CSUGGEOGRAPHIC INFORMATION SCIENCE IN THE CALIFORNIA STATE UNIVERSITY SYSTEM VOLUME 17 - SPRING 2020

Humboldt

Analyzing Landslide Susceptibility in Monterey County, California Using Maxent Modeling Software



Figure 2: Map of landslide susceptibility throughout Monterey County, California.

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Figure 1: This landslide occurred at Mud Creek along Highway 1 in Monterey County, California in May of 2017 (Photograph by Mark Reid, U.S. Geological Survey).



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SAVE THE DATE! Please note that the 2020 ESRI User Conference is going remote and will now be from July 13-15	

DIRECTOR'S MESSAGE 2020



Geospatial Learning from Disease

As I am writing this column, we are near the two-week mark from the start of self-isolation in California, and I certainly hope things have gotten better by the time this issue goes to print (or at least digital print). I was already planning to make this column related to health geography—a Chico

burgeoning area of geospatial research connected with issues of social disparity-but this pandemic has really pushed the issue to the forefront. There are many lessons from this event that I cannot begin to enumerate, but one thing that is clear is that there will be an effect on the way we do things and learn things, and geospatial learning is no exception. As an eternal optimist, I am hoping that we will see a silver lining to this disaster. If nothing else, we have certainly learned some new ways to communicate with our students and colleagues-I have learned for instance that teaching GIS programming online actually works better than in person, but I certainly cannot say the same thing about fieldintensive education and research. Depending on the source of our data, we are either more productive-with fewer distractions -or less productive if we need to collect our own data. Being sequestered in our households has presented us with many challenges in the use of our indoor spaces, but perhaps we have gained a new appreciation for our neighborhoods and the interconnectedness of our planet. The level of creativity exhibited in posts in social media has been phenomenal and psychologists will probably be studying this for years, but we can also see great creativity and innovation in geospatial data science in new online mapping of the disease including data mined from cell phone network data. It feels a lot like a massive experiment that we are in, but hopefully at the other end we will appreciate the part that we have played in advancing health geographies.

> Jerry Davis, *Director*, CSU GIS Specialty Center San Francisco State University

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Figure 1: Older populations left the area at a higher rate than those between the ages of 18 and 65.

The 2018 Camp Fire: Mapping a Displaced Population

[Authors Note: The data presented in this article is not comprehensive of all Camp Fire survivors and does not represent any official count.]

spent much of the morning of November 8, 2018 watching the Camp Fire from the seventh floor of Butte Hall on the CSU, Chico campus. As I watched the constant stream of headlights pour out of our Butte County foothills, I wondered where all of those 50,000 evacuees would go for refuge while the fire was active. And as we learned of the extent of the damage (more than 18,800 structures lost), I wondered where they would take their lives next. The immediate region lacked the housing capacity to support that many displaced. The vacancy rate of nearby Chico hovered around 2% and only about 250 homes were listed for sale.

Since the 2018 fire, I have worked with Department of Geography and Planning professor Dr. Jacquelyn Chase to examine the how, why, and where survivors have gone. In studying the fire's displacement effect, we hope to give demographic context to where people have relocated, recognize trends in who has left Butte County and who stayed behind, and help identify policy and planning considerations to adjust to these population fluctuations. We wanted to answer questions such as, What were the economic and social characteristics of the affected population? Where did our working-age families go? Are the new addresses in another high fire hazard area? This information also helps on a local level to know who remains. For instance, in looking at a comparison based on ages, half of the over-65 group for whom we have new addresses have left the immediate region. Known as an affordable community, will Paradise and the rest of the burn scar area no longer be an enclave for our senior populations or those on fixed-incomes? Does that change how and what we rebuild?

The College of Behavioral and Social Sciences supported this effort by funding a data purchase so we could acquire more

Los Angeles

Empower Community to Use LA City's Data Portal and GeoHub for Public Good: The Perfect Marriages of GIS and Big Data, Education and the Urban Community, Public University and Nonprofits

Story Map

The Inequality of Justice: Housing with a Record

Finding affordable housing in the Los Angeles area is already difficult in itself, but adding a criminal record to it can make this situation more difficult and at times impossible.

For some getting out of prison is a second chance at life. Whether it is getting back to family and friends or learning to be on your own, this second chance provides hope of a new start, but being in a situation where one can not find shetter may lead to recidivism.



Rent Burden and Color Divide

ding affordable housing in Los Angeles is already a allenge, but adding other components like a criminal cord makes it harder. Some housing facilities will turn ray individuals that have criminal records making it bilematic for these individuals to obtain bursing.

According to Looney and Turner, they gathered data from the IRS and found, In the first full calendar year after their release, only 55 percent of those previously incarcented have any reported earnings and the median earnings of those that do are just above \$10,000" (sec ofted in brookengs dou) in addition, in most areas that have individuals whose relis 30% or more of their income is

Looney and Turner article: <u>https://www.brookings.edu/research/w</u> opportunity-before-and-after-incarceration/

layer source: https://lahubcom.maps.arcgis.com

Housing for Formerly Incarcerated People

households with rent > 30% of income) against predominant racial population to show intersectional housing challenges.

Figure 1: Mapping

rent burden (% of



Showing intersectional inequalities: rent burden and racial inequity

n 2018, California State University Los Angeles (Cal State LA) received a \$1 M, 3-year National Science Foundation grant designed to use Big Data and geographic information system (GIS) science to promote active learning and curricular enhancements for community engagement and civic learning. We developed strategic partnerships with the City of Los Angeles Chief Data Officer, and with Community Partners' Senior Program Director and Programs and Operations Manager. Each of these organizations offered the integrity and vitality necessary for engaging Cal State LA students and faculty, serving local nonprofits and communities, and promoting the City of Los Angeles' data initiatives through the LA GeoHub and Open Data Portal (ArcNews 2016). This project closely aligns with the universities' mission (Gomez et al. 2019) to transform local communities by providing underserved residents access to data and technology (Willner 2019).

Methods

Courses: The collaborative team sent out calls for spring course redesign proposals in early fall. Applicants needed to demonstrate how using the LA GeoHub with local nonprofits could engage real-world problem solving and enhance their students' learning outcomes while impacting the Greater Los Angeles Area for the public good. To facilitate the participation of nonprofits, Community Partners recruited organizations and provided information sessions and tutorials on GIS and the GeoHub.

Once courses were selected, faculty participated in workshops on how to (1) use ArcGIS (many of them had little experience) and access data (Training Workshop list 2019); (2) create new learning outcomes for the course; and (3) match project goals among faculty, students, and nonprofits. In addition, six in-class and online workshops were developed for students taking these course as part of learning material (Training Workshop List 2019). Faculty and student participants were supported throughout the semester by two graduate assistants, a data analytics coordinator, and ESRI staff. Students created individual or group projects based on the goals mutually established by them, their faculty members, and the nonprofits. Students showcased their projects through ESRI StoryMaps or posters during a public community forum. Attendees included students, faculty, and external partners (nonprofits, Los Angeles Deputy Mayor, CEO of Community Partners, members of the business community).

Intern Selection: Students who have taken one of the spring redesign courses were encouraged to apply for paid summer internships and work for one of the nonprofits. Known as Social Equity Engagement geo-Data Scholars (SEEDS), these interns worked with their respective nonprofits on data acquisition, organization, management, and analyses. As a final culmination, SEEDS presented their work to all related constituents at an end-of-the-summer gathering that showcased their results and highlighted the impact of their work.

Results

Courses: We selected five courses for the first cohort (e.g., ANTH3200 – Where in the California Community Are You?; GEOG3690 – Fundamentals of GIS; SOC348 – Sociology of Race/Ethnicity, Class, and Gender; SOC4050 – Service Learning and Sociology Internships; and SOC4420 – Social Change). A total of 104 students who enrolled in the redesigned courses consulted with 28 nonprofits and produced 41 projects (Big Data Community Forum, 2019). One student, for example, created a Spyglass app that allowed users to see how rent burdens differentially affect neighborhoods of color (Figure 1) (Examples of products,

Crowdsourcing to Reduce Tobacco Use and Litter on California College Campuses

obacco use is the leading cause of preventable death and disease in the United States (Danaei et al., 2009). Joining a nationwide initiative, CSU and UC systems have adopted 100% smoke and tobacco free (STF) campus policies (CYAN, 2018). However, lack of enforcement is a critical barrier to having effective college STF policies and novel outreach and education strategies are needed. Crowdsourcing offers a broad, sustainable vehicle to engage a community in tracking and solving problems such as tobacco use and waste. In our Tobacco Related Disease Research Program-funded pilot between CSU San Marcos and UC Davis (#27IP-0041), we developed a GIS-based Tobacco Tracker to

promote campus community

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Screen shot of Tobacco Tracker.

engagement on the STF policy through crowdsourcing observational reports.

The Tobacco Tracker, created using Esri's Survey123 data collection application, enables campus community members to report real-time, GIS-tagged locations of active smoking or vaping and related litter. Identification of "hotspots" using data collected by the Tracker produces the opportunity for prompt and responsive data-driven outreach and educational efforts. Receiving actionable information through the Tracker is crucial to implementation of the CSU and UC enforcement plans that rely on education and outreach.

Figure 1 displays a screen shot of the smartphone-based Tracker tool. We used the Survey123 Connect Excel formbased authoring tool to create the Tracker tool, rather than the default web interface. Survey123 Connect has additional features that were important for this project, such as the ability to include graphics along with the text of the survey answer choices. We feel this helped us create a more visually engaging crowdsourcing tool.

Project staff used the data and map sharing capabilities of ArcGIS Online to make the data accessible for members of the research team tasked with data cleaning and reporting. The analysis reports built into Survey123 were used to make weekly progress reports while the GIS team members created analytical data layers that were displayed in story maps for weekly status meetings using Zoom. We used the ArcGIS Online "Aggregate Points" analysis tool to summarize the number of smoking/vaping or litter reports collected in zones that covered the two campuses. We also used the ArcGIS Online "Calculate Density" analysis tool to create a density plot of the number of reports per square mile on each campus. The density analysis was categorized using an equal interval method and symbolized with a continuous color ramp that displayed the highest report density areas in red. These "zone reports" and the density reports could then be used to inform the placement of non-smoking signage.

Figure 2 displays a map with individual locations of reported smoking or vaping, litter from smoking or vaping, or "looks good"- no smoking, vaping, or smoking/vaping litter for one of the campuses. The Tobacco Tracker has been in use since February 2019 at one CSU (San Marcos) and one UC (Davis). Each university has their own ArcGIS survey which re-directs to a URL consistent with campus STF program branding (www.clearcampus.org and www.healthy.ucdavis.edu/smoketobacco-free). The Tobacco Tracker accumulated 939 reports in a nine-month period (February-November 2019). Nearly half (47.9%) were reports of smoking/vaping. Reported sources of smoke/vapor were cigarettes (54.9%), e-cigarette (29.6%), and marijuana (6.2%). Almost a quarter (22.5%) were reports of tobacco-related litter, predominantly cigarette butts (91.9%). Cigarette packaging (17.5%), e-cigarette litter (4.3%) and marijuana litter (0.9%) were also reported. Figure 3 (next page) displays a map with a density plot of smoking/vaping or litter reports that can be used to prioritize the locations for signage and outreach efforts.

Litter from tobacco products poses a tremendous environmental burden (Novotny & Slaughter, 2014). Problems with non-biodegradable, toxic cigarette butts are well known and recognition of the threat from new tobacco products, (e.g., electronic cigarettes), is emerging (Mock & Hendlin, 2019). Waste generated by e-cigarettes includes lithium ion batteries, painted metal cases, plastic internal parts, and microprocessor circuit boards (Hendlin, 2018). The Tobacco Tracker is an innovative tool for addressing this problem.

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Figure 2: Map of individual reports on UC Davis main campus.



Figure 3: Density plot of smoking/vaping or litter reports at CSUSM main campus.

Humboldt

Salmon Spawning Suitability Model



Figure 1: Location of study area where LiDAR, hydrological, and redd observation survey data was gathered to create a salmon suitability spawning model.

he Lewiston Dam was constructed on the Trinity River in 1963 as part of the Central Valley Project that diverts water from northern California for many domestic and industrial purposes. Dams change historic river flow causing impacts to salmon and steelhead populations across the Pacific Northwest, along with altering spawning habitat, which requires wetted gravel for an extended period of time (Becker, 1983, Becker, 1985).

The purpose of this project is to create a spawning habitat suitability model for Chinook (*Oncorhynchus tshawytscha*) and Coho salmon (*O. kisutch*) during baseflows (~9 cms) and safety-of-dams flow releases (~28-99 cms) downstream of Lewiston Dam, which usually occur during fall and winter months. The objective is to assess potential spawning habitat suitability with different wetted areas, some of which result in dewatered redds when safety-of-dams flows return to baseflow conditions.

Methods

This project uses 1 foot resolution LiDAR data, along with bathymetric sonar data from the Trinity River downstream of Lewiston Dam shared by the Trinity River Restoration Program (TRRP). This data is used to better understand how flow management below Lewiston Dam impacts anadromous fish that rely on a natural hydrograph and flow variability to replenish and maintain water conditions and spawning habitat.

To create the salmon spawning habitat suitability model, this project used Hyper Envelope Modeling Interface, version 2 (HEMI 2). HEMI 2 fits Bezier curves over histograms of occurrences for each covariate. Doing this requires covariates to be input as raster grids to create a habitat suitability model (HSM) that can be based on up to 10 covariates (Graham et al. 2019). Shapefiles from the National Hydrological Dataset of wetted area were converted to a grid of points, where each point represents 37 m^2in wetted area in the Restoration Reach of the Trinity River, i.e. Lewiston Dam to North Fork Trinity River (Figure 1). The point grids represented wetted areas at five chosen flow conditions: 9cms (baseflow), 16cms, 28cms, 57cms and 142cms. The values of each covariate were created from the point grids using ESRI's ArcMap v10.6.1 software. The covariates used to predict suitable salmonid spawning habitat are distance to tributary (m), distance to pool (m), distance to thalweg (m), and depth (m). Covariate values were extracted to the point grids that would later be converted to raster files and used as predictor variables for suitable spawning habitat. Redd survey data from 2014, 2015, and 2016, supplied by US Fish and Wildlife, was used as the response variable and compiled in BlueSpray, a GIS package. HEMI 2 was then used to create spawning habitat suitability models at multiple flow conditions (Figure 2).

Results

HEMI2 produced a salmon spawning habitat suitability model by fitting a Bezier curve to each predictor variable. The model's outputs included area-under-the-curve (AUC) values ranging 0.64 - 0.74. The covariate's depth (m) and distance to pool (m) were the top preforming predictors for suitable spawning habitat at multiple flow conditions based on their individual response curves (Figure 3.). An environmental biases created by a cluster of redds near the river ending at Lewiston Dam were observed so a portion of those redds were removed to improve the models predictive abilities in the rest of the study area.

Conclusion

The methods used imply that high resolution raster data of environmental covariates can be a powerful tool in predicting habitat usage for salmonid spawning. Combined with the wetted area models, this information can be used to determine areas where spawning attempts may be unsuccessful due to impacts from flow management.

With improved abilities to gather spatial data from technological advancements, models can show how a species uses it surroundings. A greater understanding of the spatial structure of the underwater river topography and those elements critical to salmon spawning can be of even more value to long term river restoration projects.

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Figure 2:

Steps taken to convert wetted area shapefiles into raster files that included values for predictor variables for HEMI 2 to create a spawning suitability model;

(1) Wetted area polygon overlaid on the DEM.

(2) Grid of points from converted wetted area polygon.

(3) Raster created from values in the grid of points to be used as a predictor variable.

(4) HEMI 2's output of a raster containing suitability values.

Figure 3: Individual response curves for the predictor variables used to create the salmon spawning suitability model. The Y-axis represents frequency of occurrence and the X-axis represents the value in the raster file, used as a predictor variable.



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Mapping the Fast Food Environment in Relation to California Schools to Understand the Effects of Nutrition Policies



Figure 1: Example of open grocery stores in 2000 and 2012 in a school's service areas in Los Angeles, CA

n this article, we highlight the logic of the geospatial methods used to derive a more accurate spatial representation of where all public schools and fast food outlets in the state of California are located. Previous research has shown that a disconnect between US Postal Service 5-digit postal numbers and the spatial mapping of these numbers to zip code tabulation areas (ZCTAs) that started with the 2000 decennial Census can have spatiotemporal implications. For example, addresses could be "correctly" geocoded to a zip code that did not exist preceding the decennial Census and "zip code-level analyses have yielded socioeconomic gradients contrary to those reported in the literature" (Krieger et al. 2002). Research by Kaufman et al. (2015) found that "re-geocoding data may improve spatial precision, particularly in early years" and "though geoprocessing [the National Establishment Time Series (NETS)] is a large investment, the accuracy of business establishment locations is central to valid aggregate measures of commercial business access." Thus, to capture the most accurate location information possible with regard to spatial precision, we demonstrate a method to "recover" low accuracy NETS addresses.

Methods and Data Schools and Service Areas

School address data for each year from 2000 to 2018 were downloaded from the California Department of Education (CDE). Schools from the newest 2017-2018 school year were excluded if they opened after June of 2018, were completely virtual (had no actual campus populated by students), or if they offered and served preschool through fourth grade levels or adults only. All California school addresses were geocoded using the 2013 Esri US Street Address Locator (Esri 2013a, 2013b) or using the ESRI World Geocoding Service (2019) with the 1984 World Geodetic System (WGS 1984) as the geographic coordinate reference system. Schools and fast food locations were projected to a California Teale Albers projection, which is optimized for area calculations (CDFW, 2018). Comparisons were made between the CDE's original latitude/ longitude and the newly geocoded coordinates. When there was agreement, or near agreement, the CDE coordinates were kept. "Near agreement" was defined as matching the CDE latitude and longitude coordinates up to 3 decimal places (approx. ~100m) of the geocoded latitude and longitude. If there was missing coordinate information from the CDE, or there was not a near-match between coordinates, the geocoded coordinates were used.

Service areas were created in 0-0.25 mile (0.40 km), 0.25-0.5 mile (0.80 km), 0.5-0.75 mile (1.21 km), and 0.75-1.0 mile (1.61 km) rings around each school using ESRI's Network Analyst extension with the 2013 Esri US Streets Network Dataset (ESRI 2013a, 2013b). A service area includes all the area that can be accessed travelling along a road network for the specified distance from the school location starting point. Service areas represent a more realistic depiction of how pedestrians and motorists traverse the landscape than a radial buffer, though the accuracy of service areas is limited by the accuracy of available road data.

Fast Food

Fast food location data for businesses (2000-2012) were purchased from the National Establishment Time Series (NETS; Walls & Associates, 2012), a unique historical database providing location information about commercial resources to an accuracy of block face (highest accuracy), street segment, block group, census tract centroid, or ZIP code (lowest accuracy). Greater zip code-level accuracies were observed in earlier years as the accuracy of location data improved substantially over



Figure 2: Description of the process used in the methodology.

Mapping the Fast Food Environment from page 9

time. An assumption of this analysis is that ESRI's 2019 geocoding service would provide a more up-to-date street network dataset than the geocoding services that Dunn & Bradstreet and Walls & Associates originally used to compile the NETS location information. Thus, this analysis focused on "re-geocoding" all business locations provided by NETS from 2000-2012 that were less accurate than block face (14,528). The ESRI World Geocoding Service (ESRI 2019c) was used to "re-geocode" businesses to 'point address-level' or 'sub-address-level' accuracy, which were considered comparable to the 'block face-level' accuracy provided by NETS. A minimum of 75% match score was considered as an acceptable address location (ESRI 2019 World Geocoder).

To assess the accuracy of using a 2019 ESRI Geocoder to locate addresses from 2000 - 2012, approximately 30 random re-geocoded addresses (ESRI 2019c) were crosschecked against Google Maps (Google 2019) to determine distance as a threshold for accepting re-geocoded addresses as valid. Distances between the original NETS coordinates and the re-geocoded coordinates were calculated with Python (v. 3.4) to evaluate quality control and assurance. Figure 2 describes this process.

Results & Discussion

Of the 219,253 total businesses provided in the 2000 -2012 NETS dataset, 14,528 businesses (6.63% percent) were open after 2000 and classified as a lower accuracy than block face. Of the 31 randomly selected establishments that were re-geocoded, 11 were confirmed as valid after crossreferencing with Google Maps. Valid establishments averaged a 14-mile (23 km) distance away from the original NETSprovided locations, while the remaining 20 establishments were confirmed to be invalid and averaged a 127-mile (204 km) distance from locations provide by NETS. Therefore, an arbitrary, though conservative, 10-mile (16 km) threshold was chosen in order to filter out re-geocoded addresses that were likely to be anomalous. In other words, re-geocoded locations whose distance was greater than 10 miles (16 km) from the NETS locations were considered implausible and therefore excluded (approx. 1.4% of the 14,528 re-geocoded business addresses) and the original coordinates from the NETS dataset for these locations were retained. Figure 3 illustrates one business location's accuracy improvement with the regeocoding.

Of the total 219,253 NETS business addresses from 2000 to 2012, we recovered 3.18% of these locations. Of the total NETS businesses in the same period, there were 14,528 nonblock face level food establishments that fell within the 10 mile (16 km) validity threshold that were re-geocoded. Of those, we recovered approximately 48%.

The recovery of 3.18% of the total business addresses from 2000 – 2012 from NETS and 48.0% recovered of those that were re-geocoded increases the sample size of the establishment data, and importantly, the accuracy of the locations, enabling a more robust spatial analysis. In 2000, 8.28% of the NETS locations had a level of precision at zip-code level accuracy. With re-geocoding, we were able to reduce this to 3.33%. For 2010, we reduced this from 1.18% to 0.98%. Kaufman et al. (2015) attempted a similar analysis and by re-geocoding NETS addresses, they were able to recover business locations to an accuracy better than zip code from 16% in 2000 and reducing this to only 2% and for 2010, from 2% to 1% after using a



Figure 3: Example of improvement from an establishment between the NETS coordinates and the ESRI World Geocoder coordinates (distance of 5 miles). In this case, the improvement was from Zip code-level to Point address-level accuracy.

Cut off Distance (miles)	Addresses recovered	Number of Addresses excluded	Percentage of Addresses recovered of the total post 2000 not D (14,528)	Percentage of Addresses recovered of the total post 2000 (219,253)
0	7,170	0	49.35%	3.27%
10 (arbitrary)	6,968	202	47.96%	3.18%
15 (arbitrary)	7,039	131	48.45%	3.21%
100 (Census Tract)	7,124	46	49.04%	3.24%

Table 1: Percentage of NETS business locations (total = 14,528) open after 2000 with improved accuracy using the ESRI 2019 World Geocoder considering a cut off distance for accepting re-geocoded addresses as spatially valid

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combination of geocoders for NETS New York City business addresses. Consistent with their analysis, we also saw the most improvement in recovering addresses for the earlier years of the dataset. These re-geocoded values should improve the accuracy of further spatial analysis research evaluating the impact of the food environment near schools on children's health.

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Empowering Community continued from page 3

2019). Additional examples of student projects that are important to our communities are shown in Figures 2-4.

Interns: We selected seven SEEDS to work with seven nonprofit organizations during the summer of 2019. Collectively, SEEDS worked a total of 1,440 hours (SEEDS projects 2019). Most began with a low level of confidence in their technical skills and all finished their internships confident in their projects and in their technical growth, which included strides in using the LA GeoHub, statistical computing and data management software, and coding. Many students were able to leave behind instruction manuals and structural frameworks for nonprofit employees and future interns to keep the projects going. All nonprofits expressed interest in more workshops, more help, and a long-term connection with the project having seen the immediate pay offs in the first year.

The impact of students' academic trajectory and selfassurance in using GIS was remarkable. Tarkhanyan Takouhi, a senior in Psychology and a GIS novice, cleaned up the Los Angeles Regional Reentry Project's (LARRP) outdated

database and created an interactive map of resources and services for the reentry community. LARRP used her product to secure a \$175,000 grant and offered her a full-time position that she described as "a dream job". She will further expand these interactive maps as a tool for their community resource advisors. Another student, Alfredo Estrada, a geology major, taught himself Visual Basic coding and cleaned and organized over 100,000 data entries for City Plants (during 2014-2019). He produced visualization products and set up automatic updates when new entries are added to the datasheet. Now, City Plants can see the distribution of their trees and spot underserved areas where they need to focus for the next year. City Plants is a partner of Mayor Garcetti's urban forest development to combat climate crisis (Mayors' Office Press release, 2019). Alfredo, inspired by internship experience, decided to enroll in our GIS certificate program. Martha Solorio, a junior in geology who worked with Wildwoods Foundation, increased her interests in GIS and took more GIS and coding courses. Her skills and interest secured her a summer internship position at ESRI for the upcoming summer 2020.

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Figure 3: An

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interactive story map showing student suspension counts and green spaces in a student class project: Green Space and Academic and Health Indicators within Title 1 School.



Empowering Community continued from previous page

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Homies Unidos :Fighting Stigmas Together

Homes Undos is an organization which work to wid the dehumanization of our undocumented youth coming from III Salvedor. These individuals are foring ging related VIDEIRCE and ensures insues of pOVerTY back in their homeland. It takes a lot to their from their homes and leave their families behind, but some do it in hopes of coming to America for a more promising future.

"Tor more than 14 years. However, and promote passes in our change, working to and violence and promote passes in our communities through gang prevention, the promotion of human rights in immigrant communities, and the empowerment of youth through positive alternatives to gang involvement and distructive behavior."

Using maps to draw connections between

local and global issues



Changing Narratives about Immigrant Youth

Youth Population in Immigrant Families
This map is measuring children who are either
foreign born or living with foreign born parents.

families near the area in which Homies Unidos primarily serves.

mi<mark>es Unidos Creates Change</mark>

Homicides in Central America

- This map depicts the homicide rates in Central America.
 High homicide rates are pushing these Central American individuals out of their country in search for
- a safer life in America.

involvement of the U.S. in Central America caused mass mi solence inflicted by the U.S...



Figure 4: Mapping immigrant communities against homicide rates to situate local issues in global processes of Change.

Analyzing Mudslide Susceptibility continued from cover page

primarily ultramafic, and the rocks are believed to have been formed from the submarine eruption of oceanic crustal and upper mantle material, which is described as the coast range of Ophiolite. The average rainfall for the county is 500 mm, with the most precipitation occurring in winter months. Landslides have been reported throughout Monterey County, but they are primarily concentrated along the coast. Weight of evidence from prior landslides and selected triggering factors were modeled within the Maxent software package to create landslide susceptibility maps. Maxent uses a machine learning technique called maximum entropy modeling to express a probability distribution from a set of environmental grids and georeferenced occurrence localities (Phillips et al., 2004). Past occurrence data were obtained from the National Aeronautics and Space Administration (NASA) global landslide catalog (GLC) which takes into account all reported landslides in the media, disaster databases, and scientific reports from 2007 to present day. A collinearity analysis was performed to eliminate redundant variables, resulting in 8 main environmental layers (triggering factors) used for modeling: annual precipitation, distance to fault lines, distance to roads, soil stability, geology, soil liquefaction, slope, aspect, Topographic Position Index (TPI). Models were run using 70 % of the data as training while the other 30 % was used for testing (validation).

The Maxent model produced training and testing AUC values of 0.98 and 0.928, respectively, with distance from roads being the main triggering factor (Table 1). The landslide susceptibility map from the model is shown in Figure 2 and the response curves of each triggering factor are presented in Figure 3. As Figure 2 shows, Monterey County has a linear pattern of high landslide susceptibility areas. Most of these susceptible areas are along roads and faults, with roads contributing the most (see Table 2 for the actual percentage contribution values). Logically, traffic movement and the cutting of hillslopes to construct roads increase land instability and thus susceptibility to landslides as demonstrated in traffic-movement related operations such as timber harvesting where skid roads eventually lead to enormous amounts of erosion and detrimental land damage (Trimble et al., 1953). Although we assume that all past landslides observed were reported, sampling bias in the GLC data could have limited the accuracy of our modeling as there are no occurrence points reported in the inland remote roads. However, removing roads from the analysis yielded noisy outputs suggesting a low modeling power if such an important variable is excluded. Our results should therefore be interpreted with caution as they are limited to how NASA collects the presence points. For a future study, we recommend factoring in the thresholds used in collecting presence points and a subsequent sensitivity analysis, especially to better interpret the likely reasons behind the areas modeled as lowly susceptible. We encourage more analyses like our study to identify areas of high landslide risk potential and thus allow for preventive measures to be taken before the economic hardships of massive repairs or worstcase scenario loss of life. 🥭

Variable	Percent Contribution	Permutation Importance
Roads	64	89
Faults	16.7	2.2
Slope	6.4	3.9
Aspect	5.2	2.9
Geology	2.7	0.4
Liquefaction	1.8	1
Soil Stability	1.6	0
ТРІ	0.8	0
Annual Precipitation	0.7	0.6

 Table 1: Estimates of relative contributions of the environmental variables to the Maxent model.

ACKNOWLEDGEMENTS:

The environmental rasters used in modelling were generated from data obtained from the Monterey County GIS Website.

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Analyzing Mudslide Susceptibility continued from previous page

Table 2: Estimates ofrelative contributions of theenvironmental variables usedin the Maxent model (Run#1).

Variable	Percent Contribution	Permutation Importance
Roads	64.4	89.1
Faults	16.8	2.9
Slope	6.3	2.8
Aspect	4.2	0.7
Geology	2.1	0
ТРІ	2	1.1
Liquefaction	2	0.3
Soil Stability	1.3	0.6
Annual Precipitation	0.9	2.4
Flow Accumulation	0	0.1
Earthquakes	0	0
TWI	0	0

Figure 3: Response Curves for the triggering factors used in modeling landslide susceptibility.



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Mapping a Displaced Population continued from page 2

insightful information than basic parcel data or aggregated summary reports. The data was provided by InfoGroup, a data-aggregation firm specializing in mail marketing and consumer characterization, and was stated to include names and addresses of all adult-aged residents of Butte County as of October 2018. Names and address are required to query for permanent National Change of Address (NCOA) submissions to the United States Postal Service (USPS).

The addresses were geocoded and showed that 37,198 adult-aged individuals fell within the Camp Fire footprint. Of those, 11,957 returned new mailing addresses from our first USPS NCOA query in April 2019. By September 2019, the number grew to 13,153 new mailing addresses, representing roughly one-third of the affected population.

Over 80% of the new mailing addresses were found in California (11,164), with about two-thirds of those based in Butte County (7,204). Other western states, Oregon (480), Nevada (207), Arizona (197), Idaho (165), and Washington (137), made up the next most displaced locations. Per this dataset, a Camp Fire survivor can be found in 46 states and around 20% of US counties. Several destinations show only one or two survivors; however, this speaks to the magnitude of the displacement as well as the individuality of recovery.

Along with required names and address for NCOA querying, our dataset also included variables regarding household and individual level demographics, such as age, income, familial status, home value, and owner-renter status. We were able to group residents by their displaced location along the variables stated above. To overcome the uneven distribution of individual city quantities, we categorized the displacement locations into: "Moved to Chico", "Within 30 miles of the fire perimeter", and "Beyond 30 miles of the fire perimeter."

We were also able to compare owner-renter status. Of the owner group, we have "permanent" changes of address for about 45 percent. We only have new permanent addresses for 17 percent of the renter group. If you take the ability to "permanently" relocate as a proxy for capacity and capability, renters have not shown the same ability to recover. Insurance plays a role, as the maximum benefit is drastically different for these two groups.

To that point, the service organization Butte 211 provided an online intake form a year after the fire for those still needing assistance. Of the about 2,000 submissions, nearly 75% identified as renters and identified as still requiring some very basic assistance (shelter, food, money). The majority of those still do not have any case management.

We know disasters can affect different populations disproportionately, and the kind of work we are doing can aid in researching and confirming those outcomes. This is important as we experience more catastrophic events resulting in mass displacement, both domestically and globally.

I hope that with our own research at Chico State, and partnering with other community entities, we can continue to examine the lasting impacts of the Camp Fire and support planning decisions for our region and any other communities who experience such devastation.

ACKNOWLEDGEMENTS

InfoGroup (Butte County consumer mailing list, October 2018) and USPS NCOALink (accessed September 2019).

INTERACTIVE MAPS

Map of relocation destinations nationally: https://arcg.is/1bnaCq

Map of neighborhoods in the fire perimeter showing relocation destinations: https://arcg.is/1iL0SC

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Mapping a Displaced Population continued from previous page

Figure 2: Residents with children were most likely to move to Chico or within 30 miles of their previous home, compared to those without children who largely relocated outside the area.

Presence of children in home



Estimated household income



Figure 3: Many of the most affluent households relocated to Chico and individuals with the lowest income moving out of the area.

Figure 4: Home value also appears to influence a factor in where people settle, as those with higher home values were far more likely to move to Chico.



Figure 5: The wildfire hazard status of the new addresses remains a topic for further inquiry.

Wildland Urban Interface (WUI) status of new address

