

Essay #3, WATER

Draft version due/accepted Thur Mar 6, Final version **due Thur Mar 13, no later than 5pm!**

Choose one of the following topics. It would be best to choose the one related to the experiment you are doing, but see us if you would like to change.

W1 - OCEAN WAVES

Natural disasters come in many forms, but some are particular to specific regions of geography, especially coastlines. Some disasters can be “predicted”, e.g., the likelihood of a hurricane making land-fall in a particular place is examined and foretold in subtropical regions, but others are sudden, e.g., earthquakes. One disaster that combines features of both, but is still not predictable enough to completely prevent loss of life is an ocean wave -- a **tsunami**, or in some old references “tidal wave” (which is incorrect, why?). Explore the nature of this wave (“deep” or “shallow”?, transmitted like in the movies as a huge surface wave?), what tends to make them land where they do, and what is done for warning people in danger and how effective is it (start with <http://www.pmel.noaa.gov/tsunami-hazard/>). Use examples from Indonesia and Hawaii to explore how the shape of the depth profile affects the amount of damage.

W2 - OCEAN ESTUARIES AND TIDES

Estuaries typically contain large areas of wetlands where particular flora and fauna flourish and contribute greatly to the overall food web, on both local and global scales. A variety of things, but especially human population increase, farming, and development, have reduced the number and area of these wetlands. Choose two areas in the Pacific Northwest, such as the Nisqually River delta, where **wetlands** have been **modified** (drained, channeled, diked), and discuss the positive and negative impacts on both people and wildlife in these regions, contrasting management decisions that contribute to those impacts.

W3 - CIRCULATION OF THE GLOBAL OCEAN AND CLIMATE CHANGE

This experiment allows you to examine one part of the great heat engine on the planet, the ocean’s thermohaline circulation. Much of the climate change debate centers on what may happen as our global average temperature rises. The density of seawater can change, both due to the direct warming and due also to decreasing salinity of the surface waters (the melting of ice and increase in rainfall is most likely to effect the far north). Much of this information is based on interpreting signals from paleo-climatology (or paleoceanography), the study of ancient climates so be sure to read and cite some of these studies as well. Research and write about what is **predicted** to happen to this “meridional overturning”, particularly in respect to how a change in it will affect upwelling regions. These regions are usually found on the west-coast of continents, along the equator, and in sub-polar regions (high north and south latitudes) and are especially important to biological productivity of the whole ocean ecosystem. (see <http://www.int-res.com/abstracts/meps/v197/p41-49.html> as a start on upwelling)

W4 - RIVER FLOW, SEDIMENT TRANSPORT AND EROSION

Many of the world's great river basins are full of dams which are impeding sediment flow seaward. Research and detail what changes in sediment flow and erosion patterns have been caused by the **dams on the Columbia River** here in the Pacific NW. Be sure to include effects both beneficial and detrimental to people and the ecosystem.

W5 - GROUNDWATER FLOW – AQUIFERS AND POLLUTION

Chapter 5 of McNeill discusses “The history of water use and water pollution” but does not discuss **groundwater pollution**. Yet, starting with Love Canal, groundwater pollution has been a major component of the US Environmental Protection Agencies Superfund program. Consider the time scales of pollution, and how grain or particle size play a roll in adsorbtion of that pollution. What are the characteristics of the contaminants (especially PCBs and organic solvents), and the difficulty of remediation? How do we measure groundwater recharge and discharge rates to start with? Discuss one or two specific examples of PCB and/or organic contaminent pollution in groundwater. Is this a widespread problem in the US or is it limited to a few high profile sites? Cite data to support your position.

W6 - MICROCOSMS AND BIOSPHERES (note, no recycling your AIR essay for this unit!)

Biosphere II is the name of an experiment in Arizona which was an attempt at building a totally isolated ‘microcosm’ in which a few human beings were to live for some years. It failed. Find out how the experiment was designed and why it failed. In particular, make estimates of the amount of plant material needed to support the oxygen needs of 6 people. Was there an imbalance in these amounts that contributed to failure?

W7 - IRRIGATION - EVAPORATION AND SALINIZATION

Due to using river water for irrigating large arid areas, like **Eastern Washington**, a problem arises with evaporation and salinization. This experiment should demonstrate that on a small scale. In your essay, discuss and detail the large-scale effects of this situation on food production and the possibility/probability (or lack) of recovering farmland for other use (or even returning it to a wild state). Concentrate on both Washington and **California's Central Valley**, often known as the “bread basket” and “vegetable basket” of America.