H A&S 222a Introduction to Energy and Environment (Life Under the Pale Sun) Spring 2006
Tues/Thurs 10.30-12.20 Mary Gates Hall 242
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Abstract: **four** ***parallel streams***

1. Energy: an organizing principle for studying Nature
   - forces: electrostatic, electromagnetic, gravitational
   - mechanical, thermal, chemical
   - production, flux, storage, transformation
   - the ultimate energy source: the sun
   - flow of energy through the Earth
   - *water* and heat
   - atmosphere
   - ocean
   - biosphere
   - conversion, storage
   - 'physics' of biology: photosynthesis, carbon cycle
2. The global environment:
   - earth, air, fire, water
   - circulation of atmosphere and ocean
   - global biosphere: its relation with circulation, energy and nutrient supplies
   - the end of Nature?
3. Humans and their energy use
   - global population and its 'footprint'
   - global energy resources
   - the great debate over oil
   - alternative fuels
   - relation to global change, global warming
4. Life at the rim of the Arctic: people and ecosystems
   - interaction with energy: human use
   - energy resources in the far North
   - native culture and its relation to energy issues
   - global change and its Arctic amplification

An underlying environmental ethic, and a practical strategy for success, both require an understanding of the place of humans among ecosystems of the Earth. A part of this understanding comes from scientific observation and analysis…which requires familiarity with some of the underlying principles of natural science, coming from physics, chemistry, and biology.

Week 1: 28/30 March 2006

Note taking: We will put a lot of the ideas and observations on the class web-site and in some handouts, but taking good lecture notes is still a very good idea. A strategy is to buy one of those hard-bound lab books (with lines) and use it for both class notes, homework drafts and essay drafts.

Assignment: Check your computing resources:

- ability to download, save and organize Adobe PostScript files
- email organization and storage
- class website found and explored (www.ocean.washington.edu/courses/as220a)
- your ability to do online submission of essays and homework (this is not required yet it is efficient for all, we can accept handwritten work if you favor it).
- confirm your email address and tell us how good your web access is:
  - -all the time, easy
  - -I have to go to a UW computing lab
  - -I can't access the Web at important times like evening/weekends
  - -My access is low-speed (telephone modem), high-speed (cable-modem or better)

(brief) Essay #1: A Favorite Place (Environmentally Speaking).

out: Tues 28 March 2006

due: Thurs 30 March 2006 (i.e., the 2d meeting of class)

On one page describe an outdoor place that you remember as being exceptionally beautiful, peaceful, interesting or inspiring....naturally. Frame your discussion in terms of your emotional or artistic reaction to this place. You might ponder *why* you reacted so strongly, making yourself a part of the picture.

On a second page describe the same place in terms of its function: for example if it were a waterfall you could discuss why it is there, where the water originates, how it has affected the geology (rocks) and ecology (plants and animals) of the area; if there are plants and animals you could think about who is doing what to whom. Are humans involved in its function (or, potentially will they affect its future)?

Reading week 1: McNeill *Something New Under the Sun:*

on energy: preface xxi-xvi

Ch. 1 Peculiarities of a Prodigal Century 3-21

Harte, *Consider a Spherical Cow* p. 1-14

handouts: McKibben, Ehrlich

Thoughts about your writing.

A page is about 450 words, say 30 lines of 15 words each; if using Microsoft Word, use 1.5 line spacing and a 12 pt font like Times New Roman with about 1" margins. Your word count is easily checked. But we are happy if you don't use Microsoft Word. In a way it is sad to see everyone on Earth using the same writing tool.

Writing is an essential part of this course. Good writing will get you far. But scientific writing and other kinds of prose or poetry differ. We are a science-based course, though with an important component of humanities. We wonder, for example, "How do people and ecosystems relate to and react to the winds and currents around them?" Tersely focused writing is taught, for example by Strunk & White's classic little book *The Elements of Style*.

Something important has happened to science writing in the past few years. It has become much better, more effectively channeling information and ideas between scientists and non-scientists (yes, both ways). People with Ph.D. degrees in physics have become full-time writers of articles in magazines and of books. A good example is Phillip Ball, author of *The Matrix of Life: a Biography of Water*. By combining hard science with an understanding of its impacts on humans—you might call this philosophy of science—writers like Ball give us a deep understanding of things that matter. Sometimes they fool us into thinking that we really understand the essence of a difficult scientific idea (as in *Genius-the Life and Science of Richard Feynmann*, a biography of the physicist by James Gleick). But, as

in this course, they can succeed by using some results of science (not derived or demonstrated) and from these, showing an important result (for example, if we are given the amount of sulfur put into the atmosphere each year by human activity, and the observed concentration of sulfur in air we can calculate the average lifetime of a sulfur atom—how long it resides in the atmosphere before being rained out. And, in a way that is what scientists all do; they understand some parts of a complicated system, far less than they would like, and yet deduce something important about it.

Other authors are highly successful scientists who also like to write. For example Prof. Brownlee of UW Astronomy has written in '*Rare Earth*', about the chance of finding life elsewhere in the Universe. Fred Hoyle, the most prominent astronomer in England for many years, wrote wonderful science fiction (*The Black Cloud, October 1st is Too Late).*

On the other hand, non-science (almost rhymes with nonsense) authors like Gretel Ehrlich (*This Cold Heaven*, about Greenland) write as artists infatuated with Nature, and seeing scientific ideas in their own way. They have much to teach scientists about what's important. And so we will read excerpts from her book.

Make a conscious effort to study science writing in a variety of media: news magazines, nature magazines (like *Audubon* Magazine), 'popular' science magazines (*Discover, Smithsonian*, and yes even *Popular Science*), and more intense publications like Scientific American (famous for its obscurity). Each Tuesday the *N.Y. Times* has a science section which is good and readable.

One of the reasons for all these good books on science is that they manage to communicate its beauty and power, and yet (most) science is real, unlike the deluge of fiction and fantasy that surrounds us.

These ideas may help you to think of your audience as you write: are they well-educated non-scientists, school children in 8th grade, or rocket scientists? As you go through drafts of your essays, you can try them out on a friend.

A good example of multiple viewpoints in this field is seen in the terrible floods that engulf Bangladesh, which is a low-lying country, essentially a river delta, tucked in between India on the west and Burma (Myanmar) to the east. Bangladesh is hit by tropical cyclones (hurricanes) quite frequently and there is great loss of life. Scientists look at this as a prediction problem (giving warning), a prevention problem (building dykes), yet an economist (in this case Amartya Sen, a Nobel Prize winning 'social economist") may argue that it is more important to look after people in the weeks, months and years following a devastating flood: loss of employment, infrastructure, and family stability may be as important, or more important than, the immediate loss of life. A variant of this continuing tragedy occurred with hurricane Katrina, which devastated New Orleans, last hurricane season (August 2005). The last time I taught this course I spoke of hurricanes as causing some economic damage in the USA but little loss of life here. Yet with Katrina we saw at least 1600 people die and, as Amartya Sen argues, the lives of 10s of thousands of people totally dislocated by the storm and the inadequate levee. At that earlier time, fall 2004, I also noted that hurricane Andrew in 1992 was the most damaging storm economically and that if it had hit Miami directly it would have done $100B of damage; yet that is close to the estimate of Katrina's actual damage (uncertain yet greater than $75B). (Note that 1992 dollars and 2005 dollars differ due to inflation and need to be reconciled.)

The big numbers of the environment make it difficult to learn: they are difficult to remember and 'sense'. This is something to address in your writing: ways to make the enormity of the environment understandable. Whether it's the size of Greenland, the number of barrels of oil consumed per day (about 90M ..90 million), global population or tragic events, like the 1600 deaths in hurricane Katrina; more than 18,000 deaths in hurricane Mitch which sat over Nicaragua/Honduras in 1998; 3000 in the terrorist attacks of 11 Sept. 2001; tens of thousands in the Iraq war and hundreds of thousands in the decade of economic sanctions before that war.

Sources: solving problems more than collecting facts

A major challenge in studying the environment is finding 'facts', 'data' (lots of facts), as well as finding ideas. The Web is where we go, more often now than the library. But please remember the description of the Web as "a mile wide and an inch deep". Of course it's better than that but when we limit our searching to Google, we probably will not find the one person in the world who really understands a problem we need to solve. That person may have written a book or a journal article, and others will know of him or her. There is still a wealth of ideas in books and journals, inaccessible on the Web. A sort of 'grapevine' of communication will develop where one smart person hears a good idea and passes it on. Someday the Web will work this way but not yet. Look for smart people and ask them.

As a 'test case' visit the site of Wikipedia, the online encyclopedia written by its users (you can write or comment on an entry).

http://en.wikipedia.org/wiki/Main_Page