Characterization and Management of Food Loss and Waste in North America
David Donaldson
Commission for Environmental Cooperation

Global Methane Forum
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About the CEC

• The CEC was created in 1994 by Canada, Mexico and the United States through the North American Agreement on Environmental Cooperation (NAAEC), a side agreement to NAFTA.

• The CEC facilitates cooperation and public participation to foster conservation, protection and enhancement of the North American environment for the benefit of present and future generations.

• The CEC Council is comprised of the ministers of Environment and Climate Change Canada, US Environmental Protection Agency and Secretaría de Medio Ambiente y Recursos Naturales (Semarnat).
Presentation Overview

- Foundational Report and White Paper
- Food Loss and Waste in North America
- Environmental and Socio Economic Impacts
- Opportunities
- Commitments and Initiatives
- What’s Next
Our Report

Characterization and Management of 
Food Loss and Waste 
in North America

White Paper

Foundational Report
Food Recovery Hierarchy

Source: Adapted from US EPA 2016a; MacRae et al. 2016; Papargyropoulou et al. 2014; Kelly 2014; WRAP 2013.
Overview of Stakeholders

**ICI**
- **Institutional**
  - Schools
  - Hospitals
  - Correctional Facilities
  - Civic Facilities
- **Commercial**
  - Multinational Companies
  - Franchises
  - Independent Businesses
  - Cooperatives
  - Social Enterprises
- **Industrial**
  - Packaging and Slaughter Facilities
  - Processing Plants

**GOVERNMENT**
- Local/Regional
- Province/State
- Federal

**NGO**
- Food Rescue
- Advocacy
- Foundations
- Academia
Data Collection and Research Approach

- A total of 167 interviews conducted
- Expert panel meetings
- Case studies in each country across the food supply chain
- Review of reports, white papers, academic papers, news articles, media recordings and government databases
- Literature review including scan of on-the-ground programs and projects implemented by the ICI sector, governments and NGOs in North America and beyond
- North American Workshop, Toronto, ON
- International Food Waste Workshop hosted jointly with the World Bank, Washington DC
- CEC Joint Public Advisory Committee Public Meeting, Tuxtla Gutiérrez, Chiapas
What is Food Loss 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 loss is primarily due to inefficiencies in the food supply chain.
- Examples include food that rots in the field or in storage because of inadequate management, technology or refrigeration, or food that cannot make it to market because of poor infrastructure and thus goes unconsumed.

**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.

- Food waste often occurs by choice, through poor stock management, or through neglect, and includes food that has spoiled, expired, or been left uneaten after preparation.
Estimates of Food Loss and Waste Per Capita, North America

By country:
- **Canada**: 396 kg, Pre-harvest 116 kg, Post-harvest 38 kg, Processing 43 kg, Distribution 29 kg, Consumer 170 kg
- **Mexico**: 249 kg, Pre-harvest 83 kg, Post-harvest 44 kg, Processing 45 kg, Distribution 40 kg, Consumer 37 kg
- **United States**: 415 kg, Pre-harvest 118 kg, Post-harvest 33 kg, Processing 47 kg, Distribution 29 kg, Consumer 188 kg
Estimates of Food Loss and Waste Total, by Country

- **Canada**: 13 (Pre-harvest 6, Post-harvest 4, Processing 1, Distribution 5, Consumer 1)
- **Mexico**: 28 (Pre-harvest 4, Post-harvest 5, Processing 5, Distribution 5, Consumer 9)
- **United States**: 126 (Pre-harvest 36, Post-harvest 10, Processing 14, Distribution 9, Consumer 57)
Estimates of Food Loss and Waste Per Capita, by Region

<table>
<thead>
<tr>
<th>Region</th>
<th>FLW (kg/person/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>274</td>
</tr>
<tr>
<td>North America and Oceania</td>
<td>302</td>
</tr>
<tr>
<td>Industrialized Asia</td>
<td>234</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>182</td>
</tr>
<tr>
<td>North Africa, West and Central Asia</td>
<td>233</td>
</tr>
<tr>
<td>South and Southeast Asia</td>
<td>124</td>
</tr>
<tr>
<td>Latin America</td>
<td>220</td>
</tr>
</tbody>
</table>

By Region:
- **Pre-harvest**
- **Post-harvest**
- **Processing**
- **Distribution**
- **Consumer**
## Environmental and Socio-Economic Impacts

<table>
<thead>
<tr>
<th>Impact Category(^1)</th>
<th>Unit</th>
<th>Canada</th>
<th>Mexico</th>
<th>United States</th>
<th>North America</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life-Cycle Greenhouse Gas Emissions for Landfilled FLW(^2,a)</td>
<td>million tonnes CO(_2)e per year</td>
<td>21(^a)</td>
<td>49(^b)</td>
<td>123(^b)</td>
<td>193</td>
</tr>
<tr>
<td>Water Use(^3,c)</td>
<td>billion m(^3) per year</td>
<td>1.5</td>
<td>2.7</td>
<td>13.4</td>
<td>17.6</td>
</tr>
<tr>
<td>Wasted Cropland(^3,e)</td>
<td>million ha per year</td>
<td>1.8</td>
<td>4.4</td>
<td>15.9</td>
<td>22.1</td>
</tr>
<tr>
<td>Fertilizer Use(^3,e)</td>
<td>million tonnes per year</td>
<td>0.33</td>
<td>0.63</td>
<td>2.97</td>
<td>3.94</td>
</tr>
<tr>
<td>Biodiversity Loss(^3,d)</td>
<td>loss equivalent to X million US$ per year</td>
<td>26</td>
<td>64</td>
<td>229</td>
<td>319</td>
</tr>
<tr>
<td>Energy Use(^3,o)</td>
<td>10(^{18}) Joules per year</td>
<td>1.0</td>
<td>3.4</td>
<td>8.9</td>
<td>13.3</td>
</tr>
<tr>
<td>Wasted Landfill Space(^2,f)</td>
<td>million m(^3) per year</td>
<td>4.2</td>
<td>8.6</td>
<td>25.9</td>
<td>38.6</td>
</tr>
<tr>
<td>FLW Tipping Fees(^2,j)</td>
<td>million US$ per year</td>
<td>326</td>
<td>249</td>
<td>1,293</td>
<td>1,867</td>
</tr>
<tr>
<td>Market Value of FLW(^3)</td>
<td>billion US$ per year</td>
<td>24(^g)</td>
<td>36(^h)</td>
<td>218(^i)</td>
<td>278</td>
</tr>
<tr>
<td>Wasted Calories(^3,l)</td>
<td>trillion kcal per year</td>
<td>20</td>
<td>20</td>
<td>177</td>
<td>217</td>
</tr>
</tbody>
</table>

1. Assumptions and parameters for quantifying environmental and socio-economic impacts are provided in the CEC foundational report *Characterization and Management of Food Loss and Waste in North America*, Section 6 and Appendices 4 and 6 (CEC 2017).

2. Life-cycle greenhouse gas emissions, wasted landfill space and wasted tipping fees were only calculated for landfilled FLW; the estimates exclude FLW disposed of, unharvested, or lost by other means.

3. While not explicitly stated in each methodology, estimates assume FLW from all stages of the food supply chain are included. Estimates shown only include the direct cost (market value) of FLW. Indirect costs such as labor, transportation, storage and wasted resources are not included.

*Note: CO\(_2\)e = carbon dioxide equivalent; m\(^3\) = cubic meters; ha = hectare; kcal = kilocalories.*

Environmental and Socio-Economic Impacts

22 MILLION
hectares per year of wasted cropland from FLW in North America = the area of the US state of Utah

US$1.9B
spent on landfill tipping fees each year

The yearly caloric value of FLW in North America is enough to feed close to 260 million people

3.9 MILLION
tonnes per year of wasted fertilizer from FLW in North America = enough to cover the state of Chihuahua!

US$278B
lost every year in FLW in North America

The energy embodied in FLW in North America is enough to power 274 million homes each year

39 MILLION
cubic meters of landfill space wasted per year in North America on landilling FLW — equivalent to 13 football stadiums

US$319M
value of biodiversity loss due to FLW in North America every year

18 BILLION
cubic meters per year, the estimated water footprint of FLW in North America = the volume of 7 million Olympic-size swimming pools

193 MILLION
tonnes CO₂e per year of life-cycle GHG emissions from FLW in North America

= 41 million cars driven continuously for a year
### Causes of Food Loss and Waste

<table>
<thead>
<tr>
<th>Post-Harvest</th>
<th>Processing</th>
<th>Distribution</th>
<th>Retail</th>
<th>Foodservice</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Grading standards for size and quality</td>
<td>- Inadequate infrastructure, machinery</td>
<td>- Damage during transport</td>
<td>- Inaccurate supply-and-demand forecasting</td>
<td>- Plate composition</td>
</tr>
<tr>
<td>- Inaccurate supply-and-demand forecasting</td>
<td>- Inefficient systems design</td>
<td>- Inaccurate supply-and-demand forecasting</td>
<td>- Overstocking</td>
<td>- Expansive menu options</td>
</tr>
<tr>
<td>- Order cancellations</td>
<td>- Damage during production</td>
<td>- Contamination</td>
<td>- Food safety concerns</td>
<td>- Over-serving</td>
</tr>
<tr>
<td>- Employee behavior</td>
<td>- Inaccurate supply-and-demand forecasting</td>
<td>- Trimming and culling</td>
<td>- Inconsistent/confusing date labels</td>
<td>- Over-preparing</td>
</tr>
<tr>
<td>- Low market prices and lack of markets (especially for second-grade products)</td>
<td>- Inconsistent/confusing date labels</td>
<td>- Supply/demand issues</td>
<td>- Order minimums and fluctuations in delivery from suppliers</td>
<td>- Unexpected demand fluctuations</td>
</tr>
<tr>
<td>- Inadequate sorting</td>
<td>- Inconsistency in quality of ingredients</td>
<td>- Inappropriate transportation and storage conditions</td>
<td>- Cold-chain deficiencies</td>
<td>- Preparation mistakes</td>
</tr>
<tr>
<td>- Damage from handling</td>
<td>- Food safety issues</td>
<td>- Incorrect/ineffective packaging</td>
<td>- Rejection of shipments</td>
<td>- Improper handling and storage</td>
</tr>
<tr>
<td>- Spillage and degradation</td>
<td>- Production line changes</td>
<td>- Delays during border inspections</td>
<td>- Poor record keeping</td>
<td>- Rigid management</td>
</tr>
<tr>
<td>- Inappropriate transportation and storage conditions</td>
<td>- Cold-chain deficiencies</td>
<td>- Road infrastructure challenges</td>
<td>- Inappropriate transportation and storage conditions</td>
<td>- Facility employee behavior</td>
</tr>
<tr>
<td>- Cold-chain (refrigeration during transportation and storage) deficiencies</td>
<td>- Facility employee behavior</td>
<td>- Excessive food distribution centralization</td>
<td>- Inconsistent/confusing date labels</td>
<td>- Food safety concerns</td>
</tr>
<tr>
<td>- Labor shortages</td>
<td>- Product differentiation</td>
<td>- Market over-saturation</td>
<td>- Rejection of shipments</td>
<td>- Use of trays</td>
</tr>
<tr>
<td>- Facility managers</td>
<td>- Facility employees</td>
<td>- Increased marketing standards</td>
<td>- Overstocking</td>
<td>- Marketing practices</td>
</tr>
<tr>
<td>- Farm owners</td>
<td>- Facility employees</td>
<td>- Farm owners/workers</td>
<td>- Food safety concerns</td>
<td>- Marketing practices</td>
</tr>
<tr>
<td>- Facility managers</td>
<td>- Retailers</td>
<td>- Facility employees</td>
<td>- Over-serving</td>
<td>- Marketing practices</td>
</tr>
<tr>
<td>- Facility managers</td>
<td>- Distributors</td>
<td>- Service providers (equipment, transport, packaging)</td>
<td>- Over-preparing</td>
<td>- Marketing practices</td>
</tr>
<tr>
<td>- Facility managers</td>
<td>- Processors</td>
<td>- Service providers (equipment, transport, packaging)</td>
<td>- Unexpected demand fluctuations</td>
<td>- Marketing practices</td>
</tr>
<tr>
<td>- Facility managers</td>
<td>- intermediaries</td>
<td>- Processors</td>
<td>- Preparation mistakes</td>
<td>- Marketing practices</td>
</tr>
<tr>
<td>- Facility managers</td>
<td>- Food service</td>
<td>- Distributors</td>
<td>- Improper handling and storage</td>
<td>- Marketing practices</td>
</tr>
<tr>
<td>- Facility managers</td>
<td>- Food rescue organizations</td>
<td>- Service providers (packaging, technology)</td>
<td>- Rigid management</td>
<td>- Marketing practices</td>
</tr>
<tr>
<td>- Facility managers</td>
<td>- Government (various levels)</td>
<td>- Food rescue organizations</td>
<td>- Facility employee behavior</td>
<td>- Marketing practices</td>
</tr>
<tr>
<td>- Facility managers</td>
<td>- Government (various levels)</td>
<td>- Government (various levels)</td>
<td>- Food safety concerns</td>
<td>- Marketing practices</td>
</tr>
<tr>
<td>- Farm owners and managers</td>
<td>- Government (various levels)</td>
<td>- Government (various levels)</td>
<td>- Use of trays</td>
<td>- Marketing practices</td>
</tr>
<tr>
<td>- Facility employees</td>
<td>- Government (various levels)</td>
<td>- Government (various levels)</td>
<td>- Marketing practices</td>
<td></td>
</tr>
</tbody>
</table>

### Key Players That Can Address Causes

- Farm owners
- Farm workers
- Retailers
- Processors
- Distributors
- Food rescue organizations
- Service providers (storage, equipment)
- Government (various levels)

### Sources
Opportunities

Cross-cutting
• Develop FLW Policies
• Foster Multi-Stakeholder Collaboration
• Create Voluntary ICI FLW Initiative
• Strengthen Regional Collaboration

Source Reduction
• Standardize Date Labels
• Update Food Grading
• Improve Cold-Chain Management
• Expand Value-Added Processing and Packaging Innovation

Measuring, Tracking and Reporting
• Standardize Measuring, Tracking and Reporting
• Track and Report Performance

Food Rescue and Recovery
• Explore Food Rescue Incentives
Case Studies

- Twelve case studies per country from across the food supply chain link food waste solutions to pragmatic and proven approaches.

**Producing Meal from Fish Waste, La Nueva Viga Fish Market, Mexico City**

- Before La Nueva Viga started selling fish waste to meal processing, they paid for collection of fish waste $8,379 USD per month. Now, receive $11,229 USD per month of revenue for fish waste processing.

**Grocery Meat and Food recovery Terminal, Montreal food bank**

- Food recovery hub that specializes in recovering perishable food, such as meats, vegetables and fruits. Over 85% needs to be refrigerated or frozen, which is opposite to most food banks which recover mostly dry goods.
TARGET 12.3

By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.
# Government Programs and Commitments in North America

<table>
<thead>
<tr>
<th>Country/Region</th>
<th>Programs and Commitments</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>- North American Climate, Clean Energy, and Environment Partnership Action Plan</td>
</tr>
<tr>
<td></td>
<td>- North American Initiative on Food Loss and Waste Reduction and Recovery</td>
</tr>
<tr>
<td>Canada</td>
<td>- Strategy on Short-lived Climate Pollutants</td>
</tr>
<tr>
<td>Mexico</td>
<td>- National Strategy and Program of Sustainable Production and Consumption</td>
</tr>
<tr>
<td></td>
<td>- National Crusade Against Hunger</td>
</tr>
<tr>
<td></td>
<td>- Champions 12.3 Initiative</td>
</tr>
<tr>
<td>United States</td>
<td>- FLW Target (reduce by 50% by 2030)</td>
</tr>
<tr>
<td></td>
<td>- Food Recovery Challenge</td>
</tr>
<tr>
<td></td>
<td>- FLW 2030 Champions</td>
</tr>
</tbody>
</table>
### Toolkits for ICI Sector
- Provision Coalition (processors and manufacturers, Canada)
- Food Waste Reduction Alliance (industrial, commercial and institutional ICI sector, United States)

### Action Programmes
- National Crusade Against Hunger (Government of Mexico)
- Orange County Food Rescue Pilot, Waste Not OC Coalition (nongovernmental organization [NGO], United States)

### Awareness Campaigns
- Sauve Ta Bouffe (Recyc-Québec [NGO], Canada)
- Love Food Hate Waste campaign (regional government, Canada)
- Zero Waste Initiative (Unilever Food Solutions [ICI], Mexico)
- The Thematic Network on Food Security (NGO, Mexico)
- Food: Too Good to Waste (EPA, United States government)
- Save the Food (Natural Resources Defense Council [NGO], United States)

### Incentive Programs
- Food Recovery Challenge and US Food Waste Challenge (EPA and USDA, United States government)
- Tax incentives (various locales)

### Policy and Strategy
- Strategy on Short-lived Climate Pollutants (Government of Canada)
- National Food Waste Reduction Strategy (National Zero Waste Council, Coalition Canada)
- System of Integral Measurement and Productivity Improvement (International Labor Organization [ICI], Mexico)
- National Strategy and Special Program of Sustainable Production and Consumption (Semarnat, Government of Mexico)
- Program of Trade and Market Development (Sagarpa, Government of Mexico)

### Food Donation Awareness
- Industry Food Donation Guidelines (British Columbia Center for Disease Control)
- Programme de Récupération en Supermarchés (supermarket recovery program, Quebec)
- Feeding America (United States)

### Portion Size and Nutrition Education
- Dalhousie University and University of Alberta (Canada)
- Slow Food Mexico (NGO, Mexico)
- Mexican Diabetes Association (NGO, Mexico)
- University of Massachusetts and Iowa State University (United States)
What’s Next?

• Continue work in new project to improve measurement of food loss and waste across the food supply chain

• Developing food waste outreach and learning tools for youth organizations
Organic Waste

• Companion comprehensive research on organics processing and diversion in North America
For More Information

North American Food Loss and Waste Initiative:

http://www3.cec.org/fw/

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