Landfill Tipping Fees in California

California Department of Resources Recycling and Recovery

February 2015

STATE OF CALIFORNIA

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Publication #DRRR-2015-1520

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Executive Summary

For California to reach the statewide goal of 75 percent recycling (source reduction, recycling, and composting) in 2020, more waste must go to its highest and best use while minimizing greenhouse gas emissions. California must maximize source reduction, recycling, and composting while reducing disposal. Solid waste landfills compete for the same resources and wastes, so the cost of landfill disposal affects the flow of these materials. While high disposal (tipping) fees could push material away from landfills, disposal fees that are too low essentially incentivize disposal. In order to provide a broad basis for future policy development, this study explores California landfill tipping fees.

Through websites and phone surveys, CalRecycle staff gathered the publicly posted tipping fees, or gate fees, paid by "self-haul" customers delivering municipal solid waste (MSW) to all 98 active California landfills that accept waste from the public. Included in the analysis are tipping fees for MSW at transfer stations, landfills located out of state, and transformation facilities. Green waste tipping fees at landfills, transfer stations, chipping and grinding facilities, compost facilities, and biomass conversion facilities were also surveyed.

Most landfills have more than one tipping fee. They usually have a publicly posted fee for individuals or businesses "self-hauling" waste, but they also negotiate rates with solid waste haulers, cities, counties, and other facility operators. This is an important distinction because in California, only about 20 percent of disposal is self-hauled waste. The other 80 percent of disposal is transported to landfills by solid waste haulers[1] and thus would be more likely to be subject to negotiated disposal rates. A census, or statistical sampling, of negotiated rates is not included in this report, because these rates are often considered to be proprietary information and thus are not readily available. Some negotiated rates were obtained and included to provide an anecdotal narrative to help complete California's overall tipping fee picture.

Disposal tipping fees in California are as complex and varied as the state itself. Tipping fees vary due to the unique circumstances at each landfill, such as location, owner, size, proximity to other landfills, and other operational factors. Using a single number (average or median) to describe the enormous variation in California is challenging, but it does allow for comparisons to other entities inside and outside of the state.

The tipping fee data was analyzed and the main findings were:

- The median "self-haul" tipping fee in California for MSW disposal at landfills was $45 per ton, with a range of $0 to $125 per ton. Staff found the median to be a more meaningful representation of landfill tipping fees than a simple average because the range included such extremes and the distribution was asymmetrical. A majority of landfills charged $36 to $50 per ton (Figure 1, Table 1).
- Based on a small sample of negotiated rates among 22 landfills and various haulers, negotiated rates for MSW disposal at landfills were discounted at 20 of the landfills. The median discount for negotiated tipping fee was $25 per ton less than their publicly posted counterparts. If this is accurate, the $45 per ton median tipping fee is a high estimate for most landfill disposal in California. If the negotiated fees are as low as suggested by this preliminary anecdotal research, landfills are likely the cheapest path for materials to flow

down. If true, this makes building a competitive recycling and composting infrastructure very challenging.

- The median green waste tipping fee at landfills in California was $39 per ton. More than half of landfills (58 percent) charge less for green waste than MSW, while only 16 percent charge more for green waste (Figure 4).
- California's per ton landfill tipping fee data had pronounced regional fee differences. The Bay Area and Coastal Area median tipping fees were $68 and $64. The Southern region median tipping fee was $56. The Central Valley median tipping fee was $43, with only four landfills with fees above the statewide median. The Mountain region appeared to have the lowest median of $42, but this data set is split with half of the fees below $42 and the other half above $70, so the median does not describe this data well (Table 6).
- The 27 private landfills had a much narrower range in tipping fees, with a median of $57 per ton, which was well above the $45 median of the more variable 71 public landfills (Table 8).
- Tipping fees vary most at smaller landfills (less than 200,000 tons per year), while there is less variation in tipping fees at medium (from 200,000 tons to 1,000,000 tons per year) and larger landfills (more than 1,000,000 tons per year). Lower fees were also more common at these medium and larger landfills (Table 10).
- Areas with many nearby landfills tend to have lower tipping fees than landfills without other landfills nearby (Table 11).
- When comparing California tipping fee data to other entities that use averaged data, it is necessary to use the California average tipping fee as a more comparable metric rather than the median.
    - In the United States, the average tipping fee at landfills was $49 in 2013, $5 less than California's average tipping fee of $54 per ton (Figure 12).
    - In the European Union, the average tipping fee at landfills was $100 in 2012, nearly double California's average tipping fee of $54 per ton (Figure 16).
- In both the United States and the European Union, states or countries that landfill more of their waste have lower average tipping fees compared to states or countries that landfill less of their waste. When viewed in this context, California charges slightly less than expected given our high percentage of waste diverted from landfills. (Figure 13 and Figure 18).

Some general conclusions can be drawn from these finding:

- Tipping fees in California are complex and have a lot of local variation.
- California has lower landfill tipping fees compared with other environmentally progressive areas such as the Northeastern and Northwestern regions of the United States and the European Union. With some exceptions, the higher the tipping fee, the lower percentage of waste a region landfills.

- California has lower landfill tipping fees than would be expected given its percentage of waste landfilled.
- California's low landfill tipping fees likely present the lowest cost option for the disposition of most of the materials that make up MSW.
- California's low landfill tipping fees do little to drive materials to higher and better uses, and may make it more difficult to reach the 75 percent statewide recycling goal by 2020. Unlike the European Union, California has not pursued policy directives that increase tipping fees or landfill taxes to dis-incentivize landfilling.
- As California moves toward its 75 percent statewide recycling goal, the resulting reduction in waste disposal will cause a sharp decline in disposal, tipping fee revenue for landfills, and governmental fee revenue for both local governments and the state. That decline in tipping fee revenue, both for landfills and agencies that charge taxes on disposal tonnages, could make it difficult to meet all statutory obligations. Imposing (or increasing) the governmental fees on landfill disposal could dis-incentivize disposal and raise needed revenue. However, with landfills projected to play a diminishing role in solid waste and materials management, disposal and diversion program funding options should be explored that are not solely reliant on landfill fees.

Introduction

A comprehensive and sustainable waste management system in California must maximize source reduction, recycling, and composting while reducing disposal. As California moves toward reducing, recycling, and composting 75 percent of waste generated in the state by 2020, CalRecycle wants to ensure that waste generated in California goes to its highest and best use while minimizing greenhouse gas emissions. As noted in the ARB 2014 Scoping Plan Update,[2] recycling can help minimize disposal and reduce greenhouse gas emissions. Disposal fees play an important role by influencing the flow of materials. High tipping fees could encourage waste reduction, facilitate the recovery of materials, and allow for more expensive recycling technologies, while low tipping fees could incentivize more disposal.

In 2013, a significant amount of green material was landfilled as waste (about 2 million tons) and as alternative daily cover, alternative intermediate cover, or beneficial reuse (about 2 million tons). Differentials in green waste tipping fees between disposal and recycling facilities likely impact the flow of green waste to these facilities.

In past years, CalRecycle surveyed landfill operators regarding tipping fees, but this practice ended almost 15 years ago. Articles published by BioCycle,[3] Columbia University (EEC),[4] the Environmental Protection Agency (EPA),[5] and the National Solid Wastes Management Association (NSWMA)[6] have discussed landfill tipping fees at a country or state level for publicly posted MSW rates, but these reports are not current, do not discuss California in depth, and do not include materials other than MSW. Additionally, the data is only collected from the largest landfills in each state. No data source exists that adequately addresses California landfill tipping fees.

The purpose of this study was to explore landfill tipping fees in California. The scope of this study was to conduct a census of the publicly posted tipping fees, or gate fees, paid by "self-haul" customers delivering municipal solid waste to landfills. Included in the analysis are similar tipping fees for MSW at transfer stations, landfills located out of state, and transformation facilities. Some data on green waste tipping fees at landfills, transfer stations, chipping and grinding facilities, compost facilities, and biomass conversion facilities were also collected. In order to provide a broad basis for future policy development, this study explores California landfill tipping fees and compares them to fees in the United States and the European Union.

The publicly posted fees researched in this study are generally accepted as an indicator of the local cost of landfilling and are also the basis for most tipping fee analyses in the current literature. The NSWMA article[7] describes these fees as the "spot market" value and explains that fees accepted under long-term contracts, discounts, and special waste fees could be higher or lower than the spot market price described by tipping fees.

In most cases, landfills do not have just one tipping fee. Fees vary by types of material, types of delivery vehicle, volume delivered, and, most importantly, contractual relationships. This study focuses on the publicly posted fees for "self-haul" disposal of waste (described by NSWMA as the "spot market" value). Some anecdotal information is included on negotiated rates between the landfill operators and solid waste haulers, cities, or counties and other facility operators. This distinction between public rates and negotiated rates is important because in California 80 percent of the waste stream is transported to landfills by solid waste haulers,[8] who are more likely to have a negotiated rate with a landfill. Currently it is unknown how much of the waste stream is actually

charged a negotiated rate, but for the purposes of this study it is assumed, based on research from CalRecycle's 2008 waste characterization study[9], that 20 percent of loads, at a minimum, are charged the public rate, and 80 percent or less are subject to negotiated rates. Some negotiated rates were obtained to provide a more complete picture of California's overall tipping fee, and this area will be the subject of future research if additional data can be obtained. A census (or statistical sampling) of negotiated rates is outside the scope of this research. These data were not readily available during the data collection portion of this study and are considered proprietary business information by many in the solid waste industry.

This study also explores some of the factors that might influence tipping fees on a local level in California: region, landfill owner, county, location, landfill disposal amount, and landfill proximity (how close landfills are to each other). The factors that could be more easily quantified were explored in detail, but it is important to acknowledge that many other factors influence tipping fees, including demographics, economics, recycling rates, operating and transportation costs, land values, land acquisition costs, climate, geography, and local policies and/or regulations.

Data collected from the United States and the European Union were compared to California's average MSW tipping fee to provide a broader context and to compare policy strategies in the context of tipping fees. While there is no country-wide landfill policy in the United States, there is in the European Union. The European Union's Landfill Directive requires that by 2016, each member state landfill 35 percent or less than what they landfilled in 1995.[10] This difference in mandate makes comparisons to the European Union valuable as California's progressive policies may align more closely with the European Union than with the United States as a whole. The European Union has also done more research on the effect that tipping fees and other factors have on the amount of waste landfilled.

Methodology

Data Collection

Information on public fees for self-haulers was collected in this study. Solid waste haulers that negotiated special agreements with individual landfills may pay different fees and are not reflected in the survey portion of this study. A small sample of negotiated fees was collected, and these are discussed briefly in comparison to the public fees in the results. Publicly posted fees are generally accepted as indicators of landfilling costs locally and are used in the mentioned literature.

Data was gathered for facilities and operations through facility websites or by telephone if the facility did not have a website. As a result of these surveys, facilities were categorized into one of three groups: facilities that were surveyed (accepted MSW or green waste from the public), facilities that did not accept disposal from the public, and facilities that were not surveyed. All 98 landfills that accepted waste from the public for disposal were surveyed. More detail is provided in Appendix A.

Data for each facility surveyed included the following, and is presented in Table 2:

- Minimum Charge: User-based fee that is a base line fee for loads that fall under a certain weight threshold (76 percent of the sample).
- Per Ton: Unit-based fee (weight) that is the charge for 1 ton of waste (79 percent of the sample).
- Per Cubic Yard: Unit-based fee (volume) that is the charge for 1 cubic yard of waste (approximately the size of a washing machine) (7 percent of the sample).
- Per Vehicle: User based fee that is divided into subcategories:
    - Per Car: User-based fee for one passenger car or SUV (17 percent of the sample).
    - Per Truck (pick-up): User-based fee for a small to large pickup truck (definition varies by landfill) (21 percent of sample).
    - Per Truck Loaded Over Cab: User-based fee for a pickup truck with waste stacked higher than the cab of the truck (~4-5 ft. high) (10 percent of the sample).
    - Per Generic Vehicle: User-based fee for a "vehicle," which usually indicates that the landfill used the word "vehicle" or another vague term (auto, load) to describe its tipping fee. These definitions vary the most by landfill.
- Standardized Tipping Fee: For all 98 landfills (100 percent of sample), CalRecycle staff converted other fees to "$ per ton." The individual conversion factors used to determine these fees are discussed in the analysis section.

The standardized tipping fee is the basis for most of the analyses below, because it allows for comparisons between facilities and for data aggregation and analyses. Unless otherwise indicated, tipping fee dollar amounts are given for one ton (2,000 pounds) of material.

Data Analysis

Data on disposal tonnages for landfills and counties were obtained from CalRecycle's Disposal Reporting System (DRS),[11] and facility information was obtained from CalRecycle's Solid Waste Information System (SWIS).[12] Disposal data from 2012 was used in this study's analysis because at the time of the original surveys, this was the current finalized year (DRS finalizes the previous year's disposal data every June). Disposal only increased by 1 percent from 2012 to 2013, so 2012 data should accurately represent current disposal in California for the purposes of this study.

Median, Average, Weighted Average, and Range

In order to provide the most useful analysis, staff looked for an indicator that correctly expresses the central tendency of the tipping fee data points. Averages have traditionally been the most popular because they are mathematically easy to calculate. However, averages have the disadvantage of being affected by high or low outliers. For a skewed distribution with outliers, medians can be a better measure of the central tendency. The median finds the middle point in a set of data, with an equal number of values higher and lower than the median. Averages are the totaling of a list of values and dividing by the total number of values. Weighted averages, in this study, take into account how much waste each landfill disposed to calculate an average.

Because of the skewed distribution of California's tipping fee data (Figure 1), medians should be the most representative of the three measurement methods, and therefore provide the best summary. Averages are used in this study to compare fees in California with other studies from the United States and the European Union.

Conversion Factors

Conversion factors were used to create a standardized fee (in dollars per ton) for all facilities to facilitate comparisons. The conversion factors used were landfill-specific and reported to CalRecycle by the landfill in 2012 DRS annual or quarterly reports. Site-specific conversion factors were used because MSW has a wide range of conversion factors to convert from cubic yards to tons, and landfills are more aware of the type and consistency of waste they receive.

All green waste values were converted using a standard conversion factor from CalRecycle.[13] For green waste received at chipping and grinding facilities, biomass conversion facilities, and landfills, staff use the green waste conversion factor because these operations collect more lightweight yard waste materials. A food waste conversion factor was used for compost facilities, which could receive more dense materials such as food or other organic materials.

Spatial Analysis

ArcGIS software was utilized to spatially analyze the standardized tipping fees in California (Figures 6-11). Staff investigated and looked for correlations between tipping fees and:

- Geographic region
- Public and private ownership
- Location in the state (by region and county)
- Facility disposal amount
- Landfill proximity to other landfills

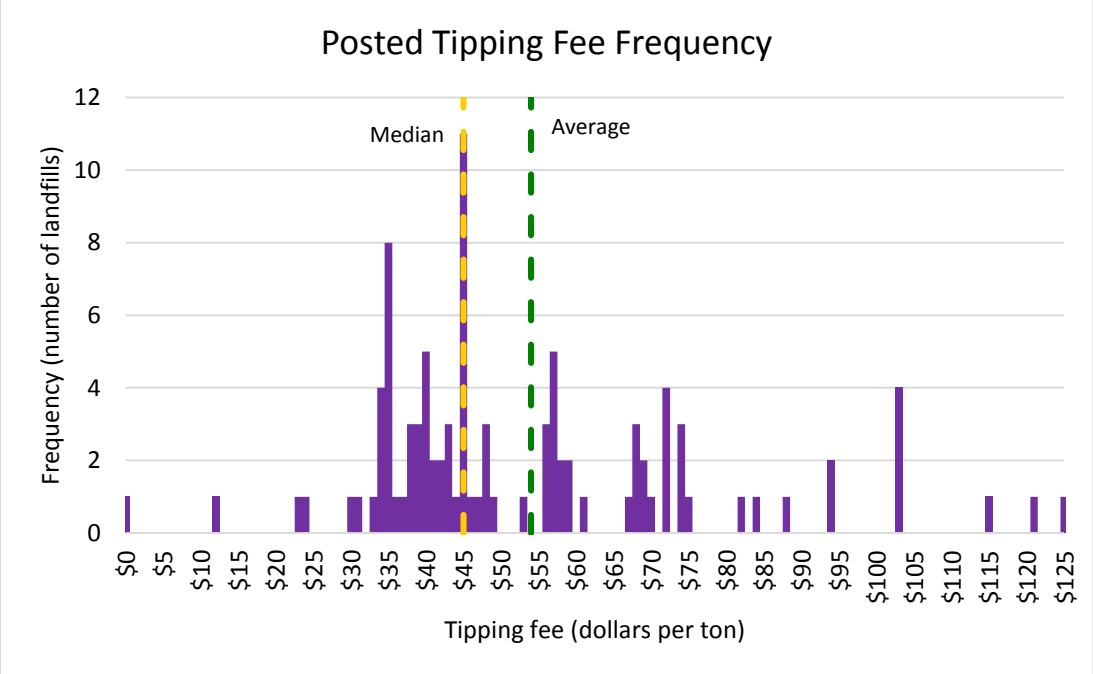
Results

Posted Landfill Tipping Fees for Municipal Solid Waste (MSW)

Publicly posted tipping fees for MSW at landfills in California were found to vary from $0 to $125 per ton. The median of this data set was $45 per ton, which was the most meaningful representation of publicly posted landfill tipping fees in California. The average, $54 per ton, was higher than 60 percent of landfills in the state, making it less useful as an overall representation of tipping fees in California. The frequency chart (Figure 1) of all the tipping fees at landfills in California illustrates these results. The standardized posted tipping fees were grouped in $1 increments. One dollar was a small enough increment to show detail without losing the granularity of the frequency distribution.

Here, the median and average posted tipping fee in California can be compared with the frequency distribution. Due to numerous outliers and non-normal distribution, the median value is thought to be most representative of the central tendency of this data set.

Figure 1: Posted tipping fee frequency. All landfills accepting public disposal in California, by tipping fee. The yellow dashed line represents the median of the data set, and the green line represents the average of the data set.



The data presented in Table 1 summarizes the frequency chart in Figure 1. Almost half of California's landfills charge between $36 and $50 per ton, supporting the use of a median value to represent the central tendency of the data set. Another frequently used statistical measure is the mode, or the most frequently observed value, which in this case is also $45 per ton. Table 1 was also used as the basis to classify data in the map section of this study into groups of data points between $36 and $50, between $51 and $75, the low outliers ($0 to $35) and the high outliers ($76 to $125).

Table 1: Frequency from Figure 1 divided into ranges of posted tipping fee data (used in mapped data section)

Range (Per Ton)	Number of Landfills	Percentage of Landfills
$0-$35	12	12%
$36-$50	45	46%
$51-$75	28	29%
$76-$125	13	13%

Table 1 uses the "standardized tipping fees" based on tonnage. Table 2 summarizes all the landfill data collected and provides calculations for the medians, averages, and weighted averages.

Posted landfill tipping fees are generally a user-based or a unit-based fee:

- The "user-based fee" (minimum or per vehicle fee) does not vary based on the amount of waste discarded and is a standard value per user or per vehicle.
- The "unit-based fee" or variable pricing (per ton, per cubic yard, standardized fee) does vary based on the amount of waste disposed; as disposal increases, the tipping fee increases. Unit-based pricing creates an incentive to reduce the amount of waste discarded.

Landfills have different resources available for gatehouse staff to use in order to decide how much to charge a customer (e.g. operational scales, other estimation tools), but the vast majority of landfills surveyed charge a minimum fee (90 landfills) and a per ton fee (82 landfills). Less common charges were volume estimations or vehicle type charges, with less than one-third of the landfills surveyed using these charges.

The difference between the weighted and unweighted averages in Table 2 shows that, on average, landfills that receive more waste charge more for minimum fees, for a cubic yard, for pickup truck loads and for "vehicle" loads, while charging less by weight for car and truck loads stacked higher than the cab.

Finally, the "standardized" tipping fee calculated by CalRecycle staff is included in Table 2. Many landfills charge both per ton fees and per cubic yard fees, but some charge only per cubic yard fees. The 16 landfills that charge only volume fees were converted to tonnage fees for the rest of the analysis in this paper. This standardized fee allows all 98 landfills to be analyzed in one group.

The most meaningful indicator for posted landfill tipping fees is the median of $45 per ton of MSW.

Table 2: Posted landfill MSW tipping fees.

Fee Category	Number of Landfills that Reported the Fee	Median Fee	Average Fee	Average Fee Weighted by Annual Disposal
Minimum Charge	90	$13	$17	$27
Per Ton	82	$48	$54	$50
Per Cubic Yard	22	$13	$15	$27
Type of Vehicle				
Car	19	$9	$11	$9
Truck (Pickup)	29	$20	$22	$24
Truck Loaded Over Cab	14	$34	$31	$29
Vehicle	13	$15	$22	$36
Standardized Tipping Fee (Per Ton)	98	**$45**	$54	$51

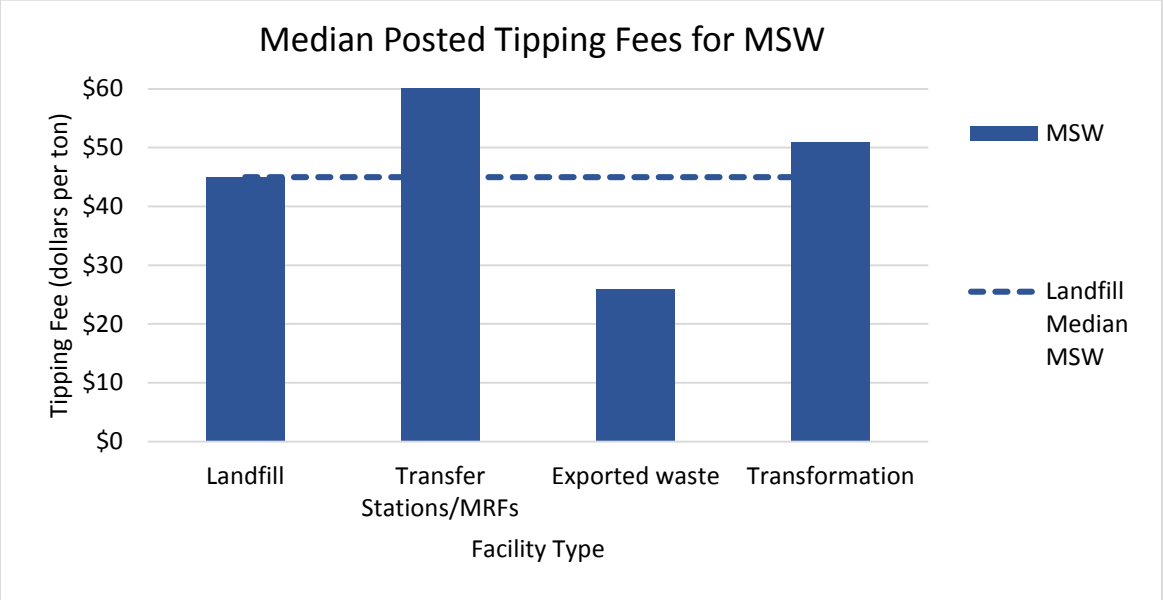
Posted Landfill MSW Tipping Fees Compared to Other Facilities

Landfill tipping fees in California were also compared to other solid waste management activities in the state. While the vast majority of waste disposed in California during 2012 was landfilled in state (96 percent), waste was also exported to landfills in Nevada and Oregon (1 percent) and sent to one of three transformation facilities (3 percent). Transfer stations also accept waste in the state for processing and transportation to landfills. Table 3 and Figure 2 summarize tipping fee survey results by facility type, material type, median, average, and range.

Table 3: Median, average, and range of posted tipping fees for each disposal facility surveyed in dollars per ton. All landfills and transformation facilities were surveyed in this study; data for other facilities are from a sampling of facilities (Appendix A).

Facility	Median MSW	Average MSW	Range MSW
Landfill	$45	$54	$0- $126
Transfer Station	$61	$74	$0-$178
Exported Waste	$16 per cubic yard NV $26 per ton OR	N/A	N/A
Transformation	$52	$52	$50-$53

Figure 2: Median posted tipping fees for MSW. The blue line is the landfill median. All landfills and transformation facilities were surveyed in this study; for other facilities, a portion of facilities was sampled (Appendix A).



Exports

Waste from California was exported to Lockwood Regional Landfill in Nevada and Dry Creek Landfill in Oregon in 2012. Lockwood Regional Landfill charged $15.50 per cubic yard (California Median: $13 per cubic yard) and Dry Creek Landfill charged $26 per ton (California Median: $45 per ton). While the tipping fees in Nevada were comparable to California, the Oregon tipping fee was lower than the California median. This might help explain why some border counties choose to send their waste to Oregon or Nevada rather than pay higher transportation and disposal costs at a neighboring county's landfill. For some communities, the out-of-state landfills are closer than landfills in California.

Transformation Facilities

Transformation facilities are CalRecycle-permitted waste-to-energy facilities. Three permitted transformation facilities were in operation in California during 2012, located in Stanislaus County in the Central Valley and in Los Angeles County. These transformation facilities charge between $50 and $53 per ton of waste, a median (and average) of $51.50 per ton, which is higher than the statewide landfill tipping fee median of $45 per ton. Around the Central Valley transformation facility, four of the five landfills within 35 miles of the facility charge between $33 and $45, with only one facility charging more than the state median, at $88. Around the Los Angeles County facilities, half of the landfills charge $38 to $41, while the other half charge between $49 and $59 within 35 miles. This local data again affirms why the median values are so important. When using the statewide average ($54), transformation appears less expensive than landfilling, while transformation is actually a more expensive alternative to landfilling in California when compared to the statewide median as well as the surrounding landfills. Negotiated rates at the transformation facilities may also differ significantly from the public "self-haul" rates.

Transfer Stations

Waste can also be taken to a transfer station. There, it is either transported directly to a landfill for disposal, or the recyclables are sorted and processed for end users and recyclables markets prior to the transport of the residuals to a landfill. This consolidated waste is usually transported longer distances in fewer vehicles to a landfill. These added steps (transportation and sorting) may also play a role in the tipping fees charged at these facilities. In many counties without landfills, transfer stations are the only self-haul option for the public.

Transfer stations charge a median fee of $61 per ton for MSW, which is $16 more per ton than the median that landfills charge for MSW. This higher fee may be a result of transportation costs as well as tipping fees incurred by the transfer station for final disposal at the landfill. The range of transfer station tipping fees, from $0 to $178, is higher than all other facility types surveyed. The maximum of the transfer station tipping fee data set is $50 higher than any other facility. This suggests that transfer stations have additional costs that lead to higher tipping fees.

Posted Landfill Tipping Fees for Green Waste

Landfills often charge different fees based on material type disposed, so the tipping fees for MSW discussed in the previous section will now be compared to green waste tipping fees at California's landfills. Many landfills charge different fees for green waste, construction waste, and hard-to-handle items such as appliances and carpet.

CalRecycle does not directly track how much green waste is disposed at landfills or how much green waste is sent to diversion facilities. However, CalRecycle does conduct periodic waste characterization studies, which provide estimates for the waste stream composition in California. Based on these studies, CalRecycle estimates that 7.1 percent of the waste disposed at landfills was green waste and 15 percent was food waste in 2008.[14] Green waste landfill disposal is estimated to be about 2 million tons annually.

Landfills are required to report green waste tonnages if they are used as alternative daily cover (ADC) or alternative intermediate cover (AIC) on site. For the purposes of local jurisdiction diversion mandates, this tonnage is not considered disposal until 2020 (and would be in addition to the 7.1 percent of the waste stream[*]).[15] Green waste ADC and AIC accounted for about 2 million tons annually.[16]

Most tipping fee studies, particularly those cited in this study, focus primarily on MSW at landfills. In California, the 4 million tons of green waste going to landfills annually could go to higher and better uses. Recent legislation expands organics recycling,[17] and the California Air Resources Board (ARB) 2014 Scoping Plan Update[18] has noted green waste recycling's potential to reduce greenhouse gas emissions.[19] Redirecting this recyclable material away from the landfill can play a key role in determining whether California meets waste recycling and greenhouse gas reduction goals in the future. Given this background, it is important to understand how the fees charged for green waste vary by facility type. Twenty-two landfills (about 15 percent of landfills) are co-located with compost facilities.

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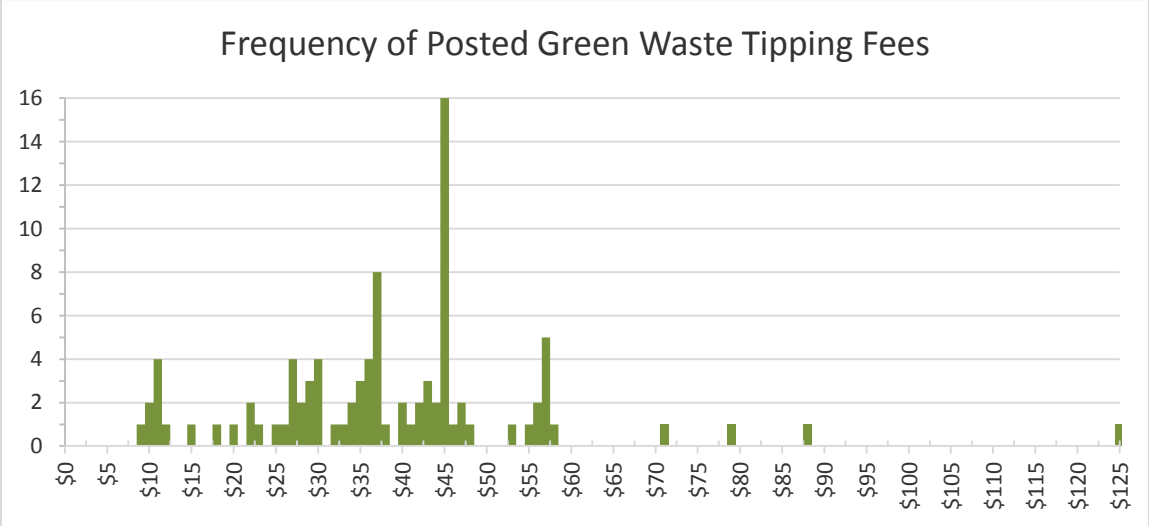
[*] Due to passage of AB 1594 (Williams, Chapter 719, Statutes of 2014), green waste ADC will no longer be considered diversion as of 2020.

The median public tipping fee for green waste at landfills was $39 per ton, $6 less than the MSW public tipping fee. The complexity in how landfills charge customers for MSW is similar for green waste material, as noted in Table 4. The median is likely a more accurate representation of green waste tipping fees, but the average is only $1 higher.

Table 4: Posted landfill green waste tipping fees from survey in detail.

Fee Category	Number of Landfills that Reported the Fee	Median Fee	Average Fee
Minimum Charge	88	$11	$15
Per Ton	78	$42	$41
Per Cubic Yard	25	$7	$10
Standardized Tipping Fee (Per Ton)	97	$39	$40

Figure 3: Frequency of posted green waste tipping fees. Chart of all landfills accepting green waste from the public in California by tipping fee.



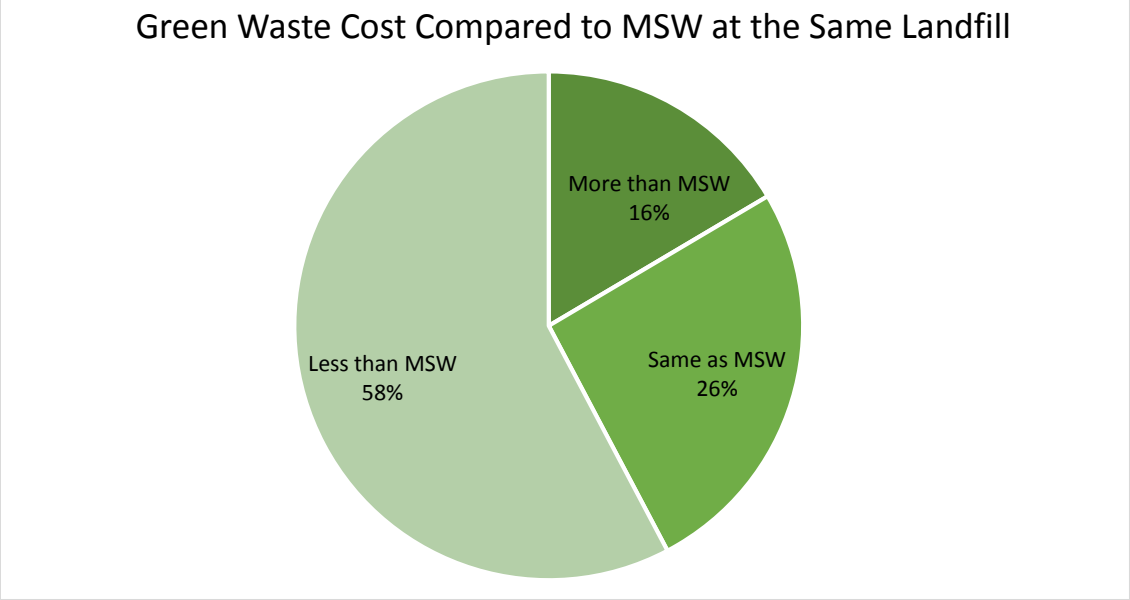
Green waste was less expensive to send to a landfill than MSW by $6 per ton, but not all landfills charge less for green waste. Staff found that while most facilities (58 percent) charge less for green waste than MSW, there were 16 percent that charged more for green waste than for MSW (Figure 4).

Landfills might charge less for green waste than for MSW because:

- Green waste may be easier to handle.
- Green waste may be a resource when used as ADC or other purposes on-site.
- Landfills do not pay the $1.40 state disposal fee on green waste ADC.

Landfills might charge more for green waste than for MSW to discourage green waste disposal.

Figure 4: Posted green waste cost compared to MSW at the same landfill. Chart compares the green waste fees and MSW fees at the same landfill.



Posted Landfill Green Waste Tipping Fees Compared to Other Facilities

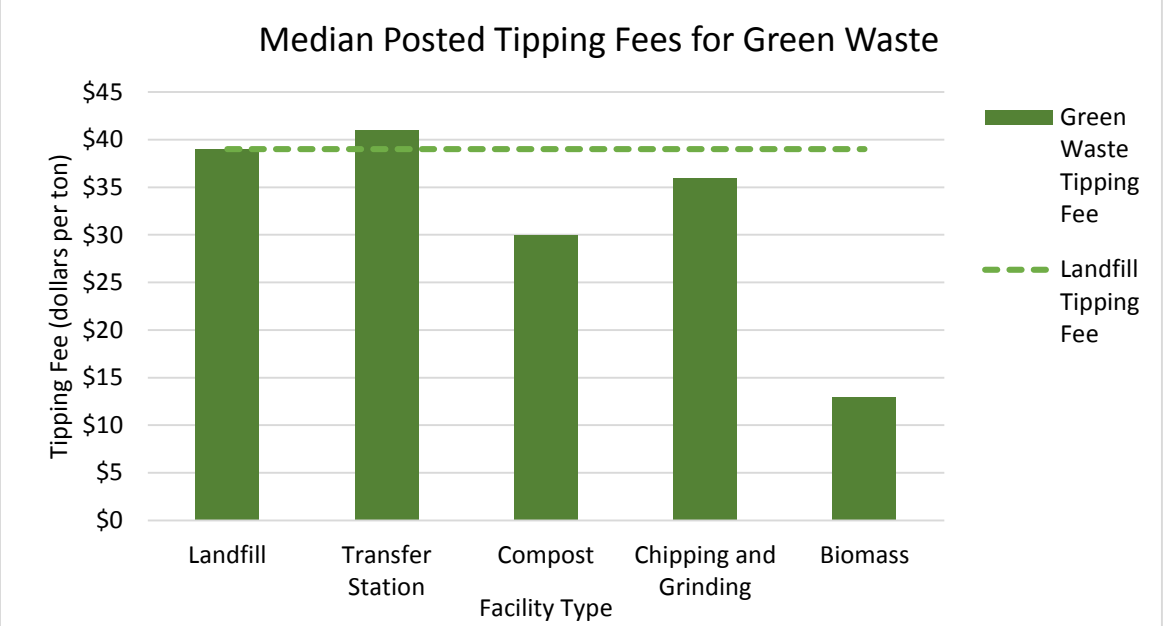
This section discusses tipping fees at facilities that dispose of MSW and green waste, and facilities that divert green waste. Table 5 and Figure 5 show the medians, averages, and ranges for green waste tipping fees by facility type.

Landfills and transfer stations (usually associated with the "disposal" of waste) charge the most per ton for green waste received compared to the other facilities surveyed in this study. Landfills and transfer stations might have the benefit of being the culturally accepted means of dealing with waste in the United States, as noted in the Columbia University study,[20] requiring other facilities to compete with landfills for business. It is also important to note that public fees are not paid by solid waste haulers with negotiated rates, so the dynamics of the fees actually charged by landfills or other facilities may be complex.

Table 5: Posted green waste tipping fees at disposal and diversion facilities that accept green waste in California.

Facility	Median Green Waste	Average Green Waste	Range Green Waste
Landfill	$39	$40	$9-$126
Transfer Station	$41	$49	$0-$178
Compost	$30	$30	$0-$127
Chipping and Grinding	$36	$40	$0-$128
Biomass	$13	$16	$0-$47

Figure 5: Median posted tipping fees for green waste. The green line is the landfill median. All landfills were surveyed in this study; other facilities have a portion of facilities sampled.



A substantial amount of green waste generated in California goes to facilities other than landfills. In California, disposal is tracked in CalRecycle's DRS, but for the most part diverted materials are not directly tracked. Green waste materials can be recovered for recycling at some transfer stations (those that act as material recovery facilities), converted into energy at a biomass conversion facility, processed at a chipping and grinding facility for future use, or composted at a composting facility (includes anaerobic digestion). Compost, chipping and grinding facilities, and biomass conversion facilities capture organic material and process or convert the material for a more beneficial use. The products from these facilities are sold to agricultural and horticultural consumers as soil amendment and mulch or to public utilities as electricity from biomass conversion. There are more than 350 of these facilities in California.

Compost, chipping and grinding facilities, and biomass conversion facilities that accept green waste on average charge less than disposal facilities accepting green waste. As an incentive to secure feedstock, green waste diversion facilities may take green waste for free, which significantly lowers the median fee of this data set. The pricing contrasts at green waste facilities plays out at the local level between facilities directly competing for feedstock, rather than at the statewide level. Chipping and grinding facilities charged the most per ton of green waste ($36), which was slightly less than landfills. Compost facilities and biomass conversion facilities had lower medians than other green waste diversion facilities ($30 and $13 per ton respectively). Some of the difference may be attributed to the fact that green waste is not subject to the $1.40 per ton state fee. Green waste can also be turned into a product (compost or energy) at these facilities, creating a source of revenue that could offset tipping fees. More work is needed to understand the financial complexities related to green waste handling in California.

Negotiated Tipping Fees in California

When discussing tipping fees, one must take into account the fee structures at landfills. In addition to the public "self-haul" tipping fee, landfills can have negotiated rates. Negotiated fees are tipping fees agreed to between the landfill and a city, county, hauler, or other facility. The negotiated fees are usually for a given time period and can be renegotiated once they expire. In California, solid waste haulers, which are most likely to have a negotiated fee, transport about 80 percent of the waste received at landfills.[21] So, up to 80 percent of loads are charged a negotiated rate.

Negotiated fees may be lower or higher than the "self-haul" fee on a case-by-case basis. Based on a small sample size of 22 negotiated tipping fees at a handful of different landfills across the state, the majority of negotiated tipping fees were much lower than the public tipping fees. When taking the difference between the two, the median difference was $25. The discount from the public fee to the negotiated fee ranged from an 11 percent discount to a 76 percent discount. Only two negotiated fees in our sample were higher than the publicly posted tipping fees, each being about 20 percent higher.

So while the public tipping fees in California have a median of $45 per ton disposed, about 80 percent of loads at landfills in California could be charged much less in tipping fees. This lowers an already low statewide tipping fee. While this sample of negotiated rates is small, not statistically representative, and doesn't capture every nuance of the state, the results suggest that the effective median landfill tipping fee for most waste in California could be as low as $20 per ton.

Mapped Landfill MSW Tipping Fee Data

There are major differences between landfills in terms of demographics, ownership, scale, population, material bans, volume, types of materials handled, capacity, local regulatory policies or fees, as well as site specific factors such as terrain, climate, and accessibility. These are just a few of the ways that landfill tipping fees can be influenced. Looking at the data for the state as a whole can lead one to easily miss the nuances of local data. While not every variable that could influence how a landfill sets its tipping fee was quantified, some descriptive factors that may differentiate landfills are explored in the following maps.[†] They include:

- Regional location
- Rural or urban county location
- Public or private ownership
- 2012 disposal tonnage amounts
- Landfill proximity to other landfills

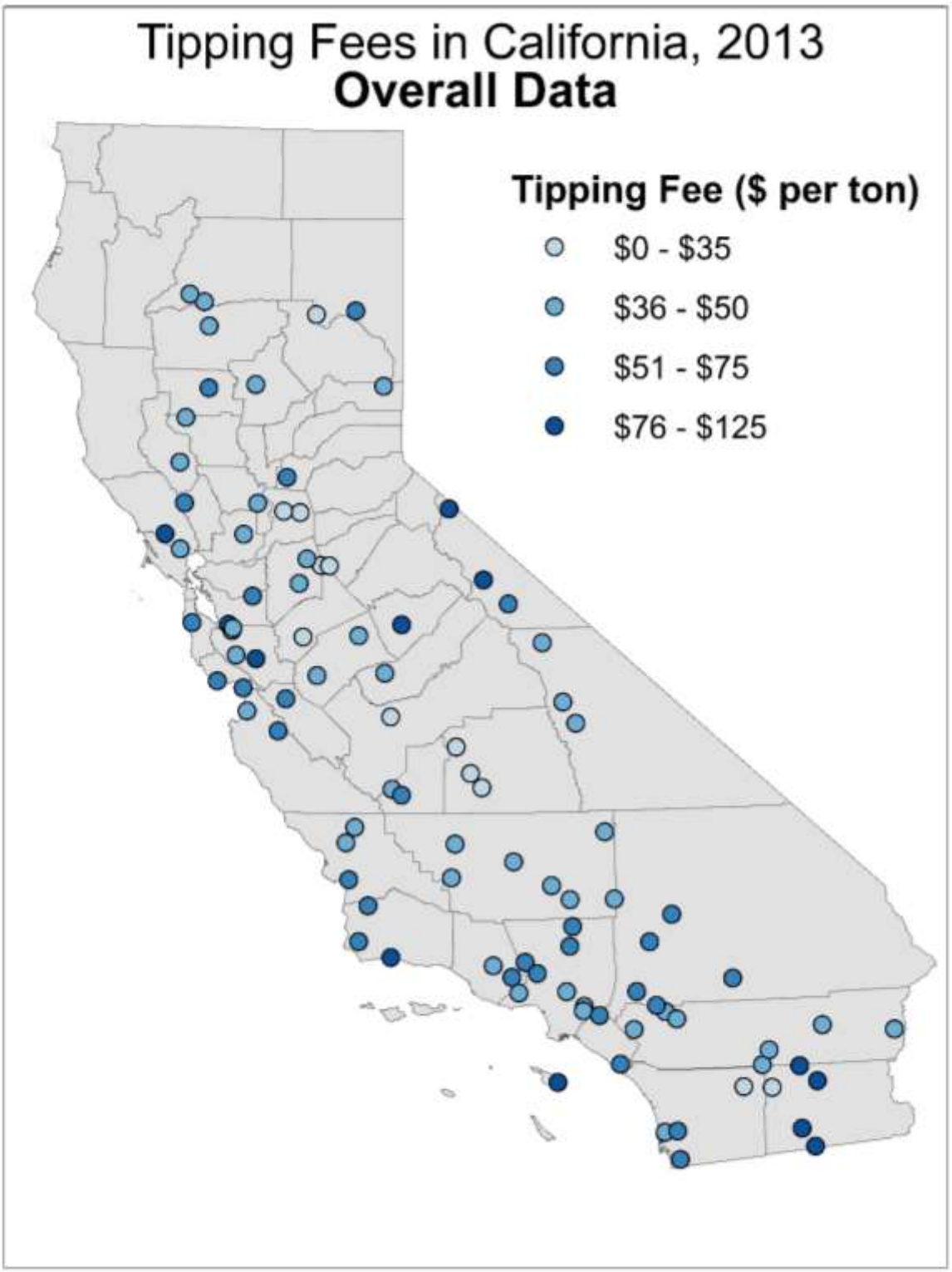
[†] All of the maps in this section present tipping fee data as $ per ton, except for the disposal tonnage and landfill proximity comparison maps (these maps use a low, mid, high scale). The frequency graph (Figure 1) was used to choose appropriate classifications (ranges) of tipping fee data when mapping, and the classifications remain constant throughout the mapped analysis (Table 1).

Overall Data

Figure 6 presents the tipping fees for all the landfills surveyed in this study. The darker colors (higher tipping fees) occur primarily in the Bay Area and Sierra (mountainous) regions, while lighter colors fall in the Central Valley.

The detail presented on this general map emphasizes the complexity of data within the state of California, while also revealing certain patterns or data clusters. California, as a state, has a wide range of market types, communities, climates, county sizes, population centers, and concerns (environmental, business, etc.), which are just as important to understanding tipping fee data as the landfill factors stated in the previous section. California is a complex state, so, naturally, data concerning California's landfills will also be complex.

Figure 6: Overall data. Map of all landfills with tipping fees. The tipping fees are $ per ton. See Table 1 for a breakdown of the tipping fee data.



Regional Data

Figure 7 divides the state into five regions based upon certain shared characteristics (i.e. demographics, climate, economics, and industry) that impact waste management practices. These regions are identical to those used in CalRecycle's 2008 waste characterization study.[22]

Table 6: Regional Data. Median fees for facilities in regions as drawn in Figure 7.

California Regions	Median Fee	Number of Landfills	Range of Fees	Percentage of Waste Disposed in CA
Bay Area	$68	11	$37 - $115	15.5%
Coastal	$64	12	$45 - $82	5%
Southern	$56	34	$12 - $126	61%
Central Valley	$43	30	$23 - $75	18%
Mountain	$42	11	$0 - $121	0.5%

- **Bay Area:** These are urban counties in the San Francisco Bay Area. They are metropolitan and have strong industrial components. Most landfills in this region are privately owned. The median tipping fee in the Bay Area region, $68 per ton, is the highest in the state.

- **Coastal:** These are northern and central coastal counties (not in the Bay Area or Southern regions). The coastal region is more populated than the rural mountain region and has a large agricultural component similar to the Central Valley. The central coast has a mix of public and private landfills. The tipping fee median in this region is $64 per ton, with all fees in the data set at, or above, the statewide median (data range: $45 to $82).

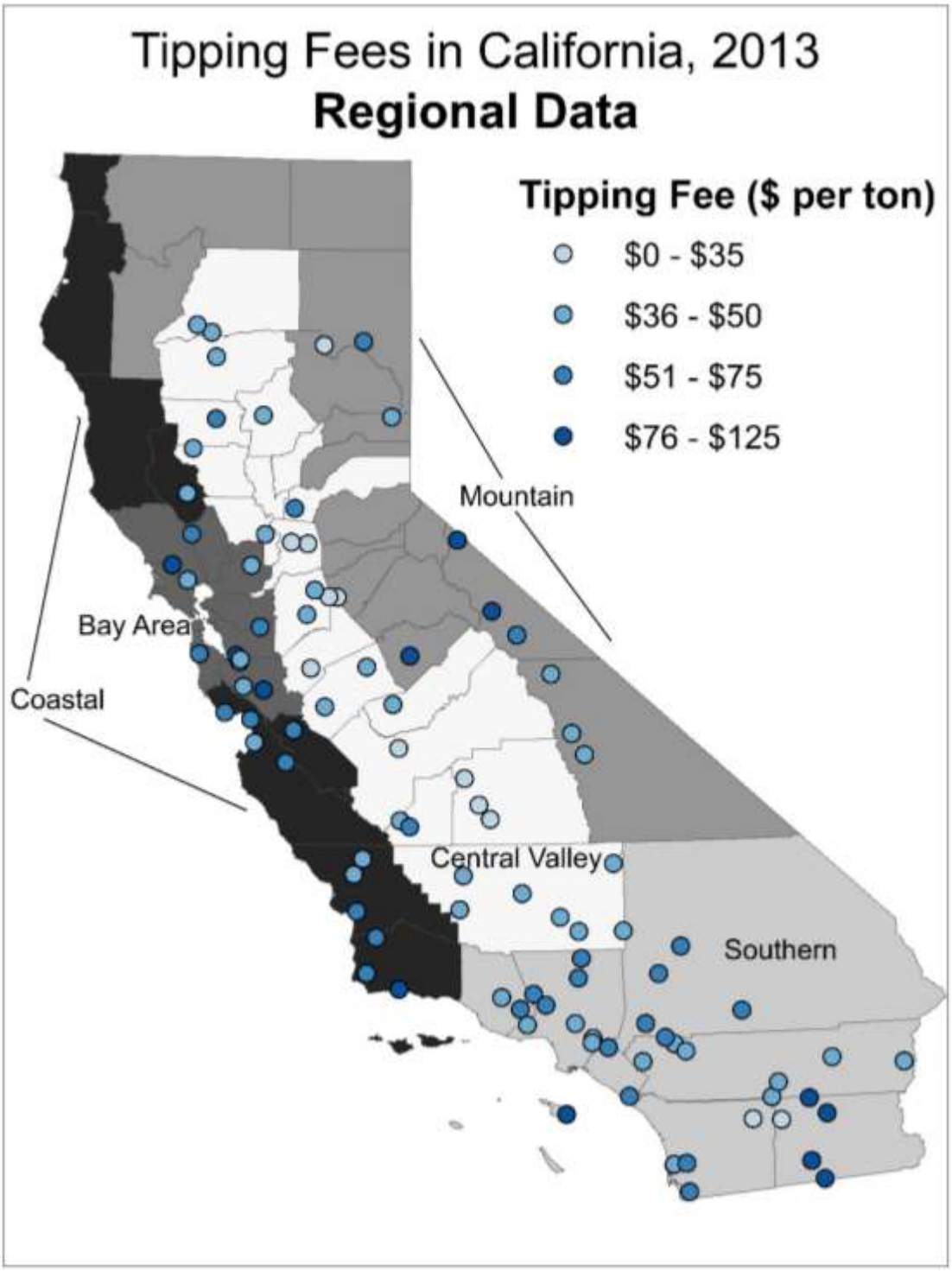
- **Southern:** These southern counties are strongly industrial with large populations and some agricultural influences. This region has the most landfills in the state (34) and a mix of landfill owners. The median tipping fee in this region was $56 per ton, $11 above the state median.

- **Central Valley:** These counties between the Mountain and the Coastal regions have a major agricultural base, some important population centers, and some manufacturing. The median tipping fee is $43 per ton and is just below the state median. The range of tipping fees has the lowest maximum in the state ($75). Only four tipping fees in the Central Valley region are above the state median.

- **Mountain:** These are rural counties with strong agricultural economies, a low population density, and a low industrial base. All landfills are publicly owned. The median of $42 per ton is below the state median, but the data set is the only one with a clear division in fees: Half the data set is $42 and below, the other half is $70 and above. More counties in this region have no tipping fees ($0) and use other methods (e.g. property taxes) to fund their landfills.

There are clear regional differences in California's tipping fees. The Bay Area and Coastal regions have the highest median tipping fees, $20 above the statewide median, but with different distributions. The Southern region has a lower median fee than these two regions at $56, but it is still above the statewide median. The Mountain and Central Valley regions both fall below the statewide median.

Figure 7: Regional data. Regions are shaded to show the geographic extent. Medians are presented in Table 6. Region borders were determined using CalRecycle's waste characterization study regions.



Owner Data

In Figure 8, tipping fees are mapped with private landfills in purple and public landfills in green. Privately owned landfills are owned by a private company, while public landfills are owned by a city, county, or federal entity (i.e. military base). Landfills owned by a public entity but operated by a private company were considered publicly owned for this analysis. Table 7 breaks down this data by the overall category, public or private, and by specific owner. In the public category only counties and cities are considered, but there are other types of public owners in California. The data presented in Table 7 shows that landfill owner has a strong correlation to tipping fees.

Table 7: Median landfill tipping fee based on owner.

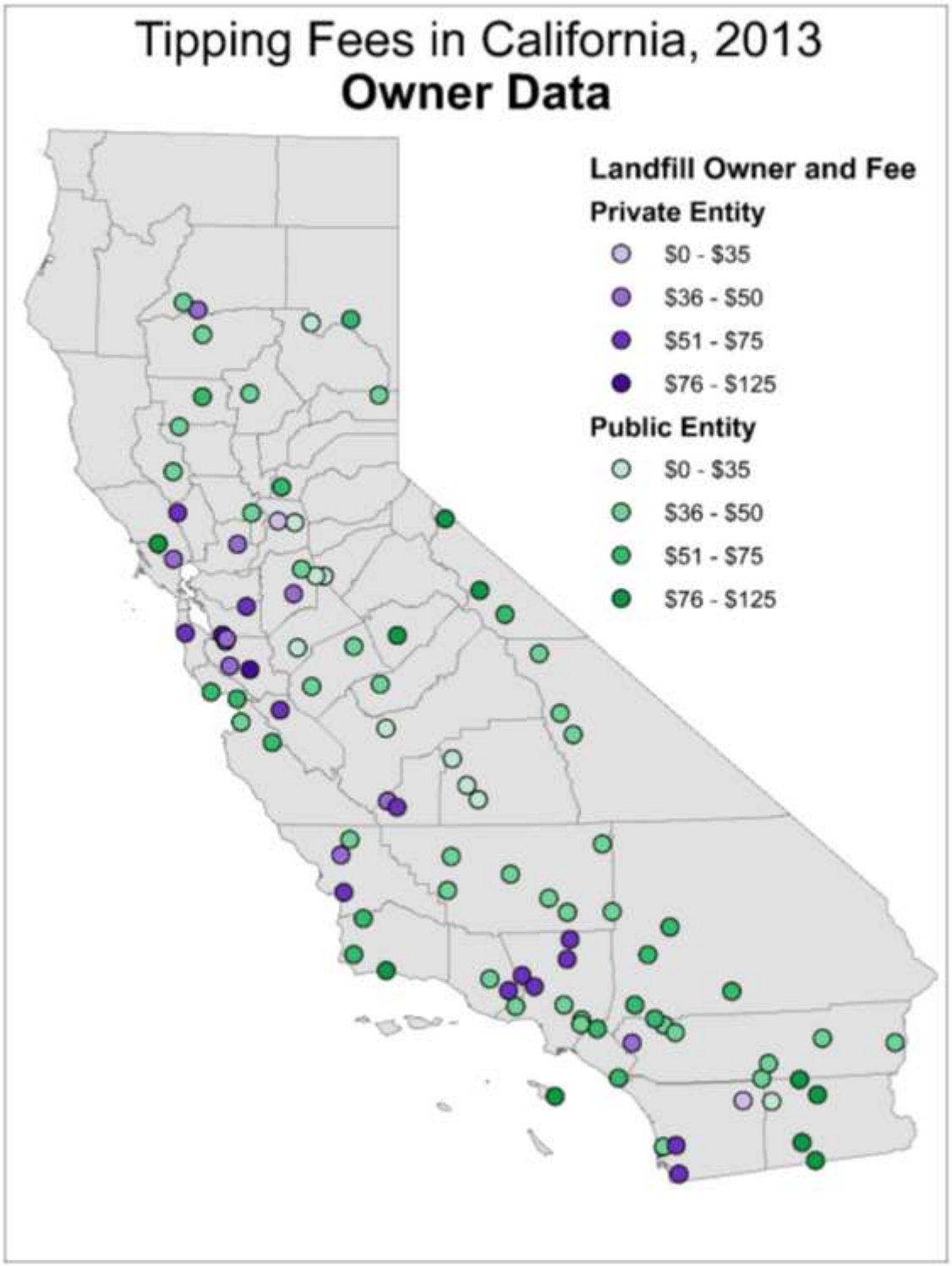
Owner	Median	Number of Facilities	Range of Fees
Public	**$45**	**71**	**$0-$125**
City	$49	11	$38-$125
County	$45	56	$0-$121
Private	**$57**	**27**	**$31-$88**
Recology	$40	1	$39.50
Republic	$64	8	$31-$72
Waste Connections	$60	4	$40-$72
Waste Management	$56	10	$35-$88
Other Independent	$45	4	$35-$69

Public and private landfills have considerably different median fees. Public landfills have a median fee of $45 per ton (the same as the state); private landfills have a much higher median fee of $57 per ton. Public landfill tipping fees range from $0 to $125, while private landfill tipping fees only vary from $31 to $88.

Private landfills are predominately located in the larger metropolitan areas of Southern California and the Bay Area, where they are more likely to be able to take advantage of economies of scale (large production of waste) to contain costs.[23] There are only a few private landfills outside of high-population areas. Conversely, public landfills are distributed throughout the state but are uncommon in the Bay Area. More than two-thirds of California's 98 landfills that accept waste from the public are owned by a public entity (71).

Public landfills rely on both public taxes and tipping fees, while private landfills rely only on tipping fees as a source of revenue.[24] According to national data on public landfills, 30 percent of landfills receive all their revenue from tip fees, 35 percent receive all revenue from local taxes, and 35 percent cover the costs through a combination of tip fees and local taxes.[25] Public entities are also responsible for an entire solid waste management program (i.e. special waste pick-up, recycling, outreach), not just the landfill. These fundamentally different funding structures based on landfill ownership likely have an impact on tipping fees.

Figure 8: Owner data. Tipping fees at public and private landfills in California. Medians and ranges are presented in Table 7. Some public landfills may be operated by private companies; these are considered public.



Rural and Urban Data

California is often considered an urban state, and the majority of landfills are located in urban areas. However, more than half of the state's counties (34) are considered rural.‡ During 2012, 20 rural counties had landfills. Figure 9 splits landfills into four separate categories (Table 8) and symbolizes each facility by tipping fee, owner, and county location. As a group, the 34 rural counties disposed 2,201,142 tons (7.6 percent of total disposal) in 2012, with the landfills in these rural counties making up 5.8 percent of California's total in-state disposal. (Some rural counties export their waste to Oregon or Nevada.)

Urban landfills have a median tipping fee of $45 per ton, the same as the statewide median tipping fee. Rural landfills have a median tipping fee that is only $2 more than this ($47 per ton), so it would seem that rural and urban landfills charge fairly similar rates. The maximum values between rural and urban are also similar, but the minimums are not. In fact, 4 of the lowest tipping fees are in rural counties.

Table 8: Median landfill tipping fees by rural and urban county and owner.

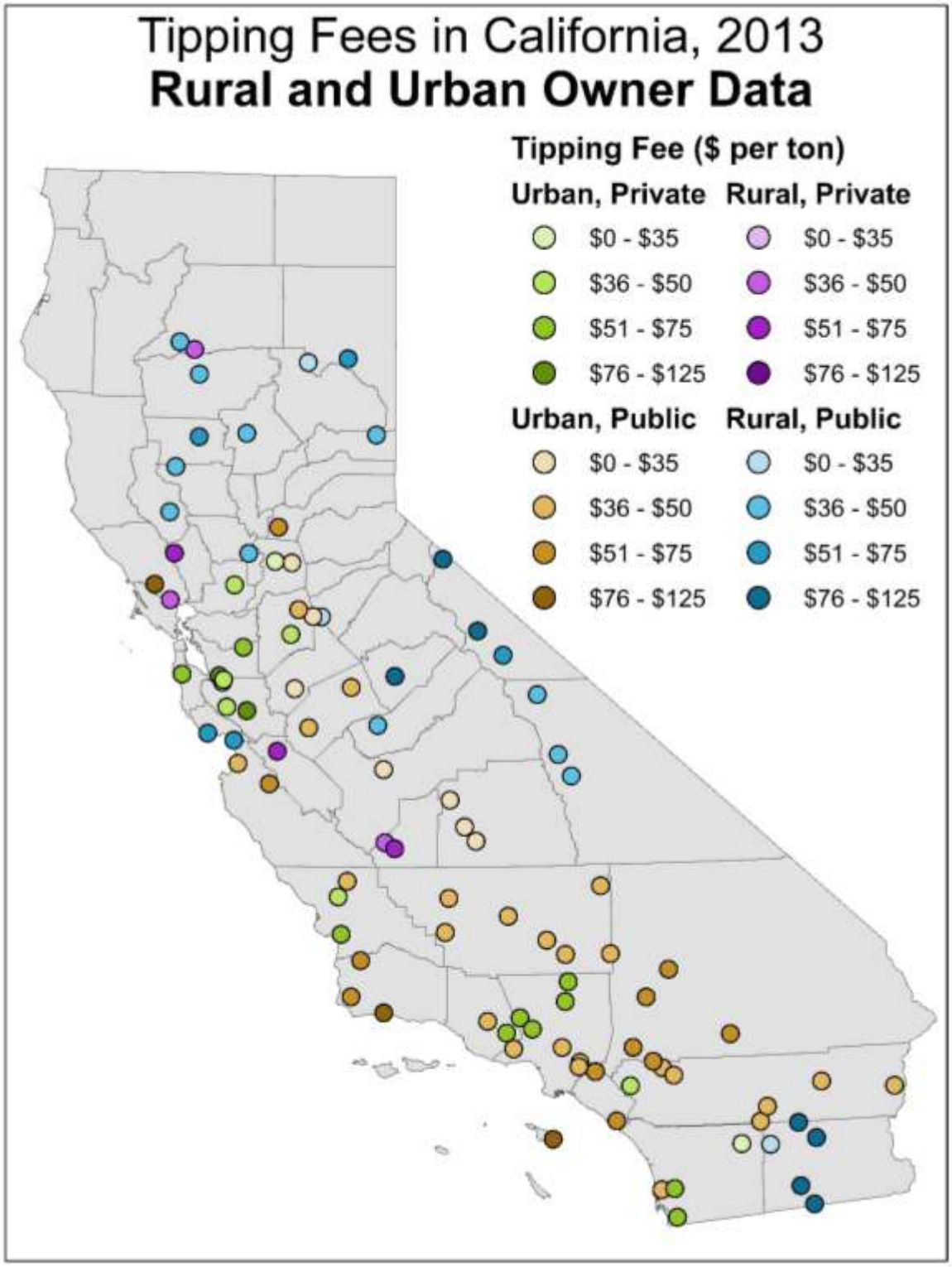
Category	Median Fee	Number of Landfills	Tipping Fee Range
Rural	**$47**	**32**	**$0 - $121**
Public	$47	26	$0 - $121
Private	$53	6	$38 - $75
Urban	**$45**	**66**	**$23 - $125**
Public	$45	45	$23 - $125
Private	$57	21	$31 - $88

Building on the previous section, rural landfills are also predominately owned by a public entity. Of the 32 rural landfills, more than 80% were owned by a public entity, while only 6 were owned by a private entity. Further, the 6 privately owned landfills in rural counties are located in either the more populated areas of the Central Valley or Central Coast, or along a major transportation corridor.

The most common type of landfills are publicly owned urban landfills, and these landfills charge the lowest median tipping fee ($45 per ton). This all suggests that rural or urban county location does not influence tipping fee price as much as landfill owner.

‡ According to Public Resources Code (PRC) Section 40183-4 rev. 2008, a rural county is defined as only disposing of 200,000 tons in a given year. Table included in Appendix B with rural counties, their disposal, and if they have a landfill or not.

Figure 9: Rural and urban owner data: Rural and urban owner tipping fees.



Disposal Tonnage and Tipping Fee Data

The amount of waste disposed at a landfill annually also appears to impact tipping fees. In Figure 10, each landfill was categorized (Table 10) based on tipping fee and amount disposed using criteria from Table 9.

Table 9: Definitions for low, mid-range, and high fees and disposal tonnages

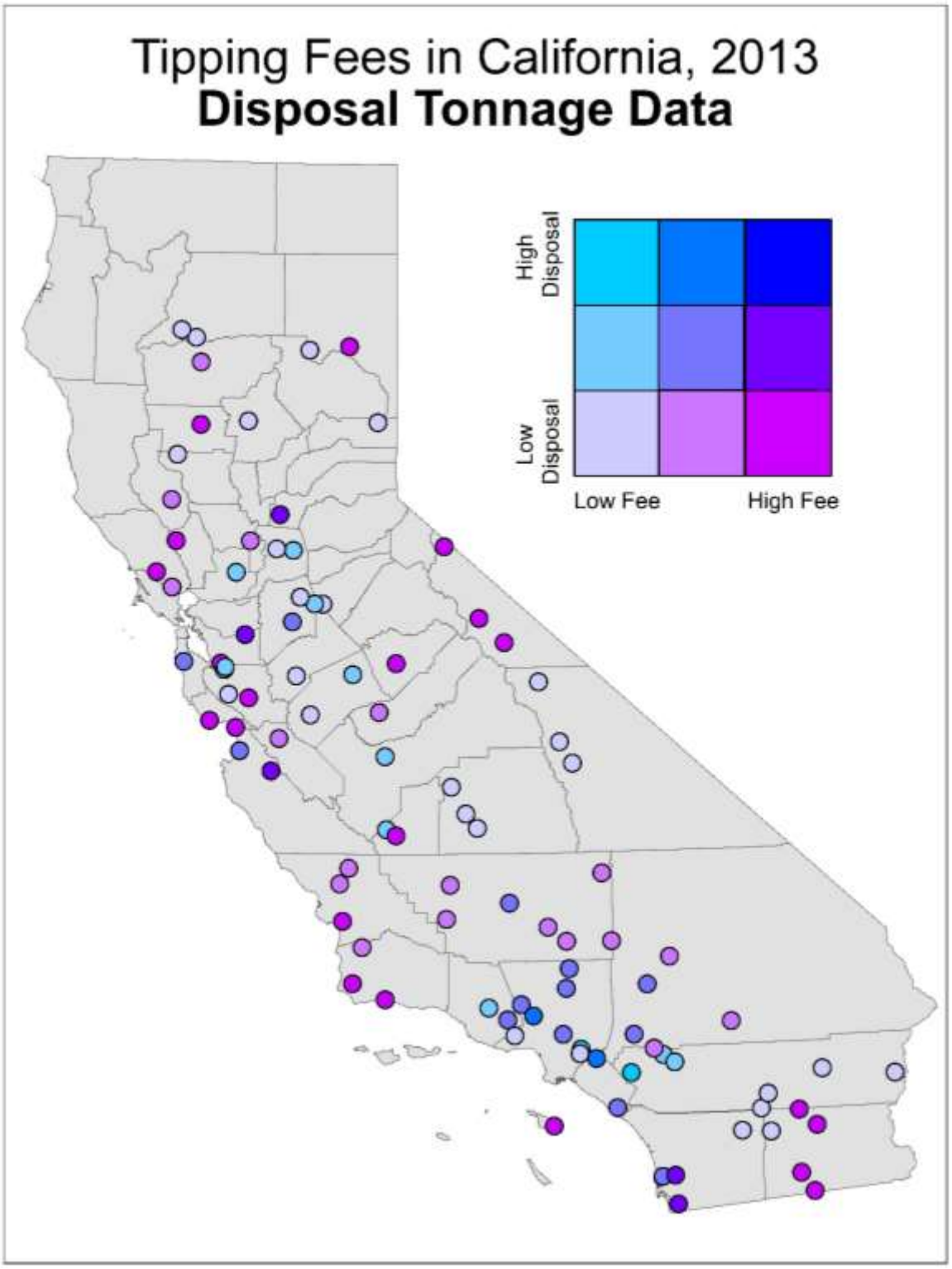
Disposal Category	Fee Category
Low Disposal <200,000	Low Fee <$35
Mid-Range Disposal 200,000-1,000,000	Mid Fee $35-$75
High Disposal >1,000,000	High Fee >$75

Two-thirds of landfills fall into the "low disposal" category and their fees span the full range from low to high. The most common combination (28 percent) was low tipping fee and low disposal landfills. One quarter of landfills are mid-range disposal and are more likely to charge low or mid-range tipping fees. The very small percentage of landfills with high disposal also charge a low or mid-range fee. Landfills taking in a high volume of waste do not appear to require as high tipping fees to support their operations. The variability in fees charged at public landfills with low volumes may suggest that some of these landfills may have a variety of funding sources other than just the tipping fee.

Table 10: Facilities that fall into each category, as defined in Table 9 (the organization of this table correlates to the key in Figure 10).

Low Fee, High Disposal 2 (2%)	Mid-Range Fee, High Disposal 2 (2%)	High Fee, High Disposal 0	**4%**
Low Fee, Mid-Range Disposal 10 (10%)	Mid-Range Fee, Mid-Range Disposal 13 (13%)	High Fee, Mid-Range Disposal 5 (5%)	**28%**
Low Fee, Low Disposal 27 (28%)	Mid-Range Fee, Low Disposal 18 (18%)	High Fee, Low Disposal 21 (22%)	**68%**
40%	**33%**	**27%**	**100%**

Figure 10: Disposal tonnage data: Map ranking disposal tonnages and tipping fees. Each point is symbolized based on its disposal rank and fee rank (Table 9 and Table 10).



Landfill Proximity and Tipping Fee Data

In Figure 11, tipping fees were clustered into low, mid-range, and high categories (same criteria as Table 9), and landfill proximity was similarly categorized using an ArcMap contouring tool.[§] The number of landfills in a given geographic area (landfill proximity) appears to have some impact on the tipping fees at landfills. The number of facilities charging within each fee category was recorded by each density range in Table 11.

Table 11: Landfill proximity and tipping fee distribution.

	Low Fee	Mid Fee	High Fee
Low Density	16	14	14
Mid-Range Density	10	13	8
High Density	13	6	4

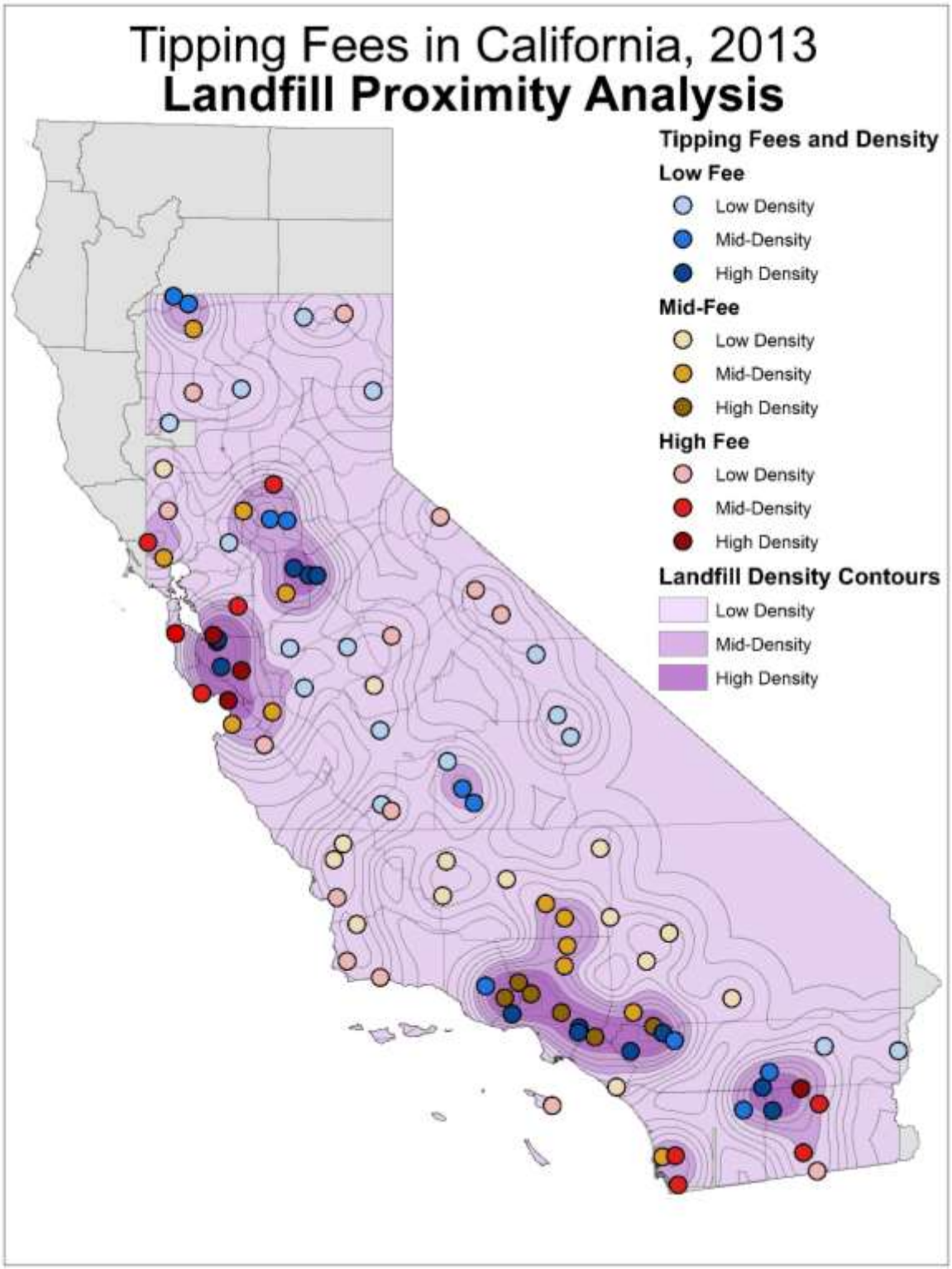
In areas with only a few landfills, there is no relationship between proximity and tipping fees. A landfill in these low-proximity areas is as likely to charge a high or low fee, suggesting that other factors besides landfill proximity are more significant in terms of setting tipping fees.

Mid-density landfill areas follow a similar pattern. Mid-density landfill areas are most likely to charge a mid-range fee, but there is only a slight difference between those likely to charge a low or high fee. This difference is so low that it suggests the same concepts as for the low density areas; there is more freedom in setting prices when a landfill is low to mid proximity areas.

Differences in tipping fees emerge in high density locations where there are more landfills located near each other. These landfills are twice as likely to charge a low fee over a mid-fee, and three times as likely to charge a low fee over a high fee. This suggests that competition between nearby landfills may result in lower tipping fees.

[§] Contours were created by first turning the landfill points into a heat or density map, with hot spots or darker areas containing more landfills than lighter areas. The contouring tool then took this raster heat-map and created contour lines, which were numbered .0002 through .0012. These contour lines were then divided by staff into regions of high density, medium-range density, and low density. (These lines are included in Figure 11).

Figure 11: Landfill proximity analysis: Tipping fees and landfill proximity (Table 11). Landfill proximity was determined using an ArcMap contouring tool, with the contours displayed here.



California Tipping Fees Compared to the United States and the European Union

U.S. Tipping Fees

To understand how tipping fees may impact waste management decision making, this study reviewed national data compiled by BioCycle[26] and Columbia University (EEC)[27] detailing landfill tipping fee data and other MSW data. Columbia University's and BioCycle's bi-annual survey, *State of Garbage in the United States*, is considered the authority on waste management practices in the United States. In 2011, Columbia University took over the research and replaced this bi-annual report with a more comprehensive study of waste management practices in the United States. The data collected by both BioCycle and Columbia rely on state-reported statistics, and for this section the latest data[28] from 2011 is used and presented in Figure 12. Due to the fact that Columbia and BioCycle used averages in their analysis, this section will use California's average rather than median value for comparison. It is important to note that California's average ($54 per ton) is inflated due to skewed data, the median ($45 per ton) is more representative, and California's predominance of negotiated tipping fees most likely drives this price even further down. Because these surveys looked at a few of the largest facilities in each state rather than a census of all facilities, the results may not be directly or completely comparable to the data gathered for this report. As in California, each state's full set of landfill tipping fees may show characteristics that would suggest that the averages for the limited samples may or may not be the best representation of their fees. As a result, these comparisons, while illustrative, should not be considered conclusive.

Figure 12 compares statewide average tipping fees in the United States to California's average tipping fee. Average tipping fees in the Northeast and West regions are the highest in the United States and are higher than California's tipping fee average. Columbia University reported an average U.S. tipping fee of $49 for 2011.

The average tipping fee in a region generally correlates with the percentage of waste landfilled in that region (Table 12). With some exceptions, the higher the tipping fee, the lower percentage of waste a region landfills. In the Northeast and Mid-Atlantic, a greater percentage of waste is sent to waste-to-energy facilities rather than to landfills, the West sends more generated waste to be either recycled or composted, and all of these regions have the highest tipping fees in the United States. Higher landfill tipping fees may make other alternatives like transformation or recycling competitive economically. The Southern and Midwestern states charge well below California's average tipping fee, and they landfill a majority (up to 75 percent) of their waste. Higher tipping fees appear to be discouraging landfilling but may not spur recycling unless this option is specified as a priority by state-level policy, as it is in the Western states.

Figure 13 plots this information but with the added detail of each state's data and a trend line that shows the relationship between tipping fees and percentage landfilled. Based on the national data, California charges less per ton than expected based on the percentage landfilled in each state.

Figure 12: California tipping fee average compared to tipping fees in the United States. Average tipping fees for each state in 2011 (Columbia University) compared to California's average landfill tipping fee of $54.[29] Dataset provided in Appendix C.

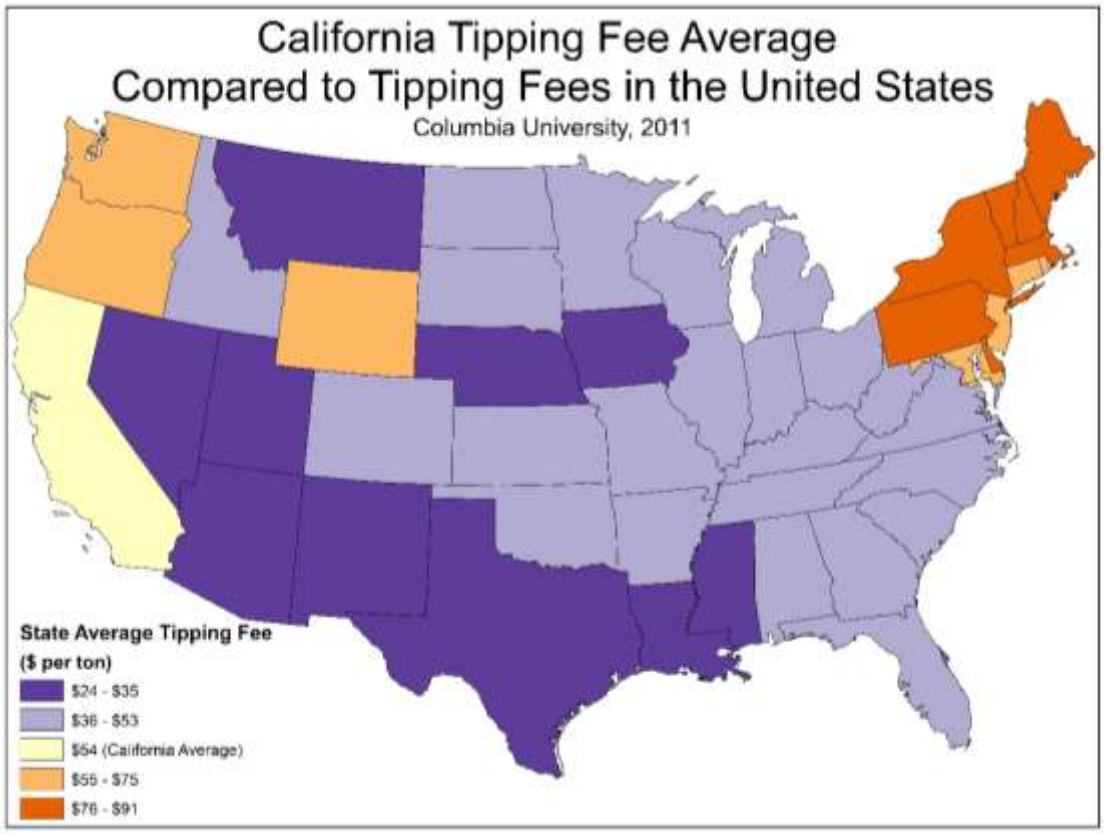


Table 12: Average tipping fees and percentage of waste landfilled (based on tonnage and tipping fees reported by Columbia University)[30] and using BioCycle's regions.[31] A complete table is provided in Appendix C.

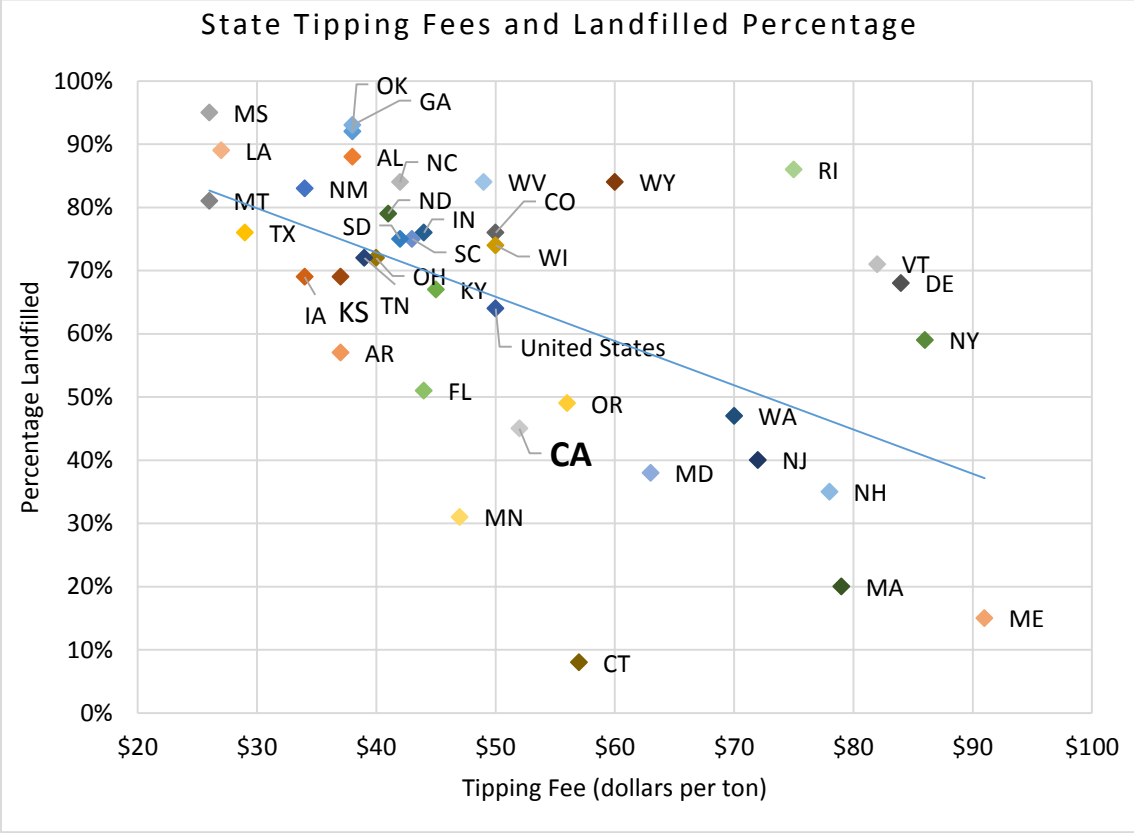
United States Regions	Tipping Fee Average	Percentage Landfilled
New England	$77	24%
West	$51	46%
Mid-Atlantic	$72	49%
South	$39	73%
Midwest	$36	75%
Great Lakes	$45	76%
Rocky Mountains	$39	84%

When comparing other states to California, it is imporant to consider factors outside of the amount landfilled that could affect tipping fees. First, landfills in each state have various operational needs and concerns. Among others, these concerns could include operating

conditions, land value, climate, demographics, and the cost to implement technologies that protect the environment. There is also the policy side of landfilling, with jurisdictions, counties, and states across the United States regulating landfill behavior to different levels. Many states have bottle bills, landfill bans, and other policies that limit landfilling, encourage waste-to-energy projects, or incentivize recycling. While higher tipping fees may disincentivize landfilling, other programs, policies, or economic instruments likely contribute to lowering the percentage of generated waste landfilled in a state.

California appears to have a low tipping fee when compared to the United States, especially when compared to other regions that have similar environmental policies.

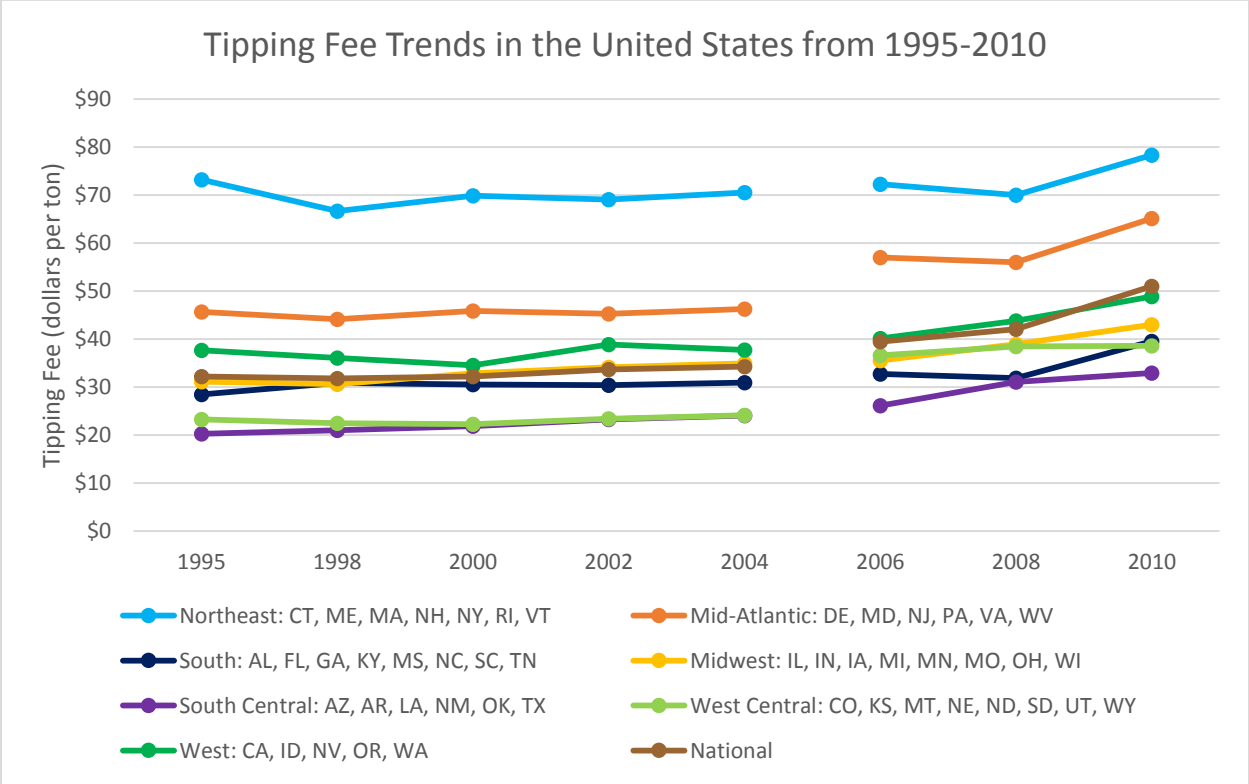
Figure 13: State tipping fees and landfilled percentage. Trend of landfill tipping fees and percentage of generation landfilled (recycled + composted + combusted + landfilled = generation, according to Columbia University)[32]



Historic Tipping Fees in the United States and California

As was mentioned in the introduction, tipping fees have been the subject of research for many years. The NSWMA relied on information from the *Solid Waste Digest* to record tipping fees from 1995-2004 for seven regions of the United States and the national average. The national average and tipping fees in general stayed relatively consistent between 1995 and 2004, but between 2004 and 2010 tipping fees rose $1.62 per year, which NSWMA has attributed, in part, to rising fuel costs (Figure 14).[33]

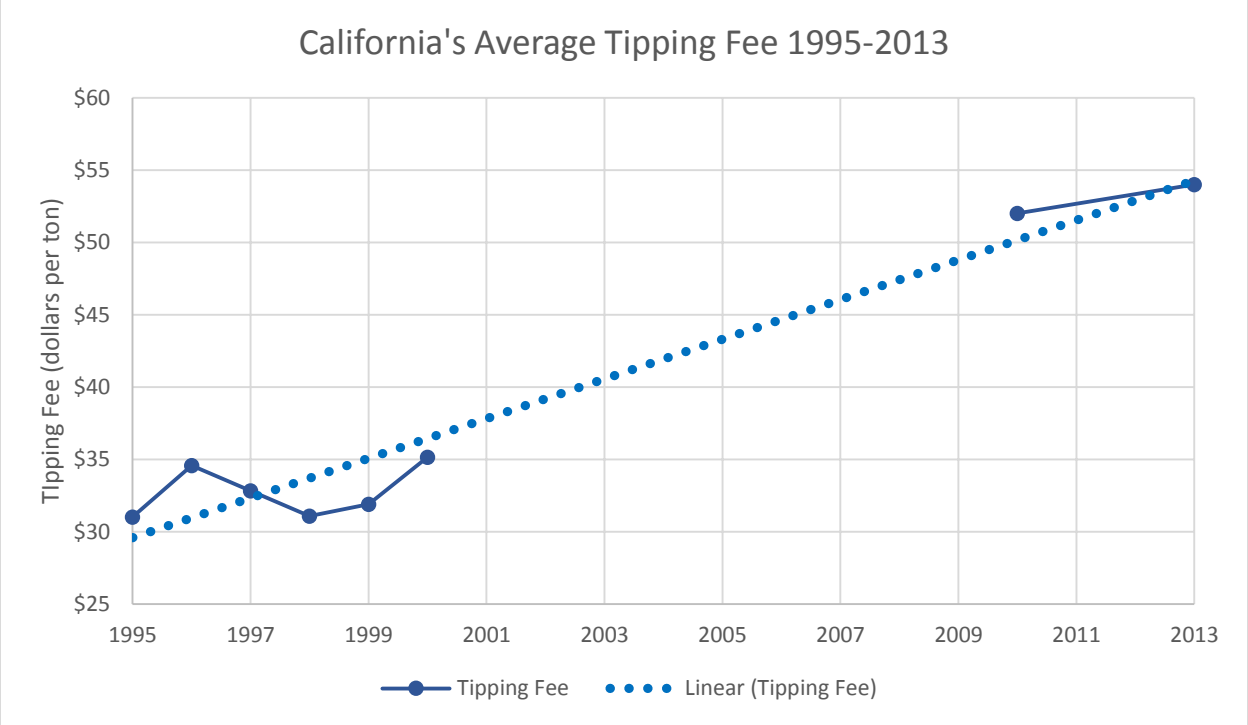
Figure 14: Posted tipping fee trends in the United States from 1995-2010. Data from 1995-2004 for the nation's regions and the national average for all years are from NSWMA's article,[34] and data from 2006-2010 are from BioCycle and Columbia University's statewide surveys.[35,36,37] Regions on this graph are from NSWMA's publication and are slightly different from BioCycle's regions used in the previous section.



With limited data for California for the years between 1995 and 2013, we are able to piece together how California's tipping fee has increased in the last 20 years. Between 1995 and 2000, when the last CalRecycle tipping fee surveys were conducted, the tipping fee average varied between $30 and $35 per ton. Between 2010 and 2013 the average was $52 to $54 per ton. For the years between 2000 and 2010, California-specific data is not available, NSWMA's article only provided data by region, and in the BioCycle surveys California did not supply an average tipping fee. Therefore, as a general trend, in the 10 years between 2000 and 2010, California's average tipping fee increased $17, an average of $1.70 per year, which is comparable to the

national trend of $1.62 per ton increase per year, but the exact increases and trends are not known (Figure 15).

Figure 15: California's average posted tipping fee 1995-2013: Data prior to 2000 was collected by the California Integrated Waste Management Board (CIWMB, CalRecycle's predecessor), 2010 data is from Columbia University's study, and 2013 data is from this study.



European Union Tipping Fees

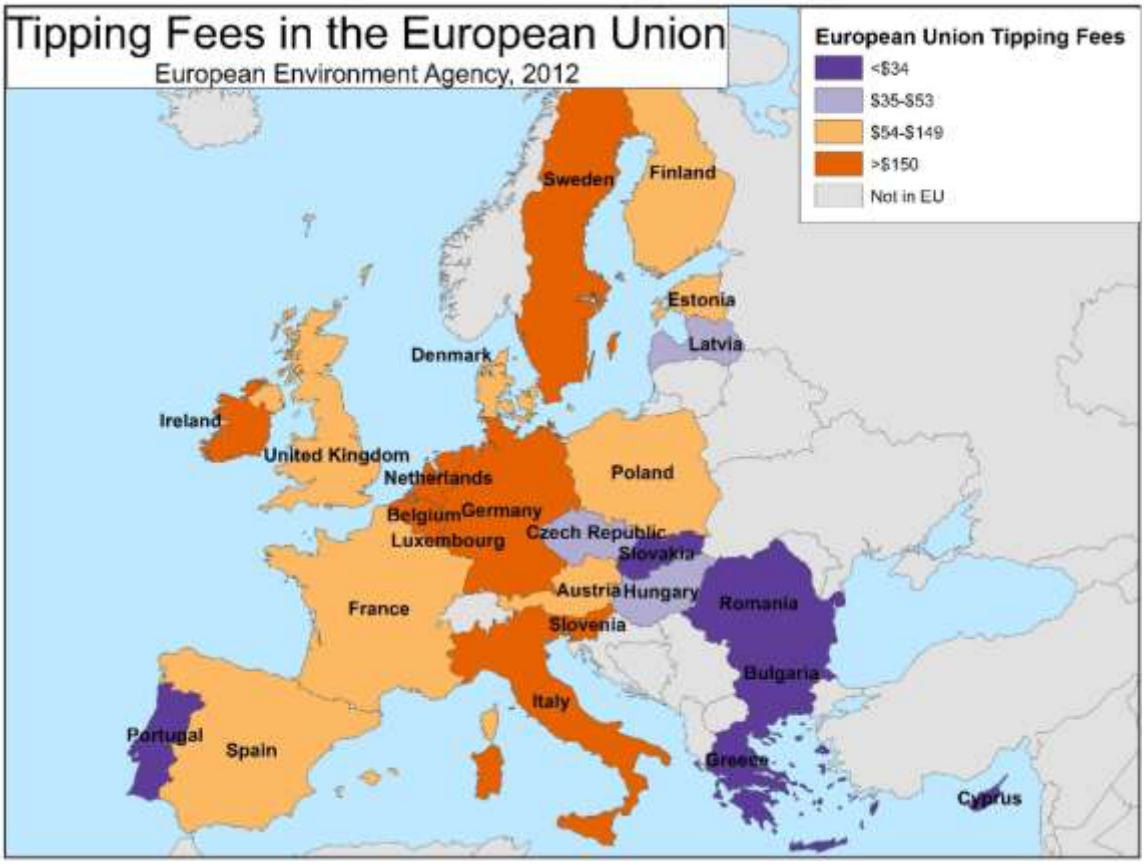
Given the higher rates of recycling and the ambitious policy directives that focus on moving waste away from landfilling in the European Union, landfill tipping fees in the European Union may be more relevant for understanding how landfill tipping fees could impact future policy development in California. Tipping fees for the European Union member states are displayed in Figure 16. The average "typical" tipping fee in member states of the European Union was $100 per ton in 2012, with a range of $0-$215.[38] California's average MSW tipping fee at landfills, $54 per ton, is much lower than the European Union's average MSW tipping fee at landfills, and the European Union's range is almost double that of California's ($0-$125).

When comparing the European Union and California, it is important to consider the differences in policy priorities. In the European Union's Landfill Directive states that by 2016 each member state should be landfilling only 35 percent of what they landfilled in 1995.[39] California jurisdictions are required to divert 50 percent of their generated waste by meeting a disposal target measured as "per capita disposal."[40] In addition, jurisdictions may receive diversion credit for using waste as a feedstock for energy, which lowers a jurisdiction's per capita disposal. Transformation accounts for approximately 3 percent of solid waste disposed statewide. Further, California has not promoted the use of waste as a feedstock for energy in the last decade. In the

European Union, waste-to-energy (WTE) is considered a benificial way to limit waste reaching the landfill and promote energy independence. This is a difference in approach to the issue of waste management: California has concentrated its efforts more on reduction, reuse, recycling, and composting of waste, while the European Union has considerable reliance on WTE.

The range of average tipping fees in the United States is both lower and smaller ($24 to $91) than the European Union average tipping fee range ($4 to $215). The higher average landfill tipping fee in the European Union may be partially attributed to its landfill directive (the United States does not have a nationwide landfill goal or directive). The wider range in the European Union may be due to the fact that newer member states do not have to meet the landfill directive (or are newly forming waste management strategies) and therefore have lower fees.

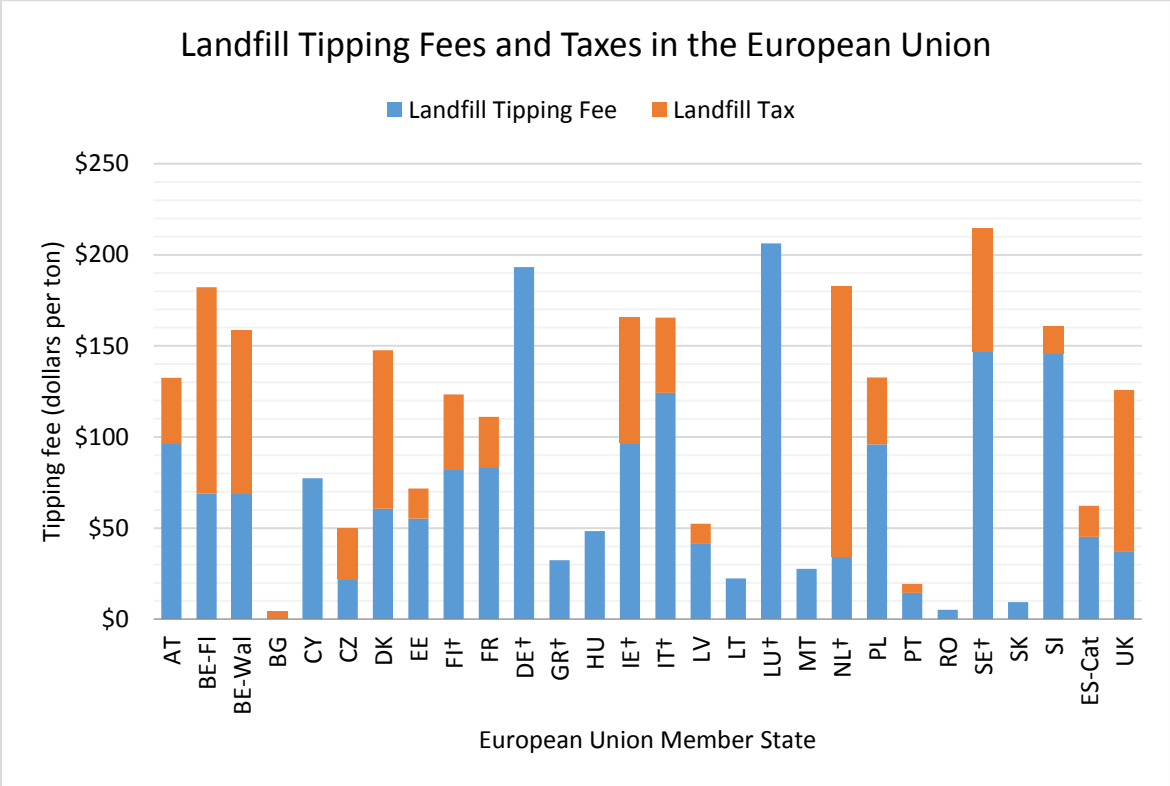
Figure 16: Tipping fees in the European Union. European Union averages (converted from euros to dollars)[41] compared to California's average tipping fee of $54.[42] Fees below California's average are light and dark purple, and those above California's average are light and dark orange. Dataset provided in Appendix D.



The European Enviornmental Agency (EEA) analysis of European Union tipping fees noted that the landfill directive requires that gate fees cover all costs associated with operating a landfill, including siting, closure, and after-care for up to 30 years, and that this requirement may have led to higher tipping fee costs.[43] Another important factor to consider when contextualizing European Union landfill data is that the data set used in Figure 16 combines landfill gate fees (charged by the operator, the focus of this study) and landfill taxes (charged by public entities). European

Union landfill taxes average $35 per ton but vary greatly, as shown in Figure 17. California's $1.40 per ton state fee on each ton of waste landfilled hardly compares to these larger fees, although some local jurisdictions in California do charge landfill taxes that were not researched in this study. Due to these high landfill taxes, the authors of the EEA calculated a "typical landfill fee," which included both the average tipping fee and the landfill tax of each member state.

Figure 17: Landfill tipping fees and landfill taxes in the European Union, based on EEA data.[44] Country abbreviations and dataset provided in Appendix D.

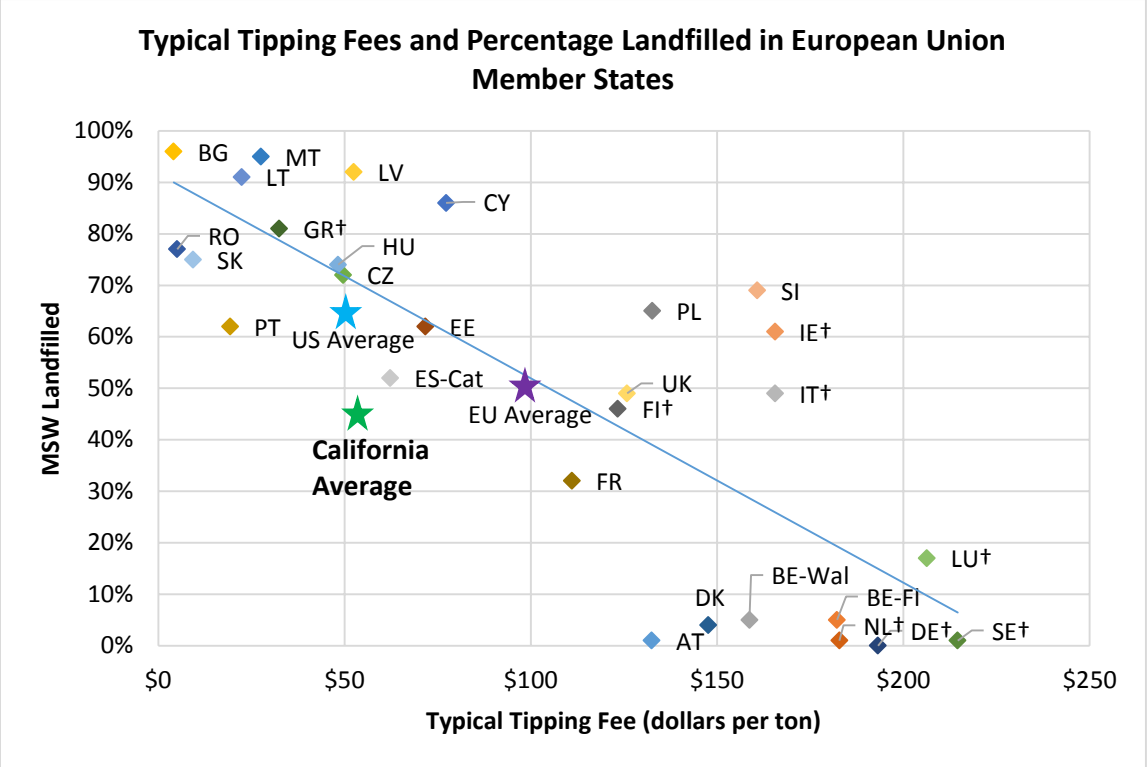


Due to these landfill taxes, the authors from the European Environment Agency (EEA) noted that member states fell into one of three groups[45] (plotted in Figure 18):

- high "typical landfill fee" and low landfill percentage
- mid-range to high "typical landfill fee" and mid-range landfill percentage
- low "typical landfill fee" and high landfill percentage

The same correlation was also observed for landfill fees and the amount of waste recycled and composted.[46] The authors concluded that as an economic instrument for behavior change, increased landfill gate fees and taxes can lower the amounts landfilled, and specifically landfill taxes can change consumer behavior if the customer believes the taxes are high.[47]

Figure 18: Typical tipping fees and percentage landfilled in European Union member states. European Union member state "typical tipping fees" (which include landfill taxes presented in Figure 17) and percentage landfilled.[48] Country abbreviations are provided in the Appendix.



Further, in their research, the authors found that while increasing fees at the landfill moves some waste up the waste heirarchy (i.e. to incineration, recycling, or composting), other programs and policies were used in countries that achieved the lowest percentages of landfilling. Germany, for example, has one of the lowest landfilling percentages, one of the highest landfill fees, but also has a landfill ban in place. The EEA authors concluded that while landfill taxes disincentivize landfilling, other programs or economic instruments must be used to achieve a low landfilled percentage.[49, 50]

Conclusion

Landfill Tipping Fees Are Complex and Varied

Tipping fees in California are as complex as the state itself. Tipping fees vary by the unique circumstances at each landfill, which can include, among other factors, their regional location, rural or urban location, ownership, annual disposal tonnage, proximity to other landfills, and operational factors. California is a large state with many different demographics, climates, political subdivisions, and environmental concerns that could also lead to diverse landfill tipping fees. Generalizing about California landfill tipping fees can be difficult and is perhaps more illustrative than decisively conclusive in many cases. Even with these limitations, some interesting findings and conclusions from this preliminary research are included below:

- Larger (more annual disposal) landfills tend to have lower fees than smaller landfills.
- Landfills with other landfills nearby tend to have lower fees than remote landfills.
- Privately owned landfills tend to charge more than government-owned landfills.
- Privately owned landfills are more likely to operate in urban areas, while government-owned landfills are more evenly distributed throughout California (with the exception of the Bay Area).
- Based on a comparison within the United States and with the European Union, landfill tipping fees in California are lower than would be expected based on the percentage of MSW that is landfilled in the state.

Low Landfill Tipping Fees for MSW

This report supports the general conclusion that tipping fees in California are lower than would be expected in a progressive state with effective programs and ambitious waste management goals. The cost of landfilling solid waste may be too low to promote the behavioral changes needed to push materials to higher and better uses. In relation to the statewide goal of 75 percent recycling by 2020, low landfilling costs do little to help drive the changes that are needed to reach the goal. Data presented in this report for both the United States and the European Union show a correlation between tipping fees and the amount of waste landfilled. In countries that landfill very little waste, tipping fees were higher than in countries that landfill a majority of their waste, and California's data fell below the expected level given its moderate level of landfill disposal. Further, the policy directives of the European Union include economic instruments like increased tipping fees and landfill taxes to act as disincentives to landfilling while they simultaneously promote producer responsibility, environmentally responsible packaging, recycling, and composting. While raising tipping fees is not the only method to change behavior and reduce disposal, it has been an effective strategy in other localities and could be a policy option to explore.

Although the posted "self-haul" tipping fees analyzed in this report only reflect about 20 percent of overall disposal, the limited data for solid waste haulers suggest that the negotiated tipping fees are up to 30 percent (or $20 per ton) lower than the already low tipping fees in California. These commercial rates should be more thoroughly researched and analyzed in future work, considering that solid waste haulers make up approximately 80 percent of the waste stream in California. If

the negotiated fees are as low as suggested by this preliminary anecdotal research, landfills are likely the cheapest path for materials to flow down. If true, this makes building a competitive recycling and composting infrastructure very challenging.

Regardless of its relative cheapness in California, solid waste disposal is big business in California. If 20 percent of the landfilled waste in 2013 (6 million tons) had a landfill tipping fee of $45 per ton and 80 percent of the waste had a landfill tipping fee of $25 per ton (24 million tons), the total would be almost $900 million. This is an extremely rough calculation with oversimplified assumptions and is only meant to be illustrative, but it does show the order of magnitude of landfill tipping fees in California.

Lack of Disincentive for Green Waste Going to Landfills

Diverting green waste and other organics away from landfills is a priority for both greenhouse gas reduction and to meet CalRecycle's 75 percent statewide recycling goal. However, current tipping fees for green waste, both within landfills and at other facilities, do not appear to significantly incentivize diversion and drive materials to their highest and best use. As noted in the European Union study, a perceived high fee influences consumer behavior,[51] but currently a majority of landfills do not have high green waste fees that would be likely to significantly change consumer behavior.

If tipping fees for green waste are going to send appropriate market signals to the consumer, it should be considerably less expensive to divert the material than to dispose of it. Currently, the $15 difference between landfills and green waste diversion facilities may not be enough to drive consumer behavior; this may be especially true at landfills where consumers see it is cheaper to send green waste to the landfill than MSW. If landfills are negotiating even lower prices that compete for these resources (for use as ADC, AIC, or beneficial reuse), these materials will be even less available for higher and better uses. Further, if green waste continues to flow into landfills due to convenience, price, or habit, it will continue to draw feedstock away from other green waste diversion facilities; this will hamper efforts to site more green waste diversion facilities and build the infrastructure needed to appropriately handle these materials.

Tipping Fees and Landfill Capacity

Based on the European Union and United States data, when landfills play a more limited role in waste management, tipping fees are usually higher. Currently, California's tipping fees are not as high as expected in relation to our level of landfilling. Given the ample amount of total landfill capacity in California (approximately 1.7 billion tons), it is unlikely that landfill tipping fees will rise quickly due to supply constraints. In addition, as recycling increases, there will be less disposal, so demand is likely to decrease over time. In 2013, 30 million tons of waste were disposed at landfills. Only 16 million tons are projected to be landfilled in 2020 if the 75 percent goal is achieved. Even with increases in population over time, it may be many years before there are significant shortages in statewide landfill capacity. (This may not always be true at the local or regional levels.)

As California moves toward its 75 percent statewide recycling goal, the resulting reduction in waste disposal will cause a sharp decline in disposal, tipping fee revenue for landfills, and governmental fee revenue for both local governments and the state. That decline in tipping fee revenue, both for landfills and agencies that charge taxes on disposal tonnages, could make it difficult to meet all statutory obligations. Imposing (or increasing) the governmental fees on

landfill disposal could dis-incentivize disposal and raise needed revenue. However, with landfills projected to play a diminishing role in solid waste and materials management, disposal and diversion program funding options should be explored that are not solely reliant on landfill fees.

Future Research

This study began research into the field of tipping fees in California. There are additional questions that could be answered and additional areas to explore:

- The tipping fees researched in this study are for a minority of waste hauled in the state of California. Self-haul makes up about 20 percent of the disposal at Californian landfills. Future research could seek to understand the negotiated tipping fees that apply to the other 80 percent of disposal. Only limited anecdotal information was available for negotiated fees, but in the future there could be a more methodical and representative approach to collecting and analyzing negotiated tipping fee data for solid waste haulers at landfills. However, challenges related to proprietary data may hamper this effort unless some solid waste industry sources are willing to provide this data.
- Further research could more comprehensively compare tipping fees at facilities using green waste for ADC, compost, biomass, anaerobic digestion, and other alternatives for recycling organics.
- National, state, and local fees and/or taxes on landfill disposal have a direct monetary impact on tipping fees. A more comprehensive and complete comparison (currently underway) with other localities, states, and nations could help illuminate the relative impact and magnitude of these fees.
- As part of a broader exploration of total available landfill capacity in California, additional research could be done on the relationship between landfill capacity and tipping fees.

Data Limitations

As discussed above, this report is based on research with some limitations:

- The data represents a census of landfills of tipping fees on waste accepted from the public but does not contain tipping fee information on waste accepted from solid waste haulers.
- Data sets for facilities other than landfills were not censuses or even statistically representative due to difficulties in contacting or obtaining information from them.
- Negotiated agreements between haulers and landfills were not thoroughly researched in this report because of proprietary concerns.
- More robust statistical tools (beyond averages and medians) could be used to further explore the data, particularly if a more robust data set can be gathered.
- Tipping fees change over time; this report only contains a snapshot in time.

Abbreviations and Acronyms

ADC – Alternative Daily Cover

DRS – Disposal Reporting System

EEA – European Environment Agency

EEC – Earth Engineering Center (Columbia University)

FacIT – Facility Information Toolbox

MRF – Material Recovery Facility

MSW – Municipal Solid Waste

NSWMA – National Solid Wastes Management Association

PRC – Public Resources Code

SWIS – Solid Waste Information System

WTE – Waste-to-Energy

Glossary of Terms

Biomass conversion: The process of using controlled combustion of specified types of organic materials (essentially wood, lawn or crop residue) to produce electricity. Biomass conversion facilities are not permitted as solid waste facilities or regulated by CalRecycle. See PRC 40106 (a).

Chipping and grinding: The process that separates, grades, and resizes woody green wastes or used lumber to be sent to a composting facility, a landfill to be used for ADC, or miscellaneous end markets such as feedstock at biomass to energy plants.

Commercial composting: The process of taking organic materials such as green waste, manure, food waste and other organics and transforming them through controlled biological decomposition for sale as an end product, usually in the form of home or farm soil amendments.

Disposal Reporting System (DRS): The system used to track disposal information in California. For more information go to: http://www.calrecycle.ca.gov/LGCentral/DRS/default.htm

Disposal: The process of collecting municipal solid waste and transferring it to a transfer station, landfill, or transformation facility.

Exported waste: Waste that is sent out of the state of California for disposal.

Facility Information Toolbox (FacIT): Informational database on disposal and recycling activities in the state of California. For more information go to: http://www.calrecycle.ca.gov/FacIT/

Food waste: All surplus food scraps. The term has fallen out of favor with some composters, who prefer to view this material as a resource rather than as waste material. However, this term is interchangeable with food scraps.

Green waste: A term used to refer to urban landscape waste generally consisting of leaves, grass clippings, weeds, yard trimmings, wood waste, branches and stumps, home garden residues, and other miscellaneous organic materials.

Green waste diversion facilities: The term used in this study to describe compost facilities, chip and grind facilities, and biomass conversion facilities.

Landfill: A permitted facility that provides a legal site for final disposal of materials including mixed solid waste, beneficial materials used for landfill construction, ADC, and specialized material sites such as waste tires and construction and demolition waste.

Material recovery facility (MRF): An intermediate processing facility that accepts source-separated recyclables from an initial collector and processes them for wholesale distribution. The recyclable material is accumulated for shipment to brokers or recycled content manufacturers, or for export out of state.

Municipal solid waste (MSW): Garbage. Refuse that may be mixed with or contain nonorganic material, processed industrial materials, plastics, or other recyclables with the potential for recovery. It includes residential, commercial, and institutional wastes.

Rural: According to Public Resources Code (PRC) section 40183-4 rev. 2008,[52] a rural county is defined as one that disposes 200,000 tons or less MSW in a given year.

Self-hauler: A person who hauls their residential or business waste themselves to a solid waste facility.

Solid waste hauler: A waste hauler that collects residential or business waste for a fee and transports that waste to a solid waste facility. These haulers may be contracted or franchised and might have a negotiated fee with a landfill.

Solid Waste Information System (SWIS): The database that tracks solid waste facilities in California. For more information go to: http://www.calrecycle.ca.gov/SWFacilities/Directory/Default.htm

Tipping fee: As defined in this study, a tipping fee is the amount of money per ton of waste charged at the gate of a landfill for a self-hauler and is publicly disclosed either online or by phone.

Transfer station: Receives, temporarily stores, and ships unprocessed waste/recyclables. The ones we considered in this study accepted MSW, green waste, or both.

Transformation facility: The use of incineration, pyrolysis, distillation, or biological conversion (other than composting) to combust unprocessed or minimally processed solid waste to produce electricity. See PRC 40201.

Appendix A: Survey Information

During the course of this study, every active, permitted landfill that accepts disposal from self-haulers (the general public) in California was contacted and provided staff with a tipping fee.

Lists for landfills, compost facilities, and transfer stations were pulled from CalRecycle's SWIS database, as these facilities are permitted. Unpermitted facilities (facilities that have special permits or are regulated by other agencies) were pulled from the FacIT database. Due to the nature of the permits, and how facilities are stored in the SWIS and FacIT databases, staff had to make sure that each facility was only counted once in the survey process. Facilities can house more than one operation, and Table A1 shows the complication of the SWIS database: Some facilities showed up on the lists more than once. Therefore, staff weighted the operations. Landfills had first priority (so all landfills on the SWIS list are considered "landfills" in our study, regardless of whether they have transfer or compost facilities co-located). The second priority was compost facilities, because the "transfer" permit is most likely there to allow the compost facility to house and use green material. Transfer stations had final priority in the survey, mostly because there were so many and also because at other facilities they are often secondary operations.

The FacIT lists only show operations, so these would be in addition to the SWIS lists. Chip and grind and biomass conversion facilities are not in the SWIS database and are entirely operations. Some transfer stations and compost facilities are considered operations in the state and are considered separately in Table A2 but averaged with the overall survey data.

Due to the smaller nature of most green waste diversion facilities (compost, chipping and grinding, and biomass) and transfer stations, not all facilities or operations were contacted or participated. Chip and grind facilities and biomass conversion facilities were the hardest to contact because many did not have current contact information in CalRecycle's FacIT database or were pilot projects (biomass).

As a result of these surveys, facilities were categorized into one of three groups:

- Surveyed. The facility fell into the scope of our research (accepted MSW or green waste from the public) and was surveyed.
- No public disposal. The facility:
    - Exclusively processed materials that did not fall under the purview of this study (i.e. construction material, recyclables, etc.) or
    - Was not open to the public, so no fee information was collected.
- Not surveyed. The facility fell under the scope of research but could not be contacted (had no website and did not respond to at least two phone calls) or refused to provide CalRecycle staff with tipping fee information.

Table A1: Due to the way SWIS pulls data, it is important to note that some facilities fall into more than one category because more than one activity may be permitted at a facility.

Facility	Number of Facilities
Landfills Only	112
Landfill and Transfer	7
Landfill and Compost	13
Landfill, Transfer, and Compost	6
Total Landfills	138
Compost Only	56
Compost and Transfer	26
Total Compost Facilities	82
Transfer Station Only (Total)	271

To determine how a facility was defined in this survey, we considered landfills first, compost facilties second, and transfer stations third, meaning that if a facility was a landfill and a compost facility or a transfer station, or all three, its tipping fees were in the "landfill" survey. Compost and compost/transfer stations were on the compost list, and transfer stations only are on the transfer station list. This is primarily because the study focused on what the facility is primarily doing: A landfill is usually a landfill that homes other operations, and transfer stations that are "with" landfills or compost facilities are usually not the main focus of the operation.

Table A2: Survey information. Breakdown of the facilities surveyed, facilities not accepting public disposal, and facilities that were not surveyed. Landfills were the only facility type of which all facilities were either surveyed or did not have public disposal. Some transfer station and compost operations were also surveyed in addition to the permitted facilities and are therefore not counted in the totals.

Information Obtained	Number of Facilities	Percentage of Facilities
Landfills		
Surveyed	98	70%
No Public Disposal	42	30%
Total	140**	100%
Transfer Stations		
Surveyed (Facility)	74	28%
Surveyed (Operation)	55	(not included)
No Public Disposal	69	25%
Not Surveyed	127	47%
Total	271	100%
Compost Facilities		
Surveyed (Facility)	35	43%
Surveyed (Operation)	29	(not included)
No Public Disposal	12	14%
Not Surveyed	35	43%
Total	82	100%
Chipping and Grinding Operations		
Surveyed (Operation)	47	30%
No Public Disposal	12	8%
Not Surveyed	100	62%
Total	159	100%
Biomass Conversion Facilities		
Surveyed (Operation)	8	26.7%
No Public Disposal	8	26.7%
Not Surveyed	14	46.6%
Total	30	100%

** Two landfills have closed between the time of this survey and now.

Appendix B: Rural Counties in California

Table A3: Rural counties

Tons Disposed	County	Landfill in County?
1,652	Alpine	No
27,455	Amador	No
197,203	Butte	**Yes**
32,695	Calaveras	**Yes**
22,037	Colusa	No
18,590	Del Norte	No
133,245	El Dorado	No
19,203	Glenn	**Yes**
84,491	Humboldt	No
178,915	Imperial	**Yes**
21,213	Inyo	**Yes**
94,750	Kings	**Yes**
35,628	Lake	**Yes**
17,979	Lassen	**Yes**
117,354	Madera	**Yes**
180,704	Marin	**Yes**
11,362	Mariposa	**Yes**
51,224	Mendocino	No
5,318	Modoc	No
22,530	Mono	**Yes**
99,518	Napa	**Yes**
50,324	Nevada	No
16,424	Plumas	No
55,803	San Benito	**Yes**
163,579	Santa Cruz	**Yes**
145,343	Shasta	**Yes**
2,376	Sierra	**Yes**
29,458	Siskiyou	No
62,506	Sutter	No
41,921	Tehama	**Yes**
7,473	Trinity	No
35,481	Tuolumne	No
154,882	Yolo	**Yes**
62,506	Yuba	**Yes**

Appendix C: United States Data[53]

Table A4: United States data

States, by Region	Tipping Fee Average (dollars per ton)	Percentage Landfilled††
New England	**$77**	**24%**
Connecticut	$57	8%
Maine	$91	15%
Massachusetts	$79	20%
New Hampshire	$78	35%
Rhode Island	$75	86%
Vermont	$82	71%
West	**$51**	**46%**
California	$52‡‡	45%
Nevada	$25	69%
Oregon	$56	49%
Washington	$70	47%
Mid-Atlantic	**$72**	**49%**
Delaware	$84	68%
Maryland	$63	38%
New Jersey	$72	40%
New York	$86	59%
Pennsylvania	$76	42%
West Virginia	$49	84%
South	**$39**	**73%**
Alabama	$38	88%
Florida	$44	51%
Georgia	$38	93%
Kentucky	$45	67%
Louisiana	$27	89%

†† Percentage landfilled for each region was calculated by totaling the generated waste from each state in the region and the total landfilled tonnage from each state in the region, not by averaging the percentage landfilled. This is due to the fact that smaller states would skew the true percentage landfilled.

‡‡ The tipping fee referenced for California in this table is from the Columbia University study and is not the same as the median or tipping fee found in this study. This is most likely due to inflation (the data collected at Columbia University and for this study were collected in different years).

States, by Region	Tipping Fee Average (dollars per ton)	Percentage Landfilled††
Mississippi	$26	95%
North Carolina	$42	84%
South Carolina	$43	75%
Tennessee	$41	79%
Virginia	$46	66%
Midwest	**$36**	**75%**
Arkansas	$37	57%
Iowa	$34	69%
Kansas	$37	69%
Missouri	$38	80%
Nebraska	$31	87%
North Dakota	$39	72%
Oklahoma	$38	92%
South Dakota	$42	75%
Texas	$29	76%
Great Lakes	**$45**	**76%**
Illinois	$43	89%
Indiana	$44	76%
Michigan	$47	87%
Minnesota	$47	31%
Ohio	$40	72%
Wisconsin	$50	74%
Rocky Mountains	**$39**	**84%**
Arizona	$33	94%
Colorado	$50	76%
Idaho	$44	91%
Montana	$26	81%
New Mexico	$34	83%
Utah	$24	81%
Wyoming	$60	84%

Appendix D: European Union Data[54]

Table A5: European Union data

Full Member State Name	Abbreviation	Converted Tipping Fee (dollars per ton)	Converted Typical Fee (includes Landfill Taxes, in dollars per ton)	Percentage Landfilled
Austria	AT	$97	$132	1%
Belgium, Flanders	BE-Fl	$69	$182	5%
Belgium, Wallonia	BE-Wal	$69	$159	5%
Bulgaria	BG	$0	$4	96%
Cyprus	CY	$77	$0	86%
Czech Republic	CZ	$22	$50	72%
Denmark	DK	$61	$148	4%
Estonia	EE	$55	$72	62%
Finland	FI†	$82	$123	46%
France	FR	$83	$111	32%
Germany	DE†	$193	$193	0%
Greece	GR†	$32	$32	81%
Hungary	HU	$48	$48	74%
Ireland	IE†	$97	$166	61%
Italy	IT†	$124	$166	49%
Latvia	LV	$41	$52	92%
Lithuania	LT	$22	$22	91%
Luxembourg	LU†	$206	$206	17%
Malta	MT	$28	$28	95%
Netherlands	NL†	$35	$183	1%
Poland	PL	$96	$133	65%
Portugal	PT	$14	19.32	62%
Romania	RO	$5	$5	77%
Sweden	SE†	$147	$215	1%
Slovakia	SK	$9	$9	75%
Slovenia	SI	$146	$161	69%
Spain, Catalonia	ES-Cat	$45	$62	52%
United Kingdom	UK	$37	$126	49%

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