



Three Ways the CSU is Using Geographic Information Systems (GIS) to Inform Decisions

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California State University, Office of the Chancellor
California Association of Institutional Research – 2016
Los Angeles, CA
16 November 2016



Has Anyone Used GIS?



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Has Anyone Used GIS?

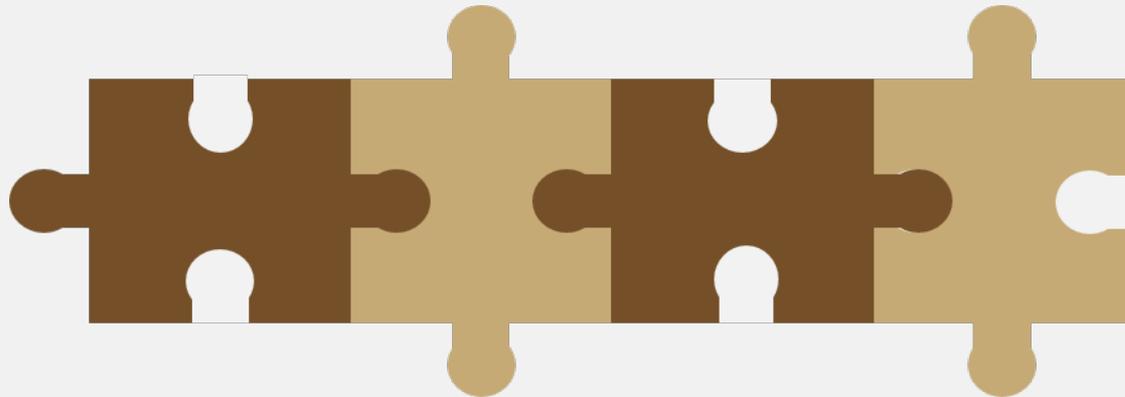


Has Anyone Used GIS for Institutional Research?



GIS and IR: Complementary

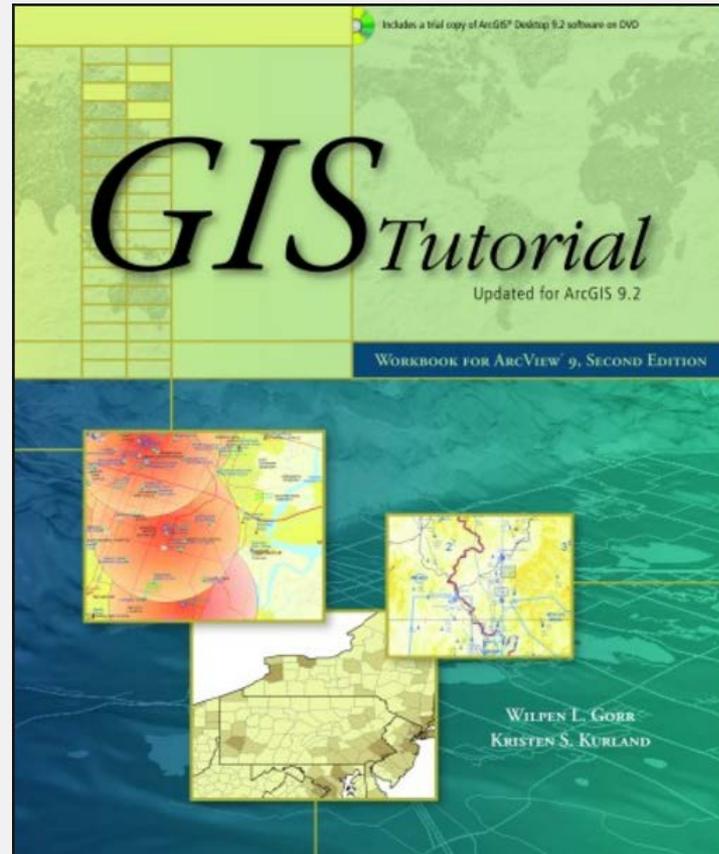
- A Geographic Information System (GIS) lets us
 - Consider space and geography
 - Display information visually
 - See spatial patterns





Today's Presentation

- I. Foundation of GIS principles
- II. Three Case Studies
 1. Commuting
 2. Grant Support
 3. Impaction
- III. Other Potential Applications, Discussion



FOUNDATION OF GIS



GIS Terminology

Vector Data

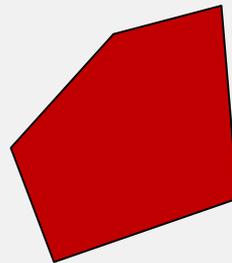
Point



Line



Polygon



Attributes/Variables



UltraEdit



Notepad



GIS is a “Public-Domain” Environment

- Practitioners share files and data freely
- Gov’t agencies make shapefiles available





Many GIS Software Packages Exist

- Maptitude
- ArcExplorer
- BusinessMAP
- Microsoft's MapPoint
- Esri's ArcGIS products
 - **ArcGIS for Desktop** and **ArcGIS Online**





3 CASE STUDIES



1) Calculating Commuting Distances

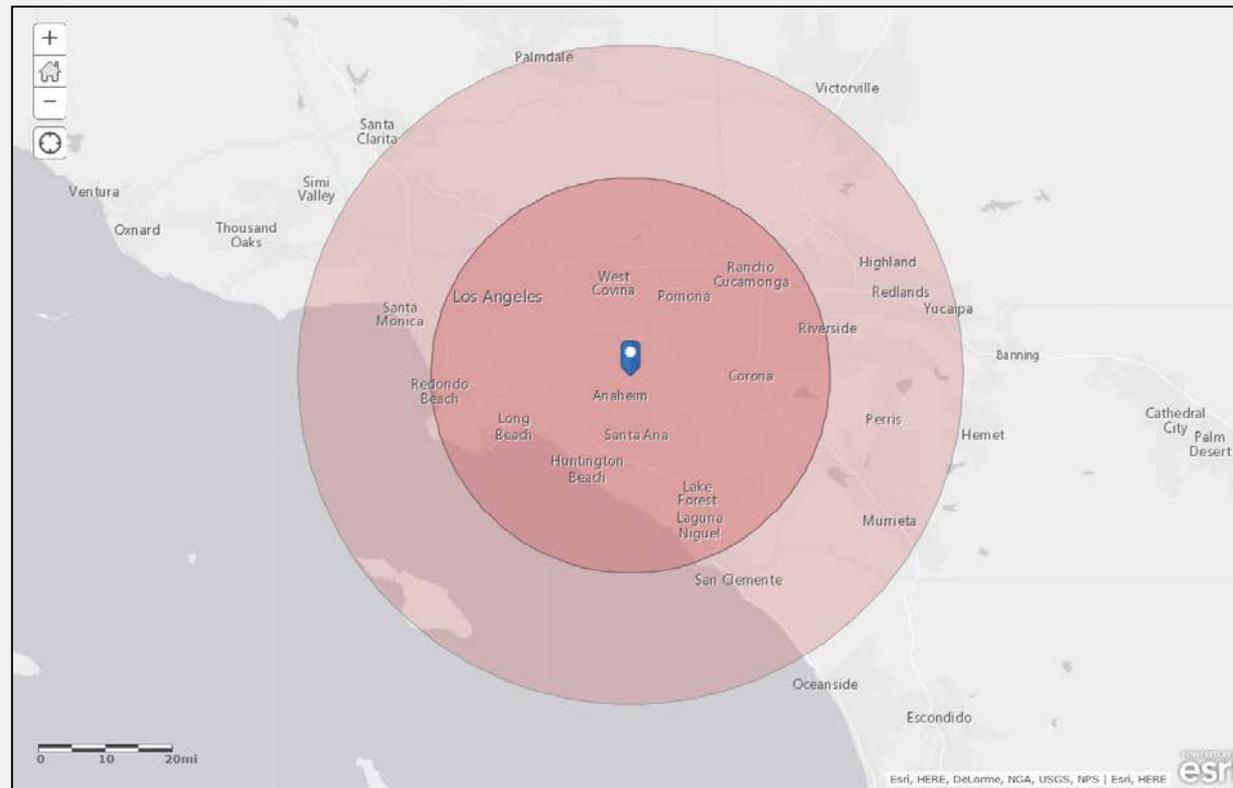




1) Calculating Commuting Distances

Distance Radii:

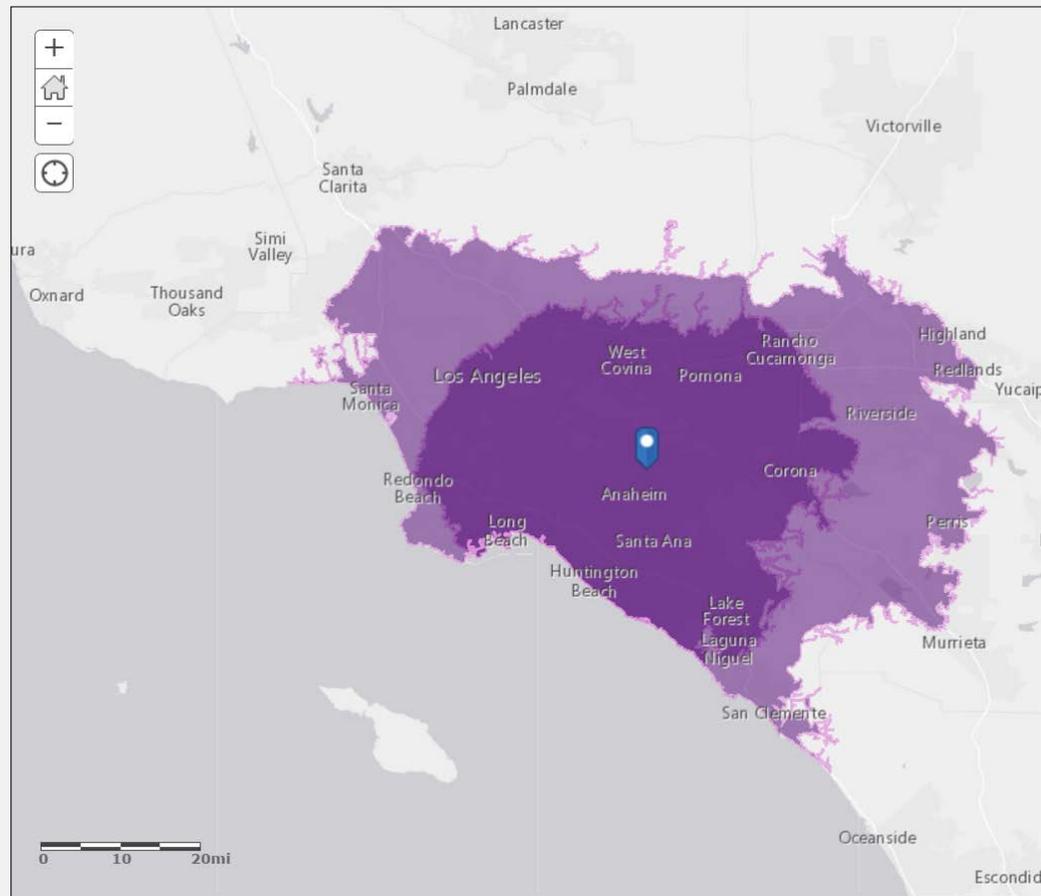
- 30 miles
- 50 miles



1) Calculating Commuting Distances

Driving
Distance
Polygons

- 30 miles
- 50 miles



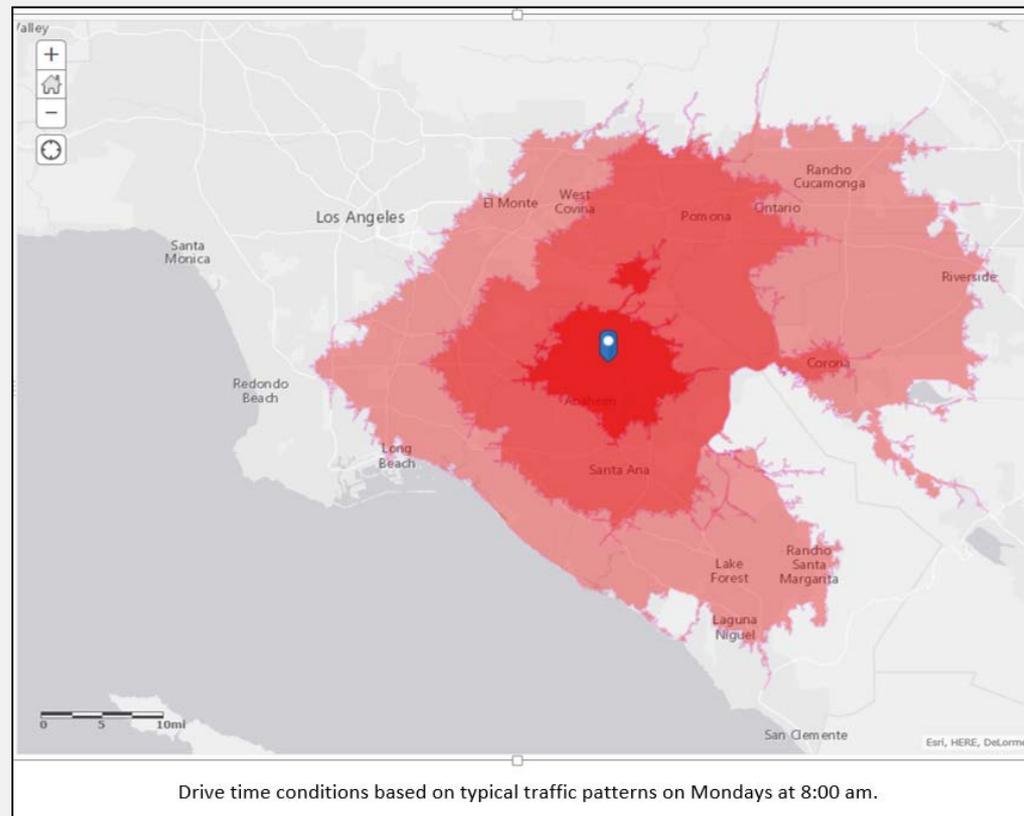


1) Calculating Commuting Distances

Driving Time

Polygons

- 15 minutes
- 30 minutes
- 45 minutes





Procedure in ArcGIS Online

The image displays a grid of map thumbnails from the ArcGIS Online interface. The top-left thumbnail shows a 3D aerial view of a campus with roads labeled 'JOHN F. KENNEDY DR', 'HIGHWAY 75 GARDEN DR', 'CONCOURSE DR', and 'MIDDLE PASSAGE'. Other thumbnails include a topographic map, a network diagram with red and blue nodes, a map with a red boundary and numerical labels (11, 12, 16, 2, 11, 4, 5, 5, 5), and a map of a river system. The text 'ArcGIS Online Maps and Apps for Everyone' is overlaid on the bottom-left of the grid.

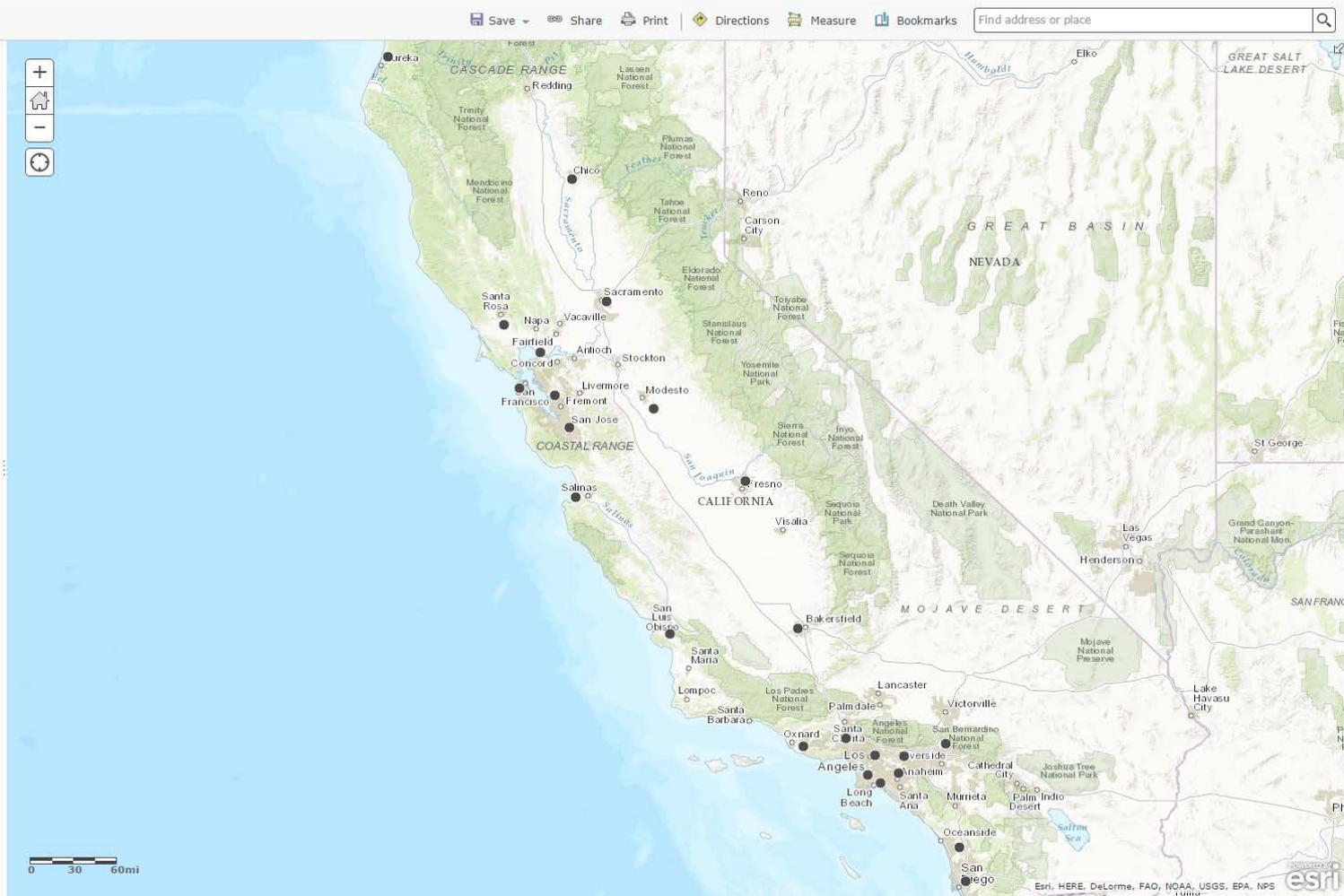
ArcGIS Online
Maps and Apps for Everyone

Details Add Basemap Analysis

About Content Legend

Contents

- CampusAddresses
- Topographic



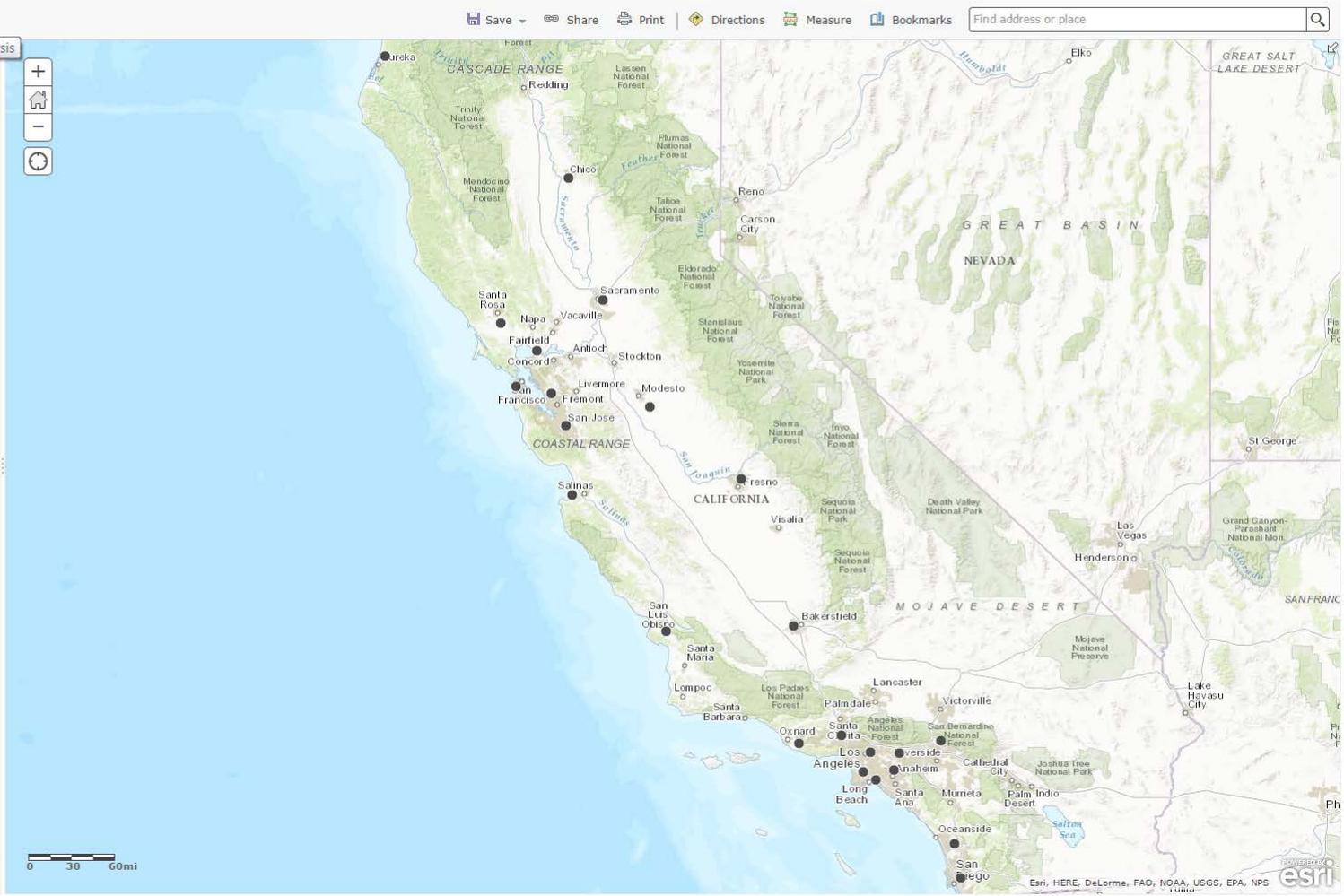
Details Add Basemap Analysis

Perform Analysis

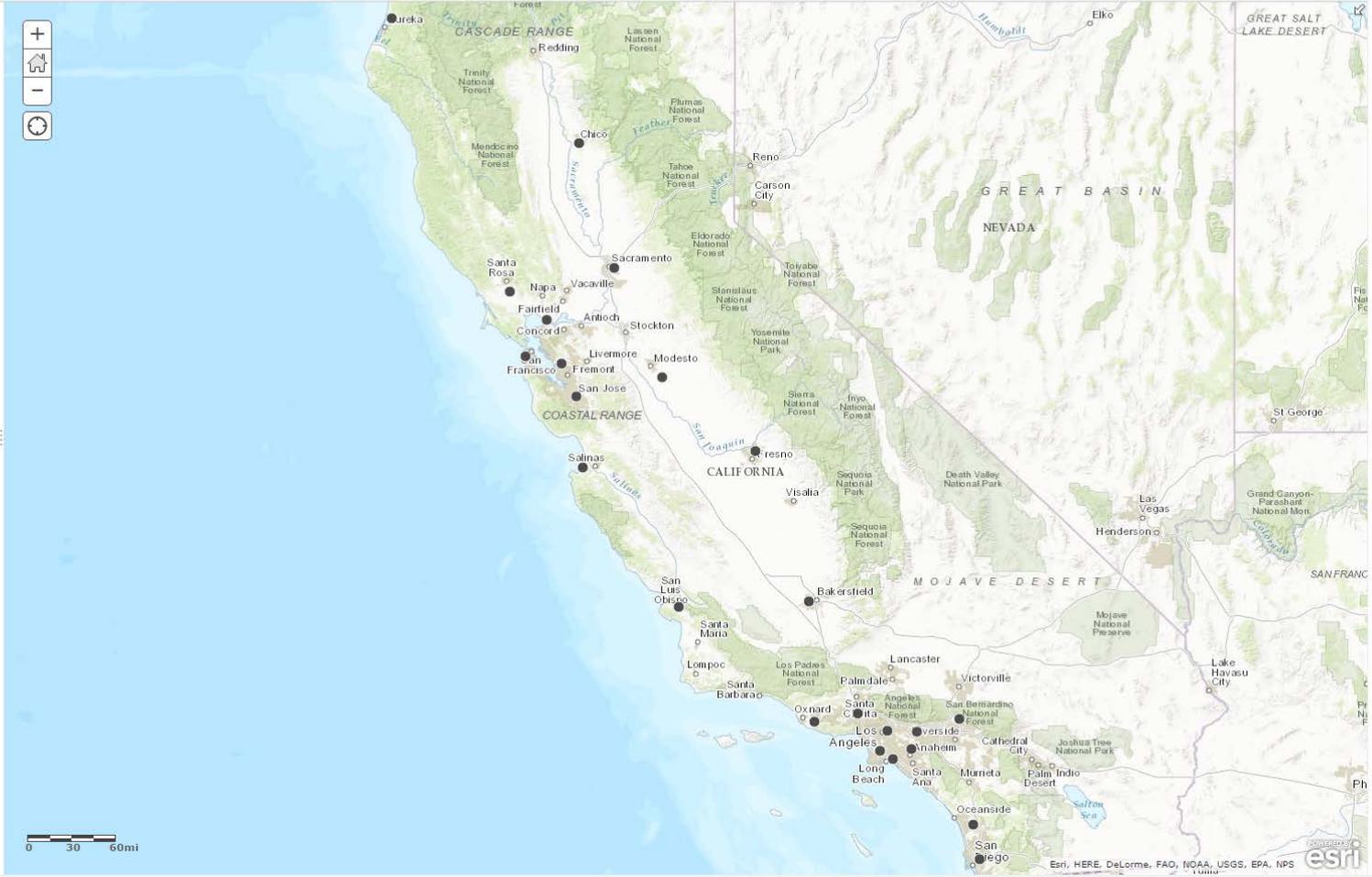
About Content Legend

Contents

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- Topographic



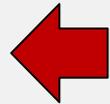
- Perform Analysis
- Summarize Data
 - Find Locations
 - Data Enrichment
 - Analyze Patterns
 - Use Proximity
 - Create Buffers
 - Create Drive-Time Areas
 - Find Nearest
 - Plan Routes
 - Connect Origins to Destinations
 - Manage Data





Perform Analysis

- ▶ Summarize Data
- ▶ Find Locations
- ▶ Data Enrichment
- ▶ Analyze Patterns
- ▼ Use Proximity
 -  Create Buffers
 -  Create Drive-Time Areas
 -  Find Nearest
 -  Plan Routes
 -  Connect Origins to Destinations
- ▶ Manage Data





Create Drive-Time Areas

1 Choose point layer to calculate drive-time areas around

CampusAddresses

2 Measure

- Driving Distance
- Walking Time
- Rural Driving Distance
- Driving Time
- Driving Distance**
- Walking Distance
- Rural Driving Time
- Trucking Time
- Trucking Distance

Use current map extent [Show credits](#)

RUN ANALYSIS



Create Drive-Time Areas ⓘ ◀

1 Choose point layer to calculate drive-time areas around ⓘ

CampusAddresses ▾

2 Measure ⓘ

 Driving Distance ▾

30 ▯ Miles ▾

To output multiple areas for each point, type sizes separated by spaces (2 3.5 5).

3 Areas from different points ⓘ

 **Overlap**  **Dissolve**  **Split**

4 Result layer name ⓘ

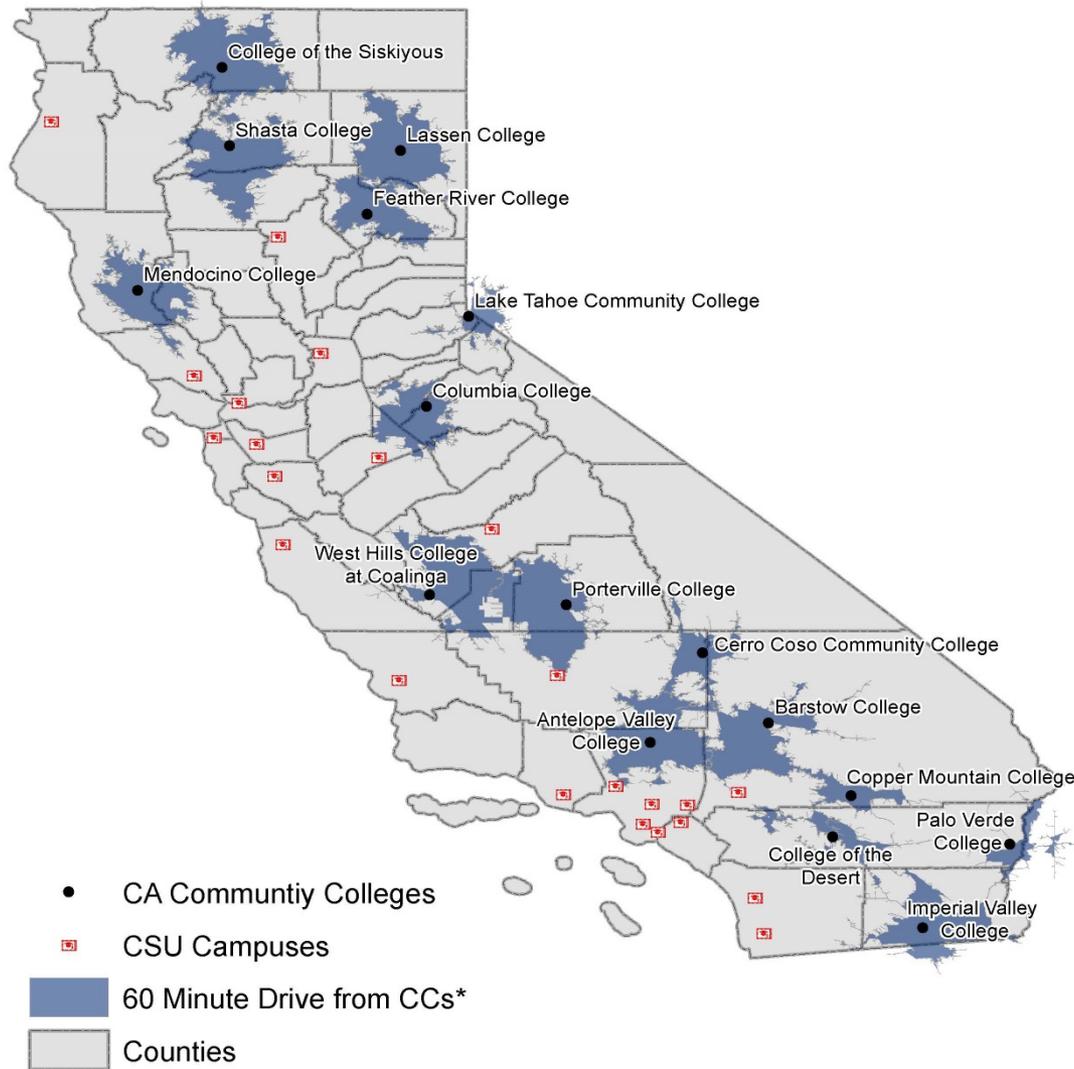
Travel from CampusAddresses (30 Miles) ▯

Save result in dianalavery ▾

Use current map extent Show credits

RUN ANALYSIS

Sixteen Community Colleges Not in Commutable Distance from a CSU Campus



*Based on Mondays at 8:00 am



2) Identifying Campuses Eligible for Environmental Justice Grant





2) Identifying Campuses Eligible for Environmental Justice Grant



Sustainability Programs inquired,
“We provide a benefit to environmentally disadvantaged communities! How can I show this in order to get grant money?”



What Share of Our Students Come from These Communities?





Very Few Variables Needed

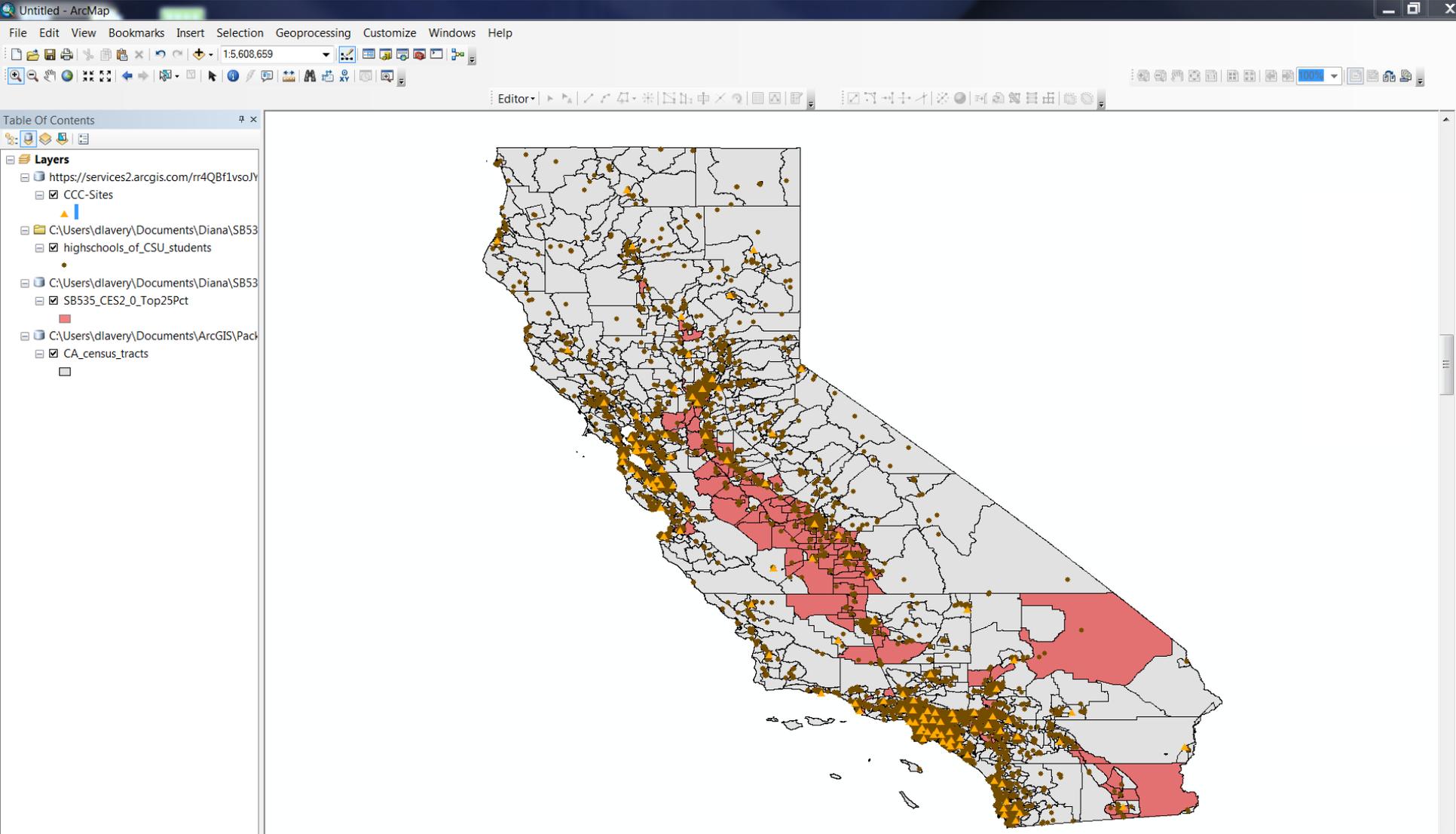
- **Census Tract polygons:**
 - Tracts of interest from CalEPA
 - All tracts from Census Bureau
- **Institution of origin points:**
 - High schools & community colleges
- **Enrollment Data**



Step 1: Procedure in ArcGIS for Desktop



The screenshot displays the ArcMap application window titled "Untitled - ArcMap". The menu bar includes File, Edit, View, Bookmarks, Insert, Selection, Geoprocessing, Customize, Windows, and Help. The toolbar contains various icons for navigation and editing. On the left, the "Table Of Contents" pane is visible with a "Layers" section. The "Add Data" menu is open, showing options: "Add Data...", "Add Baseman...", and "Add Data". A tooltip for the "Add Data" option is displayed, containing the text: "Add new data to the map's active data frame. Tip: You can also drag data into your map from the Catalog window." The main map area is currently blank. The status bar at the bottom shows the coordinates "-9.896 991.667 Unknown Units".



Untitled - ArcMap

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

1:5,608,659

Editor

Table Of Contents

Layers

- https://services2.arcgis.com/rr4QBf1vsoJY
- CCC-Sites
- C:\Users\d\lavery\Documents\Diana\SB53
- highschools_of_CSU_students
- C:\Users\d\lavery\Documents\Diana\SB53
- SB535_CES2_0_Top25Pct
- C:\Users\d\lavery\Documents\ArcGIS\Pacl
- CA_census_tracts

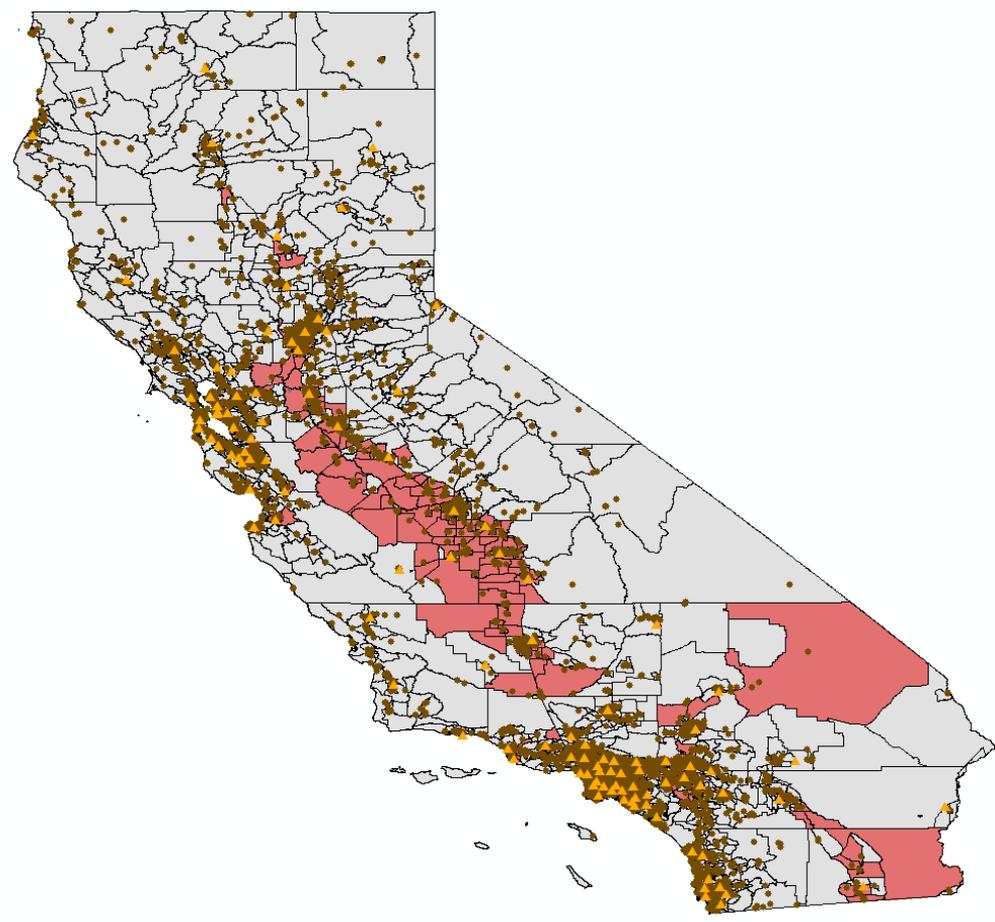
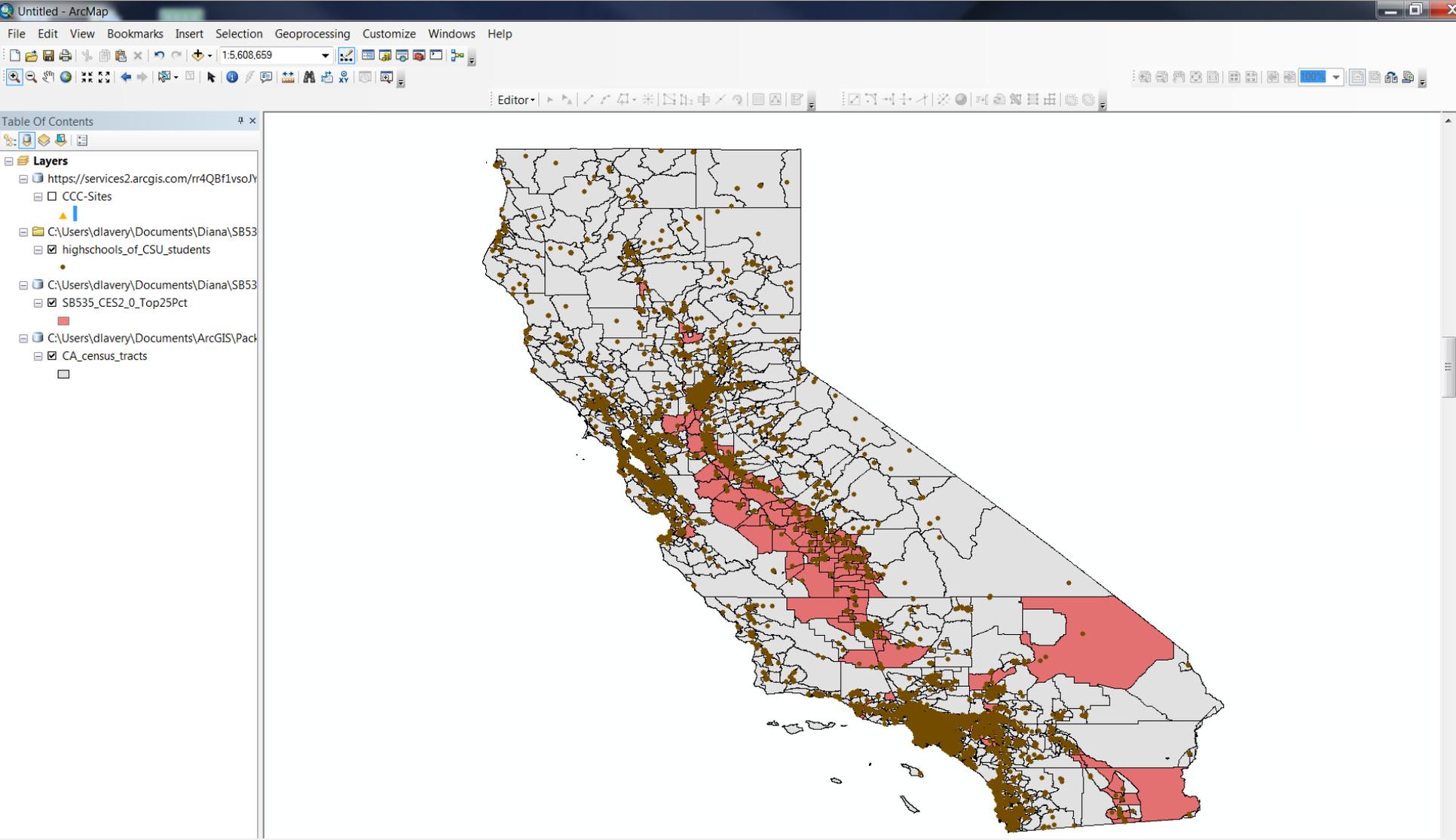


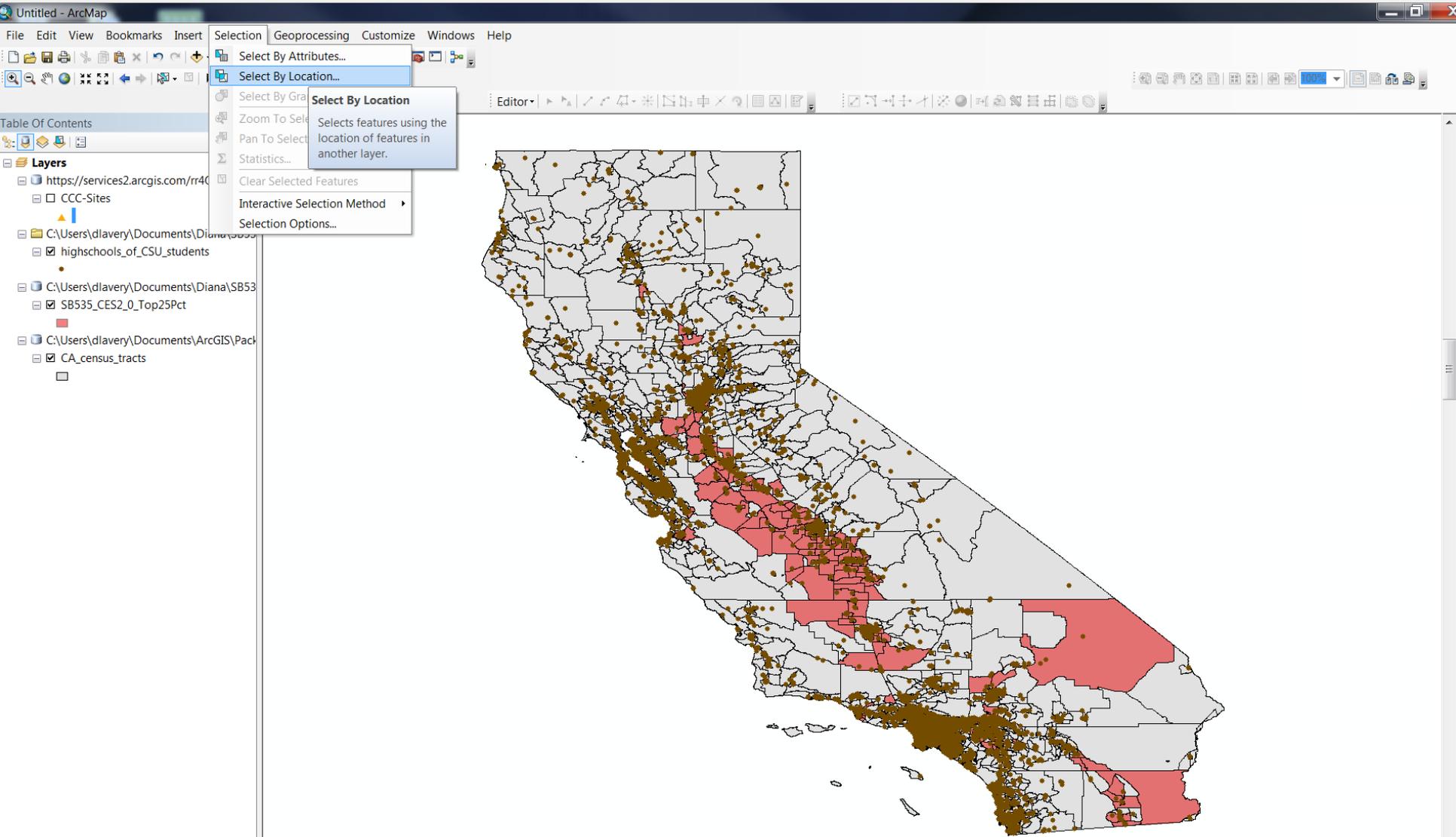


Table Of Contents 🔍 ✕

    | 

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 - CCC-Sites
 -  
 -  C:\Users\dlavery\Documents\Diana\SB53
 - highschoools_of_CSU_students
 - 
 -  C:\Users\dlavery\Documents\Diana\SB53
 - SB535_CES2_0_Top25Pct
 - 
 -  C:\Users\dlavery\Documents\ArcGIS\Pack
 - CA_census_tracts
 - 





Select By Location

Select features from one or more target layers based on their location in relation to the features in the source layer.

Selection method:
select features from

Target layer(s):

- CACommunityColleges
 - CCC-Sites
 - highschoools_of_CSU_students
 - SB535_CES2_0_Top25Pct
 - CA_census_tracts

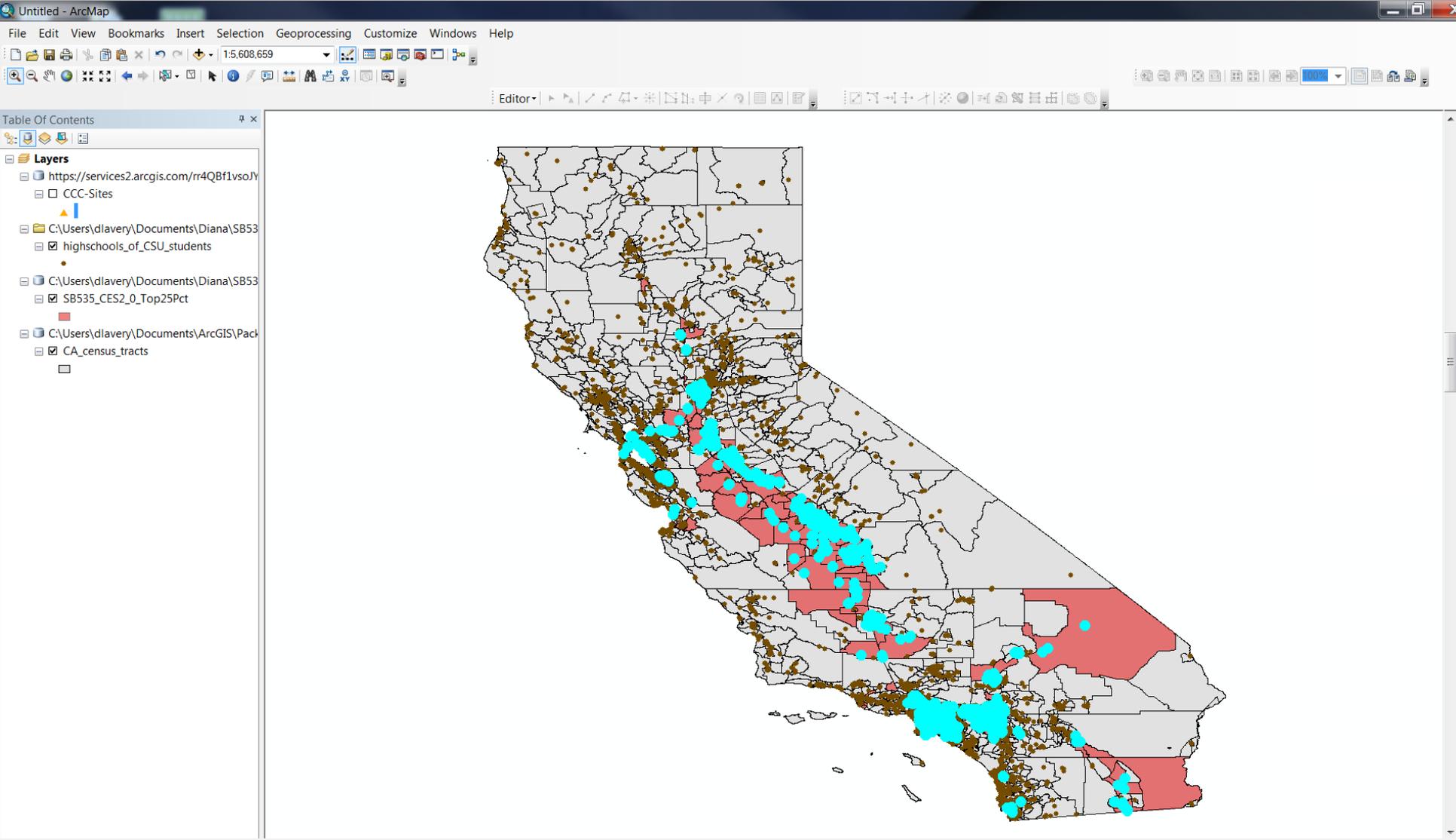
Only show selectable layers in this list

Source layer:
SB535_CES2_0_Top25Pct

Use selected features (0 features selected)

Spatial selection method for target layer feature(s):

- are completely within the source layer feature
- intersect (3d) the source layer feature
- are within a distance of the source layer feature
- are within a distance of (3d) the source layer feature
- contain the source layer feature
- completely contain the source layer feature
- contain (Clementini) the source layer feature
- are within the source layer feature
- are completely within the source layer feature
- are within (Clementini) the source layer feature
- are identical to the source layer feature
- touch the boundary of the source layer feature
- share a line segment with the source layer feature
- are crossed by the outline of the source layer feature
- have their centroid in the source layer feature



Untitled - ArcMap

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

1:5,608,659

Editor

Table Of Contents

- Layers
 - https://services2.arcgis.com/tr4QBf1vsoJY
 - CCC-Sites
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 - highschools_of_CSU_students
 - C:\Users\dlavery\Documents\Diana\SB535_CES
 - C:\Users\dlavery\Documents\Diana\CA_census

Copy

Remove

Open Attribute Table

Joins and Relates

Zoom To Layer

Zoom To Make Visible

Visible Scale Range

Use Symbol Levels

Selection

Label Features

Edit Features

Convert Labels to Annotation...

Convert Features to Graphics...

Convert Symbology to Representation...

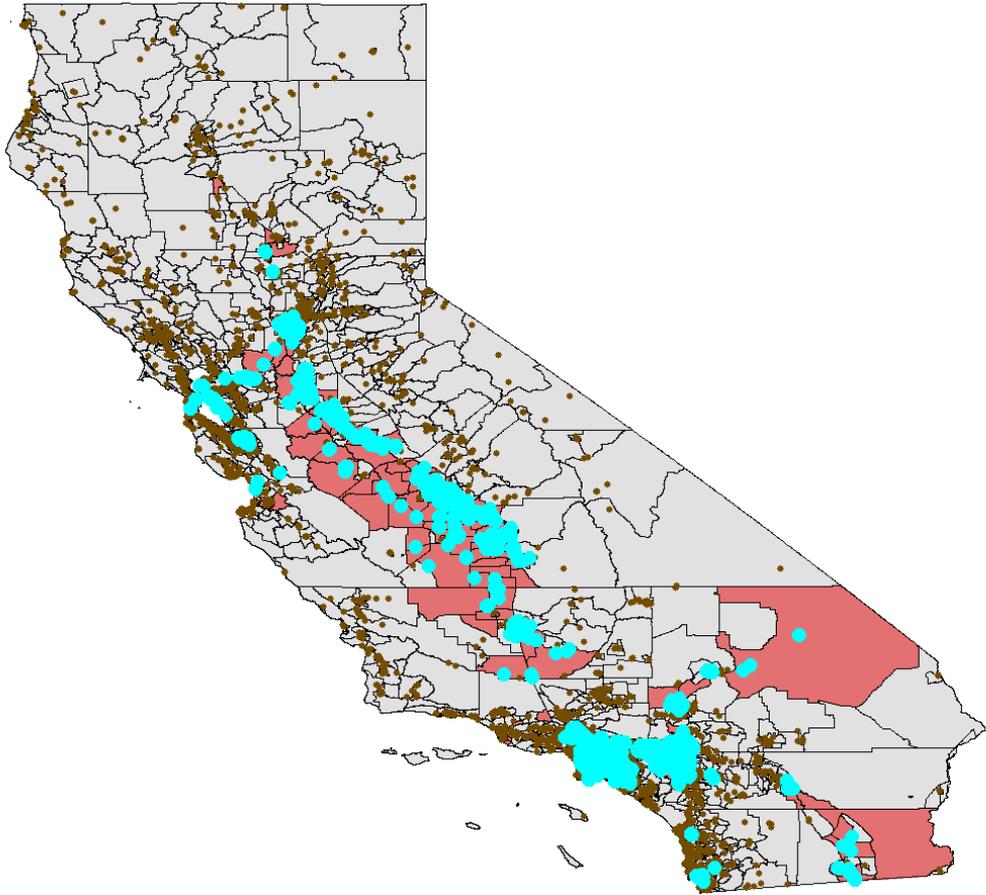
Data

Save As Layer File...

Create Layer Package...

Properties...

Open Attribute Table
Open this layer's attribute table. Shortcut: CTRL + double-click layer name OR CTRL + T.



Table

highschools_of_CSU_students

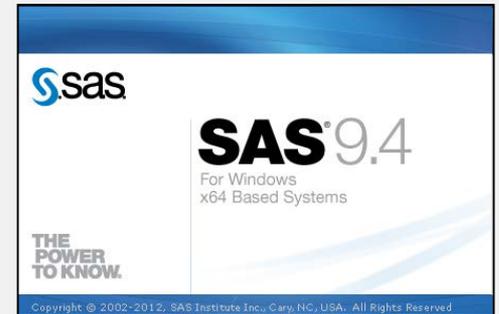
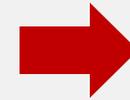
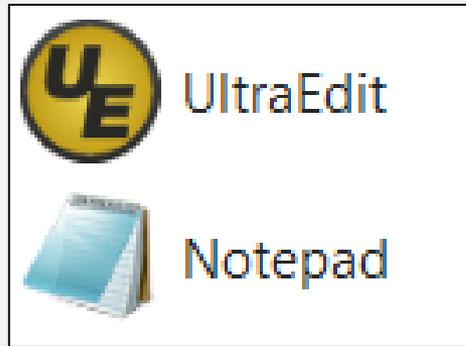
FID	Shape *	Org_Id	Inst_Orig	CDS_Code_7	Name	Address	City	Zip	ObsCode	Type
0	Point	C31003134	74045	7100456	A Better Change School/Cal. Au	4075 Lakeside Dr.	Richmond	94806	0	4
1	Point	C31003848	94303	7103039	A Tutoring Place	2979 Coloma St.	Placerville	95667	0	4
2	Point		193508	126508	A. F. Hawkins Responsible Indigenous Social Ent.	825 West 60th Street	Los Angeles	90044	0	3
3	Point	C31033835	373782	107821	A. Phillip Randolph Leadership Academy Charter	5285 Imperial Ave.	San Diego	92114	0	3
4	Point	C31003849	504402	7104029	A.L.C.C.A.	1309 Pelton Ave.	Modesto	953513636	0	4
5	Point	C31003850	374116	7101165	A.Q.'s Robotic Special Education Program	392 Winewood St.	San Diego	92114	0	4
6	Point		193034	1930346	ABC Adult	12254 Cuesta Dr.	Cerritos	90703-2801	0	3
7	Point	C31000663	199559	1995596	ABC Secondary (Alter.)	13435 E. 166Th St.	Cerritos	90703-2301	0	9
8	Point		433617	125617	ACE Charter High	660 Sinclair Drive	San Jose	95116-2621	0	3
9	Point		191812	6138127	AGBU Vatche and Tamar Manoukian High School	2495 East Mountain St	Pasadena	91104	0	1
10	Point		13523	115238	ARISE High	"3301 East 12th St., Ste 205"	Oakland	94601	0	3
11	Point		199012	124438	ARTLAB at Sonia Sotomayor Learning Academics	2050 N. San Fernando Rd.	Los Angeles	90065-1267	0	9
12	Point	C31033781	363773	107730	ASA Charter	2050 East Pacific St.	San Bernardino	92405	1	3
13	Point		363773	107730	ASA Charter	3512 North E St.	San Bernardino	92405	0	3
14	Point	C31004311	193034	1930340	Abc Adult	12108 Del Amo Blvd.	Lakewood	90715	1	3
15	Point	C31003851	154247	6202477	Abc Christian Academy	2739 Diamond St.	Rosamond	93560	0	4
16	Point	C31003852	364278	7102783	Abc Hope For Kids	1720 S. Mountain View Ave.	Loma Linda	92354	0	4
17	Point	C31033736	341148	7091481	Abc School-Sacramento	4540 Harlin Drive	Sacramento	95826	0	1
18	Point		193559	1935590	Abc Secondary	13435 East 166th Street	Cerritos	90701	0	3
19	Point	C31003853	304157	7071574	Ability Plus	220 El Camino Real	Tustin	92780	0	4
20	Point	C31001926	434362	6923627	Abraham	3155 Golf Dr.	San Jose	951522056	0	4
21	Point	C31003854	44223	6202238	Abraham Lincoln Academy	2279 North Ave.	Chico	95926	0	4
22	Point	C31001335	383324	3833241	Abraham Lincoln High	2162 24th Ave.	San Francisco	94116-1723	0	3
23	Point	C31001303	373584	3735842	Abraxas Continuation High	12450 Glenoak Road	Poway	92064-3098	0	3
24	Point	C31004312	374000	3740000	Abraxas Experimental High	1350-30th St.	San Diego	92102	0	4
25	Point	C31004313	374220	3742200	Abraxas School	540 Thorn Street	San Diego	92103	0	4
26	Point	C31033847	493881	108811	Abraxis Charter	1207 Cleveland Ave.	Santa Rosa	95401	0	3
27	Point	C31002794	114755	7087554	Abundant Life Academy	6256 Country Road 39	Willows	95988	0	4
28	Point	C31002783	194711	7087117	Abundant Life Academy/Sovereign Grace Academy	1530 Elizabeth St.	Pasadena	91104	0	4
29	Point	C31004314	14978	149780	Abundant Life Christian	28695 Ruis Road	San Leandro	94579	0	4
30	Point	C31004785	334530	6205306	Abundant Life Christian Academy	201 N. State St.	San Jacinto	92583	0	4
31	Point	C31002887	304231	7092315	Acaciawood School- Inc.	1900 W. Ball Rd.	Anaheim	92804	0	4
32	Point	C31004315	374014	3740140	Acad Of The Little Flower		San Luis Rey		0	4
33	Point		199232	122325	Acad of Medical & Hlth Sci at Roosevelt High CLOSED Use 193742	456 South Mathews St.	Los Angeles	90033-4326	1	9
34	Point	C31033859	199992	109926	Academia Avance Charter	115 North Avenue 53	Highland Park	90042	0	9
35	Point	C31003855	194126	6201263	Academic Academy Center	4321 W. Rosecrans	Hawthorne	90250	0	4
36	Point		193804	117721	Academic Leadership Community	322 Lucas Ave.	Los Angeles	90017	0	3
37	Point	C31001534	453020	4530200	Academic Options	2200 Eureka Way	Redding	-96001	0	3
38	Point		199707	117077	Academic Performance Excellence Academy	1309 North Wilton Pl.	Hollywood	90028	0	9
39	Point	C31001516	443024	4430245	Academic/Vocational Institute	294 Green Valley Rd	Watsonville	95077-1359	0	3
40	Point	C31033871	363989	109892	Academics & Responsibility Charter	16955 Lemon St.	Hesperia	92340	0	3
41	Point	C31033539	191118	6131189	Academie Authentique	"422 West School Street, Office 422"	Compton	90220-2018	0	1
42	Point		193661	126615	Academies of Education and Empowerment at Carson High	22328 South Main St	Carson	90745	0	3
43	Point		199003	126003	Academies of the Antelope Valley	6300 West Avenue L	Lancaster	93536	0	9
44	Point	C31004241	434268	6202683	"Academy For Educational Excellence, The"	22520 Kinst Ct.	Cupertino	95014	0	4
45	Point	C31004316	14005	140050	Academy Of Christian Education-Evan.	2433 Coolidge Ave.	Oakland	94601	0	4
46	Point	C31033571	371732	7097322	Academy Of Exploration International	2890 Poplar Meadow Court	Jamul	91935	0	1
47	Point	C31004317	374002	3740020	Academy Of Holistic Education	8263 Camino Del Oro 272	La Jolla	92037	0	4
48	Point	C31003856	174020	6200208	Academy Of Independent Study	18380 Pinnacle Ct.	Middletown	95461	0	4
49	Point	C31003857	394395	7103955	Academy Of Learning	2536 Tamarisk Ave.	Stockton	95207	0	4
50	Point	C31002187	374010	6938757	Academy Of Our Lady Of Peace	4860 Oregon St.	San Diego	921161393	0	4
51	Point		564038	5640380	Academy Of St Catherine 'DEFUNCT		Ventura		0	4
52	Point	C31033522	101309	6133094	Academy Of The Sierras "NAME CHANGE 12-1-2010	42675 Road 44	Reedley	93654	1	1
53	Point	C31002775	194689	7086903	Academy Of The Two Hearts	5150 W. 132nd St.	Hawthorne	90250	0	4
54	Point	C31004176	263083	2630832	Academy For Academic Excellence	47500 Main Road	Antelope Valley	92307	0	4



Whole Workflow Process



Step 1



Step 2



Output to Sustainability Programs Office

campus_name	count	percent
Bakersfield	2957	32.04
Channel Islands	569	9.23
Chico	1363	7.92
Dominguez Hills	6015	41.10
East Bay	2192	14.12
Fresno	10106	41.87
Fullerton	6138	15.76
Humboldt	1137	12.93
Long Beach	8136	21.73
Los Angeles	11237	40.60
Maritime Academy	78	7.26
Monterey Bay	745	10.49
Northridge	8435	20.30
Pomona	4510	19.02
Sacramento	2868	9.47
San Bernardino	6016	30.04
San Diego	1326	3.87
San Francisco	2131	7.04
San Jose	1665	5.08
San Luis Obispo	1109	5.30
San Marcos	443	3.46
Sonoma	438	4.66
Stanislaus	2059	22.18



Output to Sustainability Programs Office

campus_name	count	percent	over_25pct_flag
Bakersfield	2957	32.04	1
Channel Islands	569	9.23	0
Chico	1363	7.92	0
Dominguez Hills	6015	41.10	1
East Bay	2192	14.12	0
Fresno	10106	41.87	1
Fullerton	6138	15.76	0
Humboldt	1137	12.93	0
Long Beach	8136	21.73	0
Los Angeles	11237	40.60	1
Maritime Academy	78	7.26	0
Monterey Bay	745	10.49	0
Northridge	8435	20.30	0
Pomona	4510	19.02	0
Sacramento	2868	9.47	0
San Bernardino	6016	30.04	1
San Diego	1326	3.87	0
San Francisco	2131	7.04	0
San Jose	1665	5.08	0
San Luis Obispo	1109	5.30	0
San Marcos	443	3.46	0
Sonoma	438	4.66	0
Stanislaus	2059	22.18	0

Some CSU campuses could apply for the environmental justice grant!



3) Examining Impaction and the High School & Community College Pipeline





3) Examining Impaction and the High School & Community College Pipeline

- Each impacted CSU set their own

Local Admissions Area -

boundaries based on either

- Major Roads
- Counties
- School Districts



Local Admissions Area Descriptions

 <p>CAL POLY POMONA BRONCOS</p>	<p>All high schools west of the 15 Freeway, north of the 60 Freeway, east of the 605 Freeway and south of the 210 Freeway.</p>
 <p>SACRAMENTO STATE HORNETS</p>	<p>All high schools in El Dorado, Placer, Sacramento, San Joaquin, Solano, and Yolo Counties.</p>
 <p>CAL STATE SAN BERNARDINO</p>	<p>The following school districts in San Bernardino County: Apple Valley, Chaffey, Colton, Fontana, Hesperia, Morongo, Redlands, Rialto, Rim of the World, San Bernardino City, Victor Valley, and Yucaipa. Riverside County: Banning, Beaumont, Coachella Valley, Desert Sands, Jurupa Valley, Moreno Valley, Palm Springs, and Riverside.</p>



How well are the Local Admissions Areas serving our students?

- How aligned are the Local Admissions Areas with potential commuting areas?
- How many A-G eligible high school grads are there within these Local Admissions Areas?



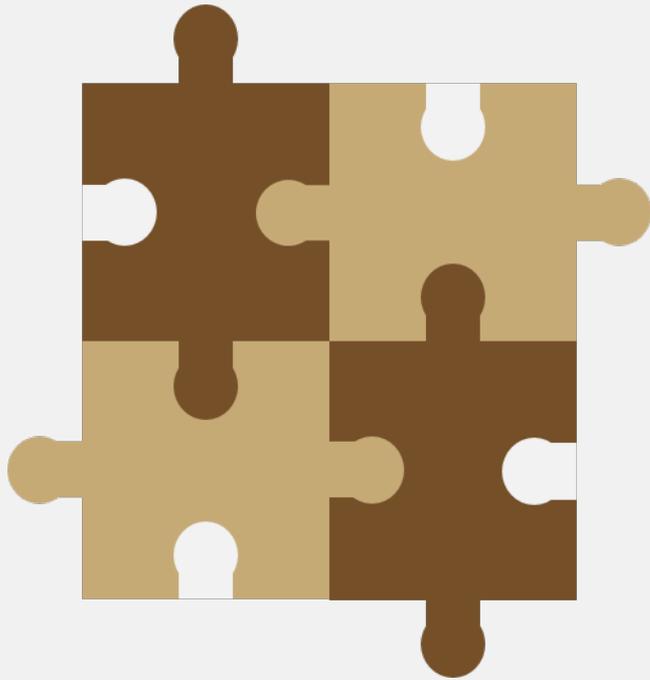


Pre-work: Gathering Data and Creating Shapefiles for Local Admissions Areas

- Local Admissions Area descriptions
- Shapefiles/Geography
- High School data
 - Addresses
 - A-G eligible graduates
- Potential Commuting Areas

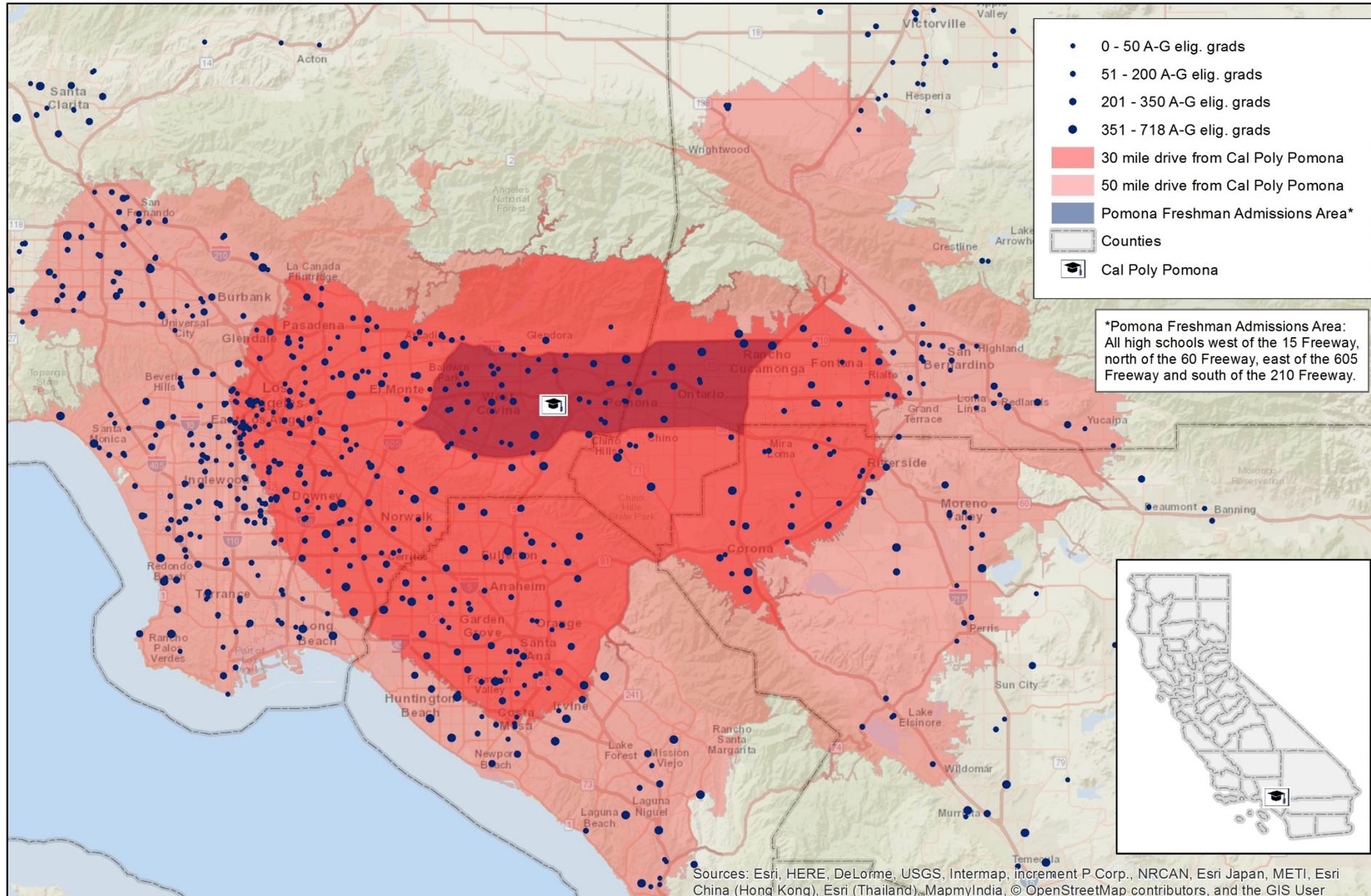


Now We Have What We Need to Work

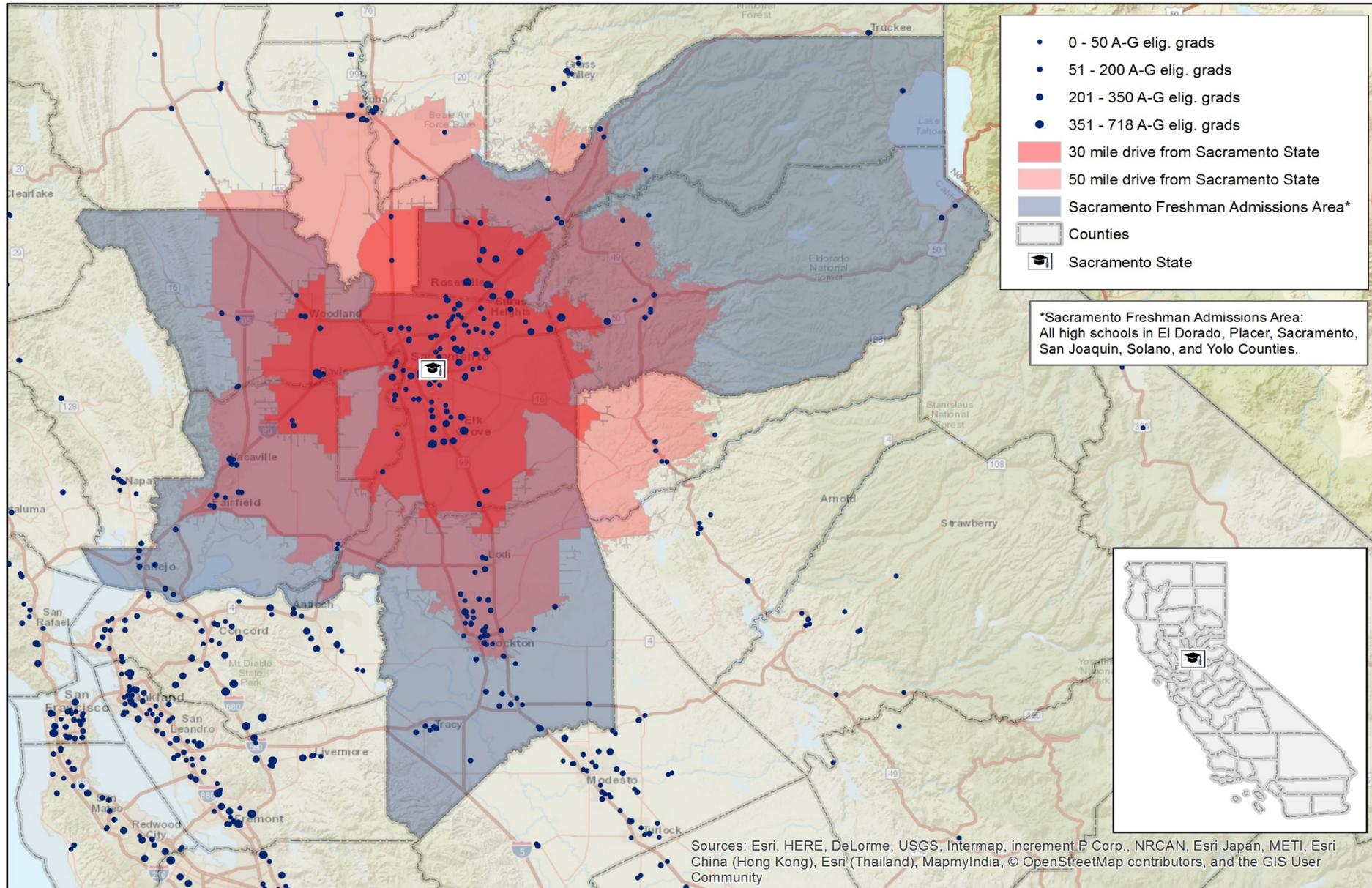


- **Step 1:** Translate description of Local Admissions Area into shapefiles
- **Step 2:** Compare to Potential Commuting Areas
- **Step 3:** Map high schools
- **Step 4:** Join A-G eligible numbers to high schools

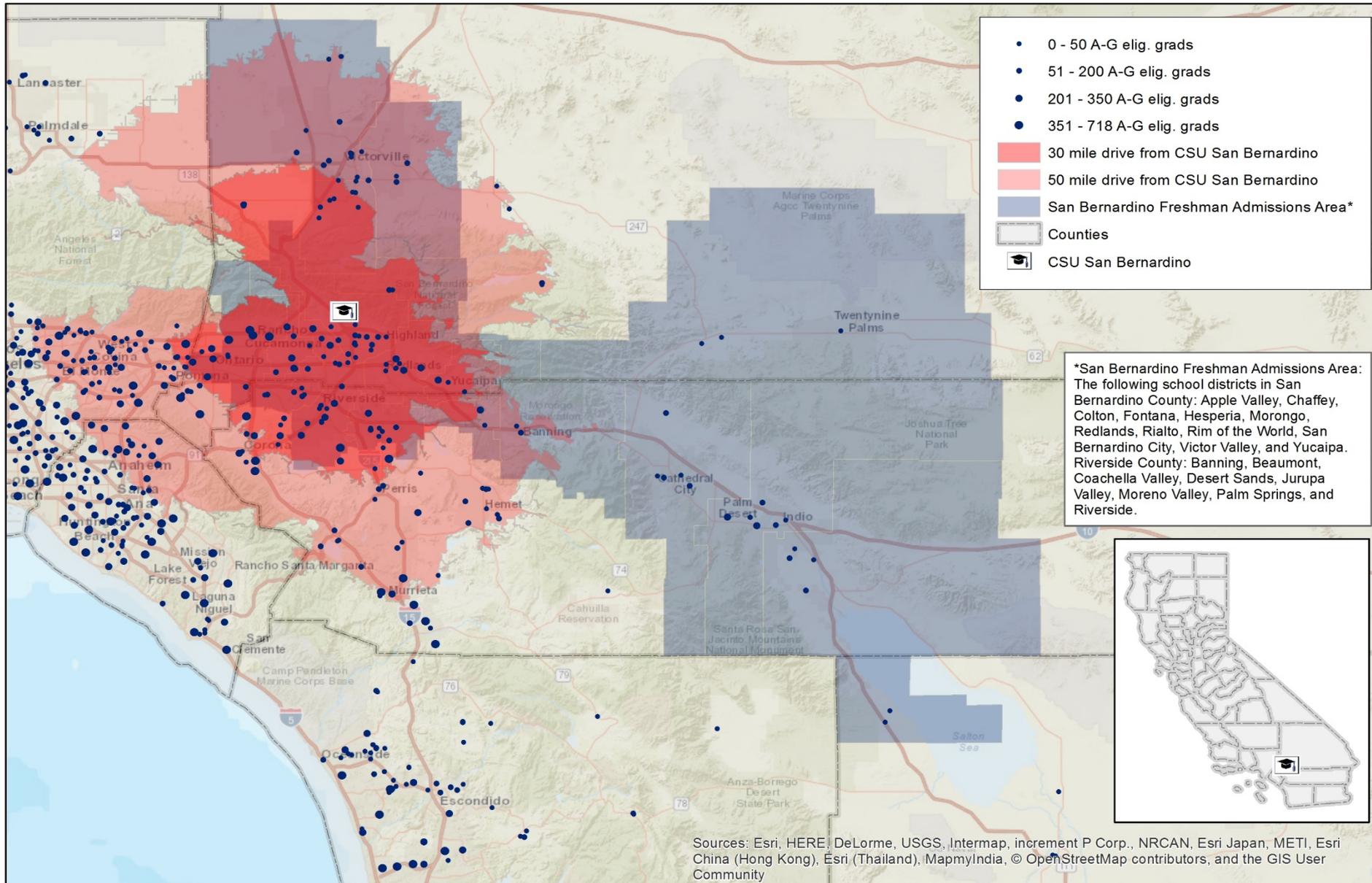
Pomona: Public High Schools Sized by A-G Eligible Grads in Commuting Distances vs. Admissions Area



Sacramento: Public High Schools Sized by A-G Eligible Grads in Commuting Distances vs. Admissions Area



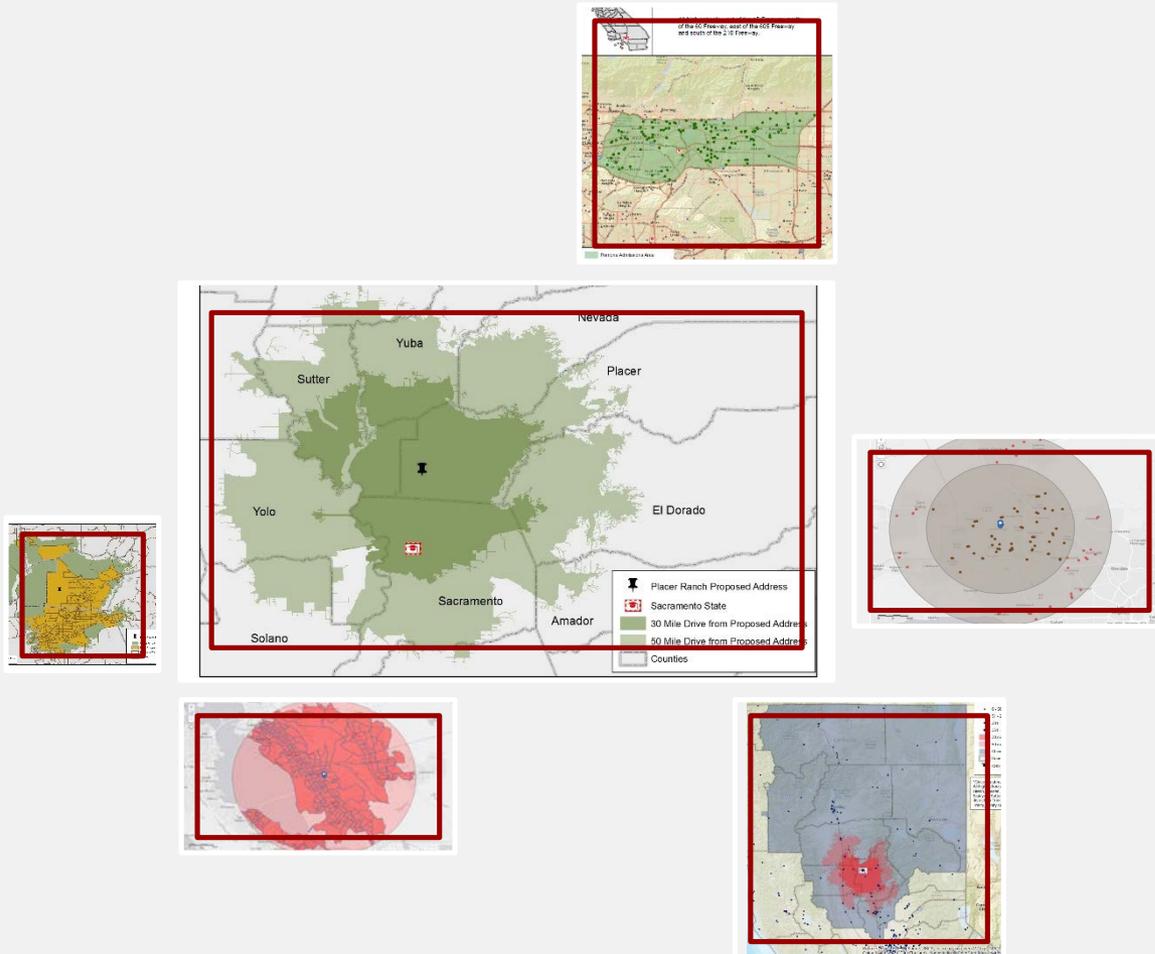
San Bernardino: Public High Schools Sized by A-G Eligible Grads in Commuting Distances vs. Admissions Area





3) Examining Impaction and the High School & Community College Pipeline

- Did this for all CSU campuses
- Looked at some racial and ethnic groups
- Used app/admit/enroll data by HS to get yield



MORE APPLICATIONS FOR IR



Many More Applications for IR

- Enrollment management/boundary definitions
 - Considering locations for new off-campus centers
 - Reach of distance learning programs
 - Recruitment efforts (for both students & faculty)
- Identifying populations for grant opportunities
- Alumni/workforce patterns for teachers, nurses

Good news: lots of IR data is already geographically referenced!



Thinking Spatially

- Use geographic information
- See spatial patterns





Thinking Spatially

- Use geographic information
- See spatial patterns
- Spatial modeling





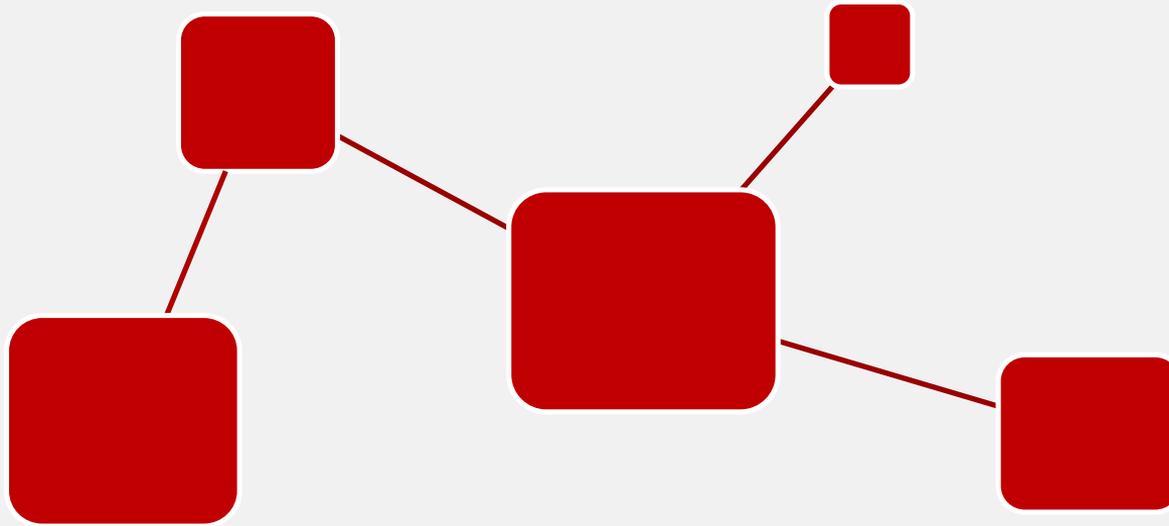
Thinking Spatially

- Use geographic information
- See spatial patterns
- Spatial modeling
- ***Inform Decisions and Better Serve Students!***





Other Applications in Your Work?



Questions? Comments?

Contact Information



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APPENDIX

Resources and More Info for ArcGIS

- Coursera!
- <http://www.esri.com/>: tutorials, example maps, forums, trainings
 - <http://www.esri.com/software/arcgis/arcgis-for-desktop/pricing>
 - <http://www.esri.com/landing-pages/arcgis-desktop-sub>
 - <http://www.arcgis.com/features/plans/pricing.html>
- I recommend “Standard” level of ArcGIS for Desktop, “Basic” is really bare-bones and does not have functions that I use regularly.
- You can get a 60-day free trial at arcgis.com
- You probably already have a site-wide license through your Geography, Urban Planning, Earth Science, or Social Science Departments.
- If you do want to purchase it yourself, Esri usually gives discounts to public interest organizations, so worth asking about!