

2016

# Turning Waste into Compost in Napa, California

Liana D. Solis  
*Pomona College*

---

## Recommended Citation

Solis, Liana D., "Turning Waste into Compost in Napa, California" (2016). *Pomona Senior Theses*. Paper 147.  
[http://scholarship.claremont.edu/pomona\\_theses/147](http://scholarship.claremont.edu/pomona_theses/147)

This Open Access Senior Thesis is brought to you for free and open access by the Pomona Student Scholarship at Scholarship @ Claremont. It has been accepted for inclusion in Pomona Senior Theses by an authorized administrator of Scholarship @ Claremont. For more information, please contact [scholarship@cuc.claremont.edu](mailto:scholarship@cuc.claremont.edu).

# Turning Waste into Compost in Napa, California

Liana Solis

In partial fulfillment of a Bachelor of Arts Degree in Environmental Analysis,  
2015-16 academic year, Pomona College, Claremont, California

Readers:

Char Miller

Marc Los Huertos

## Acknowledgements

I would like to thank Professor Char Miller for being a fantastic advisor and reader who was always able to provide speedy feedback and support. I would also like to express my gratitude to my second reader, Professor Marc Los Huertos for all of his advice and help.

I also want to acknowledge the huge contributions of the City of Napa Recycling Division and NRWS for taking time to talk with me about composting and all the waste services that are provided. I would like to especially thank Kevin Miller and Chris Shoop for letting me get involved with the City of Napa Recycling Division and providing me with much information. I also could not have done my thesis without the help of Stephanie Turnipseed, who not only answered all the questions I had, but would track down the documents and people that would further answer my questions. I would also like to thank the other city employees that helped me in one way or another, particularly TJ Markel, Rafa Diaz, and Lena Kara. Thanks are also due to Tim Dewey-Mattia, of NRWS, for allowing me to interview him and answering all my e-mails of questions throughout the past six months.

I could not have done this without the help of my family and friends. Thank you Mom, Mike, Dad, Grandma, and Grandpa for supporting me so much while I worked on my thesis. I am also grateful for Savannah Rose, who offered encouragement over our weekly chai drinking and theses writing sessions. Thank you Andrea Sartorius, for always being there through both the stressful and fun times. Finally, a huge thanks to Jon Stover for never letting me give up and always encouraging me to move forward in addition to his patience while I ranted about garbage for the last few months.

Table of Contents:

Preface ..... 3

Introduction to Napa ..... 4

What is the NRWS?..... 6

What goes into each cart? ..... 11

Why does Napa care about preventing things from ending up in landfill? ..... 11

How did Napa begin composting? ..... 16

Pilot Programs and Public Outreach ..... 18

Educating Napa ..... 22

The transition from a pilot program to a complete program ..... 26

Fate of the composted food ..... 34

Compost and Surrounding Communities ..... 36

Can Napa’s Program be applied to other locations? ..... 46

What are Napa’s next steps? ..... 54

Conclusion ..... 58

Bibliography ..... 60

Preface:

A few weeks before I entered my freshman year at Pomona College, my family moved from Fairfield, California to Napa, California. I had never spent any time in the largest city in Napa County located just north of San Francisco and hardly knew anything about my new home. When I returned during my summer break following my first year at Pomona College, I decided to volunteer with the City of Napa's Recycling Division. I had not yet selected my major in Environmental Analysis, but was excited to learn about recycling because I had never paid much attention to what happened to my waste after it was put out to the curb as trash. I soon learned that the Recycling Division was also known as the Materials Diversion Division, as recycling is only a fraction of the story when it comes to people's waste.

My last project as a volunteer with the Recycling Division was to pass out three-gallon kitchen composting pails to a pilot neighborhood. I had never heard of a curbside composting program before my boss explained what I would be doing that day. I was amazed that I had never questioned the previous lack of composting at home because composting leftover food had quickly become a habit when I ate meals in the dining halls at Pomona. My two future coworkers and I spent the next few days walking around the neighborhood carrying stacks of kitchen pails to doorsteps. Later that summer I was hired as a Recycling Assistant and learned in greater detail what went on behind the scenes to create a city-wide curbside composting program and was able to see how one city's efforts to divert waste could lead to a more sustainable environment and act as an example to other cities.

## Introduction to Napa:

Napa has embarked on a composting program that is not unrelated to the county's remarkable impact on food culture in the United States. Composting benefits the county as well as provide further benefits that result in making Napa a more sustainable community. Although Napa's composting program has been created to accommodate the local waste diversion goals, with few changes, its program has potential to be adapted beyond this region. The City of Napa is located in Napa County, California and is part of the San Francisco Bay Area. Within its limits, the city covers 17.84 square miles, a small portion of the county's 748.36 square miles; (U.S. Census Bureau 2015b; U.S. Census Bureau 2015a) 80,011 constitutes a majority of the 141,667 people living in Napa County (U.S. Census Bureau 2015b; U.S. Census Bureau 2015a). Napa is not a racially diverse city, with only two different races accounting for the majority (94.7%) of the population. More than half of the population, about 57.2%, are white alone, while 37.6% of the population is Hispanic or Latino. The city is a fairly good representation of the county, which has a population that is 54.5% white alone and 33.4% Hispanic or Latino (U.S. Census Bureau 2015a). Over a third of the population in Napa, or about 39.5% in the city and 35.0% in the county, speak a language other than English at home, most commonly accounted for by Spanish (U.S. Census Bureau 2015b; U.S. Census Bureau 2015a).

There is a large Hispanic or Latino population in Napa because of all the agricultural jobs such as pruning, suckering, leaf removal, shoot positioning, and hand harvesting wine grapes that are available in the area. In Napa County, about 75 percent of the grapes are handpicked, these hand picked grapes are usually used for high-end wines; cheaper wine tend to be made from grapes that have been mechanically picked (Martin 2000). Napa County has been an

agricultural community since the 1820s, when it was still a territory of Mexico. After the Mexican-American War, the county was able to expand its markets allowing for agricultural production to increase. Napa County's main agricultural production throughout the last two centuries have been cattle, cherries, prunes, walnuts, pears, barley, and grapes (Clark 2014). Napa County's main crop is now wine grapes, which have been a prominent commodity since the early 1900s (County of Napa 2009; Clark 2014). In the early 1900s, there were approximately 140 wineries in Napa County. Since then, the wine industry has thrived and there are now over 1,084 wineries according to the Wines Vines Analytics database (Franson 2015; Clark 2014). In 2014, out of the \$720,831,700 of gross value from all agricultural production, the wine grape crops accounted for \$714,810,900, or 99.16% of the total (Clark 2015).

Napa's wineries also bring tourists to the region from all over the world, attracting 3.3 million visitors in 2014. In a survey conducted by Destination Analysts, it was found that the three favorite aspects of tourists visiting the Napa Valley was its wineries, beautiful landscape, and the weather (Destination Analysts, Inc. 2015). The weather is also crucial to the agriculture in the Napa Valley. Napa Valley has a Mediterranean climate, meaning it is hot and dry during the summer, but cool and rainy during the winter. While this climate is especially important for wine grapes, since vines are dormant when it rains and require sun to produce grapes, this weather allows for it and many other crops to thrive all year long (Boyd 2004; Goldsmith 2010). While wine grapes may not be of any bother to the average Napan, a term for a person that lives in Napa, the plants growing in their own yards are. With plants that grow all year round, they also have to be maintained which produces yardwaste 12 months a year. This prompts Napa Recycling and Waste Services (NRWS) to provide brown compost carts, in addition to gray

landfill and blue recycling carts, to their customers 52 weeks a year (Dewey-Mattia and Turnipseed 2015).

### What is the NRWS?

NRWS is the company that the City of Napa has contracted with to handle the community's waste. In 2004, the City of Napa purchased the Materials Diversion Facility (MDF) (Miller 2014b). The following year, in 2005, NRWS entered into a ten-year contract with the city to become the city's contracted operator of the MDF, with the option of four one-year extensions. In 2014, the city granted one of these year-long extensions allowing NRWS to continue with its current contract through the end of 2016 (Wetzstein 2014). The NRWS is the part of the main part of the company that services the City of Napa and the part of the company that services the unincorporated South Napa County is called the Napa County Recycling and Waste Services (NCRWS) (NRWS 2013a). In the current contract between NRWS and the city of Napa, NRWS must divert a minimum of 50% of the waste from the landfill. Since 2005, NRWS has more than doubled the amount of waste that was getting diverted from the landfill and in 2013 reached a diversion rate of 65% (County of Napa 2009; Miller 2013; Wetzstein 2014).

NRWS has reached this diversion rate through a variety of ways. In 2005, it introduced single-stream recycling: this means that Napers can throw anything recyclable into their blue bin without having to sort it themselves (Courtney 2005). After the introduction of single-stream recycling, NRWS saw a 25% increase in the recycling rate during the first year it was implemented in Napa (NRWS 2013a). NRWS accepts paper, cardboard, rigid plastic of all



numbers and colors, metal, and glass (NRWS 2013i). In April 2013, NRWS started a program called Recycle More. This program lets anyone in the City of Napa to schedule an appointment, either online or by phone, and have NRWS pick up their textiles, electronics, appliances, cooking oil, or oversized metal items from their home for free (Hollis 2013). In addition, NRWS customers have an incentive to reduce their solid waste cart size because they can receive significant savings on their garbage bill by downsizing to a smaller cart. NRWS customers also get up to two brown compost carts and up to two recycling carts for free when they pay for solid waste service. NCRWS customers get the same benefits, but can get up to four compost cats for free (NRWS 2013e).

The savings from downgrading cart sizes is significant for most households and businesses. A residential customer in Napa could save \$256.08 each year if they switched from a 95 gallon trash cart to a 65 gallon cart. A switch from a 95 gallon cart to a 65 gallon cart would require that approximately 30% of the waste they were putting in the landfill card was instead being sorted and placed in their recycling or compost cart. Switching from a 65 gallon cart to a 35 gallon cart could save \$165.72 per year, and changing from a 35 gallon cart to the smallest cart, 20 gallons, they could save \$62.76 per year. NRWS customers can upsize their recycling carts or add an extra cart or add an extra brown cart if up to a maximum of two recycling carts and two brown carts any time they wish for no charge (NRWS 2015a). While the county residents will not see such a dramatic savings by switching to a smaller cart size, their savings would not be negligible. If a county resident could downsize from a 96 gallon cart to a 65 gallon cart, they could save \$160.68 each year. If a customer with a 65 gallon cart could reduce their service to a 35 gallon cart, they could save \$108.00 each year. NCRWS customers could also

upsized and add up to two recycling carts for free as well as add up to four brown carts (NCRWS 2014; NRWS 2013e).

Commercial customers see the most savings when they either downgrade to a smaller bin or reduce their service by one pickup per week. If a business has a 6 yard bin and they are able to change to a 4 yard bin, they can save \$4,500.60 per year. If a business has a 4 yard bin and can reduce their service to a 3 yard bin, they would see a savings of \$2,117.52 each year. Downsizing from a 3 yard bin to a 2 yard bin would result in a \$2,257.32 per year. Commercial customers may also increase their recycling for free by either upsizing their bin or adding recycling carts. While NRWS cannot offer food scrap composting to commercial residents for free, commercial customers can add this service starting at \$40.72 each month where \$40.72 is added per 65 gallon cart per pickup each week. This is only 75% of the price that a cart for solid waste of the same volume would cost. With this 25% savings, if a business wanted to start composting their food scraps, they would easily be able to cover the costs of their new food scrap carts by downgrading their trash pickup and adding food carts (City of Napa 2015).

**Figure 1**  
NRWS Residential Rates:

CART SIZE	MONTHLY RATE
20 gallon	\$20.63
35 gallon	\$25.86
65 gallon	\$39.67
95 gallon	\$61.01

(NRWS 2015a)

**Figure 2**  
NCRWS Residential Rates:

CART SIZE	MONTHLY RATE
35 gallon	\$17.76
65 gallon	\$26.76
96 gallon	\$40.15

(NCRWS 2014)

**Figure 3**

NRWS Commercial and Multifamily Rates:

**MONTHLY RATES FOR BINS PROVIDED BY  
NAPA RECYCLING AND WASTE SERVICES, LLC TO CUSTOMERS**

Bin Size	CURRENT RATES					
	1x/wk	2x/wk	3x/wk	4x/wk	5x/wk	6x/wk
One 1.5 yd.	\$313.78	\$657.20	\$978.74	\$1,312.06	\$1,672.34	\$2,086.55
Two 1.5 yd.	\$668.67	\$1,419.54	\$2,114.08	\$2,834.03	\$3,612.24	\$4,506.93
Three 1.5 yd.	\$993.73	\$2,109.59	\$3,141.76	\$4,211.69	\$5,368.17	\$6,697.80
Four 1.5 yd.	\$1,337.36	\$2,839.09	\$4,228.14	\$5,668.06	\$7,224.45	\$9,013.85
One 2 yd.	\$403.39	\$859.13	\$1,287.53	\$1,731.61	\$2,211.49	\$2,762.92
Two 2 yd.	\$859.25	\$1,855.74	\$2,781.04	\$3,740.26	\$4,776.81	\$5,967.91
Three 2 yd.	\$1,241.14	\$2,680.48	\$4,017.08	\$5,402.63	\$6,899.80	\$8,620.31
Four 2 yd.	\$1,670.75	\$3,608.35	\$5,407.60	\$7,272.75	\$9,288.20	\$11,604.27
One 3 yd.	\$591.50	\$1,282.75	\$1,925.21	\$2,591.24	\$3,310.86	\$4,137.73
Two 3 yd.	\$1,218.50	\$2,642.46	\$3,965.97	\$5,337.94	\$6,820.38	\$8,523.75
Three 3 yd.	\$1,845.49	\$4,002.18	\$6,006.70	\$8,084.66	\$10,329.89	\$12,909.75
One 4 yd.	\$767.96	\$1,686.62	\$2,542.80	\$3,430.34	\$4,389.17	\$5,490.51
Two 4 yd.	\$1,581.98	\$3,474.45	\$5,238.17	\$7,066.52	\$9,041.66	\$11,310.46
Three 4 yd.	\$2,396.01	\$5,262.25	\$7,933.53	\$10,702.68	\$13,694.18	\$17,130.39
One 6 yd.	\$1,143.01	\$2,519.73	\$3,803.79	\$5,134.92	\$6,572.85	\$8,224.39
Two 6 yd.	\$2,354.62	\$5,190.65	\$7,835.82	\$10,577.92	\$13,540.07	\$16,942.23

**Figure 4**

**COMMERCIAL AND MULTIFAMILY SOLID WASTE CART RATES**

	<b>1X/WEEK</b>	<b>2X/WEEK</b>	<b>3X/WEEK</b>	<b>4X/WEEK</b>	<b>5X/WEEK</b>	<b>6X/WEEK</b>
35 gallon	\$27.09	\$54.18	\$81.28	\$108.37	\$135.46	\$162.55
65 gallon	\$54.29	\$108.58	\$162.87	\$217.18	\$271.47	\$325.77
95 gallon	\$81.31	\$162.62	\$243.94	\$325.27	\$406.56	\$487.89

(City of Napa 2015)

NRWS services schools, residential, multifamily, and commercial units. NRWS, the City of Napa, the county of Napa, and the Napa Valley Unified School District have an agreement for the schools to receive an 80% discount off of commercial rates based on the agreement that they will maintain a 50% diversion rate district-wide. This agreement may be updated for the district to maintain a 75% diversion rate to match the city's diversion goal but has not been updated yet as of late 2015 (Turnipseed 2015; City of Napa 2004). Residential units that are serviced by NRWS pay a monthly rate depending on the size of their solid waste cart.

Residential customers get their waste picked up once a week. Cart sizes offered for NRWS customers are 20 gallon, 35 gallon, 65 gallon, and 95 gallon (NRWS 2015a). NCRWS customers are offered 35 gallon, 65 gallon, and 96 gallon carts (NCRWS 2014). Commercial and multifamily units have the option of using 35 gallon, 65 gallon, and 95 gallon carts or bins in 1.5 cubic yards, 2 cubic yards, 3 cubic yards, 4 cubic yards, or 6 cubic yards and can have their trash picked up a maximum of six times a week (City of Napa 2015).

### What goes into each cart?

NRWS asks customers to “Please only put non-recyclable, non-compostable items in the trash cart.” Single stream recycling makes it simple to keep recyclables out of the trash cart, but what exactly are compostable items? Compostable items are food scraps, food-soiled paper products, yardwaste and other organic material (NRWS 2013e). In this context, the term organic means any material that will rot (Boone 2008). A good rule of thumb is if it came from a living thing, whether a plant or animal, then it can be composted. Between single-stream recycling and composting, the only kind of waste that should be going into the landfill cart is bags, wrappers, styrofoam, cat litter, diapers, and broken dishes. For special items such as e-waste, textiles, or cooking oil Napa residents can schedule an appointment with Napa’s Recycle More program. If a Napa resident has motor oil they wish to dispose of, they can sign up for free pick up with their recycling by calling NRWS to get a oil container or filter bag (NRWS 2013e).

### Why does Napa care about preventing things from ending up in landfill?

Napa’s actions towards reaching 75% diversion did not happen overnight; its efforts come after decades of the state of California promoting, legislating, and regulating more sustainable practices. Before the 1970s, there were no recycling programs in the United States. This led to a lot of waste because items could be easily manufactured, making it easy to toss something old and replace it with something new. Skies became full of smog and rivers and lakes became polluted in part to cars, but also because manufacturing new goods requires the

use of fossil fuels. Though environmental degradation was a factor, the oil shortage of the 1970s really pushed people to begin looking for new ways to conserve energy and resources.

To combat this dependence on fossil fuels and new resources to provide consumers with new goods, people began to recycle. This new way of recycling old goods is different than the recycling we know of now. People could only bring certain items in drop-off and buyback programs and there was definitely no common program for wood or organics. Between 1970 and 1988, these recycling programs were not widespread, but people started using them. This is significant because there had never been an option besides sending waste to the landfill, no one knew if these programs would be successful. A maximum of approximately 15-20% of people in the United States participated in these programs. Between 1988 and 2005, education and government driven programs began to push curbside collection programs. In 1989, California became the tenth state to enact waste diversion goals by passing AB 939, which sets the goal of 50% diversion by 2000 (Boone 2011). Among the majority of two cart recycling programs, a few progressive communities began to adopt the three-cart system, which allowed for the disposal of some organics. In the Bay Area, Alameda was the first city to adopt this approach in 1991 (Boone 2014). By 1995, there were only 503 curbside recycling programs statewide (CalRecycle 2002). Most of these recycling programs started to accept plastic causing trash to become “the few things we don’t know how to recycle” (Boone 2011). This pushed for the development of more markets so people could recycle more goods.

This desire for “Total Recycling” ended the “Bench-scale Recycling Era.” California is currently in the Sustainability and Zero Waste Era, which began in 2005. California’s goal of 50% diversion by 2000 did not happen until 2006 (Boone 2011). Part of this lag is because the

diversion rate was not made mandatory, it was only a goal. When there are no requirements or repercussions, there is no way to force the state to follow the suggested goal (McKaughan 2015). In 1999, AB 75 was passed. This required only state agencies and large state facilities to divert through source reduction, recycling, and composting to reach 25% diversion by 2002 and at least 50% diversion by January 1, 2004 (CalRecycle 2011). Mandatory recycling for the general public did not come about until AB 32 was passed in 2006. AB 32 was a bill that made it mandatory for California to reduce its greenhouse gas emissions. The California Air Resources Board created the Scoping Plan to lay out the strategies that California needed to carry out to reach the greenhouse gas emission reduction (CalRecycle 2015c). The AB 32 Scoping Plan made the requirement of higher recycling rates which would be met through mandatory commercial recycling. The Scoping Plan also encouraged the development of more composting programs (California Air Resources Board 2008).

As a result of the AB 32 Scoping Plan, AB 341 was passed in 2011 to clarify and address the regulations surrounding the mandatory commercial recycling (Eberle 2013; CalRecycle 2015e). AB 341 determined that any commercial business or public entity that generates four or more cubic yards of commercial solid waste per week would have to comply in addition to multi family dwellings that have five or more units no matter the amount of solid waste they generate (CalRecycle 2014). AB 341 also encouraged “the collection of residentially and commercially-generated food scraps for composting and in-vessel anaerobic digestion” (California Air Resources Board 2008). The mandatory recycling and encouragement of composting programs were put into place to try to reach the new statewide diversion goal of 75% by 2020 (Eberle 2013; CalRecycle 2014).

In response to AB 341, the City of Napa formally adopted a Disposal Reduction Policy in July 2012 to achieve a level of at least 75% diversion rate through waste reduction, recycling, and composting by the year 2020 (Miller 2013). Napa is already above the current 50% diversion rate set by AB 393, but to improve the city's current diversion rate of 65% to at least 75% in the next five years will take more than just recycling and waste reduction (Miller 2015). To achieve this goal, the city in conjunction with NRWS, chose to implement a countywide composting program to residential, school, and commercial customers (Dewey-Mattia and Turnipseed 2015). While the city created this program to divert more waste, this was also in preparation for AB 1826 which was signed in 2014 to go into effect in 2016 (CalRecycle 2015f; Chesbro 2014).

AB 1826 is targeted to commercial waste producers which consist of multifamily units and businesses. Like in AB 341, a multifamily dwelling consists of five or more housing units. While this law only targets commercial units to compost, a composting program must first be set up. By 2016, all local jurisdictions must have an organic waste recycling program in place. AB 1826 will be phased in so that only the largest waste producers will have to comply first, while smaller waste generators will not be required to comply until a few years later. Any business that generates eight cubic yards or more of organic waste, must begin to participate in a composting program by April 1, 2016. This means a business that produces eight yards of organic waste, not including all other waste generated is required to comply. By January 1, 2017 any business that generates four cubic yards or more of organic waste must arrange to have composting (CalRecycle 2015f; Chesbro 2014). All jurisdictions must provide annual reports to the California Department of Resources Recycling and Recovery, called CalRecycle, from 2017



onward. While the 2016 and 2017 implementation dates will affect some businesses, they will not affect a large number of businesses because there are only a few very large businesses such as hospitals or some hotels can produce more than four yards of organic waste each week (Turnipseed 2015).

Many more businesses will be affected on January 1, 2019, the date by which any business that produces four cubic yards or more of commercial solid waste per week must begin participating with the composting program. AB 1826 does not create any additional mandatory composting deadlines, but does set a deadline for CalRecycle to review the annual reports beginning on August 1, 2020 for all of California's jurisdictions. By fall of 2021, CalRecycle must "determine if statewide disposal of organic waste (that is organic waste being sent to the landfill) in 2020 has been reduced to 50% of the level of disposal during 2014." If CalRecycle determines that the state has not reduced 50% of the amount of organics being sent to landfills since 2014, then CalRecycle has the power to decide that businesses which generate two or more cubic yards of commercial solid waste each week must begin mandatory composting. If CalRecycle determine that the businesses that generate two or more cubic yards of solid waste would not "result in significant additional reductions of organics disposal," then these businesses would not be required to compost (Chesbro 2014; CalRecycle 2015f). If CalRecycle determined that any business which generates two or more cubic yards of solid waste must recycle, it would affect approximately 336 businesses in the City of Napa (NRWS 2015c).

### How did Napa begin composting?

To prepare for its own waste diversion goals and to be in compliance with AB 1826 by 2016, Napa had to set up the correct infrastructure to handle the acceptance of food scraps at Napa's MDF. The MDF is located on 18.6 acres in an industrially developed area of unincorporated Napa County approximately two miles south of current city limits where it receives and processes all residential and commercial recyclables and yardwaste. Of these 18.6 acres, 1.2 acres is dedicated to the Materials Recovery Facility (MRF) and about 12 for handling organic materials. The MDF had to receive different permits from CalRecycle for recycling, composting, green waste chipping, and food waste composting. The permit for recycling allows the MRF to operate up to 24 hours a day, seven days a week and accept a maximum of 760 tons of recyclable material. NRWS's permit for composting allows the compost facility to operate from 8am to 5pm seven days a week and accept up to 400 tons of organic material per day. The MDF had to receive a separate permit to be able to accept and compost food waste along with the collected yardwaste. The MDF must also use no more than 386 vehicles per day to pick up and transport the collected material (Eberle 2013; CalRecycle 2015b; CalRecycle 2015a).

After NRWS received the permits from the state for demonstrating their ability to safely collect and handle organic waste, they must let the California Department of Food and Agriculture (CDFA) conduct an audit at least once a year on the finished compost to comply with Title 14 California Code of Regulations. In Article 5 of the Title 14 Regulations, it states that a composting operation that sells or gives away more than 1,000 cubic yards of compost each year must have their compost checked for their levels of metals and pathogens to make sure they are safe for to be used on food crops and do not have a negative impact on human health

(CalRecycle 2012). NRWS decided to go beyond the minimum requirement of simply creating compost and getting it reviewed as safe and a high enough quality to be given to customers by applying to have their compost certified organic. There are multiple organizations to get compost to be certified organic or certified for being high quality.

Perhaps the most reliable certification comes from the CDFA, which has an Organic Input Material Program as part of their Fertilizing Materials Inspection Program. The Organic Input Material Program requires the CDFA to do annual audits to ensure that the compost is of quality to be used in organic production in addition to following the California Fertilizing Materials Law and Regulations and USDA National Organic Program Standards (CDFA 2012). In addition to being approved by the CDFA, NRWS also gets their compost certified organic by the Organic Materials Review Institute (OMRI) (NRWS 2013b). The certification that gives OMRI is one of the most identifiable certifications to customers (Dewey-Mattia and Turnipseed 2015). The widely recognizable certification from OMRI is the main contributor for NRWS seeking this certification rather than relying only on the CDFA's organic certification. OMRI does not actually send anyone to the composting facility to test the compost, instead they request information to be sent by the facility that created the compost. OMRI will approve compost that comply with their own OMRI set Standards and also the U.S. National Organic Program standards (OMRI 2015). In addition to the CDFA and OMRI certifications, Napa's compost is also certified with the United States Composting Council's Seal of Testing Assurance (NRWS 2013b). To earn this certification, NRWS sends a sample of the compost for the US Composting Council to conduct laboratory analysis on the compost to determine if it has safe levels of pH, soluble salts, nutrient content, moisture content, organic matter content, bioassay, stability, particle size,

pathogens, and trace metals (US Composting Council 2010). Napa is able to achieve these certifications because they monitor the compost piles and do not add anything synthetic to the compost (Dewey-Mattia and Turnipseed 2015). Making sure NRWS had the space, enough vehicles, the ability, and certifications was perhaps the simplest part of implementing a food composting program. The most challenging part of having a food composting program is actually getting people to participate in it.

### Pilot Programs and Public Outreach

The next step in implementing a food composting program is getting the word out to the people that are producing the food waste. The people that produce waste can be divided into different groups of waste generators: residential, commercial, and school.

In 2014, NRWS collected about tens times the amount of organic waste from residential customers than commercial customers, making residential customer a vital component in the success of the food composting program. While it is important to get the word out to all waste generators, the fact that residential customers produced 14,166.4 of the 25,281.54 tons of organic waste in the year 2014 according to NRWS's 2014 Annual Collection Report, makes them a valuable component of the program (NRWS 2015c). Approximately 36.4% of all California residents waste is compostable, with food being the majority of this taking up 21.9% (CalRecycle 2015g). NRWS serviced approximately 20,574 households in 2014 that have yardwaste carts, getting the word out about the food composting program in an effective way required many different aspects of social marketing (NRWS 2015c).

Before Napa rolled out the food composting program to the entire city, they first selected a few pilot neighborhoods. The first pilot neighborhoods were introduced to the food composting program in 2008. This was open to about 20 businesses in Napa County as well as provide a food compost drop off location for any county households located at NRWS's in-city office. The county residents received a mailer, brochure, and compost pail notifying them of the program (Dewey-Mattia 2015a). In 2013, Napa introduced their second wave of the pilot program and began the first residential pilot, with two locations, the largest located within the city limits of Napa and the other group located in the southern county (Dewey-Mattia and Turnipseed 2015; Dewey-Mattia 2015a). The approximately 1,520 city households were located in the Browns Valley neighborhood. Between the county pilot and the city pilot a total of 2,242 households participated (NRWS 2013h; NRWS 2015c). This neighborhood was selected to be the pilot neighborhood for the city because it is located on the opposite side of the city as the county pilot program and Browns Valley neighborhood's yardwaste and trash pick up routes matched up very closely. This allowed NRWS to analyze the weight differences between their compost and solid waste carts.

Unfortunately, yardwaste is very volatile so the amounts fluctuate throughout the year and also inconsistent between different years. Ultimately, this made it difficult to see any clear changes in composting habits with the pilot program. To help get a better sense of how the pilot program responded, NRWS monitored how the garbage tons was affected. It was also difficult to see the effects of the food scrap composting because recycling rates have continued to increase which also contributes to less garbage, so any change they saw could have been either attributed to increased composting or increased recycling. It is also difficult to analyze

this in the long run because while recycling and composting rates may change, the economy also has an affect on the amount of waste people produce. When the economy is poor, people tend to buy less stuff, and when people buy less, they have less to waste or throw away (Dewey-Mattia and Turnipseed 2015).

Browns Valley neighborhood was notified by having a mailer sent to them, and a brochure with a three gallon compost pails delivered to their door. The brochure explained what the pail was for, what items to compost, and give reasons for why households should participate in the program. The compost pail also contained a flyer on how to fully utilize all the features of the compost pail (NRWS 2013h). This is perhaps one of the best forms of outreach to the public because it gives them not only a physical reminder of what should be done, but a simpler means of doing it. Giving people a kitchen top compost pail is much more effective than telling them they should put food in their brown bin because it gives them a convenient way to compost while removing the barrier of leaving their kitchen while they cook (Dewey-Mattia and Turnipseed 2015; Godwin and Zanolli 2015).



(NRWS 2013d)

Although people would like to believe that they do a good job at recycling and composting, and will claim that they are, in reality they are usually not as accurate as they claim to be. This is because the benefits do not outweigh the barriers to them. A barrier that prevents someone from composting or recycling can be as small as having to walk to another room to use the correct bin (Godwin and Zanolli 2015). Napa's pilot program was introduced to get an understanding for what would encourage Napers to compost before starting the composting program city-wide (Dewey-Mattia and Turnipseed 2015). Food composting is a new concept for most people and requires them to develop a new habit. An important step in getting people to develop this habit is to directly identify what they should do differently (Godwin and Zanolli 2015). Napa could have simply alerted everyone that they could start putting all organics in the brown cart, but instead handed out a pail to each household with instructions to keep it in their kitchen and fill it with food scraps. In doing this, Napa has been specifically pointing out what the new habit is that residents should be doing, a means of doing it.

The city sent a survey to the pilot residential neighborhoods to learn their opinions of the program and to see if there were any major changes they should make when starting the program city-wide. While only 550 of the 2,242 households responded, the city gained insight and decided to use a similar method for the full rollout of the program (NRWS 2013g; Dewey-Mattia 2015a). With the full rollout, the main goal was to continue to educate people on what the program was and why it is beneficial, as it is not mandatory except for certain commercial customers as outlined in AB 1826.

## Educating Napa

It is very difficult to get information to every single person in Napa. To get information out to as many people as possible, Napa used a diverse range of outreach techniques. Similar to the pilot program, when the city wide program was released, a pail with a brochure was given to every household. With the entire city able to participate in the program, Napa was able to spread information throughout the city rather than being limited to mailers and deliveries. Using the tagline “Include the food,” Napa invested in a variety of advertisements in as many local spaces as possible. All of these ads include the web address to the NRWS website, which hosts all the information about the composting program. The city bought advertisements spots from Napa’s public buses to place ads on the buses so people either using the bus or people driving around the city would see the advertisements. They also bought bus shelter ads so people waiting for buses would be exposed to the program. In addition to buses, they also put advertisements on the NRWS trucks, which drive throughout the city collecting waste five days a week. Napa has also made video advertisements that play in movie theaters before the films.

Napa has also utilized local media outlets by writing articles, placing advertisements, or both, in magazines such as the Napa Valley Marketplace Magazine and Napa Valley Life Magazine. These articles either focus on specific tips, such as when to put paper in the recycling and when to put it in the compost, or the general benefits of composting. Every month, NRWS customers’ garbage bill comes with a bill insert. Napa has made many of these inserts throughout 2015, each with a different tip on composting. Napa also makes many of its brochures in English and Spanish so that they do not exclude anyone from getting the information that is available.



Perhaps some of the best ways to get information out to the residents of Napa is to actually tell them in person. The City of Napa always has a booth at community events throughout the year such as the Napa County Fair or the Napa-Solano Home and Garden Show. At these events, it is easy for residents to get their exact questions answered or concerns addressed. There are also a variety of brochures, pamphlets, and recycling guidebooks available for people to take at these community events so that they can have access to the information after they leave the booth. The City of Napa also hires organizations such as C Squared or the nonprofit CAN-DO to help market the composting program by going door to door and talking to people. The City of Napa goes through these organizations to ensure that there are bilingual people that can talk directly to any Napa resident that may not speak English. Some other ways Napa gets into direct contact with the people that participate in the program is by offering free trainings to restaurants or any multifamily buildings such as apartments. For these, the city gets in contact with the building manager and sets up a time when they can meet with the residents or workers and demonstrate what is acceptable for the compost and what is not and point out some specific examples that they may encounter at that location. For instance, a greasy, food-soiled pizza box is a common compostable item found at apartment complexes, but not found at a sit down restaurant. Meeting with a specific location allows the city to cater precisely to their audience rather than give a general list of items that anyone can compost. The city will also provide free signage and indoor bins for any multi family units or businesses that need them regardless if they set up a free training or not (Dewey-Mattia and Turnipseed 2015).

While anyone in single family housing may not have the opportunity to get a free training of their own, the city offers free home composting workshops to anyone. This

workshop teaches people how to set up a compost bin in their backyard, either with or without worms. The city holds these workshops a few times each year in both English and Spanish at various locations around the county (NRWS 2013f). These backyard compost bins compliment the city wide composting program because backyard composting does not get hot enough to breakdown items such as meat and dairy products, which are acceptable in the city's program.

The city reaches out to residents of all ages to teach about composting. The city offers free assemblies and presentations to schools in the Napa Valley Unified School District that are participating in the food composting program. The city has also created new curriculum to be taught in the classroom about waste, focusing on why people should reduce how much they throw away and about the benefits of composting and recycling over throwing waste away. Currently, only a dozen schools in the Napa Valley Unified School District as of 2015 have food scrap composting programs. The participating schools have their lunch set up with a set of three cans, and many schools have created programs that train students in what can and cannot be composted so they can watch and help at the bins as their peers throw away their waste. The city hopes that kids will get into the habit of composting at school and will bring practice into their homes and help educate their parents. It may also encourage the parents get into the habit of composting if their kid questions why they are not composting and instead doing something harmful to the environment by putting food in the landfill trash can (Dewey-Mattia and Turnipseed 2015).

Napa also publicizes that composting can be economically beneficial to both residential and commercial customers. From CalRecycle's 2014 waste characterization study, 36.4% of waste generated by residential households can be composted. If households were able to

completely move this to their compost cart rather than keep it in their solid waste cart, they could downsize and save money on their garbage bill each month. Similarly, commercial businesses can also see a savings. 34.8% of commercial waste is compostable, therefore removing over third of their waste from the trash would lead to significant savings of their garbage bill (CalRecycle 2015g). To highlight this, the city will approach specific businesses with their current waste service and sit down with the manager or owner and explain the steps that business will have to take to take if they would like to begin composting. In this way, the city has specific numbers along with a plan for the business to follow. This also allows for the business to resolve any questions or concerns they might have about composting food.

NRWS and the City of Napa realizes that Napers will not change their habits overnight, similar to how people did not create the habit of recycling immediately. In many ways, this process of teaching people how to compost is similar to when recycling had began to be available to every household. Composting has potential to be adopted faster than recycling because composting is much more simple. Compost can be any food scraps, soiled paper products, or organic matter whereas when recycling was introduced, people had to learn what was materials could be recycled and the exceptions such as different types of plastic or waxed and unwaxed cardboard. The transition to compost may also be aided by the fact that people already separate their recyclables from their trash, so they are used to the concept of thinking about what they are putting in a specific bin. When recycling first was introduced, no one had ever had to separate what they threw away, so it was a completely new concept (Boone 2011).

### The transition from a pilot program to a complete program

While the city-wide program started in April 2015 and as of this writing has only been in effect for a few months, the pilot program has had nearly two years to adjust. This has given the city insight on the obstacles that have to be addressed when rolling out the composting program. The process is simple once people participate: food gets put in the brown carts, it gets picked up once a week, dropped off at the MDF, and then NRWS turns it into compost. What Napa has found through the pilot program survey results is that people either do not know or do not want to participate in the program for a variety of reasons. The most common response to why a household was not participating was because they put food down the garbage disposal (NRWS 2013g). The City of Napa responded to this by explaining that, “Unfortunately this is not a good option because food that goes down the drain ends up at the wastewater treatment plant, where removal of the food increases treatment costs. Also it is estimated that a household uses about 900 gallons of water annually just to wash food scraps down the garbage disposal (NRWS 2013h).” It uses so much water because it takes more water to push the food down the drain line than if it were only water going to the sewer, making this a discouraged practice, especially while California has been in a drought. Napa also highlights that soiled paper, bones, seafood shells, fruit pits, and fibrous food scraps, as well as fats, solidified oils, and grease can all go in the compost, but not the drain. This means that even if a household is claiming that they put all their compostables down the drain, that they are either mistaken or are doing something harmful to their pipes that will lead to extra costs.

**Figure 5: Reasons for Not Participating in Curbside Food Composting**

Answer	Response	%
I put food scraps in the garbage disposal	85	17%
I'm concerned about odors	74	14%
I am concerned about flies, bugs or rodents	62	12%
I don't have enough yardwaste to mix/layer with food in my cart	55	11%
It's inconvenient	54	10%
I already compost in my backyard bin	53	10%
Other	37	7%
It seems dirty	28	5%
I give leftovers to my pets	23	4%
It takes too much time	20	4%
I don't have enough information	17	3%
I don't have room in my yardwaste cart	7	1%
Total	515	100%

(NRWS 2013g)

The next most common reason as to why people did not participate was because they were concerned with odors. To address this, the city included a “Kitchen Pail Care” section in the brochure in addition to writing articles for local magazines and online newsletters. This offered suggestions such as buying compostable bags to line their pails which can reduce odor because food residue would not build on the kitchen pail and a bag can be easily taken out and moved to the brown cart. The city also advertises this option by giving samples of compostable bags away at events. Many of the local grocery stores, hardware stores, and even Ben & Jerry’s in Napa have begun to carry three gallon compostable bags to accommodate anyone that wants to use this option. The city realizes that this may not be a viable option for everyone if one does not want to buy compostable bags, or cannot afford them, so they offer a variety of other suggestions such as telling people they can line the pail with newspaper or wrap messy food in newspaper to prevent the food from sticking to the kitchen pail. All of the tips that the city give on preventing odors work just as well for preventing bugs and rodents, which is the next biggest concern from the pilot survey (Sustainable Napa County 2015; NRWS 2015b).

The next concern that NRWS and Napa have worked together to address is if people do not have enough food and yardwaste to fill their brown cart. Napa advertises that NRWS offers a smaller cart and provides residents with the contact information for NRWS. NRWS offers a 35 gallon yardwaste cart as an alternative to the 65 and 95 gallon carts and will downsize customers carts free of charge (NRWS 2015a; Sustainable Napa County 2015). For the next complaint about the food scrap composting program, "It's inconvenient," Napa is already doing all it can to make composting easy by providing a kitchen top compost pail. To try and convince people that composting is not any more inconvenient than recycling or throwing something away in the trash can, Napa tries to increase education. In conjunction with getting the word out about the program, Napa also explains why this program is beneficial and deserves people to participate in it. Napa gives reasons such as "Households compost an average of 10 lbs per week through curbside food compost programs – that's 520 pounds per year per household! If all Napa Recycling & Waste Services and Napa County Recycling & Waste Services household customers composted 520 pounds annually that would be almost 7000 TONS per year of organics no longer wasted in landfills" (NRWS 2015b). Public education involves answering concerns that people submit to the letter to the editor in the Napa Valley Register (the local newspaper), attending local events to talk to people directly, including facts and supporting data in their brochures, and writing magazine articles (Dewey-Mattia and Turnipseed 2015).

In the July 17, 2015 paper of the Napa Valley Register, a concerned Napan wrote a letter to the editor to say "It's been a month of taking the new food garbage container to the green garbage can. This morning, I noticed maggots crawling on the inside of the large can. YUCK! There has to be a better way. Biodegradable inserts?" (Rothwell 2015) A few hours after this

letter was posted online, NRWS responded with “There are compostable bags that work great at keeping the kitchen pail and brown cart clean. They are available for sale at many local stores, including Vallerga's, Browns Valley Market, Whole Foods, Target, Home Depot and others ... You can also buy them in bulk online or at Costco.” NRWS also included links to their website, one containing a complete list of all the local retailers that have compostable bags, and another that has tips on avoiding pests such as maggots. Also included in the response was information for switching to a smaller brown bin if needed and contact information for NRWS if any customers had questions (NRWS 2015e).

There are some other barriers preventing commercial customers from joining the program. One barrier is shared trash enclosures. In many locations around Napa, there are multiple restaurants or businesses that share the same trash enclosure. This means that one restaurant is not responsible to the entire garbage bill, it is typically split among all of the businesses using the few bins. If one business wants to begin composting, it is an issue because the other businesses that are not joining the composting program will not want to pay a higher garbage bill for something that they do not get any use out of.

Another issue that trash enclosures pose is their capacity for more carts or bins. When a business joins the composting program, they will need to receive 65 gallon food composting carts from NRWS. In some situations, there is no space in these trash enclosures for any additional carts. NRWS only offers 65 gallon food carts because food waste is extremely heavy and they do not want to risk breaking their trucks by trying to pick yards of food scraps at once, like they are able to with recycling or solid waste. While this is better for the trucks, it also means that most businesses will consider getting multiple carts, which further impacts the

amount of space available in trash enclosures. Building new trash enclosures is very costly because there have been new ordinances since the original construction of many trash enclosures which would require the new structures to comply with updated building codes. Currently, there is no simple solution to this problem. The best way to go about getting more space for composting bins is to decrease the solid waste bin size. By downsizing a bin, there should be more room created in the trash enclosure. This should be possible if the business was able to completely remove all compostables from their trash and instead put it in their food carts. Usually when businesses are first starting out, they do not know how much they can divert from their solid waste bins and cannot downsize right away. It is not viable to guess and downsize before starting the program so businesses will have to come up with a temporary solution such as keeping their food carts inside their building and taking them outside of the enclosure on pick up days until they are able to downsize their trash bin.

Another issue that commercial customers face when adding food carts to their service is how to manage the new costs of the food carts. If businesses are using food carts to their maximum potential, they will save 25% compared to the price of service for the same amount of waste in their landfill cart. The reason price is an issue is again from the inability to downsize solid waste service immediately. During the first few weeks, businesses will be paying for food carts in addition to their regular service until they can determine how much waste they can move to their food waste carts instead. There is no way to avoid this initial cost increase until the business downsizes their trash service, so many businesses are dissuaded from trying to join the program initially. To try to make this transition of using food carts to their full potential and as quickly as possible, the city provides businesses with free signs, trainings, and indoor bins. If



composting is made simple as simple as possible, it should be relatively easy to quickly transition from throwing food into the compost instead of the trash and allow for the business to downsize their service and begin to save money.

Getting businesses to begin composting is also more difficult compared to starting residential customers with composting because multiple people handle the food in businesses like restaurants whereas the same, often smaller groups of people handle the food in a residential setting. It can be challenging to train every employee that works for a business. One challenge of training everyone is that employees have different shifts, so it is difficult to educate everyone at once and can be a time consuming process to try to get everyone updated on the new composting practices. Another difficulty in teaching employees how to compost is that some people may already be familiar with what items are compostable if they are residents of Napa while others may be from other nearby counties that either lack composting programs or have slight differences in their composting programs at home. It is also more difficult to ensure that food reaches the correct waste bin when it changes hands from multiple chefs to the waiter to the customer to the bus person that clears the table. This means that the person who creates the compostable food scraps is not necessarily responsible for their correct disposal; they have to trust that the next person who handles that food will throw it away in the correct container.

Another reason that some businesses are resistant to joining the composting program is that they are afraid that the food scraps will smell and potentially attract rodents. To remedy this, Napa suggests that businesses use compostable bags. Using compostable bags is not necessary or required for the composting program. If businesses choose to not use

compostable bags, NRWS will swap out the dirty food carts with clean ones. The businesses do not get charged for this service, it is complimentary for joining the composting program. A large reason that businesses are resistant to using compostable bags is because of their cost. A typical kitchen sized compostable bags cost around 50 cents per bag, but this can vary depending on the size and if bought in bulk or not. Different businesses have different frequencies in which they take out the compost so it can vary how much of an extra cost a business will use from compostable bags. In special circumstances, the city has decided that if a business is willing to join the composting program, but they cannot due to the extra costs, they will work out a deal with the business to provide BioBags at no cost for an agreed period of time. As of mid-2015, Napa has entered this kind of special agreement with two businesses. They have been providing the Wine Train with BioBags for an indefinite amount of time and City Winery with BioBags until the end of the year.

Perhaps the largest difficulty that Napa has faced when trying to transition commercial customers to the composting program is that NRWS serviced the businesses that participated in the pilot program for free on the condition that they did not reduce their current trash service. Many businesses that were in the pilot program got used to having their normal service and their new food carts at no additional cost, so when the pilot program ended and the food carts required a service fee, they did not want to continue because of the increased cost. This change from free service to the full cost of the program was difficult to explain to participants, so Napa set up meetings to speak one-on-one with the businesses that were impacted to try to find out how continuing food composting could still work financially. Tim Dewey-Mattia, the Public Education Manager of NRWS, stated that he would not recommend another city taking this

approach, instead he suggested in an interview that other cities considering creating a composting program begin with a pilot rate to help smooth the transition. A change in price between the pilot and full program would make it easier to explain to people why there is a difference in price than trying to explain to a customer why they suddenly have to pay for a service they had been getting for free during the last year.

Most other aspects of working with customers to make the transition to composting is smoother than explaining an increase in the price of services. The City of Napa is fortunate when they face these obstacles because they have a fair amount in their budget from grants for personalizing efforts that help NRWS customers. Napa can create signs specifically for schools, restaurants, or multifamily complexes and include items that are commonly found at each of these locations instead of giving all customers the same generic sign which may or may not be helpful to them. Napa can also afford to supply a variety of indoor equipment at no charge. A benefit to being able to supply equipment and signs to schools, restaurants, and multifamily units allows the indoor and outdoor bins to be standardized in colors so that people can recognize what each bin is for no matter where they are and if there are signs or not. In addition to the ability to give these resources to customers, Napa also makes time to set up the bins or signs instead of simply dropping off the equipment and leaving. This creates a stronger foundation for people to use the bins correctly and keep good recycling and composting habits (Dewey-Mattia and Turnipseed 2015).

### Fate of the composted food

After the food and organic waste has been collected and taken to the facility, it is turned into compost. Compost is a natural process that provides many environmental and economic benefits (Northern Recycling 2014). In Napa, the organic waste is delivered to the facility and is run through a grinder to increase the surface area of the material to help it break down. Then the material gets screened to get rid of the noncompostable material that has gotten into the organics. After this process, it gets placed in large piles with no cover called open windows (Eberle 2013). These large piles get monitored to ensure that they stay between 131 and 160°F and that they are getting watered often enough (Dewey-Mattia and Turnipseed 2015). These piles get turned by machines until the material is ready to go through the sifter separating the compost into fine and larger material in addition to getting rid of any non-compostable material that was not screened out previously (Eberle 2013). The entire process takes approximately fifteen days for the organic waste to be made into usable compost, but the compost at NRWS's facility is usually on site for about a month (Dewey-Mattia and Turnipseed 2015).

NRWS has no difficulties selling this compost to the public, at a price of \$10 per cubic yard (NRWS 2013b; Dewey-Mattia and Turnipseed 2015). NRWS produces approximately 42,000 tons of compost a year, with a permit capacity to produce up to 144,000 tons per year (NRWS 2015d; Eberle 2013; CalRecycle 2015b). Over half of the total compost produced is sold in bulk to soil yards. Approximately a third of the compost is sold to the wine industry for use in the county's vineyards. The remaining compost is sold for various agricultural and landscape uses, and is bought in smaller loads by residents of Napa county for use in their gardens or yards (Dewey-Mattia and Turnipseed 2015).

The compost is appealing to locals for more reasons than being sold nearby and at a good price, there are many benefits brought from using compost. One of the most beneficial properties of compost during California's droughts is the ability for compost to retain more moisture in the soil. This allows for more efficient watering of plants, meaning that farmers or gardeners can save water. Another perk to using compost is that compost is rich in nutrients which encourages the growth of healthy plants. Compost also aides in the suppression of plant diseases and pests, helps reduce or eliminate the need for chemical fertilizers, and promotes higher yields of crops. Compost has uses beyond agriculture, it can be put on the banks of rivers, creeks, and lakes as well as roadsides, hillsides, and sports fields to help prevent erosion. Each of these uses while helpful, can also save users' money because they will be able to spend less on water, synthetic fertilizers, and pesticides. The benefits of composting go beyond the advantages an individual receives. If the organic waste was not turned into compost in the first place, it would be in the landfill creating methane, a greenhouse gas that is approximately 23 times more powerful than the carbon dioxide that is released in the creation of compost (Northern Recycling 2014). Landfills are the second largest producer of anthropogenic methane in the United States, so reducing the amount of methane they produce can be beneficial by reducing anthropogenic greenhouse gas emissions (DeLonge, Ryals, and Silver 2013). Greenhouse gas emissions are also reduced from transportation of the material because the organic waste can stay in Napa instead of being driven to the Potrero Hills Landfill in Suisun, Solano County located approximately 25 miles away (Dewey-Mattia and Turnipseed 2015; NRWS 2013c).

Marin County, located to the west of Napa County, has conducted several studies for the Marin Carbon Project that further suggest that compost is beneficial in reducing greenhouse gas emissions. Marin County has both created a model and collected supporting data from locations that use compost. They determined that the greatest savings in greenhouse gas emissions came from landfill diversion (DeLonge, Ryals, and Silver 2013). The Marin Carbon Project also determined that when applied to grasslands, a single addition of compost can greatly increase the amount of carbon storage due to increased net primary productivity. Their study lasted for three years and the effect of adding compost once lasted the entire duration of the study, suggesting it is likely that the grasslands are continuing to have the benefit of increased carbon sequestration after multiple years (Ryals and Silver 2013).

#### Compost and Surrounding Communities

Napa did not create the first food composting program in the Bay Area. It was influenced by nearby counties and cities as well as other programs developed across the west coast. San Francisco was the first city to create a city-wide food composting program in 2009. Not only was it the first program of its kind in the Bay Area, but the entire United States (Environment 2015). One reason Napa created a similar composting program to those seen along the west coast is because they are able to send NRWS and City of Napa employees to conferences on waste management and sustainability. At such conferences, people from cities that have well developed composting programs such as San Francisco, Portland, and Seattle can connect and network with others that are developing their cities' own composting program.

Influence from surrounding areas affect the professional setting in making composting programs a reality, but also help gain public interest and puts the public into a new mindset by making them more conscious about what they throw away. When Napa residents visit other parts of the Bay Area, they come across ads and campaigns similar to how Napa advertises the food composting program (Dewey-Mattia and Turnipseed 2015). In Alameda County, for example, a public agency called Stop Waste that is managed by Alameda County Waste Management Authority, the Alameda County Source Reduction and Recycling Board, and the Energy Council, has created a campaign called “Stop Waste.” While Stop Waste touches on a wide range of topics, one their goals is to increase composting, or “food scraps and plant debris recycling” (Stop Waste 2015a). Stop Waste has created ads for billboards and bus shelters to grab the attention of Alameda County residents, these ads have been effective in getting greater awareness about the program. Their “Make it Second Nature” campaign has not only gotten locals to have interest in the program but has also been noticed by other cities around the United States and discussion on blogs and social network sites such as Pinterest and Facebook (Pollin 2009; Stop Waste 2015b). This ad campaign began in 2009 before many cities had a residential composting program, and before the state created the mandate for commercial waste producers, and started to give public awareness to the topic of compost. Alameda also ran these ads in Spanish to reach their entire audience, a technique that Napa followed as well. Not only are these humorous ads memorable, but they lead residents of Alameda and visitors talking about compost, making it a conversation topic among locals and visitors alike.



(Lublin et al. 2012)



(Stop Waste 2015b)



(Stop Waste 2015b)



(Pollin 2009)

Alameda County started its curbside residential composting program in 2001, over a decade before Napa began their pilot food scrap composting program. Alameda County now has one of the largest composting programs in the country, generating 173,914 tons of residential organic waste in 2010 (Stop Waste 2014; Yepsen 2012). Alameda took its efforts to remove organics from their landfill a step further by banning grass cuttings, tree trimmings, and other plant waste from disposal in county landfills. This ordinance was created in response to the results of the The Waste Reduction and Recycling Act of 1990, a ballot initiative passed by



the voters of Alameda County, which set the goal of 75% waste diversion from landfills by 2010 (Wolff 2009). While the City of Alameda reached this goal of 75% diversion, the county as a whole had a diversion rate of 70% by 2010. The county of Alameda is continuing to improve its diversion rate: in 2014 it reported a 73% diversion for the entire county while the City of Alameda had 76% diversion (Stop Waste 2015c). Alameda County is about a decade ahead of Napa in its efforts to reduce organics and recyclables from the landfill. Another reason they are a step ahead of Napa is because Alameda passed an ordinance that went into effect on July 1, 2014 that made it mandatory for all commercial customers to recycle and compost (Sun Staff Reports 2014). This ordinance has placed Alameda County well ahead of most of the state.

Perhaps the only other county in the Bay Area to rival Alameda's composting and recycling programs is San Francisco. Alameda county's goal for 2020 is to reach a 90% diversion rate, but San Francisco's goal is zero waste (Stop Waste 2015a; SF Environment 2003). Both Alameda and San Francisco are ahead of Napa with their waste reduction policies and implementation of composting programs. Due to their success in the Bay Area, Napa has adopted parts of these other counties' campaigns. For instance, in San Francisco, customers can receive kitchen compost pails for free if they contact San Francisco's waste hauler, Recology (Recology SF 2015). Napa borrowed this same concept, but delivered the compost pails to each household instead of being prompted by customers that request a pail. Napa adopted similar practices of other counties in how to address the concerns of their customers. Napa had offered similar programs to San Francisco such as door-to-door multilingual outreach, creating county specific stickers for bins, and offering trainings (Environment 2015).

Although Napa has been following many of San Francisco's practices, it will still take some time until it can match San Francisco's current amount of waste management programs and implement them. One way in which Napa is lagging behind San Francisco is that it does not force, or require, people to recycle or compost. It can only educate and encourage people, but San Francisco has passed ordinances making it mandatory to recycle and compost. San Francisco passed the mandatory recycling and composting ordinance in 2009 and it targets all residents of the county, not solely commercial customers that are often the only target in California laws such as AB 341 or AB 1826, and it does not matter how much waste is produced. San Francisco created this ordinance to promote greater consumer responsibility which will come from the mandatory participation in diversion programs (Blumenfeld 2009). Making participation mandatory is an important part in creating successful programs because it ensures that people will change their actions from joining and utilizing these programs. This in turn, helps the county reach its waste diversion goals. With optional programs, such as the program in Napa, there is no enforcement so it is up to the residents to voluntarily join it.

However, it is not evident that San Francisco's mandatory programs have actually increased the city's diversion rates. In 2012, the mayor of San Francisco announced that San Francisco had achieved a diversion goal of 80% (SF Environment 2012). A diversion rate of 80% would be the highest in North America (MacBride 2013). In reality, San Francisco did not reach an 80% diversion rate and Recology, San Francisco's waste hauler, faced much scrutiny (Bowe 2014; Minter 2014; MacBride 2013). When calculating diversion rates under current California legislation, jurisdictions can claim that recycling, compost, and alternative daily cover count as landfill diversion because it is not being disposed. Alternative daily cover is any "material other

than earthen material placed on the surface of the active face of a municipal solid waste landfill at the end of each operating day to control vectors, fires, odors, blowing litter, and scavenging.” Beginning on January 1, 2020, green material will no longer count towards alternative daily cover (CalRecycle 2015d). When calculating San Francisco’s waste diversion rate, Recology had included large amounts of construction and demolition material as alternative daily cover. Under current California laws, this would have been acceptable, except Recology was not grinding the construction and demolition to a fine enough size. When these fines are sent to the landfill as alternative daily cover, Recology does not have to pay a fee to dispose of this fine, ground up material because it counts as diversion, but it would need to pay if it was considered waste (Bowe 2014; Minter 2014). In reality, San Francisco’s diversion rate in 2012 was approximately 60%, a substantial difference from the reported 80%, if the construction and demolition waste is excluded from their calculation (MacBride 2013). Recology was taken to court under the False Claims Act for lying about their diversion rate. Recology lied about the diversion rate to receive a bonus of \$1.36 million from the City of San Francisco. The court found Recology guilty and is making them repay the city the bonus money in addition to paying a fine of up to almost \$4 million (Bowe 2014).

Since the false report that was produced by San Francisco, it is difficult to find a more current diversion rate since 2012. Unless San Francisco has drastically improved their diversion rate within the last three years, it is unlikely that Napa is very far behind. By comparison, the county of Napa had a 2012 diversion rate of 59 percent NRWS calculation of this diversion rate included recyclables, yardwaste, recyclable bulky goods (collected separately from recyclables), and e-waste that was diverted from the landfill (NRWS 2015c). This is significant because it

means that although Napa had not created any programs that require residents to participate, Napans are voluntarily acting more environmentally friendly and separating their waste before discarding it.

As Napans continue to voluntarily participate in sustainable practices and develop a good habit which progresses towards lowering the diversion rate, it is important that the city or county works with the waste hauler to help encourage this behavior to last. Complications between the city wanting to continue its composting program, but failing to work with their hauler happened less than 50 miles away from Napa in Oakland, located in Alameda County<sup>1</sup>. In 2014, the City of Oakland's contract with Waste Management was ending and the City of Oakland had to choose a trash hauler to sign the next ten year contract with. Oakland decided to select Waste Management again because it had thought their new contract would not have any issues and have smooth transitio since they had already worked with them for decades, but the city did not realize that Waste Management would be charging different rates. The new contract began on July 1, 2015 and and Waste Management immediatly began charging commercial composters extremely high rates. While most residential customers did not experience a large increase in their garbage bills, most commercial customers saw an new rate that was approximately 300% of their former garbage bill (Swan 2015). The contract also omitted the senior discount that had allowed many seniors to afford their waste services (Blasky 2015b).

The City of Oakland did not realize the implications of the new contract until it went into effect. The day the new contract began, the city council had to hold a last minute hearing to

---

<sup>1</sup> Multiple waste haulers service Alameda County, similar to the way NRWS services the City of Napa, but not other cities located in Napa County.

address the dramatic rate increases that commercial customers faced (Swan 2015). The new commercial composting rates were more expensive than trash rates, which eliminated any incentive to separate organics from the rest of the waste (Blasky 2015b). For example, with the new rates, if a business had a 64 gallon cart picked up twice a week it would cost \$165.42 per month for trash and \$198.00 per month for compost. The rates are still more expensive at the lowest amount of service with the smallest bin with Waste Management charging \$27.97 per month for once a week pickup of a 20 gallon trash cart, but \$33.84 per month for once a week pickup for a 20 gallon food cart (Oakland Recycles and City of Oakland 2015).

**Figure 6: Monthly trash and compost carts collection rates for Oakland businesses**

<b>Trash Collection Service - Carts</b>	<b>1/week</b>	<b>2/week</b>	<b>3/week</b>	<b>4/week</b>	<b>5/week</b>	<b>6/week</b>
20 Gallon Cart	\$27.97	\$55.94	\$83.91	\$111.88	\$139.85	\$167.82
32 Gallon Cart	\$38.26	\$76.52	\$114.78	\$153.04	\$191.30	\$229.56
64 Gallon Cart	\$82.71	\$165.42	\$248.13	\$330.84	\$413.55	\$496.26
96 Gallon Cart	\$127.07	\$254.14	\$381.21	\$508.28	\$635.35	\$762.42
<b>Compost Collection Service - Carts</b>	<b>1/week</b>	<b>2/week</b>	<b>3/week</b>	<b>4/week</b>	<b>5/week</b>	
20 Gallon Cart	\$33.84	\$67.68	\$101.52	\$135.36	\$169.20	
32 Gallon Cart	\$45.40	\$90.80	\$136.20	\$181.60	\$227.00	
64 Gallon Cart	\$99.00	\$198.00	\$297.00	\$396.00	\$495.00	
96 Gallon Cart	\$152.54	\$305.08	\$457.62	\$610.16	\$762.70	

(Oakland Recycles and City of Oakland 2015).

The reason city council accepted the contract in the first place was because it did not go through the fine print, instead relying on information of its contents that city staff from the public works department presented to it. The staff from public works also provided the council members with a detailed 300-page information packet about the contract and a six page supplemental staff report summary, but the council members relied on the six page summary for their vote to approve the new contract. Unfortunately, the summary report did not go into

detail about the additional fees that commercial customers would face (Swan 2015). The local business community was rightfully upset and made quite a bit of outcry. Letters to the editor were written from restaurant owners such as Sal Bednarz, the owner of Actual Cafe and Victory Burger Oakland stating opinions such as “Oakland City Government ought to be embarrassed. This deal is indicative of a lack of care for Oakland's fragile independent business community at the expense of moneyed interests and pocket-liners...” (Bednarz 2015). In addition to letters to the editor, over 30 restaurant owners brought their compost bins to City Hall on July 10, 2015, the Friday after they received their new rate, to protest and demand an alternative while bringing awareness to the Oakland community about the situation (Blasky 2015a).

This situation demonstrates how important it is to have transparency between the city and the contractor when creating or maintaining new programs. Nearly three months after the rate change, Oakland city council voted to amend the contract and lower the cost of commercial compost rates at the expense of some benefits in the original contract (Blasky 2015c). The city council also created an ordinance that allows Oakland set a maximum cost of service for compost in relation to the trash rates so this situation would never be repeated in the future (Simmons 2014).

The City of Napa, by contrast, works very closely with NRWS and has a very small department that is specifically dedicated to recycling and waste diversion, so the same group of people go through the contracts and negotiate with the same group of people at NRWS. This allows a smaller city such as Napa to have an advantage in the smooth transitions between contracts than larger cities such as Oakland. One of the major reasons that Oakland has such a rough transition to the new contract was because it had so much inconsistency of which city

employees, administrators, and public works directors were overseeing the creation of a hauler's contract. To fix this problem of miscommunication and lack of communication between the waste hauler, city employees, and the city council members the city of Oakland is going to receive an audit and determine what the best way to deal with this is to avoid a repeat scenario (Blasky 2015c). It is important for cities to keep their progress once they achieve it, otherwise they might have to start all over again to reintroduce the program.

While Oakland is trying to make up for lost progress, some Bay Area cities, such as those located in Solano County, are still trying to make initial steps toward meeting the state mandated commercial composting and upcoming 75% diversion rate because they are behind in improving its waste diversion. Solano County is service by six different waste haulers. Benicia and Benicia Unincorporated is serviced by Republic Services; Dixon and Dixon Unincorporated is serviced by Recology Dixon; Fairfield, Suisun City, Travis Air Force Base, Fairfield Unincorporated, and Suisun Unincorporated are serviced by Republic Services, known as Solano Garbage Company; Rio Vista and Rio Vista Unincorporated are served by Rio Vista Sanitation Service; Vacaville, Vacaville Unincorporated, and Vallejo Unincorporated are serviced by Recology Vacaville Solano; and Vallejo is serviced by Recology Vallejo. Of these, only Fairfield, Suisun Unincorporated, Suisun City, and Travis Air Force Base accepts food waste in their yardwaste carts as part of their normal service. The Solano County 2015 Recycling Guide reported that Vallejo Unincorporated will be the next area to begin food composting (Solano County 2015). Because Solano County is lagging behind the rest of the Bay Area, it is looking to its neighboring counties that are ahead of Solano county in their program start dates and public outreach and education. For this reason, Solano County is looking to Napa, among other

counties, for their next steps after creating a food composting program. Solano county has an Integrated Waste Management Local Task Force that meets once a month to “develop goals, policies, and procedures in accordance with California Integrated Waste Management Board rules and regulations, guide the development of the City and County Source Reduction and Recycling Elements, to comment on and assist in the development of the Siting Element and Countywide Summary Plan, and to recommend and coordinate the implementation of waste and disposal reduction programs” (Untal 2015). The Waste Management Local Task Force had Grey Kelley, the General Manager of NRWS, and Dirk Dudgeon, the Vice President of Business Development for Zero Waste Energy, give a presentation at their May 2015 meeting to talk about the future plans that Napa has for their composting program (Dum and Gonzalez 2015). Dirk Dudgeon was part of the presentation because NRWS and the City of Napa are working together with CH2MHill, Zero Waste Energy, and Cornerstone Environmental Group to begin building an anaerobic digester in 2016 (Miller 2014a). Solano County invited NRWS and Zero Waste Energy to talk at their meeting to see how other jurisdictions are addressing the upcoming legislation such as AB 1826.

#### Can Napa’s Program be applied to other locations?

While many Californian cities have succeeded in reaching and maintaining the current 50% diversion rate for the state set by AB 939, many cities still have to improve their diversion rate to reach the goal of 75% by 2020 that was set by AB 341. Napa has a head start compared to many of its neighboring cities and is also ahead in their composting efforts to cities around the United States. BioCycle, an Organics Recycling Authority, publishes a monthly magazine on



composting, organics recycling, anaerobic digestion, and renewable energy. In a study published in July 2014 of the 39 states that responded to BioCycle’s survey, only eight reported to have waste-diversion mandates (see fig. 7) (Platt and Goldstein 2014). Waste diversion mandates encourage jurisdictions to find alternatives to taking every material to the landfill. When there are no significant consequences of not reaching the mandate, it is very difficult to make jurisdictions abide by mandates. The case of California not reaching the 50% diversion mandate by 2000 illustrates this point well. This makes it unlikely that any significant diversion will occur by states that do not have a diversion mandate (Boone 2011). It also means that not only is California ahead of most states in its waste diversion efforts, but Napa may be ahead of most Bay Area cities in addition to cities from around the nation.

**Figure 7: Diversion mandates- state-by-state summary**

States with waste diversion mandates	States with no waste diversion mandates	Sates that did not respond
California	Alaska	New Mexico
Connecticut	Arizona	New York
Iowa	Arkansas	North Carolina
Maryland	Colorado	North Dakota
Massachusetts	Delaware	Ohio
New Jersey	Florida	Oregon
Tennessee	Idaho	Pennsylvania
Vermont	Indiana	Rhode Island
	Kansas	South Carolina
	Kentucky	South Dakota
	Maine	Utah
	Minnesota	Virginia
	Mississippi	Washington
	Montana	Wisconsin
	Nebraska	Wyoming
	New Hampshire	
		Alabama
		Georgia
		Hawaii
		Illinois
		Louisiana
		Michigan
		Missouri
		Nevada
		Oklahoma
		Texas
		West Virginia

(Platt and Goldstein 2014)

Although California is the only state in the country that has the ability to fine jurisdictions that are noncompliant with state mandates, it does not currently pose as a great source of pressure to those jurisdictions that are in noncompliance because it is not harsh enough to motivate most noncompliant jurisdictions. It is still another tool that should be utilized to further encourage the development of composting programs (Platt and Goldstein 2014; Boone 2015). Besides a lack of diversion mandates, many states do not offer any financial assistance for creating the infrastructure needed for composting. If there is no funding available, creating a composting program is unappealing even if it will offer significant benefits in the long run (Platt and Goldstein 2014). Napa is fortunate in that it receives more than sufficient funding from the city government. Not only can the City of Napa and NRWS afford to create the infrastructure needed for food-scrap composting programs, but they can offer many complementary services to their customers such as free trainings in multiple languages, personalized signs, and free indoor bins. They can also afford to advertise the service in a variety of different locations around the city (Dewey-Mattia and Turnipseed 2015).

Another advantage that Napa has with their composting program is that it can provide their customers with carts to collect the organic waste. NRWS did not have to deliver new carts to every household because residents could simply put their organics in the bin they were already using to throw away yardwaste. Using bins is its own advantage. Some cities only collect waste in bags. When food is separated from other waste, it is much heavier alone in a bag or cart compared to the same volume of mixed material. The weight of a bag with only food waste could be a problem for the durability of the bag and make it more difficult to collect than

regular waste. It might also be easier for rodents to get into a bag that holds only food (Dewey-Mattia and Turnipseed 2015). Cities that collect waste in bags would likely have to switch to using carts if they wanted to collect food waste. This would require a completely new infrastructure to accommodate the new method of waste collection. In BioCycle's 2014 study, only seven of the 39 responding states offered loan programs for organic waste programs and 14 of the 39 responding states offered grants (see fig. 8) With no way to fund a change in infrastructure, adding carts for a composting program is not a viable option for these cities.

**Figure 8: Funding programs to support composting: state-by-state summary**

Responding State	Grant	Loan
Alaska	No	No
Arizona	No	No
Arkansas	No	-
California	No	Yes
Colorado	Yes	No
Connecticut	No	No
Delaware	No	No
Florida	No	No
Idaho	No	No
Illinois	No	No
Indiana	No	No
Iowa	Yes	Yes
Kansas	Yes	-
Kentucky	No	No
Maine	No	Yes
Maryland	No	No
Massachusetts	Yes	Yes
Minnesota	Yes	Yes
Mississippi	Yes	No
Montana	No	No
Nebraska	Yes	No
New Hampshire	No	No
New Jersey	No	No
New Mexico	Yes	Yes
New York	Yes	No
North Carolina	Yes	No
North Dakota	No	No
Ohio	Yes	No
Oregon	No	No
Pennsylvania	No	No
Rhode Island	No	No
South Carolina	No	No
South Dakota	Yes	Yes
Tennessee	Yes	No
Utah	No	No
Vermont	No	No
Virginia	No	No
Washington	Yes	No
Wisconsin	No	No
Wyoming	No	No

(Platt and Goldstein 2014)

Creating a composting program is also influenced by the local weather conditions. In Napa, there is a Mediterranean climate, so it never snows or has regular freezes during the winter months. Both yardwaste and food waste is generated all year round. For cities that are in areas with very cold winters where there is maritime temperate or subarctic climate, there is no need for yardwaste bins in the winter. Especially for residential customers, there would not be enough organic material generated to make a weekly pick up worth it to the waste haulers (Dewey-Mattia and Turnipseed 2015). It is also more difficult to compost in locations with cold climate. Cold temperatures slow down the microbes in the compost that break down the organic matter. While the compost needs to get turned regularly, this may disrupt any insulation from the cold that microbes might have, further slowing the decomposition process (Nusbaum 2015). The microbes also need a balanced compost pile with “green material” such as food scraps that provide nitrogen and “brown material” such as yard trimmings that provide carbon. If a waste service company cannot pick up enough carbon-rich material, then the microbes will not have the optimal nutrients to efficiently break down the organic waste. With all of these factors, composting during the winter can be an extremely slow process that requires extra effort, which may not be a viable option to cities that are beginning a composting program (Slocum 2011). Composting programs may be the easiest adapted to locations with mild winters, though not impossible to implement in colder regions.

If finances are not a setback for jurisdictions in cold regions, waste facilities can deviate from the common window composting method, where organic waste is put in large piles outside, and instead invest in newer technology. The organics recycling facility on the University of Wisconsin’s campus in Oshkosh, Wisconsin uses a biodigester called BIOFerm.

BIOFerm allows food collection to continue in the winter months even if though waste facilities are not composting until spring. With the BIOFerm, a mix of food waste, animal bedding, and yardwaste is placed into fermentation vessels. When the fermentation vessel is full, it is closed and begins the 28-day fermentation process. Once the vessels are shut, a liquid percolate is sprayed into the organic waste which fills the biomass pore spaces and shifts bacterial activity to anaerobic digestion. This produces biogas which is collected and is used in the on site generator for heat and power. The heat is used to keep the vessels at a constant temperature during the winter months. The excess electricity that is produced is sold back to Wisconsin Public Service under a Power Purchase Agreement. After the 28-day fermentation period, if it is not during the winter months, half of the digestate is taken to an offsite facility to be added to compost made by the typical window method and the other half is reused for the next fermentation period (Platt et al. 2014; UW Oshkosh 2014). During the winter, when it is too cold to compost, the digestate is stored in an outdoor storage unit that holds approximately 6,000 tons until composting starts again in the spring (BioCycle 2015). By using fermentation vessels, facilities in cold places can still work on creating compost and diverting food from the landfill.

Another barrier that Napa did not have to face when implementing its composting program is getting new trucks to service the compost carts. NRWS was able to keep the same trucks to pick up the same carts because Napa residents were able to combine their food into the same cart as their yardwaste. If a location had to add carts for people to begin composting, it could be possible that they would also need more trucks to pick up the food waste. To be able to start a composting program and for a waste hauler to be allowed to get more trucks, they

must apply for a new waste facility permit. All jurisdictions in California receive permits from CalRecycle, so any composting program in California will not vary greatly from one facility to the next (Dewey-Mattia and Turnipseed 2015). While BioCycle's 2014 study determined that many of the yard trimming facilities in the United States had the potential to acquire permits for food composting programs instead of building completely new facilities, assuming that they made a few changes to their current yard trimming facilities. But In their current state, "many of the 3,453 yard trimmings composting operations in the U.S. are not staffed or equipped to comply with requirements for receiving food scraps, nor are the materials receiving and composting pads adequate to manage incoming feedstocks with high moisture content" (Platt and Goldstein 2014). This reality demonstrates that with more resources to improve infrastructure, more cities could begin to create a food scrap composting programs.

Ultimately, Napa's program could be adapted to many cities across the United States. Napa has an advantageous situation that allowed it to expand their program to the entire city and parts of Napa County that NCRWS services, due to its financial situation, the encouragement from the state mandate, pre-existing infrastructure, and favorable climate. Its program itself can be applied to other locations even if these other facilities face disadvantages or barriers. Composting is a way to manage food waste anywhere. It is unlike recycling where a facility has to find a buyer for the collected material, food is the same anywhere and can be composted in the same way. Even if a city does not adopt the program exactly, they can still adopt specific parts that will work for their local region, similar to Napa's borrowing of ideas from other Bay Area cities, just as these cities and others adopted the best practices of such innovative composting programs as offered in Portland and Seattle.

### What are Napa's next steps?

The City of Napa in collaboration with NRWS is currently in the process of developing the Napa Renewable Resources Project (NRRP). The NRRP consists of five steps. The first is to transition to covered composting because NRWS currently uses an open air windrow system. NRWS would like to use an AC Composter which is a Covered Aerated Static Pile System. The AC Composter has a cover made of a UV resistant and impermeable fabric that will go over the compost piles (Engineered Compost Systems 2015). The piles will be placed in three-sided bunkers so that the open side is facing the front of the setup. Beneath the piles, there is an in-floor aeration system which can either push air out or bring air in. This ability to change aeration will ensure that the pile is kept between a temperature of 114°F and 150°F while maintaining oxygen levels (Eberle 2013). Besides the ability to keep and maintain optimal composting conditions which speeds up the composting process, covered composting is more effective because it will prevent rain water contamination, odors, and vectors. It is also anticipated that in the future, the uncovered windrow composting systems will become obsolete and no longer be permitted (Dewey-Mattia 2013).

NRWS would also like to improve its existing stormwater system. For nearly twenty years, the MDF has had an aerated retention pond and a bioswale stormwater treatment system (Miller 2013). Updating the stormwater system would not only be an improvement of the existing system, but would also work in conjunction with the covered composting system because it has a leachate and condensate collection built into the composting system (Eberle 2013). This will have to be done by once the new composting system is put into place because the State Water Resources Control Board issued a General Waste Discharge Requirements for



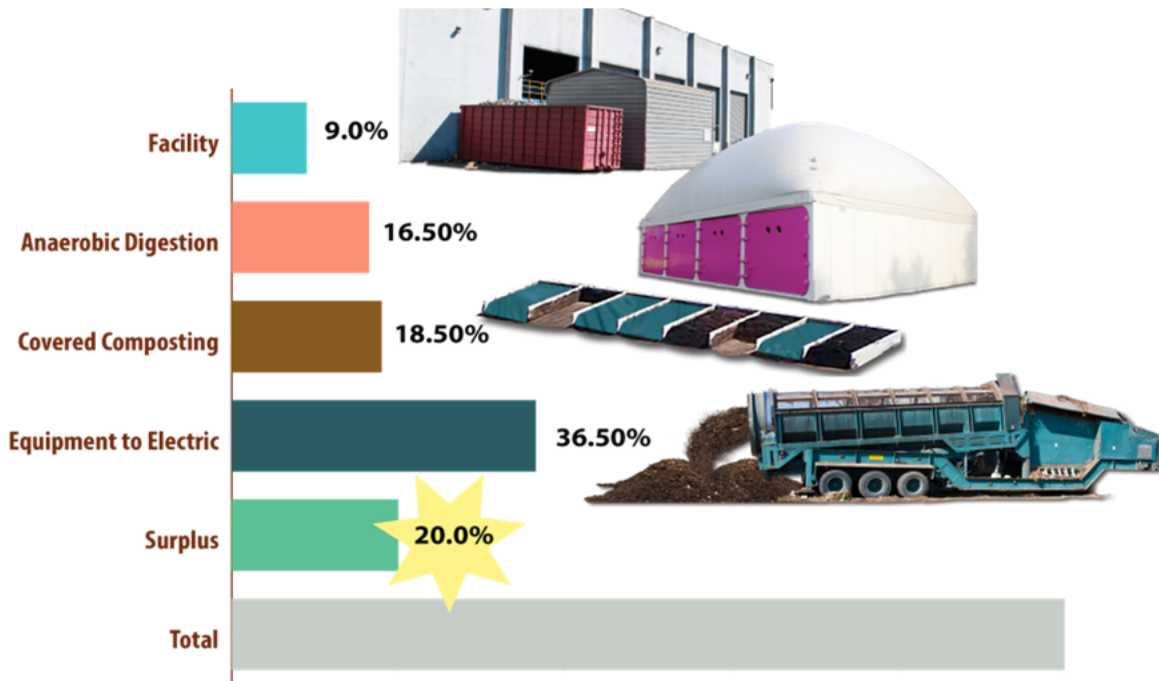
Composting Operations (General Order) in August 2015. The General Order requires that any composting facility handling at least 500 cubic yards of allowable compost materials must abide by the regulations set by the State Water Board to contain leachate and condensate so that it is prevented from entering the groundwater (State Water Board 2015). NRWS considers both the covered composting and a new stormwater system something that they must have for the future whereas the next three steps of the NRRP are desirable to achieve local sustainability, but are not going to be required to comply with any mandates (Dewey-Mattia 2013).

The City of Napa and NRWS's most desired addition to the MDF is an anaerobic digester. This step of the NRRP is called the Anaerobic Digestion-to-Renewable Compressed Natural Gas Project (AD to RNG). Napa wants to take current sustainability to the next level so that it collect the energy that is produced by the compost to fuel their collection trucks. They will use a dry anaerobic digester, which will not require any water or water removal which will save costs on water and wastewater treatment (Miller 2014a). The anaerobic digester is made of a unit which consists of a series of four modules. Food and yardwaste is collected and placed into a module where it ferments. This fermentation process produces methane gas that is captured in the cap of the module (Dewey-Mattia 2013). The city has determined that the amount of organic waste generated NRWS customer, representing approximately 100,000 people, can be converted into RNG to meet the fuel demand of the truck fleet that collects all organic material from the community. In fact, "NWRS will use six trucks to collect eight tons of organics per load, twice per day Monday through Friday, to deliver 25,000 tons per year to the Napa MDF. From that organic waste feedstock, there will be enough fuel for a fleet of 35 trucks, which would include fueling the fleet that collects the recyclables and other waste materials" (Miller 2014a). The

anaerobic digester also produces combined heat and power which is used to add heat to the anaerobic digester to speed the fermentation process (Dewey-Mattia 2013). This will allow the city and NRWS to contribute and go beyond waste diversion to become a more sustainable community.

NRWS and the City of Napa also want implement a Biomass system that produces energy by using clean wood from large wood debris and scrap construction lumber. The woody biomass is put into a conversion chamber and synthetic gas created produced and captured. The synthetic gas is combusted in a generator system that produces electricity. This electricity will be used to power the activities and equipment of the facility (fig. 9) and any leftover electricity, will be sold to Pacific Gas and Electric (PG&E) by transmission lines that would be installed if the MDF developed the anaerobic digester and biomass system (Eberle 2013). The end conversion result of the woody biomass is “BioChar,” which is essentially a very concentrated soil amendment. Like compost, the BioChar has the ability to sequester carbon when used as a soil amendment (Dewey-Mattia 2013). Selling electricity back to PG&E and creating soil amendments have benefits to the local community, not only NRWS and the City of Napa. This closed loop system allows the community to receive electricity produced by the waste collected within it and makes soil amendments that can be used locally for agricultural uses.

**Figure 9: Where does the biomass energy go?**



(Haddad 2013)

Finally, the NRRP proposal includes the installation of solar panels. As of late 2015, the roof of the MRF is old and needs to be replaced. When the roof is inevitably replaced in the future, the new roof should have solar panels installed (Dewey-Mattia 2013). The solar panels would cover approximately 20,000 square feet of roof and reduce the electricity that is bought from PG&E (Eberle 2013). If all of the proposed projects are implemented, then the NRWS and the City of Napa will achieve “a carbon neutral facility producing carbon negative fuel and would be considered a Net Zero facility by California Air Resources Board (CARB)” (Miller 2014a). It would also reduce its greenhouse gas emissions from these additions to the facility by 93% (Dewey-Mattia 2013). This compensation of gas emissions will result in about 30% overall

reduction from the MDF's 2010 levels (Zero Waste 2015). The NRRP is also significant in showing that private and public entities can work together to create sustainable development in waste diversion with a focus on composting.

The city began to plan for the NRPP in 2011. To begin the process, Napa hired CH2M Hill Engineers to review the MDF and determine a long term plan for the facility. On March 25, 2014, the city was awarded a \$3 million grant from the California Energy Commission for the implementation of the anaerobic digester (Miller 2014b). The city will pay \$5,300,000 towards the project initially with the remainder financed over a period of 20 years at 5% interest (Miller 2014a). The total project will cost about \$12 million (Scriven 2014). Preliminary construction has begun in the summer of 2015 and should be fully operational by 2018. As of November 2015, the processing line was set up and the new electric grinder is operational in the organics receiving building that was constructed in summer 2015. In spring 2016, construction will begin for the covered aerated static pile composting system and should take six to twelve months to complete. Once the covered composting system is built, construction of the anaerobic digester will begin. (Zero Waste 2015; Dewey-Mattia 2015b). With the NRRP being implemented before 2020, Napa should be able to reach 75% diversion before the mandate is in effect.

### Conclusion

As the NRRP demonstrates, waste diversion can create benefits that reach beyond waste-diversion goals. More composting programs must be created if all jurisdictions in California are going to reach 75% diversion by 2020. Not only will these programs be beneficial to reaching this goal, but they have become mandatory to accommodate the required

commercial composting that was set up by AB 1826. In the City of Napa, a composting program has been rolled out to the entire city, not only the commercial customers that will be required to compost. Napa can act as an example to other California cities and allow them to create their own program by following its process. By using Napa's example as a type of road map, other cities that are not currently on track to reach a 75% diversion rate by 2020 can get on the correct path or expedite their planning.

As California strives for a 75% diversion goal by 2020, that should not be the end goal. Eventually the state should strive for zero waste, by achieving 100% diversion. Jurisdictions can continue to take steps as Napa has done to create sustainable systems such as their composting program and NRRP. Once cities create sustainable practices for collecting waste, the focus should shift from recycling and composting programs to trying to reduce waste at the source. Napa has clearly demonstrated that while laws are put into place to encourage sustainable practices, the results of the programs can lead to benefits for the entire community. Locally, the diverted organic waste can be made into compost for the community to use, it can save residents money when they use their brown cart instead of their garbage cart, and reduces the number of miles the service trucks have to travel to go to other counties to use the landfill space for waste that could be composted in their own county. Beyond the local implications, composting also reduces greenhouse gas emissions, and if expanded to include such technologies as anaerobic digesters and biofuel systems, can create negative carbon emissions.

## Bibliography

- Bednarz, Sal. 2015. "Piedmonter/Montclarion Letters: Oakland's Trash Contract an Assault on Business Community." *The Piedmonter and Montclarion*, September 16.  
[http://www.insidebayarea.com/news/ci\\_28822803/piedmontermontclarion-letters:-oaklands-trash-contract-an-assault-on-business-community](http://www.insidebayarea.com/news/ci_28822803/piedmontermontclarion-letters:-oaklands-trash-contract-an-assault-on-business-community).
- BioCycle. 2015. "BioCycle: Oshkosh, Wisconsin: University AD Plant Boosts Revenues With Compost, Heat Sales." *BioCycle* 56 (9): 17.
- Blasky, Mike. 2015a. "Oakland Restaurant Owners Outraged over Dramatic Compost Collection Rates." *Oakland Tribune*, July 9.  
[http://www.insidebayarea.com/news/ci\\_28460941/oakland-restaurant-owners-outraged-over-dramatic-compost-collection-rates](http://www.insidebayarea.com/news/ci_28460941/oakland-restaurant-owners-outraged-over-dramatic-compost-collection-rates).
- Blasky, Mike. 2015b. "Oakland Still Wading in Trash; Council Delays Action." *Inside Bay Area*, July 20.  
[http://www.insidebayarea.com/news/ci\\_28513365/oakland-still-wading-in-trash;-council-delays-action](http://www.insidebayarea.com/news/ci_28513365/oakland-still-wading-in-trash;-council-delays-action).
- Blasky, Mike. 2015c. "After Stink Raised, Oakland Amends Billion-Dollar Garbage Contract." *Inside Bay Area*, September 29.  
[http://www.insidebayarea.com/news/ci\\_28898637/after-stink-raised-oakland-amends-billion-dollar-garbage-contract](http://www.insidebayarea.com/news/ci_28898637/after-stink-raised-oakland-amends-billion-dollar-garbage-contract).
- Blumenfeld, Jared. 2009. "Regulations Implementing Mandatory Recycling and Composting Ordinance (Ordinance No100-09)." #SFE-09-02-MRO. San Francisco Department of Environment Regulation.
- Boone, Arthur. June 1-3, 2015. "Introduction to Recycling Class." San Francisco .
- Boone, Arthur. 2008. "ITR- Introduction to Basic Materials: General Comments on Materials and Their Recycling." In , 1-13. Northern California Recycling Association.
- Boone, Arthur. 2011. "The Five Eras of Discards Management." In . The Northern California Recycling Association.
- Boone, Arthur. 2014. "ITR- Step Three: How People Pay for Disposal Practices." In . Northern California Recycling Association.
- Bowe, Rebecca. 2014. "Jury Finds Recology Cheated in Waste Diversion Bonus Program." *San Francisco Bay Guardian*, June 20.  
<http://www.sfbg.com/politics/2014/06/20/jury-finds-recology-cheated-waste-diversion-bonus-program>.
- Boyd, Gerald D. 2004. "The Science Behind the Napa Valley Appellation."
- California Air Resources Board. 2008. "Climate Change Scoping Plan."
- CalRecycle. 2002. "'Innovations' Case Studies: Curbside Recycling, the Next Generation." *CalRecycle*. California Department of Resources Recycling and Recovery. October 2.  
<http://www.calrecycle.ca.gov/lgcentral/library/innovations/Curbside/Program.htm>.
- CalRecycle. 2011. "AB 75, Chapter 764, Statutes of 1999." *CalRecycle*. October 14.  
<http://www.calrecycle.ca.gov/stateagency/requirements/AB75.htm>.
- CalRecycle. 2012. "Regulations: Title 14, Natural Resources--Division 7, CIWMB Chapter 3.1. Composting Operations Regulatory Requirements." *CalRecycle*. October 1.  
<http://www.calrecycle.ca.gov/laws/regulations/title14/ch31a5.htm>.

- CalRecycle. 2014. "Mandatory Commercial Recycling Frequently Asked Questions." *CalRecycle*. November 6. <http://www.calrecycle.ca.gov/recycle/Commercial/faq.htm>.
- CalRecycle. 2015a. "Permitting & Assistance Branch Staff Report."
- CalRecycle. 2015b. "Solid Waste Facility Permit."
- CalRecycle. 2015c. "Climate Change." *CalRecycle*. April 15. <http://www.calrecycle.ca.gov/climate/>.
- CalRecycle. 2015d. "Alternative Daily Cover (ADC)." *CalRecycle*. April 29. <http://www.calrecycle.ca.gov/lgcentral/basics/adcbasic.htm>.
- CalRecycle. 2015e. "Mandatory Commercial Recycling." *CalRecycle*. August 19. <http://www.calrecycle.ca.gov/recycle/commercial/>.
- CalRecycle. 2015f. "Mandatory Commercial Organics Recycling." *CalRecycle*. September 10. <http://www.calrecycle.ca.gov/recycle/commercial/organics/>.
- CalRecycle. 2015g. "2014 Disposal-Facility-Based Characterization of Solid Waste in California" California Integrated Waste Management Board; Cascadia Consulting Group .
- CDFR. 2012. "Organic Input Fertilizing Material Program." *California Department of Food and Agriculture*. January. [http://www.cdfa.ca.gov/is/ffldrs/fertilizer\\_OIM.html](http://www.cdfa.ca.gov/is/ffldrs/fertilizer_OIM.html).
- Chesbro, Wesley. 2014. "AB-1826 Solid Waste: Organic Waste." *California Legislative Information*. September 28. [http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201320140AB1826&search\\_keywords](http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140AB1826&search_keywords).
- City of Napa. 2004. "Resolution Supporting a Cost-Saving District-Wide Waste Reduction and Recycling Program."
- City of Napa. 2015. "CITY OF NAPA NOTICE OF PUBLIC HEARING ON PROPOSED CHANGES TO RATES FOR COLLECTION OF SOLID WASTE, RECYCLABLE MATERIALS, YARDWASTE AND FOOD SCRAPS IN THE CITY OF NAPA."
- Clark, Greg. 2014. "2013 Agricultural Crop Report." Napa County Department of Agriculture and Weights & Measures.
- Clark, Greg. 2015. "2014 Agricultural Crop Report Released." *County of Napa*. May 12. <http://www.countyofnapa.org/Pages/DepartmentNews.aspx?id=4294983793>.
- County of Napa. 2009. "About Napa County." *The County of Napa*. <http://www.countyofnapa.org/pages/departmentcontent.aspx?id=4294967635>.
- Courtney, Kevin. 2005. "Napa Recycling Makes What's in the Blue Bins Top Priority." *Napa Valley Register*, October 23. [http://napavalleyregister.com/news/local/napa-recycling-makes-what-s-in-the-blue-bins-top/article\\_a149672e-9f32-5b52-a931-bb1bd2d8f89e.html](http://napavalleyregister.com/news/local/napa-recycling-makes-what-s-in-the-blue-bins-top/article_a149672e-9f32-5b52-a931-bb1bd2d8f89e.html).
- DeLonge, Marcia S., Rebecca Ryals, and Whendee L. Silver. 2013. "A Lifecycle Model to Evaluate Carbon Sequestration Potential and Greenhouse Gas Dynamics of Managed Grasslands." *Ecosystems* 16: 962–79.
- Destination Analysts, Inc. 2015. "Visit Napa Valley 2014 Napa Valley Visitor Profile."
- Dewey-Mattia, Tim. 2013. "Napa Renewable Resources Project (NRRP)." February 11.
- Dewey-Mattia, Tim. E-mail to Liana Solis. 2015a, October 1.
- Dewey-Mattia, Tim. E-mail to Liana Solis. 2015b, November 23.
- Dewey-Mattia, Tim, and Stephanie Turnipseed. 2015, August 26.
- Dum, Amanda, and Sandra Gonzalez. 2015. "MINUTES: Solano County Local Task Force (LTF) for Integrated Waste Management." Integrated Waste Management Local Task Force.

- Eberle, Kevin. 2013. "Mitigated Negative Declaration." PL12-0022. City of Napa.
- Engineered Compost Systems. 2015. "AC Composter - Composting Systems - Aerated Static Pile (Covered)." *Environmental Xprt*.  
<http://www.environmental-expert.com/products/ac-composter-composting-systems-aerated-static-pile-covered-142659>.
- Environment, S. F. 2015. "Frequently Asked Questions - Recycling and Composting Ordinance." *SF Environment*. San Francisco Department of the Environment.  
<http://www.sfenvironment.org/article/recycling-and-composting/faqs-recycling-and-composting-ordinance>.
- Franson, Paul. 2015. "How Many Wineries Are Enough?" *Wines & Vines*. March 13.  
<http://www.winesandvines.com/template.cfm?section=news&content=147919>.
- Godwin, Amanda, and Ashley Zanolli. 2015. "Community-Based Social Marketing and Food Waste Training." presented at the 2014-15 West Coast Climate Forum Webinar Series, West Coast Climate & Materials Management Forum, March 24.
- Goldsmith, Judith. 2010. "Winter Is a Great Time for Gardening in 'Mediterranean' Climate Areas!" *Permaculture Research Institute*. October 6.  
<http://permaculturenews.org/2010/10/06/winter-is-a-great-time-for-gardening-in-mediterranean-climate-areas/>.
- Haddad, Becki. 2013. *Where Does the Biomass Energy Go?* Digital. City of Napa.
- Hollis, Bob. 2013. "Recycle More." *Napa Recycling and Waste Services*. March 29.  
<http://naparecycling.com/recycle-more/>.
- Lublin, Abby, Anasha Cummings, Lucy Greetham, Mary Alice Pasanen, and Guy Schaffer. 2012. "Municipal Composting in Troy Draft Report of the Citizens Working Group— Composting."
- MacBride, Samantha. 2013. "San Francisco's Famous 80% Waste Diversion Rate: Anatomy of an Exemplar." *Discard Studies*, December 6.  
<http://discardstudies.com/2013/12/06/san-franciscos-famous-80-waste-diversion-rate-anatomy-of-an-exemplar/>.
- Martin, Philip. 2000. "Napa: Wine, Farm Workers and Housing." *Changing Face*. September 27.  
<https://migration.ucdavis.edu/cf/more.php?id=59>.
- McKaughan, Laura. 2015. presented at the Introduction to Recycling, San Francisco, June 1.
- Miller, Kevin. 2013. "Informational Report on Napa Renewable Resources Project at City's Materials Diversion Facility." In *City of Napa City Council*. Materials Diversion Administrator.
- Miller, Kevin. 2014a. "Project Narrative: California Energy Commission Grant Solicitation." PON-13-609. City of Napa.
- Miller, Kevin. 2014b. "Agreement with the California Energy Commission to Receive Grant Funding of \$3 Million for an Anaerobic Digestion to Biofuel Facility." City of Napa.
- Miller, Kevin. 2015. "Two-Year Solid Waste and Recycling Rate Recommendations." presented at the Napa City Council, January 20.
- Minter, Adam. 2014. "San Francisco's Recycling Claims Are Garbage." *Bloomberg View*, July 12.  
<http://www.bloombergview.com/articles/2014-07-11/san-francisco-s-recycling-claims-are-garbage>.
- NCRWS. 2014. "SCHEDULE OF AMENDED RATES." *Napa Recycling and Waste Services*.  
<http://naparecycling.com/wp-content/uploads/2013/03/NCRWS-Rates-Oct2014.pdf>.
- Northern Recycling. 2014. "Napa and Zamora's Organic Compost: A Natural Choice." *Northern*



- Compost. <http://northerncompost.com/benefits/>.
- NRWS. 2013a. "About Us." *Napa Recycling and Waste Services*.  
<http://naparecycling.com/about-us/>.
- NRWS. 2013b. "COMPOST: A Natural Choice." *Napa Recycling and Waste Services*.  
<http://naparecycling.com/compost/>.
- NRWS. 2013c. "Devlin Road Recycling & Transfer Facility." *Napa Recycling and Waste Services*.  
<http://naparecycling.com/devlinroadrecycling/>.
- NRWS. 2013d. *Food Composting Pail*. Photograph.
- NRWS. 2013e. "Guide for Residential Curbside Services." *Napa Recycling and Waste Services*.  
<http://naparecycling.com/residential/>.
- NRWS. 2013f. "Home Composting." *Napa Recycling and Waste Services*.  
<http://naparecycling.com/home-composting/>.
- NRWS. 2013g. "Residential Curbside Compost Pilot Program - Survey Results."
- NRWS. 2013h. "Residential Food Composting Program." *Napa Recycling and Waste Services*.  
<http://naparecycling.com/residential-food-composting/>.
- NRWS. 2013i. "Single-Stream Recycling." *Napa Recycling and Waste Services*.  
<http://naparecycling.com/single-stream-recycling>.
- NRWS. 2015a. "Collection Rates With 4.95% Increase Effective April 1, 2015."
- NRWS. 2015b. "Welcome to Napa's Curbside Food Composting."
- NRWS. 2015c. "Annual Collections Reports: 2014."
- NRWS. 2015d. "Annual MDF Reports: 2014."
- NRWS. Letter to George Rothwell. 2015e, July 17. *Napa Valley Register*.
- Nusbaum, Joan. 2015. "Cold Weather Compost." Colorado State University.
- Oakland Recycles, and City of Oakland. 2015. "Monthly Trash & Compost Collection Service Rates For Businesses." July 1, 2015 - June 30, 2016.
- OMRI. 2015. "What to Expect." *OMRI*. <http://www.omri.org/suppliers/review-requirements>.
- Platt, Brenda, and Nora Goldstein. 2014. "State Of Composting In The U.S." *BioCycle* 55 (6): 19.
- Platt, Brenda, Nora Goldstein, Craig Coker, and Sally Brown. 2014. "State of Composting in the US: What, Why, Where and How." *Institute for Local Self-Reliance*, July, 1–113.
- Pollin, Emma. 2009. "When Food Scraps Dream." *All the Rest Is Commentary*. April 29.  
[http://www.alltherestiscommentary.com/2009\\_04\\_01\\_archive.html](http://www.alltherestiscommentary.com/2009_04_01_archive.html).
- Recology SF. 2015. "Residential Recycling, Composting & Trash Services." *Recology*.  
<http://www.recologysf.com/index.php/for-homes/residential-recycling-compost-trash#composting>.
- Rothwell, George. 2015. "Better Way to Compost Food." *Napa Valley Register*, July 17.
- Ryals, Rebecca, and Whendee L. Silver. 2013. "Effects of Organic Matter Amendments on Net Primary Productivity and Greenhouse Gas Emissions in Annual Grasslands Read More:  
<http://www.esajournals.org/doi/full/10.1890/12-0620.1>." *Ecological Applications: A Publication of the Ecological Society of America* 23 (1): 46–59.
- Scriven, Eric. 2014. "NRRP Financing Analysis." City of Napa.
- SF Environment. 2003. "Zero Waste by 2020." *SF Environment*.  
<http://www.sfenvironment.org/zero-waste/overview/goals>.
- SF Environment. 2012. "Mayor Lee Announces San Francisco Reaches 80 Percent Landfill Waste Diversion, Leads All Cities in North America." *SF Environment*, October 5.  
<http://www.sfenvironment.org/news/press-release/mayor-lee-announces-san-francisco-r>

eaches-80-percent-landfill-waste-diversion-leads-all-cities-in-north-america.

Simmons, Latonda. 2014. "Ordinance 13258." Oakland City Council.

Slocum, Genevieve. 2011. "Cold-Weather Compost." *Rodale's Organic Life*. February 9.  
<http://www.rodalesorganiclife.com/garden/cold-weather-compost>.

Solano County. 2015. "Solano County Recycle Guide 2015." Resource Management.

State Water Board. 2015. "General Waste Discharge Requirements for Composting Operations." WQ 2015-XXXX-DWQ . State Water Resources Control Board.

Stop Waste. 2014. "History: StopWaste Milestones: 1976–2014." *Stop Waste*.  
<http://www.stopwaste.org/about/about-stopwaste/history>.

Stop Waste. 2015a. "A Public Agency Reducing Waste in Alameda County." *Stop Waste*.  
<http://www.stopwaste.org/>.

Stop Waste. 2015b. "StopWaste.Org." *Facebook*. <https://www.facebook.com/StopWasteOrg/>.

Stop Waste. 2015c. "Disposal Tonnages and Diversion Rate by Jurisdiction." Stop Waste.

Sun Staff Reports. 2014. "Don't Merge Waste as of July First." *Alameda Sun*, June 5.  
<http://alamedasun.com/news/don%E2%80%99t-merge-waste-july-first>.

Sustainable Napa County. 2015. "Food Composting Program Tips." *Sustainable Napa County*.  
<http://www.sustainablenapacounty.org/site/the-issues/recycle-and-waste?article=130>.

Swan, Rachel. 2015. "Soaring Garbage Costs Raise Stink in Oakland." *San Francisco Chronicle*, July 26.

Turnipseed, Stephanie. Letter to Liana Solis. 2015, September 16.

Untal, Narcisa. 2015. "Integrated Waste Management Local Task Force." *Solano County*.  
 September.  
[https://www.solanocounty.com/depts/rm/boardscommissions/integrated\\_waste\\_management\\_local\\_task\\_force/default.asp](https://www.solanocounty.com/depts/rm/boardscommissions/integrated_waste_management_local_task_force/default.asp).

U.S. Census Bureau. 2015a. "Napa County, California QuickFacts." *U.S. Census Bureau*. August 5.  
<http://quickfacts.census.gov/qfd/states/06/06055.html>.

U.S. Census Bureau. 2015b. "Napa (city) QuickFacts." *U.S. Census Bureau*. August 6.  
<http://quickfacts.census.gov/qfd/states/06/0650258.html>.

US Composting Council. 2010. "If It Isn't STA Certified Compost, What Is It?" *United States Composting Council*. <http://compostingcouncil.org/seal-of-testing-assurance/>.

UW Oshkosh. 2014. "RENEWABLE ENERGY FROM WASTE: Extra Credit, UW-Oshkosh Biodigester Next Steps." *BIOFerm*, August 20.  
<http://www.biofermenergy.com/university-wisconsin-oshkosh-biodigester-waste-heat/>.

Wetzstein, Janelle. 2014. "Garbage Hauler given Contract Extension." *Napa Valley Register*, April 15.  
[http://napavalleyregister.com/news/local/garbage-hauler-given-contract-extension/article\\_22f8cadc-c515-11e3-a6ba-001a4bcf887a.html](http://napavalleyregister.com/news/local/garbage-hauler-given-contract-extension/article_22f8cadc-c515-11e3-a6ba-001a4bcf887a.html).

Wolff, Gary. 2009. "Ordinance 2008-01 An Ordinance Prohibiting the Disposal of Certain Materials at Alameda County Landfills." The Board of the Alameda County Waste Management Authority.

Yepsen, Rhodes. 2012. "Residential Food Waste Collection in the U.S." *BioCycle* 53 (1): 23–33.

Zero Waste. 2015. "City of Napa Biogenic CNG Facility." Zero Waste Energy; City of Napa; Napa Recycling & Waste Services.