Supplementary Material

Disclaimer:
I was able to conduct a greenhouse gas emissions modeling of the food served in Emory's DUCling between the months of September 2018 and February 2019 because I signed a Non-Disclosure Agreement (NDA) with Bon Appétit at Emory. Without signing an NDA, I would not have had access to Bon Appétit's invoices for the DUCling, and I would not have been able to conduct a GHGE modeling. Being able to work with Bon Appétit's invoices was a unique opportunity, and I am very thankful for this opportunity because the GHGE modeling plays a large role in my thesis.

Methodology for the 2018-2019 School Year DUCling Greenhouse Gas Modeling:

The modeling I conducted quantifies most of the food-related greenhouse gas emissions (GHGE) from the DUCling during the following one week periods from the months of September 2018 to February 2019:[1]

- August 31, 2018 to September 6, 2018[2]
- September 28, 2018 to October 4, 2018
- October 26, 2018 to November 1, 2018
- November 30, 2018 to December 6, 2018
- January 18, 2019 to January 24, 2019
- February 1, 2019 to February 7, 2019

[1] Some food providers that Emory sources from do not list the weight of the food on the invoice. Those invoices could not be included in this modeling. Additionally, some food products were listed in units that could not be accurately converted to lbs or kg, so those foods were not included in the modeling. There were some food products that were not listed with GWP values in Heller et al., Clune et al., or Berners-Lee et al., so those food products were not included in the model. These reasons are why this model does not quantify *all* of the food the DUCling orders, but it does quantify a majority of the food ordered by the DUCling. A list of food providers as well as food products not included in the modeling can be found in the supplementary material.

[2] I included the White Oak Pastures order from September 7 in this week because White Oak Pastures usually places one order a week, but did not place an order the first week of the school year. Instead, they placed two orders during the second week, but still only four orders during September, so including their September 7 order in the first week helps maintain consistency with other weeks of ordering data.

Because I received access to ordering data from Bon Appétit at Emory, I could calculate the weights of each food ordered by the DUCling. I then needed GWP values for each food the DUCling ordered, so I could multiply the weight of the food times the food's corresponding GWP value to equal an amount of GHGE, in units of $kgCO_2$-eq/kg of food.

I chose Heller et al., 2018[3] to provide the majority of my GWP values, and I used Clune et al., 2017[4] and Berners-Lee et al., 2012[5] to supplement the GWP values that Heller et al. had not calculated (Heller et al. did not calculate GWP values for most processed foods). I used the GWP values from Heller et al. for two reasons. One was because it developed a database of GWP values based on a literature review of other life-cycle analyses, mainly peer-reviewed journals, but also NGO reports, databases, industry-based reports, government reports, and conference proceedings. This means the GWP values in Heller et al. are averages of GWP values from other publications, which decreases the possibility for too high or too low of a GWP value if one LCA happened to calculate a GWP that was an outlier. Also, all GWP values were cross-referenced with Clune et al., which helps decrease the possibility of outlier GWP values. The second reason I mainly used Heller et al. for GWP is because it provided the most extensive review, meaning it calculated GWP values for the largest number of foods. As described in more detail in the supplementary material, because the DUCling orders such a high number of foods, many of which are specific and not included in Clune et al. or Berners-Lee et al., I wanted to

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[3] Martin C Heller et al., "Greenhouse Gas Emissions and Energy Use Associated with Production of Individual Self-Selected US Diets," *Environmental Research Letters* 13, no. 4 (April 1, 2018): S1–41, https://doi.org/10.1088/1748-9326/aab0ac.

[4] Stephen Clune, Enda Crossin, and Karli Verghese, "Systematic Review of Greenhouse Gas Emissions for Different Fresh Food Categories," *Journal of Cleaner Production*, Towards eco-efficient agriculture and food systems: selected papers addressing the global challenges for food systems, including those presented at the Conference "LCA for Feeding the planet and energy for life" (6-8 October 2015, Stresa & Milan Expo, Italy), 140 (January 1, 2017): 766–83, https://doi.org/10.1016/j.jclepro.2016.04.082.

[5] M. Berners-Lee et al., "The Relative Greenhouse Gas Impacts of Realistic Dietary Choices," *Energy Policy* 43 (April 1, 2012): 184–90, https://doi.org/10.1016/j.enpol.2011.12.054.

have the most accurate modeling of GHGE from the DUCling's food, so I wanted to use a journal article that had GWP values for as many foods as possible. The GWP values in Heller et al. are similar to those in other peer-reviewed journal articles, which also provides confidence that the GWP values I am using are accurate. Also, Martin Heller is a prominent researcher of life cycle assessments of food and agriculture systems at the University of Michigan Center for Sustainable Systems, a prominent center for life-cycle research. While some life-cycle researchers may critique some of the GWP values from Heller et al., as I'm sure researchers always critique life-cycle analyses, I reviewed as many journal articles as possible that could provide the most accurate GWP values for the highest number of foods and Heller et al. was the best option.

With the weights per food from the ordering data and the GWP values from Heller et al., I was able to quantify the GHGE from the DUCling's food over the six weeks listed above. I calculated the GHGE from the DUCling's food during the 6 one-week periods in each month from September 2018 to February 2019. Then I multiplied each weekly total by the number of weeks Emory was in school during that particular month. (This was assumed to be four, unless there was a break). This provided six different amounts of GHGE for each of the six months because the food ordering was a bit different each month. Then, for the months of March 2019 through May 2019, whose ordering data was not available yet, I found an average of the GHGE totals for the six weeks of ordering data I had calculated. This same average was then used for each week from March to May.

To allow for the most accurate calculation of the DUCling's total food-related GHGE, the model does not include weeks that Emory is on break, but assumes that each month is four weeks long.[6] This means there are 29 weeks accounted for in the model. Here is the model:

GHGE from the DUCling During the 2018-2019 School Year (kgCO2-eq)

Month	September (kgCO2-eq)	October (kgCO2-eq)	November (kgCO2-eq)	December (kgCO2-eq)	January (kgCO2-eq)	February (kgCO2-eq)	March (kgCO2-eq)	April (kgCO2-eq)	May (kgCO2-eq)	Total (kgCO2-eq
Week 1	49333.89667	51844.12788	58305.5606	55324.59615		47704.71533	51083.3552	51083.3552	51083.3552	415762.962
Week 2	49333.89667	51844.12788	58305.5606	55324.59615		47704.71533		51083.3552	51083.3552	364679.60
Week 3	49333.89667	51844.12788		55324.59615	43987.23454	47704.71533	51083.3552	51083.3552		350361.28
Week 4	49333.89667	51844.12788	58305.5606		43987.23454	47704.71533	51083.3552	51083.3552		353342.245
Total	197,335.59	207,376.51	174,916.68	165,973.79	87,974.47	190,818.86	153,250.07	204,333.42	102,166.71	**1,484,146.10**

Key	Definition
	GHGE emissions I computed for that specific week
	Average GHGE emissions per week that I computed (denoted by salmon color cells) using the Septemeber through February numbers (used because March, April, and May purchasing data was not available)
	Total GHGE from the 2018-2019 school year

Figure 1. GHGE from the DUCling During the 2018-2019 School Year (kgCO2-eq)[7]

Limitations to the Model

One limitation to this model is that ordering data from Sysco, the DUCling's largest supplier of food, was only available starting November 13, 2018. Because Bon Appétit catalogues invoices from Friday to Thursday, I did not include November Sysco data. November 13 was a Tuesday and the following week was Thanksgiving so ordering data from Friday, November 16 to Thursday November 22 or Friday, November 23 to Thursday, November 29 would not be representative of a normal week of Sysco data. This means the months of December, January, and February have the proper Sysco data. After calculating the total GHGE from the Sysco data in those three months, I found the December total was in between January and February's GHGE total. Because the December total was in the middle, I then added the

[6] During the 2018-2019 school year, Emory had Fall break on October 6-9 and Thanksgiving Break during the second half of the third week of November 2018, November 21-25, the model assumes these breaks combined are about one week, so instead of not account for data from two half-weeks, DUCling data from the third week of November is not accounted for. Emory's winter break was from December 21, 2018 to January 14, 2019, which is about three weeks of ordering data that are not accounted for. Emory's spring break was from March 9 to 17, 2019, which is the second week of March and is not accounted for. Emory's final exams end on May 10, 2019, so only the first two weeks of May are accounted for in the model.

[7] See "2018-19 Extrap Data w Breaks" excel tab in the supplementary material.

same December Sysco total to the months of September through November. This created weekly GHGE totals for September through February that are all relatively similar.

A less significant, but still notable, limitation to this modeling is that there were some "farm to fork" (also known as local vendors) invoices not in Bon Appétit's files. This created variability in the farm to fork GHGE calculations, but I made some small assumptions to account for the missing invoices. For example, there are no "farm to fork" invoices (also known as local vendors) from the first week of December. Because I wanted to have an accurate monthly calculation of GHGE that includes the farm to fork vendors, and because the farm to fork invoices are very similar across months, I included the first week of November farm to fork purchases as part of the December week 1 GHGE total. This provides a more accurate December week 1 GHGE calculation.

Assumptions and Unit Conversions for GHGE Modeling

All GWP values are from Heller et al., 2018 with the exception of the following values that are included in the modeling, but use GWP values from Clune et al., 2017 and Berners-Lee et al., 2012:

- Clune et al. (used the mean GWP value)
  - Cream: GWP = 5.32
  - Butter: GWP = 11.52
- Berners-Lee et al. (examples of each food category are in parentheses)
  - Biscuit: GWP = 2. 30 kgCO2-eq/kg food
  - Bread (churro, pie crust, pita bread, dough, bun, croissant, English muffin, roll, wrap, tortilla): GWP = 1.28 kgCO2eq/kg food
  - Condiments (mayonnaise, curry, mustard, ketchup, sauces, salad dressings): GWP = 3.33 kgCO2eq/kg food
  - Desserts (cookies, Oreos): GWP = 2.21 kgCO2eq/kg food
  - Crisps, snacks & nuts (crackers, saltines): GWP = 2.53 kgCO2eq/kg food
  - Ice Cream Products (ice cream): GWP = 3.84 kgCO2eq/kg food
  - Jam/Marmalade/Honey (jelly, preserves): GWP = 3.25 kgCO2eq/kg food
  - Ready meals, pizza & pasta (noodles, pasta): GWP = 5.99 kgCO2eq/kg food

- Cereals[8] (Frosted Flakes, Lucky Charms): GWP = 1.61 kgCO2eq/kg food
- Frozen Foods (frozen eggroll): GWP = 3.46 kgCO2eq/kg food

GWP and Food Type Assumptions:[9]

- Assuming rosemary, thyme, oregano are "herbs, other" from Heller et al.
- Assuming all types of milk have the same GWP as "milk"
  - Half and Half GWP will equal ½ milk GWP + ½ cream GWP
  - Skim milk, 2% milk, chocolate milk, buttermilk, old hyspt= milk (not including cream)
  - Heavy whipping cream and sour cream will equal "cream" from Clune et al, which means they have a GWP = **5.32** (the mean value for cream)
- Assuming "green" and "red" peppers are "bell peppers"
- Assuming salad dressings are "condiments"
- Assuming snow pea is "Pea, edible podded, succulent"
- Assuming snap pea and sugar snap is "Bean, snap, succulent"
- Assuming pepperoni is ½ beef and ½ pork (so, it will have GWP = ½ beef GWP + ½ pork GWP)
- Assume all spices, seasonings, and salt are "spices, other"
- Assuming capers are olives
- Assuming wine is "grape, wine and sherry"
- Assuming pickle is the same as "cucumber" because a "pickle" is a pickled cucumber
- Assuming edamame bean is a "soybean, seed"
- Assuming green bean is "bean, broad, succulent"
- Assuming cornmeal and grits is "corn, field, meal"
- Assuming canola oil is "sunflower, oil" because it is a similar oil and there is no canola oil GWP value in any of the three studies
- Using cream GWP value from Clune et al because there is not one in Heller et al
- Assuming all fish species (Cod, Pollock, Pangasius, Tilapia) are saltwater fin fish
- Assuming molasses is "sugarcane, molasses," not "beet, sugar, molasses"
- Assuming corn dog has same GWP as beef, unless noted that the turkey is made of turkey
- Assuming corn dog with turkey has same GWP as "turkey"
- Assuming tahini paste has the same GWP value as tomato paste
- Assuming green pea and blackeye pea are "pea, dry"
- Assuming all rice types are "rice, white"

[8] The model assumes "cereals" in Berners-Lee are cereals, such as apple jacks and frosted flakes because Berners-Lee provides GWP for numerous processed foods, and the GWP number for cereals is 1.61, while the other types of cereals, such as "millet, grain" and "wheat, grain" have GWP of 0.470 and 0.347, respectively in Heller et al., which is much less than GWP = 1.61.

[9] These assumptions are necessary because not every type of food is listed in Heller et al., Clune et al., or Berners-Lee et al. In order to conduct the most accurate GHGE modelling, some foods that are not specifically listed in any of the studies were assumed to be similar to foods that are listed in the studies. For example, rosemary, thyme, and oregano are not listed in any of the studies, but "herbs, other" has a GWP in Heller et al., so I used that GWP to quantify the GHGE of the DUCling's order of rosemary, thyme, and oregano. This assumption means that whenever foods not listed in the studies were assumed to be the same as another similar type of food, the not-listed food would use the GWP of the food listed in one of the three studies.

- Assuming romaine hearts are "lettuce, head" not "lettuce, leaf" because lettuce hearts are more similar to lettuce heads than lettuce leaves
- Assuming strawberry puree has the same GWP as tomato puree because it is the only puree listed in any of the three studies
- Assuming all squash and zucchini have same GWP as "squash, summer" (zucchini is a summer squash)
- Assuming pancake syrup is "maple syrup"
- "Slaw" GWP is assumed to equal ½ carrot GWP + ½ cabbage GWP
- Assuming "kimchi" is "Cabbage, Chinese, napa"
- Assuming arugula is "lettuce"
- Assuming quinoa is wheat, grain
- Assuming a tomatillo is a tomato
- Assuming "salami" is pork
- Assuming salt is "spices, other"
- Assuming sunflower butter has same GWP value of peanut butter because there are no nut butters in any of the three studies
- Assuming couscous is "wheat, grain" because couscous is made from grains of durum wheat
- Assuming cream cheese is "cheese," not "cream"
- Assuming tahini paste has the same GWP value as tomato paste
- Assuming brown sugar has the same GWP as granulated sugar
- Assuming baked beans have same GWP as "navy beans" (https://en.wikipedia.org/wiki/Baked_beans)
- Assuming "greek yogurt" and "yogurt" have the same GWP

Products Included in the GHG Modeling that do not have GWPs from Heller, Clune, or Berners-Lee:[10]

- Beyond Burger has GWP = **3.527** kgCO2-eq/kg because BB has 0.4kgCO2/4oz and after doing unit conversion, the final answer is 3.527
- Morningstar Farms Black Bean Burger has GWP = **6.87** kgCO2-eq/kg because the Black Bean Burger has 0.4124kgCO2-eq/60g, so the final answer is 6.87kgCO2-eq/kg

Units of Measurement by Food Type[11] (for foods not listed in invoices with units of lbs):

- Apple: 1 lb = 3 medium apples, so 1 apple = 1/3lb (https://hypertextbook.com/facts/2009/AliciaMcGeachy.shtml)
- Orange: Average medium-sized orange according to USDA is 131 grams = **0.288806lbs** (https://www.reference.com/food/average-weight-orange-dc0ec85723e2b74c)
- Churro: 10" churro = 2.6oz (http://articles.latimes.com/2002/jul/29/health/he-churro29)
- Lettuce: Average head of romaine lettuce is assumed to be **1 lb**—the average = 16.75oz, so assuming average head = 16oz = 1lb is not far off and lettuce has a small GWP, so this

[10] These products were included because they each had peer-reviewed life-cycle analyses to calculate total GHGE throughout their life-cycle

[11] These unit of measurement assumptions outline the different units used to measure each type of food, specifically for the foods that did not have their ordering weight measured in pounds.

small difference does not change the total GHGE substantially (https://moneysmartfamily.com/blog/head-lettuce/)

- Swiss chard: Average head assumed to be 1lb based on the fact that one head of lettuce is **1lb**
- Shallots/garlic/banana peppers: measured in gallons and converted to pounds using **1 gallon = 4.54lbs** (https://www.aqua-calc.com/calculate/food-volume-to-weight)
    - Assuming garlic and banana peppers have similar density to shallots and will have similar amount of weight per gallon
- Tomato grape red: assuming 1 pint = 1 lb because the tomatoes are being measured in weight not volume (http://mathforum.org/library/drmath/sets/select/dm_tsp_oz.html) (http://sio.midco.net/poornima/conversion.html)
- Italian parsley: weighs about 2 oz, which is **1/8 of 1 lb** (https://www.howmuchisin.com/produce_converters/parsley)
    - 10-3ea bags means 10 bags of 3 bunches of parsley each, so 3 x 1/8lb x 10
- Cilantro: weighs about **2.8 oz** according to https://www.howmuchisin.com/produce_converters/cilantro
- Tortilla: 6" tortilla (corn and tortilla) weighs an average of **30g = .0661387lbs** (http://www.answers.com/Q/How_much_does_a_tortilla_weigh)
- Lime juice: 1 gallon = **8.54lbs** and **4 quarts** (https://www.aqua-calc.com/calculate/food-volume-to-weight/substance/lime-blank-juice-coma-and-blank-raw)
    - 1 quart = 0.25 gallons = **2.135lbs**
- Lemon juice: 1 gallon = **8.47lbs** and **4 quarts** (https://www.aqua-calc.com/calculate/food-volume-to-weight/substance/lemon-blank-juice-blank-from-blank-concentrate-coma-and-blank-canned-blank-or-blank-bottled)
    - 1 quart of lemon juice = **2.12lbs** (https://www.aqua-calc.com/calculate/food-volume-to-weight)
- Cantaloupe: average-size cantaloupe weighs **3 lbs** (https://www.thekitchn.com/how-many-cups-of-fruit-are-in-a-pound-of-cantaloupe-234490)
- Honeydew: ranges in weight from 4.0 to 7.9lbs, but because honeydews are similar to cantaloupe, I'm assuming it weighs **4.0lbs** (https://en.wikipedia.org/wiki/Honeydew_(melon))
- Bushel units—using the highest end of the approximation, so 1 bushel of peppers = 30lbs (the chart says 25-30lbs) (https://foodbankcny.org/assets/Documents/Vegetable-conversion-chart.pdf)
    - 1 bushel of cucumber = 48-50lbs (used 50lbs)
    - 1 bushel of eggplant = 33-35lbs (used 35lbs)
    - 1 bushel of peppers = 25-30lbs (used 30lbs)
    - 1 bushel of summer squash/zucchini = 40-44 lbs (44lbs)
    - 1 bushel of tomatoes (tomatillo) = 53lbs
    - I am using the upper approximations because the reality is that I am not including bread, kosher section, and many prepared goods, so my GHGE number will be an underestimate to begin with
- Pineapples: assume the weight of the pineapple is **2lbs**, which is said to be the average in US grocery stores (https://www.thespruceeats.com/pineapple-equivalents-and-measures-1807474)
- Milk: 4 pints =1/2 gallon; 4 quarts = 1 gallon; **1 quart = ¼ gallon = 8.6 x 1/4**

    - Liquid equivalents: **1 pint = 16fl oz = 1lb** **(**http://sio.midco.net/poornima/conversion.html)
    - Assume a **gallon of milk = 8.6lbs** (https://www.progressivedairy.com/topics/management/how-much-does-the-farmer-get-when-a-consumer-buys-milk)
    - Assuming soy and coconut milk have similar density to dairy milk, so a gallon of soy and coconut milk will also = **8.6lbs**
        - this site says soymilk has 1 gallon = 8.36lbs, so it's very close (https://www.aqua-calc.com/calculate/food-volume-to-weight)
- Half and Half: **1 quart** of half and half **= 2.05lbs** (https://www.aqua-calc.com/calculate/food-volume-to-weight/substance/cream-coma-and-blank-half-blank-and-blank-half-coma-and-blank-fat-blank-free)
    - Assuming mg oldsty is closer to half and half than heavy whipping cream, so 1 quart of mg oldsty will equal 2.05lbs, just like half and half
    - Using same GWP for "mg oldsty" and half and half because it is also comes in 1 quart, while milks come in 5 gallon shipments
- Heavy whipping cream: 1 quart of heavy whipping cream = **1.06lbs** (https://www.aqua-calc.com/calculate/food-volume-to-weight)
    - Heavy whipping cream and half and half have GWP = ½*GWP of milk + ½*GWP of cream = **3.2615**
    - Using same GWP for heavy whipping cream and half and half
- Molasses: Assume a gallon of molasses weighs **11.89lbs** (https://www.aqua-calc.com/calculate/food-volume-to-weight)
- Tofu conversion: Density conversion, I had 0.1g/cm^3, so I converted grams to lbs because 1 gram = 0.00220462lb and then 0.000264172gallons = 1cm^3. Then I multiplied by one gallon to cancel out gallons and was left with lbs.
    - 5 gallons of tofu = **4.172 lbs**
- Pear: 1 medium pear = 178 grams = **0.39lbs** (https://www.traditionaloven.com/foods/multi-units-converter/pears-raw.html)
- Mayonnaise: 1 gallon of mayonnaise = **7.79lbs**, 3.53kg (https://www.aqua-calc.com/calculate/food-volume-to-weight)
- Ice cream: 1 gallon of ice cream (soft serve, fat) = **6.07lbs** and 2.75kg
- Bread (https://www.2fatguyscooking.com/buns-and-roll-weights-and-sizes/):
    - Hamburger bun: bun is **1.4oz** because sysco order says 4inch bun and this site approximates weight of 3.5inch bun, which is very close
    - Hot dog bun: bun is **1.4oz**
    - Hoagie bun: 6-inch hoagie roll = 3.5oz
- Cauliflower: 1 average medium head of cauliflower = **1.3lbs** (https://www.traditionaloven.com/foods/multi-units-converter/cauliflower-raw.html)
- Red Hot Sauce: assuming red hot has similar density to Texas Pete hot sauce, which has 1 gallon = **11.68lbs** (https://www.aqua-calc.com/calculate/food-volume-to-weight)
- Soy Sauce: 1 gallon of soy sauce = **10.16lbs** (https://www.aqua-calc.com/calculate/food-volume-to-weight)
    - 1 liter of soy sauce = 2.68lbs (https://www.aqua-calc.com/calculate/food-volume-to-weight)

- Ketchup: 1 gallon of ketchup = **9.59lbs** (https://www.aqua-calc.com/calculate/food-volume-to-weight/substance/tomato-blank-ketchup-coma-and-blank-upc-column--blank-5051379003890)
- Italian salad dressing: 1 gallon = **8.47lbs** (https://www.aqua-calc.com/calculate/food-volume-to-weight)
- Fennel: 1 bulb of fennel = **3.07oz** (https://www.aqua-calc.com/calculate/food-volume-to-weight/substance/fennel-coma-and-blank-bulb-coma-and-blank-raw)
- Kale: average weight of one bunch of kale is **6.5 oz** (https://h7opolo.wordpress.com/2015/04/01/kale/)
- Olive Oil: 1 gallon of olive oil = **7.9lbs** (https://www.aqua-calc.com/calculate/food-volume-to-weight)
- Sunflower oil/Canola oil: 1 gallon = **7.9lbs** (https://www.aqua-calc.com/calculate/food-volume-to-weight)
- Green onion: assuming medium-size green onion = 0.5oz, so 1 dozen bag of green onion (12 onions) = 6oz, so 4-1dz bags = 4*6oz = **24oz** (https://hannaone.com/Recipe/weightgreenonion.html)
- Jalapeno pepper slices: 1 gallon = **8.47lbs** (https://www.aqua-calc.com/calculate/food-volume-to-weight)
- Leeks: weighs an average of **9oz** (https://www.clovegarden.com/ingred/li_leekz.html)
- Cabbage: 1 gallon weighs **5.29lbs** (https://www.aqua-calc.com/calculate/food-volume-to-weight)
- 1 liter of Balsamic vinegar = **2.39lbs** (https://www.aqua-calc.com/calculate/food-volume-to-weight)
- 1 gallon of red wine vinegar = **8.41 lbs** (https://www.aqua-calc.com/calculate/food-volume-to-weight)
    - Assuming rice wine vinegar and red wine vinegar have the same density, so their poundage per gallon is the same
- Maple Syrup: 1 gallon of maple syrup = 11.01lbs (https://www.aqua-calc.com/calculate/food-volume-to-weight)
- Eggs: Assuming the large dozen eggs = 24oz per dozen (https://www.thekitchn.com/medium-large-jumbo-how-egg-sizes-actually-measure-up-ingredient-intelligence-200891) which gets their numbers from USDA calculations
- Parsley: Each count is 2oz = 1/8lb, so 30ct = **30/8lbs** (https://www.howmuchisin.com/produce_converters/parsley)
- Celery: 1 bunch = **1lb** (https://www.howmuchisin.com/produce_converters/celery)
- Sorbet: Assuming you need need 2 lbs of fruit per liter of sorbet, and no other ingredients added, so you need 100lbs for 50L, which is the assigned weight on the invoice
    - This means that for "mango sorbet," the GWP value is for mango and assumes 100lbs x GWP value for mango = GHGE for mango sorbet
- Avocado: Assuming avocados weigh 1 lb each[12]
- Assuming an average grapefruit weighs **8.7oz** (https://hannaone.com/Recipe/weightgrapefruit.html)

[12] This weight assumption is a bit high, but I wanted to keep the avocado weight consistent, so I did not switch the weight after I had inputted the first few orders of avocados.

- Assuming flat **pita** bread = 84g because bag of 12-7" pita bread have net weight of 2lbs 2oz, which means each pita bread weighs **0.177lbs** (https://www.amazon.com/personal-sandwiches-Limited-Quantity-Available/dp/B07MJCHL4H/ref=sr_1_12?keywords=pita+bread+flat&qid=1551477037&s=gateway&sr=8-12)
- English Muffin: assuming 1 English muffin weighs 57g = **2oz** (using Nature's Own English muffin as an example (https://www.fitbit.com/foods/English+Muffin+Original/5533960)
- Croissants: assuming average weight to be around **1.125 oz**, which is on the lower side because I have seen the croissants in the DUCling and they are relatively small (https://www.amazon.com/Pierre-Natural-Butter-Flavored-Croissant/dp/B00B044BFA/ref=sr_1_2?keywords=butter+croissant&qid=1551497689&s=gateway&sr=8-2)

Holes in the Data due to Missing Invoices:

- There are no "farm to fork" orders from the first week of December. Because I want to have an accurate monthly calculation of GHGE that includes the farm to fork vendors, and because the farm to fork invoices are very similar across months, I have included the first week of November farm to fork purchases as part of the December week 1 GHGE total. This provides a more accurate December week 1 GHGE calculation
- There is only the one White Oak Pastures order from the first week of October. The October Week 1 invoices are missing. It seems likely there are no Farm to Fork orders in December Week 1 because it was leading up to winter break, so the suppliers were not able to provide their full orders to Emory due to the short period until winter break, when the suppliers would not be supplying food for Emory. It is also a possibility that Emory ordered food from their Farm to Fork suppliers in advance because they did not want to have food being delivered so close to the end of the semester, which could provide a high chance the food goes to waste.
    - With only White Oak Pastures invoices for farm to fork vendors from the first week of October, that means there are no invoices from Georgia halal meat, savannah river farms, or common market
- P1 week 1 invoices were available, but may not be full because they were thought to be lost, so I had to pick them out of the "completed" invoices folder, which had scattered invoices from multiple months

DUCling Food Suppliers Not Included in the Modeling:

- Not including the following suppliers because they do not list quantities in units of weight:
    - Tucker Farms
    - Kosher Gourmet
    - Masada Bakery
- Not including the following suppliers because they provide a small quantity of food relative to the other suppliers. I also only had one week to input all of the DUCling's ordering data, so I wanted to input the ordering data from the largest suppliers who Emory orders the most food from:
    - Tropical Nut and Fruit Co

- Emerald City Bagels
- Gourmet Food International
- UNFI (these invoices were not always in the DUCling invoice folders, too)

Foods Not Counted in the Modeling:

- **Not counting** "cracker saltine" because the unit is 2pk, which would be 4.24lbs x 2 because 1pk = 4.24lbs, but that would mean the 500 packs of cracker saltine is **1 qt = 0.53lbs**, so 1pk = 4.24lbs (other crackers with proper units are counted)
- **Not counting** vanilla extract because there are no ingredients with a GWP in any of the three studies that are similar to vanilla extract
- **Not counting** cocoa, powder even though "cocoa bean, powder" is in Heller et al. because the unit is 50ct, and I don't know how heavy a ct is
- **Not counting** the "cereal hot grits quick" that have a unit of 12ct because it is not possible to calculate how much a "ct," which is a count, of grits weighs because there is not an individual count of grits to weigh, like you can weigh one count of honeydew (the weight of one honeydew melon)
- **Not counting** "yeast" because there was no yeast or any fungis listed in any of the three studies
- **Not counting** "dough biscuit southern style" from 11/30/18 invoice because the unit of "1.0.125" is not a computable number for unit lbs (other biscuits with proper units are counted)
    - I could not use the same logic for the units of biscuit dough as I did for the units of oyster crackers because unlike oyster crackers, where it was clear the unit was a decimal point error, the biscuit unit from the 1/23/19 invoice is 1.2 oz (0.075lbs) and the unit from the 1/18/19 invoice is 3.17oz (0.198lbs), which are not similar to 1.0125lbs.
- **Not counting** ciabatta roll from 2/4/19 because it says the weight is 3.0.3125, which is not a computable number for unit lbs (other rolls with proper units are counted)
- **Not counting** beyond meat "STRIP CHICKEN-FREE LTY SEASON" because there is not GWP in any of the three studies for a soy-based chicken strip
- **Not counting** 4 bags of corn from 12/4/18 invoice because it is not clear how many lbs a bag of corn is (other corn with proper units are counted)
- **Not counting** cornbread mix because it has many different ingredients, such as flour, baking soda, salt, sugar), which all have different GWP values
- **Not counting** pancake mix because it has many different ingredients, such as flour, baking powder, salt, sugar), which all have different GWP values
- **Not counting** the following categories of products from Sysco:
    - "Paper and Disposables"
    - "Chemical and Janitorial"
    - "Dispenser Beverage": these are syrups and there are no corresponding GWPs

Unit Conversion Assumptions

- Assuming 1 pint = 1b
- Assuming 1 liter = 1 kg
- Assuming 1 quart = 1 liter of ice cream

- Assuming 1 Fl OZ = 1 OZ
- Assuming 1pk = 8 dry quarts (https://www.britannica.com/science/peck)

Invoicing Units (the conversion of these units were explained to me by DUCling Chef Battles)

- "**Case**" **is 20lbs average** (according to Battles)
- 4-3# means 4 3lb bags = 12 lbs
- 4-1 dz bags means 4 bags of 1 dozen green onion bunches
- Blackberry, blueberry, and raspberry **clamshells** are **half pints** (so 12 blueberry clamshells are 6pints)
- Strawberry clamshells are **1lb**
- Georgia Halal Meat: 1 box = 40lbs

Miscellaneous Calculations:

Sysco Calculations:

- December Sysco: to cell 246 = 27,979 kgCO2-eq
- January Sysco: to cell 242 = 26,317 kgCO2-eq
- February Sysco: to cell 242 = 28,868 kgCO2-eq