

# Post Camp Fire Regional Population and Transportation Study

Prepared for:

Butte County Association of Governments

Report of Pre and Post Camp Fire Conditions

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# Introduction

This Technical Report functions as a combined deliverable for Tasks 4.2. and 4.3. These two tasks focused on identifying the Camp Fire's impacts on travel patterns, economics, and demographics across Butte County. Multiple data sources were analyzed including:

- Traffic Counts
- Large Employer Commute Surveys
- Butte County Travel Survey
- Public Outreach
- Inventory of Land Use
- Cellular Device Travel Information

This memorandum begins with an overview of key findings from the various sources. Following that is a detailed breakdown by data source, highlighting the relevant analysis. At the end of the memorandum is an overview of disaster recovery activities in other jurisdictions.

*An analysis of public transit services can be found in a separate Technical Memorandum titled **Butte County Transit and Non-Motorized Plan Update - DRAFT***

# Overview of Key Findings

The Camp Fire (November 2018) was the single deadliest and most destructive wildfire in the history of the State of California. It not only destroyed most of the Town of Paradise, it also had ripple effects that extended to Chico, Oroville, the other small towns in the county, and even communities over the county line.

The restoration process involves the preparation of the Post Camp Fire Regional Population and Transportation Study. The first step is identifying the effects the fire had on transportation, economics, and demographics.

After collecting, reviewing, and analyzing the data from a variety of sources, we have determined that the following were key outcomes from the Camp Fire.

## Vehicle Activity

- Traffic counts at 343 locations were collected during the middle of the week (Tuesday-Thursday) between September-November 2017, September-October 2018, and November 2019. Among these locations, 54 were identified where count data was collected both before and after the fire.
- Overall traffic volume (including trucks) across all traffic count locations decreased by 3% post fire. The changes by jurisdiction are listed below.
  - Biggs increased by 10%
  - Chico increased by 11%
  - Gridley increased by 17%,
  - Oroville and Thermalito increased by 15%
  - Paradise and Magalia decreased by 43%
- Overall average daily passenger vehicle volumes (excluding trucks) decreased by 11%.
- Despite the overall reduction, there were several areas that experienced a significant increase in daily traffic volume including:
  - Chico**
    - East Ave east of Esplanade Rd, +5,076 (+21%)
    - Cohasset Rd south of East Ave, +4,082 (+19%)
    - Esplanade Rd south of East Ave, +3,777 (+18%)
    - East 1st Ave west of Sherman Ave, +3,693 (+21%)
  - Oroville**
    - 18th St north of Oro Dam Blvd (+29%)
    - Montgomery St west of Table Mtn Blvd (+13%)
    - Orange Ave west of Acacia Ave (+21%)
  - Unincorporated County**
    - Aguas Frias Rd south of Durham Dayton Rd (+68%)
    - Los Verjeles Rd south of La Porte Rd (+39%)

- Lower Wyandotte Rd west of Alverda Dr (+44%)
- Not surprisingly, Paradise experienced a decline in traffic volume. There were several other locations that also show a decrease in volume. The largest decreases in total vehicle volume are shown occurring at:
  - Paradise**
    - Clark Rd north of Pearson Rd, (-49%)
    - Skyway south of Pearson Rd, (-30%)
    - Clark Rd north of Wagstaff Rd, (-54%)
    - Pearson Rd east of Clark Rd, (-61%)
    - Bille Rd east of Skyway, (-65%)
  - Chico**
    - Skyway south of Bruce Rd (-15%)
    - W 3<sup>rd</sup> east of Ivy St (-12%)
  - Unincorporated County**
    - Skyway east of Cliffhanger Ln (-23%)
- Vehicular travel across the Butte County line (to and from) experienced a substantial increase (15% increase in both directions).
- There was a significant increase (206%) in medium-duty truck activity across all locations, especially in Paradise along Skyway.
- While overall average heavy-duty truck traffic dropped by over one-third (38%), some areas did see an uptick including:
  - Chico**
    - Skyway east of Bruce Rd, (+78%)
    - Cohasset Rd north of Eaton Rd, (+602%)
  - Paradise**
    - Wagstaff Rd west of Pentz Rd, (+387%)
    - Pentz Rd north of Pearson Rd (+179%)
  - Unincorporated County**
    - Skyway east of Cliffhanger Ln, (+254%)
- As for vehicle speeds:
  - Activity in the higher vehicle speed ranges (30-50 mph and 50 mph+) decreased by 7% and 26% respectively.<sup>1</sup>
  - Overall volumes in the 0-30 mph range increased by 10% across all locations.<sup>2</sup> The roadways experiencing the largest increases in this speed range include:
    - Cohasset Rd south of East Ave (+40%)
    - East 1st Ave west of Sherman Ave (+70%)
    - Park Ave north of East Park Ave (+65%)

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<sup>1</sup> Travel volumes shifted from the higher speed limit roadways into the lower speed ranges within cities.

<sup>2</sup> Based on the increased volume on roadways within Chico and non-rural roads, the speed increase is mostly due to increased volume on roadways with speed limits of less than 30 mph. This can be verified by looking at the “before and after” speed changes at the locations. It appears that the change in volume did not cause a major change in observed speed.

## Travel Patterns and Habits

Surveys were conducted in-person and online between November 1, 2019 and February 29, 2020. Anonymized cellphone data was collected by obtaining information from telecommunications and evaluated for travel patterns of residents, workers, and visitors in Butte County. The data was collected in September and October 2018 (pre Camp Fire) and September, October, and November 2019 (post Camp Fire).

### *Large Employer Commute Survey*

Employees at 165 large employers completed a survey about their commute activities. We learned that:

- Over 50% of respondents run errands to/from work (trip chain), which can make switching to ridesharing and transit more difficult.
- Transit currently does not work for most people (e.g., inadequate hours and frequency and a lack of emergency guaranteed ride home).
- 90% of respondents do not work on the weekends.
- When asked what would incentivize individuals not to drive alone, the greatest responses were: 1) provide some type of financial incentive and/or 2) provide a guaranteed ride home for emergencies.

### *Butte County Travel Survey<sup>3</sup>*

This survey was administered online and at pop-up events. Key findings include:

- Most respondents (66) were employed and drive alone to/from work
- As the number of vehicles in a household increases, the use of transit by people in that household tends to decrease

### *Public Outreach*

Respondents at pop-up events in 2019<sup>4</sup> were asked what issues kept them from walking or bicycling more frequently. The most frequent responses include:

- Issues walking outside: 34% missing sidewalks, 30% unsafe crossing/intersection, 26% personal safety
- Issues biking: 37% no bike paths/lanes, 35% high car traffic speed/volume, 15% no place to park bike at destination

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<sup>3</sup> For information about issues related to public transit services please refer to Butte County Transit and Non-Motorized Plan Update – Draft

<sup>4</sup> According to AIM Consulting, a total of more than 80 people (combined) attended pop-up events on November 24 (Chico Christmas Preview, Chico, CA) and December 5 (Paradise Alliance Church Community Dinner, Paradise, CA).

### *Cellphone Data<sup>5</sup>*

- Total weekday trip activity<sup>6</sup> decreased marginally (-6%) in the year following the Camp Fire.
- Total weekend trips experienced a more significant decrease (-18%) than weekday trips during the same period.
- Total weekday trips entering Butte County experienced a significant increase (+14%) over the same period while weekend trips decreased (-9%). Of the total weekday increase in trips into Butte County, Tehama accounted for 40%, Yuba accounted for 23%, and Sutter accounted for 18%.
- Total weekday trips leaving Butte County over the same period also experienced an increase of +10%. For the increase of trips, the major destinations to surrounding counties were Tehama (+43%), Yuba (24%), and Sutter (17%).
- Total weekend trips exiting the Butte County decreased substantially (-10%).
- Weekday trips that stayed within Butte County decreased by 9% between 2018 and 2019. Weekend trips declined by 25% over the same period.

## **Demographics, Businesses and Economics**

The residential and business location datasets consist of records of households and businesses from 2018 (pre Camp Fire) and 2019 (post Camp Fire).

### *Where did people relocate?*

The main counties where Camp Fire survivors relocated include Sacramento, Placer, Sutter, and Yuba. For people who relocated within Butte County, the two main destinations were Chico and Oroville.

### *Home Values and Ownership*

The data did not reveal any significant changes in home values following the fire.<sup>7</sup> Not surprisingly, there was a decrease in home ownership and an increase in renting.

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<sup>5</sup> Anonymized cellphone data representing between 10% and 20% of the population obtained from telecommunications companies were collected, evaluated for travel patterns of residents, workers, and visitors, and aggregated to represent "before and after" conditions. When comparing travel patterns from 2017 to 2018 and 2018 to 2019, there is an increase in relocating from 14% to 17%, respectively.

<sup>6</sup> The definition of the cellphone trip is based on the location of the origin of the trip compared to the destination of the trip, regardless of trip purpose or location of residency. For example, a trip starting within Butte County and ending outside of Butte County is considered a trip leaving Butte County. When combining purpose (to work, to home) with direction, it is inferred the resident trip is for home purposes. For example, a trip starting outside of Butte County with a trip purpose of "to home" is inferred to be a resident of Butte County and is described as a trip entering Butte County to their home within Butte County.

<sup>7</sup> The InfoGroup data are based on the estimated value of the home at its last appraisal, not the asking or market value. The data are also only a sample for each year, and the overall data are only for residents who lived in Butte County before or after the fire, not the location they lived before the fire outside of Butte County. The InfoGroup data may have this result because of the data collection method being a sample, or it could be that those who relocated purchased houses in roughly the same price range because that is what they could afford. Those who could not afford or did not want to stay in Butte County are those that migrated out of the county.

### *Changes in Business*

There were no significant changes in business types (based on percentage of businesses) following the fire with one exception: Health Care and Social Service-related businesses declined by a few percentage points. Businesses that had to relocate tended to go to Sutter County. New businesses that have started post fire have been mostly in Chico and Oroville.

### *Buildings (residential and commercial)*

As expected, almost all residential and commercial reductions in Butte County occurred in Paradise as a direct result of the fire. Single-family structures within Paradise were reduced by 85%, multi-family structures were reduced by 71%, and mobile homes were reduced by 96%. Some reconstruction did begin in Paradise in 2019 including many temporary residential units (648).

## **Overall Impression**

From a transportation perspective, most of Butte County can be considered low density and/or rural, and this characteristic has a direct impact on transportation and mobility. There are limited options for using public transit, except within the City of Chico, and in many areas, it is physically difficult to walk or bike between destinations due to limitations in the pedestrian and bicycle network such as lack of sidewalks, lack of complete bicycle lanes, etc. Historically, most people have had to drive to get from one place to another within the county.

The findings seem to support what one would expect following a major natural disaster that literally destroyed most of a town. Traffic levels were up in the primary surrounding community, traffic in the impacted community decreased, weekday activity between the impacted county and neighboring counties increased (contractors, supplies, people commuting to temporary housing and jobs, etc.). Cars were still the dominant mode of travel and will likely remain so without significant capital expenditures for increased transit service plus improvements to bicycle and pedestrian facilities.

# Data Sources and Analysis

## Traffic Counts and Travel Patterns

### Traffic Counts

Traffic counts at 343 locations were collected during the middle of the week (Tuesday-Thursday) between September-November 2017, September-October 2018, and November 2019. Among these locations, 54 were identified where count data was collected both before and after the fire. These counts were summarized by hour of day, Federal Highway Administration (FHWA) vehicle class, and by direction. **Maps 1-3** show the counts by location for pre Camp Fire and post Camp Fire plus the net change. **Maps 1-3** can be found in **Appendix A – Maps** (file title Appendix A - Maps.pdf). **Charts 1-18** can be found in **Appendix B – Traffic Counts** (file title Appendix B-Traffic Counts.pdf).

After the fire, there was an overall reduction in traffic volume of 3%. **Chart 1** compares pre- and post-Camp Fire average total daily volume at each count location and **Chart 2** shows the difference between pre- and post-Camp Fire average total daily volume. Total volume decreased at 18 of the 54 locations. At locations where the total volume decreased, the average reduction was 37%; while at locations where the volume increased, the average increase was 20%. Notable increases were measured at:

#### Chico

- East Ave east of Esplanade Rd, +5,076 (+21%)
- Cohasset Rd south of East Ave, +4,082 (+19%)
- Esplanade Rd south of East Ave, +3,777 (+18%)
- East 1st Ave west of Sherman Ave, +3,693 (+21%)

#### Oroville

- 18th St north of Oro Dam Blvd (+29%)
- Montgomery St west of Table Mtn Blvd (+13%)
- Orange Ave west of Acacia Ave (+21%)

#### Unincorporated County

- Aguas Frias Rd south of Durham Dayton Rd (+68%)
- Los Verjeles Rd south of La Porte Rd (+39%)
- Lower Wyandotte Rd west of Alverda Dr (+44%)

Notable decreases were measured at:

#### Paradise

- Clark Rd north of Pearson Rd, (-49%)
- Skyway south of Pearson Rd, (-30%)
- Clark Rd north of Wagstaff Rd, (-54%)
- Pearson Rd east of Clark Rd, (-61%)
- Bille Rd east of Skyway, (-65%)

#### Chico

- Skyway south of Bruce Rd (-15%)

- W 3<sup>rd</sup> east of Ivy St (-12%)
- Unincorporated County**
- Skyway east of Cliffhanger Ln (-23%)

### *Vehicle Class (Type)*

The 13 FHWA classes were aggregated into three groups: 1) passenger vehicles and lightweight trucks, 2) medium-duty<sup>8</sup> trucks, and 3) heavy-duty<sup>9</sup> trucks. In cases where count data was available for the same location from multiple days, outlier counts beyond three standard deviations of the mean were discarded. Then, for each location, average daily totals, shares, and changes in volume were calculated for pre- and post-fire conditions.

Average daily passenger vehicle (i.e., cars and light trucks) volumes are illustrated in **Chart 3** and the difference in passenger vehicle volumes between pre- and post-Camp Fire is shown in **Chart 4**. There was an overall reduction of 11% in passenger vehicle volume, which decreased at 23 of the 54 locations. At locations where the passenger vehicle volume decreased, the average reduction was 38%; while at locations where the volume increased, the average increase was 13%. Notable increases were measured at the following locations:

#### **Chico**

- East Ave east of Esplanade Rd, (+25%)
- Cohasset Rd south of East Ave (+19%)
- Esplanade Rd south of East Ave (+17%)

#### **Oroville**

- Orange St west of Acacia Ave (+17%)
- 18<sup>th</sup> St north of Oro Dam Blvd (+18%)

#### **Unincorporated County**

- Lower Wyandotte Rd west of Alverda Rd (+33%)
- Aguas Frias Rd south of Durham Dayton Rd (+40%)
- Richvale Hwy east of Midway (+41%)

Notable decreases were measured at the following locations:

#### **Chico**

- Skyway south of Bruce Rd (-15%)
- W 3<sup>rd</sup> east of Ivy St (-12%)

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<sup>8</sup> Class 3 – Medium Duty includes flat-bed trucks, box trucks, and extended bed cargo vans with a GVWR of 10,001 to 14,000 lbs. and 6 tires or more; Class 4 – Medium Duty includes delivery vans, small buses, and conversion vans about the size of an ambulance with a GVWR of 14,001 to 16,001 lbs. and 6 tires or more; Class 5 – Medium Duty includes RVs, dump trucks, or medium-size refrigerated trucks with a GVWR of 16,001 to 19,500 lbs. and 6 tires or more; and Class 6 – Medium Duty includes buses and medium size cargo or delivery trucks with a GVWR of 19,501 to 26,000 lbs. and 6 tires or more.

<sup>9</sup> Class 7 – Heavy Duty includes large delivery trucks and tractor-trailer combinations with a GVWR of 26,001 to 33,000 lbs. and 6 tires or more and Class 8 – Heavy Duty includes motor coaches, all tractor-trailer combinations, refuse trucks, and construction vehicles with a GVWR of 33,001 or more and 10 or more tires.

**Paradise**

- Clark Rd north of Pearson Rd, (-63%)
- Skyway south of Pearson Rd, (-41%)
- Skyway east of Cliffhanger Ln, (-37%)
- Skyway east of Bruce Rd, (-31%)
- Pearson Rd east of Clark Rd, (-73%)
- Clark Rd north of Wagstaff Rd, (-63%)
- Bille Rd east of Skyway, (-74%)

**Unincorporated County**

- Skyway east of Cliffhanger Ln (-37%)

Average daily shares of passenger vehicles at each location are shown in **Chart 5** and the difference in passenger vehicle shares between pre- and post-Camp Fire is shown in **Chart 6**. While passenger vehicles accounted for more than 60% volume at every location post-fire, the share still decreased at 49 out of 54 locations. At these 49 locations, on average, a reduction in the share of passenger vehicles of 12% was observed. The locations with the highest volume reductions also saw the largest drops in passenger vehicle share.

Average daily medium truck volumes are illustrated in **Chart 7** and the difference in medium truck vehicles between pre- and post-Camp Fire is shown in **Chart 8**. In aggregate, across all locations, medium truck volumes increased by 206%, virtually tripling from pre-fire counts. Medium truck volumes increased at 53 out of 54 locations. The largest increases were measured at:

**Chico**

- Skyway south of Bruce Rd (+489%)

**Paradise**

- Elliot Rd east of Clark Rd (+2,532%)
- Skyway south of Pearson Rd, (+318%)
- Pearson Rd east of Clark Rd (+1,323%)

**Unincorporated County**

- Skyway east of Cliffhanger Ln +292%)

Average daily shares of medium-duty trucks are shown in **Chart 9** and the difference in medium truck shares between pre- and post-Camp Fire is shown in **Chart 10**. The share of medium trucks relative to total volume increased at 53 of the 54 locations. On average, the increase in medium truck share observed was 11%. However, at 25% of the locations, increases of 15% or higher were observed.

Average daily heavy-duty truck volumes are illustrated in **Chart 11** and the difference in heavy truck vehicles between pre- and post-Camp Fire is shown in **Chart 12**. In aggregate, heavy truck volume decreased by 38% across all locations. Heavy truck volumes decreased at 40 of 54 locations, decreasing by 64% on average. The largest decrease was measured at East Avenue East of Esplanade Road: -1,137 (-76%). Notable increases in volume were measured at:

**Chico**

- Skyway east of Bruce Rd, (+78%)
- Cohasset Rd north of Eaton Rd, (+602%)

**Paradise**

- Wagstaff Rd west of Pentz Rd, (+387%)
- Pentz Rd north of Pearson Rd (+179%)

**Unincorporated County**

- Skyway east of Cliffhanger Ln, (+254%)

Average daily shares of heavy trucks are shown in **Chart 13** and the difference in heavy truck shares between pre- and post-Camp Fire is shown in **Chart 14**. The share of heavy trucks decreased at 38 out of 54 locations. Heavy trucks accounted for less than 4% of the total volume at all locations in the post-fire data. At Richvale Hwy east of Midway, the heavy truck share was highest before the fire, 12%. This decreased by a range of 10% to 2%. Other locations where heavy truck share decreased from larger percentages compared to before the fire are Chico River Road west of Alberton Road, B Street east of First Street, East Avenue east of Esplanade Road, and Aguas Frias Road south of Durham Dayton Road.

*Speed*

Vehicle counts at 54 locations were aggregated into four speed bins: 0-30 mph, 30-50 mph, 50-70 mph, and 70+ mph. The preprocessing methodology followed for this data was like the methods for the class counts data, including removal of outliers from multi-day counts. After preprocessing, the data from before and after the fire were compared.

The volumes of vehicles traveling at speeds between 0-30 mph at each location are displayed in **Chart 15**. Overall, volume in this bin increased by 10% across all locations. The volume of vehicles in this bin increased at 32 of 54 locations. Notable increases were measured at:

- Cohasset Rd south of East Ave (+40%)
- East 1st Ave west of Sherman Ave (+70%)
- Park Ave north of E Park Ave (+65%)

Notable decreases were seen at:

- Skyway south of Pearson Rd (-58%)
- Pearson Rd east of Clark Rd (-68%)
- Clark Rd north of Wagstaff Rd (-92%)

The volumes of vehicles in the 30-50 mph bin before and after the fire are displayed in **Chart 16**. In aggregate, there was a 7% decrease in volumes across all locations, with volumes decreasing at 32 of 54 locations. Notable decreases were measured at:

**Chico**

- W 3<sup>rd</sup> St east of Ivy St (-78%)

**Paradise**

- Clark Rd north of Pearson Rd (-64%)
- Bille Rd east of Skyway (-87%)
- Wagstaff Rd west of Pentz Rd (-89%)
- Pentz Rd north of Wagstaff Rd (-53%)
- Elliot Rd east of Clark Rd (-86%)
- New Skyway east of Pentz Rd (-25%)

**Unincorporated County**

- Aguas Frias Rd south of Durham Dayton Rd (-84%)

The volumes of vehicles traveling at speeds between 50 mph and above are displayed in **Chart 17**. This volume decreased at 35 of 54 locations, leading to an aggregate decrease of 26% after the fire. The largest volume decreases were measured at:

**Chico**

- Bruce Rd north of Skyway (-99%)
- Skyway east of Bruce Rd (-17%)

**Paradise**

- Clark Rd north of Wagstaff Rd (-39%)

**Unincorporated County**

- Skyway east of Cliffhanger Ln (-19%)
- Durham Pentz Rd east of SR 99 (-53%)

The relationship between total volume and truck volume is shown in **Chart 18**. The lower volume roads have higher truck percentages while the higher volume roads have lower truck percentages. Roadways such as Skyway connecting the major destinations have middle of the range volumes and truck percentages since there are few alternative routes.

## Travel Patterns

### *Large Employer Commute Surveys*

Surveys were developed for employees of large employers to gather information about travel behavior and new mobility options. Highlights of the 165 large employer survey results are noted below. Overall, the need to make more than one stop and the difficulty of finding a carpool/vanpool results in the large single-occupant commute.

- 50% of respondents need to make other stops or prefer to drive their own car, 39% cannot get home in an emergency, 35% find it difficult to organize carpool/vanpool, and 34% work irregular hours. The existing schedule and routes do not align with 37% of respondents' commute hours.
- Over 90% of respondents have Saturday and Sunday off

- Shift start: Before 7 AM (17%), 7-8 AM (26%), 8-9 AM (37%), 9 AM (15%)
- Shift End: Before 4 PM (22%), 4-5 PM (32%), 5-6 PM (52%)
- When asked what incentives would motivate people to not drive alone, 66% responded financial incentives; 36% responded guaranteed ride home; 33% biking access; 27% showers and lockers; and 25% shuttle between transit and work. With the responses not being mutually exclusive, some combination of these factors may be most effective.<sup>10</sup>

### *Butte County Travel Survey*

The Butte County Travel Survey was administered online and at pop-up events to collect information from the public on commute patterns and household demographics. Of those surveyed (66), nearly all are employed and drive alone for their commute of 20 minutes or shorter. Personal safety, vehicle speeds, and the lack of a complete active transportation network were the main reasons for not walking or biking. This is consistent with the employer survey where most people drive and might walk or bike if they felt safe in terms of personal security and from collisions (fast moving vehicles or lack of infrastructure).

Highlights from the Butte County Travel survey are summarized below. Travel pattern charts **19-25** can be found in **Appendix C – Travel-Demographics-Economics-1** (file title Appendix C – Travel-Dem-Econ-1.pdf).

**Chart 19** shows the primary mode of travel for those who are employed, students, or neither. All respondents were either employed (66 people, 98%) or in school (1 person, 2%) and had their primary mode of transport being drive alone (58 people, 85%) with carpool/vanpool (5 people, 7.5%) being the second most used mode.

**Chart 20** shows the number of people per household who regularly use B-Line compared to those who do not regularly use B-Line. The more people per household, the less likely someone is to use B-Line regularly. This is consistent with the transit survey describing the per person fare of transit compared to the fixed cost of driving relative to the number of people traveling.

**Chart 21** shows the number of vehicles (car, motorcycle, or scooter) available for those who regularly use B-Line compared to those who do not regularly use B-Line. The more vehicles per household, the less likely someone is to use B-Line regularly. This is consistent with the transit survey describing the lack of vehicles available or that using a personal vehicle would cause an inconvenience for another household member.

**Chart 22** shows the household income for those who regularly use B-Line compared to those who do not regularly use B-Line. Although there is one response for each of the income groups who do regularly use B-Line, the higher income groups not using B-Line is consistent with the transit survey.

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<sup>10</sup> Respondents were allowed more than one response.

**Chart 23** shows the gender for those who regularly use B-Line compared to those who do not regularly use B-Line. The split between female and male is roughly equal in those who do not take B-Line. Although not a statistically significant difference due to low sample size, there are 4 (4%) females and 1 (1%) male who regularly use B-Line.

**Chart 24** shows reasons for not taking B-Line for only those who are not B-Line regulars and do not have or are unsure if they have transit serving their area (20 people, 26%). Of those without service, approximately half of the respondents prefer to drive (11 people, 55%) with the next most common reason being that the service does not go where or when they need it (9 people, 45%) or the service is too expensive (9 people, 45%). Note that the responses sum to over 100% since respondents could select multiple answers.

Since there were no clear patterns for the overall survey based on income, **Chart 25** shows the household income for those currently not using B-Line regularly because it does not serve their area but responded they would take transit if it were offered. The number of responses of people who said they do not currently use B-Line but would if it were offered in their area is fairly low, so the results are not statistically significant and are a similar distribution to the income of the overall survey.

### *Public Outreach*

Pop-up events were organized in November and December 2019 to gather input on how to improve multimodal transportation in Butte County. Similar to the results found in the other surveys, improving infrastructure (facilities and parking) and personal safety would encourage more active transportation, and improving the access and quality of service (frequency and hours of operation) would encourage more transit usage. Some of the most interesting highlights from the survey centered around the issue of what things keep people from walking or bicycling more frequently:

- Issues walking outside: 34% missing sidewalks, 30% unsafe crossing/intersection, 26% personal safety
- Issues biking: 37% no bike paths/lanes, 35% high car traffic speed/volume, 15% no place to park bike at destination

### *Cellphone Data*

Travel datasets from anonymized cellphone data representing trip counts between census blocks and organized by time of day, weekend vs weekday, and trip purpose, were collected in September-October 2018 and September-November 2019 by Teralytics. A separate equivalency was utilized to aggregate the data from the census block level to city and county levels.

Travel pattern, demographic, and economic **Charts 26-90** can be found in **Appendix D – Travel-Demographics-Economics-2** (file title Appendix D – Travel-Dem-Econ-2.pdf)

Total trip volumes in Butte County for weekdays and weekends are shown in **Chart 26** and **Chart 27**, respectively. A 4% decrease in number of weekday trips was observed from September 2018 to

September 2019. Between October 2018 and October 2019, this reduction was 1%. These can be considered marginal changes.

The changes in trip volumes for weekday trips in Butte County before and after the fire are presented in **Chart 28**. The changes for weekend trips are shown in **Chart 29**.

### Trips Entering Butte County

Weekday counts are displayed in **Chart 30**, weekend counts in **Chart 31**, changes in weekday counts in **Chart 32**, and changes in weekend trips in **Chart 33**. Trips entering Butte County from other counties on weekdays increased by 15% between September 2018 and September 2019. The same type of trip count increased by 6% in October 2019. The change in weekday and weekend counts by county of origin for September are displayed in **Chart 34**. **Chart 35** presents the change in weekday trips by county for October. The change in weekend trips for September by county of origin is shown in **Chart 36.1** and for October in **Chart 36.2**. Trips from Yuba, Tehama, Sutter, and Glenn counties increased by 25%, 22%, 10%, and 8%, respectively, while trips from Yolo County decreased by 12% from September 2018 to September 2019. Trips from Tehama and Yuba counties to Butte County increased by 12% and 15% respectively, while trips from Sacramento (8%) and Yolo (19%) counties decreased significantly in October 2019 compared to October 2018.<sup>11</sup> Weekend trips most likely decreased due to: 1) a decrease in recreation travel into or out of the county, and/or 2) a decrease in trips by those who moved out the county and now needed to travel in/out of the county less frequently for their activities on the weekend.

### Trips Leaving Butte County

Trips leaving Butte County on weekdays are shown in **Chart 37** and on weekends in **Chart 38**. Changes in weekday and weekend trips are shown in **Chart 39** and **Chart 40**, respectively. Trips exiting Butte County increased by 15% in September and by 6% in October from 2018 to 2019. The change in weekday trips leaving Butte County by county of destination for September and October is shown in **Chart 41** and **Chart 42**, respectively. Changes in weekend trips for September and October by county of destination are shown in **Chart 43** and **Chart 44**, respectively. In September, trips from Butte County to Yuba and Tehama counties increased by 26% and 23% respectively while trips to Yolo County decreased by 15%. Yolo County was the only destination to which trips decreased. In October 2019, the major increases were in trips from Butte County to El Dorado (30%), Tehama (12%), and Yuba (15%) counties, while trips to Yolo County decreased by 20%.

### Trips Within Butte County

Trips within Butte County are shown in **Chart 45** for weekdays and in **Chart 46** for weekends. Trips within Butte County decreased by 9% in September 2019 and by 4% in October 2019. **Chart 47** through **Chart**

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<sup>11</sup> A general note about the variations - There are variations in monthly travel. Data from September were compared to October within one year to compare the monthly variation to the difference pre- and post-Camp Fire conditions to determine if the change is a normal variation or an actual observed difference due to the fire.

**54**<sup>12</sup> present the top increases and decreases in trips between cities in Butte County for weekdays and weekends between September 2018 and October 2019. Trips between Chico and unincorporated areas of Butte County (+41%), as well as trips between Chico and Oroville (+29%), saw significant increases, while trips between Paradise and Chico (-19%), trips within Paradise, and between Paradise and unincorporated areas (-16%), as well as between Oroville and unincorporated areas (-18) saw significant reductions. From October 2018 to October 2019, trips from Chico to Oroville (+18%), Chico to unincorporated areas (+11%), and Chico to Gridley (+28%) increased significantly while the only major decrease was in trips from Chico to Paradise (-32%).

### Trips by Purpose

Trips with at least one trip end in Butte County are shown for weekdays by Work-bound, Home-bound, and Other-bound trip purposes on **Charts 55-57**. Home-bound trip volume was approximately equal between September 2018 and September 2019 but increased by 16% between October 2018 and October 2019. Work-bound trip volume fell by 14% in September 2019 and by 11% in October 2019. Other trips decreased by 15% in September 2019 and by 10% in October 2019.

The top 10 increases and decreases in home-bound, work-bound, and other trips in September and October compared to 2018 are shown in **Charts 58-69**. Work trips to Chico increased the most (+14%). While not surprising that work trips to Paradise from all locations were in the top 10 decreases, work trips in the Unincorporated County also had a significant decrease (-43%). The largest increase by far for home-bound trips was between Chico and Oroville (+111%), while Paradise was the primary jurisdiction to have a reduction between all other locations of -63%. For other trips, Gridley had the largest increase (+21%), while trips within Paradise (-71%) and trips within Oroville (-56%) and between Chico and Orland (-50%) had the largest decrease.

## Economics and Demographics

The residential and business location datasets consist of records of households and businesses from 2018 and 2019 from InfoGroup.<sup>13</sup> Individual residents, families, and businesses are provided unique identifiers,

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<sup>12</sup> For Charts 51 and 52, when comparing changes, the primary focus is to compare before and after the Camp Fire rather than September to October. September before had many more observations than after, while October was relatively similar before and after. September in both before and after had more trips observed than October, so the main point of these charts is to reinforce the idea that there is variability of data and comparing September before and after separately to October before and after is important.

<sup>13</sup> Residential household (address, size, income, number of workers, number of vehicles, tenure) and business information (location, firm size, firm name, industry type, small business, estimated revenue, tenure) was collected at a disaggregated level. Residential information was collected from over 90 sources (i.e., real estate mortgages, voter registration, consumer transactions, offline subscriptions, school registrations, etc.) in 2018. In addition, information from over 4,000 business sources (i.e., business licenses, utilities, employee taxes, etc.) was also collected in Butte County in 2018. Each household and business location across the county were identified and verified quarterly as part of the standard business operating procedure. The Post Camp Fire Regional Population and Transportation Study team obtained the preexisting data for pre and post Camp Fire and evaluated the subset of households and businesses that were in Butte County in September or October 2018 and their location in [Butte County] or [Butte, El Dorado, Placer, Sacramento, Sutter, Yolo, and Yuba counties] in September or October 2019.

which can be used to investigate post-fire changes. The residential data is in units of households and the non-residential data are in units of businesses. Data for the person within household and employee within businesses are not available due to confidentiality.

### Families and Residents

Pre- and post-fire records of households including detailed addresses, homeownership status, tenure, home values, household sizes, years of construction, etc., were utilized to understand the status of the county population. Records of 193,596 households in Butte County were listed in the 2018 dataset while records of 200,906 households in Butte County were listed in the 2019 dataset. 38,322 families (20%) – 41,935 residents – that were listed in the 2018 data were not listed in the 2019 data.<sup>14</sup> The American Community Survey (ACS) product from the Census for 2019 estimates 86,209 households consisting of 219,186 residents.

### Migration

Family migration out of Butte County is shown in **Chart 70** and **Chart 71**. The largest migrations occurred from Chico (38%), Paradise (32%), Oroville (15%), and Magalia (8%) to cities outside Butte County. Primary relocation destinations include Sacramento County (30%), Placer County (24%) and Sutter County (21%). A substantial number of inter-city migrations was also observed from Paradise to Chico (66%). Other notable migrations within Butte County include Paradise to Oroville (16%) and to Unincorporated County (8%).

### New Residents<sup>15</sup>

**Chart 72** shows the distribution of new residents in 2019. The highest number of new residents (55%) was observed in Chico, followed by Oroville (22%), Paradise (7%), Magalia (5%) and Gridley (4%).

### Tenure

Tenure of families in their current residences is shown in **Chart 73**. The share of families living in their current address for six months to one year decreased between 2018 and 2019, while the share of residents who had moved in the past six months increased.

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<sup>14</sup> This was described in Task 1 memo. Residential information from over 90 sources (i.e., real estate/ mortgages, voter registration, consumer transactions, offline subscriptions, school registrations, etc.) and over 4,000 business sources (i.e., business licenses, utilities, employee taxes, etc.) were collected in Butte County in 2018. Using the residential and business data sources, each household and business location across the county were determined and verified quarterly as part of the data providers standard business. The Post Camp Fire Study obtained the preexisting data for pre- and post-Camp Fire and evaluated the subset of households and businesses that were in Butte County in September or October 2018 and their location in Butte County or outside of the county in September or October 2019. To maintain individual and household privacy, migration information was summarized at a city level or higher and when reporting cross classified attributes (i.e., household size and income) maintained minimum reporting sample of 50 households or greater.

<sup>15</sup> "New residents in 2019" means that the household was not located in the same jurisdiction or the household formation (i.e., people in the household) changed in 2019 compared to 2018

## Home Value

The distribution of estimated home values from the InfoGroup data before and after the fire is shown in **Chart 74**. The median home value (approx. \$210,000) did not change between 2018 and 2019. More than 25% of families lived in homes valued at less than \$100,000. The share of families living in homes valued between \$150,000 to \$200,000 fell slightly. As a point of comparison, the ACS for 2019 estimated the median home value at \$248,100. Zillow estimated the median home value at approximately \$330,000 and estimates that home prices have increased by approximately 25% after the Camp Fire.

## Year of Construction

The distribution of construction years for homes in 2018 and 2019 is shown in **Chart 75**. The share of families living in homes built in the 1970s and 1980s decreased in 2019, while the share of families living in homes built in the 1990s and 2000s increased. Houses built in the 2010s are the same in 2018 and 2019.

## Home Ownership

Home-owning families constituted 80% in 2018. This dropped to 68% in 2019, resulting in a rise in renters from 20% to 33%. This is shown in **Chart 76**.

## Household Size

The distribution of household size is displayed in **Chart 77**. Single-person households constituted more than 60% of the total despite this share dropping slightly in 2019. Small increases in shares of 3-, 4-, 5-, and 6-person households were observed resulting in an average household size in 2018 of 1.57 and in 2019 of 1.63. As a point of comparison, the ACS for 2014-2018 estimated the average household size of 2.55 people per household.

## Businesses

Records of 12,702 businesses were listed in the 2018 dataset while records of 13,457 businesses were listed in the 2019 dataset. The total number of businesses in the dataset by industry type, year established, and number of employees is shown in **Charts 78-80**, respectively. Note that the values are in terms of businesses and not employees and are based on payroll taxes and other similar datasets described earlier in the report. When compared to the Economic Census data for 2019, the rank based on percentage of businesses and employees is similar for all business sectors.

**Chart 78** shows the jobs by sector for both 2018 and 2019. The share of Health Care and Social Assistance businesses fell from 2018 to 2019 by -11% and the share of Retail Trade businesses decreased by 5%. The share of Non-Classifiable Establishments rose by 23%.

**Chart 79** shows the year a business was established for both the 2018 and 2019 data. The largest fraction of businesses was established on or after 2000. This share decreased from 2019 to 2018. Shares of businesses established in the 1980s and 1990s also decreased while shares of businesses established in the 1950s and 1970s increased.

As shown in **Chart 80**, more than 85% of businesses had 10 or fewer employees both before and after the fire.

### Lost Businesses

Businesses lost are shown in **Charts 81-87**.<sup>16</sup> Between 2018 and 2019, listed businesses with Butte County addresses decreased by 2,289 (18%); presumably, they closed. Notably, 688 businesses in the Health Care and Social Assistance industry (25%) were no longer listed. Among the lost businesses, 1,840 (80%) had five or fewer employees. This points towards the fact that small businesses were affected the most by the fire. Of the 2,289 businesses, 900 (39%) were lost in Paradise, with 956 (42%) lost in Chico, and 268 (12%) in Oroville. The businesses lost outside of Paradise may be due to the typical business turnover, the business owners relocating due to their house being destroyed, lack of business due to the evacuation, or other factors beyond those included in the data. Businesses with five or fewer employees accounted for 81% of the total businesses lost in Paradise.

### New Businesses

Businesses that have either relocated to Butte County or have opened as new businesses are considered new establishments and are shown in **Charts 88-90**. After the Camp Fire, 271 businesses were established in Butte County in 2019. Among these, 39 were retail businesses. A substantial majority of newly started businesses (226, 83%) had five or fewer employees. The highest number of new businesses was seen in Chico (57%), followed by Oroville (18%), and unincorporated County (10%).

### Migration

Between 2018 and 2019, 521 businesses in Butte County changed addresses. Of these, 116 moved to different cities (22%) and seven moved outside of Butte County (1%). Notably, 70 businesses moved from Paradise to Chico (13%). Many businesses moved out of Paradise to different cities including Magalia (2%), Marysville (2%), and Oroville (2%). Four businesses (0.7%) changed their address from a physical location to a PO Box.

### Female-Owned Businesses

About 8% of businesses were female-owned in both 2018 and 2019.

### Structure Status and Development

The countywide residential total decreased by 14,146 from 2017 to 2018 with 11,570 of the decrease within Paradise. Between 2018 and 2019, approximately 400 permanent structures were rebuilt along with 648 temporary structures. In Paradise, 32 single-family homes were reconstructed along with 373 temporary units, while there was a loss of one additional mobile home and 54 multi-family homes. Temporary homes were also constructed in Unincorporated Butte County (102 units), Chico (87 units), Magalia (39), and Oroville (3). Single-family structures within Paradise were reduced by 85%, multi-family

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<sup>16</sup> These charts contain the term “non-classified”. That is a designation that simply means that the business cannot be classified within one of the currently recognized industry categories.

structures were reduced by 71%, and mobile homes were reduced by 96%. A detailed summary of the residential development over time, and the pre and post Camp Fire data for Butte County combined and by jurisdiction can be found in **Table 1**.

Within Paradise, a total of 23% of all commercial development space was destroyed: This includes:

- Retail (55% of total retail space was destroyed)
- Office (50% of total office space destroyed)
- Medical/Public (45% of total medical/public space destroyed)
- Industrial (29% of total industrial space was destroyed)

A detailed summary of the commercial development over time, and the pre and post Camp Fire data for Butte County combined and by jurisdiction, can be found in **Table 2**.

# Recovery Literature Review

To understand existing research and analogous case studies to the Camp Fire, a literature review of disaster recovery and displacement was performed. The two disaster recovery studies found to be most relevant to the Camp Fire were the Tōhoku Earthquake and Tsunami, Japan (2011) and Hurricane Sandy, United States (2012).

The 2011 earthquake and tsunami off the Pacific Coast of Japan in Tōhoku was the most powerful earthquake ever recorded in Japan that killed more than 10,000 people and resulted in \$360 billion in damage. Research<sup>17</sup> found that nationwide recovery efforts are ongoing almost 10 years later. Community members have been highly engaged in the recovery process, which has contributed to slow consensus building around where and how to rebuild. This has also resulted in a mixed recovery pattern, with some areas redeveloping under similar development patterns to pre-disaster conditions, while other areas are choosing to rebuild with new development patterns.

Hurricane Sandy in 2012 was the deadliest and most destructive Category 3 hurricane in history, causing more than \$70 billion in damage and claiming 233 lives. The recovery literature focuses on the storm's effects in New York and New Jersey although many other areas were affected. Other research on the 2012 Hurricane Sandy<sup>18</sup>, namely the case studies of Oakwood Beach (New York) and Sea Bright (New Jersey), concluded different results on disaster recovery and displacement than those of the Tōhoku study. The Hurricane Sandy study noted a much shorter time frame (i.e., less than a year) for redevelopment and repopulation of the affected areas in both cities. The recovery patterns of both areas mirrored pre-disaster development.

A main difference between these two studies and the condition in the Camp Fire is the geographic area impacted directly due to the event. In the Camp Fire, the Town of Paradise was significantly impacted while other surrounding jurisdictions had less long-term impact, allowing for temporary housing and relocation to occur within Butte County. The transportation infrastructure serving Paradise has less significant damage, but the water, sewer, and power have similar levels of impact as the two study areas.

Census data was also utilized to measure disaster recovery and displacement. Demographic and socioeconomic effects of similar devastating wildfires to the Camp Fire in Northern California, including the Tubbs Fire and the Kincade Fire in Napa and Sonoma counties, respectively, were analyzed. However, the Census data lacks the level of precision and granularity to isolate the effects of these fires on demographic and socioeconomic conditions.

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<sup>17</sup> Howitt, Arnold M. 2018. Recreating Livable Communities after Catastrophe: Managing the Recovery from Japan's Earthquake, Tsunami, and Nuclear Disaster of 2011. *Transportation Research Board TRID*.

<sup>18</sup> McNeil, Sue, Trainor, J., Greer, A., Israt, J., Mininger, K. 2016. Understanding the Relationships between Household Decisions and Infrastructure Investment in Disaster Recovery: Cases from Superstorm Sandy. *Transportation Research Board TRID*.

### Census Flows Mapper

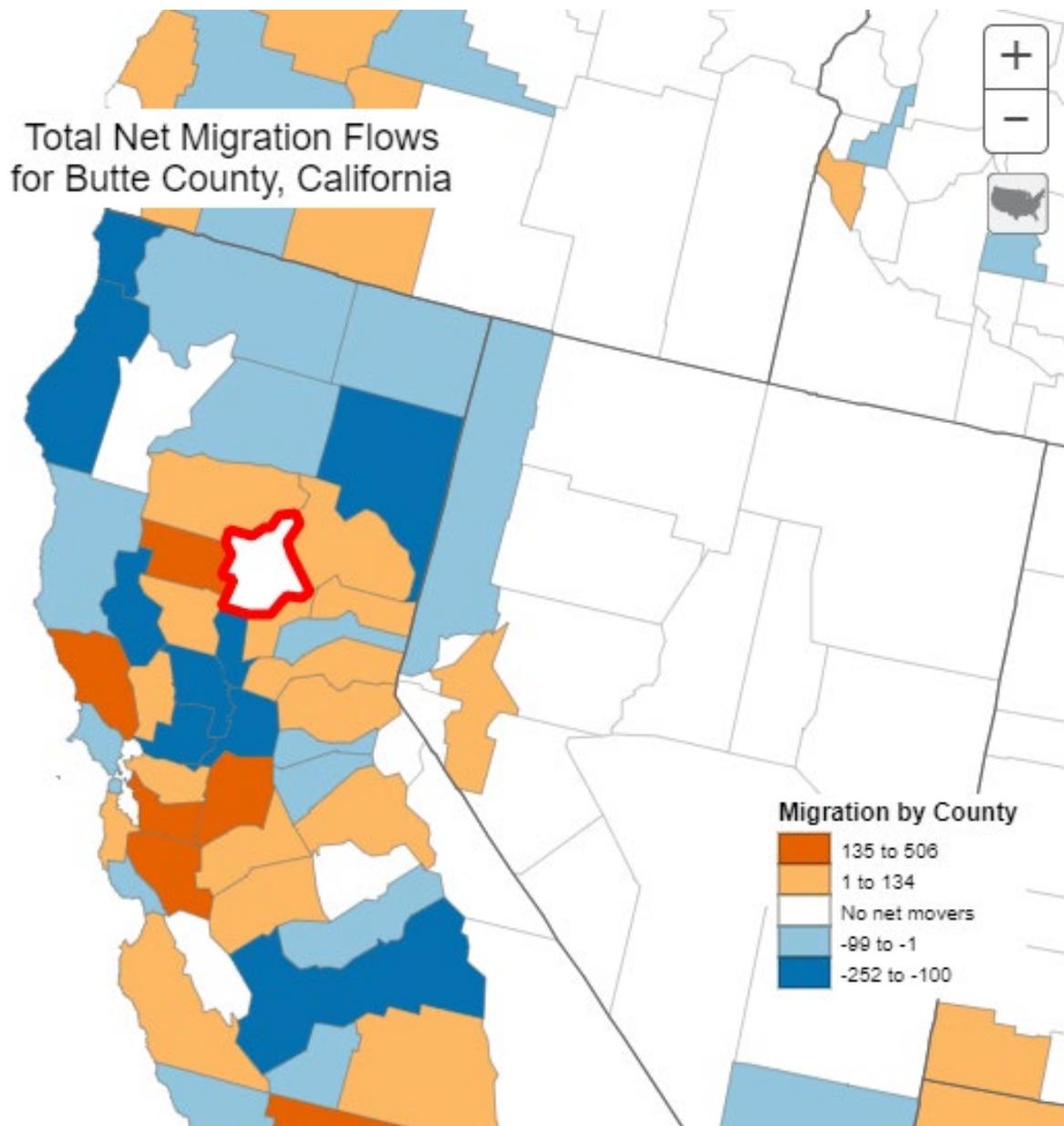
The Great Recession from 2007 to 2009 was reviewed as a proxy for measuring the larger effects of financial disasters compared to the Camp Fire. The Census Flows Mapper is an application that displays migration patterns by county in the United States<sup>19</sup>. Using this tool, migratory patterns in Butte County were evaluated from 2008 to 2012. A screenshot from this tool is provided below. The map shows the net change in inbound and outbound migration by county for the four-year period. The counties with positive numbers show that Butte County imported more residents from those counties than Butte County exported to those counties. The counties with a negative number are those where more people left Butte County for those counties than moved to Butte County from those counties.

The map shows that Butte County had a net gain of residents coming from the Bay Area counties and the counties immediately surrounding Butte County. It also shows a net loss of residents between Butte County and Lassen, Lake, Yuba, Sutter, Humboldt, Del Norte, and Sacramento counties. Reasons for these flows may be due to financial and other cost of living concerns following the economic crisis. As noted, with the regional travel and household/employee migration, the types of household and worker are shown in terms of commute patterns. A major difference between the recession and the Camp Fire is that the structures were abandoned during the recession and the infrastructure was not damaged like during the Camp Fire, allowing for recovery of housing and non-residential buildings to be closer tied to economics than redevelopment.

The 2008 to 2012 data from the Census Flows Mapper tool was also compared to the most recent available data from 2013 to 2017. Many of the migratory trends in the 2013 to 2017 data are like the 2008 to 2012 migratory trends, such as a general inbound migration to Butte County from counties in the Bay Area. However, there is a noticeable increase in the amount of inbound migration to Butte County from the far northern California counties of Siskiyou, Modoc, Shasta, Lassen, Plumas, and Trinity.

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<sup>19</sup> <https://flowsmapper.geo.census.gov/map.html#>



Source: Census Flows Mapper, 2020. <https://flowsmapper.geo.census.gov/map.html#>