

1. Purpose

This summary presents the results of a high level food flow and systems analysis and place-based circular opportunities generation for food supply chains in Nova Scotia prepared by Dillon Consulting Limited. The information presented here is intended to providing a snapshot of the current system and spur conversation and lead to the generation of more waste reduction and redirection ideas.

The food system is a critical part of Nova Scotia's economy and serves a key role in the supply of healthy and nutritious food. While crucially important, for every dollar spent on food globally, society pays two dollars in health, environmental, and economic costs. Large amounts of food are wasted, while activities related to the agrifood industry produce almost a quarter of greenhouse gas emissions, degrading the natural resources on which we all depend on¹.

The purpose of this study is to analyze the food flows in Nova Scotia and identify place-based opportunities to redirect lost products back into the supply chain, retaining value, nutrients, and reducing negative environmental impact.

1.1 What is a Circular Economy?

The circular economy is an economic model that aims to maximize the value and utilization of resources, materials, and nutrients. It is a departure from the traditional linear economy, which follows a "take-make-dispose" pattern.

More specifically, a circular food system is often described as a system which:

- Actively supports and regenerates natural systems;
- Brings production closer to where the food is eaten, where appropriate;
- Eliminates waste; and
- Designs and markets healthier food products.

The circular economy offers several potential benefits, including reduced resource consumption, decreased environmental impact, increased economic resilience, job creation, and improved product quality and consumer satisfaction. By shifting from a linear model to a circular one, it is possible to move towards a more sustainable and regenerative future.

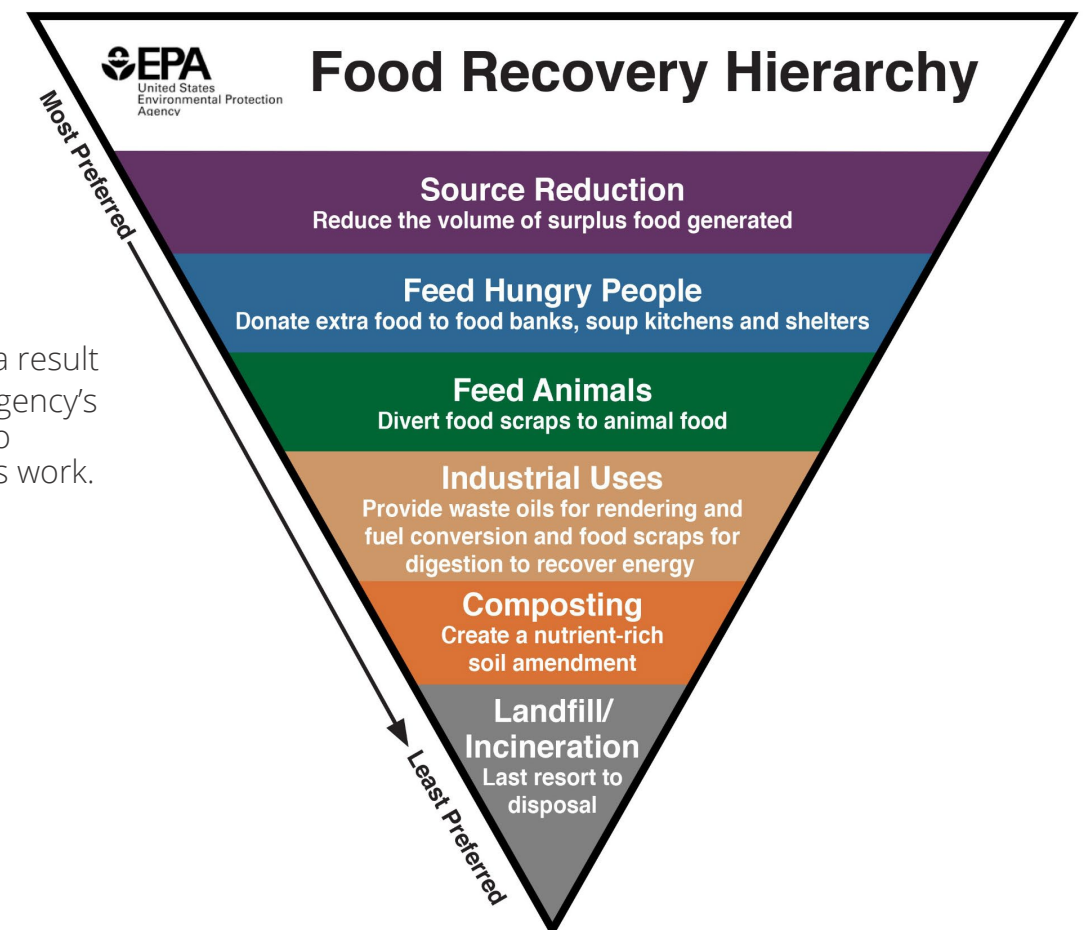
2. Methodology

Data on the amount of food produced in the province was collected from Statistics Canada. Information on how much food is lost at each step in the supply chain was generated by reaching out to supply chain participants in Nova Scotia as well as through reviewing past research on food loss and waste levels in different areas of food supply chains.

The information collected was mapped using a Sankey layout to help visualize the flow of the food. Calculations of the amount of greenhouse gasses (GHGs) generated by key hotspots were undertaken based on this analysis.

Interventions to reduce waste were then identified for the key hotspots generated as a result of this work. The Environmental Protection Agency's Food Recovery Hierarchy, **Figure 1**, is used to evaluate the interventions considered for this work.

Figure 1: EPA Food Recovery Hierarchy



3. Visual Depiction of the Flow of Food in the Province

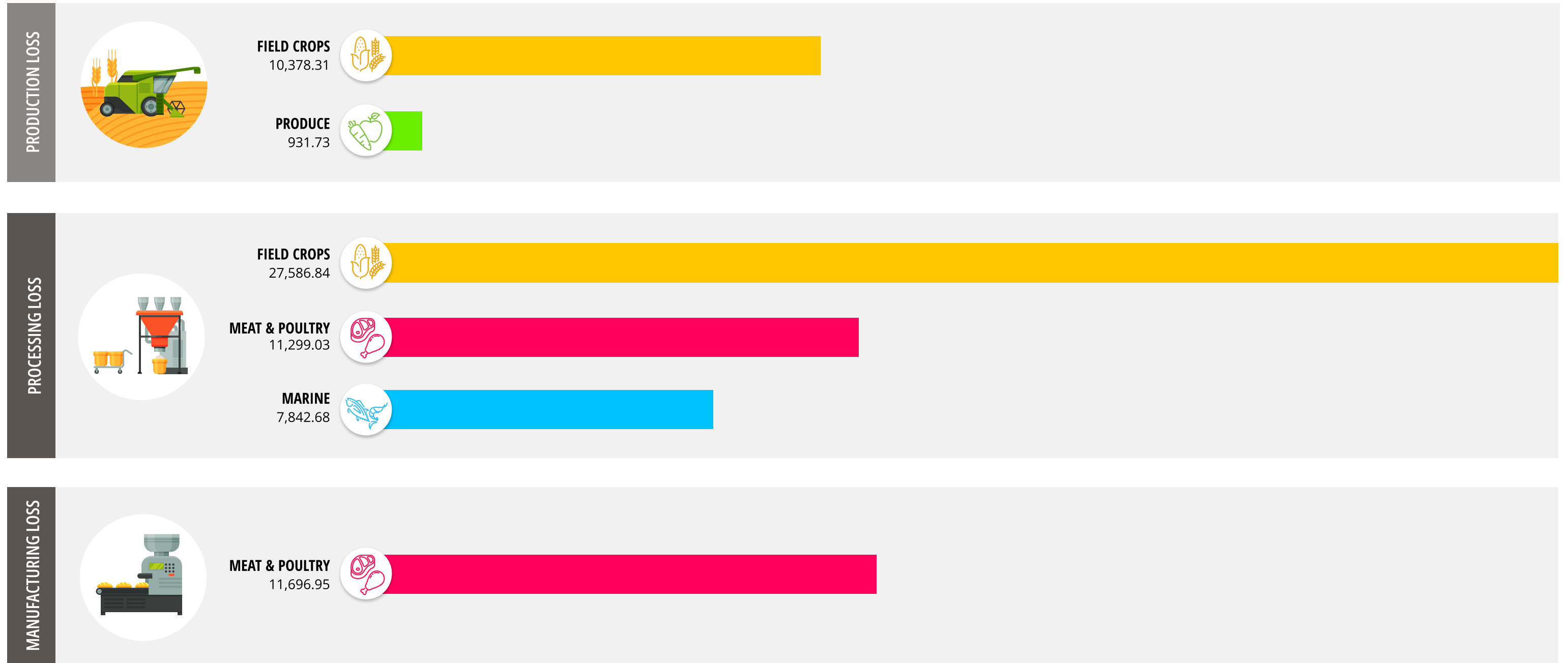
Figure 2 is a draft view of the flow of the food through the province of Nova Scotia. This figure will be updated if more information is shared up until July 21, 2023. Further, the intent of this project is to facilitate more straightforward data collection in the future; as new data is collected and the landscape of the food system in Nova Scotia changes, this figure can be updated to provide a changing visual representation of how food flows through the province.

¹ <https://emf.thirdlight.com/file/24/K6L0nrKMZq-8vK6HoTK6iyBra/Cities%20and%20circular%20economy%20for%20food.pdf>

4. Hotspots for GHG Production

Figure 3 depicts the hotspots for GHG production investigated for this study.




Figure 3: CO₂ equivalents in tonnes produced as a result of the supply chain activities related to getting the product to the point in the supply chain where it is lost.



5. Interventions for Discussion






Table 1 lists possible interventions that can be implemented to reduce the food loss that is occurring at the identified hotspots in the supply chain. These interventions represent a starting point to spur further discussion for innovative ideas that are relevant to the unique situation in Nova Scotia.

Table 1: Interventions for key GHG hotspots

Supply Chain Location	Food Category	Interventions
 Production - Farming and Fisheries	 Field Crops	<ul style="list-style-type: none"> • Straw or other plant stalks for building applications (insulation or straw-concrete). • Regenerative agriculture approaches (e.g. silvopasture). • Reduce lost food due to labour shortages through labourer recruitment and incentives. • Insect feed. • Fertilizer production (when mixed with viscera/offal and other ingredients). • Biodegradable packaging and materials from stems and chaff. • Medium-Density Fiberboard (MDF) from straw. • On-farm biogas generation, when combined with other substrates. • Using residues to grow mushrooms (e.g. straw) - diversification of income streams for farmers. • Grander produce can be used to create companion animal treats.
	 Produce	<ul style="list-style-type: none"> • Food rescue platform to share availability of excess products. • Use “ugly” produce in other products (e.g. soup, sauce, jam, juice etc.) • Donate to food security organizations. • Encourage use of grinders. • Send produce waste to farms, zoos, animal rescues for feed (or require pick-up and alert with food rescue digital platform). • On farm anaerobic digestion (capture methane gas energy).

Supply Chain Location	Food Category	Interventions
	 Field Crops	<ul style="list-style-type: none"> • Companion animal litter made out of chaff and other grain plant parts. • Collagen extraction (skin and viscera/offal). • Insect feed. • Produce “fish meal” from fish processing by-products for the agricultural livestock sector or aquaculture. • Send slaughterhouse excesses to rendering plants for conversion into fats, oil, tallow etc. • Fertilizer production from viscera and offal. • Phosphorus extraction from bone. • Optimization of production processes to reduce the amount of edible products being discarded. • Offal and other trimmings for livestock or companion animal feed. • Explore opportunities for new markets - products traditionally consumed by other cultures may provide a market opportunity in Nova Scotia (eg. pig tails or chicken feet). • Production of fish sauces or pastes for the retail market. • Biodiesel from tallow. • Industrial lubricant production from tallow.
	 Meat and Poultry	
	 Marine and Other Fish/ Crustaceans	
	 Meat and Poultry	<ul style="list-style-type: none"> • Develop a food rescue platform to share availability of excess products. • Add to feed for livestock or companion animals. • Staff training on use and trimming strategies to minimize wasted product. • Inventory management practices - adhering to First-In-First-Out (FIFO). • Production planning and forecasting improvements through training and system updates.

In addition to the hotspots identified by this research, there are possible general interventions that can be applied across other areas of the supply chain.

Distribution Waste Reduction Interventions	
	<ul style="list-style-type: none"> • Better cold chain maintenance - a cold chain with fewer breaks decreases rate of spoilage. • Inventory management practices - adhering to FIFO. • Production planning and forecasting improvements through training and system updates.
Hotel, Restaurant, and Institution Waste Reduction Interventions	
	<ul style="list-style-type: none"> • Eliminate behaviours such as placing condiments in small serving ramekins versus in reusable serving bottles. • Reduce the use of excess filler carbohydrates such as french fries, which are often wasted. • Improve communication to customers on portion sizes. • Encourage customers to bring their own “doggy bags.” • Leftovers collection app - sell leftover food at the end of the night at a discount.
Retail Waste Reduction Interventions	
	<ul style="list-style-type: none"> • Review inventory management practices and ensure regular and timely stock rotation (FIFO). • Sell more “ugly” produce and teach customers about the benefits. • Lower stacks of produce decrease damage and therefore the amount of waste. • Implement a mark down system to ensure all products close to expiration are sold.
Household Waste Reduction Interventions	
	<ul style="list-style-type: none"> • Municipal programs to provide subsidized home composters. • Educational campaigns on meal planning to budgeting to reduce over-purchasing of food that turns into waste. • Educational campaigns about proper food storage to increase shelf life and best before dates.
Overall Food Loss Reduction Strategies	
	<ul style="list-style-type: none"> • Improved supply chain communication and collaboration to minimize the number of steps products go through before becoming waste (quality standards, cold chain maintenance, bullwhip effect and resulting waste echo). • More closely integrate food recovery organizations into the supply chain (e.g. not-for-profit organizations who can redirect unsold products to those who can use it).

6. Next Steps

To allow more circular interventions to be implemented, conversations need to continue between members of the food supply chain, governments, not-for-profits, and innovators. This study is a first step in visualizing the flow of material in Nova Scotia’s food supply chains in order to fuel these discussions.