The Case for Water: Enhancing Climate Tools for Institutional Dining

Assessing opportunities to expand the Coolfood Calculator

Madeline Morales
Graduate Student Capstone Report
Swette Center for Sustainable Food Systems
Arizona State University, Class of 2025

LIST OF TABLES AND FIGURES

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Clara Cho
Data Lead, Coolfood
World Resources Institute

Sarah Rehkamp
Research Agriculture Economist
USDA Economic Research Service

Dr. Kathleen Merrigan
Executive Director
Swette Center for Sustainable Food Systems
Arizona State University

EXECUTIVE SUMMARY

As the effects of global climate change intensify, the environmental impacts of the food system are gaining increased attention from policymakers, businesses, and consumers alike. Food production is a resource-intensive sector responsible for 70% of global freshwater withdrawals and almost a quarter of global GHG emissions (FAOSTAT, n.d.; Poore & Nemecek, 2018). Therefore, the opportunity to engage large-scale institutional dining providers has emerged because of the power to shift demand, redesign menus, and influence supply chain partners.

The World Resources Institute's (WRI) Coolfood initiative has established itself as a global leader in supporting these shifts. Since 2020, Coolfood has worked with more than 80 organizations including universities, hospitals, restaurants, and corporations to reduce the climate impact of billions of meals served every year. At the center of this initiative is the Coolfood Calculator, a tool designed to analyze the GHG emissions and land use impacts of food purchasing decisions. By measuring emissions per meal and providing tailored guidance, the calculator has helped members align their food service operations with the targets of the Paris Climate Agreement.

While the Coolfood Calculator has proven effective at supporting institutional foodservice providers to reduce their carbon footprints, the food systems sustainability conversation has continued to evolve beyond solely tracking GHG emissions. Water use is another critical metric for sustainability, that is gaining significance in both environmental and business contexts. Extreme droughts, aging infrastructure, and rising consumer expectations have made water stewardship a strategic sustainability priority for many sectors including foodservice. However, the existing Coolfood Calculator tool does not take water use into consideration despite demand from the current user community.

This capstone explores the opportunity to integrate water use into the Coolfood Calculator by assessing data availability, existing frameworks and tools for tracking and communicating water metrics across different stages of the supply chain. It opens with a review of why water should be considered alongside GHGs and then provides an overview of existing research, certification programs, and measurement tools. From there, it breaks down water usage across four phases of the food system; growing, processing, transportation, and preparation. It ends with a discussion and recommendations focused on opportunities for Coolfood members to influence water stewardship within their own operations and across the food system.

Ultimately, this report aims to inform WRI's ongoing development of the Coolfood program by offering practical recommendations for expanding the calculator's scope. Incorporating water into this widely used tool would not only strengthen its value to members but also help align institutional foodservice with the next generation of sustainability standards.

INTRODUCTION TO COOLFOOD

The mission behind the Coolfood initiative from the World Resources Institute (WRI) is to help large scale food providers sell delicious meals while lowering their impact on the climate (Waite et al., n.d.). The initiative aligns with the Paris Climate Agreement whose overarching goal is to pursue efforts that hold the increase in global average temperature to below 1.5 degrees above pre-industrial levels (*The Paris Agreement | UNFCCC*, n.d.). While dietary changes alone will not hold warming at a manageable global level, the food sustainability movement needs to focus on the multiplier effect of dietary changes alongside improved producer and agricultural practices that decrease the impact on the environment (Poore & Nemecek, 2018). The Coolfood Initiative does this through a partnership between WRI, UN Environment, Climate Focus, Healthcare Without Harm, Carbon Neutral Cities Alliance, Practice Greenhealth, EAT, and The Sustainable Restaurant Association.

Since its inception in 2020, the Coolfood team has worked with influential global institutions, organizations and businesses like Panera Bread, Sodexo Food Service Management Company, Harvard University and IKEA to serve billions of sustainable meals from Seattle to Copenhagen while reducing their GHGs by 25% by 2030 ("Coolfood Impact," n.d.).

There are three phases of guided support for Coolfood members to move towards offering more plant-centric meals in their food service programs - these are *Pledge, Plan* and *Promote*.

> During the *Pledge*, phase members commit to reducing their greenhouse gas emissions by 25% by 2030 in line with targets set out by the Paris Climate Agreement ("The Cool Food Pledge," n.d.). The climate impact of their operation is determined by the Coolfood Calculator, a tool used by WRI staff to input food data and analyze climate impact.
>
> In the *Plan* phase, members are given technical assistance by the Coolfood team and Better Buying Lab to review the analysis and identify opportunities to serve more climate friendly foods (*Coolfood*, 2024).
>
> In the *Promote* phase, members are given science-backed marketing and messaging suggestions to inspire diners, employees and the general public to try climate friendly menu options and engage in the overall sustainability efforts of their dining programs ("The Cool Food Pledge," n.d.).

The Coolfood Calculator uses five metrics to measure overall climate impacts of a given menu item. These metrics are:

1. Food purchases by food type, measured in kilos or pounds.
2. Food related GHG emissions from agriculture supply chains, measured in tons of CO2.
3. Food related land use, measured in hectares.
4. Food related carbon opportunity costs, measured in tons of CO2.
5. Normalized metrics like GHG emissions per calorie or per meal.

While this calculator has proven to be extremely successful in lowering the carbon footprint for large scale dining operations, the Coolfood team and members are interested in exploring opportunities to expand the capacity of the current calculator. This report explores methods for measuring water in the food system, building a case for opportunities to enhance the current pledge and calculator.

THE CASE FOR WATER:

By the year 2030, experts predict that the global demand for water will outstrip the supply by 40% (*Charting Our Water Future*, n.d.). However, there is also evidence to believe that intervention strategies can close this gap (*Charting Our Water Future*, n.d.). As efforts to mitigate and adapt to climate change have evolved, the importance of measuring water use and quality alongside GHG emissions has gained in significance. While the Paris Climate Agreement largely focuses on GHG emissions as a solution to regulating average global temperatures, the importance of water and water-related trade-offs when it comes to sustainability decisions can no longer be ignored (Sustainability (IDOS), n.d.). The Sustainable Development Goals, of which the Paris Agreement directly aligns, reveals linkages between water and food systems sustainability through SDG 2: "End hunger, achieve food security and improved nutrition and promote sustainable agriculture" (*Food Security and Nutrition and Sustainable Agriculture*, n.d.).

Alongside increased attention from the sustainability field, demand for more information around water use has come from consumers as well. Each year, Ecolab, a global water solutions and services company, conducts a study to gain insights from consumers around the world to help inform policy and industry. Key insights from the Ecolab Study show that access to water is significant for people across the globe (*Ecolab State of Water Stewardship*, 2024.). In the United States, 33% of consumers report they have stopped using or purchasing products that they deem use too much water to manufacture (*Ecolab State of Water Stewardship*, 2024.). Similarly, 38% of Americans believe the agriculture industry is most responsible for water conservation (*Ecolab State of Water Stewardship*, 2024.).

Industry and consumer interest alongside demand from Coolfood members to build tools to measure water use make a compelling case for the calculator to include water use metrics.

TODAY'S CONTEXT: SUSTAINABILITY TRENDS IN DINING AND REPORTING

It is highly relevant to note the social and cultural context for shifting towards a more sustainable diet. According to the Plant Based Foods Association, retail sales of plant-based foods are valued at around $8.1 billion dollars (*Consumer Demand Reshapes Plant-Based Food Landscape*, n.d.). Consumers are increasingly aware of how their dietary choices affect the environment with 66% of the population more willing to pay a premium for more environmentally friendly products (*Ecolab State of Water Stewardship*, 2024.).

Historically, food trends have been set by fine dining establishments with over 70% of consumers reporting that their food preferences are primarily driven by what is offered on a restaurant menu. However, the rise of social media has shifted where many consumers are learning about trends and elevated the Gen-Z voice in the conversation (Plate, 2024.). Seeing sustainability trends present both in fine dining and university settings demonstrates diners at all levels are increasingly engaged in sustainable food systems conversations.

A growing number of Michelin star chefs are reenvisioning the farm to table movement in the urgent light of climate change. Chefs are recognizing their opportunity to influence the future of food systems to be able to thrive in the face of a growing global population (Moran, 2024). They are investigating the impacts their ingredients have on the environment and sharing these findings by building more transparency into their menus. The conversation is going deeper than just sourcing local, as they begin to probe into growing practices, transportation and social impacts (Moran, 2024). Many chefs are bringing diners along this journey through origin labeling on menus or special dinner series highlighting their supply chain partners.

FOOD SYSTEMS SPOTLIGHT: The Chef's Brigade is a coalition of over 100 independent restaurant partners dedicated to preserving the waterways in Coastal Louisiana and the Gulf Coast. They are turning restaurateurs into coastal ambassadors through immersive education experiences and programs. They have developed the Culinary Preservation Certifications for foodservice workers, educators, students, scientists and policy makers to become leaders in the sustainable food systems movement (*What We Do | Chefs Brigade | Disaster Food Assistance*, n.d.).

At the University level, cafeterias and food service are a common target for students engaged in climate change action. Upgrade Dining is a movement of students demanding action from their universities and putting pressure on food service management companies to be more transparent about the foods being served (*Home | Upgrade dining*, n.d.). There is also a growing movement of universities in the UK who have transitioned to serving only plant-based options, building momentum for others to follow their example (*About Plant-Based Universities*, n.d.).

As the cultural demand for transparency in the food system increases, so does the demand for corporate sustainability reporting. This demand comes from increased regulatory requirements, investor expectations and consumer awareness (Sustainability Reporting*, 2025*.). Accurate data and detailed reporting are in high demand and there are a plethora of tools and frameworks food companies can leverage to communicate their impact.

These trends toward sustainability in dining and reporting are especially relevant for Coolfood members, many of which are food service management companies or businesses that are directly affected by consumer trends, regulatory shifts and investor priorities. Tools like the Coolfood calculator are significant in helping members make operational adjustments that can reduce their impact on the environment. Coolfood members could greatly benefit from expansion of this tool to aid in meeting the growth in sustainability trends and reporting.

LITERATURE REVIEW

Measuring water use in the food system is extremely nuanced. This literature review aims to provide a landscape assessment of existing food systems water use data and evaluation methods to better inform what opportunities exist for incorporating additional metrics into the Coolfood calculator. Due to the dynamic nature of water research and data collection, it felt relevant to incorporate some of the leading voices in water research to continue to monitor these sources as the Coolfood project evolves. Lastly, this review outlines food system sustainability certifications with an explicit focus on their criteria regarding water use.

To begin, it is important to understand how to define the common methods for measuring water use. These terms are utilized by the prominent researchers and certifications that follow.

> **Water metering:** This is the process by which a device is installed inside a water pipe to record the volume of passing water. This is the most common and accessible way to begin tracking water use at the building level (*Glossary | U.S. Green Building Council*, n.d.).
>
> **Water Audits:** This is a comprehensive gathering of information about how and where water is used across a system. The data gathered is used to assess where losses and inefficiencies are present to develop appropriate intervention strategies (EPA. Water Audits and Water Loss Control for Public Water Systems, n.d.)
>
> **Life Cycle Analysis or Inventory (LCA or LCI):** This is a tool that measures the wide range of environmental impacts the making of any single product causes from cradle to grave. While historically omitted from LCA, sustainability professionals have started to incorporate water in this process (Jefferies et al., 2012).

Virtual Water: Also known as embedded water, is the amount of water used in the production of an item, distinct from a water footprint in that it does not account for the type of water used (*Virtual Water*, 2017.)

Water Footprint: A measurement of the total volume of water consumed, evaporated and polluted during production of a particular item. A water footprint is made up of:

Green Water: This refers to water from precipitation.
Blue Water: This refers to water from surface water (lakes, streams and rivers) or groundwater (water in the soil).
Grey Water: The amount of freshwater required to dilute the wastewater generated in agriculture from the application of pesticides and fertilizers.

Table 1 below is an overview of some of the leading certifications and how they measure water use. As Coolfood considers how to measure water and communicate water stewardship, they may look to these established certification bodies for guidance or calculator enhancement.

Table 1: *How do leading sustainability certifications measure water use?*

How do leading sustainability certifications measure water use?			
Certification	**Target Audience and Brief Description**	**Water Use Criteria**	**Consumer Facing Label**
ISO 14001	Organizations of all sizes across all sectors with specific standards for the food and agriculture sector addressing a wide range of relevant topics from farm practices to food safety.	ISO certified sites are required to have continuous improvement goals. This means that water usage is tracked with the ultimate goal of reducing or recycling water.	No
USDA Organic	Farmers, Ranchers and Food Businesses. There are four different levels of organic certification based on the amount of organically produced ingredients in the final product. Summarized: - 100% Organic - 100% - Organic - 95% - Made with Organic - 70% - Specific Organic Ingredients Listed - less than 70%	There are no explicit water requirements in the law but there are mandates for producers to improve soil condition and avoid soil erosion or contamination. Producers are mandated to implement agricultural practices that improve soil and may reduce overall water use (ie: cover crops).	Yes

How do leading sustainability certifications measure water use?			
Regenerative Organic	For food, fiber and personal care ingredients. Expands on the USDA Organic certification.	Farmers are mandated to have a water conservation plan. Processors are expected to monitor water use, minimize waste and improve water efficiency.	Yes
LEED Certification	Building owners or managers. This is a framework for healthy, efficient buildings. There are no specific certification for food processing facilities.	Water efficiency is a core aspect of this certification. Requirements aim to lower water use inside and outside buildings using water metering and efficient water use best practices.	Yes
BCorps	Businesses and brands. Global network of businesses across all sectors that center people and planet in their profit structure.	Companies are required to track water usage, implement reduction strategies and manage wastewater responsibly. Companies are given a water score that affects their overall impact score.	Yes
Alliance for Water Stewardship (AWS)	Cross sector relevance. Used by companies, investors and public sector agencies that are seeking water risk mitigation through water stewardship. Food and beverage manufacturing is a priority sector.	Requires members to adhere to a defined set of water stewardship standards.	No

The following table outlines organizations that are particularly relevant to this project. As the Coolfood team explores further expansion into water use, monitoring and engaging with the following organizations will be poignant as more data and conversation emerges.

Table 2: *Organizations Contributing Food Systems and Water Use Data*

Organizations Contributing Food Systems and Water Use Data		
Organization	**Mission**	**Relevant Data**
Food and Agriculture Organization	Dedicated to building sustainable agrifood systems through global partnerships, research and assistance.	Hosts state of the art public databases to manage the dynamic variables affecting the food system. A few relevant to water use are:

Organizations Contributing Food Systems and Water Use Data		
		- AquaSTAT: Global Information system on water and agriculture, playing a leading role in monitoring SDG 6: *To ensure availability of sustainable management of water and sanitation for all.* - CROPWAT: Data showing the crop water requirements and irrigation requirements based on soil, climate and crop data.
International Water Management Institute	IWMI is a CGIAR project with a vision for a water secure world. Their research results have led to changes in water management that have contributed to social and economic development.	Developed the Water Data Portal, a "one stop shop" for diverse datasets related to water and agriculture.
USDA - Economic Research Service	Exists to provide high quality data in emerging agriculture, food and environment trends to enhance public and private sector decision making.	Report on water use by food category in the post farm production and processing stages. *New Public database on water in the food supply chain coming soon.*
USGS - Aquaculture	Works with partners to monitor, assess, conduct targeted research, and deliver information on a wide range of water resources and conditions including streamflow, groundwater, water quality, water use and availability.	Data sources for water use in livestock and aquaculture industries.
WaterPub	Largest repository of water footprint publications.	Includes datasets along with reports, books and peer reviewed papers.

This final table serves as an overview of existing consumer-facing tools that measure water use in the food system. While the Coolfood calculator itself is not open to the public, the following are relevant to include as potential resources for Coolfood members to use. Furthermore, the Coolfood team can draw inspiration from or consider developing partnerships with the entities below.

Table 3: *Tools for Measuring Water Use in the Food System*

Tools for Measuring Water Use in the Food System		
Tool	**Description**	**Target Audience**
CoolFarm	Interactive tool that quantifies carbon footprint, water use, biodiversity. Water use tracking focuses on irrigation use and blue / green water footprints.	Farmers
Water Footprint Calculator by FoodPrint	Online tool for individuals to calculate their personal water footprint. Exists to educate and encourage behavior change.	Consumers, Businesses
Water Footprint Assessment Tool by the Water Footprint Network	Tool to calculate and map water footprint to assess sustainability and identify strategic actions to improve sustainability of water use through: - Country, River Basin and World level data - Raw product, personal business and commodity level in progress - Extended tool available for deeper individual water footprint analysis	Decision makers, Sustainability Leaders
Water Footprint Food Guide	Interactive guide associating foods with a water footprint size based on where and how it is produced.	Consumers

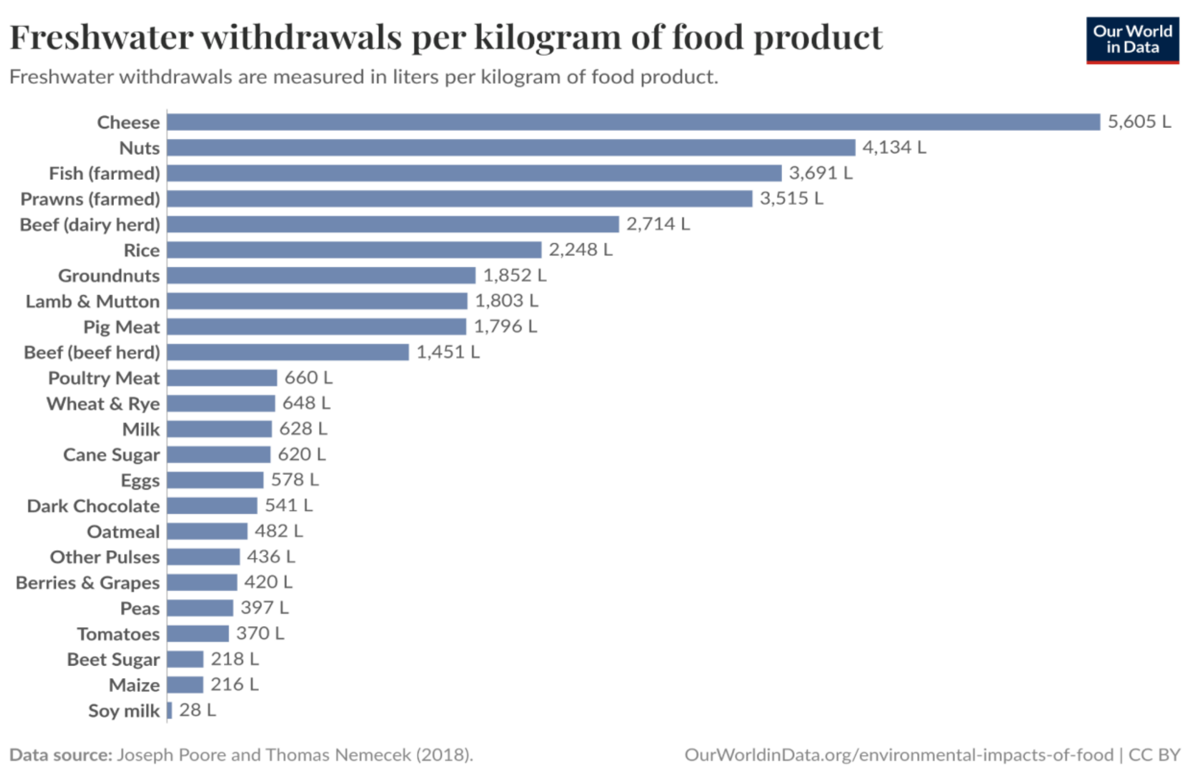
MEASURING WATER IN THE FOOD SUPPLY CHAIN

Water in the food supply chain is being measured both in terms of quality and quantity. This report will focus primarily on water quantity in the United States, but the NASA Water Quality suite of data tools and information is a great resource for those interested in the water quality body of research (Earth Science Data Systems, 2024). When considering how food gets from seed to table, water is present at every step along this chain which is why many take a life cycle analysis approach to begin quantifying overall water use impacts of a food or meal. The 2018 study from Poore and Nemecek is one of the most comprehensive and influential bodies of work in this field informing policy, consumer labeling and sustainability actions across food systems sectors (*Enabling Trust in Food Labels for Improved Environmental Outcomes*, 2025).

> **DATA HIGHLIGHT:** The full dataset for the Poore and Nemecek research can be found here: https://data.4tu.nl/datasets/7b45bcc6-686b-404d-a910-13c87156716a

This study has informed resources like Figure 1 below comparing freshwater withdrawals per kilogram of food product (*Freshwater Withdrawals per Kilogram of Food Product*, 2018.). This is extremely valuable when assessing overall impact but does not account for specific boundaries or nuances like location, farm type and time.

Figure 1: Freshwater Withdrawals Per Kilogram of Food Product



Note. Reprinted from Freshwater Withdrawals per Kilogram of Food Product by Our World in Data, 2018. www.ourworldindata.org

What follows is an exploration of ways to analyze water use along the food supply chain from the growing and harvesting phase to processing and packaging and transportation to preparation. The intention is to organize a selection of the resources mentioned above alongside other findings in a format that can inform opportunities for food service management companies and the Coolfood team to consider water usage rates in their overall calculations of what makes a meal climate friendly.

Phase 1: Growing and Harvesting

This stage includes the water use for all activities happening on the farm level. "According to a U.S. Geological Survey report, agriculture is a major user of ground and surface water in the United States, and irrigation accounted for 42 percent of the Nation's total freshwater withdrawals in 2015" (*Irrigation & Water Use*, 2025). To date, this stage in the food system is where the most research for water use in agriculture exists and is the most impactful place for water saving intervention. This section will explore:

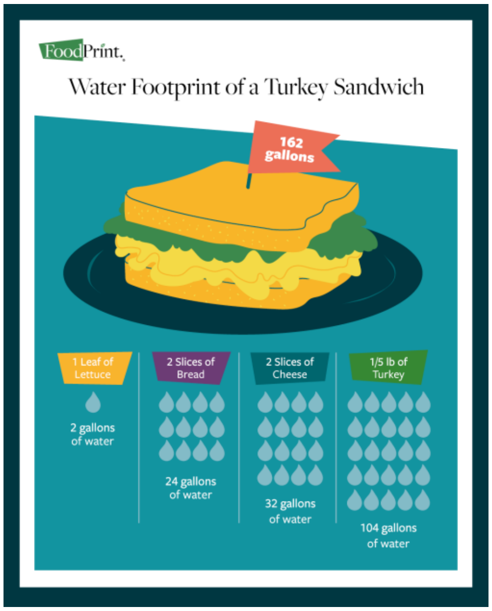
1. What a crop water footprint is.
2. How it is measured.
3. Who is measuring water use at the farm level.
4. What tools and software are available for tracking support.

When sustainability experts mention water use in the food system, they are most often referencing the on-farm phase or "crop-water footprint". The crop water footprint of a crop is the amount of green, blue and grey water necessary in the production of a crop (Mialyk et al., 2024).

A leading data set on water use for global crop production was published in 2024 and is an overview of crop water use in 175 individual crops from 1990 - 2019 (Mialyk et al., 2024). Researchers developed this work by applying a global, process-based crop model to simulate daily growth, and water use for 175 crops. It's a methodological advance over earlier, static datasets as it accounts for environmental conditions, irrigation practices, and shifting rainfed and irrigated areas. Organizations and companies are using this and other technical data to inform user friendly tools and communicate data in a way that aids farmers and food systems leaders in making choices that lessen impact on water use.

The Cool Farm Tool empowers farmers, businesses, scientists, academics, conservation project managers and consultants with metrics to communicate about sustainability, demonstrate the benefits of regenerative practices and report against reduction targets ("How to Measure Carbon Footprint, Water & Biodiversity," 2025.). To determine water usage, it measures evapotranspiration throughout growth phases of plants, identifies crop water stress points and simulates the effect of different irrigation and soil methods on water usage. With this analysis, farmers can identify management options that improve their soil condition and make the most of every water droplet used in their operation.

Figure 2: Water Footprint of a Turkey Sandwich



Note. Reprinted from The Water Footprint of Food by FoodPrint, 2024 www.foodprint.org

The Water Footprint Calculator is a public facing tool for individuals to assess their personal water footprint. The goal is to highlight how everyday actions impact water use and empower users with educational resources to make daily choices that use less water ("What Is Virtual Water?" 2022.). One of those resources is the Water Footprint of Food Guide which gives a score to individual foods based on their blue, green and grey water footprints. The poster shows how this organization is taking technical farm level data and turning it into digestible, marketable information for consumers (*Water Footprint of Food*, 2024.). Using the terminology of "water footprint" can be misleading as this tool only accounts for data gathered at the farm level. However, it can still be a helpful resource for consumers interested in learning more about trends in water usage for specific food items.

There are many agriculture technology companies that have developed software products with solutions for farmers to track and manage water usage. The leading marketing for these products highlights water savings as a method for cost-savings and labor efficiencies. While most also offer tools to help with sustainability and impact reporting, it is often less emphasized than the impacts on profits. Farmers may look to companies like CropX or Tend for software solutions.

Phase 2: Processing and Packaging

A 2012 report from the Economic Research Service (ERS) revealed that crop and livestock production was responsible for 68% of water use in the food system, and a more recent study found that just 32% was used during later stages of food production (Rehkamp, et.al, 2021). This is not an insignificant amount of water usage and should not be overlooked for monitoring and interventions. This section will explore:

1. How water is being used in the food processing and packaging stage of the food system.
2. How agribusiness companies are measuring water use.
3. What opportunities exist for water reduction interventions.

Similar to agriculture, food processing and packaging affects both the grey and blue water supply. The grey water supply is affected by water pollution from factories while blue water supply is depleted through general water use needs. Again, this study is focused on the quantity of water used and will therefore not be discussing water quality in this section. The best way to measure water use in food processing is by tracking water meter data. The table below further describes production activities and their relative water requirements in the food transformation step (Kirby et al., 2003).

Figure 3: Water Quantity and Quality Requirements for Selected Processes in Food Production

Process	Relative water quantity requirement
Direct preparation of product	Low
Bottled water production	High
Cooling water	High
Product washing	Medium–High
Fluming water - *a common process used to wash and transport produce through a production line using water*	High
Production of ice, hot water, and steam	Variable
Air conditioning and humidity control	Variable
Starting-up, rinsing and cleaning of processing equipment	High
Cleaning and disinfection of processing facilities	High
Boiler feed water and fire extinguishing	High

Note. Adapted from Water in Food Production and Processing by Kirby et. al, 2003. www.sciencedirect.com

Describing these activities reveals opportunities for tracking water use and building strategies for intervention at the factory level. Tracking water use in food processing is incentivized by the cost saving opportunities it can reveal. Furthermore, water stewardship can improve a company's reputation, differentiate them from competitors and open opportunities to achieve certain sustainability certifications.

A study conducted by Kirby, et al and published in Science Direct magazine revealed that water consumption can be reduced by 30% through simple cultural and operational changes that require little to no capital investment. Things like awareness campaigns, instituting monitoring programs or using taps that automatically shut off can significantly change overall the water use of a facility (Kirby et al., 2003). This study also identifies five major opportunities for companies to reduce water consumption.

1. **Reducing uncontrolled water use,** by eliminating or reducing instances where water is used without oversight such as leaky pipes or excessive use in cooling or cleaning.
2. **Improving planning and control,** by developing and implementing water saving techniques in operations.
3. **Reusing water,** by reclaiming water from one process and repurposing for another, for example, using the water used to wash produce for irrigation or machine cooling.

4. **Recycling water after treatment,** through the responsible treatment or disposal of water that cannot be reused within the facility.
5. **Improving design layout to build water efficiencies -** through equipment and facility modernization to the most efficient options

AgTech companies also offer solutions for companies looking to track and reduce water use at the factory level. For example, Aquacycle, a water tracking software and consulting company, has helped Fredericia Brewery win the Global Water Award for their leadership in circular water use and wastewater management in the beverage industry. The Aquacycle software has supported the brewery's commitments towards a more sustainable future by tracking their progress towards aggressive water consumption reduction goals (Moreno, 2024).

Phase 3: Transportation

Climate reduction targets in this phase are most commonly focused on GHG emissions reduction. However, water use is another factor to consider when transporting food from farm to factories, factories to distributors and distributors to eaters. Water use in this phase is measured both through direct and indirect use.

1. **Direct Water Use**, relatively lower overall usage measuring water used for activities such as washing vehicles and applying dust suppression on roadways.
2. **Indirect Water Use,** relatively higher usage because this encompasses water used to extract and refine fuel.

There are published data sets that are commonly used to measure indirect water use in transportation. Life Cycle Analysis frameworks like Ecoinvent incorporate these data sets in their data modeling services (“Database,” n.d.).

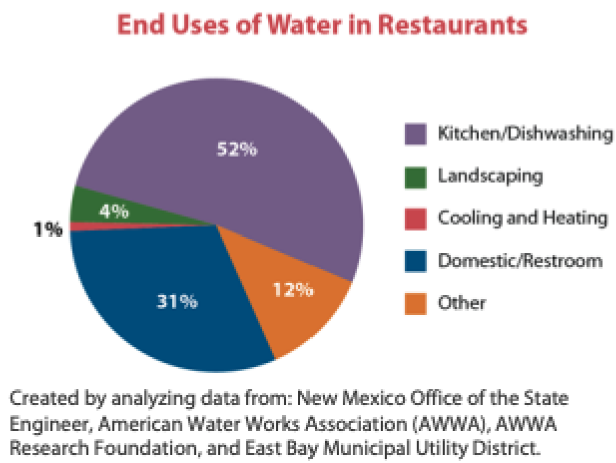
DATA HIGHLIGHT: Ecoinvent is an internationally active, mission-driven organization devoted to supporting high-quality, science based environmental assessments. They maintain life cycle inventory databases that can be used by a wide range of companies, policymakers and researchers to make informed decisions about the environmental impact of their operations and develop more sustainable practices. They have a wide range of relevant data for food systems including water use in transportation and irrigation (“Database,” n.d.).

Reducing the water footprint of food by sourcing locally is a commonly accepted and promoted solution to reduce carbon emissions and overall impact of food supply. While this can be a key driver of reduced environmental impact, it is not always feasible nor the preferred sustainability intervention. Tracking water use in transportation is important but should not distract from broader conversations around food systems transformation.

Phase 4: Preparation

The final step in the food supply chain is food preparation. This step should not be overlooked as it is where many Coolfood members likely have the most direct influence.

Figure 4: End Uses of Water in Restaurants



Note: Reprinted from Saving Water in Restaurants by WaterSense at EPA, 2012. www.epa.gov

Research from the EPA found that water used in hospitality and food service establishments accounts for approximately 15% of total water use in commercial and institutional facilities in the United States (*Saving Water in Restaurants*, 2012). There are equally strong business and environmental cases for reducing water use in commercial kitchens considering the cost savings parallel the environmental benefits. The graph illustrates where water is being used in restaurants. With 52% of water use occurring in kitchens and dishwashing, investing in water-efficient food service equipment is key to both financial and environmental savings. Further water saving techniques are outlined in the WaterSense at Work Guide developed by the EAP to promote water-efficient techniques and best practices for commercial and institutional facilities (*Saving Water in Restaurants*, 2012). Some examples of suggested water saving best practices include:

1. Upgrading dishwashers, ice machines and steam cookers to energy efficient models.
2. Maximizing efficiency of pre-rinse spray valves, disposal systems and equipment that use a boiler.
3. Educating food service professionals on water efficient dishwashing and preparation techniques.

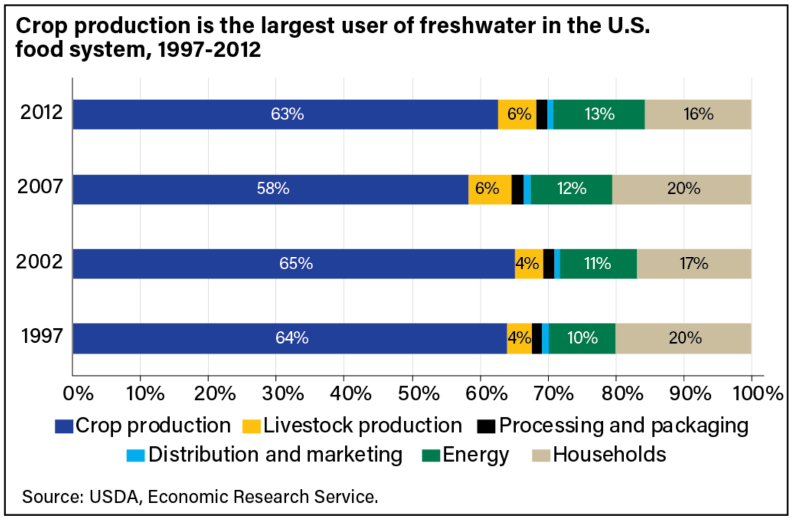
Furthermore, the Alliance for Water Efficiency is a member-based organization that published a set of best practices for water use efficiency in commercial kitchens. This guide is unique in that it is geared towards food service professionals and recommends daily best practices. The resource guides members through an analysis and action plan that begins with easy to implement strategies and builds into making changes that may require a larger investment (Hughes, 2017).

Water Use Across the Supply Chain:

Breaking down water use by supply chain phase is valuable because it can reveal opportunities for specific industry intervention. However, calculating water footprints and translating that into relatable and marketable data points requires looking more holistically at all the food system phases combined.

A comprehensive analysis of water use by food category and supply chain stage was performed by USDA Economic Research Service (ERS) in 2021 and presented a unique approach to measuring the water use of foods from farm to fork. This research analyzed water usage across the supply chain as well as the overall water footprints of specific food categories over time. This study revealed that the on-farm phase of the food supply chain is consistently and overwhelmingly responsible for the most amount of water use. It is significant here to note that crop production uses significantly more water than livestock production as demonstrated by Figure 5 below.

Figure 5: Crop Production is the Largest User of Freshwater in the US Food System



Note: Reprinted from Tracking the U.S. Domestic Food Supply Chain's Freshwater Use Over Time by Rehkamp et, al., USDA ERS, 2021. www.ers.usda.gov

While livestock production uses less water than crop production, the water footprint of meat from livestock is higher than vegetables because of the crop production water required to grow the animal feed. The study found that "substantial amounts of water are needed to produce animal feed to ultimately deliver the end meat or poultry food items purchased" (Rehkamp, 2021). Figure 6 below is modified from the ERS study and shows the total freshwater of foods commonly found in the American diet.

Figure 6: Freshwater Usage of Common Food Categories

Food Category	**Total Freshwater Water Usage Billions gallons / year**
Cereals	1,544
Bakery Products	1,492
Beef, Pork and other meats	2,534
Poultry	964
Fish and Seafood	79
Fresh Milk	339
Processed Dairy products	681
Eggs	314
Fats and Oils	784
Fresh Fruits	1,885

Fresh Vegetables	5,145
Processed fruits and vegetables	704
Sugar and sweets	1,075
Other foods	4,512
Non alcoholic beverages	1,355
Alcoholic beverages	1,243

Note: Adapted from Tracking the U.S. Domestic Food Supply Chain's Freshwater Use Over Time by Rehkamp et, al., USDA ERS, 2021. www.ers.usda.gov

It is important to note that both the quantity and composition of food items purchased within these categories matter for the attributed water use, in addition to production practices and water use efficiency throughout the supply chain (Rehkamp, 2021). For example, vegetables produced on a small, regenerative organic farm will have a different water use impact than vegetables grown in a large-scale commercial production farm. Looking at food category trends is significant to help inform strategies for reducing water use but does not account for all supply chain variables.

DISCUSSION

Analyzing water usage in each phase of the food supply chain reveals the many nuanced factors that can affect the overall water footprint of a food. Determining climate impact of a single ingredient, let alone a meal, is filled with variables that are extremely hard to boil down to a singular score or metric. However, finding transparent and digestible ways to communicate the climate impact of foods is what makes the Coolfood calculator and project so impactful. This section examines the data and information presented above and discusses opportunities for the Coolfood pledge and calculator to expand the metrics that contribute to determining climate friendly meals.

Interventions at the Final Phase (preparation) of the Food Supply Chain

Considering Coolfood members' placement on the food supply chain will be significant in understanding the most effective options for intervention. Coolfood is built for organizations that serve food to consumers at scale. They are best positioned to influence phase four, the preparation phase, of the food supply chain as this takes place in the kitchen facilities that they operate. While the current Coolfood calculator only measures data points from the supply chain, broadening this lens to the preparation phase opens opportunities for Coolfood members to align their facilities and cafeterias with the ideals of climate consciousness promoted by the Coolfood initiative.

Empowering kitchen staff to be water stewards

The food service workers running commercial kitchens are an important part of the overall water efficiency of an operation. Training sessions and signage that reinforce water-saving habits can help build awareness and develop a culture of water stewardship in the kitchen. Training could include topics such as tips for washing produce while saving water, thawing frozen ingredients sustainably, and what to do when a leak is found. At the same time, these trainings could educate staff about the Coolfood initiative and involve them in efforts to reduce their operation's overall climate impact.

Facilities improvements

Coolfood members generally have direct agency over the facilities they work in. Upgrading equipment to the most water efficient models, incorporating water metering at a facility level and monitoring for leaks could lead to overall water conservation of their operations. Pursuing facility certifications such as LEED or AWS, as discussed above, could also be established as a goal or requirement for Coolfood members further demonstrating their commitment to a culture of water stewardship.

Product traceability

RESOURCE HIGHLIGHT: The Corporate Value Chain (Scope 3) Accounting and Reporting Standard is a supplement to the GHG Protocol Corporate Accounting and Reporting Standard. The stated purpose of this standard is to provide step-by-step guidance for companies looking to prepare and publicly report GHG emissions inventory from value chain activities. It is intended to help companies understand the holistic impact of their supply chain and identify opportunities for the greatest GHG reduction and most sustainable decisions on the items they buy, sell and produce (Bhatia, et.al., 2011.).

Reporting for Coolfood members is an annual process that requires food purchasing and poundage data submitted by food category. The Coolfood calculator relies on the GHG Protocol's Corporate Value Chain Accounting and Reporting Standard and uses this resource to quantify the indirect GHG emissions of activities occurring in member supply chains (Waite et al., 2019.). A seamless way to include water in the calculator would be to use this same food poundage data already being reported by members (see figure 8 below for food items) and assign a water gallon usage metric to the same categories. The Coolfood data team would need to assess whether the current publicly available data would be sufficient for including this metric.

Figure 7: Coolfood Calculator Food Categories for Reporting

Signatories shall report the previous year's food purchase data on an annual basis. They may report at the aggregate level (shown in bold—e.g., fish and seafood; liquid dairy) or at a more detailed level (e.g., finfish, crustaceans; milk, yogurt). More detailed reporting will allow for increased accuracy. As shown in Figure 4, the mandatory items collectively tend to account for more than 80 percent of signatories' total food-related agricultural supply chain emissions, land use, and carbon opportunity costs.

MANDATORY ITEMS

Animal proteins

- **Beef**
- **Lamb/sheep/goat**
- **Pork**
- **Poultry**
- **Fish and seafood**
  - Fish (finfish)
  - Crustaceans (e.g., shrimp, prawns)
  - Mollusks (e.g., clams, oysters)
- **Liquid dairy**
  - Milk
  - Yogurt
- **Solid dairy**
  - Cheese
  - Butter
  - Ice Cream
- **Eggs**

Plant proteins

- **Legumes and pulses**
  - Beans, peas, lentils, chickpeas
  - Peanuts and peanut butter
  - Soybeans and tofu
- **Nuts and seeds, nut/seed butters**
- **Grains**
  - Rice
  - Wheat (flour)
  - Corn (maize) (flour)
  - Bread and baked goods
  - Pasta and noodles
  - Other grains and flours (as relevant or feasible)
- **Plant-based milk substitutes**
  - Almond milk
  - Oat milk
  - Rice milk
  - Soy milk

OPTIONAL ITEMS

- Fruits
- Vegetables (excluding roots and tubers)
- Roots and tubers
- Vegetable oils
- Sugars and sweeteners
- Tea, coffee, spices
- Alcoholic beverages
- Other foods (please list)

Note: Reprinted from Quick Start Guide for Food Service by the World Resources Institute, 2024. www.coolfood.org

However, to really understand supply chain water usage, Coolfood members would need to report on additional data points beyond poundage of food by category. Research throughout this report reveals that variables associated with how a food is grown, raised, processed, transported and prepared all factor into the cumulative water footprint of a meal. Empowering Coolfood members to source from supply chain partners with similar water stewardship values may lead to more accurate and transformative water savings.

Limitations

There is expansive data available regarding water use at the farm level. It was easy to find data for crop water requirements and irrigation methods impact. However, there is limited data available on subsequent phases of the supply chain. We can expect to see increased data and information as water use gains increasing significance in the broader sustainability and climate change conversation. For example, there are data projects underway at ERS that will be of great benefit to the effort of quantifying water use in the food system. This should not deter the Coolfood team from moving forward with efforts to incorporate water into the Coolfood Pledge and Calculator as there are still significant opportunities to elevate the importance of water in the climate friendly foods conversation.

RECOMMENDATIONS:

Recommendations for the Coolfood team to incorporate water into their overall initiative focus on what Coolfood members have direct influence over, namely their own kitchens and suppliers. Furthermore, these recommendations focus on lower lift, foundational additions that will allow for continued expansion into deeper water analysis. These recommendations fit best into the “plan” phase of support for Coolfood members and could enhance the current technical assistance offerings.

Recommendation 1:

A key element to the Coolfood initiative is the behavioral science and consumer marketing research that goes alongside the data tracking efforts to reduce GHG emissions. The Coolfood team has published the Food Service Playbook Promoting Sustainable Food Choices which outlines what they coined as “no-regret” solutions that are supported by research and experts to operate more sustainable food service programs (Pollicino et al., 2024). The techniques are defined by the following categories:

- **Product:** techniques that involve modifying the food being served.
- **Presentation**: techniques that involve modifying the language, imagery, and layout of menus, signs, and labels.
- **People**: techniques that target food service employees.
- **Promotion**: techniques that include communication, marketing, advertising, and campaign approaches.
- **Price:** techniques that involve modifying the cost of food or otherwise incentivizing or disincentivizing specific choices.
- **Placement:** techniques that involve modifying food displays and the physical food service environment.

This guide is a unique and highly accessible resource for current and potential Coolfood members. The format is user friendly, providing clear suggestions that make daunting tasks seem approachable and simple.

The Coolfood team could expand the “people” section to include water stewardship behaviors. The current list of techniques focuses on training for food service staff and chefs to make and sell plant rich dishes. Expanding these techniques to incorporate water stewardship strategies like those listed in the WaterSense at Work Guide developed by the EAP would be a poignant addition to the current resource. Empowering members to offer staff training and education to save water while cooking, cleaning and generally operating in a kitchen space requires little investment while establishing water saving as both a cultural and operational priority. The Coolfood team could also consider developing further water stewardship virtual training and education opportunities for their network of engaged members.

Recommendation 2:

The Coolfood team could also consider developing a playbook or similar guide with information to empower members to select supply chain partners that share the same water stewardship values. The research presented in this report demonstrates that the way in which an ingredient is grown, processed and transported can have a large effect on its overall water footprint. Simply tracking poundage of food categories will not sufficiently communicate the water use nuances across the supply chain. See below for a recommended outline for this resource.

Table 4: Suggested Outline for Food Service Supply Chain Playbook

The food service playbook for promoting water stewardship in the supply chain	
Sustainability Certifications Overview	Review of common certifications in the food supply chain and an outline of their standards for water stewardship (see Table 1).
What to ask suppliers about water stewardship	A set of questions to have conversations with suppliers about water techniques from farm to factory to truck.
Supplier Selection	What certifications and factors matter most? Setting standards for supply chain partners.
Growing with Supply Chain Partners	Strategies for influencing the water stewardship practices occurring across the supply chain.

Coolfood members are an extremely influential part of the food system and can shape practices on farms, in factories and through transportation. Demanding certain standards from their supply chain partners could turn water saving techniques from best practices to common strategies and ignite the kind of food systems transformation needed to achieve global climate change targets.

Recommendation 3:

As noted in the discussion of this report, data around water use in the food supply chain is limited. As a leader in the movement towards more climate friendly food service, the Coolfood team should remain engaged in conversations around water use in the food supply chain with the goal of driving further research on this topic. By keeping tabs on research organizations like ERS, Coolfood can be first to know about any new data or tools that are published. Furthermore, establishing water use in the food supply chain as a research priority for the Food team at the World Resources Institute would provide a pathway not only for calculator expansion, but for broader understanding for leaders across the food systems of the water impacts of foods. The Coolfood team may consider participating in events like the Global Water Summit hosted by the Global Water Intelligence network, to remain relevant and engaged with cross sector industry leaders (*Global Water Intelligence | GWI*, n.d.).

CONCLUSION

As institutional food service providers increasingly embrace climate leadership, tools like the Coolfood Calculator are vital for translating sustainability commitments into measurable impact. Expanding the calculator to include water use would align with evolving environmental priorities, deepen member engagement, and support a more holistic approach to food system sustainability. Clear pathways exist for integrating water stewardship into kitchen operations and supply chain partnerships despite some data limitations. Through expanded training and guidance for Coolfood members, partnerships with leading water organizations, and proactive engagement in advancing water research, the Coolfood team can continue to shape the future of climate smart dining.

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