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An Ecologically Sustainable & Healthy Diet for All:

A Dive into the True Meaning of Cost

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Introduction

As of 2022, 17 million U.S. households (or 12.8% of the country) were considered to be food insecure. According to the U.S. Department of Agriculture (USDA), food insecure individuals are defined as those experiencing both low food insecurity, defined by “reports of reduced quality, variety, or desirability of diet. Little or no indication of reduced food intake”, or very low food insecurity, described as “reports of multiple indications of disrupted eating patterns and reduced food intake” (*Definitions of Food Security*, 2023). The statistics indicate that 5.1 million U.S. households have access to sufficient calories, but are severely lacking in nutrition. While it may not be apparent from these statistics, the United States’ agricultural sector produces far more food than is needed to feed the entirety of the nation, exporting billions of dollars of agricultural goods each year (*U.S. Agricultural Trade at a Glance*, 2024). The USDA’s Economic Research Service describes this phenomenon below:

> With U.S. agricultural output growing faster than domestic demand for many products, U.S. farmers and agricultural firms have been relying on export markets to sustain prices and revenues. As a result, U.S. agricultural exports have grown steadily over the past 25 years—reaching $196 billion in 2022, up from $62.8 billion in 1997 (*U.S. Agricultural Trade at a Glance*, 2024).

In addition to inefficiencies in just distribution, the agricultural sector incrues enormous environmental costs. The agricultural sector is responsible for 72% of all freshwater use, as well as a major driver of planetary boundary overshoots and greenhouse gas emissions, making our goals regarding agricultural production and “efficiency” an incredibly significant point of investigation (United Nations, 2023; Campbell, 2017; EPA, 2023). Our current agricultural system disregards sustainability in favor of a design aimed towards short term, large-scale production, and yet does not fully achieve the theoretical shorter-term goals associated with a food system: feeding people.

As grocery stores remain packed and people remain food insecure, huge amounts of food are going to waste. Currently in the United States, 30-40% of the food supply is wasted at the retail and consumer levels (FDA, 2024). In the year 2010, this amounted to 133 billion pounds of food wasted, valued at a $161 billion financial loss (FDA, 2024). Despite a federal goal of cutting food waste in half by 2023, retail and consumer spheres wasted 66 million tons (132 million lbs) in 2019, and food and beverage manufacturing and processing sectors wasted an additional 44 million tons (88 billion lbs), producing 220 billion pounds of total waste in one year (FDA, 2024; Krause et al., 2023). It is very difficult to find grocery stores and food retailers who make their waste counts publicly available, but international grocery conglomerate Ahold Delhaize self-reports food waste data each year, in accordance with the Dutch Financial Supervision Act. Ahold Delhaize is made up of 16 grocery store chains, including major companies in the United States such as Hannaford and Stop & Shop (Koninklijke Ahold Delhaize N.V. and its Affiliates, 2024). In 2023, 225,425 tons of food were wasted by the company, amounting to 3.17 trillion pounds of food per million euros of profit (Koninklijke Ahold Delhaize N.V., 2024). Only 25% of unsold food was donated to feed people, with the rest heading to dumpsters (Koninklijke Ahold Delhaize N.V., 2024). These shocking statistics are stark evidence of the failure of the current system in place. In defining efficiency, is an efficient food system not one that funnels food from those who produce it to those who need it, without significant losses along the way?

Food waste incurs a severe environmental cost as well as produces a total lack of use utility for all inputs throughout the food manufacturing and distribution process. The loss of consumable food through corporate food waste is marked by the total waste of energy inputs that are taken to produce food, the lack of success in meeting a caloric and nutrient need, and the further ecological and economic harm that is carried out through letting the food decompose undigested. As measured by the United States' Environmental Protection Agency, food waste comprises 58% of methane emissions in municipal solid waste landfills, but only 24% of the waste (Krause et al., 2023). On top of the simple frustration of food going to waste rather than reaching the mouths of those in need, food waste accumulates large processing costs and has layers of negative impacts on consumer access to food.

Food exists as an essential resource, meaning that regardless of fluctuations of price, market demand should remain relatively stagnant (only falling significantly in the case of mass inability to pay). Due to the inelastic demand of food, waste decreases supply and drives food prices higher, as people must still pay for food regardless of price, allowing sellers to profit off of scarcity. The current market system results in suppliers financially benefiting from wasted food (through decreased supply allowing for increased revenue per unit) and creates economic disincentives for distributing food for free, even if it would otherwise be discarded. If efficiency is defined by an ability to meet goals through the most direct translation of energy to product, then the construct of efficiency is entirely dependent on what those goals are collectively decided or assumed to be. In the case of the food system, the goal of profit maximization does not align with the goals of just distribution, farm security, or minimizing environmental impact. There is a misalignment of goals and values in the food system that causes the essential objectives of food security and ecological health to be placed on the backburner. In this paper it will be argued that if efficiency were to be redefined according to the true goals and markers of a successful food system, the system would have to be entirely redefined.

While there have been explorations into the cost of ending hunger via financial assistance, I have been unable to find research into the costs of a program that optimizes sustainability, health, and affordability of food from farm to table. The U.S. Department of Agriculture's Supplemental Nutrition Assistance Program (SNAP, often known as food stamps) attempts to meet nutritional needs for low income individuals, but faces many shortcomings. There are modest attempts at improving diets of SNAP recipients, such as SNAP's rewards programs with farmers markets to encourage consumption of healthy local foods (*SNAP Healthy Incentives*, 2023). However, these initiatives have been provenly unsuccessful in resolving hunger and nutrient deficiency in the United States (*SNAP Healthy Incentives*, 2023). Presently, SNAP recipients report that benefits that are intended to last for one month are often depleted after one or two weeks (Carlson et al., 2021). Aside from food stamps not applying to hot meals and alcohol, there are no restrictions or substantial financial incentives to encourage consumers to expand their diets to consume more fresh and nutritious foods (*What Can SNAP Buy?*, 2023).

Relating to this, many low income communities are located in "food deserts", defined by the USDA as "Low-income census tracts with a substantial number or share of residents with low levels of access to retail outlets selling healthy and affordable foods" (*Mapping Food Deserts in the United States*, 2011). Food deserts tend to form when grocery stores that carry healthier, and hence generally more expensive, foods choose not to invest in low income areas where residents may have limited means to purchase their food products. SNAP's underestimation of need and lack of attention to nutrition, results in the program failing to create a sufficient demand for healthy foods that is capable of countering the more systemic cycle of food deserts.

A reshaping of our food system as a whole is necessary to deal with the drastic challenges we are facing now and in the future. This paper aims to open discussion to the idea of cutting the market out of the U.S. food system to eliminate abstract inefficiencies that prioritize profit over long-term sustainability and food access. An objective of this paper is to propose a mechanism for resolving the gap between production and distribution, focusing on redefining the meaning of agricultural efficiency to be a food system that achieves the goal of getting food from farm to table while minimizing waste, externalities, and hunger. To do this, we will carry out seven objectives aimed at deriving an illustrative cost estimate for providing all residents of the United States with an ecologically sustainable and healthy diet at no cost to the consumer. Objective 1 aims to determine the cost of providing the USDA's Thrifty Food Plan (TFP) diet to all U.S. residents. Objective 2 consists of a literature review aimed at narrowing down what a healthy and sustainable diet consists of in both conventional and local, agroecological agriculture. Objective 3 defines how physiological health is measured for the purpose of our modeling, focusing on calculating the nutrient content of foods as well as the nutritional needs of the average U.S. resident. Objective 4 will define the measures of ecological health for the purposes of this study, which uses greenhouse gas (GHG) emissions as a proxy for environmental damage. Objective 5 describes the calculations for representative price estimates for food groups utilized in the models. Objective 6 will tie together Objective 2 through Objective 5 in creating linear programming (LP) models that will minimize emissions or cost while meeting nutritional needs under two separate scenarios. One scenario will determine a sample diet with the food group inputs of a vegan diet, and utilize prices and emissions for conventional agriculture. The second scenario will determine a sample diet using the food groups of a vegan diet plus eggs, utilizing prices for organic agriculture and emissions for local, agroecologically grown food. The methods of Objective 4 and Objective 5 will additionally be applied to determine cost and emissions estimates for the average U.S. diet today, as well as for the sample diet put together by the USDA's Thrifty Food Plan. This study sets out to prove that providing an ecologically sustainable and healthy diet to all residents of the United States is an economically sound investment that prioritizes future goals of long-term planetary and human health.

Methods

Objective 1:

Our first objective is based upon the theoretical expansion of the USDA's Supplemental Nutrition Assistance Program (SNAP) to serve all residents of the United States, rather than only those who are deemed to be sufficiently food insecure and otherwise qualified. SNAP functions by allotting a certain monetary value in food stamps or credits that can be utilized to buy food that is ready for sale in grocery stores. Food stamps can be used for any food items that are not hot at the time or purchase, nonalcoholic beverages, and seeds and plants that produce food (*What Can SNAP Buy?*, 2023). The maximum benefit allotment that SNAP delegates to individuals and families is based upon food cost determinations presented in the USDA's Thrifty Food Plan, which estimates weekly grocery costs for a family of four with a limited budget, as well as provides weekly and monthly cost estimates for each age-sex group of the population. The plan uses an optimization model to maximize both cost efficiency and health. Using the Thrifty Food Plan model along with population statistics for the United States, I intend to apply the estimated "thrifty" food costs to all residents. To do so, I will multiply the determined monthly cost for each age-sex group by the number of individuals who make up that age-sex group in the U.S. population (Thrifty Food Plan, 2021; Census.gov, 2023). The described calculations will allow me to determine an illustrative annual cost estimate for meeting the nutritional needs of all residents. SNAP assistance has been reported as an underestimate of the amount of food needed by participants, with many reporting that food meant to last one month frequently lasts as little as one week. In order to account for this, an additional illustrative cost estimate of the Thrifty Food Plan will be determined using current market prices, alongside an approximation of GHG emissions associated with the suggested TFP diet, utilizing the methods described in Objectives 4 and 5.

Objective 2:

To provide a basis for this study, we conducted a literature review to select a diet maximizing ecological sustainability and human health based on relevant research. After conducting the literature review on healthy and ecologically sustainable diets, it was determined with wide support that within the current conventional agricultural system, a vegan diet best considers the concerns of planetary and human health (Pais et al., 2022; Seves et al., 2017; Tukker et al., 2011; van Dooren et al., 2014; Macdiarmid, 2012; Liu et al., 2017; Jenkins et al., 2009; Gussow, 1995 Allen et al., 2014). Due to the constraints of this study being a simplistic mathematical illustration based upon currently available data, the nuance of animals in agriculture cannot be properly incorporated. Based upon the findings of the literature review, eggs will be considered in one analysis minimizing cost and one analysis minimizing carbon emissions (Vaarst et al., 2015; Mock, 2010; Mechkirrou et al., 2021; BBC, 2012). As chickens kept for the purpose of household waste reduction are specifically associated with a local food production system, eggs will be incorporated into the linear programming models focused upon reducing the cost and

GHG emissions of a "local, agroecologically grown" diet, but a vegan diet without eggs will be considered in the models using GHG emissions for conventionally grown foods.

Objective 3:

To determine nutrient content of food groups, USDA data was first utilized to determine the most commonly consumed items in each food category, and the nutrient contents of each of these food items were averaged, providing a rough estimate of nutritional profiles (*Table 1*; *Tables 3-8*). For Fruits (general), Vegetables (general), and Nuts, USDA Economic Research Service data on U.S. popular consumption was used to determine the most culturally consumed food items in each category, and for Grains (general) USDA data on per capita availability by grain was utilized **(***Table 1***)**. USDA descriptions were additionally used to determine which food items to incorporate into calculations for the Beans and Peas category **(***Table 1***)**. The calculations used to determine the average nutrient content of each food group are described in *Table 1*, with details shown in *Tables 4-8* and results presented in *Table 3*. Nutritional data for the food groups (Fruits (general), Vegetables (general), Grains (general), Beans and Peas, and Nuts) is represented as the amount of each nutrient or number of calories found in one kg of that food on average, in order to align with the GHG emissions units (kg/kg) utilized in Objective 6.

Following the calculations of nutritional content in food, the average nutritional requirements of the U.S. population were then estimated (*Table 1)*. For each nutrient, the percent of the population that each life stage (age-sex) group composes was used to determine a weighted average for each nutrient requirement, aimed at representing the average U.S. resident (Census.gov, 2023). For caloric intake, as recommendations vary by activity level, the recommended values for "moderately active" males and females were used in calculations in order to provide a middle value **(**Institute of Medicine, 2002**)**. The weighted average for recommended caloric intake was used as a middle value, with the minimum calorie requirement determined as 200 calories below this value, and the maximum calorie constraint determined to be 200 calories above this value. In all calculations, children under a year old were excluded, as they would not be consuming very similar foods to the rest of the population and would disproportionately skew results. Because of the exclusion of this life stage group (1.06% of the population), the population percentages used to weight each nutrient requirement were slightly skewed in calculations (not adding up to 100%). To resolve this, 1.06% was divided by the number of life stage groups remaining in the data and this value of 0.00075714285 was added to each group. Evenly spreading the difference should result in no change to the expected results of the calculations.

Objective 4:

The GHG emissions data utilized in the linear programming models are sourced from Skyler Knox Perkins' University of Vermont graduate thesis, titled "Becoming Eco-Logical With Second-Order Systems Theory: Sustainability In Re-Organization Of Economies And Food Systems" (Perkins, 2018). For the purposes of this illustrative study, GHG emissions are used as a proxy for environmental harm. While wildly insufficient for measuring true environmental costs, GHG emissions data is an easily calculable value that is able to successfully serve the purpose of assessing an approximate cost estimate. Additionally, organic prices were utilized in the models focusing on the production of local, agroecologically grown food to represent average price premiums in these scenarios.

Objective 5:

Food price estimates were derived from data published by the St. Louis Federal Reserve Bank economic research services, and supplemented with Hannaford supermarket prices when Federal Reserve Bank data was out of date (determined as price averages reflecting trends prior to 2020) or unavailable. Data for organic prices were based on Hannaford store prices, as organic prices were not published by the Federal Reserve Bank. In determining average U.S. prices for broader food groups such as “Vegetables” or “Beans and Peas”, prices for each of the representative food items within each food group were averaged to determine the most accurate cost value for that food group (*Table 1)*.

Objective 6:

For the purpose of this illustration, linear programming will be used to determine four sample diets that meet nutritional needs while minimizing either cost or GHG emissions (used as a proxy for environmental harm). Linear programming is used to determine the optimal solution to problems with a large number of possible courses of action. To do so, models aim to minimize or maximize for a set variable while meeting inputted constraints. In this case, Solver in Excel was used to determine a sample diet while either minimizing for emissions or for cost and meeting nutritional constraints set to achieve a healthy diet. Two sets of models were utilized. The first set of models is constrained as a vegan diet and is based upon emissions and market prices for conventional agricultural production. The second set of models includes eggs as a dietary option and is based upon emissions data for local, agroecologically grown food and market prices for organic food (*Table 2*). For each diet pre-constraint, we ran one linear programming model to minimize GHG emissions and one linear programming model to minimize financial cost. The equations used in the model are as follows, using the example of cost minimization (Gass, 1985).

m = the number of nutrients

n = the number of food groups

a_{ij} = the amount of the *i*th nutrient in 1 kg of the *j*th food group

b_i = the recommended amount of the *i*th nutrient

c_j = the cost per kilogram of the *j*th food group (For Carbon Minimizations: the emissions per kilogram of the *j*th food group)

x_j = the number of kilograms of the *j*th food group to be purchased

d_i = the maximum amount of the *i*th nutrient

Total Amount of *i*th nutrient in all purchased food:

$$a_{i1}x_1 + a_{i2}x_2 + \ldots + a_{in}x_n$$

Minimize Cost Function:

$$c_1x_1 + c_2x_2 + \ldots + c_nx_n$$

While being greater than or equal to daily recommended intake values of the *i*th nutrient, making it subject to the conditions…

$$a_{ij}x_j \geq b_i$$

$$a_{1j}x_j \leq d_1$$

And

$$x_n \geq 0$$

Results & Discussion:

The results of Objective 1 estimate the total cost of providing SNAP-style access to USDA's Thrifty Food Plan diet to all U.S. residents at just under 350 billion U.S. dollars per year, paired with 659.13 million metric tons of associated GHG emissions. Compared to the 28 trillion dollar GDP of the United States in 2023, this "SNAP For All" cost estimate is hardly significant, making up just 1.22% of GDP. To put this in context, this value represents less than five months of traditionally measured economic growth (GDP) for the country (Bureau of Economic Analysis, 2024). For the average person, the potential living standard decline from a slightly lower GDP would be countered by the financial relief of free food. However, SNAP services provide a severe underestimate of what it takes to feed the average person a nutritious diet. The Thrifty Food Plan, a sample weekly food plan and corresponding estimate used by SNAP as a basis for food stamp benefits, is notorious for falling short of meeting recipients' needs. It has been found that approximately one quarter of SNAP recipients deplete their monthly benefits within one week, and about half of recipients deplete monthly benefits within two weeks (Carlson et al., 2021). In order to investigate this need gap, the cost of the Thrifty Food Plan diet was additionally approximated using recent market price data, with a resulting cost estimate of $1.06 trillion (*Table 1*; *Table 2*). While not accounting for a potential underestimate of caloric and nutritional needs, this cost estimate is expected to serve as a more accurate approximation of the cost of eating according to the USDA's Thrifty Food Plan. The market price estimate for the TFP is more aligned with the value determined through linear programming, which provides cost estimates that minimize for GHG emissions or for cost in a variety of scenarios while meeting nutritional needs (as laid out in *Table 1*). As determined through linear programming, it would cost approximately $1.5 trillion to provide an ecologically healthy and sustainable diet to all U.S. residents for one year using price and emissions data for conventionally grown agriculture (*Table 1; Table 2)*. The models aimed at minimizing associated cost and emissions for a local, agroecologically grown diet approximated a cost of $1.8 trillion, under the uncertain assumption of Organic price premiums remaining in place in the way that they currently exist (*Table 1; Table 2)*. Providing the determined "ecologically sustainable and healthy diet" would have 80.5 million metric tons of associated GHG emissions with conventional agriculture, and 48.3 million tons through a local, agroecologically grown system. Using the EPA's current estimates of the social cost of greenhouse gas emissions, each diet would have a "real cost" (social cost of GHG emissions added on to monetary cost) of $3.6 trillion and $3.06 trillion, respectively (*Table 1, Table 2;* EPA, 2020; Ritchie, 2024). Similar values were calculated for the current diet of the average U.S. resident and for the Thrifty Food Plan using the same methods, producing "real costs" of each. Currently, the average American diet has an associated "real cost" of $37.72 trillion, combining an approximate financial cost of $1.6 trillion with additional cost attached to the 1.45 billion metric tons of GHG emissions associated with the diet (*Table 1; Table 2)*. The USDA's published Thrifty Food Plan, based on nutritional adequacy, cost minimization, and current eating trends, has an associated "real cost" of approximately $18.2 trillion (*Table 1; Table 2)*. As shown by these results, simple changes in diet (when carried out on a large scale) can have astronomical effects on greenhouse gas emissions without astronomical increases in price.

It is important to recognize that the linear programming models utilized in this study are subject to several binding constraints that could have limited the number of diets able to be produced by the model. The diets produced by the LP model reach the maximum caloric requirement, as well as the minimums for various nutrients, suggesting that if the constraints on nutrient and caloric requirements were to be altered or loosened, it could impact the resulting diet. The cost and emissions estimates in this study are intended to serve solely as illustrative estimates, as the true cost of large-scale policy changes are influenced by many factors that are not entirely predictable. The derived cost estimates do not take into account administrative costs, potential inflation of food prices, or environmental costs beyond measured GHG emissions. A large-scale economic shift of this sort (the removal or partial removal of food from the market system), would likely have a wide variety of economic impacts that may be difficult to predict, especially considering the high fluctuation of food prices in the current system. However, if the general public being given access to healthy food were to cause a dramatic increase in price, it would serve as distinctive evidence that nutritious food purchases of this scale are not the current norm, providing further evidence of a necessity for change.

The derived cost estimate of $1.5 trillion from the linear programming model for conventional agriculture makes up approximately 5.36% of the GDP of the United States, which is not dissimilar to the current-dollar GDP annual increase of 5.1% experienced by the country in 2023, while still drastically reducing emissions (Bureau of Economic Analysis, 2024). As this scenario is specifically aimed at improving dietary health through provision of healthy foods, it would be expected that such an investment would significantly improve physiological health across the nation. Currently, healthcare in the United States accrues a significant bill, with poor diets being a major driver of increased costs. In 2019, unhealthy diets were responsible for nearly 20% of healthcare costs resulting from ischemic heart disease, stroke, and type 2 diabetes in the United States (Jardim et al. 2019). These costs amounted to 50 billion USD, or approximately $300 per U.S. resident, and are part of a much greater issue of nutritional deficiency and food access in the nation (Jardim et al. 2019).

Moreover, agriculture as it exists today is a major driver behind the planetary boundaries of land use change and freshwater use, as well as serving as a notable contributor to climate change (Campbell, 2017). Land use change, freshwater use, and climate change, are the planetary boundaries currently at highest risk, but agriculture additionally contributes to numerous planetary boundaries that are tentatively remaining in the safe zone (Campbell, 2017). The agricultural sector alone was responsible for 9.4% of all emissions in the year 2022 (EPA, 2023). Current EPA data shows approximately 6,343 million metric tons of CO_2 emissions produced from agriculture in 2022, with no approximation of methane emissions or N_2O emissions, which have the most direct tie to agriculture and are far more potent greenhouse gasses (EPA, 2023). In spite of this, the majority of government subsidies are directed at cash crop production operations such as corn and soybeans, that have limited and often negative ecological and physiological impacts on the planet and population at large. There is some federal investment in improving diets and increasing the sustainability of food purchased at the consumer level, but these initiatives have carried on without substantial success, as the problems of food insecurity and unsustainable agriculture remain prevalent. If the funding directed towards agriculture were to be decisively aimed at resolving these problems, the intertwined issues of hunger and poor agricultural practices could be markedly diminished. While this cost estimate does not incorporate cost variations in the construction of food and agricultural systems entirely separate from markets, our paper aims to argue that markets are entirely ineffective in allocating food. Due to its inelastic demand, food prices can be increased artificially without large decreases in consumption, as there is no alternative good to food. As described previously, the market system creates a dynamic in which corporate food waste increases profits as there is decreased supply paired with stagnant demand. In addition to this, if food can be turned for a profit, in the eyes of the producer, it economically serves them better in the garbage than in someone’s hands for free. Providing food directly to consumers in a non-market system would cut out the artificially constructed inefficiencies in the food system by deconstructing incentives to keep food away from those who need it.

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Appendix

Purpose of Data	Data Information Used	Manipulation of Data	Sources
Food Groups in All Linear Programming Models	Core Food Groups: Fruit, Vegetables, Grains, Beans & Peas, Nuts	N/A	Perkins, 2018
Food Groups in Models for Vegan, Conventionally Grown Diet	Core Food Groups	N/A	Perkins, 2018
Food Groups in Models for Local, Agroecologically Grown Diet (Vegan + Eggs)	Core Food Groups and Eggs	N/A	Perkins, 2018
GHG Emissions for Food Groups	GHG Emissions in kg/kg	N/A	Perkins, 2018
Nutrients Included in Models	Macronutrients, Vitamins, 9 Essential Amino Acids, Calories	N/A	Food and Nutrition Board, Institute of Medicine, National Academies, 2011; Food and Nutrition

			Board, National Academies, 2019; U.S. Department of Health and Human Services, n.d.; Institute of Medicine, 2002;
Minimums for Nutrient Intakes	Recommended Daily Allowances; Population Size by Age-Sex Group	Weighted average of Recommended Daily Allowances by multiplying fraction of population size in each age-sex group by the amount of nutrient recommended for that group. Used data for males and females ages 1-71+.	Food and Nutrition Board, Institute of Medicine, National Academies, 2011; Food and Nutrition Board, National Academies, 2019; U.S. Department of Health and Human Services, n.d.; National Research Council (US) Subcommittee on the Tenth Edition of the Recommended

			Dietary Allowances, 1989
Minimum and Maximum for Calories	Estimated Calorie Needs per Day by Age/Sex/Physical Activity Level; Population Size by Age-Sex Group	Weighted average of Estimated Calorie Needs by multiplying fraction of population size in each age-sex group by the amount of calories recommended for that group. Used data for moderately active males and females ages 2-76+.	Census.gov, 2023; Institute of Medicine, 2002
Average Nutrient Data for Fruits	Raw Fruits: Apples, Oranges, Bananas, Grapes, Strawberries, Pineapple, Watermelon	Conversion from per 100g to per kg of food. Each nutrient averaged.	FoodData Central, USDA
Average Price Data for Fruits	Raw Fruits: Apples, Oranges, Bananas, Grapes, Strawberries, Pineapple, Watermelon	Conversion from per lb to per kg. Prices averaged.	Federal Reserve Bank of St. Louis, 2024; Hannaford Bros. Co. LLC., 2023
Average Nutrient Data for Vegetables	Raw Vegetables: Potatoes, Tomatoes, Onions, Carrots, Head Lettuce, Sweet Corn, Romaine & Leaf Lettuce	Conversion from per 100g to per kg of food. Each nutrient averaged.	FoodData Central, USDA

Average Price Data for Vegetables	Raw Vegetables: Potatoes, Tomatoes, Onions, Carrots, Head Lettuce, Sweet Corn, Romaine & Leaf Lettuce	Conversion from per lb to per kg. Prices averaged.	Federal Reserve Bank of St. Louis, 2024; Hannaford Bros. Co. LLC., 2023
Average Nutrient Data for Grains	Wheat Flour (whole, unenriched), Wheat Flour (all-purpose, enriched, bleached), Wheat Flour (all-purpose, enriched, unbleached), Wheat Flour (all-purpose, unenriched, unbleached), Brown Rice (long grain, unenriched, raw), Brown Rice (long grain, unenriched, raw), White Rice (long grain, unenriched, raw), Corn Flour (yellow, fine meal, enriched), Rye Flour, Oat flour (whole grain), Oats (whole grain, steel cut), Oats (whole grain, rolled, old fashioned), Barley Flour	Conversion from per 100g to per kg of food. Each nutrient averaged.	FoodData Central, USDA
Average Price Data for Grains	Wheat Flour (white, all-purpose), Brown Rice (long grain,	Conversion from per lb to per kg. Prices averaged.	Federal Reserve Bank of St. Louis,

	unenriched, raw), Brown Rice (long grain, unenriched), White Rice (long grain, unenriched, raw), Corn Flour (yellow, fine meal, enriched), Rye Flour, Oats (whole grain, steel cut), Oats (whole grain, rolled, old fashioned), Barley Flour		2024; Hannaford Bros. Co. LLC., 2023
Average Nutrient Data for Beans & Peas	Cooked, Boiled Without Salt: Kidney Beans, Pinto Beans, Great Northern (White Beans), Black Beans, Lima Beans, Fava Beans, Chickpeas, Cowpeas (black eyed peas), Pigeon Peas, Split Peas, Lentils	Conversion from per 100g to per kg of food. Each nutrient averaged.	FoodData Central, USDA
Average Price Data for Beans & Peas	Beans, Dried, Any Type	Conversion from per lb to per kg.	Federal Reserve Bank of St. Louis, 2024
Average Nutrient Data for Nuts	Raw Nuts: Almonds, Hazelnuts, Pecans, Walnuts, Macadamias, Pistachios	Conversion from per 100g to per kg of food. Each nutrient averaged.	FoodData Central, USDA

Average Price Data for Nuts	Raw Nuts: Almonds, Hazelnuts, Pecans, Walnuts, Macadamias, Pistachios	Conversion from per lb to per kg. Prices averaged.	Hannaford Bros. Co. LLC., 2023
Social Cost of GHG Emissions	Estimates of the Social Cost of Greenhouse Gases (SC-GHG), 2020-2080 (2020 dollars); Breakdown of carbon dioxide, methane and nitrous oxide emissions by sector	Weighted average of social costs of methane and nitrous oxide by multiplying associated cost with fraction of agricultural emissions that are methane or that are nitrous oxide. 2% Near-Term Rate data used. Added on to monetary cost of diets to determine "real cost".	EPA, 2020; Ritchie et al., 2024

Table 1. Assumptions of Data in Use.

Diet Name	**Food Groups**	**GHG Emissions**	**Cost**	**Real Cost (including social cost of carbon)**
Current U.S. Diet	14.68% Vegetables, 13.84% Dairy, 7.78% Fruits, 7.23% Nuts/Seeds/Soy Products, 6.9%	1.45 billion metric tons	$1.6 trillion	$37.72 trillion

	Beans/Peas/Lentils, 6.54% Grains, 4.67% Seafood, 3.83% Meats/Poultry/Eggs			
Thrifty Food Plan	29.3% Dairy, 20.8% Vegetables, 19.1% Fruits, 10% Grains, 5% Miscellaneous, 4.9% Poultry, 4.3% Beans/Peas/Lentils, 2.1% Seafood, 1.6% Poultry, 1.5% Eggs, 1.4% Nuts/Seeds/Soy Products	659.13 million metric tons	USDA Price Data: $340 billion; Market Price Data: $1.06 trillion	$18.2 trillion
Low Cost, Low Emissions Diet (Conventionally Grown)	64% Vegetables, 26.3% Grains, 2.3% Beans and Peas, 7.4% Nuts	80.5 million metric tons	$1.5 trillion	$3.6 trillion
Low Cost, Low Emissions (Local, Agroecologically Grown)	64% Vegetables, 26.3% Grains, 2.3% Beans and Peas, 7.4% Nuts	48.3 million metric tons	$1.8 trillion	$3.06 trillion

Table 2. Breakdown of Diets.

FOOD (PER KG)	**Fruits**	**Vegetables (general)**	**Grains (general)**	**Beans and Peas**	**Nuts**

Calories	527.143	414.286	1786.667	1140.000	6415.000
Calcium (mg)	148.571	177.143	1403.333	431.818	1208.333
CHO (g)	135.200	91.071	343.667	223.455	176.933
Protein (g)	6.729	14.414	64.367	78.564	147.883
Vitamin A (µg)	950.000	3254.286	16.667	818.182	160.000
Vitamin C (mg)	273.000	94.714	0.333	8.182	20.500
Vitamin E (mg)	1.400	2.157	1.783	2.289	76.267
Thiamin (mg)	0.491	0.687	2.158	1.577	5.388
Riboflavin (mg)	0.403	0.341	1.180	0.710	3.078
Niacin (mg)	3.636	8.051	27.567	7.156	18.860
Vitamin B6(mg)	1.144	1.009	0.915	1.135	4.823
Folate (µg)	151.429	187.143	420.000	1269.091	560.000
Copper (mg)	0.549	0.556	1.328	2.361	12.282
Iron (mg)	2.486	2.989	19.117	20.809	34.017
Magnesium (mg)	118.570	159.430	316.670	439.540	1560.000
Phosphorus (mg)	155.714	402.857	938.333	1315.450	3411.670
Selenium (µg)	2.857	6.143	201.500	29.364	61.000
Zinc (mg)	0.957	2.514	8.400	10.673	28.960

Total lipid (fat) (g)	2.243	3.386	17.617	113.318	618.950
Fiber, total dietary (g)	17.000	32.571	34.833	72.727	94.167
Potassium (mg)	1708.570	2502.860	881.667	3804.550	6006.670
Manganese (mg)	3.383	53.754	7.920	5.293	16.817
Vitamin K (µg)	29.000	212.857	23.167	52.182	61.167

Table 2. Nutritional Content of Food Groups. (*FoodData Central Search Results*, n.d.)

Averages for Grains	**Wheat Flour (W, UE)***	**Wheat Flour (AP, E, B)***	**Wheat Flour (AP, E, UB)***	**Wheat Flour (AP, UE, UB)***	**Brown Rice (LG, UE, R)***	**White Rice (LG, UE, R)***	**Corn Flour (Y, FM, E)***	**Rye Flour**	**Oat flour (W)***	**Oats (W, SC)***	**Oats (W, Ro, OF)***	**Barley Flour**	***Average***
Conventional Price ($/kg)	-	1.25	-	-	3.73	2.24	4.54	N/A	N/A	5.62	4.03	3.51	*3.56*
Organic Price ($/kg)	-	5.73	-	-	4.70	4.70	N/A	7.34	N/A	N/A	6.28	N/A	*5.75*
Calories (kcal)	346	375	367	370	368	370	372	351	386	379	379	357	*368.333*
Calcium (mg)	38	19	21	22	8	4	0	32	43	51	46	36	*26.667*

CHO (g)	71.2	77.3	73.2	74.6	76.7	80.3	80.8	77.2	69.9	69.8	68.7	77.4	*74.758*
Protein (g)	15.1	10.9	13.1	12	7.25	7.04	6.2	8.4	13.2	12.5	13.5	8.72	*10.659*
Thiamin (mg)	0.504	0.939	1.05	0.298	0.326	0.065	0.662	0.216	0.39	0.334	0.406	0.225	*0.451*
Riboflavin (mg)	0.128	0.443	0.467	0	0.102	0.08	0.354	0.17	0.161			0.146	*0.2051*
Niacin (mg)	5.55	6.74	7.07	1.59	6.27	1.43	5.75	1.16	1.94	0.926	0.993	5.94	*3.780*
Vitamin B6(mg)	0.268	0.066	0.079	0.085	0.161	0.058	0.13	0.164	0.148	0.119	0.135	0.2	*0.134*
Folate (µg)	39	160	159	23	N/A	N/A	155	N/A	35	30	32		*79.125*
Copper (mg)	0.452	0.155	0.172	0.212	0.266	0.214	0.082	0.338	0.443	0.411	0.428	0.394	*0.297*
Iron (mg)	3.86	5.62	5.41	1.18	1.24	0.14	4.44	2.54	4	3.8	4.34	3.3	*3.322*
Magnesium (mg)	136	26.7	33.3	36.1	15	26.5	30.1	95.4	125	129	126	88	*72.258*
Molybdenum (Rg)	58.5	37.6	27.7	42.6	63.9	64.2	16.4	75.5	125	164	160	57.4	*74.4*
Phosphorus (mg)	352	108	115	134	303	108	92	280	372	417	387	234	*241.833*
Selenium (µg)	23.6	15.7	14.2	20.1	14.8	6.6	8.3	16.6	38.2	29	25.4	13.1	*18.8*
Zinc (mg)	3.24	0.72	0.9	1.15	1.85	1.35	0.62	2.33	2.75	2.84	2.74	2.14	*1.886*
Total lipid (fat) (g)	2.73	1.48	1.48	1.7	3.31	1.03	1.74	1.91	6.31	5.8	5.89	2.45	*2.986*
Fiber, total dietary (g)	10.6	N/A	N/A	3	4.3	2.77	4.3	17.9	12.9	12	10.4	16.2	*9.437*

Total Sugars (g)	N/A	N/A	N/A	N/A	N/A	N/A	1.04	N/A	N/A	N/A	N/A	N/A	*1.04*
Potassium (mg)	376	136	135	150	250	82	144	434	373	376	350	367	*264.417*
Sodium (mg)	3	2	4	2	2.5	0	0	2.5	4	2.5	1	20	*3.625*
Manganese (mg)	3.56	0.758	0.875	0.819	2.7	0.981	1.172	2.13	3.26	3.41	3.23	1.18	*2.006*
Niacin (mg)	5.55	6.74	7.07	1.59	6.27	1.43	5.75	1.16	1.94	0.926	0.993	5.94	*3.780*
Vitamin K (µg)	376	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	*376*

Table 3. Nutrient Content and Market Price of Grains. (Federal Reserve Bank of St. Louis, 2024; *FoodData Central Search Results*, n.d.; Hannaford Bros. Co. LLC., 2023)

***Key:** W (whole), E (enriched), UE (unenriched), B (bleached), UB (unbleached), AP (all-purpose), LG (long grained), R (raw), OF (old fashioned), SC (steel cut), Ro (rolled), Yellow (Y), FM (fine meal)*

Average for Nuts	Almonds	Hazelnuts	Pecans	Walnuts	Macadamias	Pistachios	*Average*
Conventional Price ($/kg)	16.18	40.50	17.61	14.30	36.86	22.02	*24.58*
Organic Price ($/kg)	29.94	N/A	51.68	43.54	N/A	N/A	*41.72*
Calories (kcal)	579.000	628.000	691.000	654.000	716.000	581.000	*641.500*

Calcium (mg)	269.000	114.000	70.000	98.000	70.000	104.000	*120.833*
CHO (g)	21.600	16.700	13.900	13.700	12.830	27.430	*17.693*
Protein (g)	21.200	14.950	9.170	15.200	7.790	20.420	*14.788*
Vitamin A (µg)	2.000	1.000	59.000	21.000	0.000	13.000	*16.000*
Vitamin C (mg)	0.000	6.300	1.100	1.300	0.700	2.900	*2.050*
Vitamin D (Rg/d)	0.000	0.000	0.000	0.000	0.000	0.000	*0.000*
Vitamin E (mg)	25.600	15.030	1.400	0.700	0.570	2.460	*7.627*
Thiamin (mg)	0.205	0.643	0.660	0.341	0.710	0.674	*0.539*
Riboflavin (mg)	1.140	0.113	0.130	0.150	0.087	0.227	*0.308*
Niacin (mg)	3.620	1.800	1.170	1.120	2.274	1.332	*1.886*
Vitamin B6(mg)	0.137	0.563	0.210	0.537	0.359	1.088	*0.482*
Folate (µg)	44.000	113.000	22.000	98.000	10.000	49.000	*56.000*
Vitamin B12 (µg)	0.000	0.000	0.000	0.000	0.000	0.000	*0.000*
Copper (mg)	1.030	1.725	1.200	1.590	0.570	1.254	*1.228*
Iron (mg)	3.710	4.700	2.530	2.910	2.650	3.910	*3.402*
Magnesium (mg)	270.000	163.000	121.000	158.000	118.000	106.000	*156.000*
Molybdenum (Rg)	0.000	0.000	0.000	0.000	0.000	0.000	*0.000*
Phosphorus (mg)	481.000	290.000	277.000	346.000	198.000	455.000	*341.167*
Selenium (µg)	4.100	2.400	3.800	4.900	11.700	9.700	*6.100*
Zinc (mg)	3.120	2.450	4.530	3.090	1.290	2,27	*2.896*
Total lipid (fat) (g)	49.900	60.750	72.000	65.200	76.080	47.440	*61.895*

Fiber, total dietary (g)	12.500	9.700	9.600	6.700	8.000	10.000	*9.417*
Total Sugars (g)	4.350	4.340	3.970	2.610	4.140	7.510	*4.487*
Potassium (mg)	733.000	680.000	410.000	441.000	363.000	977.000	*600.667*
Sodium (mg)	1.000	0.000	0.000	2.000	353.000	6.000	*60.333*
Manganese (mg)	2.180	0.000	4.500	3.410	0.000	0.000	*1.682*
Niacin (mg)	3.620	1.800	1.170	1.120	2.274	1.332	*1.886*
Vitamin K (µg)	0.000	14.200	3.500	2.700	0.000	16.300	*6.117*
Lysine (g)	0.568	N/A	0.287	0.424	N/A	N/A	*0.426*
Phenylalanine (g)	1.130	N/A	0.426	0.711	N/A	N/A	*0.756*
Valine (g)	0.855	N/A	0.411	0.753	N/A	N/A	*0.673*
Tryptophan (g)	0.211	N/A	0.093	0.170	N/A	N/A	*0.158*
Threonine (g)	0.601	N/A	0.306	0.596	N/A	N/A	*0.501*
Isoleucine (g)	0.751	N/A	0.336	0.625	N/A	N/A	*0.571*
Methionine (g)	0.157	N/A	0.183	0.236	N/A	N/A	*0.192*
Histidine (g)	0.539	N/A	0.262	0.391	N/A	N/A	*0.397*
Leucne (g)	1.470	N/A	0.598	1.170	N/A	N/A	*1.079*

Table 4. Nutrient Content and Market Price of Nuts. (Federal Reserve Bank of St. Louis, 2024; *FoodData Central Search Results*, n.d.; Hannaford Bros. Co. LLC., 2023)

Average for Fruit	**Apples**	**Oranges**	**Bananas**	**Grapes**	**Strawberries**	**Pineapple**	**Watermelon**	***Total***
Conventional Price ($/kg)	4.39	3.34	1.39	5.20	5.84	N/A	2.84	*3.83*
Organic Price ($/kg)	5.49	4.39	1.74	N/A	24.65	N/A	N/A	*5.34*
Calories (kcal)	52.000	49.000	89.000	67.000	32.000	50.000	30.000	*52.714*
Calcium (mg)	6.000	43.000	5.000	14.000	16.000	13.000	7.000	*14.857*
CHO (g)	13.810	12.500	22.800	17.200	7.680	13.100	7.550	*13.520*
Protein (g)	0.260	0.910	1.090	0.630	0.670	0.540	0.610	*0.673*
Vitamin A (µg)	3.000	259.000	67.000	165.000	13.000	61.000	97.000	*95.000*
Vitamin C (mg)	4.600	59.100	8.700	4.000	58.800	47.800	8.100	*27.300*
Vitamin D (Rg/d)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	*0.000*
Vitamin E (mg)	0.180	0.150	0.100	0.190	0.290	0.020	0.050	*0.140*
Thiamin (mg)	0.017	0.068	0.031	0.092	0.024	0.079	0.033	*0.049*
Riboflavin (mg)	0.026	0.051	0.073	0.057	0.022	0.032	0.021	*0.040*
Niacin (mg)	0.091	0.425	0.665	0.300	0.386	0.500	0.178	*0.364*
Vitamin B6(mg)	0.041	0.079	0.367	0.110	0.047	0.112	0.045	*0.114*
Folate (µg)	3.000	34.000	20.000	4.000	24.000	18.000	3.000	*15.143*
Vitamin B12 (µg)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	*0.000*
Copper (mg)	0.027	0.039	0.078	0.040	0.048	0.110	0.042	*0.055*
Iron (mg)	0.120	0.130	0.260	0.290	0.410	0.290	0.240	*0.249*
Magnesium (mg)	5.000	11.000	27.000	5.000	13.000	12.000	10.000	*11.857*

Molybdenum (Rg)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	*0.000*
Phosphorus (mg)	11.000	23.000	22.000	10.000	24.000	8.000	11.000	*15.571*
Selenium (µg)	0.000	0.000	1.000	0.100	0.400	0.100	0.400	*0.286*
Zinc (mg)	0.040	0.080	0.150	0.040	0.140	0.120	0.100	*0.096*
Total lipid (fat) (g)	0.170	0.150	0.330	0.350	0.300	0.120	0.150	*0.224*
Fiber, total dietary (g)	2.400	2.200	2.600	0.900	2.000	1.400	0.400	*1.700*
Total Sugars (g)	10.390	8.500	12.200	16.200	4.890	9.850	6.200	*9.747*
Potassium (mg)	107.000	166.000	358.000	191.000	153.000	109.000	112.000	*170.857*
Sodium (mg)	1.000	1.000	1.000	2.000	1.000	1.000	1.000	*1.143*
Manganese (mg)	0.000	0.029	0.270	0.718	0.386	0.927	0.038	*0.338*
Niacin (mg)	0.091	0.425	0.665	0.300	0.386	0.500	0.178	*0.364*
Vitamin K (µg)	2.200	0.000	0.500	14.600	2.200	0.700	0.100	*2.900*
Lysine (g)	N/A	0.038	0.050	0.014	0.026	0.026	0.062	*0.036*
Phenylalanine (g)	N/A	0.021	0.049	0.013	0.019	0.021	0.015	*0.023*
Valine (g)	N/A	0.026	0.047	0.017	0.019	0.024	0.016	*0.025*
Tryptophan (g)	N/A	0.009	0.009	0.003	0.008	0.005	0.007	*0.007*
Threonine (g)	N/A	0.018	0.028	0.017	0.020	0.019	0.027	*0.022*
Isoleucine (g)	N/A	0.017	0.028	0.005	0.016	0.019	0.019	*0.017*
Methionine (g)	N/A	0.009	0.008	0.021	0.002	0.012	0.006	*0.010*

Histidine (g)	N/A	0.013	0.077	0.023	0.012	0.010	0.006	*0.024*
Leucne (g)	N/A	0.029	0.068	0.013	0.034	0.024	0.018	*0.031*

Table 5. Nutrient Content and Market Price of Fruits. (Federal Reserve Bank of St. Louis, 2024; *FoodData Central Search Results*, n.d.; Hannaford Bros. Co. LLC., 2023)

AVERAGES FOR VEGETABLES	**Potatoes**	**Tomatoes**	**Onions**	**Carrots**	**Head Lettuce**	**Sweet Corn**	**Romaine & Leaf Lettuce**	***Average***
Conventional Price ($/kg)	2.14	4.51	4.39	2.84	3.70	2.43	6.02	*3.72*
Organic Price ($/kg)	5.14	8.80	4.41	2.98	N/A	5.38	N/A	*5.34*
Calories (kcal)	73.000	18.000	40.000	41.000	17.000	86.000	15.000	*41.429*
Calcium (mg)	6.000	10.000	23.000	33.000	14.000	2.000	36.000	*17.714*
CHO (g)	16.000	3.890	9.340	9.580	3.370	18.700	2.870	*9.107*
Protein (g)	1.810	0.880	1.100	0.930	0.740	3.270	1.360	*1.441*
Vitamin A (µg)	0.000	875.000	2.000	835.000	0.000	196.000	370.000	*325.429*
Vitamin C (mg)	23.300	13.700	7.400	5.900	0.000	6.800	9.200	*9.471*
Vitamin D (Rg/d)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	*0.000*
Vitamin E (mg)	0.000	0.540	0.020	0.660	0.000	0.070	0.220	*0.216*
Thiamin (mg)	0.051	0.037	0.046	0.066	0.056	0.155	0.070	*0.069*
Riboflavin (mg)	0.000	0.019	0.027	0.058	0.000	0.055	0.080	*0.034*

Niacin (mg)	1.580	0.594	0.116	0.983	0.218	1.770	0.375	*0.805*
Vitamin B6(mg)	0.145	0.080	0.120	0.138	0.040	0.093	0.090	*0.101*
Folate (µg)	0.000	15.000	19.000	19.000	0.000	42.000	36.000	*18.714*
Vitamin B12 (µg)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	*0.000*
Copper (mg)	0.130	0.059	0.039	0.045	0.033	0.054	0.029	*0.056*
Iron (mg)	0.370	0.270	0.210	0.300	0.030	0.052	0.860	*0.299*
Magnesium (mg)	22.300	11.000	10.000	12.000	6.300	37.000	13.000	*15.943*
Molybdenum (Rg)	7.800	0.000	0.000	0.000	0.000	0.000	0.000	*1.114*
Phosphorus (mg)	57.000	24.000	29.000	35.000	19.000	89.000	29.000	*40.286*
Selenium (µg)	2.500	0.000	0.500	0.100	0.000	0.600	0.600	*0.614*
Zinc (mg)	0.370	0.170	0.170	0.240	0.170	0.460	0.180	*0.251*
Total lipid (fat) (g)	0.260	0.200	0.100	0.240	0.070	1.350	0.150	*0.339*
Fiber, total dietary (g)	13.800	1.200	1.700	2.800	0.000	2.000	1.300	*3.257*
Total Sugars (g)	0.650	2.630	4.240	4.740	0.000	6.260	0.780	*2.757*
Potassium (mg)	446.000	237.000	146.000	320.000	139.000	270.000	194.000	*250.286*
Sodium (mg)	2.000	5.000	4.000	69.000	16.000	15.000	28.000	*19.857*
Manganese (mg)	0.160	0.114	0.129	0.143	0.082	37.000	0.000	*5.375*
Niacin (mg)	1.580	0.594	0.116	0.983	0.218	1.770	0.375	*0.805*
Vitamin K (µg)	0.800	7.900	0.400	13.200	0.100	0.300	126.300	*21.286*

Table 6. Nutrient Content and Market Price of Vegetables. (Federal Reserve Bank of St. Louis, 2024; *FoodData Central Search Results*, n.d.; Hannaford Bros. Co. LLC., 2023)

AVERAGES FOR BEANS & PEAS	**Kidney beans**	**Pinto beans**	**Great Northern (white beans)**	**Black beans**	**Lima beans**	**Fava beans**	**Chickpeas**	**Cowpeas (black-eyed peas)**	**Pigeon peas**	**Split peas**	**Lentils**	***Averages***
Conventional Price ($/kg)	-	-	-	-	-	-	-	-	-	-	-	*3.63*
Organic Price ($/kg)	3.53	4.45	N/A	4.45	N/A	N/A	N/A	N/A	N/A	4.17	4.39	*4.20*
Calories (kcal)	127.000	143.000	118.000	132.000	115.000	110.000	164.000	97.000	121.000	118.000	114.000	*123.545*
Calcium (mg)	28.000	46.000	68.000	27.000	17.000	36.000	49.000	128.000	43.000	14.000	19.000	*43.182*
CHO (g)	22.800	26.200	21.100	23.700	20.900	19.600	27.400	20.300	23.200	21.100	19.500	*22.345*
Protein (g)	8.670	9.010	8.330	8.860	7.800	7.600	8.860	3.170	6.760	8.340	9.020	*7.856*
Vitamin A (µg)	0.000	0.000	1.000	6.000	0.000	16.000	28.000	831.000	3.000	7.000	8.000	*81.818*
Vitamin C (mg)	1.200	0.800	1.300	0.000	0.000	0.300	1.300	2.200	0.000	0.400	1.500	*0.818*
Vitamin D (Rg/d)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	*0.000*
Vitamin E (mg)	0.030	0.940		0.000	0.180	0.200	0.350	0.220		0.030	0.110	*0.229*

Thiamin (mg)	0.160	0.193	0.158	0.244	0.161	0.097	0.116	0.101	0.146	0.190	0.169	*0.158*
Riboflavin (mg)	0.058	0.062	0.059	0.059	0.055	0.089	0.063	0.148	0.059	0.056	0.073	*0.071*
Niacin (mg)	0.578	0.318	0.681	0.505	0.421	0.711	0.526	1.400	0.781	0.890	1.060	*0.716*
Vitamin B6(mg)	0.120	0.229	0.117	0.069	0.161	0.072	0.139	0.065	0.050	0.048	0.178	*0.113*
Folate (µg)	130.000	172.000	102.000	149.000	83.000	104.000	172.000	127.000	111.000	65.000	181.000	*126.909*
Vitamin B12 (µg)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	*0.000*
Copper (mg)	0.242	0.219	0.247	0.209	0.235	0.259	0.352	0.133	0.269	0.181	0.251	*0.236*
Iron (mg)	2.940	2.090	2.130	2.100	2.390	1.500	2.890	1.120	1.110	1.290	3.330	*2.081*
Magnesium (mg)	45.000	50.000	50.000	70.000	43.000	43.000	48.000	52.000	46.000	36.000	0.494	*43.954*
Molybdenum (Rg)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	*0.000*
Phosphorus (mg)	142.000	147.000	165.000	140.000	111.000	125.000	168.000	51.000	119.000	99.000	180.000	*131.545*
Selenium (µg)	1.200	6.200	4.100	1.200	4.500	2.600	3.700	2.500	2.900	0.600	2.800	*2.936*
Zinc (mg)	1.070	0.980	0.880	1.120	0.950	1.010	1.530	1.030	0.900	1.000	1.270	*1.067*
Total lipid (fat) (g)	0.500	0.650	0.450	0.540	0.380	0.400	2.590	0.380	0.380	118.000	0.380	*11.332*

Fiber, total dietary (g)	7.400	9.000	7.000	8.700	7.000	5.400	7.600	5.000	6.700	8.300	7.900	*7.273*
Total Sugars (g)	0.320	0.340	0.000	0.320	2.900	1.820	4.800	3.230	0.000	2.900	1.800	*1.675*
Potassium (mg)	403.000	436.000	391.000	355.000	508.000	268.000	291.000	418.000	384.000	362.000	369.000	*380.455*
Sodium (mg)	2.000	1.000	2.000	1.000	2.000	5.000	7.000	4.000	5.000	2.000	238.000	*24.455*
Manganese (mg)	0.477	0.453	0.518	0.444	0.516	0.421	1.030	0.572	0.501	0.396	0.494	*0.529*
Niacin (mg)	0.578	0.318	0.681	0.505	0.421	0.711	0.526	1.400	0.781	0.890	1.060	*0.716*
Vitamin K (µg)	8.400	3.500	0.000	3.300	2.000	2.900	4.000	26.600	0.000	5.000	1.700	*5.218*
Lysine (g)	0.595	0.630	0.572	0.608	0.523	0.486	0.593	0.209	0.474	0.602	0.630	*0.538*
Phenylalanine (g)	0.469	0.531	0.451	0.479	0.449	0.321	0.475	0.174	0.579	0.384	0.445	*0.432*
Valine (g)	0.454	0.519	0.436	0.464	0.469	0.338	0.372	0.184	0.292	0.394	0.448	*0.397*
Tryptophan (g)	0.103	0.108	0.099	0.105	0.092	0.072	0.085	0.037	0.066	0.093	0.081	*0.086*
Threonine (g)	0.365	0.331	0.351	0.373	0.337	0.270	0.329	0.118	0.239	0.296	0.323	*0.303*
Isoleucine (g)	0.383	0.426	0.368	0.391	0.411	0.306	0.380	0.170	0.245	0.344	0.390	*0.347*
Methionine (g)	0.130	0.117	0.125	0.133	0.099	0.062	0.116	0.045	0.076	0.085	0.077	*0.097*
Histidine (g)	0.242	0.247	0.232	0.247	0.238	0.193	0.244	0.103	0.241	0.203	0.254	*0.222*

Leucne (g)	0.693	0.765	0.665	0.708	0.673	0.572	0.631	0.226	0.483	0.598	0.654	*0.606*

Table 7. Nutrient Content and Market Price of Beans and Peas. (Federal Reserve Bank of St. Louis, 2024; *FoodData Central Search Results*, n.d.; Hannaford Bros. Co. LLC., 2023)