

Feeding the World with Sustainable Whole Grains



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Whole Grains on My Mother's Farm



Image: My mother working on the farm, Sharon Palmer, RDN



Grits with Mustard Greens, Sharon Palmer, RDN

An Increasingly Hot, Crowded Planet

- 9.7 B people by 2050; Took 200,000 yrs. to get up to 1 B, 200 to 7 B
- Ecosystems: 50% planet's arable land in agriculture; leading to deforestation, climate change, loss of biodiversity
- Climate: Agriculture accounts for 24% global GHGEs; mostly from animal agriculture, methane from livestock, nitrous oxide from fertilizer use, carbon dioxide from tractors, fertilizer production
- Water: 70% of all freshwater goes to agriculture

Source: WRI, 2013

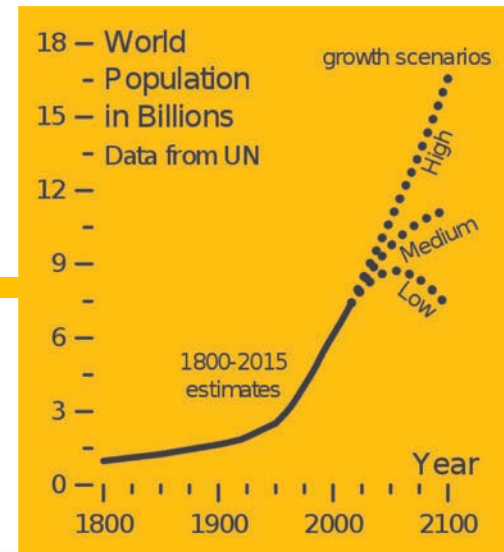


Image: Sacred Valley, Peru, Sharon Palmer, RDN

UN Panel on Climate Change



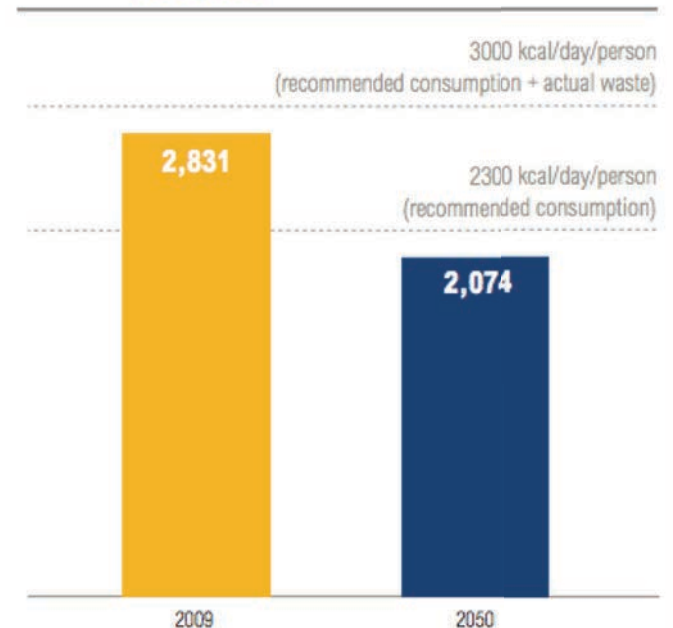
Image: West Coast, Iceland, Sharon Palmer, RDN

- 1880 to 2012, ave. global temp increased 0.85 °C
- Oceans warming, snow and ice diminishing, seas rising (19 cm on ave)
- Given current GHGEs, end of this century: 1-2 °C rise in global mean temp above 1990 level (1.5-2.5 °C above pre-industrial level)
- Alarming evidence of tipping points, leading to irreversible changes in ecosystems, planetary climate system

Feeding World by 2050

- Not enough food to feed world in 2050
- Climate change endangers food supply
- Global food system emits 5.2 B tons CO₂, which will climb by 2050 by up to 90% (*Nature*, 2018)

Figure 4 | If All Food Produced in 2009 Were Evenly Distributed to All People in 2050, Not Enough Calories Would Be Available Per Person

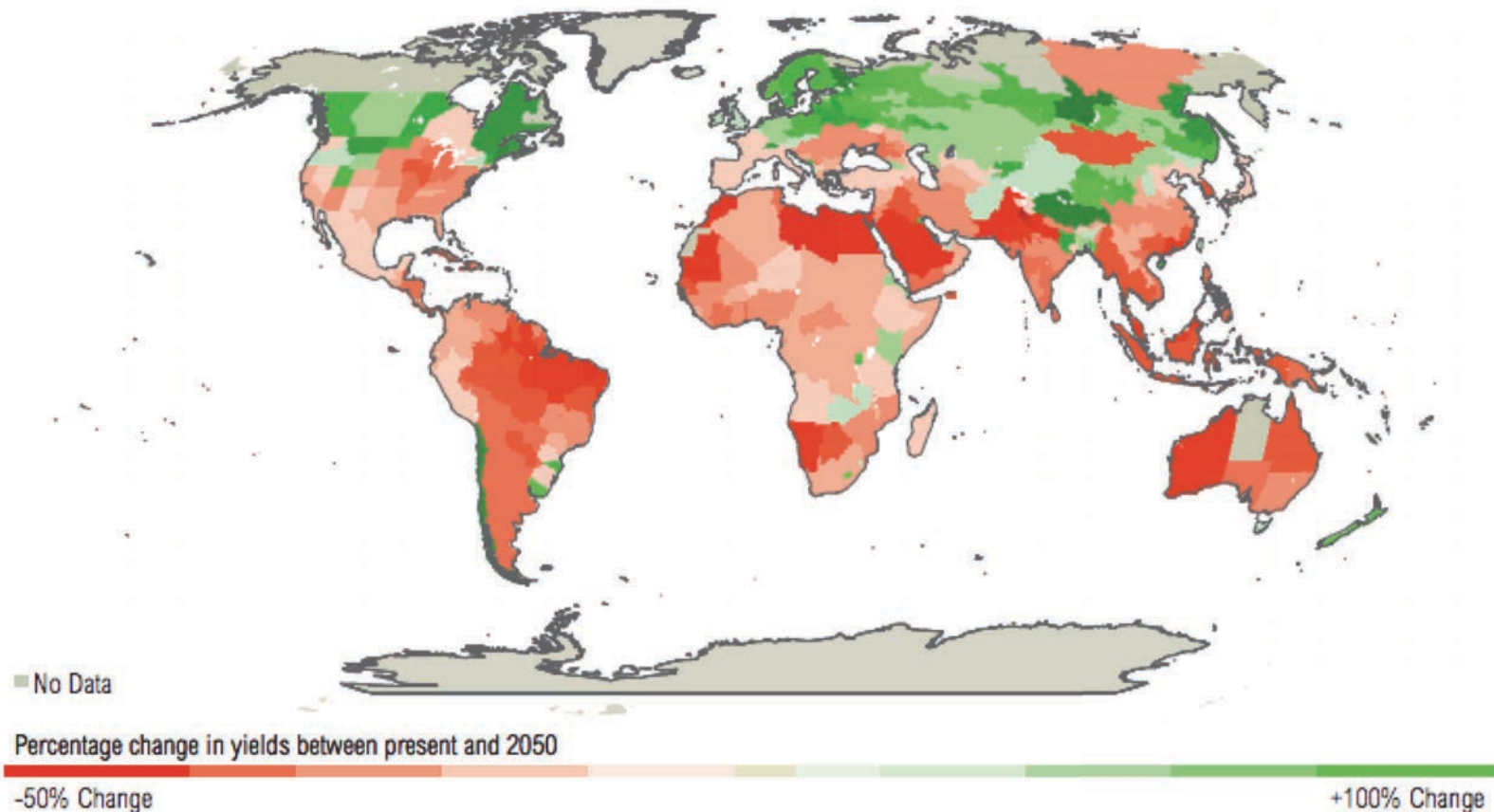


Note: Data reflects food for direct human consumption. It excludes food crops grown for animal feed and biofuels. See endnotes for assumptions used to generate the global average daily energy requirement per person.

Source: WRI analysis based on FAOSTAT 2012. *Food Balance Sheets*. Rome: FAO; UN Population Division (UNPD), 2011. *World Population Prospects: The 2010 Revision*, medium growth scenario. New York: UNPD.

Climate Change and Crop Yield

Figure 2 | Climate Change is Projected to Impact Crop Yields (3° C World)



Source: World Bank. 2010. *World Development Report 2010*. Washington, DC: World Bank.

From Western Diet to Plant-Based Diet



Edamame Ancient Grain Burgers, Sharon Palmer, RDN

- Dramatically reducing animal foods and increasing plant foods can make big impact
- Animal agriculture major driver of climate change (14.5% of GHGE) (*FAO*)
- Meat production contributes to global warming at far greater rate than grains and vegetables (*PNAS*, 2014)
- Contributes to catastrophe from rising global food demand from growing world population and climate change (*PNAS*, 2014)
- By 2050, Western diet would increase yearly GHGEs related to food by 80% (*Nature*, 2014)

Lower Eco-Impact with Plant-based Diet

- Animals inefficient at converting food into protein
- Eat plants directly from soil vs. feeding plants to animals (*PNAS*, 2014)
- Eco-impacts related to animal ag: land use, water consumption, manure, methane, fossil fuel, growth of feed (fertilizers, water, pesticides, fossil fuels) (*PNAS*, 2014)
- 40% water consumed in US used for animal food production (*UNESCO*, 2012)
- 1,600 - 2,500 gallons water to produce 1 pound feedlot beef (146 corn, 290 oats)



Stir-Fried Thai Sorghum Bowl, Sharon Palmer, RDN

Moving From Animals to Grains, Plants

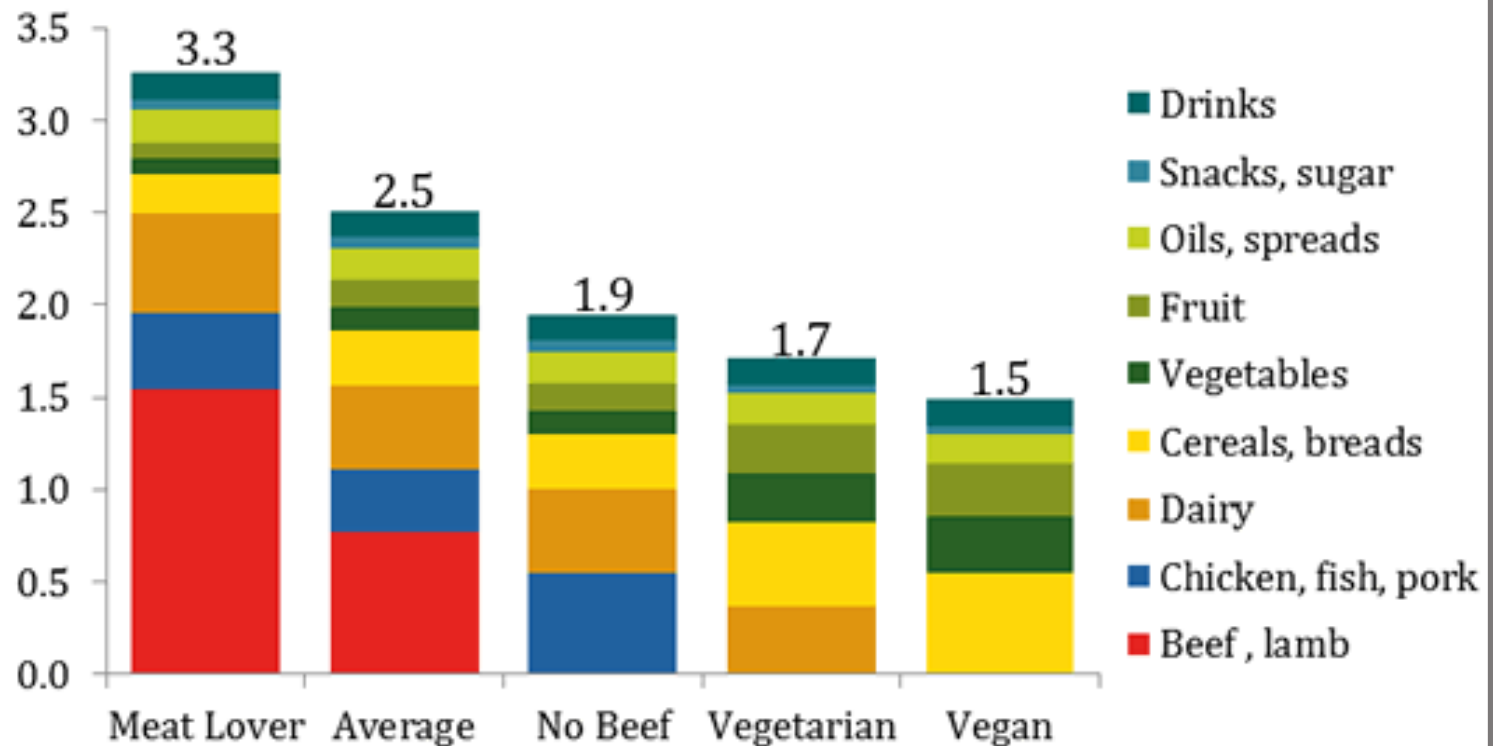


Image: Chickpea Tabbouleh, Sharon Palmer, RDN

- Reducing consumption of meats (particularly red) yields greatest returns in water, energy efficiency (*Int J Food Sci Nutr*, 2014)
- Flexitarian diet cuts GHGEs by more than half (*Nature*, 2018)
- Reducing animal products saves water; up to amount needed to feed 1.8 B additional people globally (*IOP Science*, 2014)
- Grains (and sweets) lowest carbon footprint among 483 foods & beverages (*AJCN*, 2015)
- Plant-based diet reduces GHGEs 72%, land use 58%, energy consumption 52%, water consumption 33% in Spain, compared to Western diet (*Env Health Journal*, 2013)

Dietary Patterns & Eco-Impact

Foodprints by Diet Type: t CO₂e/person



Note: All estimates based on average food production emissions for the US. Footprints include emissions from supply chain losses, consumer waste and consumption.. Each of the four example diets is based on 2,600 kcal of food consumed per day, which in the US equates to around 3,900 kcal of supplied food.

Sources: ERS/USDA, various LCA and EIO-LCA data

Grains Feed Planet Since Beginning of Time

- At backbone of traditional diets around the world since beginning of time; grain & pulse in major centers of plant domestication
- Grains grow in harsh climates (cold, hot, dry, wet), with less water & soil fertility
- 8 Neolithic founder crops Fertile Crescent: emmer wheat, einkorn wheat, barley
- Quinoa from Andes domesticated 4,000 yrs ago
- Triticum genus (wheat species), originated Near East & Ethiopian Highlands; easily cultivated, important source veg protein, allowed storage, settlements, beginning civilization in Babylonia, Assyria “Fertile Crescent”



Image: Quinoa, Sacred Valley, Peru,
Sharon Palmer, RDN

Source: *J Tradit Complement Med*, 2015)



Grains: Foundation of Cultures



*Image: Rye, South Tyrol,
Sharon Palmer, RDN*

- Wheat in form of einkorn, farro origins in Italy
- Amaranth in Mexico since Aztecs
- Teff staple in Ethiopia
- Hx: Used whole plant: bread, cereals, pasta, noodles, beer, animal feed, even thatched roof
- Ancient grains: mostly annual plants, some grew in cool season; others warm season
- Barley and rye hardiest cereals (able to overwinter in Siberia and Subarctic)
- Sorghum adapted to arid conditions
- Three Sisters Pre-Columbian ag; 7000 years ago

Whole Grains Since Beginning of Time

- Origins in cropping: Neolithic Revolution 10,000 years ago as prehistoric civilizations (Aztecs, Greeks, Egyptians) worshipped and planted grains
- New research shows wild cereals in human ancestors diets 3.5 M years; in humans diets at least 100,000 years (*Proceed NAS, 2004*)
- Ötzi the Iceman (5,300 years old) last meal: included einkorn wheat



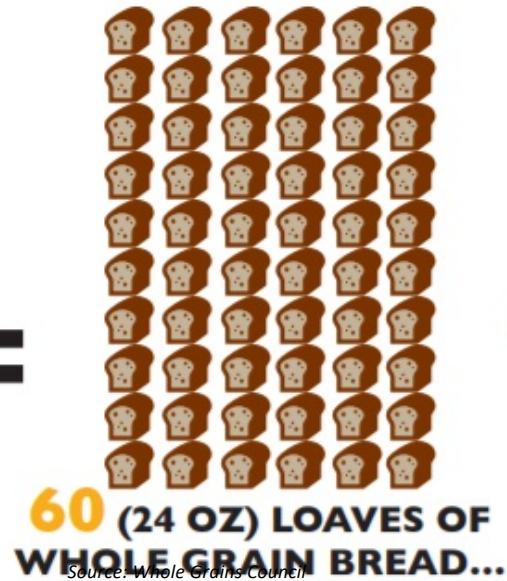
Image: Ötzi the Iceman, South Tyrol, Sharon Palmer, RDN

Whole Grains: Sustainable Choice

WHOLE GRAINS: A SUSTAINABLE FOOD
WHOLE GRAINS PROVIDE MORE FOOD, LESS WASTE



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Source: Whole Grains Council

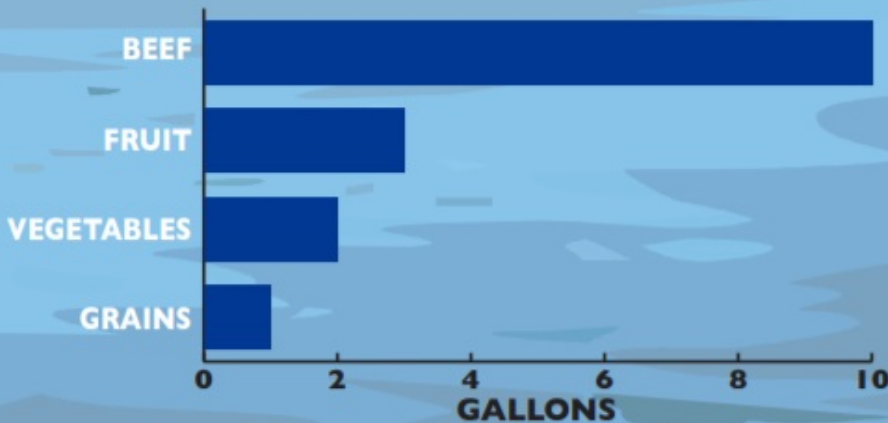
**BUT
ONLY**



Whole Grains: Water Saver

WHOLE GRAINS SAVE WATER

WATER NEEDED TO PRODUCE ONE CALORIE OF FOOD



Many of the driest regions in the world depend on hardy grain crops when water is limited.

ANCIENT GRAINS ARE MORE TOLERANT OF EXTREME WEATHER. FOR EXAMPLE:

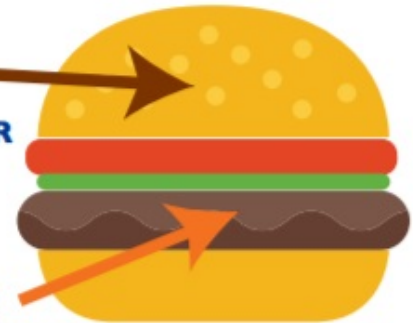
- **MILLET** has one of the lowest water requirements of any grain crop.
- **TEFF** thrives in drought and also grows well in water-logged soils.



CREATING THE **BUN**
6.4 GALLONS OF WATER



CREATING THE **BURGER**
197 GALLONS OF WATER

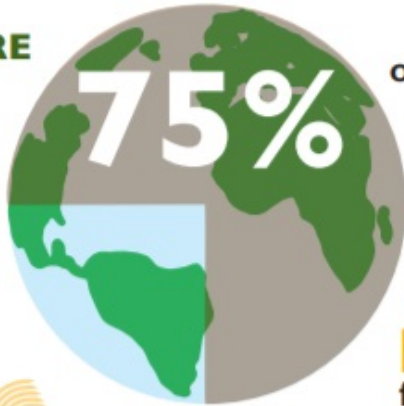


Source: Whole Grains Council

Whole Grains: Land Use & Soil

WHOLE GRAINS SUPPORT BETTER LAND USE & HEALTHY SOIL

**EATING MORE GRAIN-BASED MEALS
COULD
FEED MORE
PEOPLE
WITH
LESS
LAND.**



of global agricultural land is used for animal products which only supply **17%** of our food (in calories).



IMPROVE SOIL FERTILITY



Rotating crops with whole grains like barley, oats, rye, and triticale in the off-season can help protect against soil erosion, and also deliver nutrients back to the soil.

WHOLEGRAINCOUNCIL.ORG

Rediscovering Grains for Sustainability

- Opportunities to interact with consumers, tell a story
- Ancient grains drought, heat tolerant: teff, amaranth, quinoa, millet (*Plant Science*, 2018)
- High nutrient value, minimal food packaging, low waste = sustainable food model
- Opportunities for marginal lands, local farms
- Renaissance of small sustainable grains
- Increased demand and profitability
- “Ancient grains continue to gain strong headway in retail marketplace.” (*World-Grain.com*, 2018)
- 59% consumers say it’s important foods purchased & consumed be sustainably produced (*IFIC*, 2018)



Image: Ancient Grain,
South Tyrol, Sharon Palmer, RDN

Part of Healthy, Plant-Based Diet

- Balanced in pulses, soy foods, nuts/seeds, vegetables, fruits, healthy fats...and **Whole Grains**
- (6 servings, depending on individual needs)
 - ½ cup cooked whole grains such as wheat berries, oats, brown rice, or quinoa
 - ½ cup cooked whole grain pasta
 - 1 slice whole grain bread
 - 1 cup whole grain ready-to-eat breakfast cereal
 - 1 ounce whole grain crackers
 - 6-inch whole grain or corn tortilla



Image: Green Goddess Buddha Bowl, Sharon Palmer, RDN

Sustainable, Whole Grains on the Table



*Image: Moroccan Chickpea Sorghum Bowl,
Sharon Palmer, RDN*



*Image: Meal Prep Mediterranean and White
Bean Sorghum Salad, Sharon Palmer, RDN*



*Savory Steel Cut Oats with Spinach, Mushrooms, and Tofu,
Sharon Palmer, RDN*

Sustainable, Whole Grains on the Table



Image: Super Acai Berry Bowl, Sharon Palmer, RDN



Spelt and Red Cabbage Salad from Plant-Powered for Life, Sharon Palmer, RDN



Squash Filled with Herbed Quinoa and Cranberries, Sharon Palmer, RDN

Sustainable, Whole Grains on the Table



Image: Almond Buckwheat Pancakes, Sharon Palmer, RDN



Image: Mediterranean Edamame Quinoa Bowl, Sharon Palmer, RDN



Image: Instant Pot Banana Coconut Brown Rice Pudding, Sharon Palmer, RDN



*Image: Chipotle Tomato Rice Power Bowl,
Sharon Palmer, RDN*



*Image: Blueberry Millet Muffins,
Sharon Palmer, RDN*



*Image: Balsamic Butternut Squash and Brussels
Sprouts with Farro, Sharon Palmer, RDN*

Thank you!

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References

1. A closer look at ancient grains. World-Grain.com. <https://www.world-grain.com/articles/10783-a-closer-look-at-ancient-grains>. Published July 8, 2018. Accessed October 22, 2018.
2. Board on Science and Technology for International Development and National Research Council, Lost Crops of Africa: Volume 1: Grains, (Washington, D.C.: National Academies Press, 1996).
3. By the numbers: GHG emissions by livestock. Food and Agriculture Organization of the United Nations (FAO). <http://www.fao.org/Newsroom/common/ecg/1000505/en/stocks.pdf>. Accessed October 22, 2018.
4. Cheng A. Shaping a sustainable food future by rediscovering long-forgotten ancient grains. *Plant Science*. 2018;269:136-142. <https://doi.org/10.1016/j.plantsci.2018.01.018>.
5. Climate Change. United Nations. <http://www.un.org/en/sections/issues-depth/climate-change/>. Accessed October 22, 2018.
6. Cooper R. Re-discovering ancient wheat varieties as functional foods. *J Tradit Complement Med*. 2015; 5(3):138–143. doi: 10.1016/j.jtcme.2015.02.004.
7. Drewnowski A, Rehm CD, Martin A, Verger OE, Voinnesson M, Imbert P. Energy and nutrient density of foods in relation to their carbon footprint. *Am J Clin Nutr*. 2015;101(1):184-91. doi: 10.3945/ajcn.114.092486
8. Eshel G, Shepon A, Makov T, Milo R. Land, irrigation water, greenhouse gas, and reactive nitrogen burdens of meat, eggs, and dairy production in the United States. *PNAS*. 2014;111(33):11996-12001. doi: <https://doi.org/10.1073/pnas.1402183111>.
9. Fast Facts. National Association of Wheat Growers. <http://www.wheatworld.org/wheat-info/fast-facts/>. Accessed October 22, 2018.
10. Hans Hurni, et al. Wake Up Before It Is Too Late, Trade and Development Review 2013. United Nations Conference on Trade and Development. http://unctad.org/en/PublicationsLibrary/ditcted2012d3_en.pdf. Accessed October 22, 2018.

References

11. Harmon K. Humans feasting on grains for at least 100,000 years. *Scientific American*. <https://blogs.scientificamerican.com/observations/humans-feasting-on-grains-for-at-least-100000-years/>. Published December 17, 2009. Accessed October 22, 2018.
12. Jalava M, Kummu M, Porkka M, Siebert S, Varis O. Diet change—a solution to reduce water use? *IOP Science*. 2014;9(7). <http://iopscience.iop.org/article/10.1088/1748-9326/9/7/074016#citations>.
13. *Managing Water under Uncertainty and Risk*. UNESCO. <http://unesdoc.unesco.org/images/0021/002154/215492e.pdf>. Published 2012. Accessed September 25, 2018.
14. Herrero M, Thornton PK. Livestock and global change: Emerging issues for sustainable food systems. *Proceedings of the National Academy of Sciences*. 2013;110(52): 20878-20881. doi:10.1073/pnas.1321844111
15. Marrin DL. Reducing water and energy footprints via dietary changes among consumers. *International Journal of Nutrition and Food Sciences*. 2014;3(5):361-369. doi: 10.11648/j.ijnfs.20140305.11.
16. Mekonnen MM, Hoekstra AY. A global assessment of the water footprint of farm animal products. *Ecosystems*. 2012:401-415. <https://waterfootprint.org/media/downloads/Mekonnen-Hoekstra-2012-WaterFootprintFarmAnimalProducts.pdf>.
17. Meyer M. One-Third of Americans Are Dieting, Including One in 10 Who Fast ... While Consumers Also Hunger for Organic, “Natural” and Sustainable. *Food Insight*. <https://www.foodinsight.org/2018-food-health-press-release-diets-organic-natural-sustainable-trending>. Published May 16, 2018. Accessed October 22, 2018.
18. Sáez-Almendros S, Obrador B, Bach-Faig A, Serra-Majem L. Environmental footprints of Mediterranean versus Western dietary patterns: beyond the health benefits of the Mediterranean diet. *Environmental Health*. 2013;12:118. doi: <https://doi.org/10.1186/1476-069X-12-118>.

References

19. Searchinger T, Hanson C, Ranganathan J, Lupinski B, Waite R, Winterbottom R, et al. The Great Balancing Act. World Resources Institute. Published May 2013. Accessed October 26, 2018.
20. Springmann M, Clark M, Mason-D’Croz D, Wiebe K, Bodirsky BL, Lassaletta L, et al. Options for keeping the food system within environmental limits. *Nature*. 2018. doi: 10.1038/s41586-018-0594-0.
21. Tilman D, Clark M. Global diets link environmental sustainability and human health. *Nature*. 2014;515:518–522. doi: <http://dx.doi.org/10.1038/nature13959>.
22. University of Utah. A grassy trend in human ancestors' diets. ScienceDaily. www.sciencedaily.com/releases/2013/06/130603163749.htm. Published June 2013. Retrieved October 22, 2018.
23. Whole Grains: A Sustainable Food. Whole Grains Council. https://wholegrainscouncil.org/sites/default/files/atoms/files/WG_SustainableFood_infographic.pdf. Accessed October 22, 2018.