

Environmental impacts of recommended diets for cardiometabolic health

A Canadian perspective

Sarah Jarvis, MSc

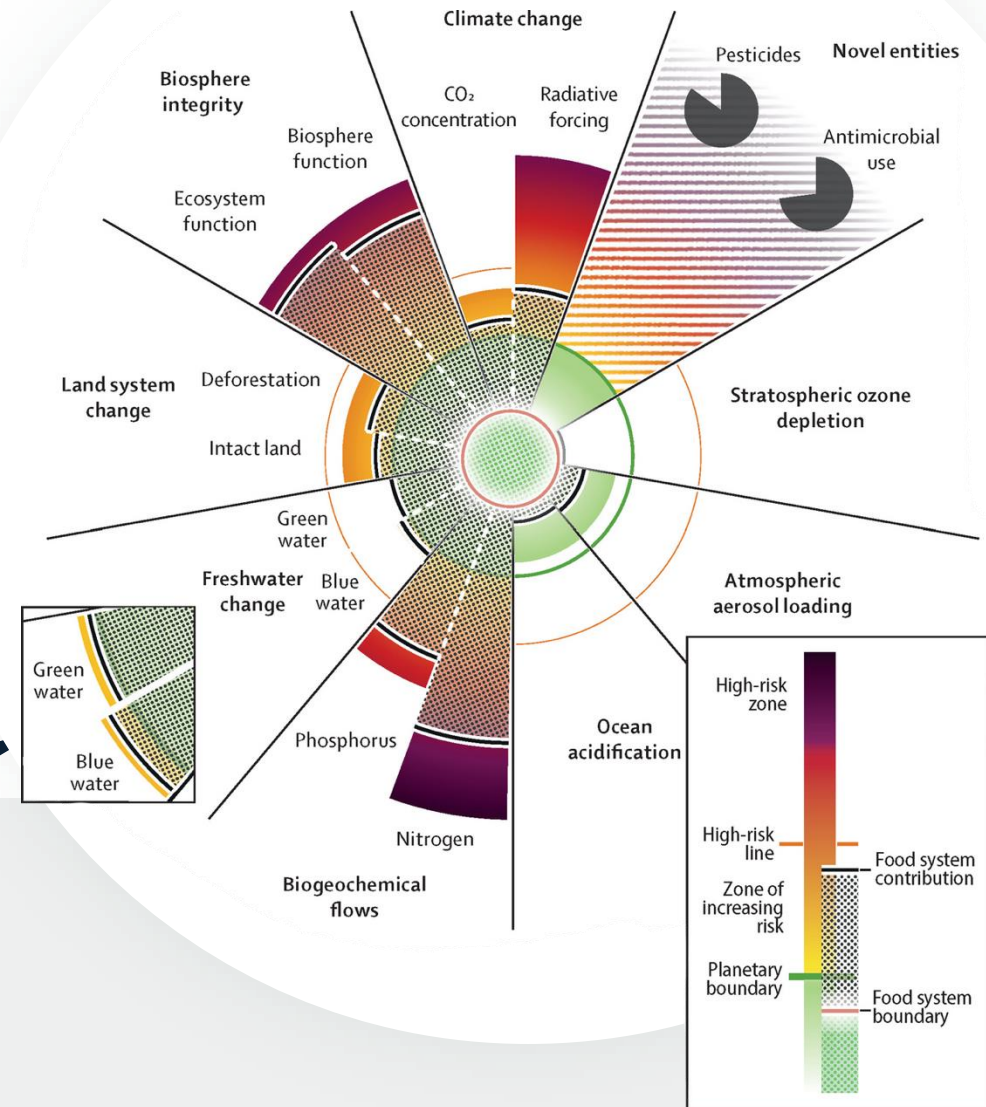
PhD Candidate, Department of Nutritional Sciences
Temerty Faculty of Medicine, University of Toronto

Supervisor: Dr. Vasanti Malik
Co-supervisor: Dr. David Jenkins

INTRODUCTION

Food systems are largely responsible for transgressions

5 of 9
Food systems primary cause for breach





70%
Water use

1/3
GHG emissions



INTRODUCTION

Food system drives climate change

33% Waste

66% Biodiversity loss

33% Degraded soils

40% Land use

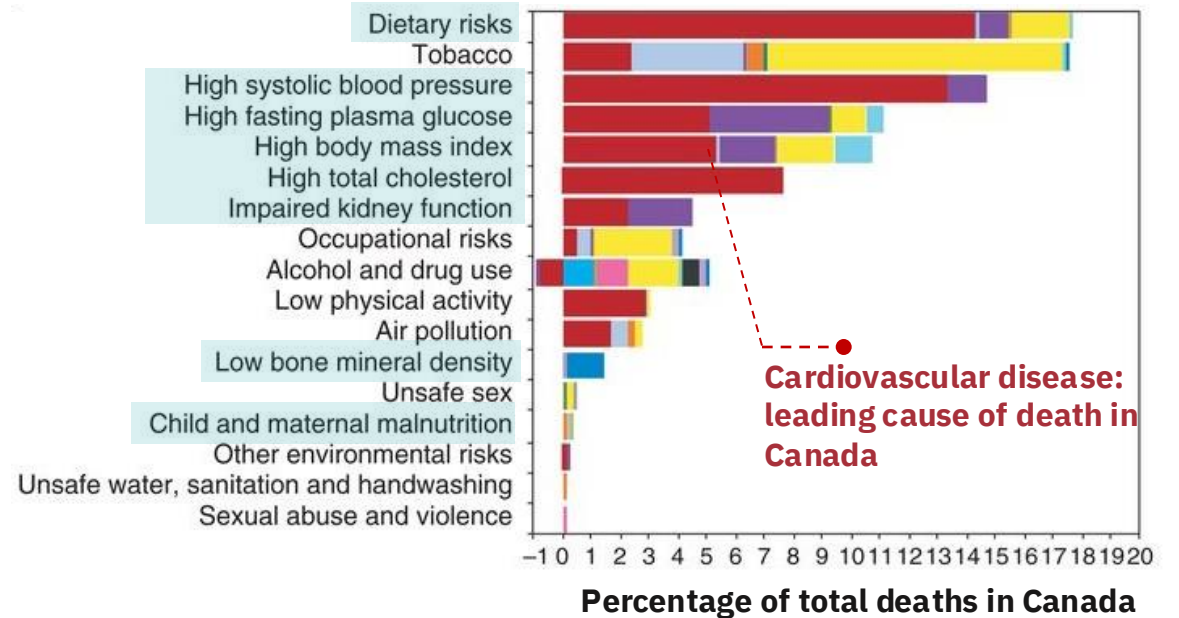
High burden of diet-related diseases in Canada

65%

Adults live with overweight/obesity

1 in 3

Diabetes /pre-diabetes



Dietary risk factors responsible for more deaths than any other risk globally and in Canada

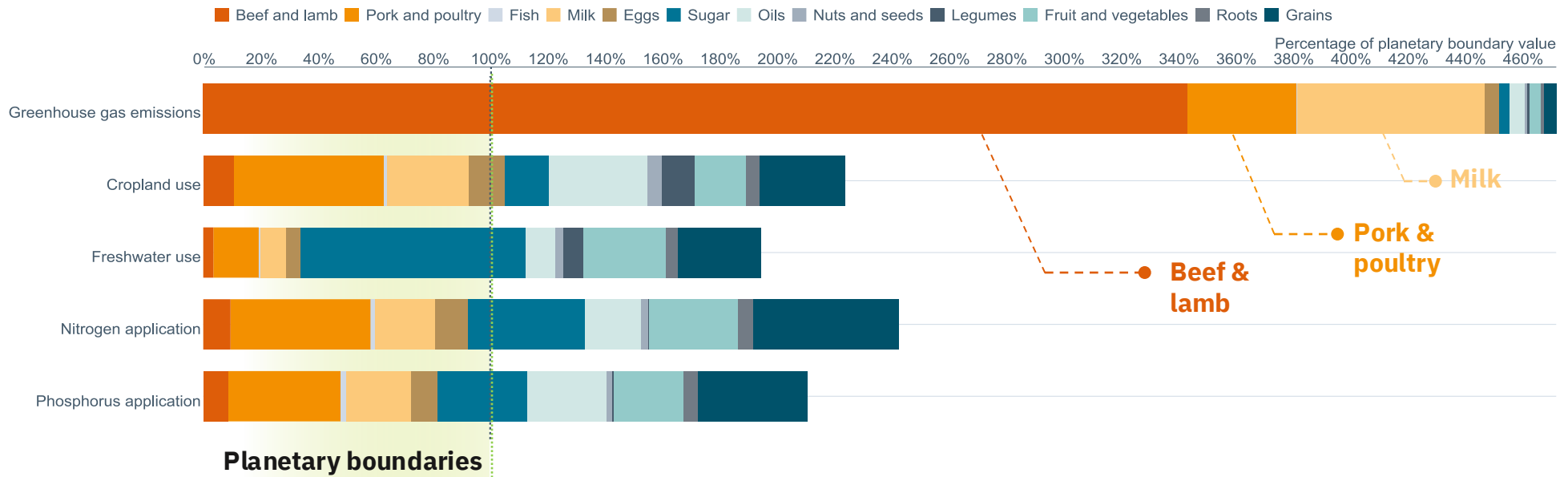
INTRODUCTION

Canadian diets exceed planetary boundaries



Urgent dietary shifts are required

Less resource-intensive diet shifts are key for system transformation



Interconnected Crises

• *Hunger & malnutrition by 2050...*

> 50% ↓ Would be expected to decline

20% ↑ Due to climate change



Diets for cardiometabolic risk reduction

Dietary pattern-based approach over nutrient-centric, taking into account food matrix and real-world setting



DASH Eating Plan	
The Benefits: Lowers blood pressure & LDL "bad" cholesterol.	
Eat This	Limit This
Vegetables	Fatty meats
Fruits	Full-fat dairy
Whole grains	Fat-free or low-fat dairy
Fish	Sugar-sweetened beverages
Poultry	
Beans	



Evidence-based major clinical practice guidelines for & CVD

Well established as healthy diets for promoting cardiometabolic health... but what are the environmental impacts?

Are clinical and public health recommendations aligned with environmental sustainability goals?

Can we develop/improve co-benefit dietary guidance?

All largely plant-based, improve glycemic control, blood pressure, lipid profiles, weight management

Therapeutic diet that emphasizes healthful plant foods, poultry, fish, and low-fat dairy; developed by NIH for lowering blood pressure

DASH Diet

Mediterranean diet
Traditional diet that emphasizes healthful plant foods, olive oil, fatty fish, and moderate dairy, eggs and poultry

Objective

Quantify and compare the environmental impacts of diets recommended for cardiometabolic health in the Canadian context

METHODS

Evaluating dietary patterns

Estimate environmental impacts based on sum of impacts of foods that constitute the pattern



Diets in Canadian context

3-day consumption (2000kcal/day) reference diets developed for the Canadian context by RD to minimize composition biases



Comparison of impacts

Environmental impacts of foods (per 1kg) adjusted by amounts of foods in diets

Canada's Food Guide
(HEFI-2019)

Mediterranean diet
(aMED)

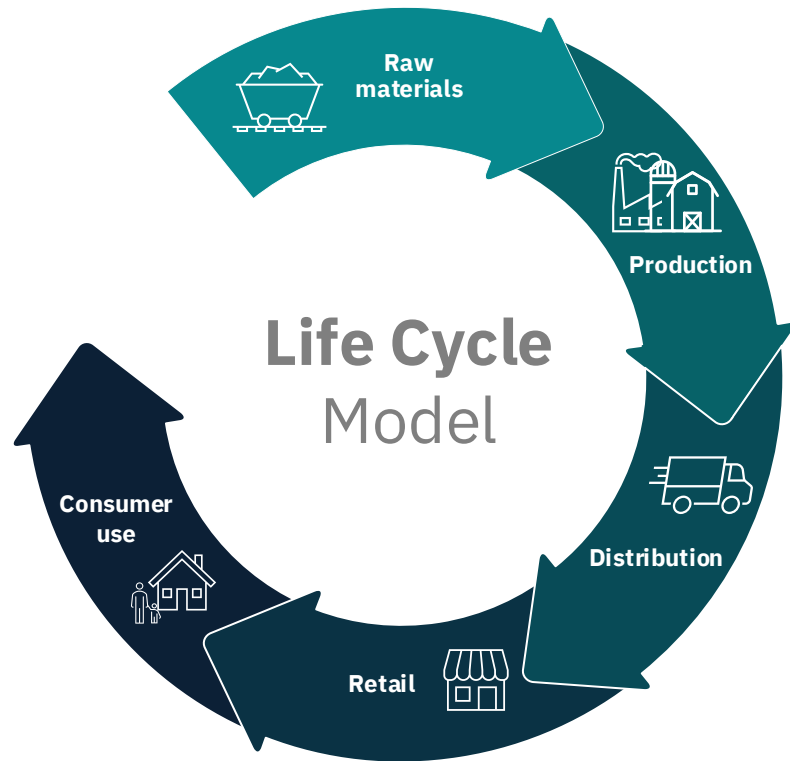
DASH diet

Portfolio diet

Typical Canadian diet
(for comparison)

METHODS

Life Cycle Assessment (LCA)



Life Cycle Assessment (LCA)
Framework ISO 14040 & 04044

System boundaries

Fertilisers, pesticides, seeds, machinery, irrigation, drying, animal feed, infrastructure, water use



Systems & materials

All inputs, outputs, activities and processes within bounds of primary food producers to consumer use



Geography

Average practices of foods consumed in Canada. Imported products production x volume annual imports



Time

Representative of current practices wherever available (i.e., average of 5 most recent years)



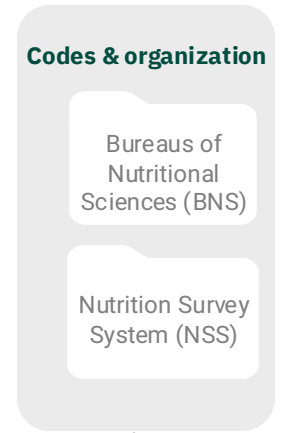
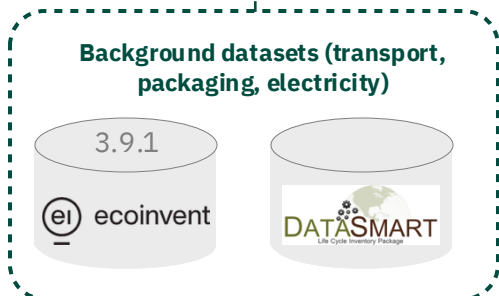
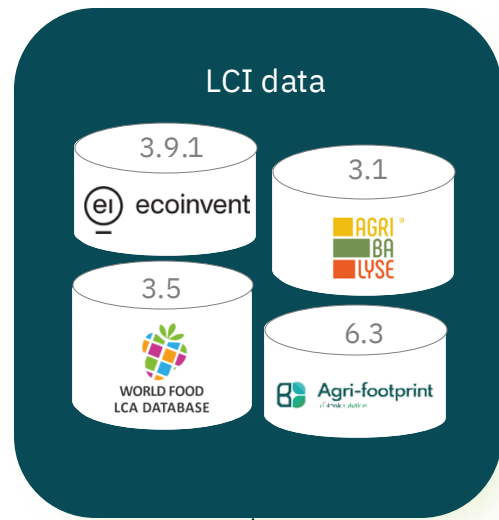
Processes

Modelling life cycle activities

T Transportation across stages modelled by:

- Mass (+ changes)**
- Distance**
- Modality**

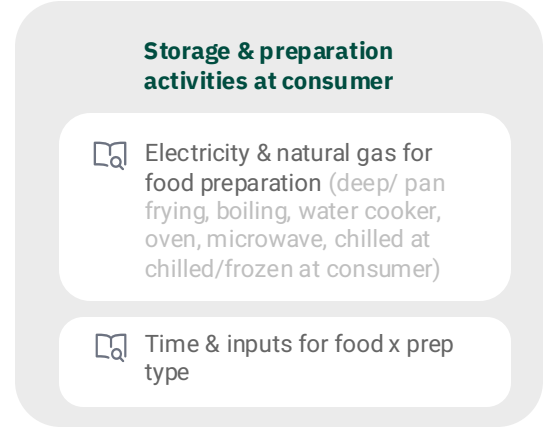
Data Collection



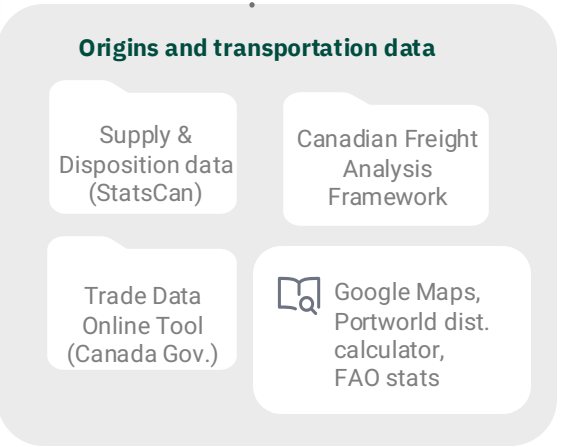
Nomenclature



Average composition of mixed foods



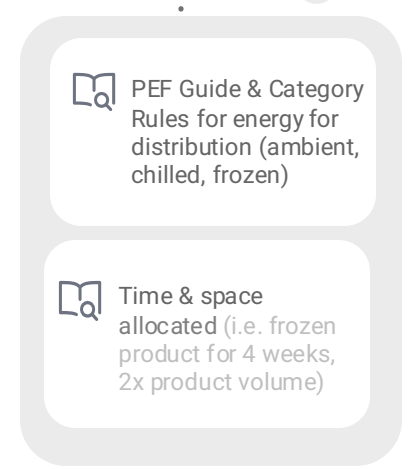
Use



Raw material origins

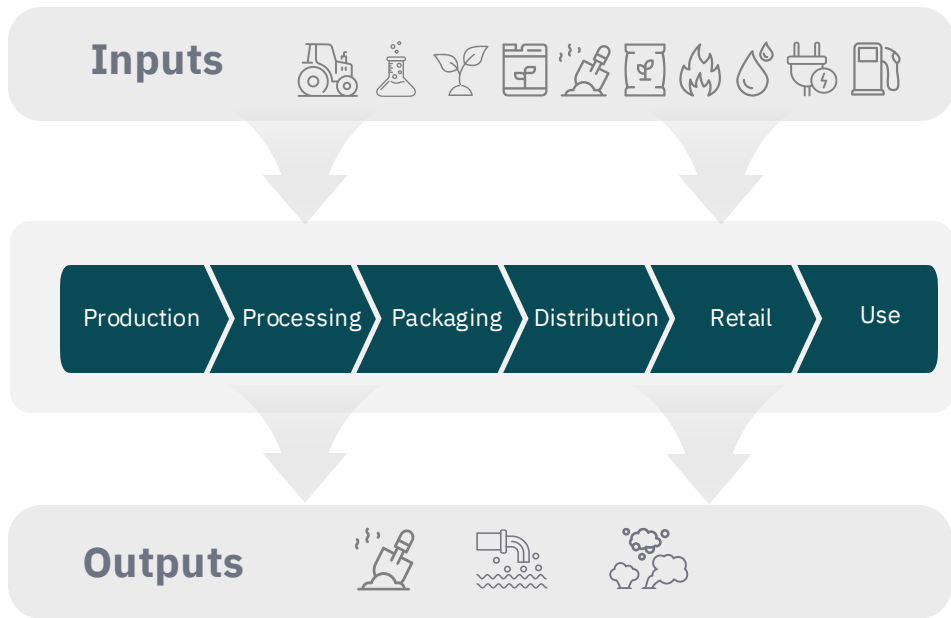


Processing & Packaging

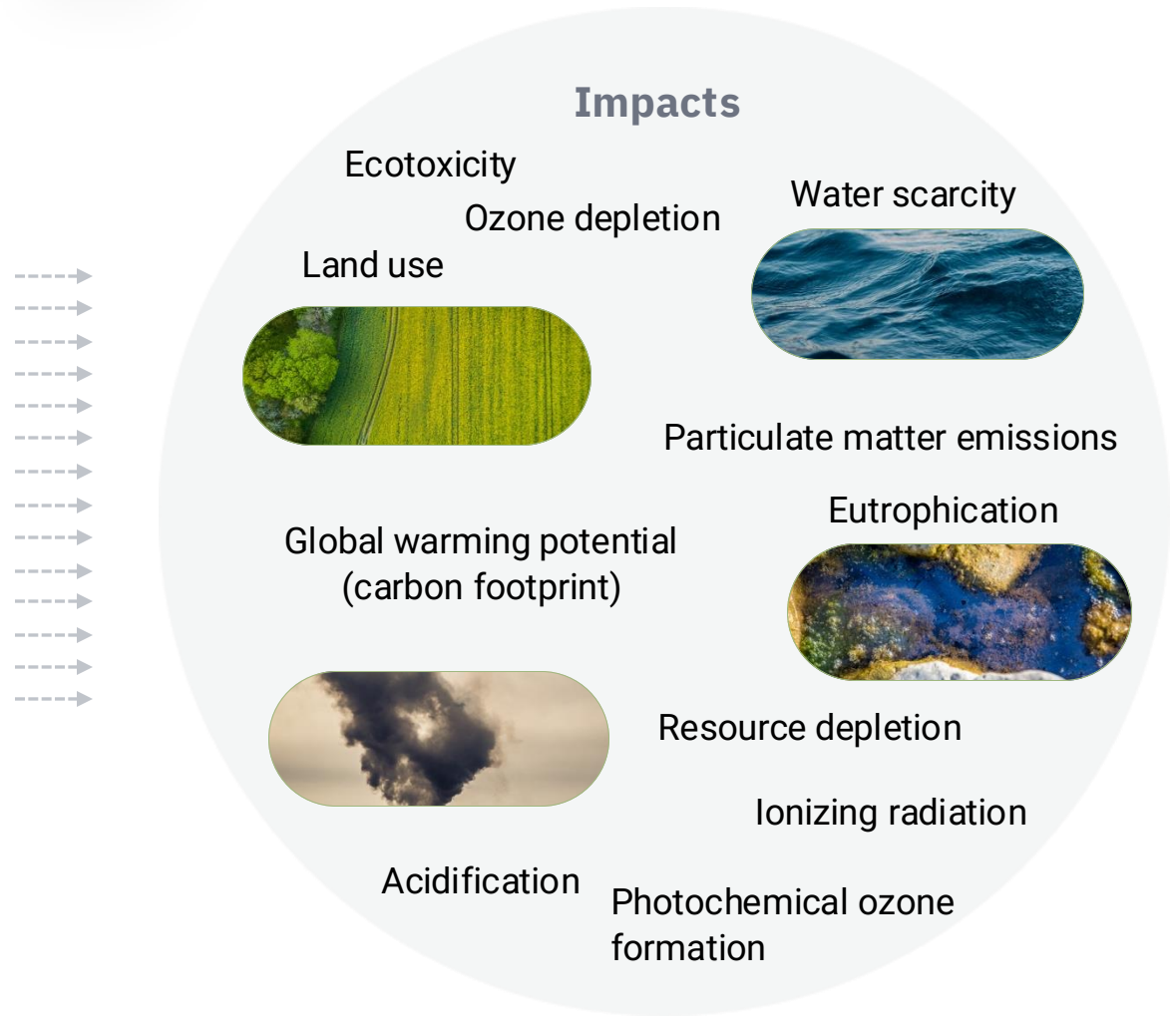


Distribution, retail

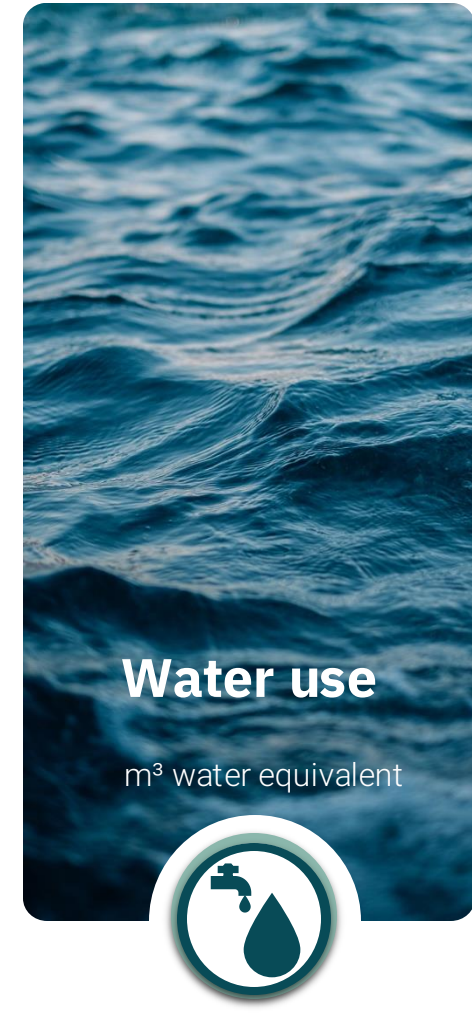
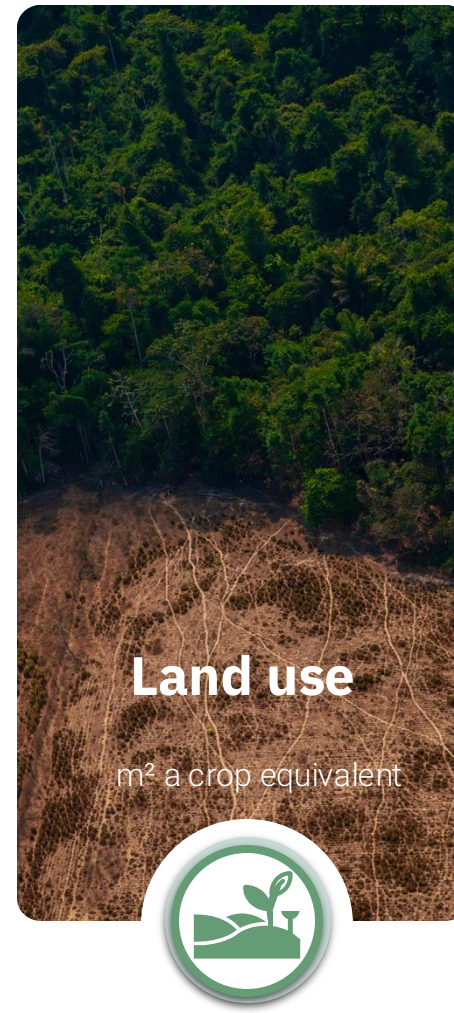
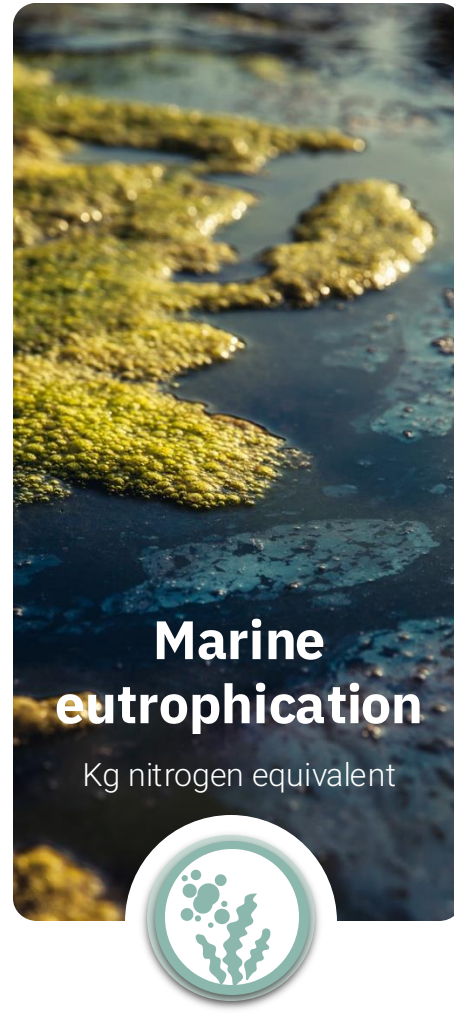




➤ Life Cycle Inventory



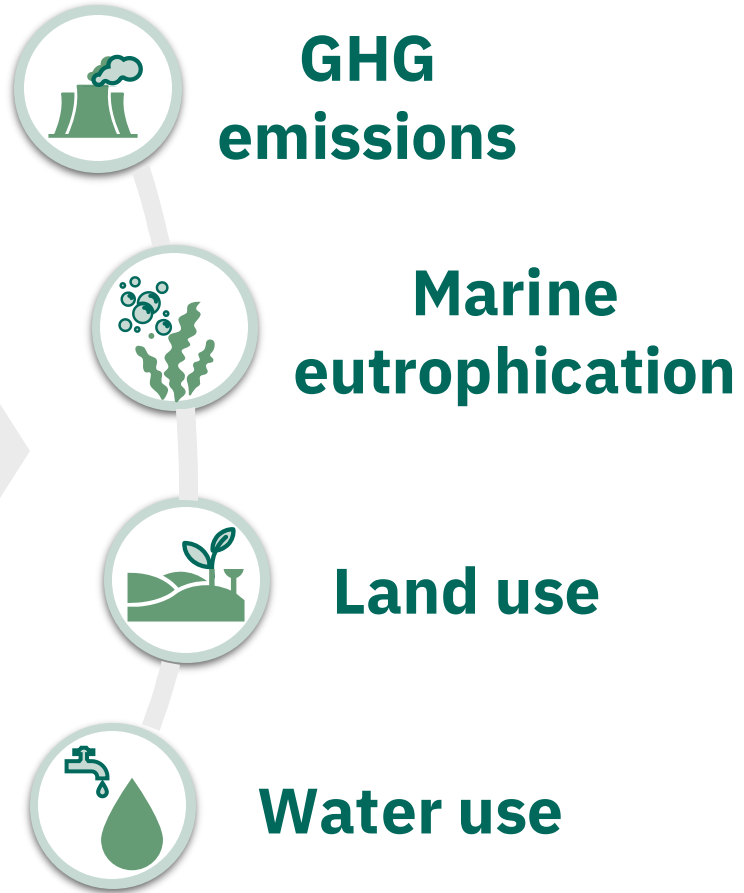
Life Cycle Impact Assessment (LCIA)



Life Cycle Inventory (LCI)

Elementary flows
Energy Consumption
Raw materials
Emissions to air
Emissions to water
Emissions to land
Solid waste
Land use and transf.
Water inputs

Impact category



Environmental impact score



Classification

Characterization

Normalization

Diet compositions (Mass)

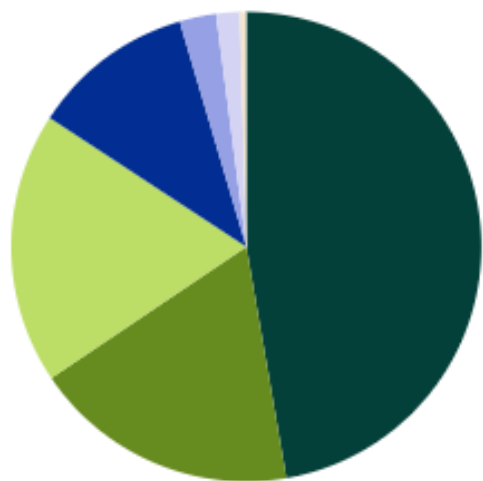
Composition by food category (by mass)

→ 3-day menus represent full adherence to diets

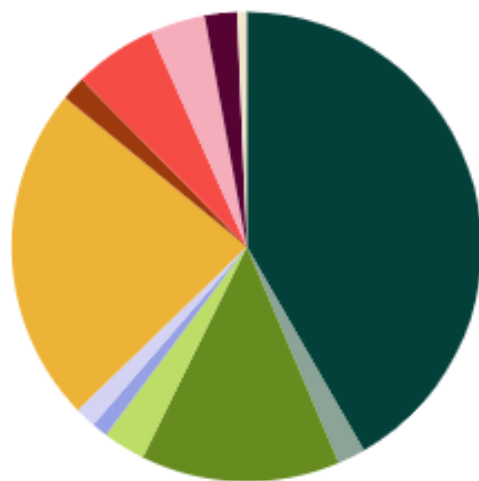
Food Groups:

- Fruits and vegetables
- Potatoes
- Grains
- Legumes
- Dairy alternatives
- Nuts and seeds
- Oils
- Dairy products
- Egg
- Meat
- Fish and seafood
- Beverages
- Other

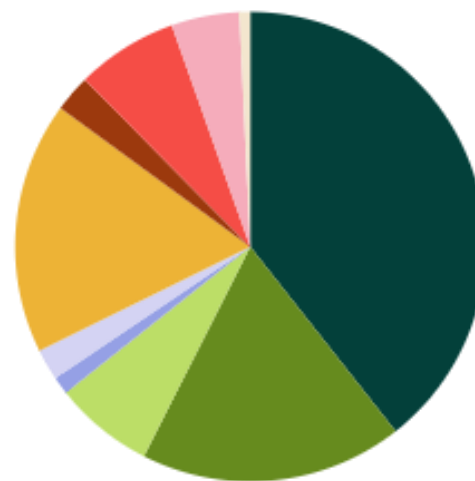
Portfolio diet



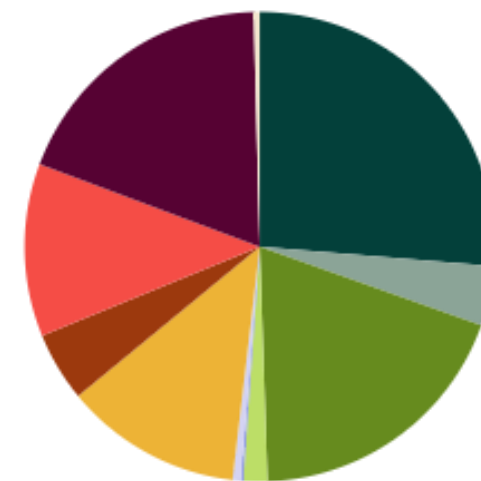
DASH diet



Mediterranean diet



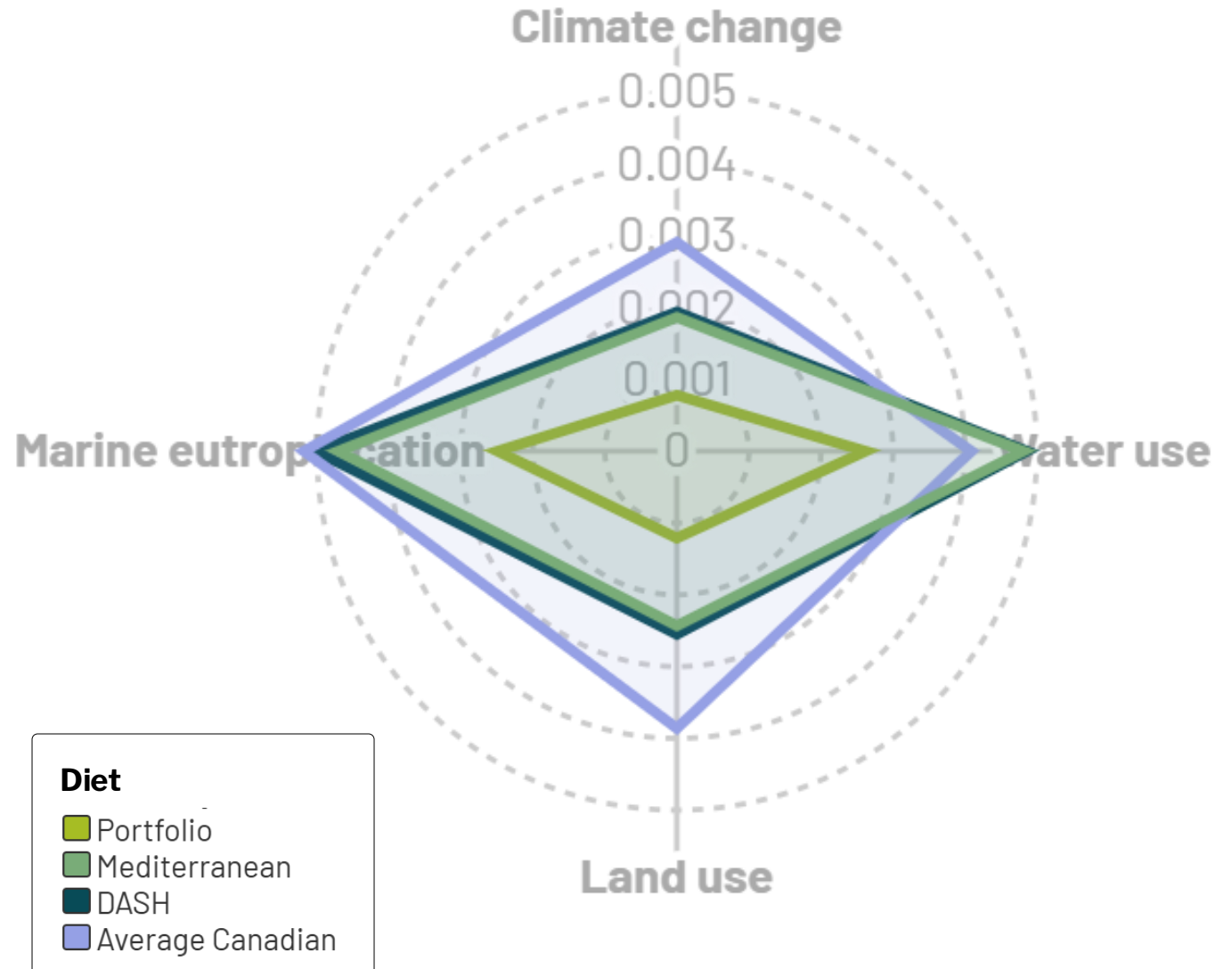
Typical Canadian



RESULTS

Total diet comparison

*Impacts of total diet
(normalized values)*

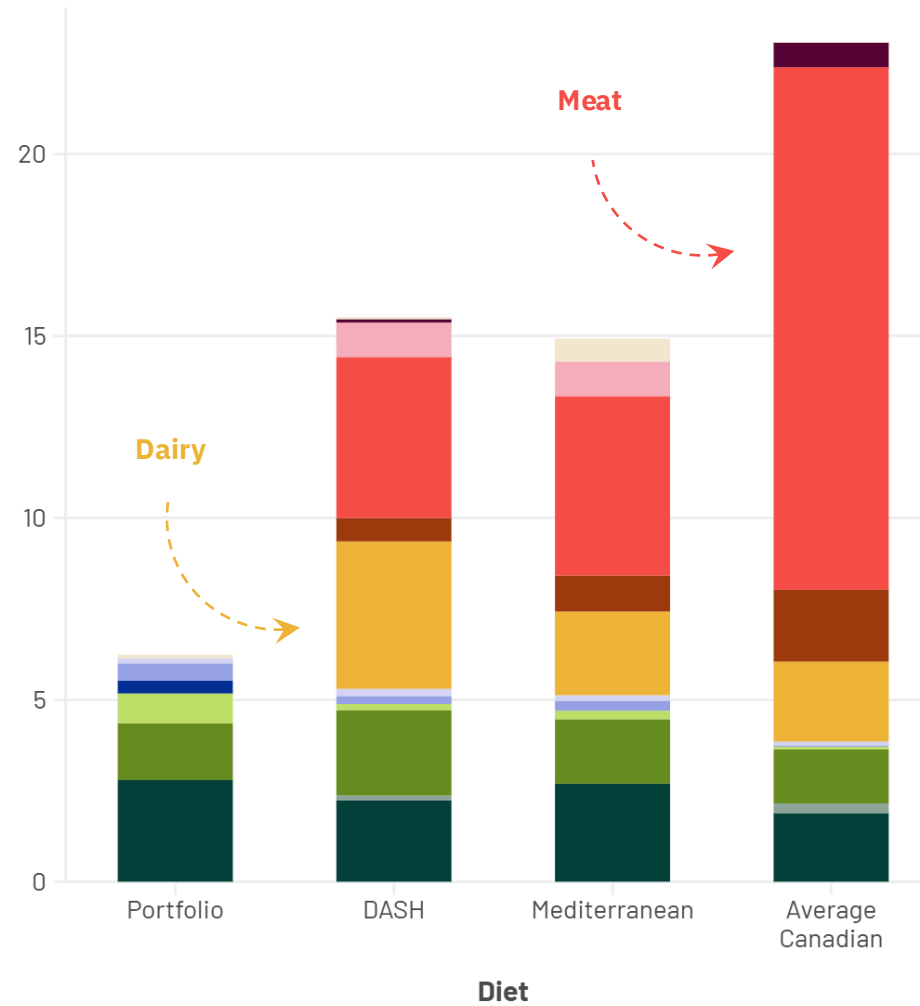


RESULTS

Climate change

Contribution of impacts from each food group for total diets

Kg CO₂ -eq

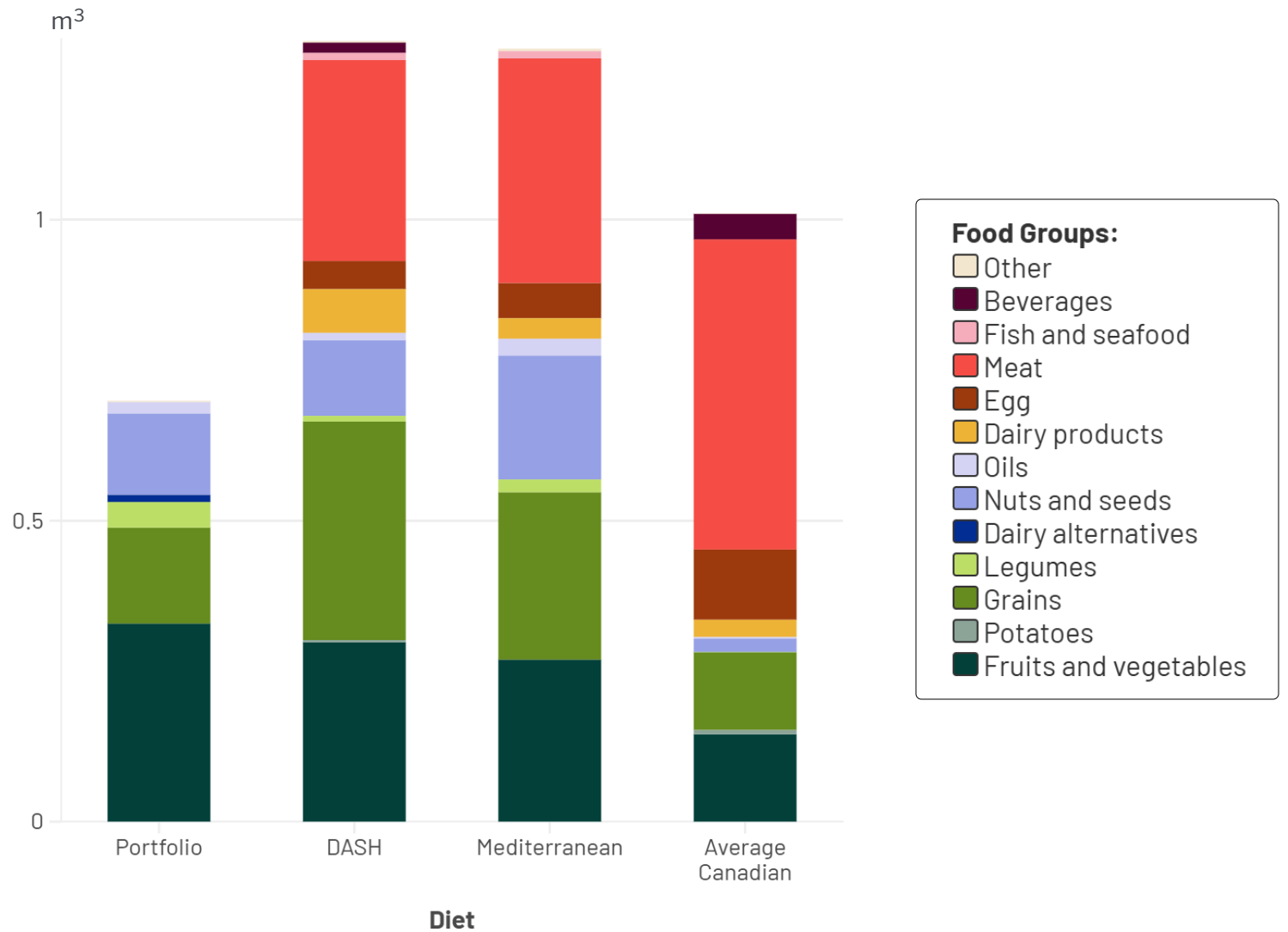


- Food Groups:**
- Other
 - Beverages
 - Fish and seafood
 - Meat
 - Egg
 - Dairy products
 - Oils
 - Nuts and seeds
 - Dairy alternatives
 - Legumes
 - Grains
 - Potatoes
 - Fruits and vegetables

RESULTS

Water use

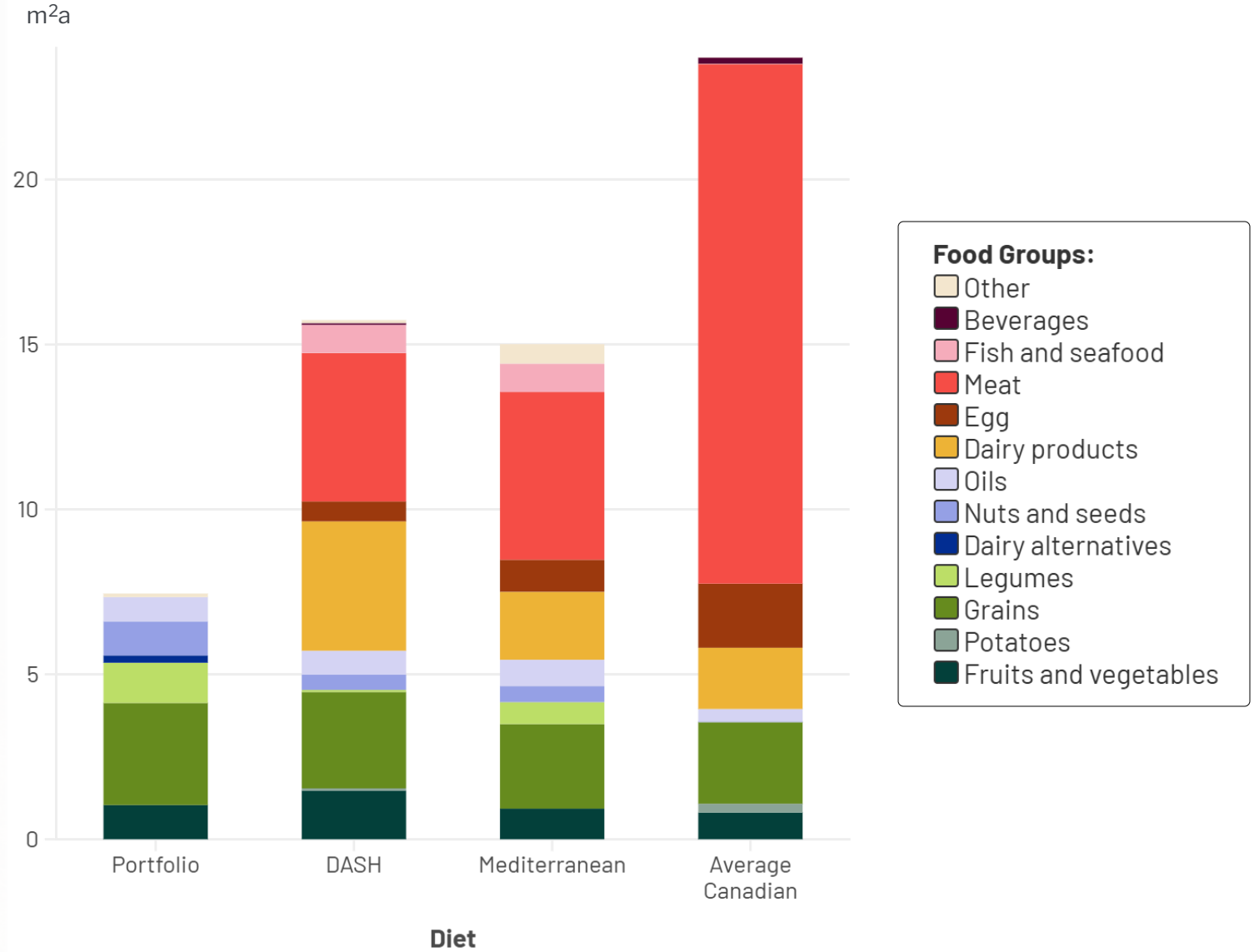
Contribution of impacts from each food group for total diets



RESULTS

Land use

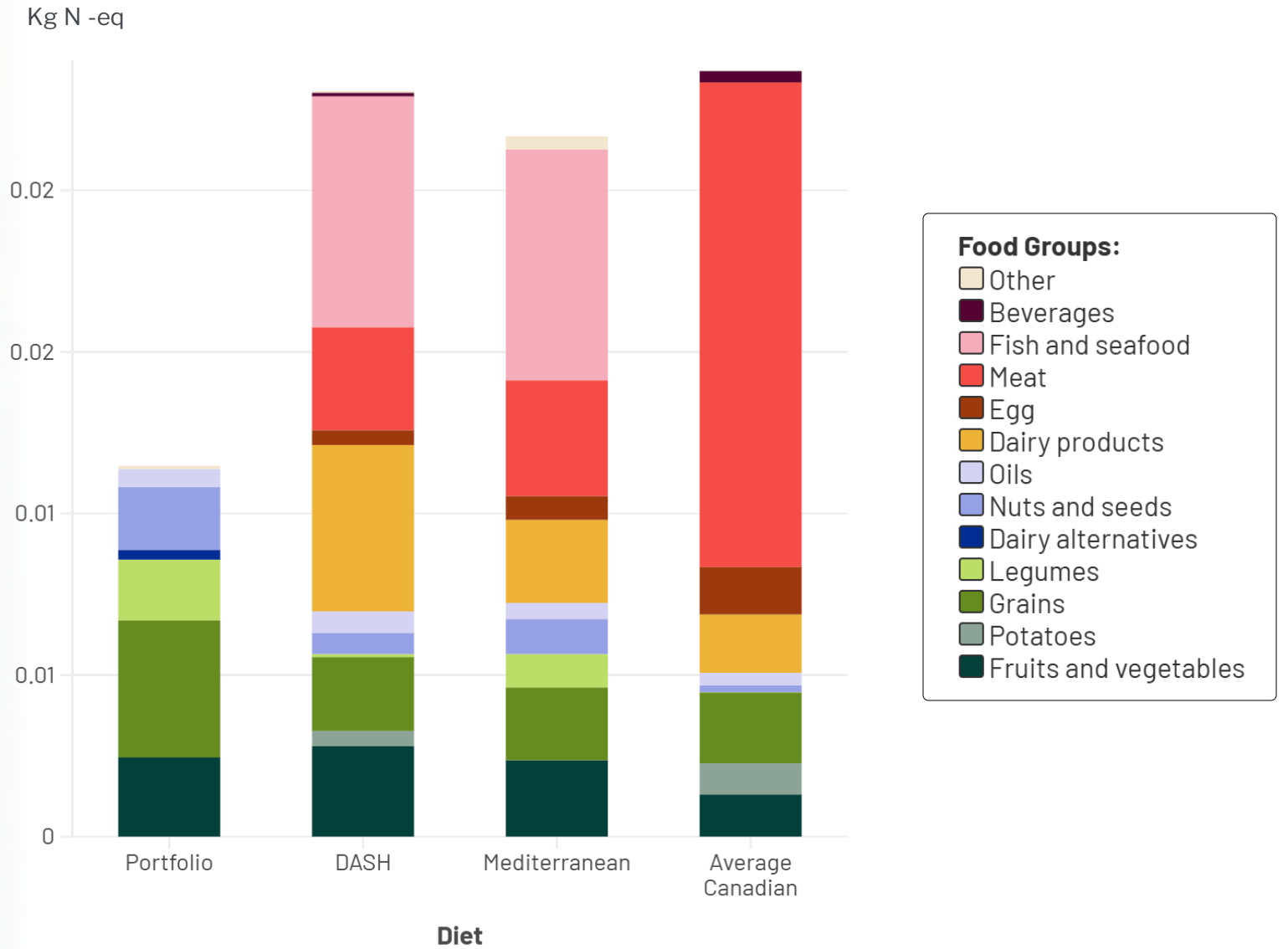
Contribution of impacts from each food group for total diets



RESULTS

Marine eutrophication

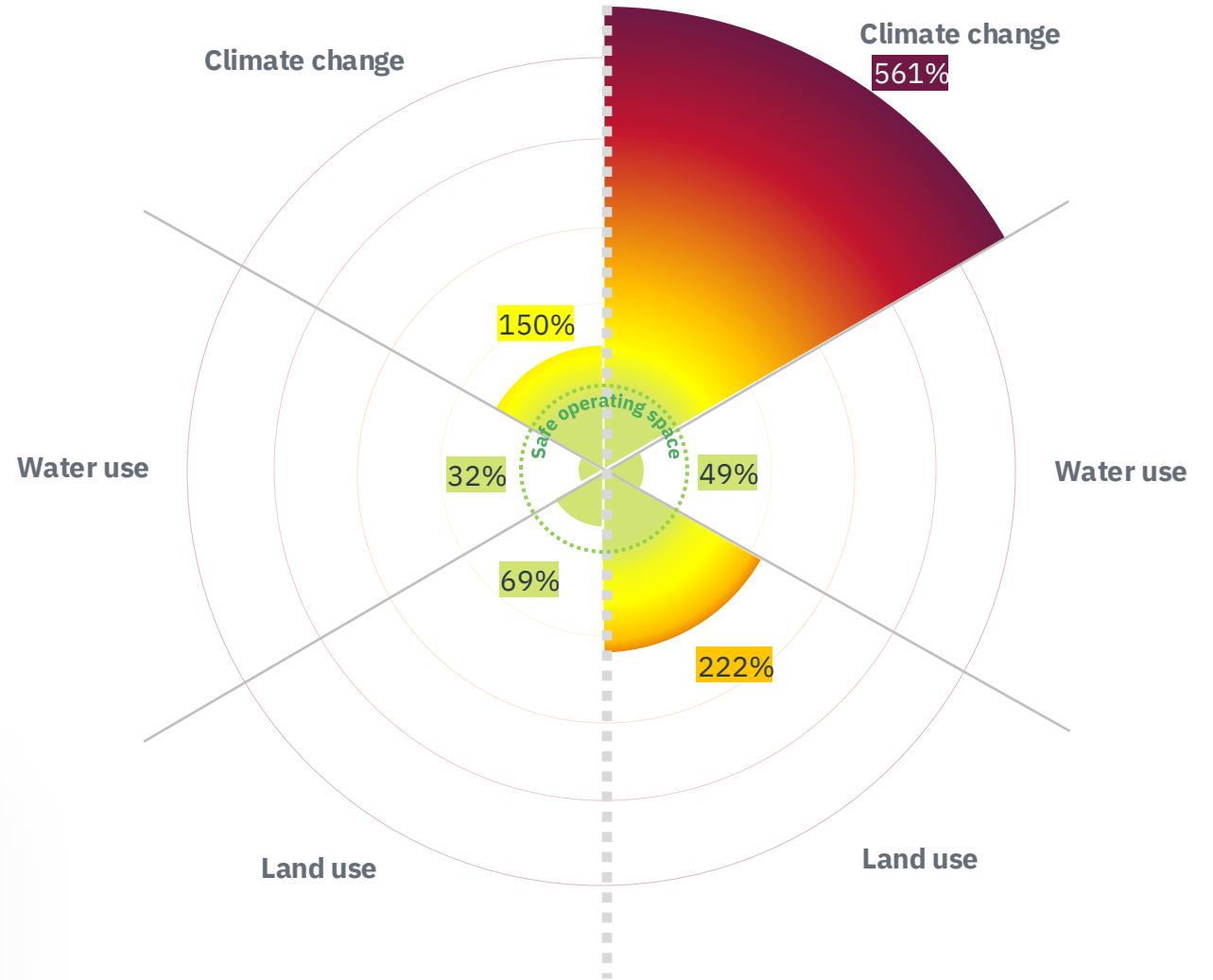
Contribution of impacts from each food group for total diets



Portfolio diet

Total diet comparison: % Share of planetary boundary for food systems

Portfolio diet ◀ vs ▶ Typical Canadian diet



Planetary boundary

Increasing risk



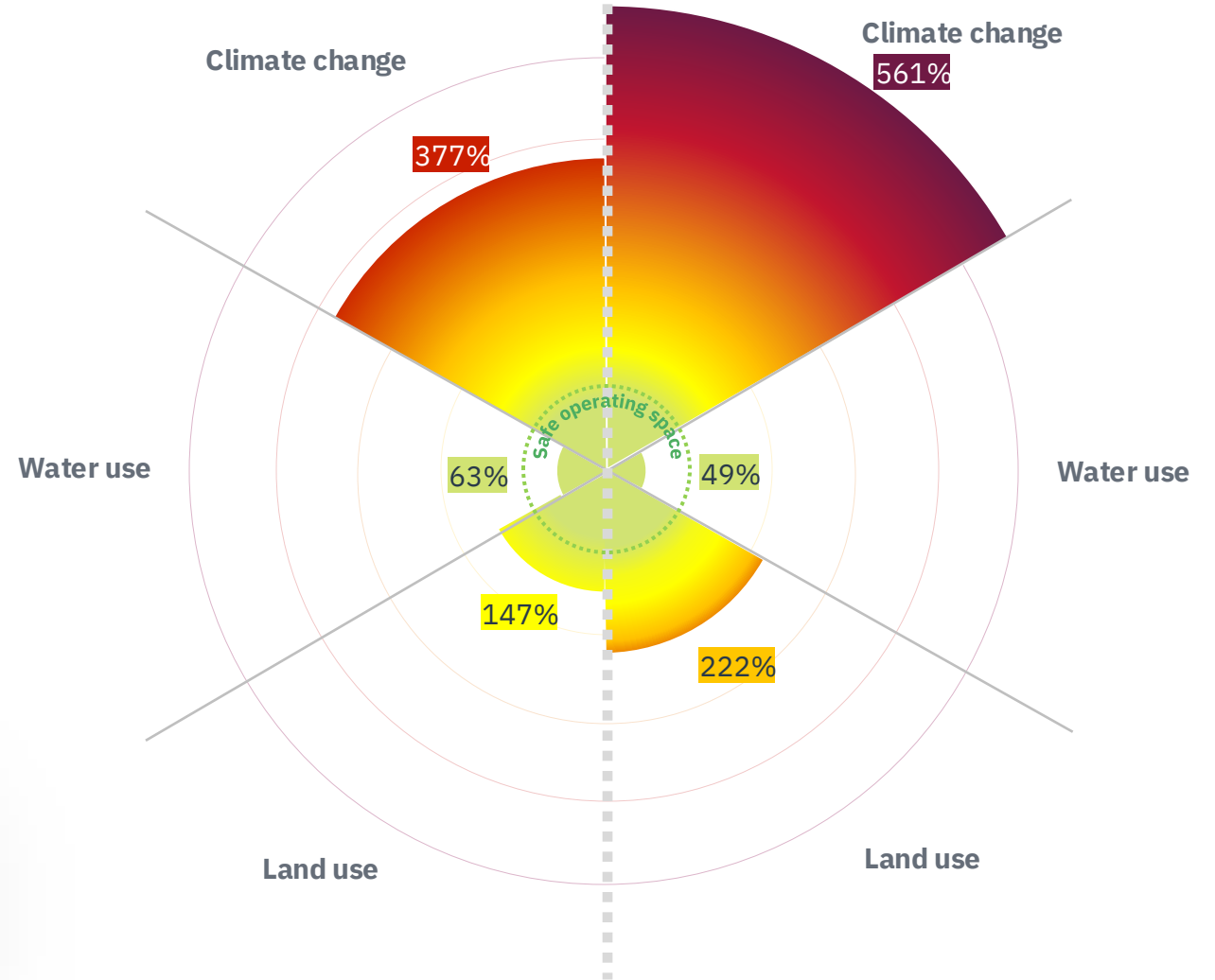
Safe operating space

Boundary transgressed

DASH diet

Total diet comparison: % Share of planetary boundary for food systems

DASH diet ◀ vs ▶ Typical Canadian diet



Planetary boundary

Increasing risk



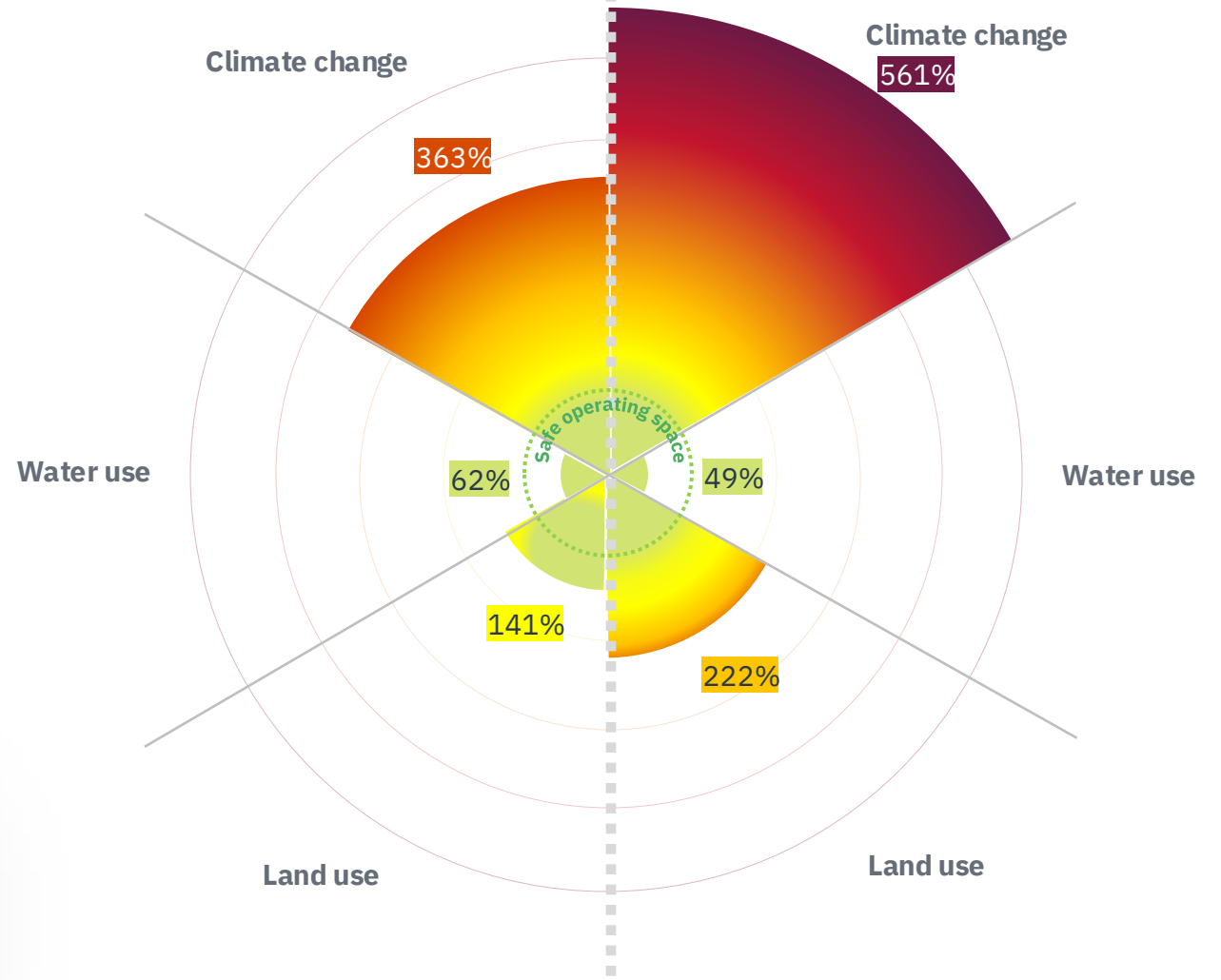
Safe operating space

Boundary transgressed

Mediterranean diet

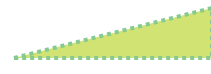
Total diet comparison: % Share of planetary boundary for food systems

Mediterranean diet ◀ vs ▶ Typical Canadian diet



Planetary boundary

Increasing risk



Safe operating space

Boundary transgressed

Portfolio diet: greatest reduction potential

Comparison with typical Canadian diet

	DASH	Mediterranean	Portfolio
Climate change	33%	35%	73%
Water use	-26%	-26%	35%
Land use	34%	37%	69%
Marine eutrophication	3%	9%	53%

1 year diet



GHG emissions

≈ 1 typical car for 6 months, or 1 round car trip Toronto to Vancouver

1 year diet



Water use

≈ 88 thousand water bottles or 584 showers saved

In conclusion...



Findings align with a shift toward plant-forward, low-meat diets in clinical nutrition



Dietary recommendations for cardiometabolic health, (especially the Portfolio diet), offer substantial environmental co-benefits



Supports incorporating sustainability metrics into dietary counseling & advancing policy goals

Acknowledgments

Supervisor

Dr. Vasanti Malik

Co-Supervisor: Dr. David Jenkins

Lab members

Michelle Nguyen Heather Gadalla

Selina Quibrantar Vivian Yin

Annette Blais Yumnah Jafri

Matthew Tatur Alexis Konopny

Suzanne Ross

Collaborators

Dr. Michaelis Hadjidakou (LCA)

Gabrielle Viscardi (menu development)

Committee Members

Dr. John Sievenpiper

Dr. Mary L'Abbe

Dr. Michael Classens

Dr. Laura Chiavaroli

Funding & support

