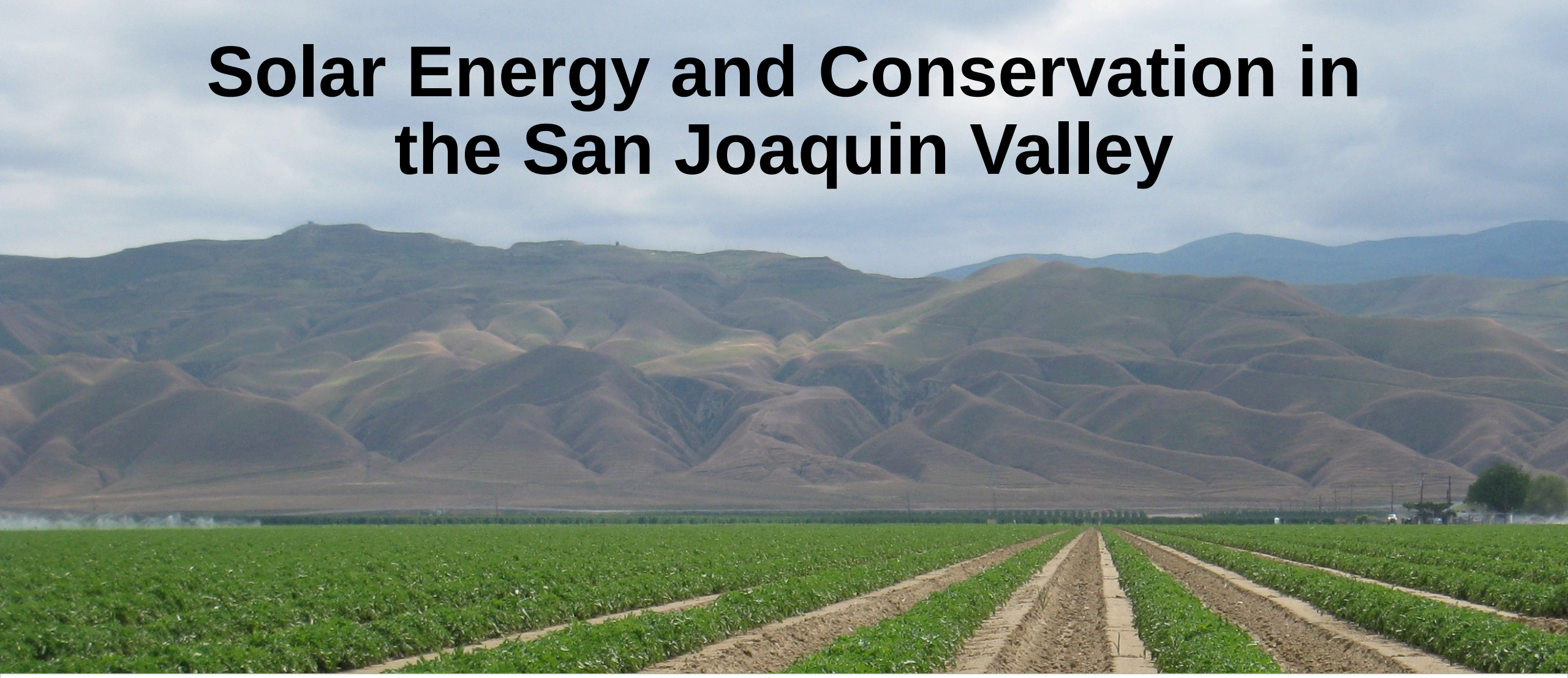
DOCKETED

Docket Number:	15-RETI-02
Project Title:	Renewable Energy Transmission Initiative 2.0
TN #:	206737
Document Title:	Solar Energy and Conservation in the San Joaquin Valley
Description:	Presentation
Filer:	clare Laufenberg
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	11/23/2015 3:07:18 PM
Docketed Date:	11/23/2015

Solar Energy and Conservation in the San Joaquin Valley

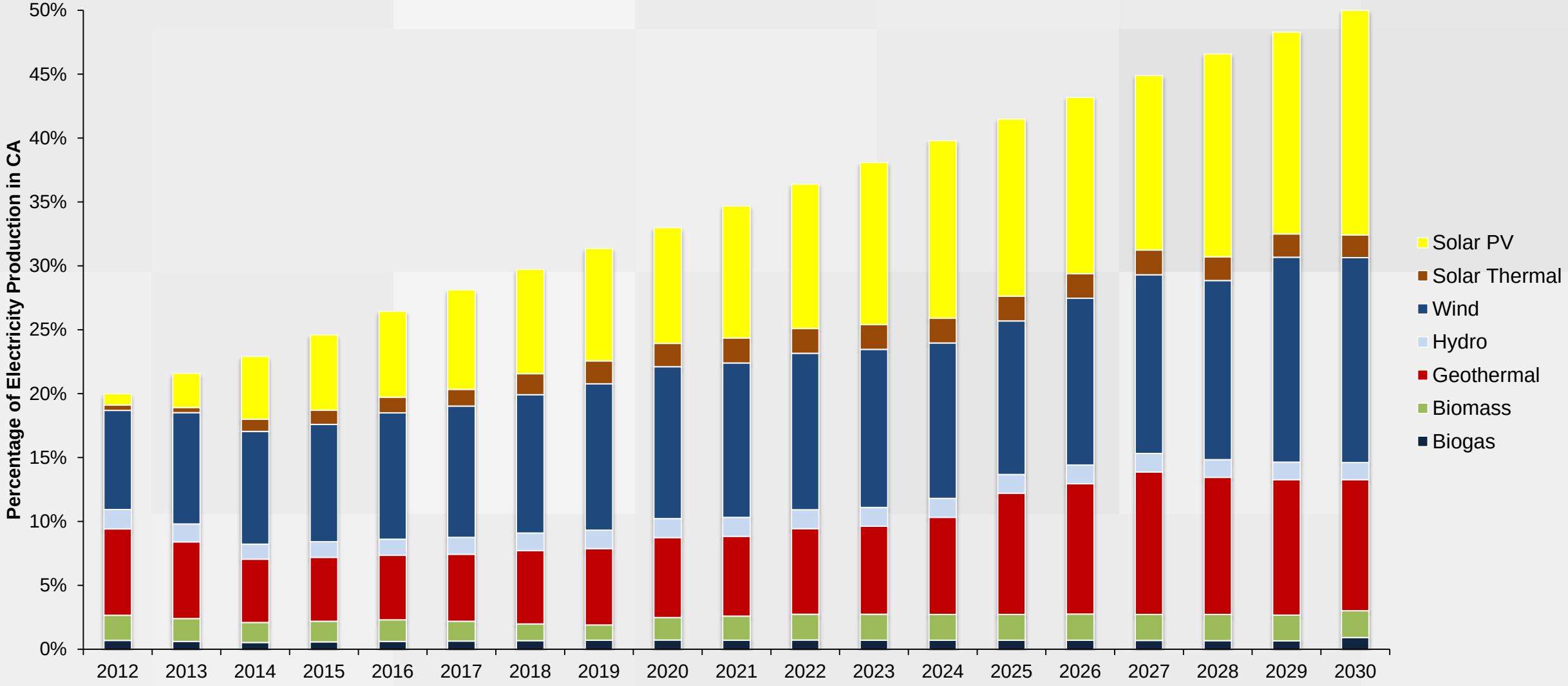


Dustin Pearce, Sam Young, Graham Wesolowski, Jane Cowan, & Andrew Gwin

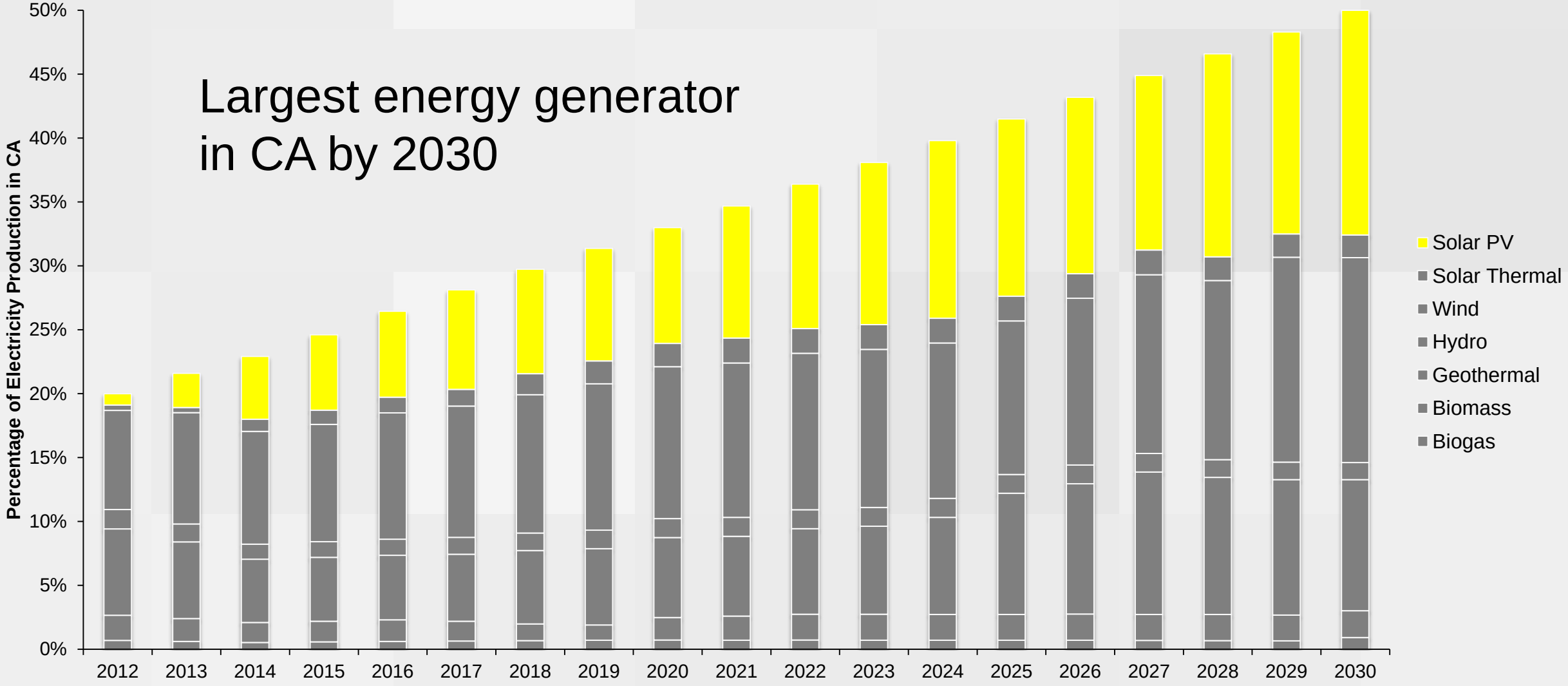
Outline

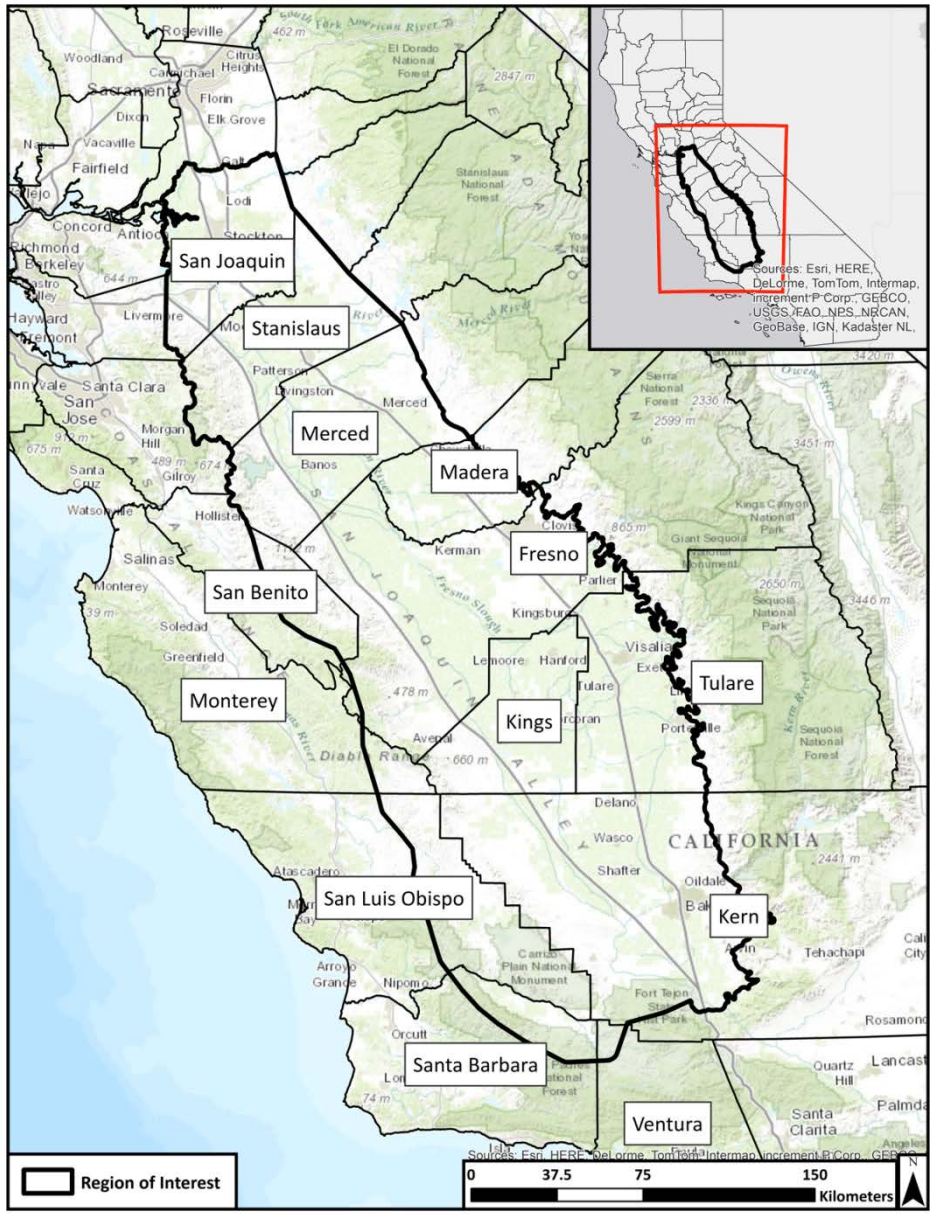
1. Introductions
2. Brief description and motivation for project
3. Methods & Data
4. Results & Next Steps
5. Conclusion

Solar PV Growth in CA's Renewable Energy Portfolio



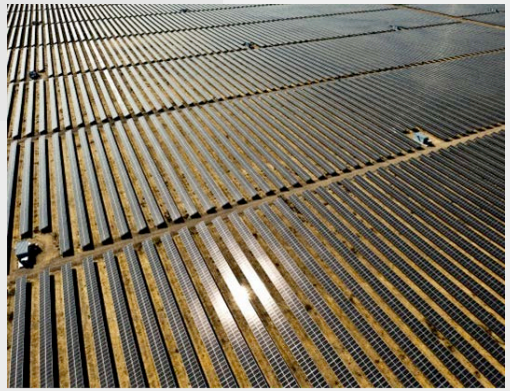
Solar PV Growth in CA's Renewable Energy Portfolio





San Joaquin Valley Region

- Mostly private lands
- 11.5 million acres



Conservation

- 90-95% original valley habitat removed
- 196 species endangered, threatened, or a species of special concern

Agriculture

- Richest agricultural region in the world
- 7 out of the top 10 producing counties in CA
- $2.2 – $6.5 billion in agricultural production

Solar

- Fastest growing renewable energy in CA
- Price frequently competes with fossil fuels

Project Objectives

Develop a decision support tool that:

1. Identifies priority areas of conservation value
2. Identifies compatible areas for utility scale solar development

For the Purpose of:

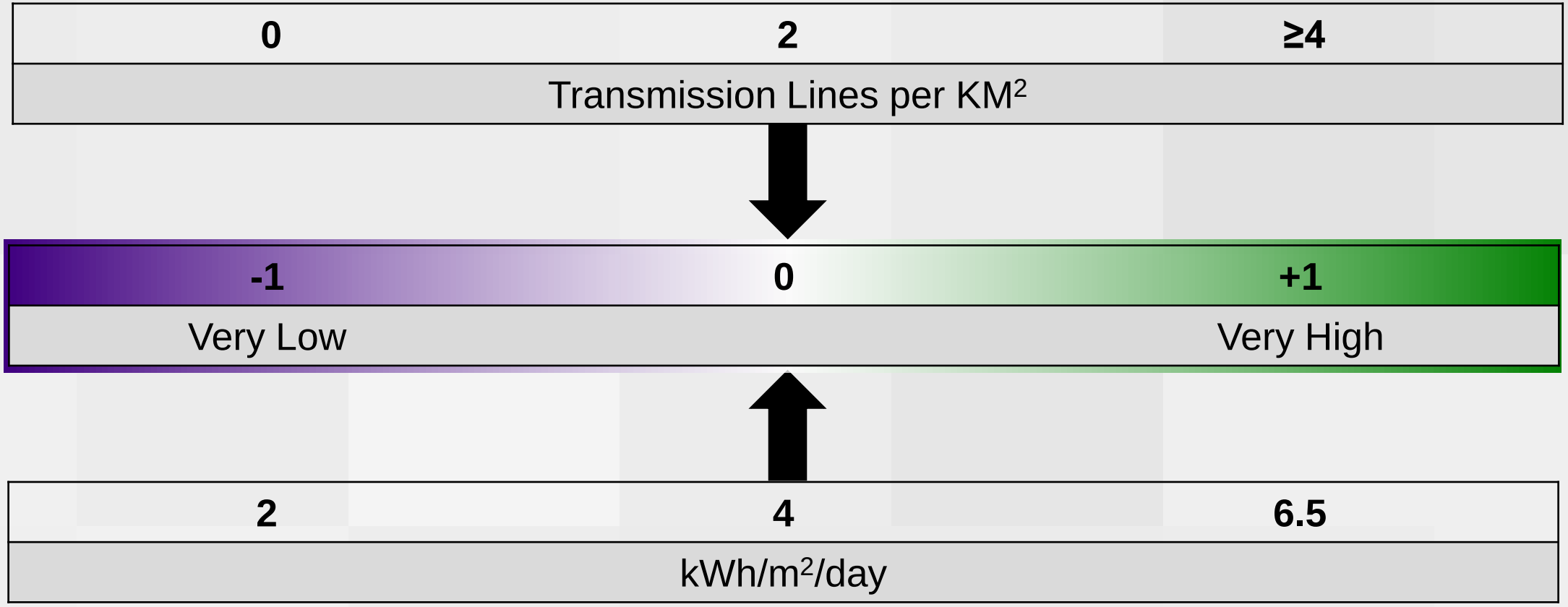
1. Illustrating application of multi-stakeholder values to land scape scale planning
2. Creating a ready to use tool to facilitate participation among diverse stakeholder groups and provide transparency in the planning process

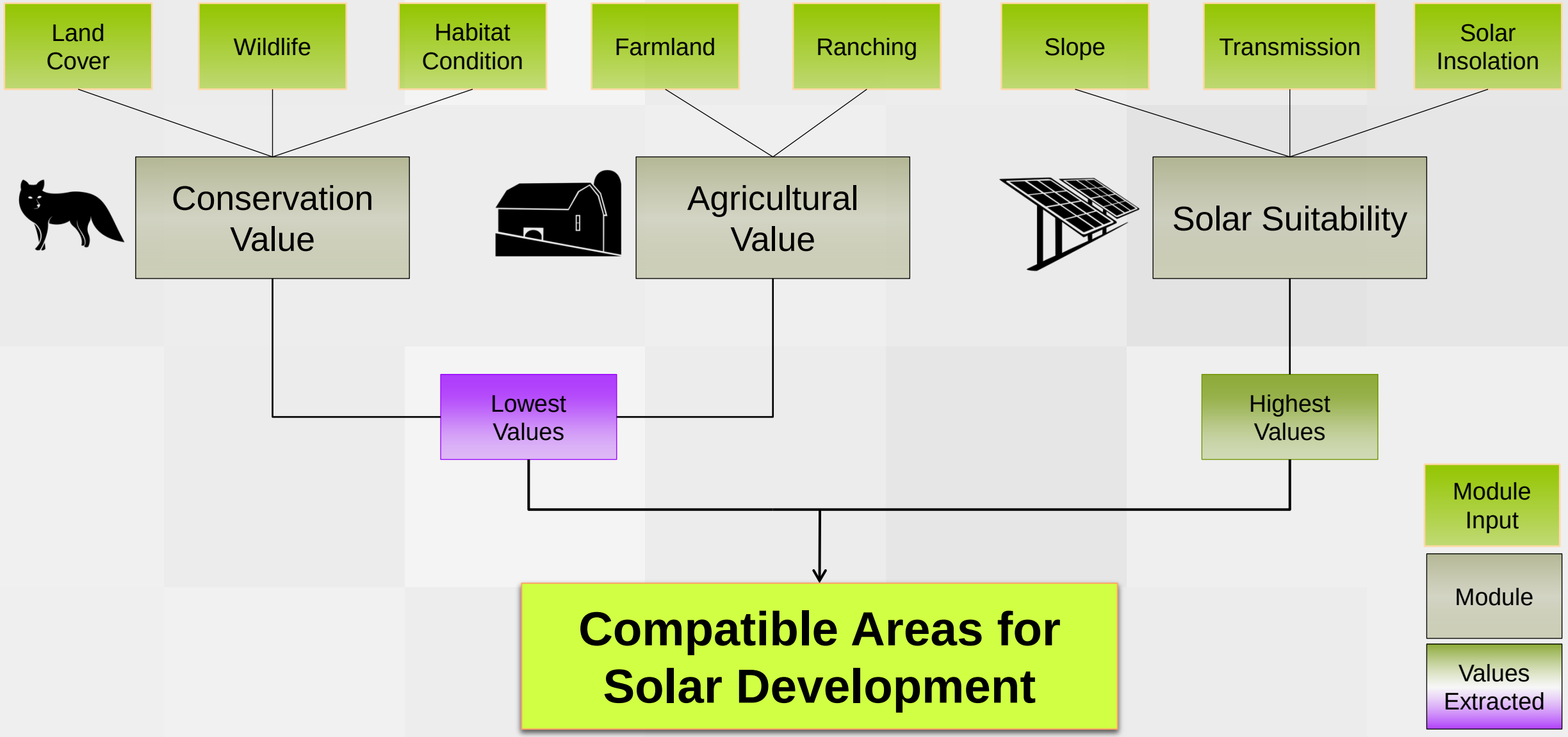
Environmental Evaluation Modeling System (EEMS)

High Priority Conservation Areas

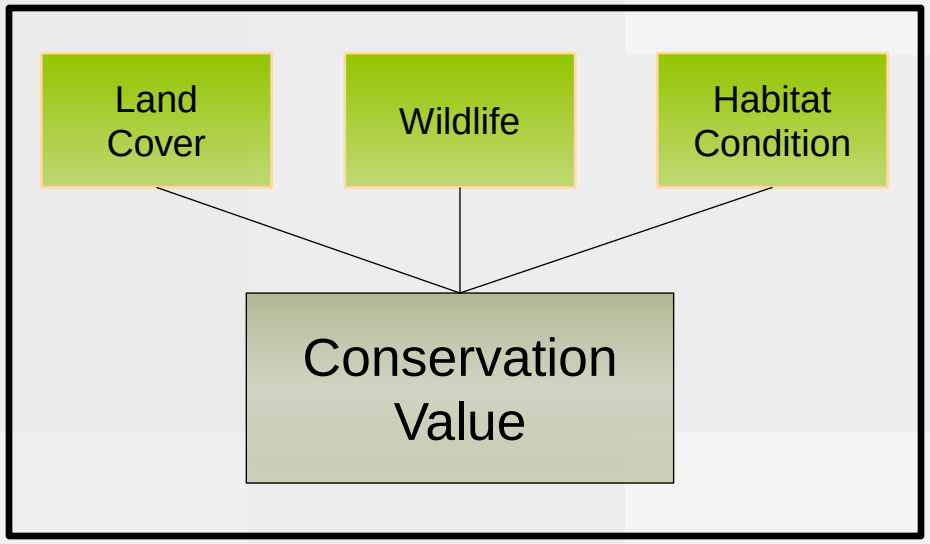
Compatible Areas for Solar Development

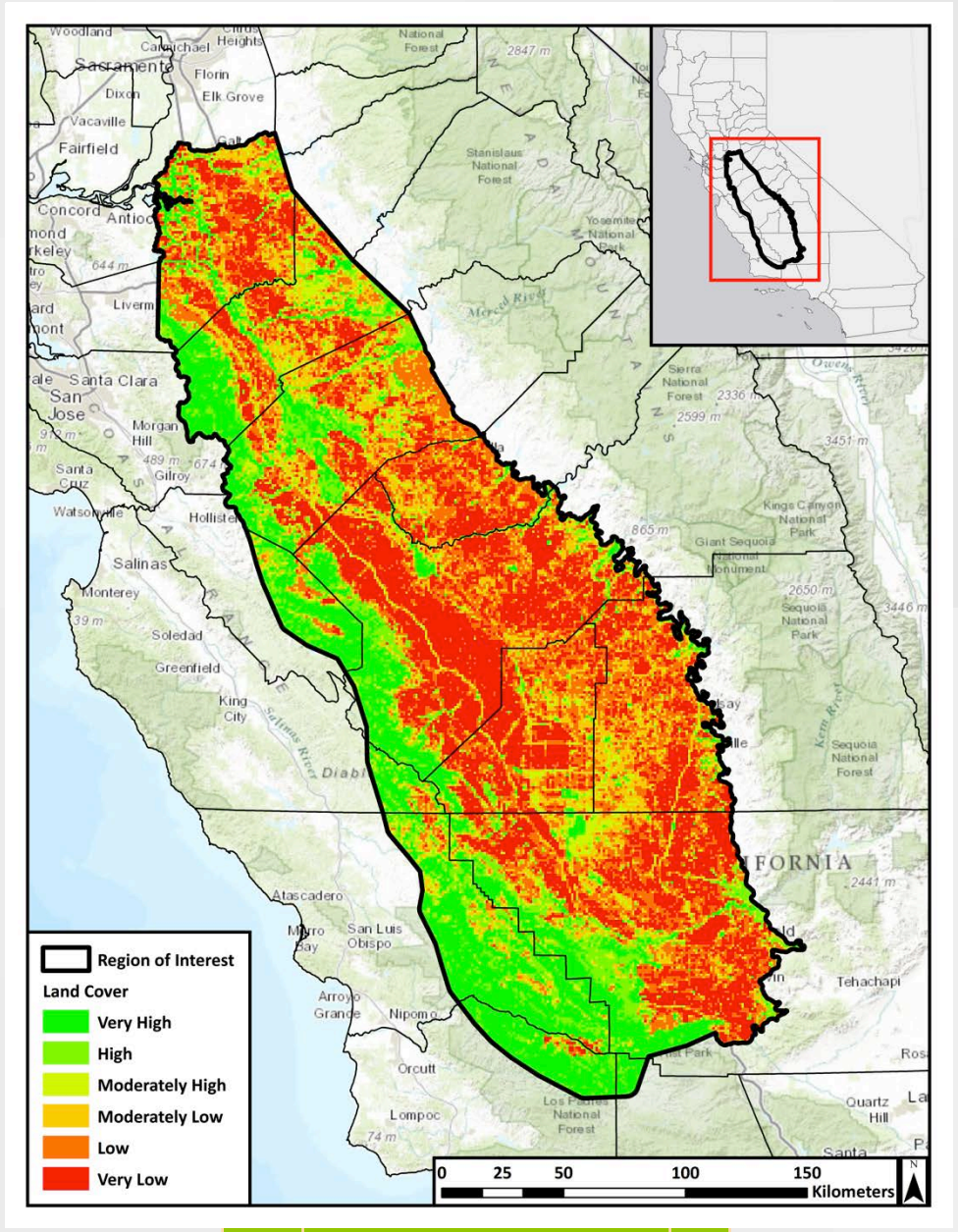
Normalized Logic Modeling




Land Cover
Wildlife
Habitat Condition
Farmland
Ranching
Slope
Transmission
Solar Insolation
Conservation Value
Agricultural Value
Solar Suitability
Lowest Values
Highest Values
Compatible Areas for Solar Development
Module Input
Module
Values Extracted

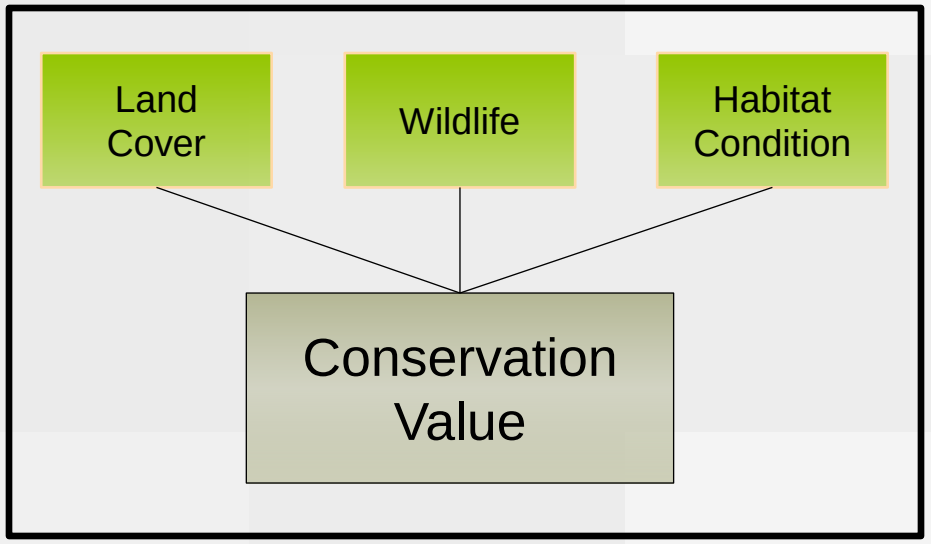
Conservation Value

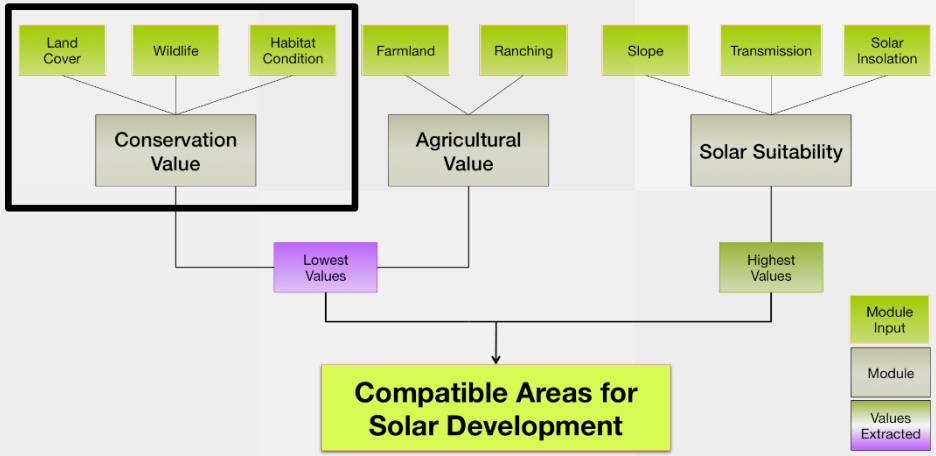


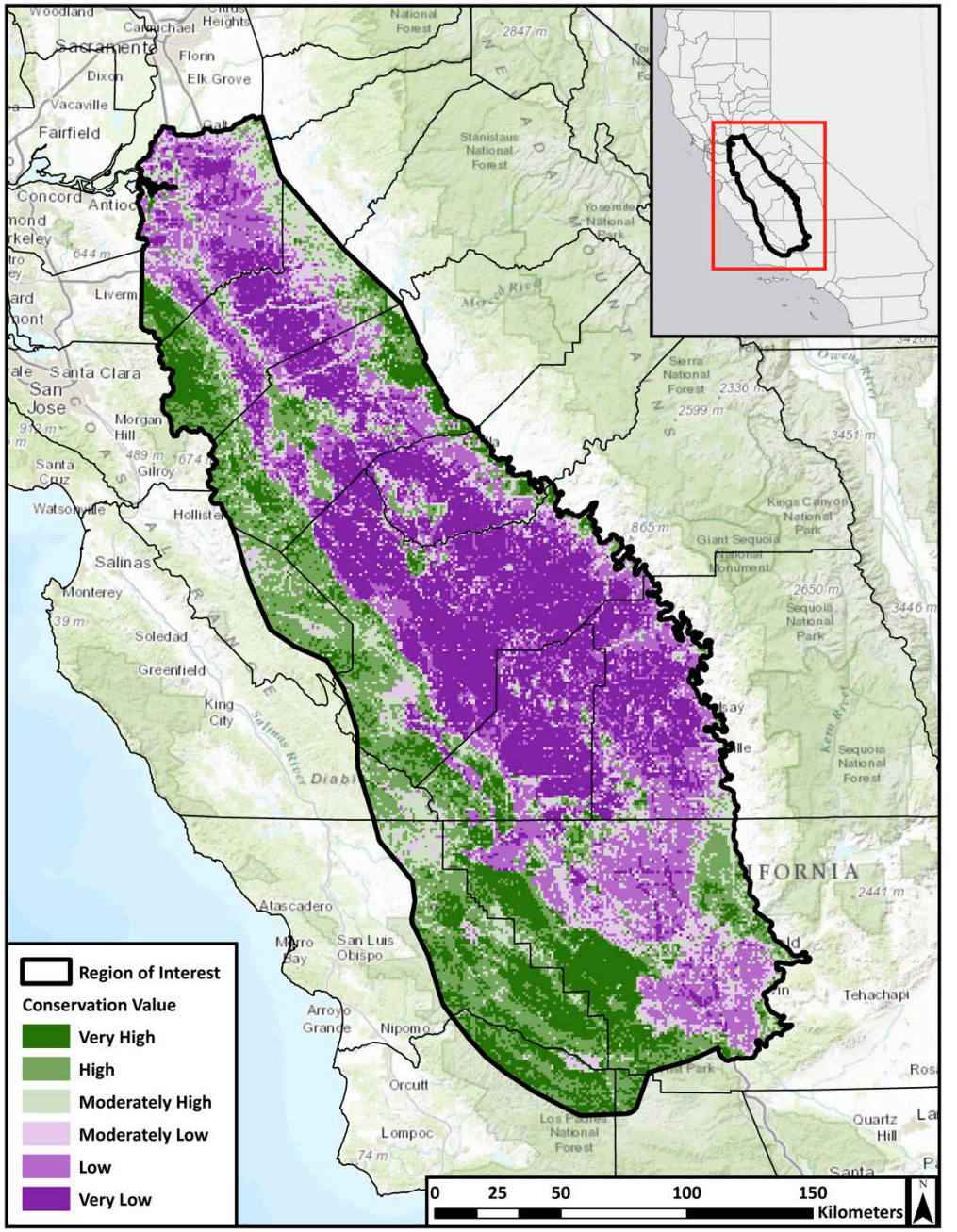


Habitat Condition Land Cover

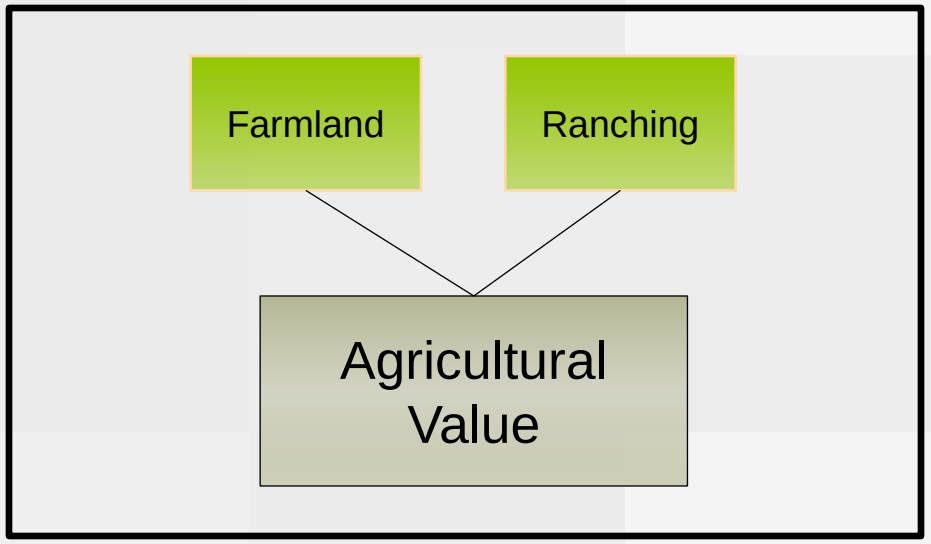
Conservation Value



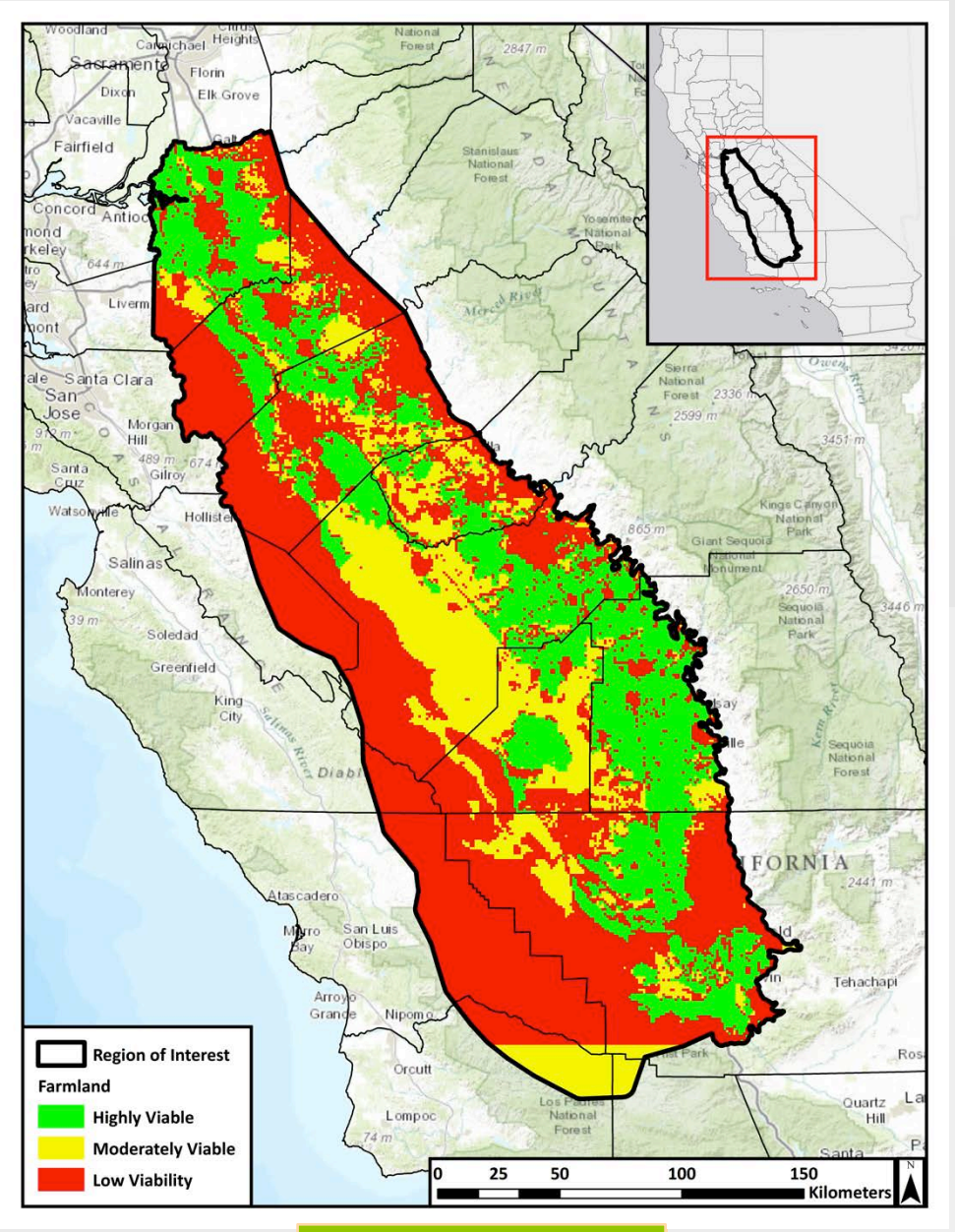




Agricultural Value

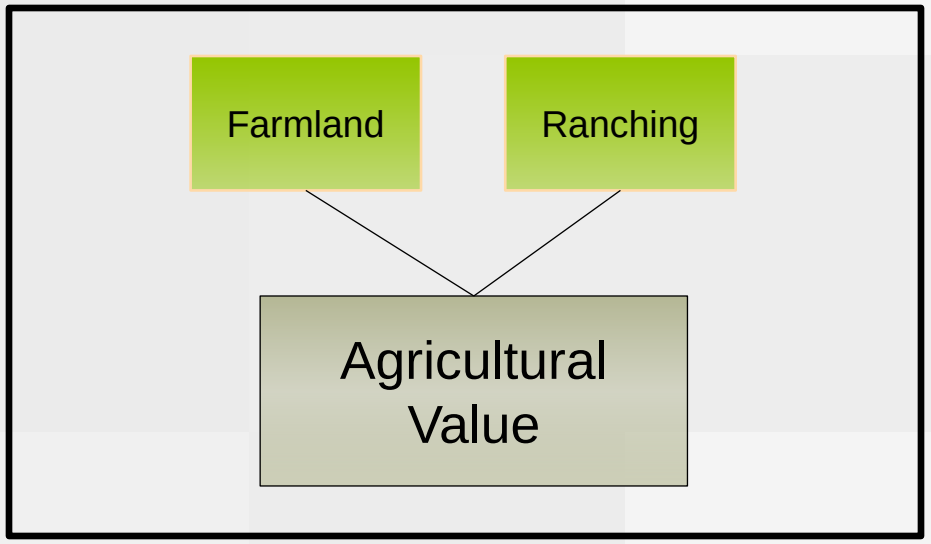


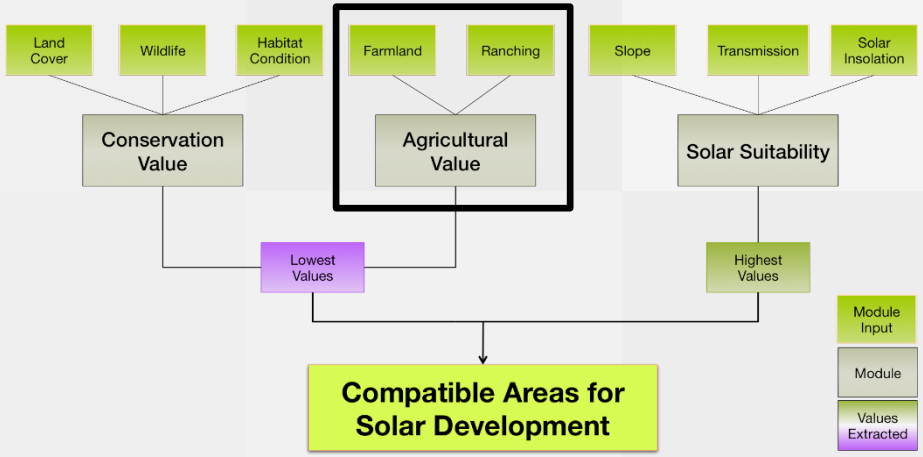
INPUTS	Source
Farmland Classifications	UC Davis American Farmland Trust
Rangeland Classifications	California Rangeland Conservation Coalition

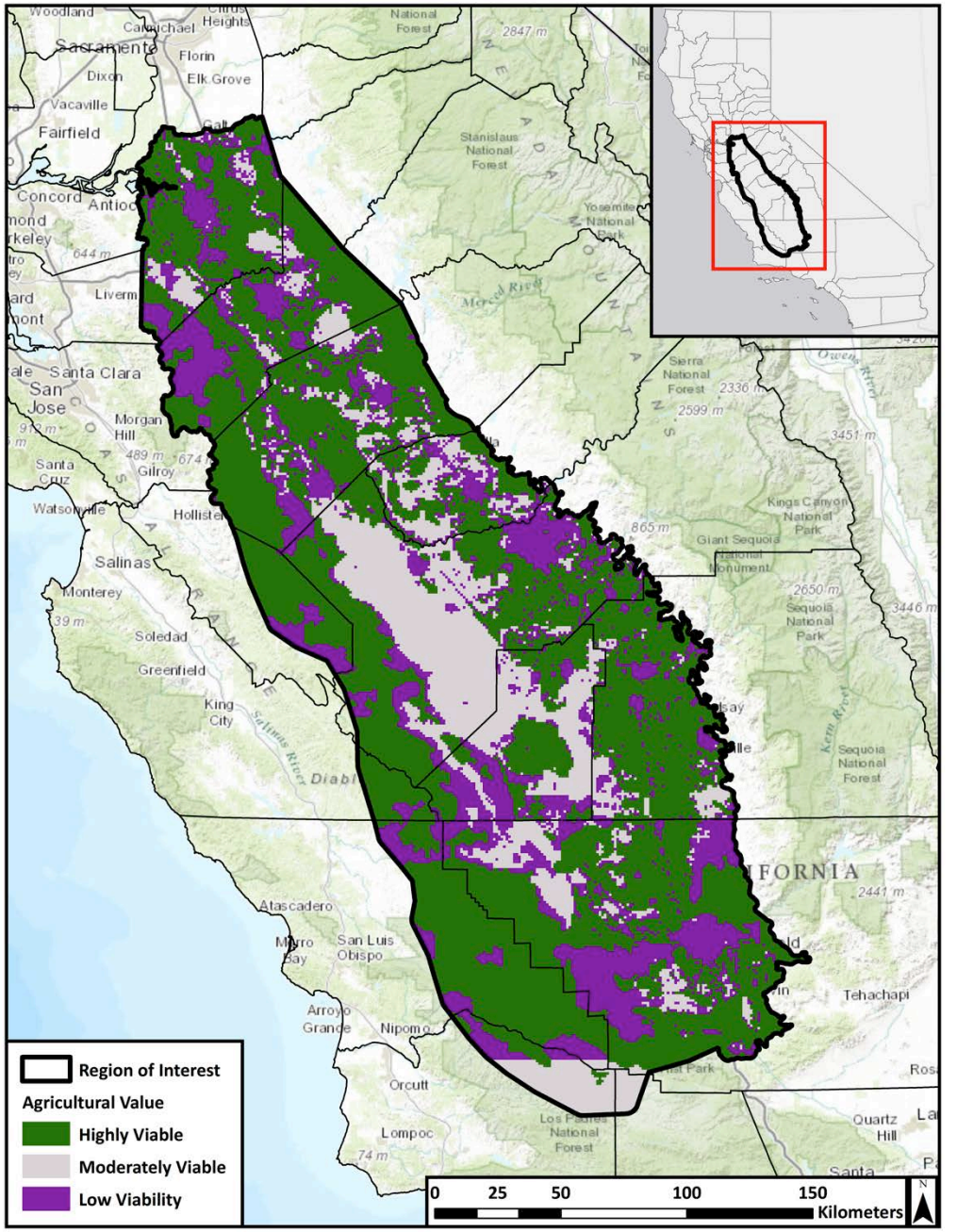


Farmland

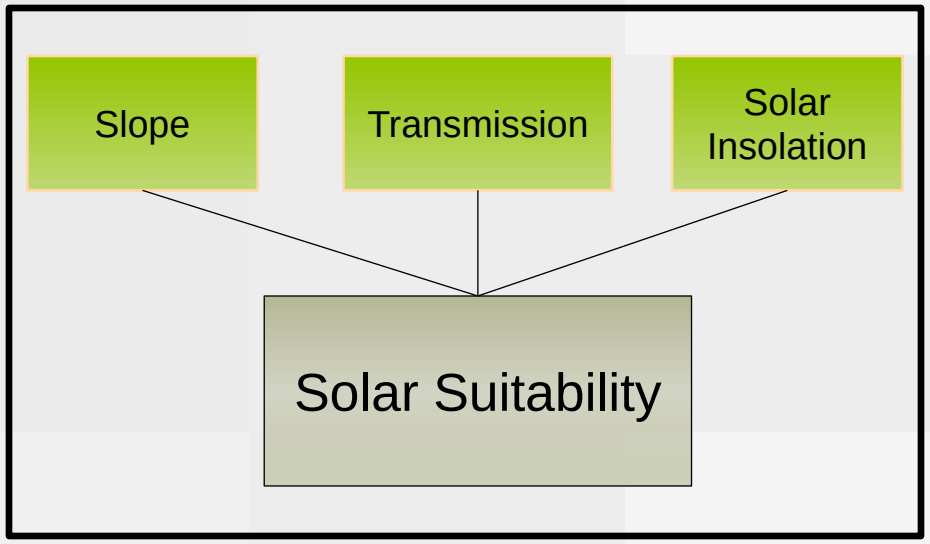
Agricultural Value



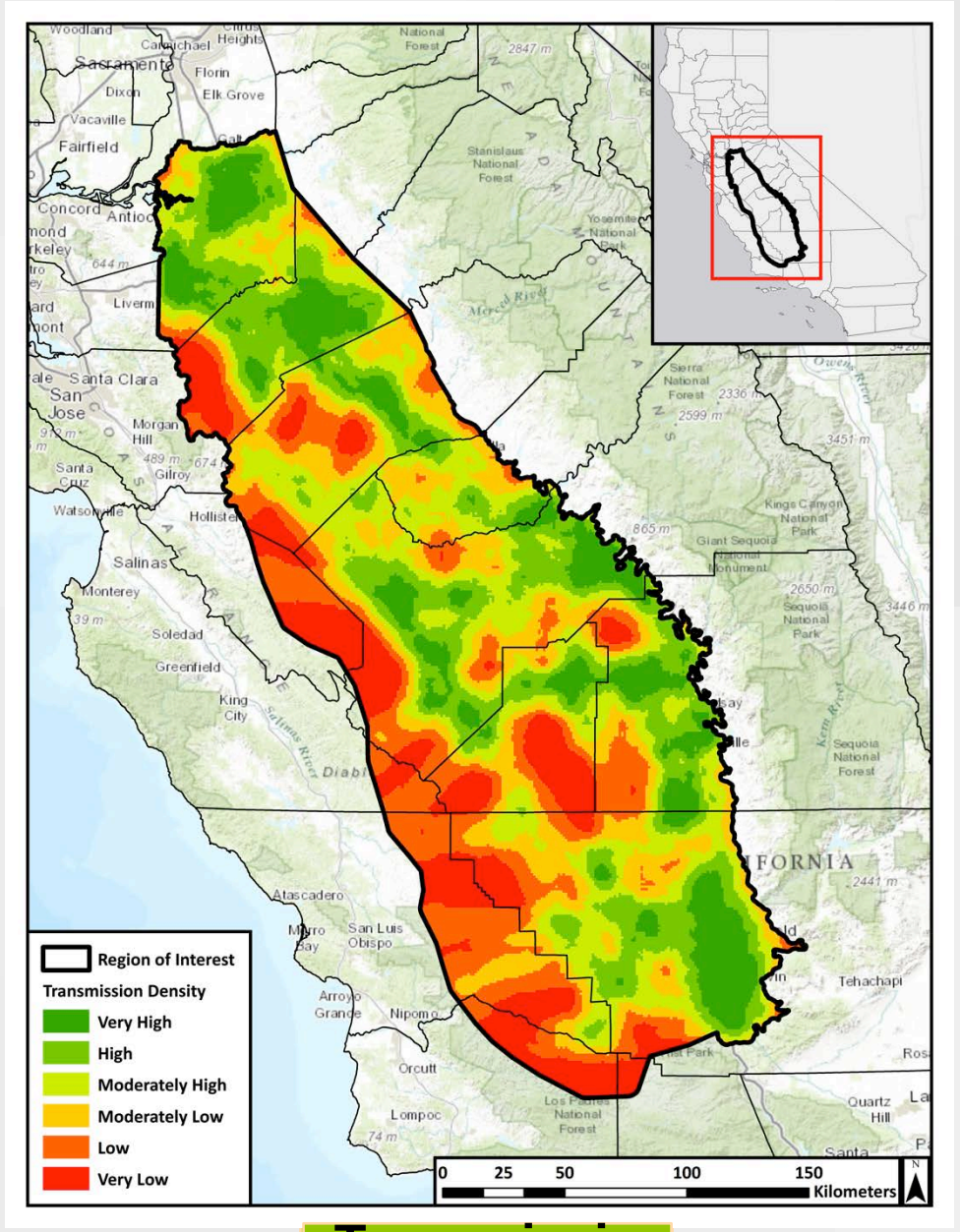




Solar Suitability

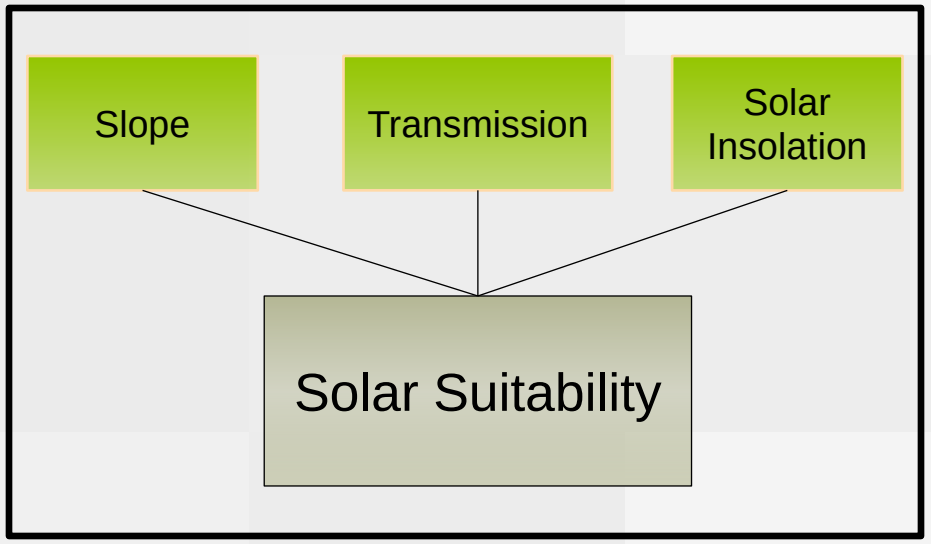


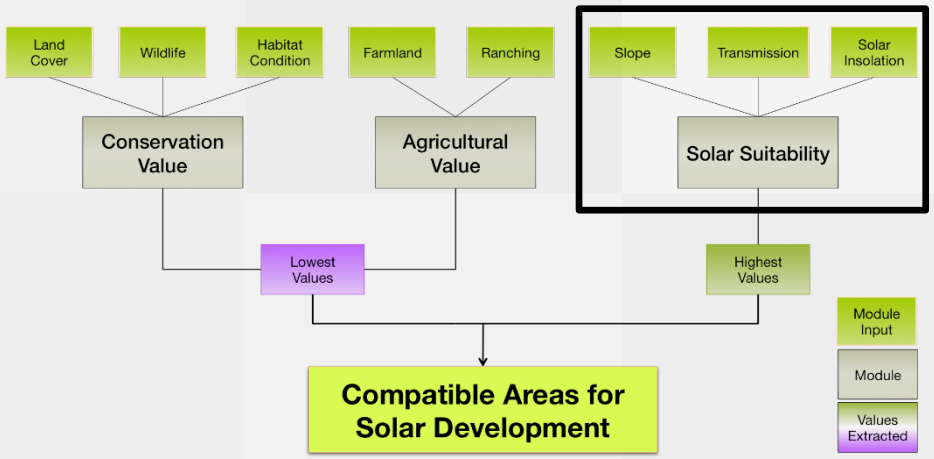
INPUTS	Source
Solar Insolation	NREL
Slope	California 10m DEM
Transmission Density	ESRI

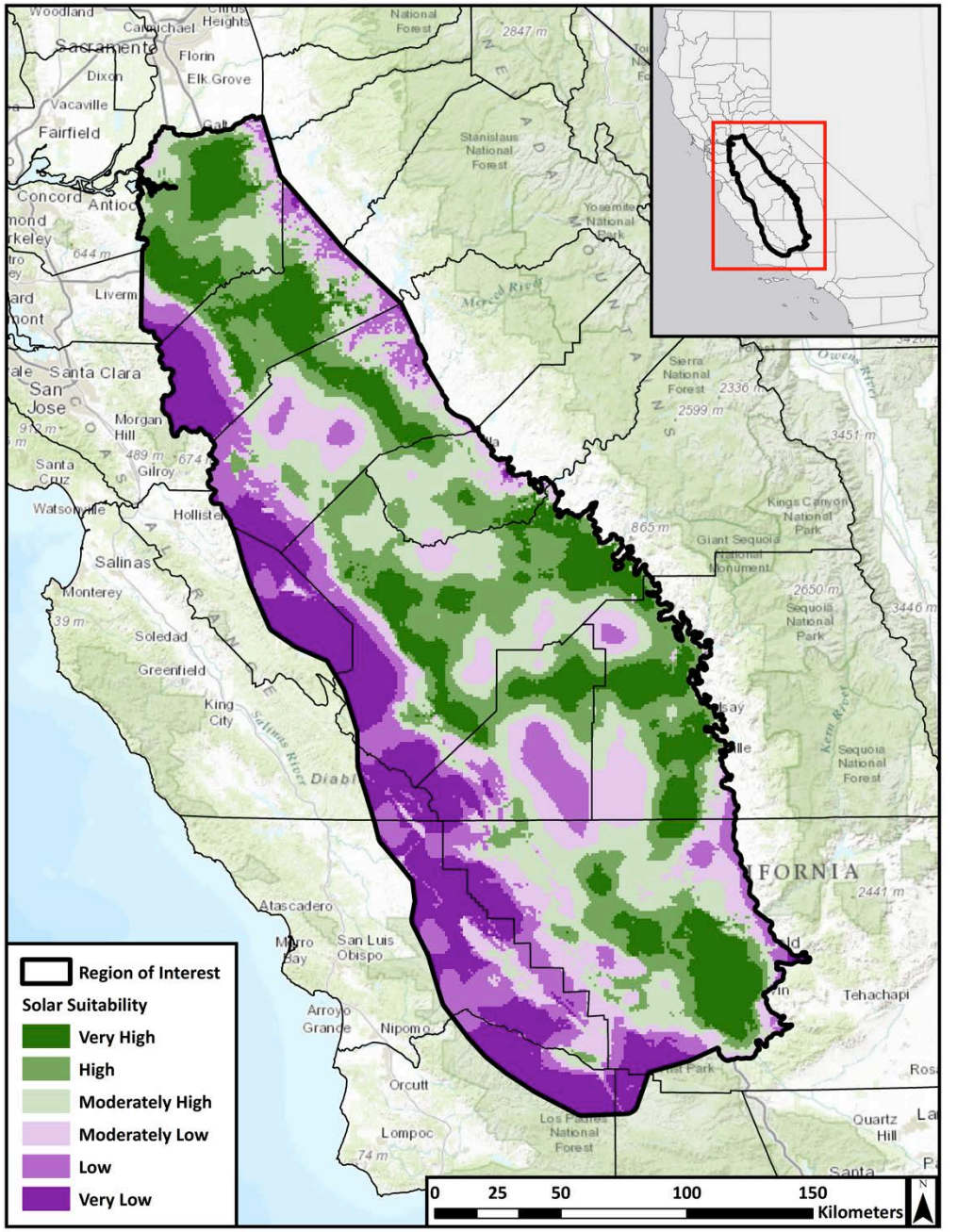


Transmissio
n

Solar Suitability







Land Cover
Wildlife
Habitat Condition
Farmland
Ranching
Slope
Transmission
Solar Insolation

Conservation Value

Agricultural Value

Solar Suitability

Lowest Values

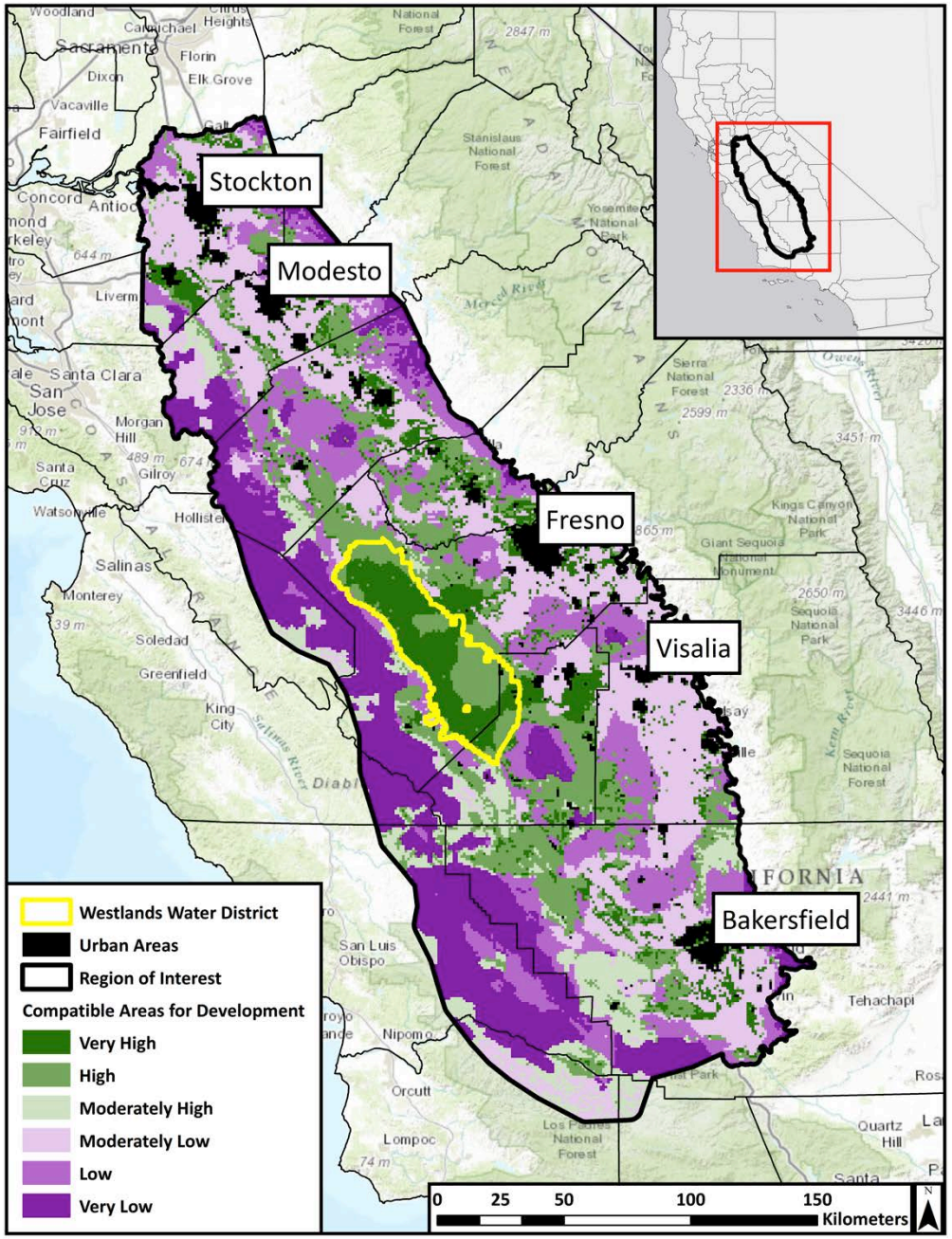
Highest Values

Compatible Areas for Solar Development

Module Input
Module
Values Extracted

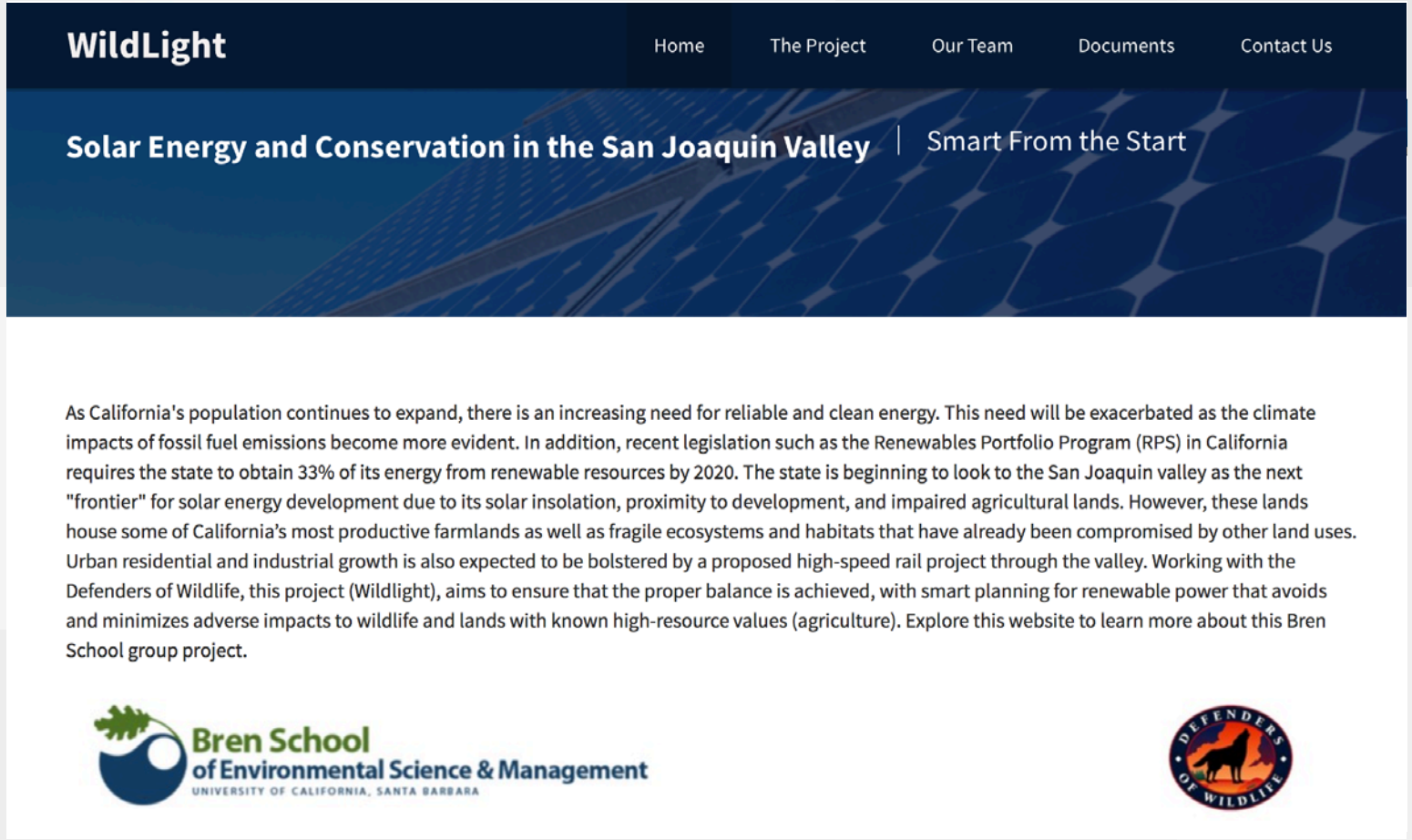
Where are compatible areas for solar development?

- Urban Areas
- Westlands Water District



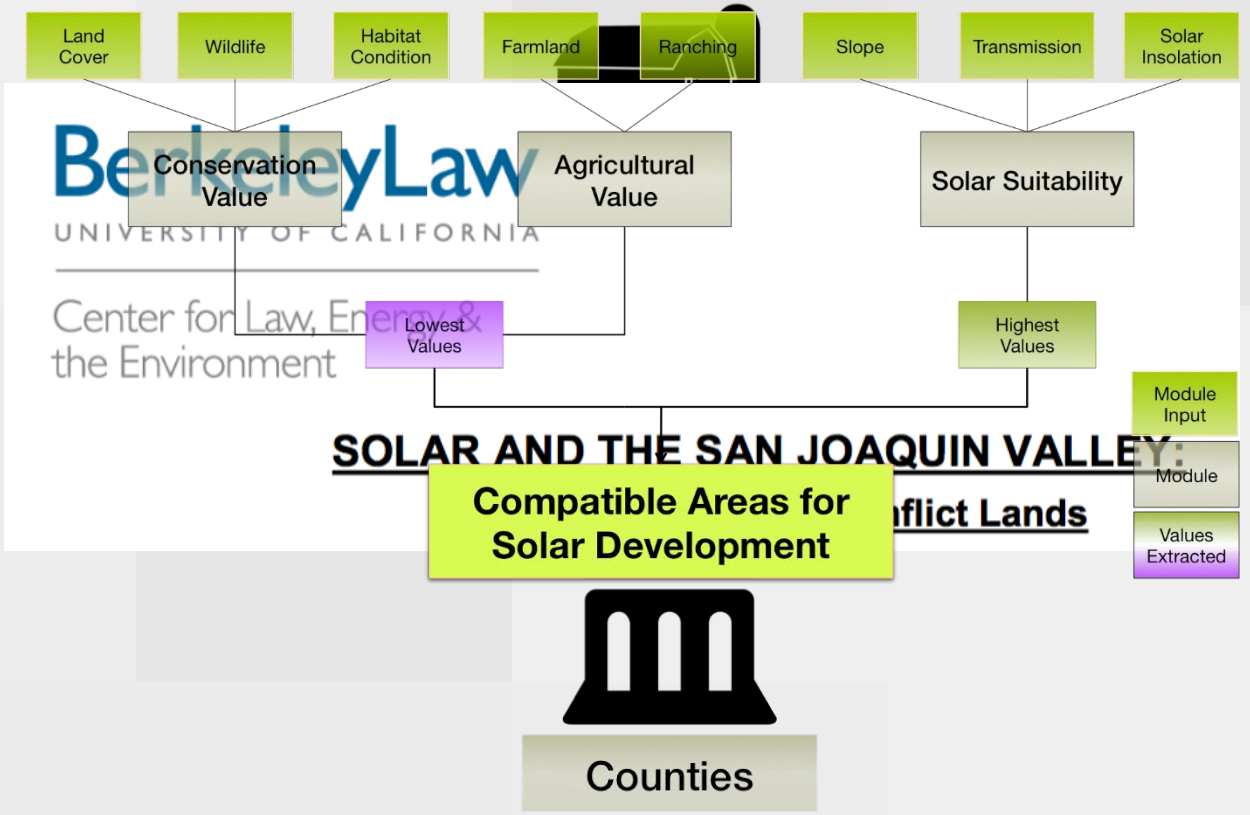
Where can you find the Data?

- Data Basin
- Bren Website



Next Steps and Opportunities

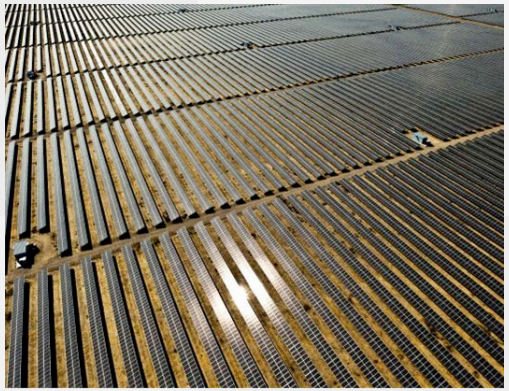
- CLEE Planning Process
- Stakeholder Input
- Refining Model Structure



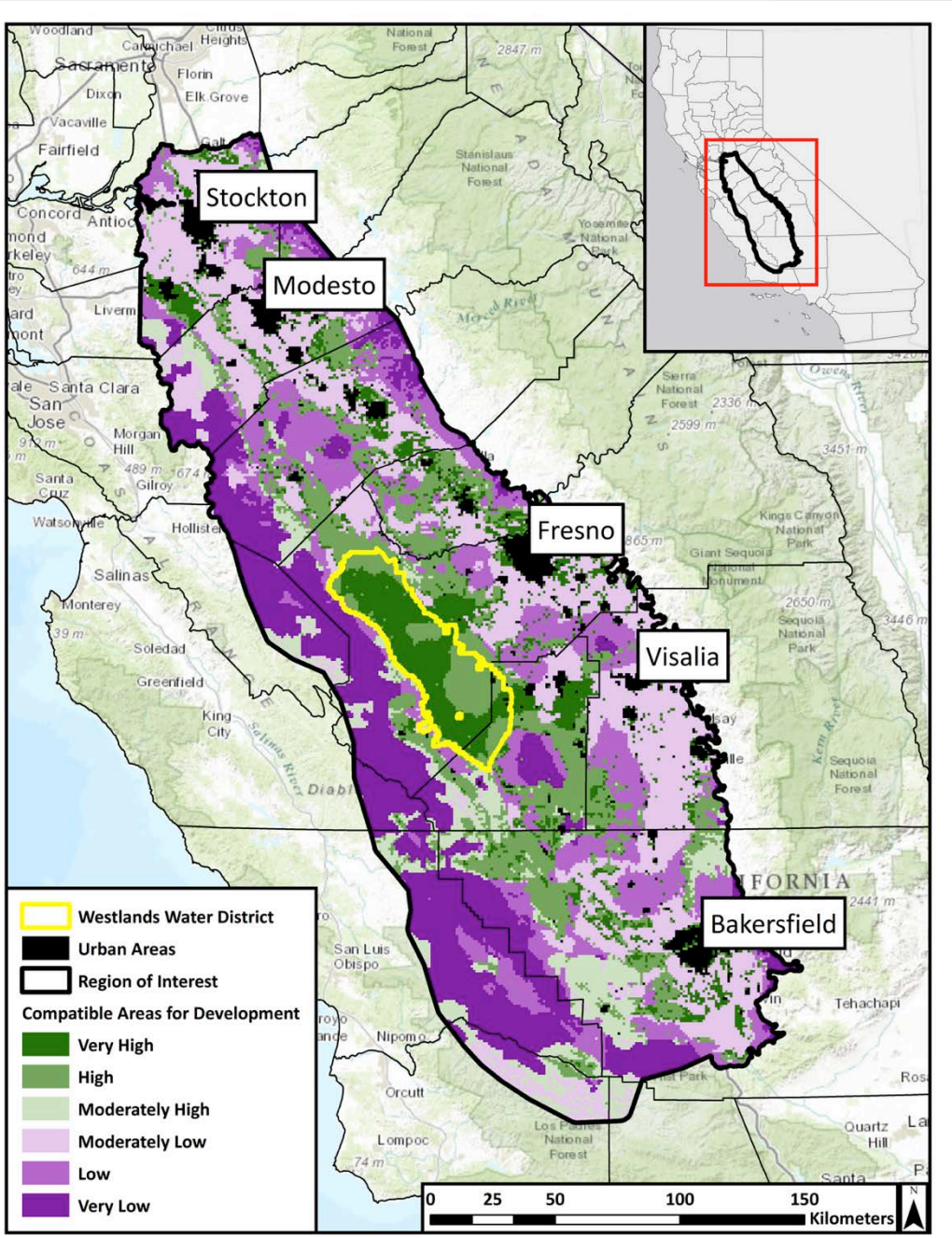
Conclusion

Agriculture

Conservation



Solar



Acknowledgements

Mark Buntaine
James Frew
Ben Best
Eric Fournier

Stephanie Dashiell
Anderson Shepard
Kate Kelly
Kim Delfino

Frank Davis

Jim Strittholt
Tim Sheehan

Scott Butterfield
Dick Cameron

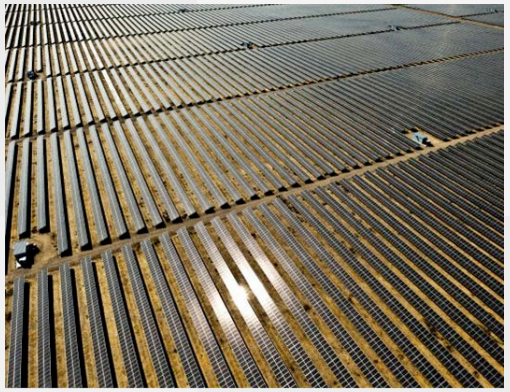
Terry Watt, Planning Consultant
Bryan Cypher, ESRP
Edward Thompson, Jr., American Farmland Trust

Nathan Roth

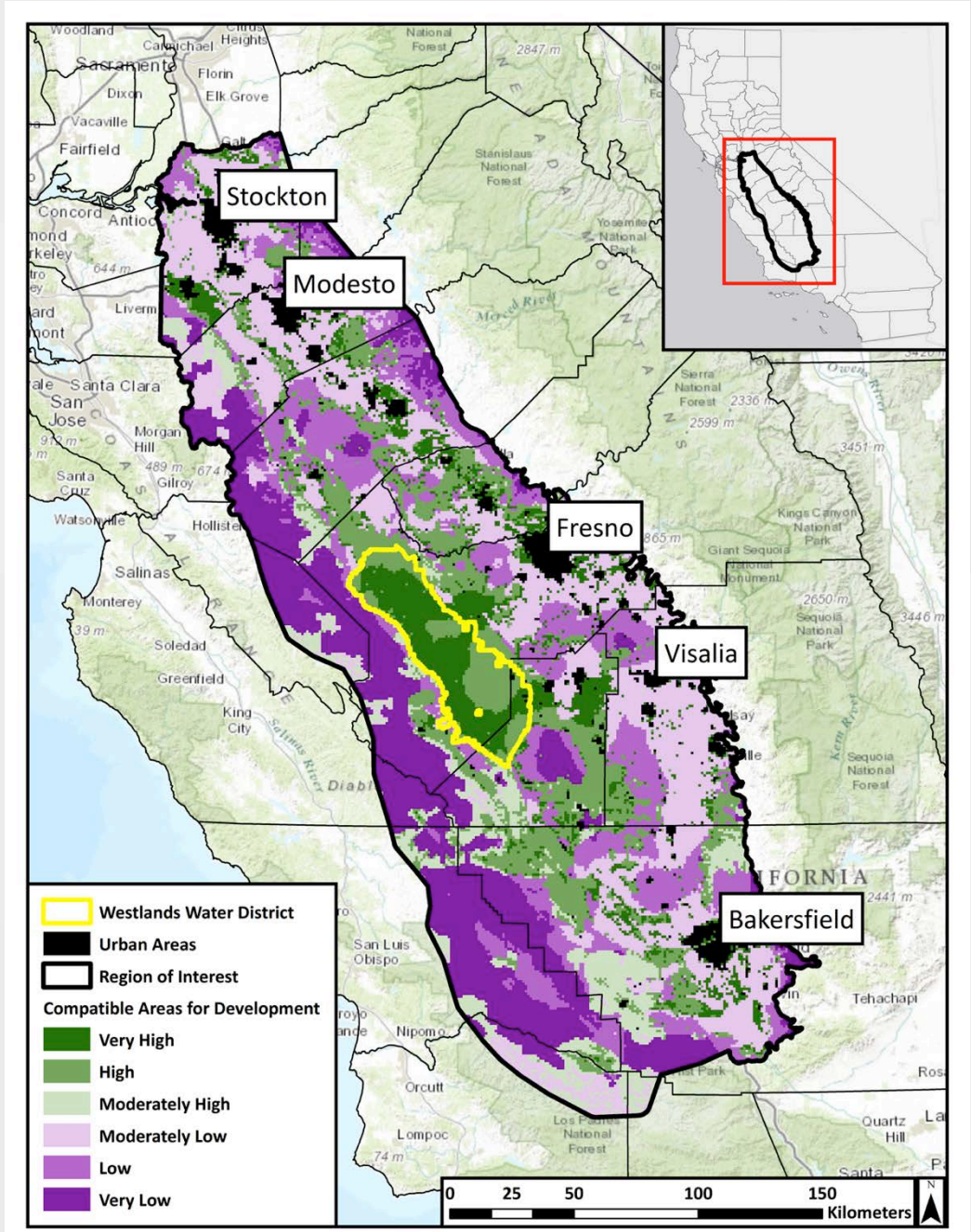
Questions?

Agriculture

Conservation

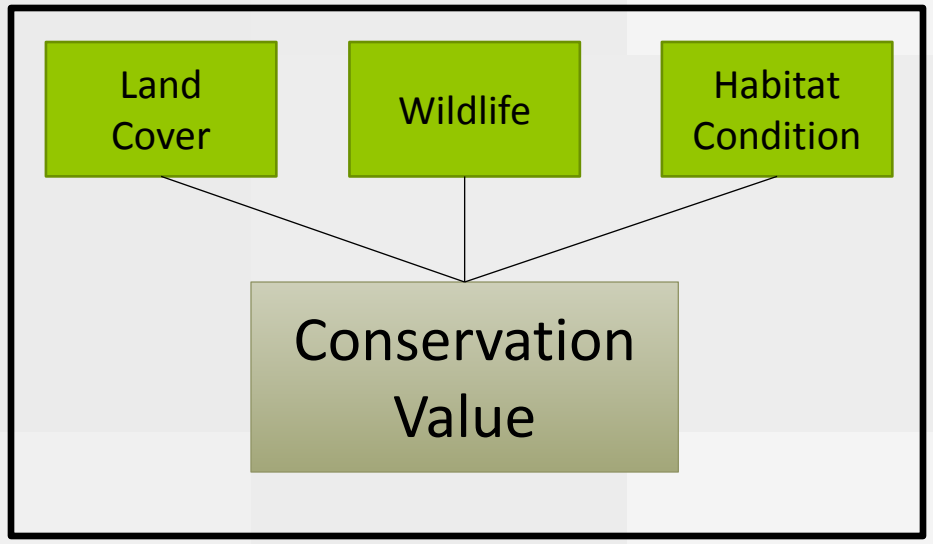


Solar



Index

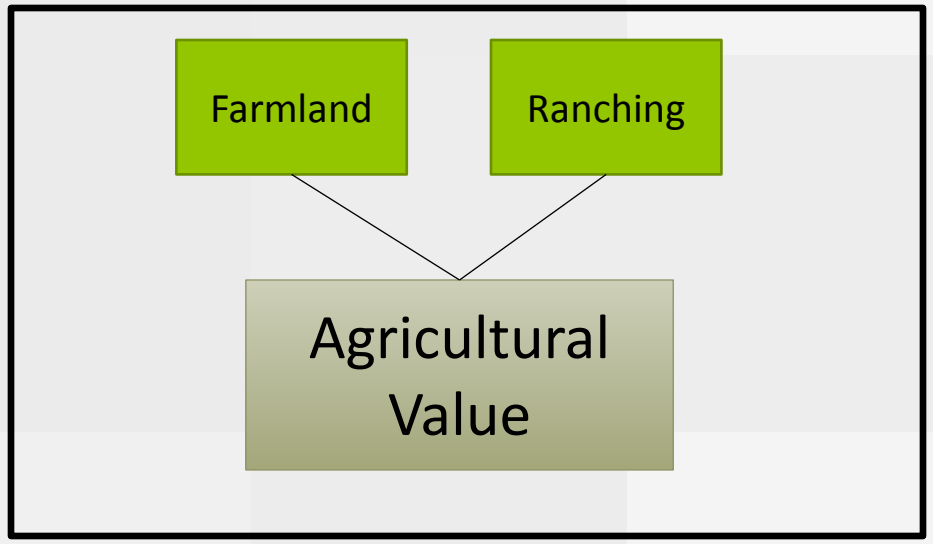
Conservation Value



INPUTS	Source
Land Cover	
Wetlands	FWS National Wetlands Inventory
Important Bird Areas	Audubon California
Vegetative Communities (Diversity)	USGS GAP
Under Represented Communities	USGS GAP
Wildlife	
Species Richness	California Natural Diversity Database
Current Habitat	SDMs (MaxEnt)
Habitat Resilience	Climate Projection SDMs (MaxEnt)
Habitat Condition	
Permeability	Theobald et al.
Landscape Condition	Natureserve

INDEX

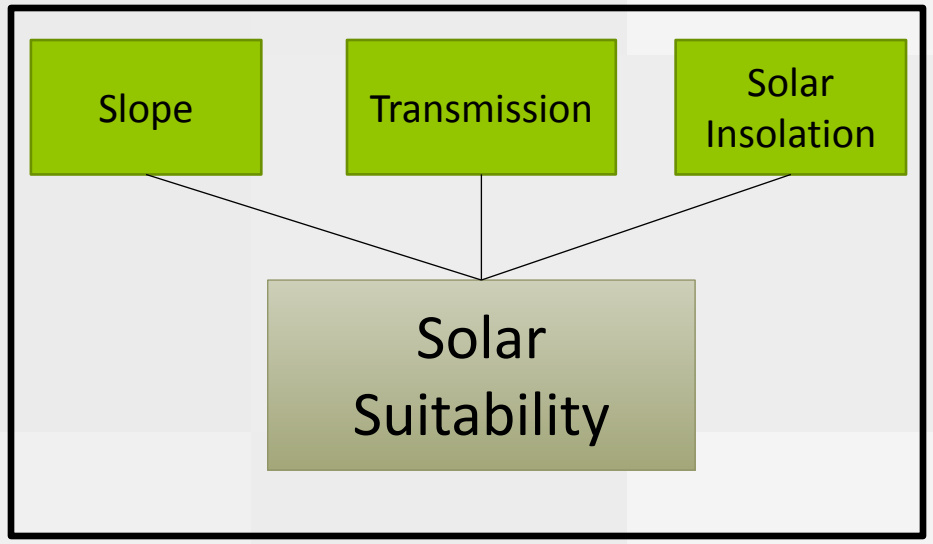
Agricultural Value



INPUTS	Source
Farmland Classifications	UC Davis American Farmland Trust
Rangeland Classifications	California Rangeland Conservation Coalition

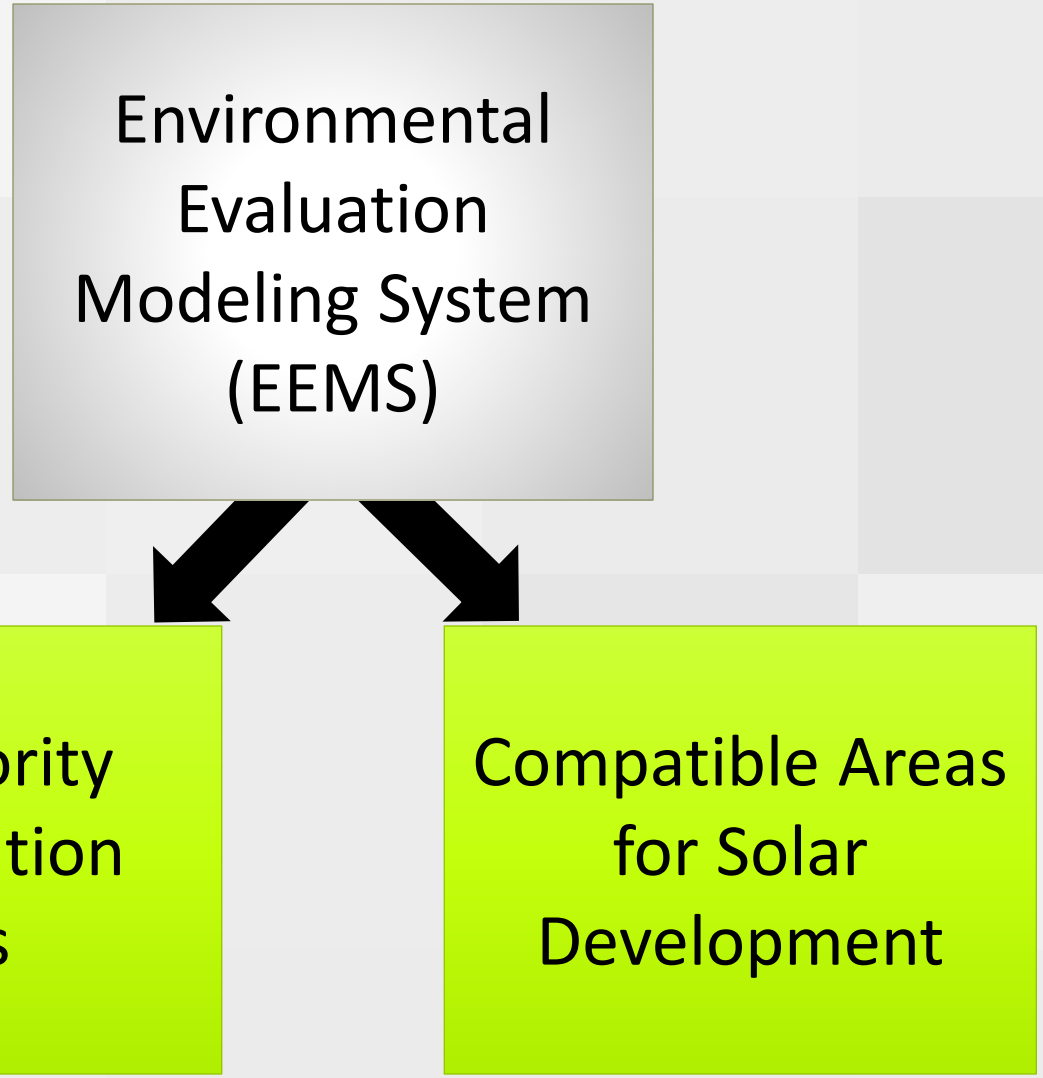
INDEX

Solar Suitability



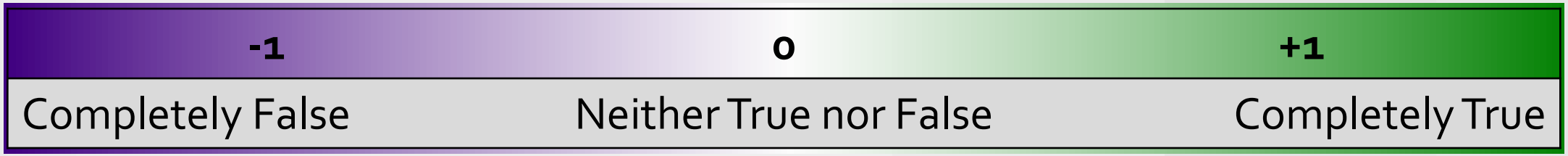
INPUTS	Source
Solar Insolation	NREL
Slope	California 10m DEM
Transmission Density	ESRI

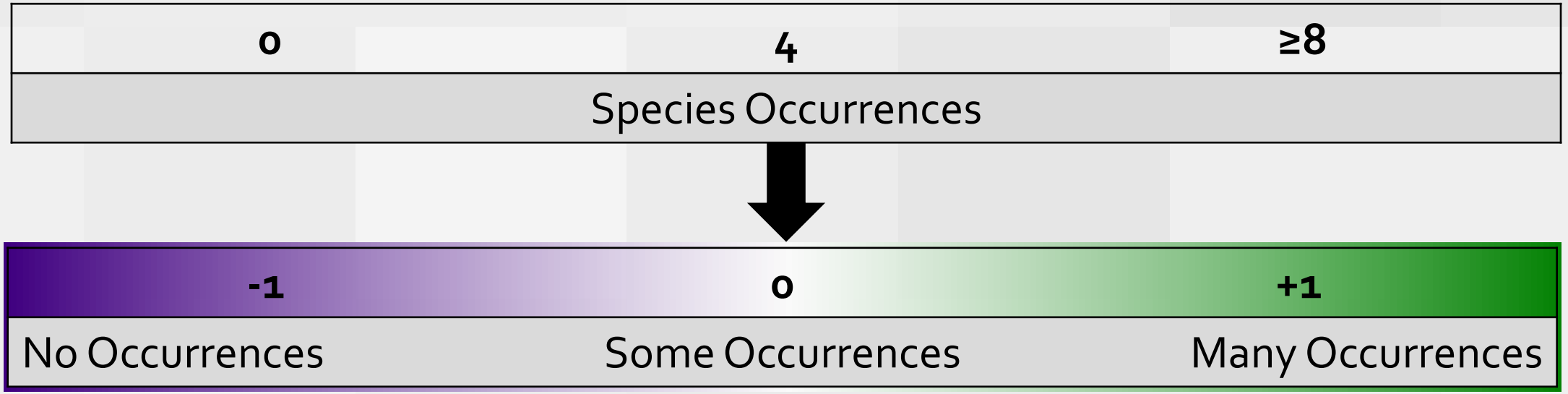
INDEX


Environmental Evaluation Modeling System (EEMS)
High Priority Conservation Areas
Compatible Areas for Solar Development

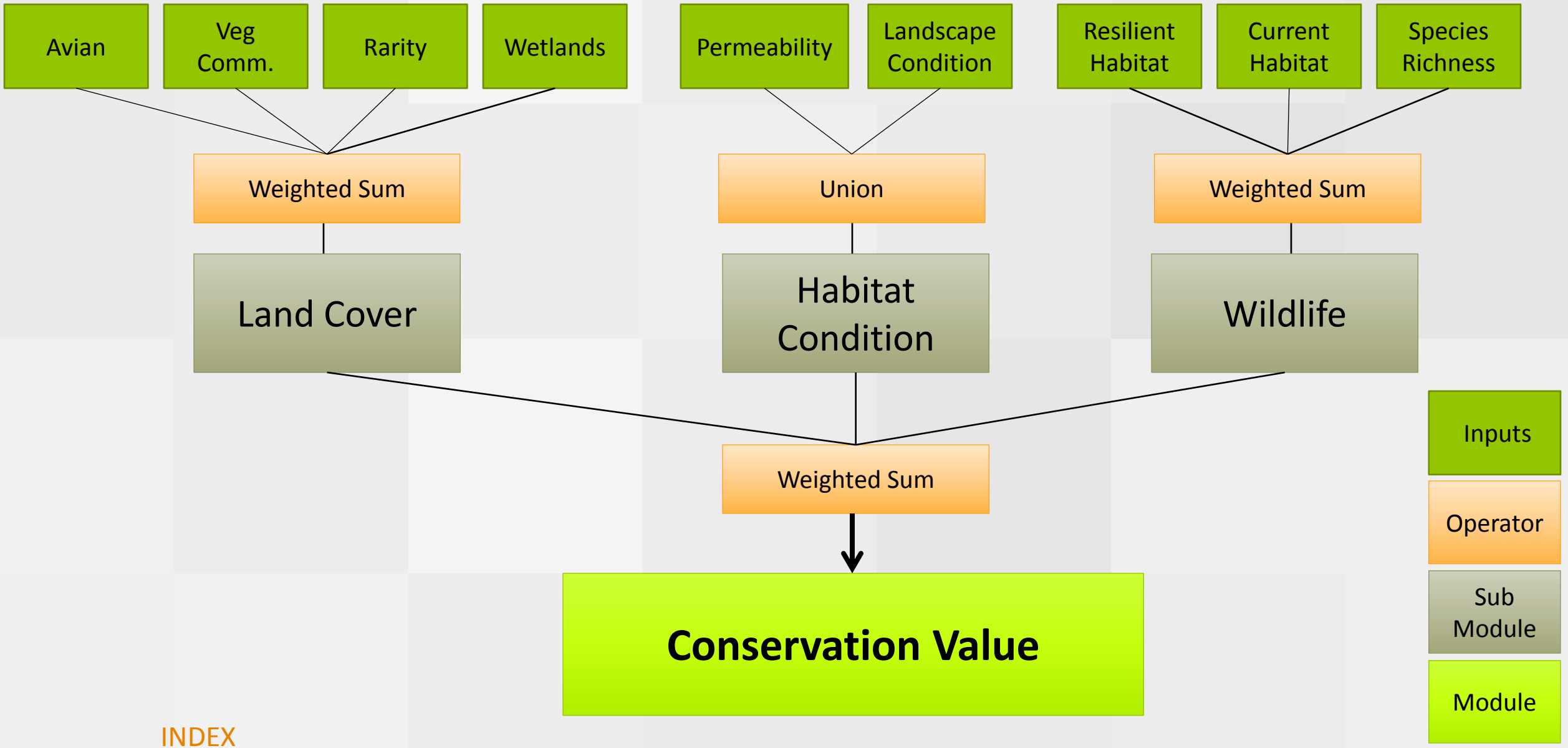
INDEX

Logic Modeling

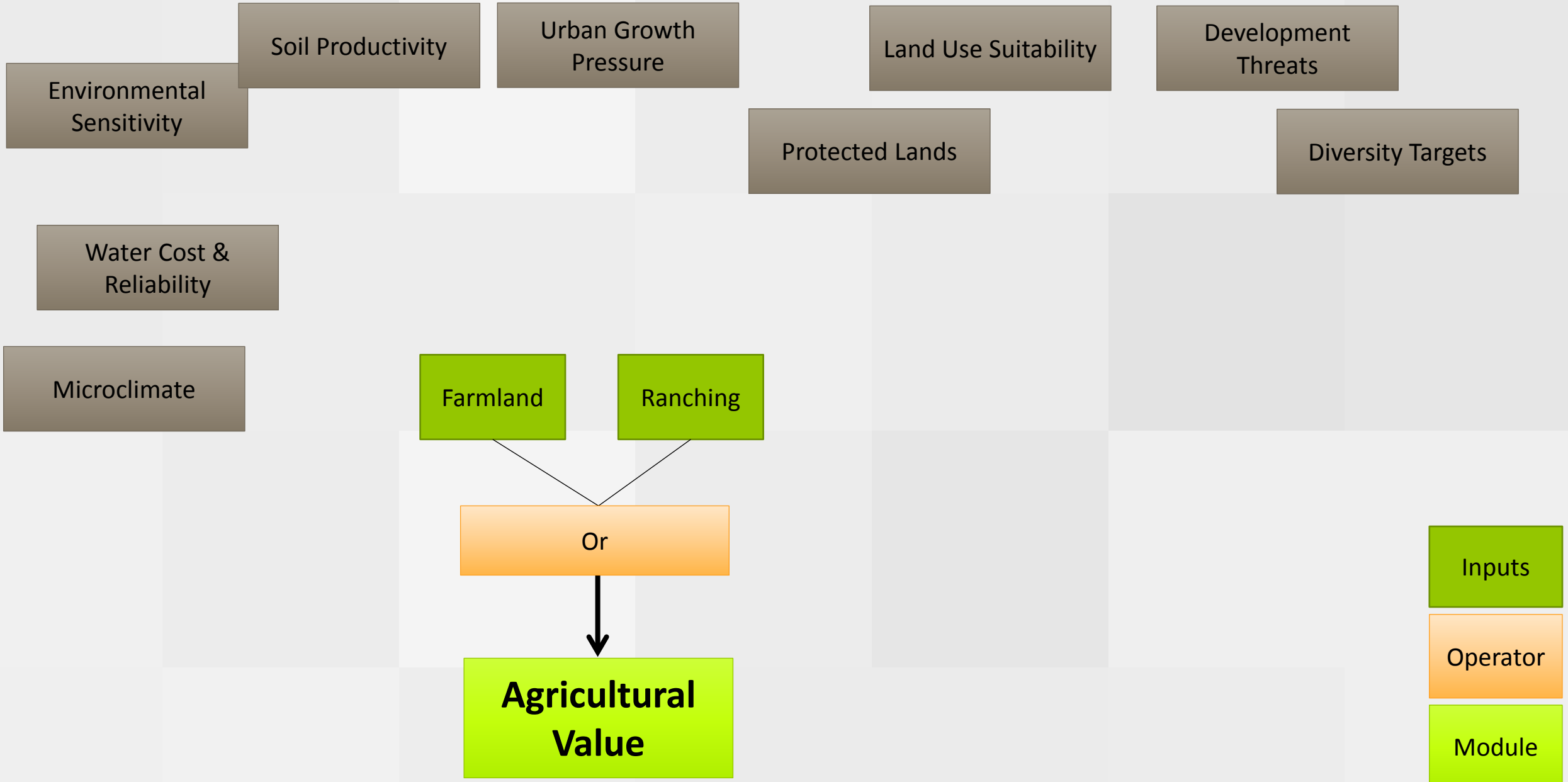




INDEX


Avian
Veg Comm.
Rarity
Wetlands
Permeability
Landscape Condition
Resilient Habitat
Current Habitat
Species Richness
Weighted Sum
Union
Weighted Sum
Land Cover
Habitat Condition
Wildlife
Weighted Sum
Conservation Value
Inputs
Operator
Sub Module
Module

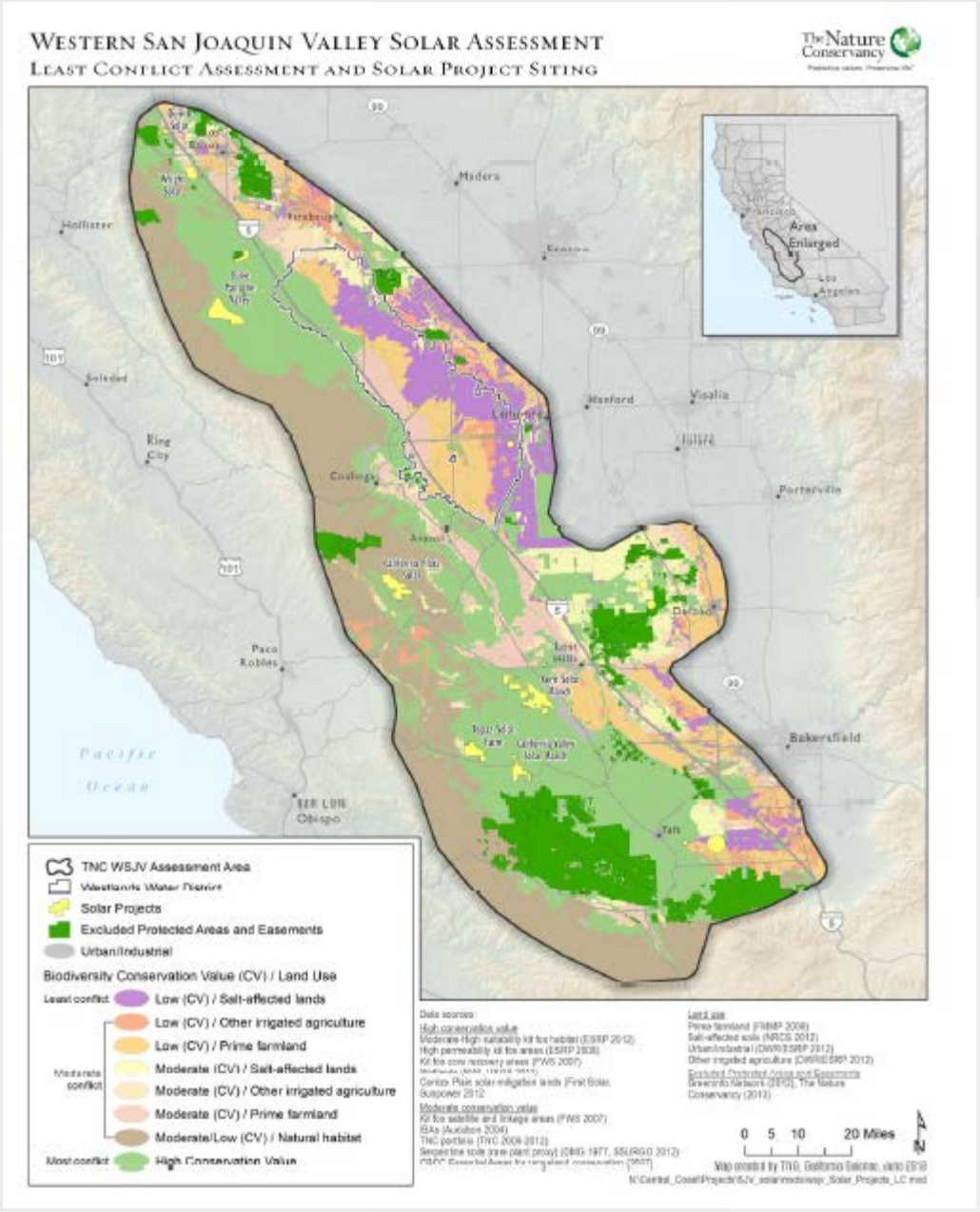
INDEX


Soil Productivity
Urban Growth Pressure
Land Use Suitability
Development Threats
Environmental Sensitivity
Protected Lands
Diversity Targets
Water Cost & Reliability
Microclimate
Farmland
Ranching
Or
Agricultural Value
Inputs
Operator
Module

INDEX

TNC Assessment

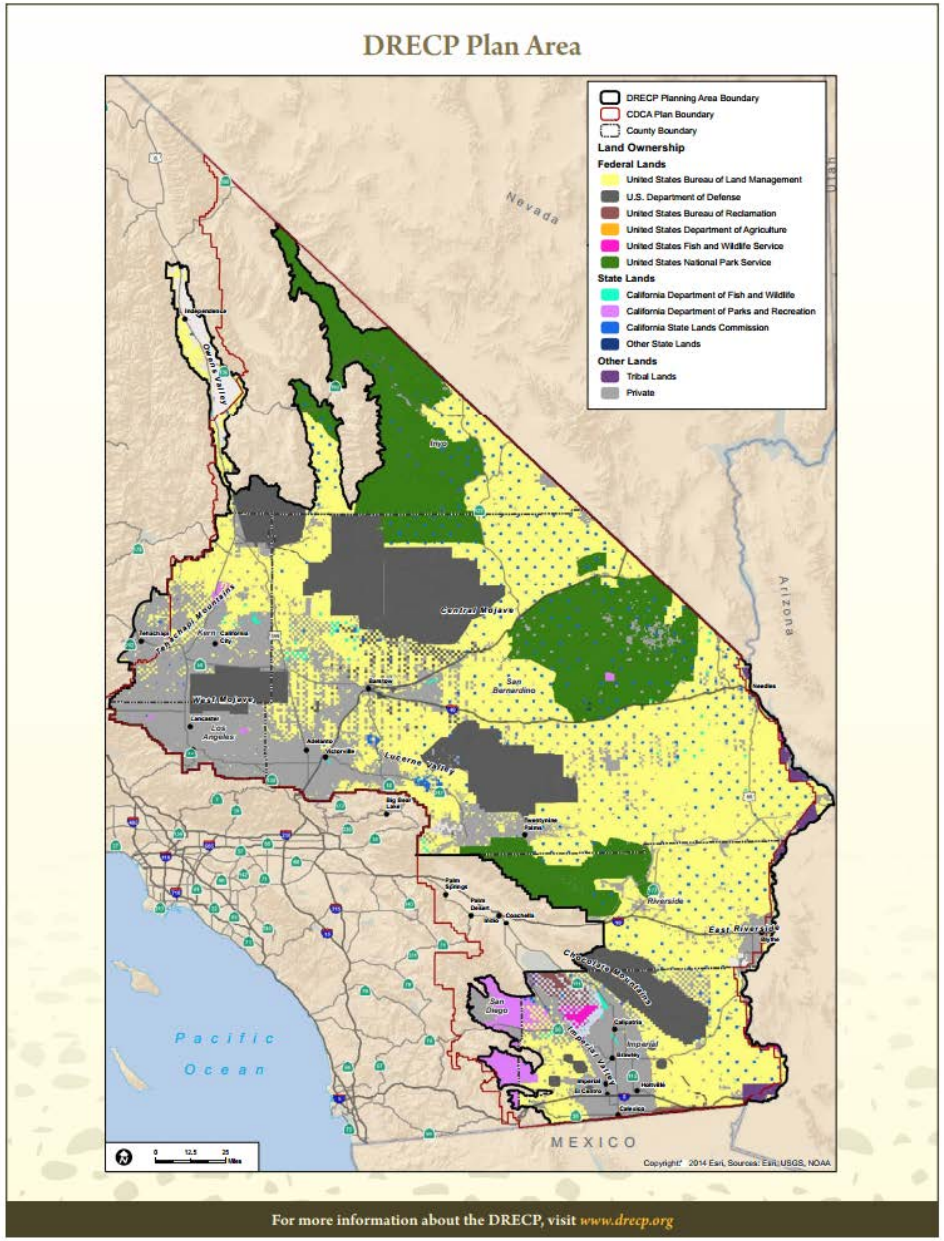
- Only included the Western San Joaquin Valley
- Classified conservation values through assertions
- Classified agricultural values based strictly on FMMP data
- Westlands Water District was also highlighted through this assessment



INDEX

DRECP Planning Process

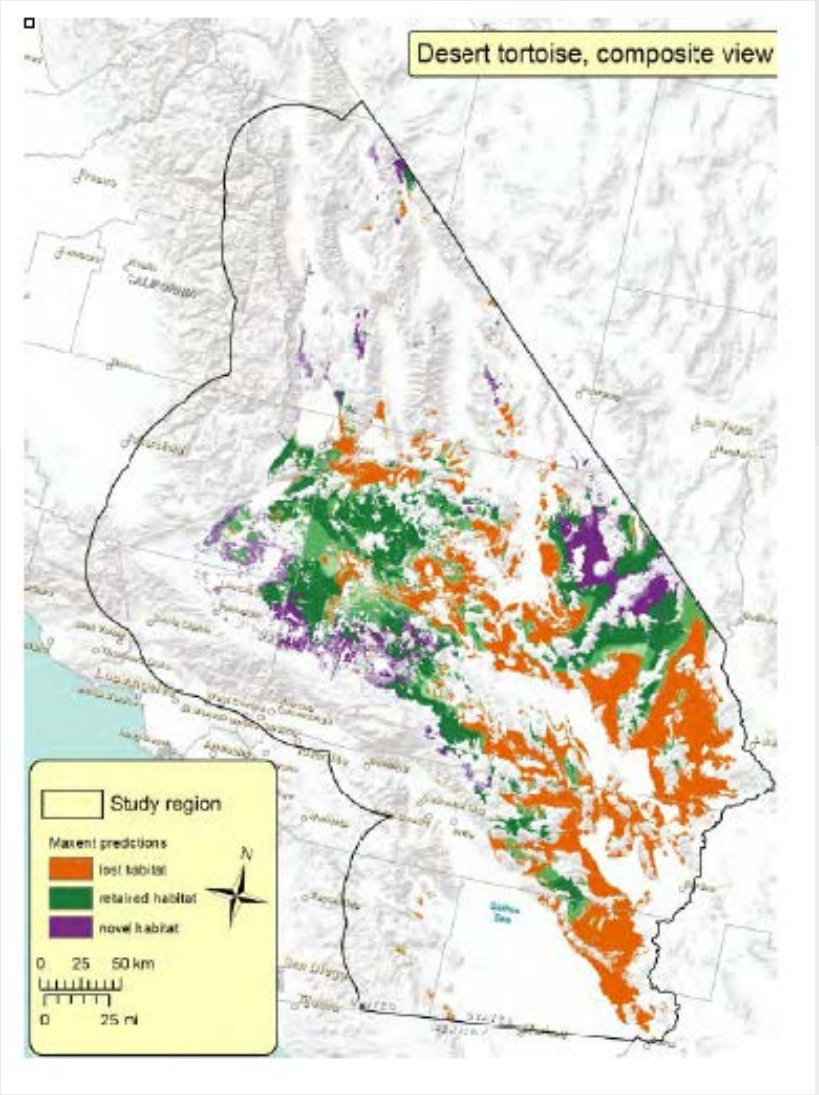
- 22 million acre assessment area
- HCP and NCCP
- 20,000 MW of RE Development
- Goals
  - Renewable Energy and Transmission Planning
  - Conservation (37 planning species and 31 natural communities)



INDEX

Cumulative Biological Impacts

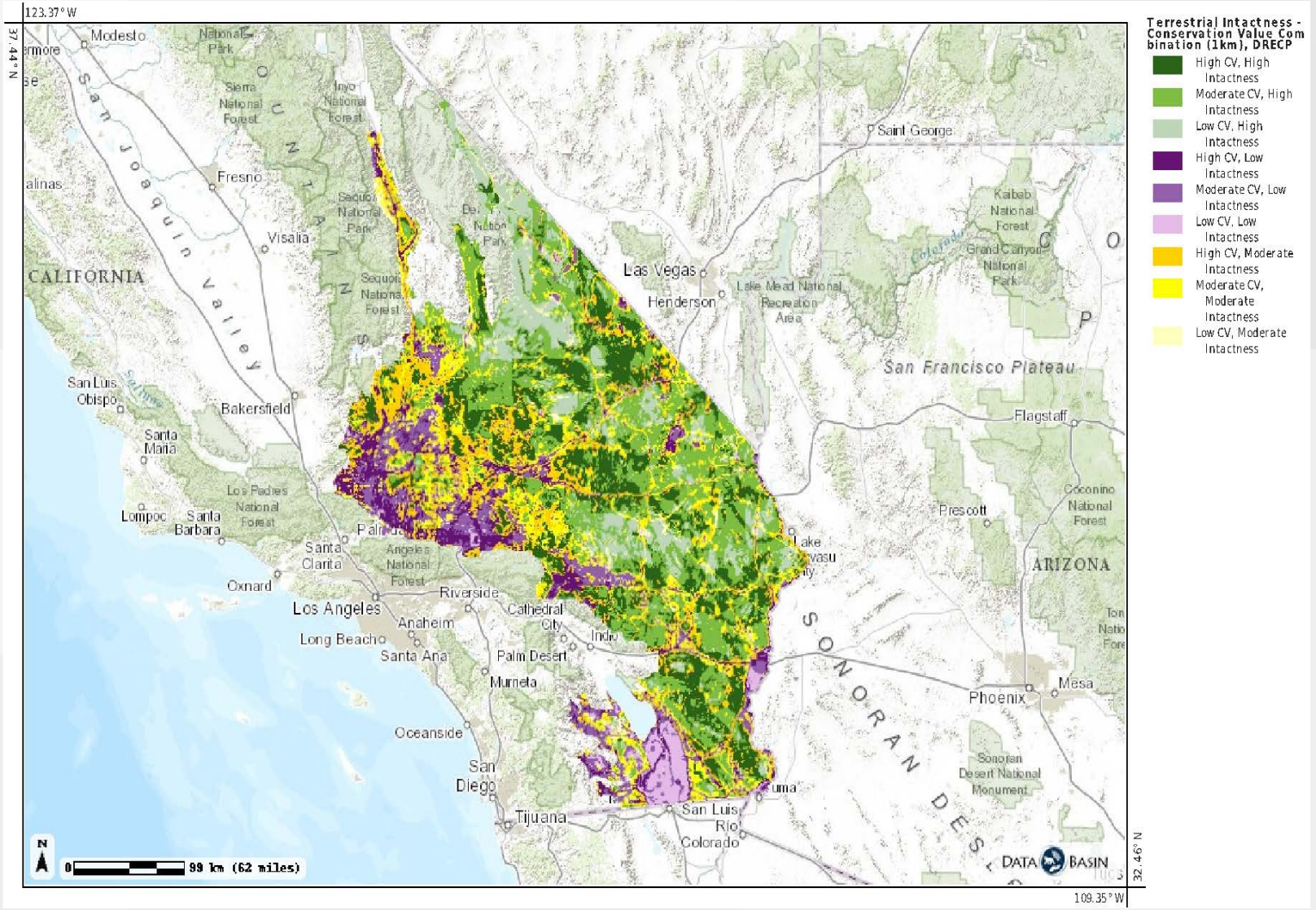
- DRECP Planning Area
- MaxEnt modeling for 65 species
  - 25 Terrestrial Wildlife Species
  - 40 Plant Species
- Modeled Climate Resilient Areas



INDEX

Conservation Biology Institute

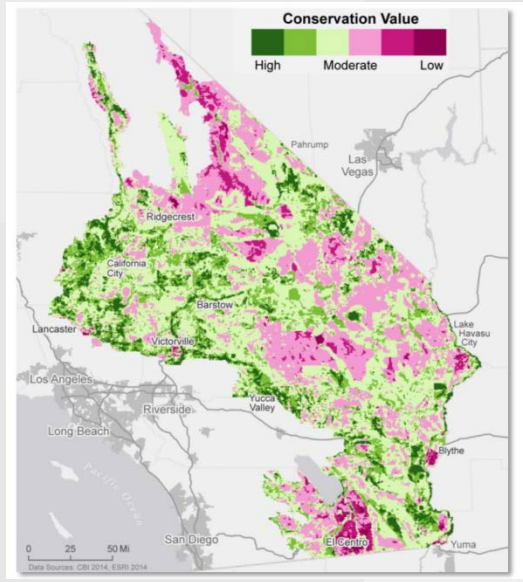
- Employed a similar model structure within EEMS
- Tasked with finding:
  - Conservation Value within the DRECP Planning Area
  - Areas suitable for Solar Development within the DRECP Planning Area

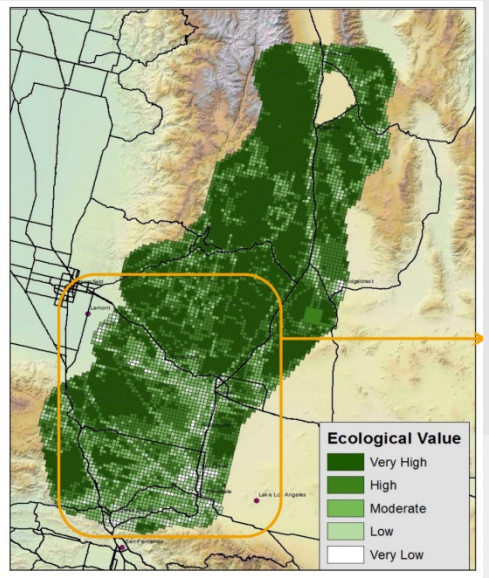


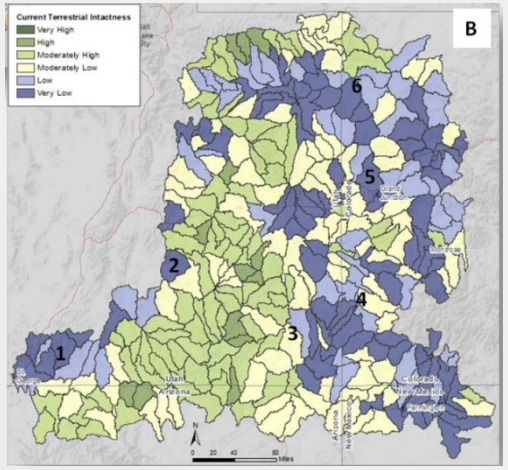
INDEX

Environmental Evaluation Modeling System

- CBI
  - Used for the Tehachapi Ranges and Southern Sierra to find areas of ecological value and areas suitable for wind development
  - Used for the DRECP Planning Area to determine areas of conservation value and areas suitable for RE development
- BLM
  - Used for the Sonoran Desert and Colorado Plateau Eco regions for Rapid Ecological Assessments

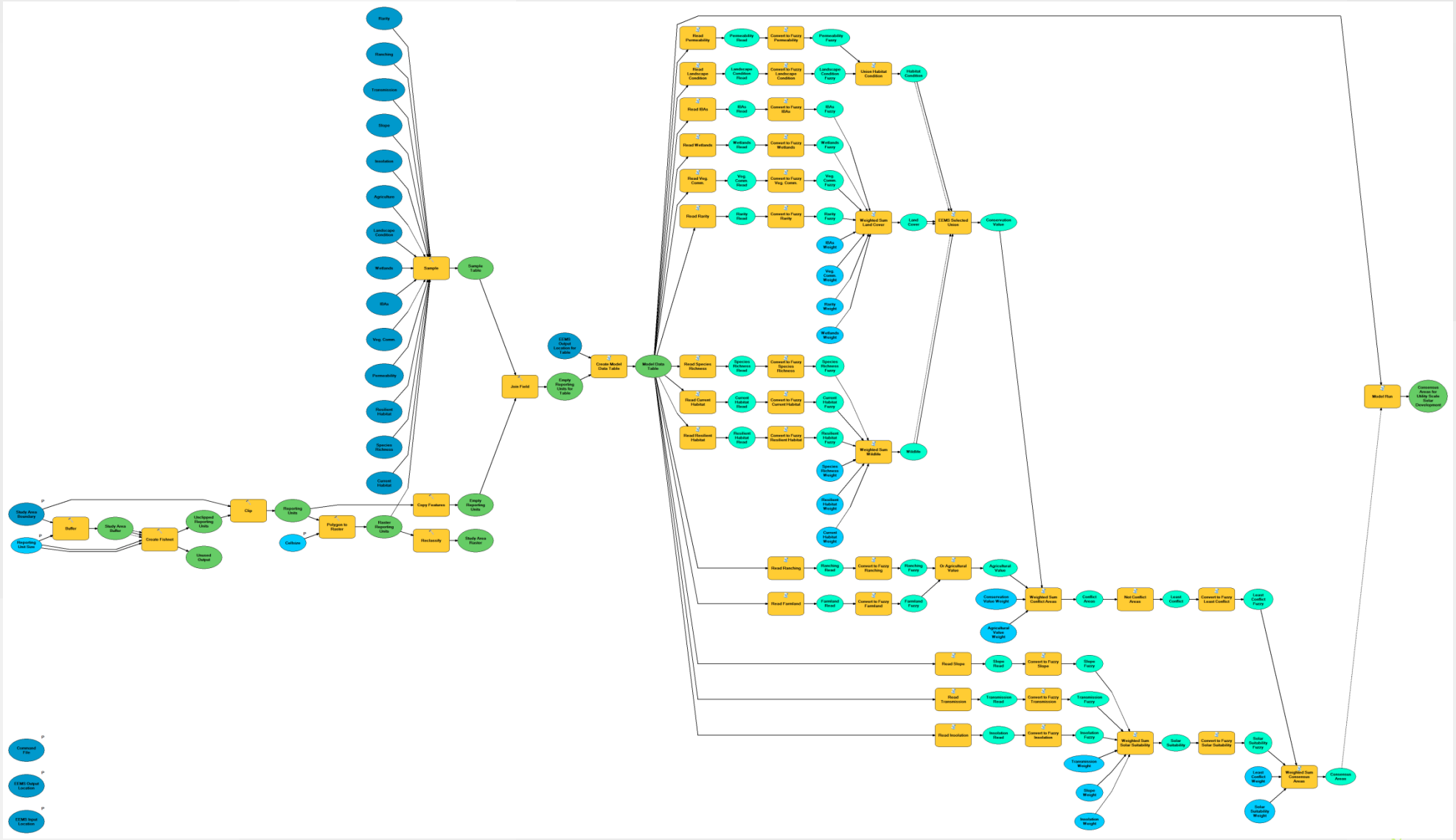






INDEX

Entire Model (GIS)



INDEX

MaxEnt SDMs

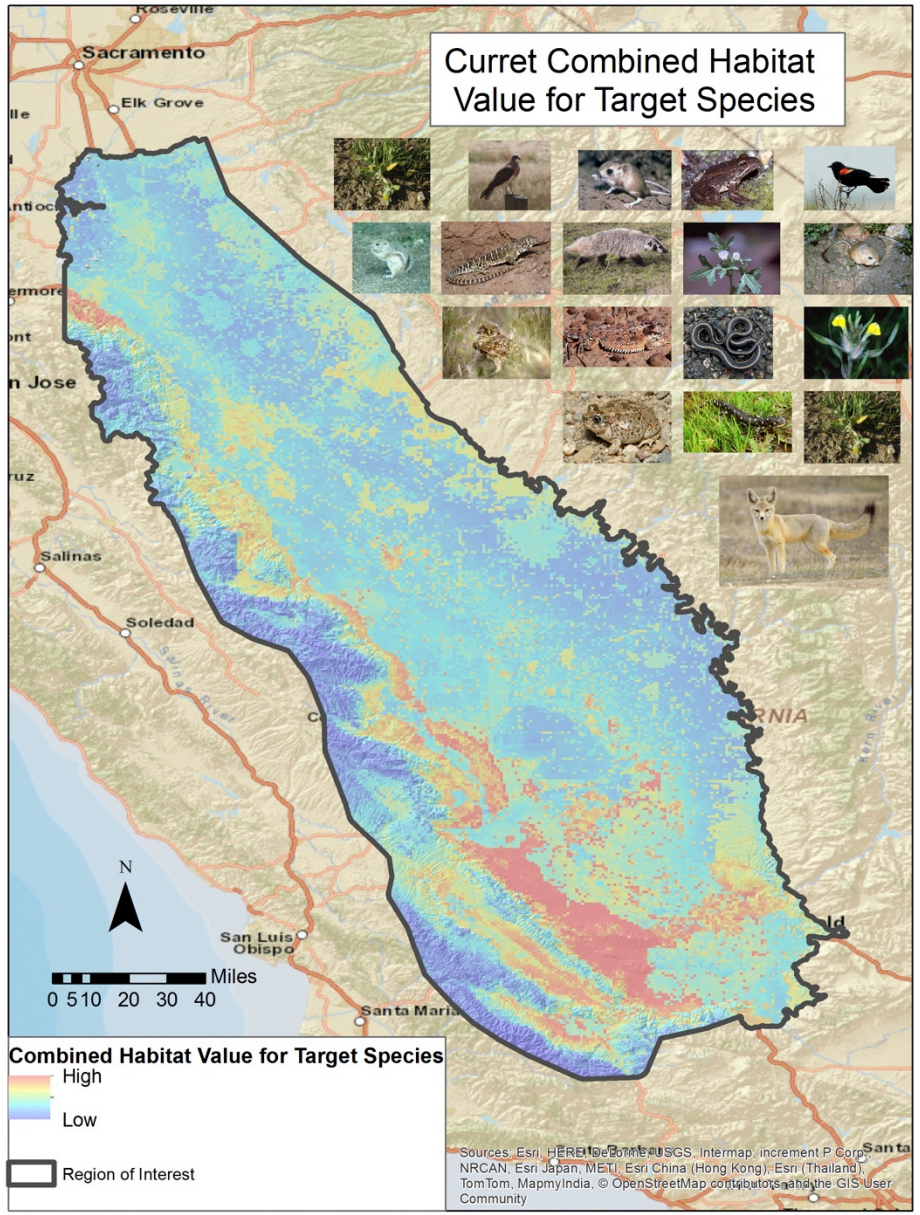
Taxa	Common Name	Scientific Name	Maxent AUC Score (Mean, n=5)	Std. Deviation (Mean, n=5)
Plants	Succulent Owl's Clover	*Castilleja campestris ssp. succulent*	0.978	0.009
	Kern Mallow	*Eremalche parryi ssp. kernensis*	0.924	0.02
	San Joaquin Woolly-Threads	*Monolopia congdonii*	0.888	0.014
Amphibians	California Tiger Salamander	*Ambystoma californiense*	0.899	0.009
	California Red-Legged Frog	*Rana draytonii*	0.964	0.018
	Western Spadefoot Toad	*Spea hammondi*	0.839	0.045
Reptiles	Blunt-Nosed Leopard Lizard	*Gambelia sila*	0.853	0.014
	Horned Lizard	*Phronosoma blainvillii*	0.804	0.074
	Giant Garter Snake	*Thamnophis gigas*	0.939	0.035
Birds	Tricolored Blackbird	*Agelaius tricolor*	0.788	0.048
	Burrowing Owl	*Athene cunicularia*	0.782	0.013
	Swainson's Hawk	*Buteo swainsoni*	0.87	0.007
Mammals	Nelson's Antelope Squirrel	*Ammospermophilus nelson*	0.902	0.018
	Giant Kangaroo Rat	*Dipodomys ingens*	0.909	0.023
	Tipton's Kangaroo Rat	*Dipodomys nitratoides nitrotoides*	0.91	0.045
	San Joaquin Kit Fox	*Vulpes macrotis mutica*	0.787	0.012

INDEX

MaxEnt SDMs

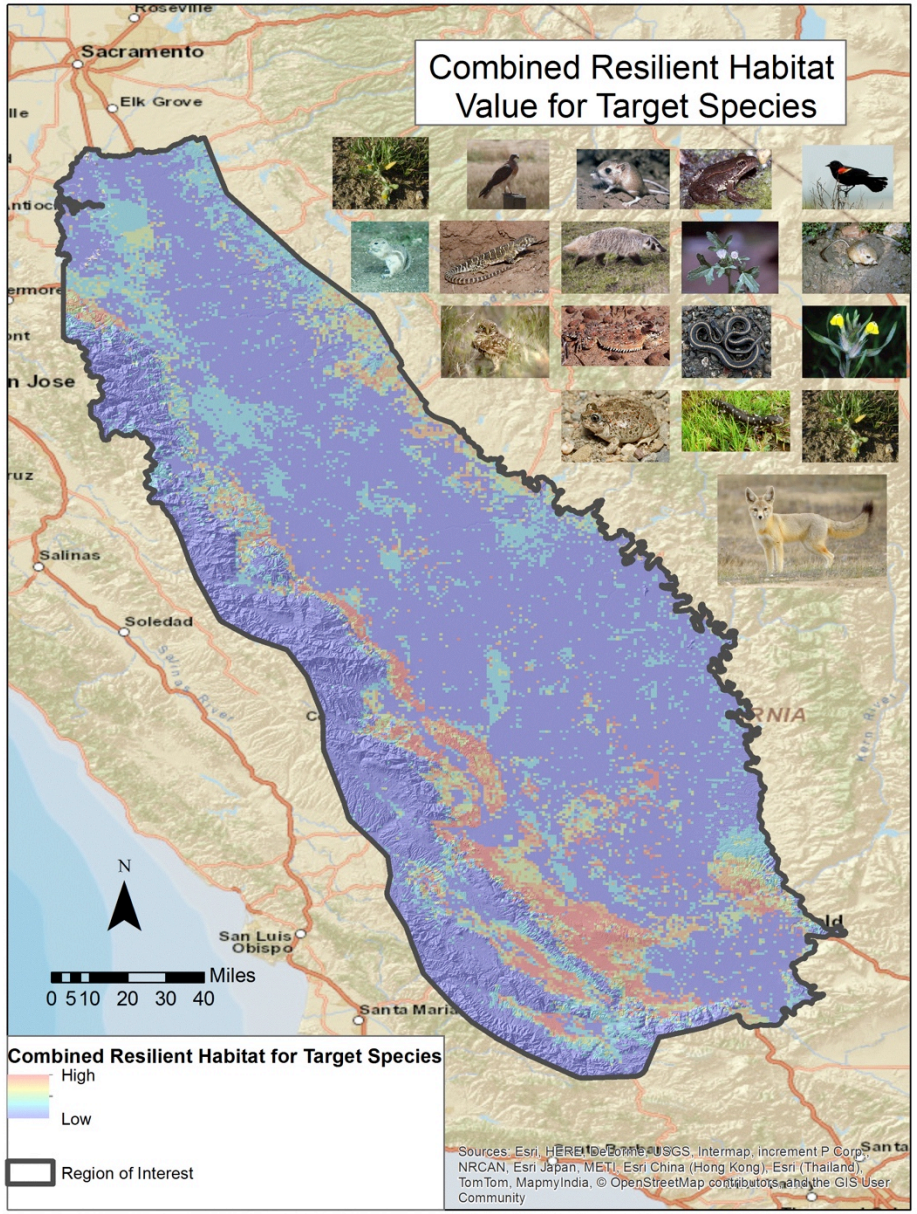
- 270m cell resolution
- 17 Species
- 20% of the Occurrences were used for training over all 5 runs

Variable Type	Variable	Source
TopoClimate	Spring Solar Radiation	Digital Elevation Model
Topographic	Slope	Digital Elevation Model
Topographic	Elevation	Digital Elevation Model
Soil	Available Water Holding Capacity (0-100cm)	SSURGO
Soil	Particle Size (Loamy, Sandy, Clayey etc.)	SSURGO
Geomorphology	Topographic Relief (ie. Hillshade)	Digital Elevation Model
Land Classification	Land cover	National Land Cover Database 2011
Land Classification	Wetland Type	USFWS CONUS
Bioclimate	Maximum Temperature of Warmest Period [June/July/August]	California Climate Commons
Bioclimate	Minimum Temperature of Coldest Period [Dec/Jan/Feb]	California Climate Commons
Bioclimate	(Aridity Index (Annual Precipitation/Potential Evapotranspiration)	California Climate Commons
Bioclimate	Annual Precipitation (mm)	California Climate Commons



MaxEnt Resilient Habitats

- Thresholded outputs (equal training sensitivity and specificity)
- Found agreement on habitat for current and all 3 climate projections
- 1981- 2010: Historic Climate Data
- 2010-2039: Projected Climate Data
  - IPSL-RCP85
  - CCSM4-RCP85
  - FGOALS-RCP85



INDEX

Thresholds & Weights

Conservation Value	Trial 13		
	True Threshold (1)	False Threshold (-1)	Weight
Vegetation			
Wetlands	43209492	0	0.5
Important Bird Areas	1	0	0.5
Vegetative Communities (Diversity)	20	1	2
Rare Land Cover	NA	NA	NA
ACEII Rare Communities	1	0	0.5
Wildlife			
Rare Species Richness	8	0	0.5
Habitat Resilience	6	0	0.3
Current Habitat	4.52	0.00610436	1
Native Species Richness	NA	NA	NA
Landscape			
Impermeability (theobald)	1	961	NA
Condition (natureserve)	77	5	NA

Agriculture	Trial 13		
	True Threshold (1)	False Threshold (-1)	Weight
Agriculture	2	0	NA
CCRC	2	0	NA

Solar	Trial 13		
	True Threshold (1)	False Threshold (-1)	Weight
Insolation	6.48	4.75	0.2
Slope	0	6	0.5
Transmission Density	0.00056412	0	1

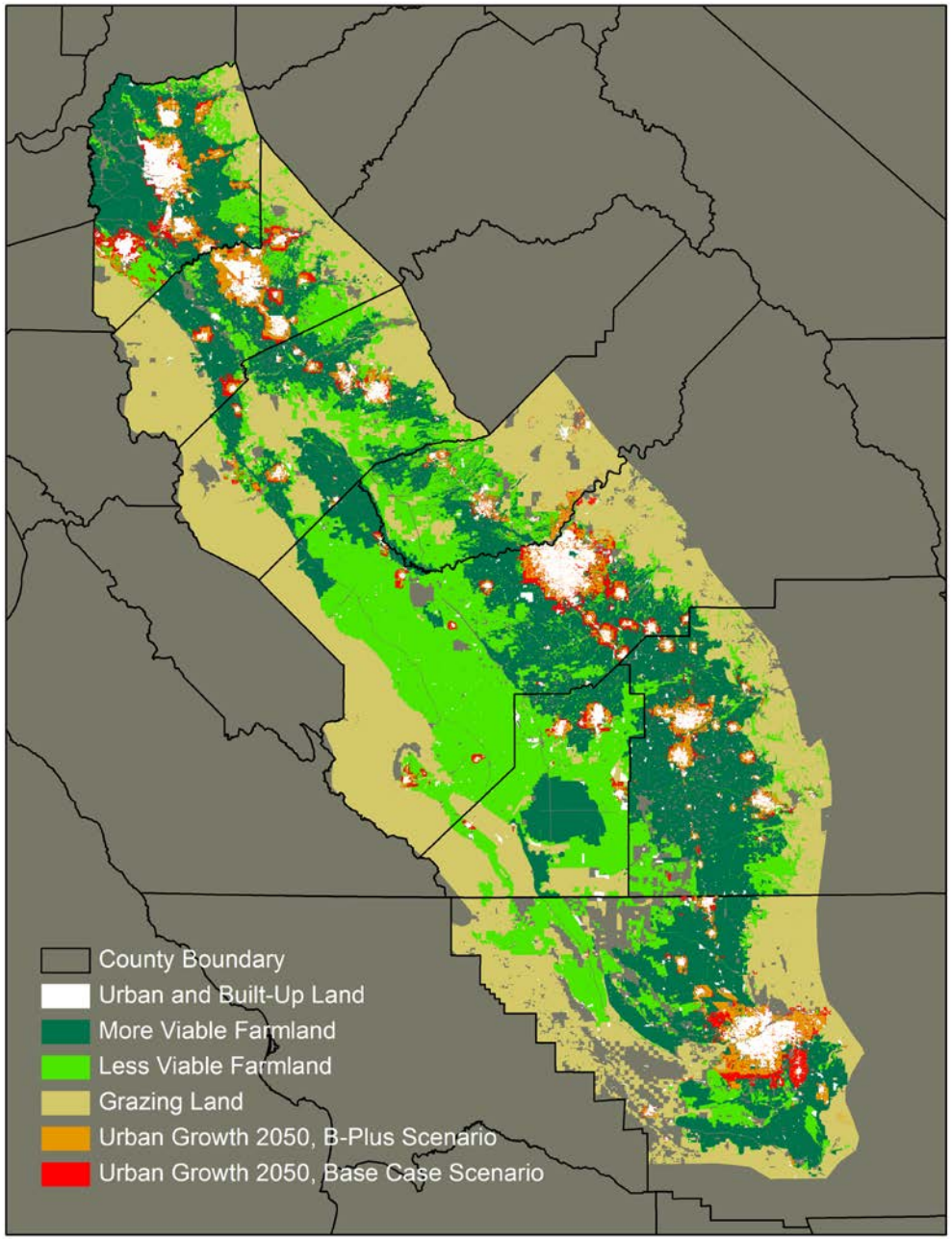
Least Conflict Areas	Trial 13		
	True Threshold (1)	False Threshold (-1)	Weight
Conservation	NA	NA	1
Agriculture	NA	NA	1

Consensus Areas	Trial 13		
	True Threshold (1)	False Threshold (-1)	Weight
Least Conflict	2	-2	1
Solarfzy	1.41	-1.41	0.5

INDEX

Agricultural Data

- UC Davis Farmland Data :
  - Economically viable for high-value commercial agriculture in the long term
- Attributes:
  - Soil productivity
  - Water cost and reliability
  - Microclimate
  - Environmental sensitivity
  - Urban growth pressure



INDEX

Solar Developer Interview Questions

1) In your organization's opinion, what have been the main drivers and incentives (i.e. Federal, state, and local policies/processes) that have incentivized your company to produce utility scale PV projects in the SJV?

2) In your organizations opinion, when your company looks at a parcel of land, what elements are most important in influencing your decision to develop a PV project on that land?

3) In your organizations opinion, if you had a map of "least conflict" zones in the SJV, how could we incentivize one to use it and how potentially useful would it be? The five pain pieces of the map would include habitat quality (including species of interest such as Kit Fox), agricultural values, transmission proximity, solar insolation, and proximity to urban build out. Solar.

4) In your organizations opinion, what is holding up the permitting time for solar projects, and how could it be streamlined?

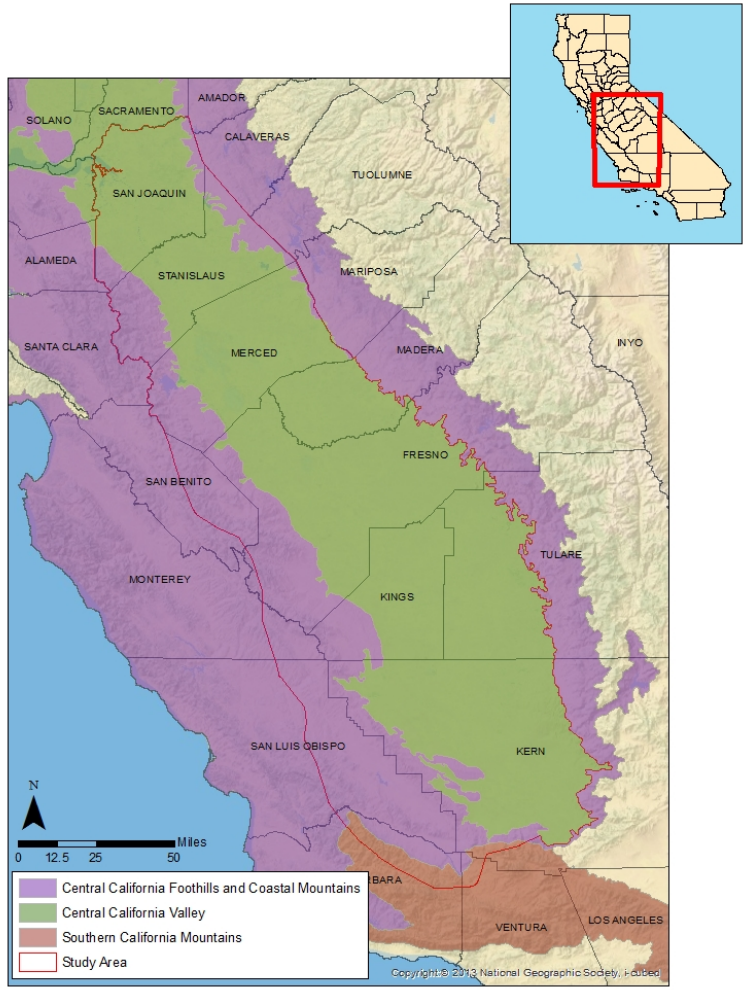
INDEX

High Priority Conservation Area Definition

- Defined as Resource Quality built around:
  - Wildlife attributes
    - ‘Regulatory’ Approach
  - Land Condition attributes
    - ‘Human disturbance and movement corridor’ Approach
  - Vegetation attributes
    - ‘Rarity and community’ Approach

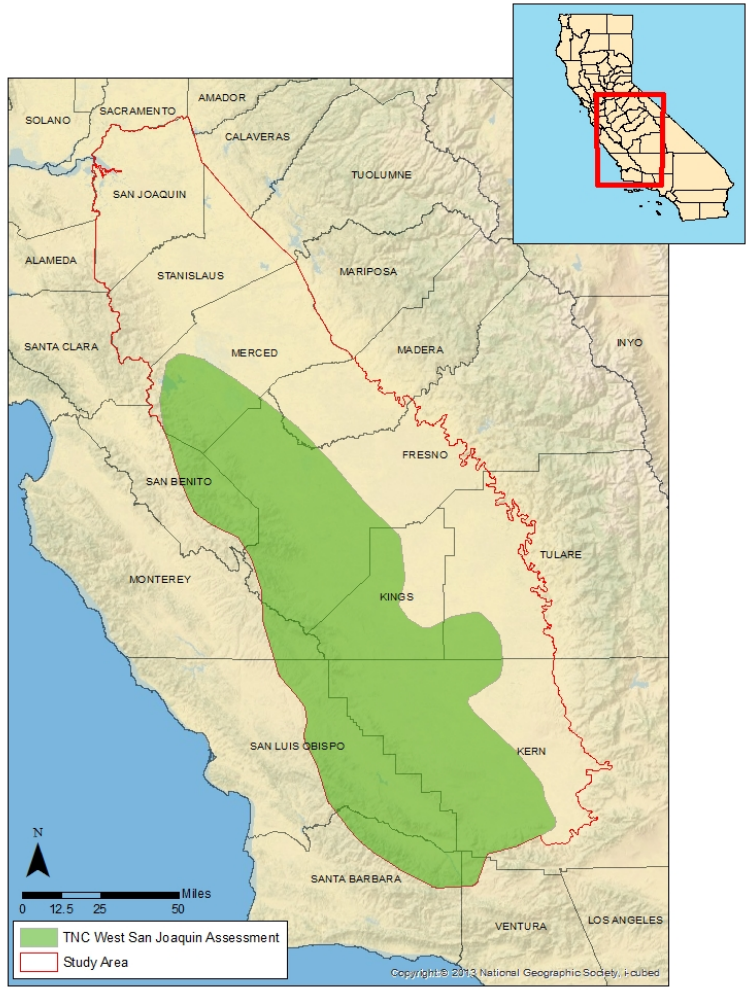
INDEX

Study Area



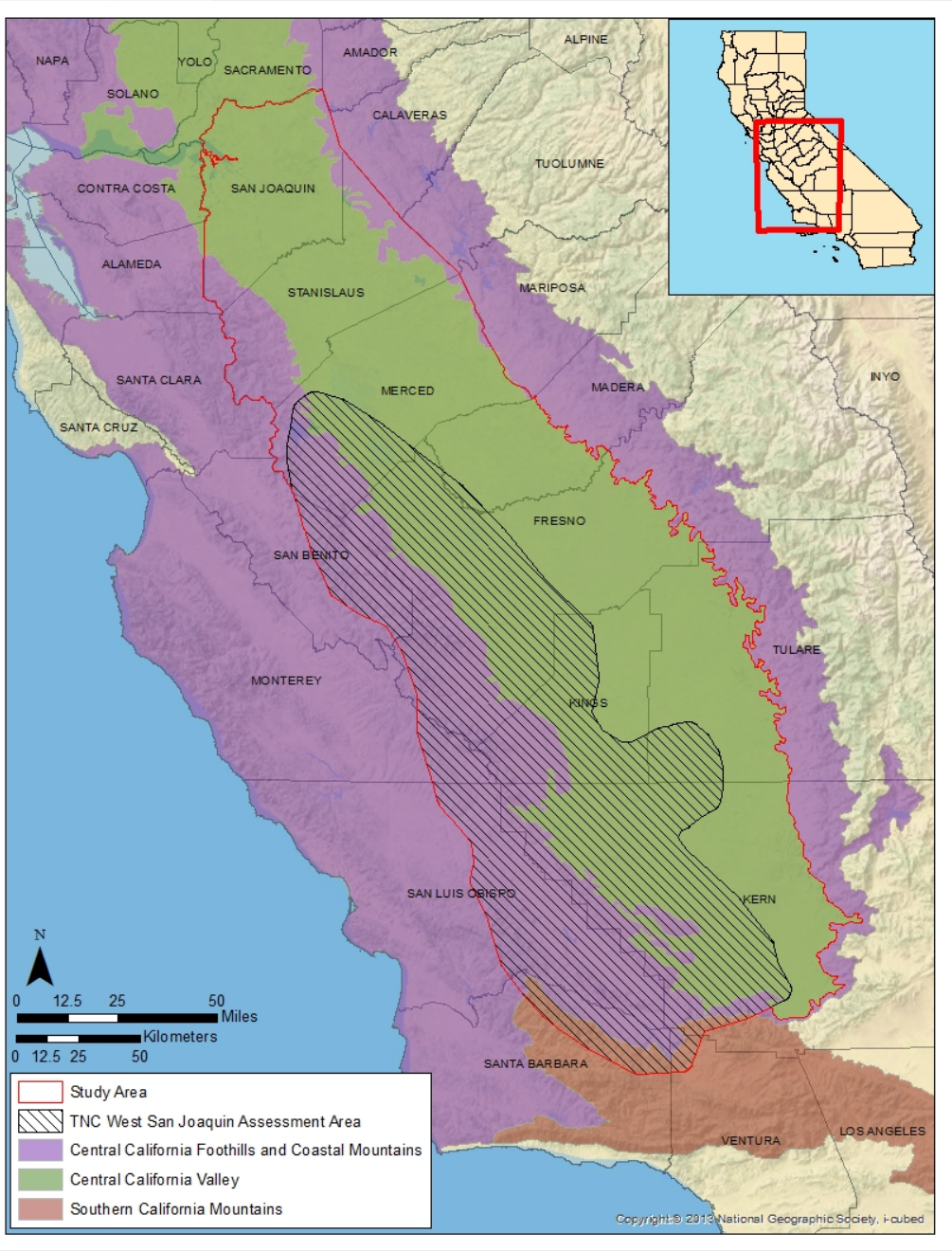
USDA Ecoregion

Counties



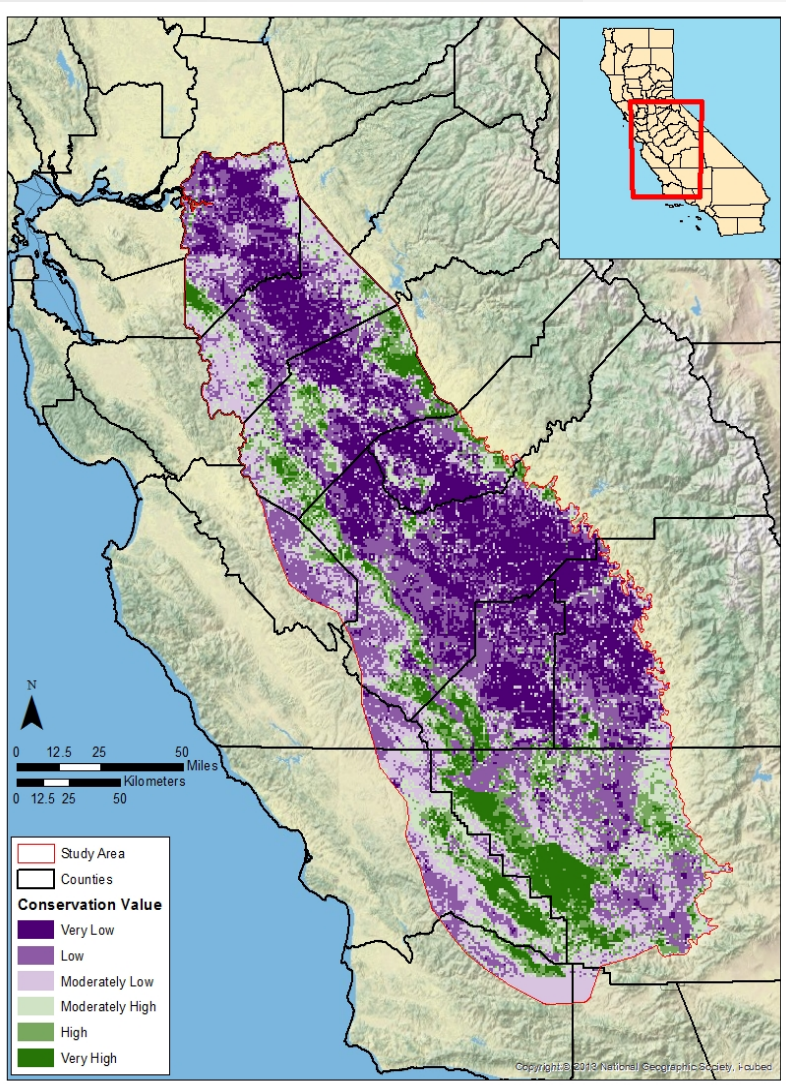
TNC West San Joaquin Assessment

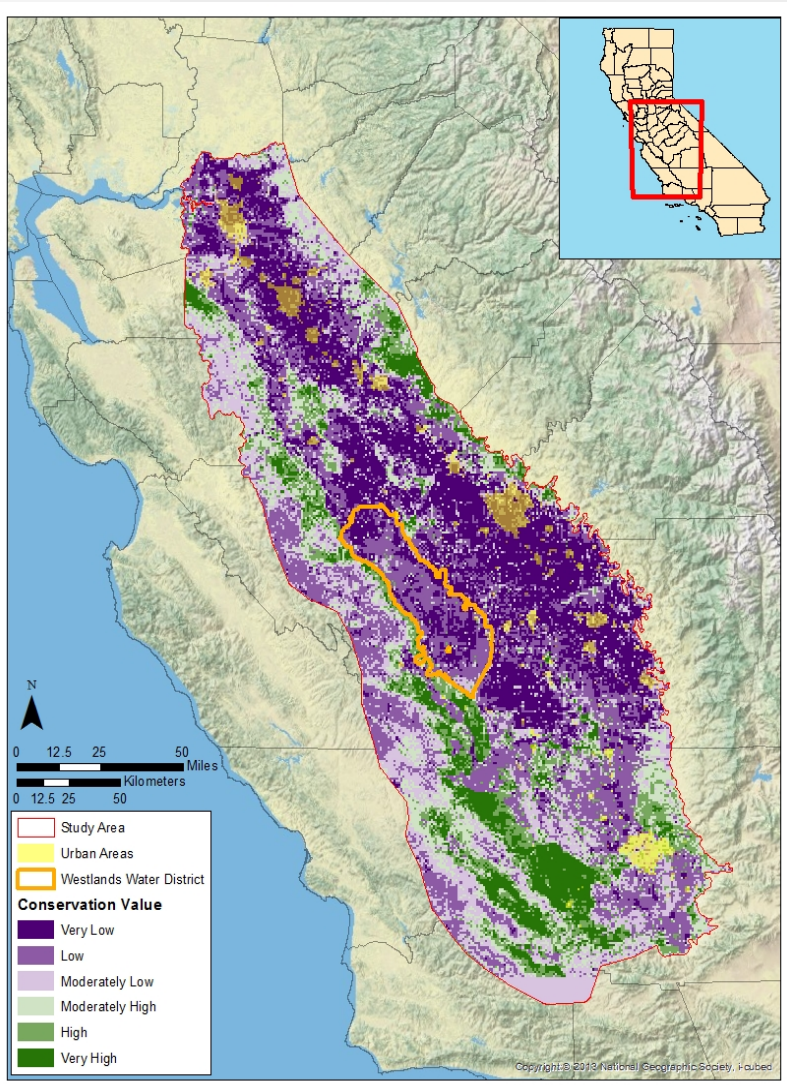
Study Area

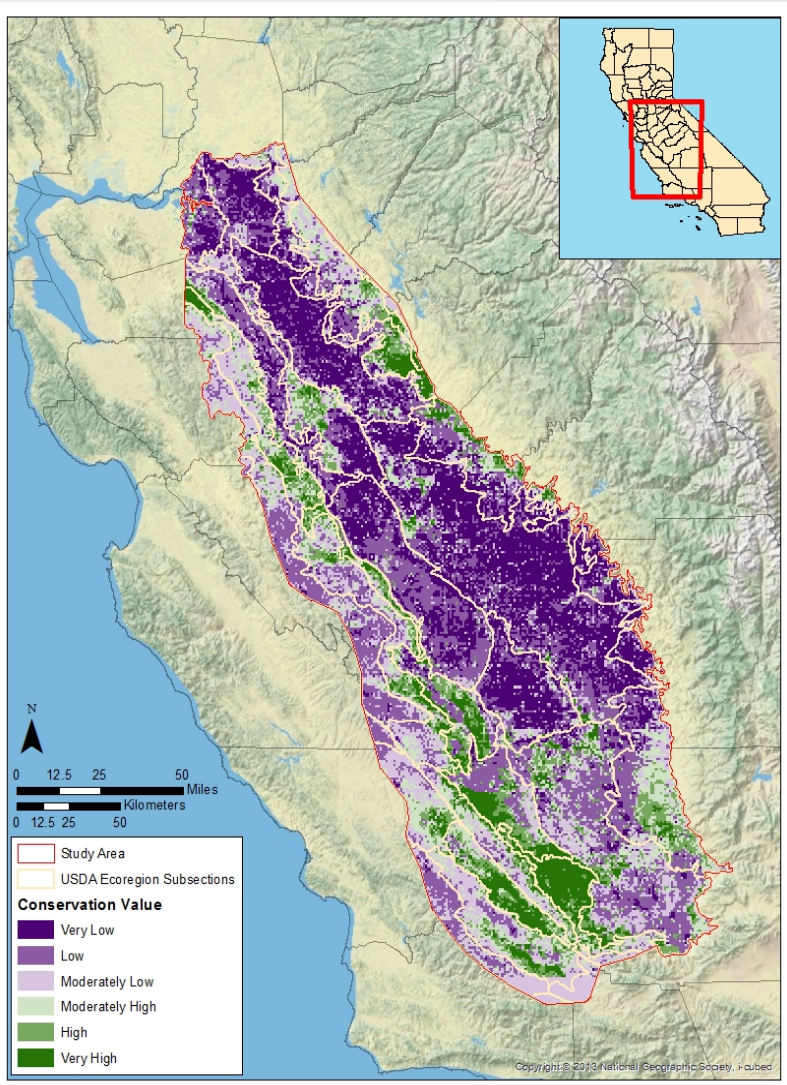


INDEX

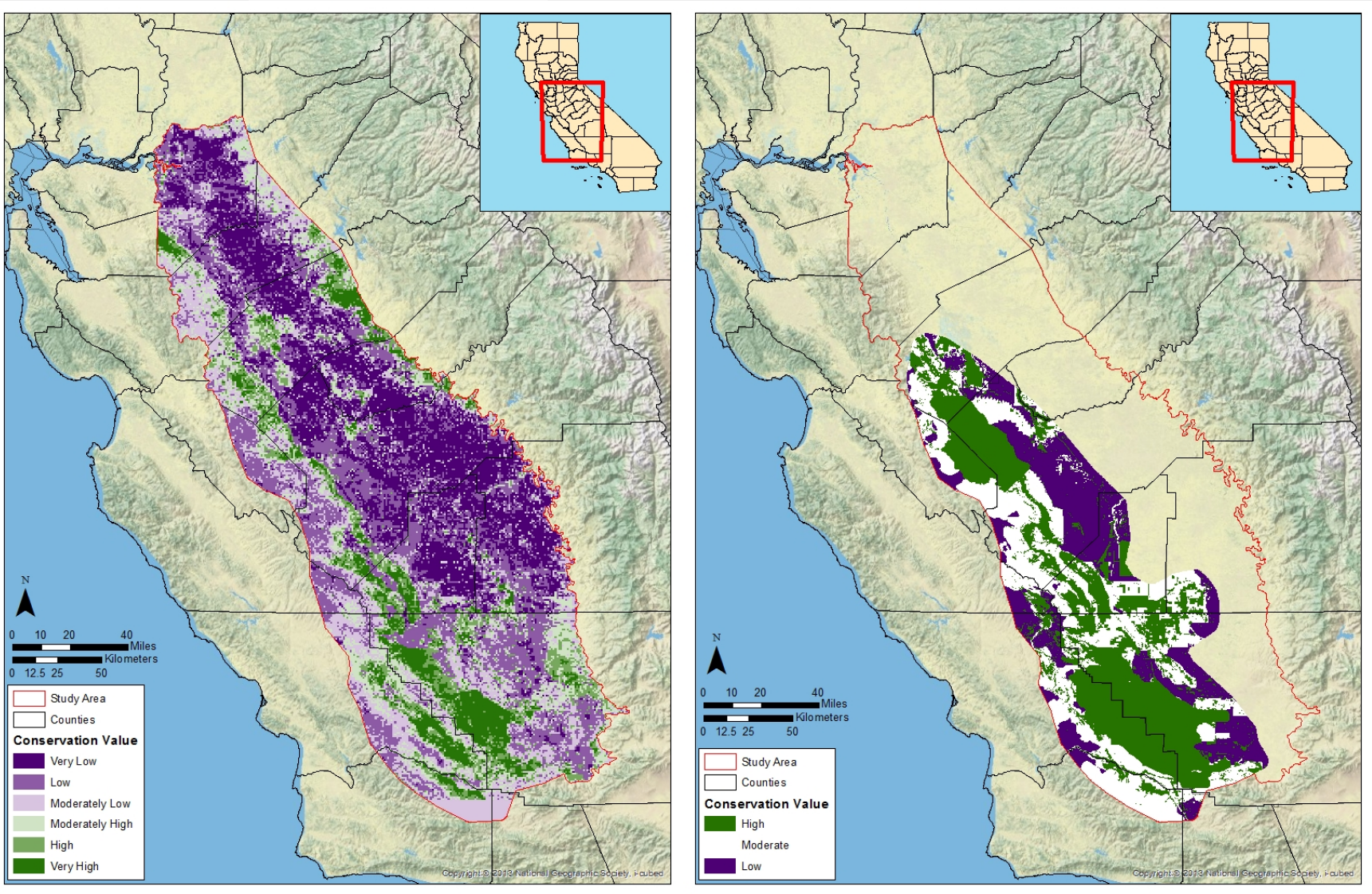
Conservation Value



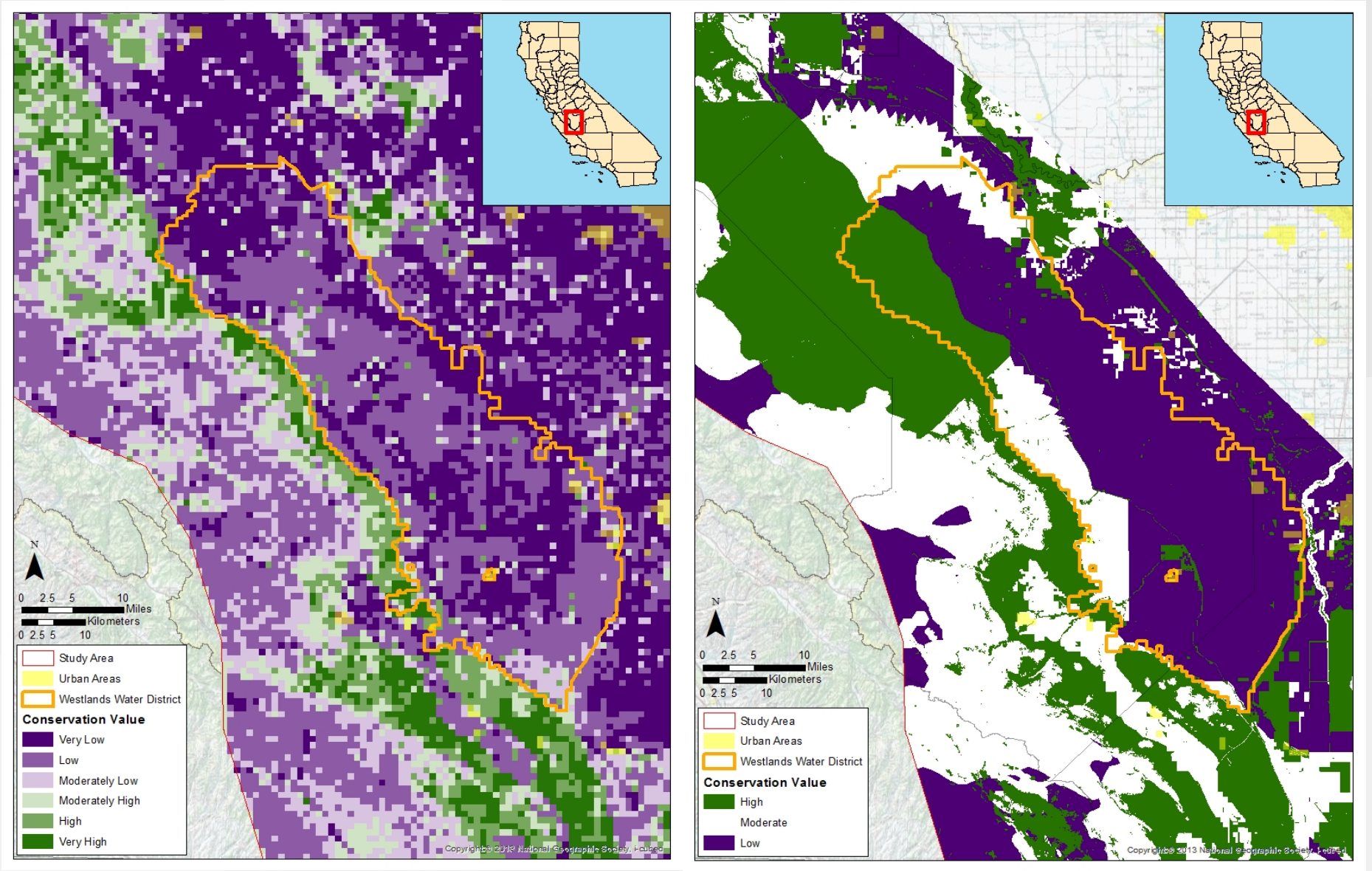




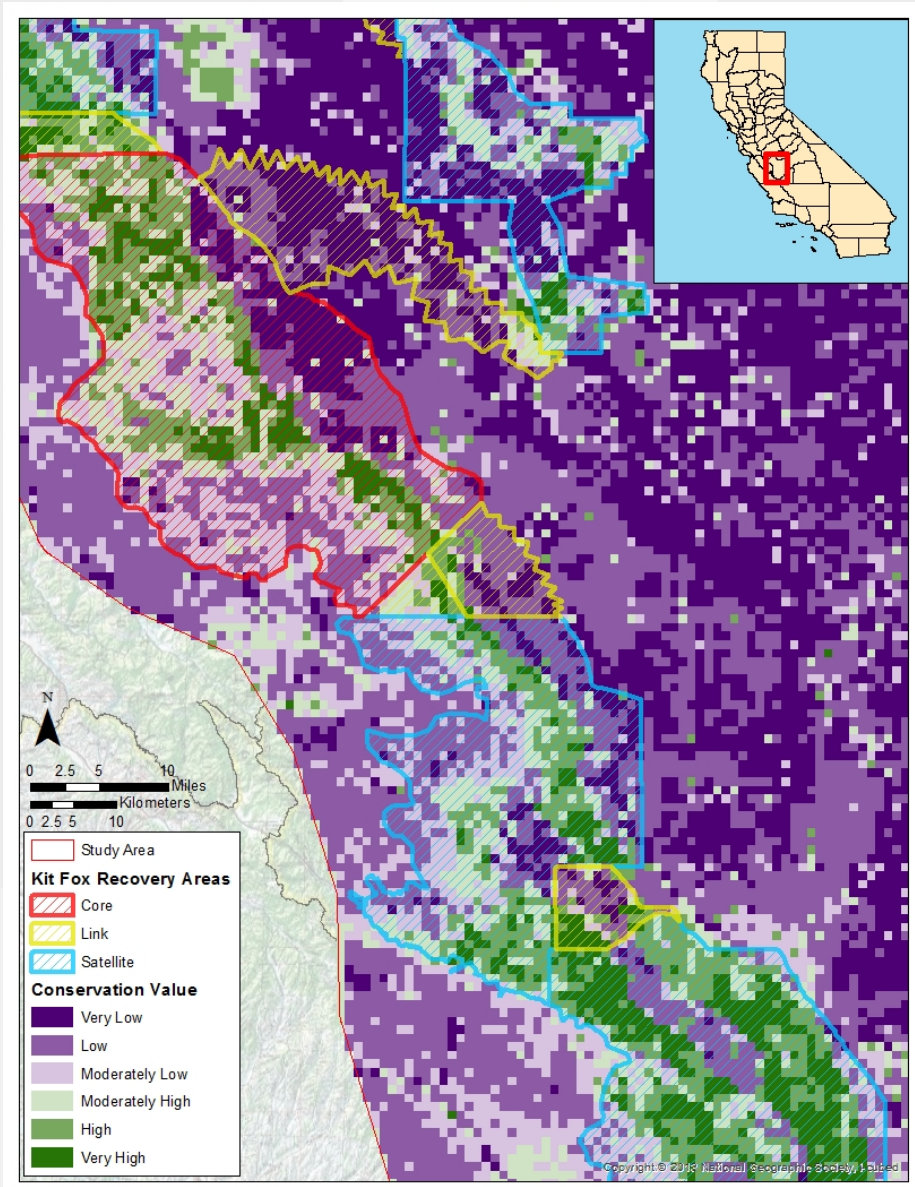
Conservation Value

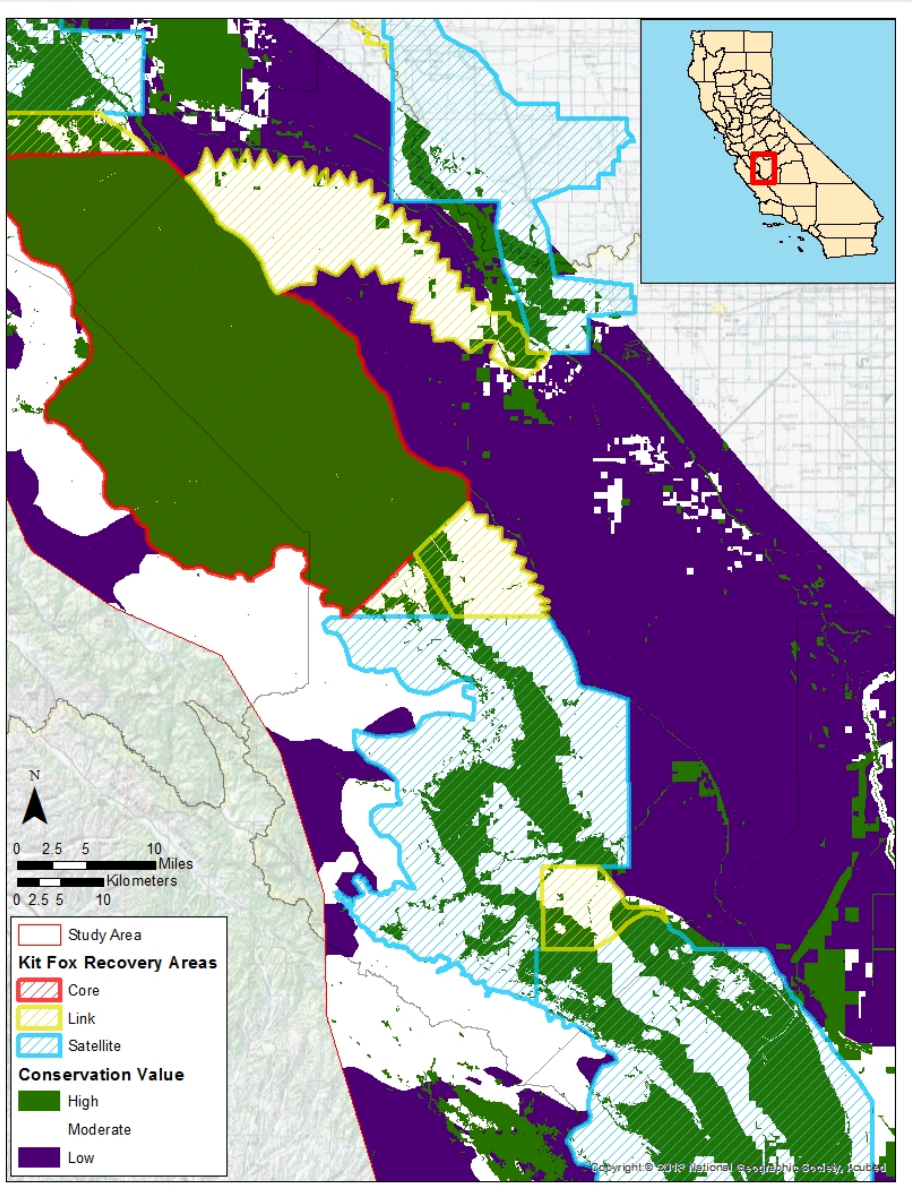


Conservation Value

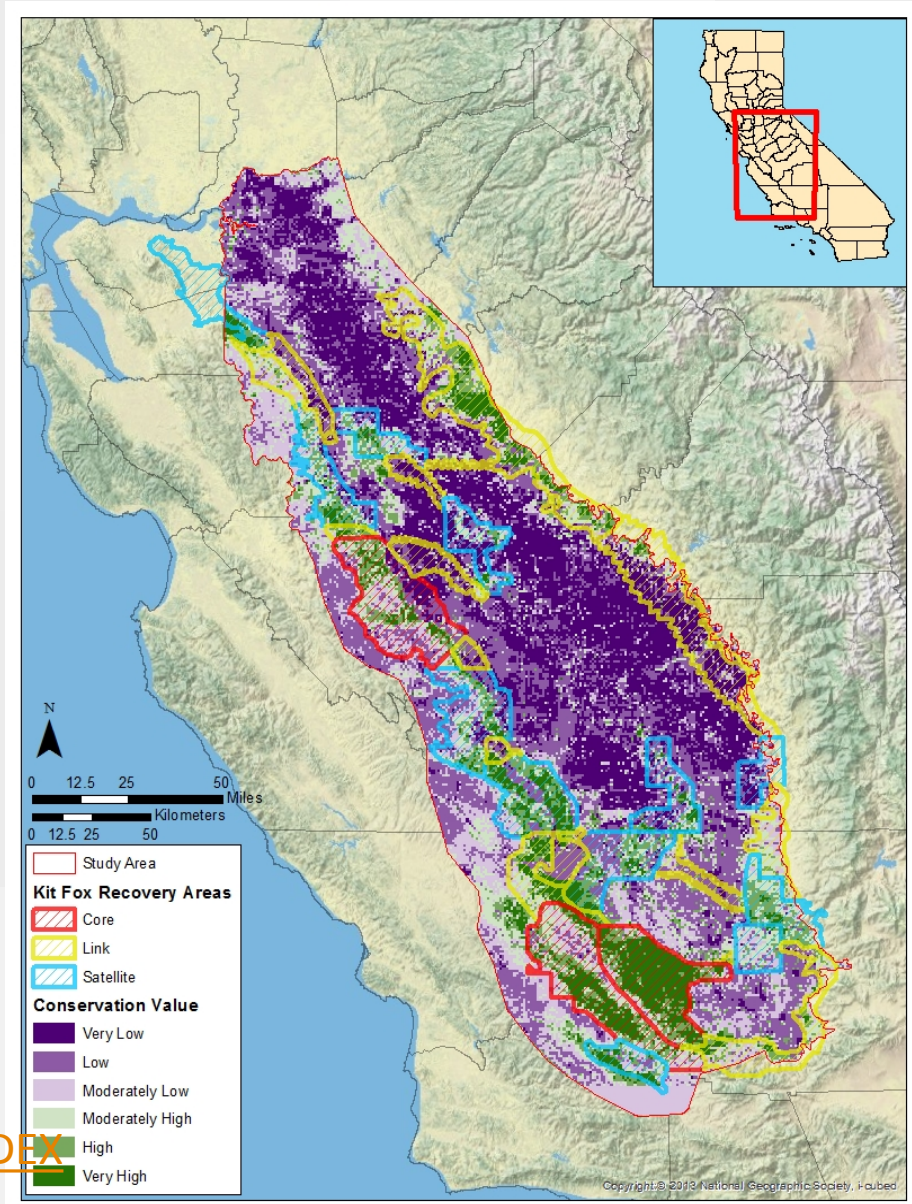


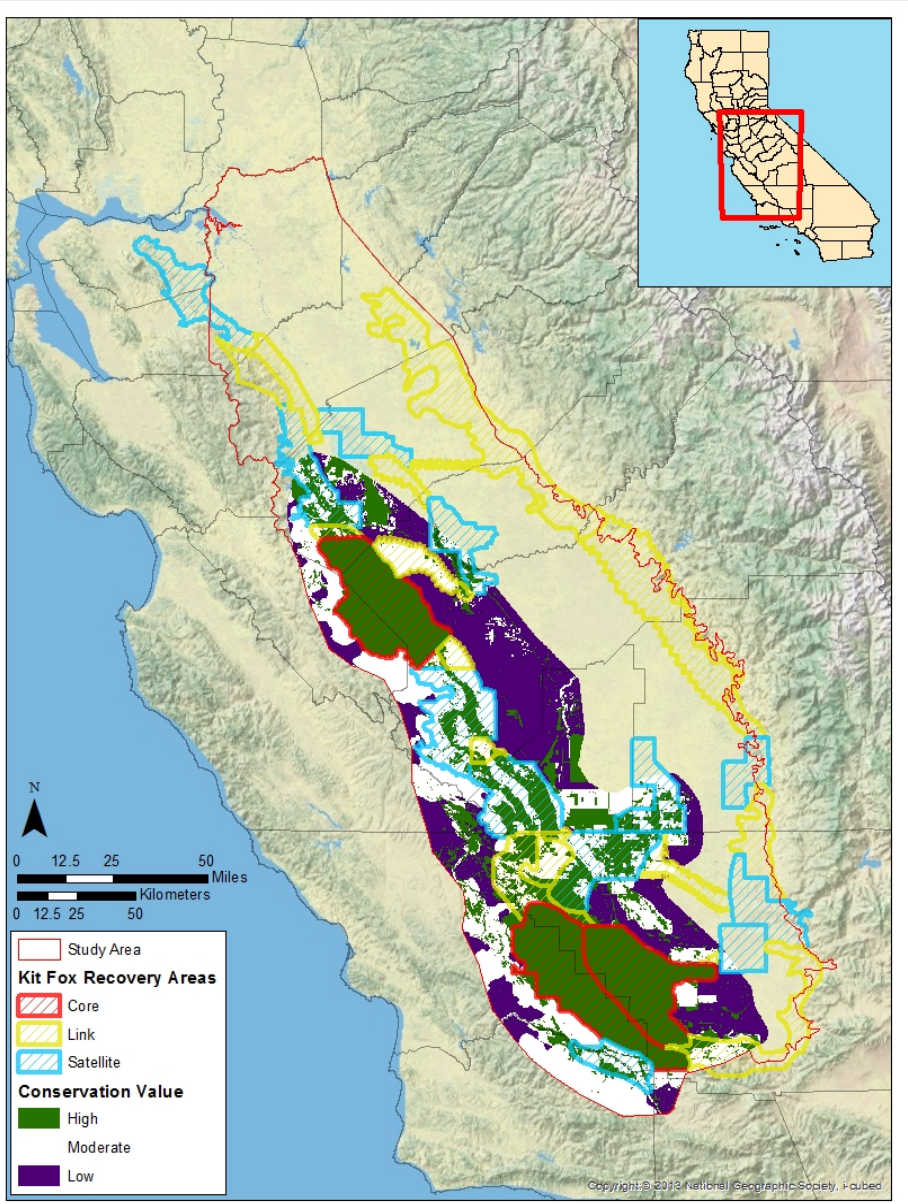
Conservation Value





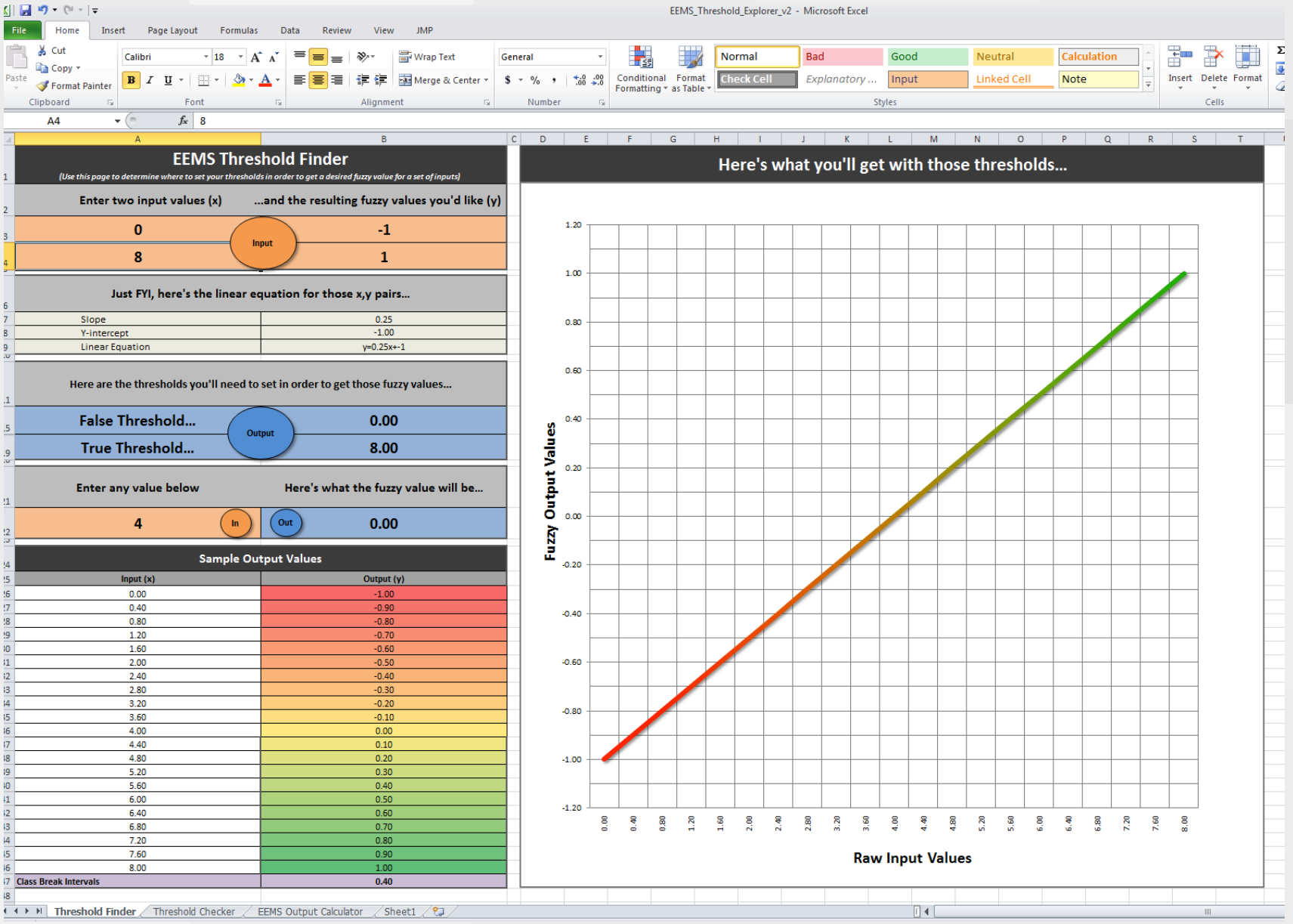
Conservation Value





INDEX

Thresholds



INDEX

Species Selection for MaxEnt Models

Criteria:

1. Listed under the Federal and/or California Endangered Species Acts

2. ≥ 50 occurrences within the Study Area "presumed extant"

Taxon	Common Name	Scientific Name	Status	Number of Extant Occurrences
Plants	Succulent Owl's Clover	*Castilleja campestris ssp. succulenta*	FT, SE, CNPS 1B.2	82
	Kern Mallow	*Eremalche parryi ssp. kernensis*	FE, CNPS 1B.1	85
	San Joaquin Woolythreads	*Monolopia congdonii*	FE, CNPS 1B.2	94
Amphibians	California Tiger Salamander	*Ambystoma californiense*	FE, ST	224
	California Red-legged Frog	*Rana draytonii*	FT, SSC	72
Reptiles	Blunt-nosed Leopard Lizard	*Gambelia sila*	FE, SE, CDFW FP	309
	Giant Garter Snake	*Thamnophis gigas*	FT, ST	53
Birds	Swainson's Hawk	*Buteo swainsoni*	ST	735
Mammals	Nelson's Antelope Squirrel	*Ammospermophilus nelsoni*	ST	251
	Giant Kangaroo Rat	*Dipodomys ingens*	FE, SE	124
	Tipton Kangaroo Rat	*Dipodomys nitratoides nitratoides*	FE, SE	77
	San Joaquin Kit Fox	*Vulpes macrotis mutica*	FT, ST	820

Species Selection for MaxEnt Models

Criteria:

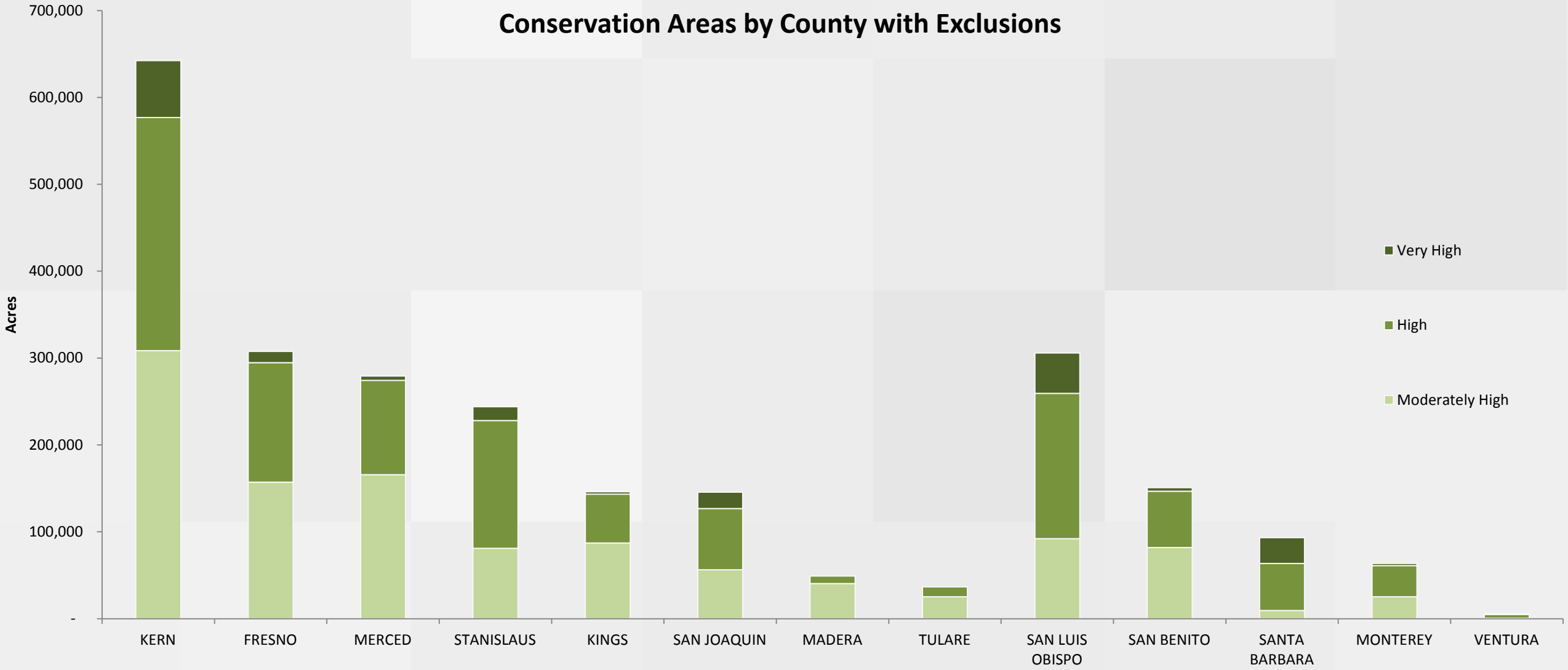
3. Added Species of Special Concern to even out taxonomic representation

4. Selected species with the highest number of extant CNDDB occurrences within the study area

Taxon	Common Name	Scientific Name	Status	Number of Extant Occurrences
Amphibians	Western Spadefoot Toad	*Spea hammondii*	SSC	161
Reptiles	Coast Horned Lizard	*Phrynosoma blainvillii*	SSC	56
Birds	Tricolored Blackbird	*Agelaius tricolor*	SSC	113
	Burrowing Owl	*Athene cunicularia*	SSC	406
Mammals	American Badger	*Taxidea taxus*	SSC	92

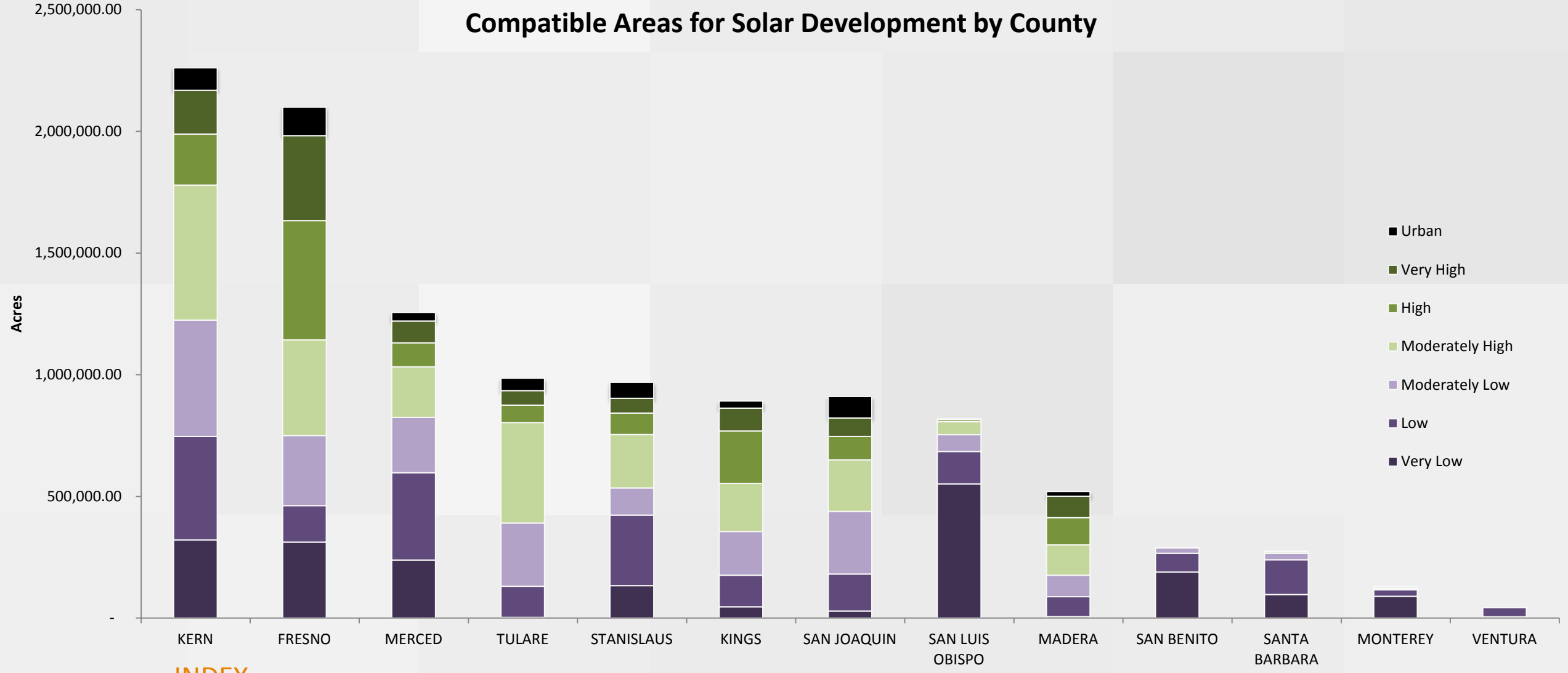
INDEX

Conservation Value Graph



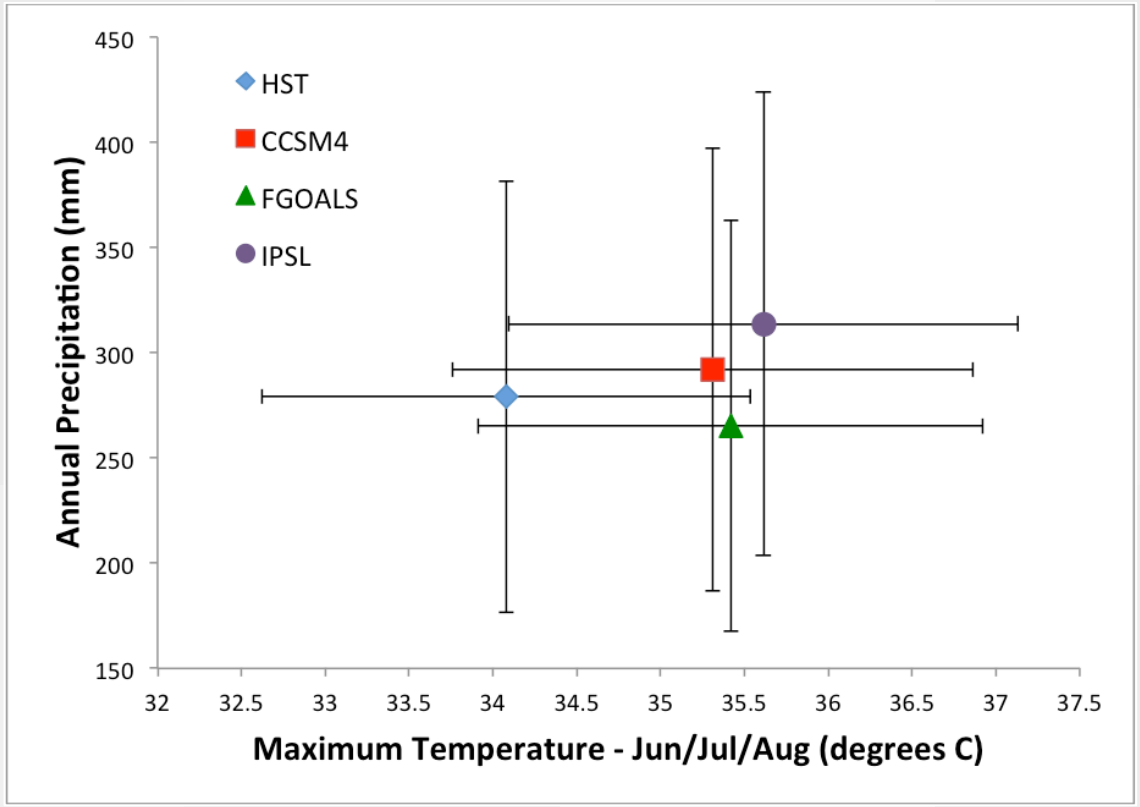
INDEX

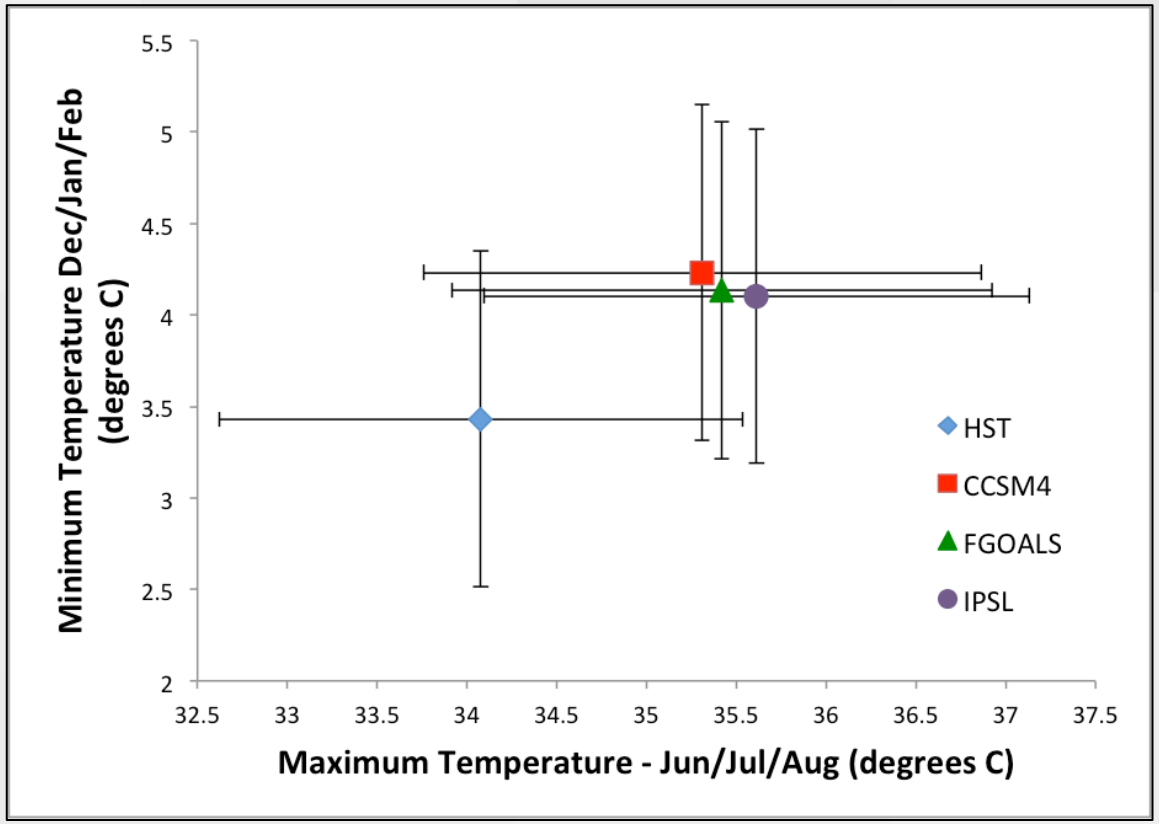
Compatible Area Graph



INDEX

Climate Models





INDEX

Where should conservation groups focus their efforts?