TRADE-OFFS BETWEEN BIOFUEL AND BIODIVERSITY IN CALIFORNIA: WHERE ARE THE SWEET SPOTS?

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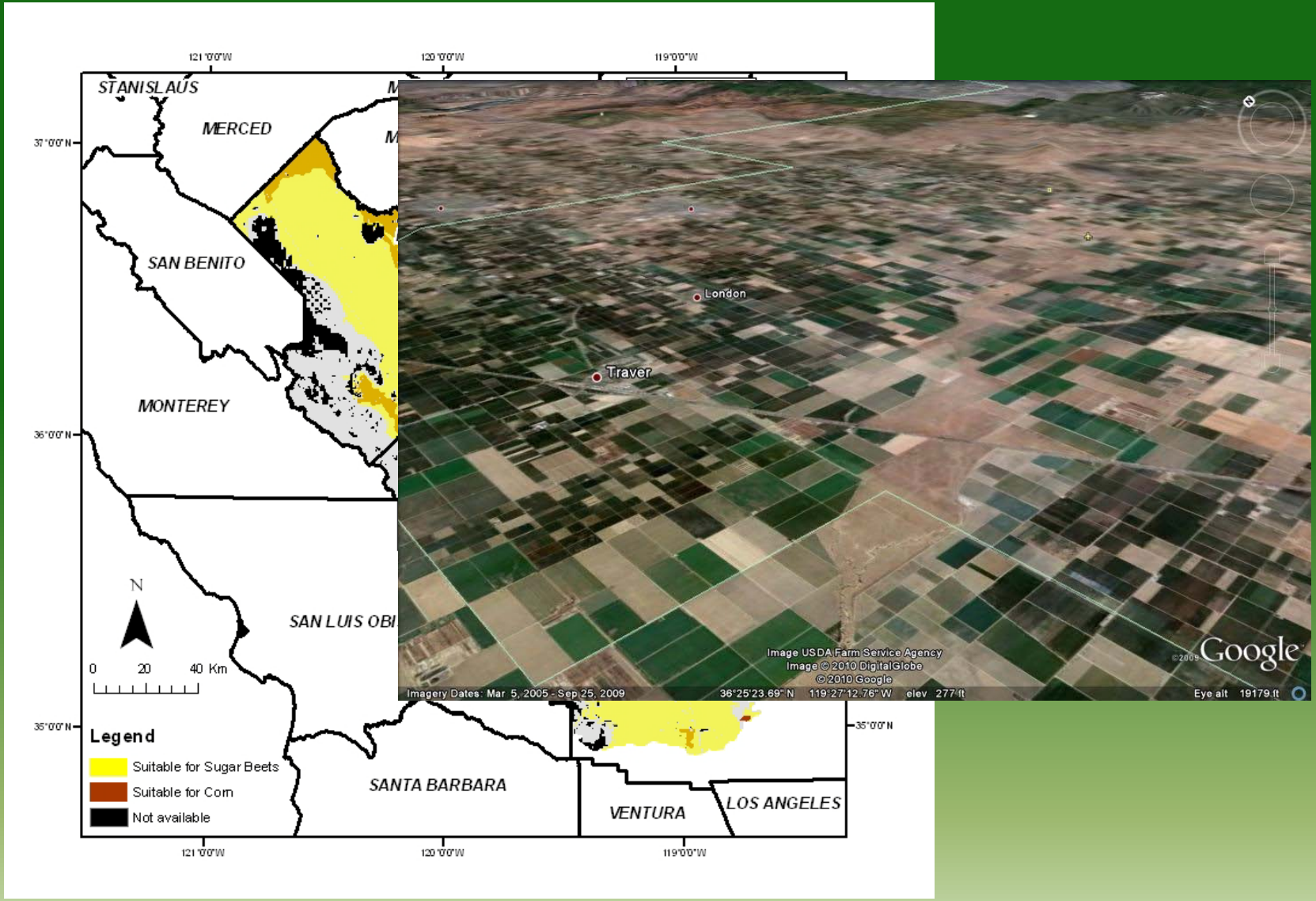
Objectives

- Where could biofuel crop targets optimally be met with minimum impact on wildlife species?
- Demonstrate a conservation planning approach as a general framework for trade-off assessment

Study area


121°0'0"W
120°0'0"W
119°0'0"W
37°0'0"N
36°0'0"N
35°0'0"N
STANISLAUS
MERCED
SAN BENITO
MONTEREY
SAN LUIS OBI
SANTA BARBARA
VENTURA
LOS ANGELES
N
0 20 40 Km
Legend
Suitable for Sugar Beets
Suitable for Corn
Not available
London
Traver
Image USDA Farm Service Agency
Image © 2010 DigitalGlobe
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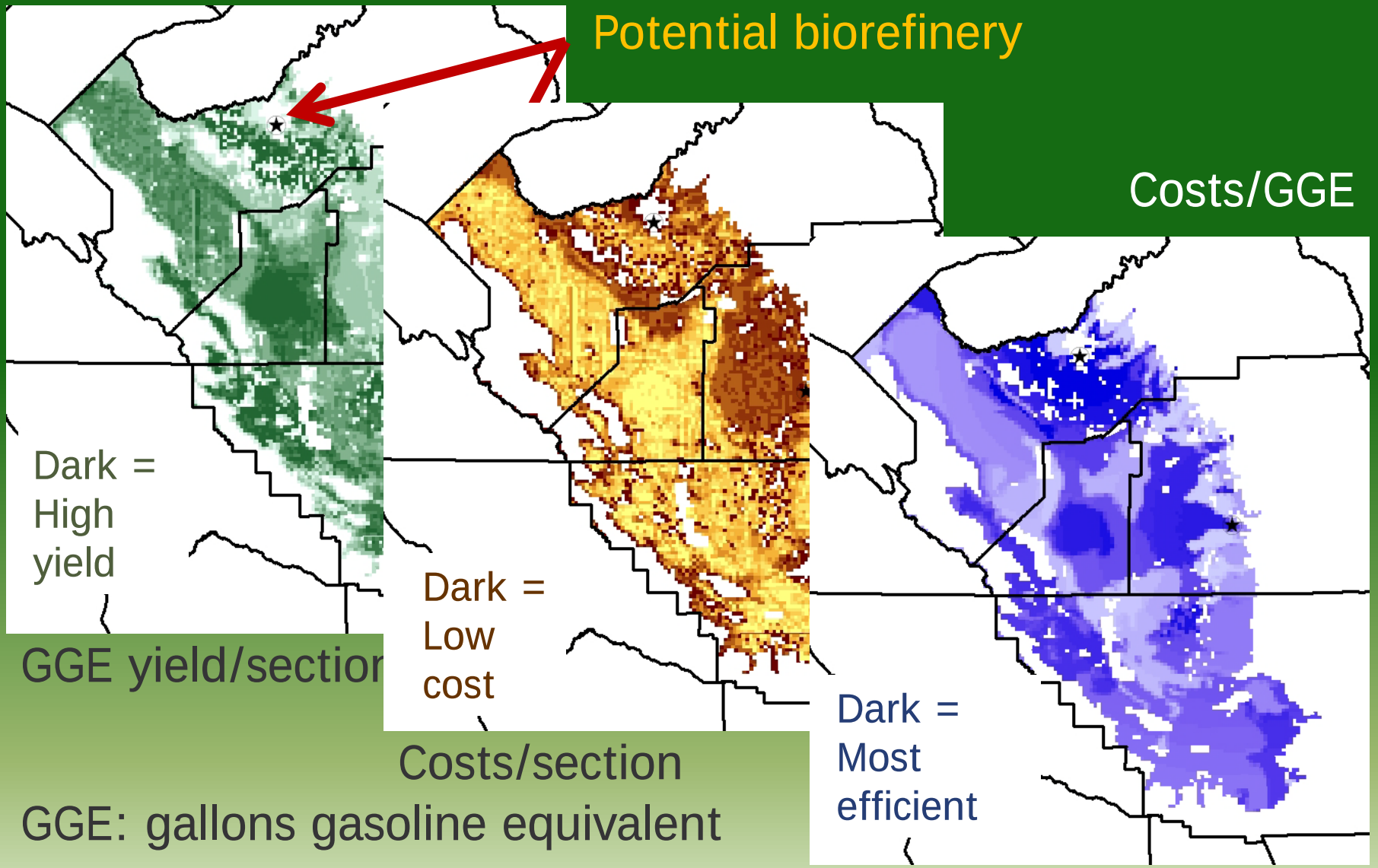
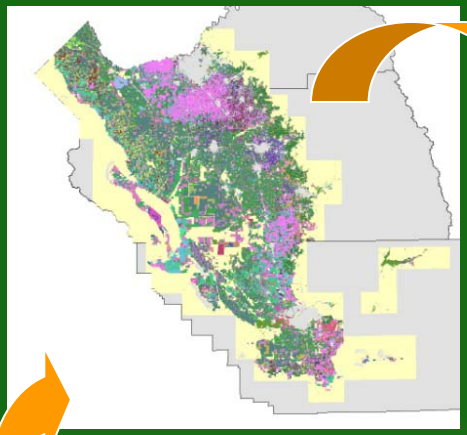
Google
Imagery Dates: Mar 5, 2005 - Sep 25, 2009
36°25'23.69" N 119°27'12.76" W elev 277 ft
Eye alt 19179 ft

Biofuel potential yield and cost

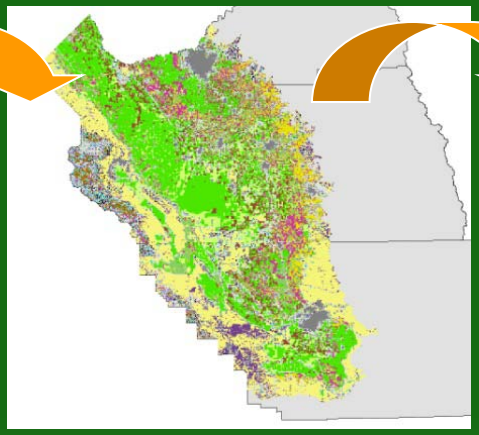


GGE: gallons gasoline equivalent

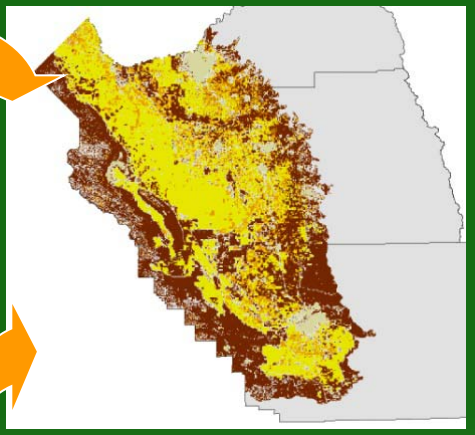
Habitat modeling flowchart



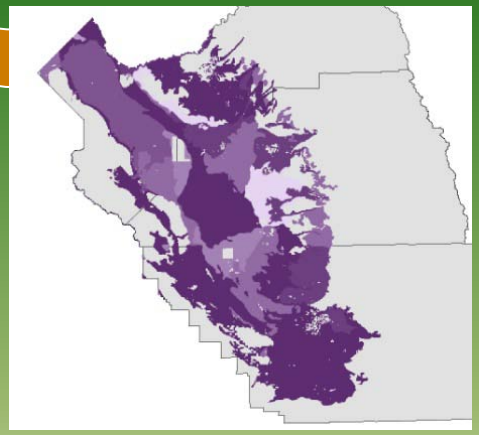
Land cover (crops)



Habitat types



Habitat suitability

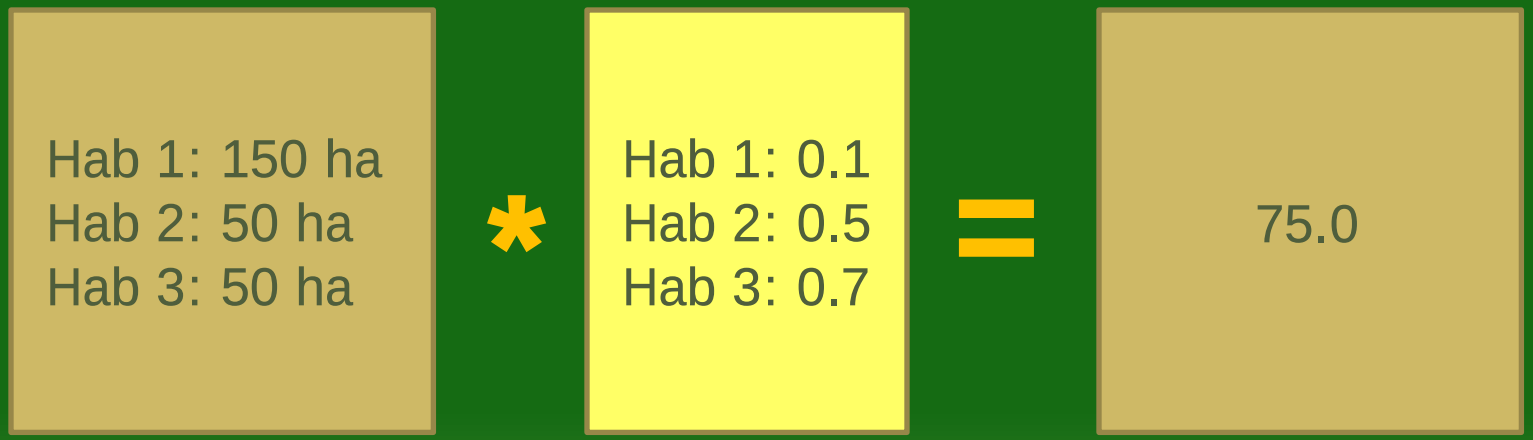


Potential crops

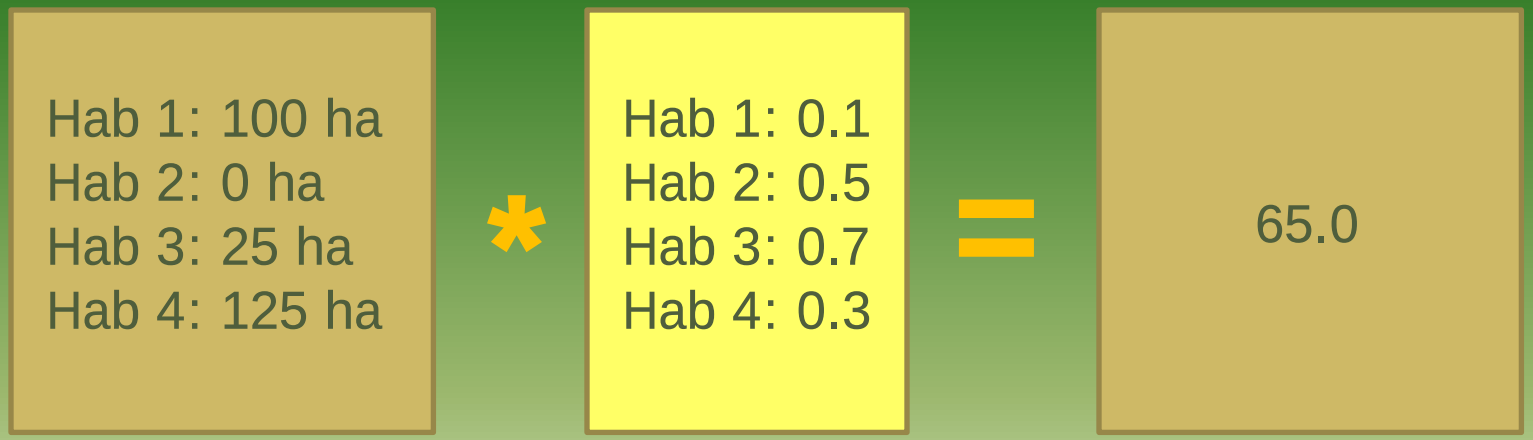
Species (*i*)	Habitat type (*j*) 1	2	3	4	5	6	7	8
Loggerhead Shrike	1.0	0.3	0.7	0.7	0.3	1.0	0.0	0.7
Western Burrowing Owl	0.3	1.0	0.3	1.0	0.0	0.0	0.0	0.7
Grasshopper Sparrow	0.7	0.7	0.0	0.7	0.7	0.7	0.0	0.7
Ferruginous Hawk	1.0	1.0	0.3	0.3	0.0	0.0	1.0	1.0
Sage Thrasher	0.7	1.0	1.0	0.7	0.0	0.3	0.7	0.0
Western Sage Grouse	1.0	0.3	0.0	0.0	1.0	1.0	1.0	0.0
Sage Sparrow	0.3	0.0	0.7	1.0	0.0	0.3	0.0	0.0
American White Pelican	0.3	0.3	1.0	0.0	0.0	0.0	0.0	0.0
Bald Eagle	0.0	0.7	0.0	0.3	0.7	0.0	0.0	0.3
Forester's Tern	0.0	0.0	1.0	0.0	0.0	0.3	0.0	0.0

Habitat suitability matrix

Habitat modeling example



One section (~640 ac.) Suitability rating Suitability score



Conversion to biofuel crop

Habitat types of biofuel crops

Biofuel crop	Code	Habitat name	# of species with suitable habitat (L-H)
Corn, sweet sorghum, wheat/barley, safflower, canola, camelina	IGR	Irrigated Grain Crops	84
Wheat/barley	DGR	Dryland Grain Crops	53
Sugar beets	IRF	Irrigated Row and Field Crops	49
Bermuda grass, switchgrass?	IRH	Irrigated Hayfield	114

The Marxan planning problem

- Select a set of conservation features
- Set targets for how much to protect
- Identify a set of sites for a reserve network from among a complete set of “planning units” that meets targets at minimum cost

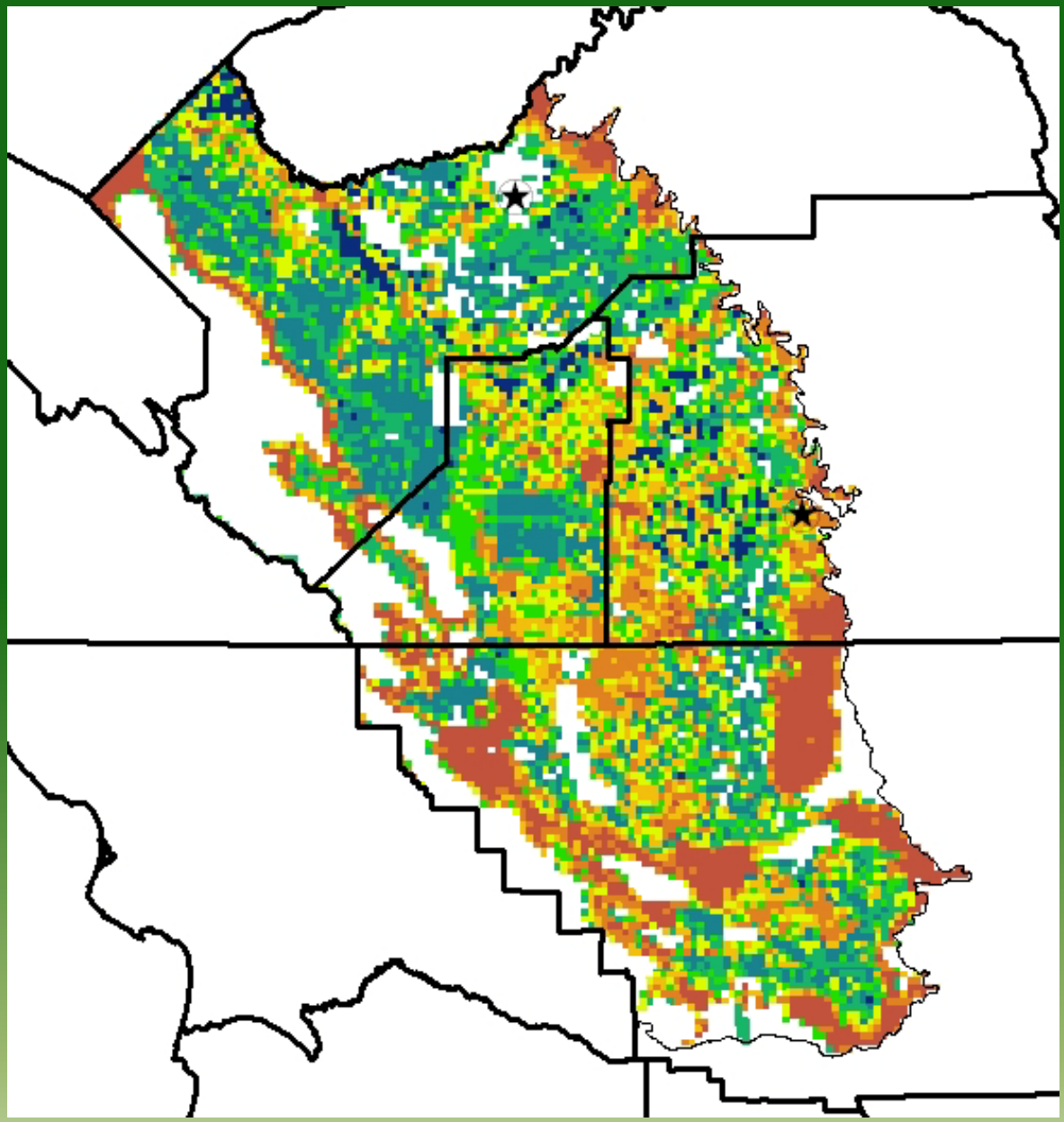
- http://www.uq.edu.au/marxan

Adaptations for Marxan

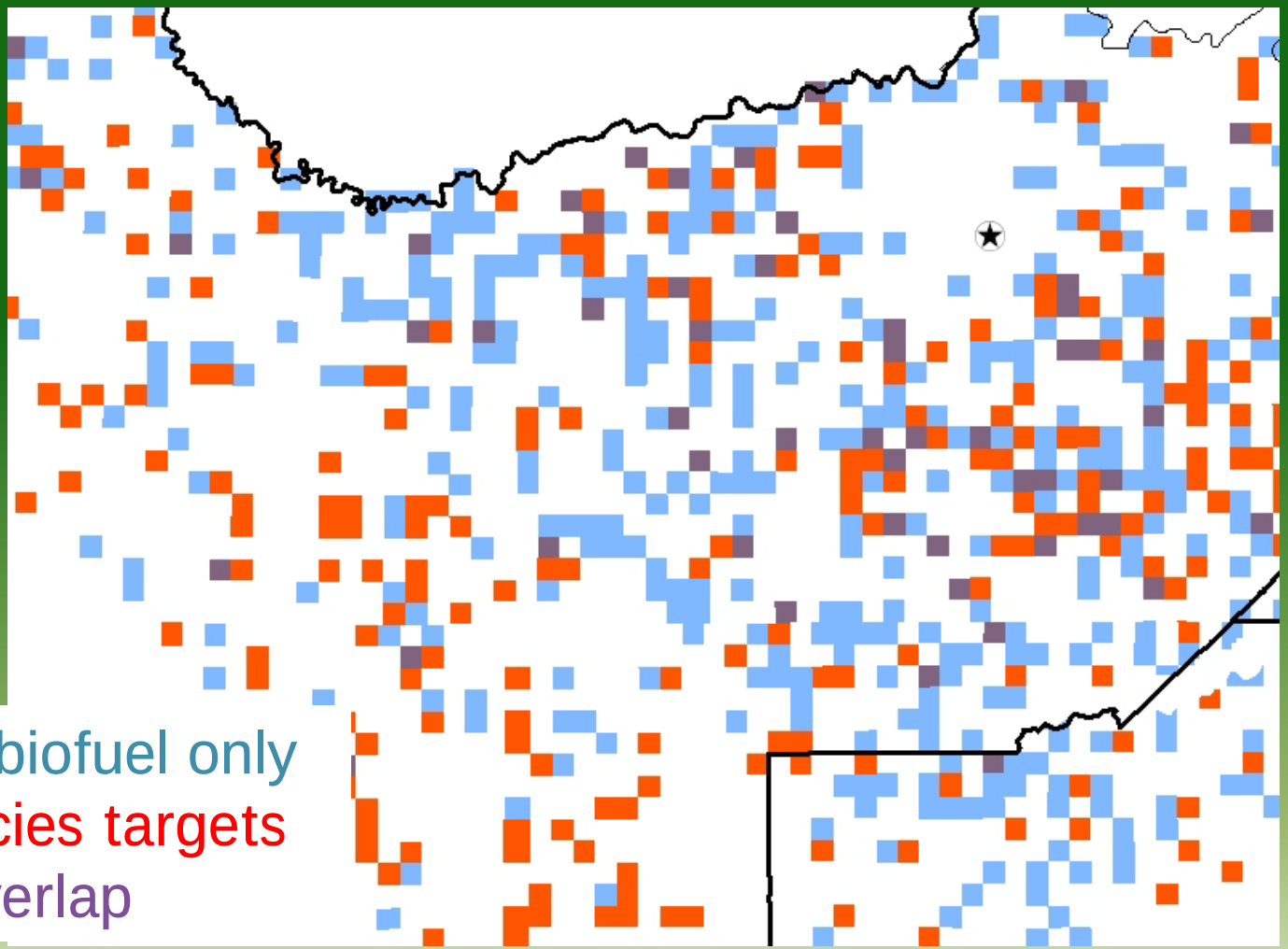
- Resource production and targets
  - Add features for biofuel yields
- Track habitat suitability from land use change
  - Add dummy planning unit with current total habitat suitability for each species and lock it in solutions
  - Change amount of features in planning unit to net change in suitability
  - e.g., 65 – 75 = -10

Potential suitability change

Brown = Large loss
Blue = Slight gain

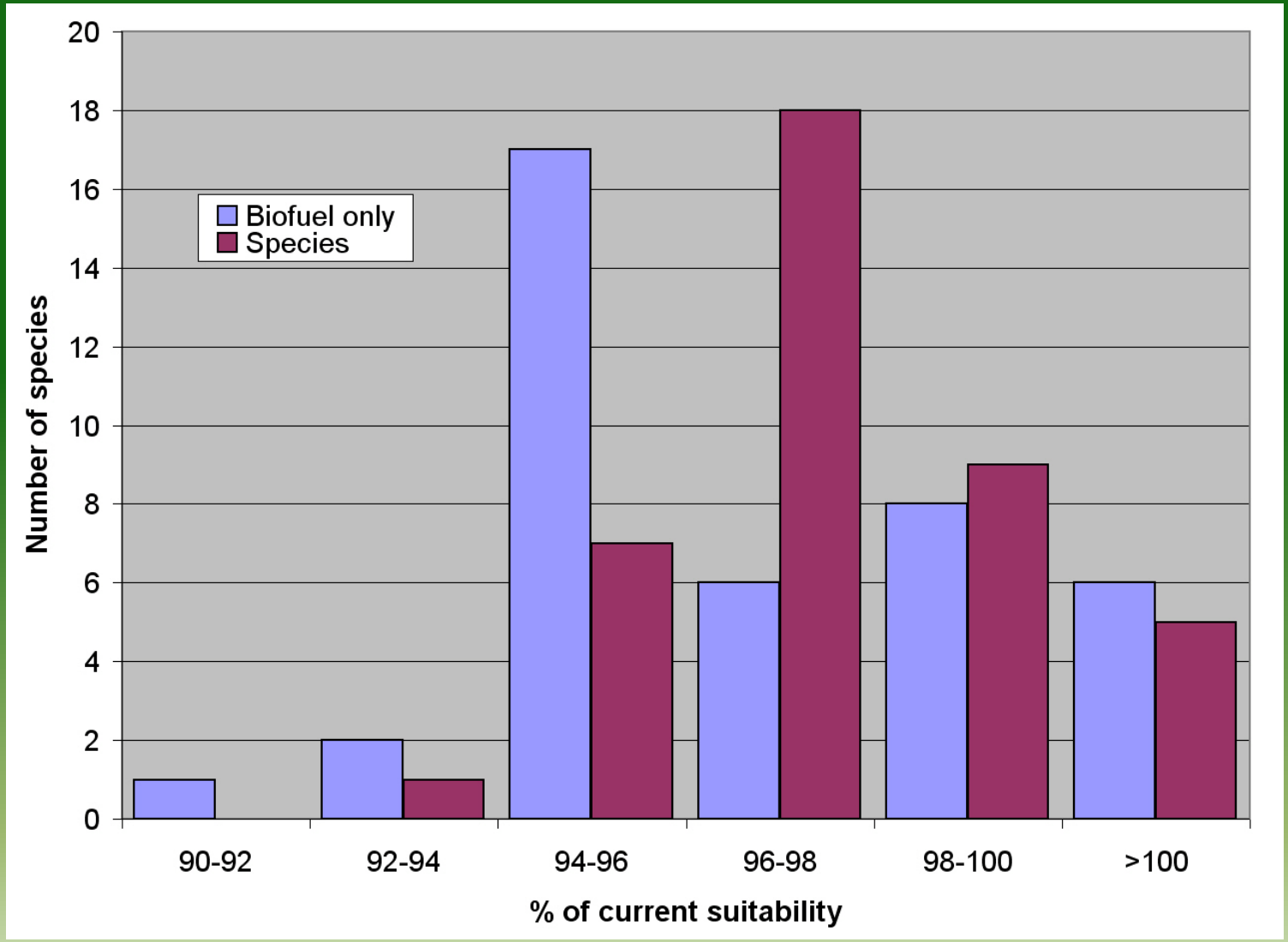


Alternative solutions



Lt. Blue = biofuel only
Red = species targets
Purple= overlap

Species effects



Final thoughts

- Framework to assess biofuel trade-offs
- Next steps
  - Incorporate agroeconomic modeling (UC Davis)
  - Add water for irrigation as a feature
  - Model rest of the state
  - Exclude prime farmland?
- Funding: California Energy Commission
- Contact: stoms@bren.ucsb.edu