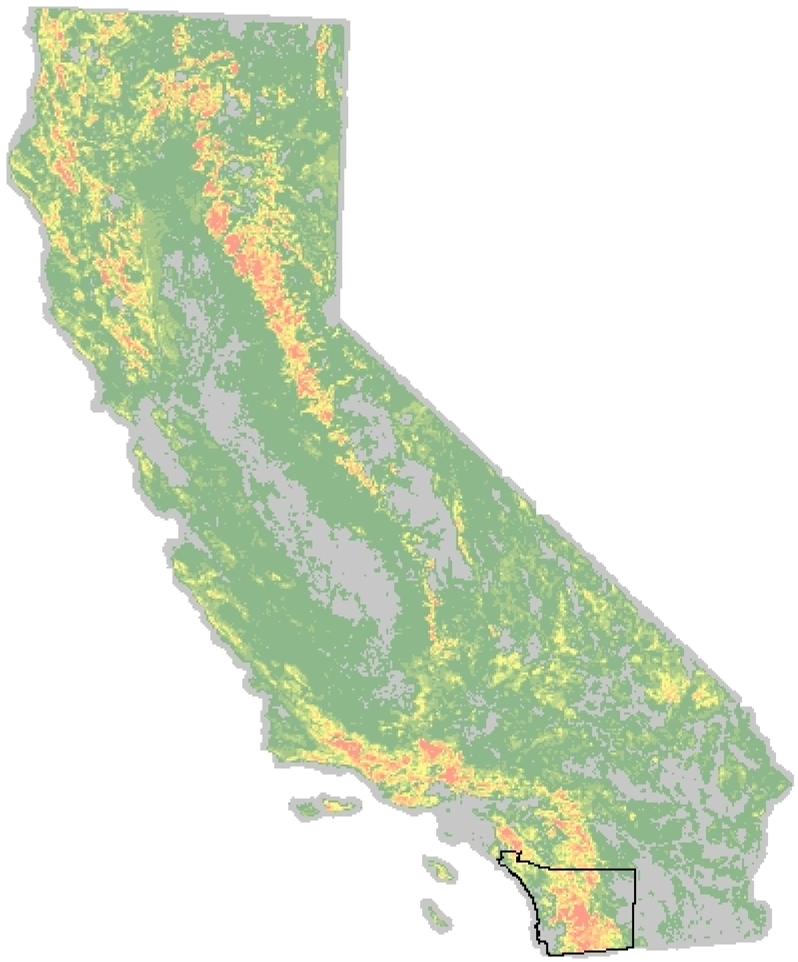
OIR Fire Threat Mapping R.15-05-006



Agenda

- Introductions (5 minutes)
- Quick run through of IOU method (10 minutes)
- SDGE Fire History and lessons learned (25 minutes)
- GIS demonstration (10 minutes)
- Slow walk through SDGE method (25 minutes)
- Appendix C method (15 minute)
- Contrast / Compare (20 minutes)
- Conclusions (15 minutes)
- Q&A

Disclaimer

- Every attempt has been made to be as accurate as possible with the information provided herein. Because the following presentations contains large amounts of information, some of which is from sources outside our control, it is possible that errors or inaccuracies could be present. Please contact us if corrections need to be made.

- Mason Withers (mwithers@semprautilities.com)
- Randy Lyle (rlyle@semprautilities.com)

We also apologize in advance for the lack of beauty in the slides

Introductions

- Randy Lyle
  - Senior Fire Coordinator

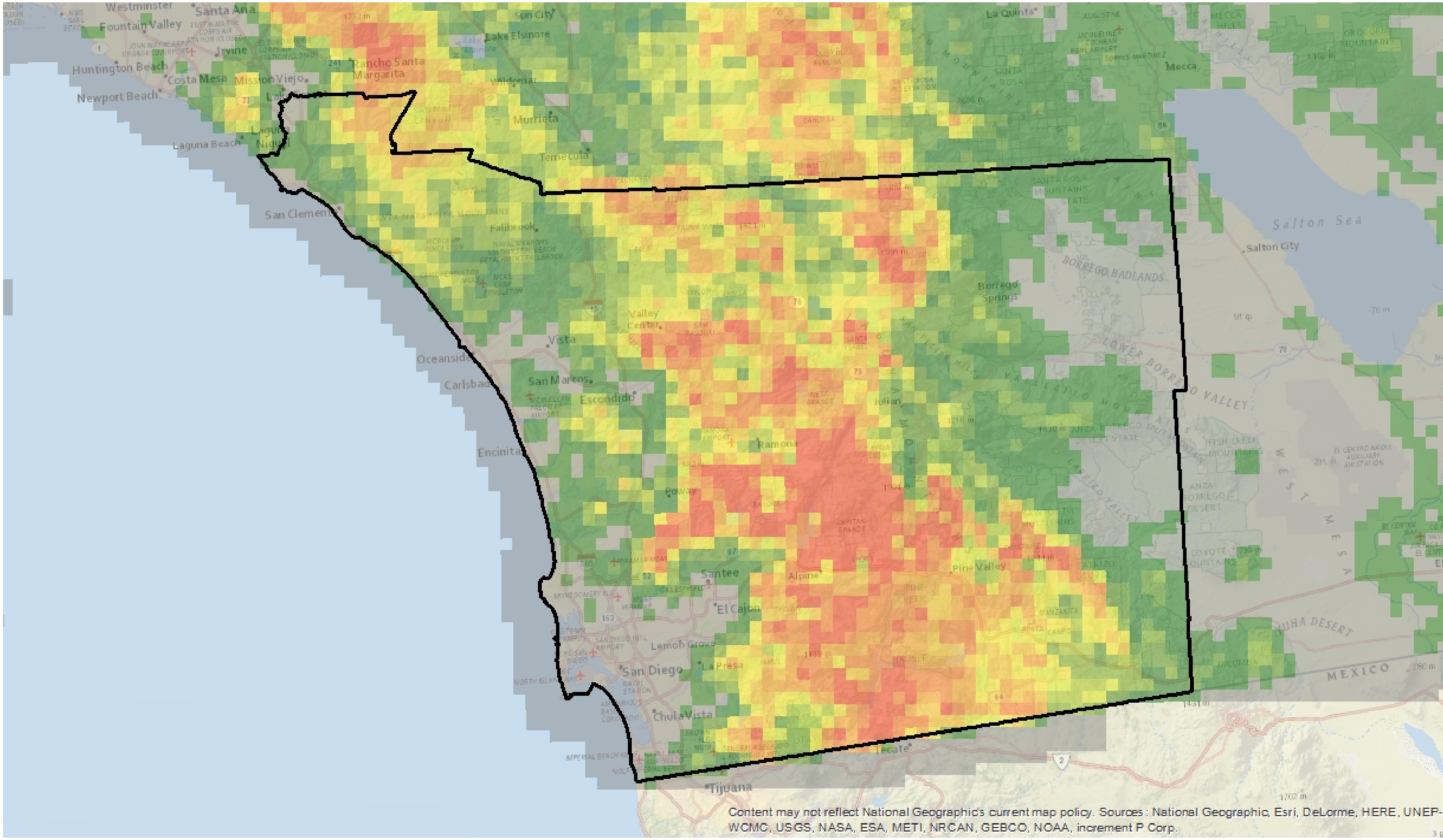
- Mason Withers
  - Quantitative Risk and Controls, Manager

SDG&E / IOU Brief Methodology

Subject: A very brief fly over of the SDG&E Pilot & Statewide Methodology

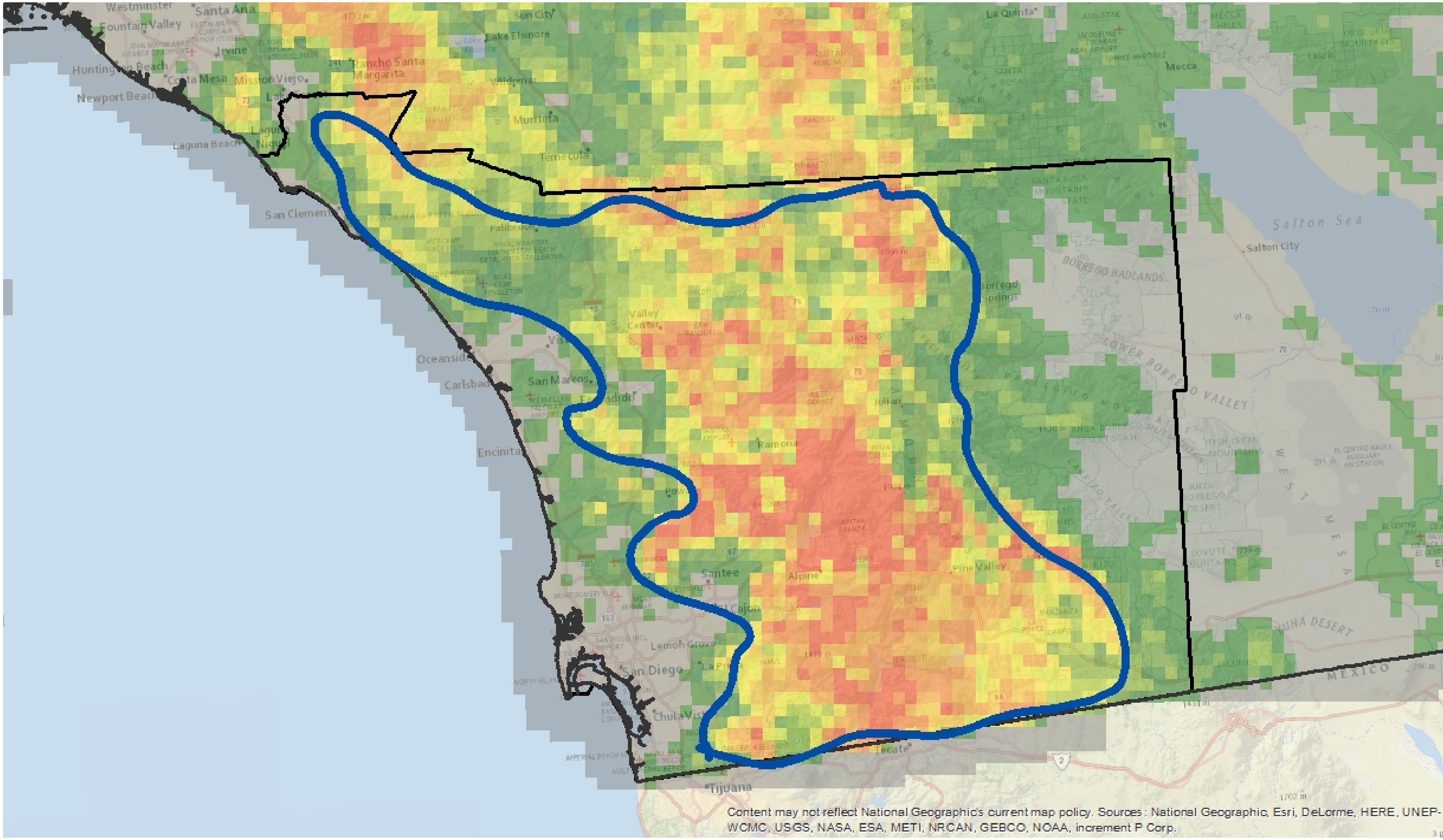
Rationale: Lay down a foundation for the concepts presented later

SDG&E Service Territory with IET

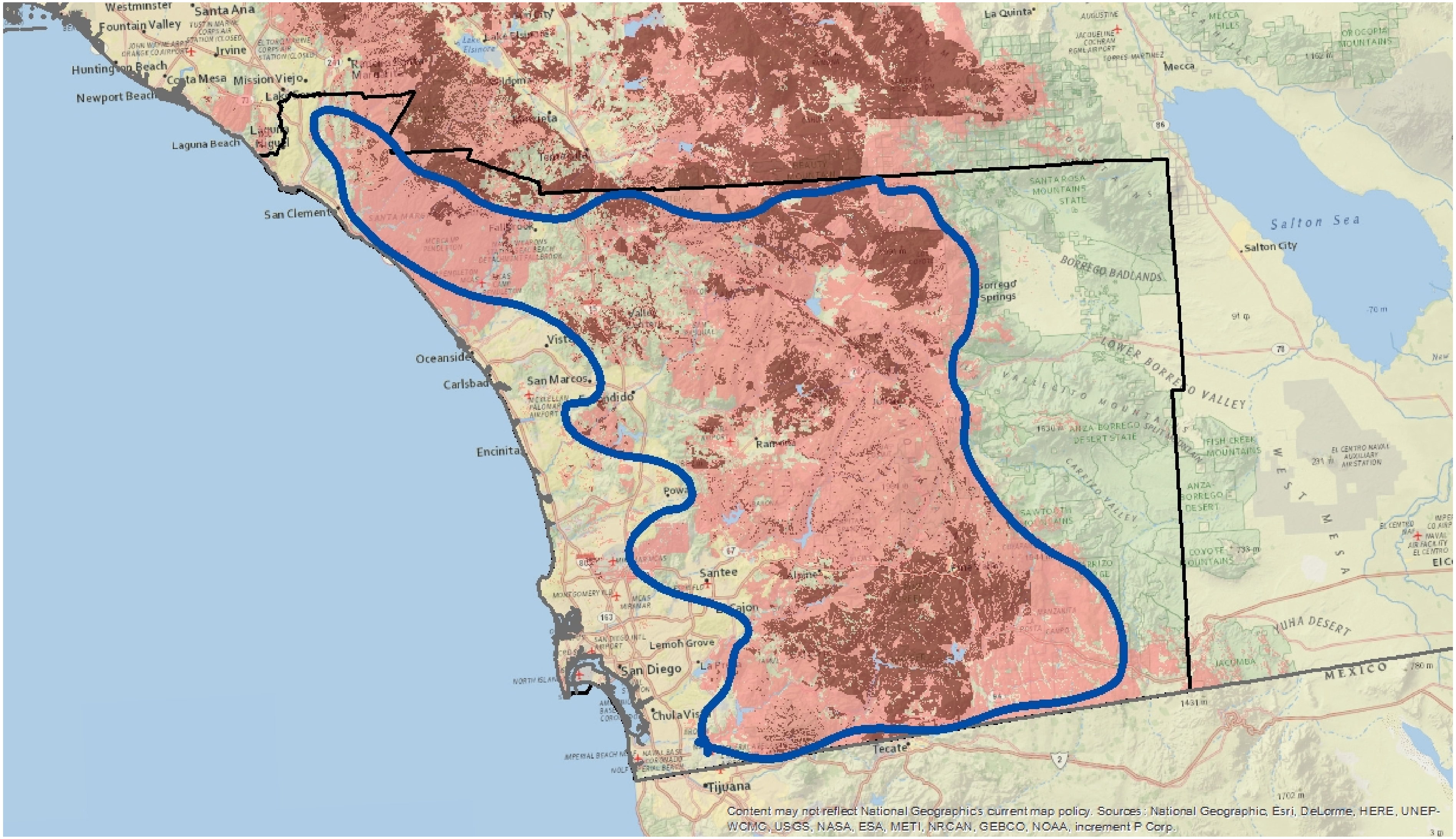


Rough approximation of IET values.

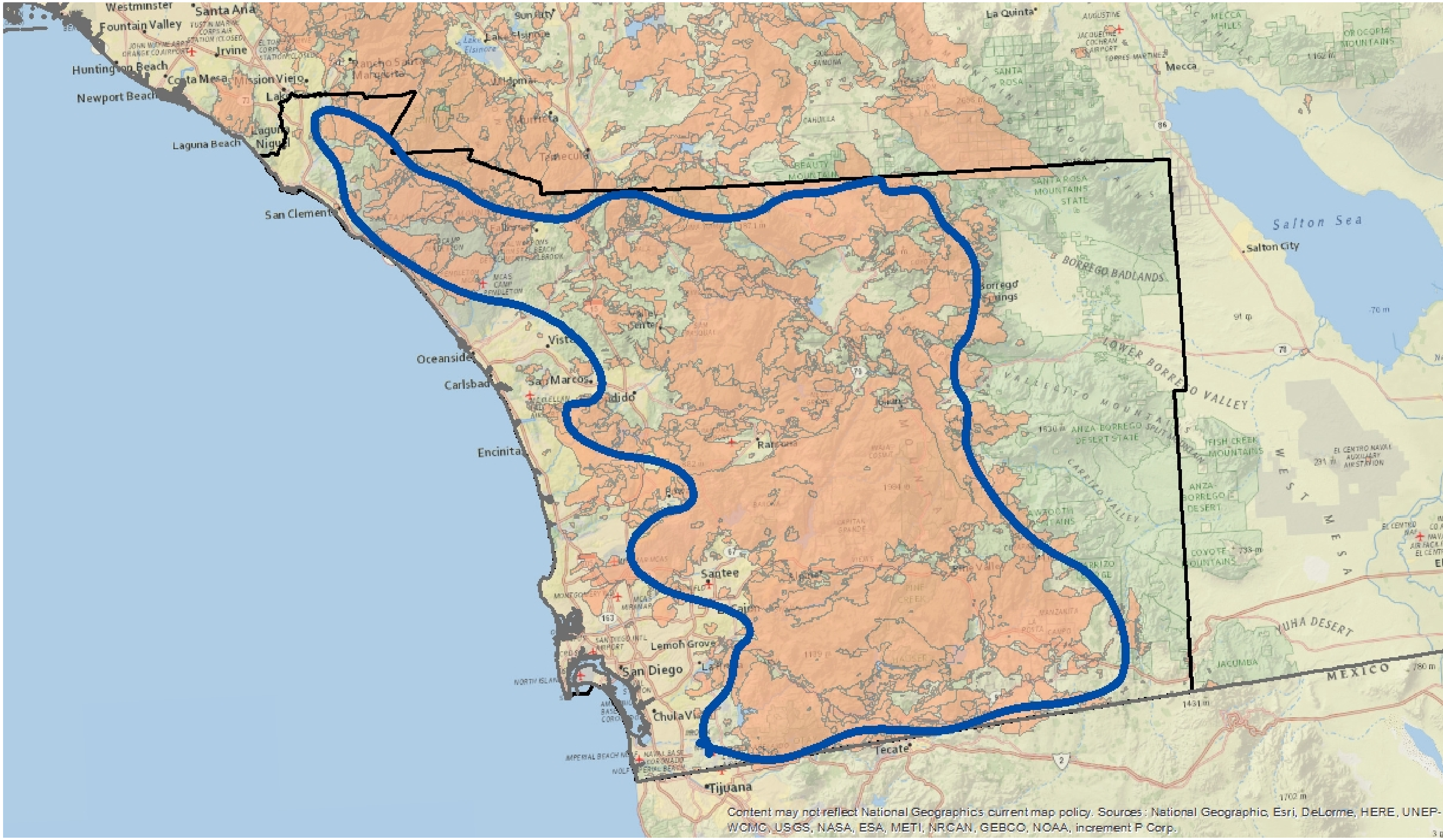
(IET value of 800 is loose starting point)



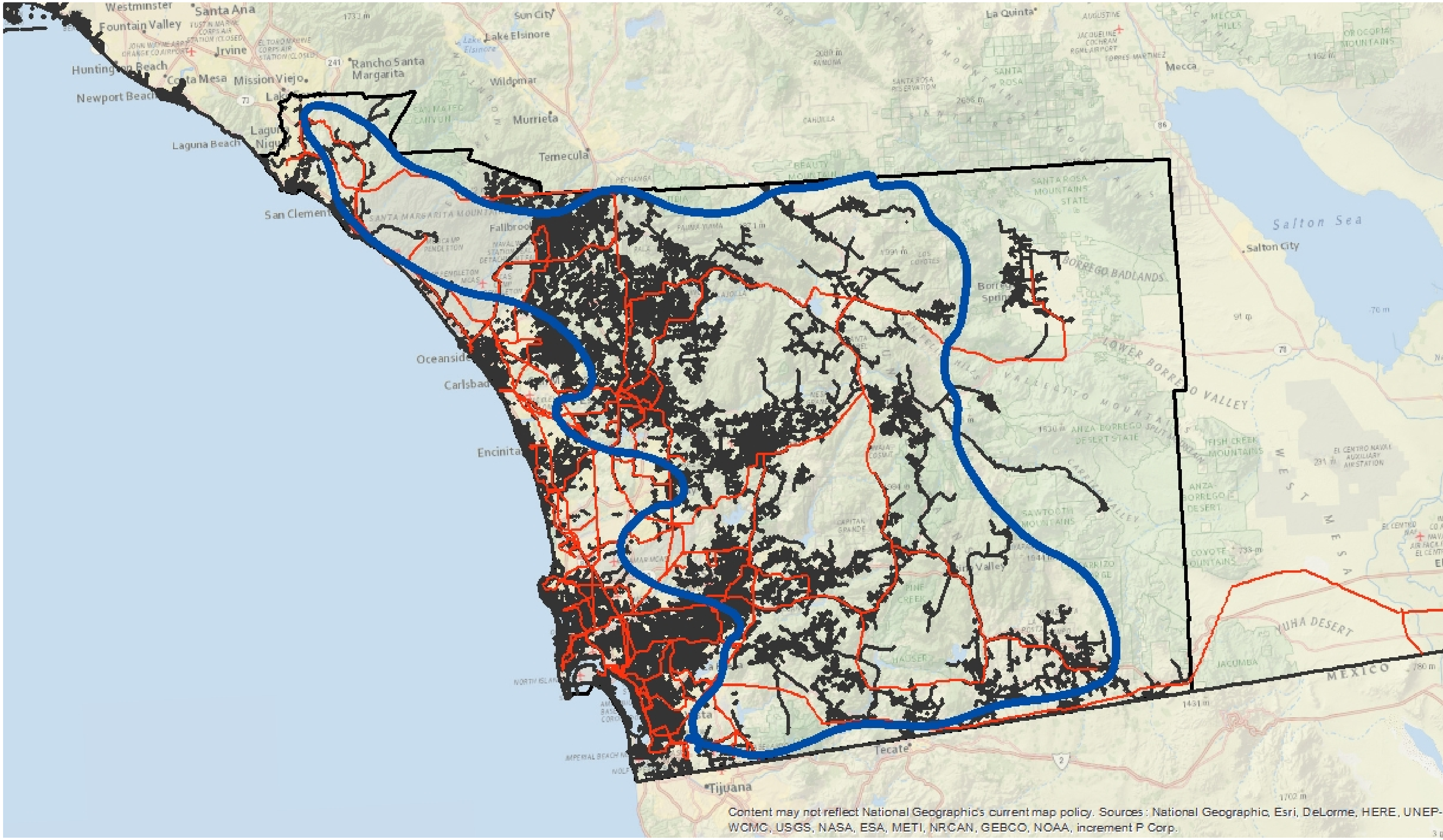
Consider CALFIRE Fire Threat data



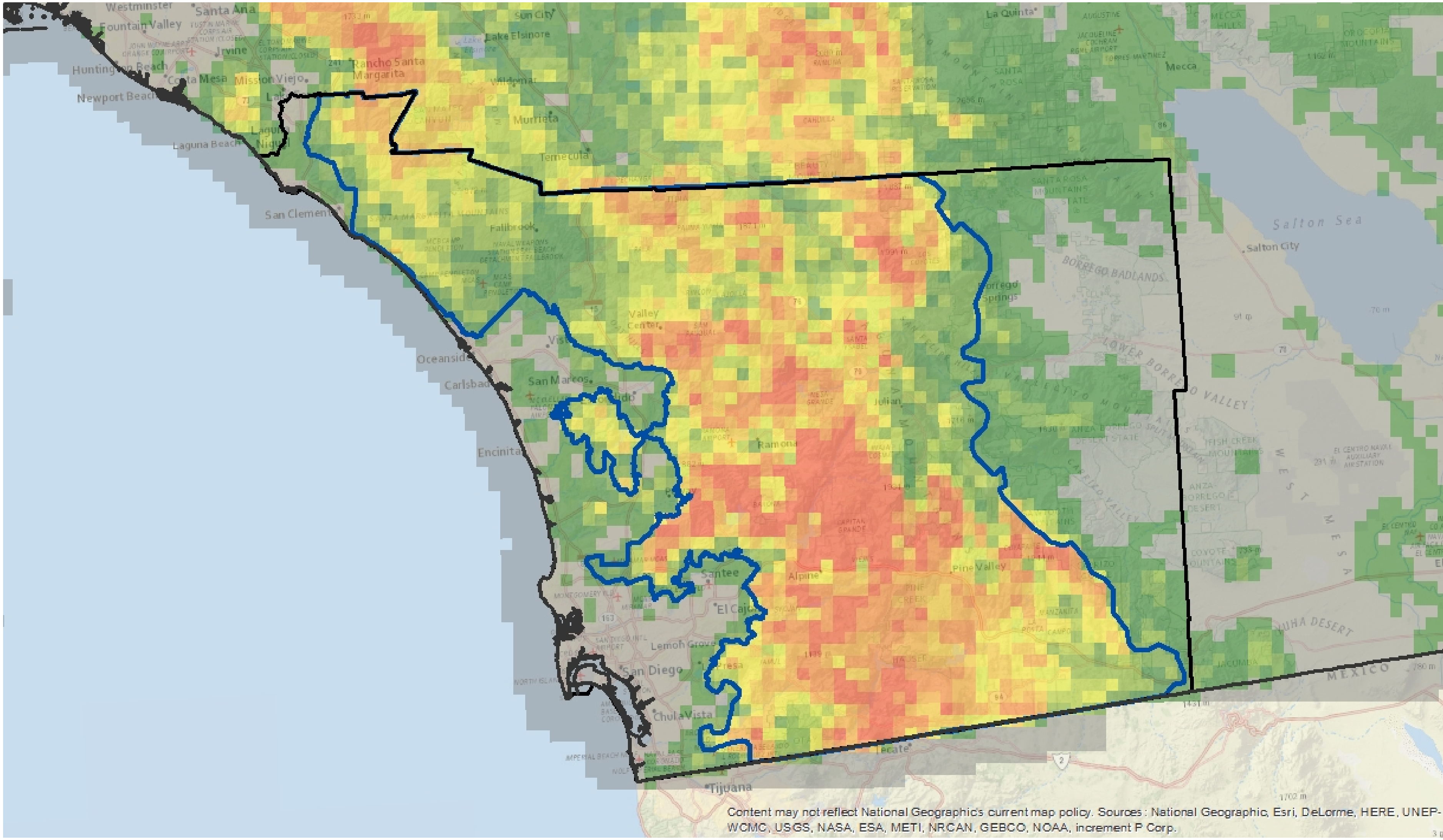
Consider historical fires
(from all causes)



Understand how the electric system is framed by the data.

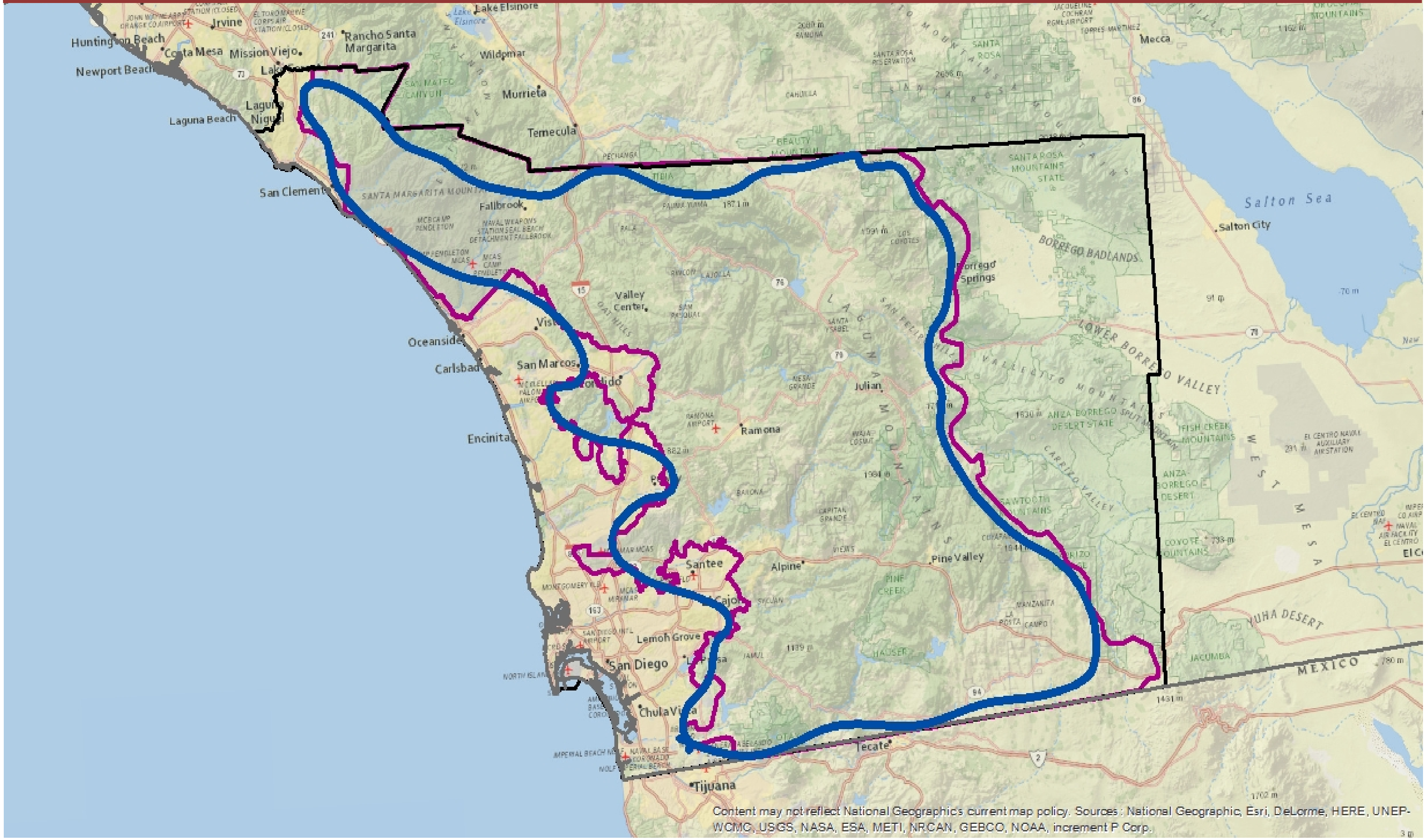


SDG&E pilot

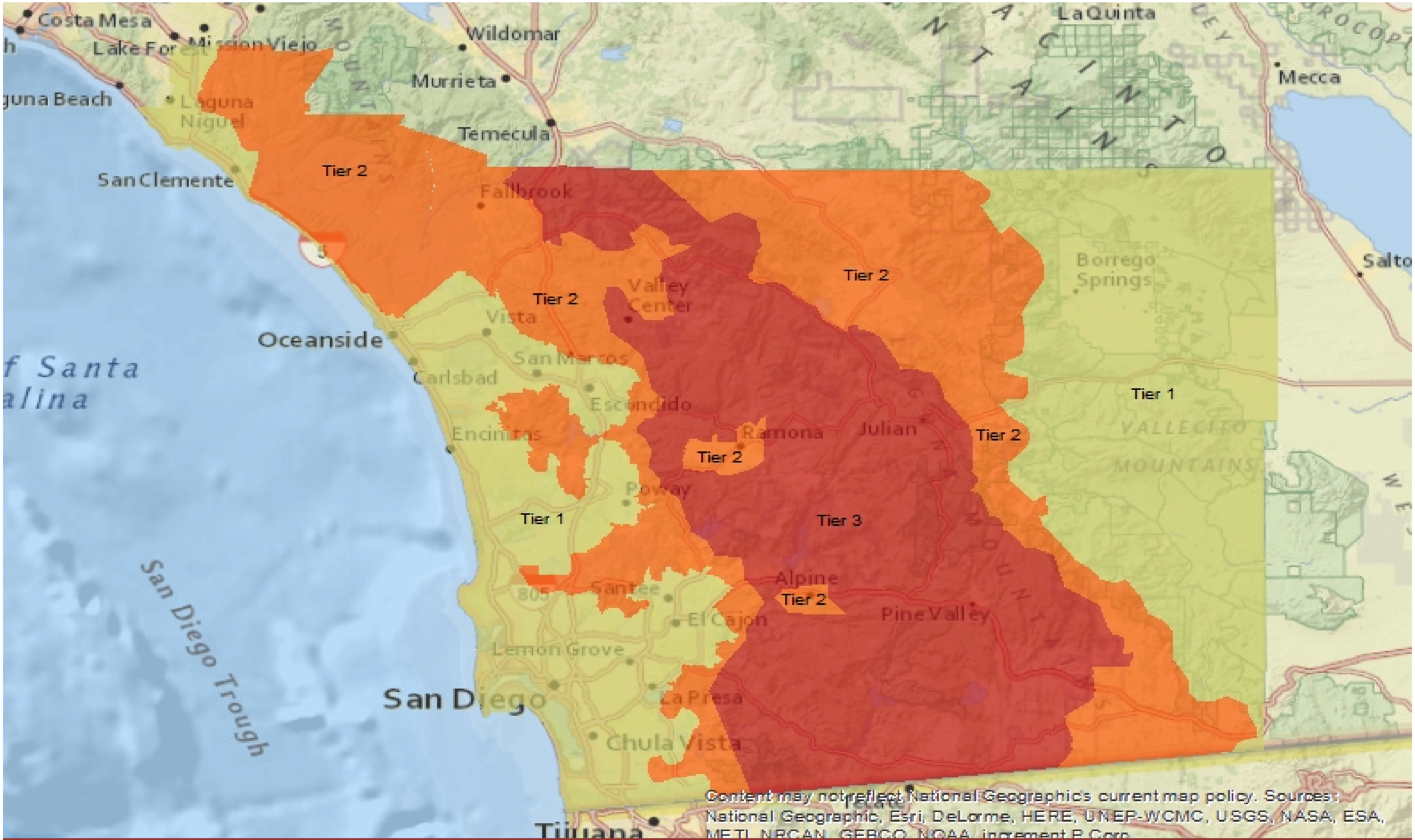


Westminster
Santa Ana
Fountain Valley
Irvine
Huntington Beach
Costa Mesa
Newport Beach
Mission Viejo
Rancho Santa Margarita
Laguna Beach
San Clemente
Sun City
Lake Elsinore
Wildomar
Murrieta
Temecula
La Quinta
Mecca
Salton Sea
Salton City
Fallbrook
Oceanside
Carlsbad
Vista
San Marcos
Escondido
Encinitas
Valley Center
Borrego Springs
BORREGO BADLANDS
Julian
Ramona
Santee
El Cajon
Alpine
Pine Valley
Lemon Grove
San Diego
La Presa
Chula Vista
Tecate
Tijuana
MEXICO
Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

SDG&E Pilot


Lake Elsinore
Irvine
Huntington Beach
Costa Mesa
Mission Viejo
Newport Beach
Rancho Santa Margarita
Wildomar
Murrieta
Temecula
Laguna Beach
San Clemente
Fallbrook
Valley Center
Oceanside
Carlsbad
San Marcos
Encinitas
Ramona
Julian
Borrego Springs
BORREGO BADLANDS
Salton Sea
Salton City
Mecca
Santee
Alpine
Pine Valley
Lemon Grove
San Diego
Tecate
Tijuana
MEXICO
YUHA DESERT
SANTA ROSA MOUNTAINS
LAGUNA MOUNTAINS
Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Develop "tiers" within the designated area
(One "Normal" tier, and two "Fire Threat District" tiers)



SDG&E / IOU Brief Methodology

Statewide process shown in later slides

SDG&E Fire History and Lessons Learned

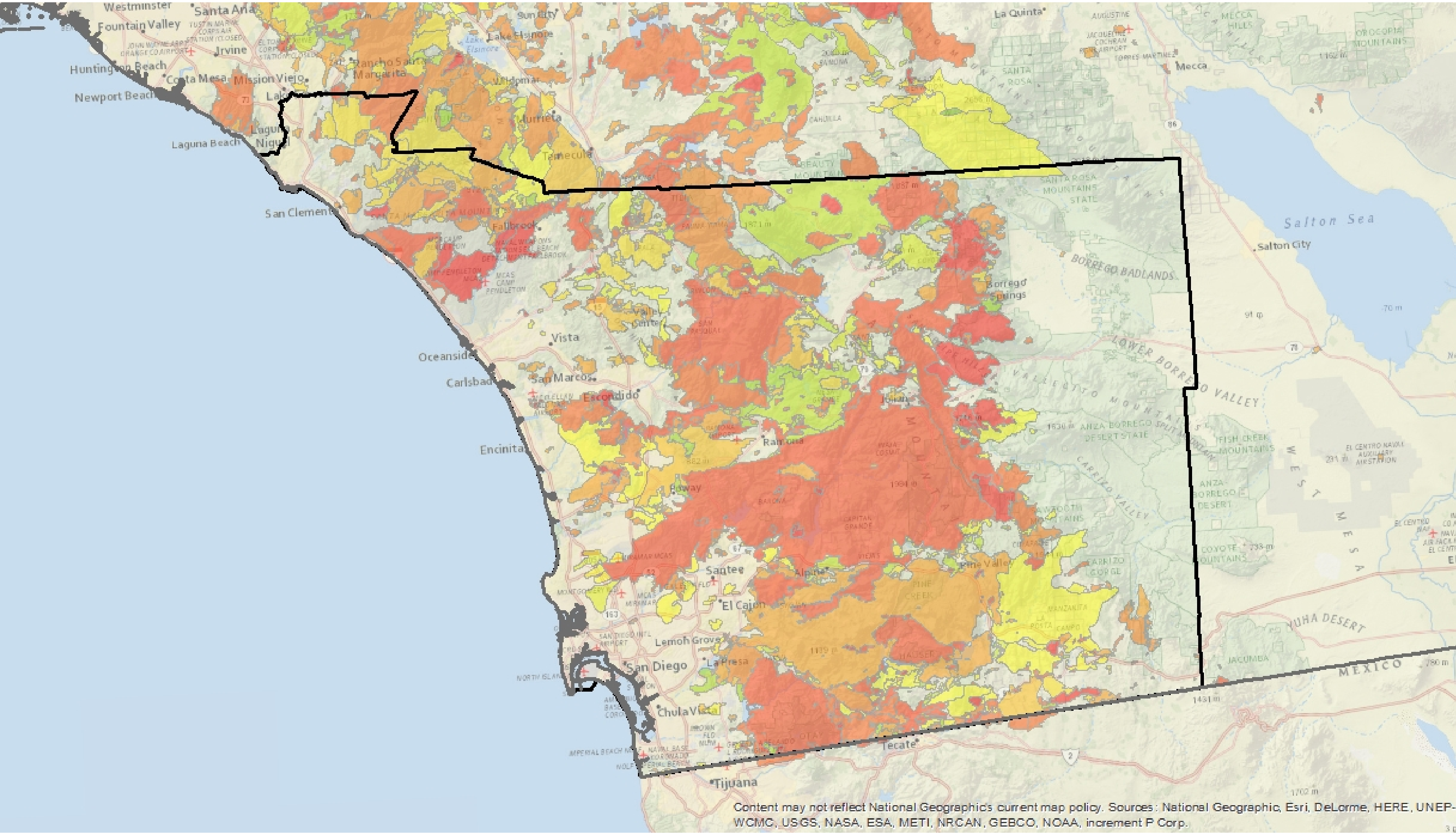
Subject: Fires of Consequence in San Diego, and what SDG&E has done about them.

Rationale: Important to see how SDG&E responded to the 2007 fires, the types of data and analysis that was undertaken, and what kind of programs might be considered at the statewide level.

Fire History

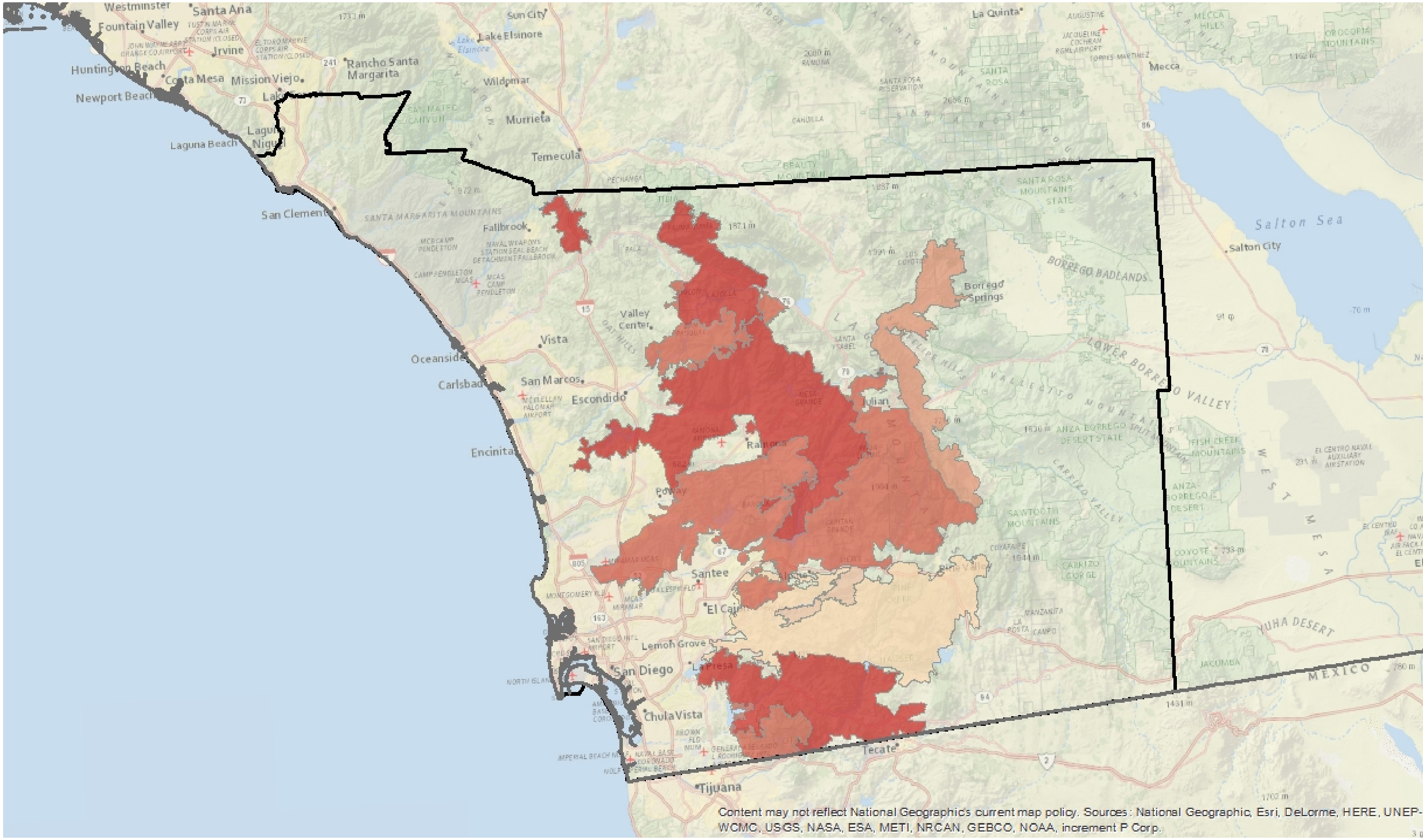
- San Diego and Orange Counties have a long fire history (see next slide)
- Fires have been due to all types of causes. Some examples:
  – Arson
  – Electric Powerline
  – Cooking
  – Signal Fire
  – Thrown Cigarette
  – Vegetation Burn

Fire History



All Fires in San Diego that are in the CAL FIRE GIS database.

Fire History



Fires in San Diego of particular interest from the CAL FIRE GIS database.

Fires That Show up on CALFIRE's "Top 20" lists

Name	Year	Cause	Acres	Buildings	Deaths
Hauser	1943	Human	13,145	0	11
Inaja	1956	Human	43,904	0	11
Laguna	1970	Powerline	175,425	382	8
Cedar	2003	Human	273,246	2820	15
Harris	2007	Migrant Camp	90,440	255	8
Witch	2007	Powerline	197,990	1650	2

The Laguna, Cedar, and Witch fires are the **ONLY** fires in California history that appear on CALFIRE's Top 20 list for a) acres, b) structures lost, and c) lives lost.

California Fire History

Top 20 Largest California Wildfires

	FIRE NAME *(CAUSE)*	DATE	COUNTY	*ACRES*	STRUCTURES	DEATHS
1	**CEDAR** *(Human Related)*	October 2003	San Diego	**273,246**	2,820	15
2	**RUSH** *(Lightning)*	August 2012	Lassen	**271,911 CA / 43,666 NV**	0	0
3	**RIM** *(Human Related)*	August 2013	Tuolumne	**257,314**	112	0
4	**ZACA** *(Human Related)*	July 2007	Santa Barbara	**240,207**	1	0
5	**MATILIJA** *(Undetermined)*	September 1932	Ventura	**220,000**	0	0
6	**WITCH** *(Powerlines)*	October 2007	San Diego	**197,990**	1,650	2
7	**KLAMATH THEATER COMPLEX** *(Lightning)*	June 2008	Siskiyou	**192,038**	0	2
8	**MARBLE CONE** *(Lightning)*	July 1977	Monterey	**177,866**	0	0
9	**LAGUNA (POWERLINES)**	September 1970	San Diego	**175,425**	382	5
10	**BASIN COMPLEX** *(Lightning)*	June 2008	Monterey	**162,818**	58	0
11	**DAY FIRE** *(Human Related)*	September 2006	Ventura	**162,702**	11	0
12	**STATION FIRE** *(Human Related)*	August 2009	Los Angeles	**160,557**	209	2
13	**McNALLY** *(Human Related)*	July 2002	Tulare	**150,696**	17	0
14	**STANISLAUS COMPLEX** *(Lightning)*	August 1987	Tuolumne	**145,980**	28	1
15	**BIG BAR COMPLEX** *(Lightning)*	August 1999	Trinity	**140,948**	0	0
16	**HAPPY CAMP COMPLEX** *(Lightning)*	August 2014	Siskiyou	**134,056**	6	0
17	**CAMPBELL COMPLEX** *(Powerlines)*	August 1990	Tehama	**125,892**	27	0
18	**ROUGH** *(Lightning)*	July 2015	Fresno	**119,069**	4	0
19	**WHEELER** *(Arson)*	July 1985	Ventura	**118,000**	26	0
20	**SIMI** *(Under Investigation)*	October 2003	Ventura	**108,204**	300	0

Top 20 Most Damaging California Wildfires

	FIRE NAME *(CAUSE)*	DATE	COUNTY	ACRES	*STRUCTURES*	DEATHS
1	**TUNNEL - Oakland Hills** *(Rekindle)*	October 1991	Alameda	1,600	**2,900**	25
2	**CEDAR** *(Human Related)*	October 2003	San Diego	273,246	**2,820**	15
3	**VALLEY** *(Under Investigation)*	September 2015	Lake, Napa & Sonoma	76,067	**1,955**	4
4	**WITCH** *(Powerlines)*	October 2007	San Diego	197,990	**1,650**	2
5	**OLD** *(Human Related)*	October 2003	San Bernardino	91,281	**1,003**	6
6	**JONES** *(Undetermined)*	October 1999	Shasta	26,200	**954**	1
7	**BUTTE** *(Under Investigation)*	September 2015	Amador & Calaveras	70,868	**921**	2
8	**PAINT** *(Arson)*	June 1990	Santa Barbara	4,900	**641**	1
9	**FOUNTAIN** *(Arson)*	August 1992	Shasta	63,960	**636**	0
10	**SAYRE** *(Misc.)*	November 2008	Los Angeles	11,262	**604**	0
11	**CITY OF BERKELEY** *(Powerlines)*	September 1923	Alameda	130	**584**	0
12	**HARRIS** *(Under Investigation)*	October 2007	San Diego	90,440	**548**	8
13	**BEL AIR** *(Undetermined)*	November 1961	Los Angeles	6,090	**484**	0
14	**LAGUNA** *(Arson)*	October 1993	Orange	14,437	**441**	0
15	**ERSKINE** *(Under Investigation)*	June 2016	Kern	46,684	**386**	2
16	**LAGUNA** *(Powerlines)*	September 1970	San Diego	175,425	**382**	0
17	**HUMBOLDT** *(Arson)*	June 2008	Butte	23,344	**351**	4
18	**PANORAMA** *(Arson)*	November 1980	San Bernardino	23,600	**325**	3
19	**TOPANGA** *(Arson)*	November 1993	Los Angeles	18,000	**323**	0
20	**49ER** (Illegal Debris Burning)	September 1988	Nevada	33,700	**312**	0

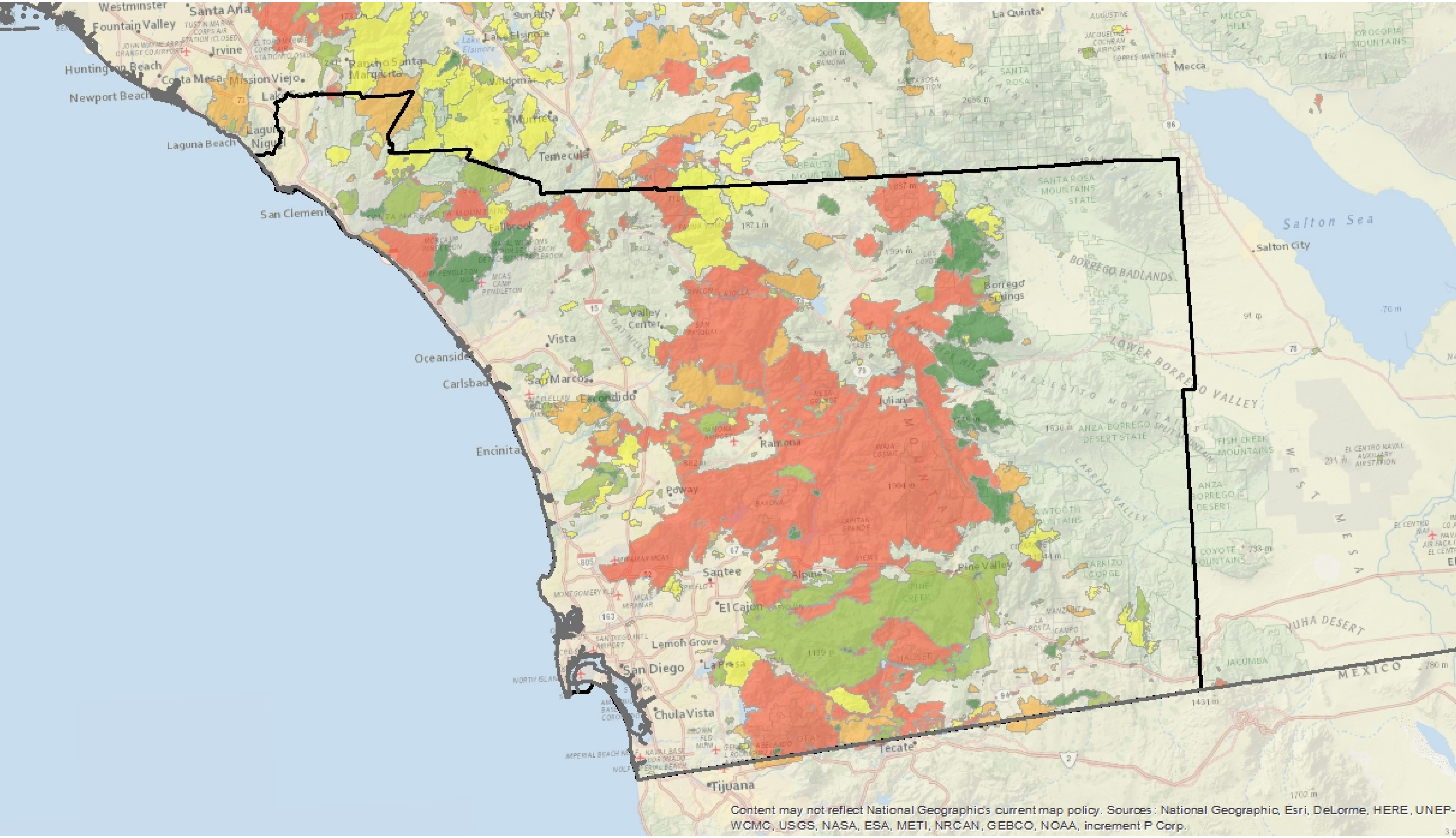
Top 20 Deadliest California Wildfires

	FIRE NAME *(CAUSE)*	DATE	COUNTY	ACRES	*STRUCTURES*	DEATHS
1	**GRIFFITH PARK** *(Unknown)*	October 1933	Los Angeles	47	0	**29**
2	**TUNNEL - Oakland Hills** *(Rekindle)*	October 1991	Alameda	1,600	2,900	**25**
3	**CEDAR** *(Human Related)*	October 2003	San Diego	273,246	2,820	**15**
4	**RATTLESNAKE** *(Arson)*	July 1953	Glenn	1,340	0	**15**
5	**LOOP** *(Unknown)*	November 1966	Los Angeles	2,028	0	**12**
6	**INAJA** *(Human Related)*	November 1956	San Diego	43,904	0	**11**
7	**HAUSER CREEK** *(Human Related)*	October 1943	San Diego	13,145	0	**11**
8	**IRON ALPS COMPLEX** *(Lightning)*	August 2008	Trinity	105,855	10	**10**
9	**HARRIS** *(Under Investigation)*	October 2007	San Diego	90,440	548	**8**
10	**CANYON** *(Unknown)*	August 1968	Los Angeles	22,197	0	**8**
11	**OLD** *(Human Related)*	October 2003	San Bernardino	91,281	1,003	**6**
12	**DECKER** *(Vehicle)*	August 1959	Riverside	1,425	1	**6**
13	**HACIENDA** *(Unknown)*	September 1955	Los Angeles	1,150	0	**6**
14	**ESPERANZA** *(Arson)*	October 2006	Riverside	40,200	54	**5**
15	**LAGUNA** *(Powerlines)*	September 1970	San Diego	175,425	382	**5**
16	**VALLEY** *(Under Investigation)*	September 2015	Lake, Napa & Sonoma	76,067	1,955	**4**
17	**PANORAMA** *(Arson)*	November 1980	San Bernardino	23,600	325	**4**
18	**CLAMPITT** *(Powerlines)*	September 1970	Los Angeles	105,212	86	**4**
19	**TOPANGA** *(Arson)*	August 2009	Los Angeles	18,000	323	**3**
20	**BUTTE** *(Under Investigation)*	September 2015	Amador & Calaveras	70,868	921	**2**

SDG&E Fire Data

- Historical fires
  - All fires, and focus on “damaging” fires
- Ignition data associated to utility
- Asset Management
  - Maps, equipment location, types of equipment
- Reliability studies
  - Highly accurate outage data since 1981
    - Location, cause, customers affected
- Wind studies
  - Academic study that modeled 50 years of weather
- Wildfire Risk Reduction Model
  - Fire behavior at every pole in service
  - Under various known local conditions

Fire History



Fires in San Diego that are in CALFIRE GIS data since 1970.

Fire History

- Cause categories:
  - External Contact with Equipment
    - Examples: Plant, animal, man-made
  - Equipment Failure
    - Examples: workmanship, beyond useful life
  - Construction / Transportation
    - Example: Welding

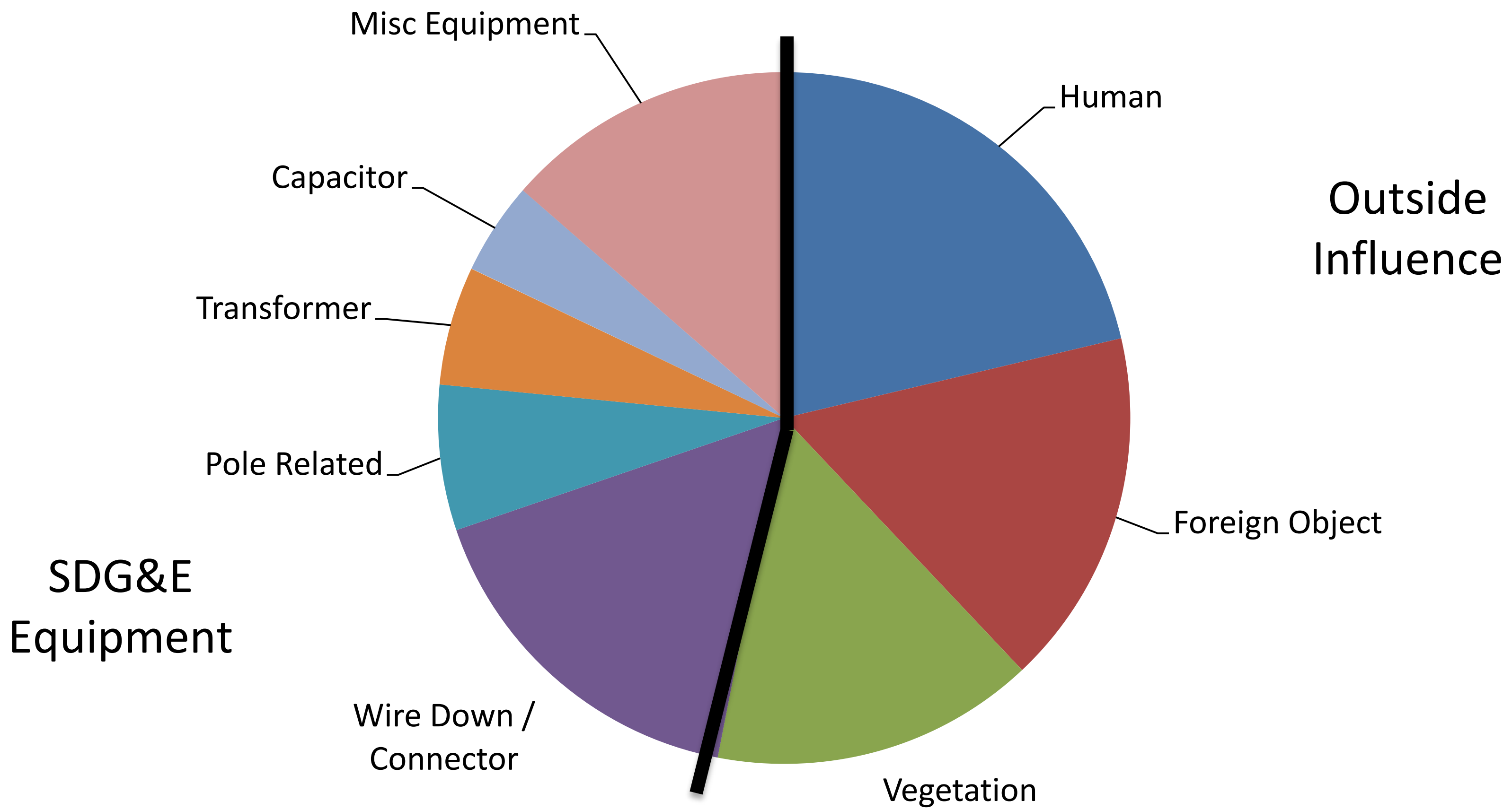
- Ignition Modes:
  - Electricity directly into flammable material
    - Electric system out of specifications
    - Example: wire down into dry grass
  - Secondary ignition
    - Electric system within specifications
    - Example: bird touching wires becomes ignited then falls to ground
  - Utility equipment sparking
    - Example: material from blown fuses lands in brush

Fire History

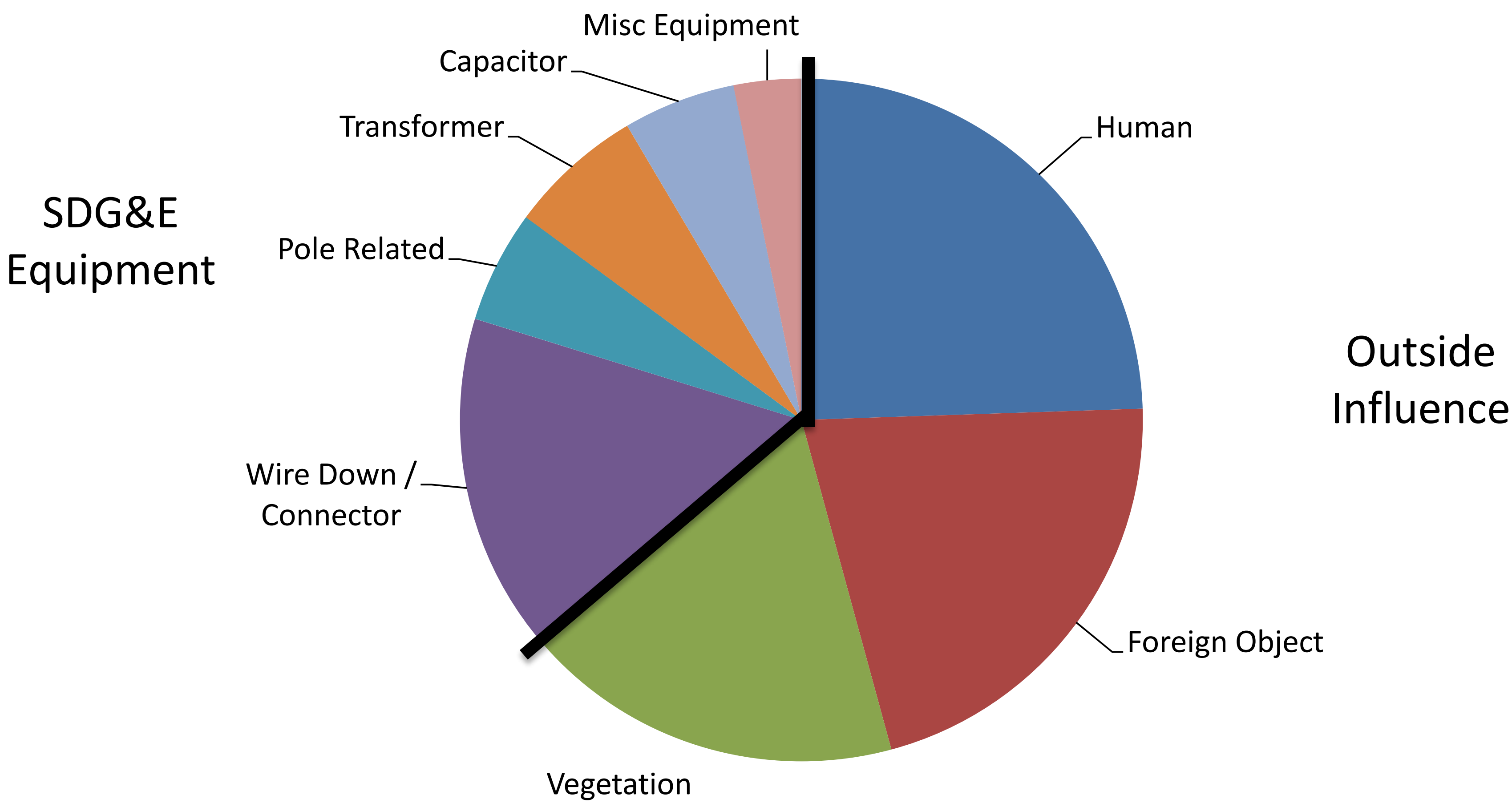
- Nearly all of San Diego's vegetated wildland has burned at least once in the last several decades.
- All fires – regardless of cause – should be considered when analyzing threats to the public
  - A previous large fire is a sign that conditions (weather, fuel, topography) could be present for a future fire when conditions return.

- Since 2003, SDG&E has been tracking all ignitions that are related to its facilities
  - No single cause of ignition is a majority of ignitions
  - Large amount not equipment failure related
    - Contacts from animal, vegetation, mylar balloon, vehicle, etc.
  - No silver bullet to eliminate majority of ignitions

- Top Ignition Causes – All Weather Conditions



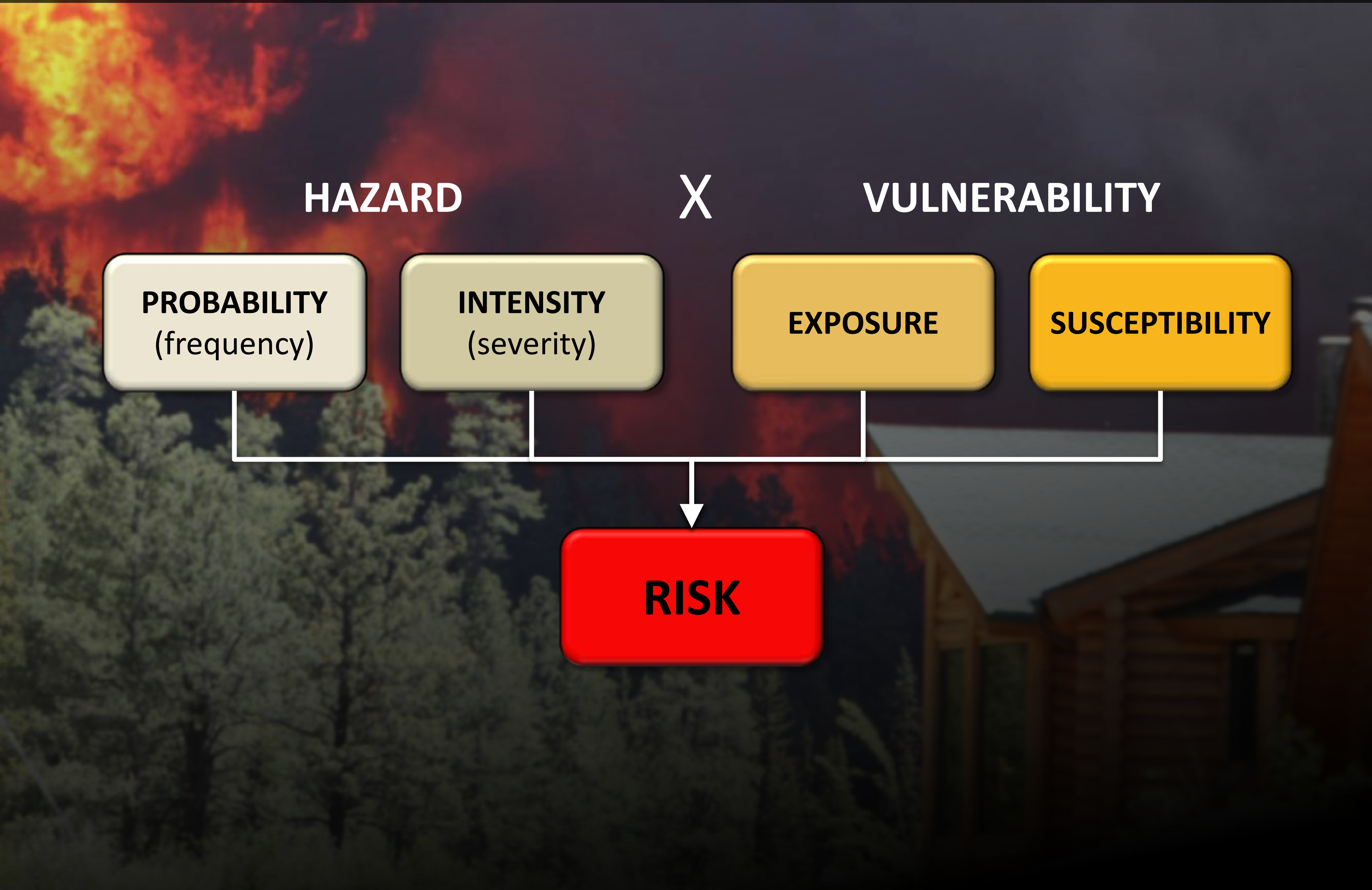
- Top Ignition Causes – Fire Weather Days

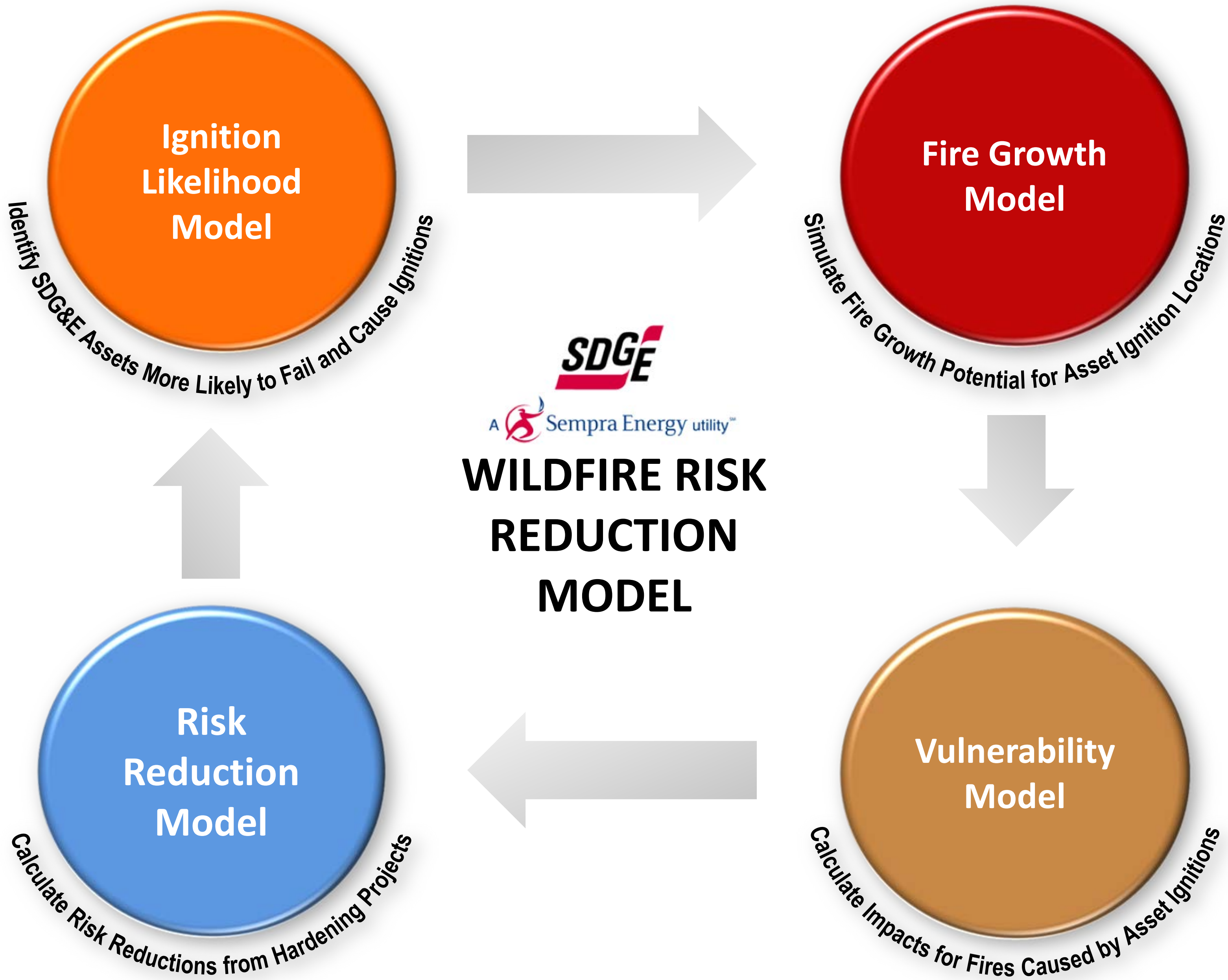


- Ignition Data led to targeted programs
  - Capacitor change outs
  - Non-expulsion fuses
  - Transformer studies
  - Connector standards and conductor replacements
  - Change in standard for grounding wires
- Wind is a double whammy:
  - Ignition and electric outage rates rise in strong wind.
  - Winds make fires harder to suppress


SDG&E WILDFIRE RISK
REDUCTION MODEL

QUANTITATIVE RISK FRAMEWORK

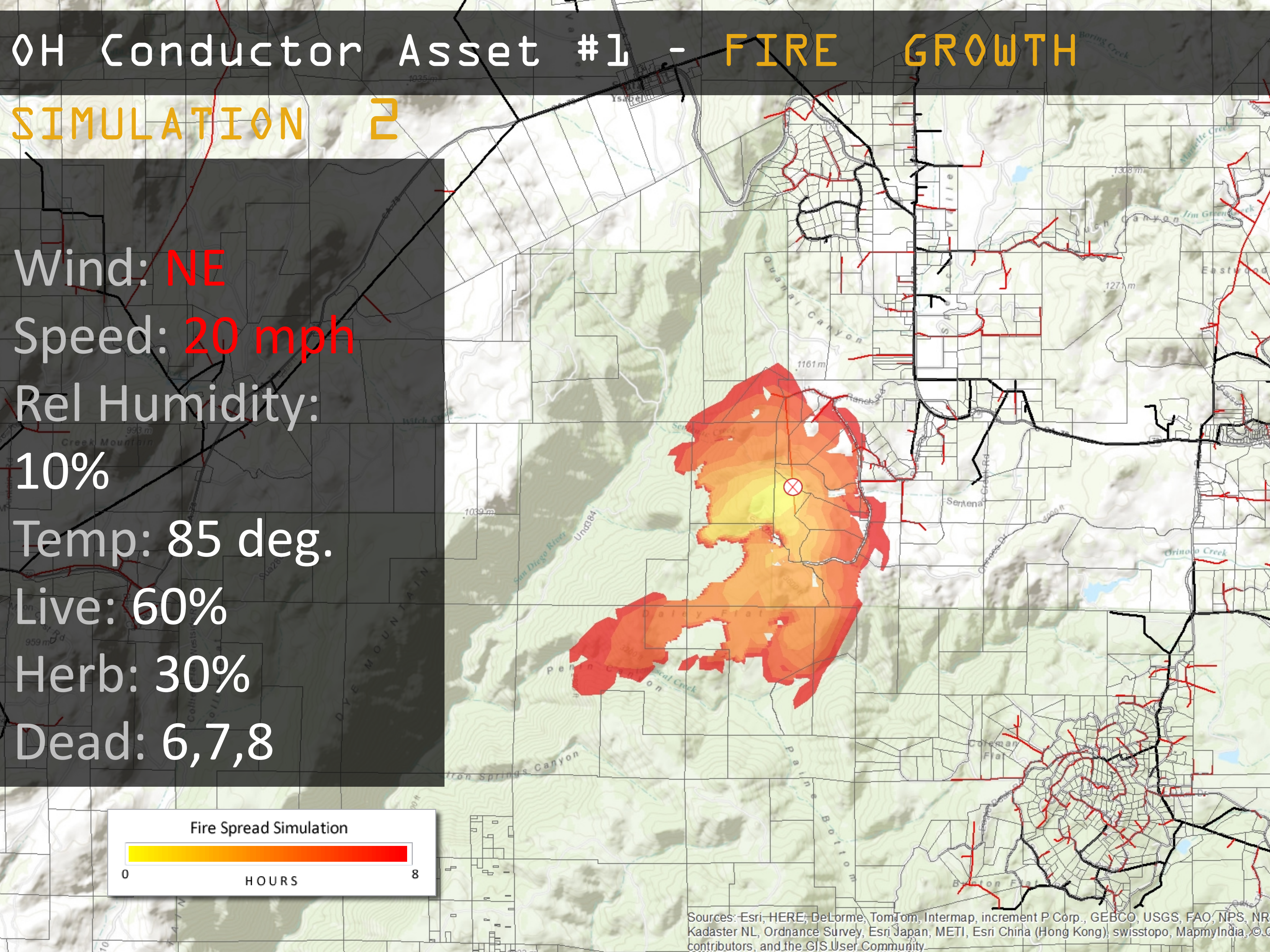




Ignition Likelihood Model
Identify SDG&E Assets More Likely to Fail and Cause Ignitions
Fire Growth Model
Simulate Fire Growth Potential for Asset Ignition Locations
SDGE
A Sempra Energy utility
WILDFIRE RISK REDUCTION MODEL
Vulnerability Model
Calculate Impacts for Fires Caused by Asset Ignitions
Risk Reduction Model
Calculate Risk Reductions from Hardening Projects

OH Conductor Asset #1 - FIRE GROWTH SIMULATION 2

Wind: NE
Speed: 20 mph
Rel Humidity: 10%
Temp: 85 deg.
Live: 60%
Herb: 30%
Dead: 6,7,8



OH Conductor Asset #1 - FIRE GROWTH SIMULATION 3

Wind: NE

Speed: 30 mph

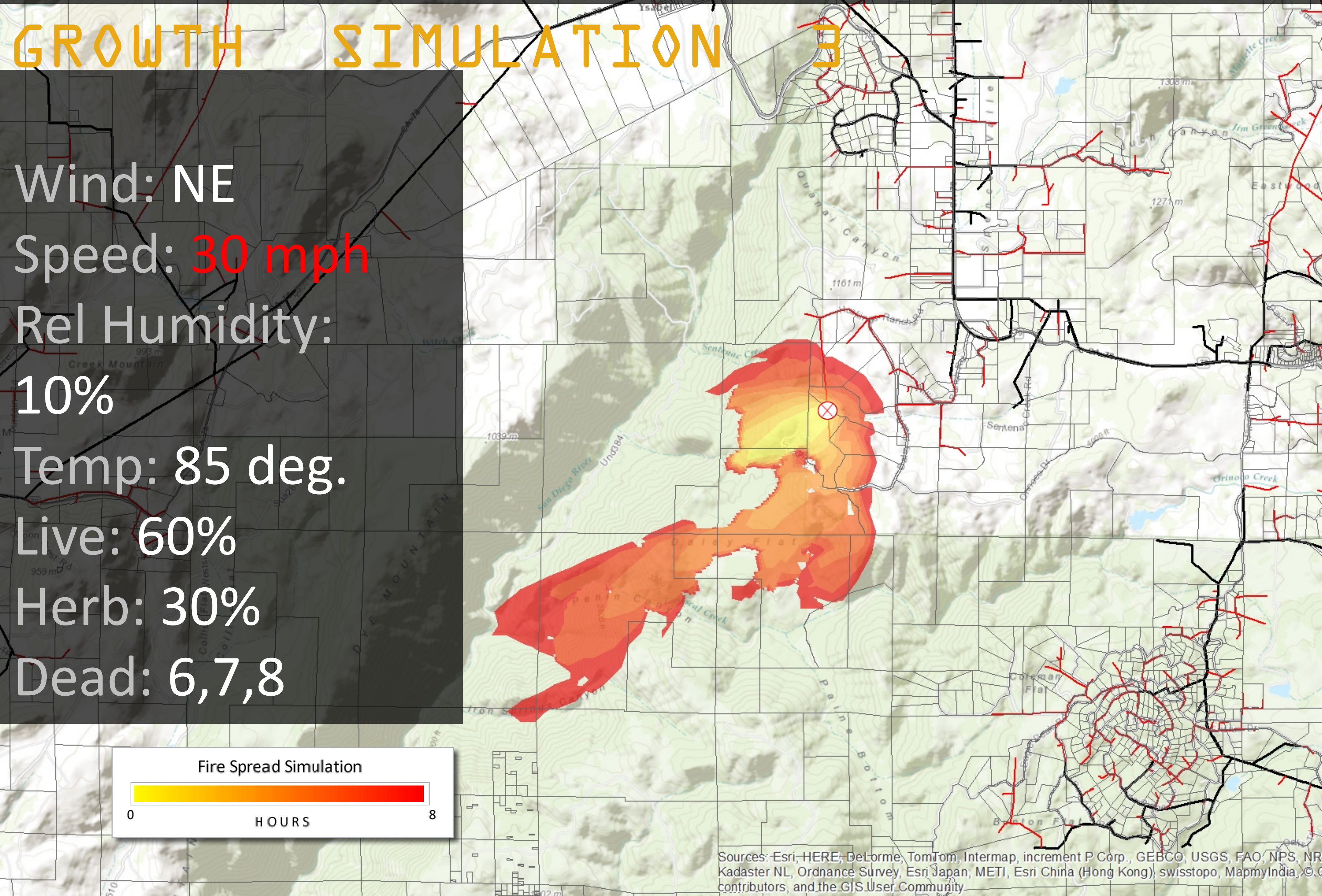
Rel Humidity: 10%

Temp: 85 deg.

Live: 60%

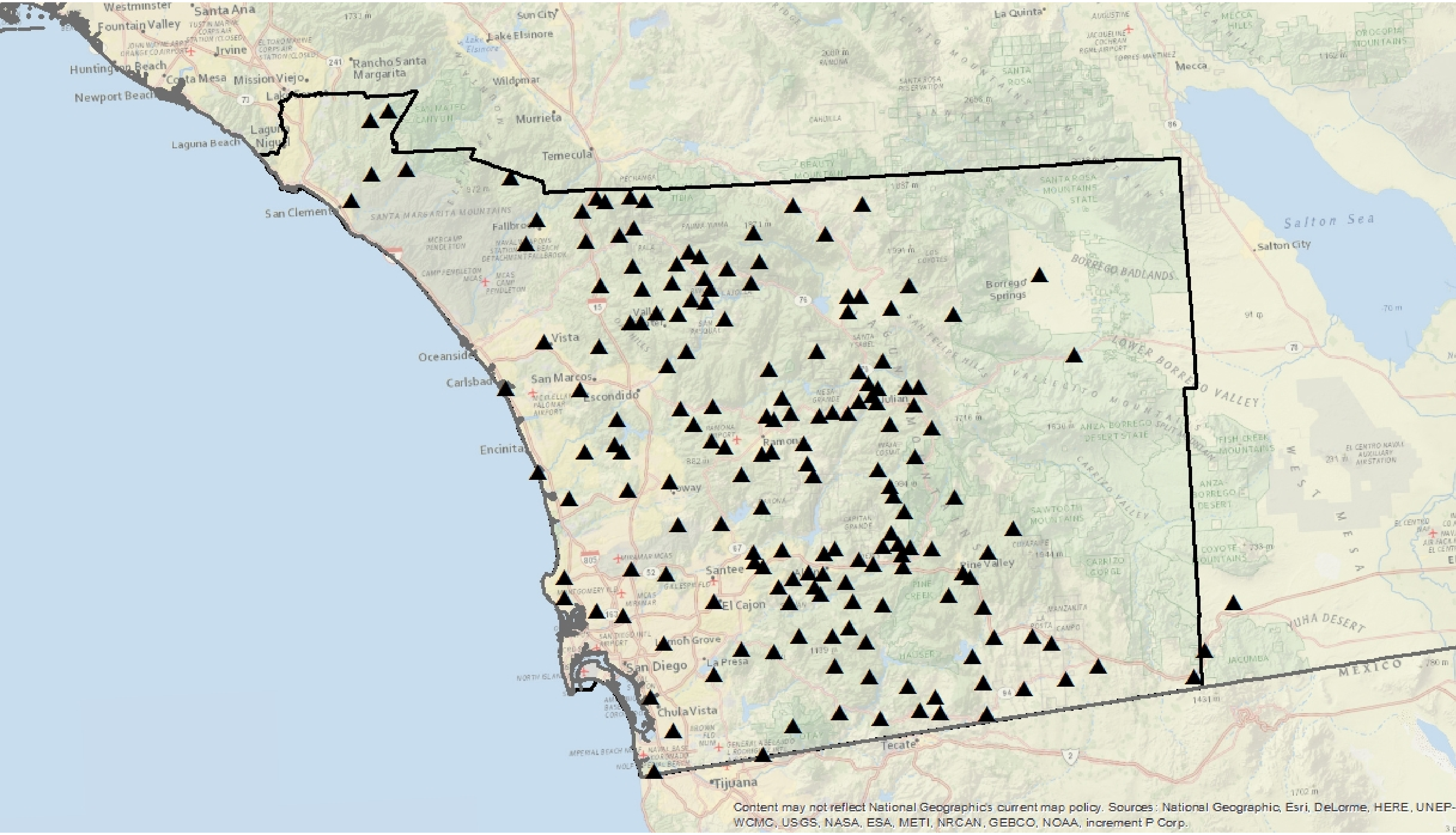
Herb: 30%

Dead: 6,7,8



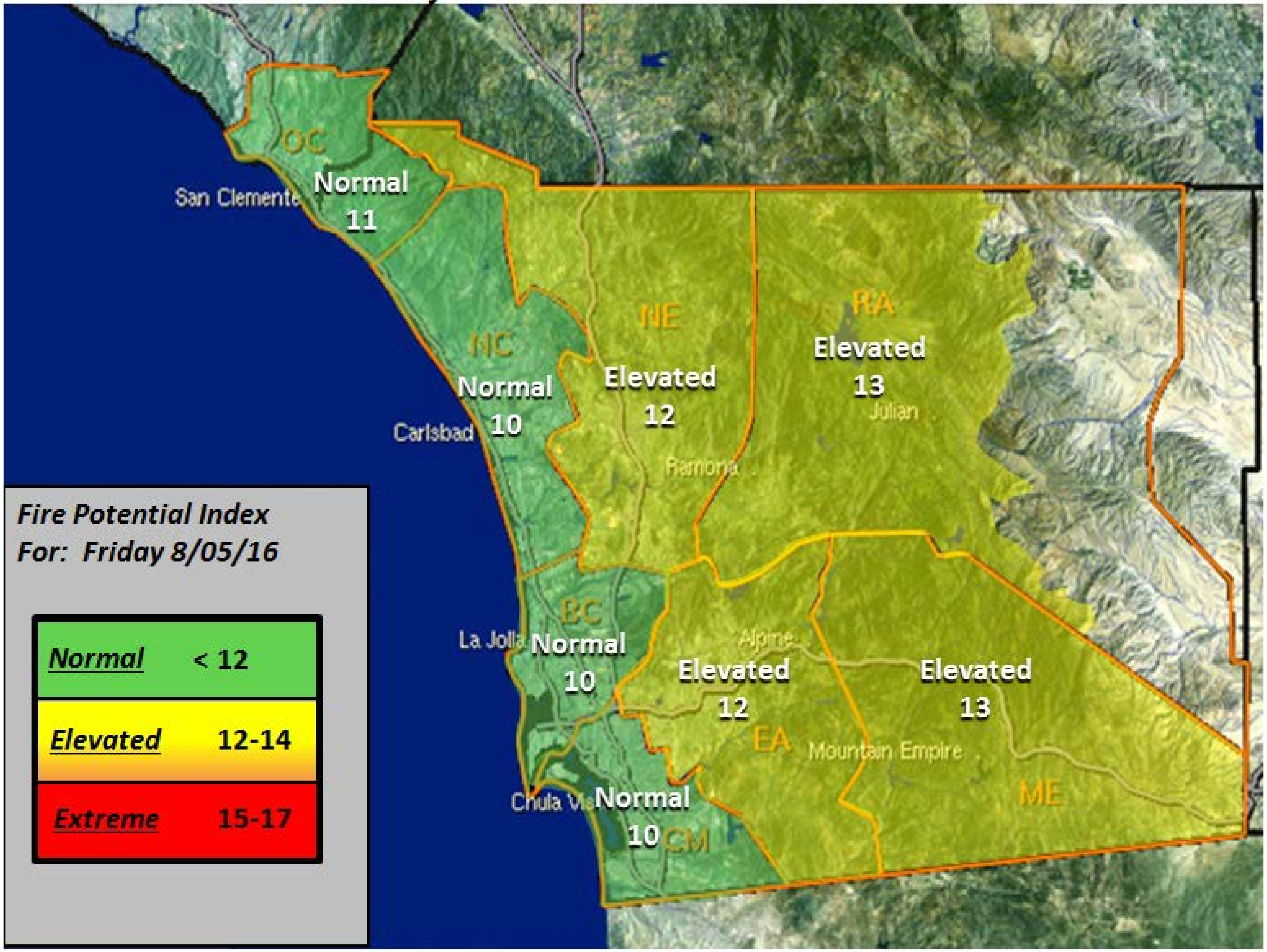
- Situational Awareness:
  - Fire Potential Index (FPI), SAWTI
  - Safety focused operating procedures based on FPI
  - System Protection settings based on FPI
  - Operational decisions for power restoration based on FPI

SDG&E Weather Network



SDG&E Fire Potential Index (FPI)

Fire Potential Index for Friday 8/05/16:



SDG&E Fire Potential Index (FPI)

Seven Day FPI Outlook:

	Today 8/04	Fri 8/05	Sat 8/06	Sun 8/07	Mon 8/08	Tue 8/09	Wed 8/10	Thu 8/11
ME	Elevated 12	Elevated 13	Elevated 13	Elevated 13	Elevated 13	Elevated 13	Elevated 13	Elevated 13
RA	Elevated 12	Elevated 13	Elevated 13	Elevated 13	Elevated 13	Elevated 13	Elevated 13	Elevated 13
EA	Elevated 12	Elevated 12	Elevated 12	Elevated 12	Elevated 12	Elevated 13	Elevated 13	Elevated 13
NE	Elevated 12	Elevated 12	Elevated 12	Elevated 12	Elevated 12	Elevated 13	Elevated 13	Elevated 13
OC	Normal 11	Normal 11	Normal 11	Normal 11	Normal 11	Normal 11	Normal 11	Normal 11
NC	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10
BC	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10
CM	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10	Normal 10

Normal	Elevated	Extreme
< 12	12-14	15-17

Santa Ana Wildfire Threat Index (SAWTI)

FORECAST REPORT

Forecast issued at: 02:03 AM **on** 08/04/2016
Valid for: 08/04/2016

Area	Threat Level
Zone 3: San Diego	NO RATING

Event Description
Santa Ana winds are either not expected, or will not contribute to significant fire activity.

Recommended Action(s)
Make sure that your emergency preparedness kit is in order. An emergency can happen at any time. For additional information visit: www.ReadySanDiego.org www.preventwildfireca.org

LEGEND

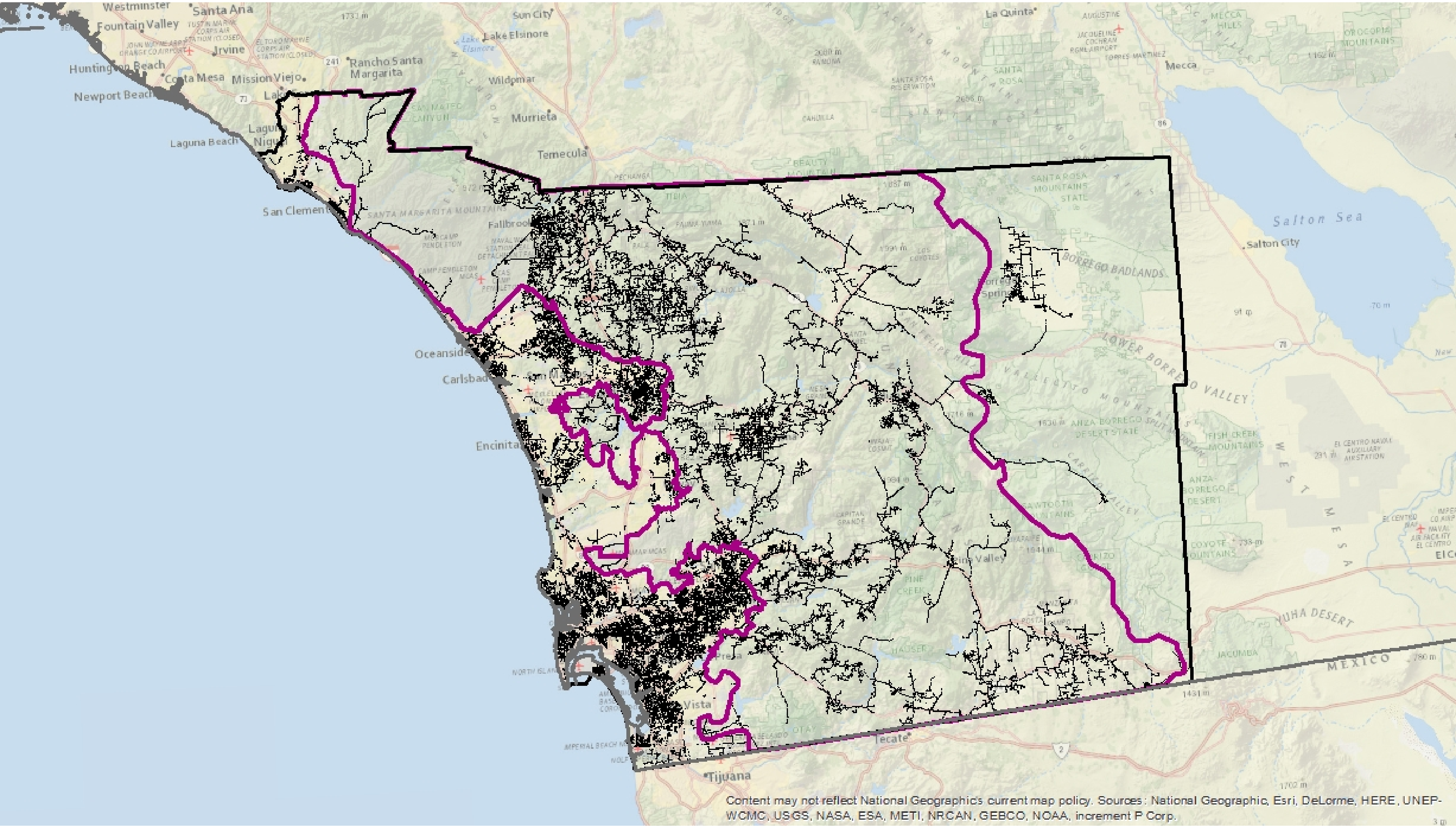
- **NO RATING:** Santa Ana winds are either not expected, *or* will not contribute to significant fire activity.
- **MARGINAL:** Upon ignition, fires *may* grow rapidly.
- **MODERATE:** Upon ignition, fires *will* grow rapidly and *will* be difficult to control.
- **HIGH:** Upon ignition, fires will grow *very* rapidly, will burn intensely, and will be *very* difficult to control
- **EXTREME:** Upon ignition, fires will have extreme growth, will burn *very* intensely, and will be uncontrollable.
- Active fire
- Inactive fire
- Weather observations

ZONES / PREFERRED ZONE	THU / AUG 04	FRI / AUG 05	SAT / AUG 06	SUN / AUG 07	MON / AUG 08	TUE / AUG 09
ZONE 1: LA-VENTURA						
ZONE 2: ORANGE-INLAND EMPIRE						
ZONE 3: SAN DIEGO						
ZONE 4: SANTA BARBARA						

Santa Ana Wildfire Threat Index (SAWTI)

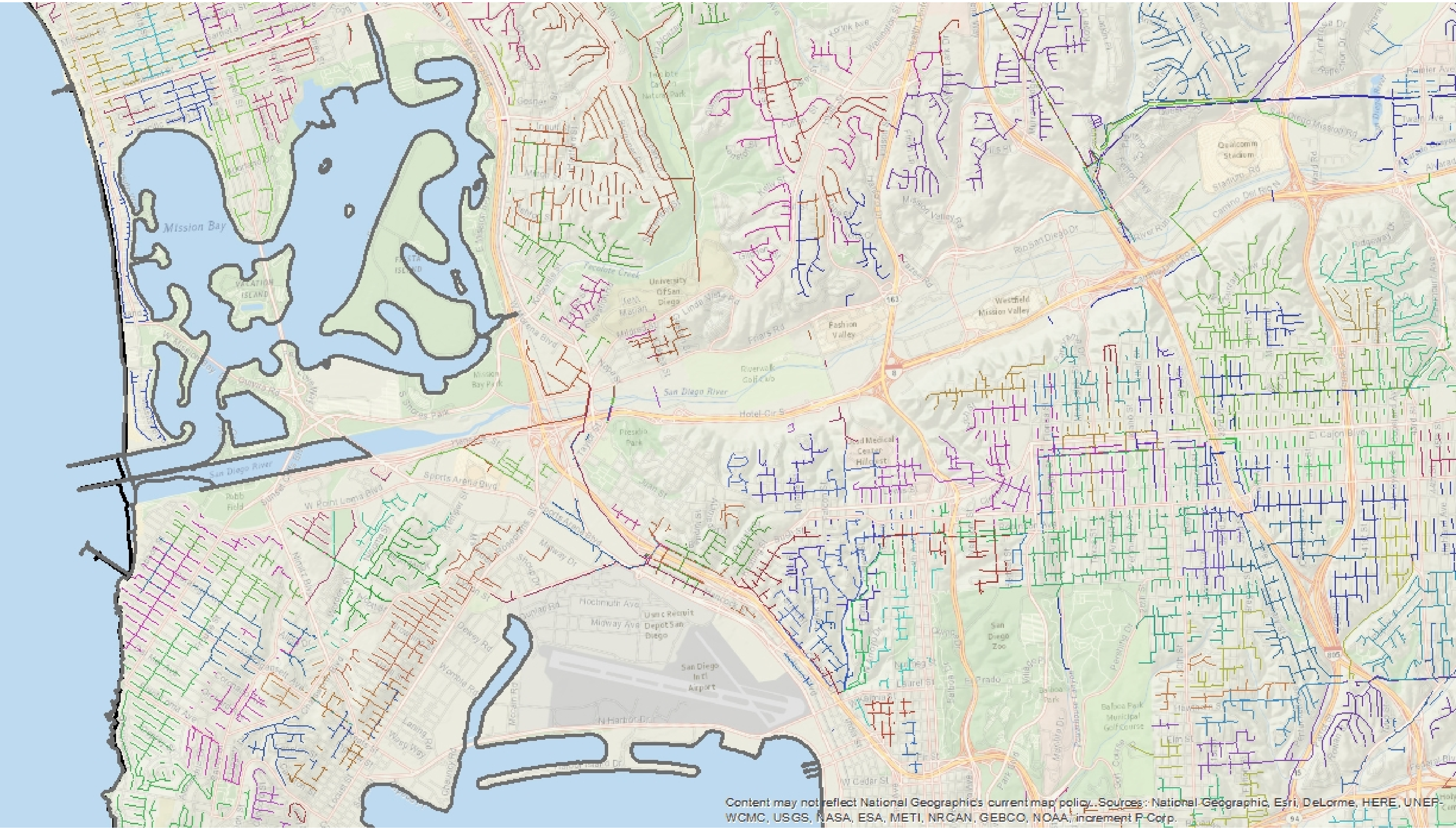
The Santa Ana Wildfire Threat Index (SAWTI) categorizes Santa Ana winds based on anticipated fire potential. The index uses a comprehensive, state-of-the-art predictive model that includes **dead fuel moisture**, **live fuel moisture**, and the **greenness of annual grasses** to create a detailed daily assessment of the fuel conditions across Southern California. This information is coupled with calibrated **weather model output** (comprised of wind speed and atmospheric moisture), to generate a 6-day forecast of Large Fire Potential. The Large Fire Potential output is then compared to climatological data and historical fire occurrence to establish the index rating. This product is produced by the USDA Forest Service and Predictive Services

SDG&E Overhead System



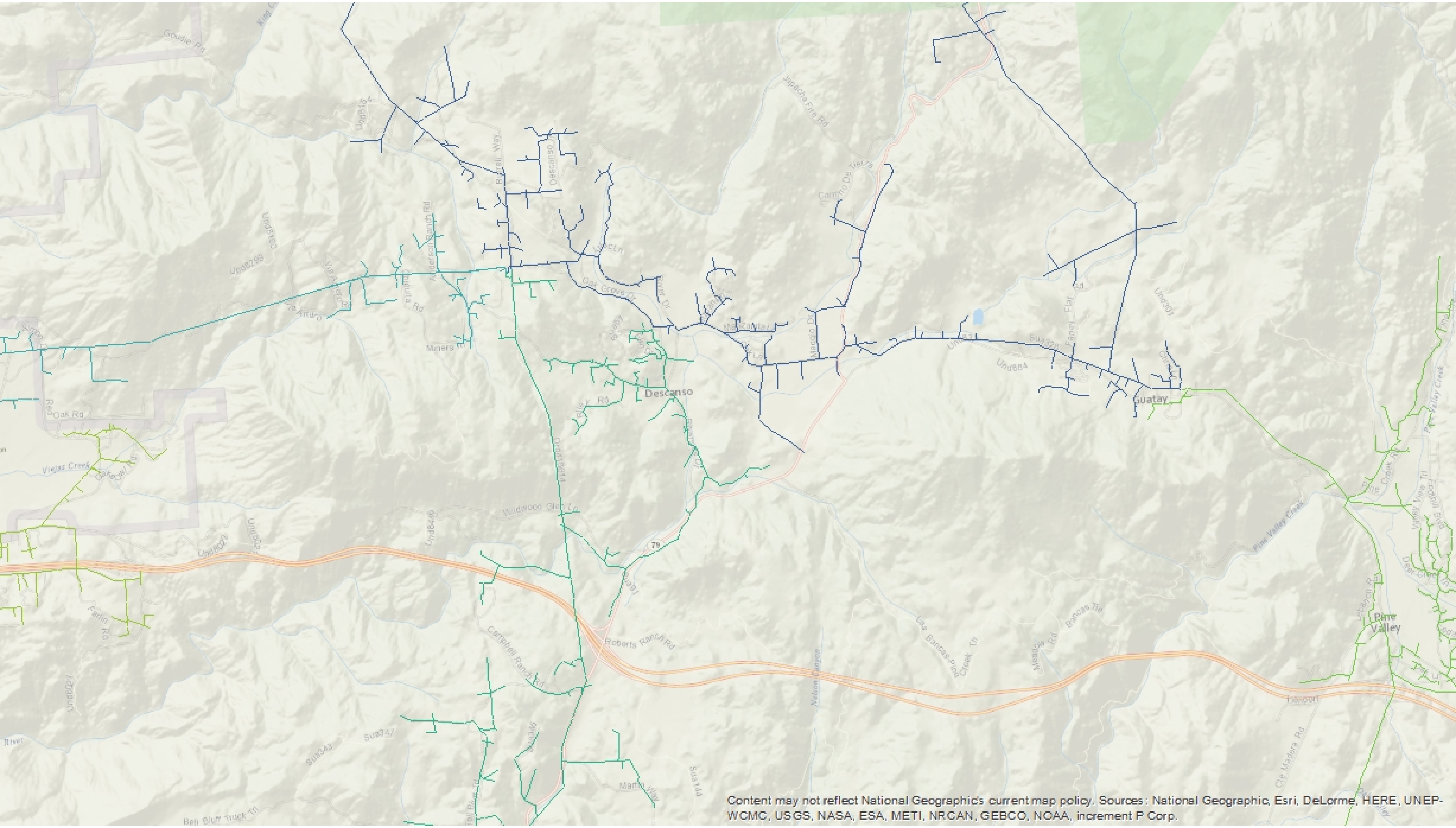
Showing Shape 2

SDG&E Overhead System



Urban circuits

SDG&E Overhead System



Rural Circuits

GIS Presentation

Subject: Randy demonstrating GIS capabilities

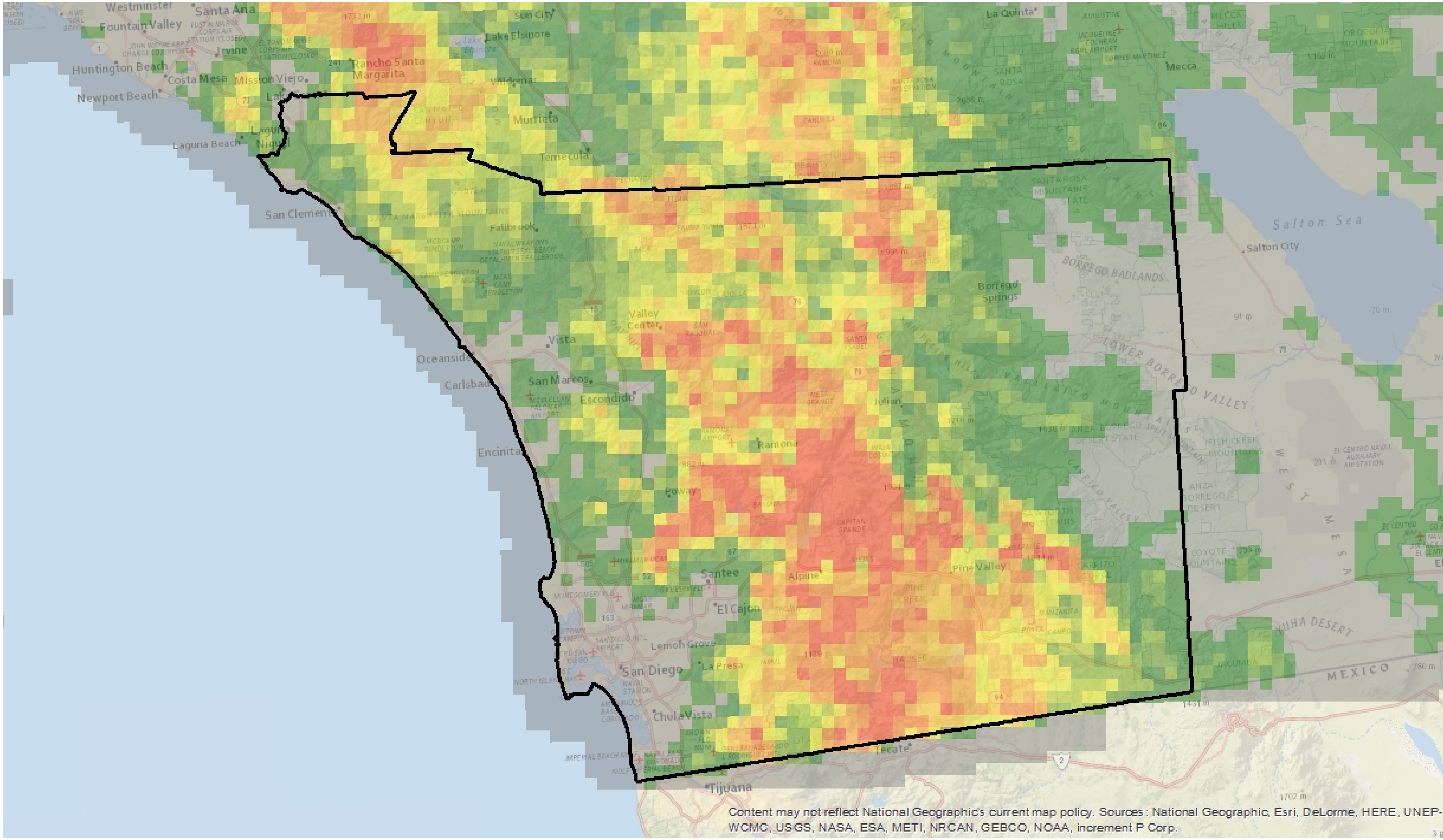
Rationale: Provide clear examples of how geographic-based data is brought together, visualized, and created.

SDG&E / IOU Method Expanded

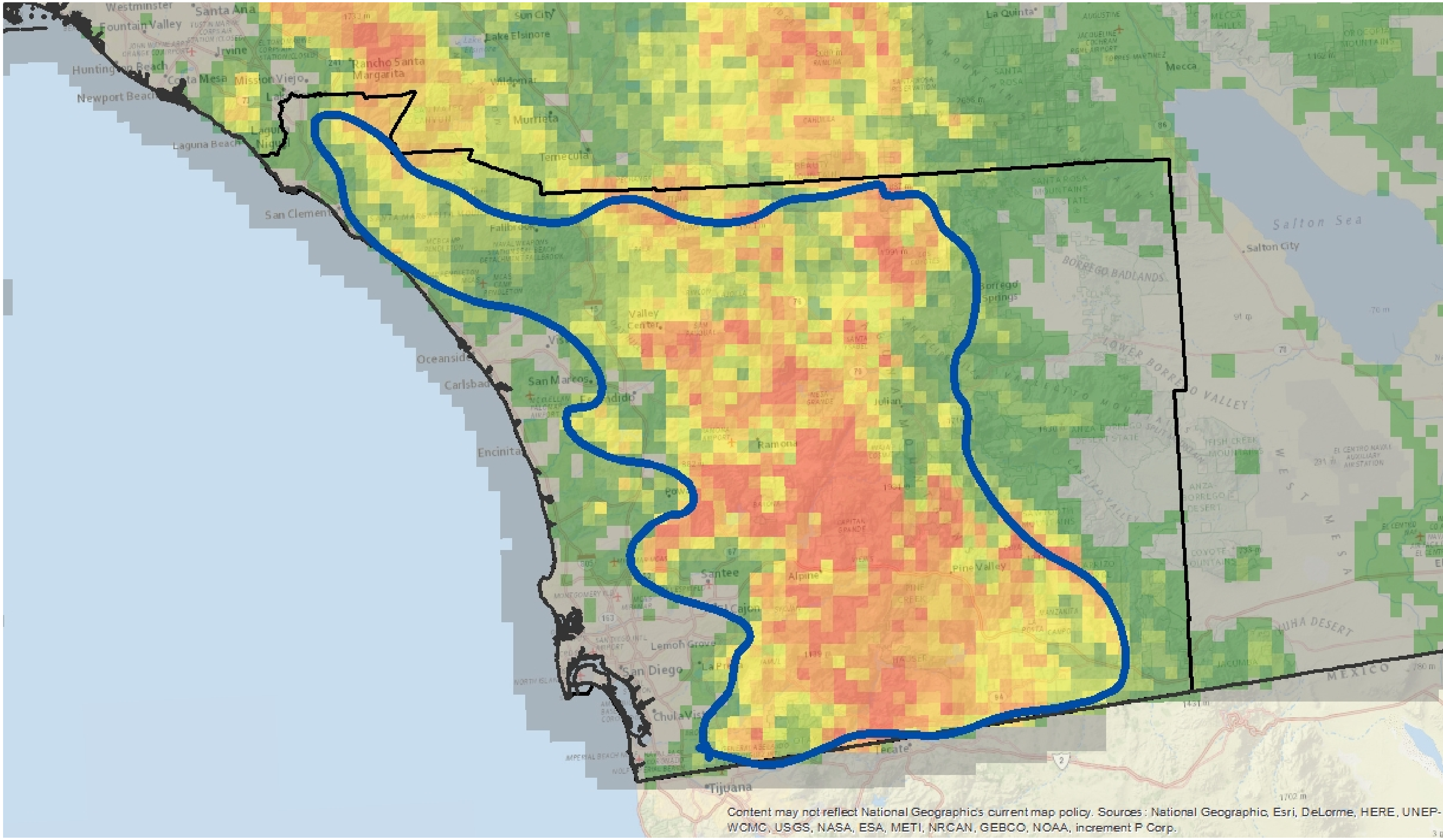
Subject: A detailed walk through of the SDG&E Pilot & Statewide Methodology

Rationale: With background in place, will be more clear to the observer why certain decisions were made.

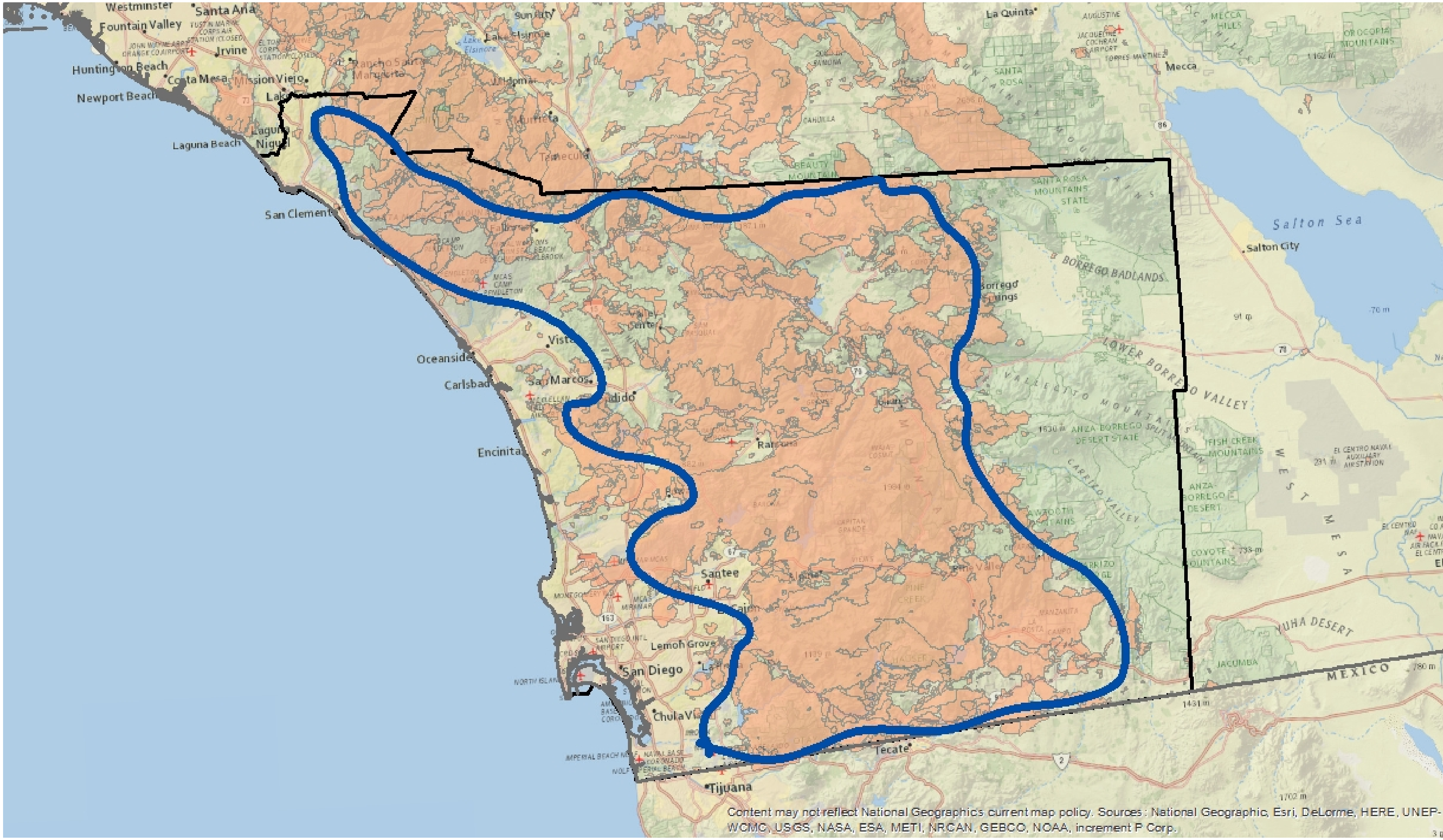
SDG&E Pilot: Display Map 1 across Service Territory



SDG&E Pilot: Delineate a first draft of areas of potential Fire Threat District.

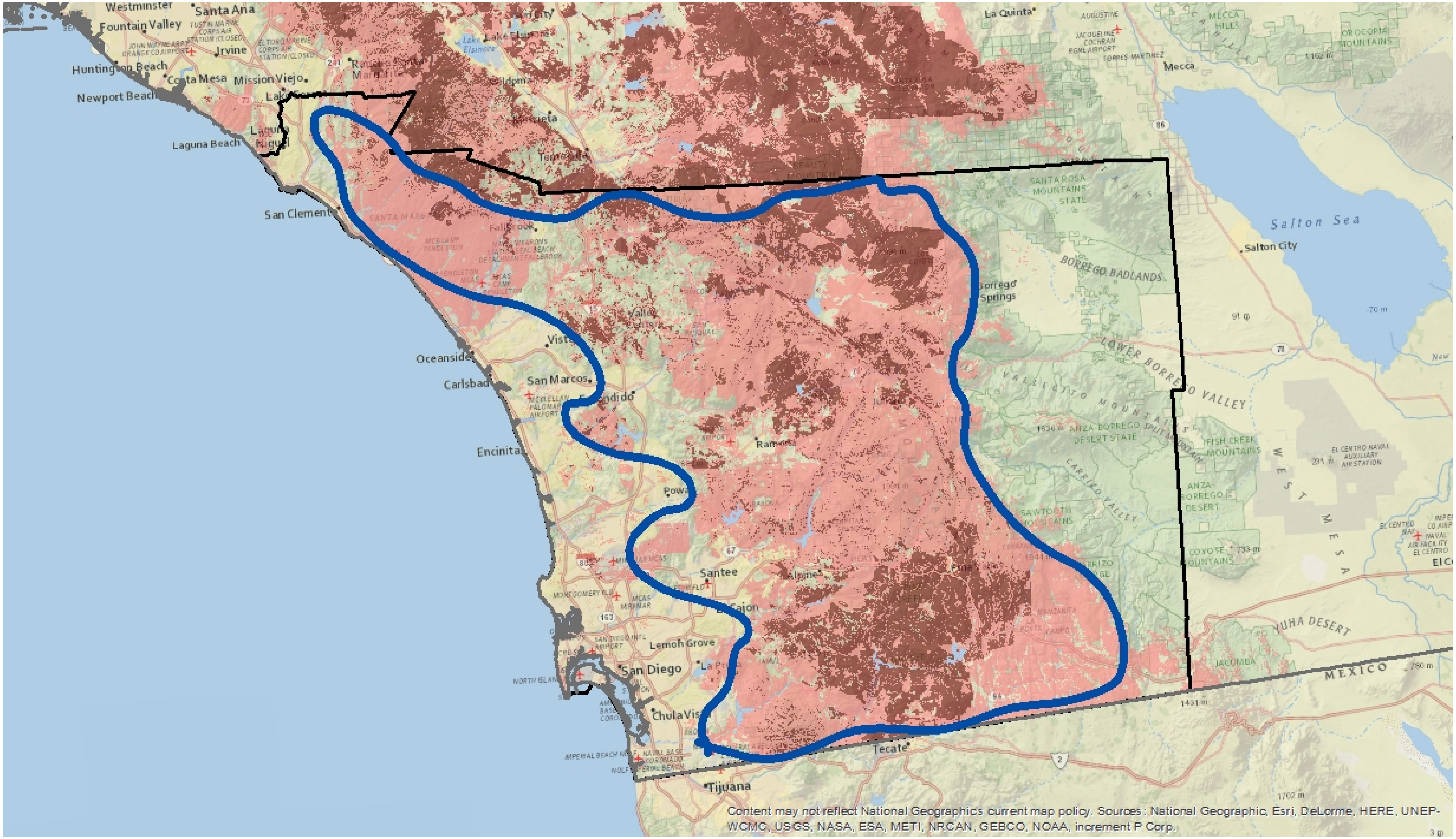


SDG&E Pilot: Use publicly available data including: Local fire history, FRAP Fire Threat Layer



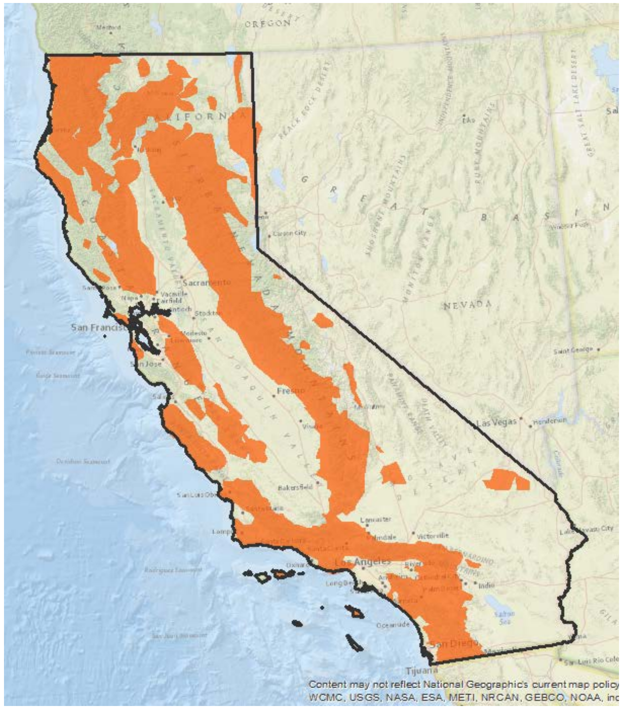
All Fire History in the CAL FIRE database

SDG&E Pilot: Use publicly available data including: Local fire history, FRAP Fire Threat Layer



- The three previous datasets would be used to generate Shape 1

- However, during the building of the SDG&E Pilot, it became evident that we could generate a statewide Shape 1 for distribution to other utilities.

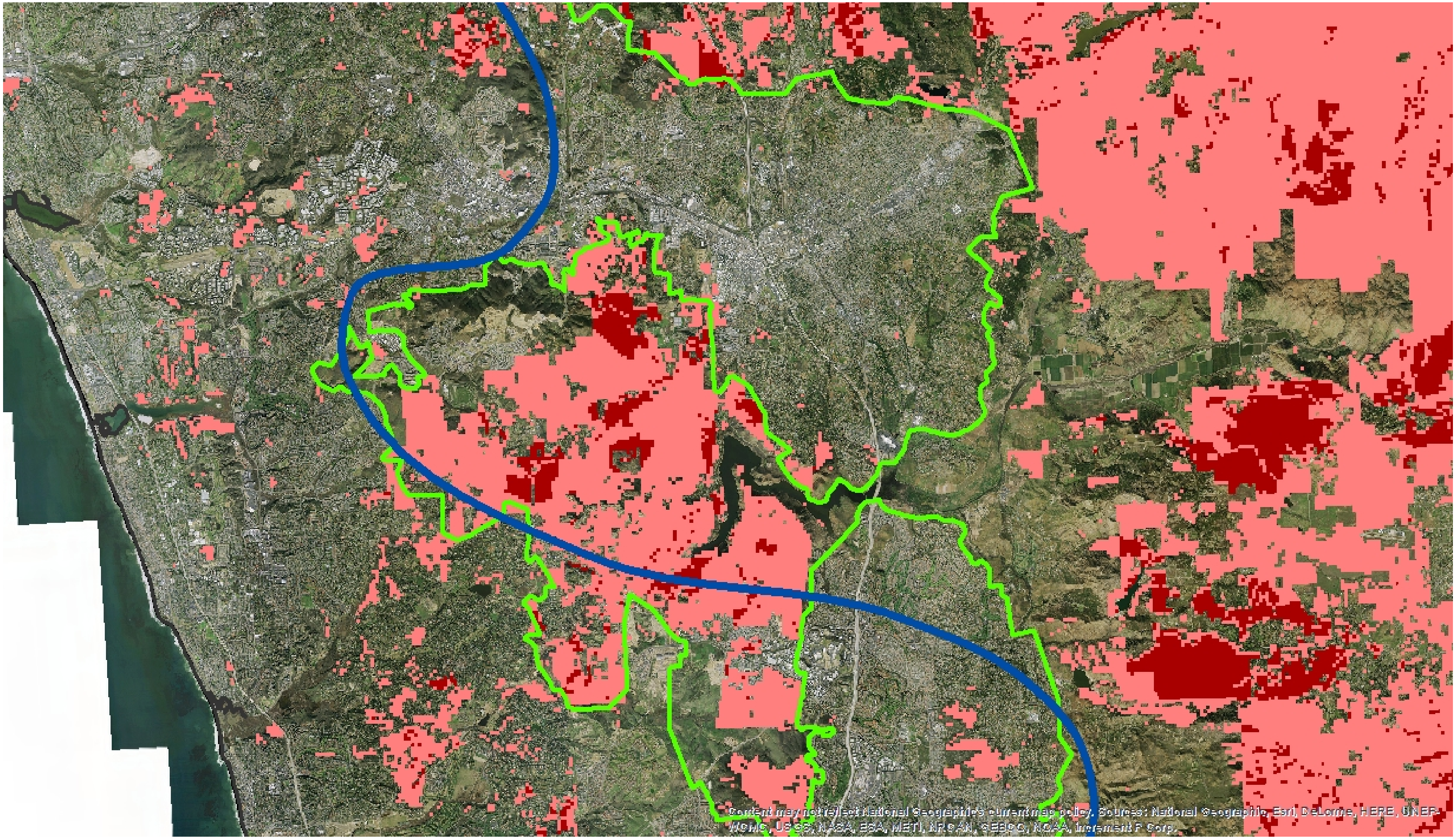


"Everything should be made as simple as can be, but not simpler" – paraphrased from Einstein

- Importance of Operationalizing the Map
  - Many business units benefit from having a simple map
    - One that doesn't cause routing issues or potential errors in interpretation
    - Simple:
      - The fewer maps the better
      - Contiguous areas of similar risk ranking
  - A comparison between an operationalized map, and other alternatives is shown later

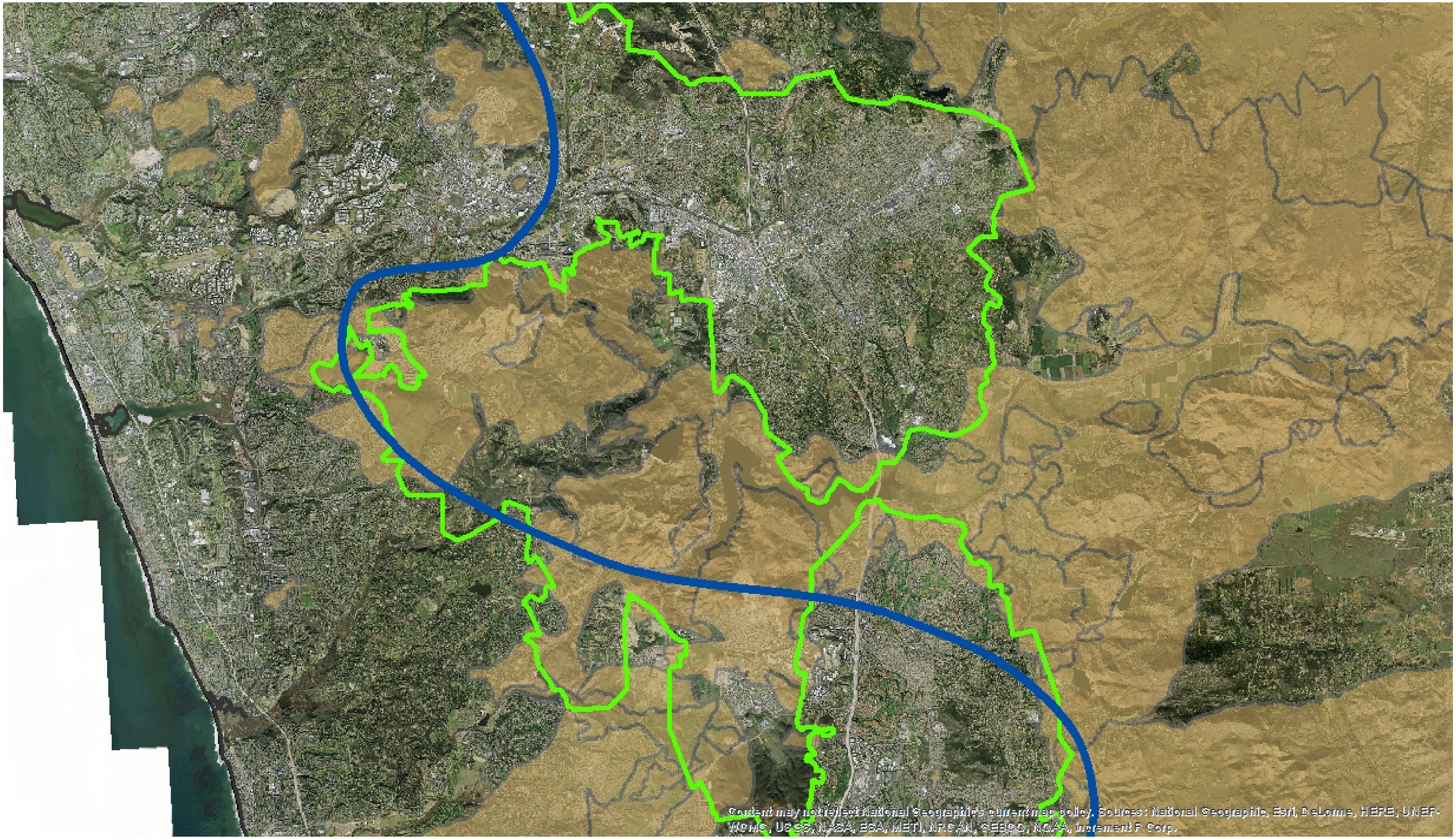
Result: Modest map adjustments with improved functionality. Minimal impact to risk. Most changes will be to the conservative side.

Statewide: Local Adjustments



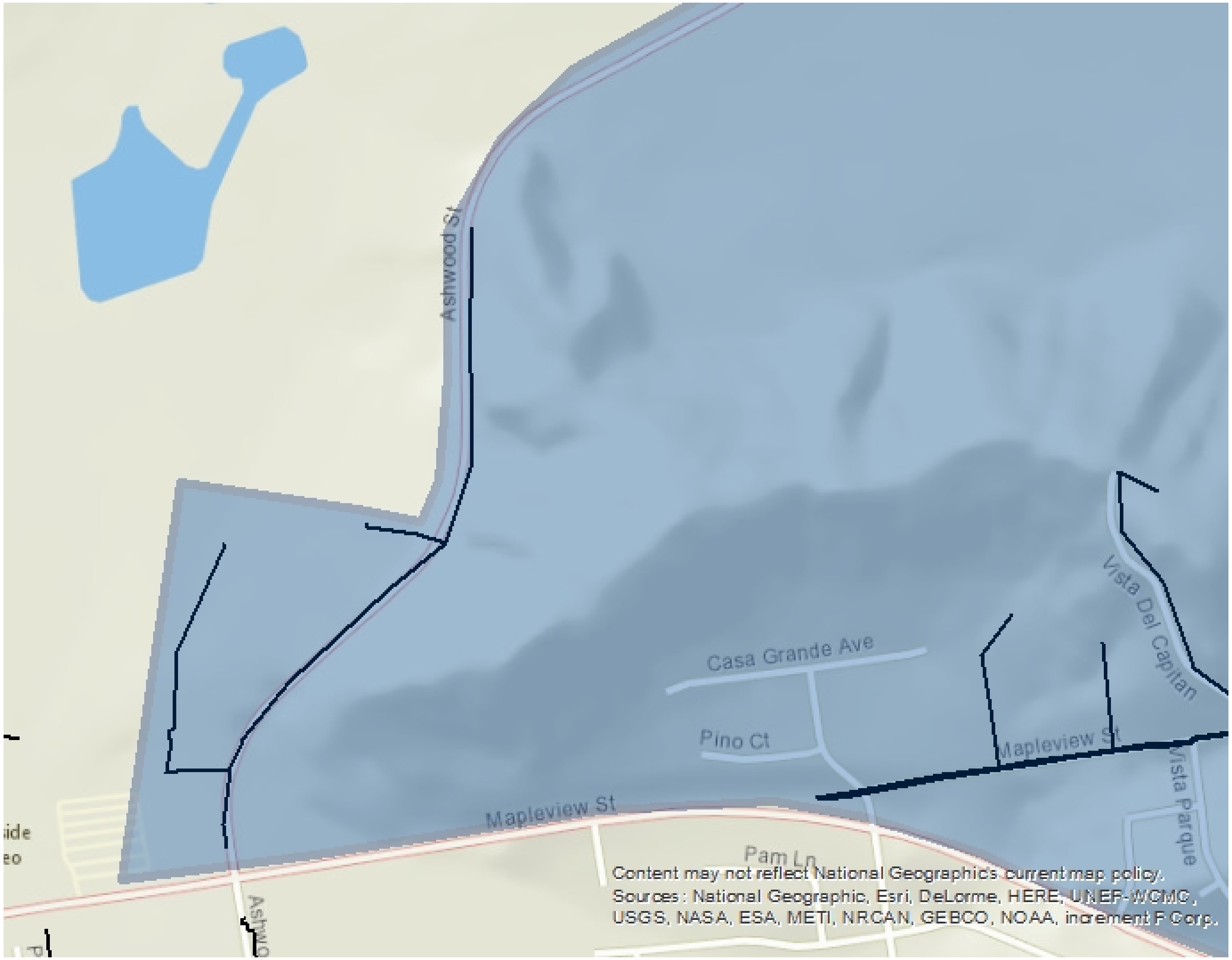
Using Fire Threat to refine Shape 1 into Shape 2

Statewide: Local Adjustments



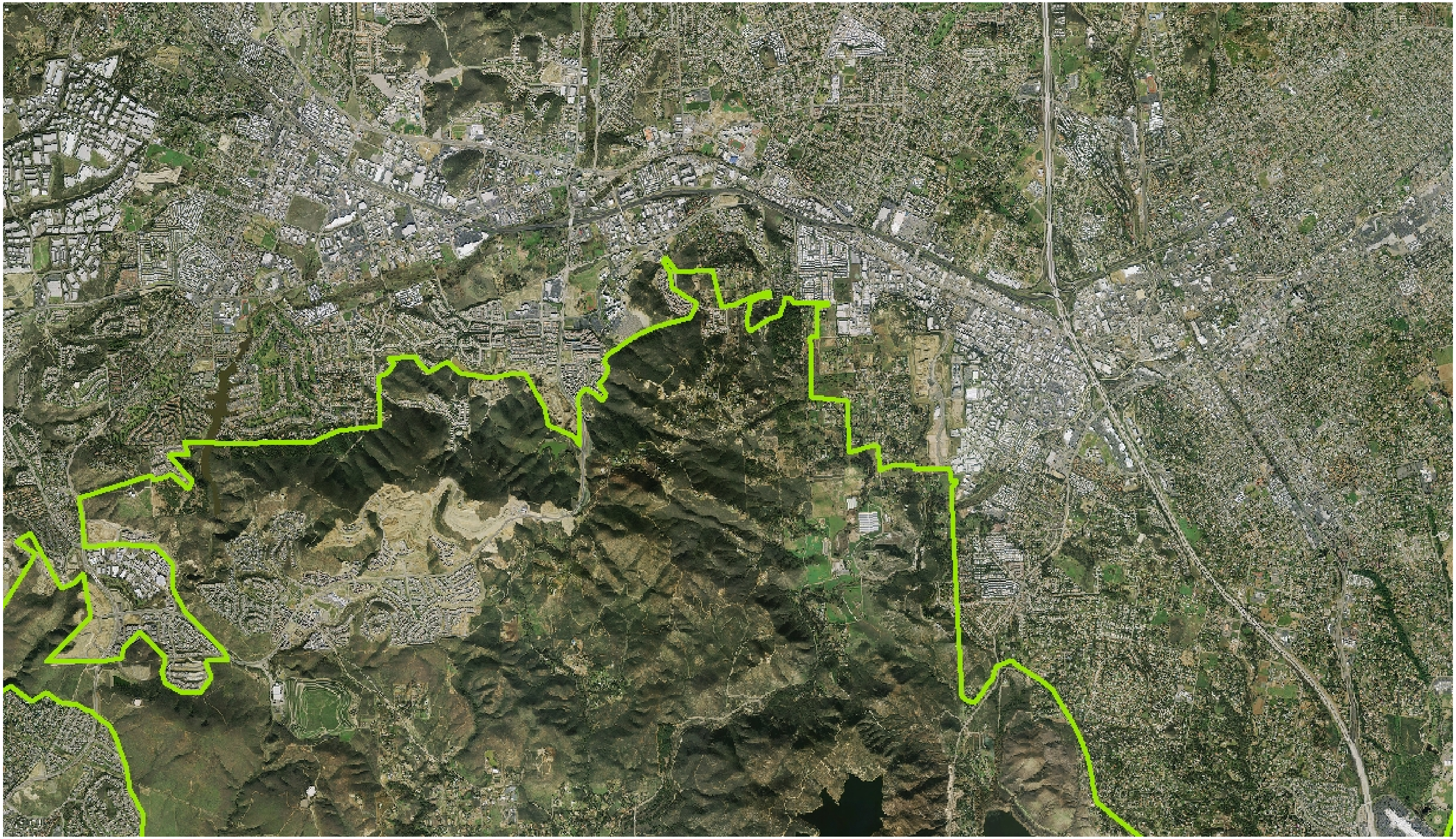
Using Fire History to refine Shape 1 into Shape 2

Statewide: Refine Shape 1

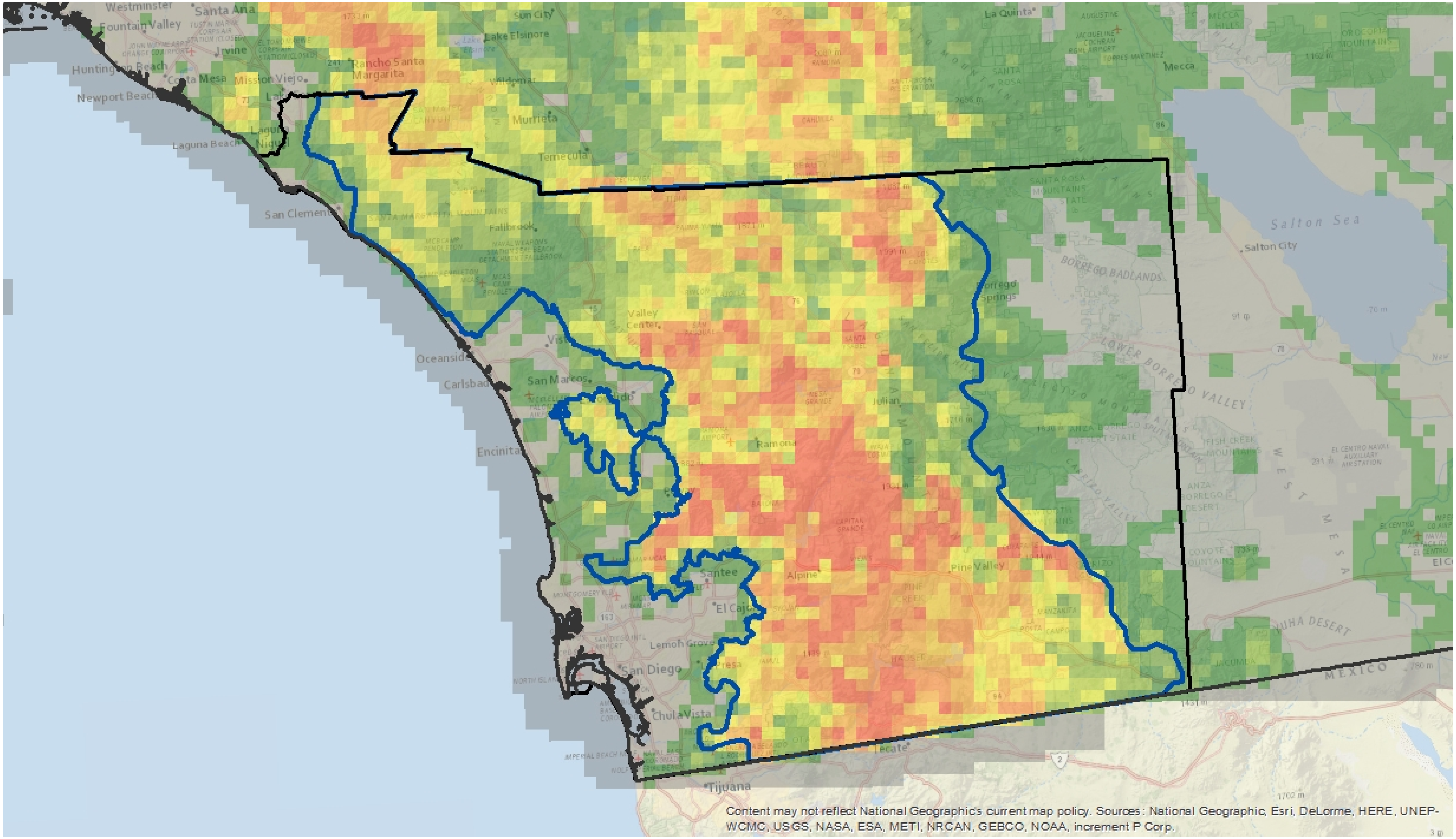


Statewide: Refine Shape 1

Statewide: Refine Shape 1

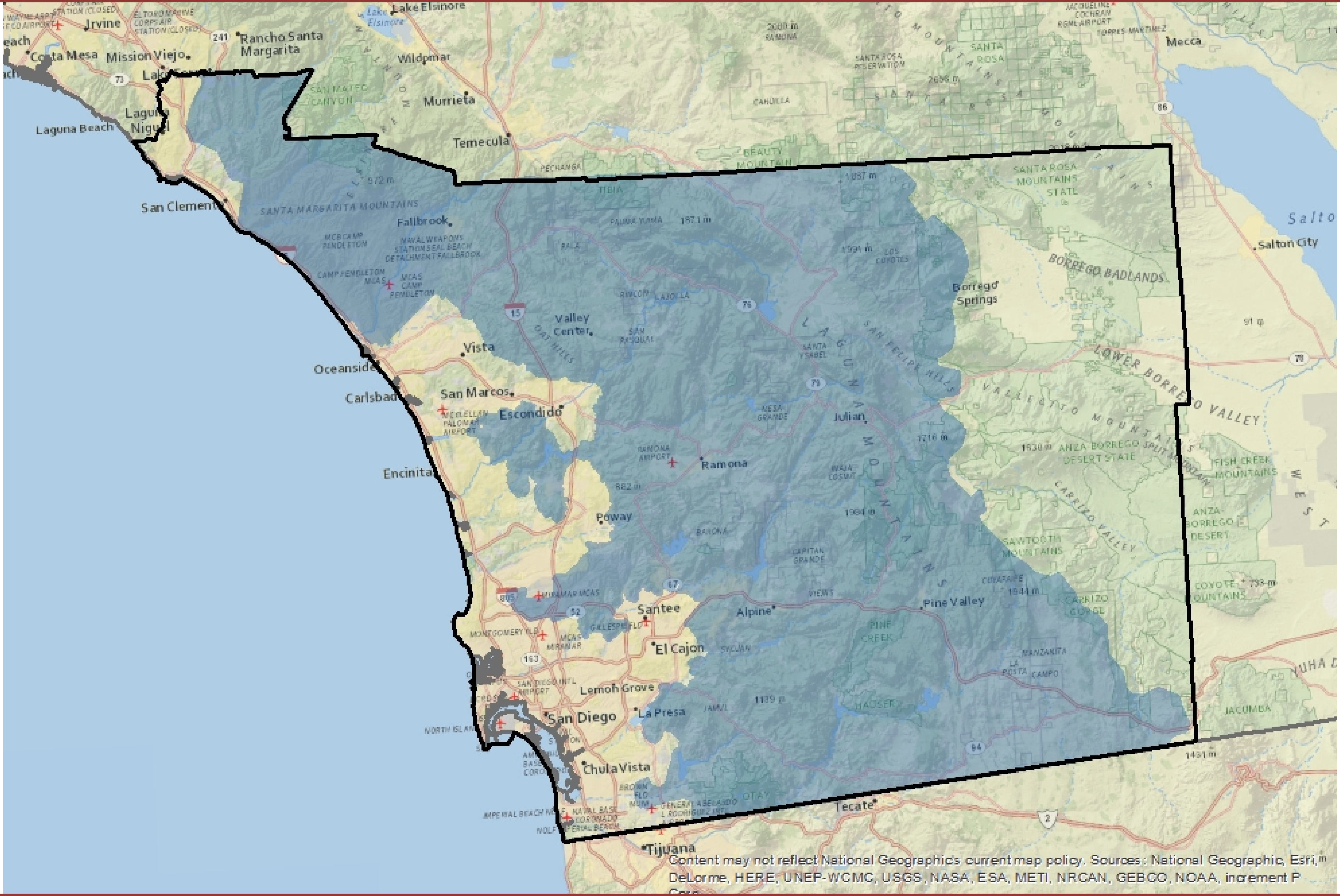


Statewide: Shape 2 has been drafted and subject to review by CAL FIRE and stakeholders

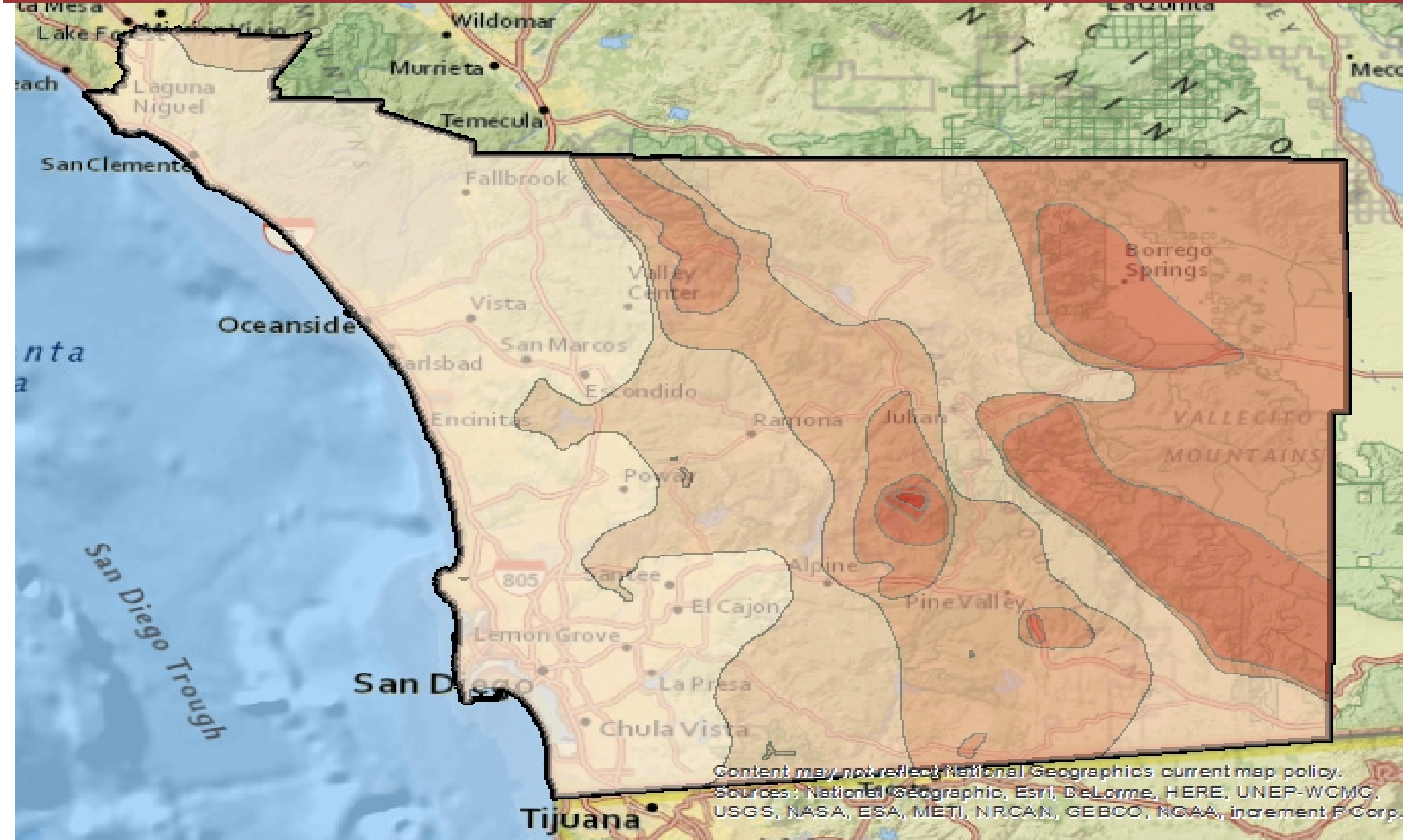


- With “Shape 2” completed, define “Shape 3” which distinguishes the most hazardous subset of “Shape 2”.
- “Shape 3” should represent areas of highest fire risk where the most restrictive rules should be observed

Statewide: Post-review Shape 2

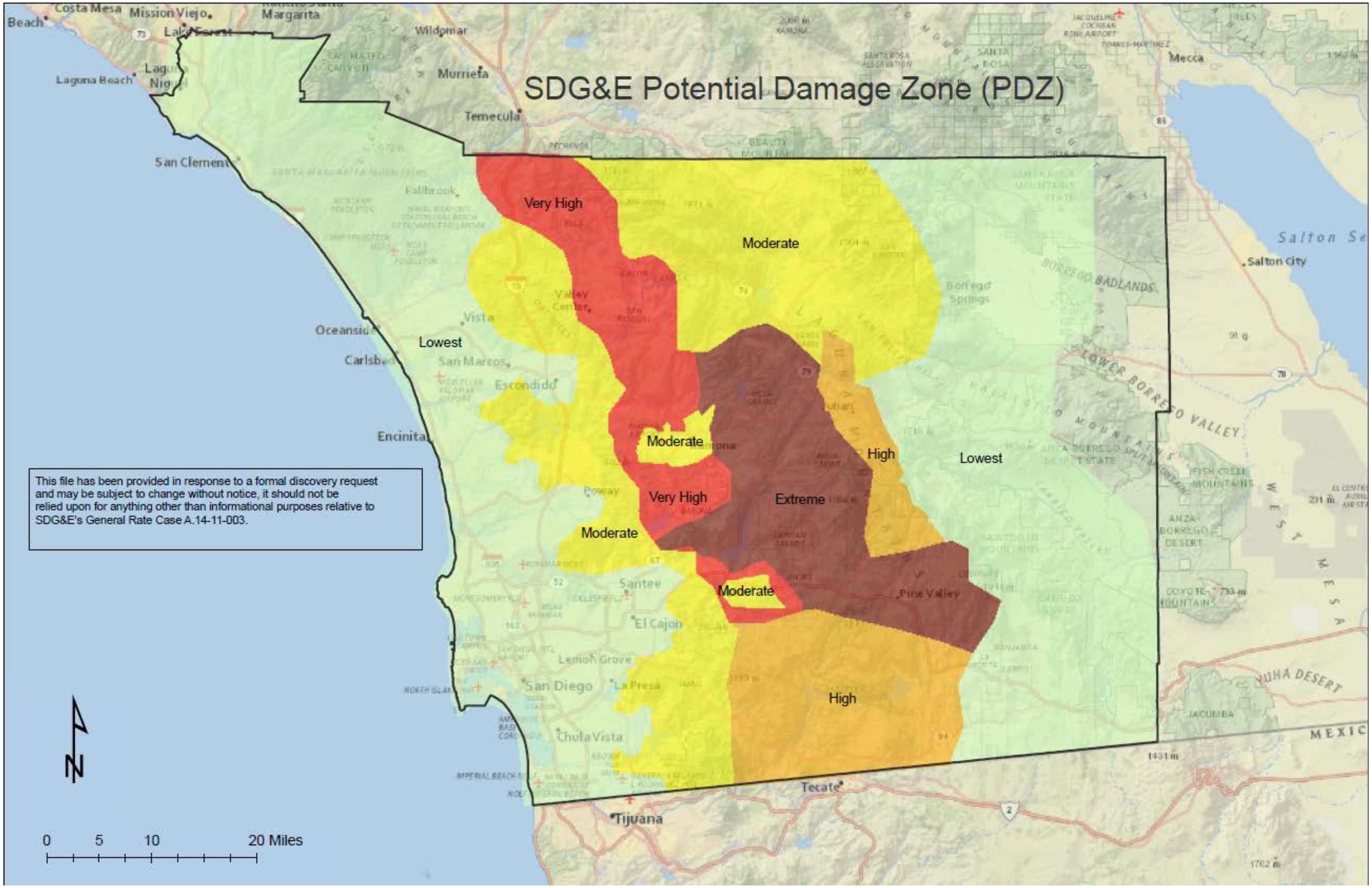


Statewide: Refine Shape 2

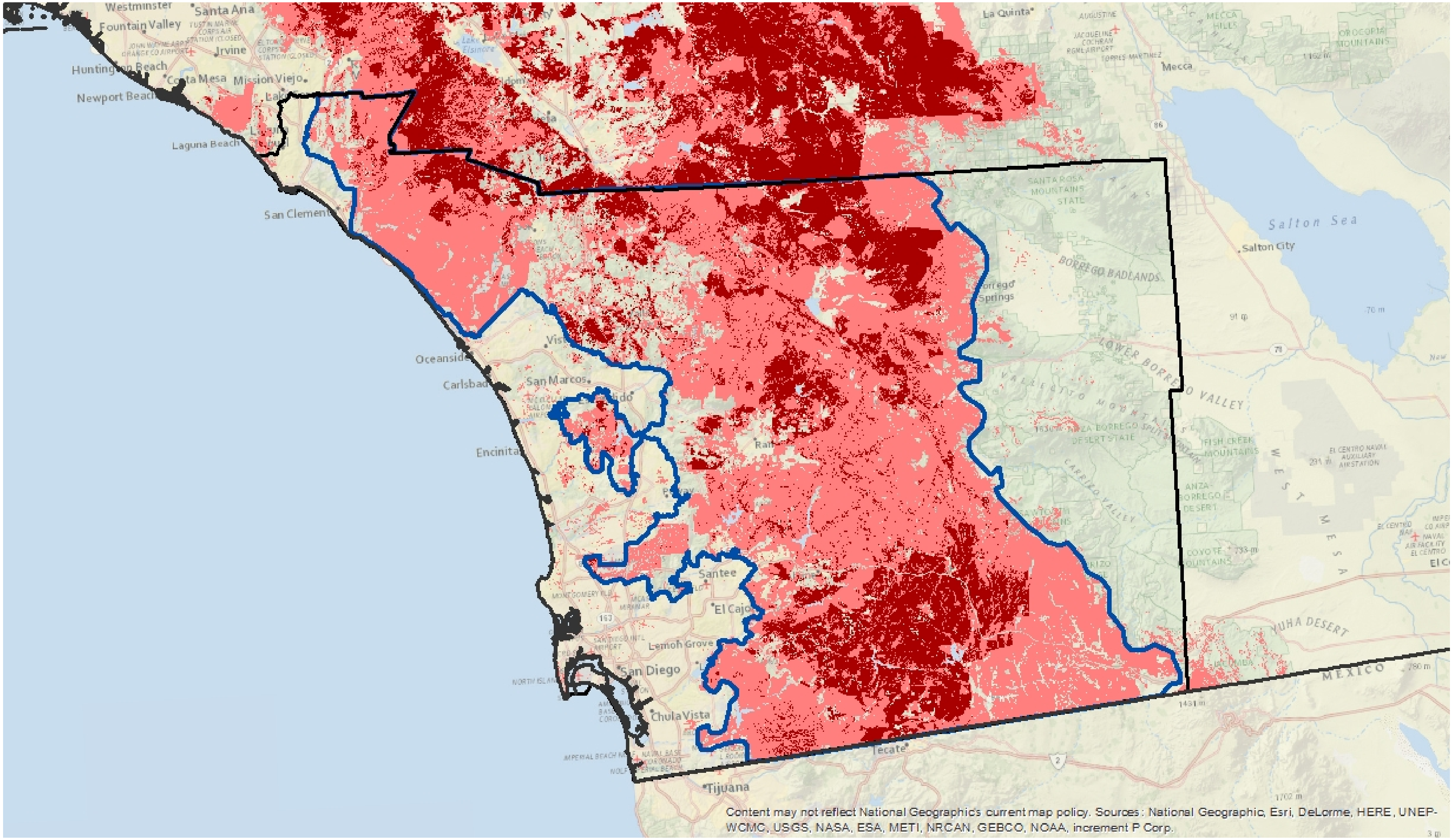


SDG&E Wind data.

Statewide: Refine Shape 2. Consider the impacts of fire: life threat, property improvements, critical infrastructure, environmental damage, etc.

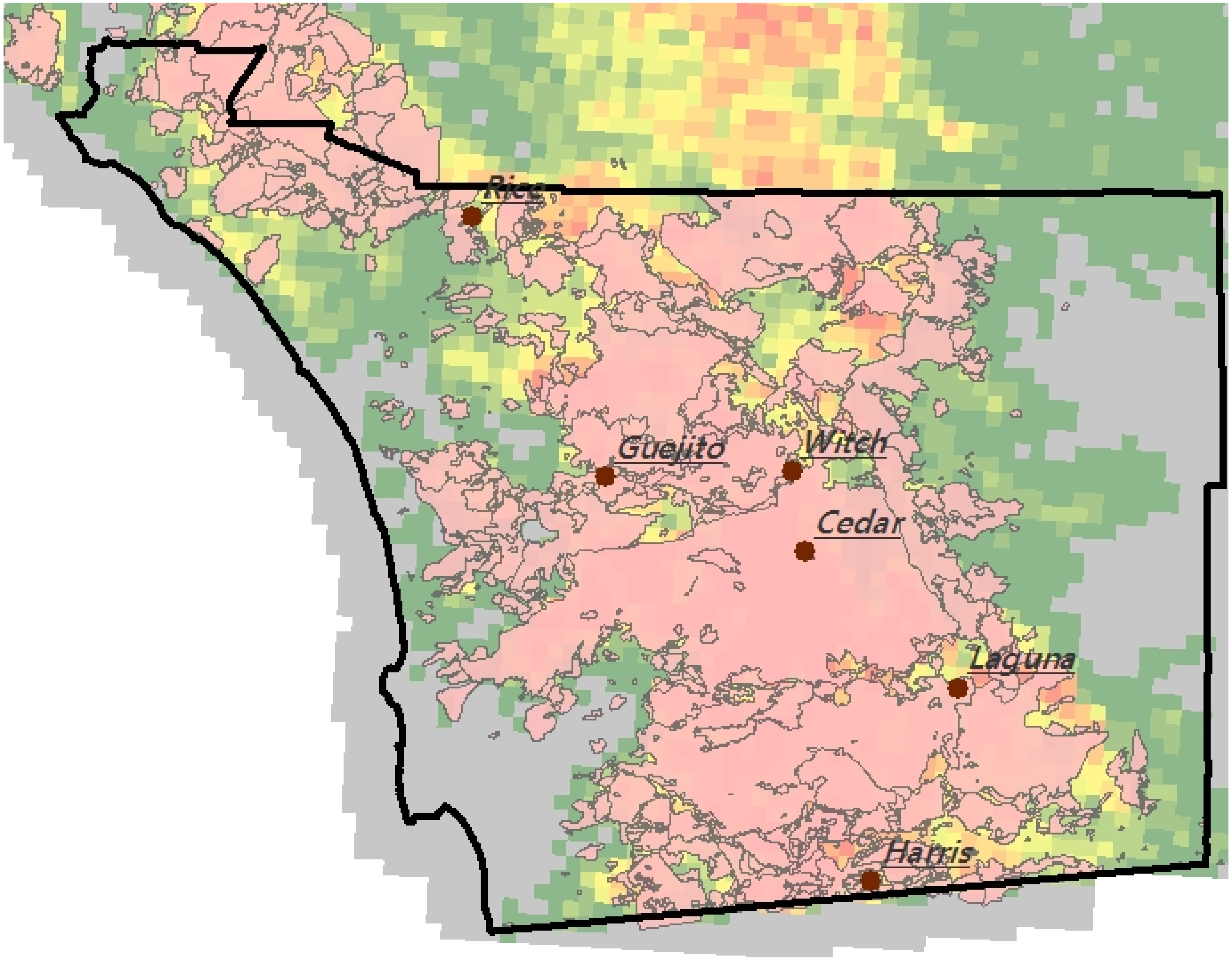


Statewide: Refine Shape 2



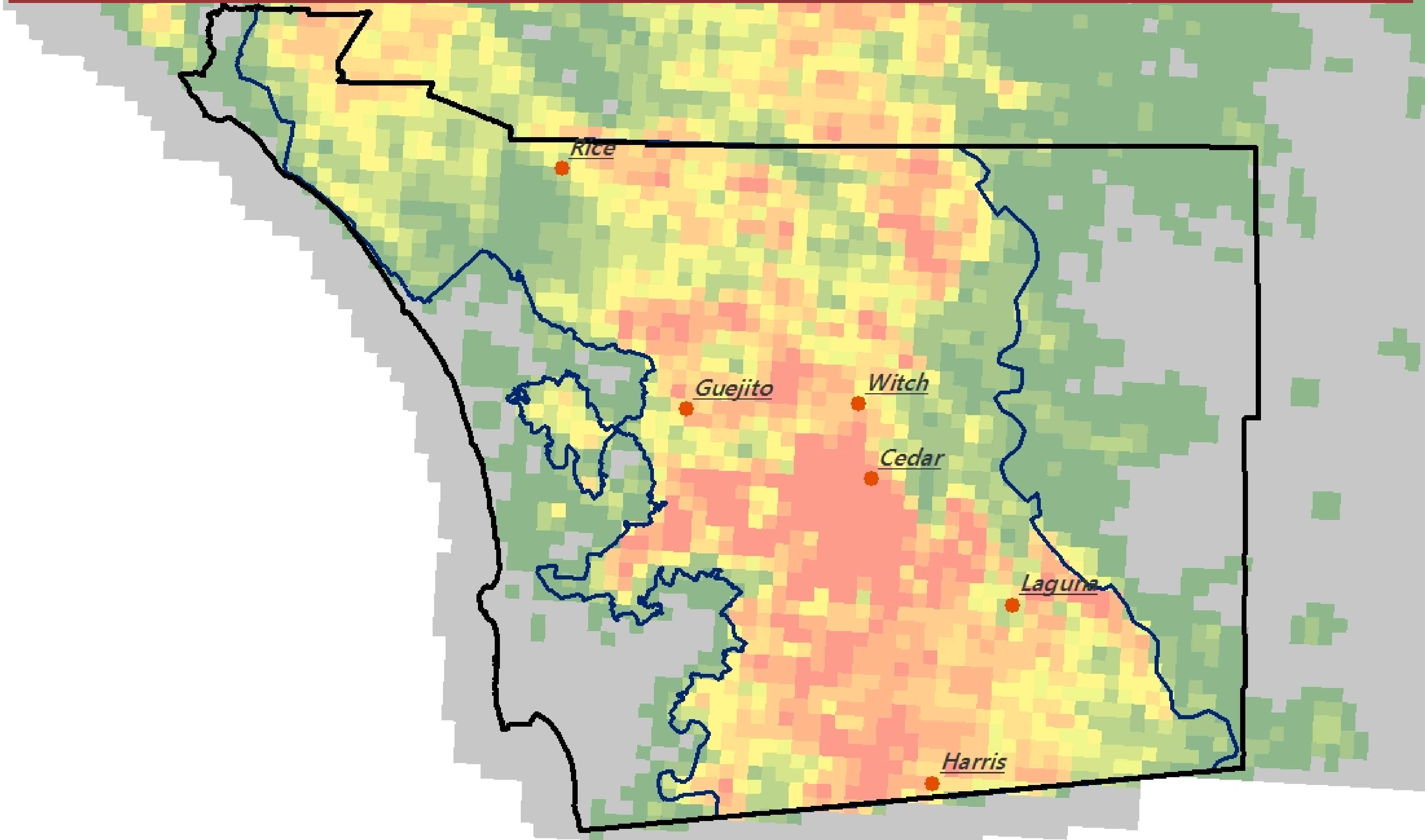
Very High and Extreme FRAP Fire Threat.

Statewide: Refine Shape 2.

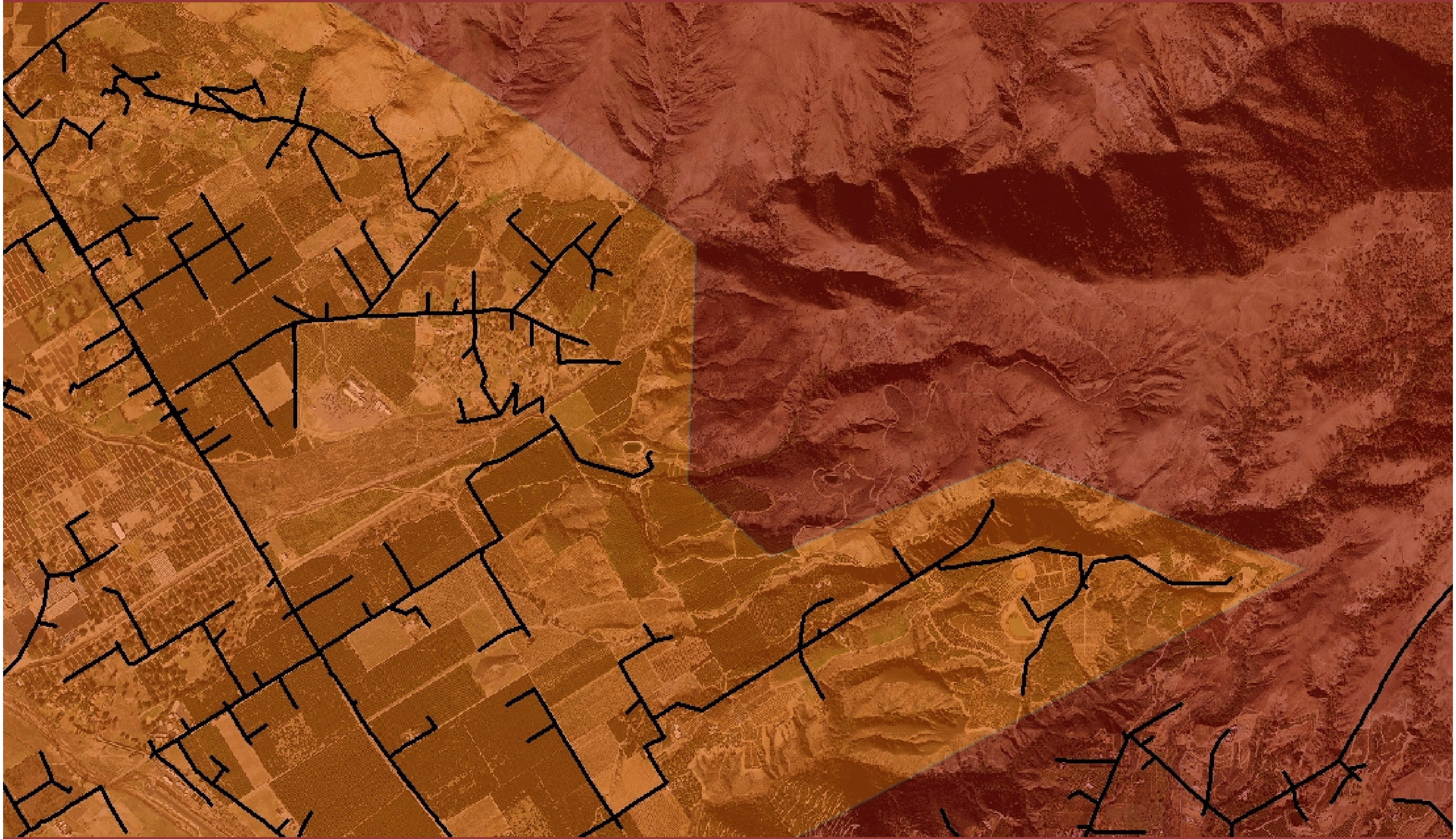


Local fire history.

Statewide: Refine Shape 2.

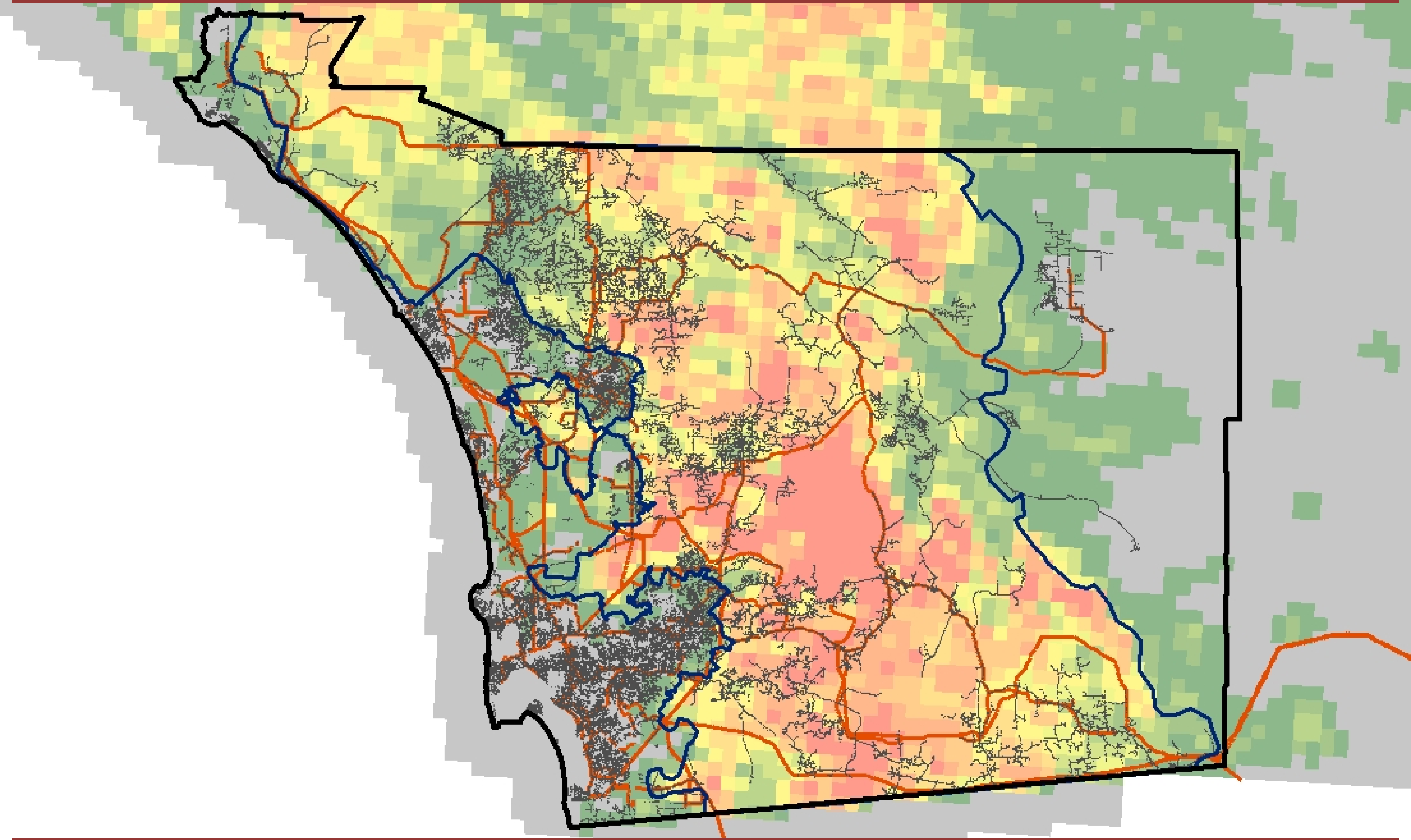


Statewide: Refine Shape 2



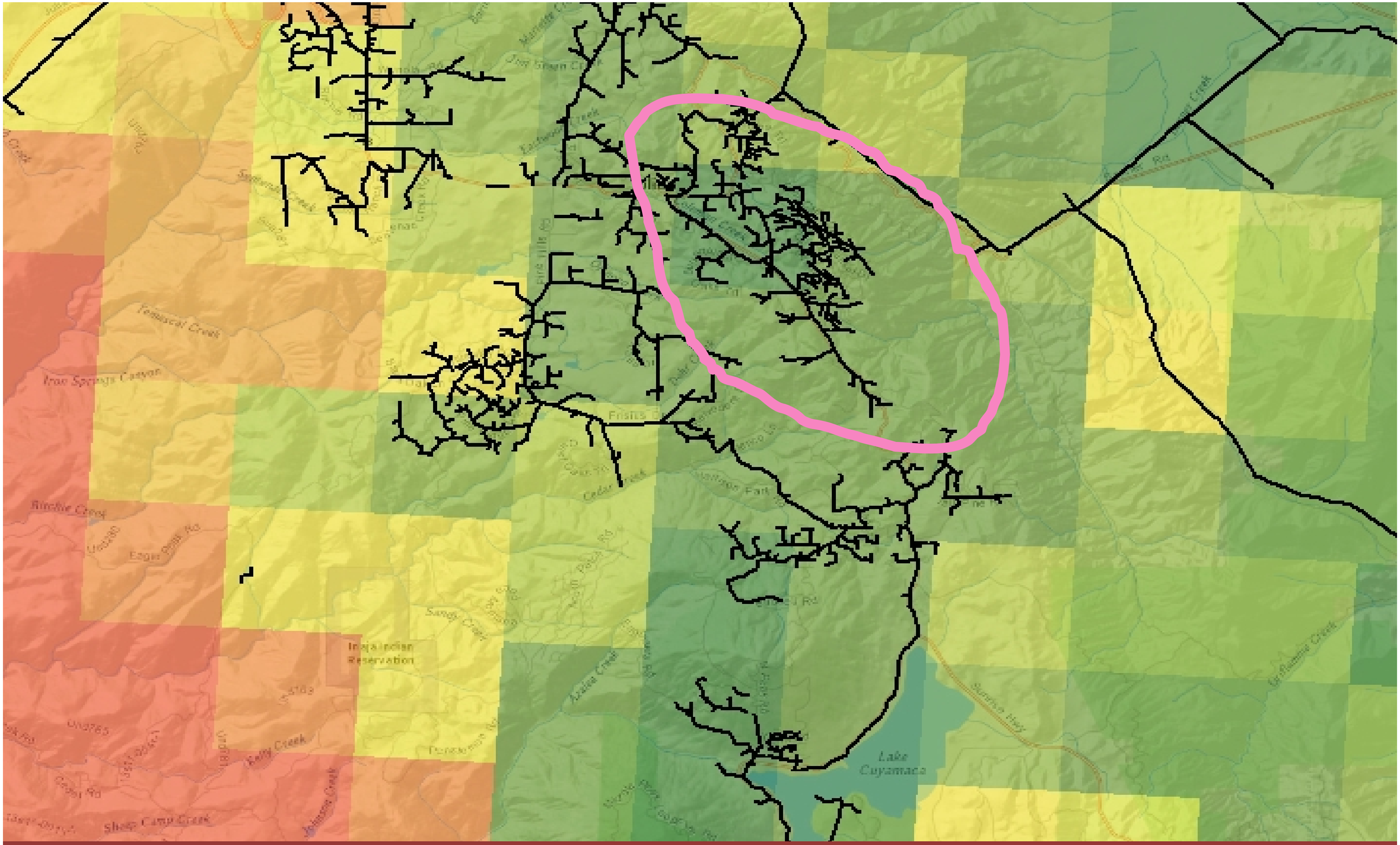
Tier boundaries are drawn to keep circuits from transitioning between Tiers as much as practical.

Statewide: Refine Shape 2



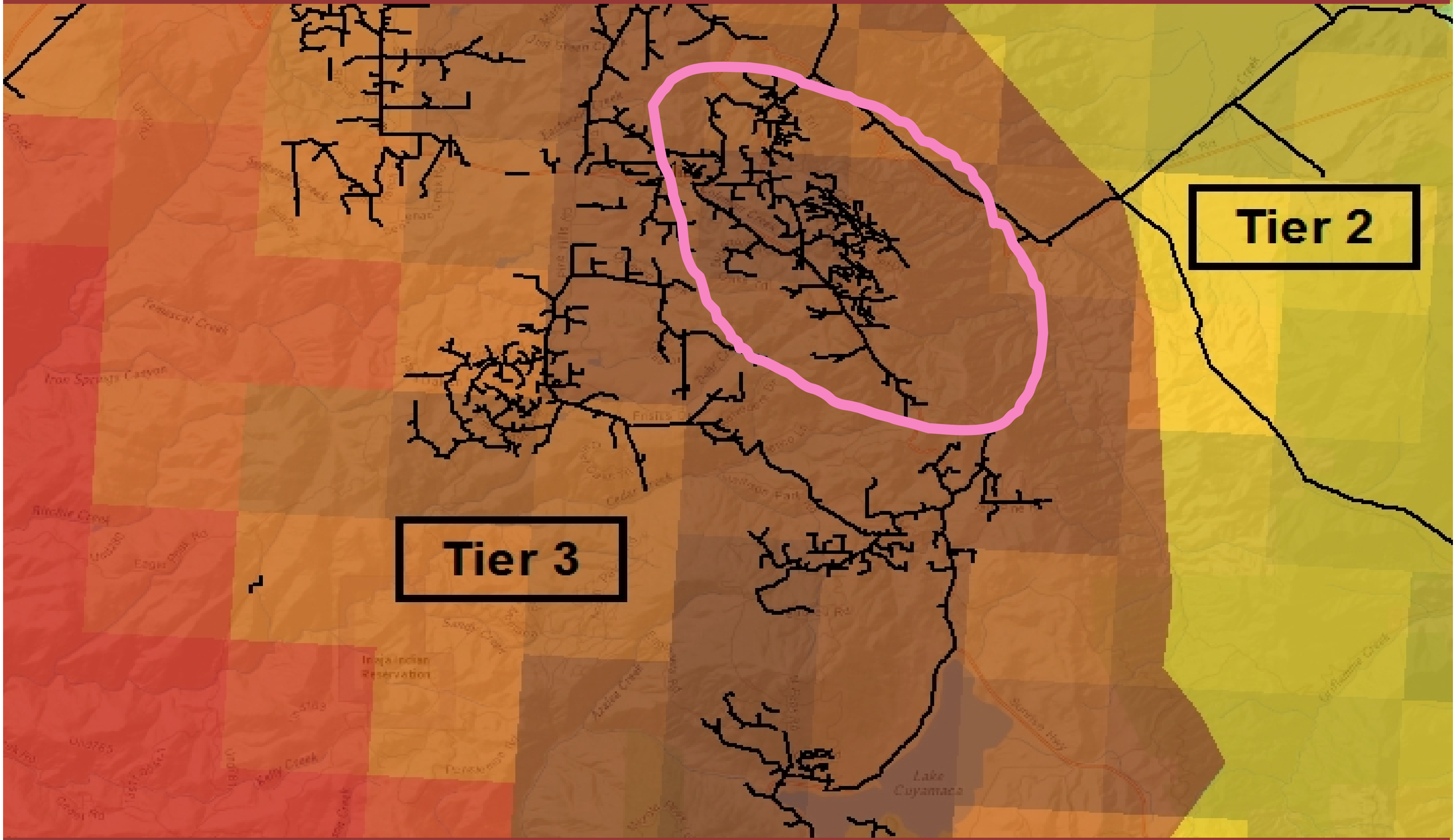
Layered Transmission and Distribution facilities.

Statewide: Refine Shape 2.



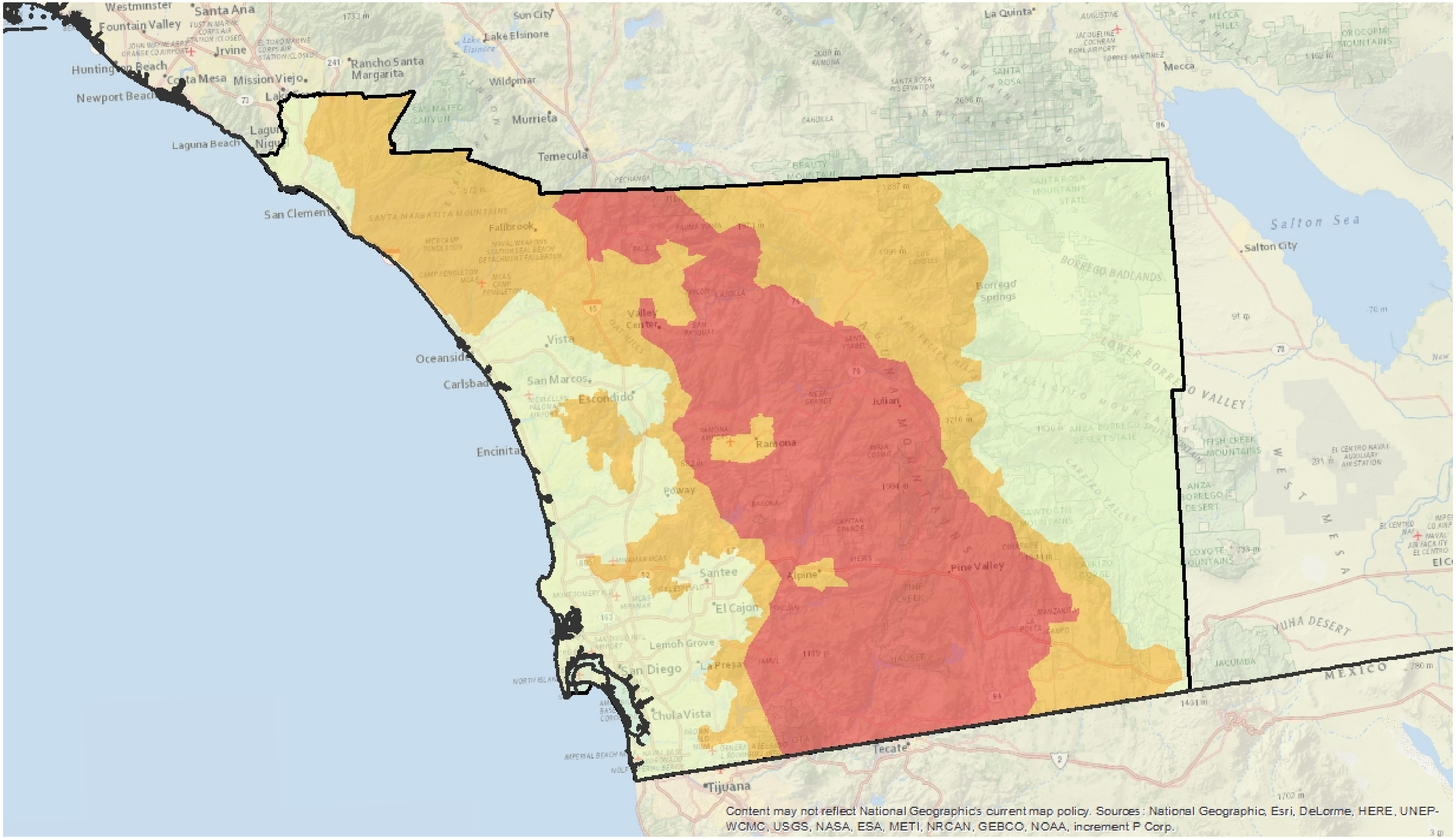
Within Shape 2, this pink area is ranked low (green) but we have included it in Tier 3. This should be documented as well as the reverse scenario.

Statewide: Maximize operational efficiency. Document inclusions and exclusions; differences between Map 1 and Map 2.



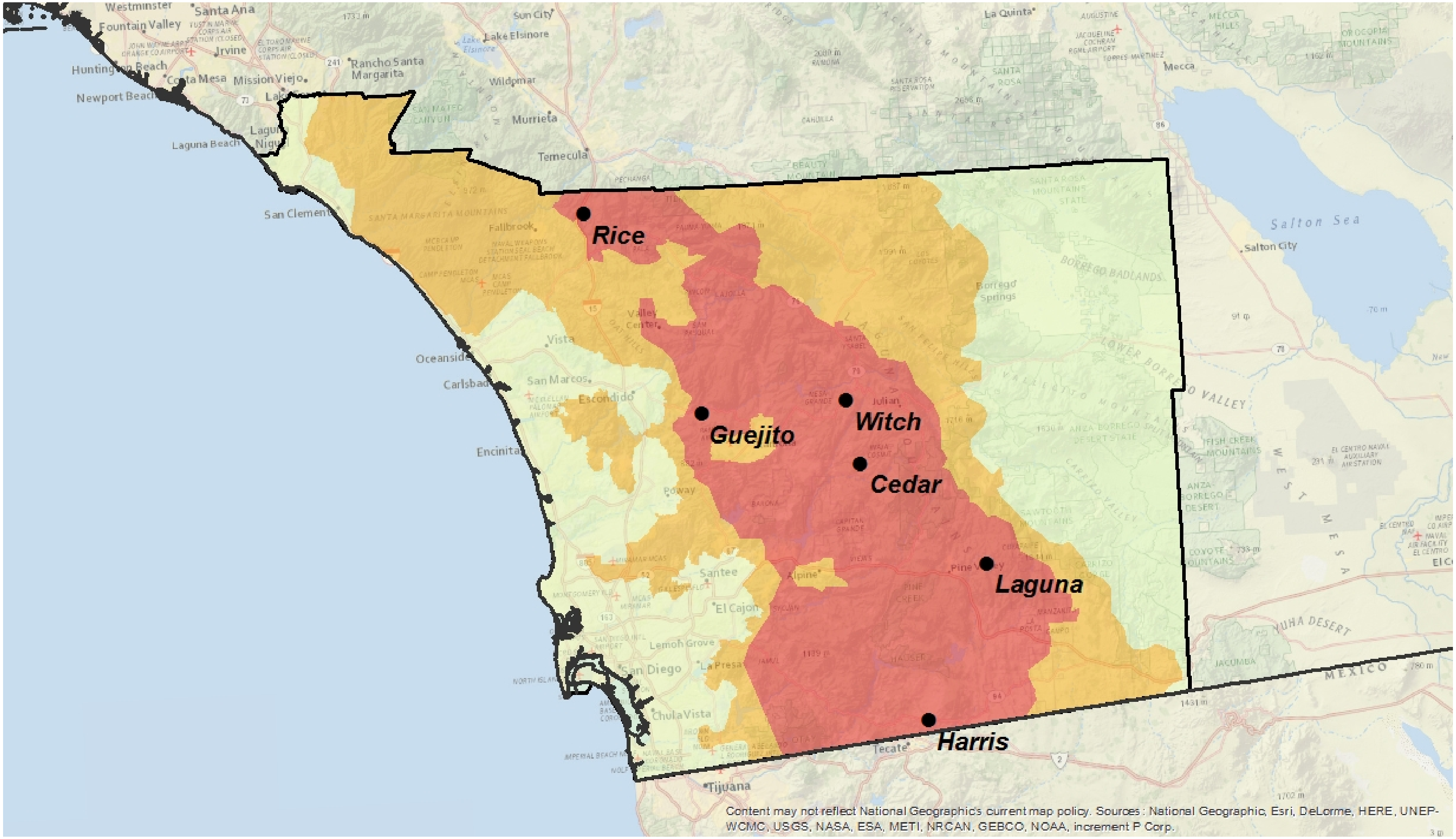
Within Shape 2, this pink area is ranked low (green) but we have included it in Tier 3. This should be documented as well as the reverse scenario.

Statewide: Draft of "Shape 3", still needs CAL FIRE review
(One "Normal" tier, and two "Fire Threat District" tiers)



Considers all data thus far seen: Fire Hx, Wind Corridors, Values at Risk, Fuel Continuity, Origins of Consequential Fires.

Statewide: Draft Tiers with important ignitions.



All of these points of ignition lie within Tier 3.

Matrix Approach

	Map Layers			
	Fire Map 2			Tree Mortality
Regulation	**Tier 1 (Moderate)**	**Tier 2 (Elevated)**	**Tier 3 (Extreme)**	**HHSZ**
Regulation W	**NO**	**NO**	**YES**	**NO**
Regulation X	**NO**	**YES**	**YES**	**YES**
Regulation Y	**6 feet**	**10 feet**	**15 feet**	**15 feet**
Regulation Z	**5 years**	**3 years**	**2 years**	**2 years**

Statewide Analysis

Subject: Using SDG&E / IOU approach on entire state

Rationale: Demonstrates how "Shape 1" is created.

Skeleton of Statewide Workplan

Step 1: SDG&E / IOU create "Shape 1" for entire state (displayed later). Using IET, Fire Threat, Fire History

Step 2: Review Shape 1

Step 3: Utilities modify "Shape 1" in their respective territories to create "Shape 2", an operationalized map with local input that establishes the Universe of Fire Threat Districts. With justification for deviations from "Shape 1"

Step 4: Review Shape 2, collaborate with adjoining utilities to ensure cross-border consistency

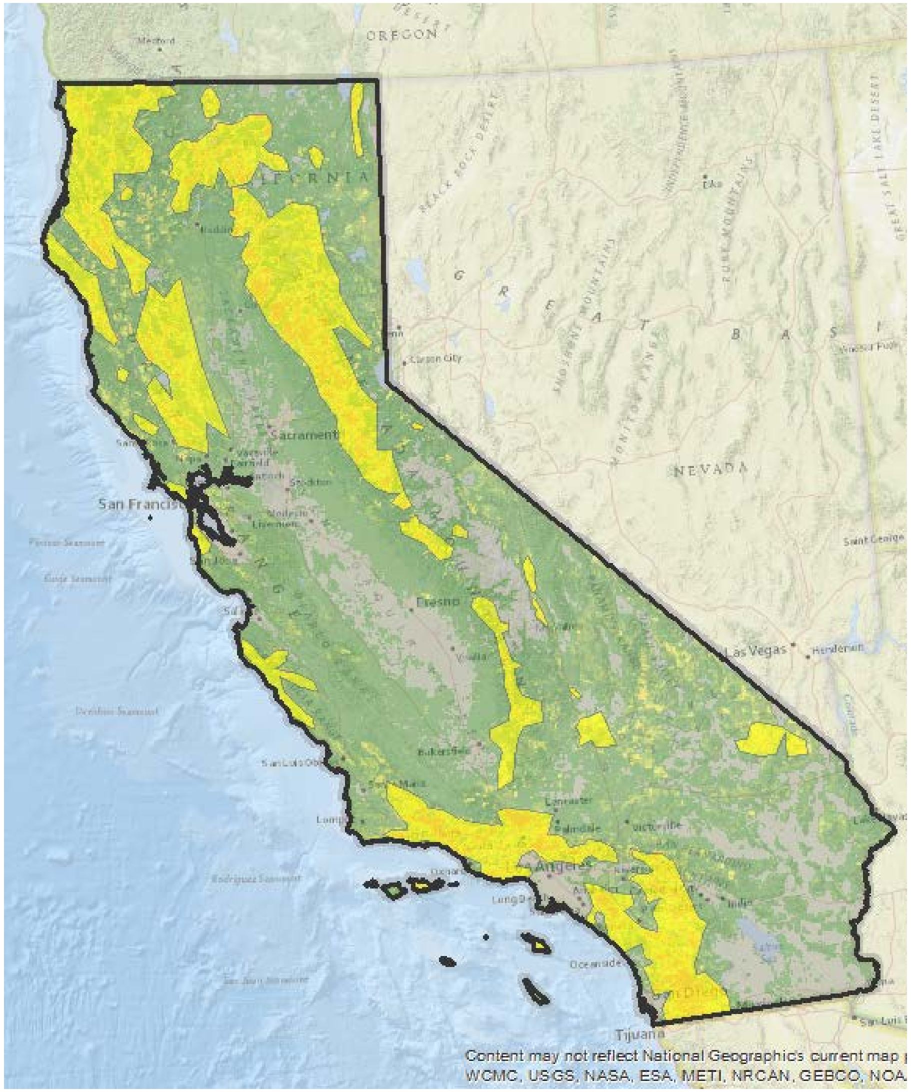
Step 5: Utilities carve "Shape 2" to create Tiers within "Shape 2", the output being "Shape 3"

Step 6: Review Shape 3

Step 7: Final review and publish

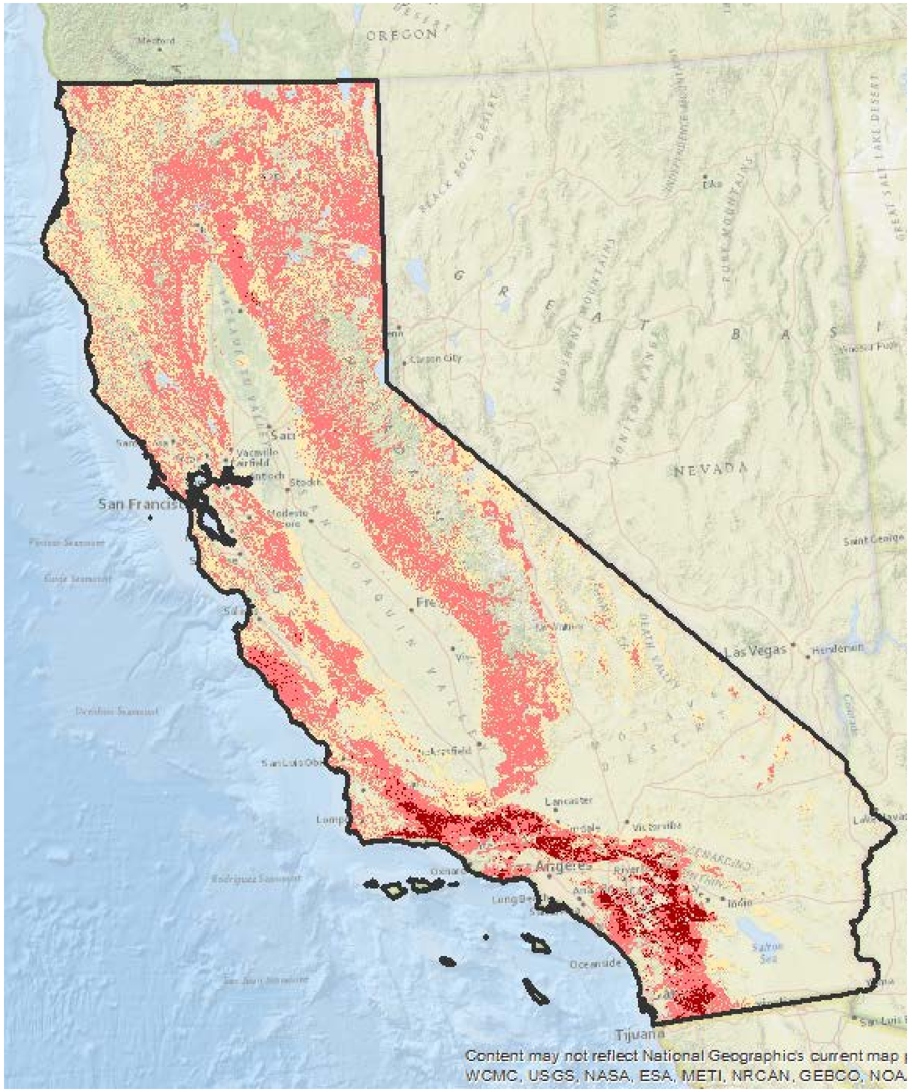
Review Subroutine: CALFIRE to assess. Additionally, if non-utility stakeholders have concerns about shape, can provide specific location and rationale of concern.

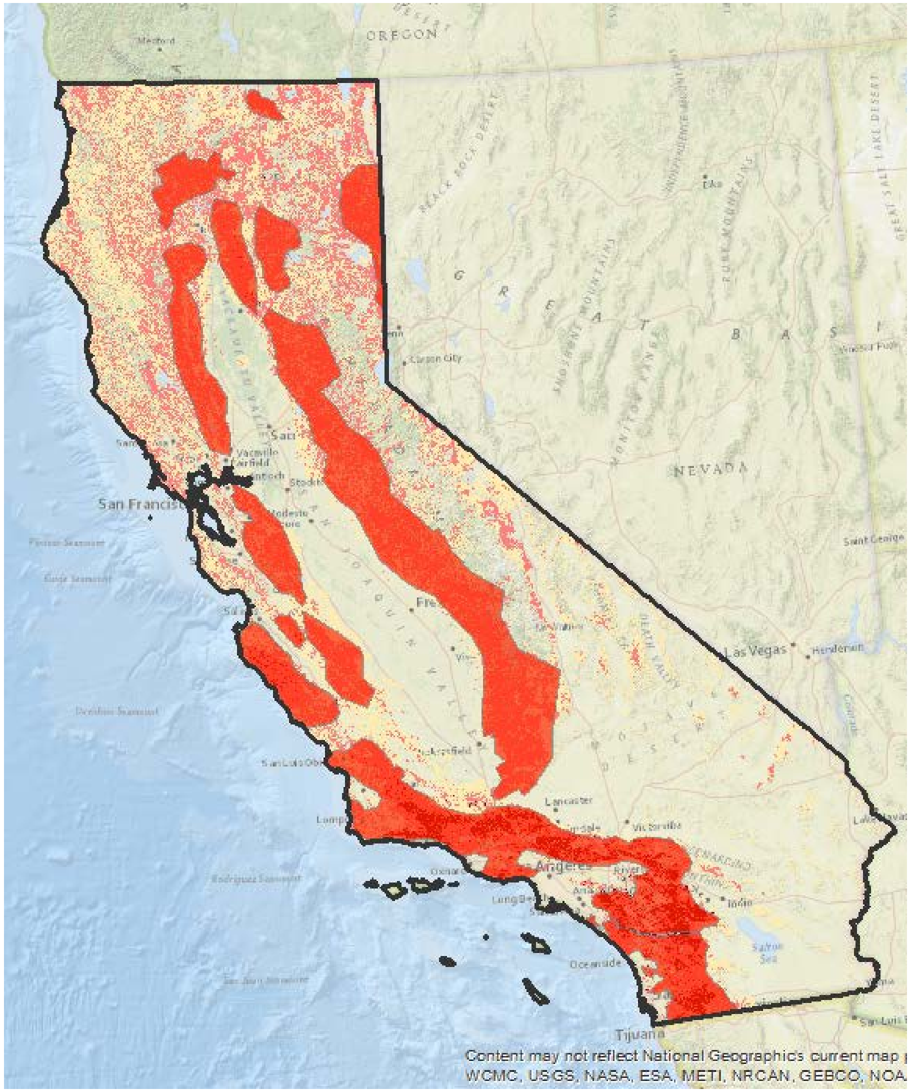
Statewide Analysis



IET output. Selecting approximately values of >800.

Statewide Analysis



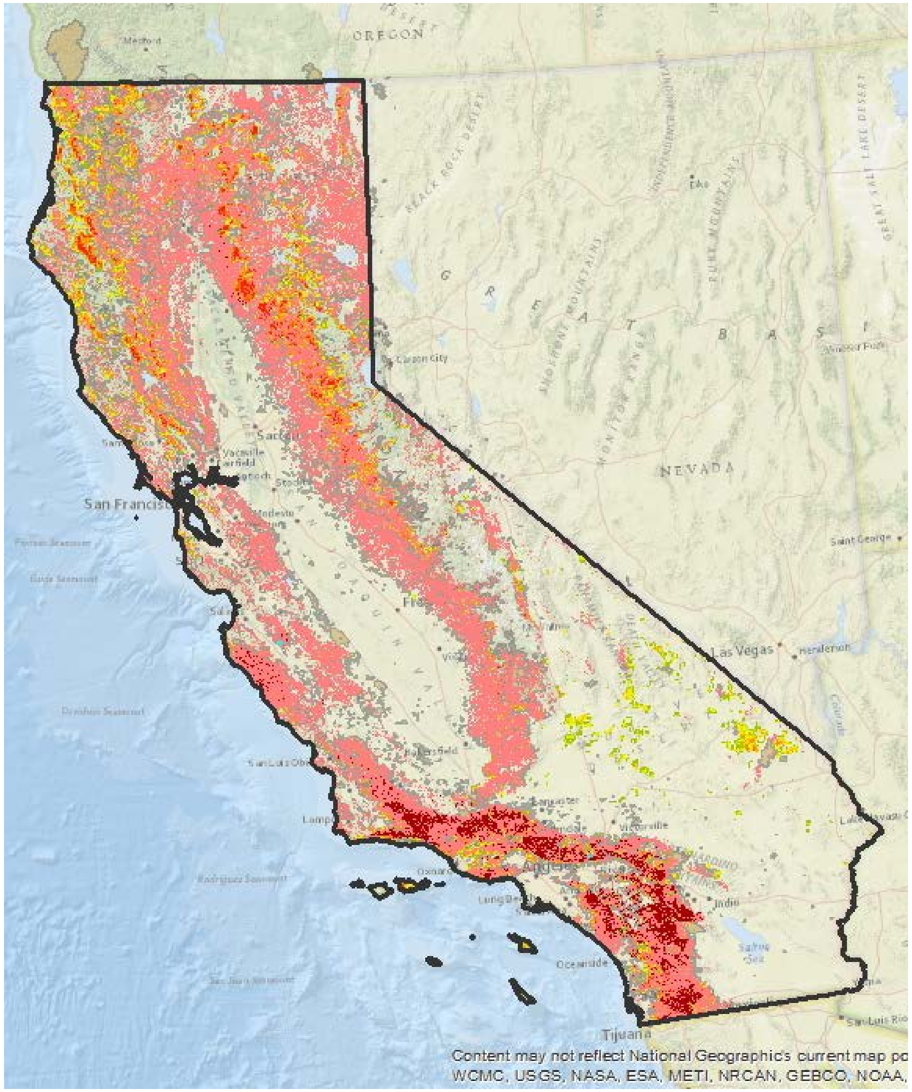


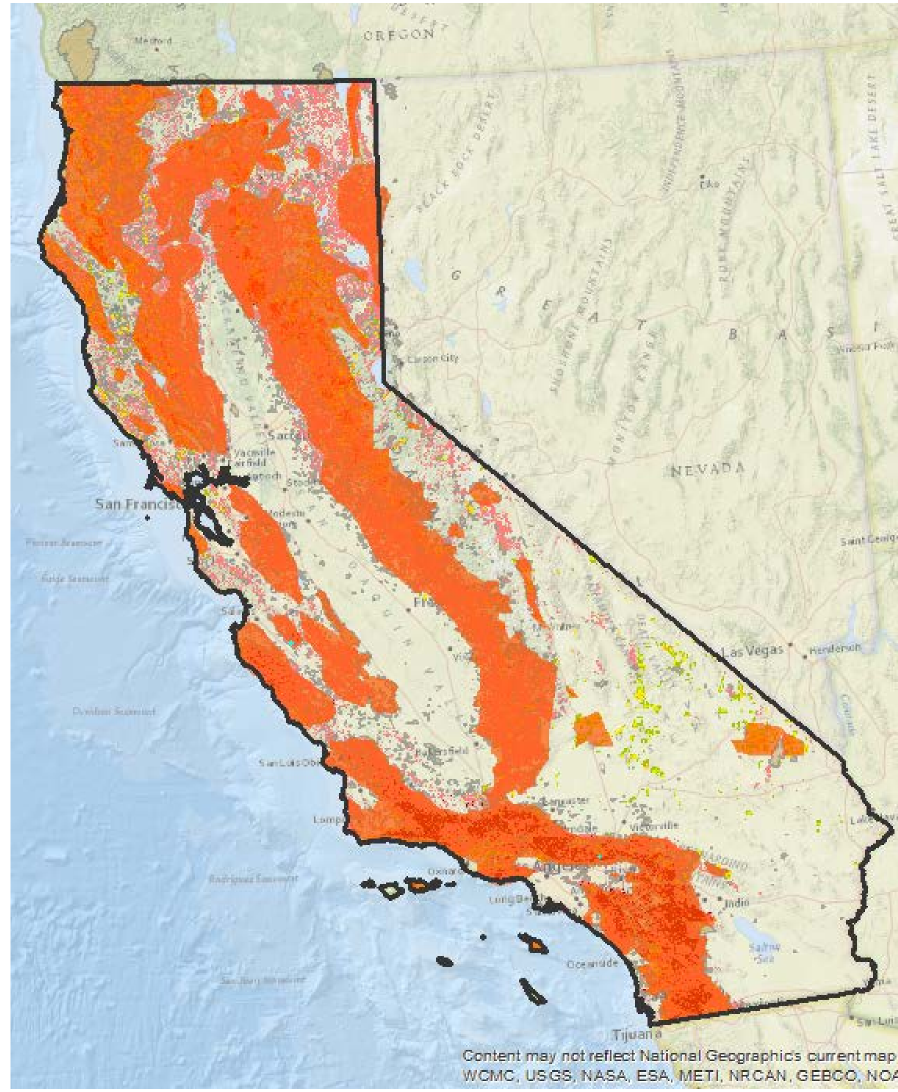
Fire Threat. Selecting large segments of Very High and Extreme

Statewide Analysis

Selecting areas of large or numerous historic fires.

Statewide Analysis





Composite of important information. Composite of selections.

Skeleton of Statewide Workplan

Step 1: SDG&E / IOU create "Shape 1" for entire state (displayed later). Using IET, Fire Threat, Fire History (complete)

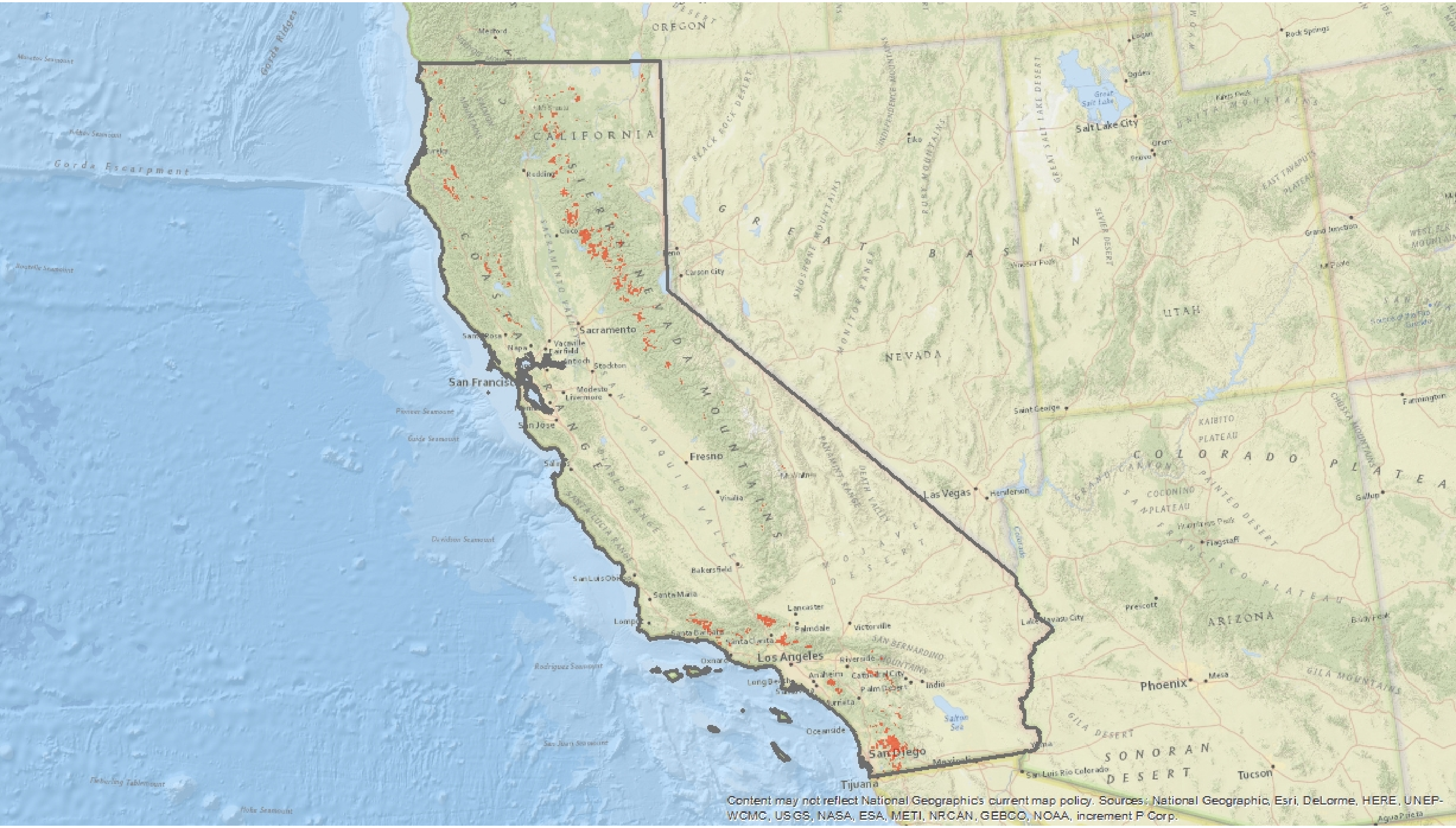
- Step 2: Review Shape 1
- Step 3: Utilities modify "Shape 1" in their respective territories to create "Shape 2", an operationalized map with local input that establishes the Universe of Fire Threat Districts. With justification for deviations from "Shape 1"
- Step 4: Review Shape 2, collaborate with adjoining utilities to ensure cross-border consistency
- Step 5: Utilities carve "Shape 2" to create Tiers within "Shape 2", the output being "Shape 3"
- Step 6: Review Shape 3
- Step 7: Final review and publish

Review Subroutine: CALFIRE to assess. Additionally, if non-utility stakeholders have concerns about shape, can provide specific location and rationale of concern.

Appendix C Proposal

Subject: Demonstration of SDG&E interpretation of Appendix C

Appendix C Proposal



IET Top 10% (?)

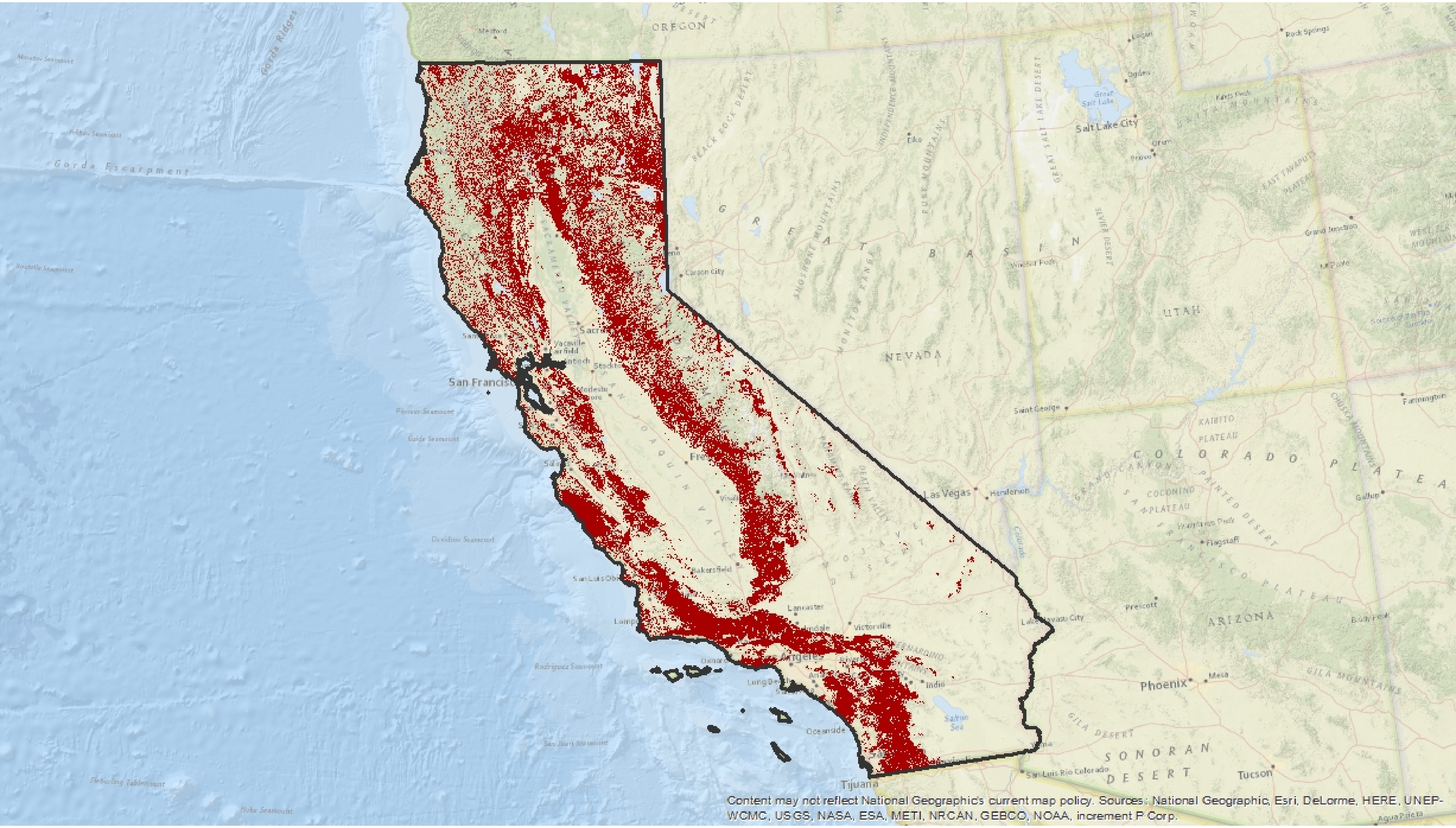
Appendix C Proposal

IET Top 20% (?)

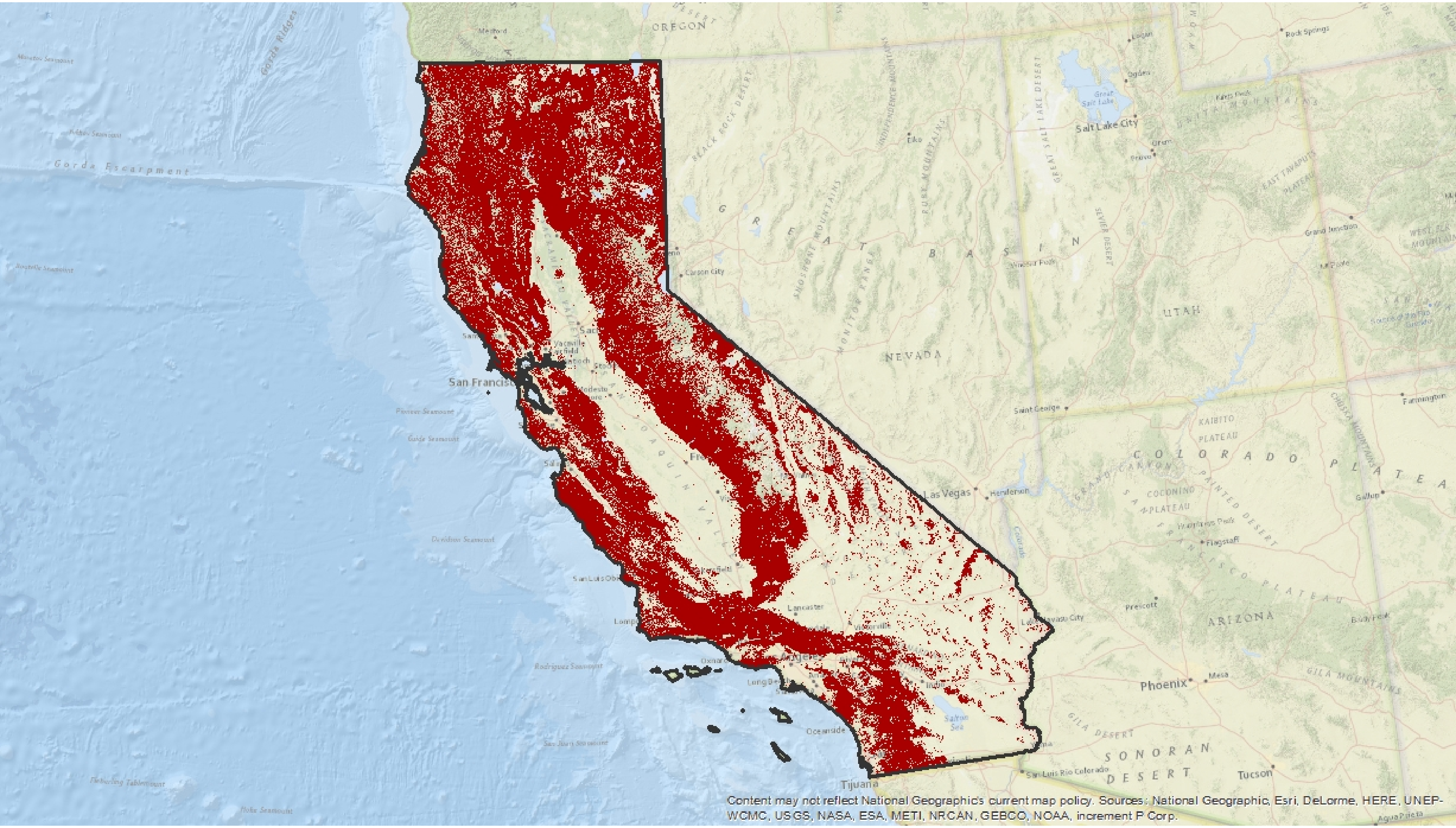
Appendix C Proposal

IET Top 40% (?)

Appendix C Proposal



Fire Threat (Very High and Extreme)

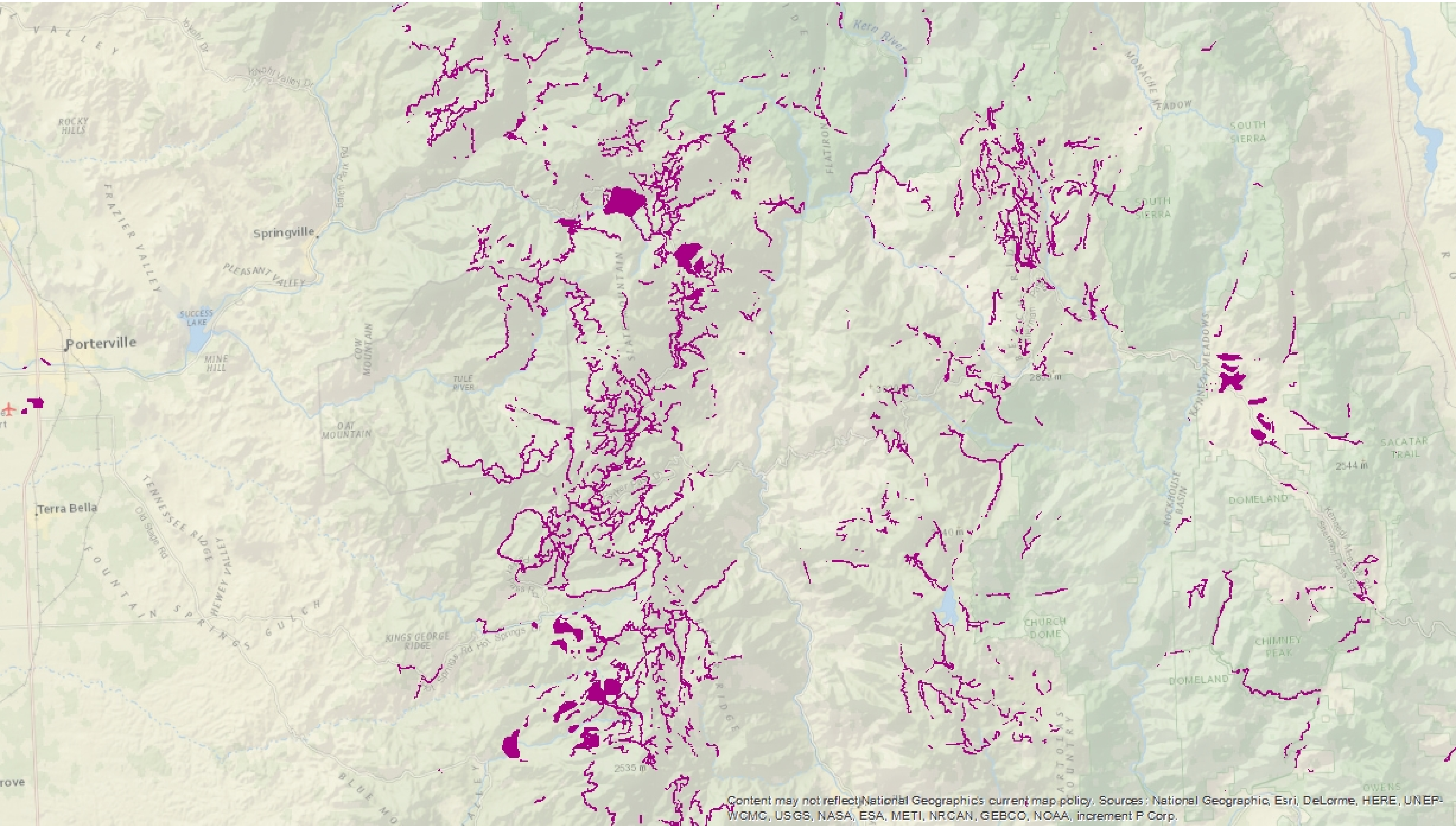


Fire Threat (High, Very High and Extreme)

Appendix C Proposal

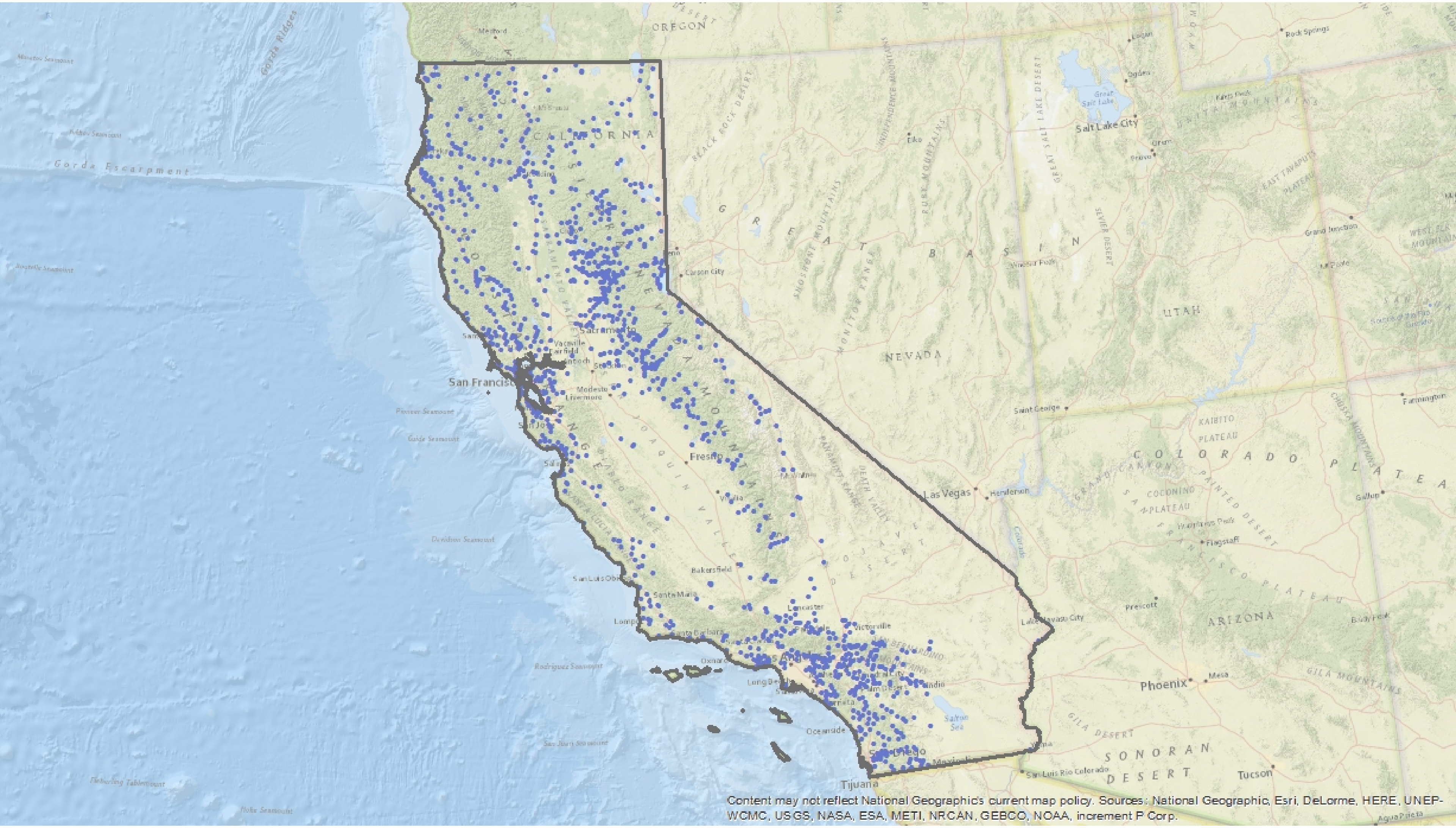
Tree Mortality Tier 1 (High Hazard Zone)

Appendix C Proposal

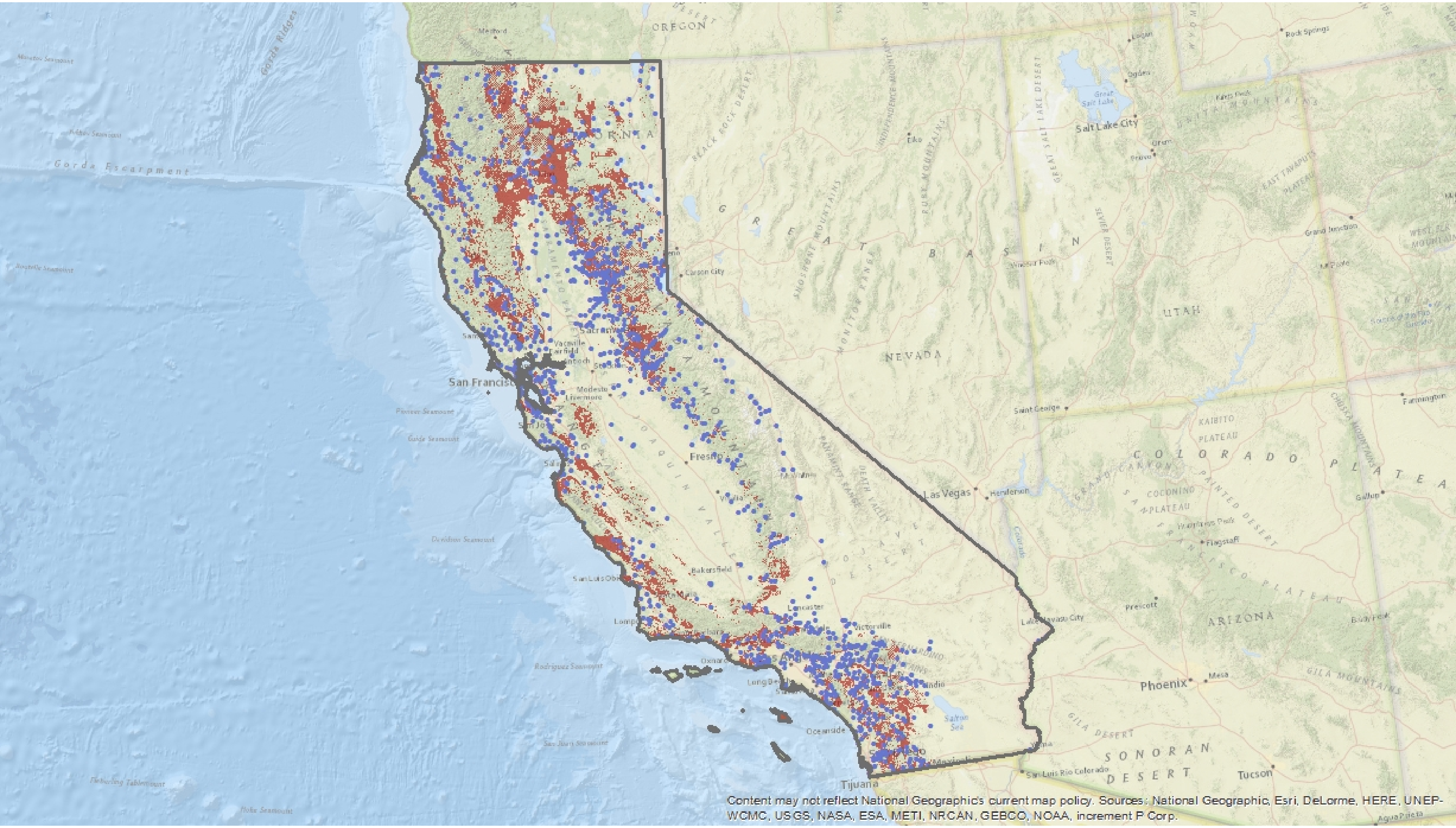


Tree Mortality Tier 1 (High Hazard Zone) –Zoomed In

Appendix C Proposal

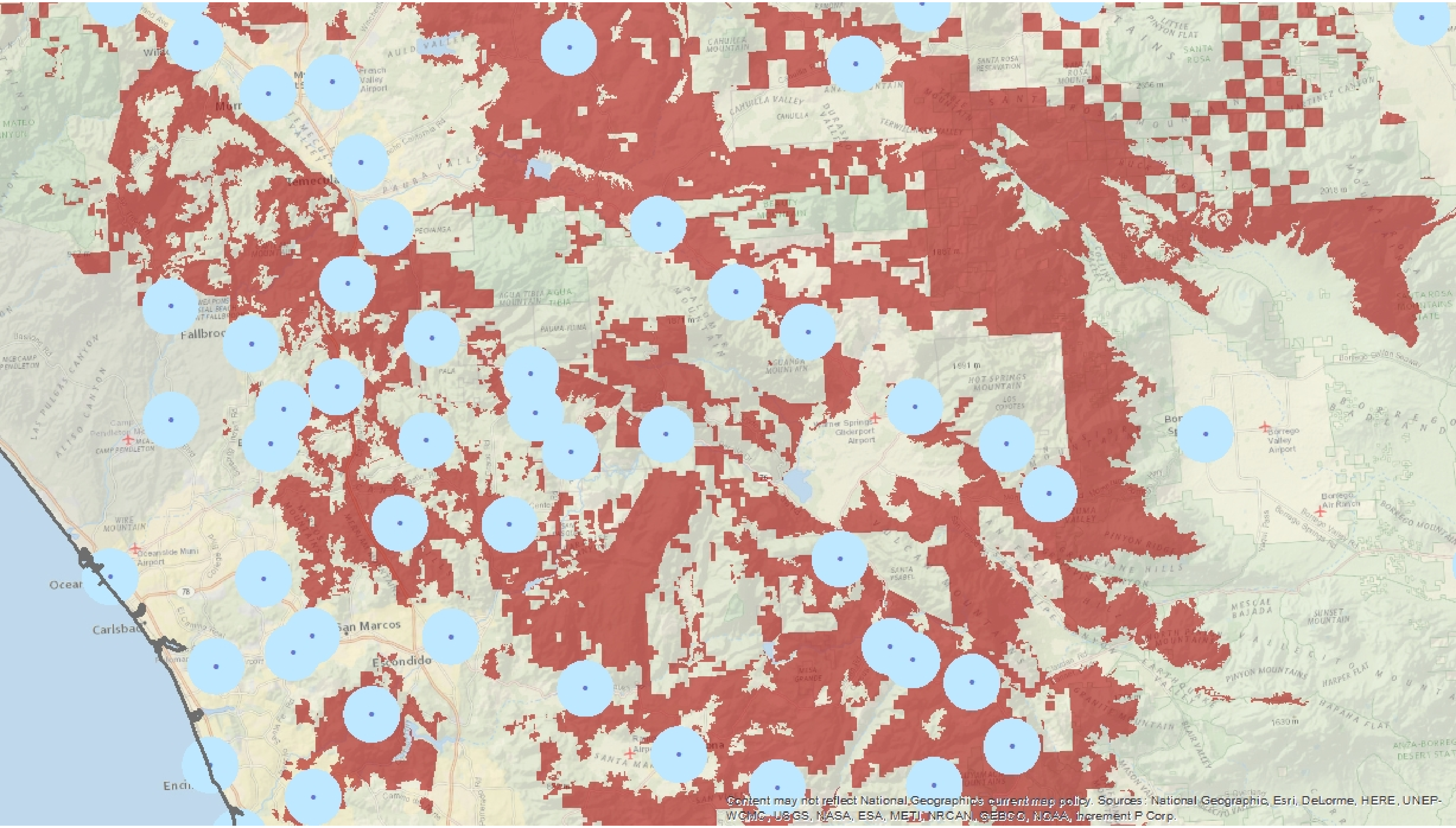


Appendix C Proposal



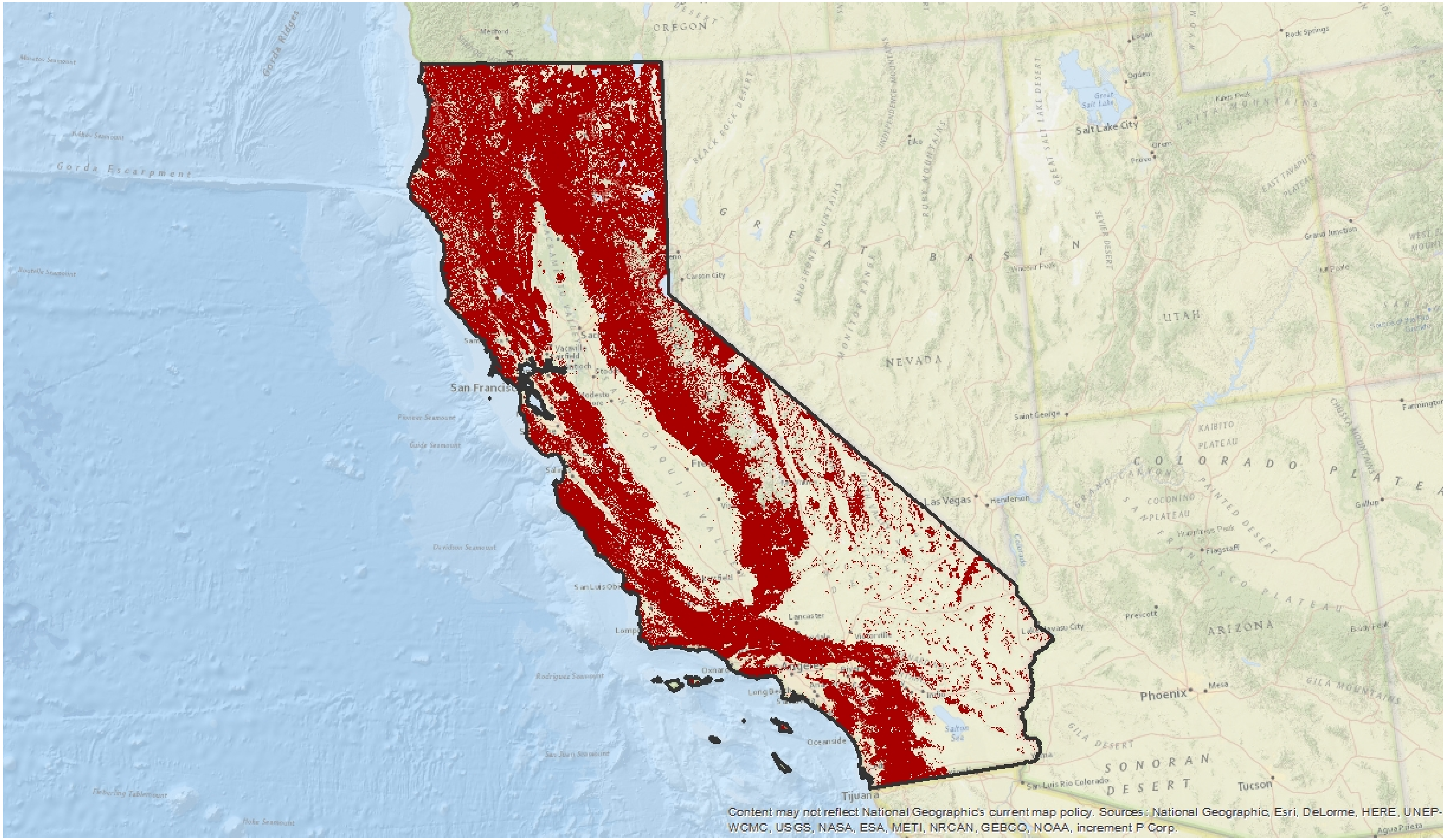
Communities At Risk (with High Fire Hazard Severity Zone)

Appendix C Proposal



Communities At Risk (with High Fire Hazard Severity Zone)

Appendix C Proposal

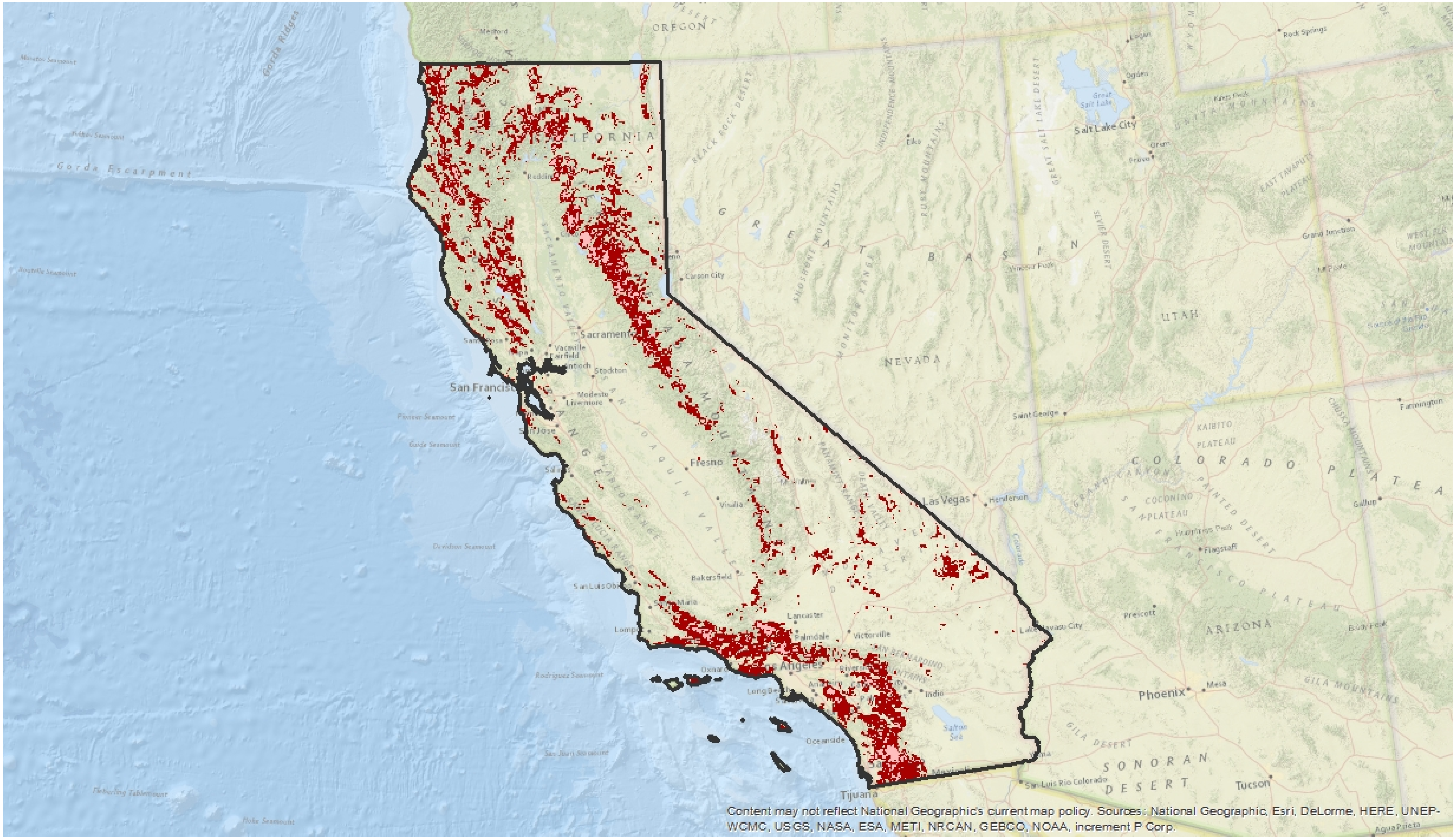


Appendix C composite

Discussion

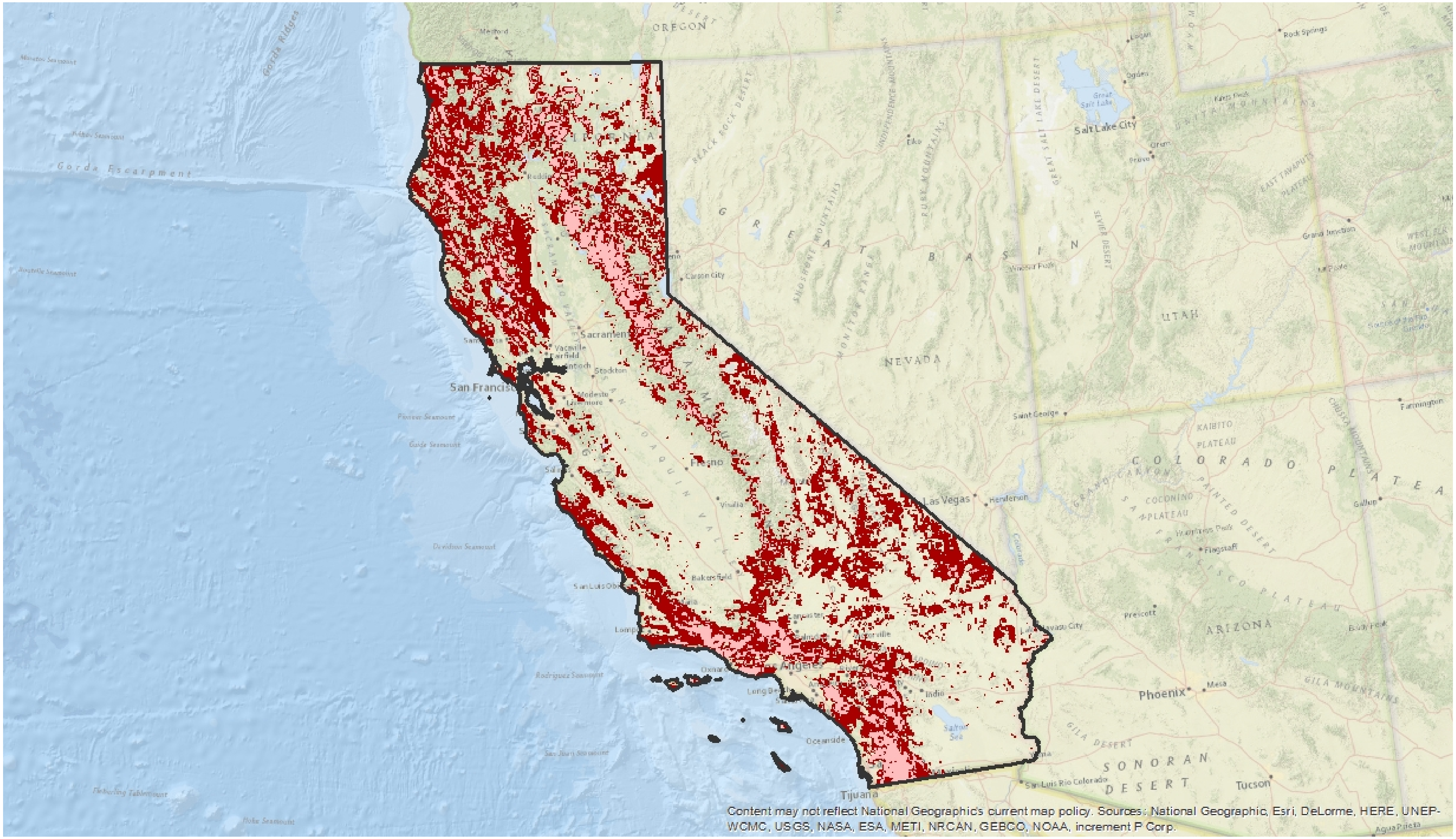
Subject: Need to clarify the 10, 20 and 40% values.

Discussion Appendix C Proposal

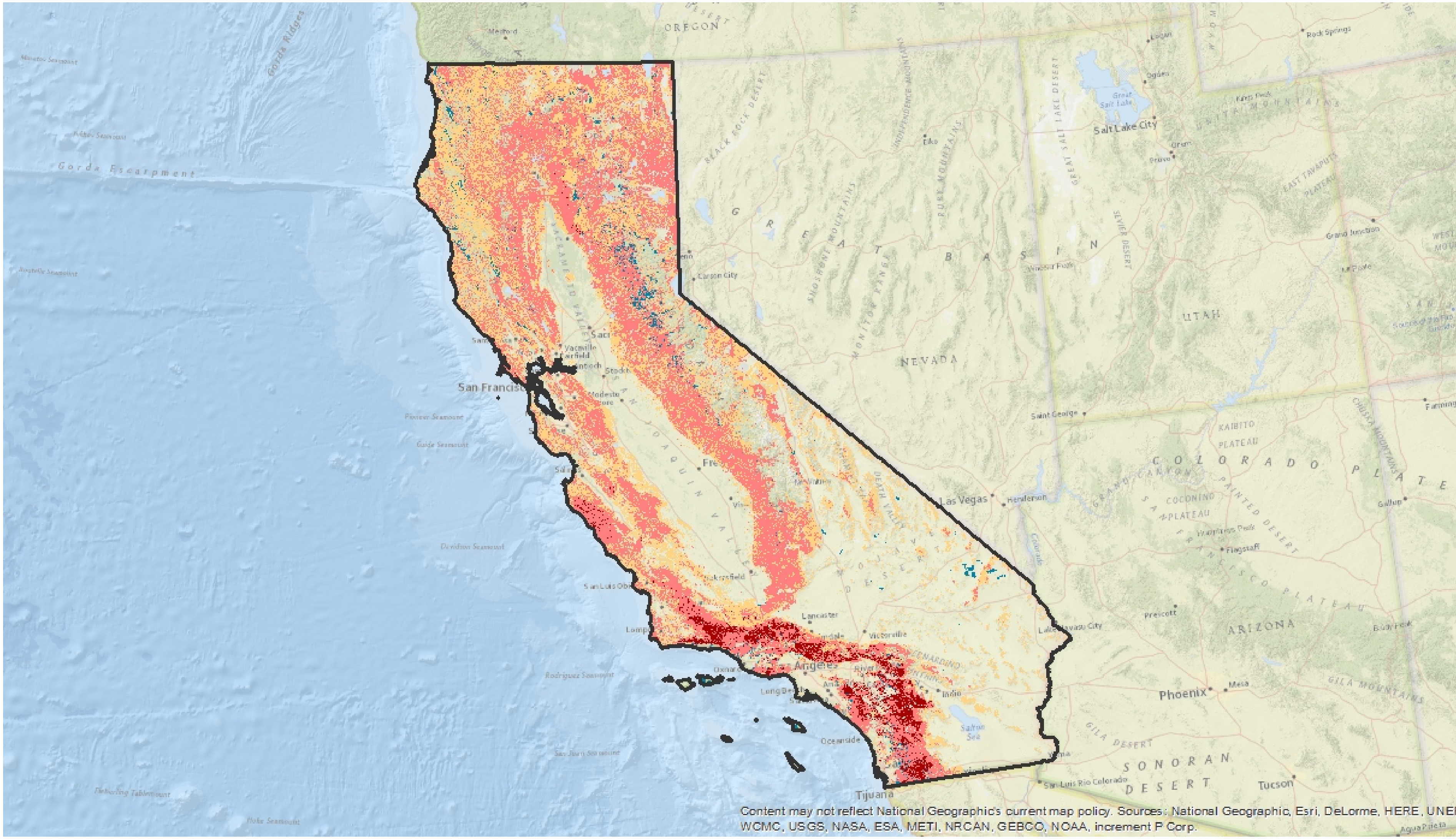


10% both methods

Discussion Appendix C Proposal

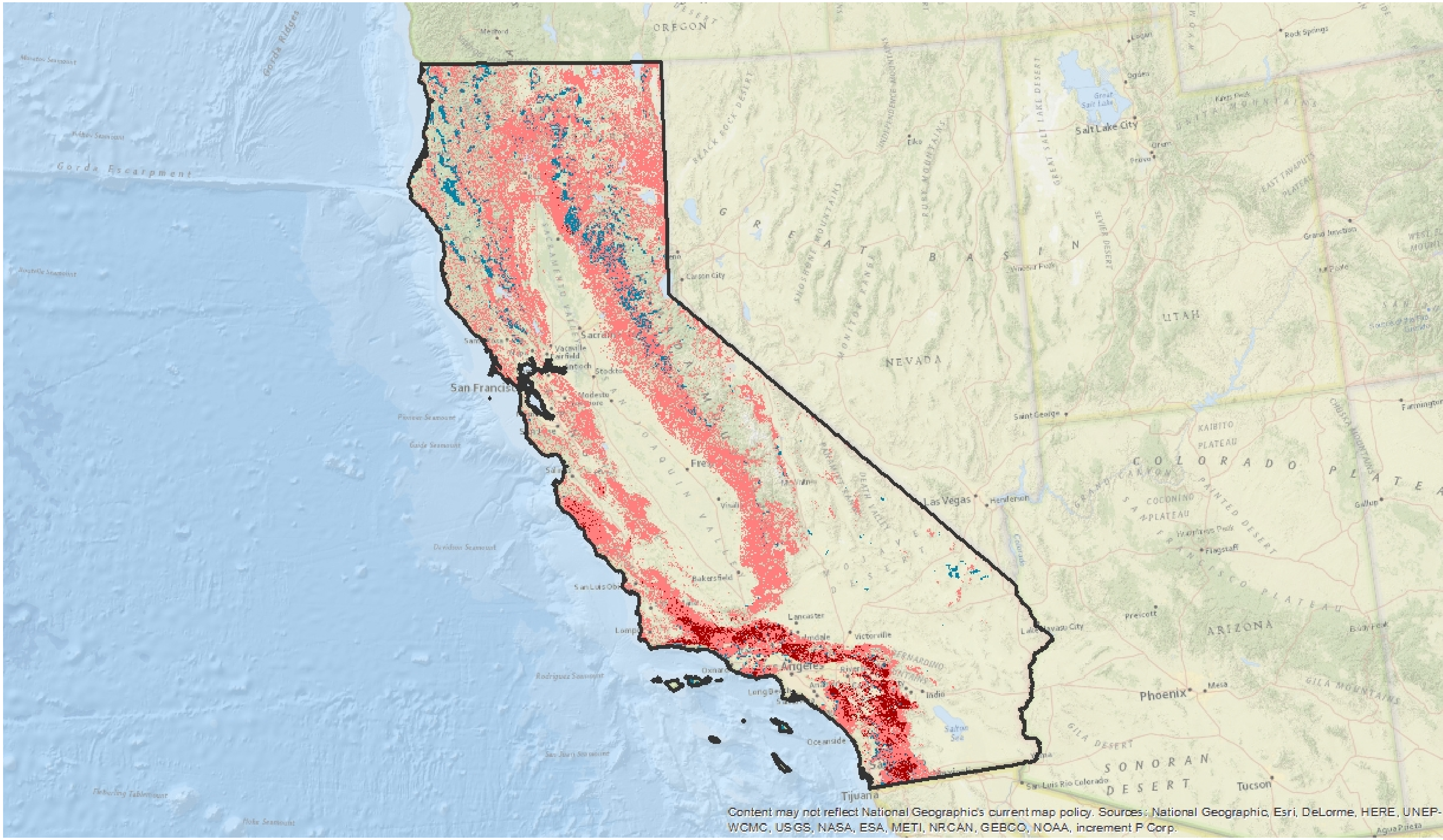


40% both methods



IET vs Fire Threat with High

Appendix C Proposal



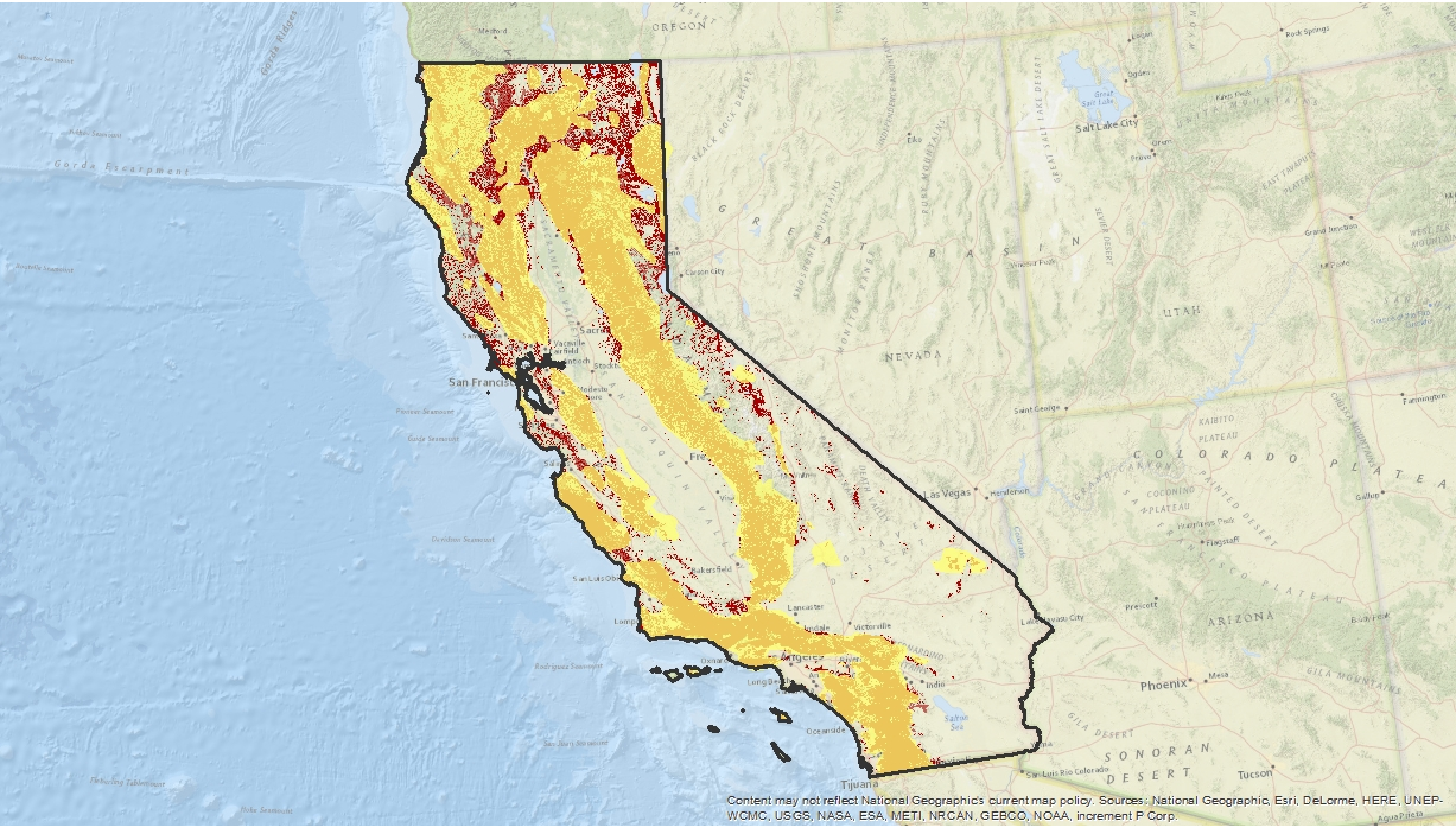
IET vs Fire Threat (Very High and Extreme)

Comparison of Two Alternatives

Subject: Comparison of SDG&E / IOU and Appendix C alternatives

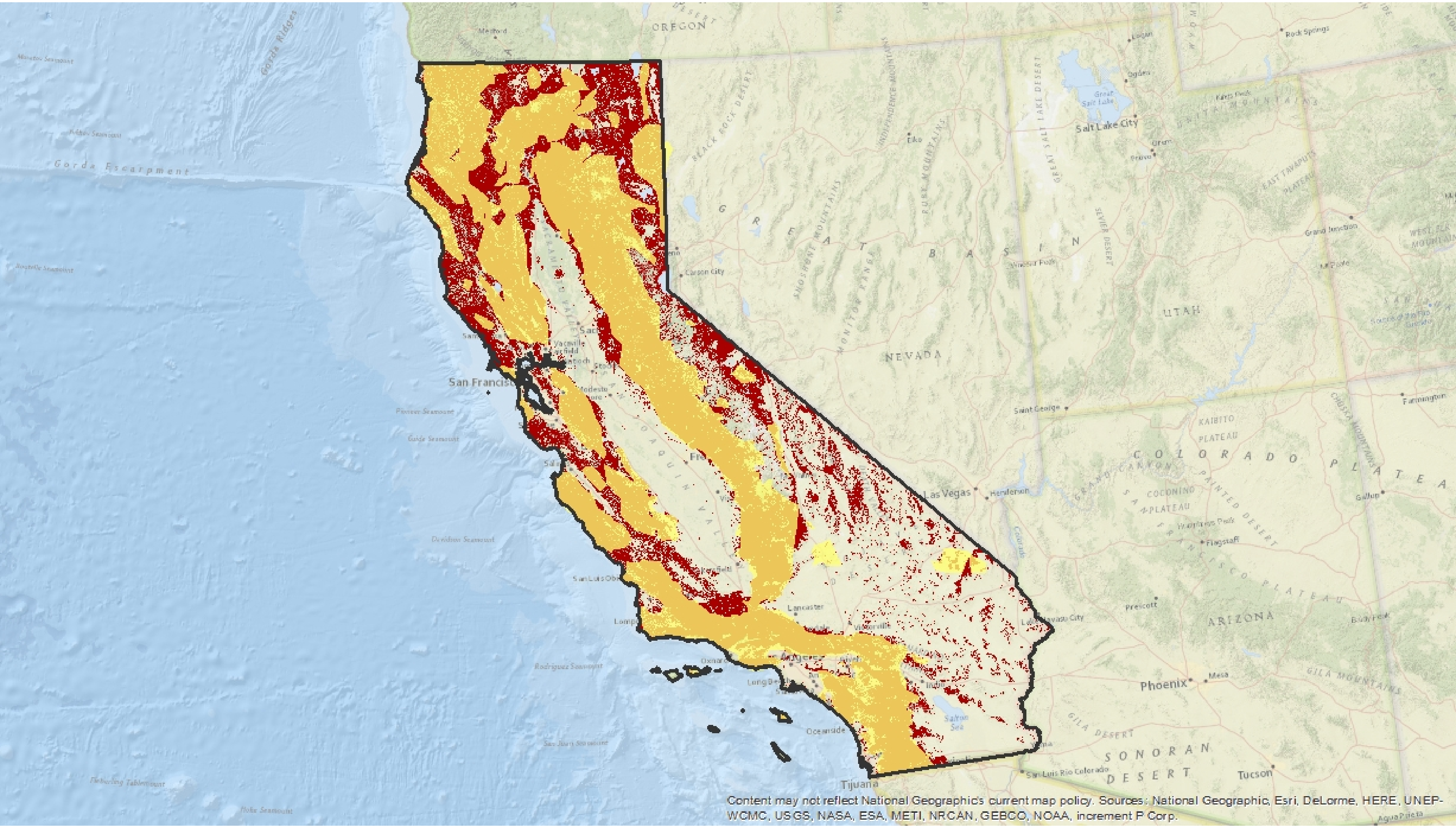
Rationale: Review both alternatives side by side to understand how they differ in approach and result

Comparison of Two Alternatives



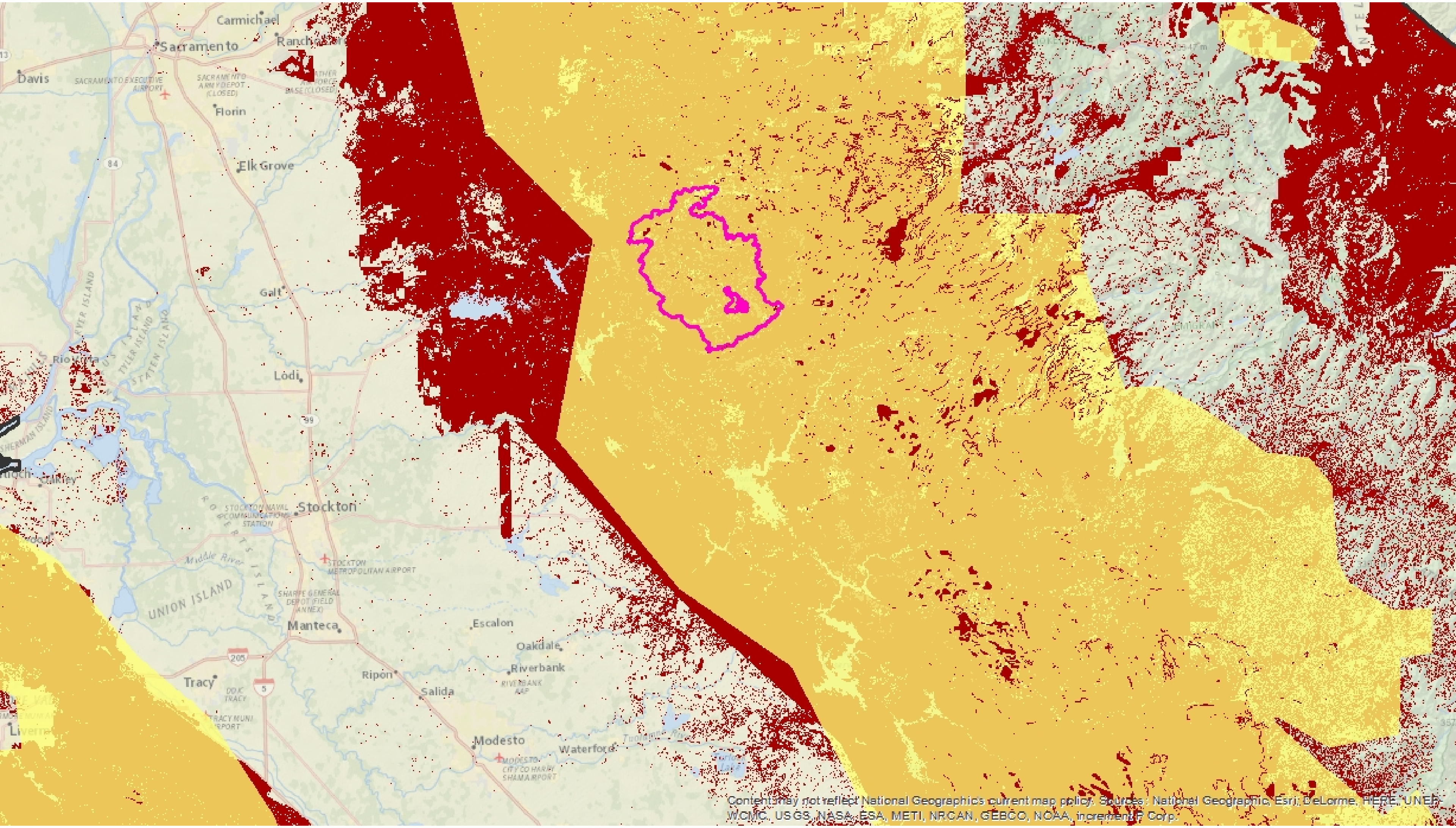
Comparing SDG&E and Appendix C (sans High Fire Threat)

Comparison of Two Alternatives



Comparing SDG&E and Appendix C

Comparison of Two Alternatives

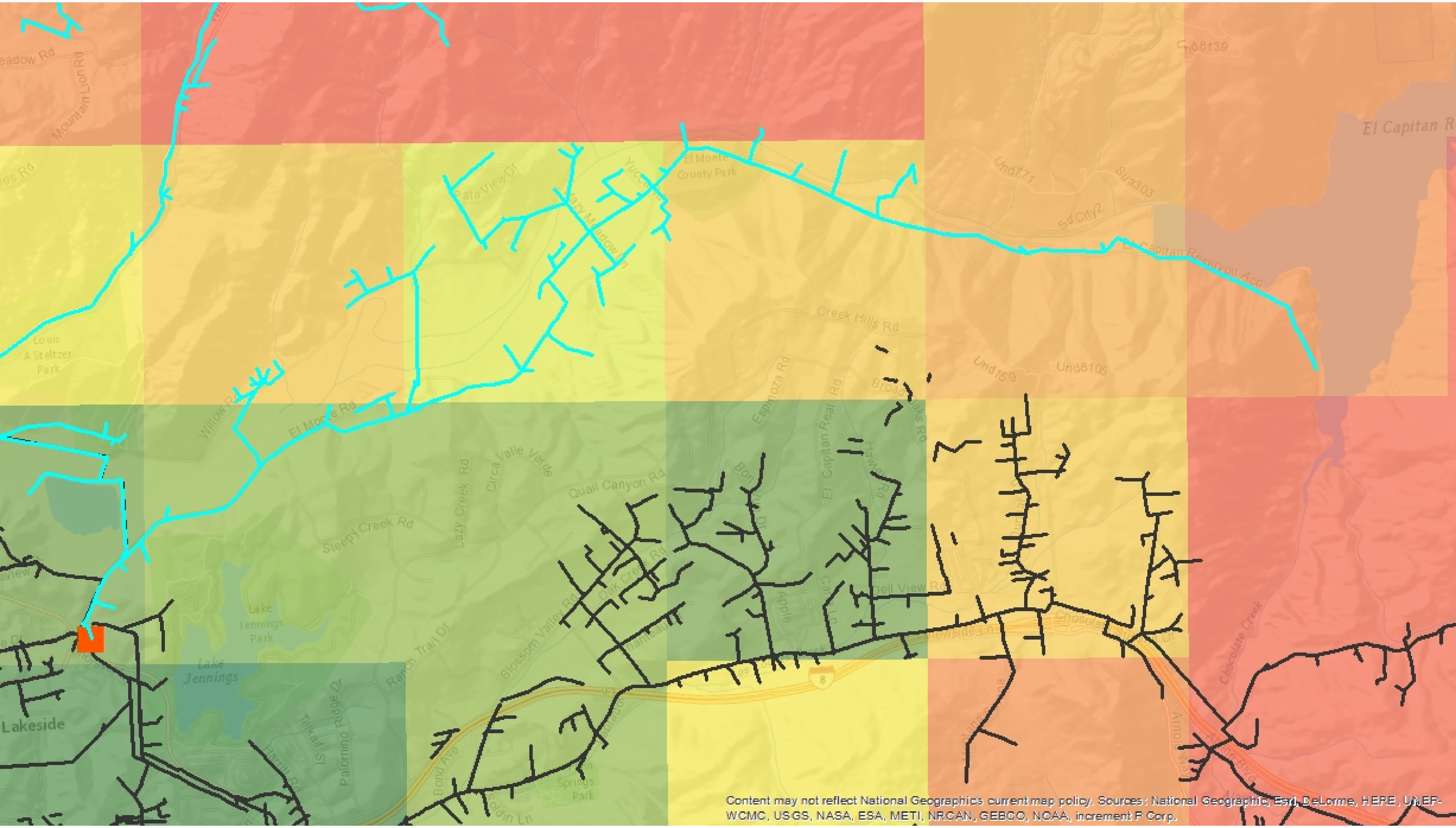


Differences between Two Alternatives

Subject: Highlights of how alternatives differ

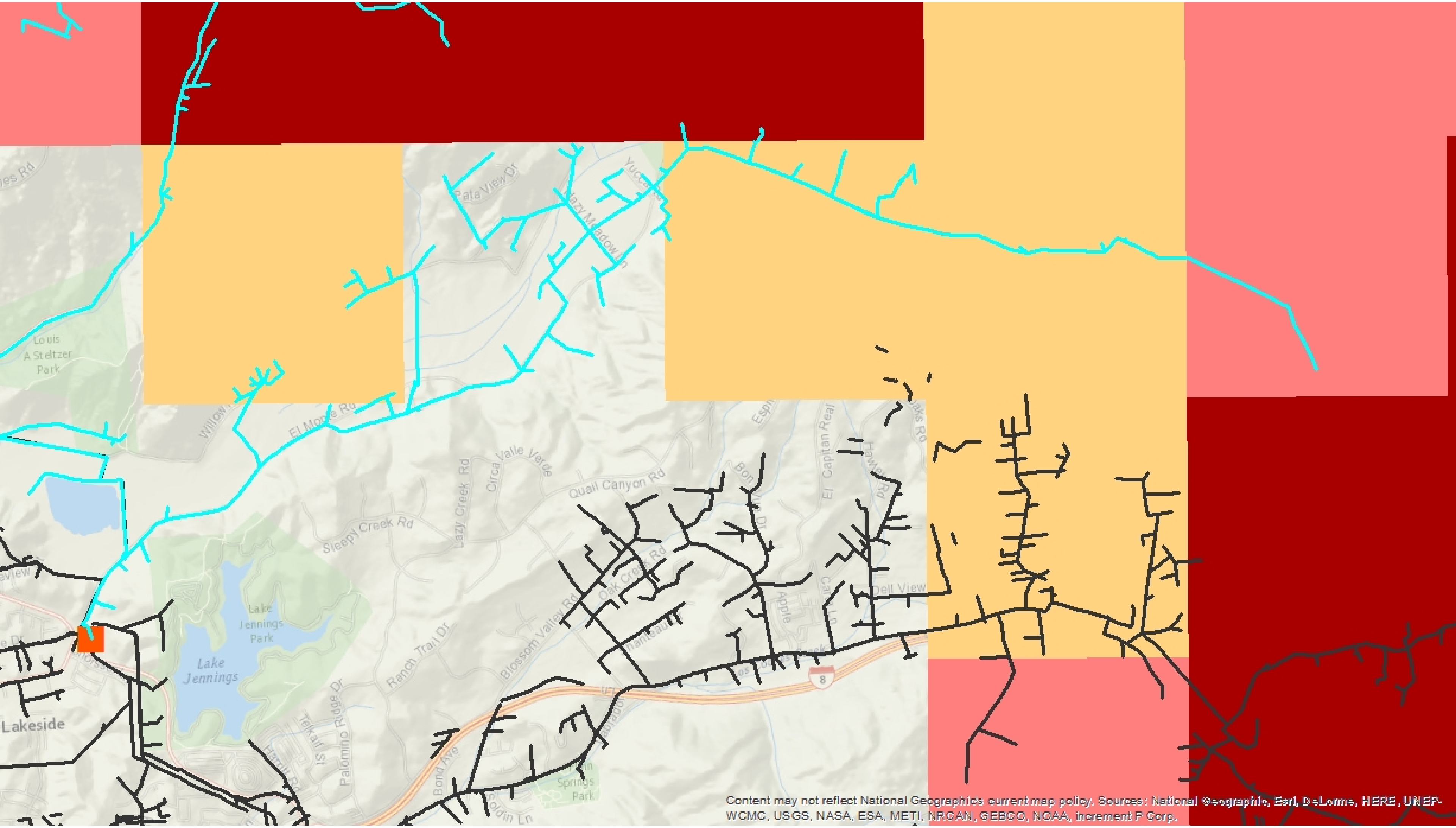
Rationale: There exist significant differences between the alternatives which will lead to different outcomes

Differences between Two Alternatives



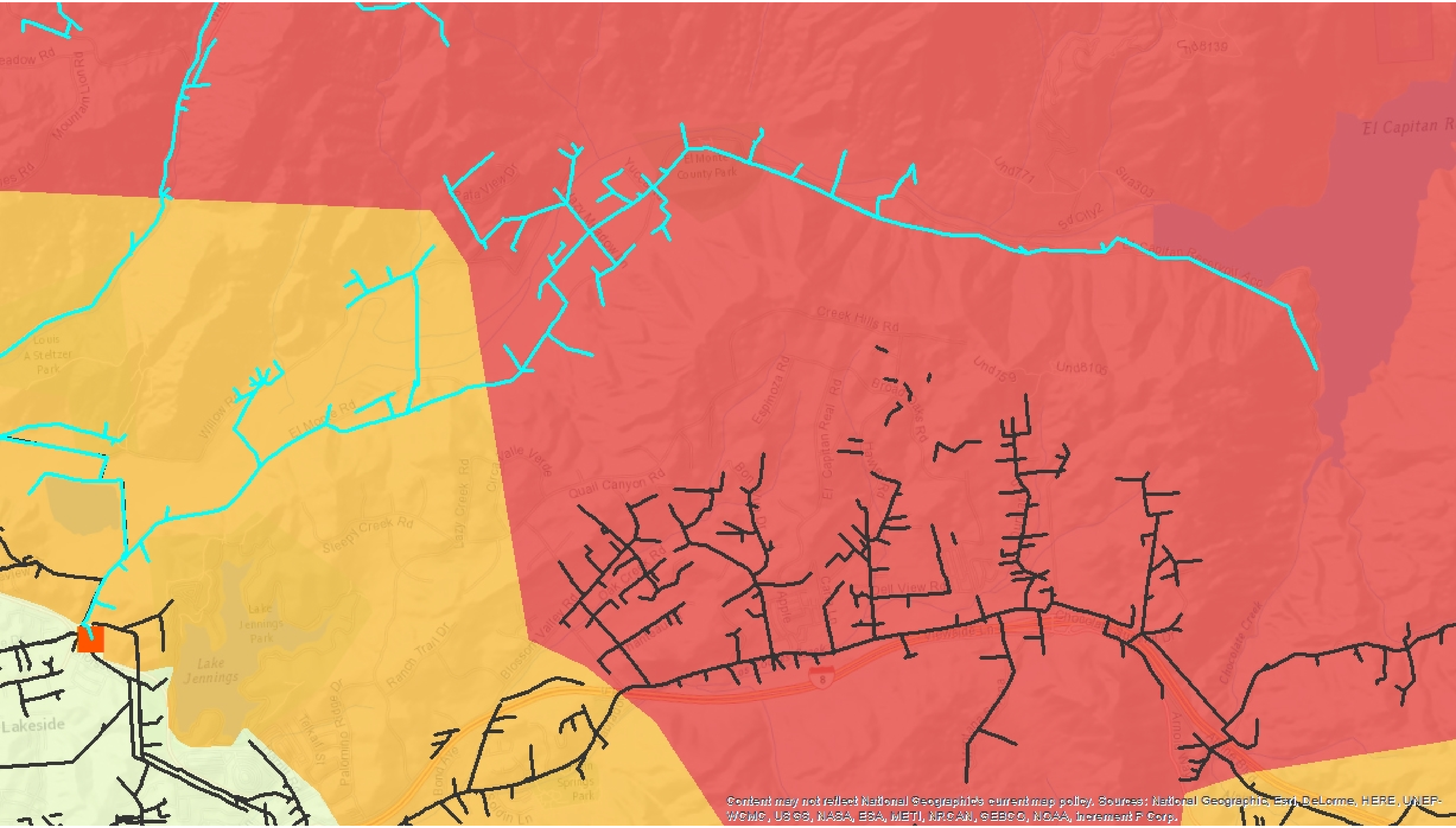
Illustrates how a single line can traverse varied IET values
Traverses IET values from 225 to 4623

Differences between Two Alternatives



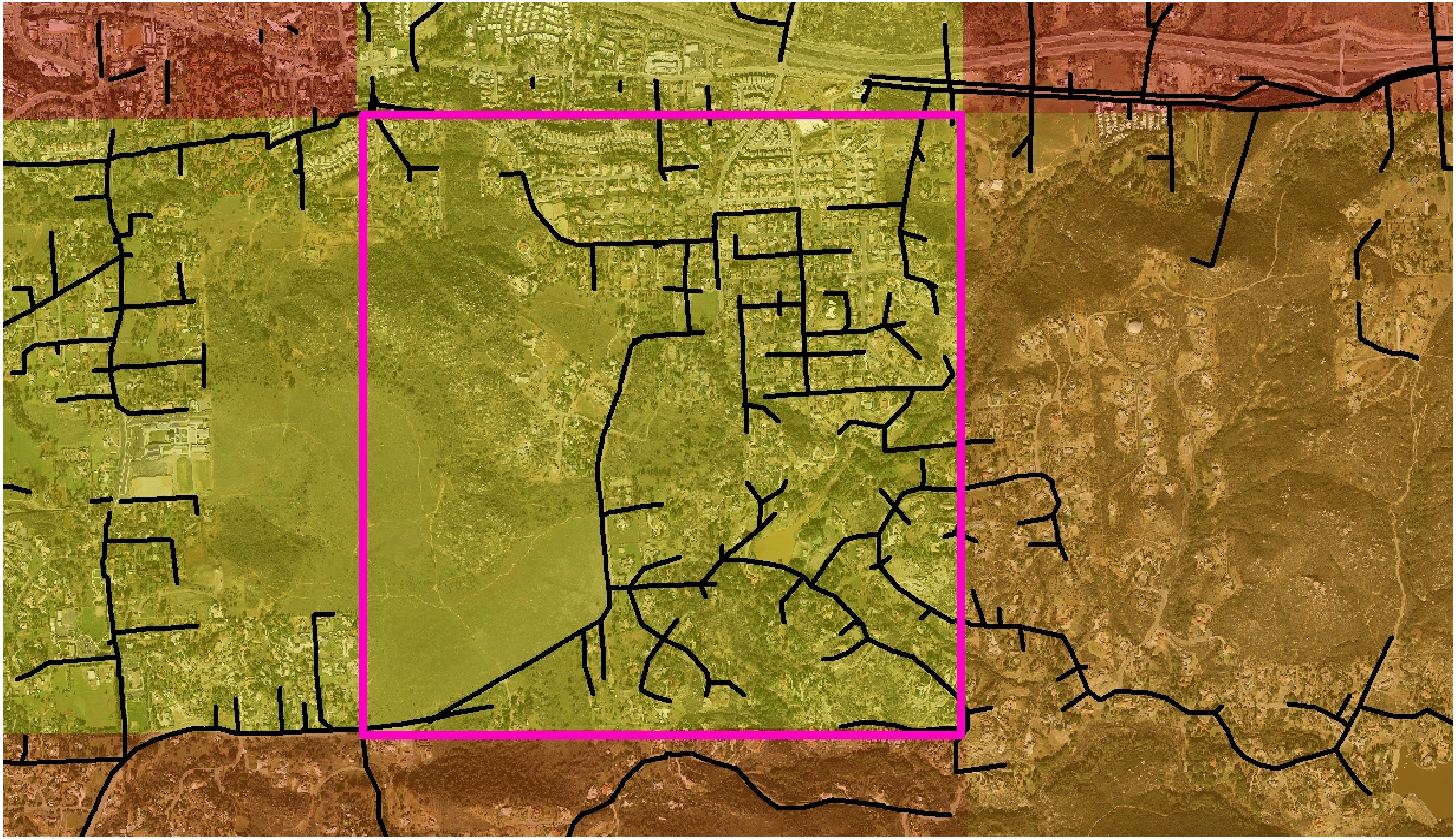
Illustrates how a single line can traverse varied IET values
Traverses IET values from 225 to 4623

Differences between Two Alternatives



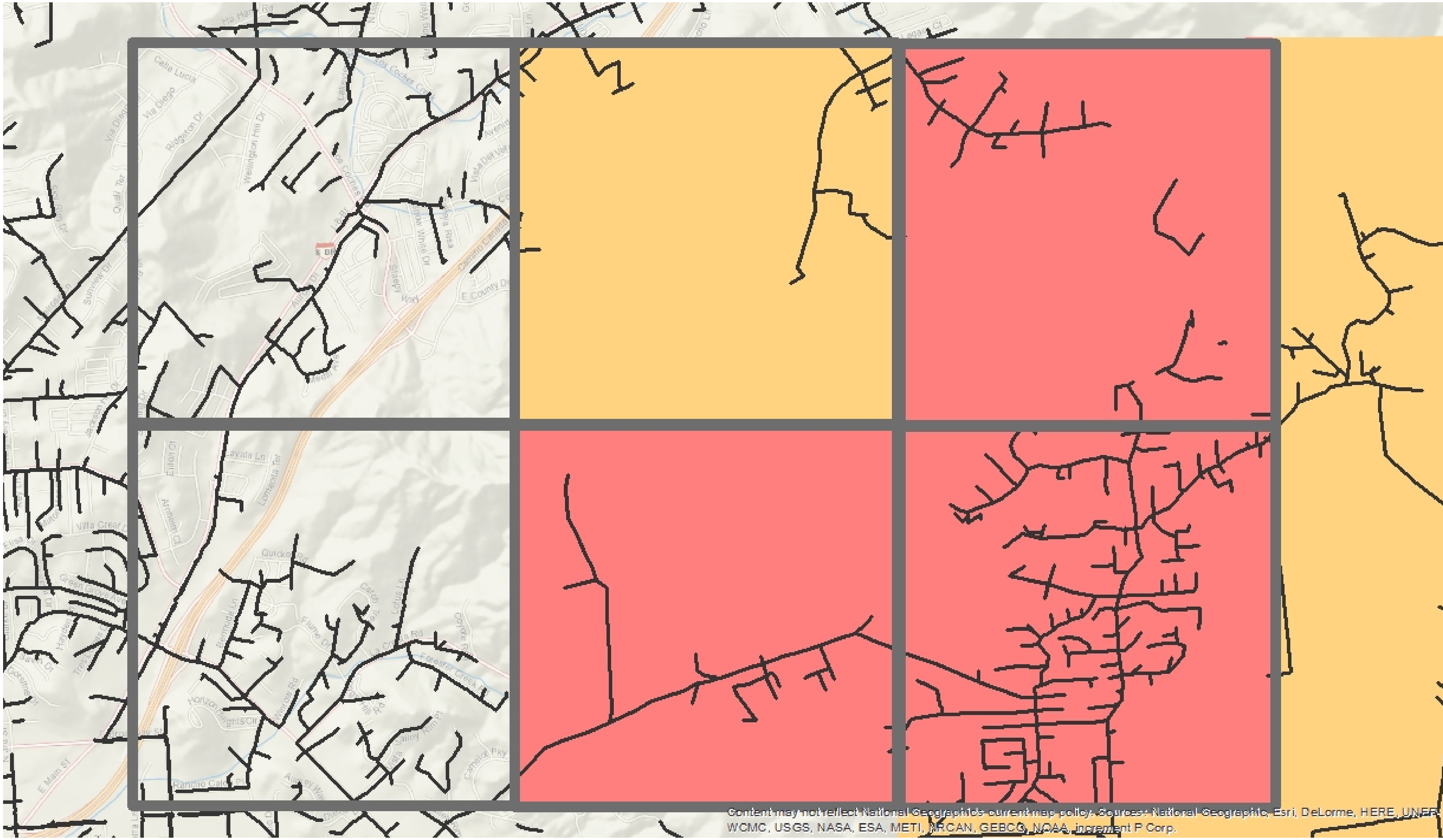
Illustrates how a single line can traverse varied IET values
Traverses IET values from 225 to 4623

Differences between Two Alternatives



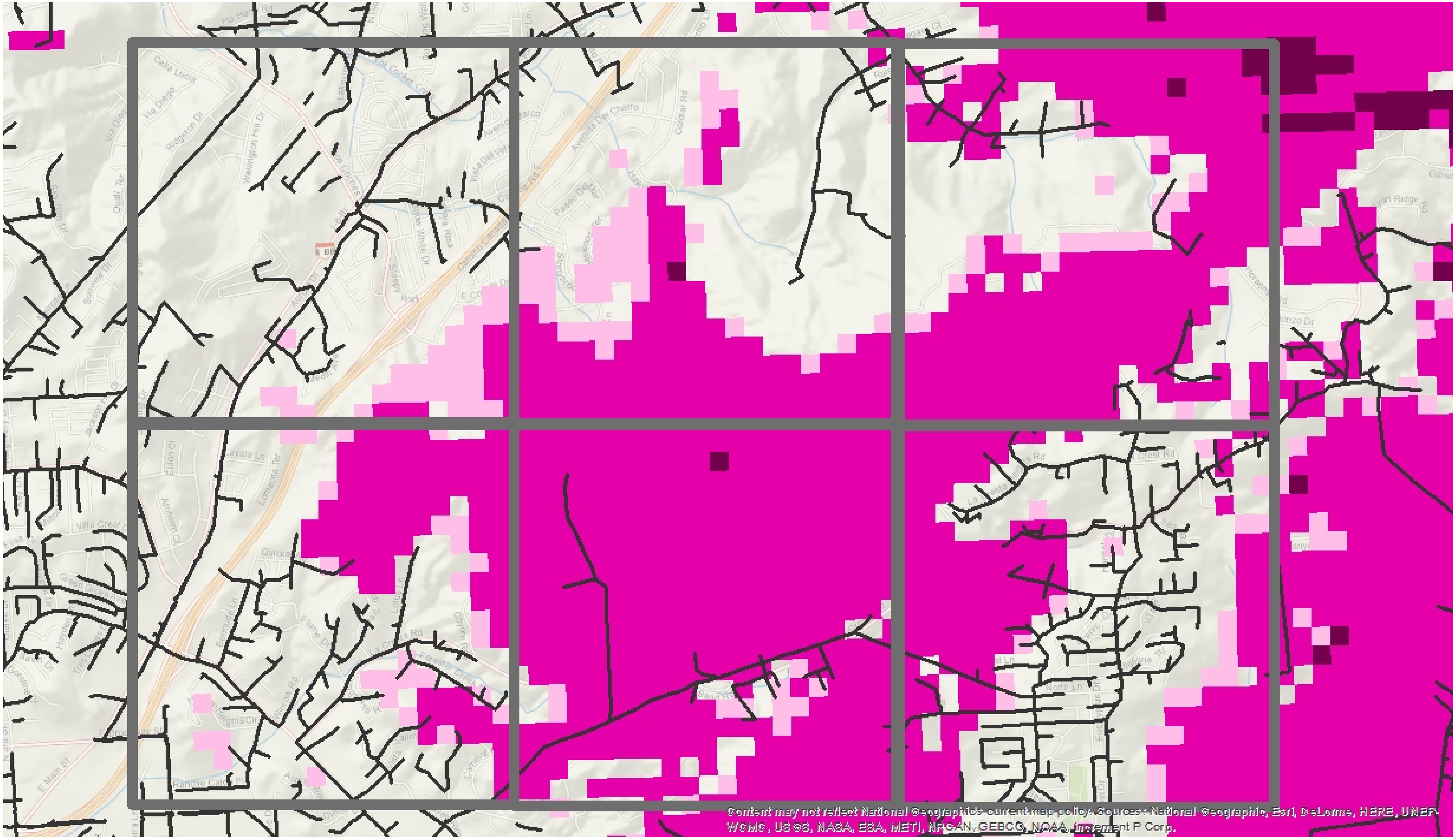
Illustrates the need for fine-tuning tiers
IET value 1441

Differences between Two Alternatives



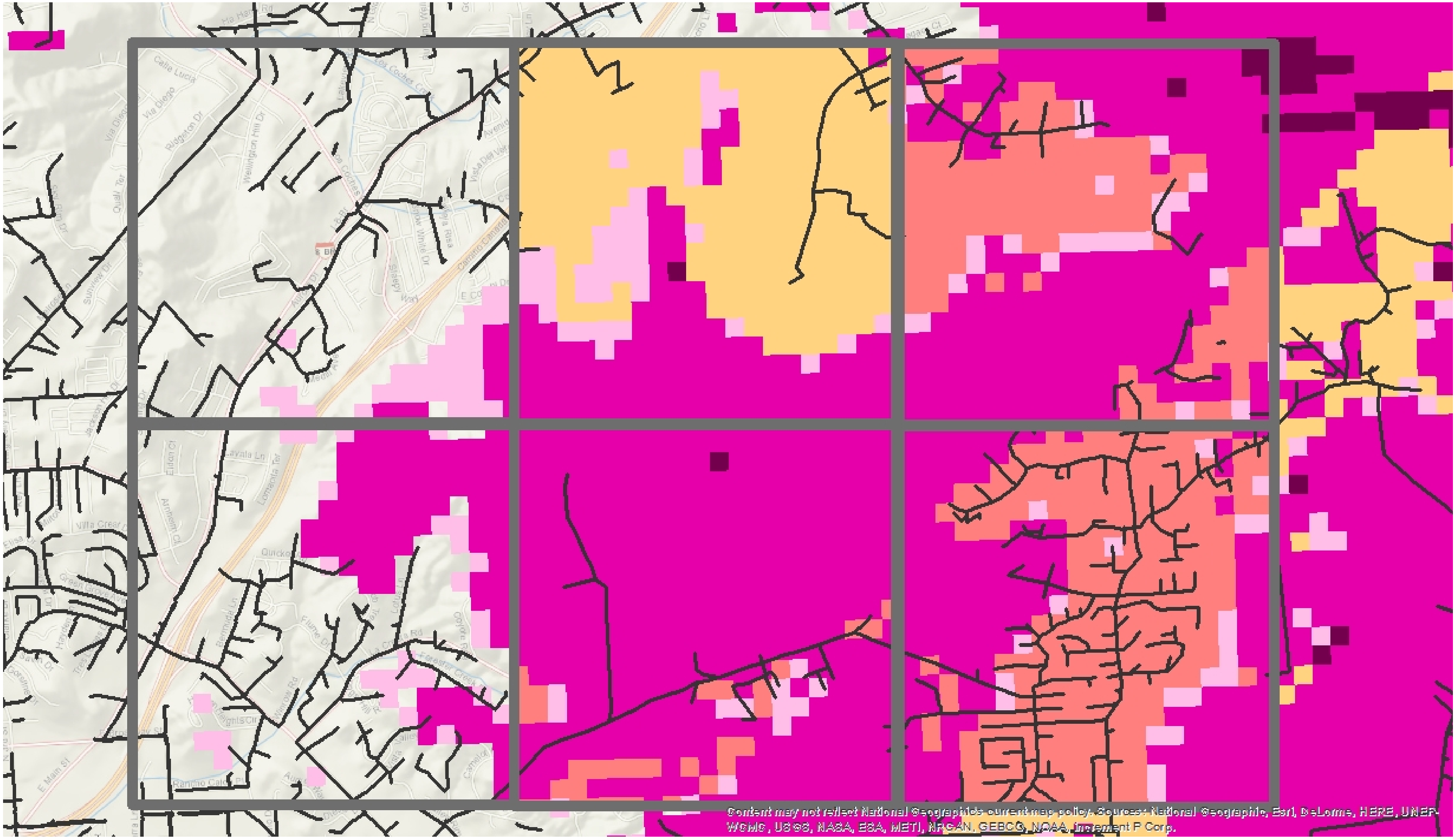
With IET

Differences between Two Alternatives



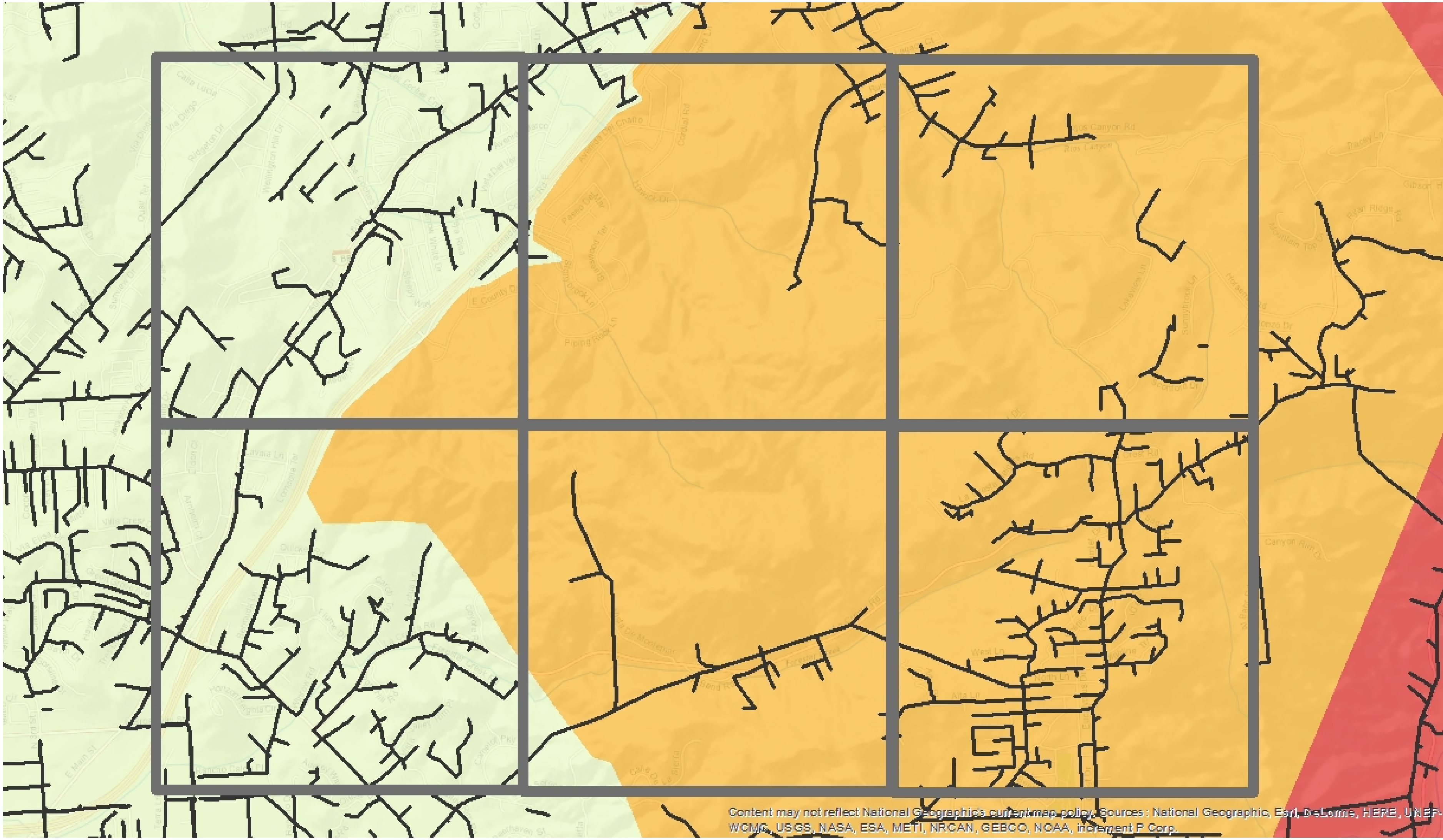
With Fire Threat

Differences between Two Alternatives



With both

Differences between Two Alternatives

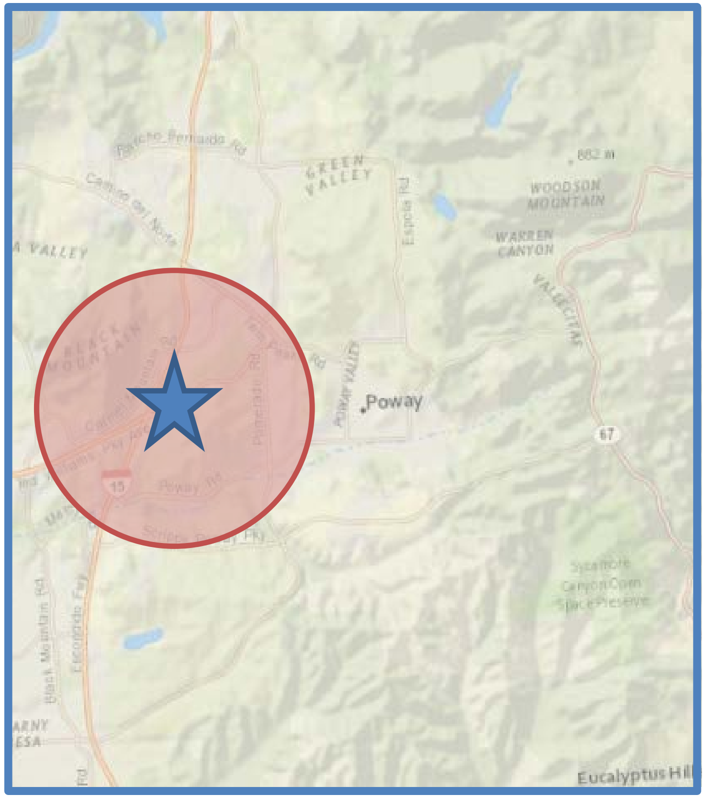


Preferred SDG&E method

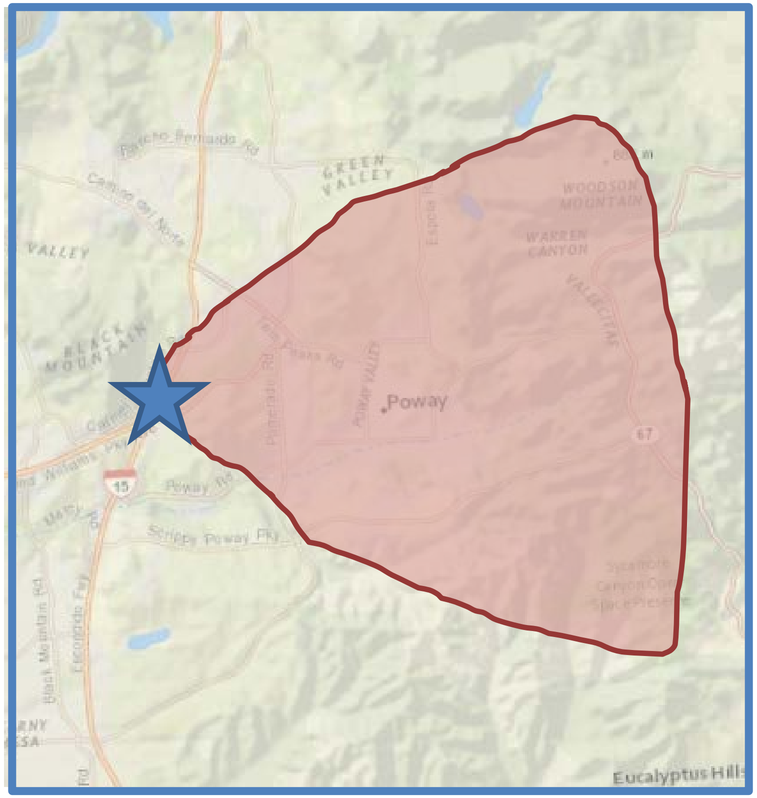
- The FRAP information for "Communities at Risk" is problematic
  - It is point based, rather than polygon
- The Community list was generated to inform which communities may be at risk due to a fire harming their citizens
  - It is not meant as a list for communities that are likely to start fires
  - Local risk analysis can be used to determine which situations will harm each community
    - As opposed to a mechanical usage of boundary + 1.5 miles

Differences between Two Alternatives

Appendix C attempts to ensure higher standards of areas in and surrounding a community at risk. However, it is more appropriate to ensure higher standards in area that could lead to communities harm.



Appendix C



More reasonable

Differences between Two Alternatives

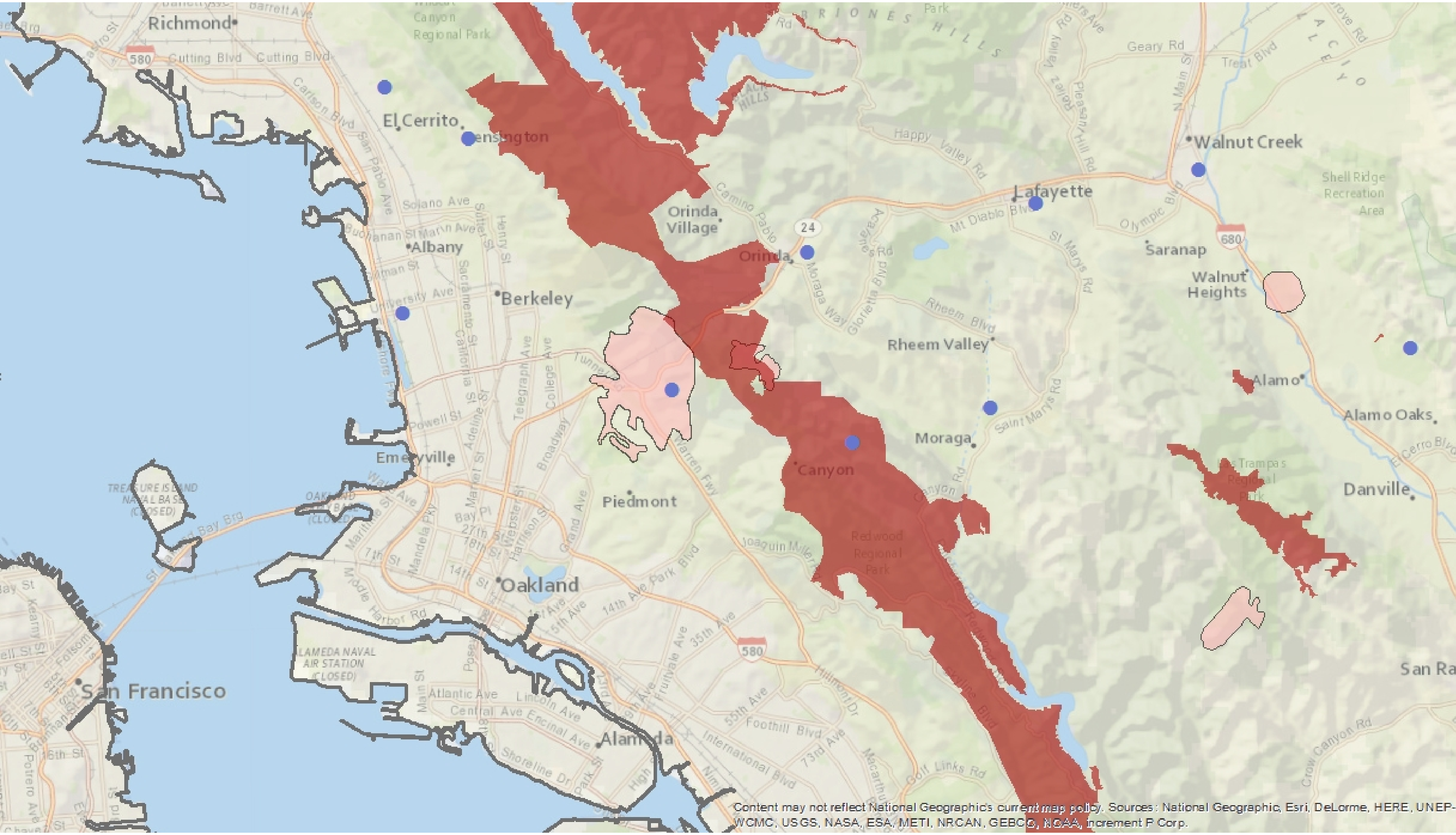
Oakland Hills Fire (Tunnel Fire)

- 1991
- 25 deaths
- 2800+ homes
- 1500+ acres

- Occurred near other large fire in 1923 that destroyed near 600 homes (cause unknown), and in 1970 which burned XXX homes.

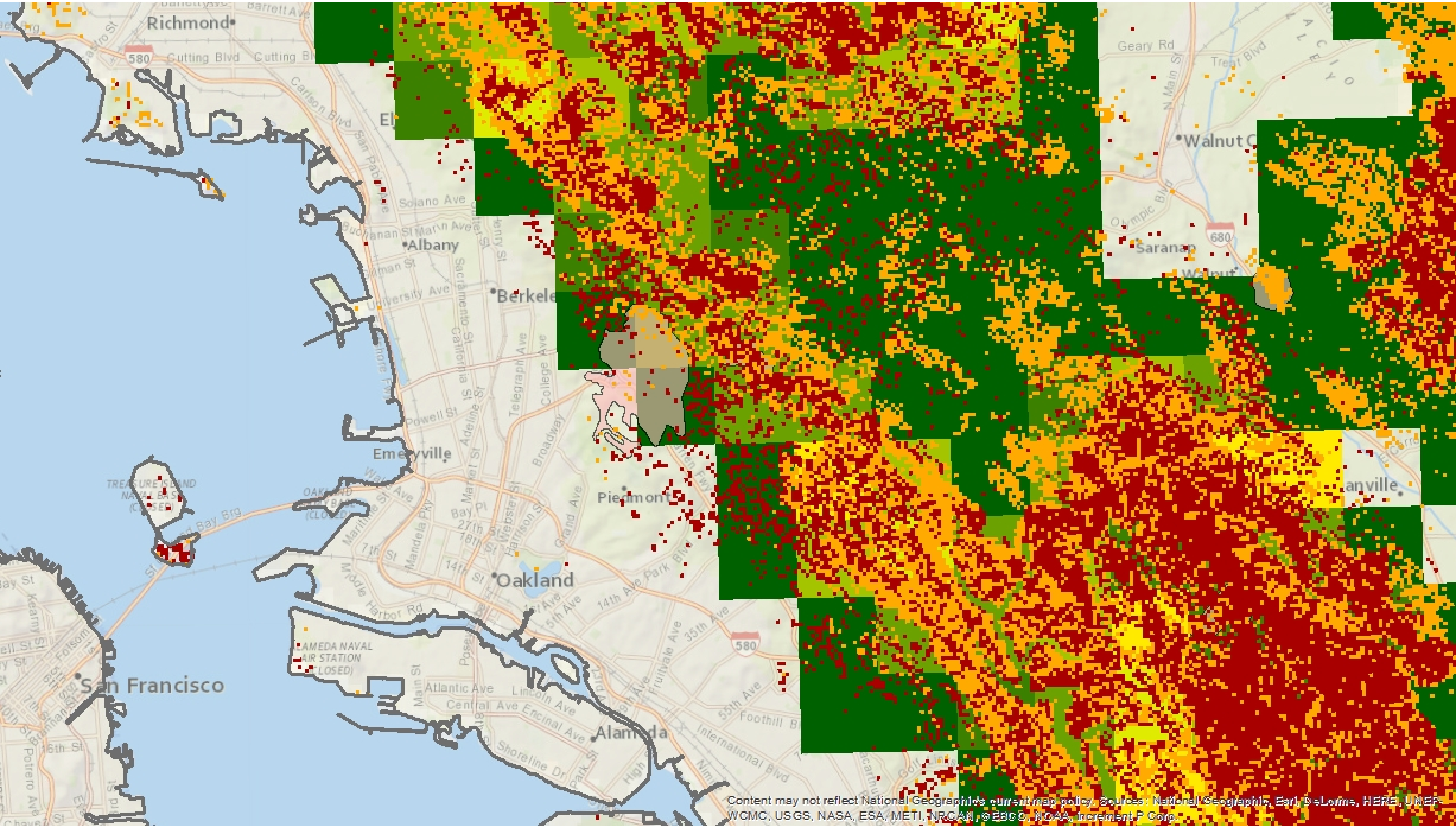
- From FEMA after-action report (USFA-TR-060: The East Bay Hills Fire)
  - "The 1970 fire followed virtually the same path as the early stages of the 1991 fire and the losses were attributed to exactly the same factors: wind, weather, natural fuels, lack of separation between structures and natural fuels, unlimited use of wood shingles, terrain, access, and water supply were all identified as major factors in both fires."

Differences between Two Alternatives



Oakland Hills Fire
Communities At Risk (with High Fire Severity Zone)

Differences between Two Alternatives



Discussion of Utility Discretion

Appendix C. 4. D.

"Additional quality control: Utilities could deviate from the boundaries of each Layer based on their knowledge of local fire hazards, risks, and other conditions. All deviations would have to protect safety."

Need clarity:

Do utility deviations occur after map creation? Or before?

If after, difficult to audit.

If before, method similar to SDG&E / IOU

Does 'protect safety' mean that all deviations need to be more conservative, or can the utility shrink the tiers if safety allows?

Utility Discretion

- Fire Map 1
  - Great effort
    - Helped advance fire science
    - Strong starting point
  - Imperfect
    - Specific areas do not have the proper values
    - Two options going forward
      - Improve Fire Map 1
      - Allow utilities to deviate with rationale
- Proposal: Allow utilities to deviate with rationale
  - As part of justification why “Shape 2” differs from “Shape 1”

Conclusion

Subject: Summarize the discussion

Rationale: After 100 slides, you need to conclude at some point

Conclusion

- Overview
  - Appendix C has many interesting and relevant points
  - SDG&E agrees that Tree Mortality should be included into rule making, but not in “Fire Map 2” per se
    - Utilize Appendix C’s approach of matrixed rules for Tree Mortality
  - SDG&E agrees that timeliness is very important
  - SDG&E agrees in the importance of consistency across service territories

Conclusion

- Both alternatives are:
  - Statewide
  - Reasonable
  - Protect public safety
  - Capture important recent events like the Butte fire

- SDG&E believes its method:
  - Is better from an audit/enforcement standpoint
  - Is more efficient to operate from
  - Allows for more local input, which has proven extremely valuable in SDG&E's experiences
  - Can be completed in a timely manner
  - Is more open to stakeholder and CALFIRE input
  - Doesn't rely on particular data as being mandatory.

Conclusion

- End of mapping discussion
- Q & A time
- If additional time is available, discussion of SDG&E Fire Mitigation Operating Procedures

- Operating Procedures (ESP113.1)
  - More risky work not permitted (unless not doing so will make risk even higher)
    - Grinding, welding, blasting

- Electric Operations during high FPI
  - Testing of lines only by exception
  - Patrolling lines before re-energization

- Utilize Emergency Operations Center (EOC) during extreme weather events
- Community outreach to alert of fire danger and potential for electric outages
- As necessary, communicate with municipalities and county Office of Emergency Services

- System protection was originally developed to protect electrical components from damage
  - Overcurrent devices such as fuses and circuit breakers
- Fault current is created when power flows at a higher current due to a short circuit or ground.
  - Phase to phase contact
  - Wire down

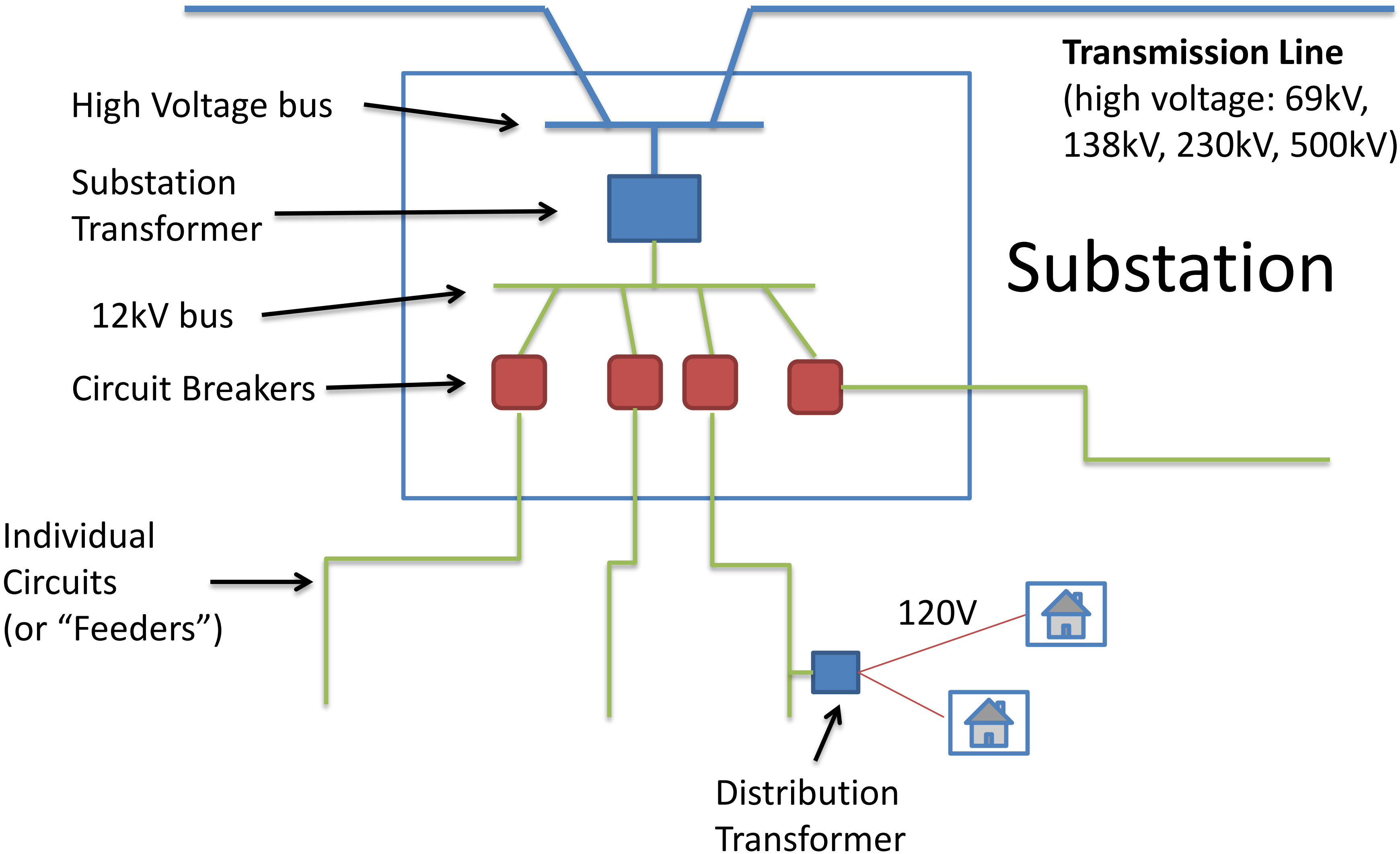
SDG&E System Protection

- At SDG&E, system protection is used to protect the public
- In a perfect world, the system would be de-energized immediately as soon as any power flows improperly
- Ignitions can occur when power flows into non-electric equipment (e.g. vegetation, animals, etc.)
- Certain equipment is better at de-energizing quickly, specifically with ground faults

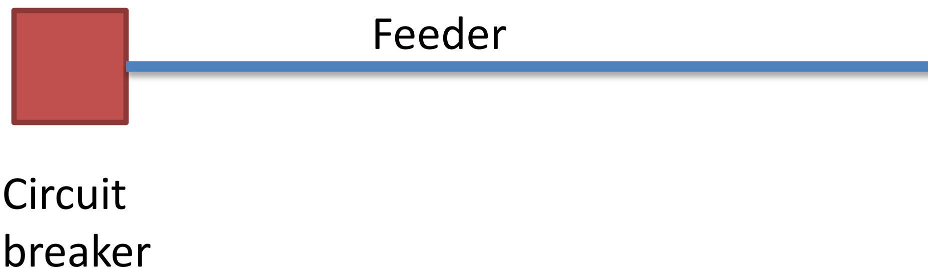
SDG&E System Protection

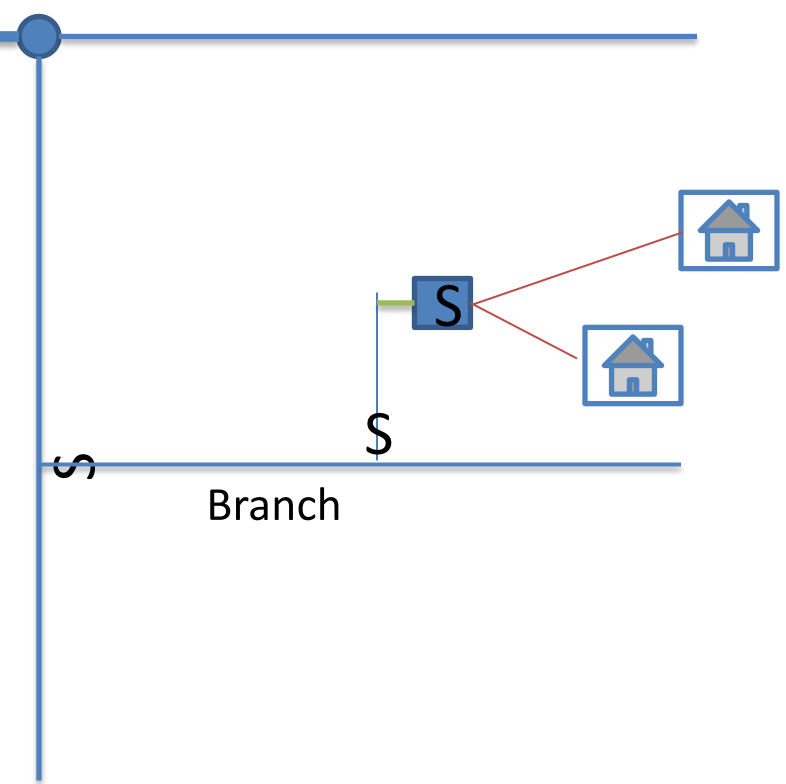
- Circuits are designed to allow 600A of current
  - Higher than that can damage the substation equipment
  - Circuit breakers will open (de-energize) at higher currents
- Large wires near the substation that directly contact each other can cause fault current of 5,000A and higher
  - The protection system will de-energize very quickly in this situation
- However, a line down involving a small wire, far from the substation and into a poorly conductive material like vegetation might have a fault current of 50A or lower.
  - The circuit breaker won't trip on fault current alone
  - 1A is enough for an ignition, given the wrong circumstances*

*http://www.energyandresources.vic.gov.au/__data/assets/pdf_file/0008/1192607/R_D_Report_-__Marxsen_Consulting_-_Vegetation_conduction_ignition_tests_final_report_15_July_2015_DOC_15_183075_-_external_.PDF

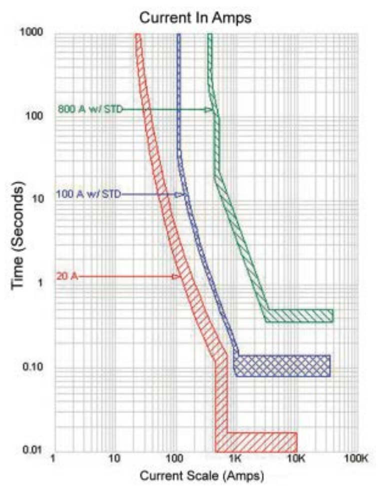


Substation Diagram (simplified)





Protection devices are “coordinated” to sectionalize the outage and reduce impacts.



- At SDG&E:
  - Automatic reclosing is no longer undertaken in Elevated FPI
    - Reclosers (aka autorecloser, line recloser, service restorers)
      - Automatically restore power after fault current has been detected
      - Typically used in OH situations where momentary faults are likely
        - » Areas with trees / animals
      - Improve reliability
  - Smart switches are set to de-energize faster and with less fault current in Extreme FPI
  - Smart switches utilized to de-energize upon ground fault
  - Fuses are being sized optimally using smart meter data

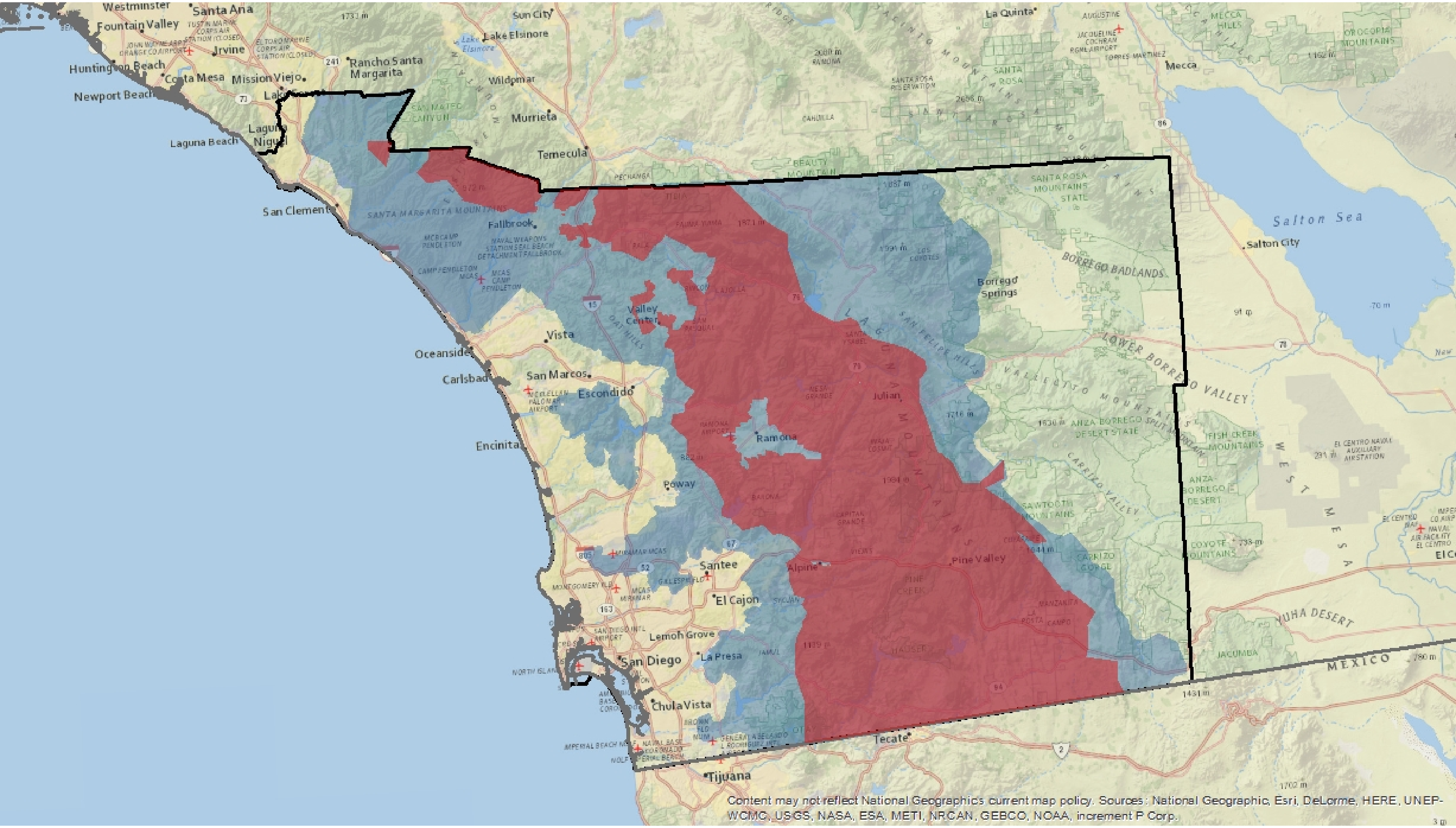
SDG&E Operations

- Patrol before energizing
- Staging crews
- Fire contractors
- Helicopters

- Special inspection in HRFA
  - To be completed no less frequent than 3 years
- Vegetation management
  - Extra inspection in HRFA prior to fire season
  - Vegetation caused outages have dropped dramatically in recent years. (see next slide)
    - The five most recent years (2011-2015) each had fewer vegetation outages than any year prior to 2011

Outages Caused by Vegetation

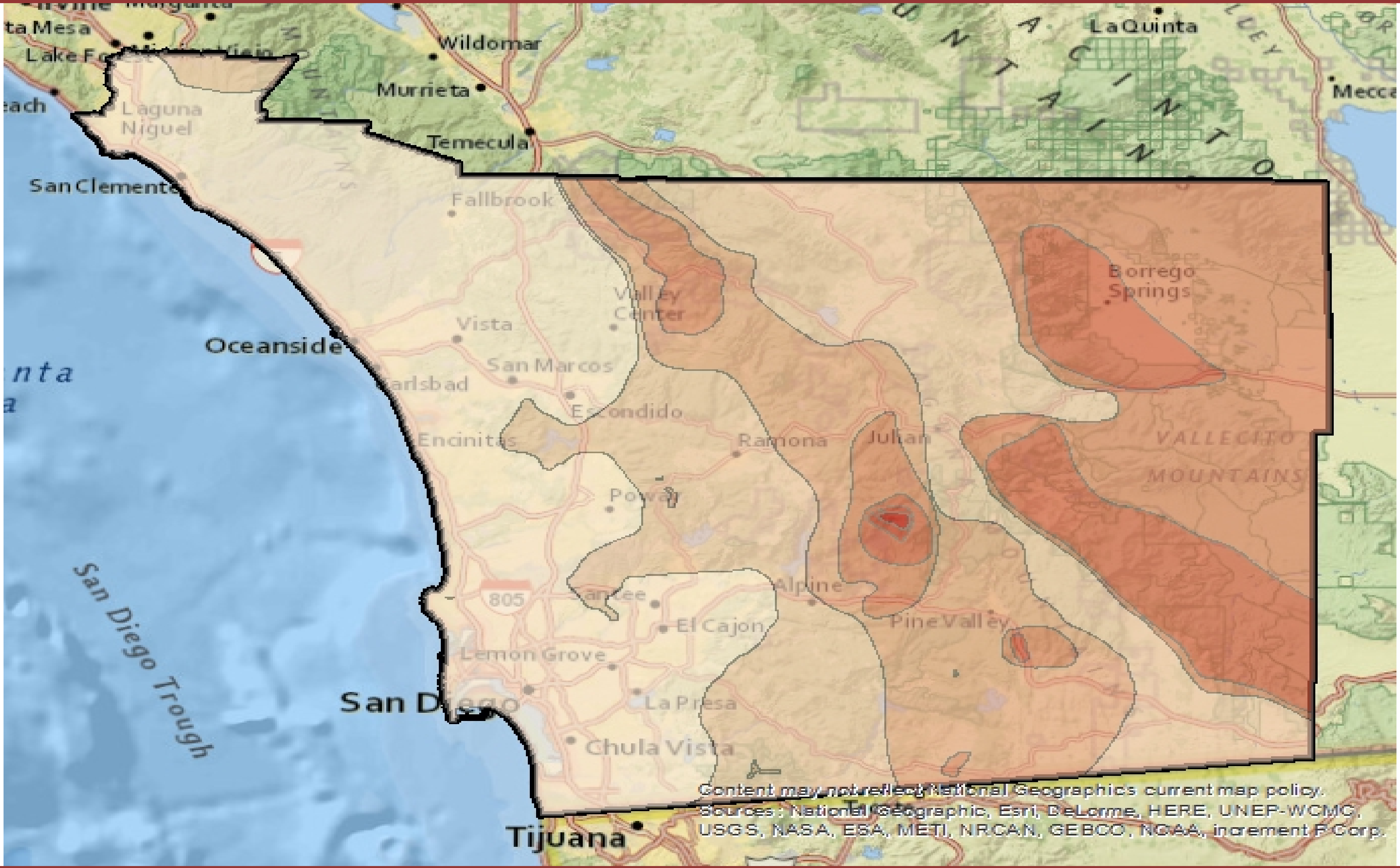
SDG&E Inspections



Fire Threat Zone (FTZ) and Highest Risk Fire Area (HRFA)

- Usage of wind data. All new construction uses wind data to apply local knowledge to wind loading calculations
- SDG&E formed Reliability Improvement in Rural Areas Team (RIRAT)
  - Focus on replacing higher-failure / higher-ignition equipment
  - Created new construction standards called the Backcountry Design guide

SDG&E Construction



SDG&E Wind data. Represents a smoothed 50 year return period.

Big Picture

- Build and maintain a system that limits ignitions
  - Prioritized by risk
- Use protection system to mitigate the likelihood that inevitable "bad" event will lead to an ignition
  - Prioritized by risk
- Be prepared for emergencies through various communications and inter-agency relationships

Behind The Scenes

- Map “risk” areas to focus time/budget
- Be aware of upcoming environmental conditions
  - FPI
- Continue to research and pilot efforts to reduce risk.
  - Tree wire, smarter switches, high impedance fault detection

END