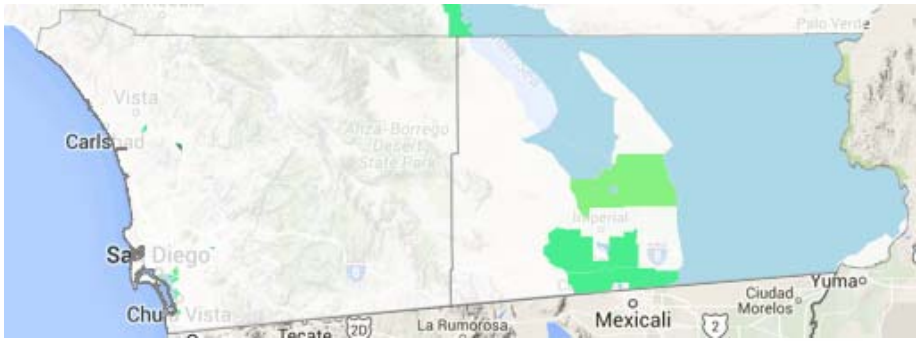
San Diego and Imperial

Difference in Income ($/hh), (R3-CP)

Distribution of Income Differences



Location of Income Differences



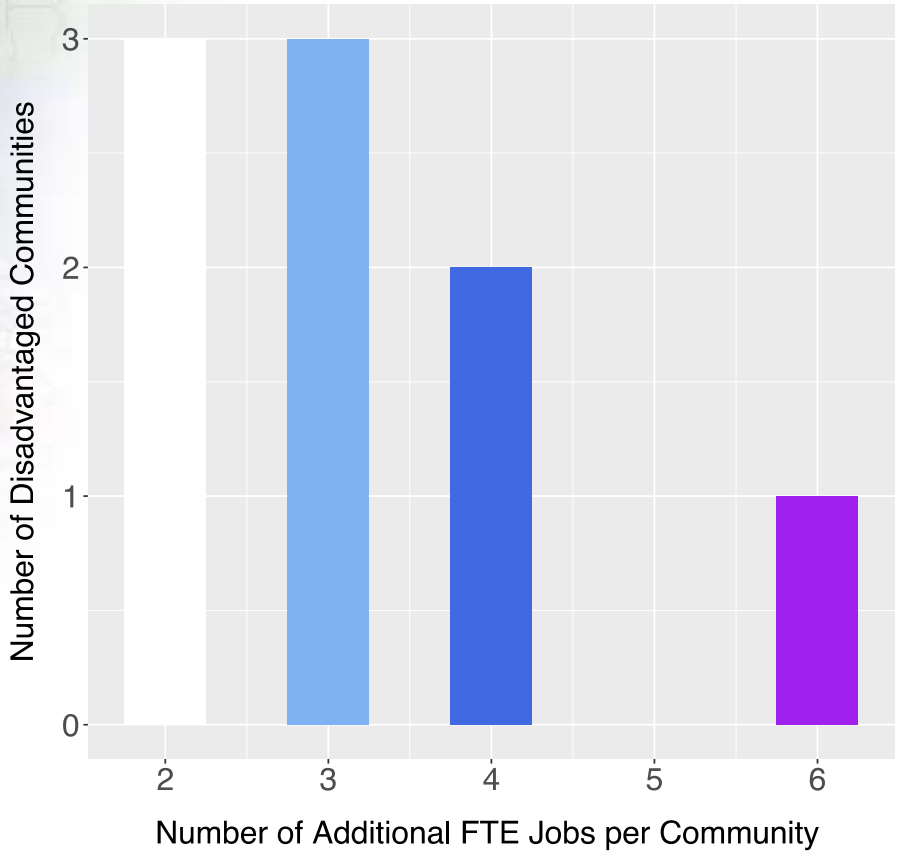
Central Coast

- 3.8% of state population
- 6.5% unemployment rate
- Average household Income = $89,943
- 9 disadvantaged communities (<1% of state total)

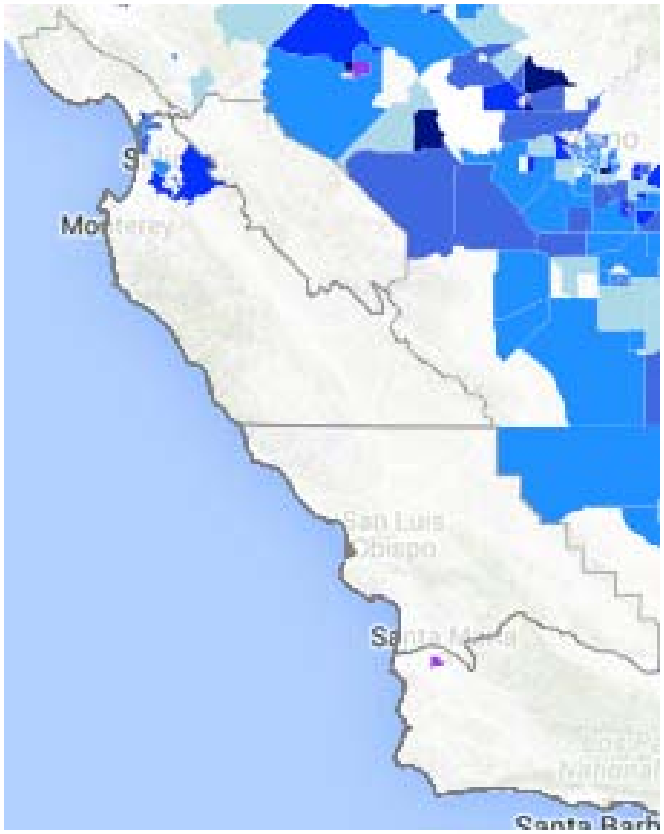
Central Coast

Difference in Jobs Created, (R2-CP)

Distribution of Job Creation Differences



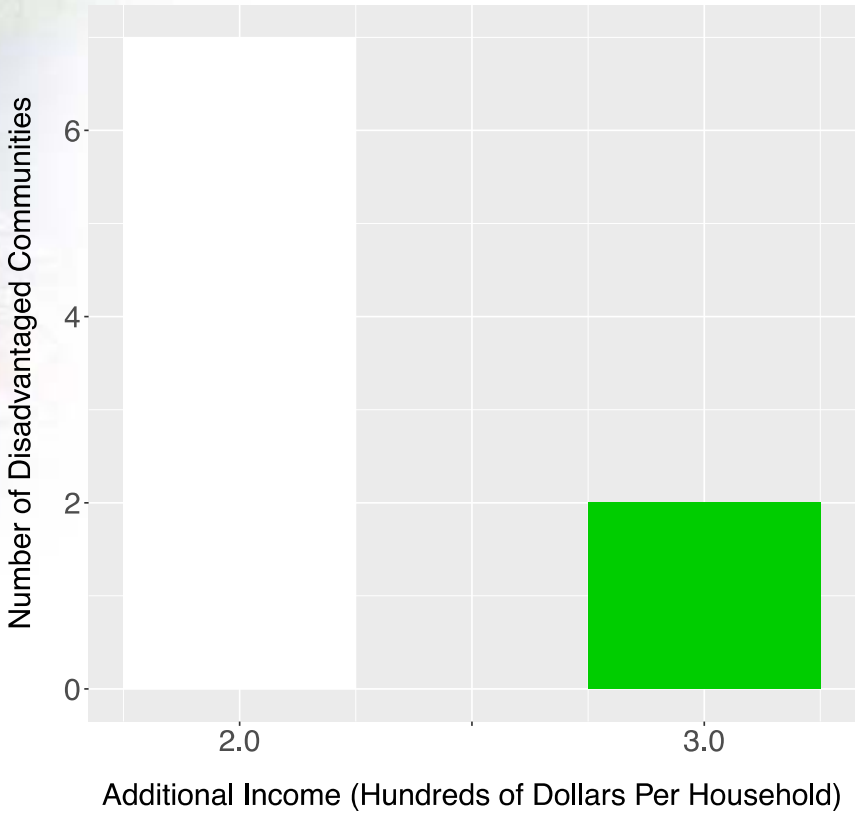
Location of Job Creation Differences



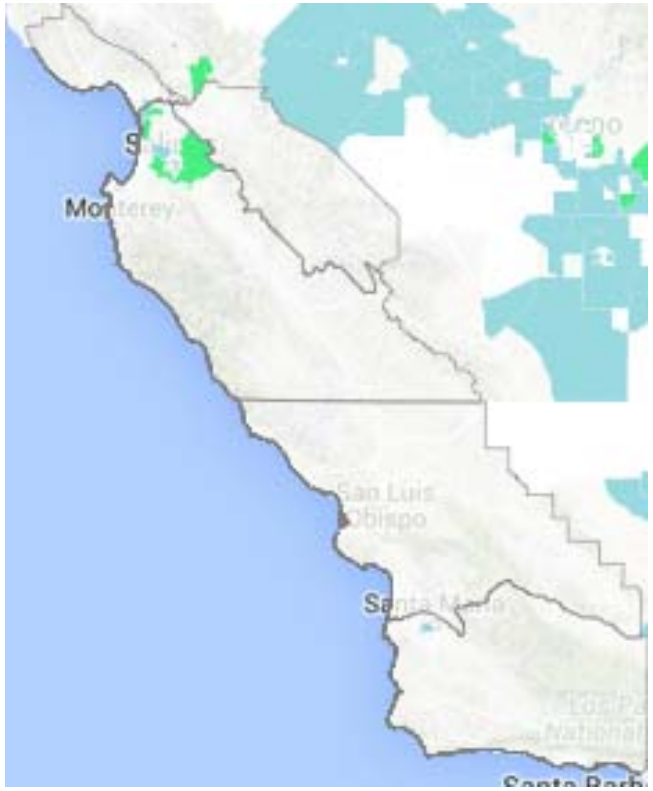
Central Coast

Difference in Income ($/hh), (R2-CP)

Distribution of Income Difference



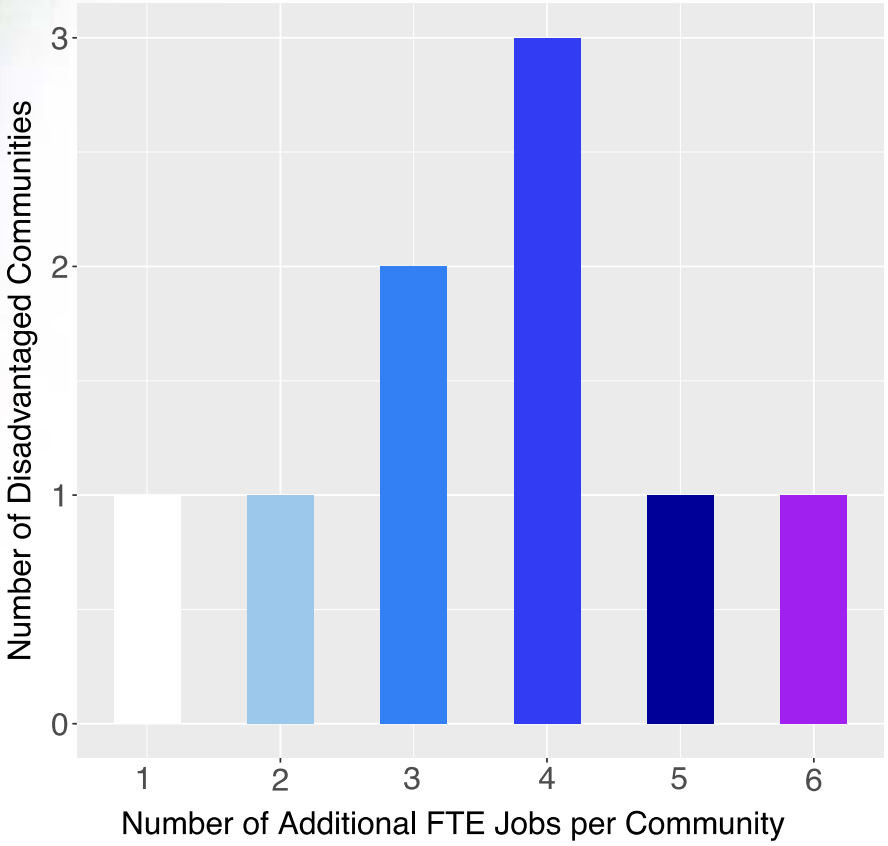
Location of Income Differences



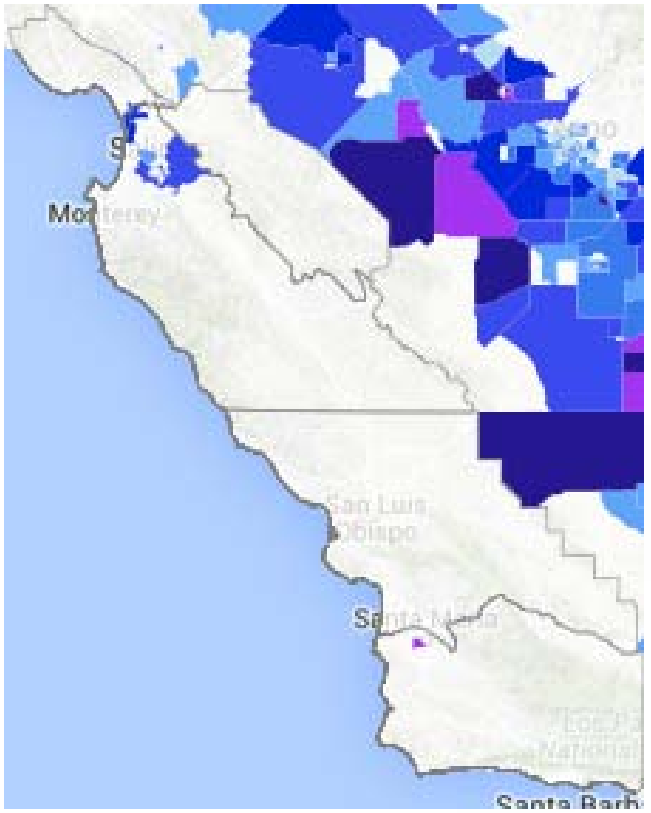
Central Coast

Difference in Jobs Created, (R3-CP)

Distribution of Job Creation Differences



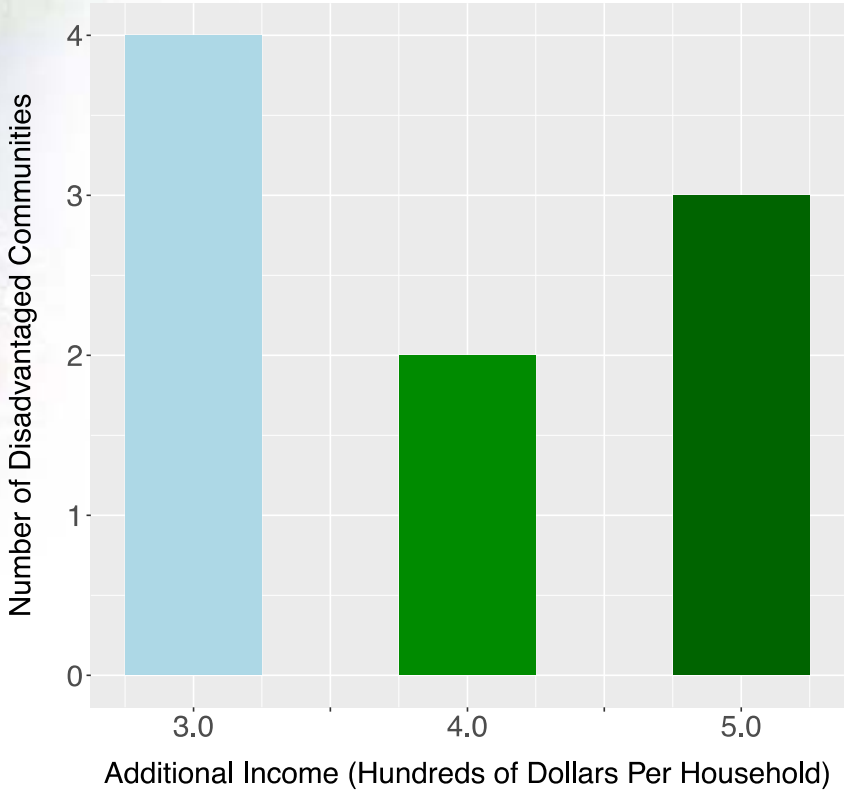
Location of Job Creation Differences



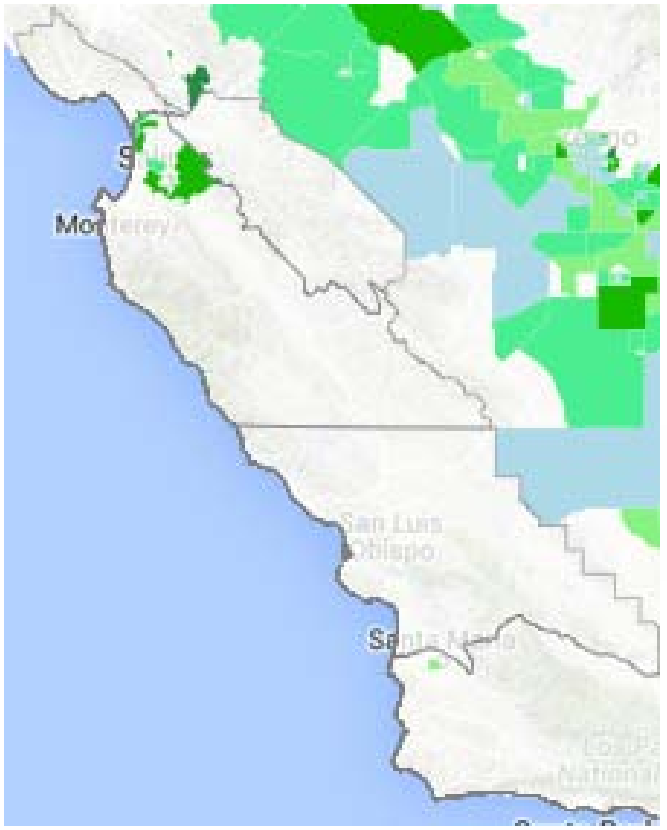
Central Coast

Difference in Income ($/hh), (R3-CP)

Distribution of Income Differences

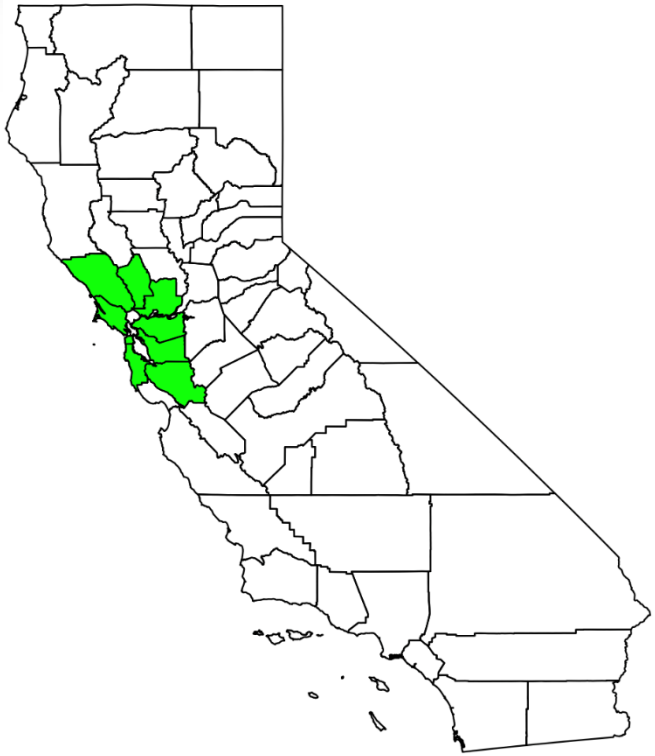


Location of Income Differences



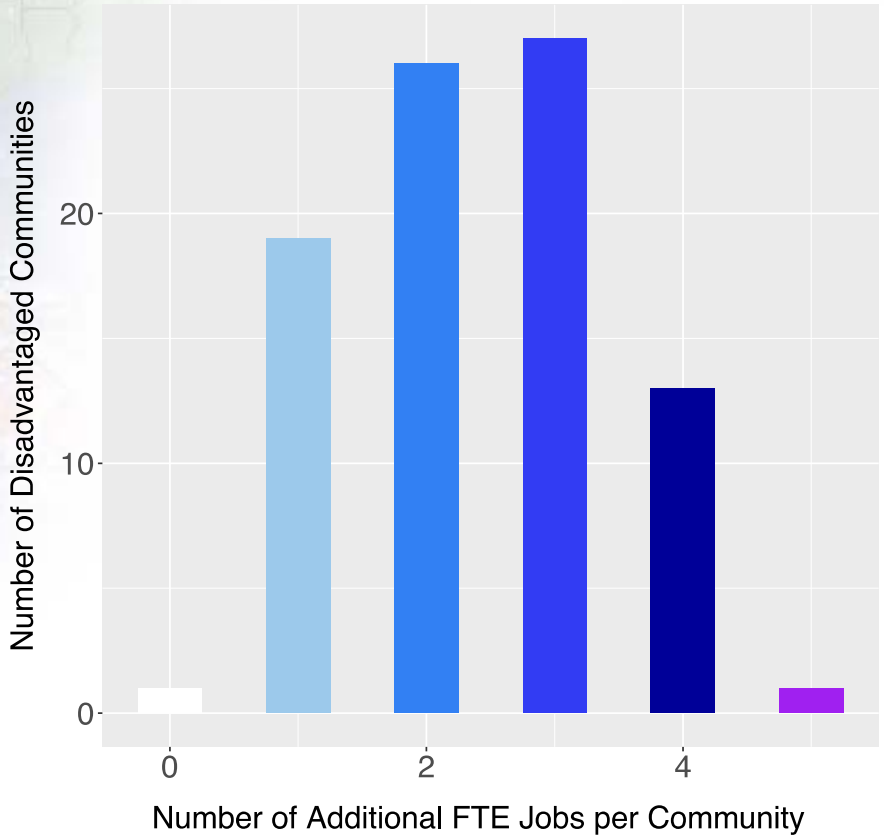
San Francisco Bay Area

- 19.3% of state population
- 4.3% unemployment rate
- Average household Income = $111,215
- 87 disadvantaged communities (4% of state total)

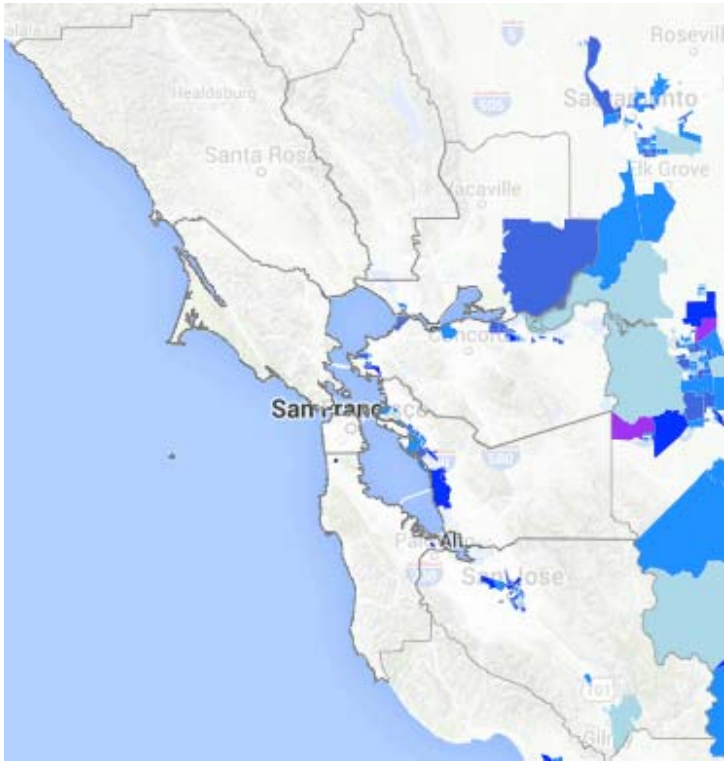


San Francisco Bay Area
Difference in Jobs Created, (R2-CP)

Distribution of Job Creation Differences



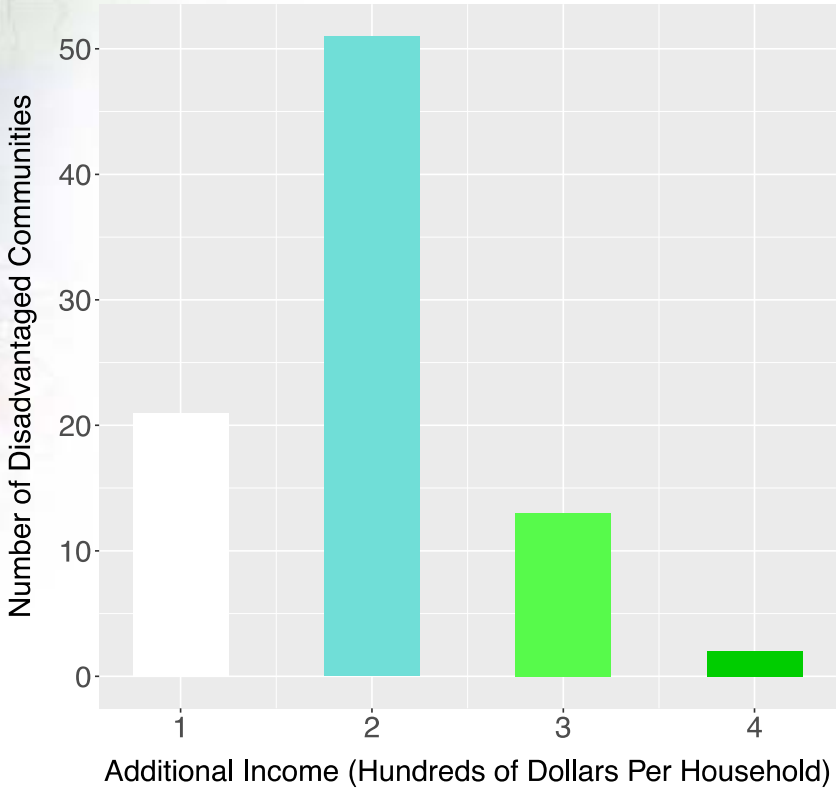
Location of Job Creation Differences



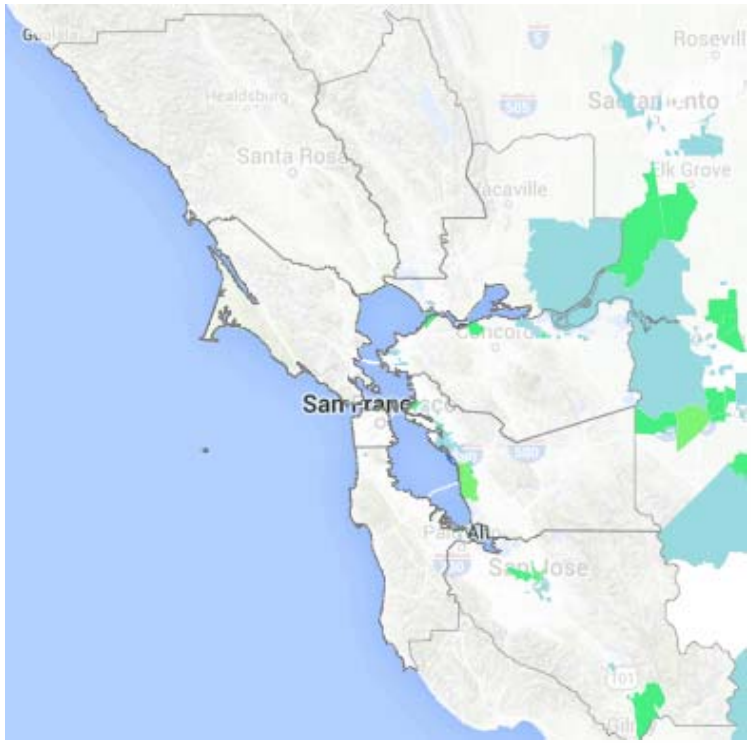
San Francisco Bay Area

Difference in Income ($/hh), (R2-CP)

Distribution of Income Differences

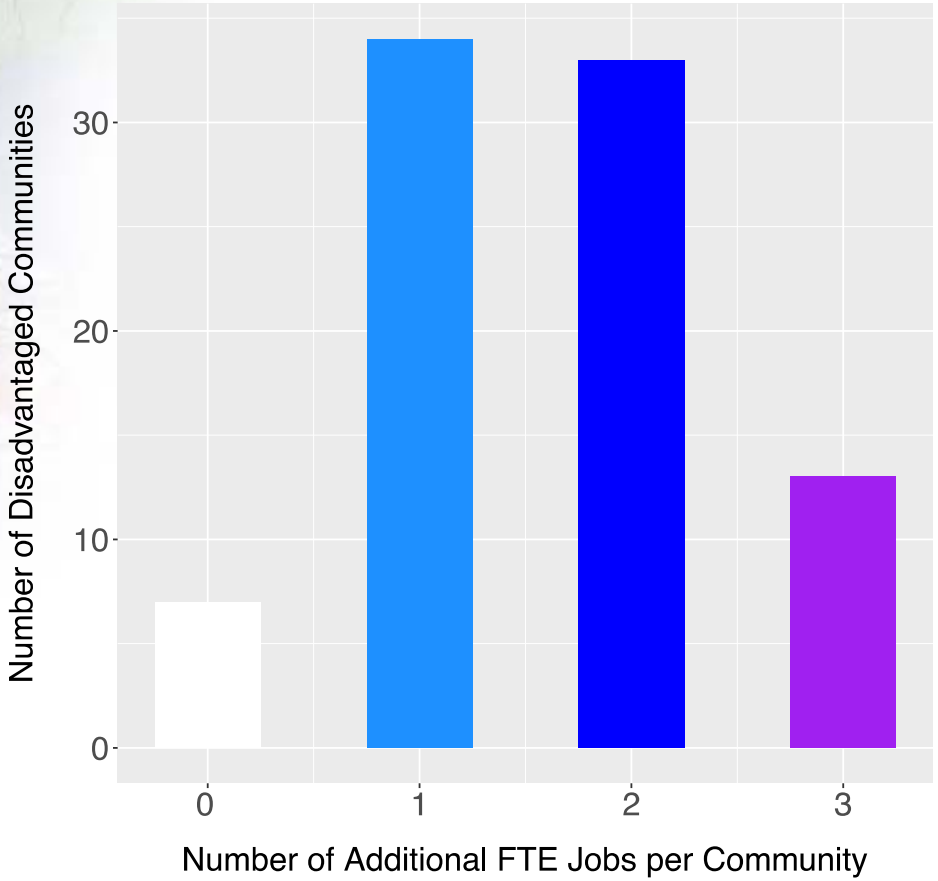


Location of Income Differences

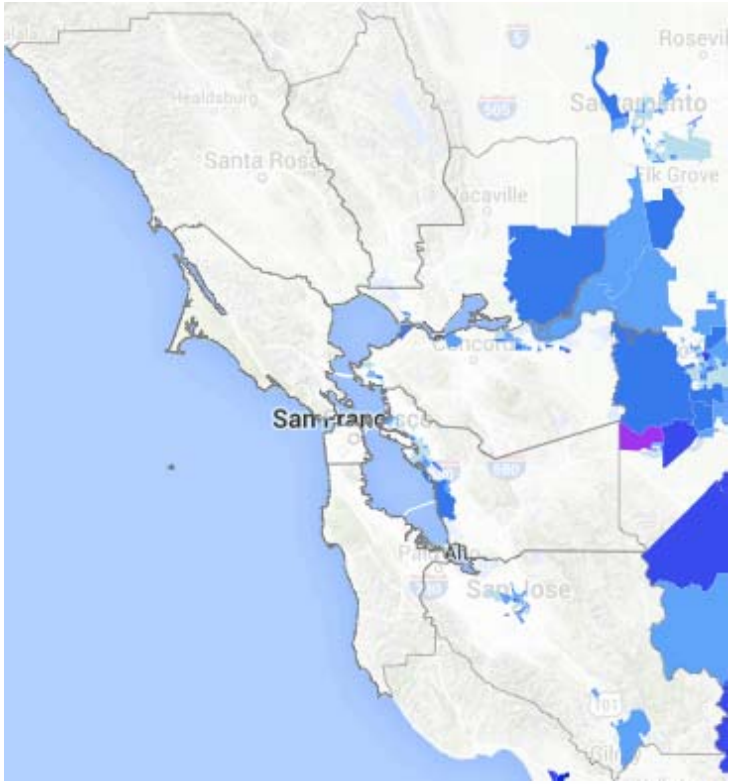


San Francisco Bay Area
Difference in Jobs Created, (R3-CP)

Distribution of Job Creation Differences



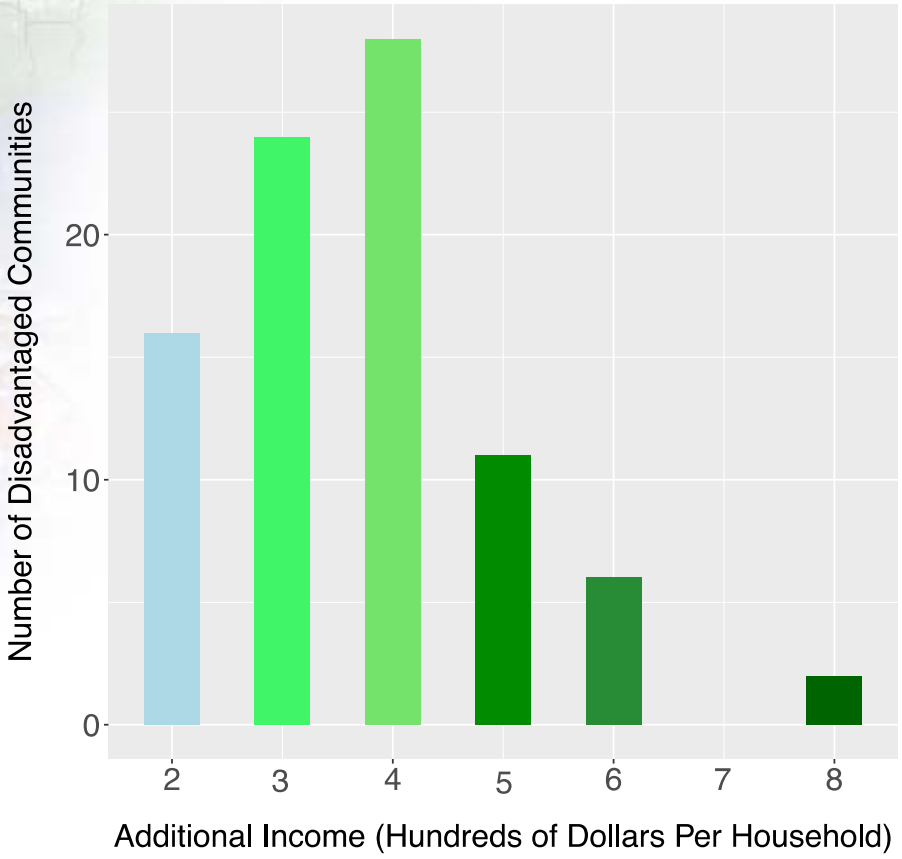
Location of Job Creation Differences



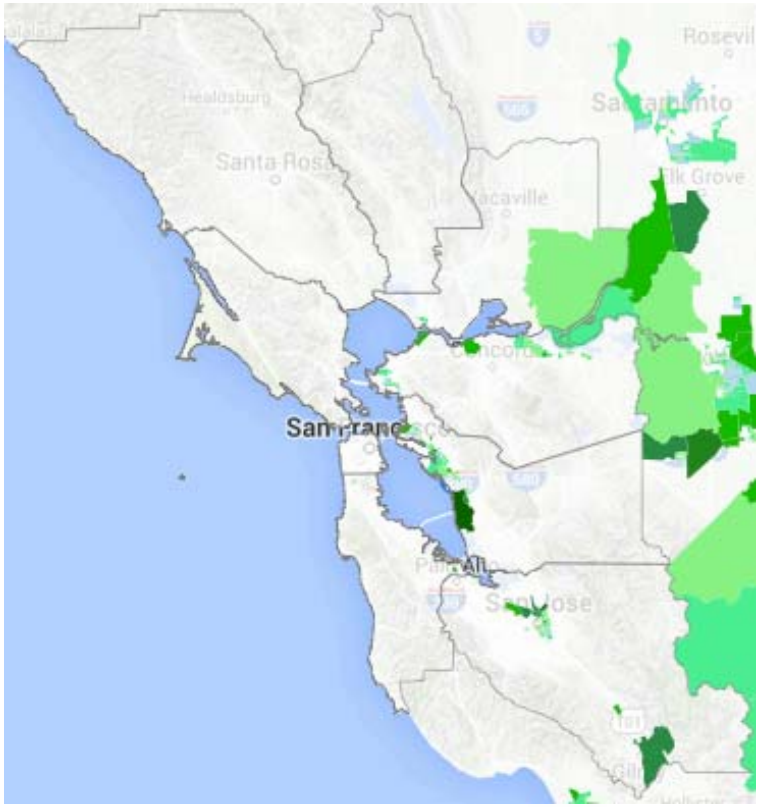
San Francisco Bay Area

Difference in Income ($/hh), (R3-CP)

Distribution of Income Differences



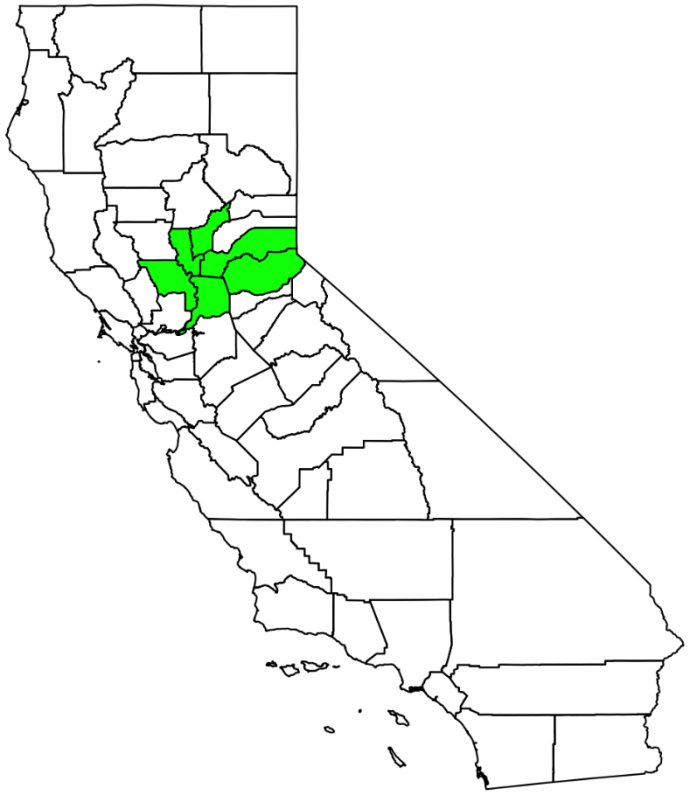
Location of Income Differences



Sacramento Area

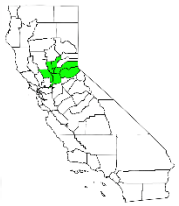
- 6.2 % of state population
- 6.1% unemployment rate
- Average household Income = $77,855
- 50 disadvantaged communities

  (2.5% of state total)

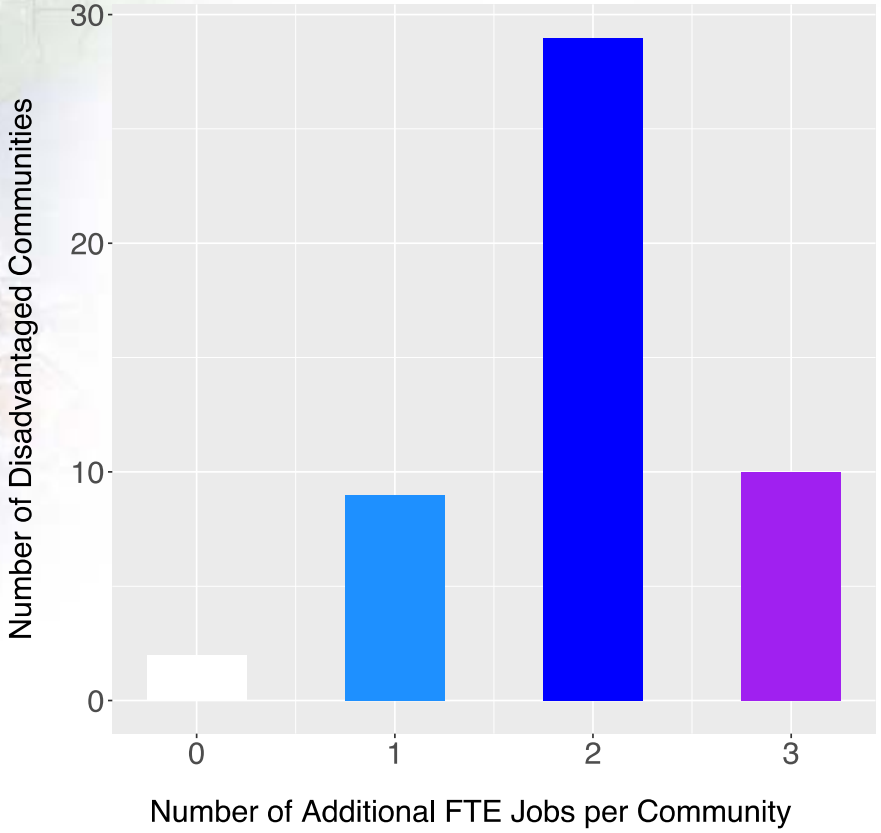


Sacramento Area

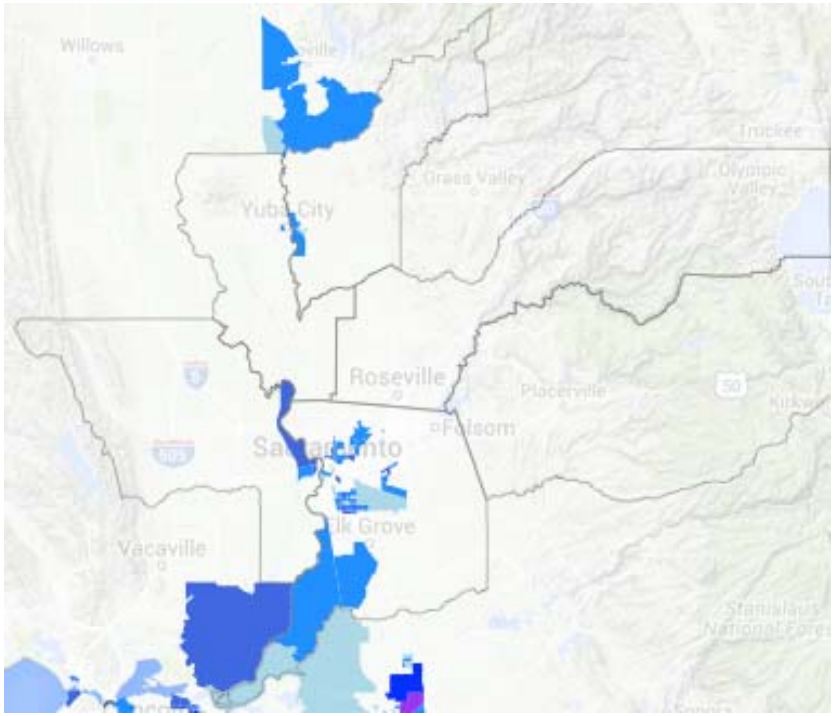
Difference in Jobs Created, (R2-CP)



Distribution of Job Creation Differences

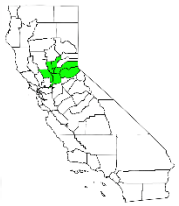


Location of Job Creation Differences

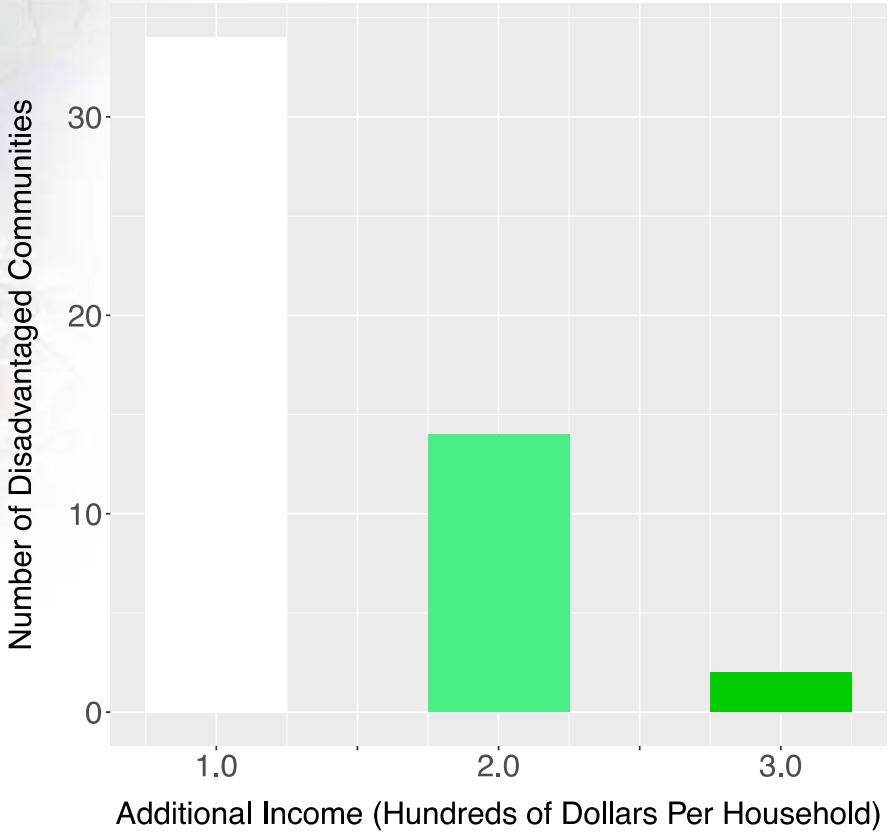


Sacramento Area

Difference in Income ($/hh), (R2-CP)



Distribution of Income Differences



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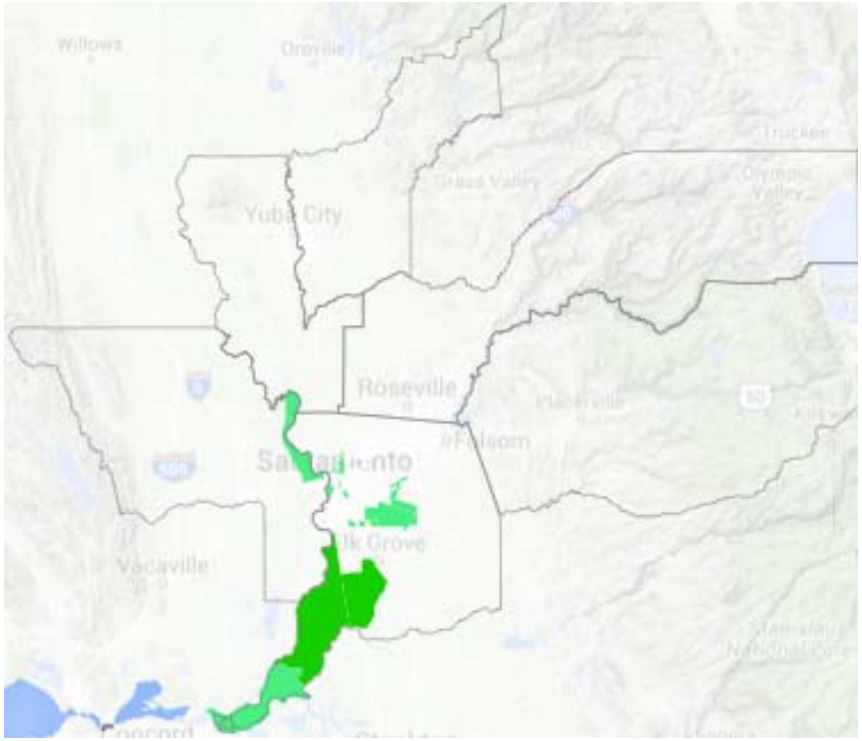
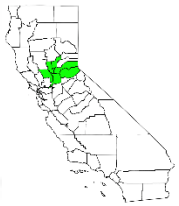
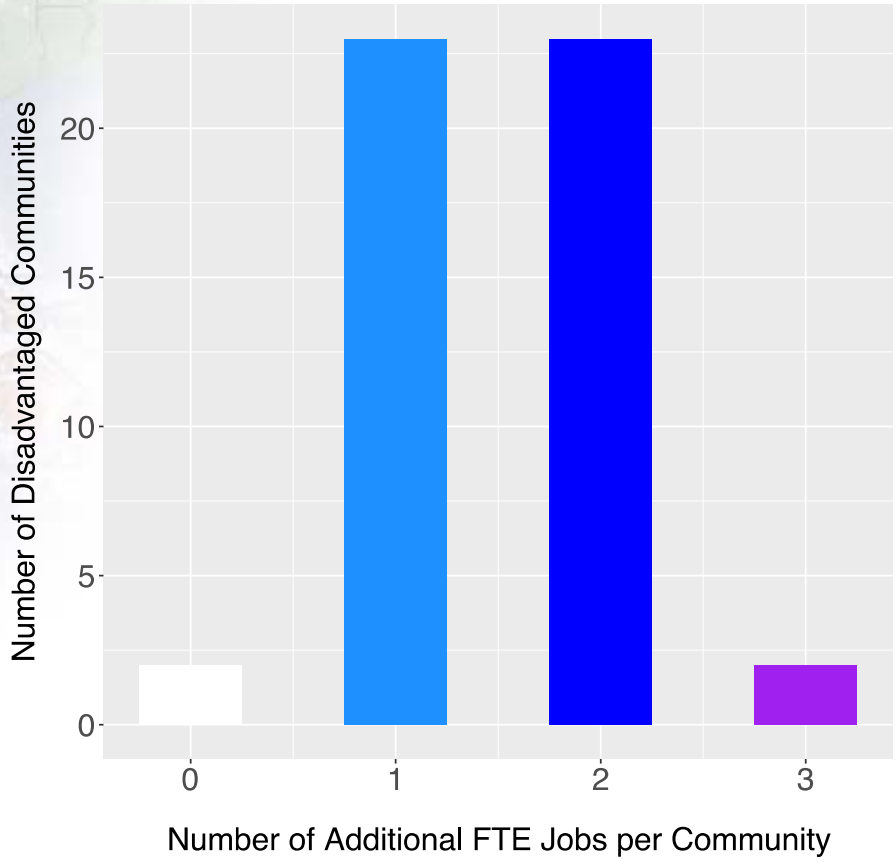


Sacramento Area

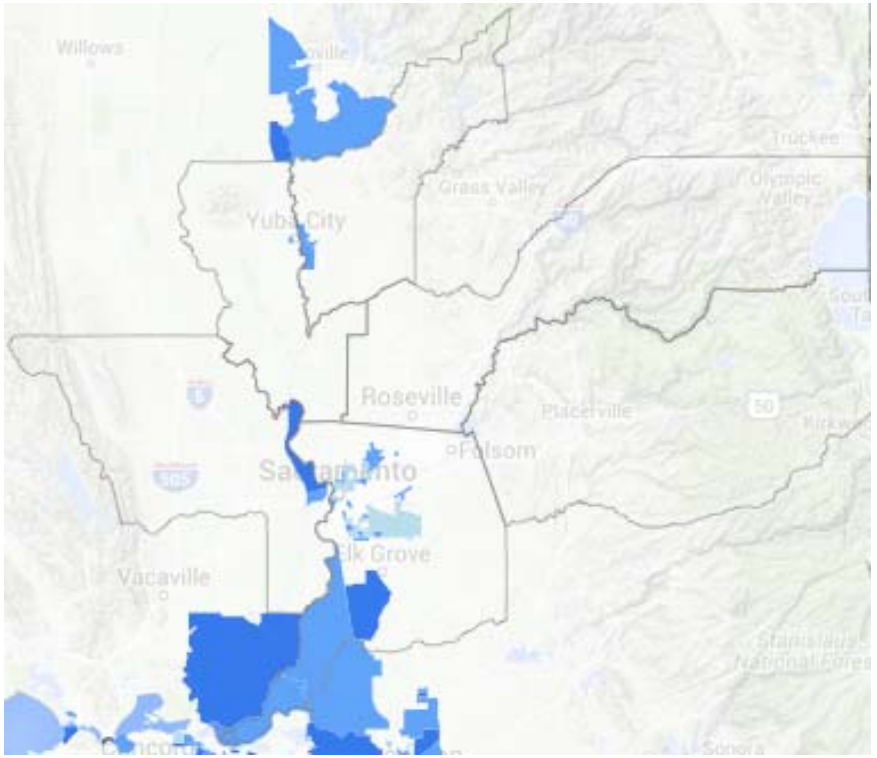
Difference in Jobs Created, (R3-CP)



Distribution of Job Creation Differences



Location of Job Creation Differences



Sacramento Area

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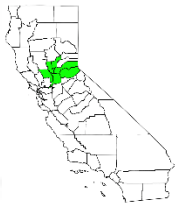
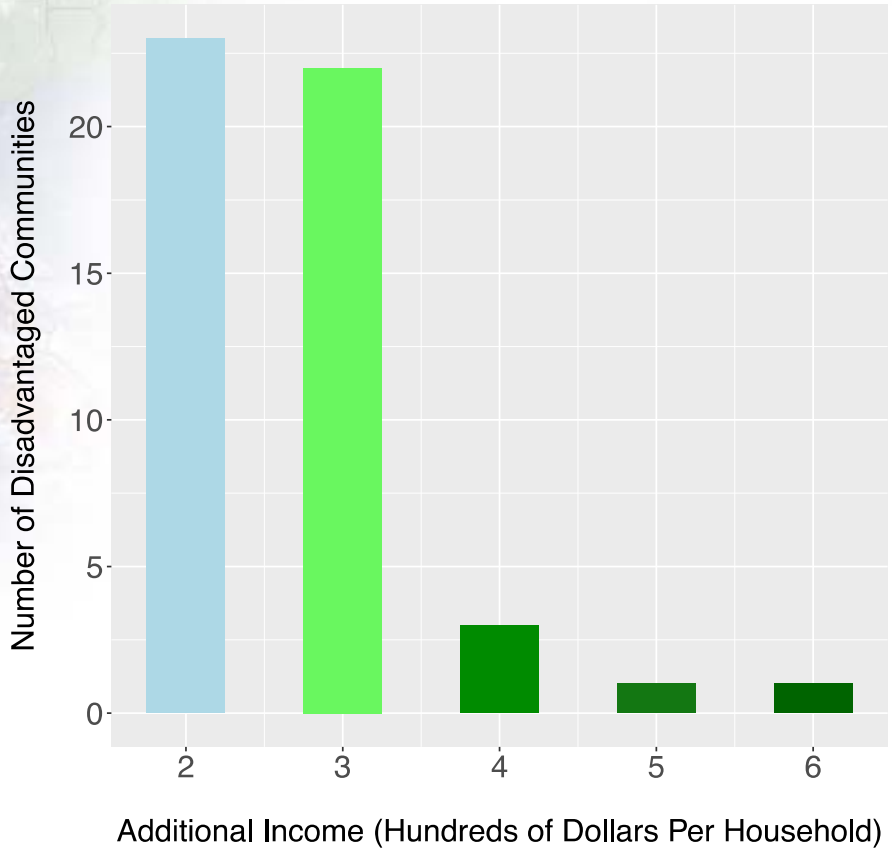
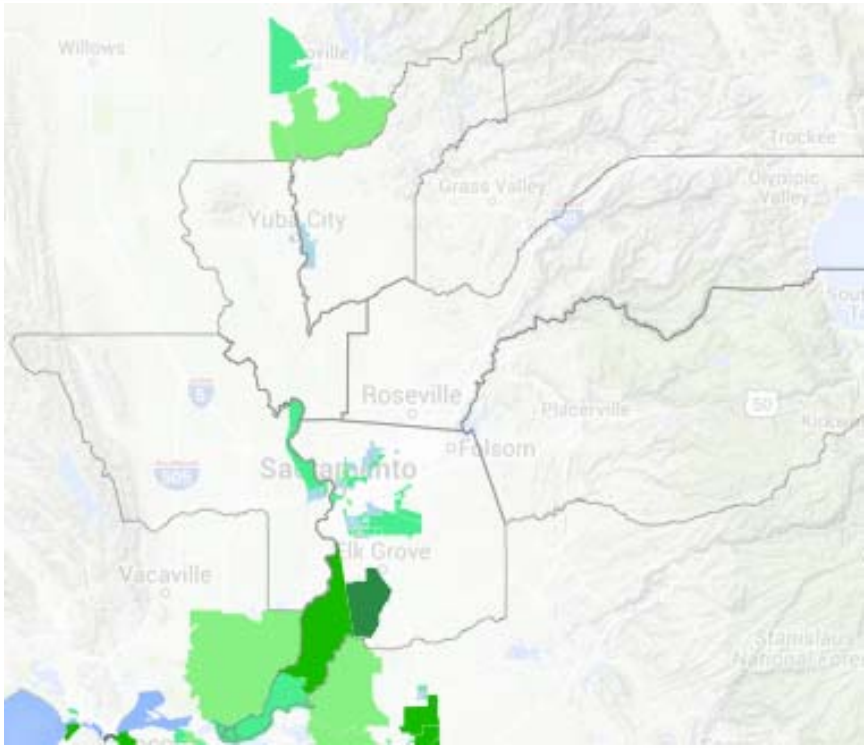


Distribution of Income Differences

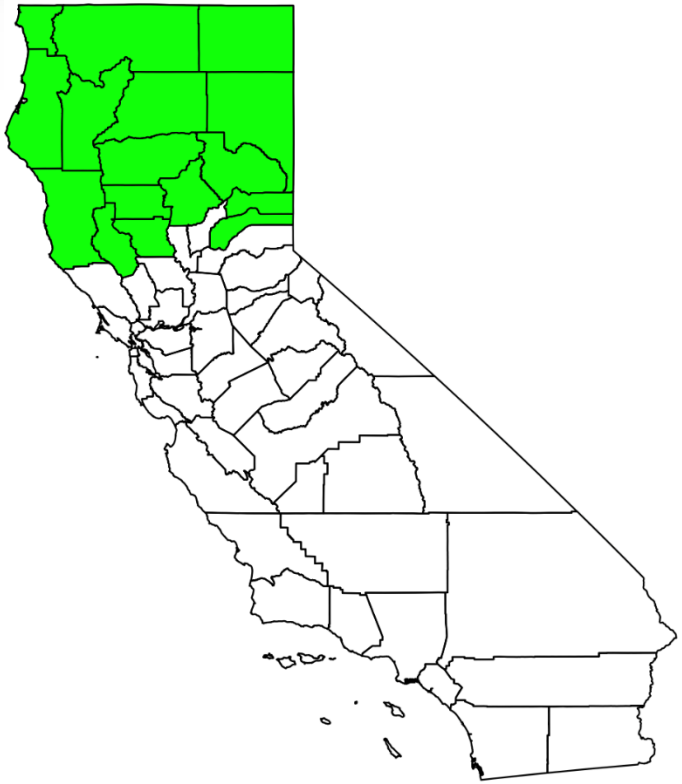


Location of Income Differences



North State

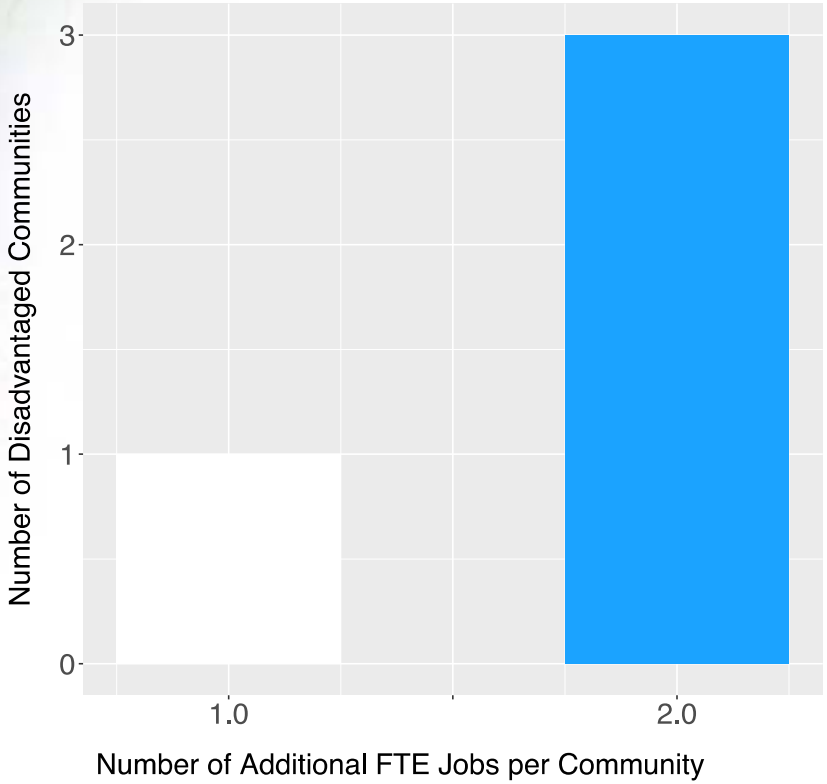
- 2.5% of state population
- 7.3% unemployment rate
- Average household Income = $57,764
- 4 disadvantaged communities (<1% of state total)



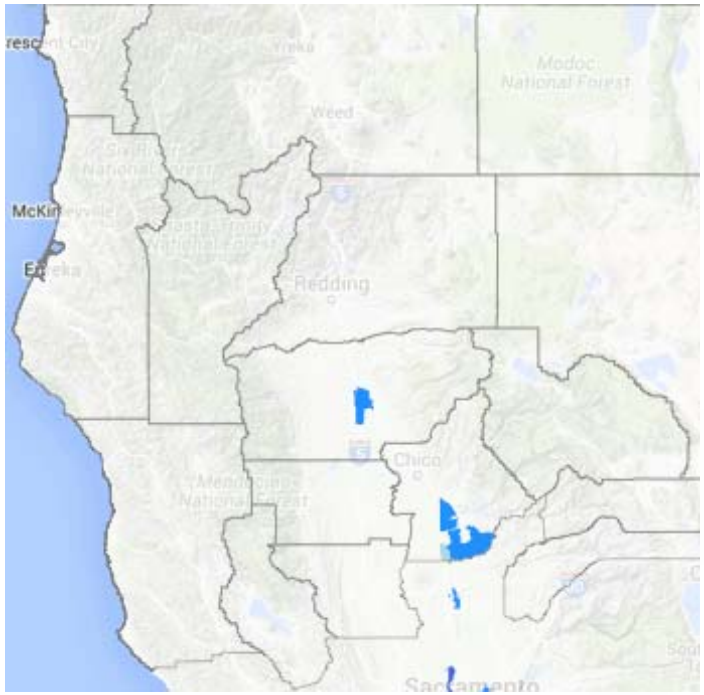
North State

Difference in Jobs Created, (R2-CP)

Distribution of Job Creation Differences

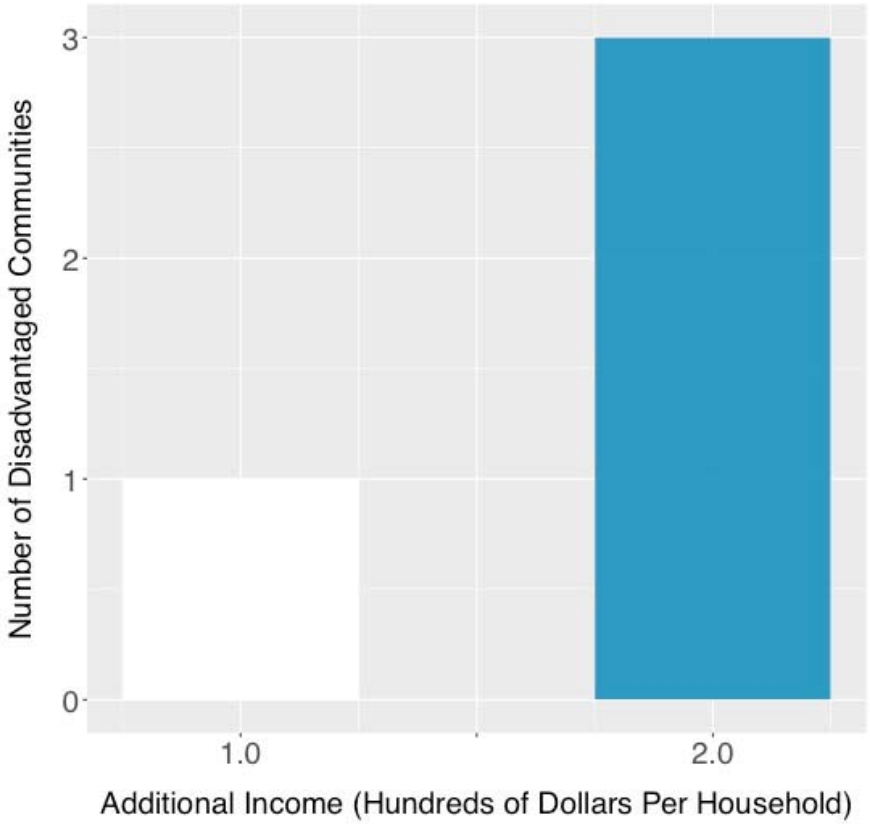


Location of Job Creation Differences



North State

Difference in Income ($/hh), (R2-CP)

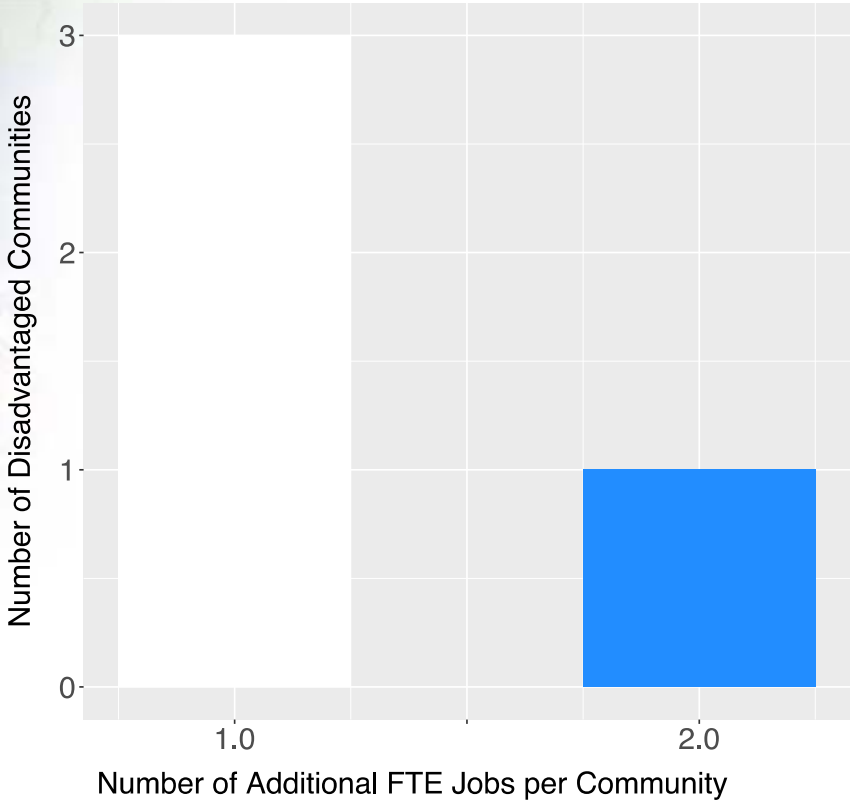


Location of Income Differences

North State

Difference in Jobs Created, (R3-CP)

Distribution of Job Creation Differences

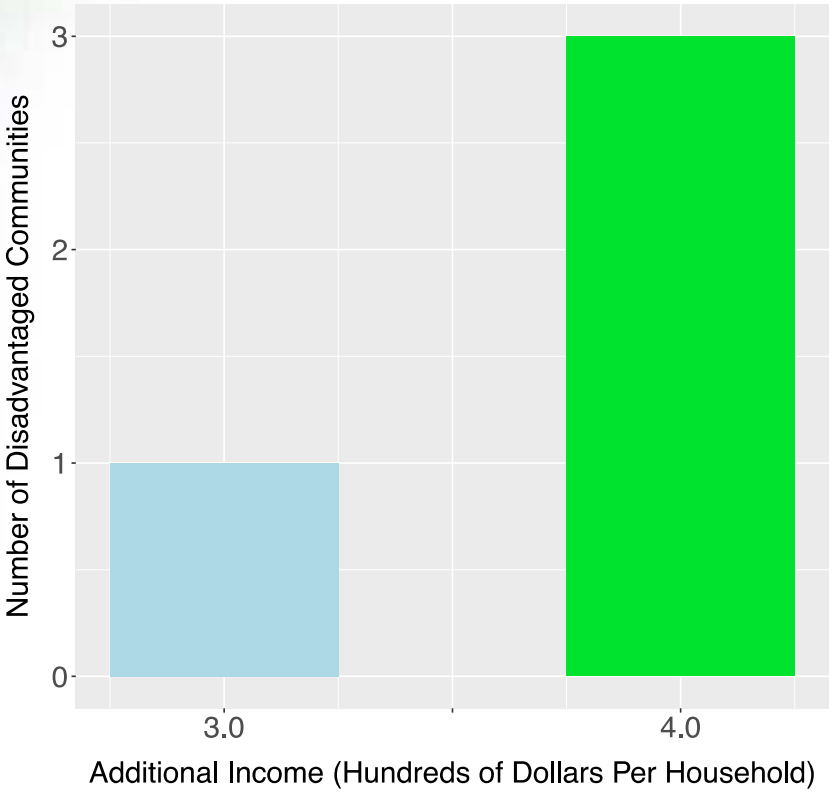


Location of Job Creation Differences

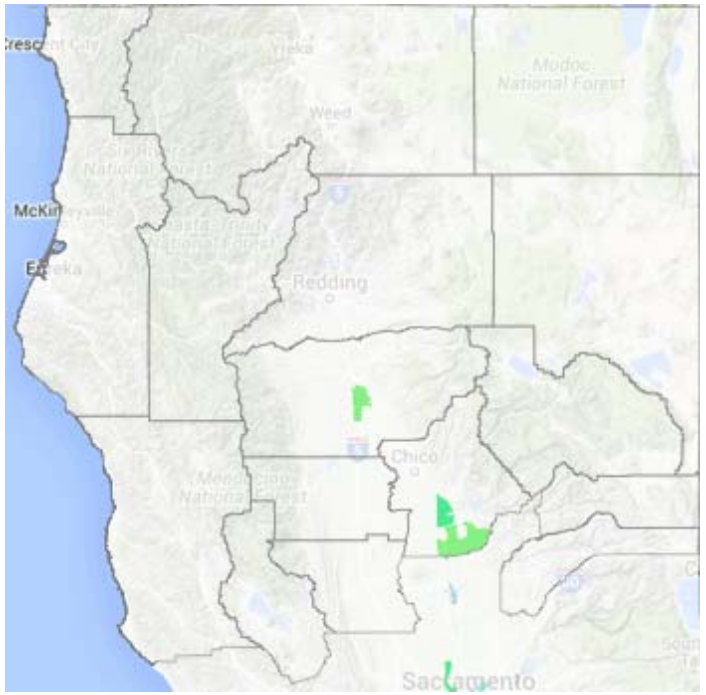
North State

Difference in Income ($/hh), (R3-CP)

Distribution of Income Differences



Location of Income Differences



SB 350 Environmental Study
Preliminary Study Results

May 24-25, 2016

Susan Lee and Brewster Birdsall,
Aspen Environmental Group

Contents

- Key Findings
- Scenarios
- Defining Renewable Resource Study Areas
- Environmental Topics
  - Land Use
  - Biological Resources
  - Water
  - Air Emissions Changes
- Disadvantaged Communities
- Comparison of Scenarios
- Appendices

Appendix 1: California Renewable Study Areas
Appendix 2: Out of State Renewable Study Areas
Appendix 3: Biological Resources Baseline
Appendix 4: Review of Out of State Transmission

Key Findings

- 2020 Regional ISO scenario includes no incremental renewable energy development:
  - No impacts to land use or biological resources
  - Slight changes in water use and emissions due to dispatch
- By 2030, changing from Current Practice 1a into Regional 2:
  - Less acreage required and fewer impacts due to wind in California
  - Less water use and lower emissions of NOx, PM2.5, and SO2 in California
  - Least water use and lowest emissions of NOx, PM2.5, and SO2 outside California
- By 2030, changing from Current Practice 1a into Regional 3:
  - Least overall renewable buildout for RPS, in MW capacity
  - Least acreage required in California and fewer impacts due to wind in California
  - Includes impacts due to Out of State wind resources for California to access (Wyoming and New Mexico) and major Out of State transmission for California RPS
  - Least water use and lowest emissions of NOx, PM2.5, and SO2 in California
  - Less water use and lower emissions of NOx, PM2.5, and SO2 outside California

Scenarios

Sector Modeling as Input to Environmental Study

Key Inputs	2020 Current Practice	2020 Regional ISO	2030 Current Practice 1a	2030 Regional 2	2030 Regional 3
Renewable Portfolios • Incremental MW buildout for California by 2030	Already contracted	No change from 2020 CP	Portfolio 1a Incremental Buildout by 2030	Compare Buildout of Regional 2 to CP1a	Compare Buildout of Regional 3 to CP1a
Production Cost Simulations • Dispatch of generation in 2020 and 2030 • MWh, Unit starts • WECC-Wide emissions	2020 Environmental Baseline	Difference in 2020 Regional ISO relative to CP	2030 Environmental Baseline	Difference in 2030 Regional 2 relative to CP1a	Difference in 2030 Regional 3 relative to CP1a
Major Out of State Transmission Additions for California RPS	None	No change from 2020 CP	None	No change from 2030 CP1a	Added
Renewables Beyond RPS, Out of State	None	No change from 2020 CP	None	Added	Added

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Scenarios

Incremental Renewable Buildout by 2030 (MW)			
Portfolio Composition	**Current Practice 1a**	**Regional 2**	**Regional 3**
California Solar	7,601	7,804	3,440
California Wind	3,000	1,900	1,900
California Geothermal	500	500	500
Out of State Solar	1,000	1,500	1,500
Out of State Wind	4,551	3,666	6,194
Total California New Capacity	**11,101**	**10,204**	**5,840**
Total Out of State New Capacity	**5,551**	**5,166**	**7,694**
Total New Renewable Capacity	**16,652**	**15,370**	**13,534**
Major Out of State Transmission Additions for California RPS?	**No**	**No**	**Yes**
Renewables Beyond RPS, Out of State	**No**	**5,000**	**5,000**

California Solar Details

California Solar Details, Incremental Buildout by 2030 (MW)			
California Solar Portfolio	**Current Practice 1a**	**Regional 2**	**Regional 3**
Greater Carrizo Solar	570	570	0
Greater Imperial Solar	923	923	512
Kramer and Inyokern Solar	375	375	375
Owens Valley Solar	578	578	305
Riverside East and Palm Springs Solar	331	1,984	0
Tehachapi Solar	2,500	2,500	1,761
Westlands Solar	2,323	873	486
Total California New Solar Capacity	**7,601**	**7,804**	**3,440**

California Wind Details

California Wind Details, Incremental Buildout by 2030 (MW)			
California Wind Portfolio	**Current Practice 1a**	**Regional 2**	**Regional 3**
Central Valley North and Los Banos Wind	150	150	150
Greater Carrizo Wind	500	500	500
Greater Imperial Wind	400	400	400
Riverside East and Palm Springs Wind	500	0	0
Solano Wind	600	0	0
Tehachapi Wind	850	850	850
Total California New Wind Capacity	**3,000**	**1,900**	**1,900**

Out of State Details

Out of State Solar and Wind Details, Incremental Buildout by 2030 (MW)			
Out of State Portfolio	**Current Practice 1a**	**Regional 2**	**Regional 3**
Southwest Solar (Arizona)	1,000	1,500	1,500
Northwest Wind (Oregon)	2,447	1,562	318
Utah Wind	604	604	420
Wyoming Wind	500	500	2,495
New Mexico Wind	1,000	1,000	2,962
Total Out of State New Capacity	**5,551**	**5,166**	**7,694**
Major Out of State Transmission Additions for California RPS?	**No**	**No**	**Yes**
Renewables Beyond RPS, Out of State	**No**	**5,000**	**5,000**

2030 Buildout Scenario for Current Practice 1a

- Inside California
  - Emphasizes solar in Tehachapi, Westlands, and Imperial
  - Distributes wind across six resource areas (3,000 MW), emphasizing Tehachapi and Solano
- Out of State
  - Emphasizes Northwest wind
  - Uses existing transmission for Southwest solar and wind in Utah, Wyoming, and New Mexico
  - No additional transmission for California to access Out of State resources for RPS

2030 Buildout Scenario for Regional 2

- Inside California
  - Emphasizes solar in Riverside East & Palm Springs, Tehachapi, and Imperial
  - Distributes wind across four resource areas (1,900 MW); no incremental wind in Riverside East and Solano
- Out of State
  - Uses existing transmission for Southwest solar and wind in Northwest, Utah, Wyoming, and New Mexico
  - No additional transmission for California to access Out of State resources for RPS
  - Facilitates renewable energy development beyond RPS (5,000 MW wind) distributed in Wyoming and New Mexico

2030 Buildout Scenario for Regional 3

- Inside California
  - Distributes solar across five resource areas; no incremental solar in Greater Carrizo and Riverside East
  - Distributes wind across four resource areas (1,900 MW); no incremental wind in Riverside East and Solano
- Out of State
  - Greatest level of Out of State resources overall
  - Emphasizes wind in Wyoming and New Mexico
  - Includes additional transmission for California to access Wyoming and New Mexico for RPS
  - Facilitates renewable energy development beyond RPS (5,000 MW wind) distributed in Wyoming and New Mexico

Defining Renewable Resource Study Areas

Treatment of Portfolios

- Define “study areas” or proxy locations for each resource type selected by RESOLVE
- To allow a focused look at potential environmental effects of the buildouts, this study separately considers:
  - In-State Renewable Resources *(see Appendix 1)*
  - Out of State Renewable Resources *(see Appendix 2)*
- Boundaries avoid high conflict and high risk areas
  - Tailored to eliminate clear “no go” areas
  - Incompatible areas defined in DRECP or WECC environmental data as high environmental risk
  - Sizes and shapes generally follow those posted on DataBasin as developed as input to CPUC’s RPS Calculator, and San Joaquin Valley “least-conflict lands”

Acreage Required Common to All Buildouts

- Each 2030 portfolio requires new solar and wind
- This requires land use conversion at each site and a portion of this land experiences ground disturbance
- Used conversion factors (acres/MW) developed through the DRECP for renewable energy development in the California desert and from NREL
  - Solar (PV): 7 acres/MW
  - Wind: 40 acres/MW; 3 acres/MW of ground disturbance
  - Geothermal: 6 acres/MW

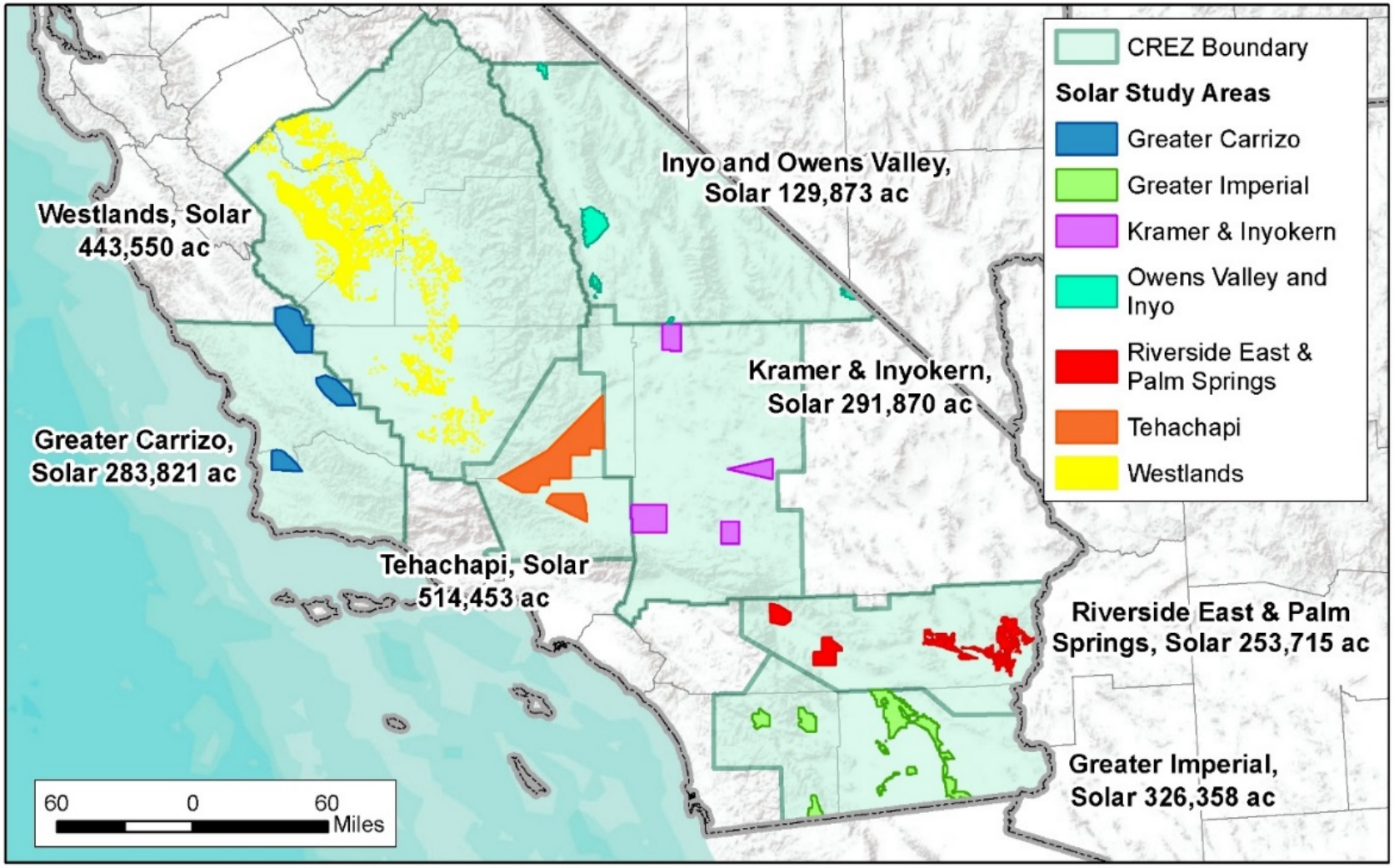
Acreage Required for Scenarios

Approximate Acres Required, Incremental Buildout by 2030 (ac)

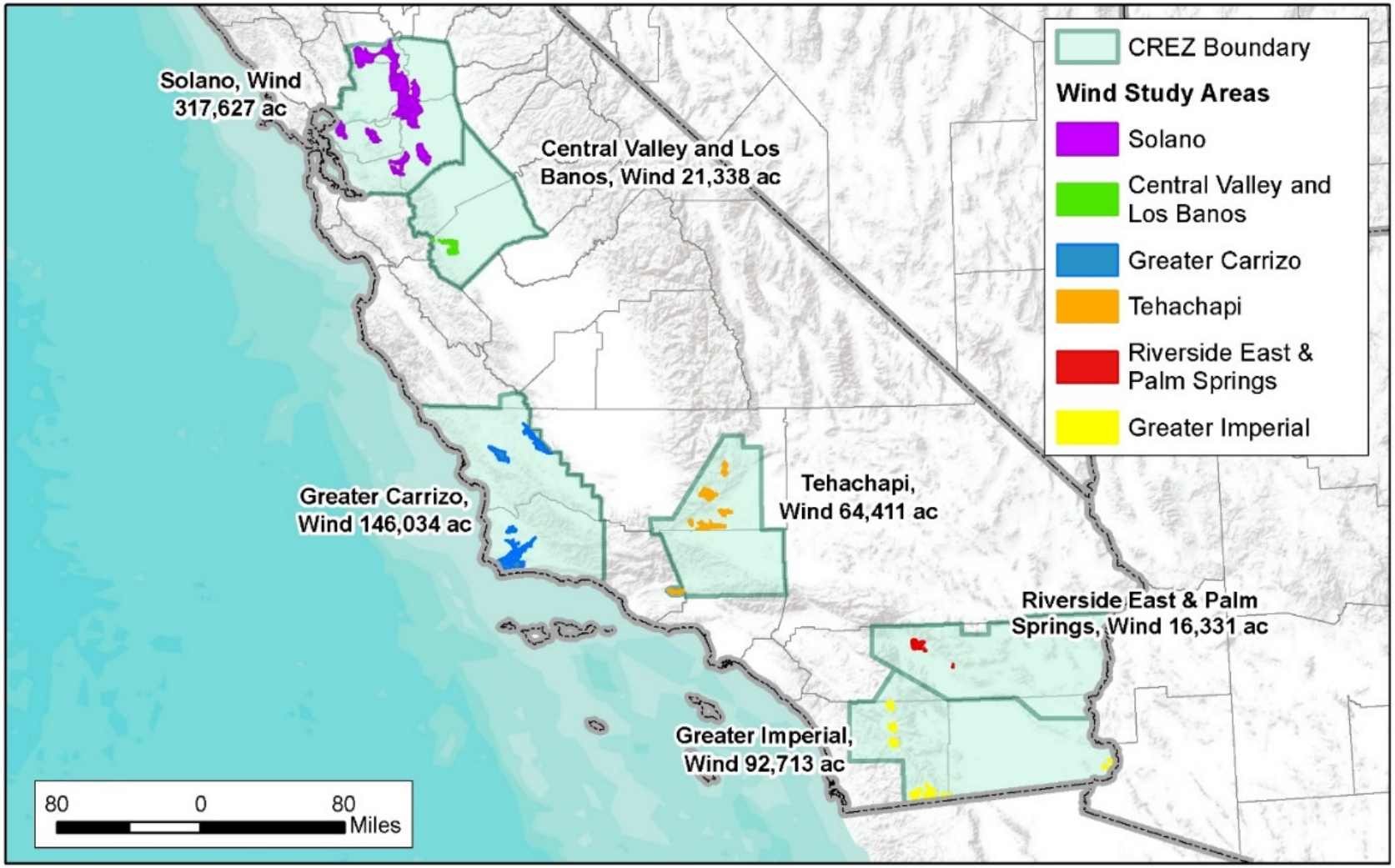
Resource Type	Current Practice 1a	Regional 2	Regional 3	Difference: Regional 2 relative to CP1a	Difference: Regional 3 relative to CP1a
California Solar	53,200	54,600	24,100	1,400	-29,100
California Wind	120,000	76,000	76,000	-44,000	-44,000
Out of State Solar	7,000	10,500	10,500	3,500	3,500
Out of State Wind	182,000	146,600	247,800	-35,400	65,800
Major Out of State Transmission Additions for California RPS?		No	Yes	No change	Added
Renewables Beyond RPS, Out of State (Wind)		200,000	200,000	200,000	200,000

- Solar acreage shown for site control and potential ground disturbance.
- Wind acreage shown for site control; ground disturbance is less than 10% of acreage.
- Common to all 2030 scenarios in California: Geothermal (500 MW); energy storage (min. 500 MW)
- Regional scenarios include renewable development beyond RPS facilitated by regional market (5,000 MW of wind) distributed in WY and NM

Study Areas for California Solar



Study Areas for California Wind



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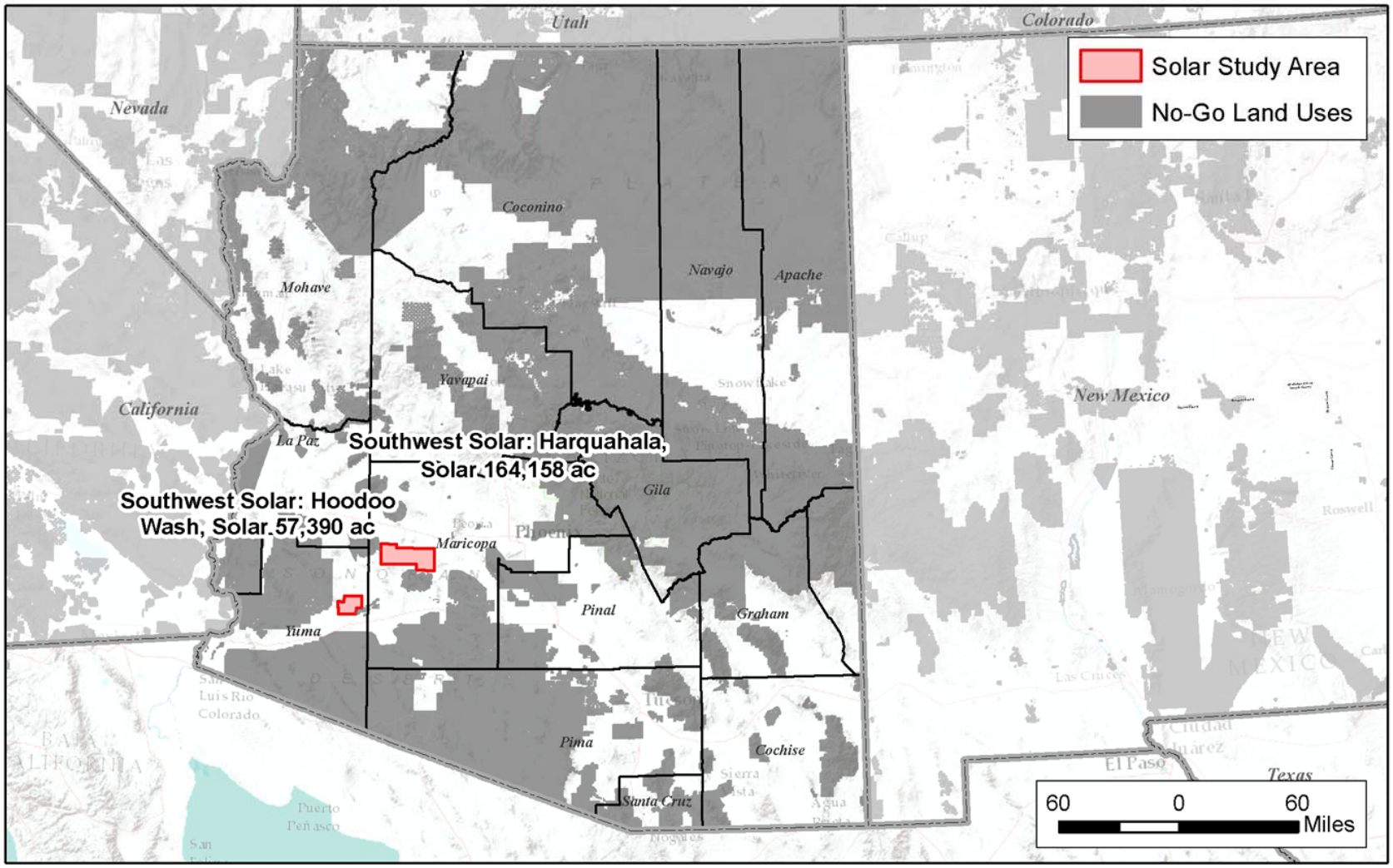
Study Areas for Southwest Solar



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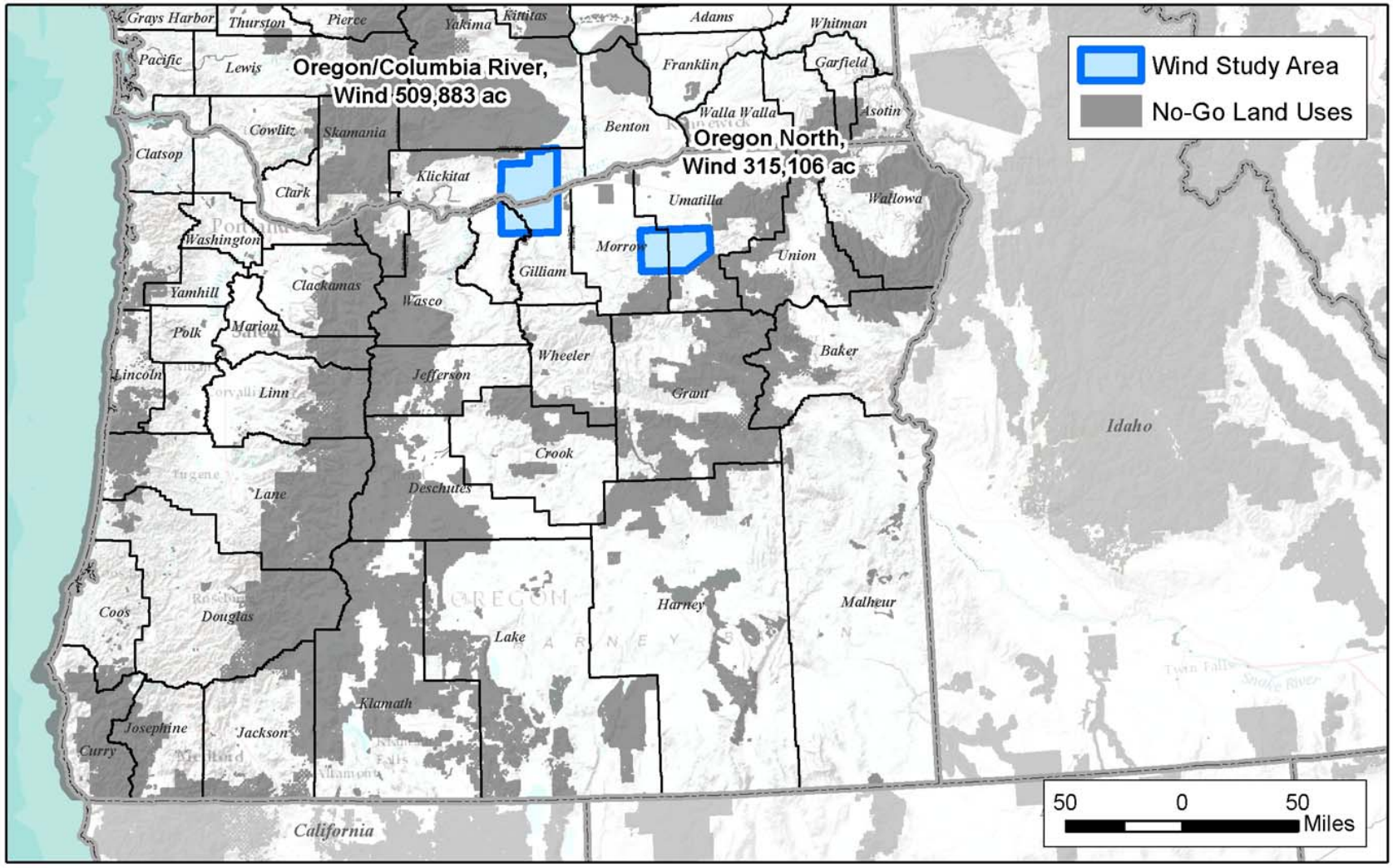
Study Areas for Northwest Wind



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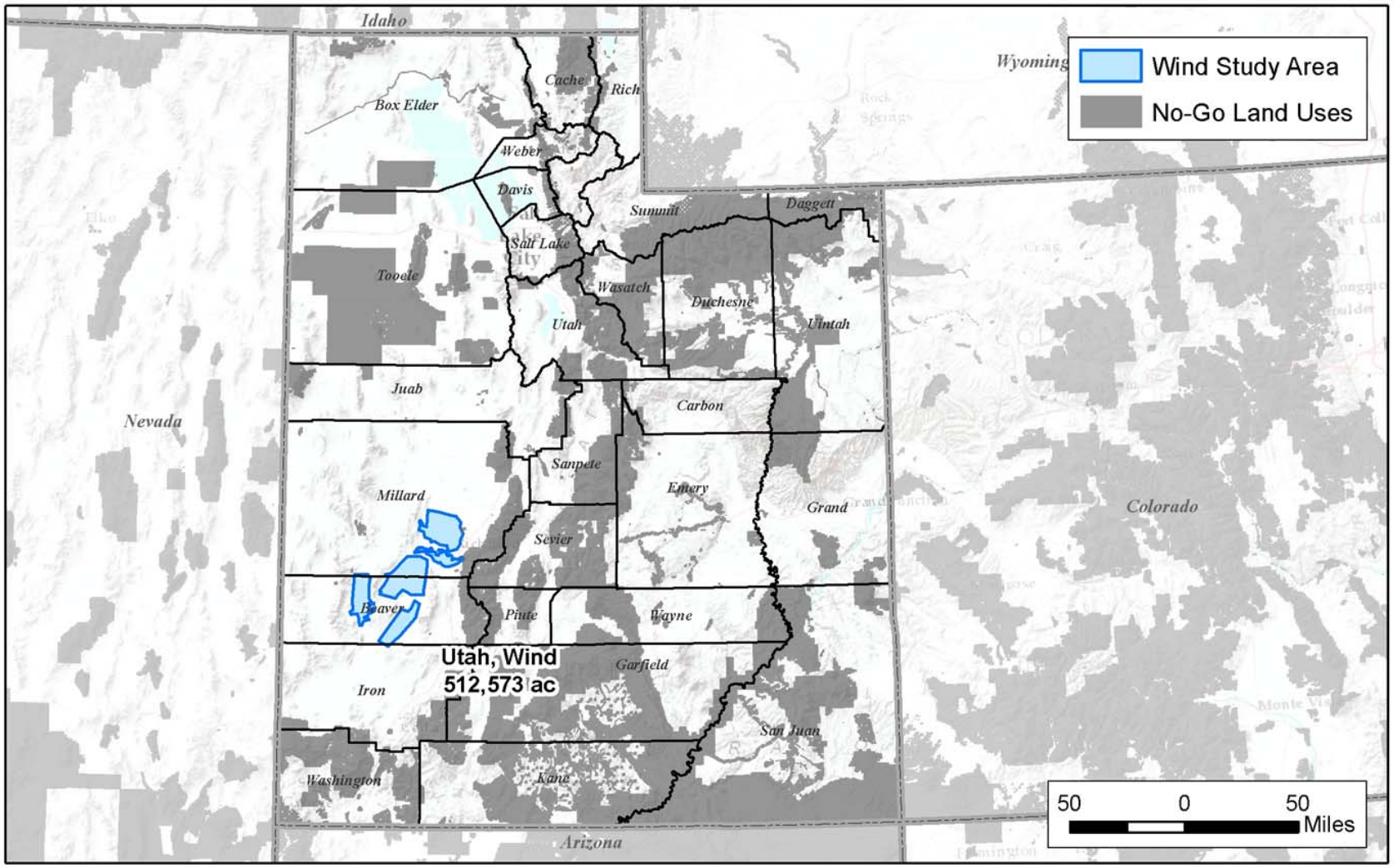
Study Areas for Utah Wind



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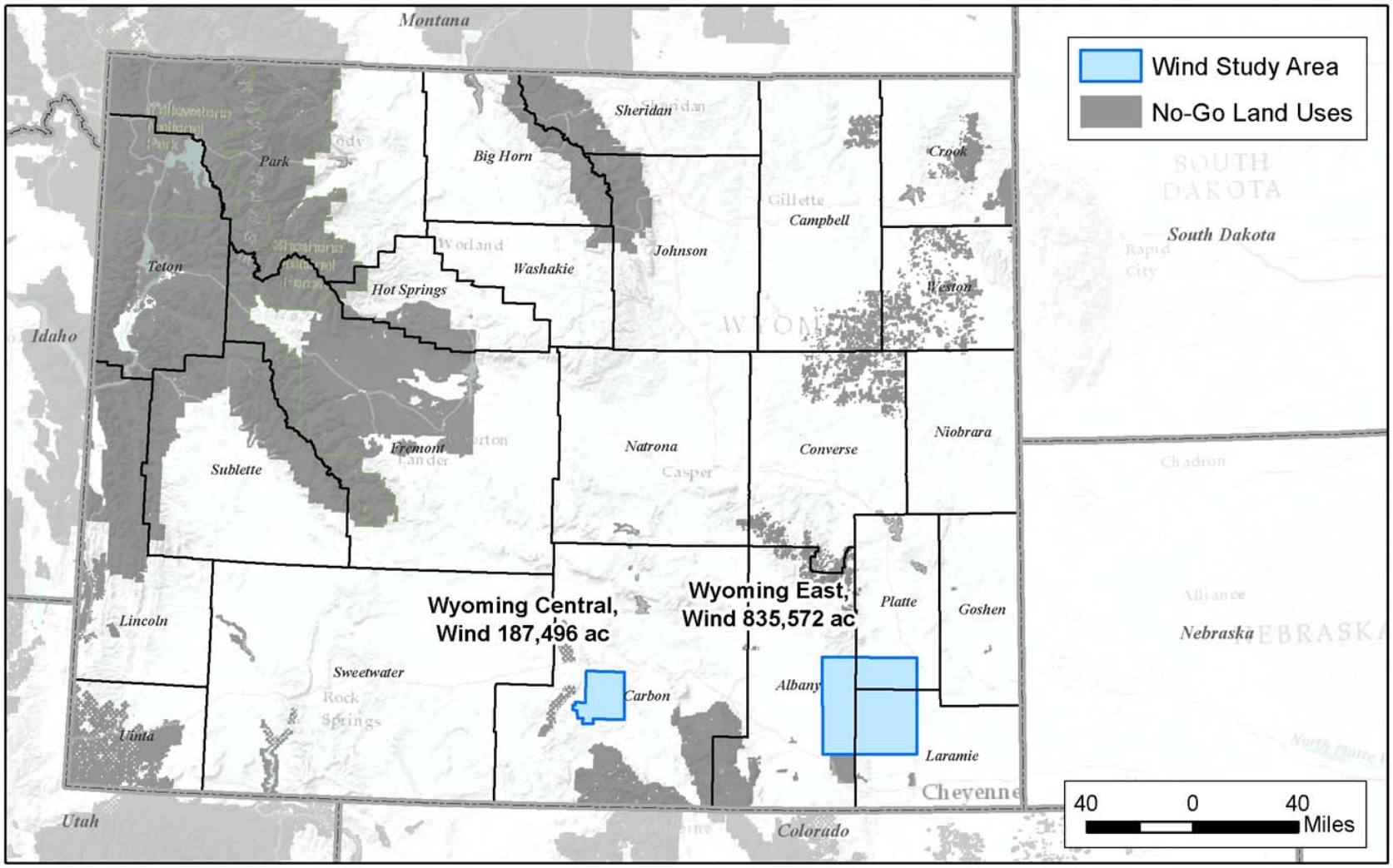
Study Areas for Wyoming Wind



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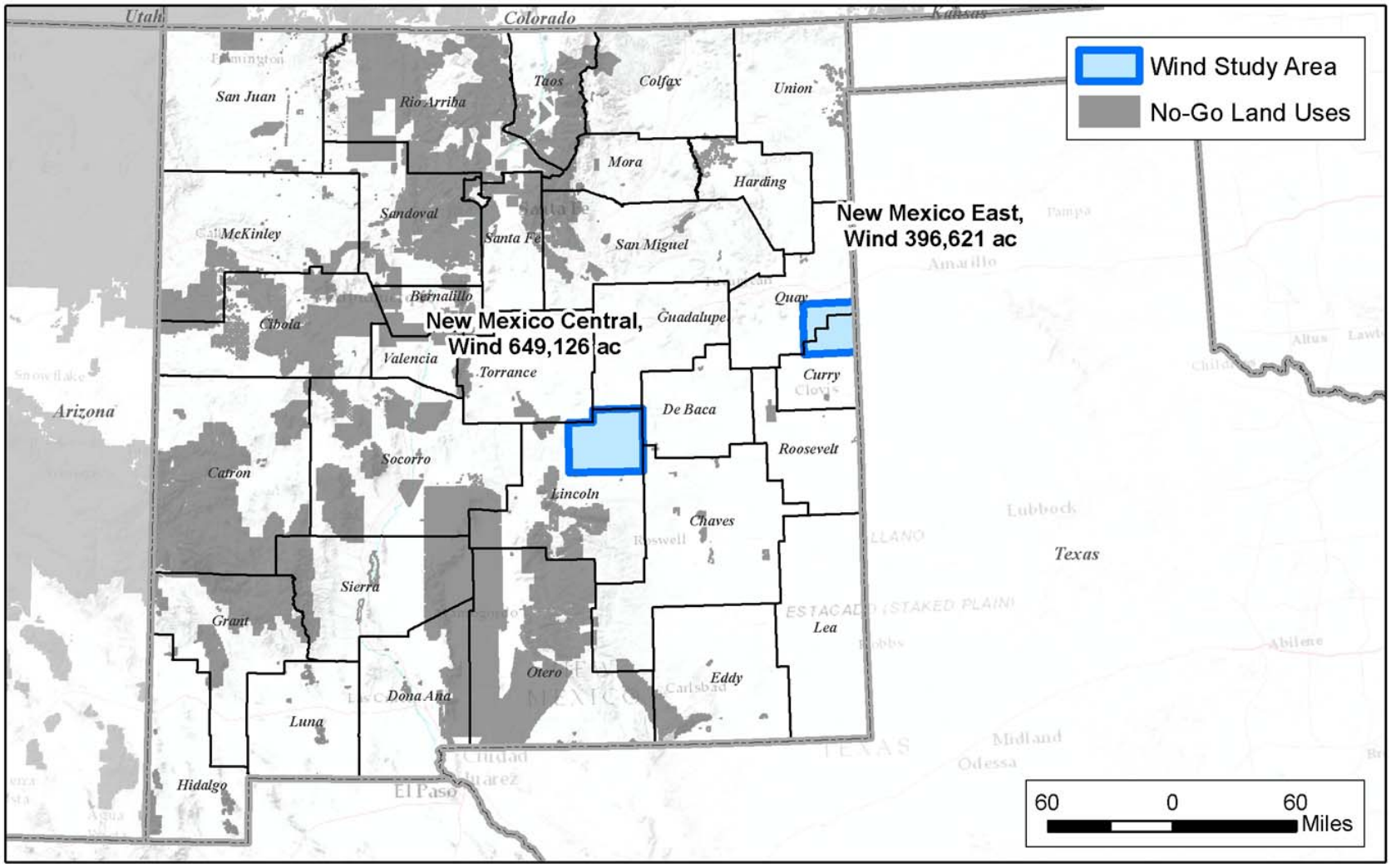
Study Areas for New Mexico Wind



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Land Use

Land Use
Methodology

- Existing population density and land uses are indicators of where conflicts may arise
  - Buildout study areas are analyzed for:
    - Population density
    - Agricultural uses
    - Coincidence with or proximity to protected land uses
  - Population density used as indicator of number of people affected and availability of open land
  - Farmland and rangeland are qualitatively reviewed for land use conversion by buildout
  - Excluded and protected areas used as indicators of incompatibility because of visual or operational concerns
- Conflicts can normally be avoided or reduced on a case-by-case basis during the siting process

Land Use Conversion and Compatibility

- Population Density
  - **Rationale:** Large census tracts are very low density, small tracts have high densities; greater numbers of people per sq. mi. increase potential for conflicts.
- Agriculture Activity
  - **Rationale:** In some instances, agriculture may be converted to solar energy production; wind is less likely to affect agriculture or rangeland, and wind areas often on ridges with little agriculture.
- Proximity to Excluded or Protected Areas
  - **Rationale:** Protected lands (National Parks, wilderness, refuges, etc.) in and around the resource areas may suggest a potential for adverse visual effects to arise, particularly for wind turbines visible over large distances, and proximity of military installations increases the potential for use and operational conflicts.

Land Use, Results

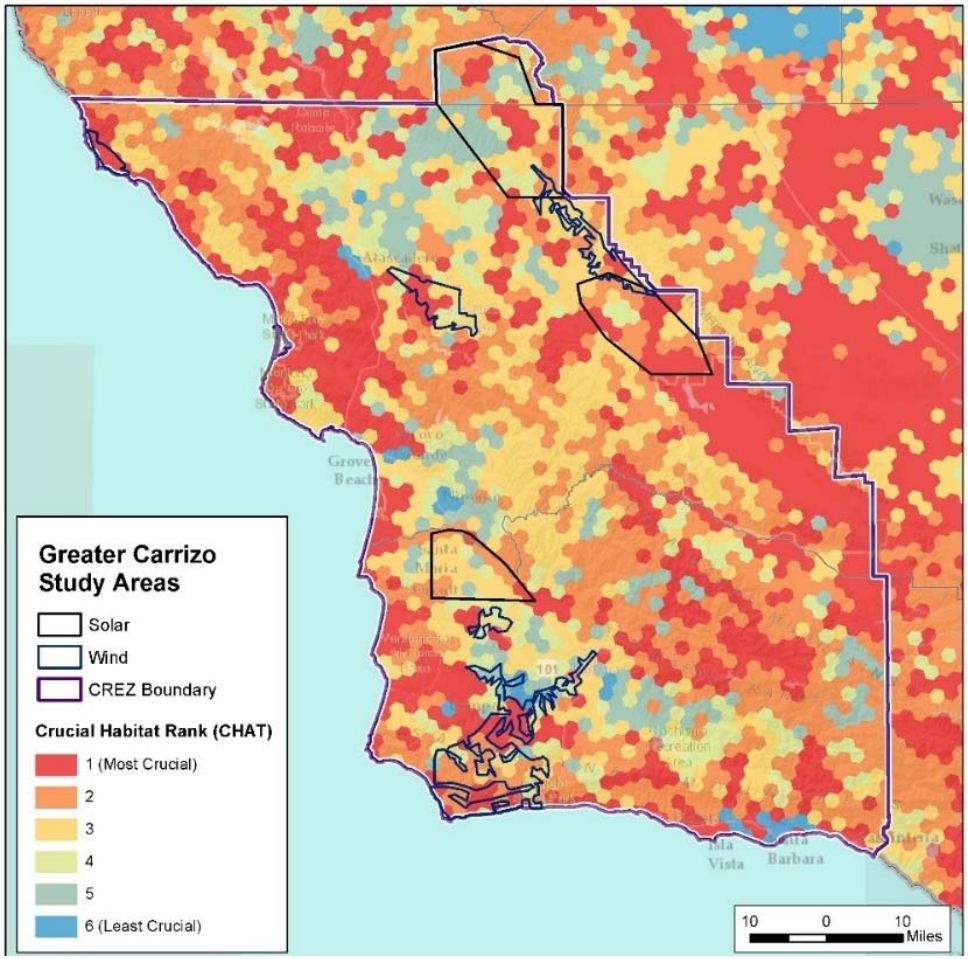
- 2020 Regional ISO scenario includes no incremental renewable energy development; no land use impact.
- Incremental buildout of renewable portfolios by 2030 in all scenarios involves some land use conversion and potential incompatibilities.
- By 2030, the change from Current Practice into Regional scenarios involves:
  - Inside California
    - Regional 2 and Regional 3 decrease the wind buildout in areas with medium or higher potential for impact due to potential incompatibilities, notably Solano
    - Regional 3 decreases the potential solar buildout in areas with some potential for impact due to land use conversion or potential incompatibilities
  - Out of State
    - Regional 2 decreases the potential impacts of wind buildout in the Northwest
    - Regional 3 increases solar and wind buildout in areas that have lower potential for impact due to relatively little potential for land use conversion and low potential for incompatibilities

Biological Resources

Biological Resources Baseline
Methodology

- Assess study areas using Crucial Habitat Assessment Tool (CHAT)
  - CHAT presents an aggregated measure of crucial habitat for species of interest in the western states
  - Crucial habitat includes places that are expected to contain the resources necessary for continued health of fish and wildlife populations or important ecological systems expected to provide high value for a diversity of fish and wildlife
  - Use of CHAT provides standardized comparison of baseline sensitivity across states
  - This study uses the top 2 “most crucial” ranks used to categorize the habitat value of the study areas
- Conservation planning and resource occurrence information
  - Provides study-area specific information on impact indicators
  - Data sets include: Important Bird Areas, Nat’l Wetlands Inventory, critical habitat, etc.

Biological Resources Baseline
Greater Carrizo: Solar, Wind



- Most crucial ranks:
  - Solar: 52% of study area
  - Wind: 57% of study area
- Study area concerns:
  - Migratory birds (coastal)
  - Giant kangaroo rat
  - San Joaquin kit fox
  - Critical habitat: CA red-legged frog, CA tiger salamander, fairy shrimp, SW willow flycatcher

Details for other study areas appear in Appendix 3.

Regional 2 and Regional 3, Biological Resources for Solar

California Solar Study Areas	Coverage of Most Crucial Habitat Ranks	Difference: Regional 2 relative to CP1a	Difference: Regional 3 relative to CP1a
Greater Carrizo Solar	52%	No change	Impacts eliminated
Greater Imperial Solar	44%	No change	Impacts reduced
Kramer and Inyokern Solar	2%	No change	No change
Owens Valley Solar	87%	No change	Impacts slightly reduced
Riverside East and Palm Springs Solar	30%	Impacts increased	Impacts eliminated
Tehachapi Solar	13%	No change	Impacts reduced
Westlands Solar	5%	Impacts reduced	Impacts reduced

Regional 2 and Regional 3, Biological Resources for Wind

California Wind Study Areas	Coverage of Most Crucial Habitat Ranks	Difference: Regional 2 relative to CP1a	Difference: Regional 3 relative to CP1a
Central Valley North and Los Banos Wind	77%	No change	No change
Greater Carrizo Wind	57%	No change	No change
Greater Imperial Wind	56%	No change	No change
Riverside East and Palm Springs Wind	55%	Impacts eliminated	Impacts eliminated
Solano Wind	73%	Impacts eliminated	Impacts eliminated
Tehachapi Wind	20%	No change	No change

Regional 2 and Regional 3, Biological Resources Out of State

Out of State Solar & Wind Study Areas	Coverage of Most Crucial Habitat Ranks	Difference: Regional 2 relative to CP1a	Difference: Regional 3 relative to CP1a
Southwest Solar (Arizona)	2%	Impacts increased	Impacts increased
Northwest Wind (Oregon)	31%	Impacts reduced	Impacts reduced
Utah Wind	10%	No change	Impacts slightly reduced
Wyoming Wind	31%	Impacts greatly increased (beyond RPS)	Impacts greatly increased (beyond RPS plus RPS portfolio)
New Mexico Wind	26%	Impacts greatly increased (beyond RPS)	Impacts greatly increased (beyond RPS plus RPS portfolio)

Biological Resources, Results (1)

- 2020 Regional ISO scenario includes no incremental renewable energy development; no biological resources impacts.
- Incremental buildout of renewable portfolios by 2030 in all scenarios involves some level of the following:
  - Inside California
    - Potential for habitat conversion within seven solar areas, reduced to five solar areas in Regional scenarios
    - Potential avian and bat mortality within six wind areas, reduced to four wind areas in Regional scenarios
    - Potential wildlife movement constriction (solar) notably in Riverside East & Palm Springs (e.g., desert tortoise) area, reduced in Regional scenarios
  - Out of State
    - Potential avian and bat mortality (wind) in study areas with a baseline of relatively high sensitivity in Northwest, Wyoming, and New Mexico

Biological Resources, Results (2)

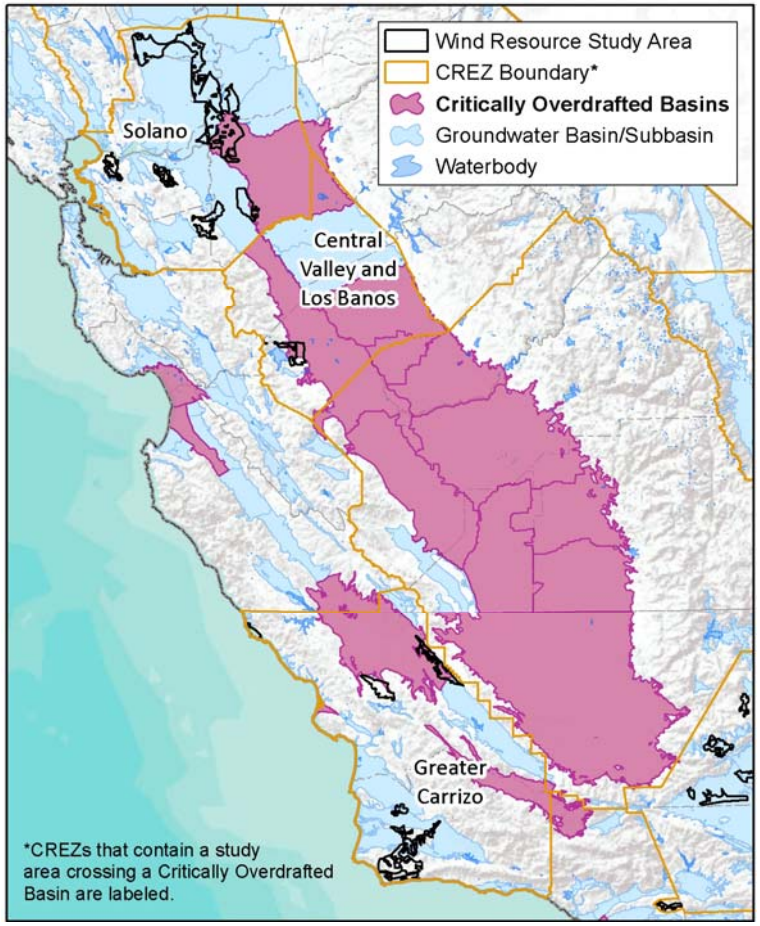
- By 2030, the change from Current Practice into Regional scenarios involves:
  - Inside California
    - Regional 2 exchanges potential impacts, by slightly increasing impacts to resources in Riverside East & Palm Springs (e.g., desert tortoise) and reducing impacts elsewhere
    - Regional 2 and Regional 3 reduce impacts to avian resources (e.g., migratory birds) by eliminating wind in Riverside East & Palm Springs and Solano
  - Out of State
    - Regional 3 reduces impacts to avian resources in Northwest wind area with a relatively high baseline sensitivity
    - Regional 3 increases impacts to avian resources in Wyoming and New Mexico due to wind for California customers in the RPS portfolio
    - Regional 2 and Regional 3 also increase impacts in Wyoming and New Mexico due to renewable energy development facilitated by the Regional market (5,000 MW wind)

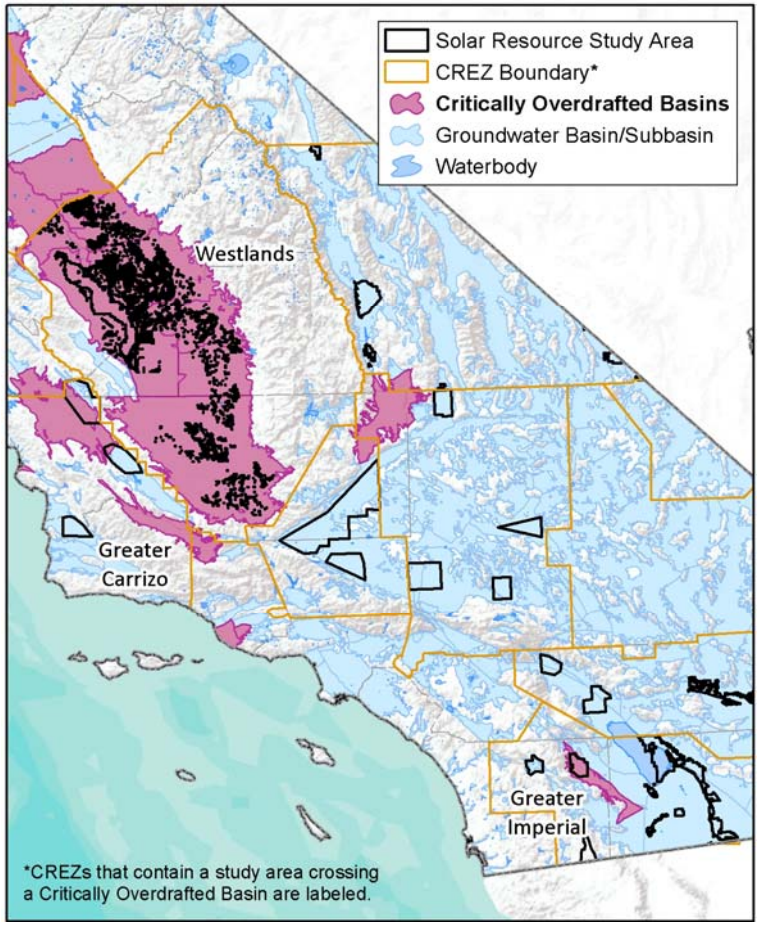
Water

Water Resources, Baseline in California

- California does not have groundwater regulations that limit the amount of groundwater extracted by wells and pumps
- Groundwater extraction and drought result in historically-low groundwater elevations in many regions of California
- Study areas overlapping **Critically Overdrafted Groundwater Basins** as defined by California Dept. of Water Resources:
  - Carrizo Solar and Wind
  - Imperial Solar
  - Solano Wind
  - Central Valley and Los Banos
  - Tehachapi Wind
  - Westlands Solar

Critically Overdrafted Basins, California DWR





Water Resources Baseline

California: Risk Categories (World Resources Institute)

California Study Areas	Area in High Risk	Area in Medium to High Risk	Area in Low to Medium Risk
Central Valley North Los Banos Wind		100%	
Greater Carrizo Solar and Wind		100%	
Greater Imperial Solar	60%		40%
Greater Imperial Wind	50%		50%
Kramer Inyokern Solar		60%	40%
Owens Valley			100%
Riverside East & Palm Springs Solar	40%	25%	35%
Riverside East & Palm Springs Wind	100%		
Solano Wind		50%	50%
Tehachapi Solar		75%	25%
Tehachapi Wind	25%	50%	25%
Westlands Solar	100%		

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Water Resources Baseline

Out of State: Risk Categories (World Resources Institute)

Out of State Study Areas	Area in High Risk	Area in Medium to High Risk	Area in Low to Medium Risk
Arizona Solar	100%		
Oregon/Washington Wind			100%
Utah Wind	100%		
Wyoming Central Wind		100%	
Wyoming East Wind	25%	75%	
New Mexico Central Wind	70%	30%	
New Mexico East Wind	70%		30%

Water Used for Construction
Methodology

- Potential impacts due to construction activities in each buildout; no net increase in thermal MW generation capacity in California
- For determining where areas of buildout-related construction activities for renewable buildout may coincide with constrained groundwater availability:
  - Inside California
    - California Dept. of Water Resources (DWR) *Critically Overdrafted Groundwater Basins*: basins and subbasins in conditions of critical overdraft, resulting from seawater intrusion, land subsidence, groundwater depletion, and/or chronic lowering of groundwater levels
  - California and Outside of California
    - World Resources Institute (WRI) *Aqueduct Water Risk Atlas* (Aqueduct) is a publicly available, global database and interactive tool that maps indicators of water-related risks
    - Provides one overall score of water risk that includes indicators of water quantity, water variability, water quality, public awareness of water issues, access to water, and ecosystem vulnerability
    - Allows for an apples to apples comparison among states using US-specific data

Water, Results for Construction

- By 2030, inside California, the Regional scenarios involve less construction of renewable resources in California's Critically Overdrafted Basins
  - Regional 2 reduces construction use of water in two critically overdrafted basins, when compared with the buildout of Current Practice 1a
  - Regional 3 reduces construction use of water in four critically overdrafted basins, when compared with the buildout of Current Practice 1a

Water, Results for Construction

Water Used for Construction of Incremental Renewable Buildout (acre-ft)	Current Practice 1a	Difference: Regional 2 relative to CP1a	Difference: Regional 3 relative to CP1a
Inside California			
High risk water area	6,887	-1,656	-4,960
Medium to high risk water area	7,186	+860	-3,236
Low to medium risk water area	4,310	+814	-1,652
Out of State			
High risk water area	6,305	+3,710	+4,359
Medium to high risk water area	477	+1,170	+1,912
Low to medium risk water area	1,039	-234	-614

Water Consumption during Operations

- For determining where changes in MWh production with cooling water demands may coincide with areas of constrained groundwater availability
- Operational effects due to MWh production by conventional or renewable technologies
  - Used NREL's *A Review of Operational Water Consumption and Withdrawal Factors for Electricity Generating Technologies* (2011)
    - The numbers were comparable with other reports (ex. *A Retrospective Analysis of the Benefits and Impacts of U.S. Renewable Portfolio Standards)*
  - Used water consumption factors for renewable and conventional technologies (gal/MWh)
    - PV = 26
    - Wind = 0
    - Geothermal = 10 for Flash and 3,600 for Binary
    - Natural Gas = 198 for Combined Cycle, 0 for Combustion Turbine
    - Coal = 687
  - Water withdrawal factors were not used because water consumption is a better representation of the effect on groundwater

Water, Results for Operations

Water Used for Operation of Generators (acre-ft)	Difference: 2020 Regional ISO relative to CP	2030 Current Practice 1a	Difference: 2030 Regional 2 relative to CP1a	Difference: 2030 Regional 3 relative to CP1a
California				
California Solar	0	4,580	295	-659
California Natural Gas (CC)	-472	41,486	-2,177	-3,982
California Natural Gas (ST)	-19	0	-52	-110
California Coal	-1	0	0	0
California Total (ex-Geothermal)	**-492**	**46,066**	**-1,933**	**-4,751**
California Geothermal	97	216,563	500	1,836
Impact of Regionalization			*-4.2%*	*-10.3%*
Out of State				
Out of State Solar	0	1,623	113	113
Out of State Nat Gas (CC)	-93	169,032	-5,761	-5,391
Out of State Nat Gas (ST)	-8	3,560	-118	-77
Out of State Coal	4,126	295,450	-8,995	-3,171
Out of State Total (ex-Geothermal)	**4,025**	**469,664**	**-14,761**	**-8,524**
Out of State Geothermal	-8	43,748	-466	-398
Impact of Regionalization			*-3.1%*	*-1.8%*

Note: Most geothermal facilities use either geothermal fluids or freshwater for cooling.

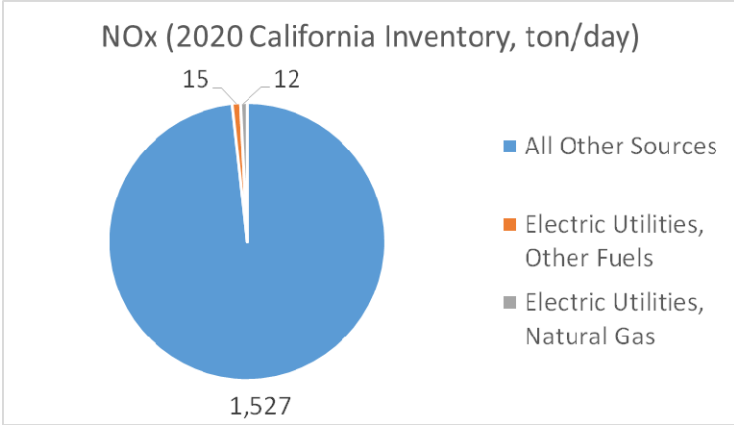
Air Emissions Changes

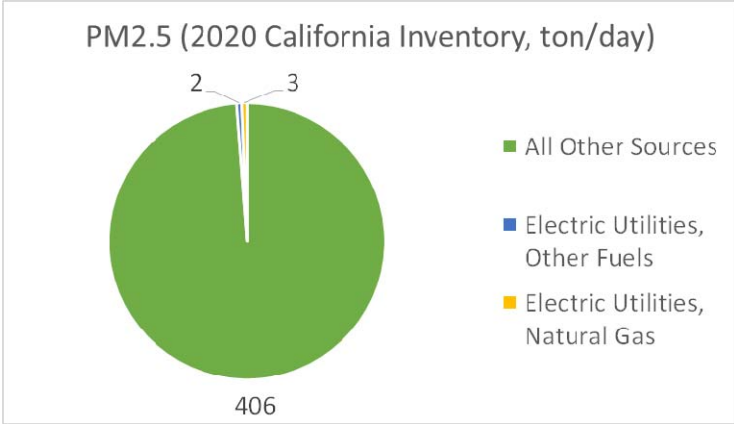
Air Emissions, Baseline for Electric Utilities in California

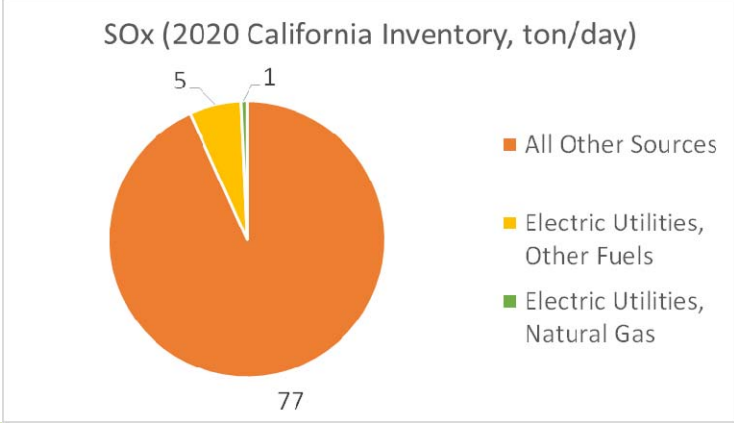
Criteria air pollutants of concern, primarily NOx, PM2.5, and SOx

- Electricity production by natural gas represents ~1% of entire California inventory
- Projections by ARB anticipate that emissions from the electric utilities subcategory will remain steady or grow slightly (about 4%) between 2020 and 2030
- Category "other fuels" includes coal and coke that are likely to be retired

Greenhouse gas (GHG) emissions analysis and CO_2 rates are presented by Brattle.







Ozone and Particulate Matter Baseline, Nonattainment Areas

California's Federal Nonattainment Areas			
California Air Basin	**Ozone Nonattainment Designation (8-hour NAAQS)**	**PM10 Nonattainment Designation (24-hour NAAQS)**	**PM2.5 Nonattainment Designation (24-hour NAAQS)**
San Joaquin Valley	Extreme	Maintenance	Serious
South Coast	Extreme	Maintenance	Serious
Salton Sea	Severe (Riverside); Marginal (Imperial)	Serious	Moderate (Imperial)
North Central Coast	---	---	---
Mojave Desert	Severe (West Mojave Desert); Marginal (Eastern Kern)	Moderate; Serious (Eastern Kern)	---
Sacramento Valley	Severe (Sacramento Metro)	Maintenance	Moderate (Sacramento Metro)
San Francisco Bay Area	Marginal	---	Moderate
South Central Coast	Serious (Ventura); Marginal (Eastern San Luis Obispo)	---	---
San Diego	Marginal	---	---

Air Pollutant Reductions by 2030 Driven by Less Fossil Fuel Use

- New renewable resource buildouts between 2020 and 2030 drive reductions in California fossil fuel use
- Incremental buildouts by 2030 involve no net increase in fossil fuel MW generation capacity in California
- Fossil fuel MWh production changes are almost exclusively between natural gas inside California and coal or natural gas outside California
  - California natural gas dispatch by 2030 is notably lower (-14% to -21%) than the 2020 Current Practice
  - Out of State coal dispatch decreases and natural gas dispatch increases by 2030 when compared with the 2020 Current Practice

California Natural Gas Dispatch (GWh)

California Natural Gas Dispatch by Air Basin (GWh)	2020 Current Practice	2020 Regional ISO	2030 Current Practice 1a	2030 Regional 2	2030 Regional 3
Mojave Desert	6,451	6,425	3,584	3,041	2,695
North Central Coast	2,454	2,423	2,504	2,510	2,602
North Coast	228	227	223	220	216
Sacramento Valley	11,087	10,800	9,712	8,835	8,326
Salton Sea	168	163	133	1	2
San Diego County	3,903	3,575	3,176	2,458	2,392
San Francisco Bay	22,608	22,131	19,724	20,678	19,688
San Joaquin Valley	35,369	35,363	30,430	29,749	29,074
South Central Coast	1,479	1,480	1,476	1,476	1,476
South Coast	21,131	20,844	19,083	17,186	16,653
Statewide Total	**104,878**	**103,431**	**90,045**	**86,156**	**83,124**
Impact of Regionalization (GWh)		**2020 Relative to CP**		**2030 Relative to CP1a**	**2030 Relative to CP1a**
Difference Statewide		**-1,447**		**-3,888**	**-6,921**
(% Relative to CP)		*-1.4%*		*-4.3%*	*-7.7%*
Difference from 2020 CP			**-14,833**	**-18,722**	**-21,754**
(% Relative to 2020)			*-14.1%*	*-17.9%*	*-20.7%*

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California Natural Gas Dispatch (Unit Starts)

California Natural Gas Dispatch by Air Basin (Unit Starts)	2020 Current Practice	2020 Regional ISO	2030 Current Practice 1a	2030 Regional 2	2030 Regional 3
Mojave Desert	154	165	350	295	240
North Central Coast	46	46	203	164	148
North Coast	3,503	3,506	3,530	3,671	3,682
Sacramento Valley	4,806	4,405	5,786	5,416	5,201
Salton Sea	759	721	1,648	7	4
San Diego County	409	395	586	468	449
San Francisco Bay	983	1,007	2,264	1,883	1,726
San Joaquin Valley	4,997	4,713	7,100	5,698	5,483
South Central Coast	94	88	98	86	86
South Coast	2,782	2,777	3,692	3,238	2,994
Statewide Total	**18,533**	**17,823**	**25,257**	**20,926**	**20,013**
Impact of Regionalization (GWh)		**2020 Relative to CP**		**2030 Relative to CP1a**	**2030 Relative to CP1a**
Difference Statewide		**-710**		**-4,331**	**-5,244**
(% Relative to CP)		*-3.8%*		*-17.1%*	*-20.8%*
Difference from 2020 CP			**6,724**	**2,393**	**1,480**
(% Relative to 2020)			*+36.3%*	*+12.9%*	*+8.0%*

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Air Emissions Changes in California

- In 2020 Regional ISO scenario, production simulation indicates a slight decrease (-0.5%) in California natural gas use. This slightly decreases NOx, PM2.5, SO2 emissions in California.
- In 2030 Regional 2 and Regional 3, production simulation indicates overall reductions (-4% to -7%) in California natural gas use with fewer startups (about -20%) of natural gas units. This decreases NOx, PM2.5, SO2 emissions in California.
- In the sensitivity scenario of 2030 Regional 3 w/o renewables beyond RPS: California natural gas use is comparable with 2030 CP1a, slightly increasing PM2.5 and SO2 (+0.9% to +1%); notably fewer startups (-17%) of natural gas units decreases NOx (-4%).

Air Emissions Changes, NOx Results in California

California Natural Gas Dispatch by Air Basin (NOx ton/day)	2020 Current Practice	2020 Regional ISO	2030 Current Practice 1a	2030 Regional 2	2030 Regional 3
Mojave Desert	0.74	0.74	0.55	0.46	0.40
North Central Coast	0.41	0.41	0.47	0.46	0.46
North Coast	0.22	0.22	0.21	0.22	0.21
Sacramento Valley	1.30	1.27	1.35	1.21	1.13
Salton Sea	0.06	0.05	0.10	0.00	0.00
San Diego County	0.49	0.46	0.48	0.36	0.35
San Francisco Bay	2.63	2.58	2.75	2.67	2.51
San Joaquin Valley	6.46	6.43	6.44	6.22	6.06
South Central Coast	0.20	0.20	0.20	0.19	0.19
South Coast	2.74	2.70	2.67	2.42	2.33
Statewide Total	**15.24**	**15.06**	**15.21**	**14.23**	**13.66**
(% of All CA Sources)	*1.0%*	*1.0%*	*1.2%*	*1.2%*	*1.1%*
Impact of Regionalization (NOx ton/day)		**2020 Relative to CP**		**2030 Relative to CP1a**	**2030 Relative to CP1a**
Difference Statewide		-0.18		-0.99	-1.56
(% Relative to CP)		*-1.2%*		*-6.5%*	*-10.2%*
Difference from 2020 CP			-0.03	-1.01	-1.58
(% Relative to 2020)			*-0.2%*	*-6.6%*	*-10.4%*

Air Emissions Changes, PM2.5 Results in California

California Natural Gas Dispatch by Air Basin (PM2.5 ton/day)	2020 Current Practice	2020 Regional ISO	2030 Current Practice 1a	2030 Regional 2	2030 Regional 3
Mojave Desert	0.45	0.46	0.26	0.22	0.20
North Central Coast	0.24	0.24	0.25	0.25	0.25
North Coast	0.03	0.03	0.03	0.03	0.03
Sacramento Valley	0.88	0.87	0.80	0.74	0.70
Salton Sea	0.02	0.02	0.02	0.00	0.00
San Diego County	0.31	0.29	0.26	0.22	0.21
San Francisco Bay	1.64	1.61	1.45	1.52	1.46
San Joaquin Valley	2.60	2.61	2.28	2.24	2.20
South Central Coast	0.16	0.16	0.16	0.16	0.16
South Coast	1.45	1.46	1.31	1.19	1.15
Statewide Total	**7.78**	**7.75**	**6.82**	**6.55**	**6.36**
(% of All CA Sources)	*1.9%*	*1.9%*	*1.6%*	*1.5%*	*1.5%*
Impact of Regionalization (PM2.5 ton/day)		**2020 Relative to CP**		**2030 Relative to CP1a**	**2030 Relative to CP1a**
Difference Statewide		-0.04		-0.27	-0.47
(% Relative to CP)		*-0.5%*		*-4.0%*	*-6.8%*
Difference from 2020 CP			-0.96	-1.24	-1.43
(% Relative to 2020)			*-12.4%*	*-15.9%*	*-18.4%*

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Air Emissions Changes, SO_2 Results in California

California Natural Gas Dispatch by Air Basin (SO2 ton/day)	2020 Current Practice	2020 Regional ISO	2030 Current Practice 1a	2030 Regional 2	2030 Regional 3
Mojave Desert	0.05	0.05	0.03	0.02	0.02
North Central Coast	0.03	0.03	0.03	0.03	0.03
North Coast	0.00	0.00	0.00	0.00	0.00
Sacramento Valley	0.09	0.09	0.09	0.08	0.07
Salton Sea	0.00	0.00	0.00	0.00	0.00
San Diego County	0.03	0.03	0.03	0.02	0.02
San Francisco Bay	0.17	0.17	0.15	0.16	0.15
San Joaquin Valley	0.28	0.28	0.24	0.24	0.23
South Central Coast	0.02	0.02	0.02	0.02	0.02
South Coast	0.15	0.15	0.14	0.13	0.12
Statewide Total	**0.82**	**0.82**	**0.72**	**0.69**	**0.67**
(% of All CA Sources)	*1.0%*	*1.0%*	*0.8%*	*0.7%*	*0.7%*
Impact of Regionalization (SO2 ton/day)		**2020 Relative to CP**		**2030 Relative to CP1a**	**2030 Relative to CP1a**
Difference Statewide		0.00		-0.03	-0.05
(% Relative to CP)		*-0.5%*		*-4.0%*	*-6.8%*
Difference from 2020 CP			-0.10	-0.13	-0.15
(% Relative to 2020)			*-12.4%*	*-15.9%*	*-18.4%*

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Results of Sensitivity: 2030 Regional 3 w/o Beyond RPS Wind

California Natural Gas Dispatch by Air Basin (ton/day)	NOx 2030 Current Practice 1a	NOx R3 w/o Beyond RPS Wind	PM2.5 2030 Current Practice 1a	PM2.5 R3 w/o Beyond RPS Wind	SO2 2030 Current Practice 1a	SO2 R3 w/o Beyond RPS Wind
Mojave Desert	0.55	0.51	0.26	0.25	0.03	0.03
North Central Coast	0.47	0.50	0.25	0.27	0.03	0.03
North Coast	0.21	0.22	0.03	0.03	0.00	0.00
Sacramento Valley	1.35	1.28	0.80	0.79	0.09	0.08
Salton Sea	0.10	0.00	0.02	0.00	0.00	0.00
San Diego County	0.48	0.43	0.26	0.24	0.03	0.03
San Francisco Bay	2.75	2.74	1.45	1.59	0.15	0.17
San Joaquin Valley	6.44	6.28	2.28	2.32	0.24	0.25
South Central Coast	0.20	0.19	0.16	0.16	0.02	0.02
South Coast	2.67	2.50	1.31	1.23	0.14	0.13
Statewide Total	**15.21**	**14.65**	**6.82**	**6.88**	**0.72**	**0.73**
(% of All CA Sources)	*1.2%*	*1.2%*	*1.6%*	*1.6%*	*0.8%*	*0.8%*
Impact of Regionalization (tpd)		**2030 Relative to CP1a**		**2030 Relative to CP1a**		**2030 Relative to CP1a**
Difference Statewide		**-0.56**		**0.06**		**0.01**
(% Relative to CP)		*-3.7%*		*0.9%*		*1.0%*
Difference from 2020 CP	**-0.03**	**-0.59**	**-0.96**	**-0.90**	**-0.10**	**-0.10**
(% Relative to 2020)	*-0.2%*	*-3.9%*	*-12.4%*	*-11.6%*	*-12.4%*	*-11.6%*

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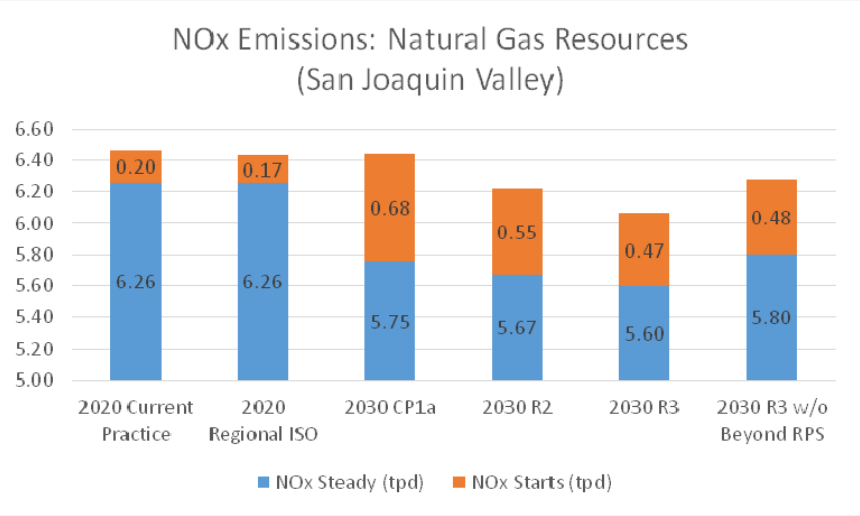
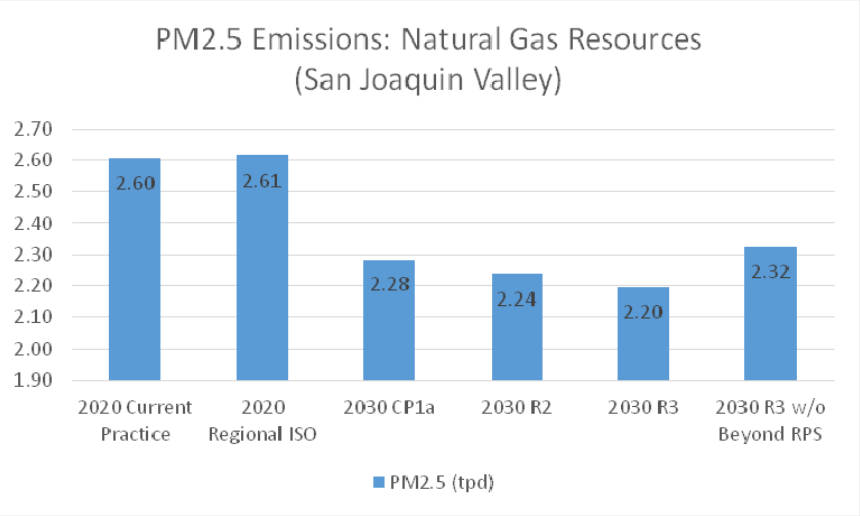
Air Emissions Changes, San Joaquin Valley Air Basin





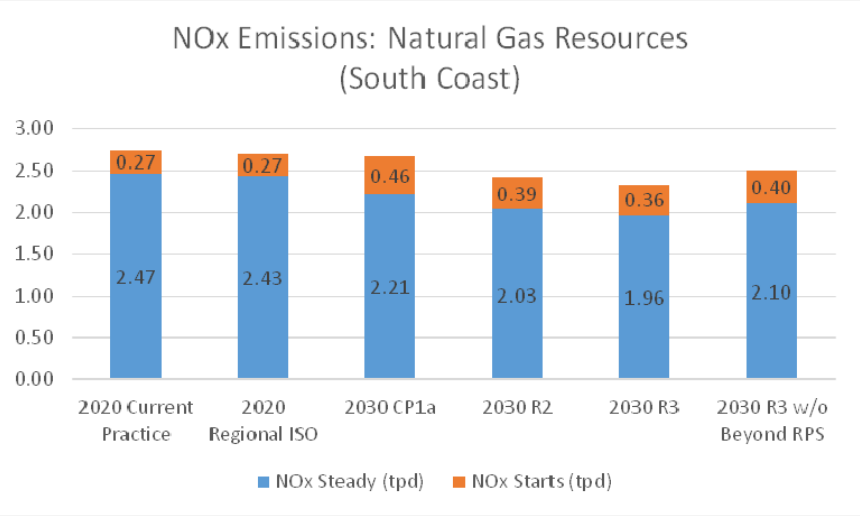
San Joaquin Valley Air Basin

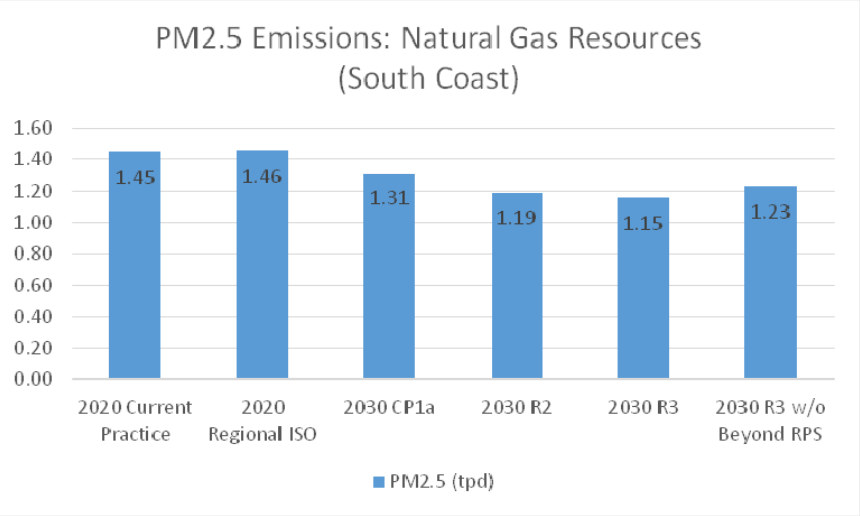
- Nonattainment for ozone (extreme) and PM2.5 (serious)
- Covers the Central Valley area of concern for disadvantaged communities

San Joaquin Valley Results

- 2020 Regional ISO (CAISO+PAC) scenario shows little change in NOx, PM2.5, SO2 emissions
- All 2030 scenarios show PM2.5, SO2 as notably lower than 2020
- 2030 Current Practice NOx is comparable to 2020; PM2.5 is notably lower
- 2030 Regional scenario facilitate a decrease in NOx, PM2.5, SO2; in the sensitivity w/o renewables beyond RPS: PM2.5 and SO2 are comparable to 2030 CP1a

Air Emissions Changes, South Coast Air Basin





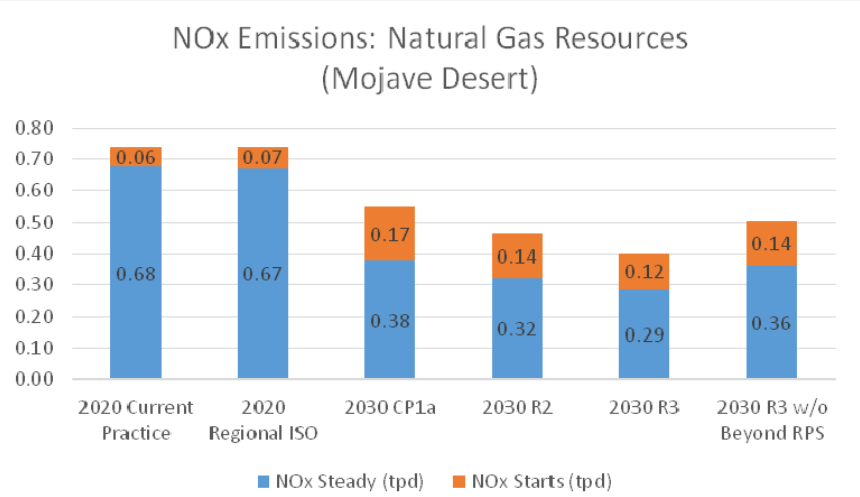
South Coast Air Basin

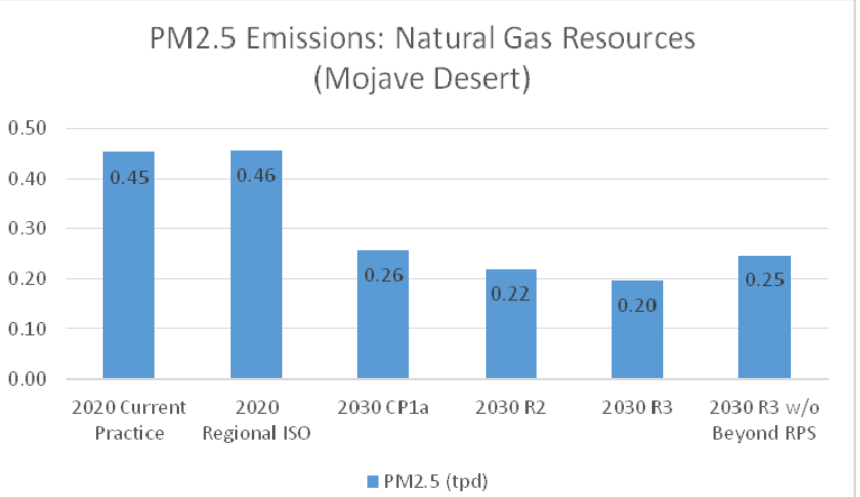
- Nonattainment for ozone (extreme) and PM2.5 (serious)
- Covers the Los Angeles area of concern for disadvantaged communities

South Coast Results

- 2020 Regional ISO (CAISO+PAC) scenario shows little change in NOx, PM2.5, SO2 emissions
- 2030 Current Practice NOx is comparable to 2020; PM2.5 is slightly lower
- 2030 Regional scenarios facilitate a decrease in NOx, PM2.5, SO2; in the sensitivity w/o renewables beyond RPS: emissions are less than 2030 CP1a

Air Emissions Changes, Mojave Desert Air Basin





Mojave Desert Air Basin

- Nonattainment for ozone (severe, partial) and PM10 (serious to moderate)
- Covers desert portion of San Bernardino areas of disadvantaged communities

Mojave Desert Results

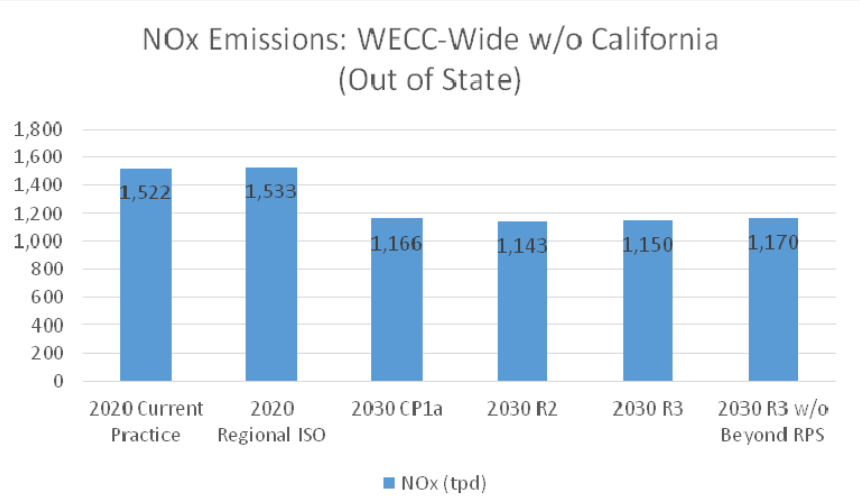
- 2020 Regional ISO (CAISO+PAC) scenario shows little change in NOx, PM2.5, SO2 emissions.
- All 2030 scenarios show NOx, PM2.5, SO2 as notably lower than 2020
- 2030 Regional scenarios facilitate a decrease in NOx, PM2.5, SO2; in the sensitivity w/o renewables beyond RPS: PM2.5 and SO2 are comparable to 2030 CP1a
- Note: Salton Sea Air Basin shows nearly zero emissions in 2030 Regional scenarios

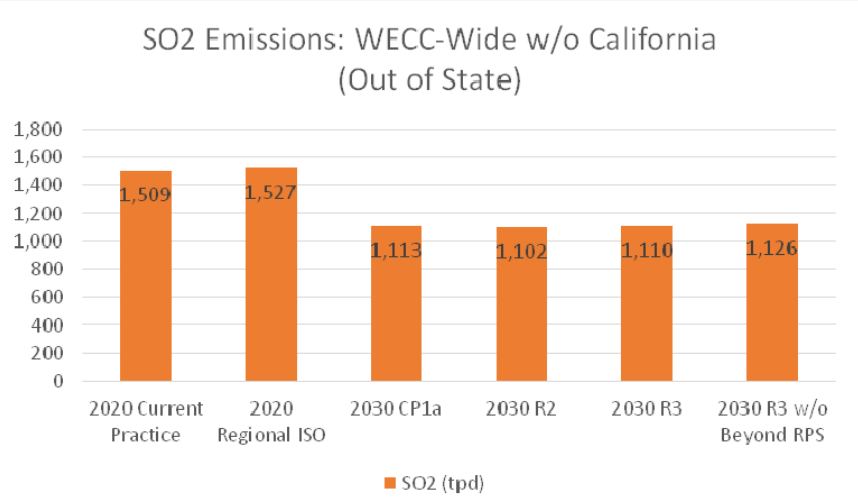
Air Emissions Changes Out of State

Air pollutant reductions outside of California by 2030 are driven by the transition away from coal:

- Between 2020 and 2030, Out of State coal dispatch decreases and natural gas dispatch increases. This reduces emissions in all 2030 scenarios when compared with the 2020 conditions.
- In 2020 Regional ISO scenario, production simulation indicates a slight (+0.5%) increase in Out of State coal use and a slight (-0.3%) decrease in Out of State natural gas use. This slightly increases emissions Out of State when compared with 2020 Current Practice.
- In 2030 Regional 2 and Regional 3, production simulation indicates overall reductions in Out of State coal and natural gas use (-0.7% to -5.3%) when compared with 2030 Current Practice 1a.
  - Regional 2 decreases NOx (-1.9%) and SO2 (-0.9%) emissions Out of State relative to 2030 CP1a
  - Regional 3 decreases NOx (-1.3%) and SO2 (-0.2%) emissions Out of State relative to 2030 CP1a

Out of State Emissions from Production Simulation





Out of State Emissions

- WECC-Wide production simulation results are shown, excluding California emissions
- Results are estimates because unit-specific emissions controls may not be reflected

Out of State Results

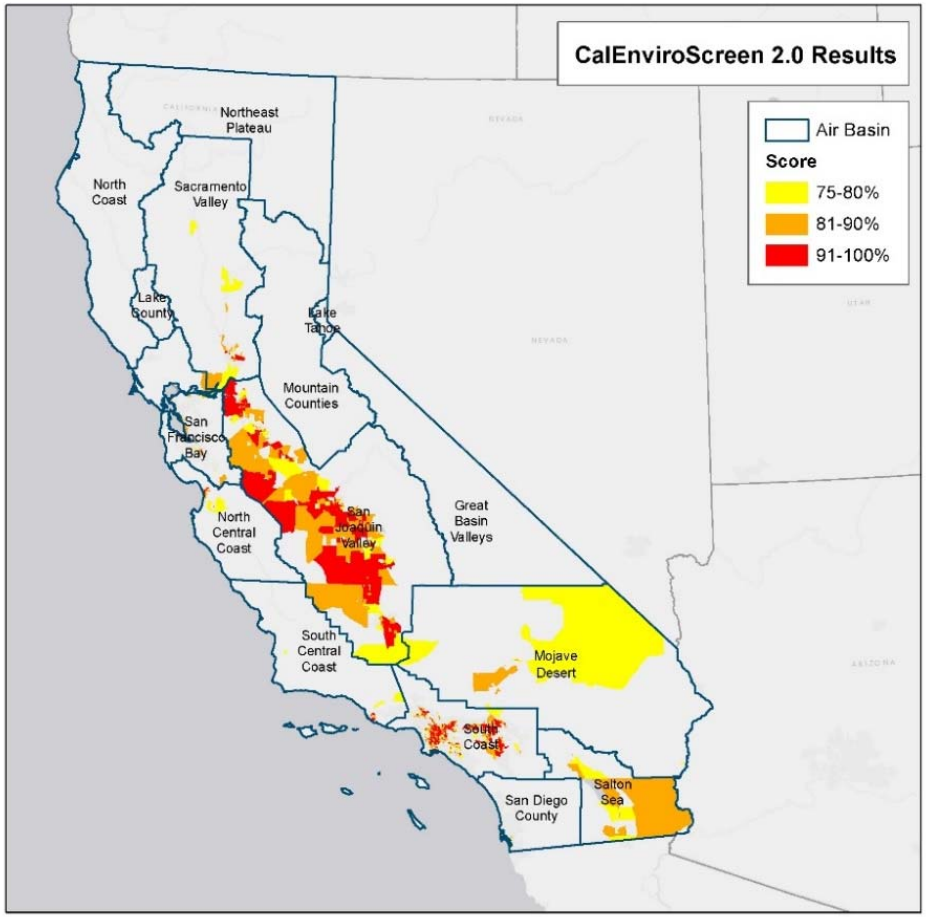
- Between 2020 and 2030, emission reductions occur due to WECC-Wide shift from coal to natural gas
- 2020 Regional ISO (CAISO+PAC) scenario slightly increases emissions Out of State
- 2030 Regional scenarios slightly decrease emissions relative to 2030 CP1a
- The sensitivity scenario of 2030 Regional 3 w/o renewables beyond RPS indicates slight increases in NOx (+0.4%) and SO2 (+1.2%) relative to 2030 CP1a

Disadvantaged Communities

Disadvantaged Communities
Methodology

Screening for Disadvantaged Communities

- Census tract scores from CalEnviroScreen 2.0 results
- 25% highest-scoring census tracts, mapped as disadvantaged communities
- Distributed and mapped within California's Air Basins and Resource Areas of this study



Screening for Disadvantaged Communities

The following geographical overlay boundaries for the SB 350 study contain the greatest fraction of population within California census tracts that are disadvantaged communities (CalEnviroScreen Score of 7.5-10).

- Locations of greatest concern for potential impacts to disadvantaged communities:
  - Air Basins:
    - San Joaquin Valley
    - South Coast
  - Resource Areas:
    - Westlands
    - Kramer & Inyokern
    - Central Valley North & Los Banos

Overview of Impact Assessment for Disadvantaged Communities

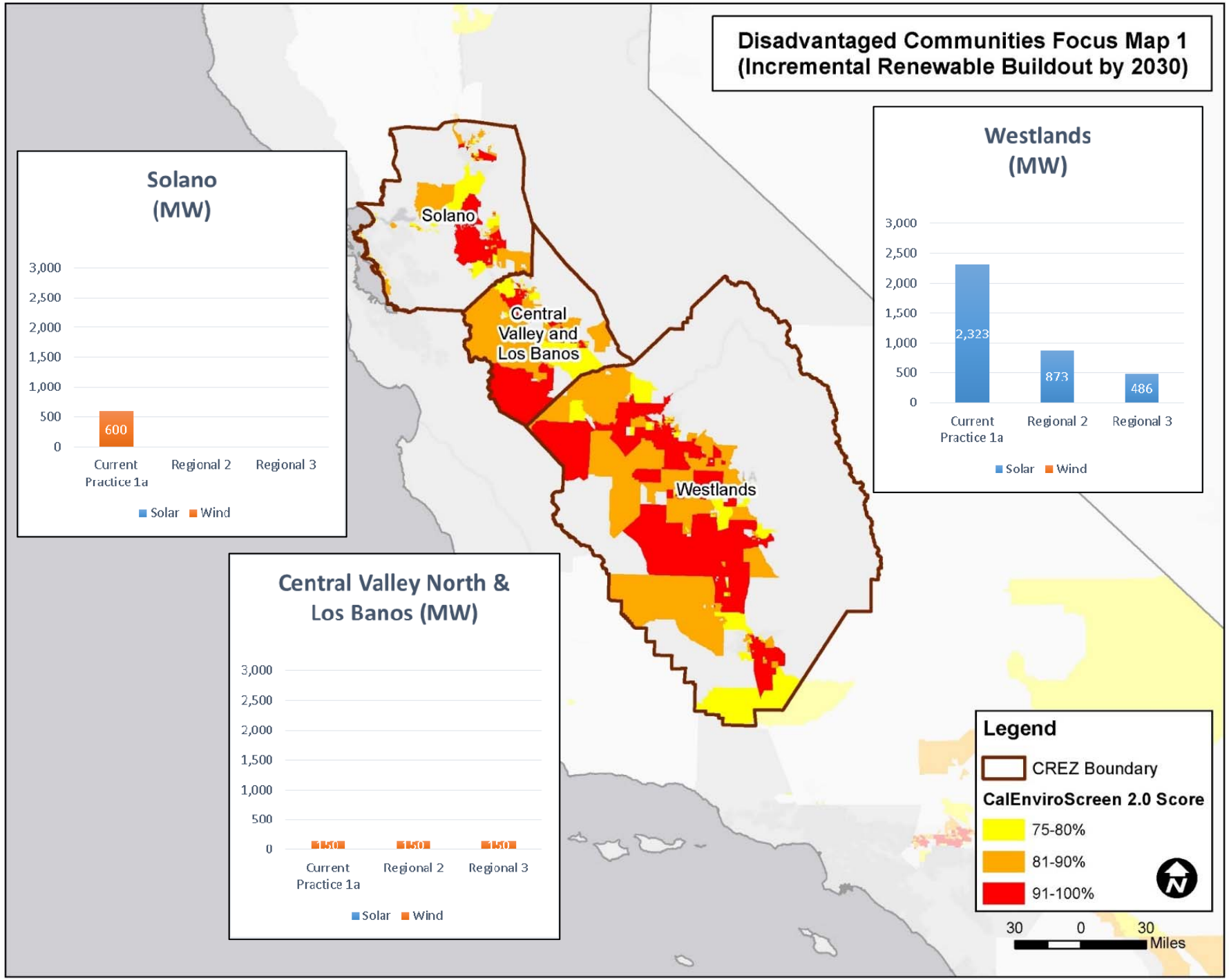
- Focus is on whether an adverse environmental impact of an action or project is likely to disproportionately burden a disadvantaged community.
- This study interprets as follows:
  - A disproportionate impact could occur if identified disadvantaged communities are the setting for most of the incremental renewable energy buildout.
  - A disproportionate impact could occur if the location of an adverse environmental impact aligns with an area of predominately disadvantaged communities.

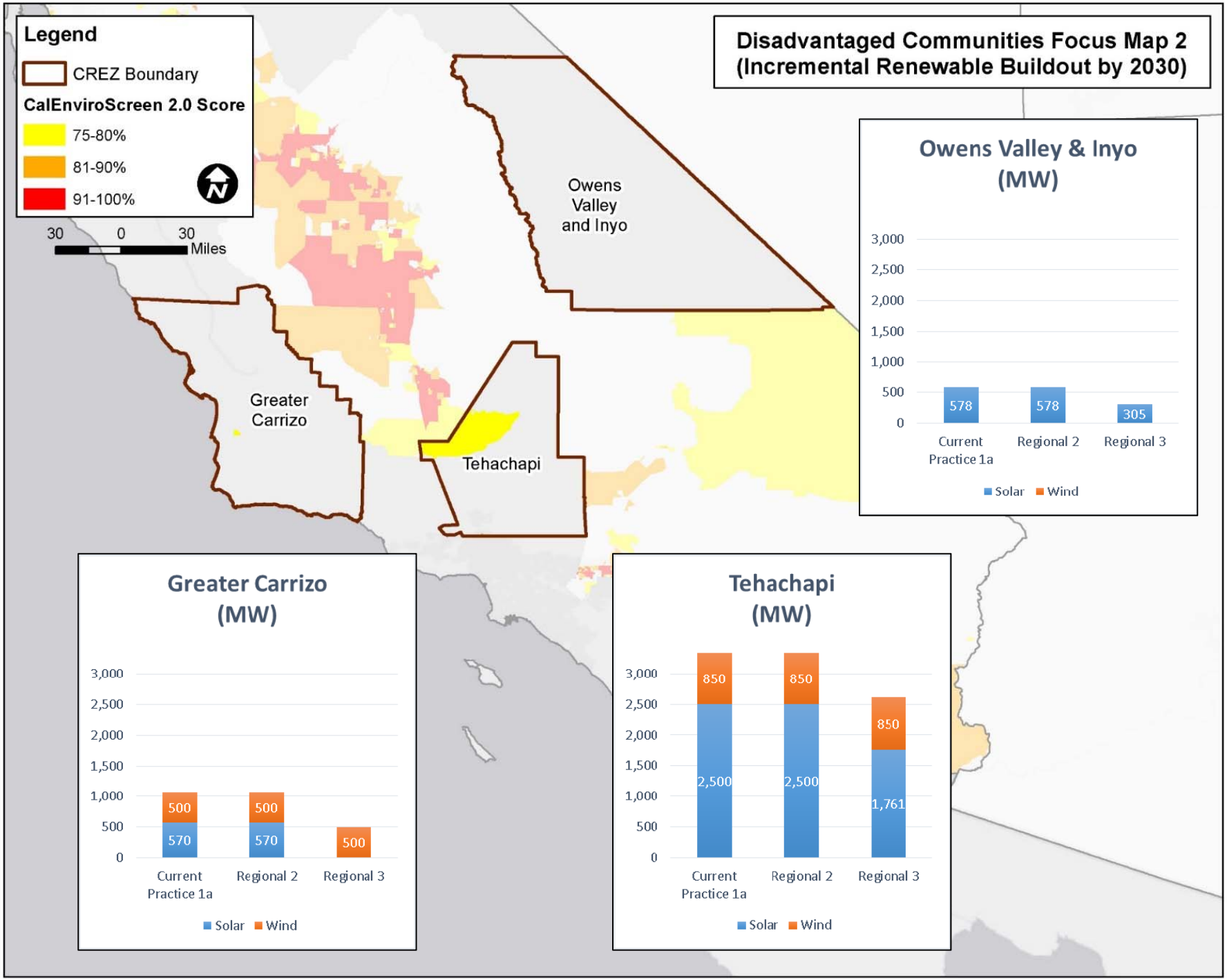
Typical Community-Scale Impacts

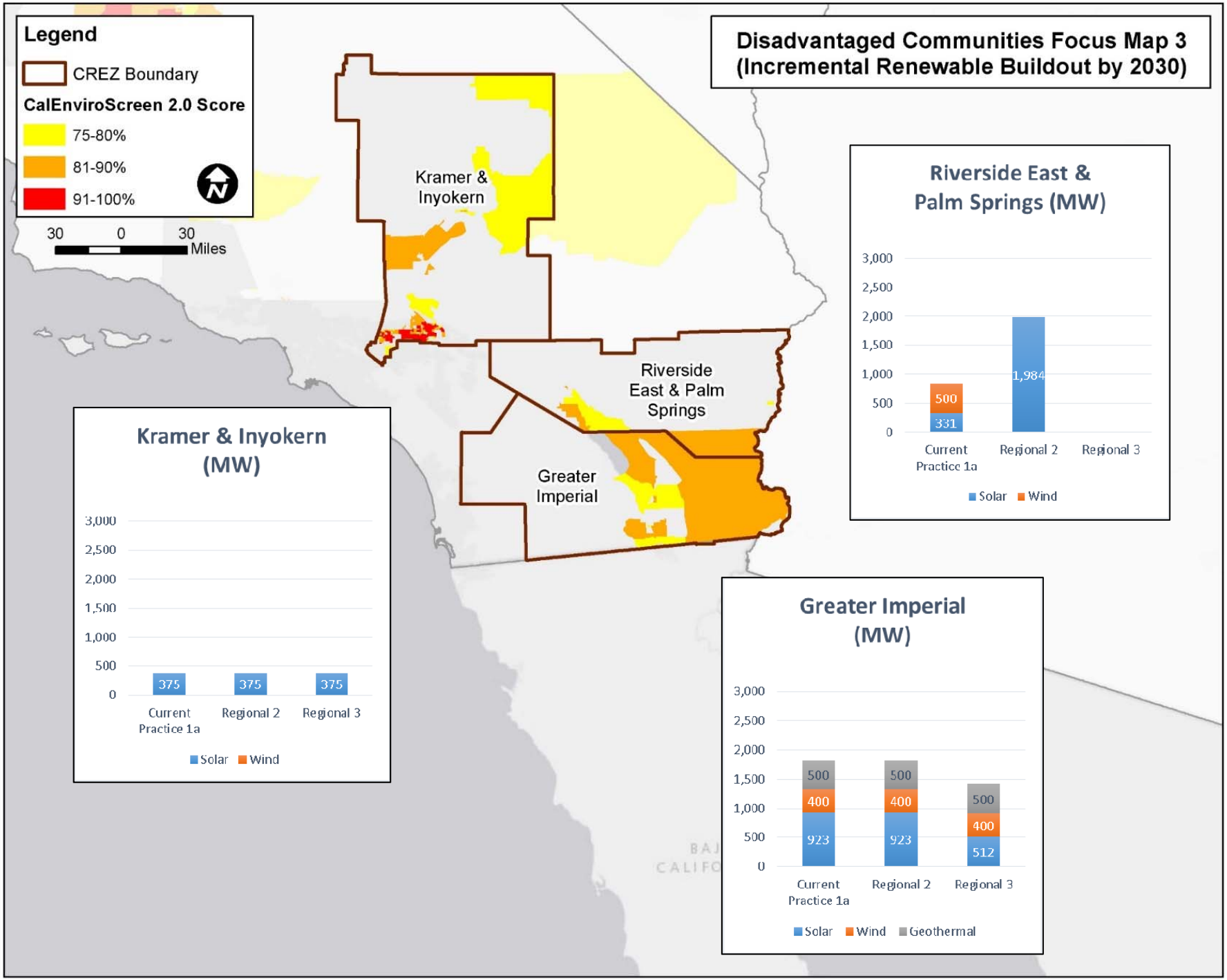
- Typical environmental impacts from the incremental renewable energy buildout by 2030 in all scenarios include the following localized or community-scale impacts:
  - Short-term (nuisance) noise, traffic, and air quality degradation during the construction of utility-scale renewable energy facilities, required transmission line interconnections, and associated access roads.
  - Visual impacts of generation and auxiliary facilities, including transmission.
  - Conversion of and limiting access to land used for agricultural, recreational, or other purposes, and land with cultural, Tribal, or religious significance.
  - Use of potable water or degradation of surface water quality.
- These impacts are normally avoided or reduced through mitigation measures applied on a case-by-case basis during the siting process.
- Potential beneficial impacts: avoided emissions from and reallocation of water used by conventional power generation; reuse of brownfield sites or degraded lands; local socioeconomic benefits.

Review of Incremental Buildouts by 2030

- Current Practice 1a buildout:
  - Emphasizes solar in Tehachapi, Westlands, and Imperial
  - Westlands (San Joaquin Valley) is one area of greatest concern for potential impacts to disadvantaged communities
- Regional 2 buildout:
  - Emphasizes solar in Riverside East & Palm Springs, Tehachapi, and Imperial
  - These areas have lower fractions of population within disadvantaged communities than Westlands
- Regional 3 buildout:
  - Lowest level of resources in California overall


Disadvantaged Communities Focus Map 1
(Incremental Renewable Buildout by 2030)
Solano
(MW)
3,000
2,500
2,000
1,500
1,000
500
0
600
Current Practice 1a
Regional 2
Regional 3
Solar
Wind
Westlands
(MW)
3,000
2,500
2,000
1,500
1,000
500
0
2,323
873
486
Current Practice 1a
Regional 2
Regional 3
Solar
Wind
Central Valley North &
Los Banos (MW)
3,000
2,500
2,000
1,500
1,000
500
0
150
150
150
Current Practice 1a
Regional 2
Regional 3
Solar
Wind
Solano
Central Valley and Los Banos
Westlands
Legend
CREZ Boundary
CalEnviroScreen 2.0 Score
75-80%
81-90%
91-100%
N
30
0
30
Miles


Disadvantaged Communities Focus Map 2
(Incremental Renewable Buildout by 2030)
Legend
CREZ Boundary
CalEnviroScreen 2.0 Score
75-80%
81-90%
91-100%
30 0 30
Miles
Owens Valley and Inyo
Greater Carrizo
Tehachapi
Owens Valley & Inyo (MW)
3,000
2,500
2,000
1,500
1,000
500
0
578
578
305
Current Practice 1a
Regional 2
Regional 3
Solar
Wind
Greater Carrizo (MW)
500
500
570
570
500
Tehachapi (MW)
850
850
850
2,500
2,500
1,761


Legend
CREZ Boundary
CalEnviroScreen 2.0 Score
75-80%
81-90%
91-100%
30 0 30
Miles
Disadvantaged Communities Focus Map 3
(Incremental Renewable Buildout by 2030)
Kramer & Inyokern
Riverside East & Palm Springs
Greater Imperial
Kramer & Inyokern (MW)
3,000
2,500
2,000
1,500
1,000
500
0
375
375
375
Current Practice 1a
Regional 2
Regional 3
Solar
Wind
Riverside East & Palm Springs (MW)
3,000
2,500
2,000
1,500
1,000
500
0
500
331
1,984
Current Practice 1a
Regional 2
Regional 3
Solar
Wind
Greater Imperial (MW)
3,000
2,500
2,000
1,500
1,000
500
0
500
400
923
500
400
923
500
400
512
Current Practice 1a
Regional 2
Regional 3
Solar
Wind
Geothermal

Impacts in Disadvantaged Communities

Are disadvantaged communities the setting for most of the new renewable energy buildout?

- Inside California, the buildout by 2030 occurs across as many as seven solar resource areas and six wind resource areas, including the following:
  - Westlands (2,323 MW solar in CP1a)
  - Kramer & Inyokern (375 MW solar in CP1a)
  - Central Valley North & Los Banos (150 MW wind in CP1a)
- Regional scenarios place less buildout inside California, with less new solar in Westlands (San Joaquin Valley) than in CP1a

Is the location of an adverse impact likely to align with an area that predominately includes disadvantaged communities?

- 2030 Regional 2 and Regional 3 decrease the amount of water used by power plants statewide
- 2030 Regional 2 and Regional 3 decrease the emissions of NOx, PM2.5, SO2 from power plants statewide and in the San Joaquin Valley and South Coast air basins

Comparison of Scenarios

Comparison of Scenarios – Land Use and Acreage Required

Study Topic	2020 Regional ISO Relative to CP	2030 Regional 2 Relative to CP1A	2030 Regional 3 Relative to CP1A
Land Use and Acreage Required in California	• No change	• Comparable impacts for solar • More solar acreage (+1,400 ac) • Fewer impacts for wind • Less wind acreage (-44,000 ac)	• Fewest impacts for solar • Lowest solar acreage (-29,000 ac) • Fewer impacts for wind • Less wind acreage (-44,000 ac)
Land Use and Acreage Required Outside California	• No change	• More solar acreage (+3,500 ac) • Impacts substantially similar except fewer impacts in Northwest (wind) • Lowest wind acreage for RPS (-35,400 ac) • Facilitates development beyond RPS (+200,000 ac, wind)	• More solar acreage (+3,500 ac) • Impacts increase in Wyoming, New Mexico • Fewest impacts in Northwest and Utah (wind) • Most wind acreage for RPS (+65,800 ac) • Adds acreage for Out of State transmission for California RPS • Facilitates development beyond RPS (+200,000 ac, wind)

Comparison of Scenarios – Biological Resources; Water

Study Topic	2020 Regional ISO Relative to CP	2030 Regional 2 Relative to CP1A	2030 Regional 3 Relative to CP1A
Biological Resources in California	• No change	• Impacts slightly increased from solar • Fewer impacts from wind	• Fewest impacts from solar • Fewer impacts from wind
Biological Resources Outside California	• No change	• Increased avian mortality due to wind beyond RPS	• Fewest impacts in Northwest and Utah (wind) • Most avian mortality for wind beyond RPS plus RPS portfolio wind • Adds impacts of Out of State transmission for California RPS
Water in California	• Slight decrease in water used for operation of generators	• Less water used during construction in high risk water areas • Less water used for operation of generators	• Least water used during construction in high risk water areas • Least water used for operation of generators
Water Outside California	• Slight increase in water used for operation of generators	• More water used during construction in high risk water areas • Least water used for operation of generators	• Most water used during construction in high risk water areas • Less water used for operation of generators

Comparison of Scenarios – Air Emissions; Disadvantaged Communities

Study Topic	2020 Regional ISO Relative to CP	2030 Regional 2 Relative to CP1A	2030 Regional 3 Relative to CP1A
Air Emissions Changes in California	• Slight decrease in emissions	• Lower emissions of NOx (-6.5%) • Lower emissions of PM2.5 and SO2 (-4.0%)	• Lowest emissions of NOx (-10.2%) • Lowest emissions of PM2.5 and SO2 (-6.8%)
Air Emissions Changes Outside California	• Slight increase in emissions	• Lowest emissions of NOx (-1.9%) • Lowest emissions of SO2 (-0.9%)	• Lower emissions of NOx (-1.3%) • Lower emissions of SO2 (-0.2%)
Disadvantaged Communities in California	• No change	• Fewer community-scale impacts from renewable buildout in California • Lower emissions from California power plants in air basins of greatest concern	• Fewest community-scale impacts from renewable buildout in California • Lowest emissions from California power plants in air basins of greatest concern

Note: Greenhouse gas (GHG) emissions analysis and CO_2 rates are presented by Brattle.

Comparison of Scenarios – Key Findings

Study Topic	2020 Regional ISO Relative to CP	2030 Regional 2 Relative to CP1A	2030 Regional 3 Relative to CP1A
Key Findings	• No incremental buildout avoids land use and biological resource impacts • Slight changes in water used for operation of generators and emissions due to dispatch	• Less overall renewable buildout for RPS (-1,282 MW) • Fewer impacts due to wind inside California • Facilitates development beyond RPS outside California • Less water used for operation of generators and lower emissions in California • Least water used for operation of generators and lowest emissions Out of State	• Least overall renewable buildout for RPS (-3,118 MW) • Fewer impacts due to wind inside California and fewest impacts from solar inside California • Most avian mortality for wind outside California • Adds impacts of Out of State transmission for California RPS • Facilitates development beyond RPS outside California • Least water used for operation of generators and lowest emissions in California • Less water used for operation of generators and lower emissions Out of State

Appendices

- Appendix 1: California Renewable Study Areas
- Appendix 2: Out of State Renewable Study Areas
- Appendix 3: Biological Resources Baseline
- Appendix 4: Review of Out of State Transmission

Appendix 1: California Renewable Study Areas

RESOLVE Portfolios of Inside-California Resources

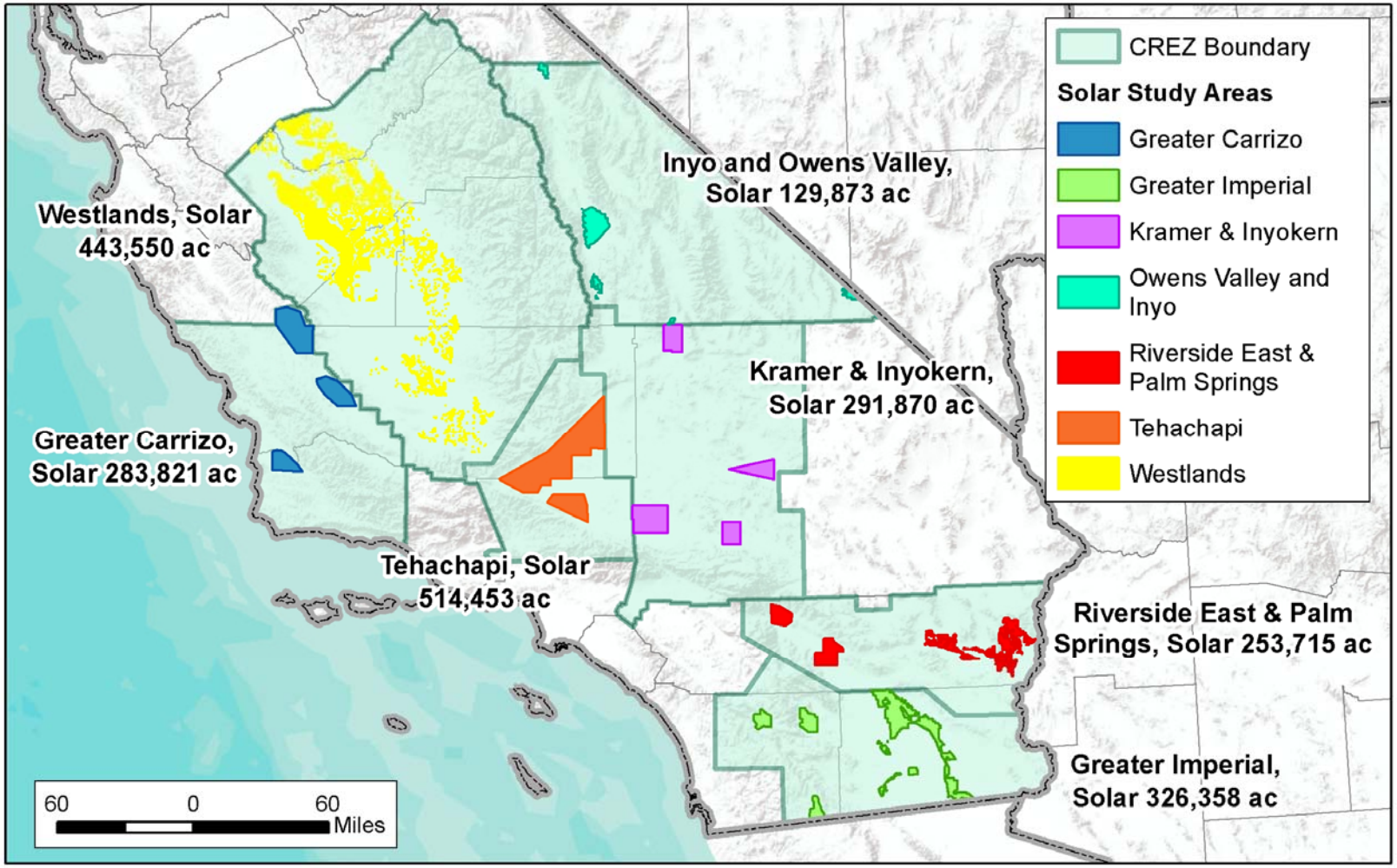
- This presents various “study areas” in Aggregated CREZs as proxy locations
- Need to focus environmental study on meaningful locations
- Need to cover the following potential resource regions in California:

– Greater Carrizo	Solar and Wind
– Central Valley North, Los Banos	Wind
– Greater Imperial	Solar and Wind
– Kramer, Inyokern	Solar
– Owens Valley, Inyo	Solar
– Riverside East, Palm Springs	Solar and Wind
– Solano	Wind
– Tehachapi	Solar and Wind
– Westlands	Solar

General Methodology - Solar

- Use RPS Calculator solar potential that avoids RETI Category 1 lands
- Review renewable resource and siting considerations
- Review local / state / federal renewable planning documents and processes
- Review existing and planned renewable projects to help determine viability
- Draft polygons of sufficient size / shape as proxy locations to facilitate study of portfolios
- Tailor polygons to eliminate clear “no go” areas within the boundaries (Protected Areas Data: National Parks, National Forest, BLM wilderness and ACECS, State Parks, and military)

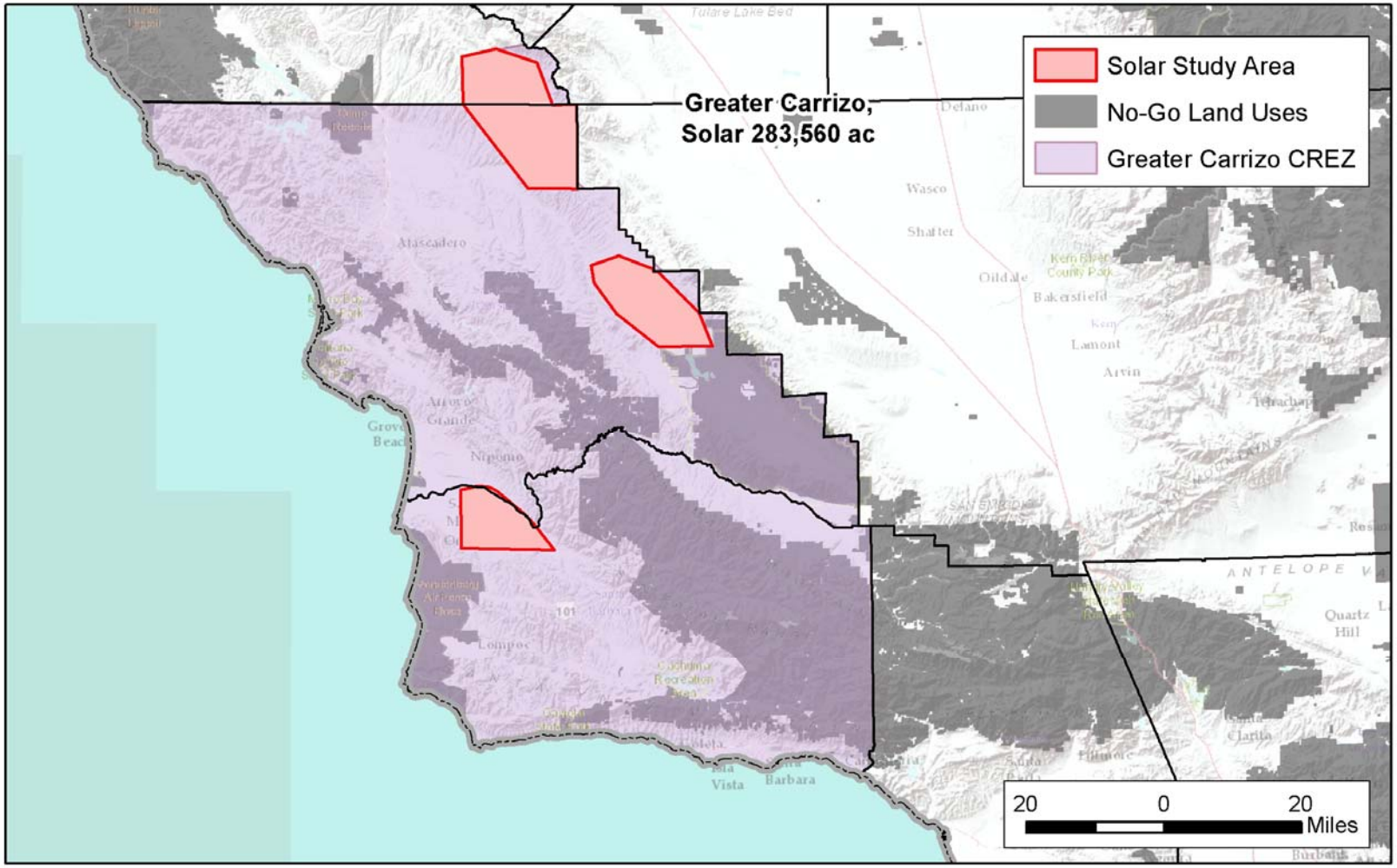
Solar Overview



Greater Carrizo Solar, Overview

- Solar resource: throughout most of the CREZ
- Slope consideration: lots of rolling hills with some large valleys in eastern part of CREZ
- Existing successful large development: mainly in Carrizo Plains and California Flats
- Tailored three polygons of representative areas
  - California Flats: San Luis Obispo and Monterey counties
  - Carrizo Plain: San Luis Obispo County
  - Santa Maria: northern Santa Barbara County

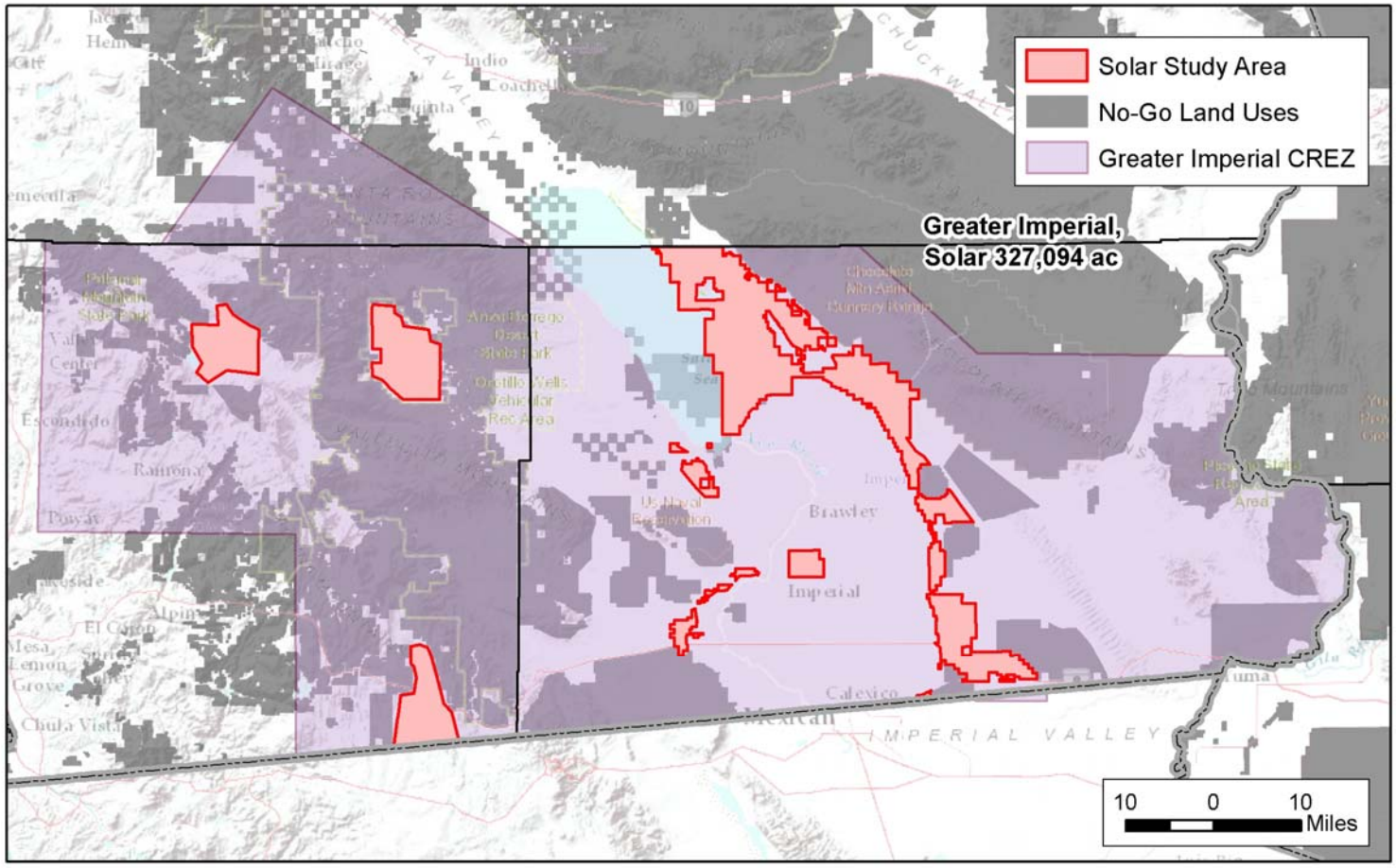
Greater Carrizo Solar



Greater Imperial Solar, Overview

- Solar resource: throughout all of the CREZ
- Slope consideration: lots of rocky hills in the western part of the CREZ
- Existing successful large development: mainly in Imperial Valley and Borrego Valley
- Used existing planning from DRECP and Imperial County General Plan
- Tailored four representative areas
  - Imperial Valley: DRECP DFAs and General Plan Energy Overlay
  - San Diego County: Boulevard, Borrego Springs, and Warner Springs

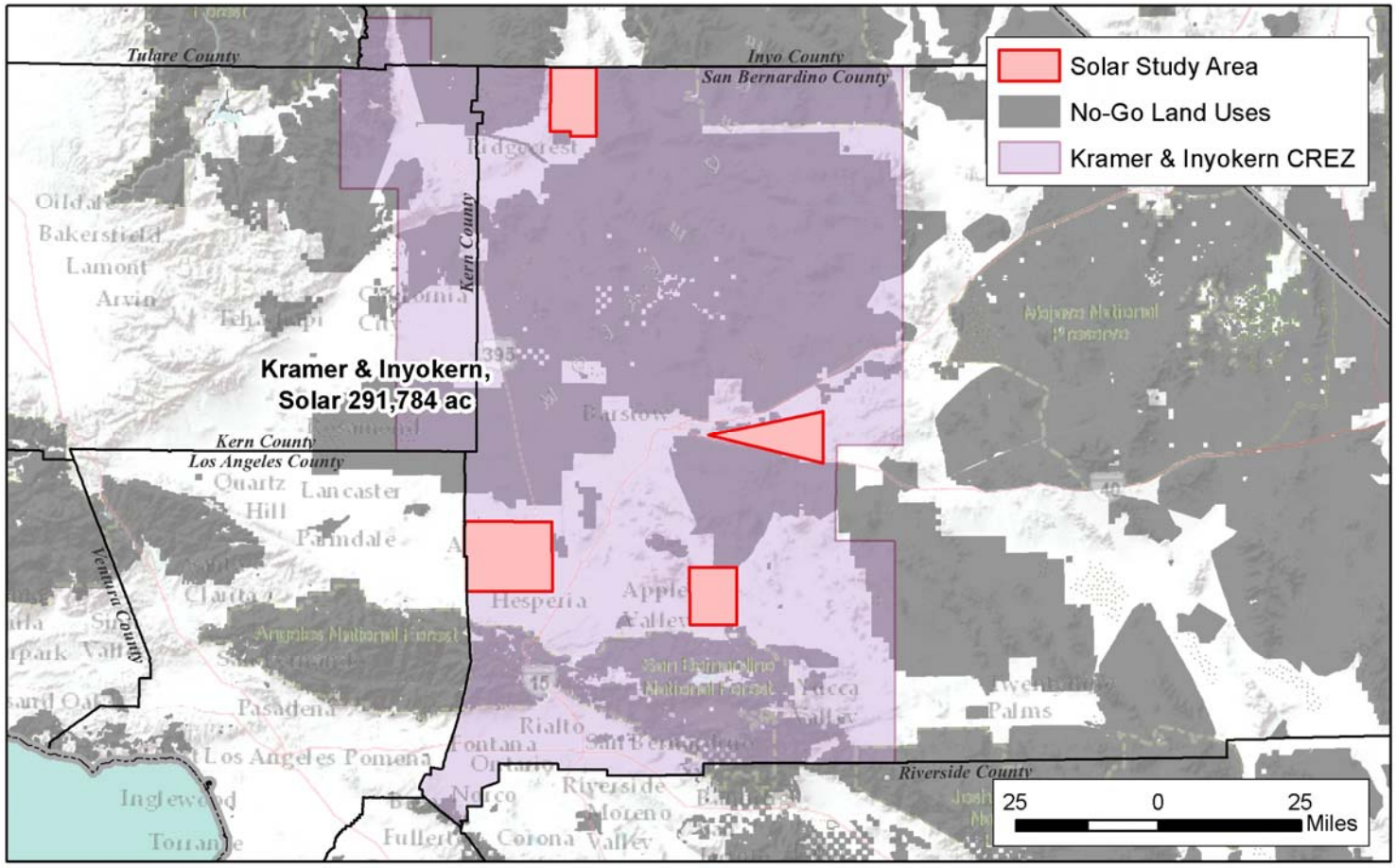
Greater Imperial Solar



Kramer & Inyokern Solar, Overview

- Solar resource: covers entire CREZ
- Slope consideration: primarily flat valleys with some mountains
- Much of the CREZ is encumbered with land designations that prohibit solar (such as wilderness or ACECs / NLCS under the DRECP)
- Tailored four polygons covering a variety of representative areas
  - Searles Valley: DRECP Development Focus Area on BLM land
  - Barstow: private agriculture land
  - Lucerne Valley and Adelanto: rural residential / private undeveloped land

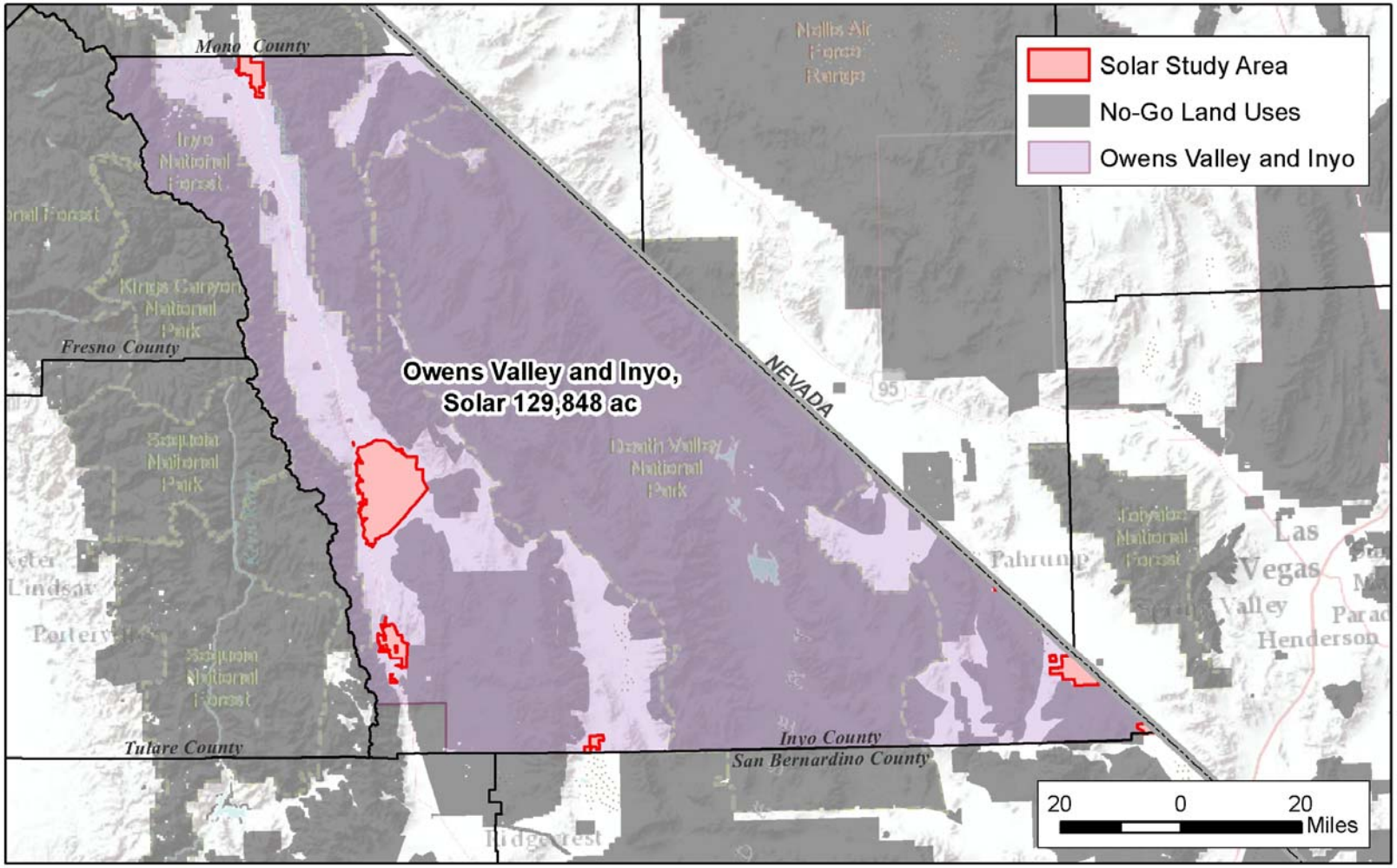
Kramer & Inyokern Solar



Owens Valley & Inyo Solar, Overview

- Solar resource: throughout all of the CREZ
- Slope consideration: majority of the CREZ is mountainous with a valley running through the western side and other smaller valleys
- No existing large development but some projects proposed in valleys
- Used existing planning from DRECP and Inyo County General Plan
- Tailored six representative areas
  - Owens Valley: DRECP DFAs and General Plan Solar Energy Development Areas
  - Eastern border: Solar Energy Development Areas near Nevada

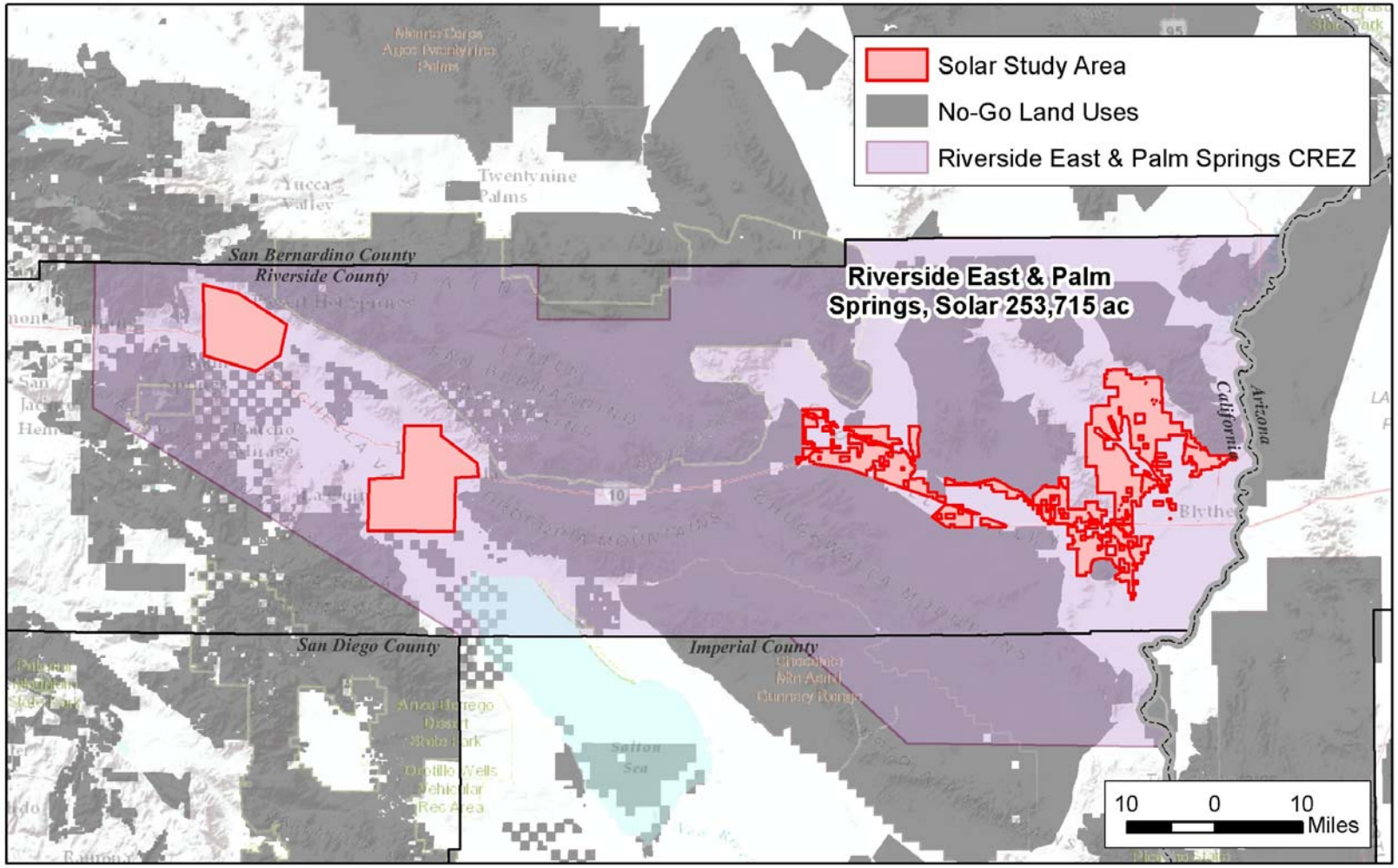
Owens Valley & Inyo Solar



Riverside East & Palm Springs Solar, Overview

- Solar resource: abundant, most of the CREZ
- Slope consideration: many valleys surrounded by mountains
- Tailored three polygons to allow for flexibility for development (size and land use)
  - Eastern Riverside: used DRECP development focus area plus private land in Desert Center
  - Indio: private, agriculture land
  - Palm Springs region: private, undeveloped or existing infrastructure land

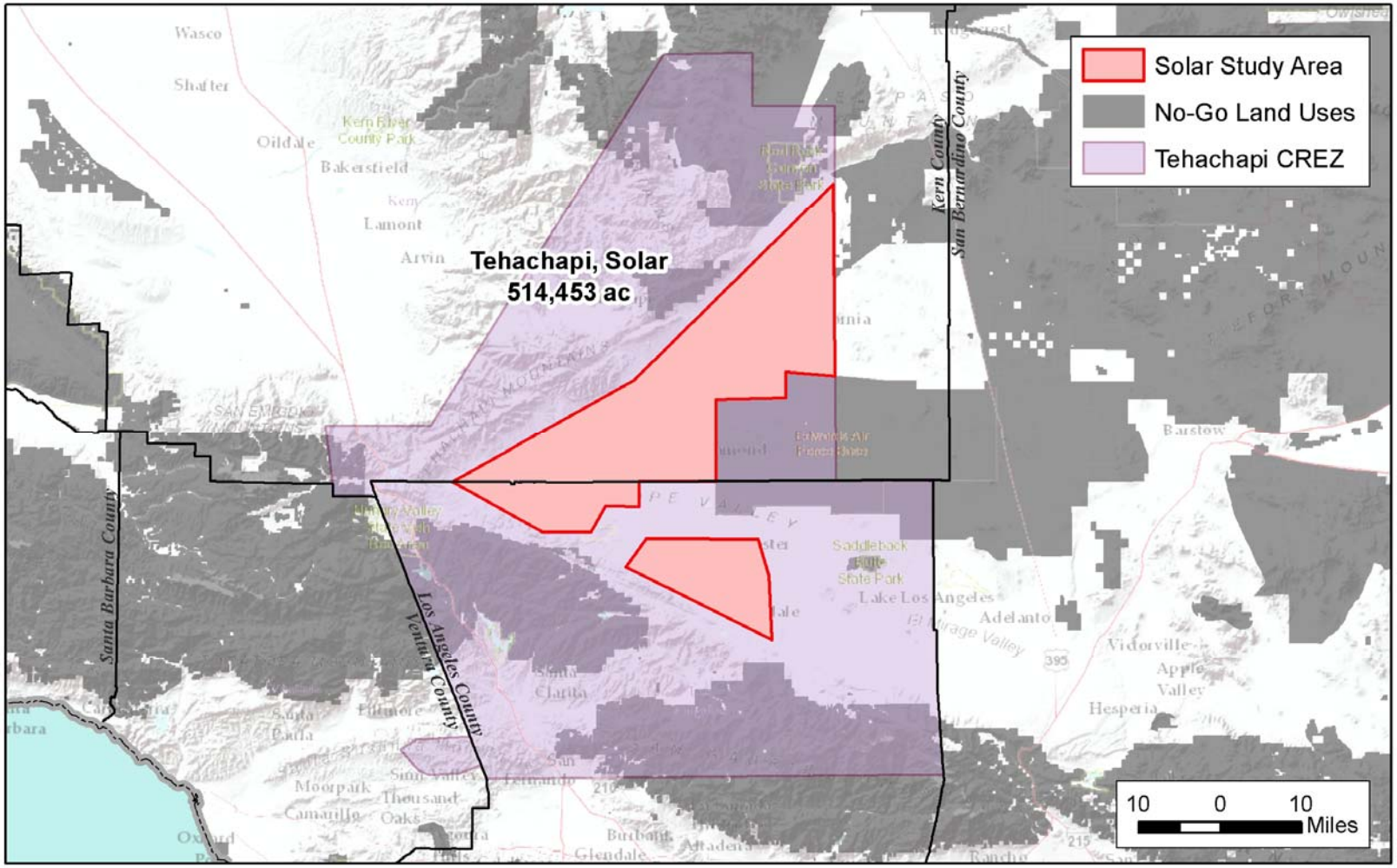
Riverside East & Palm Springs Solar



Tehachapi Solar, Overview

- Solar resource: covers entire CREZ
- Slope consideration: western part of CREZ has steep slopes
- Considered the Draft DRECP DFAs in Kern and Los Angeles County
- Incorporated the Los Angeles County Renewable Energy Ordinance exclusion areas
- Tailored three polygons with flexibility in terms of size and land use
  - Kern County: used DRECP draft development focus area / RPS solar layer
  - Los Angeles County (two polygons): private land, some agriculture

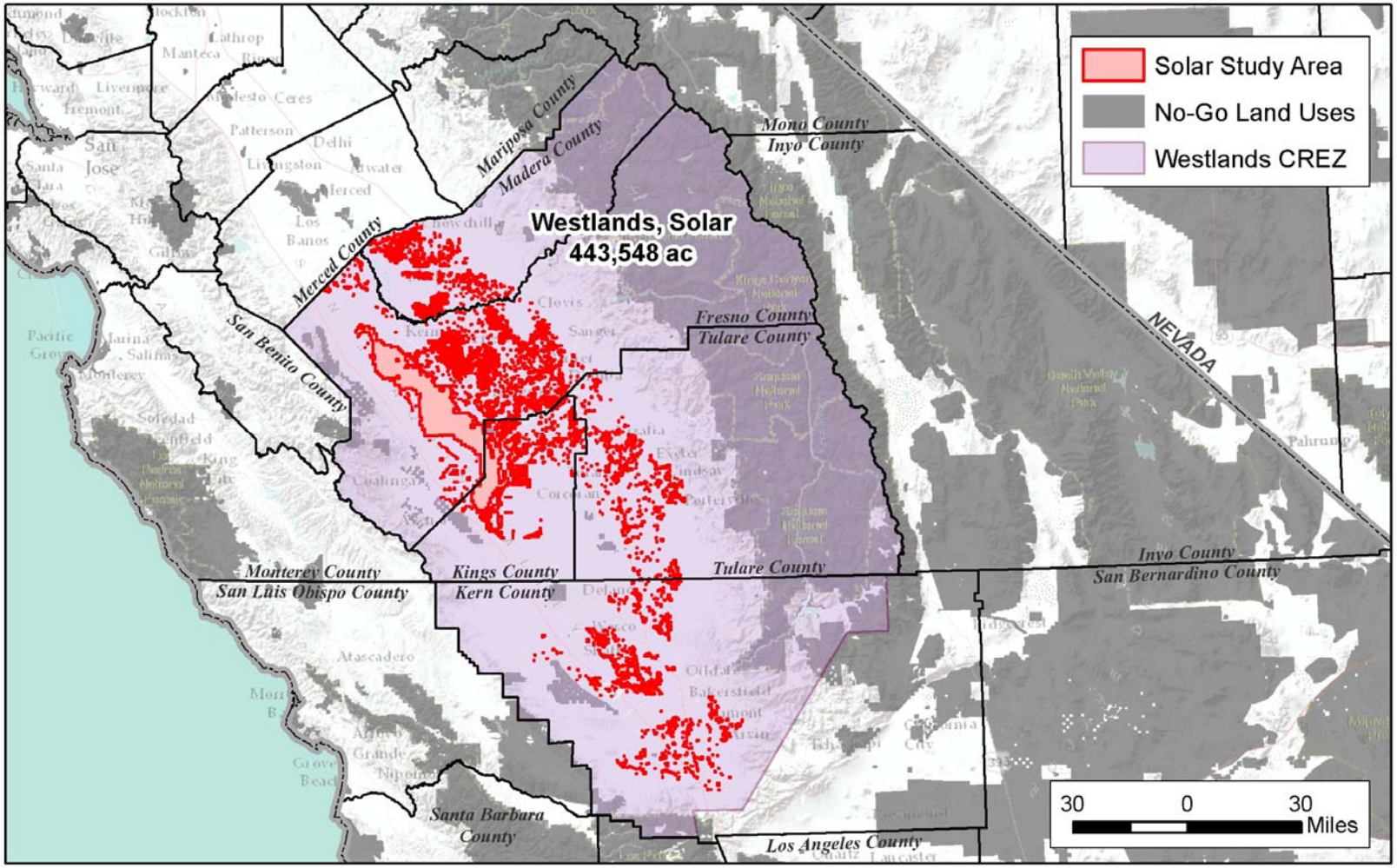
Tehachapi Solar



Westlands Solar, Overview

- Solar resource: covers the majority of the CREZ
- Slope consideration: valley is flat but surrounded by rolling hills on the eastern and western boundaries of the CREZ
- Use the San Joaquin Valley collaborative effort, including 3 categories from the “least-conflict lands”:
  - Priority least conflict
  - Least conflict
  - Potential least conflict

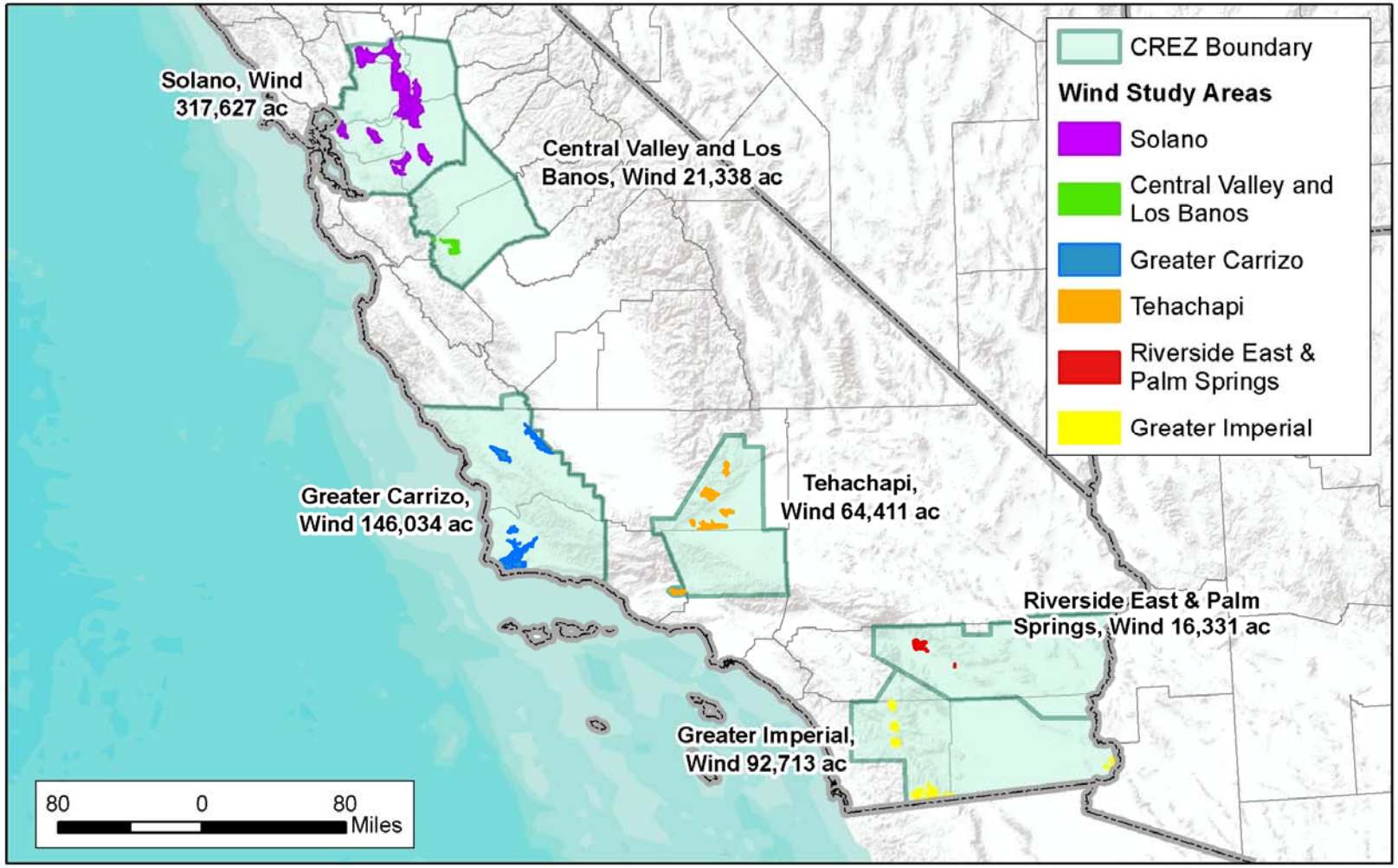
Westlands Solar



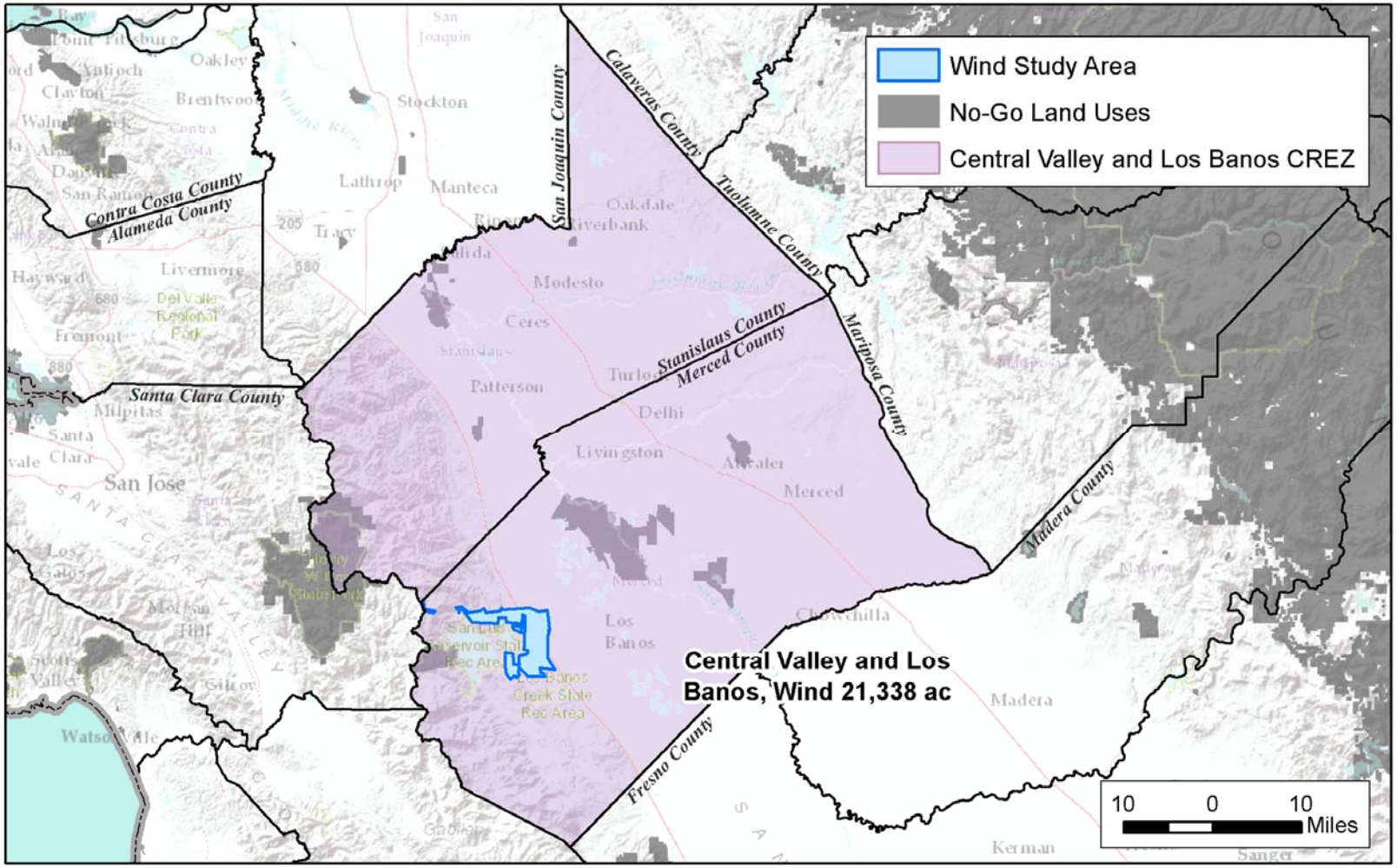
General Methodology - Wind

- Use RPS Calculator wind potential polygons
- Review local / state / federal renewable planning documents and processes and eliminated areas where wind is likely to be prohibited
  - Tehachapi CREZ: Los Angeles County prohibited wind within the county as part of the Renewable Energy Ordinance
  - Riverside East, Palm Springs and Greater Imperial CREZs: DRECP prohibits wind within ACEC and NLCS designations
  - All other CREZs use RPS Calculator polygons with no tailoring

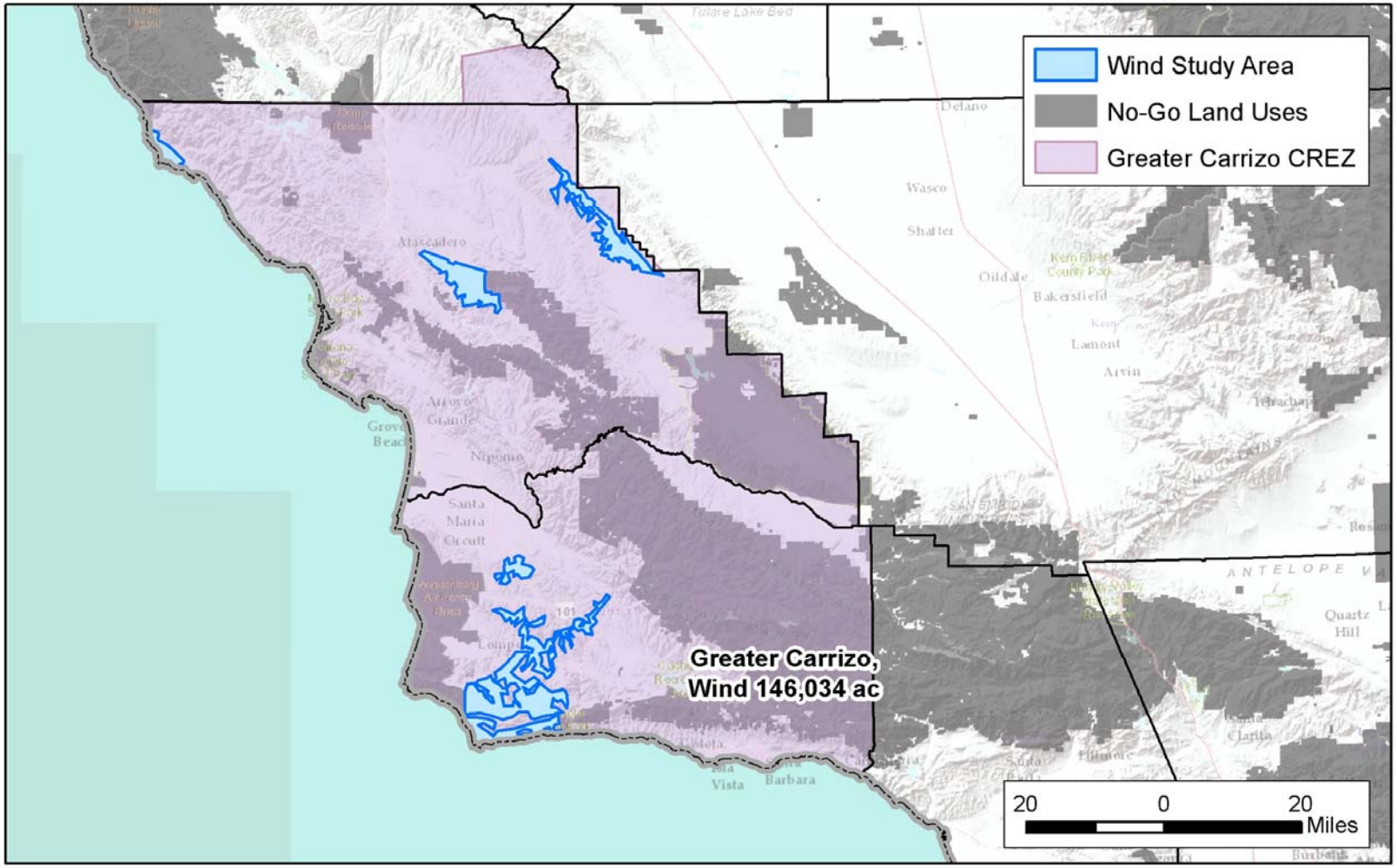
Wind Overview



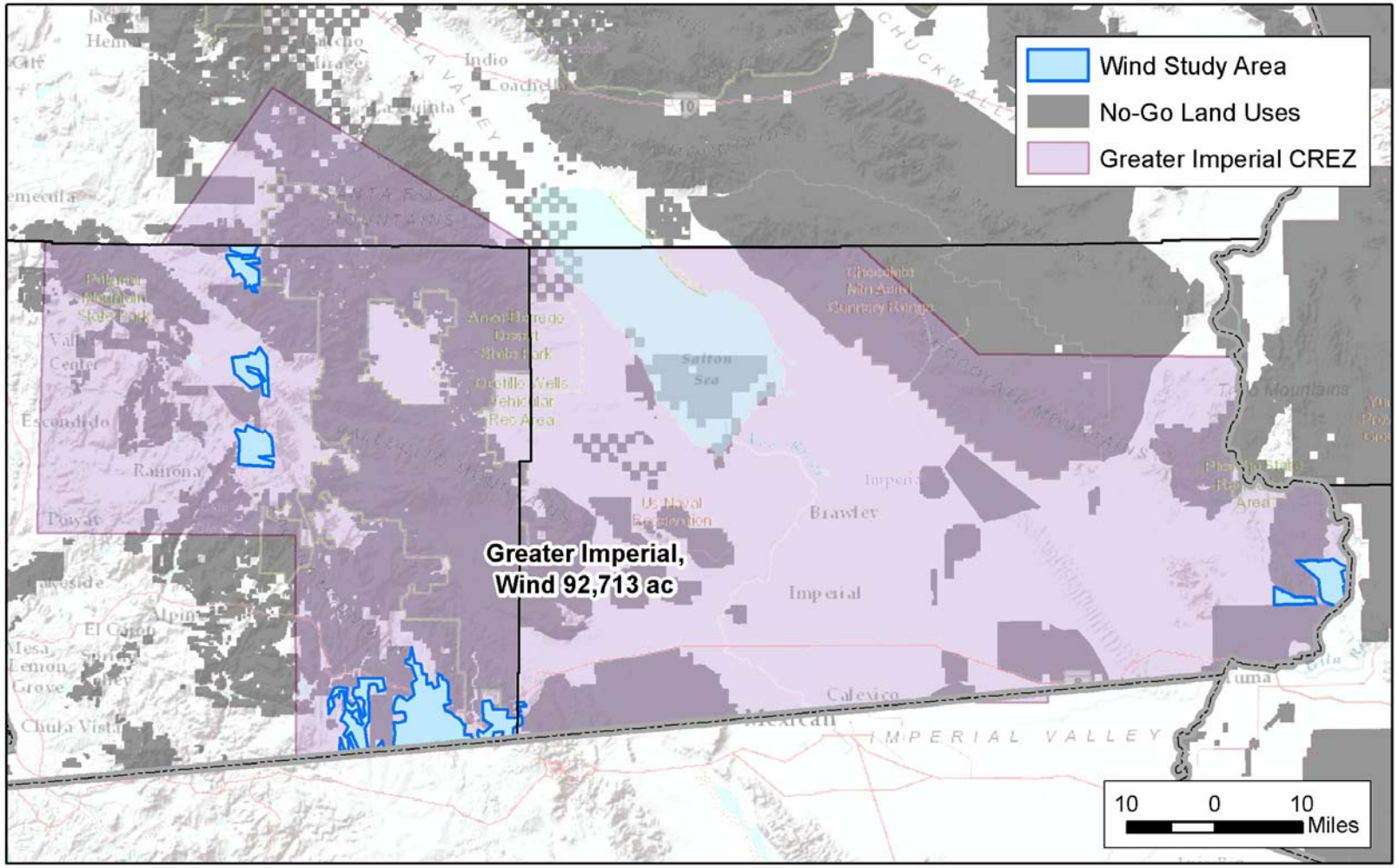
Central Valley North & Los Banos Wind



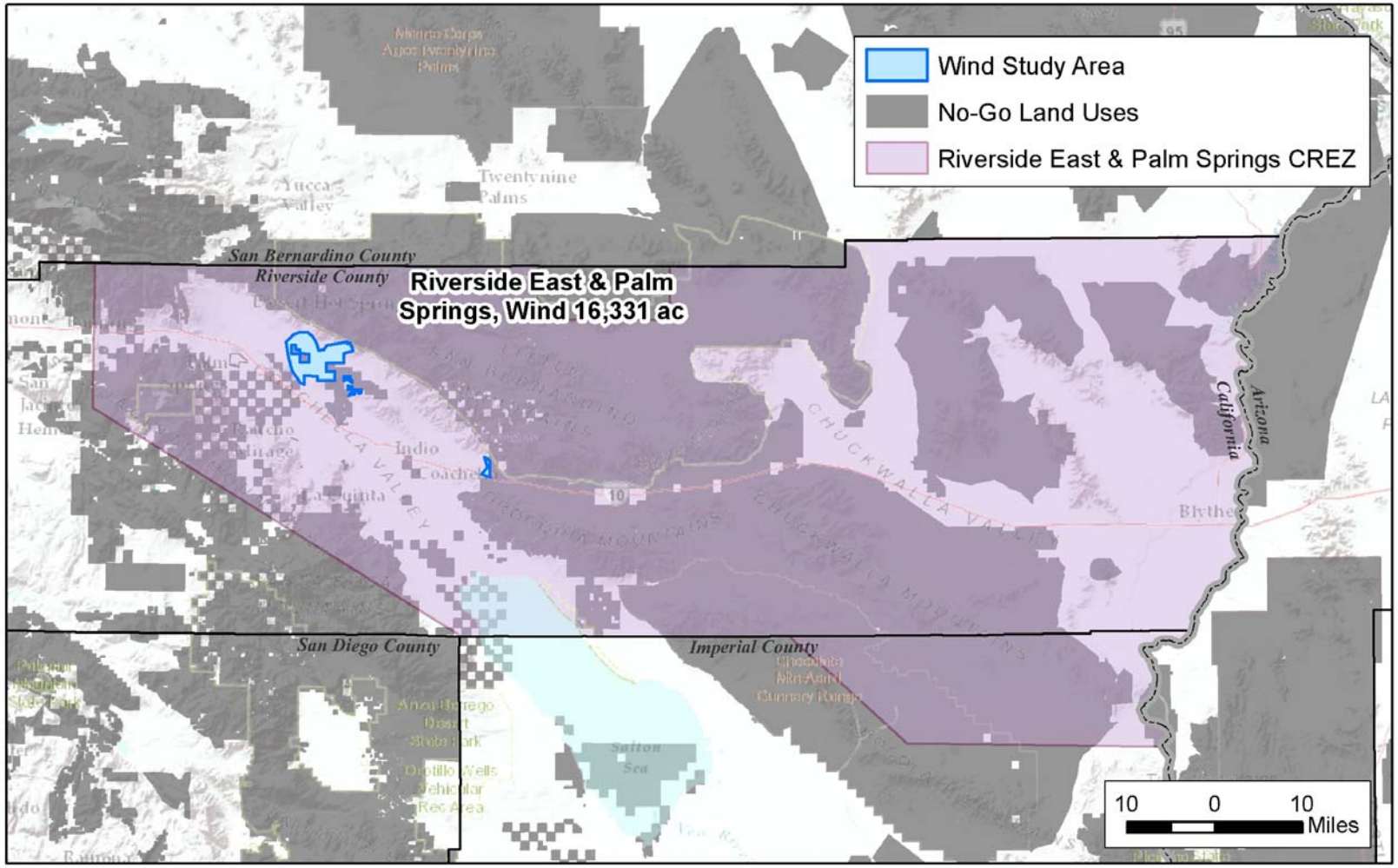
Greater Carrizo Wind



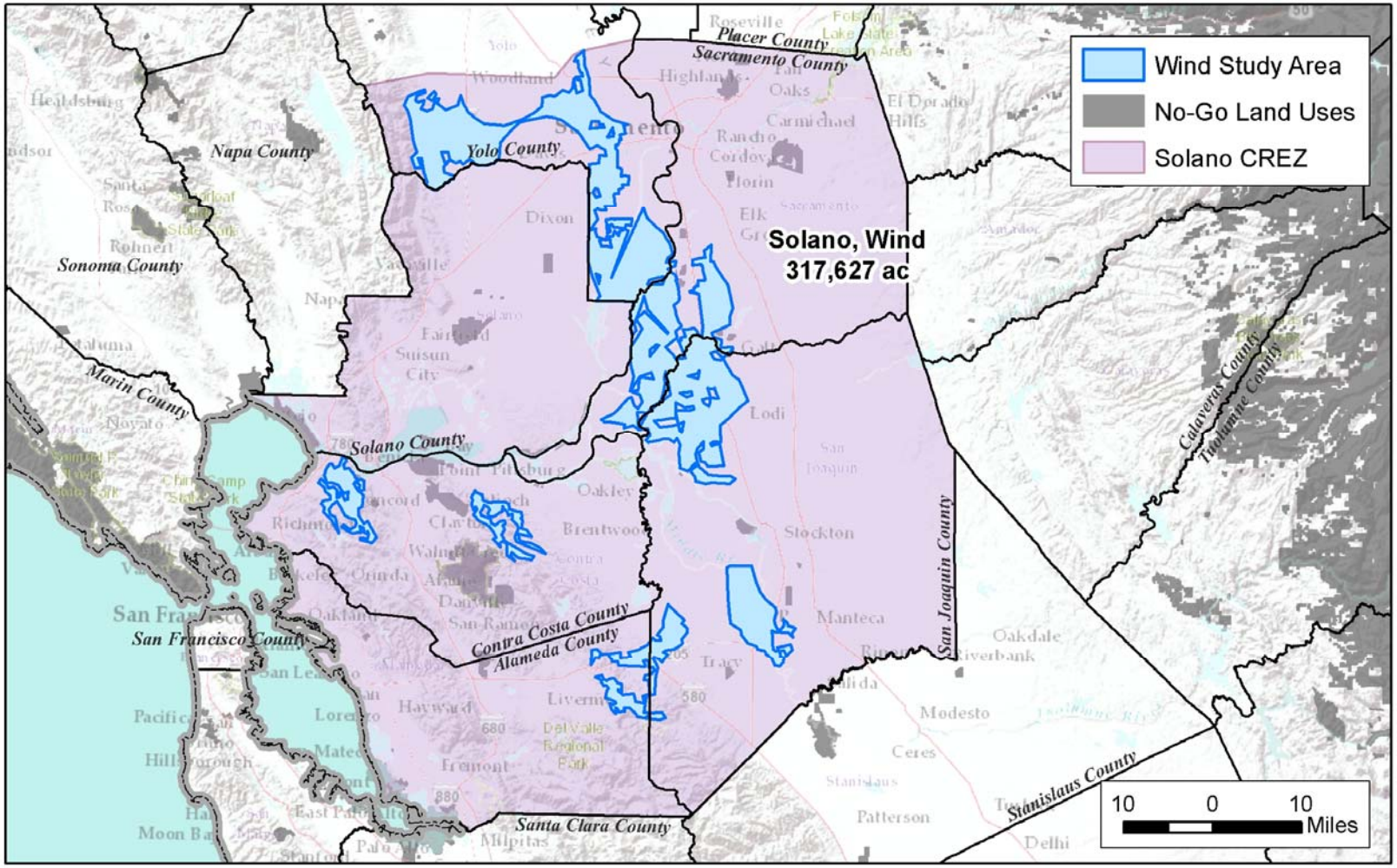
Greater Imperial Wind



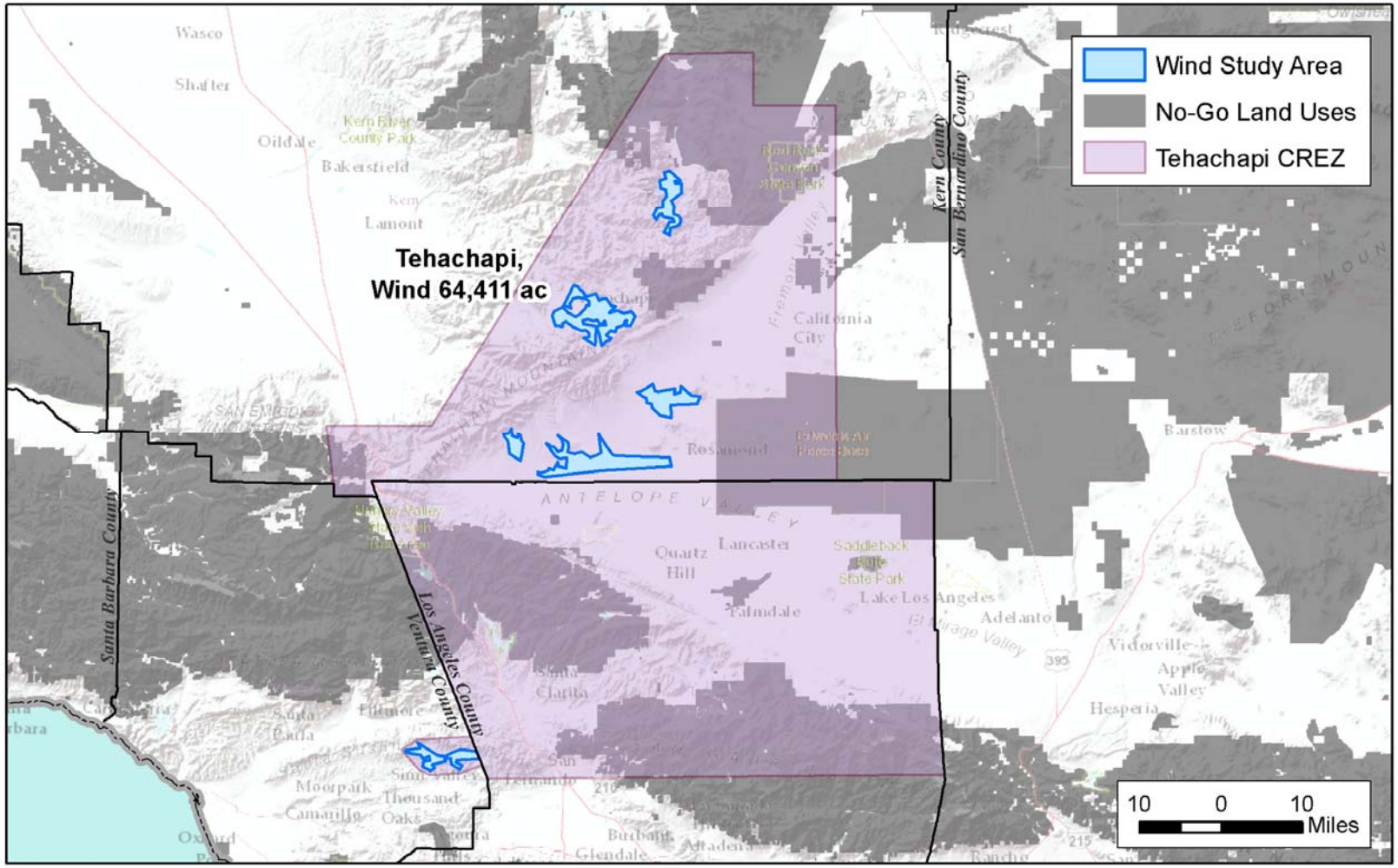
Riverside East & Palm Springs Wind



Solano Wind


Wind Study Area
No-Go Land Uses
Solano CREZ
Solano, Wind
317,627 ac
Placer County
Sacramento County
Yolo County
Napa County
Sonoma County
Marin County
Solano County
Contra Costa County
Alameda County
San Francisco County
Santa Clara County
San Joaquin County
Calaveras County
Tuolumne County
Stanislaus County
10 0 10
Miles

Tehachapi Wind



Appendix 2: Out of State Renewable Study Areas

RESOLVE Portfolios include Out of State Resources

- This presents various “study areas” as proxy locations
- Need to focus environmental study on meaningful locations
- Need to cover five potential regions of Out of State Resources:
  - Northwest Wind (Oregon)
  - Wyoming Wind
  - Southwest Solar (Arizona)
  - New Mexico Wind
  - Utah Wind

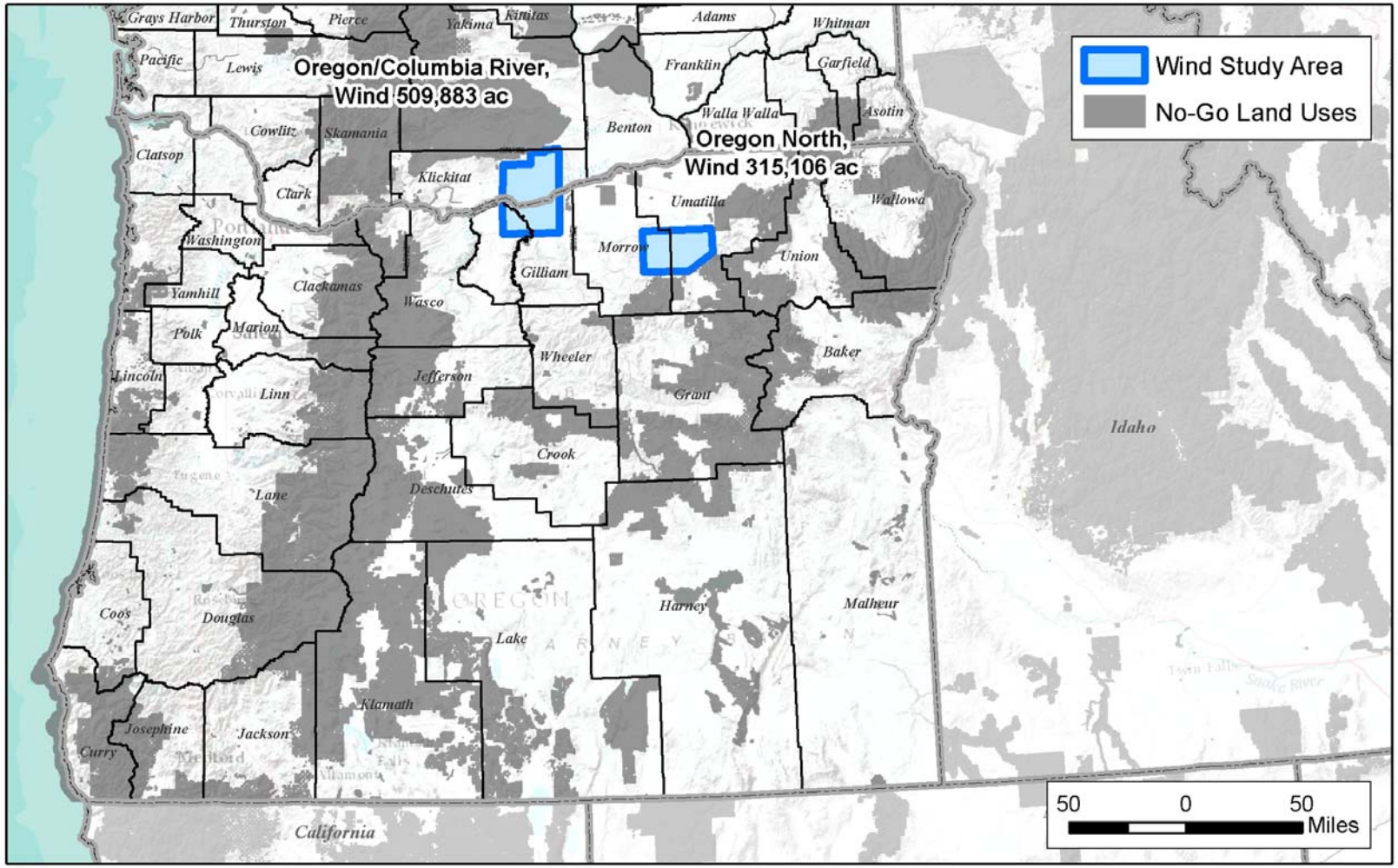
General Methodology

- Review renewable resource and siting considerations
- Review state / federal renewable planning documents and processes
- Review existing and planned transmission
- Review existing and planned renewable projects to help determine viability of renewable development
- Draft polygons of sufficient size / shape as proxy locations to facilitate study of portfolios
- Tailor polygons to eliminate clear “no go” areas within the boundaries (Protected Areas Data: National Parks, National Forest, BLM wilderness and ACECS, State Parks, and military)

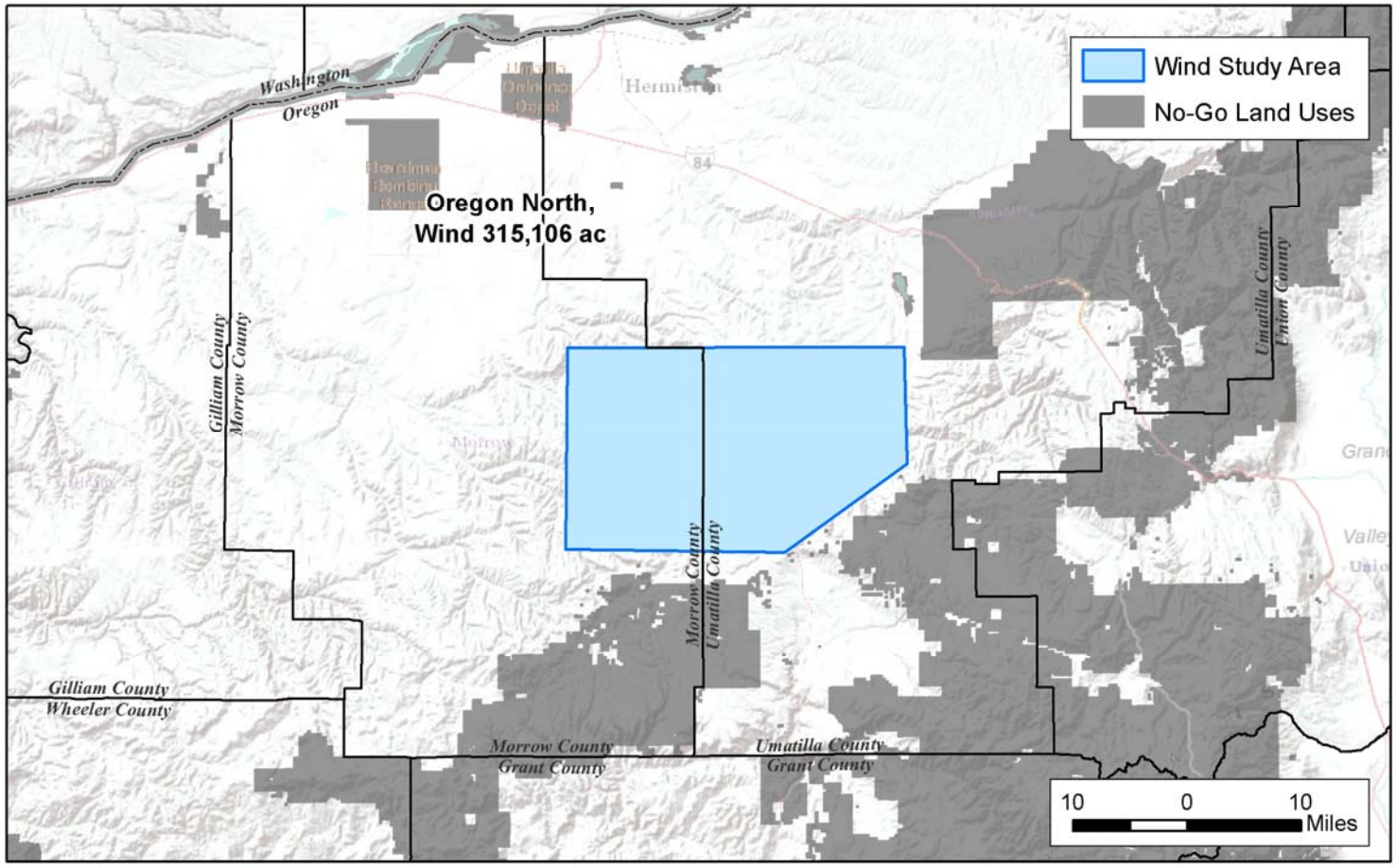
Northwest Wind (Oregon), Overview

- Wind resource: scant potential in south
- Existing successful development: mainly in Columbia Gorge
- Previous BLM planning document and earlier process regarding
  - Existing ROWs
  - Renewable Energy Development Challenges and Opportunities
- Tailored two polygons of representative areas
  - Oregon side of the Columbia Gorge, outside of existing sites
  - Southern Oregon BLM land, near existing wind testing ROWs and transmission

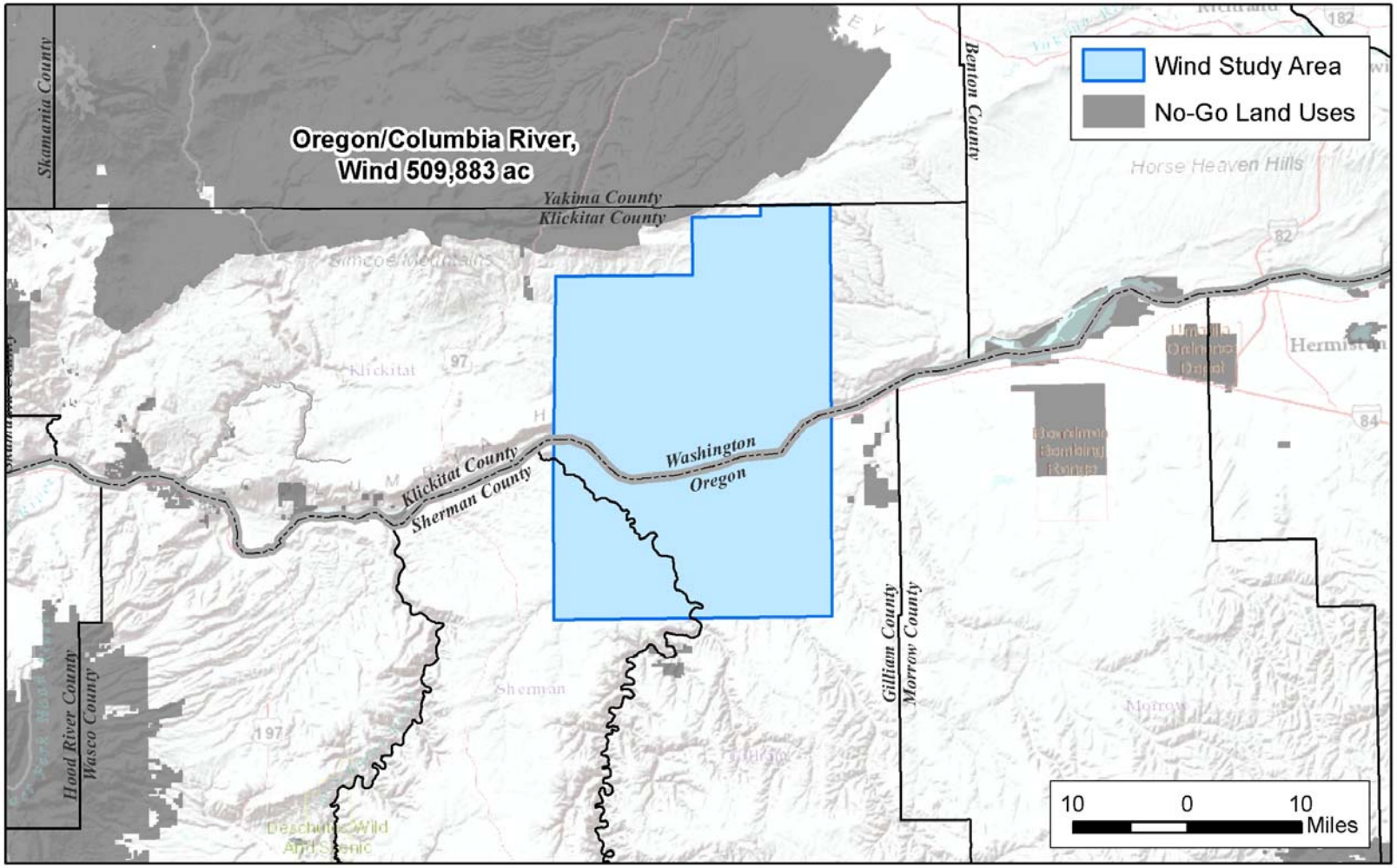
Oregon Wind, Overview



Oregon North



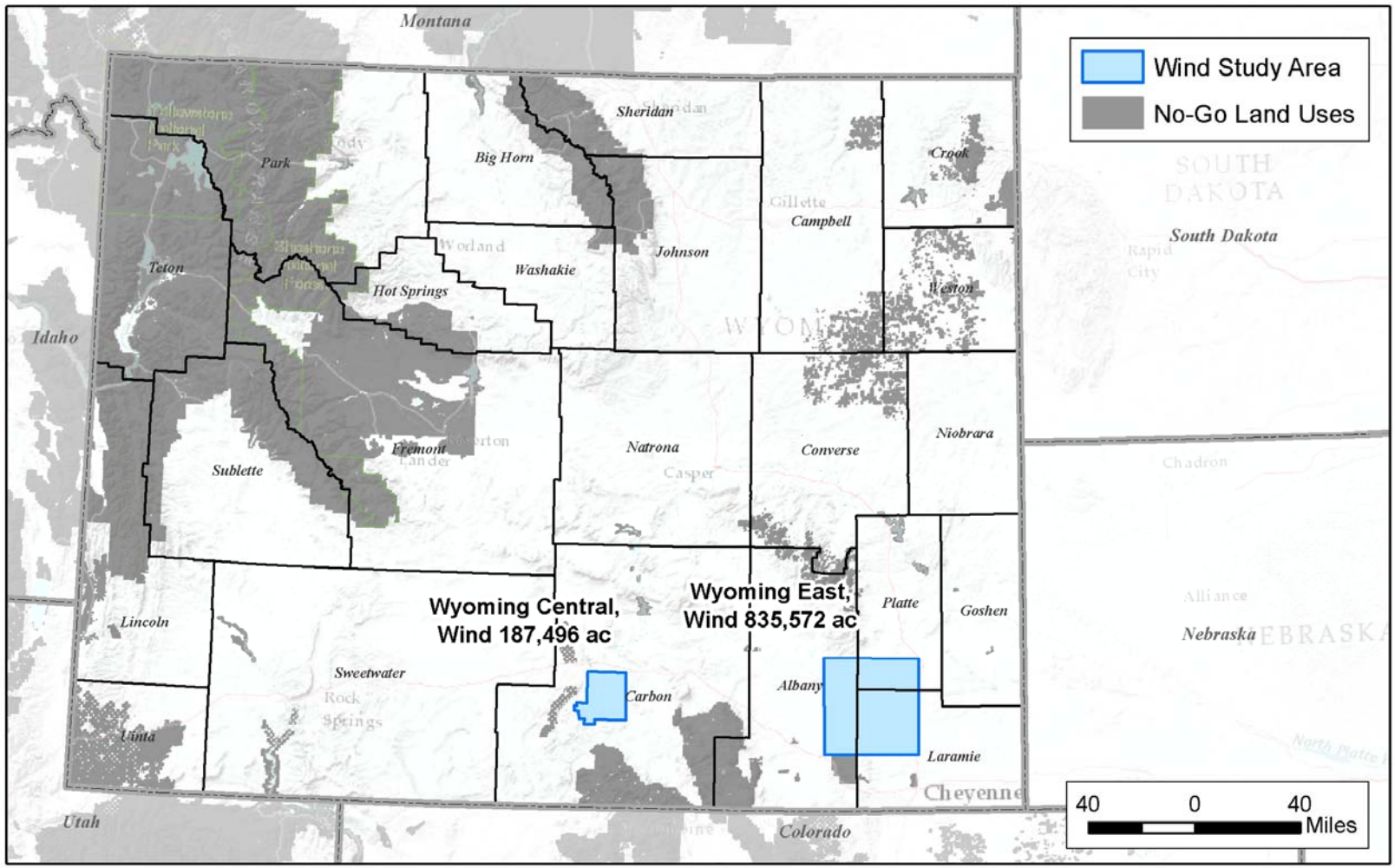
Columbia River Gorge



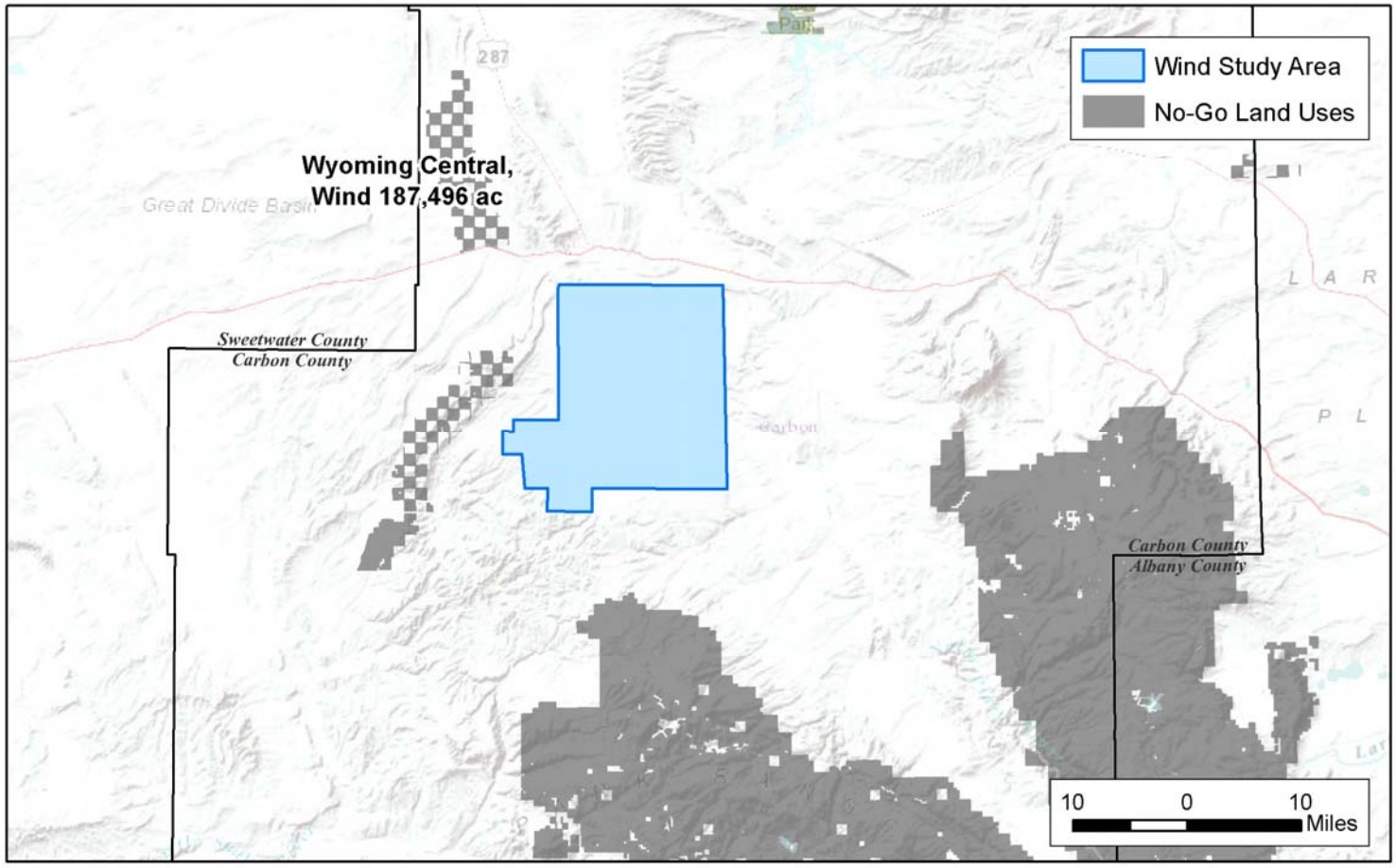
Wyoming Wind, Overview

- Wind resource: resource covers eastern two-thirds of State
- No specific state / federal renewable coordinated planning processes
- Two previously-documented transmission-driven wind projects:
  - Anschutz Corp., Sierra Madre/Chokecherry – 3,000 MW (EIS in 2012)
  - Duke, Windstar – 2,100 MW (proposed)
- Tailored two polygons where either polygon could allow for more than 2,495 MW of wind with substantial flexibility

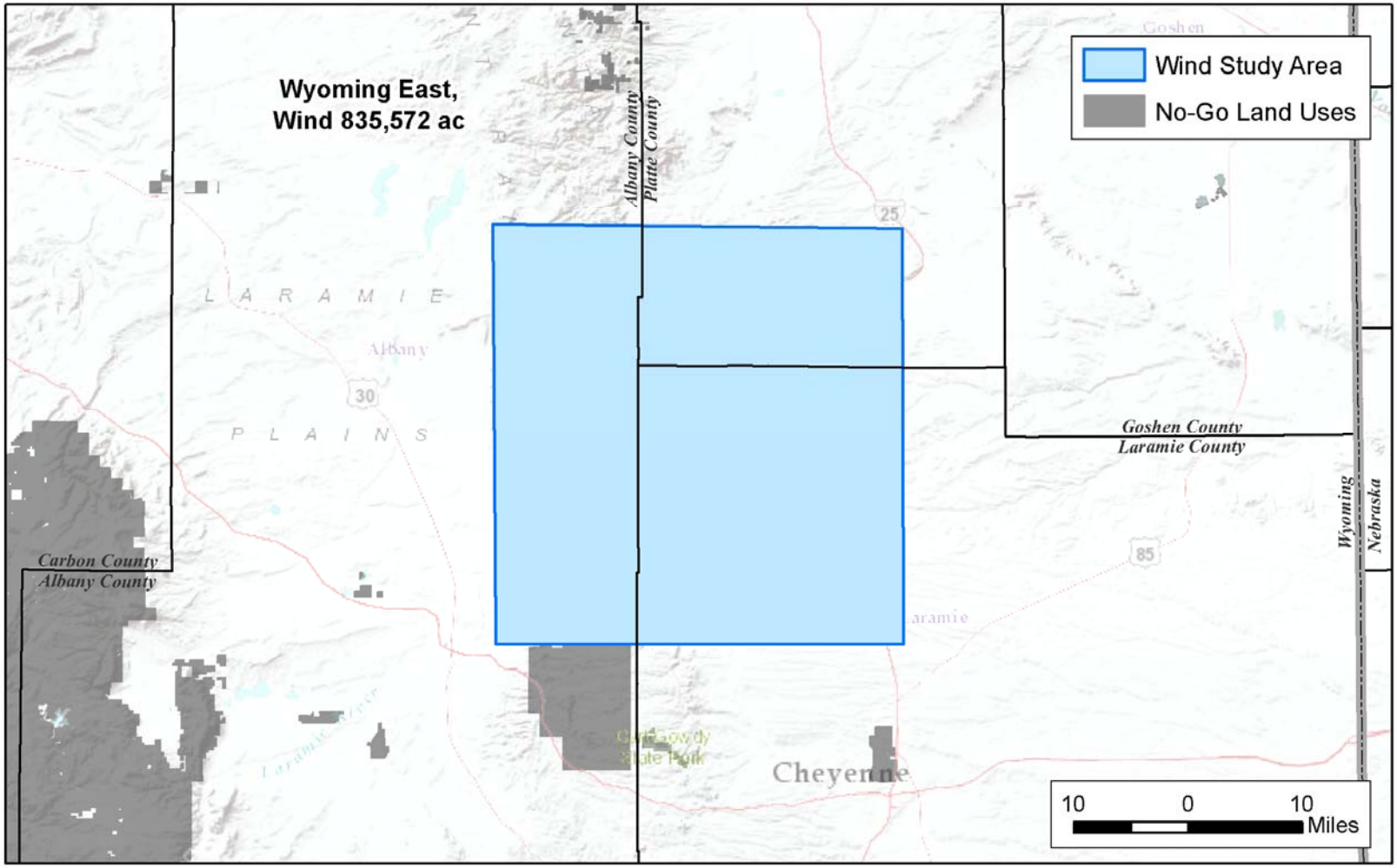
Wyoming Wind, Overview



Wyoming Central



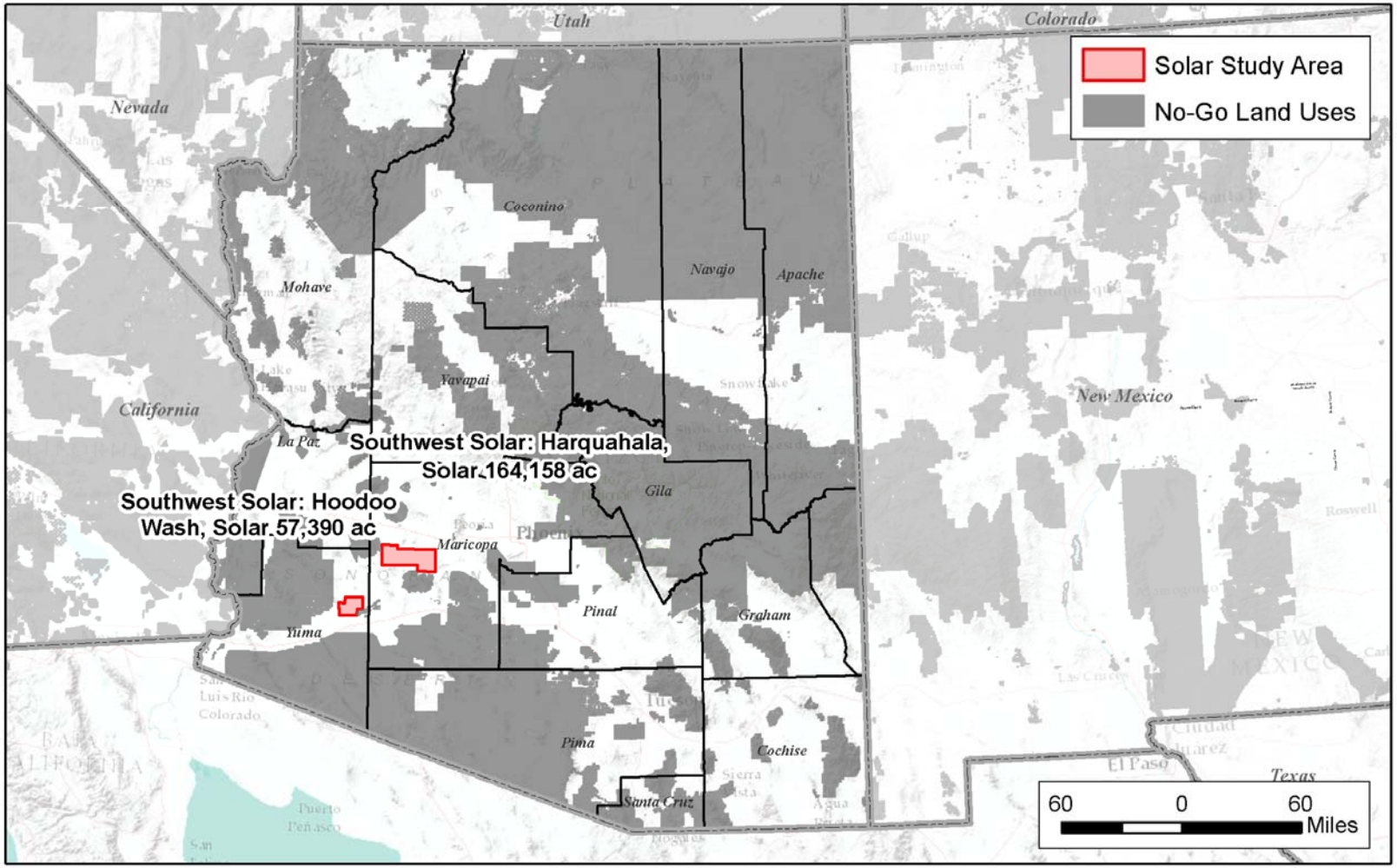
Wyoming East



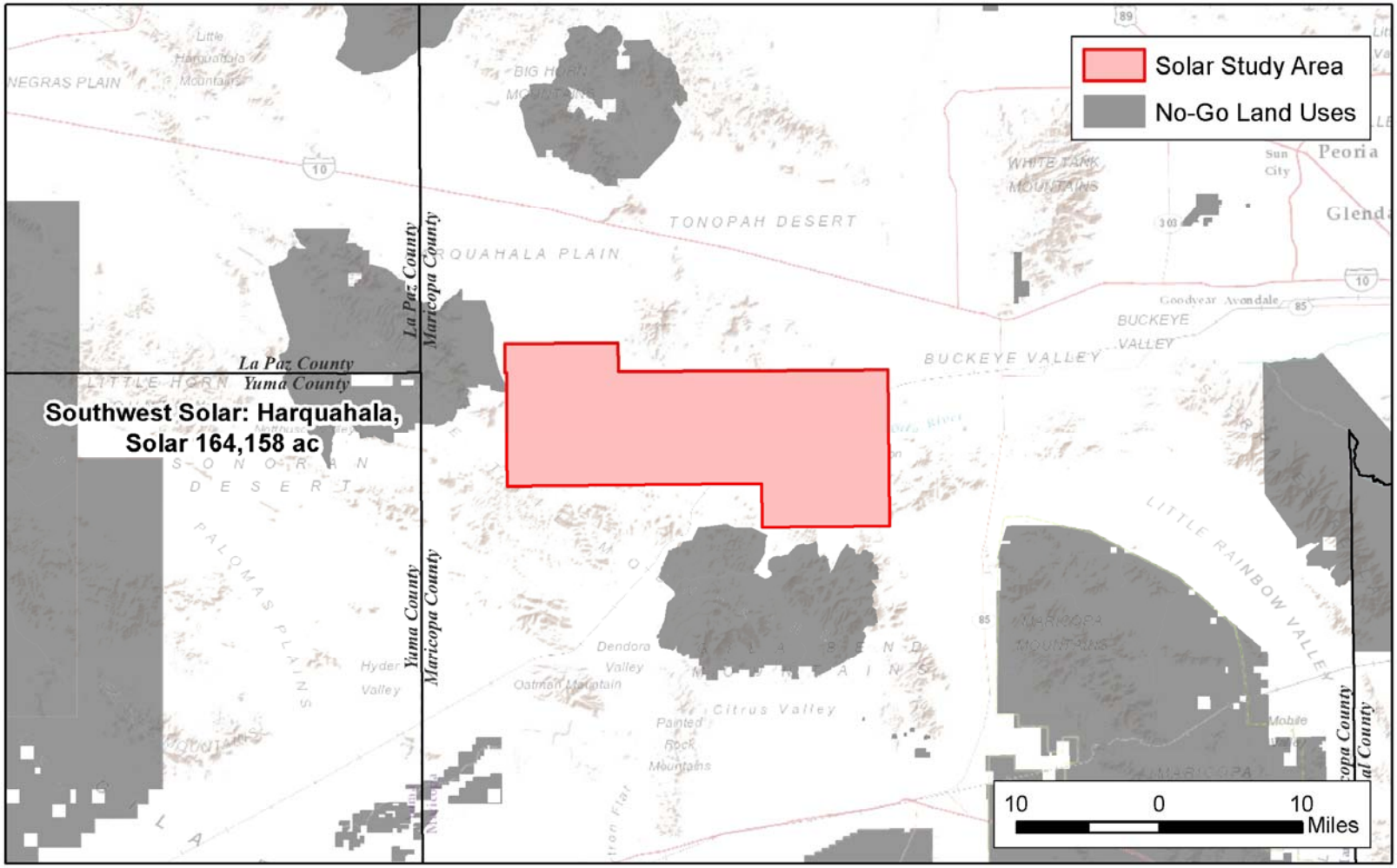
Southwest Solar (Arizona), Overview

- Solar resource: abundant, most of the State
- Reviewed previous BLM Renewable Energy Development Areas
- Considered likely substation interconnection points, including:
  - Harquahala, Hassayampa, Delaney or Palo Verde Hub
  - Hoodoo Wash
- Tailored two polygons where either polygon could allow for more than 500 MW of solar energy with substantial flexibility

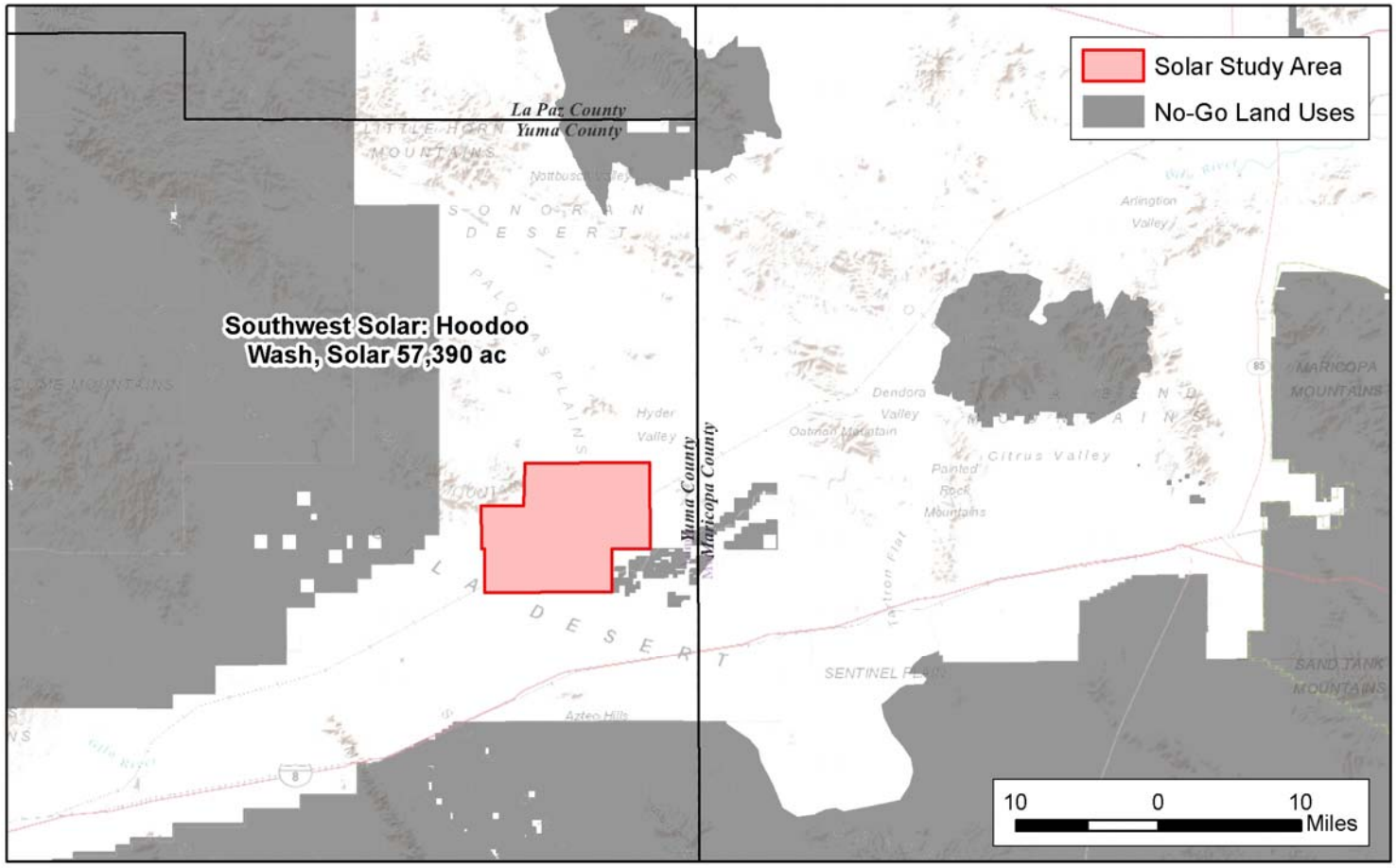
Arizona Solar, Overview



Arizona Harquahala



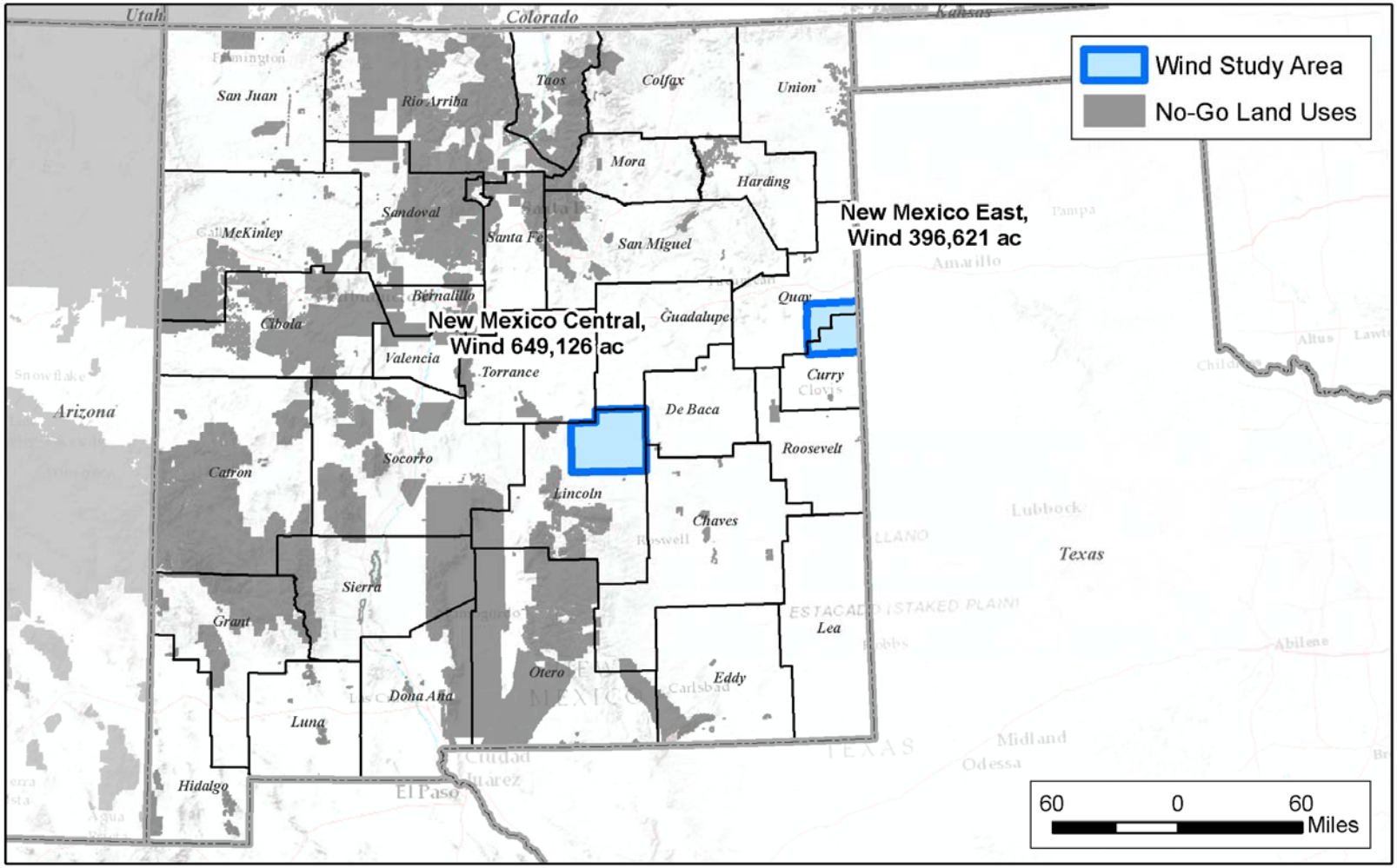
Arizona Hoodoo Wash



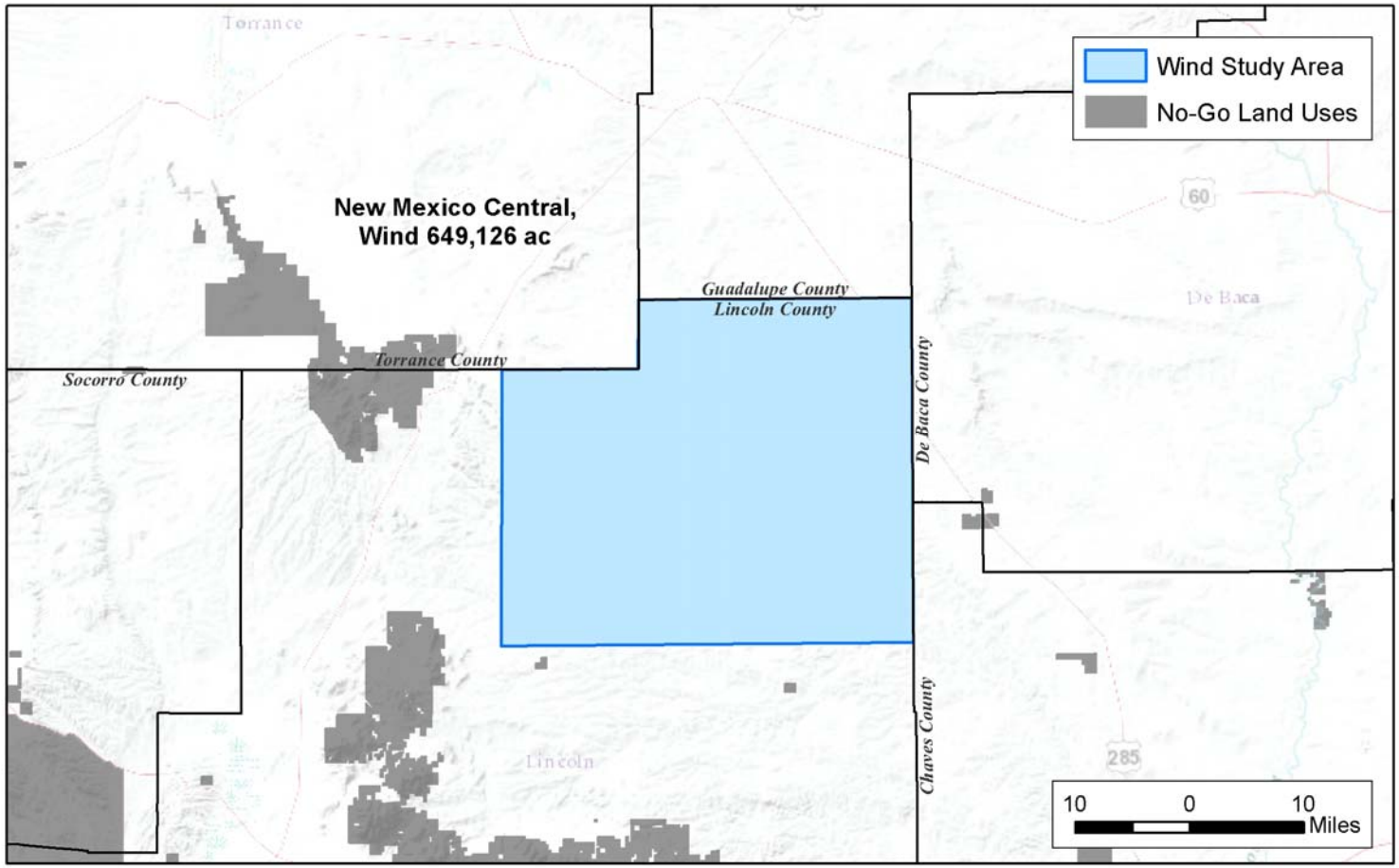
New Mexico Wind, Overview

- Wind resource: best resource covers eastern half of the State
- No specific state / federal renewable coordinated planning processes
- Tailored two polygons where either polygon could allow for more than 2,962 MW of wind with substantial flexibility
  - Central study area covering proposed endpoints for SunZia East and Centennial West Cleanline
  - Eastern study area centered around proposed Tres Amigas vicinity

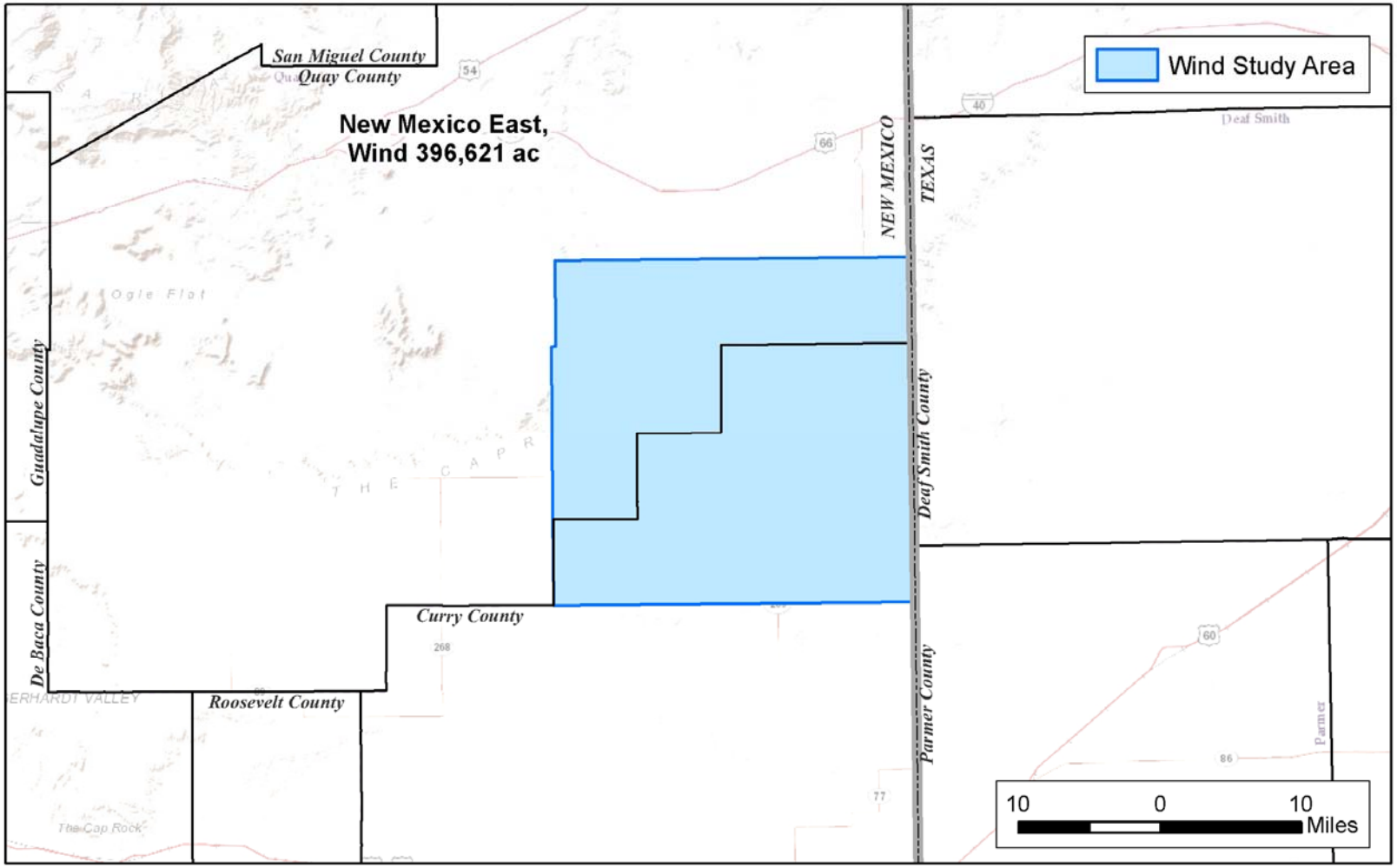
New Mexico Wind, Overview



New Mexico Central



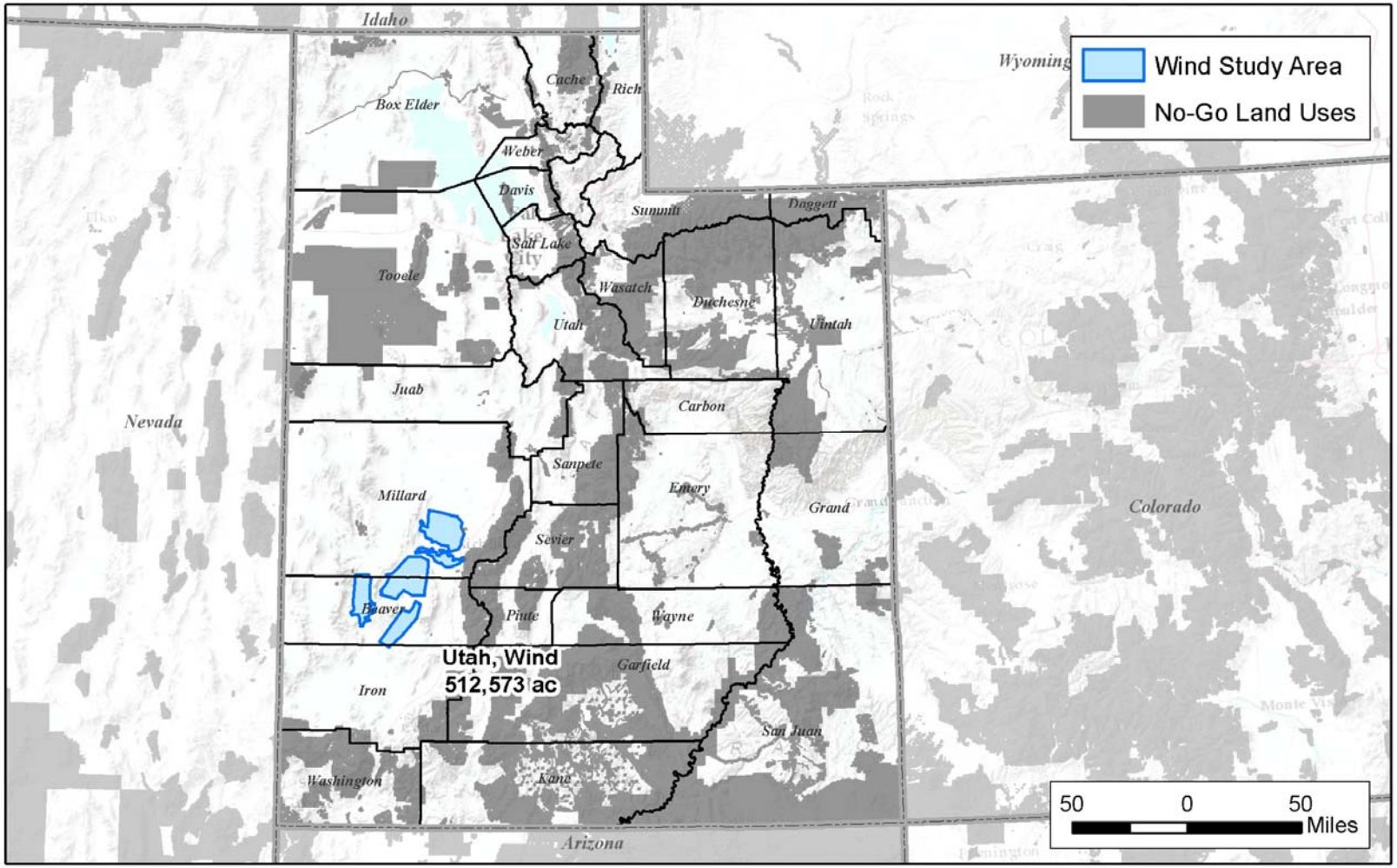
New Mexico East



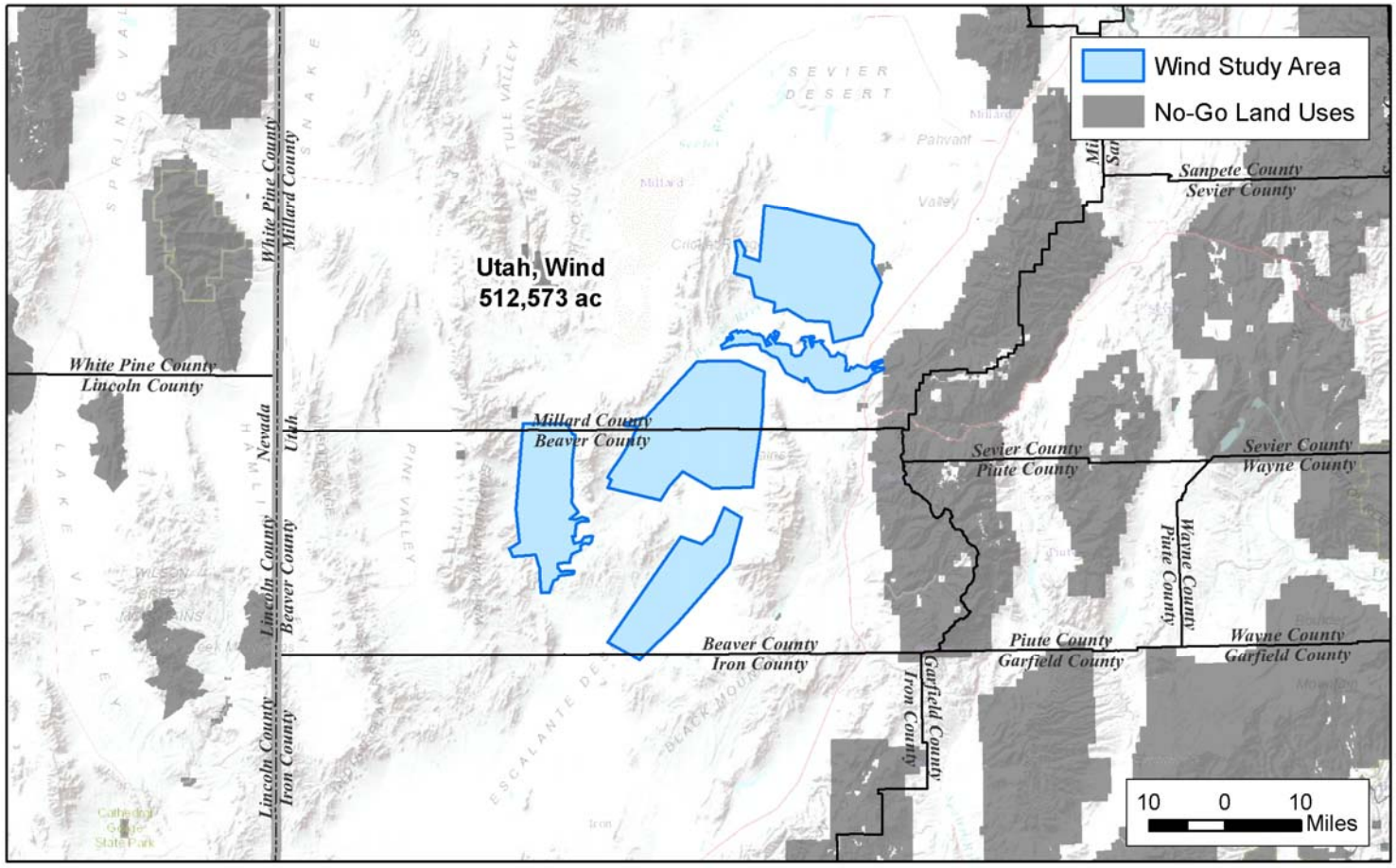
Utah Wind, Overview

- Wind resource: best resource covers western half of the State, south of the Great Salt Lake
- Utah governor commissioned a Utah Renewable Energy Zones task Force to identify areas where utility-scale energy could occur
- Zones screened out environmentally sensitive areas and military airspace and set parameters regarding development
- Use five clustered polygons that allow for more than 600 MW of wind with substantial flexibility
  - Locations are near the Wah Valley and Cricket Range

Utah Wind, Overview

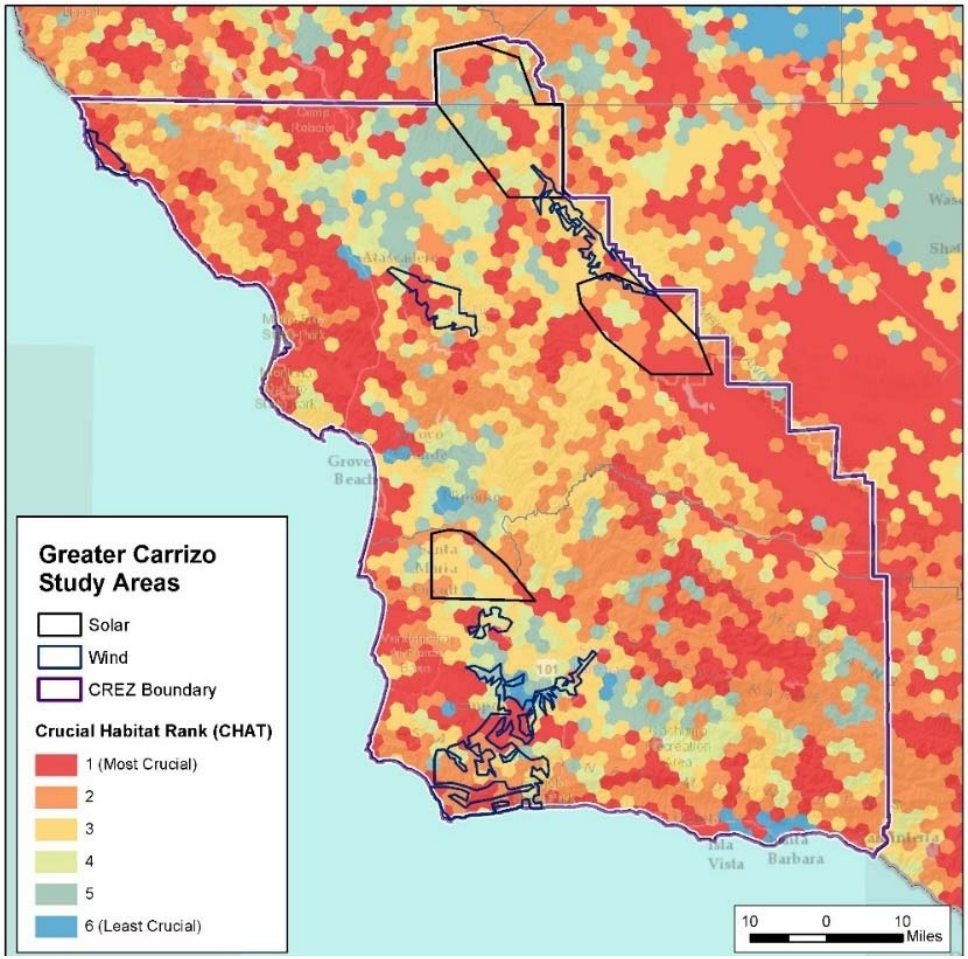


Utah Wind


Wind Study Area
No-Go Land Uses
Utah, Wind
512,573 ac
White Pine County
Millard County
Nevada
Utah
White Pine County
Lincoln County
Millard County
Beaver County
Sanpete County
Sevier County
Sevier County
Piute County
Sevier County
Wayne County
Wayne County
Piute County
Lincoln County
Beaver County
Beaver County
Iron County
Piute County
Garfield County
Wayne County
Garfield County
Lincoln County
Iron County
Iron County
Garfield County
10 0 10
Miles

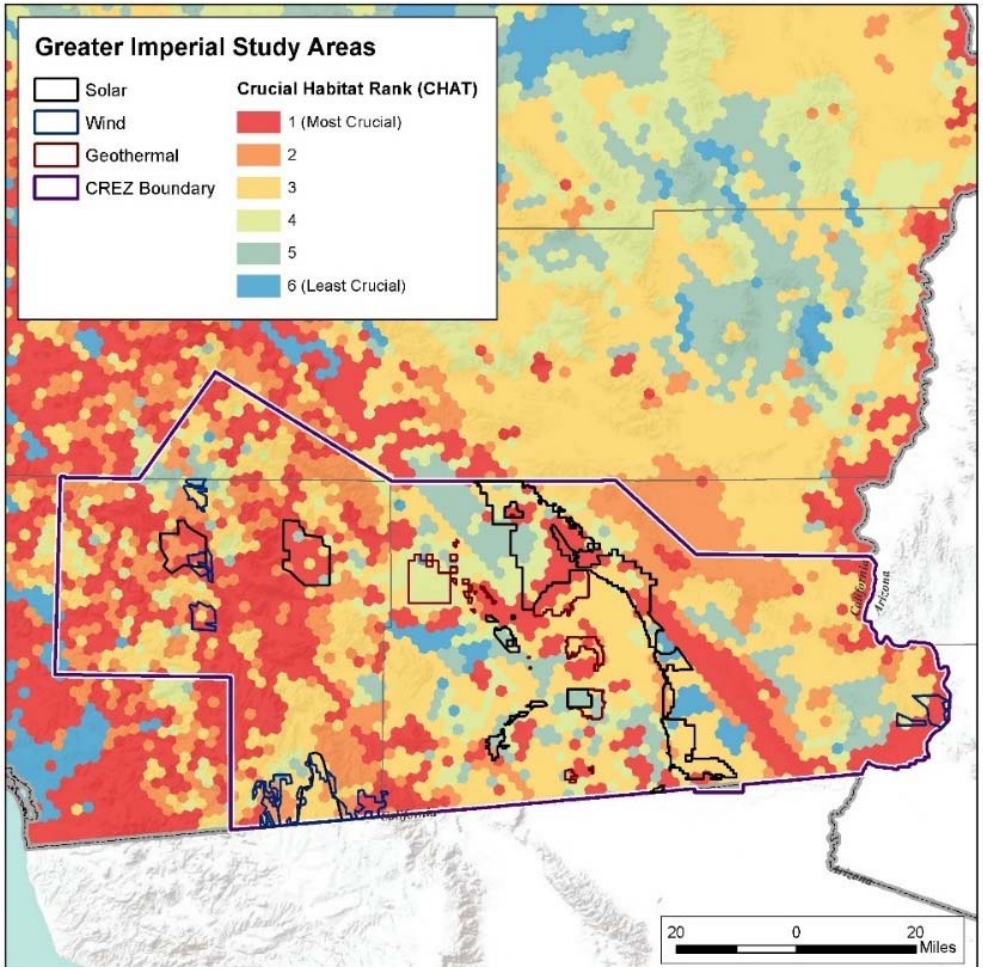
Appendix 3: Biological Resources Baseline

Biological Resources Baseline
Greater Carrizo: Solar, Wind



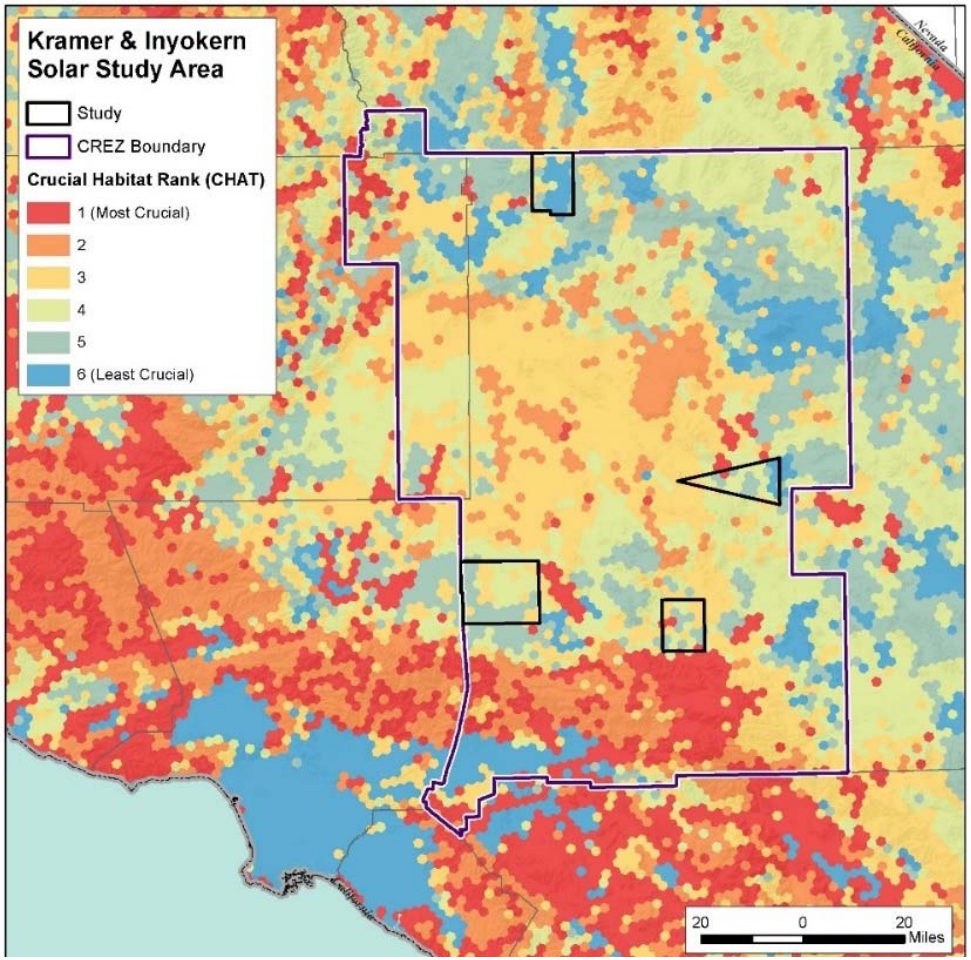
- Most crucial ranks:
  - Solar: 52% of study area
  - Wind: 57% of study area
- Study area concerns:
  - Migratory birds (coastal)
  - Giant kangaroo rat
  - San Joaquin kit fox
  - Critical habitat: CA red-legged frog, CA tiger salamander, fairy shrimp, SW willow flycatcher

Biological Resources Baseline
Greater Imperial: Solar, Wind, Geothermal



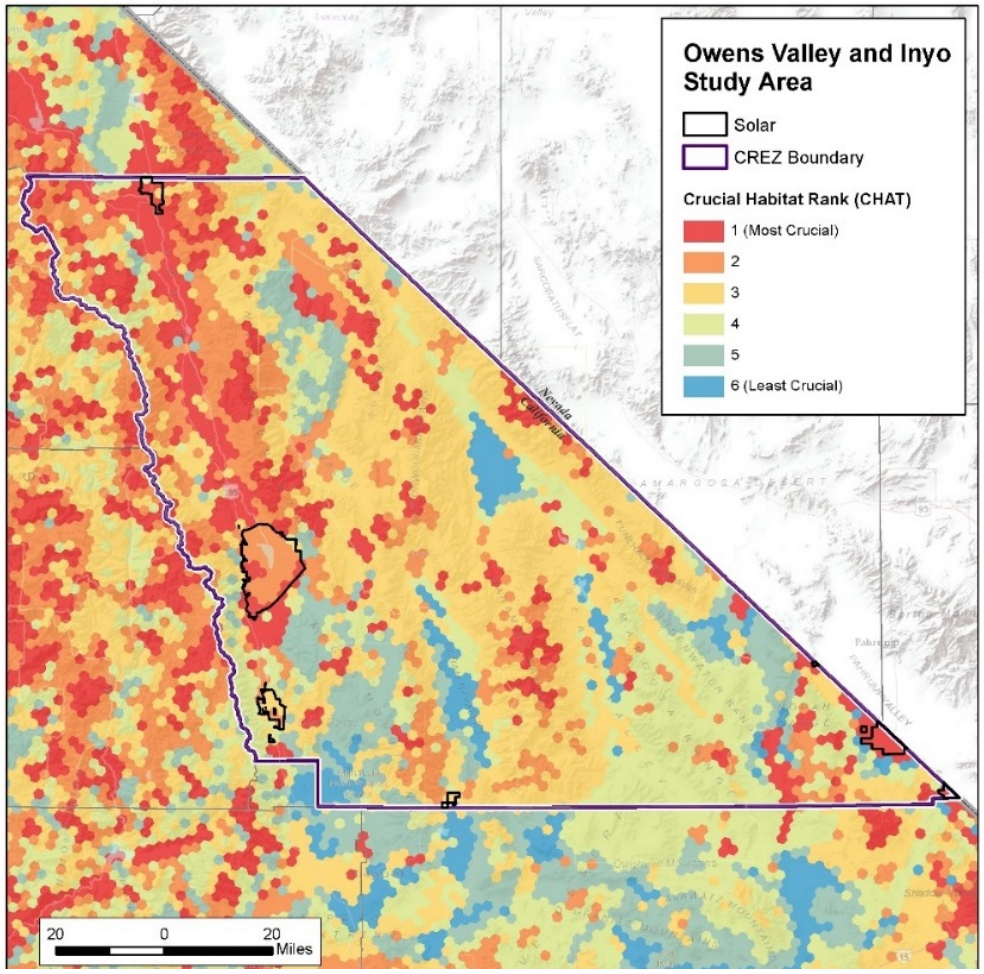
- Most crucial ranks:
  - Solar: 44% of study area
  - Wind: 56% of study area
  - Geothermal: 33% of study area
- Study area concerns:
  - Migratory birds (Salton Sea)
  - Critical habitat: peninsular bighorn sheep, arroyo toad

Biological Resources Baseline
Kramer and Inyokern: Solar



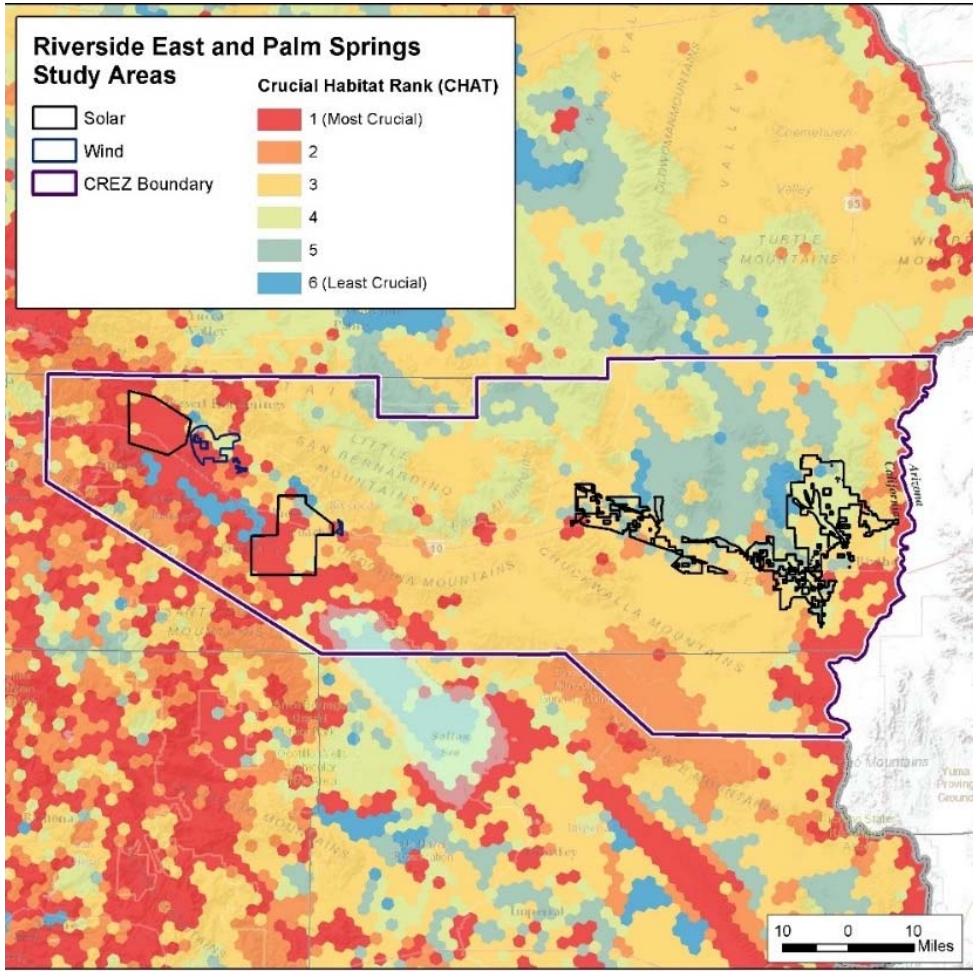
- Most crucial ranks:
  - 2% of study area
- Study area concerns:
  - Critical habitat: desert tortoise
  - California condor range expanding
  - MGS may be unmapped

Biological Resources Baseline
Owens Valley & Inyo: Solar



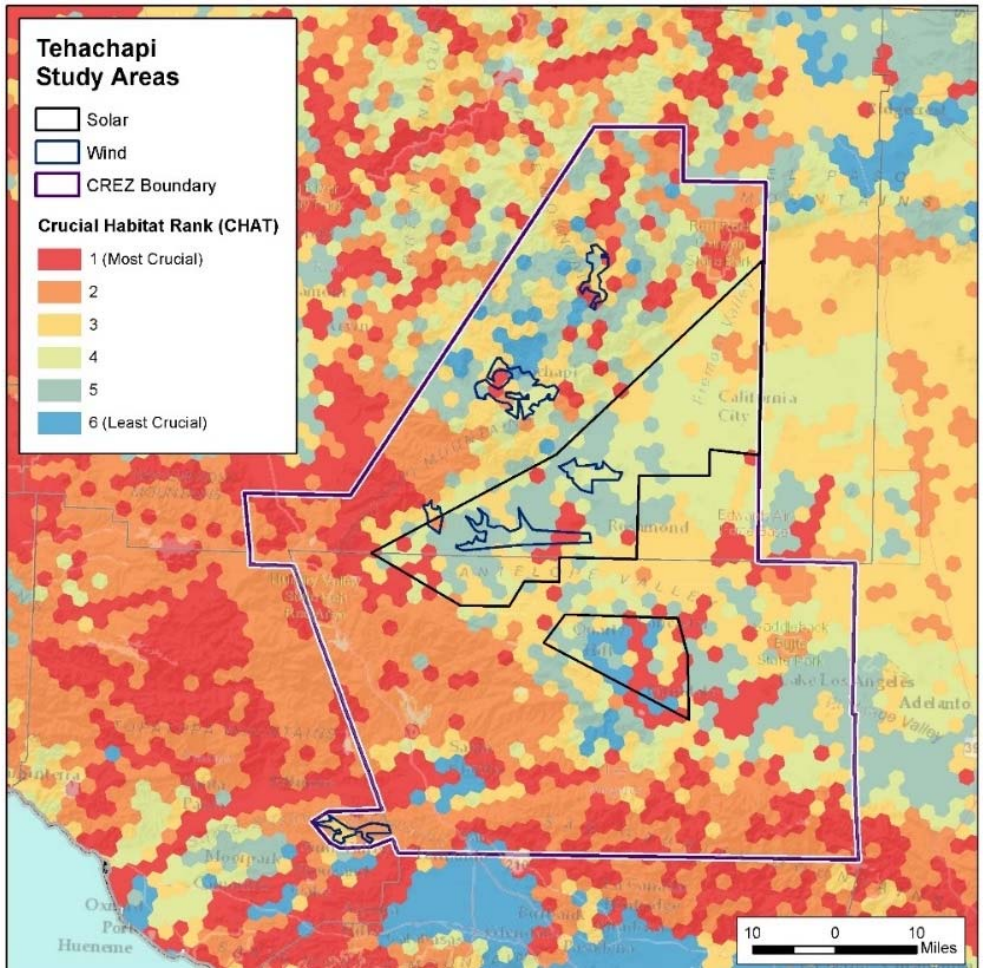
- Most crucial ranks:
  - 87% of study area
- Study area concerns:
  - Important bird area
  - Sierra Nevada bighorn sheep
  - Desert tortoise

Biological Resources Baseline
Riverside East / Palm Springs: Solar, Wind



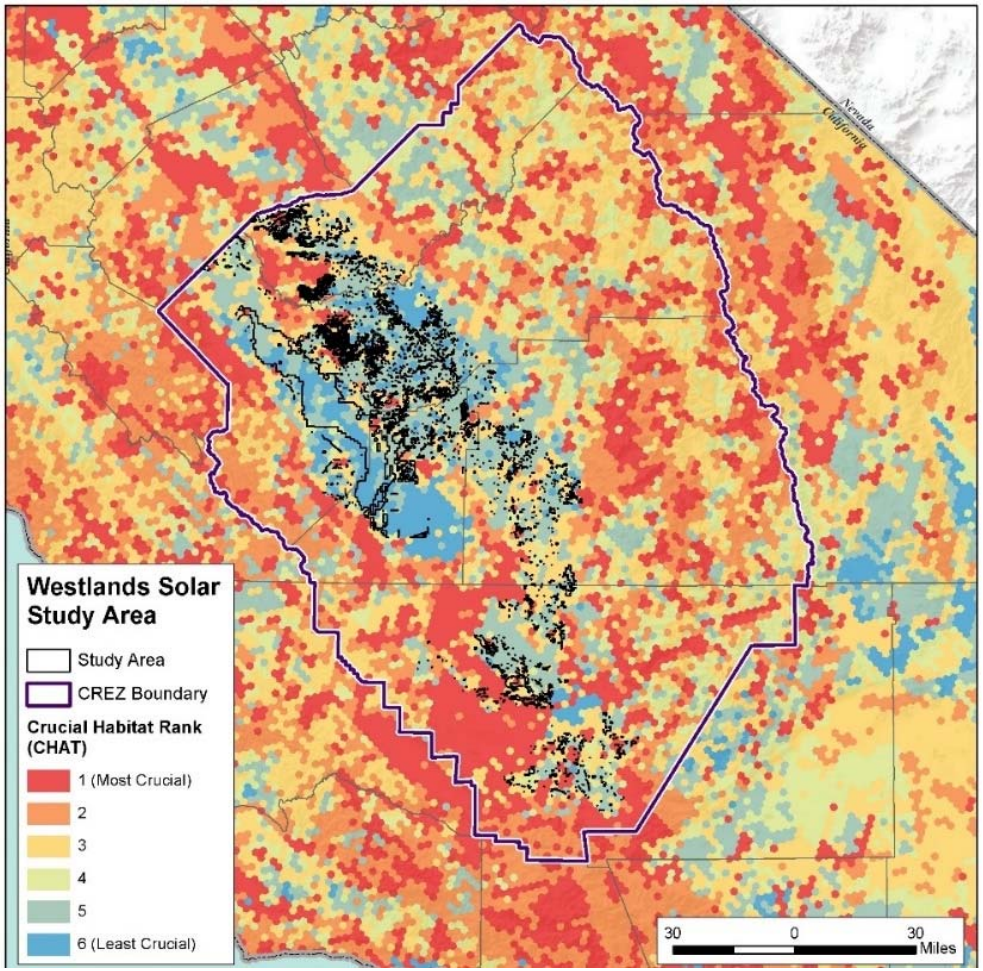
- Most crucial ranks:
  - Solar: 30% of study area
  - Wind: 55% of study area
- Study area concerns:
  - Migratory birds
  - Peninsular bighorn sheep
  - Critical habitat: Coachella Valley milk-vetch, Coachella Valley fringe toed lizard, desert tortoise
  - Desert washes

Biological Resources Baseline
Tehachapi: Solar, Wind



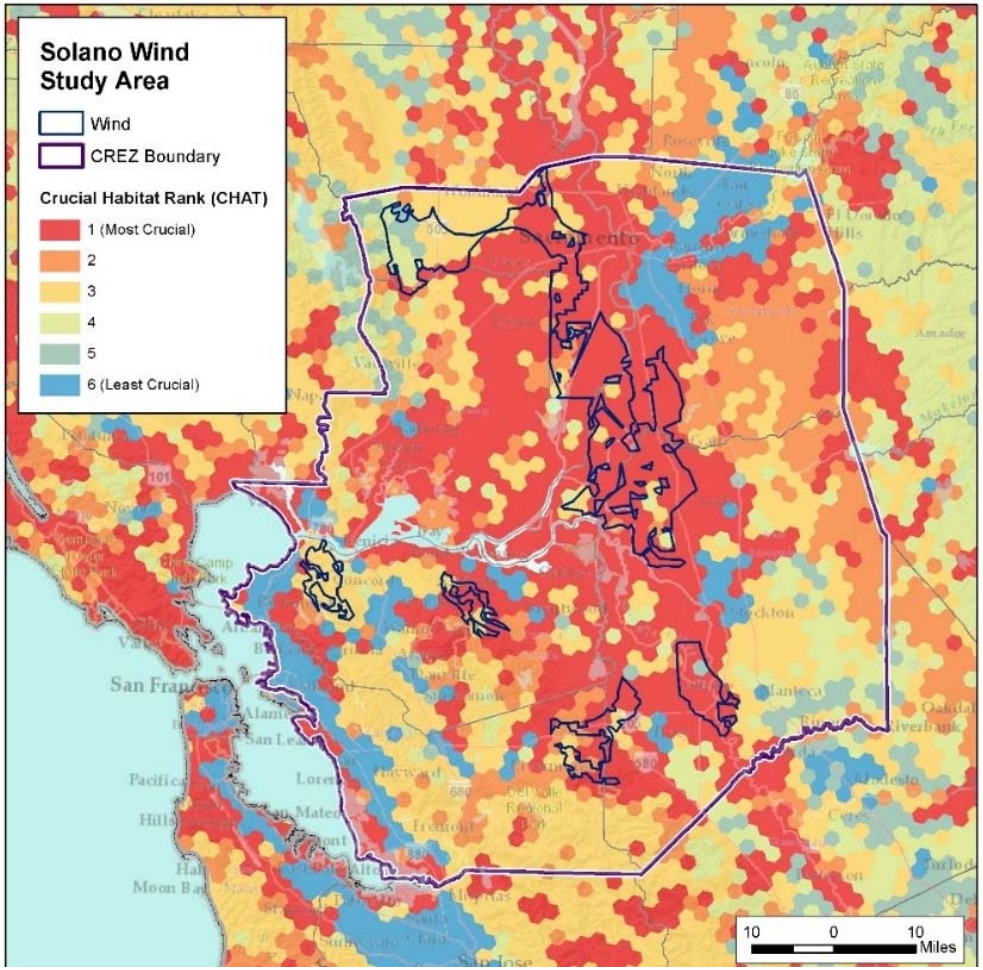
- Most crucial ranks:
  - Solar: 13% of study area
  - Wind: 20% of study area
- Study area concerns:
  - Migratory birds
  - Critical habitat: CA condor, coastal CA gnatcatcher

Biological Resources Baseline
Westlands: Solar



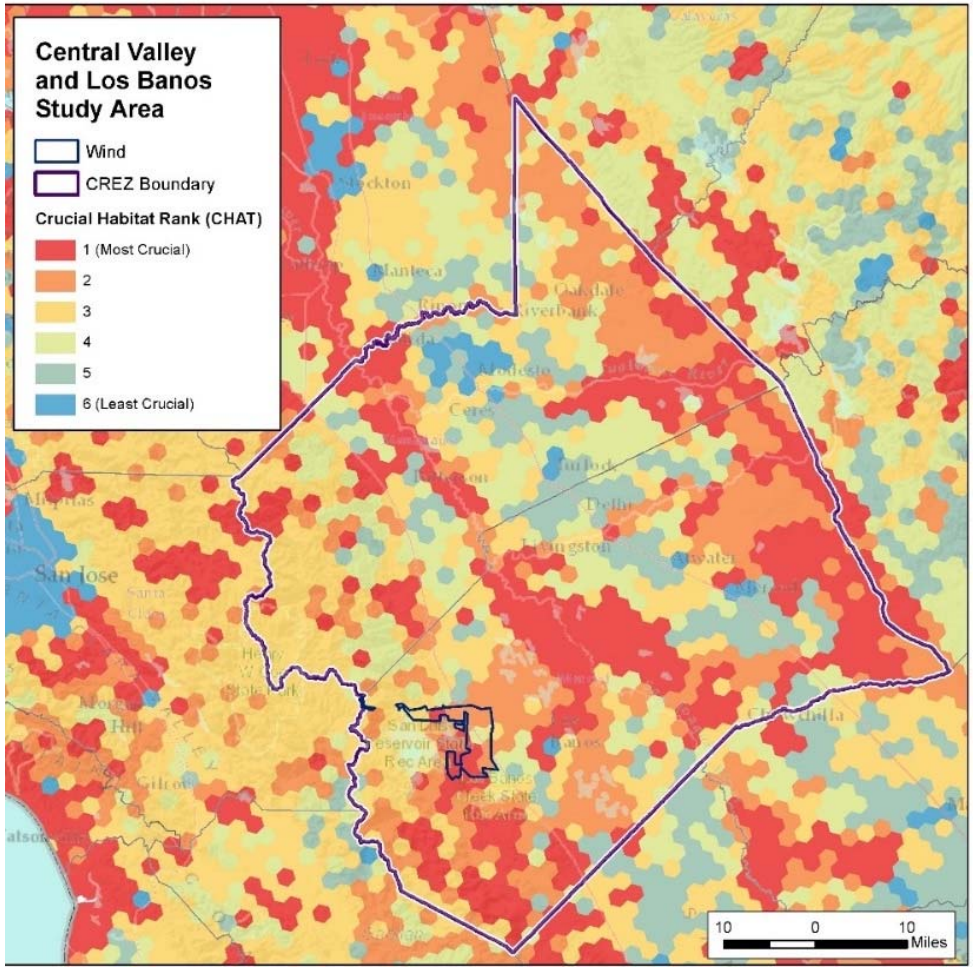
- Most crucial ranks:
  - 5% of study area
- Study area concerns:
  - San Joaquin kit fox
  - Blunt-nosed leopard lizard

Biological Resources Baseline
Solano: Wind



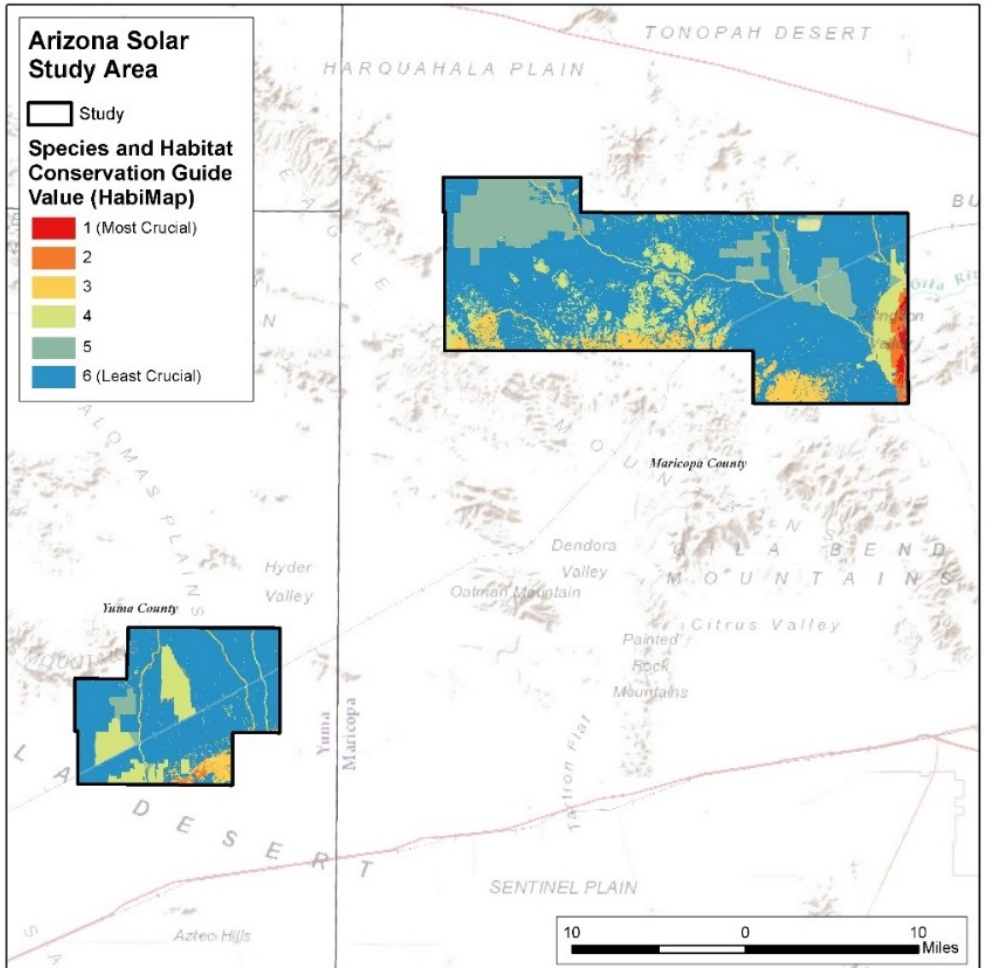
- Most crucial ranks:
  - 73% of study area
- Study area concerns:
  - Migratory birds (Delta)
  - Critical habitat: Alameda whipsnake, CA red-legged frog, vernal pool tadpole shrimp, several plants

Biological Resources Baseline
Central Valley North and Los Banos: Wind



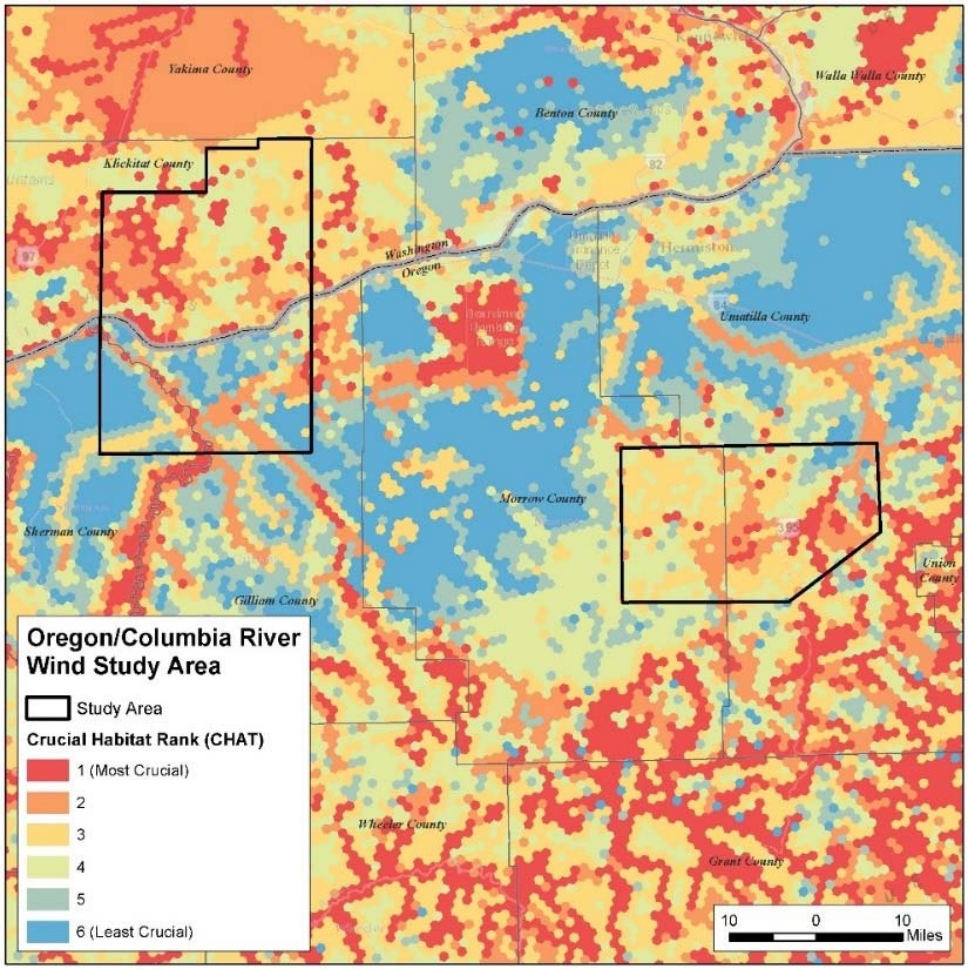
- Most crucial ranks:
  - 77% of study area
- Study area concerns:
  - Migratory birds (San Luis Reservoir)
  - Swainson's hawk
  - San Joaquin kit fox
  - Blunt-nose leopard lizard

Biological Resources Baseline
Southwest (Arizona): Solar



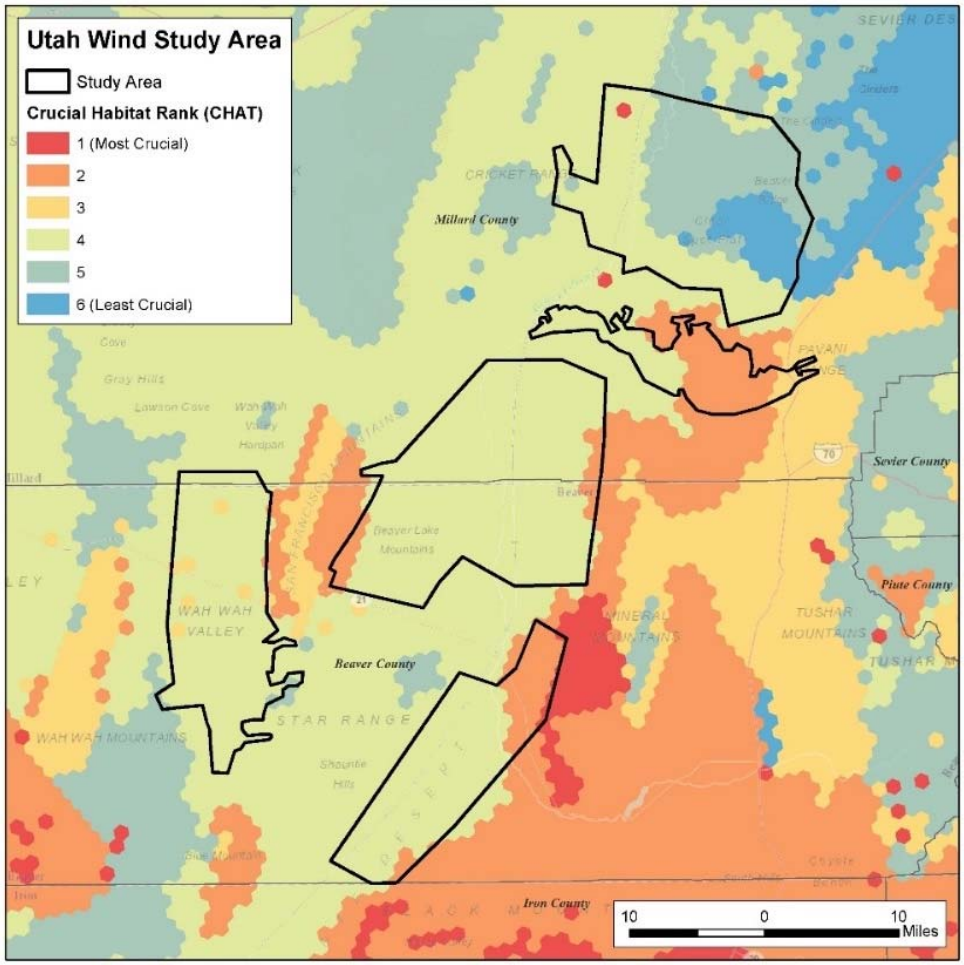
- Most crucial ranks:
  - 2% of study area
- State ranking driven by:
  - large natural areas
  - species of concern
  - species of economic and recreational importance
  - wetland and riparian areas
- Study area concerns:
  - Critical habitat: yellow-billed cuckoo
  - Gila River and desert washes

Biological Resources Baseline
Northwest (Oregon/Washington): Wind



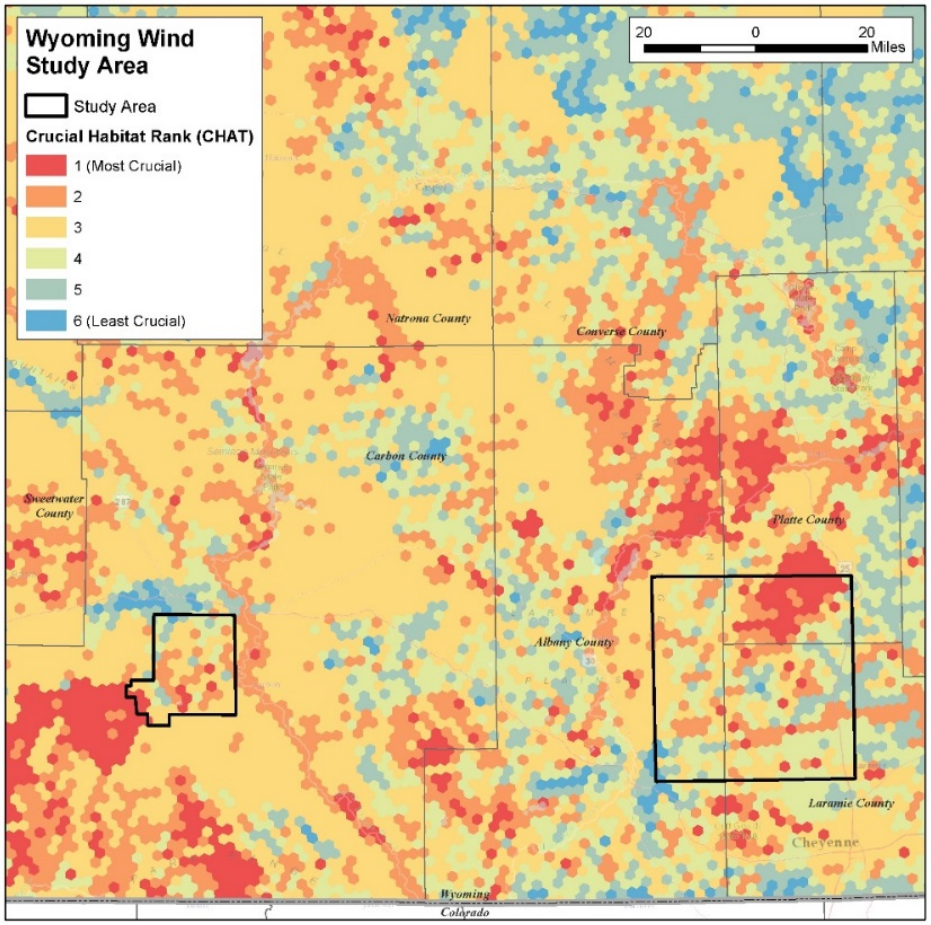
- Most crucial ranks:
  - 31% of study area
- State ranking driven by:
  - species of concern
  - freshwater integrity
  - landscape connectivity
  - large natural areas
  - natural veg. communities
  - terrestrial species of economic and recreational importance
  - wetland and riparian areas
  - wildlife corridors
- Study area concerns:
  - Important Bird Areas
  - golden eagle, Washington ground squirrel
  - steelhead and bull trout critical habitat

Biological Resources Baseline
Utah: Wind



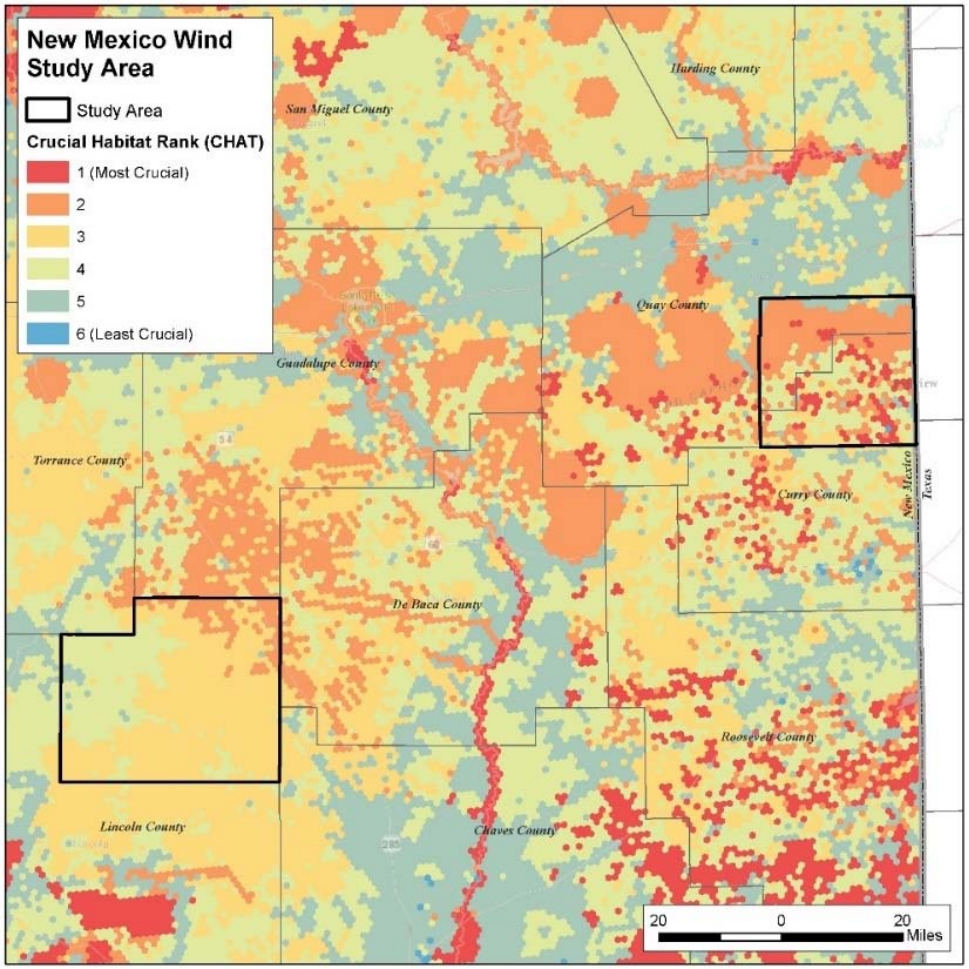
- Most crucial ranks:
  - 10% of study area
- State ranking driven by:
  - large natural areas
  - sage grouse management areas
  - national hydrography dataset
  - national wetlands inventory
  - species of concern
- Study area concerns:
  - Utah prairie dog

Biological Resources Baseline
Wyoming: Wind



- Most crucial ranks:
  - 31% of study area
- State ranking driven by:
  - large natural areas
  - species of concern
  - species of economic and recreational importance
  - wetland and riparian areas
- Study area concerns:
  - Colorado butterfly plant critical habitat
  - Big game crucial range
  - Important Bird Areas

Biological Resources Baseline
New Mexico: Wind



- Most crucial rank:
  - 26% of study area
- State ranking driven by:
  - large natural areas
  - species of concern
  - species of economic and recreational importance
  - wetland and riparian areas
  - natural vegetation communities
  - freshwater integrity
  - wildlife corridors
- Study area concerns:
  - Important Bird Areas
  - Lesser prairie chicken complex
  - Caprock Escarpment: bat populations

Appendix 4: Review of Out of State Transmission

Out of State Transmission for California RPS in 2030 Regional 3 (1)

Regional 3 is the only scenario that involves adding new transmission by 2030 for California to access Out of State wind for RPS.

Range of environmental impacts for transmission to access Wyoming wind:

- **Lands with Special Management Designations**
  - National Scenic & Historic Trails; non-motorized trails
  - Inventoried Roadless Areas
  - National Conservation Areas; Conservation Easements
  - Other sensitive areas
- **Biological Resources**
  - Many federally- and state-listed plants and wildlife species.
  - Major concerns:
    - Migratory birds and big game species
    - Greater sage grouse priority habitat

Out of State Transmission for California RPS in 2030 Regional 3 (2)

Range of environmental impacts for transmission to access Wyoming wind by 2030 (continued):

- **Land Use and Aesthetics**
  - BLM & USFS conformance; viewshed impacts
  - Residences; Agriculture/Grazing; Recreation
- **Cultural Resources, Paleontology & Mineral Resources**
  - Native American traditional cultural properties
  - Historic properties, including historic trails
  - Known fossil-bearing formations and major mineral resources
- **Ground Stability Hazards**
  - Landslides and ground subsidence
- **Cumulative Impacts**
  - Multiple transmission lines proposed within common corridors

Out of State Transmission for California RPS in 2030 Regional 3 (3)

Range of environmental impacts for transmission to access New Mexico wind by 2030:

- **Lands with Special Management Designations**
  - Wilderness Areas; Recreation Areas; other designated sensitive areas
- **Dept. of Defense (DoD) Lands and Restricted Airspace**
  - White Sands Missile Range
- **Cultural Resources and Aesthetics**
  - Gran Quivira unit of the Salinas Pueblo Missions National Monument
  - Known habitation sites and the McClellan Wash Archaeological District
- **Biological Resources**
  - Rio Grande & San Pedro River crossings
  - Interference with sandhill crane and waterfowl migration routes
  - Desert bighorn sheep movement corridor; pronghorn
  - Habitat for Sonoran desert tortoise; Tucson shovel-nosed snake

Stakeholder Comments

Wrap-Up: Next Steps

Milestone	Date
Comments due on presentation materials and meeting discussion – Please use comments template available at http://www.caiso.com/Documents/CommentsTemplate-SB350CleanEnergy-PollutionReductionAct-Presentation-Discussion.doc	June 8
Post final report	Target – Mid-June
Joint agency workshop	Target – July

Additional questions or comments can be directed to: regionalintegration@caiso.com

SB350 Study Reference Material

Today's meeting is being recorded in its entirety. The recording will be available to stakeholders on the regional energy markets webpage at http://www.caiso.com/informed/Pages/RegionalEnergyMarket/BenefitsofaRegionalEnergyMarket.aspx.

This is a service to stakeholders who couldn't join us, or would like to review the proceedings. Materials related to the SB350 study and other regional integration efforts are also available at the link provided above.

Additional reference materials:
Senate Bill No. 350 - Clean Energy and Pollution Reduction Act of 2015
https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB350
Fast Facts – Benefits of a regional energy market
http://www.caiso.com/Documents/2015RegionalBenefitsFactSheet.pdf
Early release material
http://www.caiso.com/informed/Pages/RegionalEnergyMarket/BenefitsofaRegionalEnergyMarket.aspx