



# Sustainable Food Systems: Dietitians' Roles

## *The Role of Dietitians in Sustainable Food Systems and Sustainable Diets*

JANUARY 2020

# Table of Contents

Executive Summary .....	2
Acknowledgements .....	2
Purpose and Scope .....	3
Part 1: Sustainability, Food Systems and Dietetics .....	4
Food Systems Sustainability Impacts Human Health .....	4
A Systems Perspective: Human Health as part of Planetary Health .....	5
Part 2: The Role of Dietitians in Sustainable Food Systems and Diets .....	6
Professional Practice .....	7
Communication and Collaboration .....	9
Nutrition Care .....	10
Population and Public Health .....	11
Management .....	12
Research .....	14
Part 3: Overview of Foundational Concepts .....	15
Definitions .....	15
Foundational Concepts .....	19
Food Systems and the Environment .....	19
Emerging issues in nutrition and dietetics: food choices and the environment .....	22
Food Systems and Social Sustainability .....	25
Food Systems and Health .....	28
Concluding Statements .....	30
References .....	31

## Executive Summary

Dietitians of Canada (DC) recognizes the concurrent importance of human health and the state of planetary health on which it depends, and that supporting system change for [sustainable food systems](#) is a shared responsibility requiring collaboration between diverse sectors and disciplines. Food systems are extremely complex networks that span social and environmental systems, and many relationships between the natural environment (water, soil, etc.) and human social environment (individuals, companies, governance, economics, etc.).

Dietitians are well-positioned in food systems to leverage change and are already working in diverse practice areas to advance sustainable food systems and diets (SFS/D) in their organizations and communities. Suggestions for incorporating SFS/D in individual dietitians' work in varied settings, and for the profession of dietetics, are provided.

Overall, dietitians are encouraged to:

- Critically reflect on their own assumptions and worldviews on SFS/D in order to better understand others';
- Get involved in SFS/D-related work within and beyond the workplace;
- Disseminate high-quality information and combat misinformation;
- Advocate for SFS/D;
- Balance client priorities, health outcomes, and planetary health outcomes in decision-making.

## Acknowledgements

**Lead writers:** Liesel Carlsson, PhD RD, Barb Seed, PhD RD, Fiona Yeudall, PhD PDt

**Significant contributions:** Roxane Wagner, Pamela Fergusson, Eric Ng, Jennifer Brady, Pat Vanderkooy

**Advisory Group:** Irene Laskowski, Lynn Roblin, Tracy Sanden, Marta Dingle, Cayla Runka, Bridget King, Hanna Chan

**Communications and writing support:** Acacia Puddester

### **Suggested Citation:**

Carlsson L, Seed B, Yeudall F. The Role of Dietitians in Sustainable Food Systems and Sustainable Diets. Toronto: Dietitians of Canada. 2020.

## Purpose and Scope

The purpose of this paper is to identify roles and recommend actions for dietitians that can affect positive change for [sustainable food systems](#) and diets (SFS/D) - as individuals, as a profession, and as members of collaborative work. This effort includes colleagues across disciplines and sectors, other professionals, community members, policy makers, researchers, and more.

This Role Paper has three objectives, which are to:

- Put forward a [systems perspective](#) that human health is part of planetary health
- Articulate the [role of SFS/D](#) within a dietetics scope of practice
- Provide an overview of the [foundational concepts](#) to integrate SFS/D in dietetic practice

This paper does not provide prescriptive dietary recommendations or patterns for Canadians, nor specific tools to support implementation of the recommendations and actions. As practice evolves, standards of practice need to be developed to support these roles, as do evaluation mechanisms that ensure progress. Tools and supports may be developed as resources permit.

Furthermore, while the recommendations and roles articulated in this paper are based on the current state of the evidence, this paper does not include a full review of the evidence on this vast and complex topic<sup>1</sup>. It is acknowledged that efforts to reduce bias in evidence selection and analysis are needed when dealing with the complex nature of SFS/D. The authors have endeavoured to use a critical lens to acknowledge their own bias and the potential bias in evidence sources. The evidence included and discussed is that which is necessary for dietitians to understand the rationale for the recommendations and to provide foundational knowledge of the relevant issues. It can be used to learn about central issues and to identify continuing competency goals for higher levels of expertise in SFS/D. As the body of evidence continues to grow and evolve, recommendations are expected to evolve as well.

**NOTE:** Words in red underlined font link directly to their definition in Section 3.

---

<sup>1</sup>. Where available, this review is based on systematic reviews: see References. It also draws from the annotated bibliography “Recommended Resources on Sustainable Food Systems” available on the DC Website and the evidence review [“Plant Based Diets and the Environment”](#) backgrounder available from Practice Based Evidence in Nutrition® (subscription required).

# Part 1: Sustainability, Food Systems and Dietetics

**“[t]he health of human beings cannot be  
isolated from the health of ecosystems”**

**Johnston, Fanzo & Cogill, 2014**

Part 1 introduces the importance of including Sustainable Food Systems and Sustainable Diets (SFS/D) as part of the dietetics scope of practice, situates human health as part of the broader health of the planet, and offers a way of thinking that is important to put SFS/D into practice.

---

## Food Systems Sustainability Impacts Human Health

The way in which food is produced, distributed and eaten forms an important link between human health and social and environmental systems. Current food systems have greatly increased access, variety and affordability of food in industrialized countries, and made significant contributions to economic activities and employment. However, there are also negative effects on social and ecological systems. For example: wages inadequate to support livelihoods, unsafe working conditions, exposure to harmful toxins, and the production of foods that contribute to diet-related chronic diseases (1) are all conditions that worsen inequality and undermine health. Any systems which systematically worsen inequality and undermine health are not sustainable (2,3). Current food systems also contribute to the degradation of the environmental systems on which they depend, through for example, their impacts on climate change, land use, deforestation, and water use (e.g. 4–7)<sup>2</sup>. There is evidence to suggest that several of our environmental systems have been degraded to a degree where their future state is uncertain (i.e., beyond their current capacity to sustain [ecosystem services](#) as we know and depend on them today) (5,8). This has indirect, direct, and compounding effects on human health, which further impacts social and ecological systems (1,7).

Currently, the knowledge, will and technology exist to do better. The global challenge is to achieve [food and nutrition security](#) equitably, in the context of growing populations, without undermining the needs and boundaries of ecological and social systems. These issues are part of the global discourse on SFS/D that is gaining widespread attention in response to the declining state of social and ecological sustainability (9–12). Sustainable food systems are defined by the Food and Agriculture Organization of the United Nations (FAO) as those that “...[deliver] food and nutrition security for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future

---

<sup>2</sup> DC acknowledges that in many cases there is a lack of comparable, Canadian-specific data, and so global data has been used. However, the global scale of food systems, and connectivity between scales, also renders global impact data relevant. Where possible, Canadian data is also included. Likewise, some important evidence/data is not available or easily quantifiable, and in such cases, we provide examples to illustrate the concepts and competing interests.

generations are not compromised” (13) while “[sustainable diets](#) are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations...” (14). Sustainable diets contribute to and are supported by [sustainable food systems](#) (15). See [Definitions and Concepts](#) for more discussion of these concepts.

## A Systems Perspective: Human Health as part of Planetary Health

**In this paper, two concepts provide a framework to discuss SFS/D in the context of dietetic practice: *Systems Perspectives* and *Planetary Health*.**

Dietitians of Canada acknowledges the immense complexity of food system issues, and that dietitians are not experts in all social and ecological systems; however, dietitians are encouraged to apply [systems approaches](#). A systems approach helps articulate food systems as complex networks that span social and environmental systems, and geographic scales, rather than linear processes beginning with producers and ending with consumers. Food consumers are part of this system, which positions sustainable diets as part of sustainable food systems. See [Definitions and Concepts](#) for a more detailed description of systems approaches. This systems perspective requires human health to be met by food systems that do not undermine social and environmental systems to which they belong. It also supports dietitians to make decisions in the context of balancing competing issues (client priorities, health outcomes, planetary health outcomes) in absence of one clear right answer. Dietitians are already equipped with such skills as they are part of dietetic training.

A Planetary Health perspective highlights the importance of “the health of human civilization *and* the state of the natural systems on which it depends” (16), recognizing the dependency of human health on planetary health. Planetary ‘health’ is supported by the concept of ecological boundary conditions (8), or socioecological Sustainability Principles (2) that help describe the needs and limitations of the planet. Planetary health is dependent on meeting human health needs while respecting those needs and limitations.

## Part 2: The Role of Dietitians in Sustainable Food Systems and Diets

In Part 2, recommendations for dietitians are provided and organized by practice area. These are intended to encourage action, but also to support dietitians to reflect on their level of competence and seek additional supports where necessary.

---

Canada acknowledges the importance of collaboration amongst the many food system actors to realize sustainable food systems (17). This broad level of interest and engagement is important given the complexity of food systems. The professional community of nutrition and dietetics can contribute meaningfully to intersectoral collaboration at various levels, and Part II describes the role of SFS/D within a dietetics scope of practice.

### **Dietitians of Canada (DC) recognizes:**

- **the concurrent importance of human health and the state of planetary health on which it depends.**
- **that dietitians across diverse practice areas work to prioritize and support sustainable food systems and diets that enhance human health.**
- **that supporting system change for sustainable food systems is a shared responsibility and requires collaboration between diverse sectors and disciplines.**

There has been a long history in the nutrition and dietetics profession, as well as its predecessor, home economics, of applying a socioecological systems lens to human health and nutrition (18–24). This paper is an example of how this work continues today and is an indicator of rising public prioritization of issues of sustainability in food, diets and food systems.

Dietitians are well-positioned within food systems to leverage change. Dietitians work in diverse practice areas that span sectors relevant to food systems, such as: agriculture and food production, processing, marketing, and retail settings; health care and private clinical practice settings; community-based settings; public health and policy settings; food service management settings; as well as research and academic settings. Many are already working in interdisciplinary teams to address food systems and nutrition challenges.

While some dietitians may feel prepared to ‘get involved...’ others might be ready to ‘take leadership...’ This is no different than many other areas of dietetic practice, in the normal progression from competence to expertise that comes with experience in various practice areas.

The suggested actions are informed by research from Canadian dietitians who have highlighted high-leverage action areas and approaches to integrating SFS/D into dietetic practice (25-27) as well as evidence from the international literature (12,28–30). These suggested actions are not an exhaustive list, and will continue to evolve along with the evidence and dietetic competencies.

The roles for dietetic practice are delineated according to the 2013 Integrated Competencies for Dietetic Education and Practice (ICDEP) (30) competency areas: 1: Professional Practice; 2: Communication and Collaboration; 3: Nutrition Care; 4: Population and Public Health; 5: Management. An additional category, 6: Research, has been added.

## Professional Practice

Integrating an SFS/D lens into professional practice means integrating key concepts into *how* one practices, not just *what* one does.

Dietitians of Canada encourages dietitians to:

- Critically reflect on their own assumptions and worldviews on SFS/D in order to better understand others’;
- Get involved in SFS/D-related work within and beyond the workplace;
- Disseminate high-quality information and combat misinformation;
- Advocate for SFS/D.

Dietitians of Canada will support continued evolution of dietitians’ perspectives with respect to SFS/D through evidence review, providing networking and professional development opportunities to dietitians, and supporting continual adaptation of dietetic training to incorporate SFS/D. The examples in Table 1 provide some guidance on incorporating SFS/D into professional practice by applying a systems approach (see [Definitions](#)) to dietetic practice.



*Table 1: Recommendations for Incorporating SFS/D into Professional Practice*

EXAMPLES OF ACTIONS FOR DIETITIANS	
	<b>More Specifically</b>
Be reflexive	<ul style="list-style-type: none"> <li>• Reflect on your own assumptions and values about what health means in the context of planetary health and social justice (25,31)</li> <li>• Critically appraise sources of evidence for bias and reflect on your own potential bias in evidence review</li> <li>• Develop knowledge and skills required to identify and address health inequities that are built into the everyday systems that structure our world (i.e. the food system, economic system, health care)</li> <li>• Identify and acknowledge where your own privileges lie, and how this informs your worldview particularly related to health and food, so that you can help others to do the same (31)</li> <li>• Seek to understand others' worldviews (25)</li> <li>• Develop confidence in what SFS/D means to your practice (as an example, see Roadmap for a dietitian-developed vision) (25)</li> <li>• Move beyond sustainable diets to include sustainable food systems (28)</li> </ul>
Get involved	<ul style="list-style-type: none"> <li>• Engage in professional development and networking opportunities on food systems-related topics (see DC Events and Learning on Demand, and how to engage in policy and advocacy (25,27,28,32,33)</li> <li>• Get involved in SFS/D-informed food skills and food literacy programming (25)</li> <li>• Collaborate on sustainable standards policy for use within your workplace or organization. Use a principled approach to defining sustainability: identify structural barriers to social sustainability (including but not limited to health); identify root causes of ecological damage (pollution, waste, resource use); examine appropriate organizational policies or actions (25)</li> </ul>
Disseminate and advocate	<ul style="list-style-type: none"> <li>• Help disseminate evidence-based information and dispel myths about SFS/D (25,28)</li> <li>• Be prepared to "build your case" for sustainability in a professional and appropriate manner to your workplace/role/organization (25)</li> <li>• Identify and name oppression (31)</li> </ul>
EXAMPLES OF ACTIONS FOR THE PROFESSION OF DIETETICS (Educators, Regulators, Professional Association)	
	<b>More Specifically</b>
Be reflexive	<ul style="list-style-type: none"> <li>• Adopt a reflexive approach to continually re-evaluate how dietetics defines human health in the context of planetary health and social justice (25)</li> </ul>
Provide guidance to practitioners	<ul style="list-style-type: none"> <li>• Develop common meaning, and a common language/discourse, to foster shared understanding of SFS/D (25)</li> <li>• Develop appropriate tools and preceptor supports for practical training in SFS/D (29)</li> <li>• Encourage research and knowledge translation activities in SFS/D</li> <li>• Support dietitians to critically appraise evidence</li> </ul>
Adapt dietetic education to be more inclusive of SFS/D	<ul style="list-style-type: none"> <li>• Advocate for the inclusion of sustainable food systems as a core competency in dietetic education (27,29,32)</li> <li>• Promote sustainable and healthy food systems and diets in professional associations, colleges, unions, etc. (32)</li> </ul>

	<ul style="list-style-type: none"> <li>• Develop continuing education and networking opportunities for dietitians around sustainable food systems. For example: webinars, speaker series, including tools and resources that support practice (25,27, 2829,32)</li> <li>• Consider creative opportunities for dietetic trainees to gain foundational knowledge and competence with food systems and sustainability. For example (29): <ul style="list-style-type: none"> <li>○ use of “emerging practice settings” such as community-based food centres, farmer’s markets, farm-to-institution programs, community and urban gardens, community kitchens, NGOs, food retail businesses, agriculture and agri-food industries, etc.</li> <li>○ increase the flexibility in program and placement structures to enable students to achieve the breadth of training necessary</li> </ul> </li> </ul>
--	---

## Communication and Collaboration

In all practice areas, dietitians collaborate and communicate. Clear communication and effective collaborations are essential to make contributions to SFS/D, as the issues are by nature interdisciplinary and intersectoral. Dietitians of Canada recommends that practitioners:

- build relationships and partnerships with allies across other disciplines and sectors, based on a common cause;
- take action with those partners to present a unified and stronger voice; and
- actively share SFS/D knowledge and skills.

The recommendations in Table 2 are intended to guide actions that encourage dietitians to get involved.

*Table 2: Recommendations for Communications and Collaboration that Supports SFS/D*

EXAMPLES OF ACTIONS FOR DIETITIANS AND THE PROFESSION OF DIETETICS	
	<b>More Specifically</b>
Build relationships and partnerships	<ul style="list-style-type: none"> <li>• Identify key partners or allies working for sustainable food systems; look to other disciplines and sectors such as agriculture, food science, etc. (25,27,28)</li> <li>• Foster relationships within and between organizations to support SFS perspectives in food product development and marketing</li> </ul>
Take action within partnerships	<p>With identified partners or allies:</p> <ul style="list-style-type: none"> <li>• Form coalitions to advocate for a common cause, based on a clearly defined common purpose (27,28)</li> <li>• Proactively engage at policy tables that are relevant to sustainable food systems (25)</li> <li>• Engage in activities related to education, promotion, advocacy (25,27,28,32,33)</li> </ul>
Disseminate and advocate	<ul style="list-style-type: none"> <li>• Take an active leadership approach (33) to SFS/D, where appropriate.</li> <li>• Develop and deliver SFS/D leadership training programs for dietitians (28)</li> <li>• Share tools, resources and research with your colleagues (25)</li> <li>• Disseminate high-quality information and combat misinformation</li> </ul>

## Nutrition Care

Dietitians who provide nutrition care to individuals and groups are in a privileged position to educate, influence and ask relevant questions about food choices as part of contributing to public SFS/D literacy. While it must be done with sensitivity to individual and community context, particularly with vulnerable populations, dietitians already provide nutrition counselling and care in this manner in daily practice. Dietitians of Canada recommends that dietitians integrate a Planetary Health perspective, and a systems approach to considering SFS/D outcomes when providing nutrition advice, completing nutrition assessments, and developing nutrition care plans.

*Table 3: Recommendations for Incorporating SFS/D into Nutrition Care Roles*

EXAMPLES OF ACTIONS FOR PRACTITIONERS	
	More Specifically
Consider SFS/D when providing advice on food choices	<ul style="list-style-type: none"> <li>• Address, where appropriate, common myths about sustainable food systems with your clients (25)</li> <li>• Consider both nutritional and environmental science in order to give advice about sustainable diets to individuals and households (28,32,33)</li> <li>• Provide guidance on identifying animal-based foods that address key sustainability issues (e.g., animal welfare) (28)</li> <li>• Be familiar with plant-based cuisines from a variety of cultures (28), and to draw from these to make recommendations that are culturally relevant or to support creative and tasty approaches to dietary change (34)</li> <li>• Use sensitivity in working with vulnerable populations (32)               <ul style="list-style-type: none"> <li>○ Know when sustainable diet recommendations (e.g., plant-based proteins, increased vegetables, fruit and whole grains) will require overcoming additional barriers among clients/groups based on cost, culture, food availability, etc.</li> <li>○ Combine knowledge of clinical care and sustainability: know when and how to adapt sustainable diet recommendations to meet clinical nutrition needs, disease state, etc.</li> </ul> </li> <li>• Provide practical advice such as:               <ul style="list-style-type: none"> <li>○ How to use Canada's Food Guide to make sustainable choices</li> <li>○ Recipes and tips for incorporating more plant-based proteins, vegetables, fruits, and whole grains (28)</li> <li>○ Tips for reducing <b>food waste</b> pre- and post-consumption (33)</li> <li>○ How to choose locally, field grown vegetables over greenhouse grown equivalents, when they are available</li> </ul> </li> <li>• Which foods are in season and how to prioritize those</li> </ul>
Use an SFS/D lens when completing assessments and developing care plans	<ul style="list-style-type: none"> <li>• Examine dietary assessment data for sustainability in addition to nutritional health</li> <li>• Where appropriate, recommend nutrition care plans that support planetary health (which includes human/individual health) outcomes (32)</li> <li>• Use sensitivity in working with vulnerable populations (32) (see above for examples)</li> </ul>

## Population and Public Health

Dietitians who practice in the area of population and public health are often in a position to influence the impact of structures and systems on health. As dietitians know very well, change at a systems level can have broader, deeper and more lasting changes in society. Dietitians of Canada recommends that dietitians:

- work with governments to shape and regulate a food system that supports planetary health, including supporting existing policy;
- work with organizations to support long-term and systemic strategies for addressing food system injustices such as food insecurity;
- work with clients and communities to engage in self-determined SFS/D work;
- work with institutions to implement SFS/D strategies and policies.

The following recommendations provide some ideas for how to get involved in changing systems that are more supportive of SFS/D.

*Table 4: Recommendations for Incorporating SFS/D into Population and Public Health Roles*

EXAMPLES OF ACTIONS FOR DIETITIANS AND THE PROFESSION OF DIETETICS	
	More Specifically
Work with governments to shape and regulate a healthy food system that supports Planetary Health (25,27,28)	<ul style="list-style-type: none"> <li>• Develop and advocate for policies and programs that provide public support to vulnerable sectors within agriculture, particularly where there are priorities related to health and the environment, e.g., encourage more vegetable, fruit, and legume production in Canada</li> <li>• Advocate for economic incentives that recognize the value of ecological goods and services provided by farmers, fishers and ranchers</li> <li>• Support food initiatives and structures that help diversify the scale within existing food systems (25,27), e.g., promote and support certification schemes such as Local Food and Farm Coops (Ontario)</li> <li>• Advocate for and support the development of policy and action on agricultural antimicrobial use and resistance</li> <li>• Advocate for policies that ensure food safety without creating structural barriers to obtaining foods important to culture, identity and sustainability (e.g., policies that allow flexibility in the requirement for federally vs. provincially inspected meat in schools)</li> <li>• Advocate for policies that promote equity, or better yet, which systematically dismantle inequalities (25,28)</li> </ul> <p>Examples include:</p> <ul style="list-style-type: none"> <li>• Income-based supports</li> <li>• Incomes relative to the cost of living (living wage policies)</li> <li>• Policy and income solutions that address food insecurity for isolated and/or low income communities (25,27,28,35)</li> <li>• Policies that support temporary agricultural workers with sustainable livelihoods (fair wages and working conditions, a pathway to permanent residency, etc.) (27,145)</li> <li>• With leadership from Indigenous communities colleagues, initiate/support and resource activities that respond to the recommendations in the Truth and Reconciliation Commission (TRC) Calls to Action (35,36)</li> </ul>

	<ul style="list-style-type: none"> <li>○ The TRC Identifies several specific to health (#19-24) that might be a good starting place, along with reconciliation more broadly (#53-56)</li> </ul>
Advocate for timely implementation of existing policies that help shape healthy food environments	<p>Examples of supportive policies (current or in progress) that aim to reduce consumption of ultra-processed foods and associated environmental impact:</p> <ul style="list-style-type: none"> <li>• Child Health Protection Act: Restricting Marketing of Unhealthy Foods and Beverages to Canadian Children and Youth and accompanying changes to food regulations</li> <li>• Front-of-package labelling on processed foods high in sodium, sugars and/or saturated fat</li> <li>• Ban on partially hydrogenated oils in food manufacturing</li> <li>• Monitoring and potential regulations to reduce sodium in the food supply</li> <li>• The use of Canada's Food Guide to shape the food consumption patterns of Canadian consumers, through institutional alignment with CFG, education and policy</li> </ul>
Work with organizations to support long-term and systemic strategies for addressing food system sustainability injustices	<ul style="list-style-type: none"> <li>• Assist emergency food organizations such as food banks to help inform, support and advocate for longer term strategies to support food security (25,27,28)</li> </ul>
Work with clients and communities to engage in self-determined SFS/D work	<ul style="list-style-type: none"> <li>• Support clients and communities embrace their role as food citizens to advocate for a more democratic and sustainable food system (27,28,37)</li> <li>• Develop tools to support clients in their SFS/D efforts</li> <li>• Research and make publicly available information about certification schemes such as Food Justice Certification - Agricultural Justice</li> </ul>
Work with institutions to implement SFS/D strategies and policies	<ul style="list-style-type: none"> <li>• Advocate for the inclusion of sustainable food systems in public school curriculum (25,27,32)</li> <li>• Support programs that educate children and families on SFS/D (e.g., school gardens, farm-to-cafeteria programs, etc.)</li> </ul>

## Management

Dietitians in positions that involve management of people, institutional-level food service, and organizations are in a position to leverage positive change for SFS/D by scale, volume and reach, and through cultural change within an organization. These have powerful potential to support work done at an individual and household level (primarily through Nutrition Care) as well as at a policy level (primarily in Population and Public Health practice). Dietitians of Canada recommends that dietitians in management roles:

- provide leadership that develops team buy-in with respect to SFS/D;
- engage suppliers in strengthening sustainable supply chains;
- apply culinary strategies that maximize SFS/D;
- contribute to food culture adaptation among consumers in the organization/community;
- conduct waste, energy and water audits to assess and minimize resource use;
- use resource-efficient equipment that supports SFS/D; and
- seek out ways to make sustainable food systems financially feasible and advantageous.

*Table 5: Recommendations for Incorporating SFS/D into Management Roles*

EXAMPLES OF ACTIONS FOR DIETITIANS AND THE PROFESSION OF DIETETICS	
	More Specifically
Develop team buy-in with respect to SFS/D	<ul style="list-style-type: none"> <li>Establish a sustainability management team that includes members from: nutrition and dietetics, management, maintenance and operations, and workers directly involved in daily operations to oversee continual auditing, review and improvement on sustainability-related plans (e.g., waste, energy and water-related management).</li> <li>Integrate a culture of sustainability-thinking in training staff to problem-solve and conduct themselves (38)</li> <li>Conduct regular staff training to ensure awareness of, and training on, new protocols and equipment; ensure staff understand why such changes are needed, helping to motivate change and culture (38)</li> </ul>
Engage suppliers	<ul style="list-style-type: none"> <li>Highlight the role and sustainability-related efforts of producers and processors to customers to help create demand for sustainable food and foster closer relationships in food systems (34)</li> <li>Work with suppliers and consumers to create demand for sustainable and healthy food supply chains. E.g., foster relationships with local producers and processors, support farmers who contribute to biodiversity and sustainability efforts (27,34)</li> </ul>
Apply culinary strategies to maximize SFS/D	<ul style="list-style-type: none"> <li>Focus on quality and quantity by using culinary strategies to promote satiety, value, and pleasure without fueling overconsumption, e.g. use “all you care to eat”, tray-less dining, custom order, etc. (34)</li> <li>Look to cultural cuisines from around the world to inspire culinary use of sustainable foods, support biodiversity and biocultural diversity (34)</li> </ul>
Contribute to culture adaptation among consumers	<ul style="list-style-type: none"> <li>Creatively change menus to reflect healthy and sustainable foods. Consider Canada's Food Guide and the Eat-Lancet Commissions food guidance as a framework (12,39)</li> <li>Lead with messaging around flavour to foster a culture of normalizing the sustainable choice (so it is not a less-desirable alternative chosen only by those who are ethically or health driven) (34)</li> <li>Emphasize the benefits of healthy and sustainable foods rather than focusing on what has been reduced in the menu (34)</li> </ul>
Conduct waste, energy, and water audits	<ul style="list-style-type: none"> <li>Conduct pre- and post-consumer waste audits.</li> <li>Invest in management systems and tools to minimize food and packaging waste. E.g., through creative planning, purchasing and portioning, and recovery techniques (in-house composting, relationships with food recovery or harvesters, etc.) (34)</li> <li>Conduct energy audits (can use specialized, third party organization); use the results to develop comprehensive energy management plans that inform cleaning and preventative maintenance schedules (less energy intensive), purchase of major equipment, equipment usage protocols, investment in motion-sensor lighting, investment in renewable energy sources, etc. (38)</li> <li>Conduct water audits (can use specialized third party organization); collect baseline data on current usage and work to decrease it through minor/temporary changes (e.g., low-flow nozzles), or long term changes (e.g., equipment investments such as water efficient steamers, water recycling and recovery options) (38)</li> </ul>
Acquire resource-efficient equipment	<ul style="list-style-type: none"> <li>Build the business case for investing in resource-efficient equipment, even though it may take a number of years to see the financial benefits. When replacing large equipment, look to resell, donate, or (if still in working order) recycle the components rather than send to the landfill (38)</li> <li>Examine food safety protocols with respect to any new equipment and make any adjustments necessary (38)</li> </ul>

## Research

Food systems are dynamic, complex systems. As such, what is sustainable is always changing. For example, while current scientific consensus (4,5,7) suggests that an overall population shift toward plant-based proteins will have the greatest effect on environmental outcomes (climate change, land, energy and water use), that may change as production methods and environmental conditions also change. What is most sustainable will vary given cultural and geographic conditions. We know that knowledge does not, in and of itself, lead to dietary change. Dietitians have specific competencies in food, nutrition and human health and can play an important role leading or contributing to research teams striving to produce the best evidence to guide and facilitate transitions toward more sustainable food systems. Dietitians of Canada recommends that dietitians:

- conduct and contribute to research, even when not in research-specific roles;
- advocate for access to data and funding that supports such research; and
- extend the scope of acceptable evidence to include other relevant disciplines, which is necessary when applying a planetary health perspective.

*Table 6: Recommendations for Integrating SFS/D into Dietetic Research*

EXAMPLES OF ACTIONS FOR RESEARCHERS, DIETITIANS AND THE PROFESSION OF DIETETICS	
	More Specifically
Conduct or participate in research	<ul style="list-style-type: none"> <li>• Conduct or participate in research teams on sustainable dietary patterns, in a variety of settings. Ensure sustainable diet recommendations are nutritionally sound at an individual and population level.</li> <li>• Conduct or participate in research that facilitates community-level action for SFS/D. I.e., research that helps understand how best to facilitate change for sustainable food systems.</li> </ul>
Advocate for a more supportive SFS/D research environment in Canada	<ul style="list-style-type: none"> <li>• Advocate for food security, food system sustainability, and food self-sufficiency indicators in the national census (25)</li> <li>• Advocate for more research on SFS/D in Canada, including the role of the dietitian (25)</li> <li>• Advocate for funding for action research around SFS/D (25)</li> </ul>
Ensure a broad scope of acceptable and strong evidence	<ul style="list-style-type: none"> <li>• Reaffirm the interdisciplinary roots of the nutrition profession and work to incorporate knowledges from other disciplines (e.g., climate science, political science, social sciences) (28)</li> <li>• Collaborate on production and use of interdisciplinary evidence in SFS/D work (19)</li> <li>• Extend how evidence strength is evaluated to include diverse research approaches and disciplines, to avoid devaluing critical evidence</li> </ul>
Learn from others	<ul style="list-style-type: none"> <li>• Investigate successful models that value SFS/D in other countries and cultures (25)</li> </ul>



## Part 3: Overview of Foundational Concepts

The next two sections provide definitions and an overview of the foundational concepts that support SFS/D-informed decision-making in dietetic practice and research. The topics that follow are not exhaustive, and further knowledge and locally relevant applications will be part of dietitians' learning journey.

---

### Definitions

#### Ecosystem Services

Ecosystem services are the direct and indirect contributions of ecosystems to human well-being. The Economics of Ecosystems and Biodiversity (TEEB) classifies these services into four categories: i) provisioning services (e.g., food, fresh water, medicine); ii) regulating services (e.g., climate regulation, water purification, carbon sequestration and storage, pollination); iii) habitat services (i.e. habitat for species and maintenance of genetic diversity; iv) cultural services (e.g., spiritual experience, recreation and physical health, tourism, aesthetic values) (40).

#### Eutrophication

Eutrophication is the term used to describe the biological effects of an increase in concentration of nitrogen and phosphorus and other nutrients on aquatic ecosystems; it is characterized by excessive plant and algal growth and death of animal life from lack of oxygen. Food systems contribute to this through different mechanisms, including fertilizer runoff, manure losses and [food waste](#) (41).

#### Food Losses and Waste

“Food loss refers to food that is intended for human consumption but, through poor functioning of the food production and supply system, is reduced in quantity or quality.” “Food waste refers to food for human consumption that is discarded (both edible and inedible parts) due to intentional behaviors. Food waste often refers to what occurs along the food chain from the retail store through to the point of intended consumption (42 p.2).”

#### Food and Nutrition Security

“Food and nutrition security exists when all people at all times have physical, social and economic access to food, which is safe and consumed in sufficient quantity and quality to meet their dietary needs and food preferences, and is supported by an environment of adequate sanitation, health services and care, allowing for a healthy and active life.” (43) This concept aligns closely with, but is different than, definitions of Sustainable Food Systems and Diets. Food and Nutrition Security (FNS) is not the same as Household Food Insecurity (HFI), which is a distinct term to describe when a household does not have enough money to buy food. (35,44) *Food security* more commonly focuses on population level food access, *food insecurity* generally focuses on household level financial inadequacy; confusion between the terms could impact framing of the problem and related policy responses (45). Both FNS and HFI have important relationships with SFS/D but are beyond the scope of this paper. Critical intersections are highlighted, with references to more specific information.



## **Food Systems**

Food systems are complex, non-linear, systems that “... that embrace all the elements (environment, people, inputs, processes, infrastructure, institutions, markets and trade) and activities that relate to the production, processing, distribution and marketing, preparation and consumption of food and the outputs of these activities, including socio-economic and environmental outcomes” (46).

## **Greenhouse Gas Emissions (GHGe)**

“Climate change is caused [in large part] by the increase in concentrations of greenhouse gases in the atmosphere. These increases are primarily due to human activities such as the use of fossil fuels or agriculture.... Anthropogenic (human-made) greenhouse gas (GHG) emissions... include emissions for 7 greenhouse gases (carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, perfluorocarbons, hydrofluorocarbons and nitrogen trifluoride)” (47).

## **Highly Processed Foods and Ultra Processed Foods**

Highly processed foods is used by Health Canada to describe processed or prepared foods and beverages that contribute to excess sodium, free sugars, or saturated fat, including foods such as processed meat, deep-fried foods, sugary breakfast cereals, biscuits and cake, confectioneries, sugary drinks, and many ready-to-heat packaged dishes (39). The term “Ultra Processed Foods” is similarly used by the FAO and WHO; these foods are generally made to be convenient, attractive (hyperpalatable), highly profitable (using cheap ingredients), and to displace other food groups; they are also marketed intensively (48). A Canadian study found that Ultra Processed Foods make up almost half of Canadians’ daily energy intake across all socio-economic groups, and almost 60% of energy intake among children aged 9 and over, and that the more ultra-processed foods are contained in diets, the poorer the overall nutritional quality (49). This shift in consumption patterns has been linked to the global rise in obesity rate (39). Most health professionals contend that they should be minimized or avoided in a healthy and sustainable diet (48).

## **Intensive Agriculture**

“Intensive agriculture (IA) is generally used to denote farming systems that use modern technologies ... to maximise yields relative to land use... IA is associated [in food crops] with high use of chemical fertilisers, agrochemicals, and irrigation.” (48 p.17) In livestock production, it is associated with antibiotic use (for some animals), grain feeding and intensively concentrated animal housing. Regulations and standards vary by country, but as animal foods in the Canadian food system are also imported, these generalizations are relevant.

## **Lifecycle Assessment**

The principle method used in assessing the impact of food and diets on the environment is the life cycle assessment (LCA). LCA is a standardized research method defined by the International Standards Organization (ISO): “LCA addresses the environmental aspects and potential environmental impacts (e.g., use of resources and the environmental consequences of releases) throughout a product's life cycle from raw material acquisition through production, use, end-of-life treatment, recycling and final disposal (i.e., cradle-to-grave)”(50).

## Plant-Based Diets

Dietitians of Canada defines a plant-based diet as consisting mostly, or entirely, of foods derived from plants, including vegetables, grains, nuts, seeds, legumes and fruits. Plant-based foods form the base of the diet, with animal foods (if included) in smaller quantities. This definition is in line with the British Dietetic Association, who support that it can be a variation of a vegan or vegetarian diet, including flexitarians, who occasionally eat meat or poultry (51). It is different than definitions used in other health fields, for example where it has been used to mean a minimally processed *and* vegan diet (52).

## Sustainable Food Systems

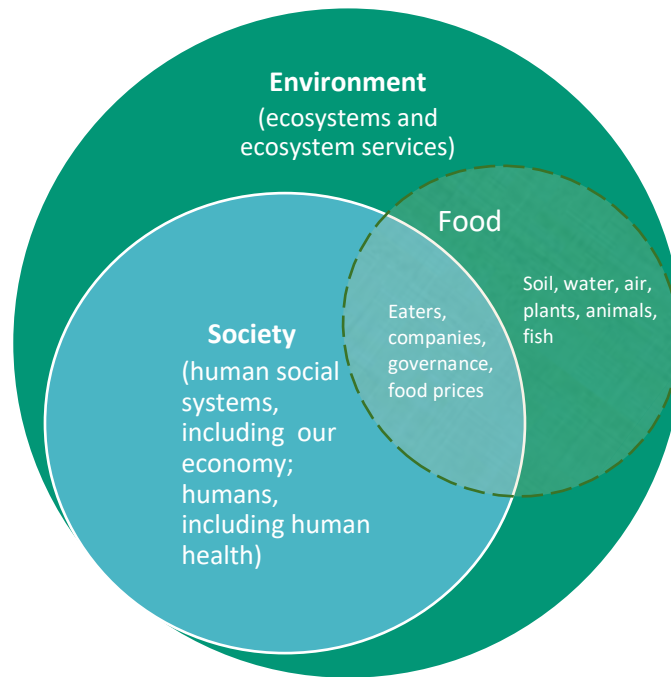
The Food and Agriculture Organization and the United Nations High Level Task Force on Global Food and Nutrition Security define “a sustainable food system [a]s a food system that delivers food and nutrition security for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised (46).” Dietitians of Canada also recognizes the importance of a Food Justice (53) perspective in achieving such “social bases”: “Food justice seeks to ensure that the benefits and risks of where, what and how food is grown, produced, transported, distributed, accessed and eaten are shared fairly. Food justice represents a transformation of the current food system, including but not limited to eliminating disparities and inequities...” and that “key to achieving food justice is to have communities who have experienced injustices empower themselves to participate in the political process (54).” “Community food security exists when all community residents obtain a safe, personally acceptable, nutritious diet through a sustainable food system that maximizes healthy choices, community self-reliance and equal access for everyone.” (55,56). Community Food Security is a *state* of food security, at the scale of a community, and reliant on SFS and social justice.

## Sustainable Diets

“Sustainable Diets are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources” (14 p. 7). Sustainable diets focus on the consumption component of the food system. They contribute to and are supported by *food system sustainability* (15) and therefore SFS/D are inseparable. Shifting dietary patterns towards sustainable diets is one of four approaches identified by Garnett (57) for moving toward food sustainability (others include reduction of food waste, changing agricultural production practices to reduce ecological effects and conserve resources, and more equitable distribution of resources).

## Systems Approaches

One key concept important to this position paper is that of *complex systems approaches*. [Food systems](#) are complex systems (networks) of actors and factors (see above definition of food systems) that are embedded within broader sociological systems. Within food systems there are many relationships between the natural environment (i.e., water, soil, etc.) and human social environment (individuals, companies, governance, economics, etc.) that form an overall system which spans disciplines, sectors and scales. Actions by one actor can have myriad impacts across systems and scales. One way a systems perspective can be conceptualized is as nested interdependencies, with each subsequent system reliant on the previous. To illustrate, the economy is nested within (and is dependent on) human society; similarly, society is nested within the environment. Food systems are nested within and across all three systems, and include a constellation of various sized actors and factors spanning those three systems.



*Figure 1: A nested systems perspective of food systems*

Considering nested interdependencies helps to clarify that if a system is degraded, it undermines the stability, or viability of another system dependent on it. For example, if we continue to systematically degrade our natural environment it will reach a point where it may not be able to support human social systems, as well as [food systems](#) (5,7). Applying a systems approach to decision making means recognizing the complex actors, factors, interactions and dependencies and using that information in daily decision making. Such decisions are often made in the absence of any ‘correct’ answer; rather, the decision maker must maximize benefit and minimize harm. As conditions are constantly changing, an iterative and reflexive approach to such decision making is critical.

## Foundational Concepts

The following sections provide evidence on how [food systems](#) impact, and are impacted by, environmental and social systems, and human health. They support the assertion that SFS/D is central to the work of dietitians and provide foundational knowledge on relevant topics required for SFS/D-informed decision making.

### Food Systems and the Environment

This section provides a high-level overview of how food systems and diets impact the environment and vice versa. It draws from a body of knowledge from research world-wide, as a comprehensive body of research specific to the Canadian context has not been completed. It is followed by a discussion organized by topical issues emerging in the food systems-environment literature and relevant to dietitians. The subsections align with and justify principles that support environmental sustainability in food choices and food systems, which are adapted from Seed and Rocha (58).

Food systems impact the environment and the environment impacts food systems. The impact that food systems and diets have on the environment is often measured using [lifecycle assessment](#) (LCA) techniques with [greenhouse gas emissions](#) (GHGe) as the most frequent indicator. Also frequently measured are land use, water and energy use (59,60). Nitrogen release into the environment is commonly assessed (60), while biodiversity is seldom measured. Briefly, LCA measures the impact of a unit of food throughout the “lifecycle” of the food, from production to consumption. The unit of food measurement varies, including weight, serving size, calories and grams of protein (61). There are other additional environmental indicators that should be included in comprehensive SFS/D assessments (60,62), but to date a lack of published research using comprehensive measures prevents their use in this role paper.

Research suggests that out of the nine boundaries identified as keeping the earth hospitable and supportive to human life (8,63), we have moved beyond the earth’s limits in four major categories: climate change; biodiversity (and species) loss; the addition of phosphorus and nitrogen to the world’s crops and ecosystems (resulting in [eutrophication](#)); and deforestation. While [food losses](#) and [food waste](#) are not typically considered environmental indicators, they impact many environmental indicators (42) and are therefore discussed here.

### Greenhouse gas emissions

It is estimated that the global food system is responsible for up to 30% of human generated GHGe (64). While Agriculture and Agri-Food Canada (65) attributes 10% of Canada's greenhouse gas emissions to crop and livestock production, this excludes emissions from fuel use, fertilizer production and agriculturally induced land use change.

### Land use

The leading cause for global deforestation is the conversion, or expansion, of land area used for agriculture (66–68). This leads to biodiversity loss, nutrient run-off, soil erosion (69,70), increased GHGe (71,72) and desertification (the transition from fertile land to infertile desert due to inappropriate land use or drought (73)). Some research supports that in certain ecosystem contexts (e.g., land otherwise not suitable for crops), grazing animals benefit soil fertility and biodiversity; other research asserts that the overall positive sustainability contribution is inadequate to recommend it on a global scale (74).

### **Water use**

Globally, the majority of freshwater withdrawal is used in food production (75) with estimated percentages ranging between 69-70% (76,77) and 80% (78). Freshwater use is also identified as a category, but researchers suggest that we have not yet moved beyond its boundaries (8,63).

### **Energy use**

Agriculture, as practiced in most Western countries, is dependent on fossil fuels both directly for crop management (e.g., fuel and irrigation), and indirectly for the production of fertilizers, pesticides and machinery (79,80). In the US, agriculture accounts for approximately 17% of fossil energy used (80). Energy use may or may not contribute to GHGe, depending on the source of the energy (e.g., electricity generated through hydro power versus coal).

### **Nitrogen release**

Nitrogen is lost to the environment from food production through fertilizer runoff, manure losses and food waste (41). Nutrients are released through fertilizer application into water and the atmosphere which leads to water acidification, eutrophication, climate change and biodiversity loss (41).

### **Biodiversity**

The loss of biodiversity is a feature of agricultural intensification (81,82). The World Health Organization (WHO) states “Intensified and enhanced food production through irrigation, use of fertilizer, pesticides (water and land, sterilization of soils), clearing land/ habitat, introduction of crop varieties and cropping patterns affect biodiversity, and thus impact global nutritional status and human health” (2017). Conversely, biodiversity is essential for food production, ensuring the sustainable productivity of soils and providing genetic resources for crops, livestock, and marine species harvested for food (83); many of these necessary key components are in decline (84). Biodiversity loss can have significant direct human health impacts if the ecosystem can’t perform in optimum ways (e.g., pollination of food plants, safe and adequate water sources, medicines and drugs sourced from nature).

### **Food loss and waste**

Food loss and waste depletes natural resources (e.g., water, soil) across the food chain (production, processing, distribution and consumption) and increases the accumulation of detrimental substances in the ecosystem, and thus has the potential to impact all of the environmental indicators listed above (42). Additionally, single use plastics (often associated with food packaging and to-go meals) are widely recognized as a global concern, especially in relation to the impact of their disposal on the marine environment (85).

### **Bidirectional Relationships of Impact between Food Systems and the Environment**

Food choices have an impact on the environment, and environmental degradation and climate change affect the food supply by impacting the ability to produce and access nutritious foods.

Environmental degradation and the loss of [ecosystem services](#) have already begun, and will continue, to impact both food quantity and quality, by affecting pest populations, erosion and nutrient depletion of soils, and growing conditions

and available water for irrigation (86). In Canada, one example of detrimental impact from environmental degradation on food supply is mercury contamination of fish.

Climate change can also create short term reliability problems with the food supply (87). Reliability (having a consistent food supply) can be impacted through variability in production, and also by disruption to the infrastructure people use to access food (e.g., road blockages due to fires).

These impacts disproportionately affect individuals and households living with low income as they may have a lesser capacity to invest in preparation or adaptive strategies such as buying extra stocks of emergency food, storing food (e.g. access to cold storage), or accessing transportation to take them to available food (64). Individuals living with low income are also less able to withstand financial or budget shocks which could result from the impacts of climate change.

Higher atmospheric concentrations of carbon dioxide (CO<sub>2</sub>), particularly in temperate regions, may result in some increases in cereal crop production. After 2050, however, crop production is anticipated to fall almost everywhere in the world due to rising temperatures (88). Further, while crop production may increase temporarily, increased carbon dioxide in the atmosphere is anticipated to decrease crop nutrient concentrations such as protein, micronutrients, and B vitamins (89), including zinc and iron (90). Climate change may also impact livestock production, for example, altering viruses affecting ticks and ruminants (91). Food safety has been raised as a significant concern, with issues raised such as mycotoxins in plant-based foods, harmful algae blooms in shellfish and potential overuse of pesticides and an increase in veterinary medicines used to compensate for issues caused by climate change (64). Fisheries are under threat due to warming and acidification of the ocean as a result of climate change (88,91,92).

## Emerging issues in nutrition and dietetics: food choices and the environment

Assessing the impact of food on the environment is complex and as research is rapidly emerging, the following topics are discussed in the context of the best available science. This section is organized according to literature emerging on the [food systems](#)-environment relationship and associated with topical issues relevant to dietitians. The subsections align with and build on key messages that support environmental sustainability in food choices and food systems (Table 7), adapted from Seed and Rocha, and emerging from evidence and dietary guidelines (58). These issues are important for dietitians making or recommending food procurement decisions at the public policy, institutional, food service, family or individual levels.

### Key messages for dietary sustainability:

- Consume a primarily plant-based diet
- Reduce meat consumption (especially ruminant meat)
- Consume seasonal, field grown vegetables and fruits
- Reduce food loss and waste
- Choose certified fish
- Breastfeed
- Limit consumption of highly processed foods

### Plant-based and animal-based foods and diets

Systematic reviews consistently demonstrate that production of animal-based foods has a higher impact than predominantly [plant-based diets](#) on the environment, as measured by GHGe (7,59,93–95), land use (59,72,94), and water use (59,94). The production of ruminant livestock (e.g., cows, sheep, goats) has the largest impact within the category of animal-based foods. Therefore, dietary patterns which are lower in animal-based foods have a lesser impact on the environment. In multiple studies worldwide, vegan, vegetarian (72) and “healthy” diets (which are defined according to study parameters) (72,93,96) have been shown to be more sustainable than diets typically consumed by the reference scenarios based on the average per capita consumption data in multiple countries. Further, studies in highly developed countries are also consistent in illustrating that dietary patterns that followed (healthier) national dietary guidelines were more environmentally sustainable than average dietary patterns or intakes of the respective populations (97).

Preliminary research shows the possibility of carbon footprints (GHGe) for some animal-based foods being lower than those reported in the evidence presented above when analyzed using nutrient density (98,99). Achieving consensus on how to define nutrient density, however, is contested (61). Further, it is essential to note that GHGe is only *one* indicator of environmental health to be evaluated. In addition to higher land, energy and water use, animal-based foods also impact other indicators such as nitrogen release and water pollution. As research evolves and industry practices change, recommendations may also shift and become more nuanced. For example, the Dairy Farmers of Canada report that milk production in Canada emits one third of GHGe compared to the global average, and the study evaluates a wider scope of [lifecycle assessment](#), including both environmental and socioeconomic performance in their analyses (100).

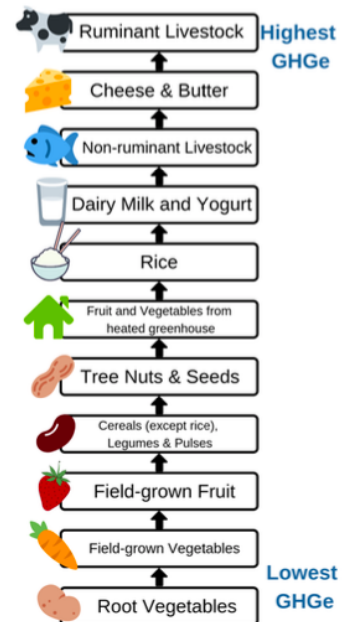
The EAT–Lancet Commission estimates that increased consumption of plant-based diets could reduce GHGe by up to 80% in 2050, whereas changes in food production practices could reduce agricultural GHGe by about 10%. Halving food loss and waste (reviewed below), could achieve a further 5% reduction. See the Dietitians of Canada PEN® background paper on Plant-Based Diets and the Environment for more information.

**Key message:** Dietary patterns that emphasize consumption of a primarily plant-based diet and reduced meat consumption (especially ruminant meat such as cow, sheep, goats) have positive environmental impacts.

## Food loss and waste

As noted in the [definitions](#), food waste often refers to what occurs along the food chain from the retail store through to consumer waste, while food loss occurs at earlier points in the food system. It is estimated that 21% - 50% of food waste occurs at the consumer stage (101). Higher income countries, like Canada, waste about 1/3 of our food (102,103); this is higher per person than low-income countries, and occurs primarily at the consumer stage. This is typical in medium/high-income countries (such as Canada) in comparison to more loss and waste in the production to distribution stages of the food supply chain in low-income countries (42). Over 50% of residential and commercial waste is organic (including paper) and the largest share of it is food waste (a significant portion of which is edible) (104).

Food waste in landfills is a key source of methane gas (a GHG which is 25 times stronger than CO<sub>2</sub>) (42). The cost of food waste in Canada is estimated to be at least \$31 billion annually. In terms of the economic value of food waste, consumers account for 47%, followed by processors (20%) and then the retail sector (10%) (105).



This figure is representative of GHGe only; consideration of other indicators may yield different results. Differences in location (e.g., country, type of land), how food is produced (e.g., pasture-fed versus feedlot), and how it is distributed (local versus air transported produce) can result in disparities within this hierarchy (Aleksandrowicz et al. 2016, Peters 2016).

*Figure 2. Hierarchy of Impacts of Food Categories on Greenhouse Gas Emission*



Prevention of waste and loss should be the first priority to preserve valuable inputs in the food system (like water) and to avoid negative outputs such as GHGe and water pollution. The reduction of food waste as a key strategy for sustainable food systems is supported in many reviews (e.g., 29,38) (5).

**Key message:** Food systems and consumption practices that emphasize reducing food loss and waste are important to decreasing environmental impacts across several indicators.

### Variations in foods and their environmental impacts

Due to the variations on the impact of food production noted above, it is important to consider how and where food is produced and distributed, and where possible to “choose better.” As we introduced earlier in this section, “choosing better” is important for dietitians making or recommending food procurement decisions at the public policy, institutional, and food service levels, and may also be appropriate at the family or individual levels.

The concept of choosing better draws on the work of the UK coalition “Eating Better”, that encourages better choices to benefit “animal welfare, the environment, health, reducing waste and for farming livelihoods” (106). While this is not clear-cut for all food types, evidence is strong for some. For example, their message of “less and better” in relation to animal-based foods suggests that as well as considering a reduction in the consumption of animal-based foods, how livestock are raised is also important. Water pollution, soil degradation, eutrophication, the degeneration of coral reefs, as well antibiotic resistance are related to intensive livestock production (68,82), and thus choosing meat that comes from less intensive production systems can have lower impacts. Another example is choosing seasonal, field grown vegetables and fruit over vegetables and fruit from greenhouses heated using fossil-fuel-based energy, which as illustrated in Figure 2, lowers GHGe.

The idea of choosing better can mean different things for different people. In Canada, it may mean supporting local farms and food businesses, supporting farms (at all scales) who are making proactively sustainable choices (reducing fossil fuel use and food waste, increasing biodiversity, land and water use efficiencies on the farm, etc.), purchasing poultry raised without prophylactic antibiotics or simply choosing legumes as a protein source more often. Due to concerns related to overfishing and some types of aquaculture (66,107,108), choosing sustainably certified fish is recommended across the globe by many organizations, including the World Wildlife Foundation (109). Recommendations for choosing sustainably certified food and/or fish are also included in the dietary guidance from Sweden (fish and palm oil) (110), Germany (fish) (111), Qatar (fish) (112), and the European LiveWell Plate (113). DC recognizes that many of these choices come with a much higher cost, and some institutions have accommodated these higher costs by offsetting higher cost ingredients by focusing on plant-based diets, seasonal menu planning, waste reduction, etc. (114). Cost savings from more energy efficient equipment are an additional opportunity.

**Key message:** The impact of dietary patterns on the environment can vary significantly between specific food choices due to variations in (primarily) production methods. Where possible, choosing meat products from less intensive production methods, and third-party certified foods, may help lower the overall impact on the environment. Choosing seasonal, field grown vegetables and fruit over those that are greenhouse grown will lower the overall GHGe of dietary patterns (see Figure 2).

## Infant feeding

Breast milk is created and consumed with a minimal ecological impact in comparison to breastmilk substitutes. The latter needs resources and energy to manufacture, package, distribute and prepare, and also generates a greater amount of post use waste (116).

**Key message:** When possible, breastfeeding reduces the environmental impact of infant feeding.

## Highly Processed foods

Limiting the consumption of [highly processed foods](#) is beneficial to human health and to the environment (48) as doing so may both reduce use of natural resources related to processing (e.g., energy, water) as well as decrease the accumulation of harmful substances in the ecosystem (e.g., plastic packaging). Similarly, bottled water produces 300 times as many GHGe as tap water mostly due to packaging and transportation (117).

**Key message:** Limiting highly processed foods, and choosing tap water as a beverage of choice, can reduce the overall impact of diet on the environment.

## Overconsumption

Policies and strategies that promote positive, healthy eating environments in all settings should aim to deemphasize the marketing and intake of overconsumption of calories. This is recommended to reduce environmental impacts of food across all aspects of the food system, as noted above (71,107,118). Sensitivity is necessary to approach this in a way that does not further exacerbate pervasive societal weight bias or disordered eating.

**Key message:** Policies and strategies that promote positive, healthy eating environments in all settings and deemphasize the marketing and overconsumption of calories can help avoid amplifying environmental costs of food consumption.

## Food Systems and Social Sustainability

Social sustainability includes socially constructed systems upon which humans rely to manage society, including economic, political and cultural systems, and food systems. As shown in Figure 1, human social systems are interconnected with and dependent on ecological systems. They are also deeply interconnected with food systems. When these social systems are systematically undermined, the food system is not sustainable. Social sustainability refers to the right to a decent life (*livelihood*), *social justice* and *participation* of all relevant stakeholders as defined by the UN Conference for Environment and Development (1992). Littig and Briebler (2005) add to this list the concept of *human dignity* while working to satisfy human needs. These four core concepts, livelihoods, social justice, human dignity and participation, frame this high-level overview of the relationship between food systems and social sustainability. Health systems and impacts are often included within the broader concept of social sustainability but given the central focus of dietetic practice on health, health considerations are explored separately.

**Key message:** Social sustainability encompasses livelihoods, social justice, human dignity, and participation of all stakeholders.

## Sustainable Livelihoods and the Food System

In 2016, The Canadian Agriculture and the AgriFood System was responsible for 6.7% of Canada's GDP (based on activity in primary agriculture, food and beverage processing, food retail and food service sectors (119)), and the food and beverage industry was the largest manufacturing industry employer in Canada. Clearly, the Canadian food system contributes to livelihoods, but not all participants benefit from sustainable livelihoods. Sustainable livelihoods require equity (in relation to distribution of capabilities, assets and opportunities) as well as sustainability (in relation to how assets and capabilities are used to maintain, enhance and preserve livelihoods, including not detracting from the ability of future generations to meet their livelihood outcomes) (120).

Economic systems facilitate interactions as part of human social systems (e.g., food exchange between producers and consumers, see Figure 1), and are very influential in decision making. As economic factors often drive client priorities, they are important considerations for dietitians. Increasingly businesses are recognizing the importance of shared value whereby businesses mobilize their resources to create economic value while simultaneously addressing social problems that intersect with their business operations (121). The August 19, 2019 statement by the U.S.-based Business Roundtable redefining the purpose of corporations beyond shareholder benefit, to include benefits of all stakeholders, is one example (122). While it is beyond the scope of this paper to provide a full analysis of food system sectors in relation to sustainable livelihoods, in order to illustrate where action is being, or can be taken, what follows are examples of challenges to sustainable livelihoods within the current food system.

Sustainable livelihoods for farmers, fishers and harvesters are integral to sustainable food systems. The most recent national snapshot of the farming sector in Canada points to changes, including a continuing trend of a decreased number of farms, with remaining farms increasing in size. The higher average age of farm operators is an ongoing concern, and almost 45% of farm operators reported off farm work in 2015. Succession planning remains a focus of the census with farms in supply managed sectors more likely to have a succession plan. While the number of farm operators under the age of 35 entering agriculture increased for the first time since the 1991 census, younger farmers were more likely to rent as opposed to own the land they farm (123). See Bessant (124) for an exploration of the relative lack of success of policies to address persistent financial difficulties within the farming sector.

Migrant farm workers are one example of a marginalized group who can face challenges in relation to sustainable livelihoods in the Canadian food system. The Canadian Agriculture and Agri-food System depends on migrant workers to fill jobs for which workers living in Canada are not available. Migrant farm work can be precarious for a variety of reasons. Where employment permits are tied to one employer, employees can find it difficult to address breaches in employment standards out of fear of further unethical repercussions such as: repatriation, barriers to accessing occupational and health services, and longer work hours (125). Following years of advocacy from a range of organizations, the 2019 Federal Budget announced an Agri-Food Immigration Pilot program, testing an industry specific approach to address labour needs, which includes a pathway to permanent residency (126). This is one example of policy that has the potential to support sustainable livelihoods.

**Key message:** Policies to support sustainable livelihoods in food systems decrease inequities between participants in the system.

## Social Justice and the Food System

Social justice refers to fair and just relations between individuals and society, and is often reflected in the distribution of wealth, opportunities and social privileges (UN 2006). Human activities such as agricultural work and resource extraction can have negative social justice impacts, including the example of the potentially precarious nature of migrant farm work discussed in the previous section, as well as the disruption of traditional Indigenous foodways. Where priority is given to resource extraction as opposed to protection of Indigenous foodways (for example where forests are managed in support of timber extraction over species habitat), and depending on the industry, there is risk of decreased food availability, and contamination of sources of food and water.

Such decision making has been called ‘environmental racism’ where it has the potential to undermine social justice (115). Understanding of historical and present day realities impacting Indigenous food systems is critical (127), and the 94 recommendations of the Truth and Reconciliation Commission (128) provide an excellent starting point to guide action, in partnership with Indigenous communities, colleagues and their allies.

Dietary inequities that are avoidable are considered unjust; an example being the declining diet quality and vegetables and fruit intakes among Canadian residents of a lower socioeconomic position (129). For a fulsome discussion of the failure of the widespread public response of food banks and charitable donations to address the root cause of income related household food insecurity, namely income insecurity, see Tarasuk and colleagues (130).

**Key message:** Food systems can create or exacerbate inequities for vulnerable groups.

## Human Dignity, Entitlements, and the Food System

Dietitians of Canada’s Backgrounder on Household Food Insecurity (35,44) points out that as a signatory to the International Covenant on Economic, Social and Cultural Rights (1966), Canada is compelled to work towards the progressive realization of a right to food (131,132). Reducing income-related household food insecurity would be one step towards the right to food for the estimated 12% of Canadian households reporting some level of food insecurity (133). The highest levels of food insecurity since standardized monitoring began in 2005 were observed in Nunavut and Northwest Territories, 46.8% and 24.1% respectively (134), geographic areas home to high proportions of Indigenous populations.

Dietitians of Canada’s Position Statement and Recommendations Addressing Household Food Insecurity in Canada (35) describes the negative impacts and public health implications of income related household food insecurity. With respect to human dignity, the dominant response within Canada when state mandated income supplements such as social assistance or minimum wage do not keep pace with basic costs of living, has been reliance on voluntary, charitable, extra-governmental food distribution (135). Emerging as its own distinct food system in the 1980s as an emergency response to increases in poverty and associated hunger, food banks have consistently advocated for more systemic solutions and recognize their inability to meet demand. Loopstra and Tarasuk (130) clearly document the inability of charitable food distribution organizations to reach all households experiencing food insecurity by comparing food bank usage and household food insecurity across several Canadian jurisdictions. Income-related food insecurity requires an income-based solution (35).

**Key message:** Policies and programs to reduce food insecurity must respect human dignity, and income-based solutions are recommended.

### Participation of stakeholders and governance of the Food System

There is a need for more transparent, accountable and participatory governance for our food systems (136–138). The emergence of intersectoral Food Policy Councils and roundtables in Canada (139) has contributed progress on this front through policy innovation, network building, education and outreach activities. Furthermore, the founding coordinator of one of Canada’s longest standing food policy councils, the Toronto Food Policy Council adds the need for intersectoral approaches to governance, integrating agriculture, health, social and economic development interests (140). Indeed one of the elements of the National Food Policy for Canada, announced in 2019, is the establishment of a Canadian Food Policy Advisory Council (141) that represents diverse expertise within food systems; Dietitians of Canada actively advocated for such a council, in recognition of the need for innovation in governance of proposed national food policy for Canada.

**Key message:** Governance of food systems needs to be intersectoral, accountable, and participatory.

### Food Systems and Health

Health extends far beyond the absence of disease and many governing bodies have developed holistic definitions for these reasons. In 1948, The World Health Organization positioned health as being a fundamental human right for people of all races, religions, political beliefs, economic and social conditions. The Ottawa Charter for Health Promotion (142) identified health as a resource, and recognized that in order to achieve health, ‘an individual or group must be able to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment’. From this work the Social Determinants of Health emerged. The concept of Ecological Health (18) recognizes complex and multilayered connections that impact human health within social and ecological systems, and informed the definition of Planetary Health used in this paper (16). All three approaches to defining health are critical to understanding, from a systems perspective, that health is strongly interconnected with, and reliant on, existing social structures as well as sustainable ecological systems.

In this section, examples are shown to highlight ways that food systems can systematically undermine health, and therefore sustainability. For a comprehensive examination of negative human health impacts of existing food systems see IPES-Food (1).

### Impacts of food production & harvesting systems on human health

Resource intensive food production and harvesting systems, reliant on high inputs of chemical fertilizers, agrochemicals, irrigation systems and prophylactic use of antibiotics (see Part 3 [Definitions](#)), regardless of scale, have without doubt increased the availability of food globally. However, there are potential negative health effects. For example, the Federal Action Plan on Antimicrobial Resistance and Use in Canada (143) recognizes the need for action spanning human, animal, agricultural, food and environmental sectors in recognition of the contribution of antimicrobial use in animal husbandry to antimicrobial resistance.

IPES-Food's report on health effects in relation to food systems also points to contamination of soil and waterways from fertilizer runoff and *E. coli* from improperly stored and treated animal feces (1). Unsafe and precarious working conditions have potential negative health impacts on food system workers, including higher risk of occupational injuries in agricultural, fishing, and food manufacturing compared to other sectors, and migrant workers are especially vulnerable (1,144,145).

### **Impact of food processing and distribution systems on human health**

Food safety risks associated with increasingly concentrated food processing and distribution systems includes the potential risk for rapid disease spread. For example, in the 2012 XL Food contamination of ground beef with *E. coli*, the 18 deaths that occurred across Canada were traced to a single plant (146). Food Safety regulations, such as the Safe Food for Canadians Regulations (147) can help mitigate such issues with new licensing requirements, preventive measures, and traceability of imported foods.

### **Impact of food retail systems and marketing on human health**

In food environments where energy dense, nutrient poor food choices are abundant, unhealthy dietary patterns often follow (148). Canada's Healthy Eating Strategy aims to improve food environments to make the healthy choice the easy choice. The strategy's actions are designed to improve healthy eating information, improve the nutrition quality of foods sold in Canada, protect vulnerable populations, and support increased access to and availability of nutritious foods.

One such action is to restrict marketing of unhealthy and highly processed food to children and youth. Dietitians of Canada's Position Statement on the Advertising of Food and Beverages to Children (149) and subsequent actions in support of restricting advertising to children have been driven by the overwhelming evidence and global consensus of the need to reduce the negative health outcomes that threaten children's rights to adequate, safe and nutritious foods as outlined in the Declaration of the Rights of the Child, ratified by Canada in 1991.

### **Impact of food consumption patterns on human health**

Ultra-processed foods are a primary factor driving unhealthy dietary intake patterns in Canada (49), as such foods are more energy dense, are low in fibre, and have more free sugars, sodium, and saturated fats. Diet-related risk factors are now recognized among the top risk factors contributing to the global burden on disease (150).

Research has demonstrated more environmentally sustainable dietary patterns *can* be healthy dietary patterns (4,5,151,152). However, diets with lower environmental impacts are not necessarily healthier, and vice versa (153,154), in part due to the many interconnected social and environmental factors explored in this paper. It is therefore important that dietitians are able to reconcile the evidence in their practice in a way that maximizes health outcomes, for individual, community and planetary health.

## Concluding Statements

The growing body of evidence highlights the interdependence of human health, social systems, and planetary health, and dietitians across diverse practice areas have a role in supporting [sustainable food systems](#).

As with any area of dietetic practice, dietitians' personal level of competence within SFS/D may vary from entry level to expert, and dietitians are well-equipped to understand which roles and recommendations are appropriate to their skill level. It should be noted that some dietitians may feel they do not meet entry-level competence in this area, as it is not included comprehensively in all dietetic training programs. The [Definitions and overview of Foundational Concepts](#) is a good starting place for those new to these topics.

Many examples of roles and specific actions are included in this paper to support dietitians with suggestions to best leverage change. Dietitians of Canada recognizes that supporting system change for sustainable food systems is not the purview of dietitians alone, and that a shared responsibility between diverse sectors and disciplines will require collaborative effort. Food systems are dynamic systems, so what is most sustainable today may change over time; dietitians should engage in professional development and seek out evolving evidence in SFS/D.



## References

1. IPES-Food. Unravelling the Food-Health Nexus: Addressing practices, political economy, and power relations to build healthier food systems. [Internet]. The Global Alliance for the Future of Food and IPES-Food; 2017 [cited 2017 Nov 14]. Available from: <http://www.ipes-food.org/health>
2. Broman GI, Robèrt K-H. A framework for strategic sustainable development. *J Clean Prod* [Internet]. 2016 [cited 2016 May 30]; Available from: <http://www.sciencedirect.com/science/article/pii/S0959652615015930>
3. Missimer M, Robèrt K-H, Broman G. A strategic approach to social sustainability – Part 2: a principle-based definition. *J Clean Prod* [Internet]. [cited 2016 May 30];140. Available from: <http://www.sciencedirect.com/science/article/pii/S0959652616303274>
4. Springmann M, Clark M, Mason-D'Croz D, Wiebe K, Bodirsky BL, Lassaletta L, et al. Options for keeping the food system within environmental limits. *Nature*. 2018 Oct 10;1.
5. Willett W, Rockström J, Loken B, Springmann M, Lang T, Vermeulen S, et al. Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet* [Internet]. 2019 Jan [cited 2019 Jan 17]; Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0140673618317884>
6. Foley JA, DeFries R, Asner GP, Barford C, Bonan G, Carpenter SR, et al. Global Consequences of Land Use. *Science*. 2005 Jul 22;309(5734):570–4.
7. IPCC. Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press; 2018.
8. Steffen W, Richardson K, Rockström J, Cornell SE, Fetzer I, Bennett EM, et al. Planetary boundaries: Guiding human development on a changing planet. *Science*. 2015 Feb 13;347(6223):1259855.
9. Food and Agriculture Organization. Building a common vision for sustainable food and agriculture: Principles and Approaches [Internet]. Rome, FAO; 2014. Available from: <http://www.fao.org/3/919235b7-4553-4a4a-bf38-a76797dc5b23/i3940e.pdf>
10. iPES Food. The New Science of Sustainable Food Systems: Overcoming barriers to food systems reform [Internet]. iPES Food; 2015. Available from: <http://www.ipes-food.org/reports>
11. The Economist Intelligence Unit, Barilla Centre for Food and Nutrition. Food Sustainability Index [Internet]. 2016. Available from: <http://foodsustainability.eiu.com/>
12. EAT. EAT Lancet Commission Summary [Internet]. [cited 2019 Jan 17]. (Healthy Diets From Sustainable Food Systems). Available from: [https://eatforum.org/content/uploads/2019/01/EAT-Lancet\\_Commission\\_Summary\\_Report.pdf](https://eatforum.org/content/uploads/2019/01/EAT-Lancet_Commission_Summary_Report.pdf)
13. Nguyen H. Sustainable food systems: Concept and framework [Internet]. FAO; 2018. Available from: [www.fao.org/sustainable-food-value-chain](http://www.fao.org/sustainable-food-value-chain)
14. Burlingame B, Dernini S. Sustainable Diets and Biodiversity: Directions and Solutions for Policy, Research and Action. Rome, Italy: Nutrition and Consumer Protection Division, Food and Agriculture Organization; 2012.
15. Meybeck A, Gitz V. Sustainable diets within sustainable food systems. *Proc Nutr Soc*. 2017 Feb;76(1):1–11.



16. Whitmee S, Haines A, Beyrer C, Boltz F, Capon AG, Dias BFDS, et al. Safeguarding human health in the Anthropocene epoch: Report of the Rockefeller Foundation-Lancet Commission on planetary health. *The Lancet*. 2015 Nov 14;386(10007):1973–2028.
17. Canada A and A-F. A Food Policy for Canada [Internet]. aem. 2017 [cited 2019 Apr 5]. Available from: <https://www.canada.ca/en/campaign/food-policy.html>
18. Lang T, Rayner G. Ecological public health: the 21st century's big idea? An essay. *Br Med J* [Internet]. 2012 [cited 2018 Jul 30];345(e5466). Available from: <https://www.bmj.com/content/345/bmj.e5466>
19. Carlsson L, Pettinger C, Mehta K. Critical Dietetics and Sustainable Food Systems. Eds. John Coveney, Sue Booth. In: *Critical Dietetics and Critical Nutrition Studies* [Internet]. Springer; 2019 [cited 2019 Apr 5]. p. 97–115. (Food Policy). Available from: <https://www.springer.com/us/book/9783030031121>
20. Dyball R, Carlsson L. Ellen Swallow Richards: Mother of Human Ecology? *Hum Ecol Rev*. 2017;23(2):17–28.
21. Gussow JD. Dietary guidelines for sustainability. *J Nutr Educ*. 1986;18(1):1–5.
22. Mason P, Lang T. *Sustainable Diets: How Ecological Nutrition Can Transform Consumption and the Food System*. 1 edition. London ; New York: Routledge; 2017. 368 p.
23. Rebrovick T. The Politics of Diet: “Eco-dietetics,” Neoliberalism, and the History of Dietetic Discourses. *Polit Res Q Salt Lake City*. 2015 Dec;68(4):678–89.
24. Wilkins JL, Lapp J, Tagtow A, Roberts S. Beyond eating right: The emergence of civic dietetics to foster health and sustainability through food system change. *J Hunger Environ Nutr*. 2010;5(1):2–12.
25. Carlsson L, Callaghan E, Dorph JR. Sustainable Food Systems that Promote Healthy Diets: A proposed roadmap for Dietitians of Canada. [Internet]. Blekinge Institute of Technology; 2017 Jul p. 17. Available from: <https://www.bth.se/eng/food-commons/>
26. Carlsson L, Callaghan E, Broman G. How Can Dietitians Leverage Change for Sustainable Food Systems in Canada? *Can J Diet Pract Res*. 2019 Mar 25;1–8.
27. Roblin L, Truscott R, Boddy M. The Development of a Provincial Food and Nutrition Strategy through Cross-Sector Collaboration. *Can J Diet Pract Res*. 2018; 79(1):28-34.
28. Pettinger C. *Sustainable Eating: Opportunities for Nutrition Professionals*. 2018;
29. Wegener J. Equipping Future Generations of Registered Dietitian Nutritionists and Public Health Nutritionists: A Commentary on Education and Training Needs to Promote Sustainable Food Systems and Practices in the 21st Century. *J Acad Nutr Diet* [Internet]. 2018 Jan 6 [cited 2018 Feb 16]; Available from: <http://www.sciencedirect.com/science/article/pii/S2212267217317380>
30. Partnership for Dietetic Education and Practice. Standards - PDEP [Internet]. 2014 [cited 2018 Jun 13]. Available from: <https://www.pdep.ca/tools/standards.aspx>
31. Brady J. Social Justice, Health Equity, and Advocacy: What Are Our Roles. In: *Critical Dietetics and Critical Nutrition Studies* Eds John Coveney, Sue Booth. Springer; 2019. p. 143–59. (Food Policy).
32. EAT-Lancet Commission. Brief for Healthcare Professionals [Internet]. [cited 2019 Apr 6]. Available from: <https://eatforum.org/lancet-commission/healthcare-professionals/>
33. Robinson-O'Brien R, Gerald BL. Practice Paper of the Academy of Nutrition and Dietetics Abstract: Promoting Ecological Sustainability within the Food System. *J Acad Nutr Diet*. 2013 Mar 1;113(3):464.
34. EAT-Lancet Commission. Brief for Food Service Professionals [Internet]. [cited 2019 Apr 6]. Available from: <https://eatforum.org/lancet-commission/food-service-professionals/>

35. Dietitians of Canada. Addressing Household Food Insecurity in Canada – Position Statement and Recommendations – Dietitians of Canada - Canadian Journal of Dietetic Practice and Research. Can J Diet Pract Res [Internet]. 2016 [cited 2019 Apr 5];77(3). Available from: <https://dcjournal.ca/doi/10.3148/cjdpr-2016-019>
36. United Nations Indigenous Peoples. United Nations Declaration on the Rights of Indigenous Peoples [Internet]. [cited 2019 Apr 6]. Available from: <https://www.un.org/development/desa/indigenouspeoples/declaration-on-the-rights-of-indigenous-peoples.html>
37. O’Kane G. What is the real cost of our food? Implications for the environment, society and public health nutrition. Public Health Nutr. 2012 Feb;15(2):268–76.
38. Peregrin T. Sustainability in Foodservice Operations: An Update. J Am Diet Assoc. 2011 Sep;111(9):1286–94.
39. Canada H. Welcome to Canada’s food guide [Internet]. 2018 [cited 2019 Apr 5]. Available from: <https://food-guide.canada.ca/en/>
40. The Economics of Ecosystems and Biodiversity - TEEB [Internet]. [cited 2019 Apr 5]. Available from: <http://www.teebweb.org/>
41. Gephart JA, Davis KF, Emery KA, Leach AM, Galloway JN, Pace ML. The environmental cost of subsistence: Optimizing diets to minimize footprints. Sci Total Environ. 2016 May;553:120–7.
42. Commission for Environmental Cooperation. Characterization and Management of Food Loss and Waste in North America. [Internet]. Montreal, Canada; 2017 [cited 2019 Apr 5]. Available from: <http://www3.cec.org/islandora/en/item/11774-characterization-and-management-food-waste-in-north-america-foundational-report-en.pdf>
43. Food and Agriculture Organization of the United Nations. Plan of Action on World Food Security. In: Rome Declaration on World Food Security [Internet]. Rome, Italy: FAO; 1996 [cited 2019 Aug 28]. Available from: <http://www.fao.org/3/w3613e/w3613e00.htm>
44. Dietitians of Canada. Prevalence, Severity and Impact of Household Food Insecurity: A Serious Public Health IssueHFI-Background-DC-FINAL.pdf [Internet]. Dietitians of Canada; 2016 [cited 2019 Aug 28]. Available from: <https://www.dietitians.ca/Downloads/Public/HFI-Background-DC-FINAL.aspx>
45. McIntyre L. Food insecurity policy is not the flipside of food security policy [Internet]. Policy Options. [cited 2019 Aug 28]. Available from: <https://policyoptions.irpp.org/fr/magazines/agri-food-policy/food-insecurity-policy-is-not-the-flipside-of-food-security-policy/>
46. HLPE. Nutrition and Food Systems. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security [Internet]. Rome: Committee on World Food Security; 2017 [cited 2017 Sep 26] p. 152. (HLPE Report Series). Report No.: 12. Available from: [http://www.fao.org/fileadmin/user\\_upload/hlpe/hlpe\\_documents/HLPE\\_Reports/HLPE-Report-12\\_EN.pdf](http://www.fao.org/fileadmin/user_upload/hlpe/hlpe_documents/HLPE_Reports/HLPE-Report-12_EN.pdf)
47. Canada E and CC. Greenhouse gas emissions [Internet]. 2018 [cited 2019 Apr 5]. Available from: <https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html>
48. Fraanje W, Garnett T. What is ultra-processed food? And why do people disagree about its utility as a concept? Food Climate Research Network: University of Oxford; (Food Source).
49. Moubarac J-C, Batal M, Martins APB, Claro R, Levy RB, Cannon G, et al. Processed and ultra-processed food products: consumption trends in Canada from 1938 to 2011. Can J Diet Pract Res Publ Dietit Can Rev Can Prat Rech En Diet Une Publ Diet Can. 2014;75(1):15–21.
50. Technical Committee : ISO/TC 207/SC 5 Life cycle assessment. ISO 14040:2006 Environmental management: Life cycle assessment principles and framework [Internet]. ISO. 2006 [cited 2019 Apr 5]. Available from: <http://www.iso.org/cms/render/live/en/sites/isoorg/contents/data/standard/03/74/37456.html>

51. Plant-based diet [Internet]. [cited 2019 Aug 28]. Available from: [https://www.bda.uk.com/foodfacts/plant-based\\_diet](https://www.bda.uk.com/foodfacts/plant-based_diet)
52. Ostfeld RJ. Definition of a plant-based diet and overview of this special issue. *J Geriatr Cardiol JGC*. 2017 May;14(5):315.
53. Gottlieb R, Anupama J. Food Justice [Internet]. MIT Press; 2013 [cited 2019 Apr 5]. 320 p. Available from: <https://mitpress.mit.edu/books/food-justice>
54. Alkon AH, Agyeman J. Cultivating Food Justice [Internet]. MIT Press; 2011 [cited 2019 Apr 5]. Available from: <https://mitpress.mit.edu/books/cultivating-food-justice>
55. Dietitians of Canada. Community food security position of Dietitians of Canada. Toronto, Ont.]: Toronto, Ont. : Dietitians of Canada; 2011.
56. Hamm MW, Bellows AC. Community Food Security and Nutrition Educators. *J Nutr Educ Behav*. 2003;35(1):37–43.
57. Garnett T. Food sustainability: problems, perspectives and solutions. *Proc Nutr Soc*. 2013 Feb;72(1):29–39.
58. Seed B, Rocha C. Can we eat our way to a healthy and ecologically sustainable food system? *Can Food Stud Rev Can Études Sur Aliment*. 2018 Sep 30;5(3):182–207.
59. Nelson M E, Hamm MichaelW, Abrams S A, Griffin T S. Alignment of Healthy Dietary Patterns and Environmental Sustainability: A Systematic Review. *Adv Nutr*. 2016;7:1005–25.
60. Jones AD, Hoey L, Blesh J, Miller L, Green A, Shapiro LF. A Systematic Review of the Measurement of Sustainable Diets. *Adv Nutr Int Rev J*. 2016 Jul 1;7(4):641–64.
61. Heller MC, Keoleian GA, Willett WC. Toward a life cycle-based, diet-level framework for food environmental impact and nutritional quality assessment: a critical review. *Environ Sci Technol*. 2013 Nov 19;47(22):12632–47.
62. Rutten M, Achterbosch T, de Boer I, Cuaresma JC, Geleijnse JM, Havlík P, et al. Metrics, models and foresight for European sustainable food and nutrition security: The vision of the SUSFANS project. *Agric Syst*. 2016;
63. Rockstrom J, Steffen W, Noone K, Persson A. Planetary boundaries: exploring the safe operating space for humanity. *Ecol Soc*. 2009;14(2).
64. Vermeulen SJ, Campbell BM, Ingram JSI. Climate Change and Food Systems. *Annu Rev Environ Resour*. 2012 Nov 21;37(1):195–222.
65. Canada A and A-F. Greenhouse gases [Internet]. 2016 [cited 2019 Apr 5]. Available from: <http://www.agr.gc.ca/eng/science-and-innovation/agricultural-practices/climate-change-and-agriculture/greenhouse-gases/?id=1329321969842>
66. Garnett T. What is a Sustainable Healthy Diet: A discussion paper [Internet]. Oxford, UK: Food Climate Research Network; 2014 Apr [cited 2015 Jul 14]. Available from: [http://www.fcrn.org.uk/sites/default/files/fcrn\\_what\\_is\\_a\\_sustainable\\_healthy\\_diet\\_final.pdf](http://www.fcrn.org.uk/sites/default/files/fcrn_what_is_a_sustainable_healthy_diet_final.pdf)
67. Kissinger G, Herold M, de Sy V. Drivers of deforestation and forest degradation: A synthesis report for REDD+ policymakers [Internet]. The Government of UK and Norway; 2012 [cited 2019 Apr 5]. Available from: <https://www.cifor.org/library/5167/>
68. United Nations Environment Programme, Division of Early Warning and Assessment. UNEP year book: emerging issues in our global environment 2012. Nairobi, Kenya: United Nations Environment Programme; 2012.
69. Turner BL, Lambin EF, Reenberg A. The emergence of land change science for global environmental change and sustainability. *Proc Natl Acad Sci*. 2007 Dec 26;104(52):20666–71.
70. Lambin EF, Meyfroidt P. Global land use change, economic globalization, and the looming land scarcity. *Proc Natl Acad Sci*. 2011 Mar 1;108(9):3465–72.

71. Garnett T. Where are the best opportunities for reducing greenhouse gas emissions in the food system (including the food chain)? *Food Policy*. 2011;36(1):S23–S32.
72. Hallström E, Carlsson-Kanyama A, Börjesson P. Environmental impact of dietary change: a systematic review. *J Clean Prod*. 2015 Mar 15;91:1–11.
73. Food and Agriculture Organization of the United Nations. Sustainable development of drylands and combating desertification: How to define desertification. [Internet]. 1993 [cited 2019 Apr 5]. Available from: <http://www.fao.org/3/v0265e/v0265e01.htm>
74. Garnett T, Godde C, Muller A, Roos E, de Boer I, zu Ermgassen E, et al. Grazed and Confused [Internet]. Food Climate Research Network; 2017 [cited 2018 Jun 13]. Available from: <https://www.fcrn.org.uk/projects/grazed-and-confused>
75. Merrigan K, Griffin T, Wilde P, Robien K, Goldberg J, Dietz W. Designing a sustainable diet. *Science*. 2015 Oct 9;350(6257):165–6.
76. Food and Agriculture Organization of the United Nations. AQUASTAT website [Internet]. 2016 [cited 2019 May 24]. Available from: [http://www.fao.org/nr/water/aquastat/water\\_use/index.stm](http://www.fao.org/nr/water/aquastat/water_use/index.stm)
77. UN Water. Statistics Detail: Agriculture is the biggest water user, with irrigation accounting for 70% of global water withdrawals [Internet]. UN Water. 2014 [cited 2018 May 24]. Available from: <http://www.unwater.org/statistics/statistics-detail/en/c/246663/>
78. Carr JA, D’Odorico P, Laio F, Ridolfi L. Recent History and Geography of Virtual Water Trade. *PLOS ONE*. 2013 Feb 15;8(2):e55825.
79. Woods J, Williams A, Hughes JK, Black M, Murphy R. Energy and the Food System. *Philos Trans R Soc B Biol Sci*. :51.
80. Pimentel D, Pimentel M. Sustainability of meat-based and plant-based diets and the environment. *Am J Clin Nutr*. 2003 Sep 1;78(3):660S–663S.
81. Millennium Ecosystem Assessment [Internet]. [cited 2019 Apr 5]. Available from: <https://millenniumassessment.org/en/Reports.html>
82. World Health Organization, Convention on Biological Diversity (Organization), United Nations Environment Programme. Connecting global priorities: biodiversity and human health: a state of knowledge review. [Internet]. 2015 [cited 2019 Apr 5]. Available from: [http://apps.who.int/iris/bitstream/10665/174012/1/9789241508537\\_eng.pdf?ua=1](http://apps.who.int/iris/bitstream/10665/174012/1/9789241508537_eng.pdf?ua=1)
83. WHO. World Health Organization Biodiversity [Internet]. WHO. [cited 2019 Apr 5]. Available from: <https://www.who.int/globalchange/ecosystems/biodiversity/en/>
84. International Water Management Institute. Synthesis\_Report: An Ecosystem Services Approach to Water and Food Security [Internet]. United Nations Environment Programme; 2019 [cited 2019 Apr 5]. Available from: [http://www.iwmi.cgiar.org/Issues/Ecosystems/PDF/Synthesis\\_Report-An\\_Ecosystem\\_Services\\_Approach\\_to\\_Water\\_and\\_Food\\_Security\\_2011\\_UNEP-IWMI.pdf](http://www.iwmi.cgiar.org/Issues/Ecosystems/PDF/Synthesis_Report-An_Ecosystem_Services_Approach_to_Water_and_Food_Security_2011_UNEP-IWMI.pdf)
85. Xanthos D, Walker TR. International policies to reduce plastic marine pollution from single-use plastics (plastic bags and microbeads): A review. *Mar Pollut Bull*. 2017 May 15;118(1):17–26.
86. Nellemann C, MacDevette M, Manders T, Eickhout B, Svihus B, Prins AG, et al. The Environmental Food Crisis—The Environment’s Role in Averting Future Food Crises. A UNEP Rapid Response Assessment. [Internet]. Arendal: United Nations Environment Program; 2009 [cited 2019 Apr 5]. Available from: [https://www.scirp.org/\(S\(lz5mqp453edsnp55rrgjt55\)\)/reference/ReferencesPapers.aspx?ReferenceID=1311626](https://www.scirp.org/(S(lz5mqp453edsnp55rrgjt55))/reference/ReferencesPapers.aspx?ReferenceID=1311626)
87. Wheeler T, Braun J von. Climate Change Impacts on Global Food Security. *Science*. 2013 Aug 2;341(6145):508–13.

88. Niles M, Ahuja R, Esquivel JM, Mango N, Duncan M. Climate Change and Food Systems: Assessing Impacts and Opportunities [Internet]. Washington, D.C.: Meridian Institute; 2017 [cited 2019 Apr 5]. Available from: <https://scholarworks.uvm.edu/calsfac/16/>
89. Ebi KL, Ziska LH. Increases in atmospheric carbon dioxide: Anticipated negative effects on food quality. *PLOS Med.* 2018 Jul 3;15(7):e1002600.
90. Weyant C, Brandeau ML, Burke M, Lobell DB, Bendavid E, Basu S. Anticipated burden and mitigation of carbon-dioxide-induced nutritional deficiencies and related diseases: A simulation modeling study. *PLOS Med.* 2018 Jul 3;15(7):e1002586.
91. Porter JR, Xie L, Challinor AJ, Cochrane K, Howden SM, Iqbal MM, et al. Food security and food production systems. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge, UK: Intergovernmental Panel on Climate Change; 2014 p. 485–533.
92. Gattuso J-P, Magnan A, Billé R, Cheung WWL, Howes EL, Joos F, et al. Contrasting futures for ocean and society from different anthropogenic CO<sub>2</sub> emissions scenarios. *Science.* 2015 Jul 3;349(6243):aac4722.
93. Clune S, Crossin E, Verghese K. Systematic review of greenhouse gas emissions for different fresh food categories. *J Clean Prod.* 2017;140(2):766–83.
94. Aleksandrowicz L, Green R, Joy EJM, Smith P, Haines A. The Impacts of Dietary Change on Greenhouse Gas Emissions, Land Use, Water Use, and Health: A Systematic Review. *PLOS ONE.* 2016 Nov 3;11(11):e0165797.
95. Wickramasinghe K, Scarborough P, Goldacre M, Rayner M. Defining sustainable diets by comparing greenhouse gas emissions from different food groups: a systematic review. *The Lancet.* 2013 Nov 29;382:S104.
96. The Eatwell Guide: A More Sustainable Diet | Carbon Trust [Internet]. [cited 2019 Apr 5]. Available from: <https://www.carbontrust.com/resources/reports/advice/sustainable-diets/>
97. US Dietary Guidelines Advisory Committee. Scientific Report of the 2015 Dietary Guidelines Advisory Committee to the Secretaries of the U.S. Department of Health and Human Services and the U.S. Department of Agriculture [Internet]. Washington, D.C.: Department of Health & Human Services.; 2015 [cited 2019 Apr 5]. Available from: <https://health.gov/dietaryguidelines/2015-scientific-report/>
98. Drewnowski A. Concept of a nutritious food: toward a nutrient density score. *Am J Clin Nutr.* 2005 Oct;82(4):721–32.
99. van Dooren C. Proposing the Nutrient Density Unit as the Functional Unit in LCAs of Foods. In Dublin, Ireland; 2016 [cited 2019 Apr 5]. Available from: [https://www.researchgate.net/publication/313164803\\_Proposing\\_the\\_Nutrient\\_Density\\_Unit\\_as\\_the\\_Functional\\_Unit\\_in\\_LCAs\\_of\\_Foods](https://www.researchgate.net/publication/313164803_Proposing_the_Nutrient_Density_Unit_as_the_Functional_Unit_in_LCAs_of_Foods)
100. AGECO. Environmental and Socioeconomic Life Cycle Assessment Of Canadian Milk. Dairy Farmers of Canada; 2018 p. 287.
101. Gooch M, Nikkel L. The Avoidable Crisis of Food Waste: Technical Report. :122.
102. Lipinski B, Hanson C, Waite R, Searchinger T, Lomax J, Kitinoja L. Reducing Food Loss and Waste: Creating a Sustainable Food Future, Installment Two [Internet]. Washington, D.C.: World Resources Institute; 2013 [cited 2019 Apr 5]. Available from: <https://www.wri.org/publication/reducing-food-loss-and-waste>
103. Food wastage footprint: impacts on natural resources: summary report. Rome: FAO; 2013. 61 p.
104. Council NZW. National Zero Waste Council - Food [Internet]. [cited 2019 Apr 5]. Available from: , <http://www.nzwc.ca:80/focus/food/Pages/default.aspx>

105. Gooch MV, Felfel A. Food Waste in Canada 27 Billion Revisited [Internet]. Value Chain Management International; 2014 [cited 2019 Apr 6] p. 41. Available from: <http://vcm-international.com/wp-content/uploads/2014/12/Food-Waste-in-Canada-27-Billion-Revisited-Dec-10-2014.pdf>
106. Dibb S, Salazar de Llaguno E. Principles for eating meat and dairy more sustainably: the “less and better” approach [Internet]. UK: Eating Better Alliance.; 2018 [cited 2019 Apr 5]. Available from: <https://www.readkong.com/page/principles-for-eating-meat-and-dairy-more-sustainably-the-6844514>
107. Ranganathan J, Vennard D, Waite R, Dumas P, Lipinski B, Searchinger T. Shifting Diets for a Sustainable Food Future. World Resources Institute; 2011 p. 90.
108. Bradbear C, Friel S. Food systems and environmental sustainability : a review of the Australian evidence. Canberra: Australian National University; 2011.
109. Sustainable seafood guides | WWF [Internet]. [cited 2019 Apr 5]. Available from: [http://www.wwf.panda.org/get\\_involved/live\\_green/out\\_shopping/seafood\\_guides/](http://www.wwf.panda.org/get_involved/live_green/out_shopping/seafood_guides/)
110. National Food Agency. De svenska kostråden: Hitta ditt sätt : Att äta grönnare, lagom mycket och röra på dig. Sweden; 2015.
111. The German Nutrition Society. 10 guidelines of the German Nutrition Society (DGE) for a wholesome diet [Internet]. 2014 [cited 2019 Apr 5]. Available from: <https://www.dge.de/index.php?id=322>
112. Qatar Ministry of Public Health. Qatar Dietary Guidelines [Internet]. Doha, Qatar: Qatar Ministry of Public Health; 2015 [cited 2019 Apr 5]. Available from: <http://www.fao.org/nutrition/education/food-dietary-guidelines/regions/qatar/en/>
113. Stuart Thompson, Robin Gower, Nicole Darmon, Florent Vieux, Donal Murphy-Bokern, Matthieu Maillot. A Balance of Health and Sustainable Food Choices for France, Spain and Sweden: LiveWell For Life Report. UK: Live Well for Life, WWF; n.d.
114. Seth C. Growing Change: Identifying Factors to Effectively Facilitate Shifts Towards Healthy, Sustainable, and Just Institutional Food Systems. [Wolfville, Nova Scotia. Canada]: Acadia University; 2019.
115. Bohunicky M, Desmarais AA, Entz M. Self-operated vs. corporate contract: A study of food procurement at two universities in Manitoba. Can Food Stud Rev Can Études Sur Aliment. 2019;6(1):43–74.
116. Rollins NC, Bhandari N, Hajeerhoy N, Horton S, Lutter CK, Martines JC, et al. Why invest, and what it will take to improve breastfeeding practices? Lancet Lond Engl. 2016 Jan 30;387(10017):491–504.
117. Sustainable Development Commission. Setting the Table: Advice to Government on priority elements of sustainable diets [Internet]. UK: Sustainable Development Commission; 2009 [cited 2014 Jul 15] p. 56. Available from: <http://www.sd-commission.org.uk/publications.php?id=1033>
118. Australian National Health and Medical Research Council. Australian Dietary Guidelines. Providing the scientific evidence for healthier Australian diets [Internet]. Canberra: Australian National Health and Medical Research Council; 2013 [cited 2019 Apr 5]. Available from: <https://www.nhmrc.gov.au/about-us/publications/australian-dietary-guidelines>
119. Agriculture and Agri-Food Canada. An overview of the Canadian agriculture and agri-food system 2015 [Internet]. 2015 [cited 2016 Apr 1]. Available from: <http://www.agr.gc.ca/eng/about-us/publications/economic-publications/alphabetical-listing/an-overview-of-the-canadian-agriculture-and-agri-food-system-2015/?id=1428439111783#a2>
120. Slater J, Yeudall F. Sustainable Livelihoods for Food and Nutrition Security in Canada: A Conceptual Framework for Public Health Research, Policy, and Practice. J Hunger Environ Nutr. 2015 Jan 2;10(1):1–21.



121. Porter ME, Kramer MR. Creating Shared Value. *Harvard Business Review* [Internet]. 2011 Jan 1 [cited 2019 Aug 28];(January–February 2011). Available from: <https://hbr.org/2011/01/the-big-idea-creating-shared-value>
122. US Business Roundtable. Our Commitment [Internet]. US Business Roundtable. [cited 2019 Aug 28]. Available from: <https://opportunity.businessroundtable.org/ourcommitment/>
123. Statistics Canada. 2016 Census of Agriculture [Internet]. Agriculture and AgriFood Canada; 2017 [cited 2019 Apr 5]. Available from: <https://www.statcan.gc.ca/eng/ca2016>
124. Bessant KC. Multiple Discourses on Crisis: Farm, Agricultural, and Rural Policy Implications. *Can J Agric Econ Can Agroeconomie*. 2007;55(4):443–57.
125. McLaughlin J, Hennebry J, Haines T. Paper versus Practice : Occupational Health and Safety Protections and Realities for Temporary Foreign Agricultural Workers in Ontario. *Perspect Interdiscip Sur Trav Santé* [Internet]. 2014 Jan 17 [cited 2019 Apr 5];(16–2). Available from: <http://journals.openedition.org/pistes/3844>
126. Immigration R and CC. Agri-Food Immigration Pilot [Internet]. gcnws. 2019 [cited 2019 Aug 28]. Available from: <https://www.canada.ca/en/immigration-refugees-citizenship/news/2019/07/agri-food-immigration-pilot.html>
127. Leblanc J, Burnett K. What happened to Indigenous Food Sovereignty in Northern Ontario? In: In Robidoux, M A, & Mason, C W (Eds) *A land not forgotten: Indigenous food security and land-based practices in northern Ontario* [Internet]. University of Manitoba Press; 2017 [cited 2019 Apr 5]. p. 16–33. Available from: <https://uofmpress.ca/books/detail/a-land-not-forgotten>
128. Truth and Reconciliation Commission of Canada. What We Have Learned: Principles of Truth and Reconciliation. [Internet]. 2015 [cited 2018 Feb 21]. Available from: [http://www.trc.ca/websites/trcinstitution/File/2015/Findings/Principles\\_2015\\_05\\_31\\_web\\_o.pdf](http://www.trc.ca/websites/trcinstitution/File/2015/Findings/Principles_2015_05_31_web_o.pdf)
129. Olstad DL, Campbell NRC, Raine KD. Diet quality in Canada: policy solutions for equity. *CMAJ Can Med Assoc J J Assoc Medicale Can*. 2019 Jan 28;191(4):E100–2.
130. Loopstra R, Tarasuk V. The Relationship between Food Banks and Household Food Insecurity among Low-Income Toronto Families. *Can Public Policy* [Internet]. 2013 Jan 7 [cited 2019 Apr 5]; Available from: <https://www.utpjournals.press/doi/abs/10.3138/CPP.38.4.497>
131. Rideout K, Riches G, Ostry A, Buckingham D, MacRae R. Bringing home the right to food in Canada: challenges and possibilities for achieving food security. *Public Health Nutr*. 2007;10(6):566–73.
132. DeSchutter O. Report of the Special Rapporteur on the right to food, Mission to Canada. Rome, Italy: United Nations; 2013.
133. Government of Canada SC. Canadian Community Health Survey (CCHS) - 2014 [Internet]. 2015 [cited 2019 Apr 5]. Available from: [http://www23.statcan.gc.ca/imdb/p3Instr.pl?Function=assembleInstr&Item\\_Id=214314](http://www23.statcan.gc.ca/imdb/p3Instr.pl?Function=assembleInstr&Item_Id=214314)
134. Tarasuk V, Mitchell A, Dachner N. Household Food Insecurity in Canada, 2014 [Internet]. Toronto, Ont.: Research to identify policy options to reduce food insecurity (PROOF); 2016 [cited 2019 Apr 5]. Available from: <https://proof.utoronto.ca/resources/proof-annual-reports/annual-report-2014/>
135. Tarasuk V, Dachner N, Loopstra R. Food banks, welfare, and food insecurity in Canada. *Br Food J*. 2014;116(9):1405–17.
136. Milano. Milan Urban Food Policy Pact homepage [Internet]. Milan Urban Food Policy Pact. [cited 2019 Apr 5]. Available from: <http://www.milanurbanfoodpolicypact.org/>
137. United Nations Standing Committee on Nutrition. The Decade of Action on Nutrition 2016-2025 [Internet]. [cited 2019 Apr 5]. Available from: <https://www.unscn.org/en/topics/un-decade-of-action-on-nutrition>

138. Lang T. Food industrialisation and food power: implications for food governance. *Dev Policy Rev.* 2004 Jan;21(5–6):555–568.
139. Schiff R. The Role of Food Policy Councils in Developing Sustainable Food Systems. *J Hunger Environ Nutr.* 2008 Aug 25;3(2–3):206–28.
140. MacRae R. A Joined-Up Food Policy for Canada. *J Hunger Environ Nutr.* 2011 Oct 1;6(4):424–57.
141. Canada S. The Canadian Food Policy Advisory Council [Internet]. aem. 2019 [cited 2019 Aug 28]. Available from: <https://www.canada.ca/en/campaign/food-policy/thecanadianfoodpolicyadvisorycouncil.html>
142. WHO. The Ottawa Charter for Health Promotion. In: WHO [Internet]. Ottawa, ON; 1986 [cited 2019 Apr 5]. Available from: <http://www.who.int/healthpromotion/conferences/previous/ottawa/en/>
143. Public Health Agency of Canada. Federal Action Plan on Antimicrobial resistance and use in Canada: Building on the Federal Framework for Action. Ottawa, Ontario: Public Health Agency of Canada; 2015. Report No.: 140538.
144. Orkin AM, Lay M, McLaughlin J, Schwandt M, Cole D. Medical repatriation of migrant farm workers in Ontario: a descriptive analysis. *CMAJ Open.* 2014 Jul 22;2(3):E192–8.
145. Salami B, Meharali S, Salami A. The health of temporary foreign workers in Canada: A scoping review. *Can J Public Health.* 2015 Nov 1;106(8):e546–54.
146. Kochhar HS. Strengthening food safety: XL Foods 2012 food safety investigation and recall. In Toronto, Ont.; 2013.
147. Legislative Services Branch. Safe Food for Canadians Act [Internet]. S.C. 2012, c. 24, S.C. 2012, c. 24 Jan 15, 2019. Available from: <https://laws-lois.justice.gc.ca/eng/acts/S-1.1/>
148. Kleinert S, Horton R. Rethinking and reframing obesity. *Lancet Lond Engl.* 2015 Jun 13;385(9985):2326–8.
149. Dietitians of Canada. Advertising of Food and Beverages to Children: Position of Dietitians of Canada. *Can J Diet Pract Res.* 2010 Nov 19;71(4):208–208.
150. GBD 2015 Risk Factors Collaborators. Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990-2015: a systematic analysis for the Global Burden of Disease Study. *Lancet Lond Engl.* 2016 Oct 8;388(10053):1659–724.
151. Payne CL, Scarborough P, Cobiac L. Do low-carbon-emission diets lead to higher nutritional quality and positive health outcomes? A systematic review of the literature. *Public Health Nutr.* 2016 Oct;19(14):2654–61.
152. Stehfest E, Bouwman L, Vuuren DP van, Elzen MGJ den, Eickhout B, Kabat P. Climate benefits of changing diet. *Clim Change.* 2009 Feb 4;95(1–2):83–102.
153. Macdiarmid JJ. Is a healthy diet an environmentally sustainable diet? *Proc Nutr Soc.* 2013 Feb;72(1):13–20.
154. Hemler EC, Hu FB. Plant-Based Diets for Cardiovascular Disease Prevention: All Plant Foods Are Not Created Equal. *Curr Atheroscler Rep.* 2019 Mar 20;21(5):18.