

## **Sentence Outline**

**IB Subject:** Environmental Systems and Societies

**Topic:** Environmental Sustainability and Veganism

**Research Question:** To what extent is a vegan diet more environmentally sustainable than a diet including animal products?

### I. Defining "sustainability"

- A. First, it should be acknowledged that there is no universal definition or explanation of sustainability. A definition will be offered to be used in the context of this paper.
- B. In the context of the environment, sustainability can be defined as "A state in which the demands placed on the environment can be met without reducing its capacity to allow all people to live well, now and in the future." (lexicon financial times)
  1. If a resource is unsustainable, it means the demands required to create the resource, transport the resource, or meet the demands for the resource are too great to sustain long term without considerable damage to the environment.
  2. If a resource is sustainable, or rather more sustainable than an alternative, it means it can be produced and used for long periods of time without considerable damage to the environment or exhaustion of the Earth's resources.

### II. How can we measure sustainability?

- A. The goal of this paper is to assess the sustainability of diets, which means evaluating the amount of resources each diet demands.
- B. The amount of water, land, and labor a resource demands for production can be measured.
- C. Furthermore, the additional environmental toll a resource takes will be taken into account.
  1. For example, the amount of greenhouse gases emitted during the process of cultivating a resource.

III. Assessing the sustainability of an average diet including animal products

- A. Livestock is a very water-intensive resource, making it less sustainable.
  - 1. "Animal agriculture water consumption ranges from 34-76 trillion gallons annually." according to the United States Geological Service
  - 2. "Agriculture is responsible for 80-90% of US water consumption." according to the USDA: Economic Research Service.
  - 3. It takes around 2,500 gallons of water to produce 1 pound of beef.
- B. Livestock produces large amounts of greenhouse gases.
  - 1. "Animal agriculture is responsible for 18 percent of greenhouse gas emissions, more than the combined exhaust from all transportation," according to the the Food and Agriculture Organization of the United Nations.
  - 2. "Livestock and their byproducts account for at least 32,000 million tons of carbon dioxide (CO<sub>2</sub>) per year, or 51% of all worldwide greenhouse gas emissions," according to World Watch.
  - 3. "Cows produce 150 billion gallons of methane per day." According to International Business Times.
- C. The production of livestock also takes up mass amounts of land to sustain.
  - 1. "Livestock or livestock feed occupies 1/3 of the earth's ice-free land." according to Time Magazine.
  - 2. "Livestock covers 45% of the earth's total land." According to the International Livestock Research Institute.

IV. Assessing the sustainability of an average vegan diet

- A. A vegan diet (a diet not including animal products), also commonly known as a plant-based diet is more sustainable than a diet including animal products because it takes less water, land, and has fewer environmental consequences.
- B. A vegan diet has a smaller "footprint"
  - 1. According to Shrink That Footprint, "An Average American's diet has a footprint of around 2.5 t CO<sub>2</sub>e per person each year. For a Meat Lover this rises to 3.3 t CO<sub>2</sub>e, for the No Beef diet it is 1.9 t t CO<sub>2</sub>e, for the Vegetarian it's 1.7 t CO<sub>2</sub>e and for the Vegan it is 1.5 t CO<sub>2</sub>e. Each of these estimates includes emissions from food that is eaten, wasted by consumers and lost in the supply chain."
- C. A vegan diet takes less water to sustain than a diet with animal products.

1. According to One Green Planet, "It takes 4,200 gallons of water per day to produce a meat-eater's diet. A plant-based diet uses only 300 gallons of water per day."
  - D. Sustaining a vegan diet also takes less land.
    1. One acre of land can yield 250 pounds of beef, while the same acre can produce 50,000 pounds of tomatoes or 53,000 pounds of potatoes. (according to One Green Planet)
- V. What are the implications or application of this data?
- A. Reducing the demand for meat would have substantial benefits for the environment
  - B. Reducing the demand for animal products could also have positive effects for humans.
    1. Currently, we produce enough calories to feed everyone in the world. However, most of those calories are fed to livestock to produce meat and animal products.

Works Cited

"Can We Solve World Hunger and Feed 9 Billion People Just by Eating Less Meat?" *One Green Planet*, [www.onegreenplanet.org/environment/world-hunger-population-growth-ditching-meat/](http://www.onegreenplanet.org/environment/world-hunger-population-growth-ditching-meat/). Accessed 22 July 2017.

"The Carbon Foodprint of 5 Diets Compared." *Shrink That Footprint*, [shrinkthatfootprint.com/food-carbon-footprint-diet](http://shrinkthatfootprint.com/food-carbon-footprint-diet). Accessed 1 Sept. 2017.

David Pimentel, Bonnie Berger, David Filiberto, Michelle Newton, Benjamin Wolfe, Elizabeth Karabinakis, Steven Clark, Elaine Poon, Elizabeth Abbett, Sudha Nandagopal; Water Resources: Agricultural and Environmental Issues, *BioScience*, Volume 54, Issue 10, 1 October 2004, Pages 909–918, [https://doi.org/10.1641/0006-3568\(2004\)054\[0909:WRAAEI\]2.0.CO;2](https://doi.org/10.1641/0006-3568(2004)054[0909:WRAAEI]2.0.CO;2) Accessed 5. Aug. 2017

Eck, Allison. "Going Vegan Isn't the Most Sustainable Option for Humanity." *PBS*, 16 Aug. 2016, [www.pbs.org/wgbh/nova/next/earth/going-vegan-isnt-actually-th/](http://www.pbs.org/wgbh/nova/next/earth/going-vegan-isnt-actually-th/). Accessed 5 Aug. 2017.

"Food Facts: How Much Water Does It Take to Produce...?" *Water Education*, Water Education Foundation, [www.watereducation.org/post/food-facts-how-much-water-does-it-take-produce](http://www.watereducation.org/post/food-facts-how-much-water-does-it-take-produce). Accessed 14 Aug. 2017.

Gerbens-Leenes, P.W. et al. "The water footprint of poultry, pork and beef: A comparative study in different countries and production systems". *Water Resources and Industry*. Vol. 1-2, March-June 2013, Pages 25-36. Accessed 5. Aug. 2017.

Goodland, Robert, and Jeff Anhang. "Livestock and Climate Change." *World Watch Magazine*, vol. 22, no. 6, [www.worldwatch.org/node/6294](http://www.worldwatch.org/node/6294). Accessed 7 Aug. 2017.

Hoekstra, Arjen Y. *The Water Footprint of Food*. Twente Water Centre, U of Twente.

*Water Footprint*, [waterfootprint.org/media/downloads/Hoekstra-2008-](http://waterfootprint.org/media/downloads/Hoekstra-2008-WaterfootprintFood.pdf)

[WaterfootprintFood.pdf](http://waterfootprint.org/media/downloads/Hoekstra-2008-WaterfootprintFood.pdf). Accessed 1 Aug. 2017.

This article also shows the water footprint of different foods- something

*Irrigation & Water Use*. United States Department of Agriculture, 12 Oct. 2016.

*Economic Research Service*, United States Department of Agriculture,

[www.ers.usda.gov/topics/farm-practices-management/irrigation-water-use/](http://www.ers.usda.gov/topics/farm-practices-management/irrigation-water-use/). Accessed 7

Aug. 2017.

"Is Meat Sustainable?" *World Watch Magazine*, vol. 17, no. 4, July-Aug. 2004. *World*

*Watch*, [www.worldwatch.org/node/549](http://www.worldwatch.org/node/549). Accessed 5 Aug. 2017.

Jacobson, Michael F. "Six Arguments For a Greener Diet: How a More Plant-based Diet

Could Save Your Health and the Environment. Chapter 4: More and Cleaner Water".

Washington, DC: Center for Science in the Public Interest, 2006

McBride, William D., and Kenneth Mathews, Jr. *The Diverse Structure and Organization*

*of U.S. Beef Cow-Calf Farms*. EIB-73. U.S. Dept. of Agriculture, Econ. Res. Serv.

March 2011. <http://www.motherjones.com/files/eib73.pdf>. Accessed 09. Aug. 2017.

Pimentel, David, and Marcia Pimentel. "Sustainability of Meat-Based and Plant-Based

Diets and the Environment." *The American Journal of Clinical Nutrition*, American

Society for Nutrition, 2003, [ajcn.nutrition.org/content/78/3/660S.full](http://ajcn.nutrition.org/content/78/3/660S.full). Accessed 5 Aug.

2017.

"Risk Assessment Evaluation for Concentrated Animal Feeding

Operations". Environmental Protection Agency. 2004.

Robins, John. "2,500 Gallons All Wet?" *EarthSave*,

[www.earthsave.org/environment/water.htm](http://www.earthsave.org/environment/water.htm). Accessed 28 July 2017.

Thornton, Phillip, et al. "Livestock and climate change". Livestock xchange. International Livestock Research Institute. November 2011.

<https://cgspace.cgiar.org/bitstream/handle/10568/10601/IssueBrief3.pdf>. Accessed 07 Aug. 2017.

"U.S. Land Capacity for Feeding People Could Expand with Dietary Changes." *Tufts Now*, Tufts University, 22 July 2016, [now.tufts.edu/news-releases/us-land-capacity-feeding-people-could-expand-dietary-changes](http://now.tufts.edu/news-releases/us-land-capacity-feeding-people-could-expand-dietary-changes). Accessed 6 Aug. 2017.

Walsh, Brian. "The Triple Whopper Environmental Impact of Global Meat Production." *Time*, 16 Dec. 2013, [science.time.com/2013/12/16/the-triple-whopper-environmental-impact-of-global-meat-production/](http://science.time.com/2013/12/16/the-triple-whopper-environmental-impact-of-global-meat-production/). Accessed 12 Aug. 2017.

"Water." *Environmental Working Group*, [www.ewg.org/meateatersguide/interactive-graphic/water/](http://www.ewg.org/meateatersguide/interactive-graphic/water/). Accessed 2 Aug. 2017.

"Water Footprint of Crop and Animal Products: A Comparison." *Water Footprint Network*, [waterfootprint.org/en/water-footprint/product-water-footprint/water-footprint-crop-and-animal-products/](http://waterfootprint.org/en/water-footprint/product-water-footprint/water-footprint-crop-and-animal-products/). Accessed 12 Aug. 2017.

"What Is Sustainability and Why Is It Important?" *Environmental Science*, [www.environmentalscience.org/sustainability](http://www.environmentalscience.org/sustainability). Accessed 10 July 2017.