ARE WE OUT TO LUNCH?
ARE THE DIETARY STRATEGIES WE SHARE ON SOCIAL MEDIA EFFECTIVE IN MITIGATING CLIMATE CHANGE?

by

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ABSTRACT

To mitigate climate change, it is necessary to shift global dietary patterns towards lower greenhouse gas (GHG) emissions. How the public pursues this goal is important, and social media data offer an opportunity to assess popular opinion. Here I explore which climate-motivated-eating strategies are communicated in a sample of Twitter and Instagram posts, and consider the evidence that supports these strategies for reducing GHG emissions. From posts shared between June 4 - August 14, 2018, a total of 120 climate-motivated-eating strategies were mentioned, which were grouped into 30 strategic themes. A targeted literature review was then used to consider the evidence supporting these strategies for reducing GHG emissions. Though climate-motivated-eating strategies shared on Twitter and Instagram were generally well-aligned with contemporary academic knowledge on how food systems contribute to GHG emissions, important misconceptions were identified. These should be corrected to ensure meaningful progress towards climate change mitigation through dietary choice.

LIST OF ABBREVIATIONS AND SYMBOLS USED

API	application programming interface
CH_4	methane
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
FAO	Food and Agriculture Organization of the United Nations
GHG	greenhouse gas
GMO	genetically modified organism
IPCC	Intergovernmental Panel on Climate Change
LCA	life cycle assessment
N_2O	nitrous oxide
ppm	parts per million (by volume)
UK	United Kingdom
US	United States of America

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1.0 CHAPTER ONE - INTRODUCTION

Positionality Statement

I have a longstanding personal interest in preserving our environment and in improving the sustainability of global agricultural systems. Therefore, I approach this research with context from my own experiences as a food consumer, where my choices are often motivated by feelings of responsibility to reduce my personal diet's contributions to greenhouse gas (GHG) emissions: I call this, climate-motivated-eating. Due to my personal involvement in this activity, throughout this thesis I refer to "we" and "our" when discussing citizens who are doing our best to mitigate climate change through decisions about what we eat. For further clarification, although I am a social media user and a climate-motivated-eater, none of my personal social media posts were included in the analysis of this research.

1.1 It is Essential to Mitigate Climate Change

Humanity faces the Herculean task of reducing the severity of climate change over a very short time horizon if substantial effects are to be avoided (Allen et al., 2018). Contemporary climate change is caused by anthropogenic GHG emissions, which are rapidly accumulating in the atmosphere at levels beyond the earth's natural assimilation capacity (Foley et al., 2011; Steffen et al., 2015). The GHGs of most concern in the context of the food system are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) (US EPA, 2019). At the time of writing, concentrations of atmospheric CO_2 are passing 415ppm (Scripps Institution of Oceanography, 2019) and have been increasing at an average annual rate of 1.57ppm per annum since 1959 (Ritchie & Roser, 2018). Of further concern is that the rate of increase has been accelerating in recent decades;

concentrations of atmospheric CO_2 have increased annually by an average of 1.91ppm since 1988, 2.13ppm since 1998, and 2.25ppm since 2008 (Ritchie & Roser, 2018). This situation is dire, and scientists agree that:

> If humanity wishes to preserve a planet similar to that on which civilization developed and to which life on Earth is adapted, paleoclimate evidence and ongoing climate change suggest that CO_2 will need to be reduced from its current [415ppm] to at most 350ppm. (Hansen et al., 2008, p.1)

The necessity to act on climate change is reinforced by the likelihood of environmental feedback effects outside humanity's control if the overshoot beyond 350ppm persists for decades (Hansen et al., 2008). Hansen et al. (2008) describe that warming of global average temperatures of 1°C beyond historic pre-industrial levels (expected to occur at 450ppm CO_2) would lead to the irreversible loss of ice sheets and biodiversity. While the Intergovernmental Panel on Climate Change (IPCC) more recently argued for limiting warming to 1.5°C above pre-industrial levels, there is clear need for immediate action to limit warming as much as possible and to prevent environmental feedbacks (IPCC, 2018); levels beyond 450ppm CO_2 could cause Earth to become completely ice-free (Hansen et al., 2008). Therefore, Hansen et al. (2008) argue that 450ppm CO_2 is a climate "tipping point" (p. 11), while the 350ppm atmospheric concentration is understood to be a "safe operating space" within which humanity can operate (Rockström, Steffen, Noone, & Scheffer, 2009, p. 473).

Although this is a dire situation, there remains tremendous opportunity to reduce GHG emissions and avoid the most severe climate change impact projections. Currently, 197 nations have signed the Paris Agreement and, in doing so, promised to limit temperature increases to well below 2°C and aim for a 1.5°C increase in global average temperature relative to 1850-1900 (United Nations Treaty Collection, 2019). While this is encouraging, it must be remembered that international agreements have been in place since 1992 with the intention of reducing GHG emissions (Hoolohan, Berners-Lee, McKinstry-West, & Hewitt, 2013), and atmospheric CO_2 concentrations have continued to not just rise but accelerate in their increase (Scripps Institution of Oceanography, 2019). Hansen et al (2008) reiterate that it is "conceivable to reduce CO_2 this century to less than the current amount … but only via *prompt policy changes"* (p. 2) and the authors recommend that this be achieved on the timescale of decades. More recently, the IPCC stated in their 2018 report:

> There is no single answer to the question of whether it is feasible to limit warming to 1.5°C … the global transformation that would be needed to limit warming to 1.5°C requires enabling conditions that reflect the links, synergies and trade-offs between mitigation, adaptation and sustainable development. (Allen et al., 2018, p. 52)

Given the slow progress of governments, it seems that it will take international cooperation, policy changes, *and* meaningful lifestyle changes by individuals on a global-scale to achieve the large-scale reductions in GHG emissions that are widely agreed to be necessary.

While reducing atmospheric CO_2 concentrations to 350ppm is a formidable challenge, this goal remains achievable. Ultimately, the accumulation of atmospheric GHGs is caused by billions of individual decisions (Wynes & Nicholas, 2017). While we as individuals often lack choice over the means of production and GHG emissions from our goods and services due to structural barriers, there are also many opportunities to make choices on a daily basis to lower our contribution to GHG emissions. This is particularly the case with food choices, as the means of production or category of food (e.g. red meat versus pulses) can have vastly different GHG emission profiles (Poore &

Nemecek, 2018). Food choices are a particularly important area to lower our contributions to climate change because the global food system is a major driver of this phenomena. Estimates of the global food system's GHG contributions (including direct and indirect impacts) as a share of total anthropogenic emissions range from 25% - 35% (Foley, 2014; Garnett et al., 2017; Gordon et al., 2017; Hallström, Carlsson-Kanyama, & Börjesson, 2015; Nelson, Hamm, Hu, Abrams, & Griffin, 2016; Poore & Nemecek, 2018). The environmental implications of the global food system will be described further in **Chapter Two – Literature Review**. There is great opportunity to mitigate the severity of climate change through widespread lifestyle changes in areas where individuals have choice, including through the food system.

1.2 Our Food System Challenge

The far-reaching environmental impacts of the food system are particularly alarming in the context of our global food system challenge: in the coming decades, we can expect growing human populations and rising global prosperity. These phenomena will increase and shift demands on the global food system, and we must reduce the environmental impacts of the food system, or face ecological peril. Importantly, the environmental impact of the food system is a product of the level of consumption (i.e. population size) *and* the characteristics of consumption (i.e. what is eaten) (Mont & Plepys, 2008; Ramankutty et al., 2018). Therefore, addressing our food system challenge while simultaneously mitigating climate change will require the increased production and distribution of foods of lower environmental impact.

1.2.1 Projected Population Growth

Although the rate of global human population growth has been slowing for several decades (UN DESA, 2017), the global population is expected to continue to increase until at least mid-century (Roser, 2019b), raising concerns about how to feed more people with already-strained environmental resources (Foley et al., 2011). It is encouraging to reflect on dramatic increases in agricultural efficiency over the past 70 years, in which agricultural production increased from sustaining around 2.5 billion people in 1950 to 7.7 billion today (Desrochers & Shimzu, 2012; Foley et al., 2011; Roser, 2019a). During this time, food consumption patterns have shifted in the context of growing populations and increasing affluence. Although food production has generally become more efficient, environmental improvements on a per-food-item basis have been largely negated by increased consumption (Mont & Plepys, 2008; Ramankutty et al., 2018). Therefore, despite substantial improvements in food production efficiency in much of the world, the food system's aggregate impact on the biosphere has continued to increase (Gordon et al., 2017). This will be of pressing importance moving forward; the environmental impacts of the food system could increase given that population growth will likely demand increased food production, and because in much of the world consumption patterns are trending towards an increase in high-impact foods, particularly meat (Clark & Tilman, 2017; Foley et al., 2011).

1.2.2 Increasing Meat Consumption

Since the 1960s, per-capita meat consumption has risen dramatically throughout the world (Lazzarini, Zimmermann, Visschers, & Siegrist, 2016; McWilliams, 2009; Reynolds, Buckley, Weinstein, & Boland, 2017). This is due to a combination of improved production efficiencies that have lowered the cost of meat production (Reynolds et al., 2017) and rising average incomes, which are closely tied to increased meat consumption (McWilliams, 2009; Reynolds et al., 2017). This trend is set to continue (Reynolds et al., 2017); demand for livestock products is projected to increase up to 70% over 2005 levels by 2050 (Gerber, 2013). It is concerning to see environmentally harmful practices like meat consumption intensifying at the very time when it is necessary to reduce the environmental impacts of the food system (Mont & Plepys, 2008).

1.2.3 Further Complexities to the Challenge

The challenge of feeding a growing population while reducing environmental impacts occurs in the context of the persistent catastrophic failure of food access and dramatic power imbalances: we live in a world where 821 million people are undernourished (FAO, 2018; Garnett, 2014). Although the *proportion* of the population that is undernourished has been declining for decades (Gordon et al., 2017), the food system remains unsuccessful at its primary function of providing adequate nutrition to all people (Garnett, 2013). While this thesis will not explore present or future food security, it is written with the understanding that our food system exceeds Earth's environmental limits, even while failing to produce and distribute adequate food for everyone currently living. This highlights our global challenge: we must feed current and future populations *equitably* while drastically reducing the environmental impact of food systems (Foley et al., 2011; Garnett, 2014).

This challenge will be exacerbated by the fact that the emerging effects of climate change will make agricultural activities more difficult and less predictable (Hoegh-

Guldberg et al., 2018; Ramankutty et al., 2018). Thus, we face a global transition towards increased meat consumption for a growing population that is already inequitably fed; alongside the 821 million of us that are undernourished, 672 million are obese (undernourishment and obesity coexist in many parts of the world) (FAO, 2018). In this context, the food system can be expected to continue to exceed Earth's environmental limits unless humanity takes drastic action (Nelson et al., 2016). It is necessary that immediate and meaningful changes be made to the food system. Current patterns are *already* unsustainable and cannot be scaled up to feed a growing population a more resource-intensive diet, particularly not if our goal remains to mitigate climate change and reduce the other environmental and injustice impacts of the food system.

1.3 Dietary Change Can Mitigate GHG Emissions of the Food System

There are two primary opportunities through which to address these challenges of the food system: 1) continue to improve the efficiency of food production and distribution and/or 2) shift large-scale patterns of food consumption through top-down regulation and/or through bottom-up cultural change (Hoolohan et al., 2013; Nelson et al., 2016). Undoubtedly, it will be necessary to pursue both strategies simultaneously, but it is worth outlining the relative opportunities of each.

1.3.1 Opportunities to Improve Food Production and Distribution

While improving the efficiency of the food system is necessary, it will likely be insufficient to ensure we tackle our food system challenge of increasing food access for a growing population, while reducing overall environmental impacts. Producers are integral to improving the sustainability of food systems, but their ability is limited to reduce environmental impacts per unit of a given food that is produced (Poore & Nemecek, 2018). While, in recent decades, there have been tremendous reductions in the environmental impacts of food production, as calculated using life cycle assessments (LCAs) (see Pelletier (2018) who found that between 1962 and 2012, the GHG emissions per unit of chicken eggs produced in Canada decreased 72%), such high rates of improvement are unlikely to continue given the declining marginal improvements in efficiency occurring with further investments. Importantly, measures of environmental efficiency do not include animal welfare considerations. It is also important to consider the heterogeneous conditions of global food production and to understand that the scale of potential efficiency improvements are not equal throughout the world (Poore & Nemecek, 2018). Further, the importance of efficiency improvements is greatly influenced by the starting environmental impact of food products. Across the board, low-impact (efficiently produced) animal products (e.g. beef) have higher GHG and land use impacts than substitutable vegetable proteins (e.g. soybeans; note: excluding nuts) (**Figure 1**) (Poore & Nemecek, 2018). Reducing GHG emissions through improved production efficiency also threatens to be unsuccessful due to the rebound effect. This phenomenon is also known as Jevon's Paradox, and occurs when increased production efficiency can decrease costs for consumers, leading to increased overall consumption, and negating the environmental benefits of efficiency improvements (Jevons, 1865).

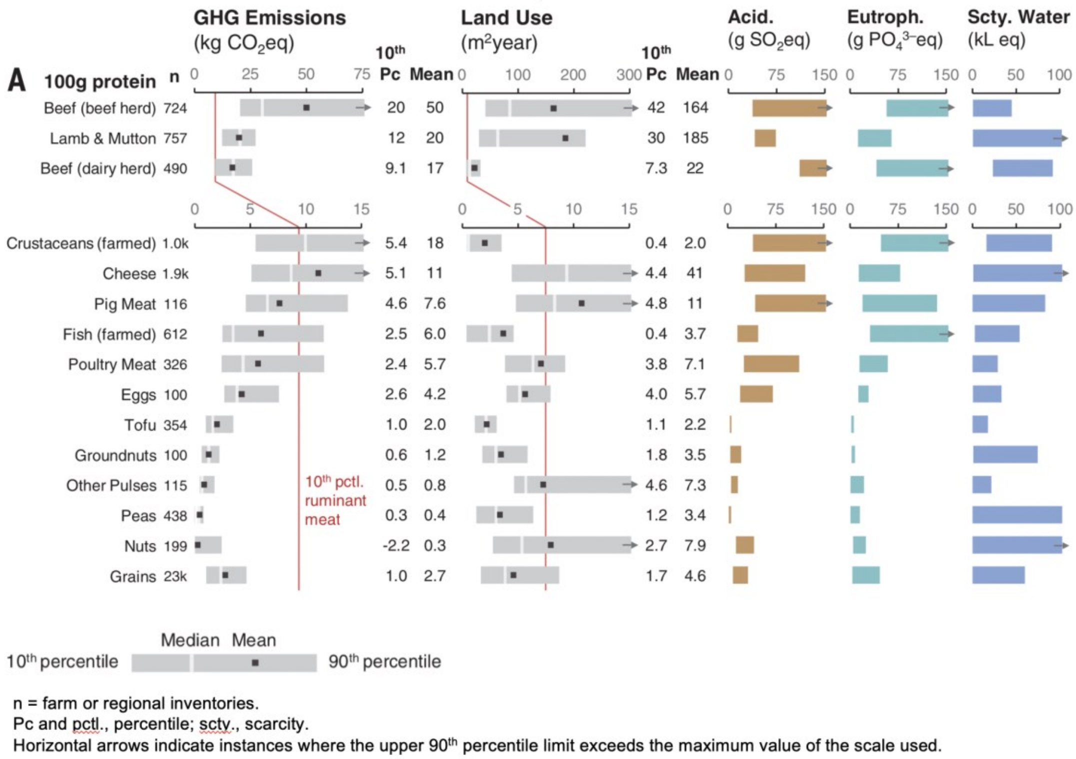

Figure 1: Range, mean, and median GHG, eutrophying, and acidifying emission rates, together with land use area and water required to produce 100 grams of protein from a range of cultivated animal and plant sources, as compiled by Poore and Nemecek, 2018.

From "Reducing food's environmental impacts through producers and consumers" by Poore, J., & Nemecek, T., 2018, *Science*, 360, 987-992, p. 988. Reprinted with permission from AAAS.

Producer-side mitigation strategies currently focus on improving agricultural efficiency, applying big-data analytics, and reducing food waste along the supply chain (KC, Fraser, Dias, Zundel, & Pascoal, 2016; Macdiarmid, Douglas, & Campbell, 2016). While there is potential for significant GHG emission reductions per unit of food through increasingly efficient modes of production, the potential GHG emission reductions from these avenues will be insufficient for meeting climate change targets (Macdiarmid et al., 2016). Therefore, while improving food system efficiencies is critical, it is necessary to *simultaneously* shift global dietary patterns towards lower-impact choices (Aleksandrowicz, Green, Joy, Smith, & Haines, 2016; Macdiarmid et al., 2016; Poore & Nemecek, 2018).

1.3.2 Opportunities Through Dietary Change

Efforts to reduce GHG emissions from the food system have generally focussed on production-side solutions, however, there is increasing awareness of the enormous potential of demand-side solutions (Ramankutty et al., 2018). It is now understood that production-side solutions *must* be accompanied by global-scale shifts towards more sustainable consumption-side efforts to sufficiently curb the environmental impacts of the food system (Aleksandrowicz et al., 2016; Garnett, 2011; Gordon et al., 2017; Hallström et al., 2015; KC et al., 2016; Mont & Plepys, 2008; Springmann et al., 2018).

When guarding against the rebound effect, changing consumption patterns can alter the forces of demand that ultimately drive production (Garnett, 2014). In this way, a focus on dietary change complements the drive for greater production efficiency by considering *different* consumption patterns. For instance, rather than finding the most efficient way to produce beef, we can consider that humans would be more efficiently fed, and many environmental impacts reduced, if vegetable and grain crops were fed to people rather than cattle, and total cattle production were commensurately reduced (Garnett, 2014). As described by Berry (1992, p. 377), “how we eat determines, to a considerable extent, how the world is used. This is a simple way of describing a relationship that is inexpressibly complex”.

Of course, there is considerable debate regarding how to define a ‘sustainable diet’, and all definitions shift with the scale of consumption. Sustainable diets have been defined as “those which are healthy, have a low environmental impact, are affordable, and culturally acceptable” (Aleksandrowicz et al., 2016, p. 2), and Garnett (2014) advocates for defining minimum requirements for meat and dairy consumption to avoid ‘wasting’ GHG emissions through over-consumption beyond per-capita protein requirements. Regardless of how sustainable diets are defined (Mason & Lang, 2017; Burlingame & Derini, 2010), there is substantial potential for improvement from current diets.

There is great diversity in the impacts of diets, particularly between households of different location, income, and size. The relative contribution of diet to a typical household’s total GHG emissions can vary from 10-30% (de Boer, de Witt, & Aiking, 2016). For the most affluent, however, dietary change could reduce the GHG emissions and land use of our diets by up to 50% (Garnett, 2014; Hallström et al., 2015). This vast potential for improvement is largely because average meat intake in many affluent nations like the US and UK considerably exceeds nutritional recommendations for protein consumption (de Boer, Schösler, & Aiking, 2014; Macdiarmid et al., 2016). This demonstrates that shifting affluent diets towards lower-impact choices, particularly consuming less meat, could lead to substantial GHG emission reductions with virtually no negative impact to individuals’ quality of nutrition or physical well-being (Hallström et al., 2015; Hoolohan et al., 2013; Lazzarini et al., 2016; Macdiarmid et al., 2016; Panzone, Lemke, & Petersen, 2016). Indeed, it has been argued that reductions in levels of red meat consumption in high-consuming nations could also deliver considerable health benefits (Aleksandrowicz et al., 2016; Biesbroek et al., 2014; de Boer et al., 2014; Friel et al., 2009; Reynolds et al., 2017; Song, Li, Fullana-i-Palmer, Williamson, &

Wang, 2017; Soret et al., 2014). It is clear that considerable GHG emission reductions and resulting climate change impact mitigation can be achieved through widespread dietary change towards lower GHG emitting food choices (de Boer et al., 2016; Foley et al., 2011; Hallström et al., 2015), and it may not be possible to achieve under 2°C in warming while feeding a growing population without this shift (Hedenus, Wirsenius, & Johansson, 2014; Springmann et al., 2018; Wynes & Nicholas, 2017).

While our dietary choices represent important opportunities for environmental improvement (Lazzarini et al., 2016; Pinto, Herter, Rossi, & Borges, 2014; Polizzi di Sorrentino, Woelbert, & Sala, 2016; Tobler, Visschers, & Siegrist, 2011), changing widespread and culturally entrenched dietary patterns will not be an easy feat (Macdiarmid et al., 2016). The complexity of food choice will be further described in **Chapter Two – Literature Review**, but briefly, at the scale of individuals, dietary patterns are relational: influenced by community contexts, including culture, class, and ethnicity (Gordon et al., 2017). Simultaneously, dietary choices at the international scale are influenced by formal and informal markets, government subsidies, sanctioned food guides, corporate lobbying, and trade agreements (Gordon et al., 2017). In this way, large-scale and conflicting factors affect what people eat by "influencing the availability, affordability, convenience, and desirability of food items" (Gordon et al., 2017, p. 3). So, in order to meaningfully reduce the GHG emissions from the food system through dietary change, it is necessary to incorporate and expand our understanding of the factors that influence the composition of diets (Lazzarini et al., 2016; Mont & Plepys, 2008).

While highlighting the importance of shifting diets for environmental benefit, it is critical to understand that changing diets is only possible for those with the *luxury of* *choice.* In 2017, the FAO estimated that 821 million people worldwide were undernourished (FAO, 2018); individuals and communities experiencing food insecurity are often unable to prioritize environmental factors when accessing food. Having the option to prioritize sustainability in dietary decisions is a privileged act (Reynolds et al., 2017). Further, individuals with the luxury of choice in our diets are very often responsible for diets resulting in higher GHG emissions (Garnett, 2014; Hallström et al., 2015).

Therefore, individuals with choice in our diets can engage in *climate-motivated-eating*, a term I use throughout this thesis to describe the practice of individuals who explicitly aim to reduce personal contributions to GHG emissions through dietary choices. Climate-motivated-eating is a component of *eco-eating*, through which individuals make dietary choices to address environmental objectives more broadly (Johnston & Baumann, 2010). These frameworks will be described further in **Chapter Two – Literature Review**.

1.4 Food Media as a Place for Discussions of Diet and Environment

Of particular interest to me is how food media - the spaces in which food is publicly discussed, including books, television, and social media - shape public understanding of how dietary choices impact the environment. Through text and images, food media teach society about "good food", and influence what is viewed as culturally acceptable to prepare, share, and eat (Goodman, Johnston, & Cairns, 2017). Engaging with food media gives eaters an accessible means to explore the food system beyond individual experiences of cooking and eating (Goodman et al., 2017). What is clear is that government factsheets are not now, nor perhaps were they ever, society's most influential source of dietary advice (Rousseau, 2012b).

1.4.1 The Influence of "Traditional" Food Media

In the past few decades, some food media have helped fuel the practice of climate-motivated-eating (Rousseau, 2012b). One prominent example is how Michael Pollan's *The Omnivore's Dilemma* (2006) generated widespread interest in how food production and consumption impact the environment (Cramer, 2011; Pollan, 2006). Further, since the 1993 launch of the Food Network, food television has found a place of importance in many North American homes (Johnston & Baumann, 2015). Facilitated by the Food Network and food television, one of the most influential aspects of food media is the proliferation of 'celebrity chefs with a mission' like Jamie Oliver, Massimo Bottura, and Alice Walters. These chefs aim to change the food system, often avoiding the public pushback faced by elected officials with similar goals (Goodman et al., 2017). Celebrity chefs may not have the authority to impose *structural* changes to how people eat, but they hold significant influence on the perceptions and behaviour of their fans; those with far-reaching fanbases may indirectly influence government policies (Rousseau, 2012b). The growing influence of celebrity chefs has led to concern that consumers of food media are becoming too reliant on "pseudo-experts" for dietary advice (Goodman et al., 2017; Rousseau, 2012b). This is concerning in the context of the intersection of diet and environmental impacts; for example, some of Jamie Oliver's advice on eco-eating does not align with what is now well-established knowledge regarding GHG emissions (e.g. Oliver (2017)). As one example, Oliver suggests eating grass-fed beef (albeit for both general environmental and animal welfare motivations), although there is academic evidence that selecting grass-fed beef without decreasing consumption is generally detrimental to the goal of reducing GHG emissions (Garnett et al., 2017). Given his revered place in food media, viewers may not think critically about the efficacy of Oliver's eco-eating strategies.

Similarly, Cramer (2011) studied how programs broadcast on the Food Network promote or disregard environmental sustainability. Cramer identified four environmental themes within Food Network discourse: civic agriculture, seasonality, vegetarianism, and sensuality (Cramer, 2011). Despite the presence of these values, vegetarianism was only shown in three out of 46 shows sampled on the Food Network (Cramer, 2011), suggesting that this form of food media is not actively promoting vegetarianism to the public, although it is closely linked to reduced environmental impacts (Hoolohan et al., 2013; Vázquez-Rowe et al., 2017; Lukas et al., 2016; van de Kamp et al., 2018; Van Mierlo et al., 2017; Wynes & Nicholas, 2017). Regardless of the qualifications or accuracy of suggestions shared on food television, the influence of traditional food media is significant (Rousseau, 2012b).

1.4.2 The Importance of Online Food Media

Contemporary food media is particularly influential in its online context (Goodman et al., 2017; Rousseau, 2012a). Over the past two decades, the Internet has proven to be a powerful generator of food communities (Rousseau, 2012a). Chowhound was founded in 1997 as one of the first online discussion forums dedicated to food, and by 2007, there were 50,000 food blogs based in the US (Rousseau, 2012a). Through regular interaction with large numbers of readers, popular food bloggers have the potential to sway broader public opinion on food issues and can serve an important function in spreading messages about eco-eating (Medaas, 2014). Medaas (2014) conducted an interesting study that examined how "food blogs act as a venue for the communication of an environmental ethic relating to food" (p. 3). By focussing on food bloggers who campaign for environmentally minded eating, Medaas (2014) explored how people communicate online about consumerism and citizenship related to dietary choices. Medaas' (2014) study found that food bloggers communicate their environmental values, as well as their strategies "for practicing more environmental conscientiousness in the procurement, production and consumption of food" (p. 99).

Social media (e.g. Facebook, Instagram, and Twitter) have evolved more recently than blogging, and have become widely used networks for the communication of food-related media and eco-eating messaging. Social media facilitate conversation and *prosumption*, since social media allows users to simultaneously *produce* and *consume* content (Rousseau, 2012a). In recognizing that social media provide multitudinous locations (albeit virtual) for publicly communicating about food, we must consider that social media broadly affect how society thinks about eating (Rousseau, 2012a). Obviously, the average Instagrammer does not have the same advertising power or ability to reach consumers as a transnational food corporation (Goodman et al., 2017), but the impact of Instagram 'influencers' with audiences of thousands of followers should not be underappreciated.

Despite the social good that can come from communicating about food on social media (e.g. sharing recipes and healthy eating strategies), I am concerned about the spread of ineffective and possibly counter-productive climate-motivated-eating strategies online. It is clear that social media allows non-experts to be perceived as experts

(Rousseau, 2012a), and online, the truth is at great risk "when opinion is misrepresented as fact" (Kuhn, 2007, p. 22). The prevalence of non-experts is particularly challenging on social media because anyone can contribute content; unlike experts on television programs whose content is, in theory, vetted by cable networks, there are no checks on the credibility of social media users who post about climate-motivated-eating. The Internet, and social media in particular, are powerful pseudo-spaces in which like-minded people can discuss ideas. This same benefit, however, leads to the proliferation of idea echo-chambers, which can limit individuals' exposure to perspectives unlike their own (Rousseau, 2012a). As of 2018, 68% of Americans who responded to a survey indicated that they at least occasionally receive news on social media feeds, although 57% of these social-media-news-consumers claim to be skeptical of the accuracy of this news (Matsa & Shearer, 2018). This reflects that despite its prevalence in our world, information shared on the Internet is frequently critiqued for lacking standards of fact-checking and being of questionable legitimacy (Medaas, 2014; Rousseau, 2012a). As discussed above, our climate crisis requires immediate and effective action to mitigate GHG emissions, and misinformation spread on social media about climate-motivated-eating could hinder these efforts. In this context, this research examines a sample of social media posts shared on Twitter and Instagram in order to understand how climate-motivated-eating is being discussed in these spaces.

1.5 Project Rationale and Research Objectives

So far, this thesis has outlined that it is critically important to mitigate climate change through all means possible and ethical, including through large-scale dietary change towards diets with lower GHG emissions. Importantly, dietary change needs to simultaneously address our food system challenge: to continue to feed more people while reducing environmental impacts for decades to come. Fortunately, the public is increasingly interested in eco-eating and climate-motivated-eating specifically, and for many, views on this topic are directly or indirectly influenced by food media. Given the complexity of the contemporary food media landscape, and the dominance of online sources of information in shaping public understanding, social media is a particularly interesting lens through which to examine how individuals engage with climate-motivated-eating. Finally, in the context of the critical imperative to address climate change as quickly and effectively as possible, I am curious about how well popular climate-motivated-eating strategies align with scientific understandings of the GHG emissions of these strategies. Therefore, the research objectives of this thesis are as follows:

1. **Explore which climate-motivated-eating strategies are communicated in a sample of Twitter and Instagram posts.**

2. **Consider the evidence that supports these strategies for reducing GHG emissions.**

1.6 Organization of Thesis

This thesis has been organized into six chapters. **Chapter One - Introduction** has laid out the background context and rationale for the importance of this work. **Chapter Two – Literature Review** will explore the importance, development, and criticisms of eco-eating and climate-motivated-eating, the complexities of consumer behaviour, and will provide an overview of how other researchers have conducted similar work. **Chapter Three - Methods** will describe the methodological approach taken for this study. **Chapter Four – Results** will present the results of this study, and **Chapter Five - Discussion** will discuss these results in their broader context, while considering this study's limitations, and will offer suggestions for priority areas for future research. Finally, **Chapter Six - Conclusion** will summarize and conclude this work.

2.0 CHAPTER TWO – LITERATURE REVIEW

Chapter Two provides greater context for the purpose and significance of this research, as well as an overview of prior research conducted on this topic. Due to this study's interdisciplinary nature, this literature review is diverse in scope. This chapter outlines: the severity of environmental impacts attributed to the global food system; the cultural development and criticisms of climate-motivated-eating and eco-eating; the complexity of consumer choice when practicing climate-motivated-eating; previously observed mismatches between individuals' intentions and impacts when changing personal behaviour to mitigate climate change; and finally, the utility of social media for understanding contemporary climate-motivated-eating strategies

2.1 Contributions of the Food System to Climate Change and Environmental Damage

To address the climate crisis and return Earth's atmospheric balance to its safe operating space, it is essential to reduce all sources of GHG emissions (Rockström, Steffen, Noone, & Scheffer, 2009). The United Nations has set ambitious mitigation targets that necessitate reducing GHG emissions from *all* sectors (e.g. electricity generation, manufacturing, food production etc.) (Hoolohan et al., 2013). The food system (defined here as the processes through which all food is produced, processed, transported, consumed, and wasted) is one area through which immediate and effective mitigation is possible (Foley et al., 2011; Garnett, 2011; Gordon et al., 2017; Hoolohan et al., 2013; Nelson et al., 2016; Poore & Nemecek, 2018; Springmann et al., 2018; Upham, Dendler, & Bleda, 2011).

The global food system is a major driver of climate change. Estimates of the global food system's GHG contributions (including direct and indirect impacts) as a share of total anthropogenic emissions range from 25% - 35% (Foley, 2014; Garnett et al., 2017; Gordon et al., 2017; Hallström et al., 2015; Nelson et al., 2016; Poore & Nemecek, 2018). It is important to note that there is great complexity in tracing these emissions, due in part to the significance of emissions from indirect sources like land-use change (Hoolohan et al., 2013) and what activities are included or excluded in the definition of 'food system'. Given this difficulty and associated uncertainty, it may be futile to provide an exact measure of the GHG emissions of the food system, but it is undoubtedly an important sector in which to focus mitigation efforts.

It is illuminating to unpack the sources of emissions within the food system. In general, most GHG emissions from the food system arise at the production stage (Reynolds et al., 2017); 61% of GHG emissions from the food system occur here, rising to 81% when calculations include indirect emissions from deforestation (Poore & Nemecek, 2018). Sources of GHG emissions from food system activities have changed over time, and while converting land from forest or grasslands to croplands was once the largest source of emissions, livestock production is now understood to be the food system's greatest source of emissions (Ramankutty et al., 2018). Meat and dairy production have disproportionality high environmental impacts, particularly when including the land-use impacts inherent in their production (Biesbroek et al., 2014; Dewey, 2018; Garnett, 2013; Hall, Cleveland, & Kaufmann, 1992). Estimates of the proportion of total anthropogenic GHG emissions that arise just from animal-based food production range from 14.5% (FAO, 2006; Macdiarmid et al., 2016) to 15-24% with the majority of this coming from cattle production (Hoolohan et al., 2013). Of the 13% of global GHG emissions caused by agricultural activities on already-converted land, 33% result from methane emissions from enteric fermentation (part of the digestion process of ruminant animals), 15% from N_2O emitted by manure and synthetic fertilizers, and approximately 12% are caused by methane produced by rice paddies (Ramankutty et al., 2018). It is clear that the food system is a major source of GHG emissions, and that there is great variation of impact within food production practices (**Figure 1**) (Hall et al., 1992; Poore & Nemecek, 2018).

Although not the focus of this thesis, beyond GHG emissions, the food system also makes substantial contributions to a wide range of other regional to global-scale environmental challenges. These include being a major driver of deforestation and biodiversity loss and the degradation of freshwater, wild lands, and soils (Aleksandrowicz et al., 2016; Foley et al., 2011; Garnett, 2013; Gordon et al., 2017; Hallström et al., 2015; Nelson et al., 2016; Poore & Nemecek, 2018; Ramankutty et al., 2018). In the context of this environmental damage and resource pressure caused by the food system, food consumption is one of the most common, yet environmentally impactful activities that we all participate in (Heard & Miller, 2016). This also means that there is great opportunity to mitigate climate change through large-scale changes to the food system.

2.1.1 Use of Life Cycle Assessment to Quantify Impacts of the Food System

Amongst the many ways in which diverse environmental impacts of food system activities are quantified is a technique, or analytical framework, called life cycle assessment (LCA) (Baumann & Tillman, 2004). LCA is an internationally recognized method of quantitatively accounting for the inputs, outputs, and contributions made to a range of environmental concerns throughout the life cycle of products or services (Baumann & Tillman, 2004; Clark & Tilman, 2017; Guinée et al., 2011; Hellweg & Canals, 2014). Analysts conducting LCAs quantify the material and energy inputs to as many stages of the provision of a product of interest as possible (e.g. production, transportation, consumer use, disposal). The resulting 'inventory' data per unit of product (or activity) of interest are then used to quantify contributions to regional or global-scale resource use (e.g. total energy dependence, water use) or environmental concerns (e.g. GHG, eutrophying, or acidifying emissions) using peer-reviewed impact assessment models (Baumann & Tillman, 2004). The resulting aggregated contributions to these 'impact categories' are expressed in terms of a standard reference unit, such as carbon dioxide equivalents (CO_2e) in the case of GHG emissions. A strength of LCA is that it permits the identification of key activities that contribute disproportionately to overall impacts (so-called 'hotspots') and hence areas for targeted improvement (Heard & Miller, 2016; Reynolds et al., 2017). By accounting for all, or nearly all, contributions to impact categories that arise throughout the entire supply, use, and disposal phases of a product, LCA researchers can identify opportunities for improving the environmental performance of products while minimizing the potential of burden-shifting from one environmental impact to another (Gutowski, 2018; Hellweg & Canals, 2014). For example, researchers conducting LCAs of clothes-washing have found that the greatest environmental improvements in this process can come from lowering water temperatures (Hellweg & Canals, 2014). Further, researchers completing LCAs of fuels have found that biofuels tend to have greater environmental impacts than conventional fossil fuels due to the imperative to shift land-use from forest or food production to producing fuel crops (Hellweg & Canals, 2014). Therefore, we can see that there is great potential for LCA research to inform both public and private decision-makers when they attempt to make *meaningful* and effective environmental change.

Like most frameworks, LCA research faces valid criticisms. Firstly, while LCA analysts can pinpoint hotspots of environmental impact in complex product systems, the broad scope of LCAs leads to simplifications and uncertainties in research (Guinée et al., 2011; Gutowski, 2018; Hellweg & Canals, 2014). When conducting LCAs, researchers face knowledge gaps about products and their impacts, often requiring that estimations be made based on similar products, affecting the accuracy of LCA results (Reynolds et al., 2017). In light of these criticisms, LCA analysts are continually developing and improving their knowledge base (Guinée et al., 2011). An emerging area of LCA research is the modelling of rebound and indirect effects; impacts that occur because of a change to a system that can unintentionally increase a product's environmental impact (Guinée et al., 2011; Gutowski, 2018; Hellweg & Canals, 2014).

Over recent decades, the use of LCA to understand the contributions of food system activities to a wide range of impact categories has expanded rapidly, increasing our collective understanding of the relative environmental impacts of dietary choices (Poore & Nemecek, 2018; Reynolds et al., 2017). Researchers who conduct LCAs that are focussed on particular food systems can identify hotspots of high-impact and develop recommendations to improve the efficiency of food production (Guinée et al., 2011; Keyes, Tyedmers, & Beazley, 2015). For example, LCA researchers have demonstrated the inadequacy of food miles as a proxy for a food's total associated GHG emissions and have revealed links in food supply chains that can improve efficiencies (McWilliams, 2009). From a food system perspective, LCA frameworks can be grouped into two primary forms: investigating the impacts of current food consumption and predicting the environmental impacts of changes to consumption (Reynolds et al., 2017). Although LCA analysts track food system impacts across many impact categories (e.g. GHG emissions, land use, eutrophication potential) (Clark & Tilman, 2017), this thesis focuses primarily on the opportunity to mitigate climate change through dietary choice, and so the remainder of this thesis is focused on the relative GHG emission intensities of food products (e.g. the GHG emissions of meats relative to vegetables).

2.2 Increasing Public Interest in Climate-Motivated-Eating

Given the diverse and substantial environmental impacts of the food system, and the potential for large-scale dietary change to mitigate GHG emissions, a growing number of us are attempting to reduce the impact of our diets. Over recent decades, there has been a marked increase in interest amongst citizens of many industrialized countries to select foods, or sources of specific foods, perceived as having lower environmental impacts, and lower GHG emissions in particular (Holmberg, Chaplin, Hillman, & Berg, 2016; Lazzarini, Visschers, & Siegrist, 2017; Roheim, Asche, & Santos, 2011; Stranieri, Ricci, & Banterle, 2017; Vermeir & Verbeke, 2008). I call selecting foods with the aim of reducing GHG emissions "climate-motivated-eating". Given the increasing prevalence of this practice, it is important to understand its current characteristics, and from where it emerged: this will be unpacked in the following section.

2.2.1 Contemporary Context of Climate-Motivated-Eating

Growing consumer interest in climate-motivated-eating can be linked to the larger cultural phenomenon of *ethical consumption*. Through ethical consumption, we as consumers direct our purchases so as to 'vote with our wallet' to support products deemed to align with our values (Medaas, 2014). Thus, ethical consumption is a way to integrate our feelings of social responsibility into our consumption decision-making, along with our preferences for taste and price (Vermeir & Verbeke, 2008). Ethical consumption has been defined as "purchasing and using products and resources according not only to the personal pleasures and values they provide but also to ideas of what is right and good, versus wrong and bad, in a moral sense" (Starr, 2009, p. 916).

Ethical eating is one particular form of ethical consumption. Through the process of ethical eating, individuals aim to make "good" and responsible choices for society and the environment, based on acquired knowledge about the production of our food (Cairns & Johnston, 2018). Importantly, ethical eating is defined by particular issues that have gained public attention (e.g. organic certification, local sourcing, and humane treatment of livestock), and often ignores ethical issues like local food insecurity and agricultural workers' rights (Cairns & Johnston, 2015; Hodgins & Fraser, 2017; Hwang, Young, Oates, & McDonald, 2010; Johnston, Szabo, & Rodney, 2011; Johnston & Baumann, 2015; McCullen, 2011). Ethical eating is often understood by consumers as being synonymous with "green eating" (Johnston et al., 2011), and environmental concerns are a prominent component of ethical eating repertoires (Lea & Worsley, 2008). Because of the strong association of ethical eating with pro-environmental objectives, I identify the phenomenon of "eco-eating", through which we as individuals select foods specifically to address environmental objectives. A sub-set of eco-eating is the more specific practice of climate-motivated-eating, in which individuals aim to reduce contributions to GHG emissions through dietary choices. In this way, climate-motivated-eating exists within the broader contexts of eco-eating, ethical eating, and ethical consumption (Medaas, 2014) (**Figure 2**). To clarify, eco-eaters are not always climate-motivated-eaters; some consumers may prioritize other environmental factors like water conservation over reducing GHG emissions.

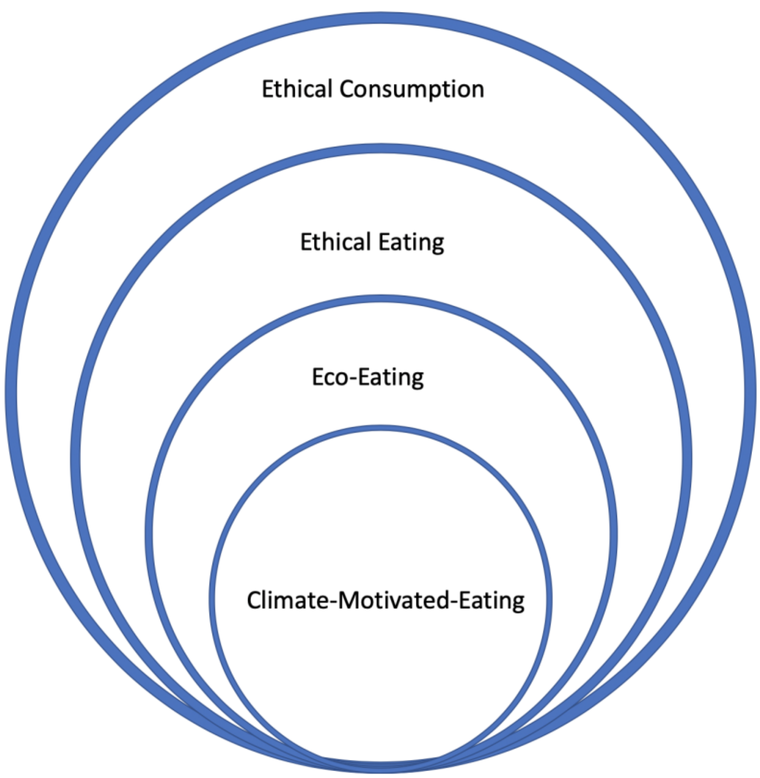

Figure 2: The practice of climate-motivated-eating fits within the broader frameworks of eco-eating, ethical eating, and ethical consumption.
Note: This does not represent the scale of the phenomena, but rather their hierarchy.

2.2.2 Cultural Development of Eco-Eating

It is important to note that eco-eating is not merely a 21st century phenomenon. One historical example is the concern and effort to eat with moral grounding that was prevalent in the 1960s. The 1962 publication of Rachel Carson's environmental catalyst, *Silent Spring*, encouraged "politically minded individuals [to eat] with a consciousness about the environmental consequences of where their food came from and how it was produced" (Civitello, 2008, p. 338; Carson, 1962). This spurred, or at least contributed to, a cultural interest in "hippie food", which was the "antithesis of all-American meat and potatoes" (Kauffman, 2018, p. 1). Interestingly, a cultural interest in local and organic eating solidified during the hippie food movement. The term *organic* was first introduced to the US in 1942 in the magazine *Organic Farming* and was printed on American restaurant menus as early as 1958 (Kauffman, 2018). However, the organic movement "took on new urgency" after the publication of *Silent Spring* (Kauffman, 2018, p. 178). In 1965, George Ohsawa published *Zen Macrobiotics* in which he wrote "do not take any fruits and vegetables that are artificially produced with chemical fertilizers and/or insecticides" (Ohsawa (1965) as cited in: Kauffman, 2018, p. 65). Incorporating the beginnings of the localism movement, Ohsawa also wrote "Do not take any food that comes from any long distance… do not use any vegetable out of season" (as cited in: Kauffman, 2018, p. 65).

From its origins as countercultural "hippie food", eco-eating transitioned to a gentler cultural shift during the 1970s (Kauffman, 2018). In 1971, *Diet for a Small Planet* was released by Frances Moore Lappé, which highlighted the environmental impact of meat production and promoted vegetarianism (Lappé, 1971). Released in the wake of the apocalyptic *The Population Bomb,* which predicted mass famines (Ehrlich & Ehrlich, 1968), *Diet for a Small Planet* taught readers, and Western culture more broadly, that eating is an empowering political act with the potential for cumulative choices to have wide-reaching effects on our world (Kauffman, 2018). In this way, *Diet for a Small Planet* laid the groundwork for environmentally motivated vegetarianism in North America (Kauffman, 2018). The concept of food choices being a political act is a lasting legacy of the countercultural food movement of the 1960s and 1970s (Kauffman, 2018). While vegetarianism continued to be practiced by many individuals, by the 1980s and through the 1990s, many of the pro-social and pro-environmental concepts of ‘hippie food’ had declined or disappeared from North Americans’ priorities; although vegetarianism had become accepted, per capita meat consumption continued to increase during these decades (Kauffman, 2018).

While earlier eco-eating did not specifically aim to address climate change, by the early 2000s, a climate-motivated-eating trend was emerging: localism. In 2006, local eating was the “hottest trend in food” as ranked by the San Francisco Chronicle, and *locavore* was the New Oxford American Dictionary’s word of the year for 2007 (as cited in: Johnston & Baumann, 2015). These trends were spurred on by Smith and Mackinnon’s popular 2007 book, *The 100-Mile Diet,* which framed local eating specifically as a platform for thinking about climate change. The 2008 release of the documentary *Food Inc* further highlighted the environmental impacts of the contemporary food system and reignited a zeitgeist of fear and mistrust of conventional food production (Holt & Cartmell, 2013). From my vantage point, it appears that the 2010s have been characterized by the continued popularity of local eating, mistrust of large-scale food production, and increasing societal concern about climate change. Clearly, contemporary eco-eating and climate-motivated-eating continue to evolve, but many of their founding principles have been present in Western culture for decades.

2.3 Tensions in the (In)accessibility and (In)efficacy of Eco-Eating

Consumers' increasing attention and concern for the environmental impacts of our dietary choices is likely facilitating broader changes in the food system. As described by Westervelt (2015), some consumers are "driving the push for dietary sustainability" (p. 1) because our preferences for foods with reduced environmental impacts are driving larger food system actors (e.g. supermarkets, food brands, policy makers) to market more sustainable foods (Jean, 2018; Westervelt, 2015). However, while eco-eating emerged from an effort to bring about positive social and environmental change, participation in eco-eating has been widely criticized for being unequally accessible along lines of class, race, and gender, and for encouraging self-protection over broader political change (Alkon, 2008; Cairns & Johnston, 2018; McCullen, 2011; Rotz, 2018; Szasz, 2007). If we accept climate-motivated-eating as a tool that could potentially address climate change, it is critical to understand how different groups engage with this practice, and to recognize how eco-eating fails at inclusion (Johnston et al., 2011).

2.3.1 Socio-Economic and Racial Inequity in Eco-Eating Practices

Spaces of ethical and eco-eating have been critiqued for inhibiting participation of low-income communities (Cairns & Johnston, 2018; Hodgins & Fraser, 2017; Kato & McKinney, 2015). More specifically, it has been observed that "many of the shopping and eating spaces articulating a discourse of ethical consumption… are positioned to serve economic elites" (Johnston et al., 2011, p. 294). The classism present within ethical consumption and eco-eating is a "paradoxical side-effect of the pursuit of a more sustainable food system" (Hodgins & Fraser, 2017, p. 3).

It is important to clarify that affluent individuals are not unique in being motivated to eat sustainably; marginalized populations are also concerned and engaged in conversations of environmental issues, but may be powerless to act to improve the system through financially and temporally costly consumption (Johnston et al., 2011; Kato & McKinney, 2015; Newman, 2018). The suggestion that low-income individuals have low levels of food or environmental literacy is "pervasive in societal discourse but is unsubstantiated in research" (Hodgins & Fraser, 2017, p. 10). Rather, even within food deserts, people with strong interests in eco-eating may participate, although at a limited rate (Kato & McKinney, 2015). Thus, we must remember that climate-motivated-eating is sometimes a matter of ability, not will (Newman, 2018).

Beyond the presence of classism, there is a problematic association between eco-eating, whiteness, and racism (Cairns & Johnston, 2018). It is well-known that white people often comprise the majority within eco-eating spaces (e.g. farmers' markets) (McCullen, 2011). In many ways the construction of the "white farm imaginary" (the romanticizing of an agrarian experience specific to white people) begins with ethical eaters' desire to buy food directly from the people who grow it, with the goal of ensuring they receive fair wages for their work (Alkon & McCullen, 2010; McCullen, 2011). Despite this noble goal, ethical and eco-eating generally ignore the mainly non-white farm workers who perform the majority of food production tasks (McCullen, 2011). As spaces for ethical and eco-eating, farmers' markets are particularly criticized for perpetuating the white farm imaginary because these markets claim to connect consumers directly with producers (McCullen, 2011); rather, they often connect consumers with farm owners rather than agricultural labourers (Alkon & McCullen, 2010). This highlights that eco-eating alone, unless paired with equality-supporting policies, will not resolve these inequities or barriers to participation.

2.3.2 Gendered Inequity in Eco-Eating Practices

Gender also has a significant effect on participation in eco-eating (Pinto et al., 2014), as ethical consumption and eco-eating are closely linked to femininity (Cairns & Johnston, 2015). In general, women tend to be more willing than men to engage in eco-eating activities like practicing vegetarianism and eating organic food (Lea & Worsley, 2008; Pinto et al., 2014). Gender has been found to be the strongest predictor of willingness to reduce meat consumption, perhaps because meat is often associated with strength and power and is considered an archetypal masculine food (Tobler et al., 2011). Beyond merely participating, women state that they are also more willing than men to embrace lifestyle change and pay *more* for products with lower environmental impacts (Pinto et al., 2014). In part, this may be due to the fact that women attach more importance to values of self-transcendence like social justice and environmentalism, whereas men often attach more importance to self-enhancement values like success and ambition (Pinto et al., 2014).

This tide is now turning, as in recent decades, men have generally increased participation in household food activities, and knowledge of food politics is now a legitimate form of expression of masculine identity in parts of western culture (Puska, Kurki, Lähdesmäki, Siltaoja, & Luomala, 2016). Despite this increase in participation, however, gender differentiation remains a major force in food media and eco-eating (Johnston & Baumann, 2015). Preparation of food in home kitchens largely remains feminine work, and women dominate the practice of food blogging (Johnston &

Baumann, 2015). This division of labour allows “foodie men” to consider relationships with food as hobbies and interests, as opposed to the obligatory relationship many women associate with the practice because of traditional gender roles (Johnston & Baumann, 2015).

In light of the gendered differences in relationships with food, proponents of eco-eating often suggest that it would be most effective to promote the practice to women given women’s greater demonstrated interest in environmental issues and willingness to change, as well as women’s continued role leading household decision-making about food (Tobler et al., 2011). Cairns and Johnston (2015) warn that we must avoid the temptation to un-equally promote eco-eating towards women as a means to reducing the environmental impact of the food system. At the household level, pressures to protect family health *and* the environment through dietary choices often falls on women: an unfair burden of responsibility (Cairns & Johnston, 2018). By over-emphasizing the importance of consumer-driven change, particularly through eco-eating, we risk creating economic and emotional burdens for women who feel responsible for addressing systemic environmental problems through everyday food choices that are already time-consuming, and typically contradictory and confusing (Cairns & Johnston, 2015).

2.3.3 Tensions Between Private Consumerism and Public Good in Eco-Eating Practices

The shifting public priority towards eco-eating is characterized by the tension between consumerism (maximizing personal outcomes) and citizenship (responsibility for a larger group) (Johnston & Baumann, 2015). Eco-eaters often feel they have minimized this tension through a “win-win”, in which eco-eating is positioned as environmental citizenship *and* as a way to maximize personal benefits by enjoying high-quality, healthy, and delicious foods (Johnston & Baumann, 2015). However, the 'vote with your fork' phenomenon has been criticized for coming at the expense of genuine political reform and more radical change (Alkon, 2008; Cairns & Johnston, 2018; Rotz, 2018).

Eco-eating is a neo-liberal form of environmentalism that relies on market mechanisms, that are in-turn dependent on informed consumers' self-interest, as the driver of environmental protection for the common good (Johnston & Baumann, 2015). In this way, eco-eating is an "individualized response to collective threat" (Szasz, 2007, p. 4), a phenomenon described at length by Szasz (2007) in *Shopping Our Way to Safety*. Szasz (2007) argues that environmentally focussed ethical consumption is a "strange, new, mutant form of environmentalism" (p. 3). Through this framing, in the presence of environmental risks like climate change, individuals engage in self-protection by purchasing specific 'safe' products, effectively removing themselves from the responsibility of leading broader political change to reduce the threat (Szasz, 2007). This point is highlighted by Whitmarsh, Seyfang, and O'Neill (2011), who found that over 90% of respondents to their survey about public engagement with climate change had never written to their Member of Parliament nor taken part in a protest about an environmental issue. Of course, citizen action about any issue is uncommon, so citizen inaction may not be unique to the environmental sphere (Whitmarsh et al., 2011). The risk here is that focussing on ethical consumption as an approach to climate change mitigation may mean that climate-motivated-eaters feel they have 'done enough' to address climate change and may not participate in other high-impact actions (see Project

Drawdown, 2019). Further, by prioritizing consumer choice as a solution to market failures (i.e. the environmental impacts of food production), we risk underemphasizing the importance of solutions from the public sector and market regulation (Johnston & Baumann, 2015). Therefore, we must be cautious when advocating for climate-motivated-eating as an easy, market-based solution where consumers "vote with our forks" to reorganize the food system and mitigate climate change (Johnston & Baumann, 2015).

2.3.4 The Risks of Ineffective Climate-Motivated-Eating for Mitigating Climate Change

Under the current pressure to mitigate climate change, there are great risks to using ineffective climate-motivated-eating strategies as mitigation tools. If climate-motivated-eating strategies are misguided, the result is not inconsequential, but rather may exacerbate climate change by increasing overall GHG emissions directly or through the rebound effect, green fatigue, and failing to meet our food system challenge. Ineffective climate-motivated-eating strategies could "lead environmentally-conscious consumers to systematically purchase high-carbon footprint food items whilst believing them to be low-carbon" (Panzone et al., 2016, p. 327). By disregarding the *entirety* of the life cycle impacts of food products or focussing on irrelevant metrics "there are risks that individual local food movements may lead to outcomes that are inconsistent with their intentions" (Hiroki, Garnevska, & McLaren, 2016, p. 480).

Another risk to widespread but ineffective climate-motivated-eating is the phenomenon of *green fatigue*, or individuals' tendency to ignore environmental guilt: in this situation eco-eaters may feel as though we have "done enough" to mitigate climate change. Szasz (2007) explains that when individuals participate in activities like climate-motivated-eating, “the feeling, correct or not, that they have done something effective … reduces the urgency to do something more about what, until then, felt threatening to them” (p. 195). Therefore, as consumers, our *intention* to reduce GHG emissions is irrelevant from the perspective of the environment (Szasz, 2007). As demonstrated by Wynes & Nicholas (2017), systematic failures on the behalf of science communicators to adequately educate the public about how our choices impact the environment, or persuade us to change, is a missed opportunity to mitigate climate change.

2.3.5 Considering All This, Should we Still Pursue Climate-Motivated-Eating for Climate Change Mitigation?

Despite these criticisms, I maintain the importance of large-scale dietary change for mitigating climate change, and given the slow response of governments, the realistic perspective that this dietary shift must be largely driven by consumers. Changing patterns of consumer demand at smaller scales often influence actions taken by larger-scale actors, like institutional food vendors (e.g. universities, hotels, and hospitals) and governments, thereby expanding the efficacy of consumer-driven action (Gordon et al., 2017; Pullman & Wikoff, 2017; Williams, McMurray, Kurz, & Lambert, 2015). There remains great potential for individual action to be a meaningful component of global efforts to mitigate climate change (Whitmarsh et al., 2011). Indeed, many governments have a strong policy preference for voluntary individual behaviour change, encouraged through economic and information approaches, rather than top-down regulation to reduce GHG emissions (Whitmarsh et al., 2011). Further, in the current global political climate characterized by a general reluctance to commit to meaningful policies to mitigate climate change, there is some imperative for individuals (with the ability) to minimize our GHG emissions through personal actions, while also simultaneously supporting more far-reaching government efforts.

Although there are important criticisms and disadvantages to prioritizing climate-motivated-eating, it is critical that we explore all possible avenues to fight the climate crisis. Climate change requires urgent solutions given that the opportunity is waning to minimize its severity. In the context of arguments that we must abandon capitalism, or rewire our democracies, the urgency suggests that we must act immediately with the tools and functions of current society, while striving to improve them (Hayhoe & Schwartz, 2017). Another reason to support climate-motivated-eating as a climate change mitigation strategy is that it can often work towards more than one goal on our societal to-do list: improving and supporting environmental protection, animal welfare, and global social justice. Further, climate-motivated-eating, particularly in the form of reduced meat consumption, may contribute to substantial societal health improvements and reductions in the economic and emotional costs of the burden of disease (Orlich et al., 2013).

2.4 Exploring Consumer Climate-Motivated-Eating Behaviour

Due to the concern that climate-motivated-eaters may not know how to achieve our goals of mitigating climate change through dietary change, I wish to recognize and examine the complexity of individuals' food purchasing decisions, to contextualize why consumers often make inaccurate assumptions about the GHG emissions associated with our food purchases.

2.4.1 The Role of Heuristics

While there is great potential for climate-motivated-eating to mitigate climate change, interested consumers' ability to *effectively* eat in a way that reduces our GHG emissions is hampered by factors outside our control. Three primary factors obstructing *effective* climate-motivated-eating are: 1) consumers do not have full access to information about food production; 2) consumers are often pressed for time, straining our ability to compare between conflicting goals of price, nutrition, taste, animal welfare, environment etc.; 3) in the absence of useful information and the time and cognitive space to consider all information, consumers behave automatically when purchasing food, using often ineffective heuristics to guide climate-motivated-eating.

2.4.1.1 Consumers do Not Have Full Access to Information About Food Production

Individuals who wish to reduce our personal GHG emissions through climate-motivated-eating face the challenge of doing so effectively in the absence of complete, or even partial information about a food's environmental impact provided to us at the point of purchase. In order for consumers to effectively estimate the GHG intensity of a food choice, we would have to consider a huge number of factors that contribute to its impact (e.g. transportation method, source of electricity, time in refrigeration etc.) (Panzone et al., 2016; Tobler et al., 2011). This estimation would necessitate that we understand the supply chain in order to determine which stages are most impactful, and upon what factors we should base our decision (Panzone et al., 2016), yet most consumers have little knowledge about the global food system's vast complexity (Cairns & Johnston, 2018; Tobler et al., 2011). Consumers can hardly be blamed for this lack of understanding, since the processes of food production are so obscured, and it is virtually impossible to determine many aspects of a food's production (e.g. was it farmed with high-till or no-till soil management?) (McWilliams, 2009), especially when shopping in conventional supermarkets or for highly processed diets. With incomplete information, environmentally motivated consumers struggle to understand the environmental impact of different food options, and so must make our decisions based on inferences (Panzone et al., 2016). This plight of climate-motivated-eaters is well summed up by McWilliams:

> In so many ways we're staring into a black hole, perceiving almost nothing about the precise methods and underlying ecologies of growing and processing the food we see in the market, be it a farmer's roadside stall or an endless Wal-Mart aisle. (McWilliams, 2009, p. 189)

This all points to the fact that while there is growing interest among consumers to eat more sustainably, there is a lack of knowledge about how to do so (Mancini, Marchini, & Simeone, 2017; Panzone et al., 2016). In contrast to this lack of transparency, consumers in many countries benefit from government-mandated nutrition labels on foods, offering insight into food products' characteristics (e.g. caloric and vitamin content) that we would otherwise have no way of knowing.

2.4.1.2 In the Absence of Information, Consumers Rely on Heuristics to Guide Climate-Motivated-Eating

Shopping for food can be an overwhelming experience; supermarkets often stock over 45,000 items (Smith & MacKinnon, 2007). Further, many consumers are engaging in increasingly complex decision-making by incorporating climate-motivated-eating priorities into our shopping decisions (Hwang et al., 2010). Therefore, it is understandable that in the absence of information about the environmental impact of food production, consumers rely on heuristics: behavioural rules of thumb that can be used to simplify a problem (Lazzarini et al., 2016; Polizzi di Sorrentino et al., 2016; Vermeir & Verbeke, 2008). Heuristics are formed through personal experience, but are often imprecise, oversimplified, and based on faulty assumptions (Panzone et al., 2016; Polizzi di Sorrentino et al., 2016; Vermeir & Verbeke, 2008); therefore, when heuristics guide climate-motivated-eating they can result in biased decisions or accurate judgments (Lazzarini et al., 2017). Often, brands, labels, or quality markers perform the function of heuristics by signalling characteristics of foods (e.g. quality or sustainability) thereby simplifying decisions for us as consumers (Mancini et al., 2017; Polizzi di Sorrentino et al., 2016; Vermeir & Verbeke, 2008). For example, simple branding choices like including green-coloured or earth-toned labelling and bucolic imagery on packaging can signal an environmentally conscious message to us as at the point of purchase.

The use of heuristics can also be explained by the fact that individuals' dietary patterns are shaped by cultural contexts and social structures, and day-to-day food decisions are dominated by intuitive cognition, rather than slower, deliberate processes of reflection (Cairns & Johnston, 2018). We make food choices very frequently, so it cannot be expected that consumers will extensively deliberate every food decision (Vermeir & Verbeke, 2008). Therefore, we behave automatically when purchasing food, with behaviour that may be irrational and biased, yet is habitual (Polizzi di Sorrentino et al., 2016; Stranieri et al., 2017), which often leads to repeating past behaviour without considering current goals (Duhigg, 2012).

Another important component of consumer behaviour around climate-motivated-eating is the *halo effect*. In this context, the halo effect refers to how learning about one positive attribute of a food product can promote further positive perceptions of it that may be unwarranted (Schuldt & Hannahan, 2013). The halo effect often causes consumers to draw illogical inferences about food products; in the health literature it is well-documented that labeling foods “low fat” or “no cholesterol” can lead consumers to (incorrectly) perceive these foods as being low-calorie (Schuldt & Hannahan, 2013). Similarly, cookies labelled as “organic” are often perceived as lower calorie than non-organic cookies (Schuldt & Schwarz, 2010), suggesting the existence of a halo effect for organic products (Lazzarini et al., 2016).

2.4.2 The Role of Virtue Signaling

In many Western societies, ethical consumption is viewed as a pro-social activity: an altruistic behaviour that benefits other people (Puska et al., 2016). By publicly and conspicuously participating in ethical eating, consumers are *virtue signalling:* expressing our social and environmental commitments through food choice (Johnston & Baumann, 2015). This is significant because displaying altruistic behaviour through the costly signal of ethical consumption can allow individuals to gain social status when the act is visible to others (Pinto et al., 2014; Puska et al., 2016; Vermeir & Verbeke, 2008).

While it has traditionally been assumed that food choices are practical rather than symbolic, contemporary research suggests otherwise (Puska et al., 2016). Rather, food choices are often expressions of our identities, values, and lifestyles (Puska et al., 2016). By allowing individuals to meet and exceed group norms, ethical eating distinguishes us from others in our social groups that do not participate (Pinto et al., 2014), and allows us to join groups that do participate. Although women are more likely to participate in ethical eating, men may participate more keenly when ethical eating is understood as the ‘in-group’ behaviour (Pinto et al., 2014). While eco-eaters are mainly young, female, well-educated, and members of households with high annual income, research also suggests that motives for participation in eco-eating are related to status and reputation (Pinto et al., 2014). Recent food sales have suggested that labels like “natural” and “organic” influence purchasing behaviour as consumers react to social pressure to exercise our environmental responsibilities through eco-eating (Johnston & Baumann, 2015).

The importance of virtue signalling to climate-motivated-eating should not be understated. Because conspicuous eco-eating is often a signal of wealth, eco-eating can signal both social status (Puska et al., 2016), and one’s commitment to addressing environmental issues (Johnston & Baumann, 2015). It is well-documented that consumers are more willing to purchase “sustainable” products and promote pro-environmental behaviour when the act is visible to others (Pinto et al., 2014; Puska et al., 2016). For example, Puska and colleagues (2016) found that consumers were more motivated to buy eco-products when shopping in public, and surprisingly these consumers preferred to publicly purchase *more expensive* eco-products rather than cheaper conventional products. Despite the well-recognized presence of virtue signalling, consumers do not usually self-identify as eco-eating for status reasons, but rather claim to do so for improved health, taste, food safety, and reduced environmental impacts (Puska et al., 2016). Regardless, the power of virtue signalling could prove helpful for increasing public participation in climate-motivated-eating if it continues to be viewed as a pro-social and admirable activity.

2.4.3 The Impact of Cultural Attachment to Foods With High GHG Emissions

A major challenge for reducing the GHG emissions from the food system is the profound cultural attachment so many communities experience with meat, which results in relatively high GHG emissions. For countless cultures, meat is consumed for many reasons other than nutrition, as it is associated with socially constructed meanings of pleasure, and the expression of values relating to personal identity (especially to express masculinity), socio-economic status, and culture (Graça, Calheiros, & Oliveira, 2015; Macdiarmid et al., 2016; Pilgrim, 2013). The ceremonial nature of meat in Western culture is highlighted by meat being the centerpiece of meals, while other foods are considered 'side dishes' (Graça et al., 2015; Tobler et al., 2011).

Given this strong cultural attachment, policies to encourage climate-motivated-eating must be cognizant of the difficulty of shifting cultural patterns away from meat. While the full elimination of animal products from global diets could substantially reduce GHG emissions from food systems (more on this in **Chapter Four - Results**), this situation would be culturally unpalatable to the majority of the global population (de Boer et al., 2014; Reynolds et al., 2017). Even for climate-motived-eaters, our relationship with meat will remain complex, and its cultural importance may sometimes be too significant to incorporate its environmental impact into decision-making about its consumption. Therefore, climate-motivated-eating strategies may be more effective and widely practiced if we advocate for individuals to eat *fewer* animal products rather than none at all, allowing for some culturally important meat consumption.

2.4.4 How Does Consumer Behaviour Affect the Potential of Climate-Motivated-Eating?

Further complicating the situation, aware of how heuristics, the halo effect, and virtue signalling affect consumer behaviour, marketers often engage in *greenwashing:* exaggerating the environmental sustainability of products (Rosenbloom, 2018). In general, consumers struggle to differentiate between meaningful labels and greenwashing (Upham et al., 2011). It is therefore genuinely difficult for interested consumers to read past misleading claims, think critically, overcome the halo effect, and shift our heuristic habits to make "well-informed" decisions about what to eat to lessen the GHG emissions of our consumption.

The complexity with which consumers make food purchasing decisions is very relevant to this project. Because consumers are unlikely to perceive the accurate environmental impact of food products, there is a great challenge in translating public *motivation* to reduce diet related GHG emissions to *effective* mitigation through dietary change (Panzone et al., 2016). However well-meaning consumers are when we use these heuristics, flawed consumer approaches to addressing climate change may have serious negative consequences by failing to adequately mitigate emissions. This concept is explained by Gordon et al. (2017), who describe that consumers are not well positioned to protect the environment through sustainable purchasing because "the system does not afford them the signals and transparency needed to do this" (p. 5).

All of this information about the difficulty of shifting consumers' heuristics should not lead us to abandon shifting dietary patterns as a strategy for mitigating climate change. Given the difficulty of accurately assessing the GHG emission realities of food products (because of the high cost and time-intensive nature of conducting LCAs), we should assume that foods will not be labelled with their respective GHG emissions in the near future. Therefore, climate-motivated-eaters will have to continue to rely on heuristics to guide our choices. Further, from the perspective of mitigating climate change as quickly as possible, dietary choices will likely remain unregulated; regulatory approaches to reducing the GHG emissions of diets would likely be limited to governments enacting carbon taxes on food or rationing high-emitting foods, which would both be politically unpopular. Therefore, the public's understanding of *effective* climate-motivated-eating heuristics may be our greatest hope to reduce the GHG emissions of contemporary diets.

Given the importance of effective action to mitigate the GHG emissions of diets, and the likelihood that this challenge will be tackled through heuristics, we must understand which heuristics are currently being used by the public to address climate change through dietary choice. Particularly because there is evidence that commonly used heuristics intended to reduce the environmental impact of food choices may be ineffective in achieving our goals.

2.5 Climate-Motivated-Eating Heuristics Often Misalign With GHG Emissions

There is potential for large-scale changes in dietary patterns to either increase or reduce the GHG emissions of the food system. Therefore, it is critically important to understand the efficacy of current climate-motivated-eating strategies in achieving our goal of reducing GHG emissions from diets. Although awareness of climate change is relatively widespread, there remains a need for improved public understanding of how individuals can effectively reduce our GHG emissions (Whitmarsh et al., 2011). Of concern is the extent to which the public is 'carbon capable' (Whitmarsh et al., 2011). In addressing this, Whitmarsh and colleagues (2011) found that, in the UK, the public's "carbon capability is below the levels required for active citizen engagement with climate change which would lead to carbon-reduction activities" (Whitmarsh et al., 2011, p. 65). Further:

> Consistent with previous literature on public engagement with climate change and carbon, we find that carbon is not a salient consideration in everyday decision-making, that misperceptions exist, and that the disparity between knowledge and behavior (the 'value-action gap') would suggest certain barriers constrain the ability of even knowledgeable and motivated individuals to act. (Whitmarsh et al., 2011, p. 63)

2.5.1 Examples of Mismatched Impact and Intention in Other Literature

Several studies highlight the phenomenon of popular, yet ineffective, strategies being promoted to mitigate climate change. One such example is a recent study conducted by Wynes and Nicholas (2017), who researched Canadian high school science textbooks and government resources to identify the most commonly communicated strategies for minimizing individuals' contributions to GHG emissions. The authors found that these texts promoted strategies that had little impact for climate change mitigation (Wynes & Nicholas, 2017). Specifically, Wynes and Nicholas (2017) found that in textbooks, the most effective strategies for reducing GHG emissions (e.g. avoiding air travel or having fewer children) were only mentioned 4% of the time; the other 96% of recommendations were moderate or low-impact actions (e.g. recycling or conserving electricity). Of the government resources studied, none suggested high-efficacy strategies like having fewer children or eating a plant-based diet, but rather had a strong focus on moderate-level actions like reducing home energy use or cycling more frequently (Wynes & Nicholas, 2017). The scale of these strategies is almost incomparable: "A US family who chooses to have one fewer child would provide the same level of emissions reductions as 684 teenagers who choose to adopt comprehensive recycling for the rest of their lives" (Wynes & Nicholas, 2017, p. 3)

This phenomenon of communicating lower-impact individual actions is prevalent, yet has a dangerous side (Thøgersen & Crompton, 2009; Wynes & Nicholas, 2017). As Whitmarsh and colleagues (2011) found, individuals commonly conserve energy in their own homes but are reluctant and unlikely to change higher-impact behaviours like air travel and shopping habits. Perhaps this reluctance is because high-impact actions (e.g. avoiding air travel) may be politically and culturally unpopular, or governments may be trying the "foot in the door technique", premised on encouraging small actions that may later lead to more substantial behavioural change (Thøgersen & Crompton, 2009; Wynes & Nicholas, 2017). However, neither reason justifies promoting low-impact strategies at the expense of high-impact ones. Rather, for individuals willing to make lifestyle changes for the sake of mitigating climate change, it is imperative that we be aware of the most effective actions so we can be empowered to make *meaningful* reductions to our personal GHG emissions (Wynes & Nicholas, 2017). Indeed, to mitigate climate change to prevent catastrophic environmental crises, it is necessary for society to adopt *significant* lifestyle changes (Thøgersen & Crompton, 2009).

2.5.2 How Climate-Motivated-Eating Strategies Misalign with GHG Emissions

I hypothesize that there is a misalignment in the intention of some, and perhaps many, popular climate-motivated-eating strategies and their actual GHG emission reduction potential, and that some climate-motivated-eaters may make choices that *unintentionally* increase GHG emissions. This concern was well summed up by McWilliams a decade ago:

> Over the past decade or so, largely under the guidance of locavores, we have searched for precise guidelines for how to eat. In undertaking this important mission, we have identified the right goal – sustainable food production – while jumping the gun on how to pursue it. What we thus often end up doing is swallowing whole a bumper-sticker mantra – eat local, buy organic, support fair trade, damn Frankenfoods – without fully examining the effect of universalizing these impassioned imperatives. It rarely occurs to us as we contemplate our dietary values that the current options might be inadequate, or even counterproductive. The virtue we currently feel as a result of our green culinary decisions, is, I fear, a false virtue. (McWilliams, 2009, p. 213)

If we promote climate-motivated-eating as an approach to mitigating climate change, it is useful to understand what criteria consumers use to evaluate the GHG impact of foods, and how well these estimates reflect actual emissions as determined through tools like LCA (Lazzarini et al., 2016). To this point, there have been few studies seeking to understand which heuristics consumers use when making GHG emission assessments of food (Lazzarini et al., 2016). In the limited studies conducted on this subject, it has been found that consumers base assessments of a food's environmental impact on the type of product (e.g. vegetable or meat products), organic labelling, seasonality, and proximity of production (Lazzarini et al., 2016; Tobler et al., 2011). Further, as consumers we tend to infer the environmental impact of food based on its price and the reputation of the retailer or supplier (Panzone et al., 2016). Research has also shown that consumers are concerned about the environmental impact of plastic food packaging, food waste, and industrial pollution from large-scale food production and retailing (Macdiarmid et al., 2016). Importantly, information related to these criteria is readily available at the supermarket, reinforcing that consumers can only make inferences about the environmental impact of foods based on the information available to us.

The aforementioned strategies are sometimes effective in achieving the goal of reducing GHG emissions from dietary choices, but they can also lead to systematic mistakes (Lazzarini et al., 2017). For example, numerous studies on individuals' understanding of the GHG emissions of dietary choice have found that people often underestimate the impacts of meat consumption, and thereby underestimate the environmental benefits that could be achieved by lowering our meat consumption (de Boer et al., 2016; Lea & Worsley, 2008; Macdiarmid et al., 2016; Reynolds et al., 2017; Whitmarsh et al., 2011). Among individuals who actively seek to reduce our GHG emission contributions by climate-motivated-eating, we tend to have a great deal of misunderstanding of the *relative* impacts of dietary choices like reducing meat consumption, eating organic and local foods, and minimizing food packaging (de Boer et al., 2016; Lea & Worsley, 2008). The literature suggests that consumers' climate-motivated-eating strategies do not necessarily reflect the actual GHG emissions of food items as found through LCAs (recognizing that the limited number of LCAs are often inaccessible to the public due to academic journal paywalls) and suggest that consumers lack accurate understanding of the GHG emissions of dietary choices (Tobler et al., 2011).

The aim here is not to criticize ineffective climate-motivated-eating, but rather to make the case that we should empower consumers to make effective choices. It is fully understandable that the public, faced with incomplete and conflicting information in the context of cultural attachment to many foods, is not well-equipped to accurately select foods in a way that reduces our GHG emissions. For example, misunderstandings about the impact of meat consumption can be explained in part by the fact that:

> Communicating information on these links [between meat consumption and climate change] appears to be a challenge for science … as it requires some understanding of the whole production process (e.g. the inefficient conversion of plant protein into meat protein, the impacts of fertilizer use and of methane produced by livestock). (de Boer et al., 2016, p. 6)

While understandable, in the context of our climate crisis and food system challenge, it is essential to correct public misunderstandings about the GHG emission consequences of dietary choices. Individuals who genuinely wish to reduce our contributions to climate change through climate-motivated-eating should be empowered to achieve our goals effectively.

2.6 Utility of Social Media as a Data Source for This Research

One means through which climate-motivated-eating strategies are communicated and propagated around the world is through social media. My research examines, in part, which dietary strategies with the aim of reducing climate change are communicated on Twitter and Instagram. In 2016, 3.4 billion people globally were online (Murphy & Roser, 2019), and the Internet is "without a doubt, the single most important, rapid change in communications, learning and interconnection in human history" (Kozinets, 2015, p. 13). Beyond merely having Internet access, more than 2.5 billion people now use social media, and it is projected that by 2021 there will be 3 billion users (Pilař et al., 2018a). Social media use is particularly prevalent in the US, where as of January 2018, a form of social media was used by 88% of American 18-29-year-olds, 78% of 30-49 year-olds, 64% of 50-64 year-olds, and 37% of people aged 65 and older (Smith & Anderson, 2018). Using social media is one of the most accessible ways that individuals from all perspectives can publicly share our thoughts (Cody, Reagan, Mitchell, Dodds, & Danforth, 2015). Because of the Internet, our access to information has exploded, however, our ability to critically evaluate this information remains in question (Rosenbloom, 2018). The ability of anyone with Internet access to share anything on social media provides an interesting context for researchers to examine current worldviews. Social media are major communication platforms and offer this research numerous benefits including avoiding survey bias and drawing from a wide global dataset.

2.6.1 Large Sample Size

A primary advantage of studying social media is that it allows examination of the perspectives of a very large sample of individuals. Because the Internet is widely accessible, studying online content allows quick collection of a huge amount of information, at very low cost (Kirilenko & Stepchenkova, 2014; Medaas, 2014). More traditionally, a study researching popular climate-motivated-eating strategies would have been conducted through expensive and logistically difficult surveys, a mode of data collection which has suffered steep declines in response rates since the 1970s (Stedman, Connelly, Heberlein, Decker, & Allred, 2019). Given the challenges of these traditional forms of data collection, researchers interested in answering questions like mine are increasingly drawn to social media to assess public opinion and sentiment from large samples of respondents (An et al., 2014; Kirilenko & Stepchenkova, 2014; Pak & Paroubek, 2010; Pilař et al., 2018a; Pilař et al., 2018b). Studying social media allows researchers new opportunities to examine patterns of public discourse (Kirilenko & Stepchenkova, 2014), and provides researchers with very large sets of "highly dynamic data, which, unlike … surveys, are not explicitly produced for scientific study" (Borra & Rieder, 2014, p. 2).

Importantly, demographic groups (e.g. age, gender, race) are not equally represented on social media relative to their proportion in society. Consequently, researchers must be cautious when extending conclusions from social media discourses to the general population (Dyar, Castro-Sánchez, & Holmes, 2014). Individuals who share climate-motived-eating strategies on social media may enjoy relatively high levels of income and education (Medaas, 2014). Not only does this bias influence the content they share, but also the ability of their interested readers to participate in climate-motivated-eating, since financially or temporally intensive climate-motivated-eating strategies may not be feasible for all readers to implement (Medaas, 2014). Further, while social media's impact on public sentiment is likely greatest in regions with high levels of Internet use, impacts will still be present in regions with lower Internet use; in these regions, individuals with access to the Internet are likely to hold influence in their communities (Williams et al., 2015). Thus, social media is another space in which the structural realities of class divisions may prohibit equal participation in climate-motived-eating (Medaas, 2014).

2.6.2 Social Media as a Place for Learning and Sharing Ideas

Social media are used by the public, in part, to learn and share ideas, making these platforms a natural fit and a rich data source for studying public sentiment (Pak & Paroubek, 2010). In general, social media offer individuals opportunities to share our unfiltered and varied ideas, values, behaviours, experiences, and opinions with the public in real-time (Bouvier, 2015; Kang et al., 2017; Medaas, 2014; Pilař et al., 2018b). Further, the general public (in the form of readers), increasingly use social media as a source of information (Cody et al., 2015). In Wallsten's (2008) study of political blogs, he identified four roles served by blogs, and I argue that these roles are also performed by social media: 1) transmission belts (posts link to news articles); 2) soapboxes (users share their political opinions); 3) mobilizers (readers are encouraged to participate in real-world action); 4) conversation starters (conversations about posts occurs in comments).

Some have argued that the increasing use of social media to create and access news has produced a form of hybrid journalism; rather than passively consuming news, the public now actively (re)produces news (O'Connor, 2017; White, 2013). Indeed, early Internet researchers were hopeful that online conversations would decrease "big media's" control and increase the public's ability for self-representation and expression in news that concerns us (Bouvier, 2015). Considering Szasz's (2007) analysis of citizen-consumers, communicating about climate-motivated-eating on social media may further hybridize the citizen-consumer; in this context, consumers take an activist approach to consumption and share their climate-motivated-eating strategies with others through self-expression on social media.

With respect to climate-motivated-eating, social media provide new platforms for persuasion and virtue signalling, and act as a forum for sharing messages about food and environment (Kang et al., 2017; Medaas, 2014). In the context of social media posts referring to climate-motivated-eating, users are often behaving as educators by sharing recipes, articles, and strategies for climate-motivated-eating, perhaps with the intention of teaching and changing the behaviour of like-minded readers (Medaas, 2014). Considering this, social media has a potentially transformative ability to facilitate the sharing of ideas. Despite all this, climate change sentiment on social media remains understudied and poorly understood (Abbar, Zanouda, Berti-Equille, & Borge-Holthoefer, 2016; Cody et al., 2015; Williams et al., 2015), and the same is true for discussions of food on social media (Medaas, 2014).

2.6.3 Accessing Unsolicited Opinions

Since social media posts are voluntarily created and shared by users (Jang & Hart, 2015), studying social media can be akin to “an unsolicited public opinion poll” (Cody et al., 2015, p. 1). Further, because there is no solicitation for users to post content, social media data can be understood as reflecting the natural perspectives, experiences, and intentions of users (Abbar et al., 2016; Medaas, 2014). This allows for non-intrusive access to “responses” that are unaffected by researcher presence or the structure or content of interview questions (Kirilenko & Stepchenkova, 2014; Medaas, 2014). Importantly, researchers still exert bias through the design of social media data collection tools and through the process of analyzing social media posts.

This reduced researcher interference is particularly helpful in studies about what people eat. It is well-understood that with self-reported data about dietary composition, people misreport their consumption (Hallström et al., 2015), and are "notoriously unreliable [when] accounting for their own behaviour around food" (Pinchin, 2018, p. 36). In part, people misreport their food consumption to researchers because they want to look virtuous (e.g. by reporting that they eat a healthier diet than may be true), and due to the deeply habitual nature of food shopping (Pinchin, 2018). Of course, identity creation and enhancement are ubiquitous on social media, but by studying what people post on social media without solicitation, researchers themselves are not responsible for introducing this bias in the dataset.

2.6.4 Social Media Conversations Reflect Those in the 'Real-World'

Several studies have highlighted that social media conversations reflect real-world phenomena, offering valuable insight into users' perspectives and experiences (Kang et al., 2017; O'Connor, 2017). For example, public mood is known to be affected by holidays or major events like elections. Bollen and colleagues (2011) examined how posts shared to Twitter (i.e. Tweets) reflect public mood; they found that three days prior to the 2008 US presidential election, there was a substantial drop in Tweets about feeling "calm", and a general increase in anxious online discourse (Bollen, Mao, & Zeng, 2011). Public sentiment was shown to change again on election day through an increase in posts about feeling energized and friendly (Bollen et al., 2011). The authors therefore suggest that "public mood can indeed be tracked from the content of large-scale Twitter feeds by means of rather simple text processing" (Bollen et al., 2011, p. 7). Another example of how social media reflects the real world is through the demonstrated correlation between Tweets about having the flu, and real-world flu epidemics (Aramaki, Maskawa, & Morita, 2011). Further, Medaas (2014) found that discussions of eco-eating on food blogs were very similar to Johnston and Baumann's (2010) results from semi-structured interviews about ethical eating. Medaas (2014) viewed this as a testament that food blogs reflect real-world sentiments, and I expect that climate-motivated-eating strategies shared on social media similarly reflect statements that would be made by the same people in 'real-world' contexts.

It is important we understand how climate change is discussed online because online climate change sentiment is likely to both reflect *and* affect real-world climate debate (Jang & Hart, 2015; Veltri & Atanasova, 2017; Williams et al., 2015). This imperative is well summarized here:

> As stakeholders from scientists to policy-makers increasingly turn to social media to disseminate information about climate change and mobilise support for (in)action on climate change and members of the public increasingly use social media, the climate change discourse on social media becomes a priority research area. (Veltri & Atanasova, 2017, p. 1)

By studying public discourse on social media, we only examine individuals' *intention* to reduce their GHG emission contributions through climate-motivated-eating; there is no guarantee that behaviour will align with this intention, except in cases where individuals share photos of their food choices. Despite this, I maintain that understanding what people *think*, without considering what they *do*, is an important form of research. Similar criticisms could be made of more traditional survey methods; by studying behaviour with surveys, researchers only examine the *intention* to behave in a certain way, through the filters of what respondents view as socially acceptable answers (Polizzi di Sorrentino et al., 2016). By understanding what people think, we can more effectively target education of mitigatory climate-motivated-eating strategies.

2.6.5 Specific Advantages of Studying Twitter and Instagram

There are numerous social media platforms, and Bouvier (2015) recommends to "avoid working in a way which isolates single instances of social media use, or making generalisations about 'social media' from one specific type of platform which itself is always evolving" (p. 158). Following this recommendation, my research examines climate-motivated-eating strategies shared on Twitter and Instagram for a more thorough, though ultimately incomplete, characterization of social media discourse.

Importantly, Twitter and Instagram are used by different demographics of people and for different purposes. Twitter is primarily used to share news and ideas, and users often share posts written by *other people* through linking to websites or re-Tweets. In contrast, Instagram is a lifestyle-based platform, and all posts contain an image, often accompanied by a written caption, both of which are usually the posting user's original content since the platforms lacks an integrated repost function.

2.6.5.1 Context of Twitter

Twitter was launched in July 2006 and quickly became one of the world's fastest-growing websites (Sakaki, Okazaki, & Matsuo, 2010). Twitter has emerged not only as a respected data source for researchers (Kim et al., 2013), but also as a culturally important repository of information – Twitter has donated its entire archives to the US Library of Congress (Borra & Rieder, 2014). The cultural importance of this platform should not be understated; in recent years important political decisions have been announced on Twitter, and it is currently one of the most significant communication platforms in the English-speaking world.

In January 2019, 44% of Americans aged 18-24 were using Twitter, compared with 22% of the total US adult population (Perrin & Anderson, 2019). In 2018, Twitter had around 350 million monthly active users worldwide (Twitter, 2019). Of course, not all demographic groups are equally represented on Twitter, and current users “are mainly young, adult, middle-class males” (Dyar et al., 2014, p. 2). In 2019, only 7% of surveyed Americans over 65 years old use Twitter (Perrin & Anderson, 2019). However, Twitter is an increasingly global application; in 2018, 79% of all Twitter users were located *outside* the US (Twitter, 2019), while in 2009, 62% of users were located *within* the US (Paul & Dredze, 2011). Many factors influence national rates of Twitter use: population size, Internet accessibility, and the local popularity of Twitter (Kirilenko & Stepchenkova, 2014). The demographics of Twitter may skew the results of research conducted on a global scale (Paul & Dredze, 2011), however it should be remembered that while it may not represent all social groups, Twitter’s usership continues to expand rapidly (An et al., 2014).

Beyond sheer numbers of users, Twitter’s popularity facilitates the sharing of information and conversations among citizens, government agencies, politicians, activists, and opinion-makers (An et al., 2014). Different topics of conversation are dominated by different demographics of users, which in turn do not necessarily represent the demographics of Twitter as a whole. Therefore, due to the differences in the use of Twitter between countries and among individuals, we must remain cautious about generalizing the results of global-scale studies to any particular community (Kim et al., 2013).

There are two primary domains of information within Twitter data: details about users (e.g. location, self-written biography, and number of followers), and the content of Tweets (Kirilenko & Stepchenkova, 2014). Within Tweets, users share content they write themselves, information from external sources (e.g. news articles), conversations with other users through comments, and re-Tweets of other users' content (Veltri & Atanasova, 2017). Therefore, Twitter is a valuable resource for researchers interested in current events and headline news (Cody et al., 2015), responses to Twitter's prompt of "what's happening?" (Kirilenko & Stepchenkova, 2014), and reflections of public opinion on virtually any topic (Williams et al., 2015).

Tweets themselves were originally limited to 140 characters, but this limit was increased to 280 characters in 2017 (Tsukayama, 2017). The brevity of Tweets creates interesting challenges for users seeking to communicate complex information, and forces users to focus only on the most salient ideas (Merry, 2013). The brevity of Tweets makes Twitter a great fit for discourse analysis, and for studying public opinion on topics as they naturally occur (Kirilenko & Stepchenkova, 2014). Because users take the time to distill often-complicated messages into a single sentence, they remove content peripheral to the core message, creating a clear and coherent sound bite where all words relate to the same idea (Kirilenko & Stepchenkova, 2014; Pak & Paroubek, 2010). Of further importance to researchers is that Tweets are by default available to the public (White, 2013). This is unlike many platforms (e.g. Facebook), where content is shared only with people that users share offline social relationships with (Auer, Zhang, & Lee, 2014; Merry, 2013). Because Twitter is used both on desktops and on smartphones, the platform is accessible to users at all times (Merry, 2013). In turn, the simple nature of messages, combined with their public nature, and easy accessibility facilitates the rapid spread of information through the “Twitterverse” (Merry, 2013).

2.6.5.2 Similar Research on Twitter

Research examining public sentiment about climate change on Twitter has been conducted by a number of researchers interested in how Tweets “alternately reveal science, misapplications of science, attacks on science, and not infrequently, no science or learned content whatsoever” (Auer et al., 2014, p. 294). For example, Cody and colleagues (2015) found that people commenting on Tweets about climate change are predominantly climate change activists, rather than deniers. This suggests that Twitter is dominated by users who agree with the scientific consensus on climate change, and that the platform may be a valuable resource for spreading awareness and support of mitigation practices (Cody et al., 2015). Of course, there are challenges to using Twitter as a public education tool. This is well explained by Merry (2013) who studied Twitter discourse following the Deepwater Horizon oil spill. The author found that Tweets related to the spill focussed solely on the responsibility of BP and failed to mention how global energy demands push for more risky, deep-water drilling (Merry, 2013). These kinds of omissions result from Twitter’s brief format and simple story lines (Merry, 2013), but this brevity is also what makes Twitter a good platform for studying the simple heuristics used by climate-motivated-eaters. The value of Twitter for studying popular climate-motivated-eating strategies is supported by Auer and colleagues (2014):

> Spontaneous, unreflective commentary and unvarnished views are standard fare on Twitter and on comparable platforms… When and under what circumstances microbloggers’ impulsive tendencies give way to reasoned discourse, including science-based discourse, are worthy research questions and mostly unexplored. We urge students of climate change communications to pursue this promising line of inquiry wherever the Tweets lead. (Auer et al., 2014, p. 295)

2.6.5.3 Context of Instagram

Instagram was launched in October 2010, and following a 19-month rise in popularity, was purchased by Facebook in April 2012 (Dumenco, 2012). Today, Instagram is the fastest-growing social network, with 800 million monthly users, who share more than 95 million pictures daily and "like" a further 4.2 billion posts from Instagram's stock of 40 billion posts (Coary & Poor, 2016; Holmberg et al., 2016; Pilař et al., 2018a; Pilař et al., 2018b). Instagram is particularly popular among young people (Holmberg et al., 2016; Smith & Anderson, 2018). As of January 2019, in the United States, 75% of 18-24 year-olds use Instagram, and 37% of all American adults use the platform (Perrin & Anderson, 2019), with a 7% increase in usership between 2016-2018 (Smith & Anderson, 2018). Further, 60% of Instagram users visit the platform daily, and among 18-24 year-olds that number is 81%, with 55% visiting multiple times per day (Smith & Anderson, 2018). There is huge potential for research within all this activity (Pilař et al., 2018a).

Like Twitter, Instagram is free to use, and posts shared on Instagram are by default publicly available (Holmberg et al., 2016). Importantly, Instagram is primarily a smartphone-based application, and although it can be accessed on a desktop computer, all posts must be made on a smartphone. With Instagram, users upload images and videos, often editing these media with integrated filters, and share these images with optional captions and hashtags (Holmberg et al., 2016). Unlike Twitter's focus on brevity, Instagram captions are limited to a substantially longer 2,200 characters and 30 hashtags (Social Report, 2019). User's intention when sharing Instagram posts is primarily to share personally captured photos and videos which tend to be reflective of personal lifestyles

(Holmberg et al., 2016). Notably, Instagram does not offer in-application reposting, but users can easily employ a third-party app to repost other users' content on their own Instagram profile.

2.6.5.4 Similar Research on Instagram

Interestingly, food photographs are one of the most commonly shared categories on the platform; posts with #food totalled 800,000 in March 2013, and 183.3 million in June 2015 (Coary & Poor, 2016), 269.2 million in April 2018, and 363 million in November 2019. It is therefore surprising that there have been few studies analyzing food-related content on Instagram (Holmberg et al., 2016). One of the few such studies was conducted by Holmberg and colleagues (2016) who examined images and written descriptions of food shared by adolescents on Instagram. They found that 94.6% of sampled images were accompanied by hashtags or captions and that sharing posts about food was an important aspect of adolescents' social media experiences (Holmberg et al., 2016). The authors also cautioned about an important methodological challenge faced by researchers conducting similar studies (Holmberg et al., 2016). Private Instagram accounts are not accessible for analysis (Instagram users have the option to allow only specific individuals to view their posts) (Holmberg et al., 2016). Because Holmberg and colleagues' research could only examine public posts, the authors were unable to determine if the posts they sampled represent all Instagram communication (Holmberg et al., 2016).

2.7 Summary

Chapter Two has outlined the severity of the GHG emissions currently attributed to the global food system. This chapter has also examined the complexity of the social and cultural factors influencing the practice of climate-motivated-eating and has outlined that the broader practice of eco-eating has often been exclusionary and steeped in classism, racism, and other power dynamics. Further, consumers wishing to reduce our contributions to GHG emissions through dietary choice face barriers to doing so effectively. In the absence of accessible information about the GHG emissions of foods, consumers rely on heuristics that often lead us to choices that are ineffective in achieving our climate-motivated-eating goals. Given the imperative to mitigate climate change effectively, it is important to understand which climate-motivated-eating heuristics, or strategies, are currently being used by the public, and social media offers valuable insights for studying this. Twitter and Instagram are complementary social media platforms to study together, which will provide insight into which climate-motivated-eating strategies are commonly shared in the contemporary context.

3.0 CHAPTER THREE - METHODS

This chapter is separated into three components, beginning with a review of the ethical considerations I undertook when conducting this social media research, and following with a description of the methods used to achieve each of the following research objectives: 1) explore which climate-motivated-eating strategies are communicated in a sample of Twitter and Instagram posts, and, 2) consider the evidence that supports these strategies for reducing GHG emissions.

3.1 Ethical Considerations

At Dalhousie University, it is not required to secure approval from the Research Ethics Board to conduct social media research. Social media research continues to fall in a grey area of oversight, and researchers are generally left to their own devices to determine how to ethically study online spaces. I argue that despite a lack of formal guidelines, researchers should engage with the ethical challenges of studying social media data: even observing people in public spaces "contains its own ethical risks" (Kozinets, 2015, p. 129).

Twitter and Instagram posts collected for this study were shared publicly and are available to anyone with Internet access. Despite this, individuals whose posts are included in this study had no reason to believe that their words would be analyzed by researchers. This conflict is well-described by Kozinets (2015), who writes:

> The fact that people know that their postings are public does not automatically lead to the conclusion that they also grant automatic unspoken consent for academics and other types of scholarly researchers to use their data in any way that they please. (p. 131)

To protect the privacy of individuals whose content is included in this dataset, any identifying information was removed from analysis and results are only reported in aggregate. However, there are still important ethical questions to consider when using these data (Hesse, Glenna, Hinrichs, Chiles, & Sachs, 2019). There is disagreement among social media researchers on how to attribute credit to individuals for the study of their content. If an Instagram post is considered similar to a letter to the editor, it is critical to give credit to the writer for their words (Kozinets, 2015). However, if studying an Instagram post is considered eavesdropping, then the content creator may expect anonymity. In other words, when posts are public, some researchers argue that users should not expect their posts to be confidential (Kozinets, 2015). The counter-argument is that users may have a false sense of privacy and expect that their posts will be read only by their friends, not by researchers (Hesse et al., 2019; Medaas, 2014).

From a legal perspective, data sourced from social media is "considered to be in the public realm if it is not password protected or when a subscription is not required to access the content" (Holmberg, Chaplin, Hillman, & Berg, 2016, p. 122). Instagram's Privacy Policy states that "any User Content that you make public is searchable by other Users and subject to use under our Instagram API" (Instagram Privacy Policy, 2017, p. 3) (note: API stands for Application Programming Interface). Similarly, Twitter's Privacy Policy states that they "use technology like … (APIs) and embeds to make that information available to websites, apps, and others for their use - for example … analyzing what people say on Twitter" (p. 2). These privacy policies emphasize that researchers may study what is posted on social media, but we must question if users truly understand what they are agreeing to when they share posts on these platforms (Hesse et al., 2019).

Ethical decisions about social media research should also consider the probability of harm to individuals whose information is being studied (Hesse et al., 2019; Kozinets, 2015). It is possible that content from minors is included in this dataset; users only have to be 13 years old to have Instagram or Twitter accounts (Instagram Privacy Policy, 2017; Twitter Privacy Policy, 2018). Teenage users may not be aware of the consequences of publicly sharing information online, and they are likely unsuspecting of researchers studying their posts (Holmberg et al., 2016). It is important to be aware of this context, but none of the posts that I analyzed in this study contained content of a personal or private nature, so the risks to minors that may be included in this dataset are very low.

To navigate the complexity of ethical research on social media, Kozinets (2015, p. 141) proposes that "when we know that data can be traced, we are obligated to gain informed consent (or attempt to make the data truly untraceable)". Given the large number of individuals whose data is included in this analysis, it was not feasible to obtain informed consent from everyone. Therefore, I decided that all data included in this dataset would be made untraceable. No identifying information was coded, and any quotes included in this thesis or in following publications have been paraphrased so that they cannot be reverse-searched nor attributed to an individual. Finally, to protect users and to maintain my separation from this work, I have never interacted with any users whose information in this dataset, nor have I 'liked' or shared any of their posts from my personal Instagram or Twitter accounts. I believe that following these precautions is the most conscientious way that I can conduct this social media research.

3.2 Methods to Achieve Objective One

3.2.1 Data Collection

Objective One aims to explore which climate-motivated-eating strategies are communicated on Twitter and Instagram. Given that hundreds of millions of Tweets and Instagram posts are shared daily, it was necessary to design a method for only collecting posts that were relevant to this study, rather than dramatically over-capturing posts and identifying relevant posts within a very large sample.

3.2.1.1 Collection Software

I selected the application programming interface (API) scanner and social network analyzer, Netlytic, to collect relevant and publicly shared posts (Gruzd, 2016). Netlytic is a popular social network analyzer (see: (Pilař et al., 2018a; White, 2013)) and has the advantages of being very affordable and designed specifically for researchers (Gruzd, 2016). This contrasts with the majority of more expensive network analysis tools that are designed for marketing companies. Netlytic allows researchers to collect publicly shared social media posts that include specific words (i.e. search terms) chosen by a researcher; (at the time of data collection, Netlytic could collect posts from Twitter, Instagram, Facebook, and YouTube) (Gruzd & Mai, 2019). Using Netlytic to study Twitter posts, researchers design Boolean searches to collect Tweets containing specific words. In contrast, to collect Instagram posts, researchers identify a single hashtag or geo-tagged location relevant to their study; after collecting posts with this hashtag or geo-tag, researchers then conduct subsequent data filtering to identify posts that contain other relevant search terms. Therefore, different search strategies are needed to acquire comparable datasets from Twitter and Instagram.

After determining the search terms I would use for this study (will be discussed later in this chapter), I programmed Netlytic to collect posts from Twitter and Instagram over specific *future* time periods; Netlytic is unable to retrieve historic posts (Gruzd, 2016). Over the collection period, Netlytic gathered Tweets and Instagram posts that included the search terms and returned these posts in the form of spreadsheets that included URL links to the original posts (Gruzd, 2016).

To collect data from Twitter, Netlytic ran a request every 15 minutes during the collection period and returned up to 1,000 Tweets per request (Gruzd, 2016). If more than 1,000 relevant posts were shared within the previous 15 minutes, only the 1,000 most-recent posts were returned (Gruzd, 2016). Importantly, Netlytic's website states that its API search is not exhaustive (Gruzd & Mai, 2019), and that "not all Tweets will be indexed or made available via the search interface" (para. 4) due to the server's inability to comb through all of the millions of Tweets that are shared every 15 minutes (Cooper, 2019a).

There were slight variations to the process collecting Instagram posts. Netlytic ran a request on Instagram every hour, at 30 minutes past the hour, and collected up to 100 posts tagged with the desired hashtag at each request (Gruzd, 2016). If there were more than 100 relevant posts tagged per hour, only the 100 most-recent posts were collected for this dataset (Gruzd, 2016).

The limitations with Netlytic's collection processes mean that it is unlikely that all posts that met the search criteria and were posted during the collection periods were collected for my subsequent analysis. Further, it should be emphasized that only Tweets and Instagram posts that were shared *publicly* were collected; posts shared to private accounts were not collected.

3.2.1.2 Search Terms

In social media research, the choice of search terms determines which posts are captured and can result in the under- or over-representation of certain discourses in the results (Kim et al., 2013; Schuldt, Konrath, & Schwarz, 2011). Finalizing the search terms to use with Netlytic's software was challenging and required a great deal of research and testing.

Selecting search terms for this study was made more complicated because there are numerous terms that refer to the phenomenon of 'climate change'. While #Climate, #ClimateChange, and #GlobalWarming are hashtags commonly associated with this topic (Williams et al., 2015), other terms include: #ClimateCrisis, #PlanetaryWarming, #AnthropogenicGlobalWarming, #AnthropogenicClimateChange, etc. Importantly, each of these terms carries different biases and meanings to users and readers. Public belief about whether the planet is warming can depend on if the question is phrased as 'do you believe in climate change?' or 'do you believe in global warming?' (Cody et al., 2015). As described by Jang and Hart (2015, p. 1), the term "'global warming' is particularly associated with hoax frames". Further, in online discourse, 'global warming' is often used sarcastically by climate change deniers (Cody et al., 2015; Williams et al., 2015); as in this archetypal Tweet, '*Sure is a cold December day today! Looks like #globalwarming is heating things up lol!'*. In general, studies have shown that belief in the phenomenon is lower when it is referred to as 'global warming' rather than 'climate change' (Schuldt et al., 2011). Importantly, the use and implied meaning of terms can change over time – just as how ‘global warming’ was once the term most commonly used by the media to refer to the phenomenon (Conway, 2008), but ‘climate change’ is now the most commonly used term (Michel et al., 2011). The shifting popularity of these words will likely continue in the future.

Given the strong biases in the meaning of terms used to refer to climate change and because Netlytic was only able to collect Instagram posts that included a specific hashtag (as opposed to a set of words), it was important to identify a single relevant term to refer to climate change with which to collect posts for analysis. Further, limiting the search to one climate-related term reduced subsequent coding to a manageable level, and is consistent with other researchers’ methods of researching climate change discussions on social media (see: Abbar et al. (2016)). After reading a great deal of literature on climate change psychology, I determined that ‘climate change’ was the term best-suited to identifying Tweets and Instagram posts that conveyed climate-motivated-eating strategies; all collected posts include #ClimateChange or the phrase ‘climate change’.

In contrast to selecting a single term to refer to climate change, I developed a diverse set of words to refer to dietary strategies. Firstly, I conducted several months of exploratory reading of social media posts that shared climate-motivated-eating strategies. Using Netlytic, I experimented with search terms to determine which combinations returned relevant posts and to learn which words are used by climate-motivated-eaters discussing their strategies on Twitter and Instagram. Through this experimentation, I realized the importance of including “save the” in my search terms, reflecting the popularity of the phrase “save the planet” in online discussions of climate change mitigation. Following this experimental phase, and in consultation with my supervisory committee, I identified several key words that referred to diet, strategies, and climate change mitigation. These words were ultimately included in a Boolean search (see **Table 1**) to collect Twitter and Instagram posts that shared climate-motivated-eating strategies.

Table 1: The search terms employed in Netlytic to collect Twitter and Instagram posts that share climate-motivated-eating strategies.

Social media platform	**Search terms used in Netlytic**	**Search terms used to identify relevant posts through subsequent analysis in Excel Version 16** (Microsoft Corporation, 2018)
Twitter	(“climate change” OR #ClimateChange) AND (food OR diet OR eat) AND (choice OR choose OR buy OR support OR pick OR select OR strategy OR combat OR reduce OR mitigate OR stop OR "save the" OR help)	N/A
Instagram	#ClimateChange	#ClimateChange AND (food OR diet OR eat) AND (choice OR choose OR buy OR support OR pick OR select OR strategy OR combat OR reduce OR mitigate OR stop OR "save the" OR help)

Using the search terms described in **Table 1**, all collected Tweets and Instagram posts contained a combination of these words. An archetypal Tweet that is representative of posts captured with this tool is (note: words from the Boolean search are bolded): ‘*You should* ***eat*** *less beef to* ***mitigate climate change****!’* Importantly, Netlytic treats the search terms are stem words, and suffixes or prefixes were also collected; for example, the tool would have collected posts including “eat” and “eat**ing**” as well as “diet”, “diet**ary**”, “diet**s**” etc.

As already mentioned, due to the differences in Netlytic’s ability to collect Twitter and Instagram posts, it was necessary to only use one hashtag (#ClimateChange) to search for relevant Instagram posts. After data collection, I imported the posts tagged #ClimateChange into Excel Version 16 (Microsoft Corporation, 2018), and I used the “highlight cells” tool to identify posts that also contained the words from the Boolean search (see Table 1). The Instagram posts retained for analysis met the same requirements as those from Twitter, but the filtering of relevant Instagram posts was conducted manually in Excel rather than automatically through Netlytic.

3.2.1.3 Time Period of Data Collection

The period of data collection on Twitter was June 4 - August 10, 2018 (67 days), and on Instagram was June 6 - August 14, 2018 (69 days). These dates were not randomly selected, but neither were they targeted to coincide with any event. The duration of the searches was also neither random, nor targeted, but coincided with the length of Netlytic’s automatic capturing; on both platforms, collection was initially set for seven days, and was then renewed for two periods of 30 days to capture larger samples. The slight mismatch in collection dates and duration was due to a miscalculation, but this is not expected to have substantially influenced the results.

3.2.2 Data Processing

3.2.2.1 Data Cleaning

Following data collection by Netlytic, I imported the Twitter and Instagram datasets into Excel Version 16 (Microsoft Corporation, 2018) for cleaning and analysis.

Both datasets were initially reviewed and cleaned to ensure that their content was relevant to my research objectives. Due to the breadth of the search terms used, posts were collected that did not substantively align with my research objectives. To be retained for further analysis, all posts had to be: 1) written in English, and 2) clearly communicate a climate-motivated-eating strategy. An example of the sort of 'false positive' Tweets and Instagram posts that were screened out is the archetypal Tweet: '*Due to #ClimateChange, sea turtles are struggling to find food. We should help the turtles!'*. Posts that required more thoughtful consideration before being screened out included posts from animal welfare activists writing about the importance of being vegan from an animal-welfare perspective. For example, a post like *'eat vegan to prevent animal cruelty #justice #healthy #ClimateChange*' would be excluded from subsequent analysis because the purpose of the post was not to mitigate climate change. In contrast, posts like '*eat vegan to prevent animal cruelty and stop #ClimateChange'* were retained in the dataset for further analysis due to the direct link being made between a dietary strategy (i.e. a vegan diet) and climate change mitigation. Other posts that were screened out from the original datasets referred to the need to adapt food systems to cope with the effects of climate change (e.g. extreme weather events impacting food security), rather than mitigating climate change. Once posts were determined to be relevant to the research objectives, they were analyzed equally no matter their geographic point of origin, nor whether they were shared by organizations or by individuals.

After posts were determined to be relevant, I corrected emojis that had been transformed into code through Netlytic's collection process (e.g. 💙🌍🌱✌🏽became □üíô□üåç□üå±,úå□üèΩ). This was done by following posts' associated URL links to open them on their respective source platform, at which point I compared the collected code with the source emoji. Using the "replace all" function in Excel Version 16 (Microsoft Corporation, 2018), I inserted users' intended emoji in the place of each transformed code. This process was important because emojis provide context for users' intentions and emotions (Ge & Gretzel, 2018). For example, *'We should eat less meat to mitigate climate change* ☹' has a different emotional context than *'We should eat less meat to mitigate climate change* 😊'. Preserving this context helped in the next analytical step, data coding.

3.2.2.2 Treatment of Reposts and 'Likes'

It is important to consider the context of reposting in these social media spaces. Although Instagram does not offer in-application reposting, it is easy for users to employ a third-party application to repost content on Instagram, but original posts remain far more common than reposts. Reposting (i.e. re-Tweeting) is extremely common on Twitter. For example, Williams and colleagues (2015) found that 39% of the Tweets they collected were re-Tweets, and White (2013) found that 50% of her collected posts were re-Tweets. Posting original content implies that users engaged directly with the content of the posts through thinking and writing (Dyar et al., 2014), whereas reposting only requires reading someone else's thoughts. This suggests that there is a difference in the motivation or confidence of users between the posts they create, and posts they *share* (Veltri & Atanasova, 2017). Because of this, some researchers treat shared posts differently than original content. For example, An and colleagues (2014) excluded re-Tweets from their analysis because "[they] assume that [they] cannot detect the sentiment of users by re-Tweeting Tweets of other users" (p. 2). In contrast, Cody and colleagues

(2015) "include retweets in the collection to ensure an appropriately higher weighting of messages authored by popular accounts (e.g. media, government)" (p.3).

In my research, I determined that reposts should be coded the same as original posts because in this context, all opinions are equally important: I am studying *which* climate-motivated-eating strategies are shared and how frequently they are shared, rather than *who* or how many individuals are sharing them. This is common practice in social media research and is further motivated by the fact that: 1) it is not possible to guarantee posts' authorship, and 2) reposts can be viewed as votes of agreement. Jang and Hart (2015) made a similar methodological choice and included reposts in their analysis "because prior literature indicates that they are an effective indicator for the extent to which messages are perceived important in the network" that is being analysed (p. 13). These points suggest that it is more reflective of online discussions to treat reposts equally to original content.

I did not monitor or analyze the number of 'likes' posts received, in part because it is not possible to determine when a post is 'done' being liked. Moreover, an analysis of likes would have been hampered by Netlytic. Netlytic collects Tweets every 15 minutes and Instagram posts every hour and only reports the 'likes' accumulated within that short period since posting. Beyond this technical challenge, it is impossible to determine the number of posts' silent followers or 'lurkers': users who read posts but do not like, comment on, or share them (Medaas, 2014; White, 2013). Therefore, the influence or reach of a post is poorly reflected by its number of 'likes' or reposts.

3.2.2.3. Data Coding

Following data cleaning, the Twitter and Instagram datasets were individually imported into the qualitative analysis software, NVivo 12 (QSR International, 2018). Within NVivo 12, and following the principles of Gibbs (2010), I conducted inductive coding to identify the climate-motivated-eating strategies that were shared in the collected posts.

Manually inductively coding these data allowed me to consider the use of slang, emojis, acronyms, and sarcasm, which would not have been possible had I used computer-mediated coding techniques, like relying on results from word frequency tests (Kim et al., 2013). Social media users employ strategic word use when posting, so *how* something is written can be as revealing as *what* is written (Veltri & Atanasova, 2017). Due to the potential complexity of meaning in these posts, it was advantageous that I am very familiar with the context of the posts, as well as the language used by the climate-motivated-eating community (of which I am a member), and that I was solely responsible for coding, allowing me to maintain a consistent interpretation of the posts' context and meaning (Kim et al., 2013).

Through the inductive coding process, I read each post and coded all climate-motivated-eating strategies shared within it. For example, in the archetypal post *'I will eat vegan and organic food to reduce my contribution to climate change'* I would have coded the strategies as 'eat vegan' and 'choose organic'. Importantly, I did not code hashtags, although #ClimateChange was used to identify relevant posts. I made this decision because it was impossible to ensure that all hashtags included in a post were intended as a strategy for mitigating climate change. The purpose of hashtags is to attract attention and 'likes' to posts and they are not always strongly related to the content. Therefore, if a post read *'eat locally to mitigate climate change #organic #vegan #vegetarian'*, only the strategy communicated in prose (*'eat locally'*) would be coded as a climate-motivated-eating strategy.

Some strategies revealed in posts relate to food system activities beyond the direct control of the consumer. For example, 'support no-till agriculture' or 'feed food waste scraps to pigs'. Importantly, these *were* coded as climate-motivated-eating strategies. I made this decision because many consumers currently have the option to select foods based on specific production practices that have gained public attention, like organic certified foods or grass-fed beef. These and other production practices are communicated to the public through labelling, allowing consumers to apply climate-motivated-eating strategies based on specific modes of production. Other production practices, like 'support no-till agriculture' *could* be similarly communicated and could in theory be used as a climate-motivated-eating strategy by consumers in the near future.

During the initial coding process, I carefully coded climate-motivated-eating strategies to very detailed and clearly articulated codes. Following the initial coding stage, I began a coding categorization process and binned codes together according to their strategic theme. For example, the detailed codes *'there is an acceptable frequency of meat-eating',* '*adopt a meat tax', 'adopt meatless Mondays', 'become a 'reducetarian', 'do not eat fish', 'eat less meat', and 'be vegetarian occasionally'* were all categorized as the larger strategic theme which they all shared: '*eat less meat'*. This categorization process is outlined in full in **Appendix A – Coding Scheme**.

3.3 Methods to Achieve Objective Two

In addressing my second objective, to consider the evidence that supports climate-motivated-eating strategies for reducing GHG emissions, I conducted a thorough review of the recent academic literature that reports how changes to food systems and dietary choices can mitigate climate change. Using the Web of Science, I undertook a set of queries to collect relevant academic journal articles. I sought out scholarship from LCA studies on food systems and dietary choices, review articles, and studies that compiled results from multiple LCA studies (see, for example, Poore and Nemecek (2018)) because these offer comparisons of the relative efficacy of different climate-motived-eating strategies in reducing GHG emissions. I collected all articles available on Web of Science that were published from January 1, 1999 – June 13, 2019 that contained the following terms in their titles:

> "climate change" OR environmental OR environment
> AND
> mitigate OR mitigation OR reduce OR reducing OR reduction
> AND
> diet OR dietary OR food OR eat

This search focussed on articles' titles because these are strategically written using keywords and through a process of linguistic refinement similar to that through which users write Tweets and brief Instagram posts. Therefore, searching only the titles of articles increased the relevance of articles returned for analysis. 'Climate change' was not the only environmental theme used in the search terms because the LCA literature I sought out for this component of my research often studies environmental impacts more broadly than just climate change impacts, and so relevant articles often do not include 'climate change' in their title.

This search yielded 144 results, which were narrowed to 98 articles published in journals, and 92 published in English. The abstracts of these 92 articles were then reviewed to exclude irrelevant articles. To be included in this review, the articles had to explicitly discuss opportunities to reduce the climate change contributions of the food system. Articles were excluded from further review and analysis if they dealt with adapting food systems to cope with climate change, or if they focussed on how climate change mitigation efforts (e.g. reforestation) would affect food security.

Following the application of these exclusion and inclusion criteria, 41 articles remained for review. I then built a spreadsheet to systematically determine how well-supported by evidence each climate-motivated-eating strategy was: each strategic code identified through Objective One was listed in a spreadsheet row, and each reviewed article was listed as a column. I closely read each article, and every time an article mentioned a climate-motivated-eating strategy, I made a note of the study's findings in the cell that corresponded with the strategic theme, or identified it as a strategy that was "not mentioned on social media" when applicable. For example, the strategic theme *'avoid food produced in greenhouses'* was supported by Benis and Ferrão (2017), and this agreement was noted in the spreadsheet. Similarly, it was noted if studies expressed a lack of agreement with a strategy; for example, Swain and colleagues (2018) did not support the strategic theme to *'avoid intensively produced food*' but rather wrote "modern, intensive livestock systems, especially for beef, offer substantially lower land requirements and greenhouse gas emissions per kilogram of meat than traditional, extensive ones" (p. 1).

After I read all collected and relevant articles, I reviewed the spreadsheet to determine whether each strategic theme was 1) consistently supported by evidence from the reviewed literature as a strategy to reduce GHG emissions, 2) inconsistently supported by evidence from the reviewed literature as a strategy to reduce GHG emissions, 3) not supported by evidence from the reviewed literature as a strategy to reduce GHG emissions, or 4) could not be evaluated due to vagueness, or was never mentioned in the reviewed literature. I decided not to rate strategic themes based on how frequently they were mentioned but based on the consistency of the scholarly assessment. That is, if a strategy was supported in a single reviewed article and was not disputed in another, it was rated as "strongly supported", just as if it had been supported in multiple articles. If a strategy was supported in one article and disputed in another, it was rated as "evidence is inconsistent". This rating system is further outlined in the following rating rubric (see **Table 2**). The aim of this rubric was to assign ordinal labels to the climate-motivated-eating strategies shared on social media, so that each strategy could be assigned to a discrete category reflecting how well they are supported by evidence.

Table 2: Rubric for determining how well the climate-motivated-eating strategies shared in the sample of Twitter and Instagram posts are supported by evidence from recent academic literature.

	Supported by evidence	**Evidence is inconsistent**	**Not supported by evidence**	**Cannot be evaluated**
Assignment criteria	Academic evidence consistently supports that this strategy could reduce the GHG emissions from the food system while maintaining or increasing yields per land area, thereby addressing our global food system challenge.	Academic evidence is inconsistent on the efficacy of this strategy in reducing GHG emissions. Some evidence suggests that this strategy could reduce GHG emissions, but other evidence cautions that this strategy could increase overall emissions if scaled-up.	Academic evidence supports that this strategy could increase the GHG emissions from the food system, or reduce yields per land area, and therefore does not address our global food system challenge.	These strategies are expressed too vaguely on social media to be evaluated or these strategies were not expressed in the targeted literature review
Criteria in layman's terms	*On the basis of current evidence, this strategy is always effective in reducing GHG emissions.*	*On the basis of current evidence, this strategy is inconsistently effective or ineffective in reducing GHG emissions.*	*On the basis of current evidence, this strategy is never effective in reducing GHG emissions.*	*This strategy cannot be evaluated using this rubric.*

The results of these methods are discussed in detail in **Chapter Four - Results.**

4.0 CHAPTER FOUR – RESULTS

This chapter summarizes the results of the research methods that were described in the preceding chapter. **Chapter Four - Results** is organized into two primary components that describe the results of this thesis' two research objectives: 1) explore which climate-motivated-eating strategies are communicated in a sample of Twitter and Instagram posts, and, 2) consider the evidence that supports these strategies for reducing GHG emissions. in the context of their GHG emissions.

4.1 Results of Objective One

Objective One aimed to explore which dietary strategies intended to mitigate climate change are communicated in samples of Twitter and Instagram posts.

4.1.1 Strategies Shared in Combined Twitter and Instagram Dataset

Over the 68- to 70-day period that Netlytic was used to sample Twitter and Instagram posts, respectively, a total of 6,579 posts were collected (**Table 3**). Of the 5,490 Twitter posts captured, almost one third (1,793 or 32.7%) were removed due to irrelevancy (i.e. they were false positives, or they shared strategies for *adapting* to rather than *mitigating* climate change) (**Table 3**). Amongst the 1,089 Instagram posts collected, just over half (566 or 52%) were determined to be irrelevant (**Table 3**). The resulting posts retained for further analysis (4,220) predominantly consisted of Twitter posts (**Table 3**).

Table 3: Total number of posts collected, removed, and retained for analysis

	Collection period	Total number of posts collected	Number of posts removed due to irrelevancy	Number of posts retained for analysis
Twitter	June 4 – August 10, 2018 *68 days*	5,490	1,793	**3,697**
Instagram	June 6 – August 14, 2018 *70 days*	1,089	566	**523**
Total: combined dataset	June 4 – August 14, 2018 *72 days*	6,579	2,359	**4,220**

Within the 4,220 social media posts that were analyzed, climate-motivated-eating strategies were shared 5,795 times (**Table 4**), for an average of 1.4 strategies shared in each post.

Table 4: Total number of posts shared, and total number of strategies shared within posts

	Number of posts included in analysis	Number of detailed strategies shared
Twitter	3,697	4,938
Instagram	523	857
Total: combined dataset	4,220	5,795

I coded these 5,795 references to climate-motivated-eating strategies as 120 unique climate-motivated-eating strategies (e.g. 'adopt meatless Mondays' or 'reduce portion sizes'). Importantly, many individual social media posts advocated for more than one strategy, as illustrated in this archetypal Tweet: '*avoid animal agriculture and eat ugly fruits and vegetables to reduce climate change!'*. In this example, two detailed strategies are shared: 1) avoid animal agriculture, and 2) eat 'ugly' fruits and vegetables (i.e. reduce food waste by eating fruits and vegetables that other shoppers avoid due to cosmetic reasons).

Amongst the 120 unique detailed strategies that were identified, many were thematically and hierarchically related. For example, the detailed strategies to ‘adopt meatless Mondays’, ‘become a ‘reducetarian’’, and ‘be vegetarian occasionally’ are all related, and can be grouped together as strategies advocating for people to ‘eat less meat’. After re-organizing detailed strategies into hierarchically related groupings, a total of 30 strategic themes were identified, and each detailed strategy was assigned to a relevant group (**Table 5** and see **Appendix A – Coding Scheme** for details of the categorization process). The 30 strategic themes were further binned into three high-level approaches: changing diet composition (48.4% of strategies shared in the social media sample), changing food production (42.1%), and reducing the impact of food waste (9.5%) (see **Table 5**).

Table 5: Frequency of climate-motivated-eating strategies shared in combined Twitter and Instagram dataset, and within each dataset individually.

High-level approach to climate-motivated-eating	**Group**	**Strategic theme**	**% frequency of strategic theme in combined Twitter and Instagram dataset**	**% frequency of strategic theme sourced from Twitter within combined dataset**	**% frequency of strategic theme sourced from Instagram within combined dataset**	**% frequency of strategy within Twitter dataset**	**% frequency of strategy within Instagram dataset**
Change diet composition. 48.4% of climate-motivated-eating strategies shared in combined Twitter and Instagram dataset. 47.1% of strategies shared in Twitter sample. 56% of strategies shared in Instagram sample.		Choose foods wisely (ambiguous)	6.8	6.4	0.3	7.5	2.2
		Eat more specific non-meat ingredients	0.3	0.1	0.2	0.1	1.2
		Change food preparation	0.4	0.2	0.2	0.2	1.6
		Avoid specific non-meat ingredients	0.2	0.1	0.1	0.1	0.6
	Reducing the impact of meat consumption	Eat vegan always	19.6	15.5	4.1	18.2	27.5
		Eat fewer animal products	10.5	9.4	1.1	11.1	7.4
		Eat less meat	5.0	3.8	1.2	4.5	8.2
		Avoid red meat	3.2	2.8	0.4	3.3	2.8
		Eat vegetarian	1.4	1.1	0.3	1.3	1.9
		Choose sustainable meat	0.6	0.5	0.1	0.6	0.7
		Change protein habits	0.5	0.2	0.3	0.2	2.0
Change food production. 42.1% of strategies shared in combined…		Change food production (ambiguous)	1.1	1.1	0.0	1.3	0.0
		Support agricultural technology	0.8	0.8	≈ 0	1.0	0.1

Table 5 (continued)

High-level approach to climate-motivated-eating	Group	Strategic theme	% frequency of strategic theme in combined Twitter and Instagram dataset	% frequency of strategic theme sourced from Twitter within combined dataset	% frequency of strategic theme sourced from Instagram within combined dataset	% frequency of strategy within Twitter dataset	% frequency of strategy within Instagram dataset
(Continued) Twitter and Instagram dataset. 44.7% of strategies shared in Twitter sample. 27% of strategies shared in Instagram sample.		Choose organic food	0.7	0.4	0.3	0.5	2.1
		Change off-farm energy use	0.1	0.1	0.1	0.1	0.5
		Avoid agricultural technology	0.1	≈ 0	0.1	≈ 0	0.5
		Avoid food produced in greenhouses	0.1	≈ 0	≈ 0	≈ 0	0.2
Change food production. 42.1% of strategies shared in combined Twitter and Instagram dataset. 44.7% of strategies shared in Twitter sample. 27% of strategies shared in Instagram sample.	Who should produce food	Avoid intensively produced food	12.2	10.4	1.9	12.2	12.5
		Source food from small farmers	0.2	0.1	0.1	0.2	0.6
		Winemakers can mitigate climate change	0.2	0.2	0.0	0.2	0.0
	Land management strategies	Change land management strategies	11.8	11.5	0.3	13.5	1.9
		Conserve non-farmland	3.3	3.2	0.1	3.8	0.7
	How to feed livestock	Add marine algae to cattle feed	9.5	9.5	≈ 0	11.1	0.1
		Change livestock feed (ambiguous)	≈ 0	≈ 0	0.0	≈ 0	0.0
		Choose grass-fed meat	0.2	0.2	≈ 0	0.2	0.2

Table 5 (continued)

High-level approach to climate-motivated-eating	**Group**	**Strategic theme**	**% frequency of strategic theme in combined Twitter and Instagram dataset**	**% frequency of strategic theme sourced from Twitter within combined dataset**	**% frequency of strategic theme sourced from Instagram within combined dataset**	**% frequency of strategy within Twitter dataset**	**% frequency of strategy within Instagram dataset**
(Continued) **Change food production.**	Locations for food production	Eat local	1.7	0.6	1.1	0.7	7.4
		Food transportation does not matter	≈ 0	0.0	≈ 0	0.0	0.2
Reduce impact of food waste. 9.5% of strategies shared in combined Twitter and Instagram dataset. 8.9% of strategies shared in Twitter sample. 17% of strategies shared in Instagram sample.		Avoid food waste	7.1	5.5	1.5	6.5	10.4
		Strategies to reduce food waste	1.7	1.3	0.4	1.5	2.9
		Strategies to reduce the impact of food waste	0.7	0.2	0.6	0.2	3.7
		Total % ≈	100	85.3	14.9	100	100

Of particular note is the high frequency (40.8%) of strategies shared with the intention of reducing the impact of meat consumption. The strategy to *eat vegan always* was the most popular, comprising 19.6% of the strategies shared in this sample of social media posts. This was surprisingly prominent in comparison with the less restrictive strategy of *eat vegetarian* which comprised only 1.4% of strategies shared in this sample. There was also prevalent discussion of a moderate form of veganism, in which social media users suggested that an effective climate-motivated-eating strategy would be to eat a mostly vegan diet, or to *eat fewer animal products* which comprised 10.5% of strategies shared in the sample.

The prevalent suggestions to *avoid food waste* (7.1% of strategies shared in the sample) far outnumbered detailed strategies on how to do so (*strategies to reduce food waste* only comprised 1.7% of the strategies shared in the sample). Similarly, the 12.2% of strategies shared in the sample referred to *avoid[ing] intensively produced food,* compared with only 0.2% of strategies suggesting that consumers *source food from small farmers.*

It was also interesting that so many climate-motivated-eating strategies referred to changing food production, including *conserve non-farmland* (3.3% of strategies shared in the sample) and *change land management strategies* (11.8% of strategies shared in the sample). These strategies suggest that the users who posted them have some familiarity with farming practices and awareness of the decisions that food producers make. The relative prevalence of these climate-motivated-eating strategies in the social media sample are displayed below (**Figure 3**).

4.1.2 Comparing Strategies Shared on Twitter and on Instagram

There was a marked difference between the frequency with which climate-motivated-eating strategies were shared within the sample from Twitter compared with the Instagram sample. Proportionately, the approach of changing food production was discussed more often on Twitter (44.7% of all strategies in the sample) than on Instagram (27% of all strategies shared in the sample). In contrast, changing diet composition and reducing food waste were more commonly shared on Instagram than on Twitter (56% versus 47.1%, and 17% versus 8.2%, respectively) (**Table 5**).

Some strategies that were popular on Twitter were hardly discussed on Instagram, and vice versa. For example, **Table 5** and **Figure 4** show that the strategy *eat local* comprised 7.4% of strategies communicated on Instagram, but only 0.7% of strategies shared on Twitter. Similarly, strategies aiming to reduce the impact of meat consumption comprised 50% of the Instagram sample, compared with 39% of the Twitter sample. Of particular note is that the strategy *add marine algae to cattle feed* comprised 11.1% of strategies shared on Twitter, and only 0.1% of strategies shared on Instagram; this will be further discussed in later chapters, but highlights the influence of viral social media trends in this kind of research.

In fact, very few climate-motivated-eating strategies comprised a similar proportion of total strategies on the two social media platforms (**Figure 4**). The few strategies with similar proportionality of sharing include *avoid intensively produced food* (12.5% and 12.2% of strategies shared on Instagram and Twitter, respectfully), *choose grass-fed meat* (0.2% of strategies shared on both Instagram and Twitter), and *choose sustainable meat* (0.7% and 0.6% of strategies shared on Instagram and Twitter, respectfully) (**Figure 4**). The discrepancy in strategy popularity on these two social media platforms will be discussed in **Chapter Five - Discussion.**

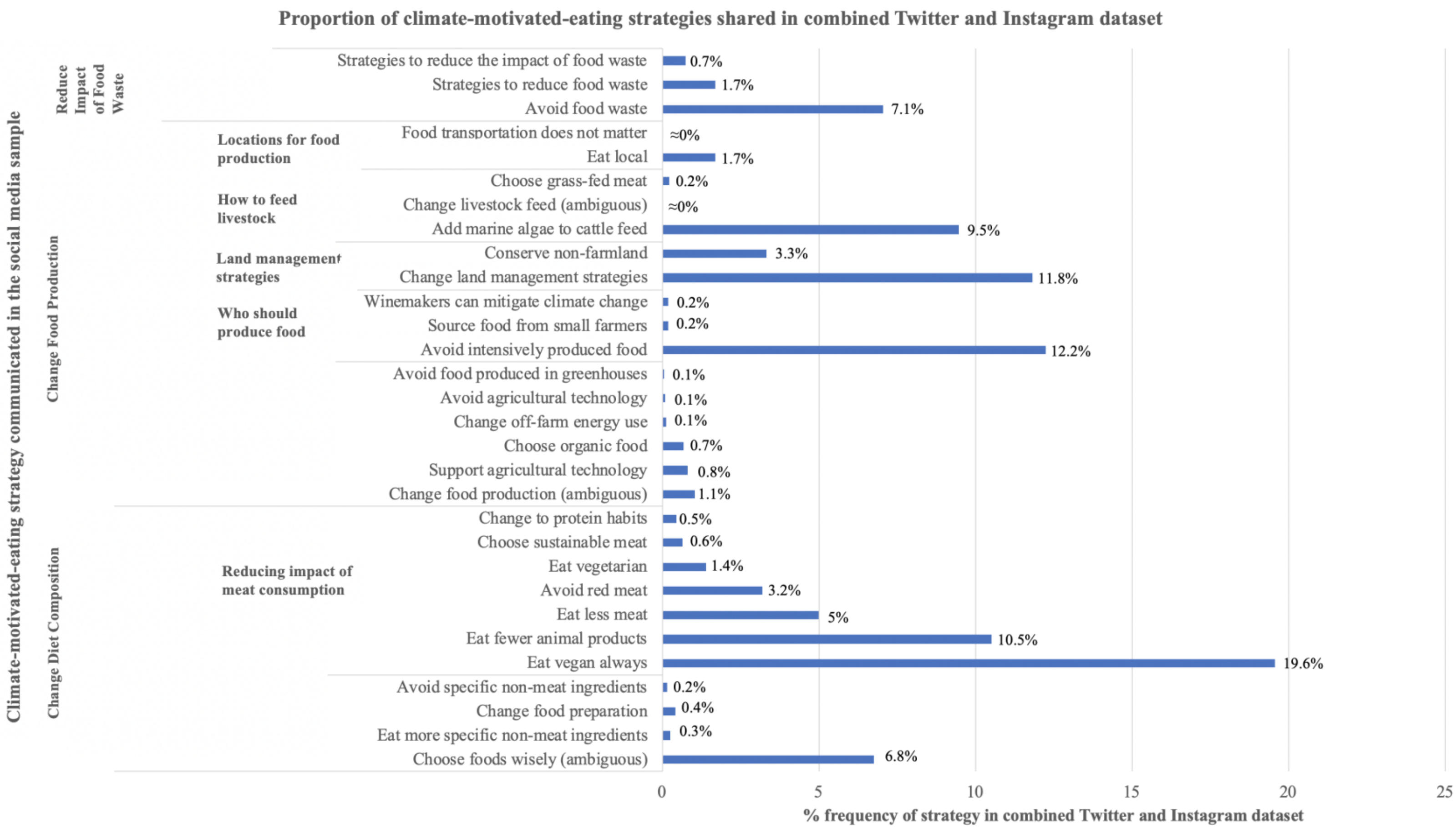

Figure 3: Demonstrating the relative proportion of climate-motivated-eating strategies that were shared in the combined Twitter and Instagram dataset.

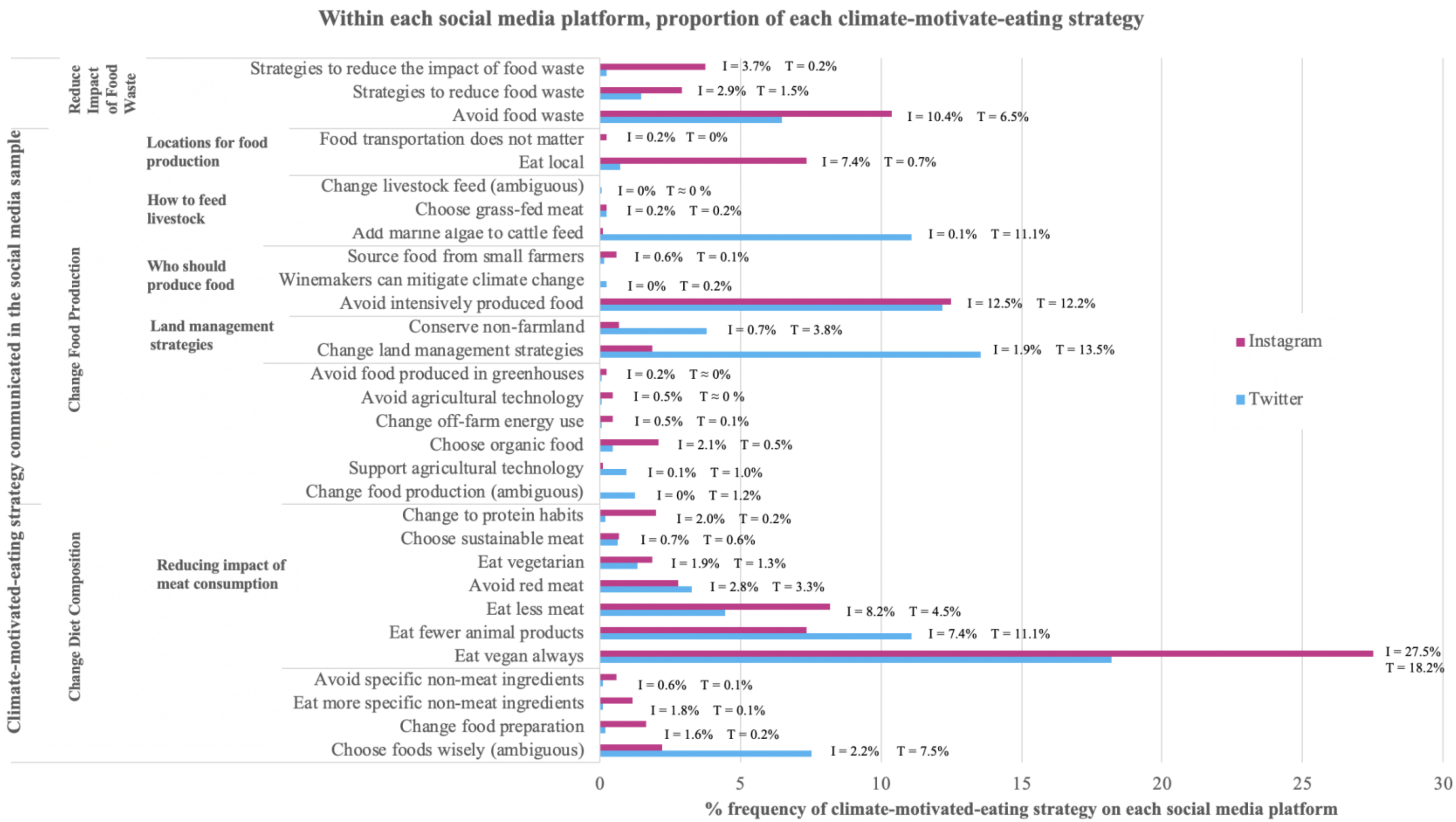

Figure 4: Comparing the relative proportion of climate-motivated-eating strategies that were shared on Instagram versus on Twitter.

4.2 Results of Objective Two

Objective Two sought to consider the evidence, as identified in a targeted literature review, that supports the climate-motivated-eating strategies shared in the social media sample for reducing GHG emissions.

4.2.1 Rating the Efficacy of Climate-Motivated-Eating Strategies Shared in the Social Media Sample

As discussed in **Chapter Three - Methods**, following a systematic search of the literature, 41 academic journal articles were identified as being relevant to this research. These articles were closely read, and careful records were kept, noting whenever climate-motivated-eating strategies were mentioned, and if the authors determined that these strategies were effective or ineffective in reducing GHG emissions from the food system. Some strategies were frequently mentioned in the reviewed literature, like *eat less meat*, whereas other strategies that had been mentioned in the social media sample did not occurred in the reviewed articles (e.g. *add marine algae to cattle feed*) (**Table 6**). Further, some climate-motivated-eating strategies were consistently supported by authors who mentioned the strategy as an effective means through which to reduce GHG emissions from the food system (e.g. *avoid red meat*) whereas other strategies were supported by some authors and not others (e.g. *choose sustainable meat*) (**Table 6**). I also tracked mentions of effective climate-motivated-eating strategies that occurred in the reviewed literature but did not occur in the sampled social media. Only four strategies were identified that were mentioned in the literature but not in the social media sample: *reducing the impact of rice production, improve manure management, adapt disease* *control to prevent food waste,* and *minimize consumers' driving distance to the point of food purchase* (**Table 6**).

Following the literature review, it was possible to determine if the climate-motivated-eating strategies that were mentioned in the social media sample were consistently or inconsistently supported by academic evidence. Using the results from **Table 6** and **Table 2** (see **Chapter Three - Methods**), I rated each climate-motivated-eating strategy for how well it was supported by evidence. **Figure 5** displays the frequency with which climate-motivated-eating strategies were shared in the combined dataset of Twitter and Instagram posts, and rates how well these strategies are supported by evidence. An in-depth exploration of the evidence that supports these ratings follows **Figure 5**.

Table 6: Examining the frequency with which climate-motivated-eating strategies were mentioned, supported, and not supported for reducing GHG emissions within 41 reviewed academic journal articles.

High-level approach to climate-motivated-eating	**Group**	**Strategic theme**	**The number of articles in which this strategy was mentioned, either as an effective or ineffective climate-motivated-eating strategy (41 articles were reviewed).**	**The % frequency with which this strategy was mentioned in the reviewed articles.**	**Within the articles that mentioned this strategy, % of articles that supported this strategy as being effective for reducing GHG emissions from the food system.**	**Within the articles that mentioned this strategy, % of articles that did not support this strategy as being effective for reducing GHG emissions from the food system.**
Change diet composition.		Choose foods wisely (ambiguous)	1	2.4	100	0
		Eat more specific non-meat ingredients	0	0	-	-
		Change food preparation	3	7.3	66	33
		Avoid specific non-meat ingredients	2	4.9	100	0
	Reducing impact of meat consumption	Eat vegan always	5	12.2	60	40
		Eat fewer animal products	11	26.8	100	0
		Eat less meat	12	29.3	100	0
		Avoid red meat	9	22	100	0
		Eat vegetarian	5	12.2	100	0
		Choose sustainable meat	6	14.6	66	33
		Change protein habits	1	2.4	0	100
Change food production.		Change food production (ambiguous)	4	9.8	100	0
		Support agricultural technology	5	12.2	100	0

Table 6 (continued)

High-level approach to climate-motivated-eating	**Group**	**Strategic theme**	**The number of articles in which this strategy was mentioned, either as an effective or ineffective climate-motivated-eating strategy (41 articles were reviewed).**	**The % frequency with which this strategy was mentioned in the reviewed articles.**	**Within the articles that mentioned this strategy, % of articles that <u>supported</u> this strategy as being effective for reducing GHG emissions from the food system.**	**Within the articles that mentioned this strategy, % of articles that did <u>not</u> support this strategy as being effective for reducing GHG emissions from the food system.**
(*Continued)* Change food production.		Choose organic food	3	7.3	66	33
		Change off-farm energy use	5	12.2	100	0
		Avoid agricultural technology	1	2.4	0	100
		Avoid food produced in greenhouses	3	7.3	100	0
	Who should produce food	Avoid intensively produced foods	2	4.9	0	100
		Source food from small farmers	1	2.4	100	0
		Winemakers can mitigate climate change	0	0	-	-
	Land management strategies	Change land management strategies	7	17.1	100	0
		Conserve non-farmland	12	29.3	100	0
	How to feed livestock	Add marine algae to cattle feed	0	0	-	-
		Change livestock feed (ambiguous)	5	12.2	100	0
		Choose grass-fed livestock	7	17.1	43	57

Table 6 (continued)

High-level approach to climate-motivated-eating	**Group**	**Strategic theme**	**The number of articles in which this strategy was mentioned, either as an effective or ineffective climate-motivated-eating strategy (41 articles were reviewed).**	**The % frequency with which this strategy was mentioned in the reviewed articles.**	**Within the articles that mentioned this strategy, % of articles that supported this strategy as being effective for reducing GHG emissions from the food system.**	**Within the articles that mentioned this strategy, % of articles that did not support this strategy as being effective for reducing GHG emissions from the food system.**
	Locations for food production	Eat local	5	12.2	60	40
		Food transportation does not matter	2	4.9	50	50
Reduce impact of food waste		Avoid food waste	15	36.6	100	0
		Strategies to reduce food waste	8	19.5	75	25
		Strategies to reduce the impact of food waste	6	14.6	100	0
Climate-motivated-eating strategies mentioned in the reviewed literature but not in the social media sample.		Reducing the impact of rice production	2	4.9	100	0
		Manure management	2	4.9	100	0
		Disease control to prevent waste	1	2.4	100	0
		Minimize consumers' driving distance to the point of food purchase	1	2.4	100	0

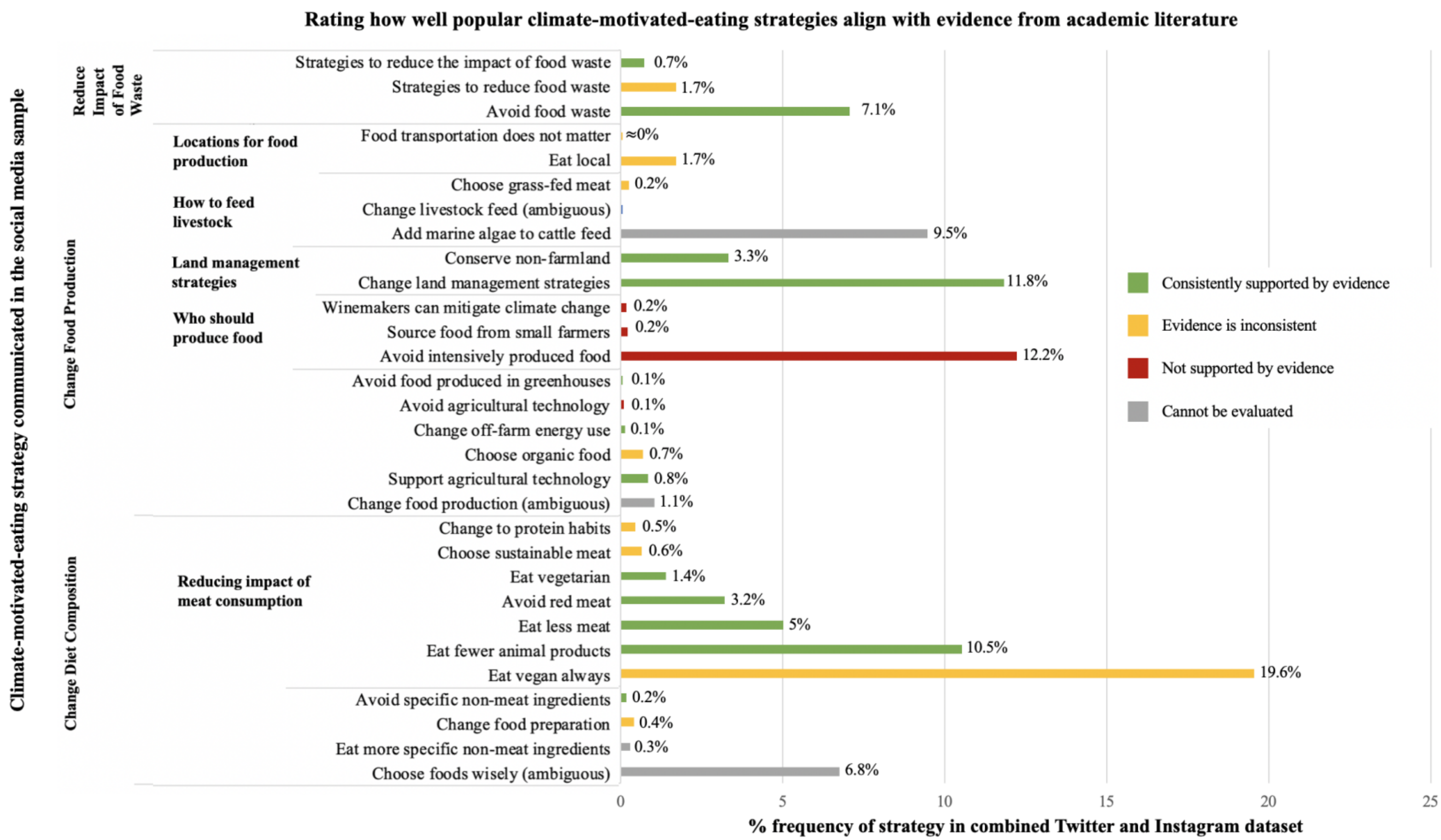

Figure 5: Rating the efficacy of climate-motivated-eating strategies that were shared in sample of Twitter and Instagram posts, as determined through a review of relevant scholarly literature.

4.2.2 Strategies Consistently Supported by Evidence

Strategies for which there was consistent support in the literature include: strategies about food waste (including *reduce the impact of food waste* and *avoid food waste*); strategies related to reducing the impact of food production (including *conserve non-farmland, change land management strategies, change off-farm energy use, avoid food produced in greenhouses,* and *support agricultural technology*); as well as numerous strategies related to reducing the GHG emissions from meat consumption (including, *eat vegetarian, avoid red meat, eat less meat,* and *eat fewer animal products*); and the strategy to *avoid specific non-meat ingredients.*

4.2.2.1 Strategies About Reducing Food Waste

Broadly-speaking, avoiding and reducing the impact of food waste were consistently supported by evidence in the reviewed literature as a means to reduce GHG emissions from the food system. Food waste is increasingly understood as a major source of GHG emissions that in theory can be mitigated (Davey, 2018; Foley et al., 2011; Graham-Rowe, Jessop, & Sparks, 2019; Heard & Miller, 2016; Kallbekken & Sælen, 2013; Usubiaga, Butnar, & Schepelmann, 2018; Willersinn, Möbius, Mouron, Lansche, & Mack, 2017a). These GHG emissions arise from decomposition, as well as the embodied energy associated with food waste: the energy inputs and GHG emissions caused by the futile production, processing, and transportation of food that is not consumed or is over-consumed (Mouron, Willersinn, Möbius, & Lansche, 2016; Porter & Reay, 2016). Because of the substantial associated GHG emissions, reducing food waste and thereby reducing requirements for food production, is considered to be an important strategy for mitigating climate change (Benis & Ferrão, 2017; Vázquez-Rowe, Larrea-

Gallegos, Villanueva-Rey, & Gilardino, 2017; Kallbekken & Sælen, 2013; Lukas, Rohn, Lettenmeier, Liedtke, & Wiesen, 2016; MacRae, Cuddeford, Young, & Matsubuchi-Shaw, 2013; Mifflin, 2019; Porter & Reay, 2016; Pullman & Wikoff, 2017). Further, it is likely preferable for GHG emission reductions to increase global food availability by reducing losses, rather than by increasing the land area under cultivation (Mahmuti, West, Watts, Gladders, & Fitt, 2009).

The priority to reduce food waste varies between nations, food types, and stages of the food chain. In developed nations, food waste is generally concentrated in households (e.g. food that is purchased but never eaten), whereas in developing nations food waste is concentrated during production or processing (Porter & Reay, 2016). Further, the GHG emissions of losses differ along the food chain; for example, because food accumulates impacts with cooking, it would be less impactful to waste raw food, rather than cooking it and *then* throwing it away (Benis & Ferrão, 2017; Mouron et al., 2016; Pullman & Wikoff, 2017). Finally, the reviewed evidence consistently supports that it is important to reduce losses of foods with higher initial or accumulated GHG emissions (Foley et al., 2011; Hoolohan et al., 2013; Poore & Nemecek, 2018; Pullman & Wikoff, 2017). Thus, due to the differences in food waste characteristics between regions, stages of processing, and commodity type, efforts to reduce food waste will require careful, targeted analysis (Porter & Reay, 2016).

The reviewed evidence consistently supports that when food waste is inevitably produced, certain efforts to reduce the impact of its decomposition can reduce GHG emissions from the food system. For example, feeding potato losses to livestock can reduce overall GHG emissions *if* it reduces production of livestock feed elsewhere and if the transportation of potato losses has low GHG emissions (Mouron et al., 2016; Willersinn et al., 2017a; Willersinn, Mouron, Mack, & Siegrist, 2017b). The form of food waste disposal also has important ramifications for climate change mitigation. Disposing of food waste in landfills can cause substantial emissions of CH_4 and CO_2, while composting food waste can greatly reduce CH_4 emissions (Huang, Singh, & Qureshi, 2015; Vázquez-Rowe et al., 2017; Wikström & Williams, 2010). Similarly, using food waste for biogas production can reduce GHG emissions when substituting for energy derived from fossil fuels (Huang et al., 2015; Willersinn et al., 2017b). Thus, the evidence suggests that when waste *is* inevitably created, there remains opportunity to reduce GHG emissions from decomposition.

4.2.2.2 Strategies About Changing Food Production

Broadly-speaking, strategies about reducing the impact of food production by *changing land management strategies, conserving non-farmland, supporting agricultural technologies, changing off-farm energy use,* and *avoiding foods produced in greenhouses* were consistently supported by evidence in the reviewed literature as effective strategies for reducing the GHG emissions from the food system.

The strategy to *change land management* by investing in healthy land and soil management was consistently supported by evidence for reducing GHG emissions from the food system (Cerri et al., 2018; Shrestha, Bhandari, Karky, & Kotru, 2017; Woolf, Solomon, & Lehmann, 2018). Supported strategies included preventing deforestation, and supporting low-carbon agriculture (Sá et al., 2017), and investing in low- or no-till farming to improve soil carbon sequestration and reduce energy requirements for agricultural machinery (Goglio et al., 2014; Khan, Khan, Hanjra, & Mu, 2009;

McWilliams, 2009). Adjusting and optimizing crop rotations were also consistently supported in the literature for reducing emission-intensive agrochemical inputs through integrating nitrogen-fixing cover crops and efforts to improve soil carbon sequestration (Delgado & Li, 2016; Goglio et al., 2014; Khan et al., 2009; Poore & Nemecek, 2018).

The strategy to *conserve non-farmland* was consistently supported in the reviewed literature as a means to avoid increasing GHG emissions from food systems (Cerri et al., 2018; Davey, 2018; Delgado & Li, 2016; Edwards-Jones, 2010; Foley et al., 2011; Friel et al., 2009; Mahmuti et al., 2009; McWilliams, 2009; Poore & Nemecek, 2018; Sala et al., 2017). It is estimated that clearing tropical forests for agricultural land accounts for about 12% of total anthropogenic CO_2 emissions annually (Foley et al., 2011). Another reason to avoid expanding agricultural land use is that most of the world's best farmland is already in use (Hall et al., 1992). Although it may depend on what is being grown (i.e. grain crops versus fresh vegetables), typically, high-quality land requires fewer agricultural inputs (e.g. fertilizers and irrigation) per unit output than low-quality farmland (Hall et al., 1992). Therefore, expanding agriculture to lower-quality farmland will increase the energy intensity of farming because of the need to increase inputs of fertilizer, water, and tillage to overcome the lands' "inherent deficiencies" (Hall et al., 1992, p. 140; Desrochers & Shimzu, 2012). Similarly, reforestation was supported in the literature as a means of carbon sequestration (Fujimori et al., 2018; Khan et al., 2009). There is great value in increasing the productivity of agriculture on current farmland, particularly if some existing farmland can be returned to nature (Davey, 2018).

The strategy to *support agricultural technology* was consistently supported by evidence in the reviewed literature as a strategy to reduce GHG emissions from the food system. Several of the reviewed studies encouraged technology transfer to improve agricultural efficiencies (e.g. improving transportation, increasing yields while reducing land use, and reducing losses) throughout the food system (Benis & Ferrão, 2017; Biesbroek et al., 2017; Delgado & Li, 2016; Fujimori et al., 2018; Monteiro et al., 2017).

The reviewed literature consistently supported the strategy to *change off-farm energy use* to reduce GHG emissions through improved energy efficiency (Khan et al., 2009; MacRae et al., 2013; Sala et al., 2017), increased use of renewable energy (Khan et al., 2009; MacRae et al., 2013; Sala et al., 2017), and reduced refrigerated transportation (Beitzen-Heineke, Balta-Ozkan, & Reefke, 2016; Garnett, 2014; Heard & Miller, 2016; MacRae et al., 2013; Tassou, De-Lille, & Ge, 2009). Similarly, the strategy to *avoid food produced in greenhouses*, which in many settings are very energy-intensive, was consistently supported by evidence in the reviewed literature as a way to reduce GHG emissions from the food system (Benis & Ferrão, 2017; González, Frostell, & Carlsson-Kanyama, 2011; Hoolohan et al., 2013; MacRae et al., 2013). Granted, new greenhouse designs may be able to reduce the energy demands of greenhouses (Bashirivand, 2019), but this was not mentioned in the reviewed literature.

4.2.2.3 Strategies About Changing Patterns of Meat Consumption

Eating fewer animal products was consistently supported by evidence in the reviewed literature as a way to reduce the GHG emissions from diets. These strategies were communicated in the reviewed climate-motivated-eating strategies as *eat vegetarian, eat fewer animal products* (i.e. less meat, eggs, and dairy), *avoid red meat,* and *eat less meat.*

The strategy to *avoid red meat* (i.e. meat from ruminant animals) was consistently supported by evidence. In particular, the literature highlighted that reducing beef consumption, can lead to substantial reductions in GHG emissions (Frenette, Bahn, & Vaillancourt, 2016; Friel et al., 2009; Vázquez-Rowe et al., 2017; Saxe, 2014; Song et al., 2017). Even if beef is substituted for a lower GHG-emitting meat (e.g. chicken, see Poore and Nemecek, 2018), substantial reductions in GHG emissions can be achieved (González et al., 2011; Hoolohan et al., 2013; Vázquez-Rowe et al., 2017; Song et al., 2017; Swain, Blomqvist, McNamara, & Ripple, 2018; Van Mierlo, Rohmer, & Gerdessen, 2017; Vetter et al., 2017). Switching from beef to chicken is much more effective at reducing GHG emissions than switching between production types of beef (e.g. intensively raised vs. grass-fed) (Dewey, 2018).

The strategy to *eat less meat* was also consistently supported by evidence for reducing GHG emissions from the food system (Dewey, 2018; Hoolohan et al., 2013; Lukas et al., 2016; Saxe, 2014; Song et al., 2017; Soret et al., 2014; van de Kamp et al., 2018). Although this strategy may result in the increased consumption of vegetables with high protein content (i.e. legumes, nuts, and grains) (de Boer et al., 2014), associated emission increases from these crops will likely be substantially outweighed by the GHG emission reductions from decreased meat consumption (Biesbroek et al., 2014; Biesbroek et al., 2017; González et al., 2011; Vázquez-Rowe et al., 2017; MacRae et al., 2013; Song et al., 2017; Van Mierlo et al., 2017). Importantly, as the global population grows, the defined level of 'sustainable' per-capita meat consumption will need to shrink continuously to maintain or reduce collective meat-related GHG emissions, unless we see *substantial* improvements to livestock production efficiency (McWilliams, 2009).

The reviewed evidence consistently supports that a *vegetarian* diet can achieve substantial reductions in GHG emissions over a typical omnivorous diet (Hoolohan et al., 2013; Vázquez-Rowe et al., 2017; Lukas et al., 2016; van de Kamp et al., 2018; Van Mierlo et al., 2017; Wynes & Nicholas, 2017).

Not surprisingly, given the above, the evidence in the reviewed literature also consistently supports the strategy of *eating fewer animal products* as an effective way to reduce GHG emissions (Aleksandrowicz et al., 2016; Benis & Ferrão, 2017; Biesbroek et al., 2014; Biesbroek et al., 2017; Dewey, 2018; Frenette et al., 2016; Friel et al., 2009; González et al., 2011; Lukas et al., 2016; MacRae et al., 2013; Saxe, 2014; Vetter et al., 2017). Animal products with the lowest GHG emissions exceed the emissions of vegetable substitutes, emphasizing the potential GHG emissions reductions possible if we lessen the amount of animal products included in diets (Poore & Nemecek, 2018).

The strategy to *avoid specific non-meat ingredients* including limiting or avoiding the consumption of discretionary products like sugar, oil, and alcohol was consistently supported, although infrequently mentioned, in the literature (Poore & Nemecek, 2018). In particular, the literature supported avoiding palm oil due to its contributions to deforestation and associated GHG emissions (Mouron et al., 2016). However, two strategies mentioned in the social media sample (*avoid melons* and *avoid* CO_2 (as an ingredient or by-product in carbonated drinks)) were not mentioned in the reviewed literature.

4.2.3 Strategies Supported by Inconsistent Evidence

Turning now to climate-motivated-eating strategies inconsistently supported by evidence in the reviewed literature, those that were mentioned in the sampled Twitter and

Instagram posts include *reducing food waste, eating locally, choosing grass-fed meat, choosing organic food, changing protein habits, choosing sustainable meat, eating vegan always,* and *changing food preparation.* The primary reason that these strategies have conflicting evidence is because their efficacy in reducing GHG emissions are very context specific.

4.2.3.1 Strategies About Reducing Food Waste

There is inconsistent evidence that supports specific strategies for reducing food waste as being effective in reducing GHG emissions from the food system. One strategy to reduce food waste that is well-supported by evidence is to breed crops for disease resistance to reduce crop losses (Mahmuti et al., 2009); however, this specific strategy did not arise amongst the social media posts that were analysed. Efficient and spoilage-limiting packaging can also reduce food losses and can be particularly valuable from a GHG emissions reductions perspective if it can reduce losses of high-impact foods; in this case, the provisioning of the packaging itself must result in relatively low levels of GHG emissions and avoid GHG emission displacement to other stages of the supply chain (Poore & Nemecek, 2018; Wikström & Williams, 2010). Additionally, reducing portion sizes can reduce overall food purchases (Kallbekken & Sælen, 2013), and associated food waste, food production, resource use, and resulting impacts including GHG emissions (Garnett, 2013; MacRae et al., 2013; Porter & Reay, 2016; van de Kamp et al., 2018). A scenario modelled on the contemporary U.S. diet found that reducing average caloric intake to recommended levels *without* changing dietary composition could result in a 9% reduction in GHG emissions (Biesbroek et al., 2017). It is therefore recommended to change not only the types of food that are eaten, but also the *volume* (Porter & Reay, 2016; Reynolds et al., 2017).

Despite the widespread support of many of these strategies, there has been little academic consideration of the potential "costs and consequences of food waste reduction" (Mifflin, 2019; p. 97). This is concerning because there is genuine risk of increasing GHG emissions through many food waste reduction strategies (Mifflin, 2019). Popular strategies to reduce food waste, like extending shelf-life (e.g. by increasing freezer use), improving inventory management (e.g. expediting food transportation), and adjusting portion sizes (e.g. packing foods in nutritionally relevant quantities) are clearly not environmentally neutral (Mifflin, 2019). It is also important to consider the possibility of rebound effects of food waste reduction efforts (Garnett, 2014; Heard & Miller, 2016; Hoolohan et al., 2013; Mifflin, 2019). If reducing food waste results in consumers saving money by buying fewer groceries, they may spend this saved money on equally high emission non-food purchases (Kallbekken & Sælen, 2013; Mifflin, 2019). Therefore, the academic evidence that was reviewed is conflicted on the potential of food waste reduction strategies to consistently result in GHG emissions reductions from the food system.

4.2.3.2 Strategies About Changing Food Production

There is inconsistent evidence in the reviewed literature to support *eating locally* as being effective in reducing GHG emissions from the food system. In some cases, local food can help to reduce GHG emissions, particularly among fresh foods prone to spoilage over long distances (Benis & Ferrão, 2017; González et al., 2011; Saxe, 2014), and some vegetables with low on-farm production emissions (Dewey, 2018; Reynolds et al., 2017).

Similarly, Edwards-Jones (2010) argues that fresh produce eaten in-season likely has lower emissions than non-local produce, however, as soon as this produce is stored or eaten out-of-season, this guidance may lose its efficacy.

Despite this, GHG emissions from food choices are not relational to the distance traveled between points of production and consumption (Desrochers & Shimzu, 2012; Dewey, 2018; Hiroki, Garnevska, & McLaren, 2016; McWilliams, 2009; Reynolds et al., 2017), and local sourcing is not an adequate indicator of GHG emissions from processes of production nor distribution (Edwards-Jones, 2010; Heard & Miller, 2016; Hiroki et al., 2016; Lazzarini et al., 2017; McWilliams, 2009). In general, the distance food travels matters far less than the *mode* of transportation used, especially when emissions are expressed *per unit* of food (Beitzen-Heineke et al., 2016; Desrochers & Shimzu, 2012; Hoolohan et al., 2013; Keyes et al., 2015; McWilliams, 2009; Reynolds et al., 2017; Tassou et al., 2009; Zimmerman, 2016). Further, it is not possible for all areas to have local food systems, or sufficiently *diverse* local food systems; in areas with poor soil or few agricultural resources, local eating will likely not lead to reductions in GHG emissions, particularly if wild land has to be converted to agriculture (Edwards-Jones, 2010; McWilliams, 2009). In conclusion, eating locally *can* sometimes reduce overall emissions from food choices, however, the evidence is conflicted on this strategy's general efficacy because it often leads to oversimplifying the complexity of GHG emission associated with food systems (McWilliams, 2009).

Choosing organic food was supported by inconsistent evidence as a strategy for reducing GHG emissions from the food system or helping to achieve our global food system challenge. The reviewed evidence suggests that compared with conventional production, organic production can result in higher GHG emissions per unit of food due to lower yields (Hiroki et al., 2016; Lynch, MacRae, & Martin, 2011). If organic production were to be scaled up, its reduced yields would likely result in more land being required for agriculture, leading to increased deforestation, GHG emissions, and biodiversity loss (Clark & Tilman, 2017; Garnett, 2013; McWilliams, 2009; Reynolds et al., 2017; Saxe, 2014). Therefore, sourcing organic food, at least as it is currently being produced, cannot be scaled up to feed a growing population while reducing overall GHG emissions from food production (Clark & Tilman, 2017; Reynolds et al., 2017; Saxe, 2014). In fact, analyses have estimated the global human carrying capacity of the planet under universal organic food production at only 3-4 billion people, woefully inadequate for the size of the current global population (Hammer, Anslow, & Connor, 2013). Despite this, there are arguments that advocate for "changing towards more sustainable farming practices, such as organic farming" (Khan et al., 2009, p. 148) to improve the energy productivity of farming. Therefore, the climate-motivated-eating strategy to *choose organic* is supported by inconsistent evidence for its ability to reduce GHG emissions from the food system, particularly when accounting for yield productivity.

There is inconsistent evidence supporting the efficacy of *changing food preparation* for reducing the GHG emission from food systems. Some studies suggest that consuming foods with minimal processing (MacRae et al., 2013), or changing processing practices like reducing the amount of oil used to fry foods (Mouron et al., 2016) could reduce GHG emissions. While these strategies appear to be supported in the literature, the strategies shared on social media that were assessed were largely related to reducing food packaging. While reducing food packaging was supported by MacRae et al. (2013), other evidence encouraged *optimizing* packaging (Wikström & Williams, 2010). In fact, Wikström and Williams (2010) found that increasing the environmental impact of packaging can reduce overall GHG emissions by minimizing food losses, particularly for high emission intensity foods like meat or dairy.

4.2.3.3 Strategies About Changing Diet Composition

There was inconsistent support in the reviewed literature to encourage *changing protein habits* towards replacing traditional animal protein with soy and insect protein. While some substitution from traditional livestock protein to soy or insect protein could reduce GHG emissions, there is evidence that insect farming can have relatively high fossil fuel requirements, and replacing the nutritional quality of beef would require additional nutrient fortifications (including, but not limited to Vitamin B_{12}, zinc, and iron fortifications) that come at increased environmental cost (Van Mierlo et al., 2017). Granted, there are few studies to review on insect farming, and because this is an emergent sector, the studies that do exist cannot assess scaled-up production, which would likely be more efficient as producer-expertise increases.

The reviewed evidence inconsistently supports choosing *sustainable meat* for reducing GHG emissions. The literature consistently supports that poultry and fish have lower GHG emissions than beef (Biesbroek et al., 2014; Parker et al., 2018; Poore & Nemecek, 2018; Song et al., 2017; Swain et al., 2018). However, the evidence was inconsistent on the potential for increased fish consumption to increase GHG emissions from the food system (Biesbroek et al., 2017; Lukas et al., 2016). This inconsistency is largely due to the fact that there is a tremendous range in the emission intensities and scale of landings within seafood systems (Parker et al., 2018).

Choosing grass-fed meat was inconsistently supported by evidence in the reviewed literature as a means to reduce GHG emissions from the food system. In the case of beef, cattle raised on pasture require longer to reach slaughter weight and consume more resources than cattle raised on corn, resulting in higher GHG emissions (González et al., 2011; Pelletier, Pirog, & Rasmussen, 2010; Pilgrim, 2013; Swain et al., 2018). Similarly, in the case of dairy, grass-fed cattle can result in higher CO_2e emissions per litre of milk than cattle fed with coproducts (Wilkinson & Garnsworthy, 2017). Further, grass-fed cattle contribute greater methane emissions than grain-fed cattle per unit of growth achieved (McWilliams, 2009; Swain et al., 2018). It is also simply not feasible to convert enough land to grassland to facilitate a widespread shift to grass-fed meat (Pilgrim, 2013). Therefore, if more livestock were grass-fed, there could be dramatic increases in GHG emissions from the food system, particularly if collective beef consumption is not dramatically reduced (Hall et al., 1992; McWilliams, 2009). These increases in GHG emissions could occur through the expansion of pasture lands into frontier areas like the Amazon basin, resulting in the release of substantial volumes of soil carbon (Garnett et al., 2017). Despite this evidence that refutes the notion that choosing grass-fed meat could reduce GHG emissions from the food system, several reviewed studies referred to the carbon sequestration potential of grass-fed livestock through farm-scale improvements to soil organic carbon (Sá et al., 2017; Shrestha et al., 2017). Importantly, this claim may not fully consider the potential of comparatively large-scale carbon sequestration of returning grazing lands to natural conditions through reforestation, natural plantings, or maintaining small-scale grazing in forested areas (i.e. silvo-pasture) (Garnett et al., 2017).

While a vegan diet can reduce GHG emissions (Hallström et al., 2015; Lukas et al., 2016; Poore & Nemecek, 2018; Van Mierlo et al., 2017) and work towards meeting our global food system challenge (Ramankutty et al., 2018), the literature was inconsistent on the efficacy of a large-scale adoption of the *eat vegan always* strategy. In general, vegan diets contribute fewer GHG emissions than omnivorous diets, but some vegan diets, particularly with high levels of fruit consumption, can result in higher GHG emissions than some omnivorous diets (Rosi et al., 2017). This may be somewhat surprising, given the previously mentioned GHG emission reductions of reducing consumption of animal products. While it is beneficial from a GHG emission reduction perspective to reduce consumption of animal products, total elimination of animal products from diets (which often results in replacing animal-derived calories with protein-rich plants) does not always result in the lowest GHG emission diets. In some cases, the high volume of vegetable foods eaten to replace animal products (i.e. nuts, oils, legumes, and grains) in fully vegan diets can result in higher GHG emissions than the animal products they are replacing (Aleksandrowicz et al., 2016; de Boer et al., 2016; Frenette et al., 2016; Reynolds et al., 2017; Song et al., 2017; Zimmerman, 2016). Further, the review of the literature revealed that from a strictly climate change mitigation perspective, it is not necessary for all of society to transition towards total veganism. The evidence suggests that moderate reductions (rather than total abstention) in consumption of animal products (particularly from diets with large-scale consumption of animal products) could result in substantial reductions of GHG emissions (Aleksandrowicz et al., 2016; Dewey, 2018; González et al., 2011). Thus, the evidence is inconsistent and suggests that a vegan diet does not guarantee GHG emission reductions (Breewood, 2018).

4.2.4 Strategies Not Supported by Evidence

Now to consider strategies that were not supported by evidence in the reviewed literature. These non-supported strategies that were mentioned in the social media sample include *winemakers can mitigate climate change, source food from small farmers, avoid intensively produced foods,* and *avoid agricultural technology.*

4.2.4.1 Strategies About Changing Diet Composition

There were no climate-motivated-eating strategies relating to diet composition shared in the social media sample that were rated as 'not supported by evidence' in the reviewed literature.

4.2.4.2 Strategies About Changing Food Production

Avoiding intensively produced food was not supported by evidence in the reviewed literature as an effective way to reduce the GHG emissions from the food system. Sampled social media users advocating for this strategy frequently talked about avoiding "factory farmed" meat. While reducing meat consumption is well-supported by evidence to reduce GHG emissions from diets, if meat *is* consumed, GHG emissions on a per-serving level are often lowest when meat produced intensively on efficient farms (Garnett et al., 2017; Sá et al., 2017; Swain et al., 2018). This argument is made by Swain et al. (2018) who state that "intensification of meat production can dramatically reduce environmental impacts" (p. 1) and that "modern, intensive livestock systems, especially for beef, offer substantially lower land requirements and greenhouse gas emissions per kilogram of meat than traditional, extensive ones" (p. 1). Similarly, *sourcing food from* *small farmers* was not suggested as a strategy in any of the reviewed literature. Rather, the literature suggested that sourcing from large-scale efficient farms could reduce overall GHG emissions from the food system (Sá et al., 2017; Swain et al., 2018).

No evidence from the reviewed articles suggested that *avoiding agricultural technology* could reduce GHG emissions from food production. Rather, there was strong evidence in support of technology to optimize and reduce the impact of food production (Benis & Ferrão, 2017; Biesbroek et al., 2017; Delgado & Li, 2016; Fujimori et al., 2018; Monteiro et al., 2017). Similarly, there was no mention in the literature of the potential for *winemakers to mitigate climate change*, and rather the literature suggested abstention from discretionary and non-foods, including alcohol, to mitigate climate change (Poore & Nemecek, 2018).

4.2.5 Strategies Mentioned in the Literature but Not in the Social Media Sample

The reviewed literature suggested several strategies for reducing GHG emissions that were not mentioned in the sampled social media posts, including *reducing rice consumption, changing manure management,* and *investing in crop disease management*.

Reducing rice consumption was supported in the reviewed literature, but not mentioned in the social media sample as a way to reduce GHG emissions from the food system. Rice production is responsible for substantial GHG emissions, particularly when compared with other cereal crops (Poore & Nemecek, 2018; Song et al., 2017; Vetter et al., 2017). In addition to reducing rice consumption, there are opportunities to reduce levels of CH_4 emissions from rice production by shifting from continuous flooding to production on dryland or with multiple periods of drainage (Vetter et al., 2017).

Adjusting management of livestock manure was supported in the literature as an opportunity to mitigate GHG emissions from the food system, although this strategy was not mentioned by social media users in the sample. The literature highlighted that changes to contemporary manure management are necessary, although not sufficient in and of themselves, to meet GHG emissions reduction targets (Friel et al., 2009; Parajuli, Dalgaard, & Birkved, 2018).

Finally, the literature supported *investments for crop disease management* to reduce on-farm losses, but this was not mentioned by sampled social media users. This strategy could improve crop yields while reducing GHG emissions, thereby helping to address our global food system challenge (Mahmuti et al., 2009).

4.2.6 Strategies That Could Not be Evaluated

The remaining strategies expressed in the sampled social media could not be evaluated against evidence because: 1) they were too vaguely described, or, 2) they were never expressed as evidence in the targeted literature review.

Add marine algae to cattle feed was never mentioned in the reviewed literature. The reasons for the high prevalence of this strategy in the social media sample (see: **Table 5** and **Figure 5**) despite never being supported by evidence will be further discussed in **Chapter Five - Discussion.** Another strategy that arose in the reviewed social media posts but which cannot be evaluated is *change livestock feed.* While there is indeed great potential to reduce GHG emissions by altering livestock feed compositions (e.g. shifting from pasture-sourced forages to compound diets), this strategy was too vaguely expressed in the social media sample to be assessed. Similarly, the strategy communicated in the reviewed social media to *change food production (ambiguous)* cannot be evaluated.

While the evidence supports changing food production to improve efficiencies and reduce GHG emissions (particularly among high-impact producers), this strategy is too vague to be evaluated; some changes to food production would undoubtedly increase overall GHG emissions, while others would decrease them.

The same is true for the strategy to *choose food wisely (ambiguous)*; while dietary change is strongly supported for reducing the GHG emissions from food systems (Poore & Nemecek, 2018), this strategy does not offer any practical guidance for *which* foods we should choose to meet this goal. Finally, the strategy to *eat more specific non-meat ingredients* cannot be evaluated because none of the specific ingredients mentioned in the social media sample (i.e. hemp, melons, vegetables, whole food, olive oil) (see **Appendix A – Coding Scheme**) were mentioned in the targeted literature review.

5.0 CHAPTER FIVE – DISCUSSION

This research has aimed to: 1) explore which climate-motivated-eating strategies are communicated in a sample of Twitter and Instagram posts; and 2) consider the evidence that supports these strategies for reducing GHG emissions. The following discussion explores the greater implications of this study's results as a reflection of public understanding of effective climate-motivated-eating, and for climate change mitigation more generally.

This thesis asks up front about climate-motivated-eating, "are we out to lunch?" and on the basis of this research, the answer is "sometimes". The high-level results of this research (**Figure 5**) indicate that the most commonly shared climate-motivated-eating strategies on Twitter and Instagram are generally supported by evidence as being effective for reducing GHG emissions. In particular, many of the sampled social media posts demonstrate that their authors are on the right track in understanding that reducing the impact of meat consumption (40.8% of strategies shared in the combined Twitter and Instagram sample) and shifting away from red meat (3.2%) are effective strategies for reducing GHG emissions from the food system. However, major misconceptions remain about effective climate-motivated-eating. Prominent among these misconceptions is that avoiding intensively produced food (12.2%) will reduce GHG emissions from dietary choices. This is concerning because of the imperative to quickly mitigate climate change, and a risk is that ineffective climate-motivated-eating strategies could *increase* GHG emissions from the food system. Policymakers and food system communicators should re-examine how the public is taught about the food system's contributions to climate change. While it is important to consider all ideas for addressing climate change, we must work to prioritize the most effective options.

While in many cases social media users are sharing effective climate-motivated-eating strategies, there remains room for improvement within social media conversations related to communicating effective strategies for reducing personal GHG emissions through dietary choice. As Whitmarsh and colleagues (2011) and Wynes and Nicholas (2017) have argued, we, the public, generally misunderstand how our personal actions contribute to GHG emissions, which limits our ability to make lifestyle changes that are effective in reducing our personal GHG emissions. Given the role that food systems play in our collective GHG emissions (Poore & Nemecek, 2018), we should be collectively empowered to know how to reduce our personal diets' contributions to GHG emissions. The results of this research demonstrate some misalignment in the intention of social media users in sharing climate-motivated-eating strategies and the strategies' actual GHG emission reduction potential: several strategies shared in the analyzed sample could actually *increase* the GHG emissions of diets.

The results of Objective One, which explored the climate-motivated-eating strategies that are communicated on Twitter and Instagram, reflect existing literature on the heuristics that consumers use to gauge the GHG emissions from dietary choices. For example, in prior research, consumers have been found to base assessments of a food's climate change impact on the kind of food (e.g. vegetables or meats), organic labelling, and the related characteristics of seasonality and proximity of production (Lazzarini et al., 2016). Further, consumers have been found to be particularly concerned about plastic packaging, food waste, and pollution from large-scale food production (Macdiarmid et al., 2016). All of these climate-motived-eating strategies also arose amongst the strategies articulated in the social media sample that I analysed (**Figure 3**). Because these strategies are not necessarily effective in reducing GHG emissions, it appears that some consumers lack a sufficiently accurate understanding of the key drivers of diet-related GHG emissions. This is a finding that Tobler and colleagues (2011) also made in their large-scale survey (6,189 respondents) in Switzerland, examining food "consumers' beliefs about ecological food consumption and their willingness to adopt such behaviours" (p. 1). My finding that some of the climate-motivated-eating strategies promoted on social media may be ineffective, or possibly even counter-productive, also echo the more general findings of Wynes and Nicholas (2017) who reflected on the pervasive promotion of ineffective behavioural-change strategies to address climate change.

Once again, the aim of this thesis is not to criticize climate-motived-eaters for being ineffective in their (our) efforts. While it is fully understandable that consumers are not always aware of the most effective climate-motivated-eating strategies, in the context of the pressing need to mitigate climate change, these misunderstandings should be corrected. Individuals who are seeking to reduce their personal contributions to GHG emissions should be empowered to make decisions to achieve our goals of climate-motivated-eating. While there is great potential to reduce GHG emissions from the food system through widespread dietary change (Poore & Nemecek, 2018; Springmann et al., 2018; Upham et al., 2011), this will not be an easy cultural shift. Policy recommendations that may be effective in facilitating large-scale behavioural change will be discussed later in this chapter.

5.1 Context for Difference in Representation of Strategies on Twitter and Instagram

As expected, there were marked differences in how often climate-motivated-eating strategies were communicated on Instagram and on Twitter, as shown in **Figure 4.** Several strategies that were prevalent in the Twitter dataset (e.g. *add marine algae to cattle feed*) were virtually absent from the Instagram dataset, and vice versa as the strategy *eat local* was prominent in the Instagram dataset but rarely mentioned within the Twitter sample.

These differences in the representation of strategies could result from simple random effects or could reflect the varied demographics of users of the platforms, and the fact that the platforms ultimately serve different purposes. As discussed in **Chapter Two – Literature Review**, in January 2019, of Americans aged 18-24, 44% were using Twitter and 75% were using Instagram, reflecting that Instagram is particularly popular among younger populations (Holmberg et al., 2016; Perrin & Anderson, 2019; Smith & Anderson, 2018). Of course, it cannot be confirmed that the demographic composition of social media users whose posts are analyzed in this sample are the same as that of Twitter and Instagram users as a whole. The global reach of the platforms is also quite different; in 2018, Twitter had 350 million monthly users worldwide (Twitter, 2019), while Instagram had 800 million monthly users (Pilař et al., 2018b). In terms of the number of posts shared per day, the inverse pattern is true, where 95 million posts are shared daily to Instagram (Clarke, 2019), compared with 500 million Tweets daily (Cooper, 2019a). This difference in the volume of posts partly explains the difference in sample sizes collected for this study, in which 5,490 Tweets and only 1,089 Instagram posts were collected over virtually the same time period.

Beyond differences in the demographics of these platforms' users, Twitter and Instagram serve different functions as social media spaces. Twitter users share either their own written content, information from other sources (e.g. news articles), or re-Tweets of other users' content (Veltri & Atanasova, 2017), all of which must be limited to a concise 280 characters (Tsukayama, 2017). Twitter is intended to answer the question "what's happening?" and content often relates to current events (Cody et al., 2015; Kirilenko & Stepchenkova, 2014). In contrast, Instagram posts are more open-ended, and users' main intention is to share personal images and videos, often accompanied by optional captions and hashtags, limited to 2,200 characters (Holmberg et al., 2016; Social Report, 2019). These functional differences in the purpose of the platforms likely affected what kinds of climate-motivated-eating strategies were communicated on them. Instagram posts tend to be more reflective of user's lifestyles; many of the posts in the Instagram dataset shared photos of meals, gardens, farms, and farmers' markets and frequently reflected what strategies the user had applied or considered that day for reducing their diet's contributions to GHG emissions. In contrast, the sampled Twitter posts more often linked to news articles, which resulted in Twitter users more often sharing posts about climate-motivated-eating strategies that they were not directly involved in, such as changing livestock feeds or changing land management practices. The differences in the primary sharing styles of these platforms (Instagram reflecting lifestyles, and Twitter reflecting opinions) may also reflect a rural versus urban divide in the climate-motivated-eating strategies being shared; urban social media users may be less likely to share photos to

Instagram of farming practices that are geographically distant from them, although they may share their opinions on these practices on Twitter. These differences in average user demographics, along with how these social media platforms are typically used, could have resulted in some of the marked differences in how climate-motivated-eating strategies were communicated on Twitter and Instagram.

5.2 Explaining the Relative Popularity of Climate-Motivated-Eating Strategies

Returning to the discussion of **Chapter Two – Literature Review**, it appears that Twitter and Instagram users are applying simple heuristics to guide dietary choices to meet their environmental goals (e.g. that foods in green packaging or locally sourced foods are better for the environment), but in several instances the efficacy of commonly shared climate-motivated-eating strategies are poorly supported by contemporary evidence (**Figure 5**).

It is encouraging to see individuals engaging with complicated discussions of how food systems interact with environmental challenges and trying to reduce their own contributions to GHG emissions. It is also understandable that the public, including social media users, are not always accurate in their understanding of how to effectively achieve this goal. Given this, and because our relationships with food are so complex, it is important to consider the context from which popular climate-motivated-eating strategies emerge; this will be the focus of the next section of this chapter.

5.2.1 Accounting for the High Popularity of the Strategy: Eat Vegan Always

These results (**Figure 5**) find that adopting a fully vegan diet was the most commonly shared climate-motivated-eating strategy shared on both Twitter (18.2% of all assessed Twitter strategies) and Instagram (27.5% of all assessed Instagram strategies), despite the conflicted evidence supporting widespread veganism as an approach to reducing the GHG emissions from the food system. This high prevalence online could be due to the combination of veganism supporting the trifecta of animal welfare (Tobler et al., 2011), human health improvements (Doyle, 2016; Tobler et al., 2011), and environmental benefits (Hallström et al., 2015; Lukas et al., 2016; Poore & Nemecek, 2018; Van Mierlo et al., 2017). The popularity of veganism in this sample could be caused by its efficacy across a range of goals, but there may also be more personal reasons for its high prevalence. For instance, there is evidence that vegans experience loneliness, cultural dismissal, and stigmatization for their unconventional dietary choice, and therefore turn to social media to connect with online vegan communities (Doyle, 2016; Whyte, 2018). Sharing one's personal choice to become vegan is a component of identity construction (Doyle, 2016), and social media provides a powerful platform for sharing this behaviour. The combination of these socio-cultural factors may partly explain why the strategy to eat a fully vegan diet was so prominent in these Twitter and Instagram samples.

5.2.2 Accounting for the High Popularity of the Strategy: Eat Fewer Animal Products

Strategies about reducing consumption of animal products (i.e. *eat fewer animal products, eat less meat,* and *avoid red meat*) comprised a combined total of 18.7% of strategies shared in the combined dataset, comparable with the strategy to *eat vegan always*, which comprised 19.6% of strategies shared in the combined dataset. Importantly, no social media users whose climate-motivated-eating strategies found their way into my datasets specified *how much* meat should be consumed, so it must be assumed that this strategy's instruction is for readers to eat less meat than however much they are currently eating. The prominence of strategies to *eat less meat* is encouraging, as it suggests the normalization of reducing meat consumption (van de Kamp et al., 2018).

The prominence of this strategy could be, in part, because consuming *less* meat still allows for some expression of the cultural importance of meat. As discussed in **Chapter Two – Literature Review**, individuals eat meat for reasons beyond nutrition: meat consumption is linked to cultural expression and values, social status, personal identity, and gender roles (Graça et al., 2015; Macdiarmid et al., 2016). Because of the deep-rooted cultural attachment to meat in many societies, it is unsurprising that decreasing consumption of animal products was a more frequently expressed strategy than eliminating meat consumption altogether (i.e. *eat vegetarian*).

5.2.3 Accounting for the Low Popularity of the Strategy: Eat Vegetarian

Because vegetarianism seems 'easier' than veganism from a personal dietary change perspective, I was surprised that the strategy *eat vegetarian* only comprised 1.4%

of strategies shared in the combined Twitter and Instagram dataset (compared with 19.6% of strategies that advocated for *eat vegan always*). This relatively low prevalence in the sample could be explained by the fact that vegetarianism has benefited from several decades of acceptance in Western culture (Kauffman, 2018), and so vegetarians may not be looking for acceptance and connection in online communities as much as vegans are. The relative novelty of veganism compared with vegetarianism may also explain the difference between the popularity of veganism and vegetarianism online, as recently converted vegans may be more vocal about their new behaviours than longstanding vegetarians. Further, a general cultural reluctance to abstain from meat consumption may partly explain the lower prevalence of vegetarianism than strategies to eat *less* meat. Many studies have referenced a cultural unwillingness to *eliminate* meat consumption; this can be due to members of the public underestimating scientific evidence linking climate change with meat production (de Boer et al., 2016; Lea & Worsley, 2008; Macdiarmid et al., 2016; Reynolds et al., 2017; Tobler et al., 2011; Whitmarsh et al., 2011), or feeling that they eat relatively little meat or have already reduced meat consumption (Macdiarmid et al., 2016). These cultural factors working against the elimination of meat consumption could partly explain why the strategy to *eat vegetarian* was not very prominent in the strategies shared online.

5.2.4 Accounting for the High Prevalence of Strategies Relating to Livestock Feed

The prevalence of *add marine algae to cattle feed* (9.5% of strategies shared in the combined dataset) as a climate-motivated-eating strategy arguably reflects the nature of virality on social media. Despite the highly experimental nature of this livestock feeding strategy (Gabbatiss, 2018; Kinley, de Nys, Vucko, Machado, & Tomkins, 2016), its popularity in the analysed social media posts would seemingly reflect some of the key characteristics of viral content: being positive, actionable, and highly transitory (Berger & Milkman, 2012; Hansen, Arvidsson, Nielsen, Colleoni, & Etter, 2011). This simply expressed (though practically difficult to execute) strategy to *add marine algae to cattle feed* offers an optimistic and seemingly simple fix to cattle farming's well-established contributions to climate change. The strategy emerged in the sample as follows: in mid-2018, a research team led by Professor Ermias Kebreab at the University of California Davis updated journalists from *The Independent* on their unpublished and highly preliminary findings about reducing methane emitted by dairy cattle by adding red algae and molasses to cattle feed (Gabbatiss, 2018). This unpublished research built upon an earlier peer-reviewed study conducted in Australia (Kinley et al., 2016). The Independent then published an online article outlining the very preliminary nature of the findings of Kebreab's work, while also stating that a "small amount of marine algae added to cattle food can reduce methane emissions from cattle gut microbes by as much as 99 per cent" (Gabbatiss, 2018). In late June, 2018, a Twitter user shared this article and the strategy to *add marine algae to cattle feed*. This Tweet was then re-Tweeted 548 times within the messages that I analysed, and the same text was also shared in one Instagram post, for a total of 549 mentions within the combined social media sample that I analyzed. As a result, this strategy comprised 11.1% of strategies shared on Twitter, but only 0.1% of strategies shared on Instagram. Due to the prolific re-posting of one Tweet that mentioned this strategy, it appears that this strategy's prevalence in the analyzed sample was caused to some extent by virality. Because of the temporal dynamics of viral concepts, I expect that if this study were conducted during a different time period (even a few weeks earlier or later), the strategy to *add marine algae to cattle feed* could be absent from the sample or would likely be much less prevalent. However, a different viral post could be included instead.

The overwhelming majority of the strategies to *change livestock feed* (in total, comprising 9.7% of strategies shared in the combined dataset) referred to *add marine algae to cattle feed* (comprising 9.5% of strategies shared in the combined dataset, and therefore 97% of the strategies within *change livestock feed*), however this interest in changing livestock feed is interesting to unpack. The prominence of strategies to *change livestock feed* may reflect a cultural desire to reduce the impact of meat consumption through producers, rather than changing diets to consume less or different species of meat. Thus, by advocating for feeding livestock marine algae, social media users may be advocating for food system change that allows them to have their meat and eat it too.

5.2.5 Accounting for the Prevalence of the Strategy: Avoid Intensively Produced Food

The prominence (comprising 12.2% of strategies shared in the combined dataset) of the poorly supported strategy to *avoid intensively produced food* points to a concerning misunderstanding of the source of GHG emissions from food production. This viewpoint is expressed in Zacharias and Stone’s (2018) book *Eat for the Planet,* which sarcastically states that "humankind decided it would be a great idea to turn farms into factories with one simple goal: to produce massive quantities of meat, eggs, and milk at the lowest possible cost" (p.13) and "the industrial livestock system is at the heart of our environmental crisis" (p.134). These quotes reflect the framing that the environmental impacts, including GHG emissions, associated with meat production comes from the *intensive* production of livestock, rather than the *extensive* raising of livestock and the sheer *numbers* of livestock that are being raised.

The prominence of this general food production strategy in this sample could, in part, be explained by the fact that the public's trust in the conventional food system is low (Macdiarmid et al., 2016; Medaas, 2014; Reynolds et al., 2017; Rotz, 2018). However, public mistrust of the food system is not a new phenomenon (as evidenced by Upton Sinclair's (1906) *The Jungle* for example), and "in the mid-1950s, and accelerating into the early 1970s, a growing body of books warned innocent diners about the dangers of fertilizers, pesticides, and food additives" (Kauffman, 2018, p. 113). These titles included Longgood's (1960) *The Poisons in Your Food,* and Hunter's (1972) *Consumer Beware! Your Food and What's Been Done to It* (as cited in: Kauffman, 2018).

Another reason why the strategy to *avoid intensively produced food* may have been so prominent is the conception that agriculture should align with nature, and that the rural idyll should be preserved (Halfacree, 1995; Swaffield & Fairweather, 1998). In contemporary ethical eating discourse, food systems are framed as being increasingly separated from nature; however, agricultural production can never be harmonious with nature as it inherently transforms nature in order to produce outputs (McWilliams, 2009). Even small-scale farming, which is often framed as being sustainable and environmentally idyllic, results from land-use change. Importantly, there is substantial evidence that some low-input, extensive food production systems can result in higher GHG emissions than their industrial, high-input counterparts when comparing GHG emissions per unit of food produced (rather than per unit of land area). As discussed at greater length in **Chapter Four – Results**, one of the more prominent examples of this is livestock production, where grass-fed beef has been found to result in higher GHG emissions per unit of edible meat than confinement-finished cattle (González et al., 2011; McWilliams, 2009; Pelletier et al., 2010; Pilgrim, 2013; Swain et al., 2018; Wilkinson & Garnsworthy, 2017). Of course, by design these measures of GHG emissions intensity do not consider the welfare implications for livestock animals in intensive versus extensive production systems. Further, it is very difficult to account for potential rebound effects, through which increased efficiency in production can lead to decreased prices for products, increasing overall consumption, and negating the environmental benefits of efficiency improvements (Jevons, 1865).

Another potential reason for the prevalence of strategies related to avoiding intensively produced food is that "a lot of recent scholarship and the smorgasbord of television reports, magazine cover stories, popular books, and shock documentaries … build on older and more questionable muckraking, populist, protectionist, pastoral nostalgia, 'small is beautiful' and 'vitalist' traditions" (Desrochers & Shimzu, 2012, p. 2). Inherent in the ideas of 'simple', 'real', 'authentic', and 'natural' production (i.e. not industrial or mass-produced) is the theme of nostalgia, where ethical eaters hold a fondness for, and wish to return to, pre-modern farming practices (Johnston & Baumann, 2015; McCullen, 2011; Medaas, 2014).

Related to this idea is the discourse surrounding small-scale farming, which Reynolds and colleagues (2017) have argued is largely driven by a feeling of a loss of consumer connections to food production, as manifested through a loss of food-based skills. In this context, shifting towards smaller-scale farming is framed as a way to increase connectivity and environmental accountability between food producers and consumers (Alkon, 2012). These ideas are expressed in online spaces, where "modernity and nostalgia coincide, and at times contradict" (Medaas, 2014, p. 2). This "preindustrial romanticism" (Kauffman, 2018, p. 14), "false nostalgia" (Rousseau, 2012a, p. 56), and the fact that historical food provisioning is being positioned as *better* than current production is important to unpack. The history of food safety and environmental impacts have been distorted by common misunderstandings of agricultural processes, and the framing of a forgotten:

> …golden age of food production – a golden age of ecological purity, in which the earth was in balance, humans collectively respected the environment, biodiversity flourished, family farms nurtured morality, and ecological harmony prevailed. Thing is, there was no golden age. (McWilliams, 2009, p. 6)

Framings of a better past erase the pervasive nutritional deficiencies, famines, ecological destruction, and slavery that occurred in food production for much of human history and continue in many parts of the world today, where, due to socio-economic inequality, many farmers are unable to access agricultural technologies and inputs that could improve their yields while reducing associated GHG emissions (Kauffman, 2018; KC & Fraser, 2017; McWilliams, 2009). As McWilliams (2009) and KC and colleagues (2016) have argued, ecologically responsible food production requires looking to history for improvements, but not for a return to outdated and inefficient techniques that are insufficient to mitigate climate change while improving food accessibility.

These underlying cultural phenomena suggest that the prominence of the strategy to *avoid intensively produced food* aligns with broader ethical eating discourses despite not aligning with evidence regarding its effect on reducing GHG emissions. Because this strategy is not supported by academic evidence but is so prominently shared online in the name of climate, it is important to reframe this discourse. Of course, many criticisms of conventional food production are valid and should not be ignored. However there remain important opportunities for correcting public understanding of this strategy that is largely ineffective in meeting social media users' stated goals of mitigating climate change by avoiding intensively produced food.

5.2.6 Accounting for the Low Prevalence of the Strategy: Choose Organic Food

The strategy to *choose organic food* only comprised 0.7% of all strategies shared in the combined dataset, surprisingly low considering the trajectory of popularity of organic food. The organic food industry has grown rapidly over the past few decades (Szasz, 2007), particularly in the US, where the number of organic farms grew 245% between 2002 and 2015 (Johnston & Baumann, 2015). Further, as discussed in **Chapter Two – Literature Review**, purchasing organic food is a well-known virtue-signaling activity, due to the public's perception that buying organic is an altruistic choice (McWilliams, 2009; Pilař et al., 2018b; Puska et al., 2016; Szasz, 2007), as well as being a status-signaling activity due to organic food's relatively high cost (Puska et al., 2016). Despite these potential motivators for promoting organic food consumption on social media, the low prominence of *choose organic* in this sample may suggest that social media users understand that organic production does not necessarily reduce GHG emissions (de Boer et al., 2016; Johnston & Baumann, 2015). Further, the popularity of organic food may be more tied to its perceived health, food safety, and taste benefits than as an environmental choice (Johnston & Baumann, 2015; Pilař et al., 2018a; Pilař et al., 2018b; Szasz, 2007). Given the higher GHG emissions often associated with organic food production when compared with conventional production (Clark & Tilman, 2017; Garnett, 2013; McWilliams, 2009; Reynolds et al., 2017; Saxe, 2014), it is encouraging that this was rarely advocated for as a climate-motivated-eating strategy in the social media sample.

5.2.7 Considering the Low Prominence of the Strategy: Eat Local

Given recent strong cultural backing for local eating, it was surprising that *eat local* only comprised 1.7% of the climate-motivated-eating strategies shared across both Twitter and Instagram samples. Local eating rose to cultural prominence in the mid 2000s, highlighted by the fact that local eating was named 2006's "hottest trend in food" by the San Francisco Chronicle, and *locavore* was the New Oxford American Dictionary's word of the year for 2007 (as cited in: Johnston & Baumann, 2015). These trends were spurred on by Smith and MacKinnon's popular 2007 book, *The 100-Mile Diet,* which framed local eating specifically as a platform for thinking about climate change. Simultaneously, the number of farmers' markets in the USA increased rapidly (Smith & MacKinnon, 2007), and local eating has been said to have "reached near common-sense status" (Johnston & Baumann, 2015, p. 124).

In previous research on public perceptions of the environmental impact of food choices, local eating has been closely linked to environmental activism, and specifically to climate change mitigation through reducing GHG emissions from food transportation (Desrochers & Shimzu, 2012; Hiroki et al., 2016; Johnston et al., 2011; Johnston & Baumann, 2015; Lea & Worsley, 2008; McWilliams, 2009; Tobler et al., 2011; Whitmarsh et al., 2011). Despite this seemingly simple relationship, as discussed in **Chapter Four - Results**, while eating locally can reduce GHG emissions from food *transportation*, this does not necessarily translate to overall emissions reductions, as overall GHG burdens depend on the scale of emissions from other parts of the food's life cycle (Desrochers & Shimzu, 2012; Dewey, 2018; Hiroki et al., 2016; McWilliams, 2009; Reynolds et al., 2017). In the context of the public's strong association between local eating and GHG reductions that have been identified in other research, it is somewhat surprising that *eat locally* was not more prevalent in this sample of climate-motivated-eating strategies. Perhaps this low occurrence signals that social media users understand that food transport emissions are not necessarily the top priority for emissions reductions from the food system.

5.2.8 Accounting for the Relatively High Popularity of the Strategy: Avoid Food Waste

Strategies relating to reducing the amount and impact of food waste comprised 9.5% of those shared in the combined dataset. This sample's strong interest in this strategy is consistent with the increasing global concern about the scale of food waste (Mifflin, 2019). Mifflin's (2019) study found that between 2009-2019 there was an 800% increase in the number of academic articles published annually to Web of Knowledge referring to "food waste" or "food loss". This prominent concern about food waste is likely motivated by a number of factors: to waste food in the context of widespread food insecurity seems unethical (although food insecurity is not caused by food shortages (Garnett, 2014)); wasting food is a poor use of the money spent to purchase it; and producing food that is never eaten or is over-consumed (eaten when not needed) is responsible for unnecessary GHG emissions (Mifflin, 2019). Given these multi-faceted framings of the problem of food waste, it is unsurprising that Twitter and Instagram users are also framing food waste reduction as a win-win for environmental and social benefits; importantly, Mifflin (2019) describes that food waste reduction is not necessarily a "win-win" as reducing food waste does not inherently lead to GHG emissions reductions.

5.2.9 Exploring Dichotomous Climate-Motivated-Eating Strategies

The prevalence of stark dichotomies is very common in contemporary discussions of how the food system impacts the environment (Johnston & Baumann, 2015), as with the binary framings of foods that are local versus distally sourced, small-scale versus industrially produced. This phenomenon is well-described by (McWilliams, 2009):

> Something about food fosters radical dichotomies. We instinctively feel an overwhelming desire to take sides: organic or conventional, fair or free trade, "pure" or genetically engineered food, wild or farm-raised fish… to be a centrist when it comes to food is, unfortunately, to be a radical. (p. 5)

This phenomenon is reflected in my research, as many of the most popular strategies shared in this sample are in their nature dichotomous. Consistent with Johnston and Baumann's (2015) findings of the dichotomous framing of 'good' and 'bad' foods, many sampled social media users directly contrasted 'bad' industrially produced foods with 'good' artisanal foods chosen for environmental motivations. Further, the strategy of veganism provides an interesting example for exploration. In a fully vegan diet, no level of consumption of animal products is acceptable, and therefore veganism can be viewed as a dichotomous strategy. Recall that strategies encouraging readers to *eat vegan always* were the most prominent in all of the datasets. In contrast, strategies encouraging readers to greatly reduce their consumption of animal products (i.e. *eat fewer animal products*), or to eat a diet with more vegan meals in it, although not fully vegan, were substantially less popular in each dataset. This suggests that veganism is primarily viewed by climate-motivated-eaters as an "all or nothing" dichotomous approach, rather than as a flexible strategy that can be employed to varying degrees (i.e. *eat fewer animal products*). Perhaps there is something about the dichotomously simple nature of this strategy that makes it appealing for broader communication by social media users.

Though popular, many of these seeming dichotomies are artificial as they reduce phenomena that occur over a gradient or spectrum to a seemingly simple binary. The persistence of dichotomous climate-motivated-eating strategies is concerning. In this time of climate crisis and facing our global food system challenge, we need to make compromises, consider trade-offs, incorporate LCA perspectives, and work collaboratively toward our collective goal of reducing the GHG emissions from food systems.

5.3 To What Extent is This Research Broadly Applicable?

5.3.1 Do Social Media Discussions Reflect Broader Society?

The demographic composition of social media users, as described in **Chapter Two – Literature Review**, demonstrates that social media users are not a representative sample of society: engagement with social media skews towards younger populations (Dyar et al., 2014; Holmberg et al., 2016; Paul & Dredze, 2011; Perrin & Anderson, 2019; Smith & Anderson, 2018). In addition, only a very small subset of social media users engage in online conversations about climate-motivated-eating, and of these, this research only studied posts written in English. Further, participation on social media necessitates a smartphone or computer and Internet connection; access to all of which are limited by financial resources and physical Internet infrastructure, both of which vary drastically throughout the world (Murphy & Roser, 2019). Therefore, readers should not infer universal applicability of this research. However, there is precedence in the literature that conversations on social media broadly reflect conversations occurring offline, as discussed in greater detail in **Chapter Two – Literature Review** (Aramaki et al., 2011; Bollen et al., 2011; Kang et al., 2017; O'Connor, 2017).

5.3.2 Does This Research Reflect Behaviour?

This research has explored the climate-motivated-eating strategies shared over a limited period of time on two social media platforms, but it has not measured individuals' food consumption *behaviour*. It is well-known that "attitudes alone are a poor predictor of marketplace behaviour" (Vermeir & Verbeke, 2008, p. 543). So, although there seems to be strong *interest* in climate-motivated-eating, the *behaviours* of individuals that posted the analysed strategies may not necessarily align with the practices they advocated; this is due to the 'attitude-behaviour gap' (Hwang et al., 2010; Mancini et al., 2017; Pinto et al., 2014; Whitmarsh et al., 2011). Therefore, it is possible that the actual food consumption of climate-motivated-eaters does not reflect the strategies expressed in this study's results. Nevertheless, understanding what people *think*, regardless of what they *do*, remains an important basis of research and is reflected in many more traditional means of assessing people's opinions and attitudes, including the use of surveys and polls to measure respondents' *intentions* (Polizzi di Sorrentino et al., 2016; Stephens-Davidowitz, 2017). Further, online discussions about climate-motivated-eating likely reflect *and* affect real-world conversations and, to some extent, behaviour (Jang & Hart, 2015; Veltri & Atanasova, 2017; Williams et al., 2015).

These results offer insight into how some social media users *think* about climate-motivated-eating, and we can extrapolate that sampled social media users understand that reducing consumption of animal products will help to reduce personal GHG emissions.

Further, it seems that the sampled social media users may benefit from clearer understanding that intensively produced foods often contribute lower GHG emissions on a per-calorie basis than extensively produced foods. With this limited gauge of the social-media-using-public's understanding, education and behavioural change policies can perhaps be better targeted to shift behaviour towards effective climate-motivated-eating strategies.

5.4 Policy Recommendations to Increase Effective Climate-Motivated-Eating

5.4.1 Recognizing the Limitations of the Knowledge-Deficit Model

In the context of ineffective climate-motivated-eating, there is a natural tendency to suggest that 'if people only knew' the GHG emissions of foods (e.g. through carbon footprint labelling), they would adjust their behaviour to make lower-emission choices. However, the efficacy of carbon footprint labelling for changing behaviour is much debated (Upham et al., 2011). While carbon footprint labelling can provide standardized information to consumers and correct the market failure that obscures this information (Upham et al., 2011), the assumption that providing consumers with more information will affect behaviour change is known as the knowledge-deficit model (Borel, 2017; Graham & Abrahamse, 2017).

It is important to highlight the knowledge-deficit model in this thesis, which ultimately considers how individuals' dietary choices can achieve the collective benefit of reduced GHG emissions. While it is concerning to see the misalignment of intentions and outcomes in the climate-motivated-eating strategies shared on social media, researchers must not

> …principally (or solely) blame individuals' lack of knowledge and understanding for their low levels of pro-environmental behavior. Rather… current systems of provision are often not conducive to such practices; and … contextual barriers contribute to the widely reported "value-action gap" (Whitmarsh et al., 2011, p. 63).

As discussed at length in **Chapter Two – Literature Review**, food choices are not simply functional nor logical decisions (Johnston & Baumann, 2015; Rousseau, 2012b), and providing information like the carbon footprints of food items will not have a straightforward effect on changing behaviour. This framing underestimates the complex socio-cultural forces influencing food choices, including personal identity, habit, emotion, and taste as well as temporal and economic constraints (Alkon, 2012; Borel, 2017; Cairns & Johnston, 2018; Duhigg, 2012; Hwang et al., 2010; Upham et al., 2011). While more knowledge can increase *concern* about issues, this does not necessarily result in behavioural change (Graham & Abrahamse, 2017; Polizzi di Sorrentino et al., 2016; Vermeir & Verbeke, 2008; Wynes & Nicholas, 2017), and even less predictably into *effective* behavioural change (Szasz, 2007). For example, in general, individuals say they care about animal welfare, and *know* that eating meat causes harm to animals, however most individuals continue to enjoy meat (Cairns & Johnston, 2018). In fact, Hoolohan et al. (2013) caution that "the provision of too much information on GHG emissions associated with individual products may be counterproductive and that promotion of … simple guidelines … may be more effective in guiding consumer choices" (p. 1,073).

Despite these cautions, carbon labelling can remain an important component of broader strategies for steering consumer choice towards diets with lower GHG emissions. Carbon labelling on foods may pressure food producers and retailers to shift towards lower-GHG emission offerings to maintain public approval (Tobler et al., 2011; Upham et al., 2011). Although consumers are unlikely to choose foods based on GHG impact alone, providing the information along with associated price incentives or disincentives, such as a carbon tax, would better encourage consumers to choose foods with lower GHG emissions (Whitmarsh et al., 2011). Governments will need to mandate these labels – as many governments have done with nutritional labels – since many food retailers and producers will be reluctant to label their products as environmentally damaging (Tobler et al., 2011), particularly in the absence of similar information being reported by their competitors. Further, if carbon labelling on foods is to be widely applied, it will need to include carbon *reduction* plans, so that food producers commit to reducing these emissions over time and to the greatest extent possible (Upham et al., 2011). To be effective, carbon labels will have to compete for consumers' attention with food marketing, sales, and nutritional information (Upham et al., 2011). Further, taste and health qualities will likely remain most important for most consumers, and there will always remain a population for whom GHG emissions are not a motivating factor in food choice (Upham et al., 2011).

5.4.2 Strategies for Developing New Heuristics

To meet the scale of dietary change necessary to mitigate climate change through the food system, individuals will need updated and coherent heuristics to guide effective climate-motivated-eating (Upham et al., 2011; Vermeir & Verbeke, 2008). In developing heuristic-shifting policies, we must remain cognizant of cultural influences on individuals' food choices. It has been observed that a major failing of medical approaches to dietary change is that they too often ignore the social aspects of eating; food serves functions beyond nutrition, so social dimensions must be considered when developing policies to improve climate-motivated-eating (Macdiarmid et al., 2016). This is highlighted by the fact that even “knowledgeable and willing individuals” may not switch to lower emission choices (e.g. reducing meat consumption) if cultural norms remain as obstacles (Wynes & Nicholas, 2017, p. 6). The challenge here is exacerbated by commensality: eating is often a social activity, which in turn restricts personal dietary changes if they are not approved of by one’s social group (Macdiarmid et al., 2016; Reynolds et al., 2017).

Recognizing this social dimension, successful efforts to adjust heuristics will vary across countries, economic statuses, genders, family sizes etc. When encouraging behavioural change, Prescott (2018) cautions that “to keep up any kind of diet – be it for health or the environment – we must find that diet to be attainable and *personally* sustainable” (p. 11). Therefore, we need to differently communicate information about the GHG emissions from food choices for different members of the population (Graham & Abrahamse, 2017). This goal can be achieved by framing solutions as multi-faceted; many low-GHG emission dietary choices can also improve public health and animal welfare, such as consuming nutritionally appropriate portion sizes and reducing meat consumption (de Boer et al., 2014). Further, targeting consumers who are going through changes in their stage of life (e.g. getting married or having a child) can be a particularly effective time to facilitate behavioural change because these are times when dietary habits are particularly malleable (Duhigg, 2012).

In efforts to shift consumer behaviour, it is important to avoid dogmatic approaches, to which people respond poorly (de Boer et al., 2014). For example, policies aiming to encourage the public to eat less meat must be carefully enacted because individuals with strong attachment to meat may respond defensively through 'loss-aversion mechanisms' that could *increase* attachment to (and consumption of) meat (Graça et al., 2015). This suggests that large-scale efforts to reduce meat consumption will need to focus on countering social conceptions of the role of meat in diets (Macdiarmid et al., 2016). The Meatless Monday movement has succeeded in bringing greater attention to reduced meat consumption through its stepwise, gradual approach and its inclusive and attainable goal of abstaining from meat once a week (de Boer et al., 2014; Tobler et al., 2011). Another potentially successful heuristic-shifting approach would be for retailers, restaurants, and food providers to employ the 'nudging effect' by making vegetarian options more prominent, or as the default for prepared meals, requiring consumers to request and then pay more for meat to be added (Graham & Abrahamse, 2017). Similarly, there is potential to reduce portion sizes (and associated food waste from overconsumption and plate waste) through subtle cues. Portion size is often reliant on automatic behaviour, so unobtrusive changes like encouraging multiple small helpings of food rather than one large helping or shrinking plate sizes may be effective in reducing overall portion sizes (de Boer et al., 2014).

Further lessons can be drawn from the effects of the high-quality meat shortage in the US during the Second World War, which led the federal government to encourage American families to substitute traditional meats with organ meats (Duhigg, 2012). Despite initial aversion to these unfamiliar meats, the government's dietary change campaign was ultimately effective because it encouraged substitutions that allowed the practice of familiar habits; for example, distributing recipes that taught how to substitute liver in meatloaf instead of higher-quality cuts of beef (Duhigg, 2012). US consumption of organ meats rose by 33% between 1941-1945, and up to 50% by 1955; even after the war, a formerly unfamiliar food had been integrated into cultural dining habits (Duhigg, 2012). The importance of disguising dietary change as familiar foods is also highlighted by the failure of other American dietary change programs (e.g. those encouraging increased consumption of fruits and vegetables), that have not camouflaged dietary change recommendations as existing habits (Duhigg, 2012).

None of the aforementioned strategies for promoting dietary changes require carbon labels, but rather the development and propagation of new heuristics that promote lower-impact foods and nutritionally grounded portion sizes (Hoolohan et al., 2013). In promoting these new heuristics, it must be remembered that people are not uniform, consistent, nor purely rational (Köster, 2003). To effect meaningful change, policy makers interested in mitigating climate change through widespread dietary shifts must embrace and communicate the complexity of how dietary choices contribute to GHG emissions, and in doing so improve scientific literacy (McWilliams, 2009; Mosby, 2018). Empathetic and informative public outreach from food system experts will be critical to achieving our collective goal of reducing GHG emissions from the food system (McWilliams, 2009).

5.4.3 Tangible Roles for Governments

Although choices at the grocery store will ultimately be left to consumers, governments can assist climate-motivated-eaters in achieving their goal of reducing the GHG emissions associated with their diets (de Boer et al., 2014; Wynes & Nicholas, 2017). While it does not go far beyond providing ‘green advice’ to consumers (Hwang et al., 2010), governments should carefully implement food guides that normalize and encourage shifting to diets with lower GHG emissions (de Boer et al., 2014). Further, given the complexity of shifting social behaviour towards choices with lower GHG emissions and the imperative to do so, governments interested in effecting reductions in food-related GHG emissions could invest in interdisciplinary research projects. This kind of research will require collaboration from experts in the fields of environment, nutrition, public health, consumer behaviour, social psychology, agriculture, food marketers, and beyond, in order to harness as much understanding as possible on the deeply interdisciplinary problem of how to reduce the food system's contributions to climate change (Graham & Abrahamse, 2017).

Structural changes can also attempt to address some of the criticisms explored in **Chapter Two – Literature Review**. These criticisms include that individual-consumption-oriented activities are ill-suited for the level of behavioural change needed to mitigate climate change, and it is unfair to burden 'responsible' citizens with the responsibility of acquiring the knowledge for *effective* climate-motivated-eating (Cairns & Johnston, 2018; Johnston & Baumann, 2015). One proposed way for governments to facilitate more structural shifts in food production and consumption is to drastically reduce or eliminate perverse subsidies. Perverse agricultural subsidies, such as those on corn production, are so significant (valued in the trillions of dollars) that they result in large-scale damage to environments (KC et al., 2016; McWilliams, 2009). Perverse subsidies have been described as "actively and aggressively work[ing] against … every food reform idea of environmental worth" (McWilliams, 2009, p. 190). There is precedent for governments to take this approach, as in the case of New Zealand, where the national government eliminated all agricultural subsidies in 1984 (McWilliams, 2009). Eliminating subsidies can go some way towards reflecting the true cost of food production, however, for many effectively unpriced environmental externalities of food production, including GHG emissions, other policy interventions will be required before their impact is transmitted into prices. Shifting demand away from foods responsible for high GHG emissions is certainly possible through policy mechanisms that work to internalize the cost of GHG emissions, but these need to be well-designed in order to affect the scale of change required for climate change mitigation (KC et al., 2016).

Ideally, any carbon pricing on food should be comprehensive and adopted on a global scale; KC et al. (2016) recommend that this be executed through the UN Framework Convention on Climate Change. Appropriately designed and implemented, carbon pricing on food could raise the price of meat products relative to most other sources of protein and encourage consumption of protein sources with lower GHG emissions, like legumes (KC et al., 2016). Finally, Poore and Nemecek (2018) argue that governments should pursue policies that ensure that low-impact producers receive higher prices for their products to encourage high-impact producers to adopt more sustainable production practices. However, this must be approached with caution, because (as has been demonstrated through organic foods) passing price premiums on to consumers limits the extent of practice change (Poore & Nemecek, 2018). Further, hundreds of millions of individuals already struggle to afford adequate nutrition, and increasing food prices could adversely affect food security.

In all of these efforts, governments must remain cautious of the rebound effect, in which widespread climate-motivated-eating may have unintended consequences that may *increase* GHG emissions (Chitnis, Sorrell, Druckman, Firth, & Jackson, 2014). Beyond the classic example of increased production efficiency reducing costs and thereby increasing consumption, the rebound effect is also characterized by the following example; efforts to promote reduced meat consumption may result in the rebound effect if consumers avoid buying expensive meat, save money, and spend their saved money on GHG-intensive activities like air travel. Therefore, solutions that genuinely aim to reduce overall GHG emissions will need to account for and minimize environmental rebounds.

5.5 Limitations of This Research

While this work was conducted with great care and under the supervision of senior researchers, there are important limitations that affect the accuracy of these results in their representation of how climate-motivated-eating is discussed on social media.

5.5.1 Lacking Inter-Coder Reliability

Given the temporal limitations of this project, it was not feasible to incorporate inter-coder reliability to ensure that the sample of social media posts would be coded the same way by another researcher. Inter-coder reliability is intended to improve the rigour of coding processes by having several coders analyze the same data (Richards, 2005). While inter-coder reliability may have been advantageous, I am confident in these results because of my strong familiarity with these data; I personally designed the study and completed the coding. Further, after the initial coding process was complete, I double-checked every post and its associated coding to ensure that I had coded consistently over the four months that it took to manually process every post in the two samples. Several mis-coded posts were caught during this process and were corrected. This careful proofreading and double-checking of the work improved the veracity and trustworthiness of the data analysis. Further, in designing the coding scheme, it was ensured that the 120 code labels (i.e. the detailed climate-motivated-eating strategies) were sufficiently descriptive that they could not be misunderstood for another meaning. For example, the code "eat more chicken" could only be applied to posts that specifically shared that strategy. Finally, I have sought to reflect upon and discuss the trained subjectivity I brought to the coding process, rather than seeking for another individual to correct my interpretation of these data with which I was so familiar.

5.5.2 Limitations of Collecting Social Media Posts

Due to the massive quantity of content shared online, qualitative researchers cannot explore social media phenomena in their entirety and must instead rely on samples. The samples explored in this research were limited to posts collected over a 72-day period, and therefore only reflect discussions of climate-motivated-eating occurring in that relatively short window of time. Further, because of my limited language abilities, I was only able to study posts shared in English, meaning that this sample only reflects the perspectives of English speakers. Of course, non-English speakers likely also discuss climate-motivated-eating on social media, and so this sample is likely not reflective of global perspectives.

Further, not all of the content in the collected sample was analyzed. I did not study the content of links or images that were included in posts, the self-written biographies or location of users, nor the nature of their social networks (i.e. numbers of followers and accounts followed). I also did not examine how many unique users' posts are captured in this study; it is conceivable that each post was written by a different user, or that a small group of users posted frequently and are over-represented in this study. While analyzing these sorts of information may have been interesting, the questions that would have driven such research (e.g. were there differences in strategies promoted by Canadian versus American social media users) were outside the scope of the study. Rather than studying *who* is leading conversations about climate-motivated-eating, this study examines what messages are being shared, regardless of the source. Further, it is impossible to know how many people have read the posts collected in the two samples (because posts can be read by followers and non-followers alike), and the *distribution* of the strategies sampled is more relevant to this study than their *source*.

Finally, a limitation of using Netlytic is that the software only captured a maximum of the 100 most-recent Instagram posts per hour and the 1,000 most-recent Twitter posts every 15 minutes, regardless of the search undertaken (Gruzd, 2016), meaning that some posts shared to these platforms that met the search criteria may not have been collected for analysis. Further, only Tweets and Instagram posts that were shared *publicly* were collected - posts shared to private accounts were not collected. While this may have limited the number of posts included in the sample, I am not aware of any reason why privately shared posts on the non-sensitive topic of climate-motivated-eating would differ in their characteristics from publicly shared posts.

5.5.3 Precision Versus Accuracy in Sampling

Another limitation lies in the design of the Boolean search used to capture social media posts. While the tool was very effective in collecting posts that were relevant for analysis, the 'framing effect' likely distorted the perspectives collected for analysis (Tversky & Kahneman, 1981). As a researcher, my use of words may differ from the words used by other individuals discussing the same topic (Jang & Hart, 2015; Schuldt et al., 2011; Tversky & Kahneman, 1981). Schuldt et al. (2011) highlight this issue in their study on the use of 'climate change' versus 'global warming'. They found that using these terms interchangeably in surveys affected how people responded to questions about planetary warming (Schuldt et al., 2011). Of importance is that individuals are rarely aware of how slight variations in wording affects their responses and opinions (Tversky & Kahneman, 1981).

Aware of the framing effect in designing this study, I deliberately excluded the term 'global warming' from the Boolean search because Schuldt et al. (2011) found that individuals who accept the science connecting anthropogenic GHG emissions with planetary warming more commonly use the term 'climate change'. Given this, I inferred that social media users aiming to reduce their GHG emissions through dietary choice would more commonly refer to 'climate change' than 'global warming'. Although I am confident that these results represent a sample of climate-motivated-eating strategies, studying only the term 'climate change' and not also the term 'global warming' may have limited this study's' results. As described by White (2013), "using the most prominent hashtag as a phenomenon for analysis is common within the literature but can be limiting" (p. 15). Some hashtags and word uses are platform-specific, and word choices also depend on the context of the users who write the posts (Holmberg et al., 2016). This highlights that word choice in data mining tools (such as the Boolean search used in this study), can have unintended and possibly substantial effects on obtained results; even among English speakers there is great diversity in the words used to describe the same phenomenon. Considering this, while the sample of posts analyzed in this study offered insight into how climate-motivated-eating is communicated on social media, the sample may not accurately represent the *entire* phenomenon of English climate-motivated-eating communications on Twitter and Instagram.

Related to this challenge of obtaining an accurate sample is the problem of false negatives: the unintentional exclusion of posts that may have been relevant to this study. This problem is highlighted in these results: while the collected sample includes many strategies referring to changing livestock feeds, the search terms that I used did not specifically include the word ‘feed’. Several of collected posts about changing livestock feed were collected due to posters’ unconventional use of the term ‘cattle food’ rather than ‘cattle feed’. It is likely that there are even more conversations occurring on social media about what to feed livestock as a strategy to reduce GHG emissions that were inadvertently omitted from the study due to my choice of search terms.

In addition to omitting false negatives, this research resulted in the capture of many false positives: the accidental capture of irrelevant posts. As shown in **Table 3**, 2,359 social media posts were collected (1,793 on Twitter and 566 on Instagram) that were irrelevant to this research. These posts were erroneously captured because of the broad nature of the search terms used and the diversity in meaning and purpose with which these terms are applied by social media users. Though not the focus of this research, and consequently not formally analysed, the content of many of these false positives was often related to promoting animal rights, *adapting* agriculture to the effects of climate change, or misunderstanding food-related plastic pollution (e.g. plastic food packaging) as a cause of climate change. Many of the false positives collected in this study were due to the prolific use of hashtags in posts as users attempted to draw likes and attention to their posts. Even in posts not about climate change (e.g. posts about the welfare of livestock animals), users often tagged the post #ClimateChange among dozens of tags, perhaps hoping that people searching for #ClimateChange would also be interested in their discussion of animal welfare.

5.6 Methodological Challenges Beyond Researchers' Control

5.6.1 The Unknowns of Social Media Algorithms

Another limitation of this study is the unknowns of how Instagram and Twitter algorithms promoted posts contained in this sample on users' timelines. These algorithms may have particularly influenced the prominence of reposted content in this study. In order for posts on Twitter or Instagram to be shared, they need to be 1) posted, 2) viewed by another user, who 3) makes a choice to repost the post to their own account. This process is complicated by the platforms' algorithms, which are frequently altered to improve user experiences (Sehl, 2019).

Between June-August of 2018, when all of the posts analysed in this research were collected, Twitter's timeline algorithms employed a mix of chronological prioritization (showing newer posts at the top of timelines) and a 'relevance' model to show users an individualized mix of Tweets that they would find interesting (Sehl, 2019). Further, posts with more 'favourites' and 're-Tweets' were displayed closer to the top of users' timelines, which in turn increased their likelihood of being read and shared further (Sehl, 2019). During this same period, Instagram's algorithm prioritized content at the top of timelines based on how often users interacted with the poster's account, the viewer's predicted interest in the content (using image and text recognition software), the recentness of the posts, and the post's popularity with other users (Cooper, 2019b).

Importantly, Twitter and Instagram are driven to generate profit (Bouvier, 2015). Algorithms influence the posts users see based not only on what they find interesting or funny, but also on consumer patterns and interactions with advertisements hosted on the platforms (Bouvier, 2015). Both Twitter and Instagram run advertisements, and it is difficult for researchers to determine how the presence of advertisements affects users' interactions with the content studied in this research (White, 2013). Due to this advertising revenue, Twitter and Instagram are financially motivated to keep users on their platforms for as long as possible, which is why their algorithms are designed to promote interesting and high-performing posts (Cooper, 2019b). Therefore, it is possible that certain popular posts included in this dataset (e.g. the highly re-Tweeted post about feeding marine algae to cattle) were 'artificially' promoted to users due the post's number of likes and re-Tweets, increasing the likelihood of it being further shared. This is the nature of the positive feedback loop of virality in social media spaces. Unfortunately, it is impossible for researchers to test the effect of algorithms (which are closely guarded for commercial purposes), but it can be speculated that they have artificially inflated the prevalence of popular posts.

5.6.2 Challenges in Rating the Efficacy of Climate-Motivated-Eating Strategies

There are challenges in presenting the relative efficacy of climate-motivated-eating strategies. Although the ratings displayed in **Figure 5** were grounded in results from the broader scientific literature, they may be over-generalized and not accurate in all situations. As discussed in **Chapter One - Introduction**, there can be great disparity in the GHG emissions that result from food production, even between producers of the same product (Poore & Nemecek, 2018). Further, there are inconsistencies in the boundaries drawn by LCA analysts studying the same products, so generalizing these findings can lead to inaccurate understandings of the GHG emissions from food products. For example, it is not possible to say that 100g of chicken *always* results in fewer GHG emissions than 100g of beef. Despite this potential limitation in the universal applicability of these ratings, I am confident that the ratings are generally applicable and could be used to guide heuristics for effective climate-motivated-eating.

5.7 Recommendations for Future Research

This topic and this social media sample are rich for further inquiry. However, future researchers will not be able to replicate this study on Instagram because the capability to collect Instagram posts through API searches, including using Netlytic, was discontinued on December 11, 2018 (Gruzd & Mai, 2019).

I recommend that future research on a similar topic include an inter-coder check to add rigour and assure robustness in the interest of limiting the potentially idiosyncratic impact on the results of relying solely on one coder. In cases where financial or temporal limitations prevent this from occurring and the coding must be done by one individual, coders should ideally not work in isolation, and be sure to discuss coding choices with other members of the research team, as was done in the case of this research.

For this study, the time period of data collection was long enough to pick up on likely transitory popularity in some climate-motivated-eating strategies (e.g. *add marine algae to cattle feed)* while also collecting a diversity of (what are thought to be) more durable patterns of strategies. The time period of collection and its global scope meant that posts were collected during the Northern Hemisphere's summer and the Southern

Hemisphere's winter, offering the benefit of year-round perspectives in what are seasonally affected discussions of agriculture. Further, the period of data collection was short enough that all collected posts could be analyzed by myself over the short time period of a Master's programme. In future, it would be interesting to collect upwards of a year of data and randomly select a manageable number of posts for analysis from amongst the collected posts (Abbar et al., 2016; Dyar et al., 2014; Jang & Hart, 2015; Kirilenko & Stepchenkova, 2014) or to compare June-August data with December-February data to see how interest in climate-motivated-eating changes during the Northern Hemisphere's winter. Similarly, conducting a sensitivity analysis could determine if studying more, or different, words (e.g. study *climate change* and / or *global warming* as well as *food* and / or *feed*) would expand the results captured here and more accurately reflect the phenomenon of how climate-motivated-eating is discussed on Twitter and Instagram.

Another opportunity for future research is to explore which strategies are shared together in the same post through statistical methods like cluster analysis or latent class analysis; this could provide insight into how climate-motivated-eating strategies are conceptualized online. For example, it would be interesting to know if *eat vegan always* is often suggested in the same posts as *avoid intensively produced food.* Similarly, given the role that cultural norms play in shaping dietary patterns, it would be interesting to examine *how* climate-motivate-eating strategies are shared by users. Do users more often self-reflect (e.g. "*I eat this way because…")* or do they encourage behavioural change more broadly (e.g. *"you should eat this way because…")*?

In future, it would also be helpful to study the webpages that were linked to many Instagram and Twitter posts in order to understand what kinds of sources are being read by climate-motived-eaters. Examining webpages may also offer clarification for strategies that were too vague to rate. For example, users posting the strategy *choose foods wisely* often linked to an external webpage, which may have offered specific strategies that could have been coded. Studying the links included in Instagram or Twitter posts has been done by other researchers, including the following: Kirilenko & Stepchenkova, 2014; Merry, 2010; Merry, 2013; Williams et al., 2015.

It would be interesting to expand the language capabilities of this study to see which climate-motivated-eating strategies are shared by non-English speakers and compare these with contemporaneous English-language strategies. Some insight may also come from studying the demographics of users whose ideas are included in this dataset. This would be particularly feasible on Twitter, where users often publish a one-sentence biography about themselves (e.g. self-describing as “journalist”, “professor”, “mom”, “dad” etc), and commonly including the city where they post from (Kirilenko & Stepchenkova, 2014). This demographic information could be used to map the locations from which climate-motivated eaters post, providing some insight into the hotspots of discussions on this topic (albeit in English).

Relatedly, by examining user networks (number and characteristics of followers) it would be possible to ask if influential users dominate information flows (Jang & Hart, 2015). While this would be interesting, only a small proportion of social media users engage in conversations about climate-motivated-eating, so even users with few followers are acting as opinion leaders on this topic. Further, followership does not equate to a user's influence, because it does not consider how many posts are *read* by followers, or if they influence readers attitudes or behaviour (Williams et al., 2015).

6.0 CHAPTER SIX - CONCLUSION

It is clear from the literature that large-scale changes to patterns of food production and consumption can provide a powerful opportunity for mitigating climate change (Foley et al., 2011; Garnett, 2011; Gordon et al., 2017; Hoolohan et al., 2013; Nelson et al., 2016; Poore & Nemecek, 2018). The importance of shifting global dietary patterns is highlighted by the dual imperative to reduce associated GHG emissions, while also increasing food access to feed a growing and inequitably fed human community (FAO, 2018; Foley et al., 2011; Garnett, 2014; Roser, 2019b). It is therefore encouraging that many individuals are practicing climate-motivated-eating in an attempt to reduce their dietary contributions to GHG emissions, and that strategies for climate-motivated-eating are being shared on Twitter and Instagram. However, it is important to consider the relative efficacy of the climate-motivated-eating strategies shared on these platforms in terms of meeting their stated goal of reducing GHG emissions from dietary choices. Given that it is essential to mitigate climate change as quickly as possible if greater than 2°C warming is to be averted, it is important that popular strategies for climate-motivated-eating are *effective* in reducing GHG emissions; there is no time to waste with ineffective strategies, nor with strategies that unintentionally increase GHG emissions. Therefore, this thesis has: 1) explored which climate-motivated-eating strategies are communicated in a sample of Twitter and Instagram posts, and 2) considered the evidence that supports these strategies for reducing GHG emissions.

Of course, mitigating climate change through large-scale dietary shifts requires awareness and careful consideration of the deeply complex relationship individuals have with food. The reviewed literature demonstrates that individual’s dietary choices are functions of interconnected forces, including but not limited to culture, gender, personal expression, socio-economic status, and nutritional requirements (Alkon & McCullen, 2010; Cairns & Johnston, 2018; Kato & McKinney, 2015; Lea & Worsley, 2008; McCullen, 2011; Pinto et al., 2014). Further, food choices are not always rational decisions, but rather result from individuals applying simple heuristics to guide decisions in food landscapes that are characterised by overwhelming choice, conflicting goals, habits, taste preferences, and incomplete information (Lazzarini et al., 2016; Polizzi di Sorrentino et al., 2016; Vermeir & Verbeke, 2008). The literature also demonstrates that ethical eating has unfortunately been characterised over recent decades as an exclusionary practice along lines of race, gender, class, and culture (Alkon & McCullen, 2010; Cairns & Johnston, 2018; Hodgins & Fraser, 2017; Johnston et al., 2011; Kato & McKinney, 2015; Lea & Worsley, 2008; McCullen, 2011; Pinto et al., 2014). Despite these challenges for participation, climate-motivated-eating remains an important strategy for climate change mitigation. Effective climate-motivated-eating can be more inclusive than traditional conceptions of eco-eating; for example, reducing meat consumption and shifting to nutritionally appropriate portion sizes will likely not be cost-intensive for individuals, and is a compromise that will be fairly palatable and achievable across communities.

To determine which climate-motivated-eating strategies are being promoted in contemporary discourse, this research embraced the utility of social media as an unsolicited poll of public opinion (Abbar et al., 2016; Cody et al., 2015; Jang & Hart, 2015). After carefully designing search terms, this research analyzed 4,220 social media posts (3,697 from Twitter and 523 from Instagram) that were shared between June 4 –

August 14, 2018. These posts shared 5,795 climate-motivate-eating strategies (4,938 of which were shared on Twitter and 857 on Instagram). These reflected 120 unique detailed strategies, which were grouped into 30 strategic themes for climate-motivated-eating. A targeted literature review identified 41 journal articles that outlined opportunities to mitigate climate change through the food system. These articles provided the evidence with which to rate the strategic themes of climate-motivated-eating identified in the social media sample according to how well-supported they were by evidence for reducing GHG emissions.

In general, social media users whose strategies were analyzed seem to be on the right track (they are *not* 'out to lunch') in identifying climate-motivated-eating strategies that are effective in reducing GHG emissions from dietary choices. In particular, social media posts in this sample correctly identified that reducing meat consumption is a well-supported dietary strategy for reducing GHG emissions (Hoolohan et al., 2013; Lukas et al., 2016; Saxe, 2014; Song et al., 2017; Soret et al., 2014; van de Kamp et al., 2018). However, major misconceptions remain, prominent among which is the idea that avoiding intensively produced foods will decrease GHG emissions from food choices. Rather, the academic evidence suggests that per food product, intensively produced foods tend to result in lower GHG emissions than small-scale production of comparable products (Sá et al., 2017; Swain et al., 2018). Importantly, this research only sheds light on the small proportion of the global population that discusses this topic on social media and may not reflect broader patterns of climate-motivated-eating strategies promoted in languages other than English or at different times of the year, etc. Regardless, this research has demonstrated which climate-motived-eating heuristics are currently being communicated in a sample of Twitter and Instagram posts and thereby offers policymakers a platform from which to promote consistently effective heuristics for climate-motivated-eating. For individuals who are actively seeking to reduce our dietary contributions to GHG emissions, it is important that we are empowered to achieve this objective.

The extent of dietary change that is necessary to mitigate climate change will be difficult to achieve but will be possible through a combination of personal choice and careful policy implementation. There is historical precedence for large-scale dietary change, as in the case of the rapid increase of organ meat consumption in the US in the 1940s and 1950s (Duhigg, 2012), and the unprecedented shift towards vegetarianism that accompanied the hippie movement in the 1960s and 1970s (Kauffman, 2018). Further, we know from individual experience that dietary patterns are not stagnant: they shift over generations and over the course of our lives. To direct dietary changes towards reduced GHG emissions, effective policies will need to be understandable, affordable, healthy, culturally appropriate, and habitually comfortable. Further, these policies need to be implemented as soon as possible, through the combined efforts of individuals, retailers, non-governmental organizations, and all levels of government to reduce GHG emissions and avoid passing climatic tipping points. Shifting diets will undoubtedly be a profound global challenge, but the alternative of not acting on climate change will result in challenges even more severe.

I believe that we cannot solve our environmental problems without optimism. The motivation of this work has been to demonstrate that great opportunities remain to mitigate climate change through collective efforts. We need to reimagine how we eat and we all need a spot at the decision-making table. These problems are not insurmountable if we remain optimistic, creative, and inclusive in our efforts to encourage effective climate-motivated-eating.

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APPENDIX A – CODING SCHEME

	Strategic theme	Detailed strategy expressed in the sampled social media
Change diet composition	Avoid specific non-meat ingredients	Avoid CO_2 as an ingredient
		Avoid melons
		Avoid palm oil
	Choose foods wisely (ambiguous)	Adopt a carbon tax for food
		Choose foods wisely (ambiguous)
		Diversify diet composition
	Eat more specific non-meat ingredients	Eat more hemp
		Eat more melons
		Eat more vegetables
		Eat whole food
		Eat olive oil because it sequesters carbon
	Food preparation	Avoid delivery food
		Avoid plastic food packaging
		Avoid BBQ (because of deforestation for charcoal)
		Eat raw food
		Reduce consumption of processed food
Reducing the impact of meat consumption	Change to protein habits	Change protein consumption (ambiguous)
		Choose lab-grown meat
		Choose plant-based burgers
		Substitute dairy with vegan alternatives
		Substitute meat with legumes
	Avoid red meat	Avoid eating beef
		Avoid red meat
		Choose pork over beef
	Choose sustainable meat	Choose sustainable meat (ambiguous)
		Choose sustainable seafood
		Eat more chicken
		Eat more sustainable shellfish

	Strategic theme	Detailed strategy expressed in the sampled social media
	Eat less meat	There is an acceptable frequency of meat-eating
		Adopt a meat tax
		Adopt meatless Mondays
		Become a 'reducetarian'
		Do not eat fish
		Eat less meat
		Be vegetarian occasionally
	Eat vegan always	Adopt a plant-based diet
		Become a fruitarian
		Become a raw vegan
		Sustainable meat does not exist
		Eat an exclusively vegan diet
	Eat fewer animal products	Avoid dairy
		Choose white coffee, not lattes or cappuccinos
		Eat more plant-based
		Eat a vegan diet occasionally
	Eat vegetarian	Eat an exclusively vegetarian diet
Change food production	Avoid agricultural technology	Avoid GMO food
		Avoid food grown with fertilizers
		Avoid food grown with pesticides
	Change food production (ambiguous)	Change food production (ambiguous)
	Choose organic food	Choose biodynamic food
		Choose fair food
		Choose organic food
	Change off-farm energy use	Improve energy efficiency
		Increase use of renewable energy
		Reduce refrigerated transportation

	Strategic theme	Detailed strategy expressed in the sampled social media
	Support agricultural technology	Support 3D underwater farming
		Embrace microalgae
		Support hydroponics
		Improve agricultural soil data
		Organic food is not effective
		Support GMOs
		Support agricultural technology
		Support vertical farming
	Avoid food produced in greenhouses	Avoid food produced in greenhouses
How to feed livestock?	Add marine algae to cattle feed	Add marine algae to cattle feed
	Change livestock feed (ambiguous)	Change livestock feed (ambiguous)
	Choose grass fed meat	Choose grass-fed meat
		Support integrated crop-livestock production
		Support managed grazing
		Choose pastured poultry
		Support silvopasture
Land management strategies	Conserve non-farmland	Adopt agricultural intensification
		Increase agricultural production
		Produce food on higher-yield land
		Support agroforestry
		Avoid deforestation
		Conserve non-farmland
		Support landscape restoration
		Protect greenfield sites from development
		Choose shade-grown coffee
		Support tree intercropping
		Support tropical staple tree crops
		Adopt agroecology

	Strategic theme	Detailed strategy expressed in the sampled social media
	Change land management strategies	Adopt climate-smart agriculture
		Adopt ecological farming
		Adopt sustainable land management
		Avoid monocropping
		Support carbon sequestration
		Support conservation agriculture
		Support healthy soil management (ambiguous)
		Support horticulture
		Support low carbon production
		Support net-zero production
		Support organic farming to sequester carbon
		Support permaculture
		Support regenerative agriculture
		Support best management practices
Where should food be produced?	Eat local	Eat locally
		Eat seasonally
		Grow your own food
		Reduce food miles
		Support urban agriculture
		Support micro farming
	Transportation does not matter	Transportation does not matter
Who should produce food?	Avoid intensively produced foods	Avoid factory farming
		Avoid food from big agribusiness
	Source food from small farmers	Source food from small farmers
	Winemakers can mitigate climate change	Winemakers can mitigate climate change
Reduce the impact of food	Strategies to reduce food waste	Avoid pressed juices
		Do batch cooking or eat leftovers

	Strategic theme	Detailed strategy expressed in the sampled social media
waste		Support blockchain
		Eat food by its best before date
		Eat ugly fruits and veggies
		Support food rescue organizations
		Freeze food
		Support gleaning
		Reduce portion sizes
	Strategies to reduce the impact of food waste	Compost food waste
		Feed food scraps to livestock
	Avoid food waste	Avoid food waste