

#7. Water and Transportation

Summary: In this module you will examine links between climate change, water and modern transportation.

Goals: By the end of this module you will be able to evaluate the GHG emissions and water footprint of your transportation needs.

Required readings:

Water Footprint of U.S. Transportation Fuels (Scown et al, 2011):
<https://pubs.acs.org/doi/10.1021/es102633h>

More detailed information -- Method for calculating GHG emission for vehicles:
https://www.epa.gov/sites/production/files/2016-03/documents/mobileemissions_3_2016.pdf

Supplemental Content (review in class or assign directly):

General Introduction -- <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>
(drill down for more detail on the transportation sector)

<https://www.epa.gov/moves> EPA model for mobile sources – too complex to run in this survey course, but might be useful to introduce it to students

Key Vocabulary: mobile source, emissions, infrastructure, resilience, life-cycle assessment, biofuel, ethanol, CO₂, CH₄, N₂O,

Assessment Tools:

Discussion Questions (can be used in classroom or for on-line discussion board):

- Many environmental activists argue that Ethanol is bad for the environment. (For example: https://e360.yale.edu/features/the_case_against_ethanol_bad_for_environment) From a water footprint perspective, does the article by Scown et al (2011) support that position? Why or why not?
- Do you think that mobile sources of GHGs are a significant driver of climate-related impacts on water resources? Why or why not? Provide examples from the assigned readings to support your position.
- What do you think is the best type of fuel to use for your own transportation needs? Why that one?

Written Plan: World Water Day is an annual observance that highlights the importance of freshwater around the globe. Write a plan or proposal for a meaningful way to mark this day in your community in 2021. <https://www.worldwaterday.org/>

Footprint determination: Calculate the water footprint of your transportation habits in a typical week. For this exercise, assume that all of your travel is done by personal auto. If you don't have a car, then select a model you would like to own and use that. If you don't know the mileage of your vehicle from personal experience, then look it up (<https://www.fueleconomy.gov/feg/findacar.shtml>). What type of fuel do you typically purchase? Use the estimate of gallons of water per mile driven from the table below in your calculations. Prepare a short write-up to describe the assumptions used in calculating your footprint.

Water Use by Mile for Various Fuels		
Fuel Source	Gallons of Water per Mile (Car)	Gallons of Water per Mile (Truck)
Corn	283	444
Grain	0.17	0.28
Cellulosic Biofuel	0.26	0.42
Petroleum	0.04	0.07
Oil Shale	0.08	0.21
Data from Sandia National Laboratories, U.S. Department of Energy and Energy Information Administration		

Source: <http://biofuel.org.uk/water.html>

Next, calculate the GHG emissions of your transportation habits over that same week . Use the method described in the assigned reading to do so. https://www.epa.gov/sites/production/files/2016-03/documents/mobileemissions_3_2016.pdf

Submit your calculations and assumptions.

Module 7 Lab Activity

Prepare a “Thought Map” on the topic of “Water and Transportation Infrastructure” using the issues raised in the readings for this module as well as those in the following article by Andrey et al (2014) available here:

https://www.researchgate.net/profile/Adam_Garbo/publication/283720777_Water_and_Transportation_Infrastructure/links/5644c13908ae9f9c13e57360.pdf

Use the phrase “Water and Transportation” for the center of your map. Add all factors that you think affect this topic in your region. Guidance on how to prepare an effective Thought Map can be found at: <https://www2.le.ac.uk/offices/ld/all-resources/study/thought-mapping>