State of Disposal and Recycling in California for Calendar Year 2018

April 6, 2020

CalRecycle

California Department of Resources Recycling and Recovery

STATE OF CALIFORNIA

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Executive Summary

California has established clear, progressive and ambitious environmental goals for managing materials and reducing solid waste. These goals address a suite of environmental challenges from resource conservation to climate change.

However, continuing challenges have slowed progress toward some of these goals. Three ongoing factors are driving the production of more waste: (1) Disposal due to economic material generation outpacing increases in recycling; (2) Disaster debris from numerous, catastrophic wildfires, and (3) Disposal of recyclables due to global trade policies and unpredictable international markets.

In calendar year 2018, California's overall disposal increased for the sixth year in a row to 46.3 million tons. As a result, California's statewide recycling rate is down to 40 percent from its 2014 peak of 50 percent. California will not meet the 75 percent statewide recycling goal in 2020 as set out in Assembly Bill (AB) 341 (Chesbro, Chapter 476, Statutes of 2011).

The Department continues to actively oversee programs and work closely with our partners in local government and the solid waste recycling industry. Some new approaches and initiatives to address the statewide recycling rate are underway. Other approaches that result in investment in domestic recycling infrastructure continue to be evaluated.

CalRecycle guides California's recycling policy development and program implementation through science-based, data-driven decisions to achieve California's ambitious goals. To support this approach and to monitor the state's progress, CalRecycle implemented the Recycling and Disposal Reporting System (RDRS) pursuant to AB 901 and conducted statewide waste characterization studies in 2018, with other related studies to be conducted soon. CalRecycle will build strong programs on this foundation of sound facts, continually evaluate progress, adopt strategies to effectively manage solid waste and materials, and protect the environment.

Providing Leadership

This report for Calendar year 2018 presents a snapshot of the state's waste management goals and progress, as well as CalRecycle's efforts, new initiatives, and monitoring mechanisms.

California remains a national and global leader in setting ambitious statutory goals for recycling, conserving resources, and preventing climate change. CalRecycle implements statutes and policies to achieve statewide mandates and goals that protect California's resources, public health and safety, and environment. This active environmental stewardship began nearly 50 years ago, and California has increasingly embraced more ambitious solid waste and recycling goals.

Goals and Mandates

- To reduce litter and clean streams of recyclables, the Beverage Container Recycling and Litter Reduction Act of 1986 (AB 2020, Margolin, Chapter 1290, Statutes of 1986) established a goal of an 80 percent recycling rate for all aluminum, glass, plastic, and bimetal beverage containers sold in California.
- To combat a looming landfill capacity crisis, California established a 50 percent diversion mandate for local jurisdictions in the California Integrated Waste Management Act of 1989 (AB 939, Sher, Chapter 1095, Statutes of 1989).
- To reduce organic wastes and their associated GHG emissions from California businesses, AB 1826 (Chesbro, Chapter 727, Statutes of 2014) established the Mandatory Commercial Organics Recycling (MORe) program.
- To increase recycling, AB 341 (Chesbro, Chapter 476, Statutes of 2011) established the statewide goal of 75 percent source reduction, recycling, and composting by 2020 and the Mandatory Commercial Recycling (MCR) program to reduce waste from California's businesses.
- To increase our understanding of the flow of materials in our state, AB 901 (Gordon, Chapter 746, Statutes of 2015) changed how organics, recyclable material, and solid waste flows are reported to CalRecycle.
- To reduce emissions of short-lived climate pollutants (SLCP) that are even more potent than carbon dioxide, SB 1383 (Lara, Chapter 395, Statutes of 2016), requires a 50 percent reduction in the level of the statewide disposal of organic waste by 2020 and a 75 percent reduction by 2025. It also requires not less than 20 percent of currently disposed edible food is recovered for human consumption by 2025. CalRecycle's ongoing implementation of this bill will rapidly increase the

recycling of organic materials which make up over two-thirds of the waste stream.

- To reduce the amount of packaging waste generated by state-owned facilities, the Sustainable Packaging for the State of California Act of 2018 (SB 1335, Allen, Chapter 610, Statutes of 2018) requires a food service facility located in a state-owned facility or operating on state-owned property to only use types of food service packaging approved by CalRecycle. This food service packaging must be reusable, recyclable, or compostable as determined by CalRecycle through adopted regulations.
- To reduce the number of single-use plastic bags in California, in 2016, California voters approved Proposition 67, the statewide Single-Use Carryout Bag Ban. As a result SB 270 (Padilla, Chapter 850, Statutes of 2014), the statewide Single-Use Carryout Bag Ban is in effect. Under the law, most grocery stores, retail stores with a pharmacy, convenience stores, food marts, and liquor stores can no longer provide single-use plastic carryout bags to their customers. Stores may provide a reusable grocery bag or recycled paper bag to a customer at the point of sale for a charge of at least 10 cents.
- To reduce single-use plastic straw litter in California, AB 1884 (Calderon, Chapter 576, Statutes of 2018), prohibits a full-service restaurant from providing single-use plastic straws to consumers unless requested by the consumer.
- To increase the end-of-life management of products through extended producer responsibility, California established a 24 percent recycling goal for postconsumer carpet by 2020 (AB 1158, Chu, Chapter 794, Statutes of 2017).

Evaluating Progress

Statewide Recycling Rate

Disposal and the Recycling Rate Calculations

According to CalRecycle calculations, after adjusting for population growth, California's 14.1 million residences and 1.5 million businesses generated 77.6 million tons of material in 2018. Based on disposal facility reports submitted to CalRecycle, overall disposal in 2018 equaled 46.3 million tons. This accounts for 60 percent of the total generated waste. By subtraction, that leaves an estimated 31.3 million tons of material that were recycled (through source reduction, recycling, and composting) in 2018. California's 2018 statewide recycling rate is 40 percent (Figure 1, See Appendix: List of Tables and Figures for source data).

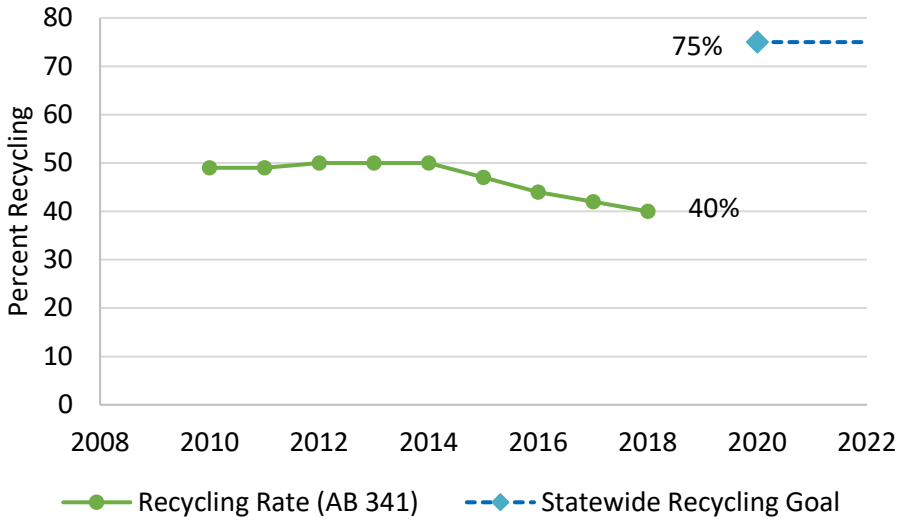

Figure 1. California's statewide recycling rate since 2010. Data from CalRecycle's 75 Percent Recycling Rate Information. Accessed 6/26/2019.

To calculate the overall disposal amount for the statewide recycling rate, CalRecycle adds landfill disposal (as used in the AB 939 jurisdiction calculations) to disposal from six disposal-related activities: alternative daily cover (ADC), alternative intermediate cover (AIC), other beneficial reuse at landfills (such as construction activities, landscaping, and erosion control), transformation, engineered municipal solid waste (EMSW), and waste tire-derived fuel.

In 2018, 39.9 million tons were landfilled either at landfills in California or in out-of-state landfills. An additional 6.3 million tons of materials went to disposal-related activities. California had a per capita overall disposal rate of 6.4 pounds per resident per day in 2018 with a population of 39.7 million (Figure 2, See Appendix: List of Tables and Figures for source data).

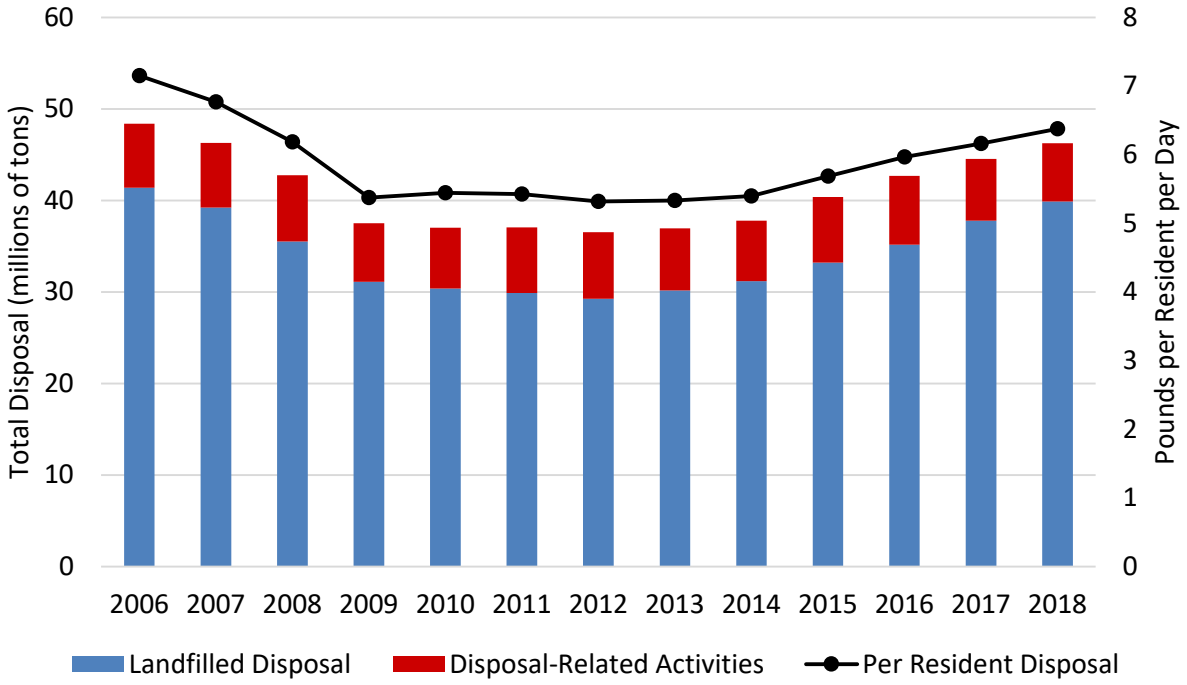

Figure 2. California's statewide per resident and total disposal (2006-2018). The left Y-axis represents millions of tons of disposal in landfills (blue), and millions of tons of disposal-related activities (red). The right Y-axis represents the number of pounds of disposal per resident per day as shown by the black line. Data is from the Disposal Reporting System (DRS) with population from the Department of Finance. Accessed 6/26/2019.

For the six types of disposal-related activities in the state, ADC was the most common, with 3.6 million tons used (Figure 3, See Appendix: List of Tables and Figures for source data). Landfills used 1.9 million tons for other beneficial reuse and 56,000 tons for AIC. Annually, transformation continued to process more than 670,000 tons of material, EMSW handled no reportable tons, and waste-tire-derived fuel managed 76,000 tons.

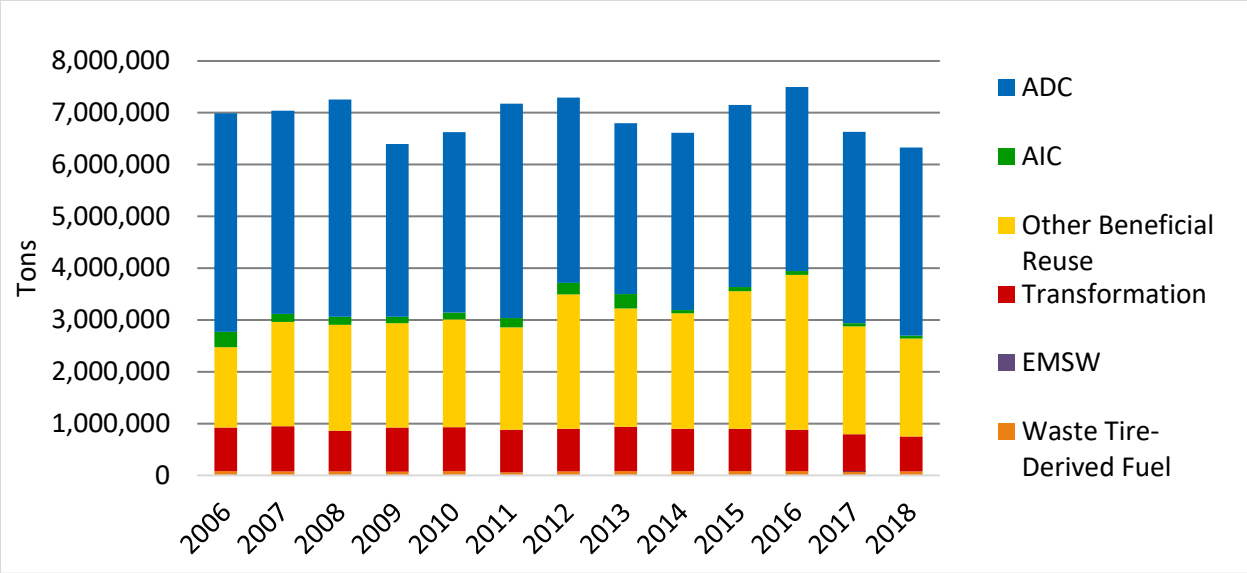

Figure 3. Disposal-related tonnage in California from 2006 to 2018. Data from DRS and waste tire derived fuel reported to CalRecycle. Accessed 6/26/2019.

As in prior years, the largest single component of ADC was green material (1.2 million tons). The prevalence of green material ADC is significant, because beginning in 2020 green material ADC will count as disposal for determining whether jurisdictions are meeting their AB 939 targets. Some jurisdictions may redirect the green material they control to other destinations or uses. However, most jurisdictions would still meet the 50 percent diversion mandate even if they do not redirect the green material and it counts as disposal.

In 2018, other beneficial reuse at landfills fell by almost 200,000 tons from 2017. Although CalRecycle requests that landfills report on the material types used for other beneficial reuse, over a third of this material was uncategorized.

In total, 46.3 million tons of material went to overall disposal. That overall disposal amounts to 6.4 pounds per resident per day, or over one ton of solid waste for every resident every year. To meet the goal in 2020, Californians would need to reduce disposal (at home and at work) to an average of 2.7 pounds per resident per day. This corresponds to less than half of a ton of waste each year. More than half of the solid waste that is currently disposed still needs to be source reduced, composted, or recycled. In addition, 2018 marks the sixth consecutive year that total disposal has increased. This increasing disposal trend is driven by several factors.

Factors Leading to Increased Disposal

Overall disposal continually grew faster than population over the past 6 years. Overall disposal went from 37 million tons to 46.3 million tons and population grew from 38

million to 39.7 million (20 percent and 4 percent, respectively). Therefore, the data indicates that factors other than population are primarily responsible for the increase in disposal. These factors include increasing disposal driven by economic factors and collapse of international markets for recyclable materials.

Economic Factors

An improving economy usually means increases in generation and disposal. Over the long-term, California has experienced robust economic growth. The GDP of California was $0.72 trillion in 1989 and rose to $3 trillion in 2018[1]. Over the same period, population increased from 28.8 million to 39.7 million. CalRecycle estimates that statewide traditional landfill disposal was 44 million tons in 1989. Through the late 1990s, landfill disposal stayed relatively flat. Then landfill disposal started to increase from a low of 34 million tons and hit a new peak of 42.2 million tons in 2006. Disposal dropped precipitously during the Great Recession (21 percent from 2007 to 2009), illustrating a strong correlation between disposal and economic growth. Disposal has increased steadily over the last six years of economic growth.

Economic indicators, like wages and construction starts, show a positive correlation with total disposal (Figure 4 and Figure 5, See Appendix: List of Tables and Figures for source data). In 2018, wages increased by about 5 percent over the previous year, while disposal increased by 5 percent from the previous year. In addition, a sustained rise in construction of single-family housing also correlated with the rise in disposal.

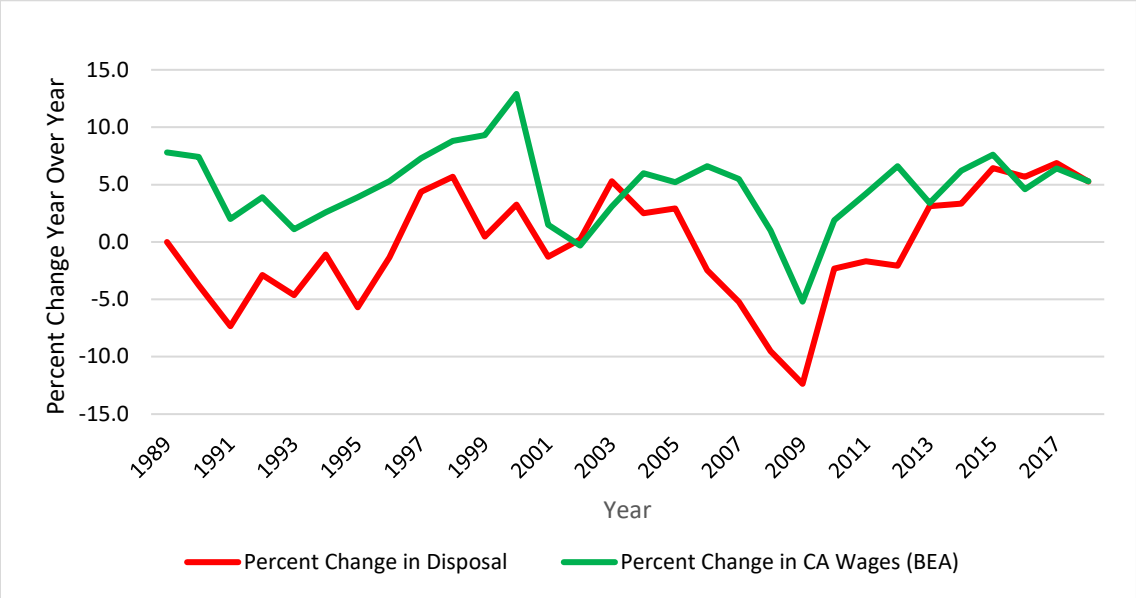

Figure 4. Percent change in disposal in California (red line) compared to the percent change in wages (green line). Data is from the federal Bureau of Economic Analysis and DRS. Accessed 6/27/2019.

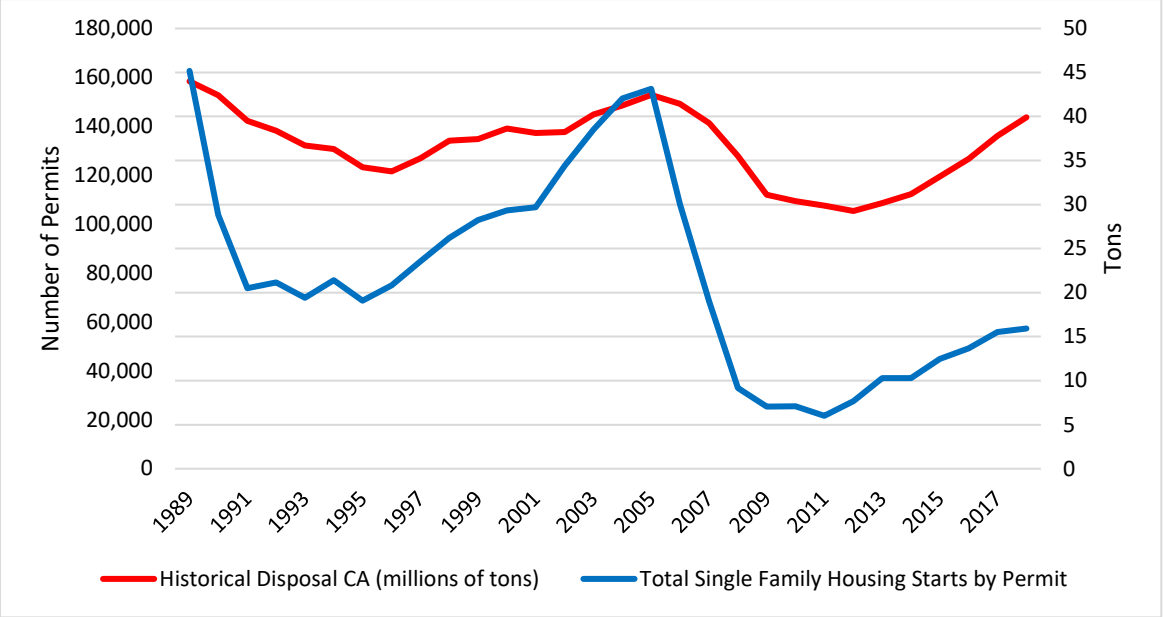

Figure 5. Change in disposal in California (red line) compared to the percent change in housing starts (blue line). Data is from Economic Forecasting, California Department of Finance, and DRS. Accessed 6/27/2019.

Cheap Disposal

In addition to the economic indicators discussed in the Economic Factors section, another factor is the relatively low tipping fee for disposal in California landfills. Tipping fees in California remain 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.

Biomass and Wildfires

In addition to economic drivers of waste generation, California faces challenges to recycling progress brought on by climate change.

For the 2018 reporting year, CalRecycle received reports from all 25 operating biomass facilities. The facilities accepted over 4.1 million tons of woody biomass, and rejected less than 350 tons of the material, primarily due to contamination and incompatibility. As shown in Figure 6, (See Appendix: List of Tables and Figures for source data) roughly one-third of the woody waste sent to biomass facilities originated from mill residue (1.4 million tons), another quarter each of the material originated from agricultural and urban

sources, and the remainder came from forest sources. Overall, the amount accepted went up from last year. Over 362,000 (or 10 percent more) tons were accepted in 2018 than in 2017.

While it increased in 2018, there has been a 17 percent decline in total material sent to biomass facilities since 2015. Multiple facility closures, changes in facility capacity, and changing energy contracts have all contributed to this long-term decline in handled material.

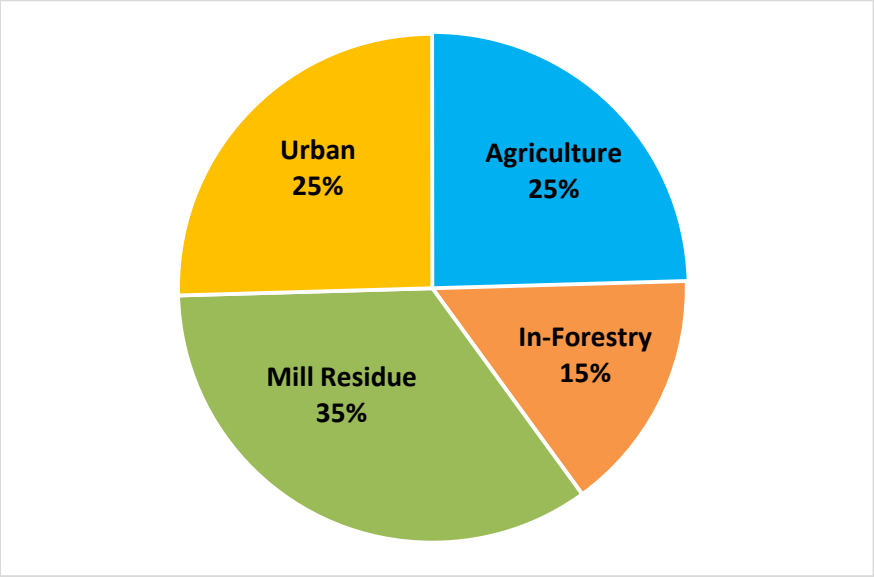

Figure 6. Source sector for more than 4.1 million tons of woody biomass sent to biomass conversion facilities in 2018. Data reported directly to CalRecycle pursuant to Public Resources Code Section 44107.

By requiring public utility companies to obtain some energy from biomass conversion facilities, SB 859 (Chapter 368, Statutes of 2016) mandates the use of dead and dying trees as an energy source and reduces the hazards associated with them. As a result, SB 859 could be responsible for about 380,000 tons (of the 640,000 tons) of "in-forestry" material converted. While this increase is a step in the right direction, it only accounts for about 0.1 percent of the potential dead tree source material.

Disasters such as forest fires, earthquakes, mudslides, and floods also increase disposal. While most disaster debris have been required to be disposed, more than 147,000 tons of concrete and more than 24,000 tons of metal have been recycled since 2014.

Current examples of disasters that generated increased waste flow include the Woolsey Fire (Los Angeles County), Woolsey/Hill Fire (Ventura County), and the Camp Fire (Butte County). According to CalFire, although there were more fires in 2017 (7,117)

than in 2018 (6,284), more acres were burned in 2018 (876,147) than in 2017 (505,956), making 2018 the most destructive on record in California. Debris removal from the Camp Fire has finished and resulted in removal of more than 3.5 million tons of debris.

Market Disruptions and Volatility

This section of the report focuses on market disruptions and volatility in recyclable materials markets on California's overall disposal and the statewide recycling rate. Please refer to CalRecycle's "Calendar Year 2018 California Exports of Recyclable Materials" report, for an in-depth view of California's export of recyclable materials.

In the past 4 years, exported recyclables have decreased in total by almost 1 million tons. In 2011, seaborne recyclables peaked with California exporting 22.3 million tons of recyclables internationally, which represented approximately 62 percent of total calculated statewide recycling. From 2011 to 2017, international exports decreased 34.5 percent to 14.6 million tons. Exports increased by 881 thousand tons in 2018 (Figure 7, See Appendix: List of Tables and Figures for source data). California's recyclables exports increased slightly, to just over 15 million tons in 2018.

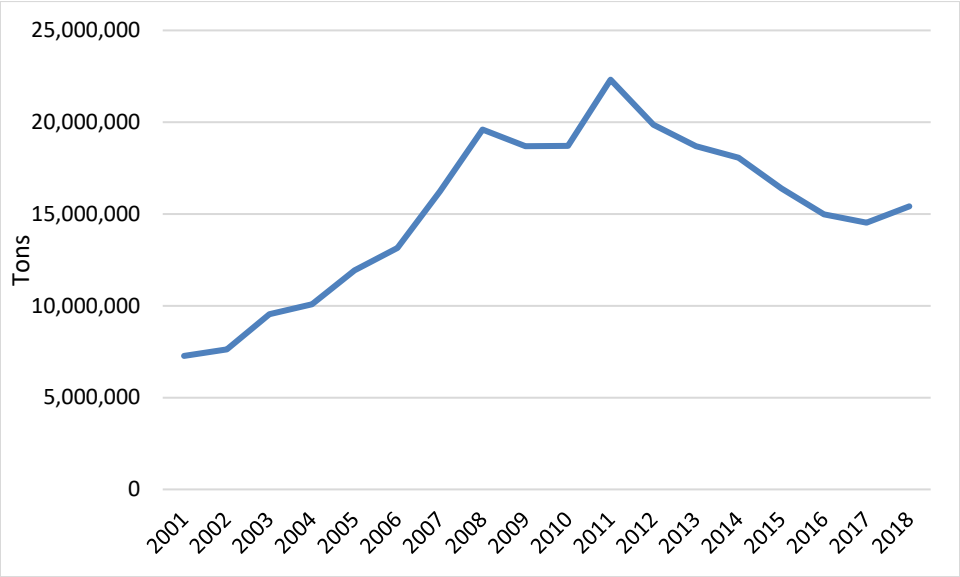

Figure 7. Internationally exported recyclables data is derived from WISERTrade.

Of the total materials generated in 2018, California exported about 14 percent (Figure 8, See Appendix: List of Tables and Figures for source data). This amount equates to almost a third of the estimated total recycling tonnage in 2018.

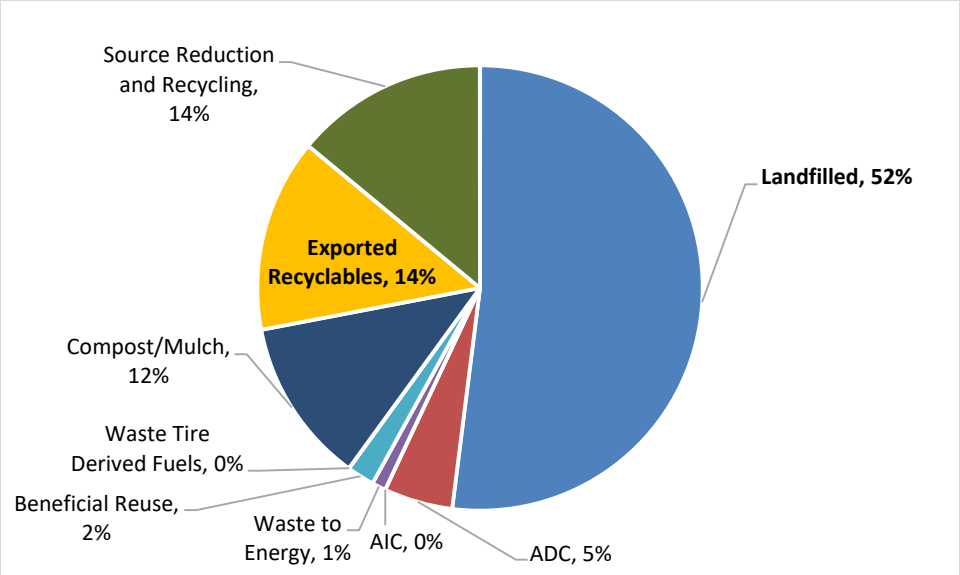

Figure 8. Estimated management of 77.6 million tons of materials generated in California in 2018. The total generation is determined from the 1990-2010 per person baseline and the 2017 population in California. Quantities of landfilled waste, waste to energy, ADC, AIC, and other beneficial reuse are derived from DRS. Waste tire derived fuel is calculated based on data reported to CalRecycle. Exported recyclables is derived from WISERTrade. Estimate for amount composted and mulched is based on published reports for chip and grind facilities and internal calculations for composting facilities.

Per WISERTrade, in 2017, California ports exported approximately 8 million tons of paper and almost 800 thousand tons of plastic to China. In 2018, California exported about 8.5 million tons of paper and about 400 thousand tons of plastic to China.

If China had banned all recyclable paper and plastic exports in 2018, the statewide recycling rate would have declined from 40 percent to 33 percent (Figure 9, See Appendix: List of Tables and Figures for source data). This assumes that there are no domestic markets to absorb the excess paper and plastic and all these materials are disposed.

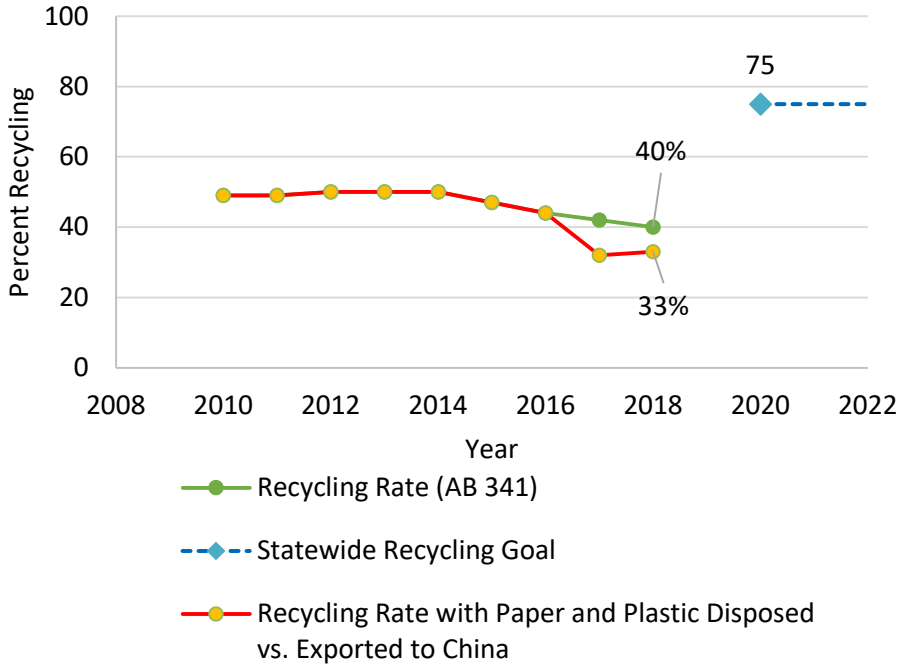

Figure 9. Recycling rate in 2018 if recyclable paper and plastic not exported to China and, instead, disposed in California. Data from WISERTrade and DRS. Accessed 6/26/2019.

Another example of market volatility is that California recyclables have increased to some countries and decreased to others in the last 3 years (Figure 10, See Appendix: List of Tables and Figures for source data). Exports to Vietnam increased by over 1 million tons from 2016 to 2018. And, the amount of exports to Malaysia, Indonesia, and India all doubled from 2017 to 2018.

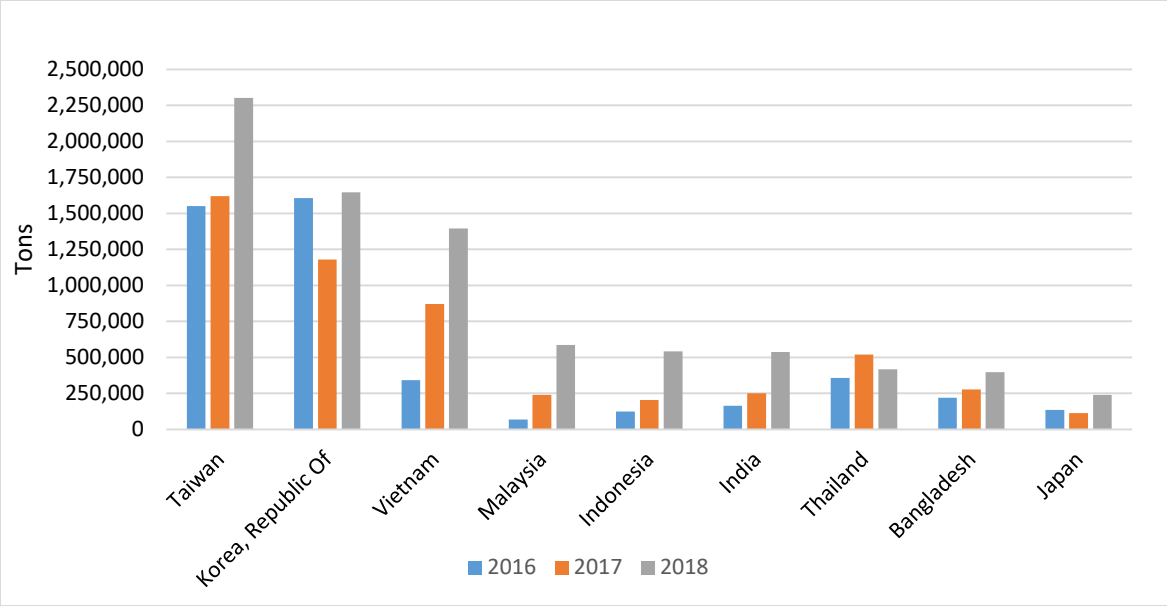

Figure 10. Increases and decreases in exports to countries beside China from 2016 to 2018. Data from WISERTrade.

In 2018, California's exported recyclables to China was surpassed by exports to other countries by almost 1.5 million tons. But, the total amount from 2016 to 2018 exported to other countries was about 6 million tons less (Figure 11, See Appendix: List of Tables and Figures for source data).

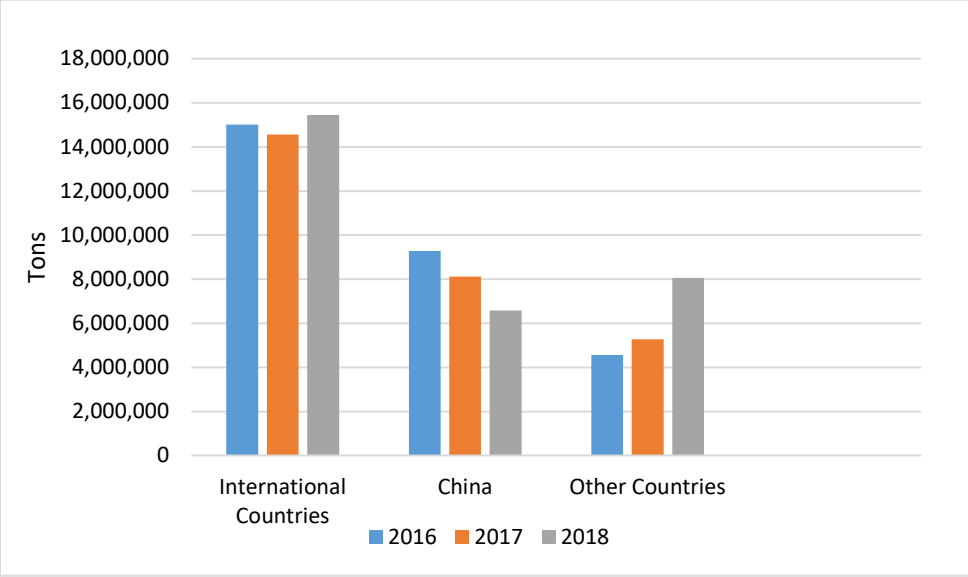

Figure 11. Exported recyclables from 2016-2018 China and Other Countries. Data from

WISERTrade. International Countries=Total All Partner Countries, which is a WISERTrade data description.

This market volatility gives Californians an opportunity to improve its domestic recycling infrastructure. Returning to older methods, such as bringing aluminum containers when shopping for dry goods and using refillable bottles for liquids, may have an impact.

Selected CalRecycle Programs

To accomplish the state's legislative goals and mandates, CalRecycle proactively oversees the management of solid waste. This oversight covers many more areas than just the statewide recycling rate, and this section highlights a few program areas.

Local Government Mandates

Local jurisdictions, along with their industry partners, direct the flow of waste and influence the ultimate destinations of materials. In 2018, twenty 20 jurisdictions were undergoing compliance evaluations by CalRecycle enforcement staff regarding the 50 percent diversion mandate of AB 939 and the mandatory commercial recycling mandate. These evaluations include six jurisdictions referred to enforcement in 2018. The status of the 20 jurisdictions on December 31, 2018 includes: the completion of eight jurisdiction compliance reviews resulting in the issuance of three compliance orders and five findings of good faith effort; six jurisdictions continuing to undergo a compliance evaluation; and six jurisdictions being monitored for implementation of their compliance order issued in a previous year.

Over the last three years (2016, 2017, 2018), CalRecycle issued a total of seven compliance orders to jurisdictions.

Beverage Container Recycling

Californians continued leading the nation by recycling more than 18.5 billion beverage containers in 2018. About 76 percent of beverage containers were recycled in 2018 at about 1,600 recycling centers and through curbside collection. The recycling rate had met the legislative goal (set by AB 2020) of 80 percent for eight years in a row. However, the recent drop to 75 and 76 percent the last two years, respectively, is likely due to a combination of factors, including the increase of 4 million beverage containers sold from 2011 to 2018, a decline in the market value of recyclables, an improvement of the overall economy, and successful enforcement measures to reduce fraud. The number of all material containers recycled increased from 16.7 to 18.5 billion from 2011 to 2018. SB 458 (Wiener, Chapter 648, Statutes of 2017) allows CalRecycle to approve of up to 5 pilot beverage container recycling programs in order to provide redemption opportunities in unserved areas.

Extended Producer Responsibility

Mattresses

Senate Bill 254 established an industry-run, statewide extended producer responsibility (EPR) program to increase the recovery and recycling of mattresses. The Mattress Recycling Council (MRC) is the certified stewardship organization responsible for developing, implementing, and administering the program, under CalRecycle's oversight. The MRC increased the number of mattresses collected from 1.3 million in 2017 to 1.4 million in 2018 (Figure 12, See Appendix: List of Tables and Figures for source data).[2] Almost 24,000 tons of materials were recycled, donated, reused, renovated, or converted to biomass in 2018. Of total mattress weight, there was an increase of 6 percent that was recycled or reused (59 percent to 65 percent), 29.5 percent was landfilled, and 5.5 percent was sent to waste-to-energy (WTE) facilities (Figure 13, See Appendix: List of Tables and Figures for source data).

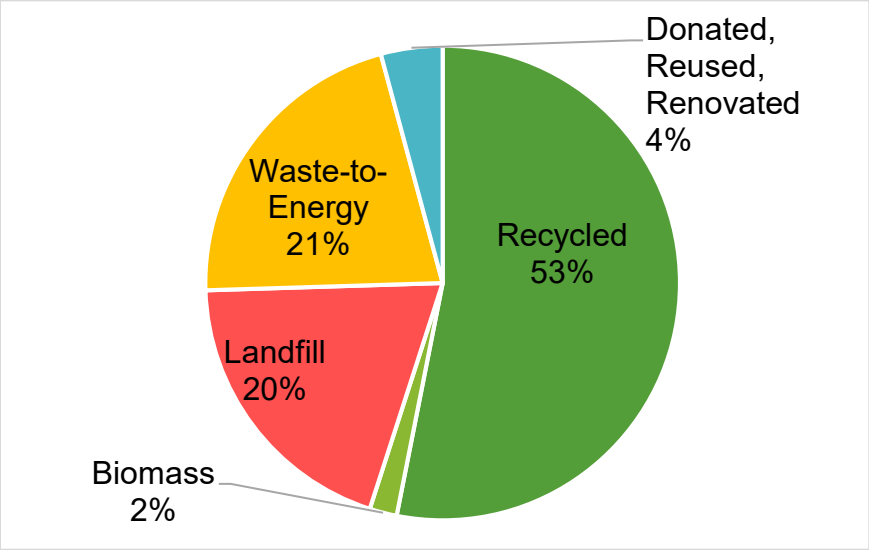

Figure 12. Mattresses disposition in 2017. Data from Mattress Recycling Council 2017 California Annual Report.

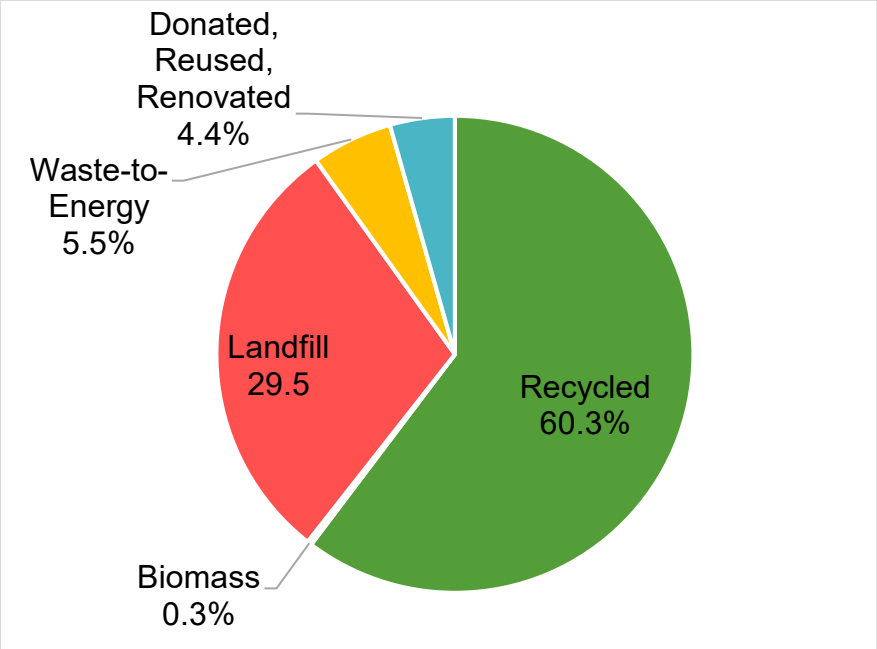

Figure 13. Mattresses disposition in 2018. Data from Mattress Recycling Council 2018 California Annual Report.

Carpet

CalRecycle also oversees the carpet recovery EPR program, mandated by AB 1158. CalRecycle's oversight of the carpet stewardship organization, Carpet America Recovery Effort (CARE), has been robust.

CARE indicated that 273 million pounds of carpet was disposed of in 2018 out of 322 million pounds of discards, with 49 million pounds of recycled output resulting in a 15 percent recycled output rate (Figure 14, See Appendix: List of Tables and Figures for source data).

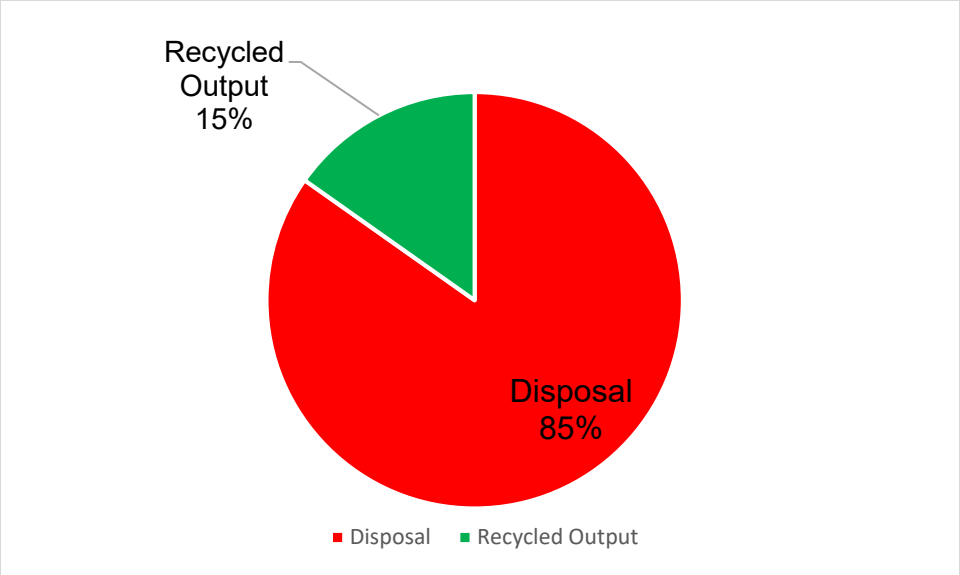

Figure 14. Carpet disposition in 2018. Data from CARE California Carpet Stewardship Program 2018 Annual Report.

Economic Support

CalRecycle has continued its successful history of administering grants, payments, and loans to help develop and maintain the recycling collection and processing infrastructure. CalRecycle annually awards almost $90 million across over 900 entities, which include local governments, private organizations, and local conservation corps, to assist in the safe and effective management of the waste stream. These awards target cleanup, enforcement, market development, and collection programs for beverage containers, tires, and used oil.

CalRecycle established the Recycled Fiber, Plastic, and Glass Grant Program in 2014 using funds from the Greenhouse Gas Reduction Fund in order to increase manufacturing of recycled-content products in California and to lower statewide greenhouse gas (GHG) emissions. In FY 2018-2019, there were five grants awarded, totaling more than $11 million to support plastic and glass recycling projects. These grants will divert over 41,000 tons of material from landfills over the grants' term and lower overall GHG emissions by expanding existing capacity or establishing new facilities in California that use California-generated postconsumer recycled plastic or glass to manufacture products.

The passage of AB 3056 (Committee on Natural Resources, Chapter 907, Statutes of 2006) created the Plastic Market Development Payment Program to develop California markets for recycled empty plastic beverage containers. Subject to the availability of

funds, CalRecycle will make payments of up to $15 million dollars for FY 2018-2019, and $10 million for the following years until 2022.

In fiscal year 2017-18, CalRecycle's Organics Grant Program (funded by the Greenhouse Gas Reduction Fund [GGRF]) selected 9 entities to receive $21 million to expand existing capacity or establish new facilities in California in order to reduce the amount of organic materials sent to landfills and lower overall GHG emissions. The 2016 Legislative Analyst's Office's report indicates that CalRecycle's GGRF grant programs are among the most cost-effective and most oversubscribed compared to other agencies statewide.[3] CalRecycle estimates the cost effectiveness is $87 per metric ton of CO2 equivalent for the Organics Grant Program. These facilities will help address California's gap in organics infrastructure by diverting approximately 430,000 tons of materials from landfills. Since the beginning of the Organics Grant Program, CalRecycle has awarded grants totaling more than $56.7 million, which will result in the diversion of 1.6 million tons over the grant terms.

CalRecycle administers the Food Waste Prevention and Rescue Grant Program, pursuant to Public Resources Code section 42999. The purpose of this competitive grant program is to lower overall GHG emissions by establishing new, or expanding existing, food waste prevention projects in California that result in reducing the amount of food being disposed in landfills through source reduction or edible food recovery programs. In FY 2017-18, CalRecycle awarded 45 grants totaling more than $14.8 million.

Through its Greenhouse Gas (GHG) Reduction and Recycling Market Development Zone (RMDZ) programs, CalRecycle combines recycling with economic development to support new and expanding businesses, create jobs, and divert waste from landfills. Both programs provide low-interest loans, technical assistance, and free product marketing to businesses. RMDZ loans are available to businesses located in one of the 40 zones throughout California that use materials from the waste stream to manufacture their products. CalRecycle approved three loans totaling almost $4.8 million in FY 2018-19.

The GHG loans promote in-state development of infrastructure to process California-generated organics and other recyclable materials into new value-added products. GHG loans are available to businesses located anywhere in California. CalRecycle approved two GHG loans totaling almost $4 million in FY 2018-2019.

Monitoring Progress

CalRecycle has been refining the mechanisms used to monitor progress and to provide the foundation for science-based, data-driven policy and programmatic decisions. Two of these mechanisms are the Recycling and Disposal Reporting System and waste characterization studies.

Recycling and Disposal Reporting System

Under the Disposal Reporting System (DRS), the data collected painted an incomplete picture of the flow of materials. Because data collection in DRS was limited to disposal information from solid waste facilities, there were gaps in information from unregulated facilities. CalRecycle needs better information regarding California's recycling infrastructure to monitor recycling progress and increase the state's recycling rate. Markets have become more dynamic, so reporting is needed on a wider range of materials and activities than before.

As a result, AB 901, and the regulations to implement it, authorized a reporting structure designed to provide that information. Since AB 901's passage in 2015, CalRecycle and stakeholders worked together over three years of informal workshops and formal rulemaking public comment periods to develop a reasonable and functional set of regulations and reporting system.

The new Recycling Disposal Reporting System (RDRS) will fill in many of the blanks that existed in DRS, such as material flows, levels of processing, and the fate of materials. Analysis of the data will increase the department's ability to target state resources to incentivize and enhance the in-state recycling infrastructure.

RDRS will provide a significant improvement in the quantity and quality of information needed to monitor progress toward the state's goals and to make the changes needed to move forward.

Waste Characterization Studies

Waste characterization means finding out how much paper, glass, food waste, and so on is discarded in the waste stream. Waste characterization information helps in planning how to reduce waste, set up recycling programs, and conserve money and resources.

CalRecycle gathers information, via contractors, on the types and amounts of specific materials being disposed. Characterization studies can look at the overall statewide waste stream, target a source sector such as construction and demolition waste, or a grouping of similar business waste generators. CalRecycle conducts these studies periodically, with studies done in 1999, 2004, 2008, 2014, and most recently in 2018. The 2018 study included three major components.

First, the study collected data on the composition of the overall statewide waste stream. The contractor collected and sorted samples at 33 solid waste facilities in 5 regions over 41 days spread over several months. To determine the composition of three different origin types, the study included the physical sorting of 282 commercial samples, 122 single-family residential samples, and 42 self-haul samples. An additional 40 samples were collected and sorted at multi-family residences. The contractor physically sorted these 486 samples into 94 material types. To further characterize self-haul disposal, the contractor conducted 410 visual assessments. To determine the contributions from the three different origin types, field crews surveyed over 5,200 vehicles as they entered the facilities.

Second, the study collected data on food waste disposal by five business types. The contractor collected 129 samples at 122 business sites and physically sorted the samples into 8 detailed food categories.

The third part of the study was a preliminary evaluation of residuals from material recovery facilities (MRFs). The contractor collected and physically sorted 201 samples of MRF residuals at 9 facilities into 94 material types to characterize residuals from 4 different processing streams (municipal solid waste, clean recyclables, organics, and construction and demolition debris).

CalRecycle staff are currently analyzing the results of the 2018 study and will release information in the coming months. These waste characterization studies provide the foundational data needed to assess progress and to set new policy and program directions.

CalRecycle also maintains a webpage with waste characterization tools designed for solid waste planning. Local government planners, haulers, and recyclers can use the tools to estimate the amount of certain materials in their waste stream. Businesses can use the tools to understand what is in their waste stream, a first step in devising ways to reduce waste and cut disposal costs. The waste characterization tools currently use data from the 2014 characterization study but will be updated soon with the 2018 study results.

Conclusion

California continues to be a leader in recycling and resource conservation, but the state's 2018 recycling rate of 40 percent means we will not meet the 75 percent recycling goal in 2020. CalRecycle takes its environmental stewardship role seriously and is pursuing a variety of ways to build on our suite of successful programs and pivot to meet the challenges of increasing disposal coupled with volatile global markets and inadequate infrastructure for recyclables and organics.

By implementing a strong program for SB 1383, CalRecycle is setting the framework for a massive shift in how organics are handled in California. The state must also address packaging and find ways to incentivize what we want more of, namely stable materials markets and adequate in-state infrastructure. Source reduction must also play a major, efficient role in reducing the amount of waste created. In addition, CalRecycle will be implementing a $15.9 million public education campaign. The department will engage stakeholders to identify workable strategies to match source reduction's implementation with its potential. CalRecycle and its partners in local government and industry are making the necessary adjustments to move forward, increase recycling, reduce disposal, and conserve resources to create a healthier environment for California.

The department will continue to monitor progress, through a robust mix of reporting and research, and use the information gained to make necessary course corrections and innovations based on sound science to protect California's resources, climate, and communities.

Abbreviations and Acronyms

AB – Assembly Bill

ADC – Alternative Daily Cover

AIC – Alternative Intermediate Cover

CalRecycle – California Department of Resources Recycling and Recovery

CARE – Carpet America Recovery Effort

DRS – Disposal Reporting System

EPR – Extended Producer Responsibility

EMSW – Engineered Municipal Solid Waste

GDP – Gross Domestic Product

GHG – Greenhouse Gas

MCR – Mandatory Commercial Recycling

MORe – Mandatory Commercial Organics Recycling

MRC – Mattress Recycling Council

MRF – material recovery facility

MSW – Municipal Solid Waste

RDRS – Recycling and Disposal Reporting System

SB – Senate Bill

SLCP – Short-Lived Climate Pollutants

WTE – Waste-to-energy

Glossary of Terms

Alternative daily cover (ADC) and Alternative intermediate cover (AIC): The use of materials to cover disposed waste in a landfill cell at the end of the landfill operating day (daily cover) or at some other interval (intermediate cover) to control odors, fire, vectors, litter, and scavenging.

Biomass conversion: The process of using controlled combustion of specified types of organic materials (essentially wood, lawn, or crop residue) to produce electricity.

Disposal Reporting System (DRS): The retiring system used to track disposal information in California.

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

Inerts: Waste that includes concrete, asphalt, asphalt roofing, aggregate, brick, rubble, and soil.

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.

Municipal solid waste (MSW): 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.

Organic materials management: Processes that grind, chip, and/or decompose organic wastes in a controlled process for intermediate or final use as a landscape material or soil amendment.

Other beneficial reuse: The use of a waste byproduct or other low-value material for a productive use, other than ADC/AIC, at a landfill within regulatory guidelines.

Per-capita disposal: A numeric indicator of reported disposal divided by the population (residents) specific to a county, region, or state.

Recycling and Disposal Reporting System (RDRS): The new system used to track recycling and disposal information. For more information go to: Recycling and Disposal Reporting System Information

Residue: Unusable waste byproducts remaining after recyclables are processed.

Tipping fee: The amount of money per ton of waste charged at the gate of a landfill.

Transfer station: A facility that receives, temporarily stores, and ships unprocessed waste and recyclables.

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

Waste tire-derived fuel: Waste tires used as fuel in a power plant or cement kiln.

Waste-to-energy: Incineration process in which solid waste is converted into thermal energy to generate steam that drives turbines for electricity generators.

Appendix: List of Tables and Figures

Figure 1: California's statewide recycling rate since 2010

This figure displays the percent recycling rate compared to the percent recycling goal from 2010-2018.

Year	Recycling Rate	Rate Goal
2010	49	-
2011	49	75
2012	50	75
2013	50	75
2014	50	75
2015	47	75
2016	44	75
2017	42	75
2018	40	75

Figure 2. California's statewide per resident and total disposal.

This figure juxtaposes landfilled disposal, disposal-related activities, and per resident disposal from 2006-2018.

Year	Landfilled Disposal	Disposal-Related Activities	Per Resident Disposal
2006	41,418,514	7.0	7.2
2007	39,254,962	7.0	6.8
2008	35,519,205	7.3	6.2
2009	31,128,136	6.4	5.4
2010	30,403,163	6.6	5.4
2011	29,890,010	7.2	5.4

Year	Landfilled Disposal	Disposal-Related Activities	Per Resident Disposal
2012	29,268,861	7.3	5.3
2013	30,182,493	6.8	5.3
2014	31,195,061	6.6	5.4
2015	33,241,828	7.2	5.7
2016	35,197,922	7.5	6.0
2017	37,810,918	6.7	6.2
2018	39,918,872	6.3	6.4

Figure 3. Disposal-related tonnage in California.

This figure shows the amounts of disposal-related materials disposed from 2006-2018.

Year	Waste Tire-Derived Fuel	EMSW	Transformation	Other Beneficial Reuse	AIC	ADC
2006	83,000		840,624	1,550,909	295,665	4,219,992
2007	77,000		870,840	2,015,163	156,770	3,922,060
2008	75,000		789,853	2,044,435	154,097	4,192,731
2009	70,000		855,826	2,009,931	124,633	3,339,609
2010	84,000		848,224	2,082,567	125,331	3,487,779
2011	62,000		821,729	1,976,567	178,424	4,137,698
2012	77,000		819,559	2,599,672	223,003	3,572,987
2013	82,000		855,592	2,287,213	273,361	3,301,578
2014	84,000		817,613	2,228,942	60,776	3,420,540
2015	85,721		812,403	2,655,301	80,175	3,516,961
2016	82,436		799,789	2,986,210	77,503	3,552,212

Year	Waste Tire-Derived Fuel	EMSW	Transformation	Other Beneficial Reuse	AIC	ADC
2017	75,989	91	717,749	2,082,675	61,185	3,691,523
2018	75,989		676,658	1,890,284	56,034	3,633,057

Figure 4. Percent change in disposal in California (red line) compared to the percent change in wages (green line).

This figure

Year	Percent Change in Disposal	Percent Change in CA Wages (BEA)
1989		7.8
1990	-3.8	7.4
1991	-7.3	2.0
1992	-2.9	3.9
1993	-4.6	1.1
1994	-1.1	2.6
1995	-5.7	3.9
1996	-1.3	5.3
1997	4.4	7.3
1998	5.7	8.8
1999	0.5	9.3
2000	3.3	12.9
2001	-1.3	1.5
2002	0.2	-0.3

Year	Percent Change in Disposal	Percent Change in CA Wages (BEA)
2003	5.3	3.1
2004	2.5	6.0
2005	2.9	5.2
2006	-2.5	6.6
2007	-5.2	5.5
2008	-9.5	1.0
2009	-12.4	-5.2
2010	-2.3	1.9
2011	-1.7	4.2
2012	-2.1	6.6
2013	3.1	3.4
2014	3.4	6.2
2015	6.4	7.6
2016	5.7	4.6
2017	6.9	6.4
2018	5.3	5.3

Figure 5. Change in disposal in California compared to the percent change in housing starts.

This figure shows the relationship between historical disposal and single family housing starts.

Year	Historical Disposal CA (millions of tons)	Total Single Family Housing Starts by Permit
1989	44.0	162,651
1990	42.4	103,819
1991	39.5	73,809
1992	38.4	76,187
1993	36.7	69,901
1994	36.3	77,115
1995	34.2	68,689
1996	33.8	74,923
1997	35.2	84,780
1998	37.2	94,298
1999	37.4	101,711
2000	38.6	105,595
2001	38.1	106,902
2002	38.2	123,865
2003	40.2	138,762
2004	41.3	151,417
2005	42.5	155,322
2006	41.4	108,021
2007	39.3	68,409
2008	35.5	33,050
2009	31.1	25,454
2010	30.4	25,526
2011	29.9	21,631
2012	29.3	27,560
2013	30.2	36,991
2014	31.2	37,091

Year	Historical Disposal CA (millions of tons)	Total Single Family Housing Starts by Permit
2015	33.2	44,896
2016	35.2	49,208
2017	37.8	55,827
2018	39.9	57,346

Figure 6. Source sector for more than 4.1 million tons of woody biomass sent to biomass conversion facilities.

This figure displays the amount of material sources accepted for biomass conversion in 2018.

Material Sources	Tons Accepted
Agriculture	1,017,574
In-Forestry	640,445
Mill Residue	1,432,021
Urban	1,055,465
Total	4,145,505

Figure 7. Internationally exported recyclables data is derived from WISERTrade.

This figure shows the amount of tons of recyclables exported from California ports in years 2001-2018.

Year	Recyclables
2001	7,271,304
2002	7,630,840
2003	9,549,578
2004	10,087,098
2005	11,938,685
2006	13,153,708
2007	16,243,610
2008	19,598,613

Year	Recyclables
2009	18,687,562
2010	18,706,811
2011	22,317,156
2012	19,860,525
2013	18,685,245
2014	18,059,733
2015	16,394,429
2016	14,976,317
2017	14,536,153
2018	15,417,931

Figure 8. Estimated management of 77.6 million tons of waste generated in California.

This figure shows waste generation management in 2018.

Waste Management Categories	Percent
Landfilled	52%
ADC	5%
AIC	0%
Waste to Energy	1%
Beneficial Reuse	2%
Waste Tire Derived Fuels	0%
Compost/Mulch	12%
Exported Recyclables	14%
Source Reduction and Recycling	14%
Estimated Generation	100%

Figure 9. Recycling rate in 2018 if recyclable paper and plastic not exported to China and, instead, disposed in CA.

This figure shows the decrease in the recycling rate in 2017 and 2018 if paper and plastic not exported to China.

Year	Recycling Rate (AB 341)	Recycling Rate with Paper and Plastic Disposed vs. Exported to China
2010	49	-
2011	49	-
2012	50	-
2013	50	-
2014	50	-
2015	47	-
2016	44	-
2017	42	32
2018	40	33

Figure 10. Increases and decreases in exports to countries beside China.

This figure shows how the amount of tons of exports to other countries have decreased or increased from 2016-2018.

Country	2016	2017	2018
Taiwan	1,551,196	1,619,378	2,301,146
Korea, Republic Of	1,607,300	1,178,723	1,645,392
Vietnam	340,523	869,907	1,394,504
Malaysia	67,926	239,454	585,216
Indonesia	124,132	204,771	542,429
India	162,760	251,111	536,479
Thailand	358,113	518,609	416,792
Bangladesh	219,257	276,411	396,620
Japan	134,147	112,253	240,277

Figure 11. Exported recyclables to China and Other Countries.

This figure shows the amount of tons of recyclables exported to all international countries, China alone, and all other international countries 2016-2018.

Country	2016	2017	2018
International Countries	15,004,616	14,563,621	15,447,065
China	9,272,618	8,120,718	6,585,473
Other Countries	4,565,355	5,270,616	8,058,855

Figure 12. Mattresses disposition in 2017. Data from Mattress Recycling Council 2017 California Annual Report.

This figure shows the disposition of mattress materials in 2017.

Disposition of Materials	Percent
Recycled	53.11
Biomass	1.86
Landfill	19.54
Waste-to-Energy	21.29
Donated, Reused, Renovated	4.2

Figure 13. Mattresses disposition. Data from Mattress Recycling Council 2018 California Annual Report.

This figure shows the disposition of mattress materials in 2018.

Disposition of Materials	Percent
Recycled	60.3
Biomass	0.3
Landfill	29.5
Waste-to-Energy	5.5
Donated, Reused, Renovated	4.4

Figure 14. Carpet disposition.

This figure shows the disposition of carpet in 2018.

2018	Million Tons
Disposal	0.14
Recycled Output	0.02

Resources

[1] U.S Department of Commerce. Bureau of Economic Analysis. GDP by state. Accessed 8/7/18.

[2] Mattress Recycling Council, California Annual Report, 2018

[3] Taylor. “Cap-and-Trade Revenues: Strategies to Promote Legislative Priorities.” Legislative Analyst’s Office, January 21, 2016.