



FOOD WASTE WARRIORS

A deep dive into food waste in US schools



ACKNOWLEDGEMENTS

World Wildlife Fund (WWF) would like to thank The Kroger Co. Foundation and the U.S. Environmental Protection Agency for their generous support of the initiatives described in this report; Melissa Terry, University of Arkansas, for her dedication and insight as one of the principal investigators on this project; and the following individuals for their support on the ground collecting the data and stories that were foundational for this work:

ATLANTA

Brenda O. McDaniel
Gwinnett County Public Schools
Suzanne Haerther
U.S. Green Building Council

BOULDER

Laura Smith, Ann Cooper, Heather Ridge, Amy Thompson, & Stephanie Dobbie
Boulder Valley School Food Project

CINCINNATI

Angela Rivera
Hamilton County Recycling & Solid Waste District

COLUMBUS

Kyle O'Keefe & Kristi Higginbotham
The Solid Waste Authority of Central Ohio

INDIANAPOLIS

Jim Poyser
Earth Charter Indiana

NASHVILLE

Diana Andrew, Brittany O'Connell, & Todd Lawrence
Urban Green Lab

PHOENIX

Robert McGehee
Arizona State University

PORTLAND

Meghan Borato & Emma Spanjer
Oregon Green Schools
Laurel Bates & Robert Jiminez-Sutton
Clackamas County Office of Sustainability & Solid Waste

SEATTLE

Erin Hislop & Alexis Alloway
Triangle Associates



ATLANTA
BOULDER
CINCINNATI
COLUMBUS
INDIANAPOLIS
NASHVILLE
PHOENIX
PORTLAND
SEATTLE

EXECUTIVE SUMMARY

In the spring of 2019, World Wildlife Fund (WWF), with support from The Kroger Co. Foundation and the U.S. Environmental Protection Agency (EPA) Region 4 (Southeast), analyzed food waste in 46 schools in nine cities across eight states including Atlanta, Boulder, Cincinnati, Columbus, Indianapolis, Nashville, Phoenix, Portland, and Seattle.



As part of the Food Waste Warrior pilot program, WWF contracted organizations in each of the cities to assist with student-led food waste audits and to deliver a WWF math and science conservation curriculum guiding students to connect the dots between food, waste, natural resources, and wildlife. The audit and data-collection methods used throughout this project are replicable and can be adapted in any school cafeteria or across an entire school district.

The objectives of the project were to engage students in the act of measuring waste, foster an understanding of connections between food and its environmental impacts, and formalize how we might gather more streamlined data on cafeteria food waste. Due to time constraints, the project was not formally testing behavioral interventions to reduce waste. However, we found that the simple act of separation and measurement often inspires students, teachers, and staff to think of how they might reduce that waste. While our modest sample size is not representative of the approximately 100,000 schools that participate in the National School Lunch Program (NSLP), we did see that the participating schools reduced their waste to varying degrees over the short project timeline with fairly simple interventions. What gets measured often gets managed.

This project confirmed that there is much variation in how food waste is managed across schools, districts, and states. For the purposes of this project, food waste was measured post-service (i.e. plate waste) in the cafeteria, not in ‘back-of-house’ pre-service operations. The results of the Food Waste Warriors program are notable:



- ▶ On average, each of the 46 schools produced approximately 39.2 pounds of food waste per student per year;
- ▶ On average, each of the 46 schools produced approximately 28.7 cartons of milk waste per student per year¹;
- ▶ On average, elementary schools produced 42.8 pounds of food waste and 37.6 cartons of milk waste per student per year;
- ▶ On average, middle schools produced 41.9 pounds of food waste and 19.4 cartons of milk waste per student per year
- ▶ Even with only informal interventions and a short project period, elementary schools averaged a 14.5% reduction over the course of the project; Our top 3 performers reduced total food waste per student by an average of 53% from first to last audit.
- ▶ When first and last audits were averaged for all participants, the full range of schools recorded an average 3% food waste reduction.
- ▶ Participating schools reduced milk waste on average by 12.4%.

FOOD WASTE COULD BE
\$1.7
 BILLION
 EVERY SCHOOL YEAR

The report highlights that food waste could be costing as much as \$9.7M per day, or \$1.7B every school year. While this also represents a loss of environmental resources, perhaps most importantly, this food waste represents lost nutrition. By raising awareness through regular measurement, student empowerment, and waste reduction initiatives, schools can potentially achieve significant savings in avoided disposal costs. These savings can be reinvested back into food service programs to improve the nutrition, health and well-being of the student population, while also establishing the cafeteria as a real-world learning environment and classroom for students.

¹ Carton equivalents of milk are used in this report regardless of delivery method for easy comparison.

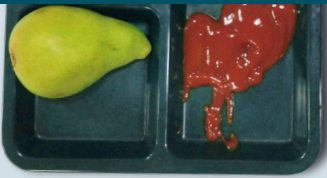
EQUIVALENT OF TAKING
12,400
PASSENGER VEHICLES
OFF THE ROAD FOR
1 YEAR

Using our sample group as a basis for estimation, we infer that national food waste in schools (excluding milk) could amount to approximately 530,000 tons per year. This translates into 1.9M MTCO₂e of embedded greenhouse gases (GHG) and 20.9B gallons of embedded water. Milk waste from schools – examined separately because of the difference in weight measurement – could be as much as 45 million gallons per year. If we could cut food waste in schools nationwide by the reductions demonstrated in our study,² it could mean huge benefits for the environment, such as the equivalent of taking 12,400 passenger vehicles off the road for one year, while also fostering the next generation of conservationists and food waste warriors.

The study illuminates many opportunities for food waste reduction and repurposing, which leads us to include two sets of recommendations – one for policymakers and another for school administrators. These recommendations range from establishing national, regional and/or local incentive programs for reducing food waste in schools that put resources into dedicated staff roles and responsibilities, to adjusting and/or clarifying offer versus serve guidelines, to investing in bulk milk dispensers, iterating on share tables, and conducting more formal experimentation of waste reducing interventions.



² Food waste was reduced 3% across schools from first to last audit.



THERE ARE NEARLY
100,000
SCHOOLS



SERVING LUNCHES TO
29,600,000
STUDENTS
EACH DAY



BACKGROUND

There are nearly 100,000 schools serving lunches to 29.6 million students each day, including 20.2 million free meals, as part of the National School Lunch Program (NSLP).³ This just accounts for the school year (typically ~180 days) and doesn't include the School Breakfast Program or the Summer Food Service Program. In 2018, approximately 4.8 billion school lunches were served as part of the NSLP.⁴ Since its establishment in 1946, this program has provided meals to children in public schools, nonprofit private schools, charter schools, and other forms of licensed childcare programs. The NSLP may be one of the most influential programs for educating youth on conservation opportunities linked to our food system.

Momentum to fight food waste in schools is building. In November 2018, the National Resources Defense Council (NRDC) launched its Wasting Less Food in K12: Best Practices for Success. In April 2019, the US Department of Agriculture (USDA), the EPA, and the Food and Drug Administration (FDA) announced the signing of a joint agency "Winning on Reducing Food Waste" initiative to advance a national goal of reducing food loss and waste by 50% by 2030. The agreement included coordination on food loss and waste actions such as education and outreach, research, community investments, public-private partnerships and policy interventions. Additionally, the Commission for Environmental Cooperation (CEC) – a collaboration between Canada, Mexico and the US on which WWF plays an advisory role – launched its Food Matters Action Kit for schools in April 2019.

3,4 <https://fns-prod.azureedge.net/sites/default/files/resource-files/sisummar-9.pdf>

PROJECT INTRODUCTION



WWF began developing its Food Waste Warrior (FWW) program as part of the Wild Classroom education platform in 2017. The program is simple: Encourage schools to engage students on food loss and waste as part of conservation curriculum. Students are empowered to discover the impact of food waste through experiential learning – conducting hands-on cafeteria waste audits throughout the school year. They simultaneously experience an integrated science and math conservation lesson plan that highlights the natural resources associated with wasting food, including the wildlife they are passionate about protecting.

Relating these impacts back to biodiversity and habitat loss creates a unique and engaging connection for students. Indeed, agriculture's expanding footprint is the single largest global contributor to biodiversity and habitat loss, at a time when it's estimated that 30-40% of the food we produce is lost or wasted across the value chain. Waste, in all its forms, is something we can no longer afford to tolerate. WWF's Food Waste Warrior program and this 6-month, multi-city project builds upon years of research and data collection by WWF and our partners. One point is consistent: the cafeteria is one of our most important classrooms, and we need to encourage deeper educational linkages through curriculum, student engagement, and a rekindled food ethic.

**THE CAFETERIA
IS ONE OF
OUR MOST
IMPORTANT
CLASSROOMS**



STUDENT-LED AUDITS FROM JANUARY-JUNE OF THE 2018-19 SCHOOL YEAR

METHODOLOGY

In December 2018, WWF convened selected organizations based locally in each of nine designated pilot cities to kick-off a project delivering the Food Waste Warrior curriculum and coordinating student-led audits from January-June of the 2018-19 school year. During the convening workshop, the group defined a consistent methodology for data collection using previous WWF pilot projects and the USDA's Guide to Conducting Student Food Waste Audits as a foundation. It was decided that school profiles and aggregate plate waste data would be collected via WWF's customized [online dashboard tool](#).

One recent study validates that aggregate plate waste data can provide reasonable estimates of cafeteria food waste when compared to more expensive and time intensive studies that individually weigh plate waste.⁵ For each participating school the following data points were collected, along with basic details on food service and material management, with only identifying information required (marked *) to allow for variation in data collection:

- ▶ School name*
- ▶ School grade level
- ▶ OVS policy
- ▶ Date and time of audit(s)
- ▶ Number of students served per school meal*
- ▶ Number of students attending the lunch period(s)
- ▶ Grade(s) attending the lunch period
- ▶ Collected waste weight data
- ▶ Listing of what was served for lunch
- ▶ How many audits were previously conducted
- ▶ If the school operated a share table
- ▶ Farm to School participation status
- ▶ Interventions to prevent waste introduced at the school
- ▶ If / how the school diverts food/organic waste
- ▶ Student and teacher feedback



⁵ Pilot Evaluation of Aggregate Plate Waste as a Measure of Students' School Lunch Consumption, Leah Elizabeth Chapman, MPH; Scott Richardson, MBA; Lori McLeod, PhD; Eric Rimm, ScD; Juliana Cohen, ScD, ScM, April 2, 2019

The waste audit data collected was segmented into the following categories:

| School/Escuela: <u>Wyoona</u> | | Date & Time/Fecha y Hora: <u>2/13</u> | | | | | | | |
|---|-----|---------------------------------------|-----|-----|---|---|---|---|-------|
| Weight of Empty Buckets (lbs) | | Recorder(s): | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Total |
| Fruits and Vegetables Frutas y Vegetales | 6.0 | 2.9 | | | | | | | |
| Milk Waste Lache | 2.3 | 2.4 | | | | | | | |
| Other Liquids Otra Liquido | 5.7 | 7.8 | | | | | | | |
| Unopened/Recoverable Food Comida sin abrir | 5.5 | 4.0 | | | | | | | |
| Other Food Waste Otra Comida | 5.7 | 8.1 | | | | | | | |
| Brought from Home Food Comida de la casa | 7.9 | 4.6 | | | | | | | |
| Landfill Reliezo sanitario | 2.4 | 3.4 | 9.8 | 1.4 | | | | | |
| Recycling Reciclaje | 4.8 | 1.2 | | | | | | | |

- ▶ Fruit and vegetable waste
- ▶ Other food waste
- ▶ Milk waste
- ▶ Other liquid waste
- ▶ Unopened/recoverable food or drinks
- ▶ Non-edible compostable waste
- ▶ Brought from home food waste
- ▶ Landfill
- ▶ Recycling

For the purposes of this project, “fruits and vegetables” was the only other category of waste collected separately from the aggregate ‘Other food waste’ stream. The aggregated collection yielded less compelling and reliable data due to the diverse nature of the types of food included, as well as the mixing of fruits and vegetables with other food types (for example, fried rice with vegetables) during service to students, which led to imperfectly segregated waste streams during audits. Milk waste was isolated as a separate variable because of its difference in density and weight, is unique nutritional and economic value, and its ubiquitousness in school lunches.

These totals were aggregated in the online dashboard tool, which generated reports detailing the GHG and water resources embedded in the production of the wasted food. These estimates were determined using the BEACN (Bay Area Environmentally Aware Consulting Network) calculator.⁶ For the purposes of this report, the emission factors used to calculate the embedded GHG and water in milk have been updated based on the best available life cycle assessment data.^{7,8} The project team also estimated the GHG emission potential from landfilling wasted food from schools using the EPA Waste Reduction Model (WARM).

6 Beacn Food Waste Calculator

7 Thoma, G., Popp, J., Shonnard, D., Nutter, D., Ulrich, R., Matlock, M.D., Kim, D.S., Neiderman, Z., East, C., Adom, F., Kemper, N. & Mayes, A. (2010). Greenhouse Gas Emissions from Production of Fluid Milk in the US. University of Arkansas & Michigan Technological University.

8 Henderson, A., Asselin, A., Heller, M., Vionnet, S., Lessard, L., Humbert, S. Saad, L., Margni, M., Thoma, G., Matlock, M., Burek, J., Kim, D., and Jolliet, O. U.S. Fluid Milk Comprehensive LCA. University of Michigan & University of Arkansas, 2012.

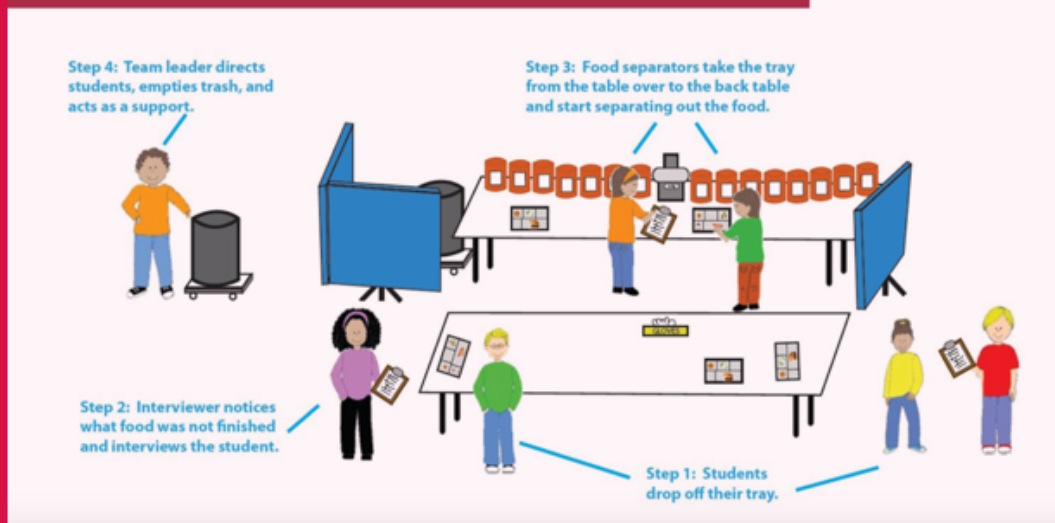


Pounds of food waste per student was chosen as a key metric to compare audits across locations as it normalizes the recorded food waste weight by how many students the meals were intended to serve. Milk waste was measured in pounds but converted to cartons for easier visualization and discussed separately throughout the report.

The data collection tool is both scalable and easily modifiable. Future data collection could benefit from a more granular understanding of the types of food thrown away, especially edible versus inedible waste, as it would refine environmental impact estimates. Furthermore, comparing food procurement cost data, as well as information on back-of-house pre-service waste, waste hauling, and staff costs, would provide more site-specific information regarding potential cost savings.

For this study, each participating school facilitated five or six audits. In many schools, several audits were done in a single day, which is why more audits are shown in the online aggregation. For the purpose of our data reporting, WWF consolidated results into audit days, meaning if a school performed multiple audits at the same school on the same day that counted as one audit day, and per student estimates. Data was collected on a combined total of 222 audit days.

Sample cafeteria setup for audit



PROJECT FINDINGS

Since any food service operation will always have some degree of food waste, one of our main objectives was to start testing a methodology for gathering data on average student food plate waste in the US. Another objective was to determine if the act of separating and auditing food waste over a defined period could result in a measurable difference. The FWW field work also looked at the difference in waste generation rates between schools that use the USDA-recommended Offer Versus Serve (OVS) provision as opposed to the ‘serve everything’ model, and the difference in milk waste rates based on service type (i.e., jug, carton, or dispenser).

On average, each of the 46 schools produced approximately 39.2 pounds of food waste per student per year, which is **9% higher than the estimated amount the average American wastes at home normalized by meals**.^{9,10} When the organic waste from all audits is summed, it totaled 19,074 pounds, comprised of 32% fruit and vegetable waste, 26% milk waste*, and 42% other food waste.

After completing audits and curriculum delivery, when all schools’ first and last audits were averaged together, the group recorded a 3% food waste reduction; elementary schools saw an even greater reduction at 14.5%. However, when looking at the average food waste generation rates from the initial audit to a sixth and final audit the population (comparing the averages of each audit number) saw a much larger decrease in food and milk waste (Figure 1).

EACH OF THE
46 SCHOOLS
AVERAGED
39.2
POUNDS
OF FOOD WASTE
PER STUDENT PER YEAR

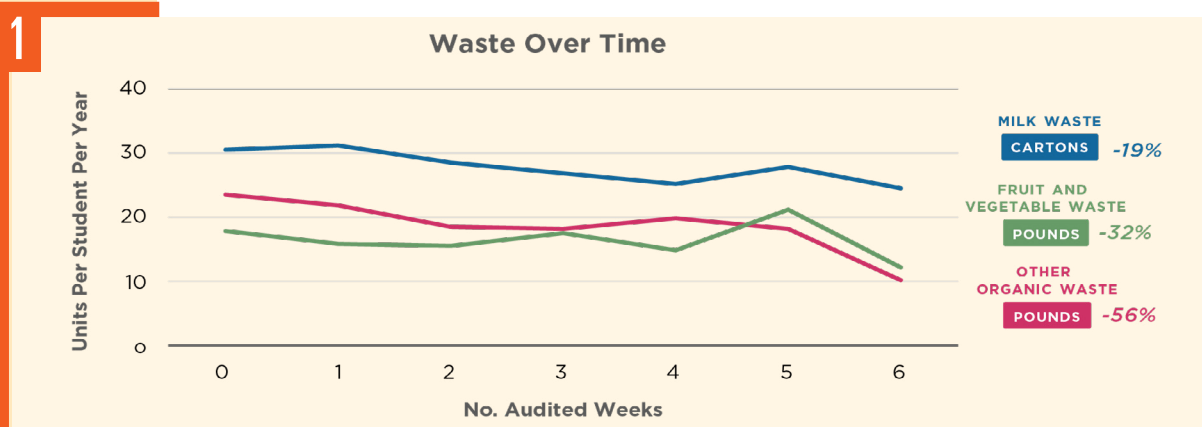


FIGURE 1 Number of audited weeks at time of audit used as a proxy for time. Milk waste is described by carton as a standardizing measurement no matter the delivery mechanism. Fruit and vegetable waste and other organic waste are measured by pounds per student per year. Other organic line includes other food and other non-milk liquid waste. Percentages indicate change from 0 audited weeks to 6 audited weeks. Increase at five weeks attributed to grapefruit rinds in one audit, averaging 1.3 pounds of food waste per student.

* Milk waste data was gathered in pounds but for the rest of this report we’ve converted pounds to cartons for simpler visualization.

9 Calculated 36.0 pounds of food waste per average American per year, assuming the average American consumes three meals per day.

10 <https://www.epa.gov/sustainable-management-food/united-states-2030-food-loss-and-waste-reduction-goal>

If we take our modest sample as a basis for estimation of all schools participating in the NSLP, national food waste in schools (excluding milk) could be as much as 530,000 tons per year.¹¹ This translates into 1.9M MTCO₂e of embedded GHGs¹² and 20.9B gallons of embedded water.¹³ If we assume the national average of 76% of food waste goes to landfill¹⁴ this could translate into 402,800 tons of food waste from schools per year going to landfill where it emits an additional estimated 217,500 of MTCO₂e (methane gas).¹⁵ The combined GHG impact of sending school food waste to landfill is like adding about 46,100 additional passenger vehicles to the road for one year.¹⁶

To examine possible correlations between food waste and other factors, the data were compared to service styles, district income levels, geographic location, and grade levels.



11 Calculated using the average pounds food wasted per meal served in project schools.

12 Conversion factor for embedded GHG is based on EPA's WARM Model v15.

13 Conversion factor for water is based on the average water footprint of peaches, tomatoes, potatoes, and lettuce.

14 <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/food-material-specific-data>

15 EPA's WARM Model v15.

16 <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

OFFER VS. SERVE

Offer versus Serve (OVS) is a provision of the NSLP that allows students to decline some of the offered food items; its goal is to reduce food waste in school meals while permitting students to decline foods they do not intend to eat.¹⁷ For the data in this study, schools using the OVS provision as opposed to those serving all daily menu items showed higher waste rates per student across all grade levels, however, the number of schools “serving” all items was much smaller than those “offering”; 31 schools “offer” while only 6 “serve.” Though offer appears to result in more waste than serve, the difference is not statistically significant ($p > 0.05$) likely due to the difference in sample sizes.

From our qualitative data, we gain additional insight into why our quantitative results seem to show that OVS increased food waste. One city team shared the following:

“The cafeteria manager noted that while the school had switched to an OVS lunch model recently, older students continued to emulate the serve model by taking one of each item that was offered, whether they wanted them or not. This resulted in significantly more uneaten items being thrown away or returned to the share table. Additionally, the manager observed that the teachers of kindergarten and first grade students would help their students fill their trays without giving them a choice. When questioned, the teachers explained that this was done to allow for students to move more quickly through the cafeteria line and prevent the younger students from spilling food. The manager suggested that these actions resulted in the unintentional consequence of continuing the “take one of everything” mentality. The manager concluded that while the serving style has changed to provide students with options and prevent waste, the behaviors are deeply entrenched in cafeteria culture.”

THE BEHAVIORS ARE
DEEPLY
ENTRENCHED
IN CAFETERIA
CULTURE

¹⁷ <https://www.fns.usda.gov/updated-offer-vs-serve-guidance-nslp-and-sbp-beginning-sy2015-16>

Qualitative results also indicated that there is substantial policy confusion among administrators, teachers, aides, and cafeteria staff about OVS options and concerns over reimbursement. This is particularly relevant for milk. To meet the nutrition standards set by the 2015 Dietary Guidelines for Americans, the NSLP requires that eight ounces of milk must be offered at school meals. Federal requirements for schools participating in the NSLP state:



Schools must ensure that at least two choices of fluid milk from the following list are offered throughout the meal service on all reimbursable meal service lines: flavored or unflavored fat-free milk, low-fat (1%) milk, fat-free or low-fat lactose-reduced milk, fat-free or low-fat lactose-free milk, fat-free or low-fat buttermilk, and fat-free or low-fat acidified milk. Students must be allowed to choose milk from at least two milk varieties, even in alternate meal service locations.¹⁸

While it is mandatory for two options of milk to be offered, students may decline to take milk and still have a fully reimbursable meal. But old habits are hard to break, and new information isn't always fully disseminated. From one city team: **“Many schools/teachers are under the impression that students ‘are required’ to take a milk and often send them back to the serving line.”** It will be imperative moving forward that state and national guidelines are aligned for clarity and that there is sufficient staff training and communication to students to ensure proper implementation.

**OLD
HABITS
ARE HARD TO
BREAK**

¹⁸ <https://www.fns.usda.gov/updated-offer-vs-serve-guidance-nslp-and-sbp-beginning-sy2015-16>

DEMOGRAPHICS

There was no strong statistical correlation between school food waste and socio-economic factors like district income levels and free and reduced-price lunch. All schools, no matter their affluency, seem to waste food at similar rates per student.

When the results were compared by geography (i.e., west coast versus southern part of the country) a few small trends emerged. There was no distinct part of the country producing the most waste, as Nashville, Seattle, then Atlanta had the highest “All Organic Waste” averages while Indianapolis had the lowest (Figure 2). Boulder had the lowest percentage of milk wasted compared to the other food categories in addition to the smallest amount of milk wasted per student, which could primarily be a result of their bulk dispenser service style. Milk tends to be wasted at higher percentages than fruits and vegetables as you go west, while fruits and vegetables tend to be wasted at higher percentages in the east.

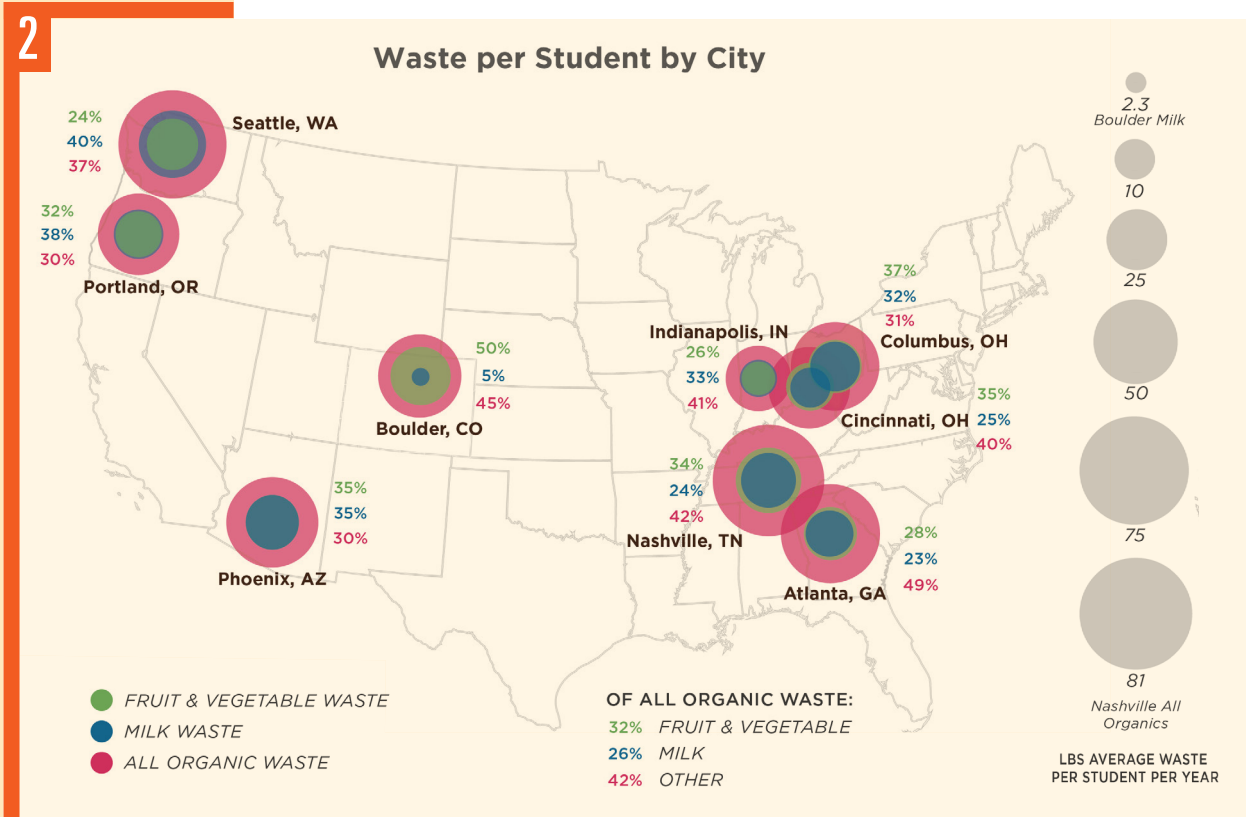


FIGURE 2 Map of waste per student by city. Area of circles is proportional to the average waste per student per year by pound for each category of waste. Total organic waste is a sum of milk, fruit and vegetable, and other waste, shown in pink circles. Milk waste (blue circles) and fruit and vegetable waste (green circles) are both shown as a portion of all organic waste. Percentages show % milk waste, % fruit and vegetable waste, and % other waste of all organic waste.

AS STUDENTS GET OLDER THE WASTE LEVELS DECREASE

The one driver that begins to show an impact on waste generation rates is grade level. **Figure 3** shows that as students get older the waste levels decrease, however, the data from the high school level may be partially incomplete since students often eat outside of the cafeteria making it harder to capture the full waste picture. From our qualitative reports we see a few potential drivers of this trend including timing of lunch periods, length of lunch periods, and portion sizes. The Oregon project team reported:

“We observed that students don’t have enough time to eat, some students were even eating while walking through the waste/recycling line. The overall feedback we got was about portion size and how the students don’t have time or appetite to eat the same amount if they are in kindergarten, versus fourth grade. We did notice that there was less food waste overall in our middle schools, which supports the assumption that the older the kids get, the more they’re eating.”

More research is needed to examine these possible correlations.

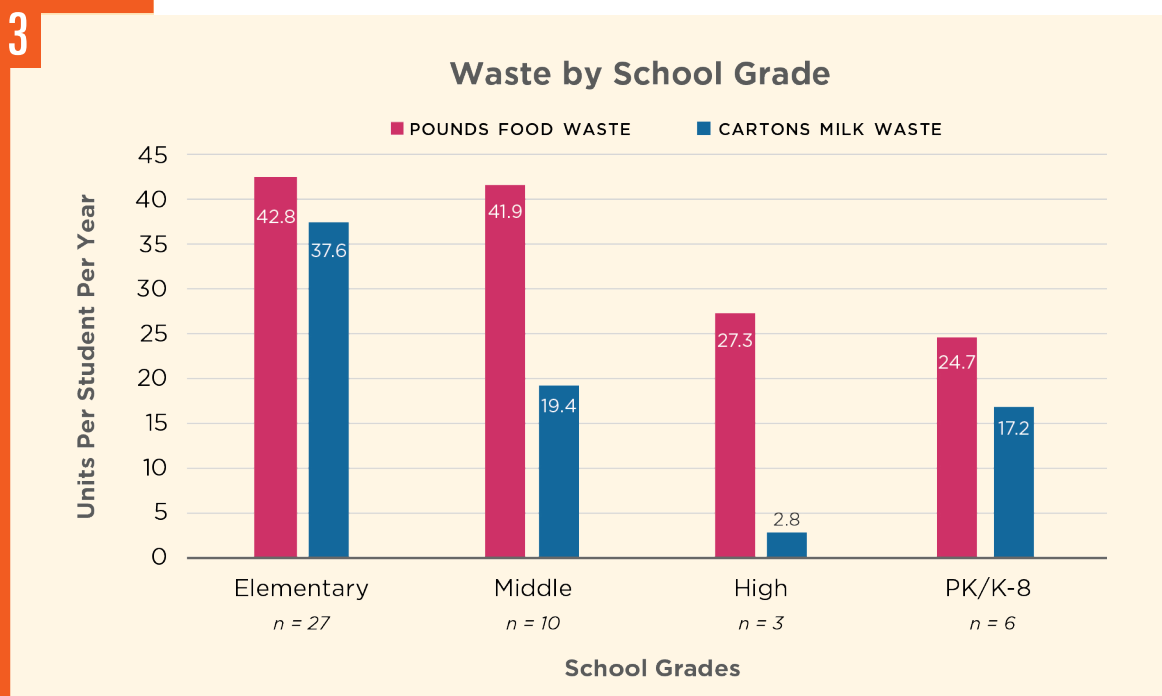


FIGURE 3 Average pounds of food and average cartons of milk wasted per student per year by school grade. Sample sizes of school grades noted as n.

MORE ON MILK

While fruit and vegetable waste represented a higher proportion of plate waste measured in our audits, we chose to do a deeper analysis on milk because it carries a large environmental footprint and is iconic to the school lunch program. As discussed above, fluid milk is a required offering with every school meal and has emerged as an area of significant potential and opportunity for service innovation. Milk is procured, distributed, consumed, and disposed of separately from other organic waste streams in a cafeteria, which makes measurement more reliable than for other food waste streams.

Milk is delivered to students in the NSLP via three primary methods: 1) individual carton/plastic containers, 2) centralized jugs, and/or 3) bulk milk dispensers. Data from this project found that, on average, each of the 46 schools produced approximately 28.7 cartons of milk waste per student per year. On average, elementary schools produced the most waste at 37.6 cartons of milk waste per student per year while middle schools produced 19.4 cartons of milk waste per student per year. The total amount of milk waste recorded from the 222 audit days was 577 gallons, though this varied significantly by delivery method (Figure 4).

4

Milk Wasted Over All Audits

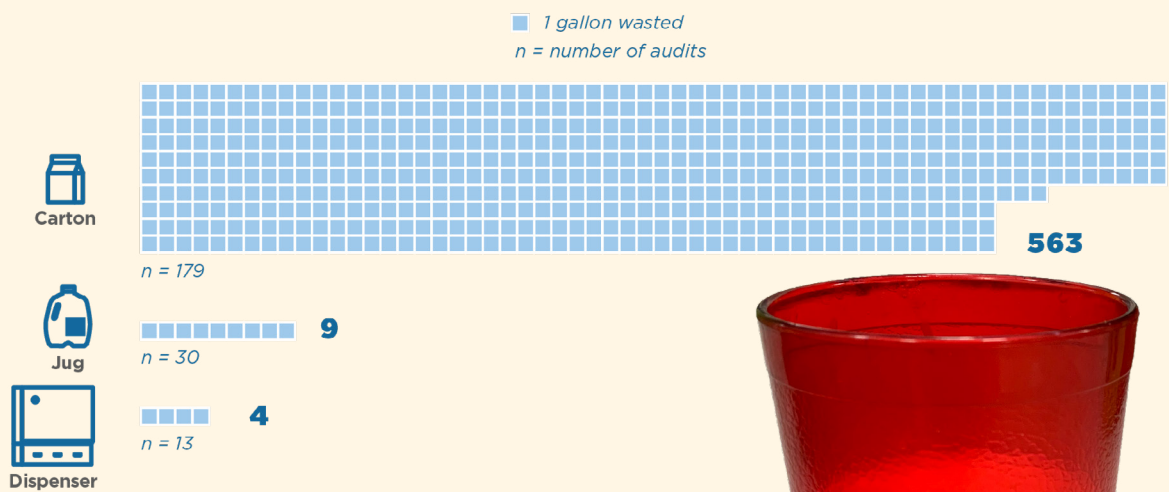


FIGURE 4 Total gallons wasted over all audits by delivery method. One square is equal to one gallon. Sample size of audits for each delivery method noted as n.

Carton milk waste per student was slightly more than 32 cartons per year and dispenser milk waste per student was 4.5 cartons per year (Figure 5 and Figure 6).

5

Milk Waste by Delivery Method

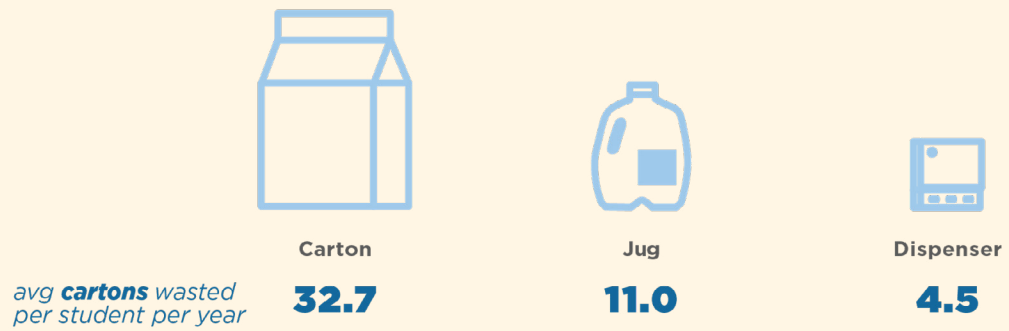


FIGURE 5 Average milk wasted per student per year by carton volume equivalents for each delivery method.

6

Milk Waste per Student by Delivery Method

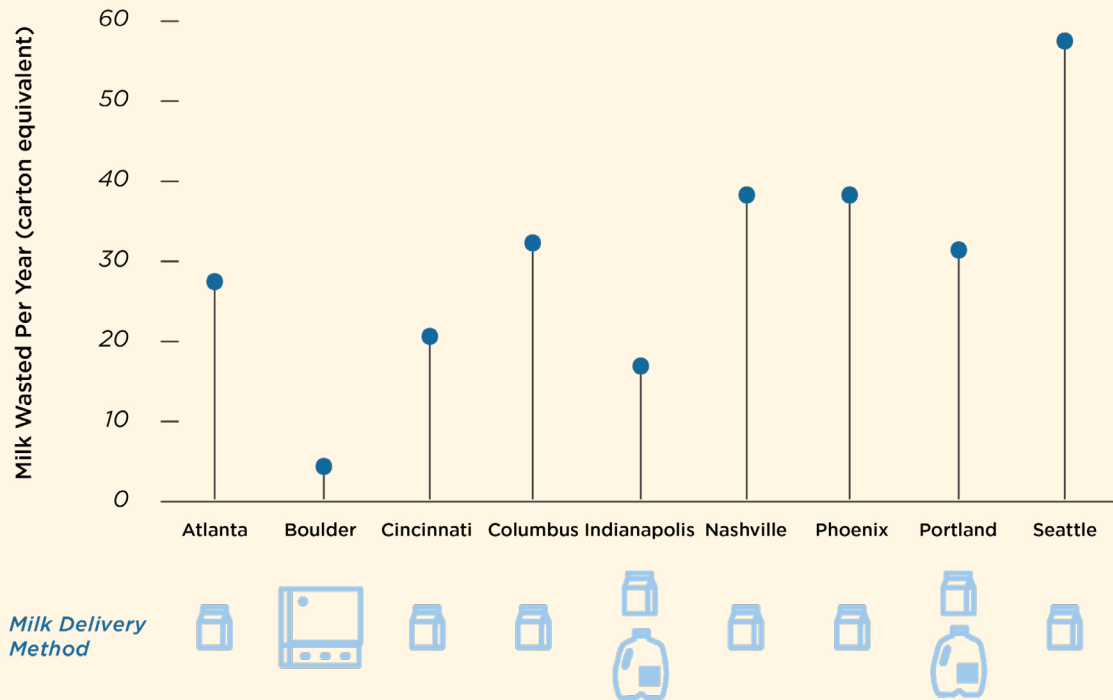


FIGURE 6 Average milk wasted per student per year by carton volume equivalents in each city. Milk delivery method(s) for each city is noted via icons.

SCHOOLS SHOULD CONSIDER SERVING BULK MILK

From this finding and other studies on the topic¹⁹ it can be inferred that schools should consider serving bulk milk if they have the capacity and administrative support to do so. Additional research indicates that switching delivery mechanisms could also reduce packaging waste and ease custodial labor.²⁰

In 2018, the USDA reported 29.6 million meals served per day and 4.8 billion meals annually.²¹ Using our 222 audit days as a basis for estimation, national milk waste in schools could be as much as 45 million gallons per year. This would represent a financial loss of \$138M²² and translate to 361,000 MTCO₂e²³ and 6.5 billion gallons of water per gallon of milk embedded in milk production.²⁴

Schools that participated in the Food Waste Warrior program reduced milk waste on average by 12.4% within a relatively short period of time. Informally tested interventions included adding unopened milk to share tables and increasing awareness that milk is optional. If schools nationally reduced milk waste by this average, that would represent a potential savings of \$17M,²⁵ a savings of 44,700 MTCO₂e,²⁶ and 807M gallons of water.²⁷ Perhaps more importantly, reduction in waste could contribute to nutrition gains through milk redistribution.



^{19,20} <http://www.chefannfoundation.org/news-media/the-lunch-line-blog/got-bulk-milk>

²¹ <https://fns-prod.azureedge.net/sites/default/files/resource-files/slsummar-9.pdf>

²² Calculated using average dollars per carton of milk purchased during the school year in project schools.

^{23, 26} Thoma et al. 2010.

^{24, 27} Henderson et al. 2012.

²⁵ Calculated using average dollars per carton of milk purchased during the school year in project schools.

FOOD WASTE REDUCTION IS NOT TYPICALLY AN INGRAINED JOB RESPONSIBILITY

LIMITED RESOURCES

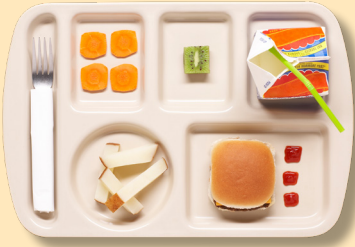
Nearly all project teams reported that a significant challenge of this program was lack of time. Though we consistently receive feedback that teachers are hungry for this kind of content and passionate about wanting to teach about food waste reduction, they expressed they have limited time to prepare or implement the related lessons plans and coordinate audits over multiple lunch periods. Too often the burden is placed on teachers to deliver and organize school programs, and we have evidence that this burden becomes unsustainable over time. Food waste reduction (or waste reduction holistically) is not typically an ingrained job responsibility but it requires dedicated individuals to ensure results.

One project team experimented with this. Teachers were offered salary credits through the professional learning department, which is required to bump teachers up to the next salary grade. Teachers were also offered seven hours of curriculum pay rate in exchange for hosting six audits during the spring semester, teaching at least two 30-45-minute food waste lessons, and developing at least one new lesson plan about food waste to add to an expanded curriculum/toolkit. The project coordinator hosted meetings with teachers that opted in to participate, facilitating group brainstorms and sharing of resources.

Teachers explained their interest was not only the salary credit and curriculum pay, but to have alignment with current curriculum, the opportunity to look at live data, being able to participate in an activity to bring awareness to environmental issues on campus, the opportunity to implement a student-led activity for developing student leadership, to address a current need on campus, to participate in a national program focused on collecting data from schools and the desire to bring attention to food waste in schools.

These schools saw significant waste reduction and all the five teachers responded that they thought while challenging, the program was successful in raising awareness about food waste in their school. One teacher said: "I think the biggest success was spreading awareness about the importance of lowering the amount of garbage we produce and giving students some tools to do that. Also showing them that the school cares about trying to lower the amount of garbage we are producing and that we are taking action."

WASTE STREAM



THERE WAS
SIGNIFICANTLY
LESS
LANDFILL
WASTE
ON DAYS WHEN
REUSABLE
TRAYS WERE USED

Universally, we saw that it is nearly impossible to examine student food waste without also illuminating issues in packaging waste, how food is plated, and the waste stream of the school cafeteria. The cafeteria drives the majority of a school's waste stream. This study saw a wide variety of service ware types, from schools using reusable cups, trays and cutlery, to compostables to Styrofoam trays. Depending on how food service is being prepared (on-site, off-site, heat-and-serve, central kitchen, etc), foods also come packaged in various papers and plastics.

While our waste audits didn't isolate and measure each of these other waste elements, there are still some qualitative points. One city noted that there was significantly less landfill waste on days when reusable trays were used versus Styrofoam trays and that fewer packaged food items resulted in less landfill waste. But there are often tradeoffs. In some schools, while reusable trays prevent the waste of Styrofoam, it might lead to an increase of waste as each element is served on an individual plastic or paper boat. Schools using milk dispensers or milk jugs with reusable cups saw lower waste rates than those that serve cartons.

While durable trays, cups, and silverware in most schools cuts down on the cost of single use products, reusables are a values-based decision as well as a financial decision. Like bulk milk dispensers, the high capacity, high temperature commercial dishwashers required to maintain reusables can be a burdensome cost without financial support for equipment upgrades. The upfront costs per tray, cups, and silverware are also higher for reusables versus repetitive, incremental purchasing of single use products. While this study did not closely examine the return on investment aspect of upfront vs single use financial costs, reductions in solid waste can lead to reductions in hauling costs.²⁸ More research on the comparative life cycle costs vs expenses could help schools make these decisions.

²⁸ <https://newfoodeconomy.org/milk-carton-dispenser-food-waste-usda-school-lunch-nsfp-oregon-washington-olympia-vancouver/>

Two other anecdotes worth sharing:

Through measurement in this project, one school's student green team learned that their school created 1,048 pounds of non-food related trash in seven days. Armed with data, the green team decided to research reusable trays and bring a case to the district to move away from single use trays, boats, and plastic containers currently used to serve lunch.

In one city, schools were able to pilot working with a commercial compost company. More than half of the usual lunchtime waste was diverted through composting instead of going to the landfill to produce greenhouse gases and take up space. This reduction in food and compostable waste also made the custodial staff's jobs much easier and cleaner every lunch period. By dumping out liquids, the trash was less messy and wet to handle. By diverting more than half of the lunchtime waste weight, the custodian had to lift fewer heavy bags with less risk for injury.

While more research is needed, the ties between organic and inorganic waste present some exciting opportunities to decrease overall cafeteria-based waste stream levels, improve energy efficiency, and recapture potentially avoidable disposal costs.



“RIGHT-SIZING” WASTE BINS AFTER REDUCTION EFFORTS

Efforts to reduce cafeteria waste often lead to reductions in a school’s solid waste stream, which could also lead to reductions in weekly waste hauling costs. Here are some recommended steps toward “right-sizing” the trash after cafeteria waste reduction efforts:

1. Take pictures of your school waste bin before pickups for at least two weeks. Note if the waste bin is full before weekly pickups.
2. Schedule a meeting with the facilities department and your school principal.
3. During this meeting, discuss the photos and estimate how many waste bin pickups could be removed from the waste hauling schedule each week.
4. Explore options for reducing the waste bin size (ex. change from 6-yard to a 3-yard).
5. Find a pickup schedule that maximizes the waste capacity of the bin and minimizes weekly pickups.
6. Talk to administrators about an incentive program where schools could share a portion of the cost savings from waste reduction efforts!





IMPACTS

The research discussed in this report represents one of the largest school waste audit samples collected to date. While our cohort is not statistically representative of the 100,000 schools participating in the NSLP, we observed the following:

**76%
OF FOOD
WASTE
GOES TO
LANDFILL**

- ▶ Using our sample, national food waste in schools (excluding milk) could be an estimated 530,000 tons per year.²⁹ This translates into 1.9M MTCO₂e of embedded GHGs³⁰ and 20.9B gallons of embedded water.³¹ If schools nationally were able to reduce waste by 3%, the average recorded in this study, it would be the equivalent of taking 12,400 passenger vehicles off the road for one year.
- ▶ It's estimated in the US that 76% of food waste goes to landfill.³² If this estimate is applied to our national food waste estimates, 402,800 tons of food waste from schools per year could be going to landfill where it emits an estimated 217,500 of MTCO₂e (methane gas)³³ equaling 46,100 additional passenger vehicles driven on the road for one year.³⁴
- ▶ Milk waste represents a high financial, environmental and nutritional loss for schools. National milk waste in schools could be an estimated 45M gallons per year. This represents a financial loss of \$138M³⁵ translates to 361,000 MTCO₂e³⁶ and 6.5B gallons of water embedded³⁷ in milk production alone. If schools nationally reduced milk waste by 12.4%, the average observed in our study, that would represent a potential savings of \$17M in lunchroom cost³⁸ and the prevention of emitting 44,700 MTCO₂e (metric tons carbon dioxide equivalent)³⁹, and use of 807M gallons of water embedded in milk production.
- ▶ WWF developed a business case exploring the return on investment associated with school food waste reduction efforts. Extrapolating from our modest sample, average combined daily food waste could be costing as much as \$9.7M per day, or \$1.7B every school year, for all the schools participating in NSLP. If schools nationally were able to reduce food waste by the 3% averaged in this study, it could mean a potential savings of \$52M per year, which could be reinvested back into nutrition and educational programs and initiatives.

29 Calculated using the average pounds food wasted per meal served in project schools.

30 Conversion factor for embedded GHG is based on EPA's WARM Model v15.

31, 34 <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

32 <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/food-material-specific-data>

33 EPA Warm Model v15.

35, 38 Calculated using average dollars per carton of milk purchased during the school year in project schools.

36, 39 Thoma et al. 2010.

37 Henderson et al. 2012.

RECOMMENDATIONS FOR POLICYMAKERS

1 Establish National, Regional, and/or Local Incentive Programs for Reducing Food Waste In Schools

This program could take a variety of different formats. A national “Cafeterias are Classrooms” education and data collection initiative would ensure a consistent national audit process, streamlined data, and reporting while also facilitating hands-on opportunities for inquiry-based student learning. We also saw that food waste management needs to be an embedded job responsibility or have devoted resources to be successful. An incentive program could take the form of federal grant awards for dedicated programmatic resources and staffing. Grant funds could also go toward purchase of waste-reducing equipment such as milk dispensers, dishwashing infrastructure, or measurement technology. Future iterations of this project and/or a data collection program could also begin to examine pre-service waste, to identify potential opportunities for prevention and recovery.

2 Consider Reforms to Mandatory NSLP Plate Portions

Federal nutrition standards require serving certain grain and meat/meat alternate sizes to all age groups. In order to meet the requirements, a kindergartner may receive the same serving size as a senior high school athlete on hot dog or burrito days. Many researchers received feedback from schools that mandatory NSLP plate portions without context for student age/grade levels are a primary cause of food waste in the cafeteria because they don’t allow for flexibility when dealing with such a diverse age and appetite base. The requirements are complex, and it’s worth more research to assess how adjusting portion size requirements relative to ages of students served might be contributing to or could help decrease student food waste rates.

3 Consider Adjustments to OVS and Expand Training

While the intention is laudable, evidence from this study indicates the current implementation of OVS is not yet fulfilling its intent. One of our project teams noted: “The name “offer versus serve” is misleading; a better way to phrase the term for increased understanding would be “offer, NOT serve” or “offer INSTEAD of serve.” OVS programs are only federally mandated in high schools; this could be extended to elementary or middle schools. The guidelines can be clarified, and more education and awareness are needed on how schools can implement OVS best practices while still serving reimbursable meals.

4 Institutionalize Share Tables & Other Food Redistribution Mechanisms

School cafeterias are risk adverse environments and more streamlined guidance around extended food service and redistribution mechanisms would be highly beneficial. Our qualitative findings indicate that share tables, community food rescue, and backpack programs have remarkable potential to reduce a school’s waste stream, and we recommend funding additional studies, developing more guidelines, and institutionalizing an education initiative on best practices. (See additional info in #4 for School Districts below.)

5 Divert School Food Waste from Landfill

Our project teams noted that there will always be food waste generated from cafeterias, even after all best practice waste prevention efforts are institutionalized. We recommend incentivizing food waste diversion from landfill to avoid secondary environmental impacts from methane emissions. While in-school composting programs can be excellent resources for demonstration purposes, federal aid or local grants could facilitate adding commercial compost hauling contracts &/or partnering with private waste haulers to divert to industrial compost facilities or to local area farms to be used as animal feed. Funding could be directed towards sustaining effective composting programs. At the state level, removing the red tape around citing for composting facilities and making them more cost competitive could also prove critical to this effort.

6 Invest in Collaborative Networks

Develop a national “Cafeterias are Classrooms” forum to help schools and administrators test new interventions by sharing experiences, lessons learned, resources, challenges and best practices. From WWF’s vantage point, the overall project saw significant benefit from creating a platform for regular communication and collaboration amongst a group of engaged practitioners, as did the teams on the ground that created a cohort within their own school educators.

RECOMMENDATIONS FOR SCHOOL DISTRICTS

1 Prevention First

When schools begin to address food waste, we see a natural tendency to look directly to compost as the first solution. However, similar to the Reduce-Reuse-Recycle trifecta, compost is lower on the EPA's food waste reduction hierarchy, and it's important to guide students toward an understanding of prevention-first strategies. While we didn't look at pre-service operations, some of this prevention can come from meal planning, adjusted portion sizing, and best management practices such as assisting students in taking only what they plan to eat. All of this can help maximize the environmental and economic benefits of food conservation.

2 Measure

Running a consistent schedule of student-led audits (ex. 1 per month) will give you a picture of what and how much is being wasted and reasons why food items are being discarded. Use this information to have regular conversations on waste reduction. Many of our project teams suggested that performing regular audits, in conjunction with related curricula, should occur periodically throughout the year to reinforce the behavior and understanding.

3 Staff Up, Delegate Responsibility, Partner

Organizing regular student-led waste audits and committing to test and iterate interventions to reduce waste must be a shared commitment and responsibility by administrators, educators, student groups, nutrition services, custodial staff, and, when possible, external assistance such as parent volunteers and consultants. However, this effort takes dedicated resources that don't currently exist as part of standard protocol in most schools. Where possible, school districts should either create a full or part-time sustainability or conservation specialist for the district in addition to adding this as a responsibility for facilities managers. Parent groups and parent-teacher associations are a potential untapped resource we were unable to explore during this project, which could offer funding and/or volunteers to assist with auditing and food repurposing.

4 Share Table Iteration

If your school doesn't have one already, give it a test run! Share tables are a great opportunity for redistributing surplus items such as fruit or other uneaten or unopened packaged foods. If you face barriers to this intervention, [check out this guide](#) to better understand what's allowed in your state or region.

However, as they start to become a more standard practice, we also want to ensure they are successful. From this study we learned that share tables often face logistical challenges to fulfilling their potential. In a few project cities, we saw that fewer students visited the share table due to not having much time to eat, the tables being poorly located or labeled, and students not being allowed to leave their seats, particularly in elementary schools. When staff collected food from the share table and walked around the cafeteria offering it to students, most of the items were eaten. This was also an opportunity to engage with students about the importance of eating what they take and eating healthy.

There is also more to be learned in analyzing where food goes after the share table or bin in calculating their success in reducing waste rates. Some schools put leftover items in the trash, while at other schools shared items go to afterschool snack programs, external community food rescue programs, and/or back to the kitchen to be washed and reserved or put back into circulation. One city program noted many of their schools saved hundreds of pounds of food waste by re-serving unopened milks and whole fruits.

5 Explore Bulk Milk Service

As indicated throughout this report, fluid milk service represents opportunities for potential savings in both food, energy, and packaging waste, in addition to cost savings. Dairy companies and regional dairy councils are primary stakeholders who are already working with some school districts across the country to incentivize a transition from milk cartons to bulk milk.⁴⁰ Replicating these models is an effective strategy that could be expanded to prevent milk container waste and increase student consumption of milk during mealtimes. Multiple factors from time to eat, temperature of the milk, refrigeration equipment, milk packaging, flavor availability & formulation, affect consumption of milk, and we encourage more work and collaboration to understand potential solutions.

⁴⁰ <https://newfoodeconomy.org/milk-carton-dispenser-food-waste-usda-school-lunch-nslp-oregon-washington-olympia-vancouver/>

6 Planning and Prep for Food Waste Reduction

While this study didn't look at pre-service operations, project participants noted that meal planning and preparation could have a big impact on minimizing both back-of-house (overproduction, prep waste) and cafeteria waste. Small steps can make a big difference – for example, offering sliced fruit led to a significant decrease in waste rates, though it precludes items from being placed on Share Tables. From our Colorado team:

“For a number of reasons, younger kids tend not to eat more than a few bites of whole apples. They have been taught to avoid the core and that leaves a lot of edible fruit remaining. This is an obvious area for future education when we return to school in the fall. Similarly, kids seem to be averse to eating the membranes of oranges and grapefruits, instead opting to suck out the juice and throw away the rest. Combined with the peels, this makes for heavier waste.”

To the extent that it fits into planning when meals are going to be eaten, based on observations from this study, we'd also recommend adjusting schedules when possible for lunches to be longer, held either slightly later in the day, and/or with recess coming before lunch, which could increase appetite and decrease wasted food.

7 Food Rescue

Schools that already had food rescue programs in this study showed lower waste levels, but only one city was successful in implementing during this course of work. Where possible, we recommend increasing opportunities for students to access surplus food items, via share tables, afterschool programs, and/or take-home snack or “backpack” initiatives. Partnering with local hunger relief organizations or other food rescue groups to redistribute surplus foods to your community is another option. It's important to note that redistribution outside of the school introduces more variables and logistical planning. If you do want to implement any of these measures, be sure to consider staff cooperation, refrigerator space, identifying partners with needs that match your school's output, and coordination for pickups or transportation.

8 Empower Students

In many participating schools, kids enjoyed taking leadership, learning new processes, and working with their peers. Older students are motivated by environmental concerns, younger students are passionate about protecting wildlife. Having older students help run audits with younger grade students is also a great service-learning opportunity for higher grade levels. Once students understand the process, giving students ownership of the project and room to lead is important. Creating the opportunity for them to speak with adults about their observations and ideas fosters additional skill development and even more investment in the project and its outcome.

9 Tie to Material Waste

Our project showed evidence that when schools analyze solid food waste and fluid milk waste, they also begin efforts to transition away from single use plastics and disposable trays to reusable trays, serving ware, and reusable cups. Institutionalizing cafeteria audits can be a mechanism for examining, discussing, and reducing a school's overall solid waste.

10 Landfill Diversion

Explore options to recycle remaining food scraps. In rural areas, there may be options to divert food scraps to local farms or zoos for animal feed. Several schools in this project either had access to commercial composting or were able to establish a successful lunchroom composting system over the course of the study. While composting is lower on the EPA resource hierarchy, it's better to recycle the excess nutrients back into the soil than to release methane emissions while rotting in a landfill.

11 Connect Students to Their Food

There can be an easy trifecta between classroom kitchens, cafeterias, and school gardens. Regular monthly "try days", taste tests, or cooking demos help students become more familiar with new foods. Growing fresh produce in school gardens can inspire kids to eat healthier foods when they grow it themselves. Composting fruit and vegetable food waste in school gardens helps students make the physical connection between their food choices, conservation practices, and soil health. Communicating with students about the relationship between the environment, wildlife and their food, can start them on a journey of being food waste warriors for a lifetime.

For even more best practices on wasting less food in K-12 settings, visit [this helpful resource](https://www.nrdc.org/sites/default/files/k-12-food-waste-best-practices-ib.pdf) from the Natural Resource Defense Council.⁴¹

⁴¹ <https://www.nrdc.org/sites/default/files/k-12-food-waste-best-practices-ib.pdf>

LOOKING AHEAD

Institutionalizing food waste measurement is a top priority of the WWF Food Waste program. These project results represent the tip of an iceberg when considering what is possible for reducing food waste and increasing conservation education in schools.

Our school partners and project team were given a very short timeline yet saw results and engagement almost instantly. WWF hopes to work more closely with government agencies on the national “Winning on Reducing Food Waste” campaign and with partners like The Kroger Co. Foundation to establish incentives that institutionalize measurement.

Performing student-led food waste audits in schools is fresh and relevant and something that should be done as a good business practice with positive environmental results. Regularly scheduling audits can empower reduction efforts and enhance any zero-waste culture. These efforts can also illustrate the linkage to conservation-minded math and science curriculum. Most importantly, institutionalizing this practice in schools is sure to get students and teachers thinking about food’s connection to our planet.

Only when we begin gathering consistent data and sharing it on a regular basis can we accelerate learning and institutionalize change.

Our challenge is to find ways to leverage public-private partnerships and create incentives that can entice all schools to prioritize this work without putting too much burden on teachers alone to deliver results. Ultimately our goal is to foster a learning environment that teaches the next generation a new respect for food and empowers them to take action to ensure its not wasted.



food
don't waste it

U.S. FOOD ADMINISTRATION

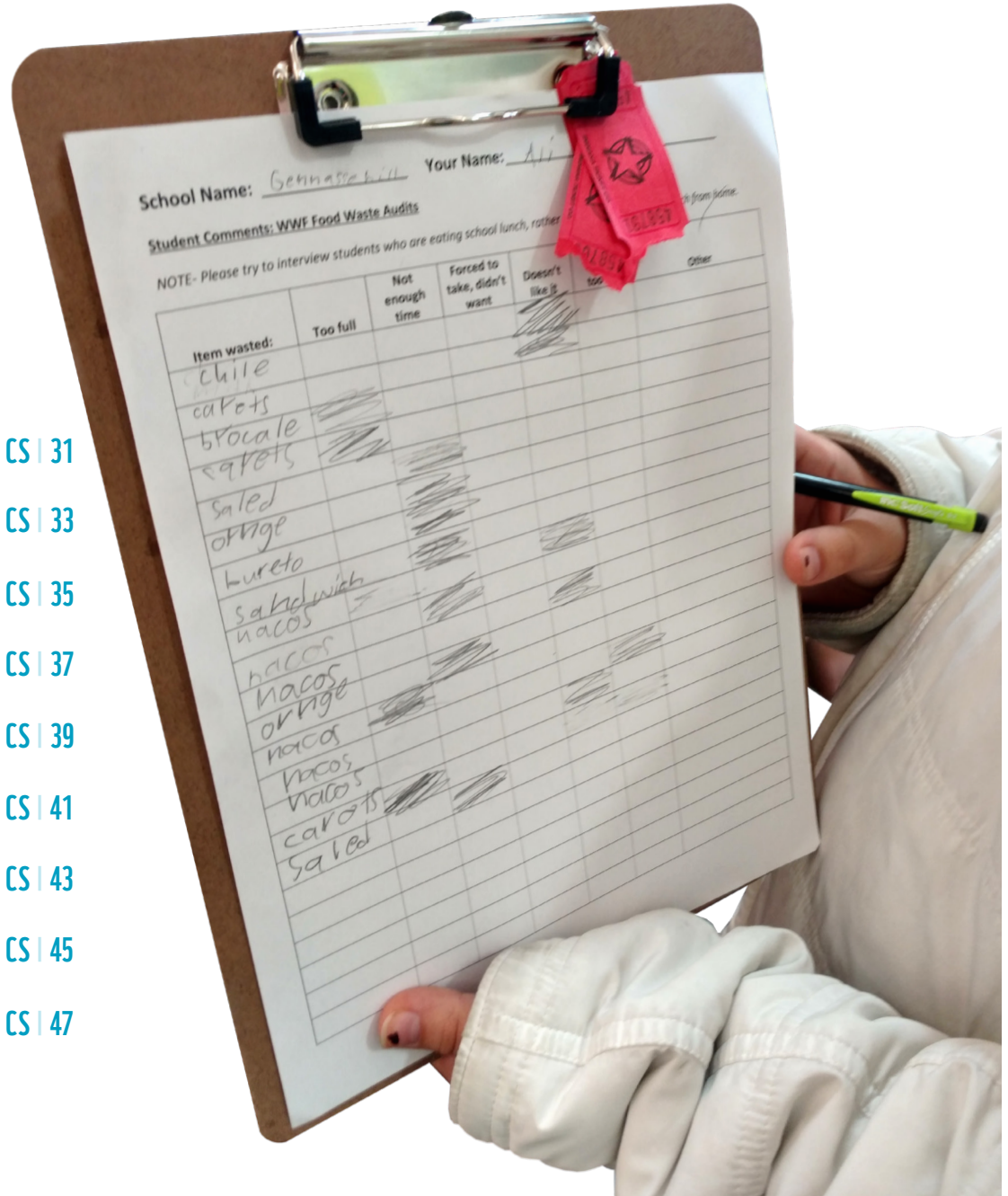
- 1- buy it with thought**
- 2- cook it with care**
- 3- use less wheat & meat**
- 4- buy local foods**
- 5- serve just enough**
- 6- use what is left**



FOOD WASTE WARRIORS CITY-BY-CITY CASE STUDIES

Food waste is not a one-size-fits-all problem. Schools and districts have opportunities to find solutions that are best within their community context. The project directive was to have schools measure their food waste and expand the experiential lesson by connecting it back to the classroom through the WWF Food Waste Warrior lesson plans. But the engaged participants didn't stop there. They took on many ancillary initiatives and set goals to learn about and reduce waste, including looking at questions of material waste, food donation, landfill diversion and community engagement. The following section features brief case studies from each of the nine cities, including their "aha" moments, challenges, and successes throughout the 2019 project.

- ATLANTA CS | 31
- BOULDER CS | 33
- CINCINNATI CS | 35
- COLUMBUS CS | 37
- INDIANAPOLIS CS | 39
- NASHVILLE CS | 41
- PHOENIX CS | 43
- PORTLAND CS | 45
- SEATTLE CS | 47



Atlanta was one of the Food Waste Warrior research pilot cities, and FWW Co-Principal Investigator Melissa Terry worked directly with the local Atlanta Project Leads to design and implement the pilot launch. Starting the Atlanta/Gwinnett County team four months ahead of the other cities helped the FWW research team understand where research design modifications were needed, monitor audit processes directly, and facilitate research deployment for the cohort as a whole.

BY THE NUMBERS



13 participating schools



31 audit days conducted

average food waste per year



95,169 lbs
per school

49.4 lbs
per student

26,751 meals served during audits | 862.9 students served on average per school per day

average milk waste per year



55,969 cartons
per school

28.8 cartons
per student

In Atlanta, Gwinnett Clean & Beautiful (GC&B) and Gwinnett County Public Schools (GCPS) teamed up on the FWW project to engage students in STEM and project-based learning around reducing cafeteria food waste. With funding assistance from Keep America Beautiful, a total of 13 schools participated: ten elementary schools, two middle schools, and one high school.

“AHA” MOMENTS



The topic of food waste aligned with curriculum objectives across all subject areas. Students waste a lot of food (on average 0.27 lbs. per student per day), including large volumes of milk (0.08 lbs. per student per day), with considerably more chocolate milk wasted than any other flavor.

Having Gwinnett County elementary students translate their data into poster sized graphs that were on display along school hallways was a great educational opportunity for the audit student leaders and their peers. The data displayed in this poster session also served as major discussion points for school administrators and district nutrition staff.

Working with high school students in the EAST and 4H programs was a huge success! The elementary students loved having the “big kids” there, and the visiting students were extremely helpful in facilitating the audit process.

The student-led audit process highlighted opportunities to significantly reduce packaging waste and the way foods are plated. Nutrition leaders realized during the audits that the policy regarding double-plating – such as putting a disposable clamshell container atop a paper plate – needed to be revised.

SUCCESSES

GCPS food and nutrition directors supported this project and have begun to look at creative ways to increase student consumption of healthy foods through behavioral economics strategies, increasing school garden participation, and starting composting programs where feasible. They are also working to clarify what foods/beverages must be offered versus served, as well as what surplus foods are allowed to be placed on Share Tables. The district is in the process of modifying policies regarding the reduction of packaging and other waste. So far, straws are being eliminated, breakfast cutlery will no longer include a fork, biodegradable trays are now being used instead of polystyrene, and condiments are no longer automatically included with entrees – students must choose to take them.



CHALLENGES

The sheer volume of food and single use disposable items being wasted is a challenge. Some schools wasted 500+ lbs. of food per day. Confusion on OVS policies are also a challenge. Many staff and teachers are under the impression that students are required to take a milk container and often send them back to the serving line to do so. Even though federal NSLP regulations require that milk is offered, it is not mandatory for students to select a fluid milk choice. Additionally, milk carton waste is a HUGE issue and a major opportunity for evaluating source reduction strategies.

Several schools needed deeper engagement, as some nutrition staff were hesitant and did not fully understand the reason for the audits. Stakeholders and staff were not able to attend all the audits, and in some instances, schools did not record all the categories required.



BY THE NUMBERS



5 participating schools



30 audit days conducted

average food waste per year

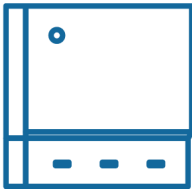


55,508 lbs
per school

42.9 lbs
per student

6,451 meals served during audits | 215 students served on average per school per day

average milk waste per year

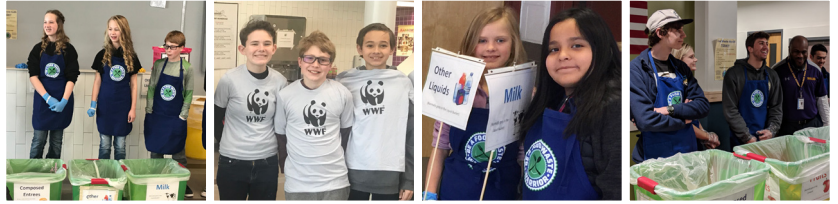


5,803 cartons
per school

4.5 cartons
per student

In the Boulder Valley School District (BVSD), five schools took part in the food waste audit project: two elementary, one middle, and two high schools. BVSD worked with LeanPath, a measurement technology company that aims to reduce food waste and engaged a part-time consultant. The consultant developed Common Core Standard-aligned lesson plans in collaboration with BVSD teachers at all grade levels and led food waste audits at BVSD schools over six weeks.

“AHA” MOMENTS



From the beginning, teachers advocated for students to take a leading role in waste collection, weighing, and data analysis, as well as coming up with new ideas and implementing changes with their peers to reach the end goal: measuring food waste in eight categories.

Audit procedures were thought-provoking. At the middle and high schools, there are typically many trash cans in various places around the cafeteria, so making all disposal occur in a single audit area provided an eye-opening look at how much waste was being generated daily. It was a powerful point to bring to the forefront of the cafeteria experience for both kids and adults.

The audits showed that composed entrees are the highest food waste category, with the most weight generated by the grain and meat/meat-alternate components of the meal. BVSD did not have as high a level of milk waste as other districts. One possible reason could be that the school uses milk dispensers, which in some cases have shown to reduce milk waste.



SUCCESSES

At each school, students were empowered to choose the food audit setup order and make changes as they saw fit. Each group of students had a unique way of presenting the data collection to their peers and making it a community-wide project. It ended up being a student-led project and had a much greater reach than if the students had remained in support roles.

“I was THRILLED that the kids were SO into the idea of being a warrior,” said one teacher. “[They] had so much interest. Loved that.”

The lesson plans developed by teachers in this district have been launched as a toolkit available to teachers district-wide. The toolkit and food waste audit materials are now available for check out from their science materials warehouse for grades 5-12.



CHALLENGES

The most challenging part of the project was lack of time; teachers had difficulties finding bandwidth to implement related lesson plans and help students develop an understanding of the potential impact of the project. Logistics were often difficult as well due to the school day schedule, with teachers unable to supervise during teaching periods.

“Some of the food waste audit days were very challenging for me simply from having no down time – all of my planning time was spent in the cafeteria,” said one teacher. “But it was an inspiring project, and if something was going to add a little stress to my life, this was certainly worth it.”

BY THE NUMBERS



3 participating schools



18 audit days conducted

average food waste per year



29,265 lbs
per school



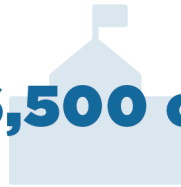
32.0 lbs
per student

1,541 meals served during audits | 128.4 students served on average per school per day

average milk waste per year



16,500 cartons
per school



21.2 cartons
per student

In Cincinnati, Ohio, the Hamilton County Recycling and Solid Waste District worked with three schools to develop an action plan to prevent wasted food from entering the landfill. Two of the schools were Cincinnati public schools, while the third was in the Wyoming City Schools District just north of Cincinnati.

“AHA” MOMENTS



During several audits, it became clear that fresh fruit being served to students was not ripe, which drove the amount of food waste up dramatically. Overuse of condiments at the salad bar also led to wasted food.

These audits revealed the large volume of packaging waste created at lunch every day. While reusable flat trays prevent the waste of styrofoam, each element of the meal is served on an individual plastic or paper boat.

One way to reduce milk waste is to make water conveniently available in the cafeteria at no extra cost. In one school under audit, milk is the only drink option aside from water bottles for purchase. There is no water fountain available, so students take milk just to drink a little of it.

SUCCESSES

Teachers and administrators went above and beyond, from translating the materials into Spanish to ensuring all food waste was gathered from younger children. The administrative, cafeteria, and janitorial staff helped the audits run smoothly by corralling students and setting up tables as necessary.

The students involved were highly motivated and capable. It was clear from students' reflections that the classroom curriculum and cafeteria audits helped students develop an understanding of how food systems work, why food is wasted, and how to prevent waste.

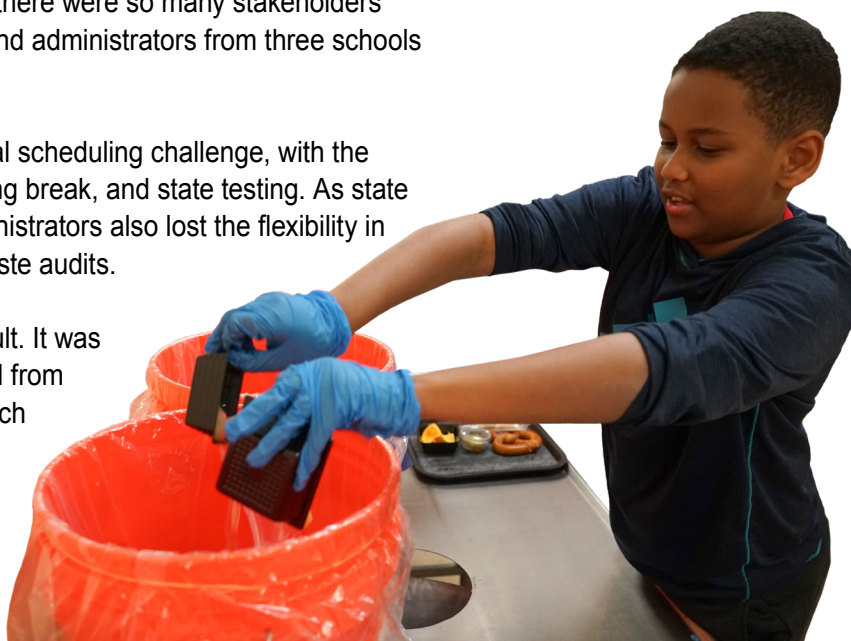


CHALLENGES

The short timeline and coordination necessary to implement this project were challenging, particularly because there were so many stakeholders involved: teachers, students, parents, and administrators from three schools and two districts.

The time of year presented an additional scheduling challenge, with the need to accommodate snow days, spring break, and state testing. As state testing approached, teachers and administrators also lost the flexibility in their schedules to focus on the food waste audits.

Gaining media attention was also difficult. It was a struggle to get the permission needed from the school districts' publicity staff to reach out to media outlets about the project.



BY THE NUMBERS



4 participating schools



24 audit days conducted

average food waste per year



45,868 lbs
per school



34.6 lbs
per student

5,308 meals served during audits | 221.2 students served on average per school per day

average milk waste per year



43,975 cartons
per school



33.0 cartons
per student

As part of its mission to improve the community's waste stream through effective waste reduction, recycling, and disposal, the Solid Waste Authority of Central Ohio (SWACO) worked with four schools in the Columbus City School District (CCS) to implement the Food Waste Warrior project.

SWACO and CCS worked with a company that collected food waste for composting from each school in wheeled carts weekly.

“AHA” MOMENTS



Many “aha” moments concerned the set-up of the audits. It is useful to have a consistent bucket line-up to reduce confusion. One recommendation is to include a straw bucket next to the recycling bin to quickly separate recyclable milk cartons from disposable straws, and to place buckets on a chair rather than on the floor to prevent splashing.

The share table is an essential element of waste-reduction; it's a good idea to remind students during lunch to participate

in the share table. Most of the share food was eaten when adult staff members walked around the cafeteria and offered it to students. This was also an opportunity to engage with students about the importance of eating everything they take and of healthy eating.

It's a good idea to make the process of food waste auditing fun. Both the elementary and middle school students were more entertained by funny and interactive presentations.

SUCCESSES

The project greatly improved waste management; more than half of the usual lunchtime waste was diverted to composting, which reduced landfill waste and made the custodial staff's jobs much easier and cleaner every lunch period.

The student-led Green Teams became a highly effectively part of the program, but all students were involved and educated through this program.



CHALLENGES

With the project launching in mid-March, schools were faced with fitting the pilot program activities into their existing busy schedules. Another challenge was logistical confusion with the company that SWACO contracted to collect the compostable material from the audits. This was a great opportunity, but proper coordination of pick-up was difficult for various reasons.

Some kitchen staff were hesitant to implement the share table because of potential risks to health and fear of breaking the confusing laws surrounding sharing food in school cafeterias.



BY THE NUMBERS



6 participating schools

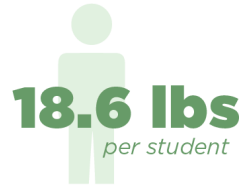


33 audit days conducted

average food waste per year



8,063 lbs
per school



18.6 lbs
per student

2,697 meals served during audits | 81.7 students served on average per school per day

average milk waste per year



3,968 cartons
per school



17.8 cartons
per student

Earth Charter Indiana, a 501(c)3 organization that is working to inspire zero-waste cafeterias throughout the state, instituted the Food Waste Warriors project in six schools in the Indianapolis area.

Five of the six schools involved in the project participate in the K-12 Food Rescue program, which connects schools with social service agencies to donate unwanted food. Audit results clearly indicate much less food waste is captured in schools where Food Rescue is part of the program.

“AHA” MOMENTS



It's a good idea to explore calendar options to consider standardized testing and school breaks and holidays. By adopting a different – or at least more flexible – calendar, the project could achieve even better results with the data.

Regular reminders about the “why” of the project helped it succeed. At each audit, students and sometimes teachers would make an announcement about the reason for the project. In some schools, students created promotional

materials that staff placed around the school. Helping custodial staff understand the project helped them embrace the process, and it is essential to recognize their contribution and thank them after every audit.

School administrators should assess the benefits of composting – off-site by a visiting contractor with potential on-site composting of product – to demonstrate circular economy.

SUCCESSES

All six schools put students in leadership roles throughout the process. In all six schools, school leaders and food-service workers enthusiastically participated. Overall, schools showed reduction in food waste or a static amount of food waste during the program. Every school took the project very seriously and wanted to determine strategies to waste less food and cafeteria materials.

CHALLENGES

Doing the project in the spring was a challenge due to standardized testing, spring break, and end-of-year activities. It was a struggle for the six schools to hold to their agreements, with one school not completing its second set of audits.

Youth involvement generally worked well enough, but in some schools, it was difficult to get kids – especially boys – to continue participating in the audits. Some children also had knowledge gaps regarding food types and categories, requiring extra coaching on basic concepts.

One school in the program wanted to hire a compost pick-up service but was prevented from doing so by district administrators.



BY THE NUMBERS



3 participating schools



17 audit days conducted

average food waste per year



88,866 lbs
per school

62.1 lbs
per student

4,669 meals served during audits | 274.6 students served on average per school per day

average milk waste per year



27,672 cartons
per school

38.5 cartons
per student

Urban Green Lab, in partnership with the Tennessee Department of Environment & Education (TDEC), led implementation of the Food Waste Warrior program in three Nashville-area schools to increase awareness of food waste, collect data through student-led cafeteria audits, and recommend systemic advancements. Each school had an individualized waste-disposal system in place prior to the audits, so the audit process was designed to meet the specific needs of each school.

“AHA” MOMENTS



The amount of waste per student decreased simply from having project representatives in the cafeteria share the reason for the project with students. After witnessing the first audit, one student stated, “I am never wasting food ever again.”

There were large quantities of milk being wasted both from opened and unopened milk cartons. Making water more readily available could be a way to reduce waste; one of the schools didn’t even have a water fountain.



SUCCESSES

There was never a shortage of student helpers, and one of the schools had a very supportive school community, with the principal and other faculty members stopping by the audit table to check in on progress and relay their support.

The lead teachers were also amazing; all three have been advocates for their schools and are leaders committed to sustainability. In all the schools, the janitorial staff was instrumental in formulating a process to meet the needs of the school and provided much-needed support.



CHALLENGES

The most difficult challenge was lack of interest, support, and involvement from school administration in two of the schools, which made the process more difficult, caused frustration for those involved, and may result in the failure of long-term waste reduction efforts.

Timing was also a challenge as standardized testing affected the project timeline.

While large quantities of milk were wasted, some cafeteria managers kept advising students to take milk even though

they were aware it isn’t required. Presumably, this was to ensure compliance with reimbursement regulations, which dictate the specifics of meals for which the USDA will reimburse school districts.

While many students are capable of correctly sorting their waste into the provided bins, students in younger grades require more assistance and hands-on supervision for composting. For long-term waste reduction efforts, this could be a barrier for elementary schools.

BY THE NUMBERS



3 participating schools



11 audit days conducted

average food waste per year



24,021 lbs
per school

35.5 lbs
per student

2,247 meals served during audits | 204.3 students served on average per school per day

average milk waste per year

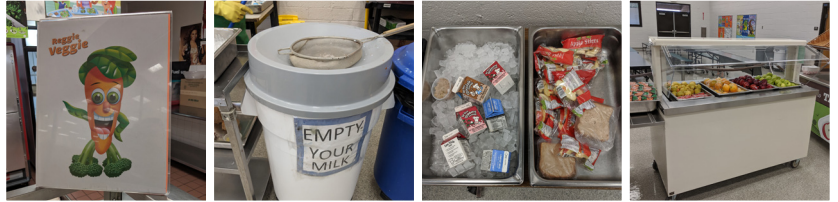


13,952 cartons
per school

37.5 cartons
per student

Working with the Osborn School District (OSD) Child Nutrition personnel, the Arizona State University (ASU) Teachers' Academy implemented the WWF Food Waste Warriors project in three OSD schools: one K-8 school, one elementary school, and one middle school. The audits covered lunchtimes for grades 1, 6, 7, and 8. ASU undergraduate student interns worked with students to conduct waste audits at all schools, facilitated the food recovery program, and provided teacher support.

“AHA” MOMENTS



In some cases, the offer vs. serve (OVS) methodology caused confusion; in one school that had switched to an OVS model recently, older students were still taking one of each item that was offered whether they wanted them or not. This resulted in significantly more uneaten items being thrown away or returned to the share table.

Students in kindergarten and first grade received help filling their trays without getting a choice about what to take, a tactic meant to help them move quickly through the line without spilling food. However, the method only reinforced a “take one of everything” mentality.

It was interesting to observe the apparent influence of peers on students’ food choices. If the first student of a group of friends selected or avoided an option, other students in the group would often do the same.

SUCCESSES

This project has led to the development of a new initiative at the Sustainability Teachers Academy. In July 2019, the Academy will host a Sustainable School Cafeteria retreat to bring together teachers, cafeteria staff, and researchers for an intensive three-day workshop to plan and develop a tool for teachers and students to evaluate cafeteria processes for sustainability. Additional phases of this initiative will include the development of a Sustainable School Cafeteria handbook compiling current research, strategies for promoting sustainability, and lessons for K-12 classes.

CHALLENGES

Standardized testing caused scheduling challenges for the audits, in part because testing was not completed in the schools in question until later than the school district contacts had indicated. The delay impacted the project timeline, making it especially challenging to deliver the project-related lessons and perform post-intervention audits before the end of the academic year.

Another challenge was that school district administrators insisted that interventions in the classroom and cafeteria should have relevant connections to students’ lives outside of school, a requirement that constrained the range of possible solutions that could be implemented.

BY THE NUMBERS



5 participating schools



34 audit days conducted

average food waste per year



52,159 lbs
per school

26.8 lbs
per student

6,772 meals served during audits | 241.9 students served on average per school per day

average milk waste per year



29,957 cartons
per school

32.4 cartons
per student

The Food Waste Warrior project in Portland was led by Oregon Green Schools (OGS), an organization that engages schools in student-driven activities that advance their understanding and ownership of sustainability. The organization's regional coordinators recruited schools and engaged a dedicated consultant, which was extremely beneficial to the success of the project.

“AHA” MOMENTS



Most participating schools were already working to prevent food waste where they can; they had share tables, commercial compost setups, carton recycling programs, and reusable trays and cutlery.

This region’s share table policy allows schools to resell and re-serve unopened/recoverable food items that were placed on share tables. Many schools saved hundreds of pounds of food waste by re-serving unopened milks and whole fruits.

Milk waste was found to be the largest category of waste, with significant financial and environmental costs. The initial audits revealed that more milk waste was happening than was previously known, and this data did not include breakfast, where milk is used in cereal. There is a strong business case for milk dispensers in schools, which could halve milk waste and reduce the district’s food costs.

SUCCESSES

The program enabled OGS to deepen relationships with schools and nutrition services staff about food waste reduction and donation opportunities. Engaging the students provided leadership and project-based learning opportunities and helped underscore the need to have the whole school community involved.

This pilot has inspired a new track for the OGS certificate focused on Green Lunchrooms. It will present a framework to encourage schools to measure food waste, standardize share tables, clearly communicate the expectations of students through OVS requirements, explore food-recovery options both within the school and with the wider community, set up milk dispensers, and engage students in food waste prevention curriculum, activities, and leadership opportunities.



CHALLENGES

The compressed timeline for the project was the biggest challenge. It also highlighted that there seems to be universal confusion surrounding OVS methods. The name “offer versus serve” is misleading; a better way to phrase the term for increased understanding would be “offer, NOT serve” or “offer INSTEAD of serve.”

BY THE NUMBERS



4 participating schools

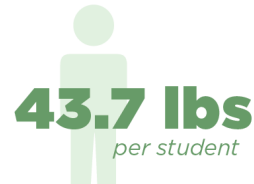


24 audit days conducted

average food waste per year



26,745 lbs
per school



43.7 lbs
per student

2,456 meals served during audits | 102.3 students served on average per school per day

average milk waste per year



18,522 cartons
per school



58.0 cartons
per student

Triangle Associates conducted the Food Waste Warrior program with four public elementary schools in Seattle. The project provided insight into how much food is wasted at schools, why food is wasted, and steps that can be taken to decrease waste.

“AHA” MOMENTS



There is a lot of confusion in schools about the OVS provision of the National School Lunch Program. This confusion leads to students taking items they don't want and don't intend to eat or drink (especially milk).

Students do not have adequate time to eat their lunch in the typical 20-minute lunch period, leading to waste. Milk comprised 25 percent of daily waste by weight, and student interviews revealed that they throw away milk primarily because they lack the time to consume it.

Focusing efforts on food waste reduction and redistribution within a school was more successful and had higher benefits than partnering with outside organizations for food rescue.

SUCCESSES

Despite scheduling challenges due to snow days, the project team was able to meet the stated goal of six audits per school and at least one classroom presentation per school. This was in part because the team had buy-in from Seattle Public Schools and support for food waste reduction at the district level from the start, including from the district's resource conservation specialist.

At all participating schools, students were actively engaged in helping the school reduce food waste. Besides participating in the WWF classroom session, students engaged in this project by conducting food waste audits, writing and facilitating all-school announcements about food waste reduction, making posters and giving presentations about food waste reduction, and creating a “clean plate” incentive program in the lunchroom.



CHALLENGES

It seems very unlikely that school staff members would have time to pursue food waste reduction practices without assistance from outside resources. Many school staff expressed feelings of being overworked and unable to take on extra initiatives like this. The project timeline did not align well with the school year calendar. Delays and cancellations led to having to reschedule numerous audits and classroom

presentations. It also created a stressful atmosphere for teachers, who felt pressure after losing valuable instruction time. School food rescue by external food distribution organizations was unsuccessful in the four project schools for a variety of reasons, including lack of staff cooperation and refrigerator space, and problems matching school foods with recipients and coordinating pick-ups.

APPENDIX A: MEDIA COVERAGE

ATLANTA

["Gwinnett schools look to reduce food waste," Atlanta Journal & Constitution](#)

["Local elementary students doing what they can to combat food waste," CBS46](#)

BOULDER

["Food Waste Warriors' Help Educate To Reduce Waste At School," CBS4](#)

["Grant Turns Students into Food Waste Warriors," VSDNews](#)

["Lunchroom Happenings: Cafeteria Food Waste Audits," BVSD Fresh Bites newsletter](#)

["Millions of dollars' worth of food ends up in school trash cans every day. What can we do?" Ensia](#)

["Should we say goodbye to the school lunch milk carton?" The New Food Economy](#)

[Citation in Green Schools Catalyst Quarterly](#)

COLUMBUS

["Local schools, SWACO work to educate students, limit waste production in Franklin County," WBNS](#)

NASHVILLE

["Students found 131 pounds of food waste. Here's what they're doing about it." Metro Nashville Public Schools blog.](#)

["Nashville school learning ways to reduce food waste," WSMV-TV News 4](#)

["MNPS Food Waste Warriors Are Rescuing and Recycling Food," Urban Green Lab](#)

[Food Waste Warrior Audit Video, Nashville Food Waste Initiative](#)

[Westmeade Matters newsletter](#)

SEATTLE

["Taking a good, hard look at what gets tossed out in school lunchrooms," Seattle Times](#)

["Third graders 'audit' Seattle school lunch waste," Q13 Fox News](#)

APPENDIX B: WORKS CONSULTED

Adams, M. A., R. L. Pelletier, M. M. Zive, and J. F. Sallis. 2005. Salad bars and fruit and vegetable consumption in elementary schools: A plate waste study. *Journal of the American Dietetic Association* 105(11):1789–1792.

[“Agriculture, Energy & Climate Change.” FoodPrints. December 2018.](#)

[Anello, Alene and Conrad Zhong. Keeping Food out of the Landfill: Policy Ideas for States and Localities n.p.: Harvard Food Law and Policy Clinic, 2016.](#)

[“Bill Emerson Good Samaritan Food Donation Act.” 42 U.S. Code § 1791. November 16, 1990.](#)

[Buzby, Jean C and Joanne F Guthrie. Plate Waste in School Nutrition Programs Final Report to Congress. n.p.: Food Assistance & Nutrition Research Program, 2002.](#)

[Byker Shanks C, Banna J, Serrano EL. “Food Waste in the National School Lunch Program 1978-2015: A Systematic Review.” *Journal of the Academy of Nutrition and Dietetics*. November 11, 2017.](#)

[Clapp, Jennifer. Distancing of Waste: Overconsumption in a Global Economy. n.p.: Western Washington University, 2001.](#)

[Christensen, Libby. “Evaluating the Economic Impacts of Farm-to-School Procurement.” *Journal of Agriculture, Food Systems, and Community Development*, Vol 8 No C \(2019\): 2019. *Economics of Local Food Systems: Utilization of USDA AMS Toolkit Principles*.](#)

[Commons, Wikimedia. “World Population Clock: 7.6 Billion People \(2018\).” Accessed December 30, 2018.](#)

[“Consumer Education Campaign.” ReFed. December 2018.](#)

[“Food Waste Context.” 2016.](#)

[“Food Waste Is a Solvable Problem.” ReFed 2018.](#)

[“Food Waste | Initiatives | World Wildlife Fund.” 2018.](#)

Gaddis, Jennifer E. *Labor of Lunch: Why We Need Real Food and Real Jobs in American Public Schools*. Univ of California Press, 2020.

[Global Agriculture Towards 2050. Food and Agricultural Organization of the United Nations, 2009.](#)

[Golan, Elise, et al. “Opportunities and Challenges in Conducting Economic Research on Food Loss and Waste.” *Applied Economic Perspectives and Policy*, vol. 41, no. 1, 28 Jan. 2019, pp. 1–19., doi:10.1093/aep/ppy035.](#)

[Gustavsson, Jenny. *Global Food Losses and Food Waste*. Rome: Food and Agriculture Organization of the United Nations, 2011.](#)

[Hanson, Craig and Tom Queded. *Food Loss and Waste Accounting and Reporting Standard*. World Resources Institute, 2018.](#)

[Honisett, Suzy. “United Nations Adopts Ambitious Food Waste Reduction Goal.” December 1, 2016.](#)

[“Hunger and Poverty Facts and Statistics.” Feeding America. 2018.](#)

[Jedraszak, Filip, Antonio Matias, and Yann Avril. *A Roadmap to Reduce U.S. Food Waste by 20 Percent*. ReFED, 2016.](#)

[Leib, Emily B. et al. “Keeping Food Out of the Landfill: Policy Ideas for States and Localities.” Harvard Food Policy and Law Center. October 2016.](#)

[Lipinski, Brian. “What’s Food Loss and Waste Got to Do with Sustainable Development? A Lot, Actually.” 2015.](#)

APPENDIX B: WORKS CONSULTED (CONTINUED)

[Lott, Melissa.](#) "UN says that if food waste was a country, It'd be the #3 global greenhouse gas emitter." [Scientific America](#). September 2013.

[Nesheim, Malden, et al.](#) "A Framework for Assessing Effects of the Food System' at NAP.edu." [National Academies Press: OpenBook, INSTITUTE OF MEDICINE AND NATIONAL RESEARCH COUNCIL: National Academy of Sciences](#), 2015

[Mckenzie-Mohr, Doug.](#) "Promoting Sustainable Behavior: An Introduction to Community-Based Social Marketing." [Journal of Social Issues](#) 56, no. 3 (2000): 543–54.

[Milk Cartons Versus Dispensers: Advantages and Disadvantages of Having Milk Dispensers in Schools versus Having Milk Cartons](#). Jeffers Foundation

["Milk Dispensers in Clackamas County Schools"](#). Clackamas County, Oregon

["New School Meal Standards Significantly Increase Fruit, Vegetable Consumption"](#). Harvard T.H. Chan School of Public Health. March 4, 2014.

["News Article: Food Wastage: Key Facts and Figures"](#). Food and Agriculture Organization of the United Nations. 2016.

[Prewaste: Reducing the amount of food waste in schools in Tampere Region, Finland](#).

[Report of the "2015 Series of International Conferences on Food Loss and Waste"](#). Food and Agriculture Organization of the United Nations. May 11, 2016.

[SKOOL Report](#). n.p.: International Food Waste Coalition, 2018.

["Smarter Lunchroom Movement: Our Ideas"](#). Cornell University, Behavioral Economics and Nutrition Center.

[Terry, Melissa and Civita, Nicole.](#) "Enabling Share Tables in the National School Lunch Program: Legal Review and Best Management Practices." [Further With Food](#). August 2017.

[Terry, Melissa.](#) "Guide to Conducting Student Food Waste Audits: A Resource for Schools." April 2016. Co-published by the USDA and EPA, respectively.

["Toolkit - Reducing the Food Wastage Footprint"](#). Food and Agriculture Organization of the United Nations. 2013.

["Tools to Reduce Waste in Schools"](#). US Environmental Protection Agency, US Environmental Protection Agency.

[U.S. dairy's environmental footprint: A summary of findings, 2008-2012"](#). Innovation Center for U.S. Dairy.

[U.S. Department of Agriculture, Food and Nutrition Service, Office of Policy Support, School Nutrition and Meal Cost Study, Final Report Volumes 1-4](#) by Sarah Forrestal, Charlotte Cabili, Dallas Dotter, Christopher W. Logan, Patricia Connor, Maria Boyle, Ayseha Enver, and Hiren Nissar. Project Officer: John Endahl. Alexandria, VA: April 2019.

["Understanding Food and Climate Change: An Interactive Guide"](#). Ecoliteracy.org, The Center for Ecoliteracy, 18 Apr. 2018

["United Nations Sustainable Development Goals"](#). United Nations 2030 Agenda for Sustainable Development. January 2016.

[United States Department of Agriculture | Food and Nutrition Service. National School Lunch Program - Fact Sheet](#). September 2018.

["Why Reducing Food Waste in School Meal Programs Matters"](#). USDA National Institute of Food and Agriculture, New Technologies for Ag Extension. August 10, 2017.

[Zipparo, Ali. Milk Service in Vermont Schools: Decision Making Criteria, Best Practices and Case Studies](#). 2016, [Milk Service in Vermont Schools: Decision Making Criteria, Best Practices and Case Studies](#)