

PUAF 745  
Spring 2012

## HUMAN HEALTH and ENVIRONMENTAL POLICY

Section 0101  
Wednesdays 1:30 to 4:00  
1203 Van Munching Hall

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This course was named, but not taught, before my arrival at the University of Maryland. I have proposed three non-anthropocentric replacement names. None has been accepted.  
My apologies.

This course reviews natural-scientific and public-policy aspects of ecological health, with the health of humans considered in parallel with the health of other species: animal, plant, and microbial, terrestrial and marine. Particular attention is directed to the conceptualization of human environmental-health risk, to the ecological-health effects of industrial activities, and to the formation of long-range ecological-health policy. While prior education in the natural sciences is not prerequisite, a willingness to engage unfamiliar disciplines is expected.

### REQUIREMENTS

- Attendance in class.
- Attention in class. Accordingly, no student computers, smart-phones, or tablets should be in use except for class-work purposes: taking notes, viewing electronic readings currently under discussion, debunking professorial assertions, et cetera. No surfing, no shopping, no e-mailing, no texting.
- Well prepared, well reasoned, and non-adversarial participation in class discussions.
- An at-home, open-everything, long-answer midterm examination.
- A policy-advisory memorandum. Each student individually will write an original all-new-work policy-advisory memorandum reviewing and interpreting scientific and technical evidence bearing upon a current, impending, or neglected environmental-health or ecological-health issue. This memorandum must be responsive to a properly posed research question. The topic must lie outside a student's prior experience and current work and must be selected in consultation with – and must be approved by – the professor. The topic-choosing and question-posing process should begin immediately.
- An oral memorandum report.
- An in-class, closed-everything, short-answer final examination.

### Soft-cover reading

Joseph V. Rodericks, *Calculated Risks: The Toxicity and Human Health Risks of Chemicals in Our Environment*, second edition (Cambridge University Press, 2007). ISBN-10: 0521788781

### Soft-copy readings

Papers and links will be posted by course week at ELMS-Blackboard.

[www.elms.umd.edu](http://www.elms.umd.edu)

## Weeks

### 1 Linear regulatory policy meets non-linear unregulated nature

Natural selection as the stochastic management of environmental stress

- at home in an RNA world
- becoming us
- becoming lifeforms other than us
- becoming you and me and no one else
- teleology from Aristotle to “ecosystem,” “ecosystem restoration,” and “ecological health”
- setting purpose aside in biology
- the overthrowing of “kingdoms” by cyanobacteria, slime molds, fungi, protists, and archaea
- the viroid, the virus, the species, and the clade
- natural selection as the original package deal
- microbial mats, stromatolites, and the selection of cooperation
- bacterial-archaeal consortia in coastal mudflats
- bacteria and their phages caught cooperating in our guts
- organelles as cooperation made flesh and fiber
- the mitochondrion, the chloroplast, the apicoplast, and other endosymbionts
- an assemblage from parts
- and then an exchange of parts
- lightning-mediated gene transfer among soil organisms
- microbial transformations of industrial chemicals
- infinitely variable mixtures of industrial chemicals
- the epigenetic reality, the polygenetic presumption, nucleotide microarrays, their transformative interpretation and instructive misinterpretation, gene-expression intensity, regulatory proteins, regulatory RNAs, chromosomal vulnerabilities, gene-environment interactions, *genome*-environment interactions, chirality, and regulators’ deepening dysphoria
- dismissing small clusters in the last days of non-personalized toxicology
- and in the early days of fetal-to-adult toxicology
- but also in an era of conversant centenarians
- “the environmentalist’s paradox”
- putting purpose in its place in policy practice

Wed 1.25.12

*Introductions to the class, course, and topic.*

### 2 Chemicals, exposures, doses, and responses

Exposures

- types and durations
- absorption, distribution, metabolism, and elimination (ADME)
- species differences
- age differences
- latency
- from ADME to routes and fates in whole ecosystems
- how the analogy helps and hinders
- dose, concentration, response, and measurement
- ballast as a vector
- collateral damage in the war against rust
- temperature
- pH
- salinity
- hardness
- mixture
- organic matter
- particulates
- aerosols
- allergens

Wed 2.1.12

*Calculated Risks*, vii-90

*Comments on the policy-advisory memorandum.*

### 3 Toxics, targets, carcinogens, and cancers

Toxicity

- varieties, mechanisms, locations
- tissue, cell, nucleus, molecule
- carcinogenesis
- mutation, initiation, and promotion
- DNA repair and its inhibition
- plant “defenses” and human cancer

Wed 2.8.12

*Calculated Risks*, 91-201

*Comments on soft-copy readings.*

### 4 Risk assessment and management

Ecological risk assessment

- risk to us
- risk from us
- ecological risk management
- statistics
- classical or frequentist
- and Bayesian or non-frequentist – or “clinical-skeptical”
- discovery, delusion, deception
- methods of epidemiology, epizology, and epiphytology
- immunity and cryptopathology
- models
- promise, reality, uses, influence
- choosing indicators
- remembering factors
- tolerance and resistance
- depletion of competitive strains
- unfortunate introductions of unfamiliar species
- the gypsy moth, kudzu, the zebra mussel, *Aedes albopictus*, West Nile virus, *Vibrio cholerae*
- choosing *H. sapiens* as an indicator

Wed 2.15.12

*Calculated Risks*, 202-319

*Policy-advisory memorandum proposals solicited.*

### 5 Animals hunted, herded, husbanded, encountered, and suppressed

Animals hunted, which mostly now is to say fished

- animals herded
- zoonoses from the domestication epoch
- zoonoses today
- influenza in

Wed 2.22.12

birds and swine • prion-associated spongiform encephalopathies • human-fed cattle, cattle-fed cattle, and cattle-fed humans • animals husbanded • raised • farmed • milked • animals in CAFOs • ammonia • atmospheric methane enrichment • antibiotics as “growth promoters” • antibiotic resistance as a consequence • arsenic as a “growth promoter” in chickens • grain-finished feedlot cattle, their fat content, and their colonic pH • slaughtered • food safety from genome to field-and-feedlot to finger-and-fork • *E. coli* O157:H7 • and O104:H4 • Hazard Analysis Critical Control Point (HACCP) techniques applied to food safety • animals encountered • skinned • smuggled • in whole • in pieces • wild • endangered • petted • ill • Chytrid fungus in amphibians • *Geomyces destructans* in the white-nose syndrome of bats • mad in America • mad in India • vulture-mediated services • parasites • insects • protozoa • malaria and the POPs • malaria and the bednet • bacteria • viruses • our lives with other animals • codependence and mutual endangerment • vegans on B12, recalling that B12 itself is a bacterial product

## 6 Woods and fields

The forest relationship • and why it’s irreducible to a sum of ecosystem services • George Perkins Marsh • scale and ecological interaction • the subdivision of habitat and the restriction of biodiversity • the gypsy moth, the oak, the acorn, the deer mouse, the raptor, and Lyme disease • urban forestry • lumber • defensins and saps • tannins • maple • rubber • “pressure treatment” with arsenic and successor substances • pulp and paper • the chlor-alkali processes • BOD • lignin and cellulose • recent progress • nuts, fruit, fodder, and bees • the U. S. Supreme Court ruminates positively on Monsanto’s GMO alfalfa • nutrients • soil • the pest complex • soil microbial ecology • glyphosate in Roundup® as a soil-microbial biocide • manure • guano, nitrogen, phosphorus, and the “cides” in history • herbicides • fungicides • resistance • insecticides • neonicotinoids, colony-collapse disorder, insect decline, and avian decline • “herd” immunity in plants • Bt • effluents • FIFRA • from the Delaney Clause to the Food Quality Protection Act to policy paralysis • pesticides and other biocides and the unnatural selection of troublesome individuals • integrated pest management • crop biodiversity • increased yields and controversy in rice agriculture • filtering • forests and other riparian vegetation as eutrophication preventives • gene flow from bent grass • organic evidence • the three-year barrier

## 7 Wastes and waters

The management of non-human animal non-point-source waste • ruminants with endogenous phytase • monogastrics without it • uses of exogenous phytase • phosphorus, nitrogen, eutrophication, *Pfiesteria piscicida*, and other blooms • microbial waste generally • human waste specifically • endogenous hormone excretion • pharmaceuticals excretion • liquid waste disposal • septic tank systems • chemical toilets • medical waste • solid waste in landfills • evidence for regional effects • teratogenicity • oncogenicity • drinking water • recreational water • waste heat in rivers • trout and their discontents • efficient sewage treatment, mild eutrophication, and more food but less oxygen • efficient irrigation but less water, higher temperature, lethargy, and death • gushers, spills, and leaks • fishkills and birdkills as outcomes and as indicators • naval sonar and marine mammals • at-sea dumping • overseas and other trans-boundary dumping • Trafigura and Côte d’Ivoire • ballast-borne invaders, ballast exchange, and cleverer schemes • the wrecks on the *Cougar Ace* • carbonating the warming oceans • pH and the calcification lysocline • depleting phytoplankton • disassembling food webs

## 8 Organics 1

Wed 2.29.12

*Policy-advisory memorandum proposals reviewed and duplicate proposals divided.*

Wed 3.7.12

*MIDTERM EXAMINATION distributed online. An at-home, open-everything, long-answer midterm test ranging over the first half of the course for e-mail submission to sprinkle@umd.edu by (or during) WEEK 9.*

Wed 3.14.12

The petrochemicals industry as feedstock producer • the biocide, pesticide, and food-animal “growth-promotion” industries • the plastics industry • its history • its scope • its scale • its typical parts • its fundamental problem • deep suspicions • phthalates • BPA • melamine • performance in fires • biodegradation and its limits • a non-durable future

## 9 SPRING BREAK

Wed 3.21.12

## 10 Organics 2

Wed 3.28.12

Organics alone • organics in mixtures • with each other • with inorganics • mixtures oozing toward the center of the policy-forcing stage • human reproductive troubles • the fetal basis of adult disease • the organic-chemical basis of acquired disease • uncharacterized plausible risks • TSCA reform overdue, underway, and old-school

## 11 Rocks, minerals, metals, metalloids, nonmetals, and nanoparticles

Wed 4.4.12

Silicosis • the Hawks Nest Tunnel disaster • asbestos • white, blue, and brown • asbestosis and mesothelioma • the Chrysotile Institute • asbestos and vermiculite • asbestos and taconite • asbestos and talc • talc alone and ovarian cancer • the mercury cycle • sources, sinks, reservoirs • bioaccumulation • bioremediation • the poisoning of Minamata Bay • ship breaking • hydrocarbons as rock, fluid, and gas • America’s catch-and-release policy for coal-fired utilities • a proposal for an emissions-credit trading scheme for mercury and the prospect of neurotoxic hotspots • the temporary de-listing of mercury • mining and dredging • why they’re inherently destructive and toxic • overburden and tailings • exposure to oxygen and water • mobilization of acids and bases, aluminum and selenium, and radioactive isotopes • hydrocarbons as rock, fluid, and gas • shale oil • methane extraction by subsurface hydraulic fracturing • the politics of “special sauce” • gold • application of toxic chemicals • uranium • radon and its daughters • why reclamation fails • a requiem for topsoil • turning West Virginia into East Kansas • and streams into dead zones • smelting • trivalent chromium, stainless steel, hexavalent chromium, lung cancer, and Public Citizen • lead • its industrial history • its toxicity range • why its most common and consequential effects were the last to be appreciated • cadmium • copper • nickel • phosphorus • fluorine • water fluoridation • natural • sodium fluorides • silicofluorides and putative effects on the absorption of other metals • arsenic and lead in American agriculture • arsenic in 2x4s • arsenic in West Bengal and Bangladesh • the deep subterranean biosphere • arsenic, sunlight, and cancer • phytoremediation • phytoextraction, phytostabilization, phytotransformation • nanosized and ultrafine particles from natural, unintentional, and intentional sources • nanomachines, nanopharmaceuticals, nanocosmetics, *et cetera* • nanotoxicology

## 12 Radiant energy

Electromagnetic radiation as a geological and evolutionary masterforce • the quantum • the photon • the electromagnetic spectrum • and why you can neither leave home nor stay home without it • frequency • wavelength • photon energy • the overlapping of emissions and effects • dose • absorption • damage • repair • starting in the middle • UVA, UVB, UVC • sunlight as a catalyst • chlorophyll • folate • vitamin D • skin cancer • in xeroderma pigmentosum • skin cancer, light, and arsenic • the lens and the cataract • the pineal and SAD • ground-level reactions • tropospheric reactions • stratospheric reactions • starting at the top • ionizing radiation • the irradiation of food • high-level waste • low-level waste • radon again • starting at the bottom • non-ionizing radiation other than sunlight • power lines • radio waves • microwaves

Wed 4.11.12

*Choose a favorite depiction of...*

### ***the electromagnetic spectrum***

*...and be prepared to explain how it became your favorite. Send an electronic copy or a URL, if either is available, to  
sprinkle@umd.edu  
in advance of class.*

## 13 Combustion and its alternatives

Power from combustion • air quality, ambient and indoor • air quality and disease • larger and smaller particulates • burn pits in Iraq • slash & burn • peat • coal, however clean • the TVA's Kingston Fossil Plant coal fly-ash slurry spill • green bricks from coal combustion waste (CCW) • greenhouse gasses • photochemical oxidants • atmospheric acids • what we know about acid rain • crops • trees • *Waldsterben und Sauren Regen* • the city planner and the sycamore tree • atmospheric effects on surface-water species • what we do not know about acid rain • methanotrophic bacteria and archaea and their pH-sensitive enzymes • PAHs • petroleum products • crude oil • distillates of oil • diesel fuel and kerosene • the diesel engine • mechanical advantages • on land • at sea • bunker-oil pollution as nobody's business • environmental arguments • regulatory initiatives • biodiesel • gasoline • tetraethyl lead and other fuel amendments • jet fuel • the solid-fuel rocket • perchlorates in ground water (and on Mars) • formic acid and iron in a hydrogen-combusting economy • biofuel generally • corn ethanol and the price of tortillas • cellulosic ethanol • heat from planetary accretion • heat from uranium decay • from scavenging to composting to boiling to burying • nuclear reactor types • the cooling tower as a sign of inefficiency across industries • geothermal heating • and geothermal cooling • water as a heat sink • power from sunshine • expressed as gravitational effects on water • expressed as temperature-differential effects on air • wind • the iconic wind mill • its redesigns • network constancy

Wed 4.18.12

*Preview of WEEK 15, the memorandum-report week, when students will say why they chose their topics, how they developed their research questions, what methods they employed, what they found, and what advise they are planning to offer. These reports will be conversational – no visuals, no handouts, no recitation of prose – and they will NOT be graded. Students will learn much about their own work by sharing it and fielding questions about it and hearing other students do the same. Lessons learned should be applied to memorandum revisions prior to e-mail submission, which should occur within two weeks.*

## 14 Organismal implications of global incremental heat retention

Thermal injury • especially in the overweight and other vulnerable populations • why hyperthermia is not fever • heat's exacerbation of particulates' effects • alteration of transmission ranges for vector-borne diseases • alteration of incidence of water-borne microbial and toxin diseases • beach closings • algal blooms in Lake Champlain 2010 • alteration of vector and transmission range as affected by heat • but not peak or mean heat only • heat's diurnal variation as a factor • agricultural losses from evaporation and wildfires • the great Russian peat-fire and wildfire summer of 2010 • desertification • decline in winter snow and spring snowmelt • increased risk of torrents and flooding • phage washout in the Ganges • decreased sufficiency of surface water • increased drawdown of aquifers • increased mobilization of subterranean metals • increased incidence of extreme events – as projected but not as yet observed • acceleration of demand for hydrocarbon combustion to compensate for warming attributed to hydrocarbon combustion • moving Wyoming to Georgia by rail

Wed 4.25.12

## 15 MEMORANDUM REPORTS

Wed 5.2.12

BACKGROUND [What problem have you been working on?] • QUESTION [What research question did you pose to yourself?] • METHODS [How did you go about answering that question?] • RESULTS [What did you find?] • DISCUSSION [What did you conclude about the implications of your findings?]

*In-class, informal, ungraded conversational descriptions of memorandum projects. No hand-outs, no displays, no recitations, no angst.*

## **16 FINAL EXAMINATION**

**Wed 5.9.12**

*The FINAL EXAMINATION, unlike the MIDTERM EXAMINATION, will be an in-class, closed-everything, short-answer test. It will range over the whole course, including questions prompted by memo reports in WEEK 15.*

## **17 MEMORANDUM DUE DATE**

**Wed 5.16.12**

*Submit as a text file – doc, docx, or rtf – and also as a PDF to [sprinkle@umd.edu](mailto:sprinkle@umd.edu).*