

# Cornucopia Science Background



The goal of Cornucopia is to illustrate how much land and water farmers need to grow different types of food. Resource requirements for different food sources were informed by previously published data and modified to allow for enjoyable game play.

In general, animal food sources such as meat and dairy require more land and water than vegetables and fruits. Also different kinds of crops have very different water needs. Tree crops such as apples and avocados typically use more water per kilogram than non-tree crops. The water needs of different types of food were estimated based on previously published data from Twente Water Centre researchers Mekonnen and Hoekstra, which is available online at [waterfootprint.org](http://waterfootprint.org).

Water and land requirements of different foods are based on USDA Nutrient Database serving sizes. According to the USDA a serving of vegetables such as broccoli and potatoes are almost twice as large as a serving of meat. Because of this large difference between the water needed for some animal foods and vegetable foods, we modified water needs from Mekonnen and Hoekstra's publication for an easier game play experience. For example, beef production requires 50 times the amount of water that's needed to grow broccoli, but in Cornucopia beef requires 15 times more water than broccoli. This allows students to realize beef's high water footprint, while dissuading them from ever trying to produce beef on their farm.

Another science, game-play balance can be found in the vegetable and protein categories. While several crops do produce fruit, vegetables and fruit were combined into a single crop output category because of the similarity in their nutrient profiles.

The amount of food produced per square of land in Cornucopia were estimated using United Nations Food and Agriculture Organization (FAO) data on crop yields, and the land requirements of animal food sources were informed by a 2014 paper by Dr. Gidon Eshel and colleagues.

## Resources

Eshel, Gidon, et al. "Land, irrigation water, greenhouse gas, and reactive nitrogen burdens of meat, eggs, and dairy production in the United States." *Proceedings of the National Academy of Sciences* 111.33 (2014): 11996-12001.

Food and Agriculture Organization of the United Nations(FAOSTAT). <http://faostat3.fao.org/home/E> (Accessed December, 2015)

Mekonnen, M.M. and Hoekstra, A.Y. (2011) The green, blue and grey water footprint of crops and derived crop products, *Hydrology and Earth System Sciences*, 15(5): 1577-1600.

United States Department of Agriculture (USDA) National Nutrient Database for Standard Reference. Agricultural Research Service. <http://www.ars.usda.gov/Services/docs.htm?docid=8964>

