Navigating Michigan Dining Towards Carbon Neutrality

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ABSTRACT

In Fall 2018, the University of Michigan made a public pledge towards carbon-neutrality. This pledge, along with pressure from concerned citizens at the local and global level, make it essential for Michigan Dining (MDining) to proactively address their greenhouse gas emissions. The goal of this research was to assess the impact of existing MDining initiatives to reduce emissions from purchased food, and to provide recommendations for navigating MDining towards carbon neutrality. The researchers used carbon emission estimates from an existing meta-analysis of food product life cycle analysis studies (LCAs) and MDining data on food purchases from the 2018-2019 school year to estimate the impact that the "Sustainable Mondays" initiative had on emissions. The results from those estimates showed that the Sustainable Mondays initiative reduced emissions by up to 45% in some dining halls, but that the implementation varied significantly across dining halls. Based on these findings, as well as best practices from the literature on behavior change and marketing, the researchers recommend that MDining: make Sustainable Mondays implementation more consistent across their dining halls; more effectively share food emissions information with students using existing digital tools; investigate student attitudes via specific survey questions; and explore possibilities such as carbon positive farming and appropriate use of offsets.

ACKNOWLEDGEMENTS

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INTRODUCTION

In Fall 2018, the University of Michigan president Mark Schlissel made a public proclamation that during his tenure, a commission would be formed to steer the institution "toward carbon neutrality and levels of greenhouse gas release that are environmentally sustainable" (Merchant, 2018). This pledge follows a 2011 commitment to reduce greenhouse gas emissions 25% by 2025 (relative to 2006 baselines.) As of 2018, this sustainability goal was far from being met, with the University of Michigan having made only a 7% reduction (Langefeld, 2019). Compounding this challenge, if the university wants its operations to be truly carbon neutral, it will be necessary to look at not only issues related to energy use, but University emissions as a whole, including emissions from food purchased by Michigan Dining (MDining). MDining serves 25,000 meals daily across nine dining halls, in addition to operating on-the-go food service in 13 cafes and nine campus markets. With that scale of impact in mind, this project will examine Michigan Dining operations as an opportunity for a sizable carbon emissions reduction within the larger institution.

Although tracking of Scope 3 emissions, which include indirect emissions from everything but purchased energy, is not currently standard operating procedure at most Big Ten schools (Langefeld, 2019), this project could encourage universities to consider doing so as they strive toward carbon neutrality. Tracking of emissions from food purchases on a broader scale will help the University of Michigan and other higher education institutions arrive at a more realistic view of what their overall carbon footprint is in order to effectively account for it.

More generally, institutions of higher education have the potential to play an influential role in addressing sustainability challenges. Research by Stephens et a (2008) describes this as an opportunity for colleges and universities to act as change agents. They argue that institutions of higher education are positioned to contribute to the societal transition to sustainability in four ways: by modeling sustainable practices themselves that others can learn from and emulate, by teaching students skills in system-thinking and coping with complex problems, by conducting real-world problem-based research, and by acting as transdisciplinary agents that connect and promote engagement between individuals and other institutions (Stephens, 2008). Institutions of higher education can be particularly powerful connectors between individuals and other institutions because people often form strong personal affinity with the college or university they attended, where their family member attended, that was close to where they grew up, or is a part of the community where they live now. Students develop such lasting attachments to towns like Ann Arbor that they frequently decide to build their

lives and raise their families there. These strong personal relationships give colleges and universities the ability to communicate messages about values and beliefs.

Because of these relationships, having a visible, directional commitment to reducing greenhouse gasses is also crucial. Dining halls are often on the front lines of student and prospective-student influence; first-year students eat a majority of their meals in halls, and visiting students and parents are frequently wooed with dining experiences. By helping MDining to leverage its platform to take demonstrable strides toward carbon neutrality, these values and beliefs of sustainability and systems thinking can be modeled by individuals long after their time at the University of Michigan.

Additionally, the threat of climate change makes the call for leadership from universities even more urgent. The 2018 report from the UN Intergovernmental Panel on Climate Change (IPCC) states that society has eleven years to limit global warming to 1.5°C, beyond which the frequency and severity of drought, floods, extreme heat, and climate-related poverty will dramatically increase (Watts, 2018). University of Michigan has shown recognition of this need with the UM Carbon Neutrality Pledge, and with the establishment of the President's Commission on Carbon Neutrality to provide recommendations on how to reach this goal. However, when it comes to making real progress towards these goals, there are significant logistical challenges.

Many of these challenges involve a large number of stakeholders, spread across campus as well as beyond it, and require getting them to work together towards a common goal. In the case of Michigan Dining, there are many stakeholders and strategies to consider on the road to carbon neutrality. This project involved analyzing the impact of one of MDining's most prominent sustainability strategies to this point, Sustainable Mondays, and making recommendations for how this initiative can be leveraged to further MDining's mission toward carbon neutrality. The research then shifted to look beyond Sustainable Mondays and provide recommendations on how MDining could reduce emissions not addressed by existing initiatives. The overall goal for this project was to share practical suggestions to guide MDining's next steps towards carbon neutrality, and to supply future research teams with a jumping-off point for their work.

BACKGROUND

More than simply analyzing the Sustainable Mondays program, this study attempted to ground itself in MDining's current sustainability efforts, both in regard to their overall sustainability initiatives and in comparison to peer institutions. The following insights highlight broad objectives and best practices for carbon-reduction initiatives at Michigan and other universities in order to contextualize Sustainable Mondays within the broader landscape of programming.

It does not appear that any other institution has implemented a completely carbon-neutral plan, however several colleges and universities have reduction measures in place. Boston University, for example, operates a "Low-carbon Dining" (Boston University, n.d.) initiative broadly, with focus on lower-impact proteins, certifications, and behavioral interventions like signage and plating. Outwardly called the Wholesome Roots program, it places strong emphasis on increasing the number of plant-based meals, reducing emissions tied to production rather than transportation, and seasonality. The Wholesome Roots program is supplemented by in-person educational events in dining halls. Of particular interest is BU's current creation of a labelling system for low-carbon foods to be used in their dining halls and retail cafes.

Princeton University has already created such a system (Princeton University, 2019). Their system, which uses a "stop-light" scheme of green-yellow-red to symbolize low, medium, and high carbon food choices in dining halls, was created using results from a study that investigated food distance, feed, production, waste, and habitat damage. Their website outlines steps taken to reduce emissions for "red" foods like beef and lamb, noting that organically-fed livestock are prioritized. Such a scheme could be organized for Michigan's halls as well, and relates to the behavior-change recommendations shared later in this report.

Oberlin College's sustainability and carbon initiatives (Oberlin College, 2019) encompass many areas of operations, dining in particular. They have non-meat protein initiatives, dedicated waste-reduction and recovery programs, and commitments to local/resource-light sourcing. They also host an eye-catching website called "eatlowcarbon.org", which includes a carbon-calculation tool. While this is more directed at dining-hall users, Oberlin has made more than ten specific commitments to lower carbon in dining on an institutional level.

MDining has currently implemented several sustainability measures. Their 2016-2017 Sustainability Guide (MDining, 2015) outlines various initiatives for lowering environmental impact, though only one with the intention to explicitly lower carbon. The report primarily highlights local sourcing as a method of reducing carbon emissions, noting that all dairy and beef come from within 100

mile and 250 mile radii respectively. There is also a stated goal of sourcing 25% of all food from local, certified suppliers by 2025. A section of interest in this report is on food waste, which was recently identified by UM-SEAS researchers as a leading source of carbon emissions for food (Heard, 2019). MDining has already implemented measures to reduce food waste, and more granular investigation into how it contributes to the overall carbon footprint could be a potential focal point for research outside the scope of this project. While this guide is somewhat dated, it does provide a template of outward-facing sustainability information from MDining and previous benchmarks to situate our assessment within.

A notable MDining initiative mentioned briefly in the Guide is Meatless Mondays, which was hosted weekly in East Quad dining hall beginning in 2015 (p. 6). Under this initiative, the dining hall in East Quad did not serve meat on Mondays, while the rest of the halls would continue operations as normal. Meatless Mondays was not well received by some students, prompting an article in the *Michigan Daily* newspaper criticizing it as an "overstep" that limited student choice (Austin, 2015). This strong reaction from students, and a reduction in visitors to East Quad on Mondays, led MDining to reconsider the initiative. The initiative shifted to "Sustainable Mondays" in 2017, which reintroduced some meat options and expanded beyond East Quad (Stewart, 2018). Sustainable Mondays focused on "educating students on plant-based diets" as an alternative to the environmental impacts, specifically, of red-meat consumption (Dunbar, 2018). MDining asked dining hall managers to "not promote red meat" on Mondays and to offer more vegetarian proteins, but did not provide specific requirements for the dining halls.

In addition to educating students, MDining sought for Sustainable Mondays to be a primary carbon-reduction effort when it came to food purchasing (Personal communication with Alex Bryan, 2019), and Sustainable Mondays was still in its early phases when President Mark Schlissel made his late 2018 announcement of the University's carbon-neutrality pledge. With MDining's new initiative in place and carbon-neutrality coming into the University's collective gaze, an assessment of the program's progress and future steps may help understand how it can contribute to MDining's goal of carbon neutrality.

METHODS

To determine how to navigate MDining towards carbon neutrality, the first step was understanding existing MDining initiatives to reduce the carbon footprint of purchased food. The primary MDining initiative working towards this goal is Sustainable Mondays, which began in Fall of 2017 and involved reducing the amount of meat served on Mondays at the nine dining halls across the Ann Arbor campus (Stuart, 2018). To assess the impact of the Sustainable Mondays initiative, we combined existing research on the carbon emissions of various food items with MDining data on each dining hall's food use.

The research we relied on for our carbon emissions estimates was a study by Heller et al. (2018), which involved an exhaustive review of food life cycle analysis (LCA) studies that were incorporated into a food impacts database. As part of this effort, Heller et al. (2018) determined the estimated greenhouse gas emissions (GHGE) in carbon dioxide equivalent (CO_2 eq) produced per kilogram of 330 different food products (Supplementary data, Table S4). For example, using their review of LCA studies they estimated that 0.470 kg CO_2 eq are emitted for every one kilogram of tomatoes produced (Heller et al, 2018). We applied these estimated GHGE values to the MDining data by labeling each of the items in the MDining dataset as one of those 330 different food products (referred to as emissions products). We also chose to label each item in the MDining dataset with a broader food category (referred to as emissions category) so that the total emissions could be grouped in more meaningful ways (i.e. "vegetables" instead of every kind of vegetable included). Those categories were mostly borrowed from the Heller et al (2018) study as well, with some changes to provide more specific totals on the emissions from different animal products (i.e. beef, pork, etc. instead of meats, and liquid dairy and solid dairy instead of dairy).

The MDining dataset we used was put together with the help of the MDining Systems team. We chose to use data from the 2018-2019 academic year because it was the most recent full academic year with Sustainable Mondays in place. We pulled weekly data reports for each of the nine dining halls, using the recipes scheduled to be served each day to estimate the exact amount of each food item that would have been needed. Actual food purchases did not happen this way, but this approach allowed us to avoid the issues that would arise from using actual purchasing data. For example, an entire month's supply of canned tomatoes might be purchased on a single day but are not representative of the meals served that day. This initial dataset was too large for us to label in a reasonable amount of time, so we also chose to focus on comparing Mondays and Wednesdays only. Mondays were when the Sustainable Mondays initiative took place, and because many classes at the University are either scheduled on Mondays and Wednesdays or Tuesdays and

Thursdays, Wednesdays seemed like they would be the most similar to Mondays and therefore the best option to draw a comparison. With the data limited in this manner, we were looking at the food items from 32 Mondays and 32 Wednesdays across the 2018-2019 academic year, with 16 weeks of data from the Fall semester and 16 weeks of data from the Winter semester. Since the dining halls all rely on the same ordering system, we were able to identify around 1700 unique food items that were a part of this reduced dataset. We went through each of these items and assigned them an emissions product and emissions category, which allowed us to assign the values from Heller et al (2018) and calculate estimated GHGE. The MDining Systems team also provided the number of MCard swipes for each Monday and Wednesday at seven of the nine dining halls, which is a good indication of how many people ate at the dining hall on a given day and allowed us to estimate the GHGE per visitor.

The next step in providing recommendations involved broadening our view from the Sustainable Mondays initiative to look at MDining as a whole. Personal correspondence with MDining staff, a summer internship working for MDining, coursework on food sustainability and environmental behavior change, and research into approaches taken by other universities and institutions provided a broader context for the analysis of the Sustainable Mondays initiative. These experiences and approaches were used to develop the recommendations found in this report.

RESULTS

Overall, a comparison of Sustainable Monday and (standard) Wednesday operations showed an estimated 14.3% decrease in total greenhouse gas emissions (GHGE) from purchased food in the dining halls (Figure 1, Table 1). In metric tons of carbon dioxide equivalent (metric tons CO2eq), the metric used to quantify emissions throughout this report, this was a reduction of nearly 264 tons (Table 1). According to the Environmental Protection Agency's Greenhouse Gas Equivalencies Calculator (2020), that reduction equates to 29,677 gallons of gasoline, 57 passenger vehicles driven for one year, or 4,361 tree seedlings being grown for ten years.

However, GHGE reductions from Sustainable Monday operations varied widely among the nine dining halls. The largest percentage reduction in GHGE came from East Quad dining hall with a 45% decrease on Mondays, followed by Mosher-Jordan dining hall with a 35.2% decrease and Martha Cook dining hall with a 17.7% decrease (Table 1, Figure 2). On the opposite end of the spectrum, North Quad dining hall's emissions were 7.9% higher on Mondays, and Bursley dining hall and Markley dining hall had 5% and 2.6% higher emissions on Mondays, respectively (Table 1, Figure 2). Total GHGE reductions also varied widely across the dining halls, in part due to their differences in size and volume of food served. Mosher-Jordan provided the largest total emissions reductions on Mondays at nearly 142 metric tons CO2eq, while East Quad had a total reduction of over 98 metric tons CO2eq and South Quad had a total reduction of almost 39 metric tons CO2eq (Table 1, Figure 2).

Examining GHGE by food category was also helpful, and we found that with (standard) Wednesday operations the largest contributors were beef (37%) and dairy (both solid and liquid, 17%) (Figure 3). In fact, animal-based products overall were responsible for 82% of Wednesday GHGE while plant-based products only made up 18% (Figure 3). In comparing Mondays and Wednesdays by food category, we discovered a similar pattern, with beef, solid dairy, chicken, and egg making up the top four GHGE contributors by category on both Mondays and Wednesdays (Figure 4).
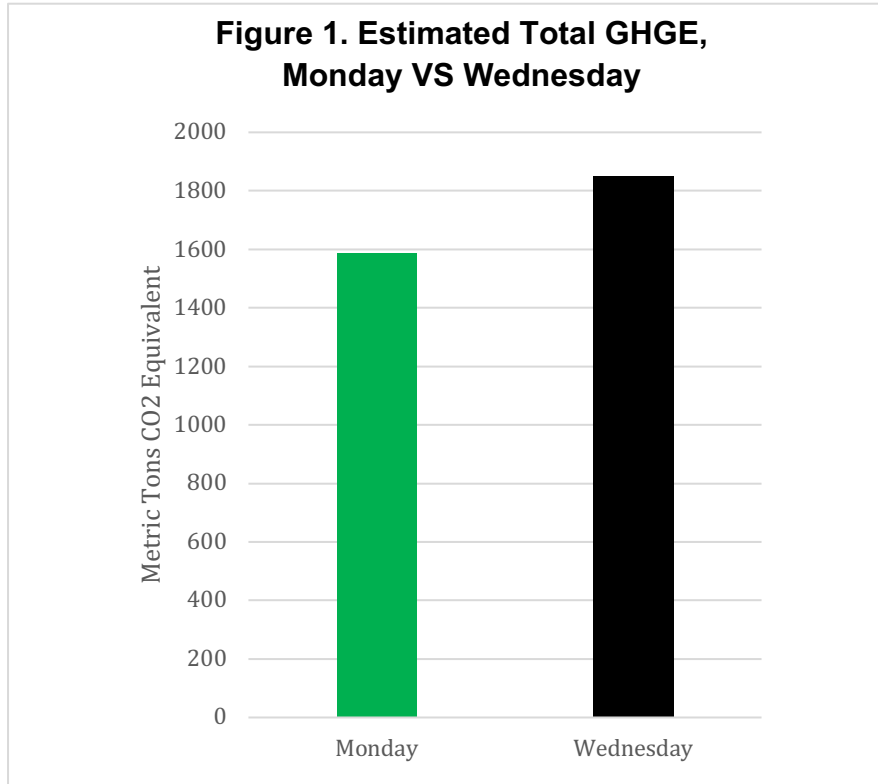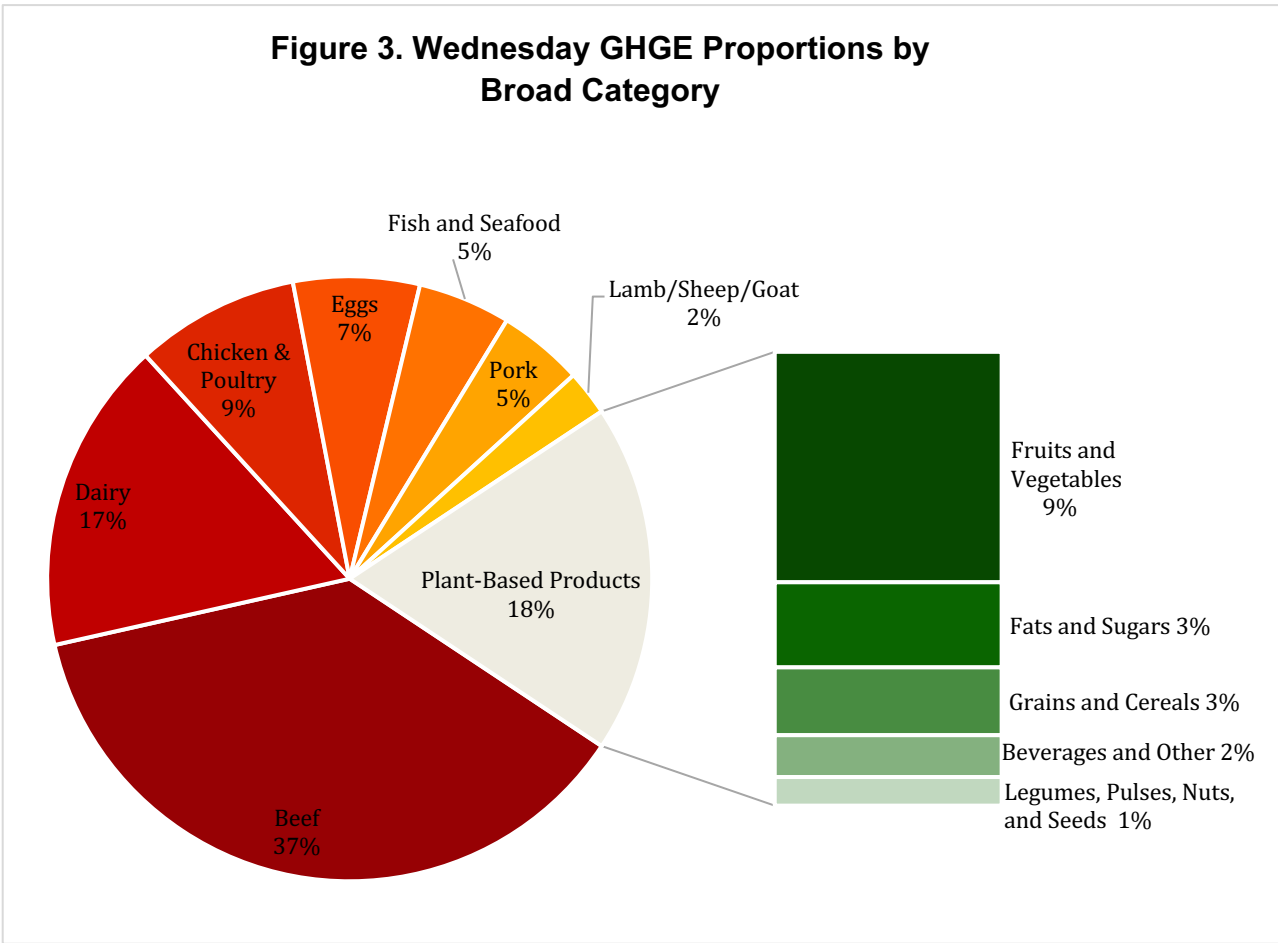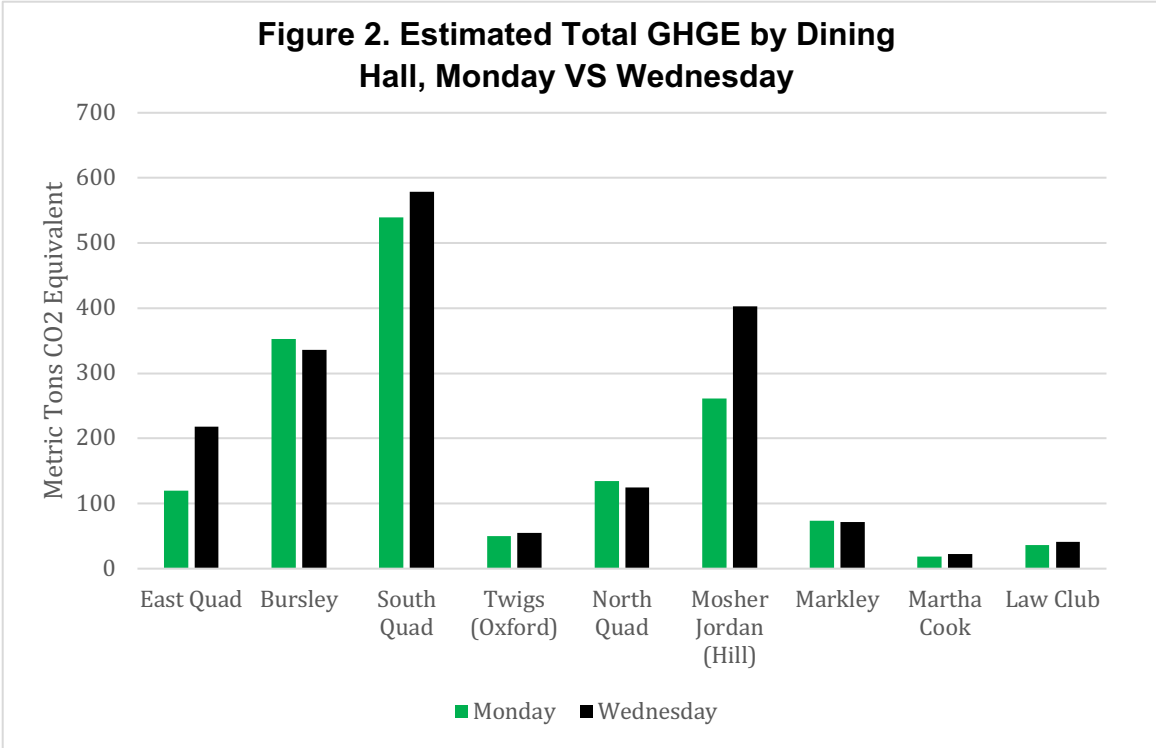
Figure 1. Estimated Total GHGE, Monday VS Wednesday

Table 1. Estimated Total GHGE by Dining Hall, Monday VS Wednesday. Totals are expressed in kilograms of CO_2 equivalent.

Dining Hall	Monday	Wednesday	Difference	Percent Change
East Quad	119,965	218,174	-98,209	-45.0%
Bursley	353,072	336,376	16,696	5.0%
South Quad	539,618	578,338	-38,721	-6.7%
Twigs (Oxford)	49,978	54,905	-4,927	-9.0%
North Quad	134,237	124,443	9,794	7.9%
Mosher Jordan (Hill)	261,269	402,930	-141,662	-35.2%
Markley	73,094	71,232	1,862	2.6%
Martha Cook	18,251	22,180	-3,929	-17.7%
Law Club	36,124	40,769	-4,645	-11.4%
Total	**1,585,607**	**1,849,347**	**-263,741**	**-14.3%**

Figure 2. Estimated Total GHGE by Dining Hall, Monday VS Wednesday

Bar chart showing Metric Tons CO2 Equivalent (y-axis, 0 to 700) for dining halls: East Quad, Bursley, South Quad, Twigs (Oxford), North Quad, Mosher Jordan (Hill), Markley, Martha Cook, Law Club. Monday (green) vs Wednesday (black).

Figure 3. Wednesday GHGE Proportions by Broad Category

Pie chart showing:
- Beef 37%
- Plant-Based Products 18%
- Dairy 17%
- Chicken & Poultry 9%
- Eggs 7%
- Fish and Seafood 5%
- Pork 5%
- Lamb/Sheep/Goat 2%

Plant-Based Products breakdown:
- Fruits and Vegetables 9%
- Fats and Sugars 3%
- Grains and Cereals 3%
- Beverages and Other 2%
- Legumes, Pulses, Nuts, and Seeds 1%

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Figure 4. Estimated Total GHGE by Category, Monday VS Wednesday

Because there was such variation between the GHGE from each dining hall on Mondays and Wednesdays, it made sense to juxtapose the emissions data by food category from several of the dining halls. Figures 5, 6, and 7 depict the GHGE on Mondays and Wednesdays by food category for the East Quad, South Quad, and Mosher-Jordan dining halls. Contrasting the emissions data from these dining halls revealed major differences in how Sustainable Mondays were implemented in each location.

At East Quad, no beef or other ruminant animal meats (lamb/sheep/goat) were served at all on Mondays, and the amount of chicken, other poultry, and pork served were all significantly decreased (Figure 5). While emissions from those categories of food product were lower, emissions from solid dairy and fish and seafood were higher, indicating that the East Quad menu may have featured more dishes with cheese and seafood on Mondays to make up for the lack of meat (Figure 5). At South Quad, there was a slight dip in the emissions from beef, solid dairy, and other ruminants on Mondays, plus a significant drop in the emissions from fish and seafood (Figure 6). South Quad Mondays also showed an increase in emissions from chicken and pork, evidence that those meat products may have taken the place of beef in the menu (Figure 6). The dramatic difference between Sustainable Mondays implementation at East Quad and

South Quad is also reflected in their overall emissions numbers, with East Quad reducing emissions 45% on Mondays while South Quad reduced emissions 6.7% (Table 1). However, despite that gap, South Quad's total reduction in emissions (almost 39 metric tons CO2eq) is nearly 40% of the total reduction from East Quad (over 98 metric tons CO2eq) (Table 1). The difference in the scale of operations at East Quad and South Quad is important to note in this case. South Quad serves more visitors than East Quad (Table 2), and its Wednesday emissions total over 578 metric tons CO2eq while South Quad's total is just over 218 metric tons CO2eq (Table 1). Although the number of visitors served does not completely account for this difference, the data shows that reductions in the amount of beef served at a high-volume dining hall like South Quad can have a big influence on MDining's overall emissions.

Mosher-Jordan dining hall presents another interesting comparison because its operations fell somewhere in-between those of East Quad and South Quad. Mosher-Jordan's implementation of Sustainable Mondays was definitely closer to that of East Quad, with a huge reduction in beef and other ruminants served on Mondays (Figure 7). However, emissions from chicken and seafood went up on Mondays, a sign that those items may have been taking the place of beef (Figure 7). Mosher-Jordan also served more visitors than East Quad, although not as many as South Quad (Table 2), and was still able to reduce emissions 35.2% on Mondays (Table 1). This was a total reduction of nearly 142 metric tons CO2eq, easily the biggest total reduction among the nine dining halls and more than half of MDining's total reduction in emissions (Table 1). Mosher-Jordan is an excellent example of the impact the Sustainable Mondays initiative can have when it is more fully implemented in a large dining hall.

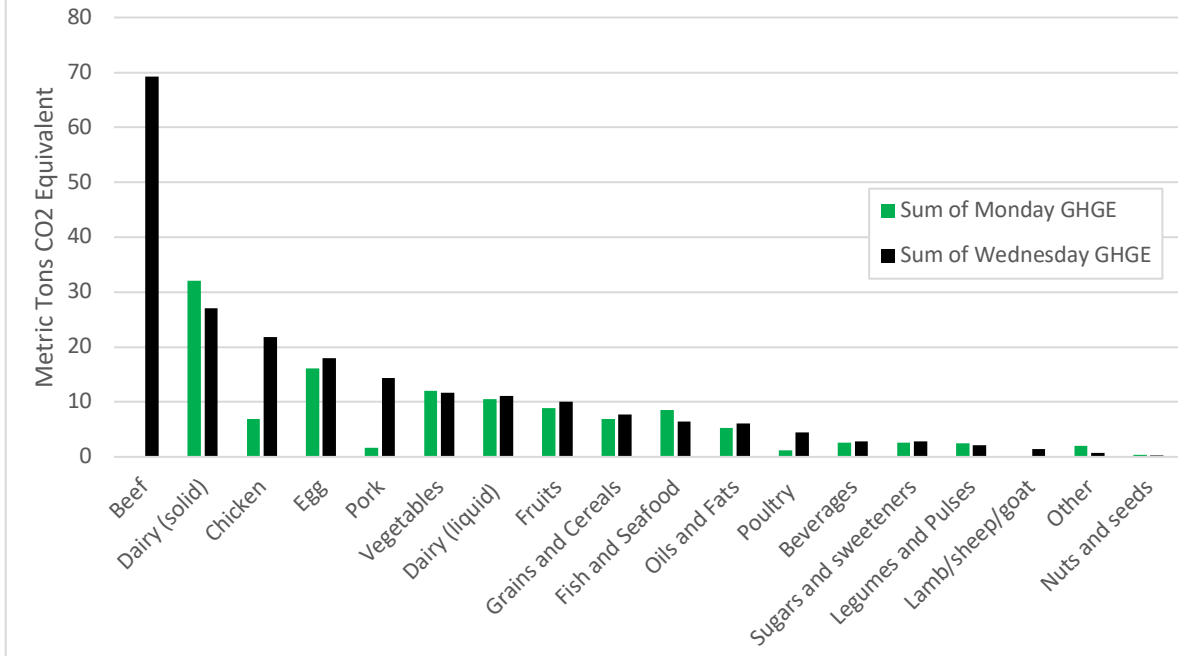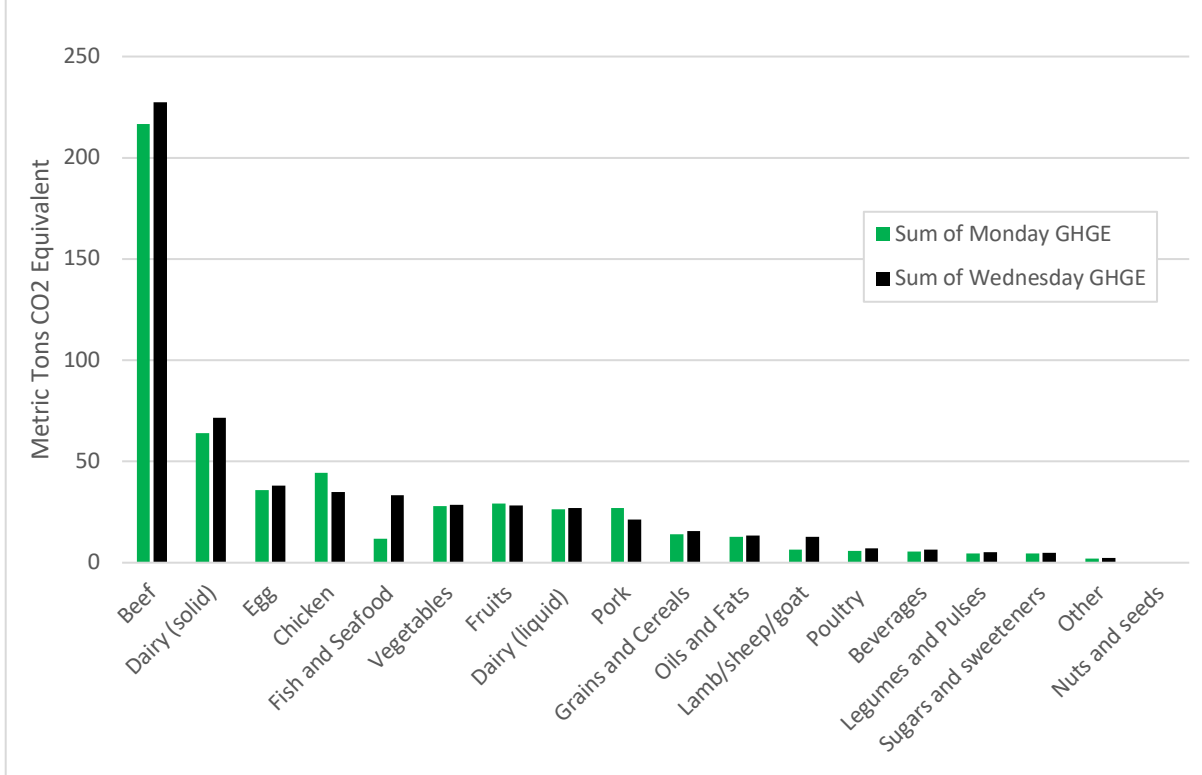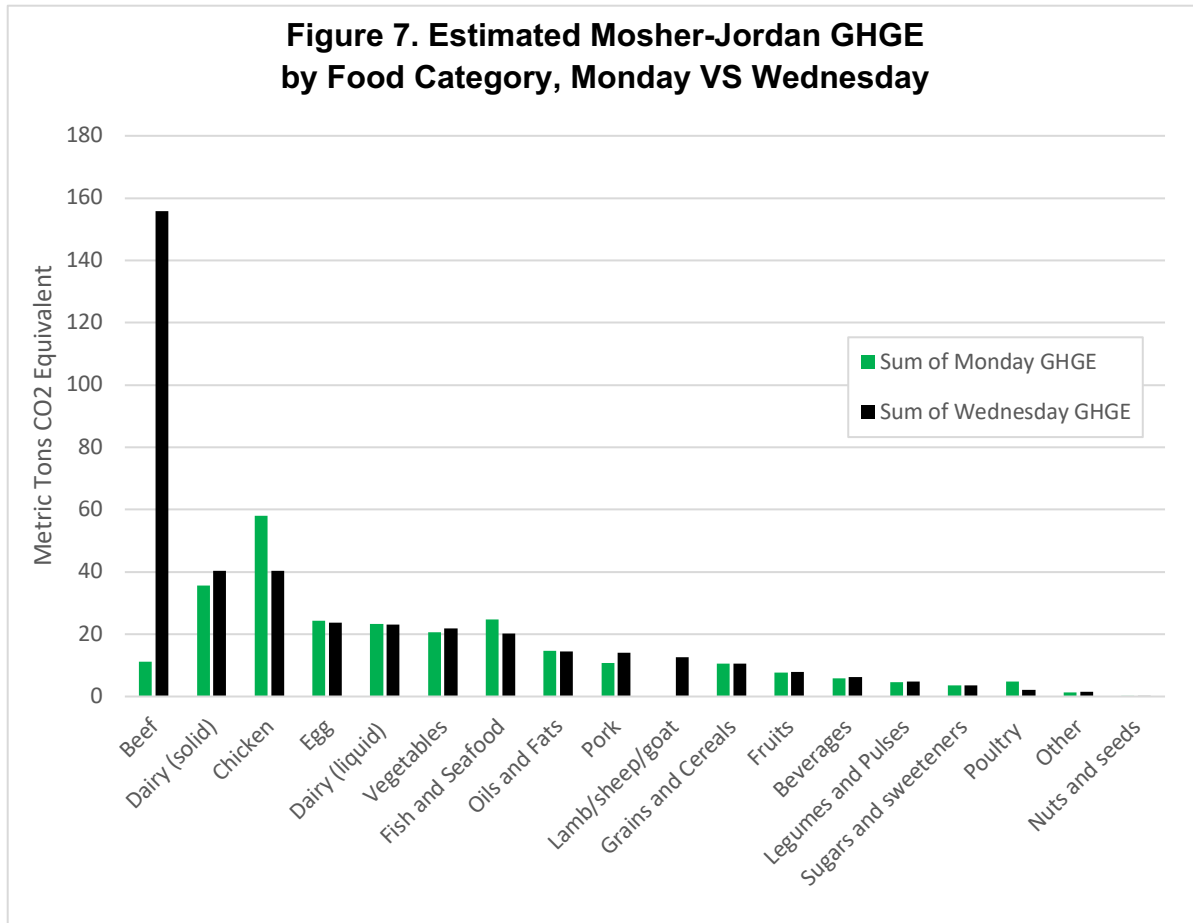**Figure 5. Estimated East Quad GHGE by Food Category, Monday VS Wednesday**

Figure 6. Estimated South Quad GHGE by Food Category, Monday VS Wednesday

Figure 7. Estimated Mosher-Jordan GHGE by Food Category, Monday VS Wednesday

With the total number of MCard swipes for seven of the dining halls, we were also able to estimate the GHGE per capita (or per visitor) for the dining halls. This data showed that overall, more visitors came on Mondays than Wednesdays, and the only dining hall with more Wednesday visitors was Bursley (Table 2). This provides some evidence that Sustainable Mondays is not keeping visitors away from any dining halls. Consistent with the results that have already been described, the lowest per capita emissions were at East Quad on Mondays (1.01 kilograms CO2eq per visitor), with Mosher-Jordan on Mondays not too far behind (1.84 kg CO2eq per visitor) (Table 2). However, the second and third-lowest per capita emissions actually came from Markley dining hall on Mondays and on Wednesdays, while South Quad and Bursley had the highest per capita emissions (Table 2). Reasons per capita emissions were so high at South Quad and Bursley while being so low at Markley were not clear from our study, and researching each dining hall's efficiency when it comes to feeding visitors would be a worthwhile future project.

Table 2. Estimated Per Capita GHGE by Dining Hall, Monday VS Wednesday. Totals are expressed in kilograms of CO2 equivalent.

Dining Hall	Monday Swipes	Wednesday Swipes	Monday GHGE	Wednesday GHGE	Monday Per Capita	Wednesday Per Capita
East Quad	118625	116162	119965	218174	1.01	1.88
Bursley	95716	99038	353072	336376	3.69	3.40
South Quad	175099	169989	539618	578338	3.08	3.40
Twigs (Oxford)	21851	20504	49978	54905	2.29	2.68
North Quad	54804	51587	134237	124443	2.45	2.41
Mosher Jordan (Hill)	142376	140373	261269	402930	1.84	2.87
Markley	43255	41835	73094	71232	1.69	1.70
Martha Cook	No Data	No Data	18251	22180	No Data	No Data
Law Club	No Data	No Data	36124	40769	No Data	No Data
Total*	**651726**	**639488**	**1531232**	**1786398**	**2.35**	**2.79**

*Totals do not include any data from the Martha Cook or Law Club dining halls

It is important to acknowledge the limitations of this study and the results presented above. In addition to the uncertainties described in the Heller et al (2018) study, which provided the base estimates for our study, this research involved many other assumptions. Those included simplifying each food item in the MDining dataset to a single ingredient, labeling and categorizing items that did not line up perfectly with the food products used by Heller et al (2018), and using menu data to estimate the food items required in the dining halls each day. One example of the challenges that came with imperfect methods was the labelling of blended burgers as "beef". Many of the dining halls use blended burgers that are still predominantly beef, but include mushroom as well so that the total quantity of beef is reduced. This initiative is intended to help reduce emissions, yet is not accurately captured in the data presented in this report. These imprecisions are consistent across all the dining halls, so it is still helpful to draw comparisons and look at overarching trends, but the data presented should be considered well-informed estimates rather than perfect quantifications.

RECOMMENDATIONS FOR SUSTAINABLE MONDAYS

The analysis of Sustainable Mondays indicated a successful reduction in carbon emissions from purchased food, however, the degree of success varied widely among the dining halls. While Mosher-Jordan and East Quad's Monday-to-Wednesday carbon reductions of 35% and 45% respectively are sizable, the scattering of lower reductions and even small increases in other halls highlights the patchwork of potential for the rest of the MDining system. With such stark reductions only occurring in some halls on one day of the week, how can MDining improve upon this initiative?

Below, three primary recommendations are outlined to address such disparities in carbon reduction and expand on the success of Sustainable Mondays' initial run:

1. **Make Sustainable Mondays implementation more consistent across all dining halls**

The first recommendation is to adopt a consistent, system-wide approach to implementation of Sustainable Mondays that every dining hall would adhere to.

When Sustainable Mondays began in 2018, the specifics of operations were left to the discretion of individual dining hall managers, who were given broad instruction to simply reduce the amount of meat served on Mondays. An example of how two different interpretations of this played out are evident in East Quad's Monday-Wednesday emissions compared to South Quad's.

Although South Quad's overall emissions for Mondays were lower than Wednesdays, the magnitude of their reduction was under a sixth that of East Quad's (6.7% compared to 45%). Looking into food category-specific emissions, the primary suspect in this disparity becomes clear. While East Quad showed complete elimination of beef and significantly lower chicken and pork offerings from Mondays' menu, South Quad's marginal reduction of beef was accompanied by increased chicken and pork. While South Quad did reduce the most carbon-intense meat it offered on Mondays, East Quad reduced all meats and completely eliminated the most carbon-intense (beef and other ruminants). This example highlights the opportunity in dining halls with modest Monday reductions to experiment with more pronounced menu changes, particularly reducing the amount of beef served. These dining halls show potential for substantially higher emissions reductions and can use Mosher-Jordan and East Quad as models for how to attain those reductions.

Under this recommendation, MDining should provide specific benchmarks and/or best practices to hall managers in order to streamline Sustainable Mondays implementation, and ultimately, outcomes. By providing comprehensive

and uniform guidelines on which food categories to reduce and by how much, MDining can prevent such widely variable interpretations of Sustainable Mondays measures. Additionally, such specific directives can allow MDining to more accurately target high-carbon foods, such as beef. MDining should complement these guidelines with specific low-carbon recipe ideas that have been well-received at Mosher-Jordan and East Quad. They should also provide opportunities for the head chefs from the dining halls to meet together and discuss Sustainable Mondays implementation, encouraging them to share ideas and collaborate to address specific challenges in the dining halls.

With specific instructions applied across all halls consistently, and best practices to guide implementation, the success of Mosher-Jordan and East Quad's bold Sustainable Mondays approaches could be more easily replicated, thus improving the efficacy of the program as a whole.

2. **Expand Sustainable Mondays practices to additional days of the week.**

A second recommendation to expand on the success demonstrated in 2018-2019's run of Sustainable Mondays is to implement its practices on more days of the week. This could be done abruptly or incrementally.

With an abrupt approach, all seven days of the week would adopt Sustainable Mondays practices. This swift action would allow MDining to immediately multiply the original reductions of Sustainable Monday. Alternatively, an incremental approach would involve other days of the week adopting Sustainable Mondays reduced-meat menus one or two at a time. Under similar rationale for selecting Wednesday as a "typical weekday" comparison to Monday due to students' block-schedules, Wednesday could be a first candidate for expansion. Followed by Tuesday-Thursdays, then Weekends, this example gradual plan would allow for MDining to expand on and continue to evaluate the reception of Sustainable (Mon)days, without drastically altering the day-to-day dining experience all at once.

Several open questions remain for these different daily approaches. Would unilaterally expanding to every day of the week incur student pushback? Would a more gradual approach provide a valuable case-study opportunity to measure student perception? How would either of these approaches be effectively marketed? These questions provide avenues for further research on the effectiveness and perceptions of top-down vs. bottom-up approaches, which align with our later recommendations for increasing student buy-in with MDining initiatives.

3. **Improve food labelling and marketing by incorporating information about the carbon emissions from food items.**

   The third major recommendation is centered on guiding diners' choices at the points of service, in concert with alterations further up the supply chain at the points of menu creation and ordering. We recommend that MDining accompany the Sustainable Mondays initiatives with enhanced food labelling and marketing strategies that communicate information about carbon emissions. These outward-facing strategies should inform diners of both MDining's sustainability initiatives generally as well as the carbon values for specific foods.

   While it is understood that carbon labels can inform consumer choice if (and only if) consumers actually pay attention to them (Babakhani, 2019), what exactly attracts attention and prompts decision making is less certain. In testimonials from customers of products with carbon labels displaying the amount of CO_2 in kg alongside a green- or red-colored bar, it was reported that while the carbon label did garner attention, buyers weren't sure how to interpret the meaning of the numbers (Babakhani, 2019). In other words, they felt the labels indicated some significance, but they weren't sure what it meant for them. So what makes a carbon label effective in actually influencing customer choice?

   Earlier research in this field cautiously suggests that carefully designed carbon labelling could have positive influence over customer choice (Beattie, 2012). Anchored in the classic decision-making theories of Nobel laureate Daniel Kahneman (*Thinking Fast and Slow*, 2011), it is suggested that labels that stimulate both unconscious, instantaneous perceptions and thoughtful consideration on the part of the consumer were ideal. *System 1* and *System 2*, as Kahneman respectively refers to these two mental processes, can work in conjunction for labelling, to first signal an emotional response followed by contextualized information for a decision.

   For point-of-service carbon labelling in Dining, this could look like a red symbol signifying "high" carbon and a green symbol for "low" carbon, similar to the "stop light" system that Princeton uses (Princeton University, 2019). These colors have societally-coded meanings, and reach System 1 responses in the brain. As indicated in the study by Babakhani, simply supplying consumers with a numerical carbon value in kilograms or pounds was not helpful. Therefore, as suggested by Beattie, further guiding the consumer's choice by helping them to "mentally plan their behavior" (i.e. giving them a System 2 framework) could lead to positive behavior choices. For example, '*if I see a high-carbon footprint product, then I will look for an alternative';* (Beattie, p. 217) gives a contingency that consumers could use when evaluating carbon labels.

While there is still much to be researched in this particular area, helping diners develop their decision-making processes could be aided with additional marketing of sustainability labels and initiatives on dining hall placards and digital signage *before* they reach the point of service. Encouraging students to plan their meals with carbon in mind (as the *MHealthy* designation already does for nutrition) could help structure the more thoughtful System 2 framework as Beattie describes. Further, developing a planning tool (whether carbon-specific or integrated with the broader, existing MyNutrition tool) via MDining's mobile app is also recommended. Some efforts to categorize and label a meal's carbon emissions have already been initiated by Michigan Catering (2019) and could provide an example to build upon.

When introducing a new labelling scheme, it is important to consider the limitation that existing labels place on the efficacy of a new one. MDining currently has seven food designation labels, not including allergen notices. New labels should be implemented in a way that does not overwhelm diners with information, but instead should meaningfully guide their choice by presenting contextualized carbon information concisely.

As of April 2020, MDining is tentatively planning to include carbon information at point-of-service for the upcoming school year (Personal communication with Alex Bryan, April 2020). It is recommended that this new labelling be accompanied by a pilot assessment and student feedback.

FURTHER RECOMMENDATIONS

The Results and Recommendations above outline an ideal Sustainable Mondays scenario -- if all halls adopted the program as strongly as East Quad, full time. However, the intent of this project was not only to pave a way for MDining to *reduce* carbon emissions, but for them to reach carbon *neutrality*. Even in a best-case of Sustainable Monday every day, everywhere, carbon reductions' maximum potential was 45%, highlighting a need for additional measures to address the remaining 55% of emissions. Though meat, and particularly beef, are responsible for a large proportion of emissions, other food products contribute to emissions as well (note that no food products in Heller et al's 2018 study were assigned a GHGE value of zero), indicating measures beyond meat reduction are necessary to reach full carbon neutrality. Below, two further recommendations are put forth to address emissions not yet captured by the scope of Sustainable Mondays:

1. **Address the remaining emissions from food purchases**
   a. **Research "Climate Positive" foods and farming methods**
   b. **Explore the role of carbon offsets, or an alternative to offsets**

The first recommendation looking beyond Sustainable Mondays is for MDining to address the greenhouse gas emissions (GHGE) that are not eliminated by removing meat. One way to address these remaining emissions could be purchasing food that has been produced in a manner that is carbon neutral or even "climate positive". "Climate positive" operations have also been described as "carbon negative" or "carbon positive" and refer to operations that remove more carbon from the atmosphere than they release (Nguyen, 2020).[1] We recommend that MDining research what carbon neutral and climate positive food products are available, look into how accessible those products are, and support further research into producing food using carbon neutral and climate positive methods.

As previously stated, even food products with a relatively low carbon footprint like fruits, vegetables, grains, and legumes still contribute significant GHGE at a large scale. However, there are projects underway that aim to produce food in a manner that is either carbon neutral or even climate positive. White Oak Pastures is a 3000-acre farm in Bluffton, Georgia that raises a variety

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[1] As stated by Natural Capital Partners (2020) in "The CarbonNeutral Protocol", the term "carbon positive" can be incorrectly interpreted as an increase in carbon emissions and the term "carbon negative" can imply that the action is an undesirable outcome. To avoid these issues, this report will rely on the term "climate positive".

of animals, including cattle (White Oak Pastures, 2019). By using regenerative land management techniques, like rotating complementary animal species through pastures and managing herds to avoid overgrazing and soil degradation, White Oak Pastures claims to store more carbon than they emit through their operations (White Oak Pastures, 2019). The Horizon Organic dairy company has also pledged to become climate positive by 2025, relying on regenerative agriculture practices like planting cover crops as well as moving to renewable energy, experimenting with new blends of cattle feed, and investing in carbon offset projects (Peters, 2020). These approaches have been picked up by large companies like General Mills, who uses White Oak Pastures as a major supplier for their Epic Provisions meat-based snack business and who sponsored the life cycle analysis of the farm's carbon emissions (Brown, 2019). General Mills has also promoted regenerative agriculture as an approach more broadly, pledging to use regenerative agriculture practices on one million acres of farmland by 2030 and naming Michigan as one of their three priority ingredient regions (General Mills, 2020). Their pilot programs to advance this initiative include technical support and coaching for three dairies in western Michigan, which produce about 16% of the milk used in their Yoplait products (General Mills, 2020).

These projects are still relatively new, and the impacts of regenerative agriculture and related approaches are still being studied and assessed. However, they have already attracted the attention of large corporations in the food industry, demonstrating their potential even at a large scale. We recommend that MDining research whether there are local or regional farms already implementing any of these practices or may be willing to implement them under the right circumstances. We also recommend that MDining support University of Michigan researchers at the student, staff, and faculty levels in pursuing topics related to climate positive agriculture and how it can be implemented, particularly at local farms. If MDining can find sources of climate positive food, those food items could act as a kind of offsets for food items that are not available or accessible from a climate positive source. Even a limited number of climate positive food items could significantly reduce MDining's overall carbon emissions if they included high-impact items like dairy. With dairy responsible for the largest proportion of emissions other than meat, and some promising examples of climate positive cattle farming, supporting research into carbon positive dairy production would be a logical area to focus initial research.

Another way to address the remaining emissions from food purchases is by procuring carbon offsets. Carbon offsets are an accounting mechanism that allows an organization or individual to pay someone else to remove or reduce a certain amount of greenhouse gas emissions (Irfan, 2020). Many organizations have made offsets a part of their approach to reducing emissions, including all of

the higher education institutions who claim to have reached carbon neutrality (Irfan, 2020; Earls, 2019). That includes American University, Colgate University, and seven other institutions who have announced reaching carbon neutrality over the last eleven years, including two that made the announcement in April of 2020 (Earls, 2019; Layne, 2020; Allegheny College, 2020). As stated by Second Nature, a nonprofit organization that supports climate action in higher education, most Climate Action Plans will include carbon offsets as an important component to address emissions that are difficult to eliminate through other means (Second Nature, n.d.).

The strengths of carbon offsets is that they are relatively easy to procure, and in theory it makes sense to reduce emissions where it is cheapest and easiest (Irfan, 2020). However, there are also a number of critiques of using carbon offsets as a method for reducing emissions or reaching carbon neutrality, and we caution MDining against relying on traditional third-party verified offsets without exploring alternatives first. One issue with carbon offsets is that they have "a long history of overpromising and underdelivering" and "a poor record of meaningful reductions in emissions" (Irfan, 2020). Investigations into carbon credits from forest preservation, and into offsets from converting landfill methane to energy, have revealed that projects may be reducing emissions less than they were supposed to, using inaccurate measurements, and even changing management practices in ways that increase in the short-term (Song, 2019; Sierra Club LFGTE Task Force, 2010). Because of these issues, carbon offsets may not be seen as meaningful climate action by important stakeholders at the University of Michigan, including students and and the President's Commission on Carbon Neutrality. As journalist Jim Giles (2020) put it, "It's easy to buy cheap carbon offsets and claim carbon neutrality, but meaningful change happens when companies reduce the emissions they control or influence."

The root of the problem with traditional carbon offsets is that they do not build the capacity or invest in infrastructure to reduce emissions locally in the future, which is essential for true carbon neutrality. For that reason, we recommend that MDining explore some alternatives to traditional offsets. One such alternative could be developing local offset projects with community benefits, as described by Second Nature (2020). For example, Middlebury College reached its carbon neutrality goal in 2016 in part by preserving 2,100 acres of forest on its Bread Loaf Mountain campus in perpetuity and hiring a company to assess and certify the carbon offsets from that land (Middlebury College, 2016). Another approach could be supporting and investing in climate positive farms and agricultural research, as described earlier in this report. An option to explore, which also relies on improving agricultural practices to increase carbon storage, is working with Zero Foodprint. Zero Foodprint is a nonprofit

organization that asks restaurants to add 1% to each customer's bill, with the choice to opt out, that is then donated towards carbon farming projects (Zero Foodprint, n.d.). These carbon farming projects are overseen by Resource Conservation Districts, and involve practices like reduced tilling, applying compost, planting cover crops, and incorporating animal grazing (Zero Foodprint, n.d.). Zero Foodprint does not currently have any farming projects in Michigan, but they do have expertise in how to approach and support carbon farming, while MDining has connections with local farms and a large customer base. A collaboration between MDining and Zero Foodprint could potentially help both organizations work towards meeting their goals and reduce overall carbon emissions.

2. **Develop more bottom-up approaches to increase student buy-in**
   a. **Incorporate best practices in behavior change**
   b. **Survey the UM student body and assess barriers to behavior change**

As it stands, Sustainable Mondays is a directive given from the top of MDining management. In reflecting upon the original Meatless Mondays' mixed reception with students, it is recommended that as Sustainable Mondays evolves, MDining should develop lines of communication and collaboration with those ultimately interacting with the program most often -- students. By laying groundwork for more bottom-up engagement and learning more about their audience, MDining can create durable behavior change in regard to meat consumption. Adopting best practices of team-based strategies for student engagement and including dining and sustainability-specific questions on campus surveys are recommended to reach this goal.

First, to engage students directly in dining sustainability, research into best practices for environmental behavior change points to participatory, team-based approaches (Staats, 2004; Fisher, 2016). Aimed at overcoming difficulties in encouraging lasting, pro-environmental behaviors, "EcoTeams", as Staats calls them, are small groups of engaged participants. These teams tend to be successful in creating lasting change because they activate three key techniques for behavior change: detailed procedural information, feedback about one's performance, and facilitate a supportive social environment (De Young, 1996). For MDining, a version of EcoTeams would be sustainability programming for and with the Dining Student Food Advisory Committee. While this group exists to engage students broadly with Dining, their participation would also be valuable specific to sustainability and carbon neutrality efforts.

Another participatory way to directly engage students in sustainability with Dining is to host a program for "brand ambassadors" who promote and educate peers on sustainability initiatives, their impact, and the carbon impact of food broadly. A similar program, Planet Blue Ambassadors, has shown similar success for the broader University's sustainability efforts.

Finally, while these student groups can be conduits for team-based engagement, reaching the broader student population is also critical for salient and successful programming. In order to assess barriers to dining-related changes in behaviors (such as reducing red-meat, for example) and to gather input on programming directly, it is recommended that questions specific to sustainability in dining be included in upcoming campus surveys including the Sustainability Cultural Indicators Program (SCIP) and National Association of College & University Food Services (NACUFS) surveys, as well as MDining's own survey. While developing specific questions was outside the scope of this Master's practicum, it presents an opportunity for future teams to develop targeted, insightful questions to assess students' interactions with sustainability, dining, and their intersections.

CONCLUSION

      In light of University-wide movements and MDining's own goals, assessing the current state of sustainability and carbon-reducing measures was vital to setting up MDining on track toward their goal of carbon neutrality. Sustainable Mondays was found to have a significant impact in reducing carbon, especially in dining halls that chose to reduce or remove beef options on Mondays. However, there are still opportunities to expand on this success, such as implementing the program more consistently across all nine dining halls and on more days of the week. Even under a scenario of full adoption, there still remains a significant portion of food-related emissions, which warrant further research into carbon positive farming and exploring the role of carbon offsets. It is worth acknowledging that while carbon reduction and ultimately neutrality are crucial steps towards action on climate change, those alone do not constitute a holistic approach to sustainability; care and thoughtfulness in meaningful engagement are also critical pieces to authentic sustainability. Therefore, we recommend MDining engage students more directly to improve buy-in and durable behavior change via team-based programming and targeted surveys. MDining's goal of carbon neutrality is ambitious; in a collegiate food service landscape where many are striving to be sustainable, but none have taken such strides, this study shows that carbon neutrality is within reach and can pave the way for other universities to follow suit.

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