I came to the Piedmont Project thinking that I would not have to stretch far to incorporate sustainability and ecological thinking into my public health course on Climate and Infectious Disease. In fact, the course had originally been developed by Christine Moe as through her prior work with the Piedmont Project, and we were just re-focusing the course to include more information on climate change.

Despite the easy entrée, integrating a focus on sustainability – particularly a focus on place – has been a challenge. The challenge came from the fact that much of the class focuses on the ecology of diseases in geographically distant, unfamiliar places; creating an educational exercise to help students experience how climate, infectious disease, and place interplay here in Georgia, where they’re learning, was the question.

I’ve tackled the issue in two ways. First, by modifying an existing exercise in the class on water quality. The exercise originally was an introduction to water quality assessment by taking a water sample from near home, plating the sample in the lab, and looking for fecal coliforms. We have broadened the exercise both geographically and temporally. I’ve encouraged the students to get samples from a place that they feel connected to (or would like to develop a connection to), or a place that has particular importance in the water cycle of Atlanta (and thus in the city’s sustainability). I’ve given them a list of parks and a general overview of the water intake and sewer discharge in Atlanta. We’re also asking them to take samples over several weeks to look at how precipitation or the lack thereof affects the number of coliforms in the sample. This gives them a better sense of how weather – as a surrogate, in this instance, for climate – affects disease ecology. I will be very curious to see how they engage the exercise and what we find.

The second way I introduced the issue was by devoting an entire class to West Nile Virus and its changing epidemiology. West Nile was not an endemic disease in North America until recently, and season and climate have very strong effects on disease incidence. Moreover, West Nile is a vector-borne zoonotic infection, with reservoirs in wild birds, so the climate effects on the ecology of mosquitoes and birds is important, as well. We will be looking at the spread of West Nile across the country and considering why this year was a particularly bad year for West Nile, and then correlating the disease’s emergence and inter-annual variability in North America with changes in climate and ecology.

Hopefully these two additions to the class will provide ample opportunities for students to relate a bit more deeply to place than they might have otherwise. I hope, too, that by grounding their inquiry in place, they will have opportunities to consider the connections between place and sustainability at a deeper level.
DEPARTMENT: Global Health / Environmental and Occupational Health

COURSE NUMBER: IH582 / EOH582

CREDIT HOURS: 2

COURSE TITLE: Environment, Climate and Infectious Disease

INSTRUCTOR NAMES: Christine L. Moe, Ph.D.; Jeremy Hess, M.D., M.P.H.

INSTRUCTOR CONTACT INFORMATION: Dr. Moe
EMAIL: clmoe@sph.emory.edu
PHONE: 404-727-9257
SCHOOL ADDRESS OR MAILBOX LOCATION: 1518 Clifton Rd, N.E., Room 716
OFFICE HOURS: 1 – 3 pm Tuesdays

INSTRUCTOR CONTACT INFORMATION: Dr. Hess
EMAIL: jhess@emory.edu
PHONE: 404-386.7585
SCHOOL ADDRESS OR MAILBOX LOCATION: EOH Department Mailboxes
OFFICE HOURS: By appointment

TEACHING ASSISTANT CONTACT INFORMATION: Elizabeth Ailes, MPH
EMAIL: ecailes@sph.emory.edu
OFFICE HOURS: By appointment

COURSE DESCRIPTION (3-4 Sentences)

This course will explore the role of the environment and climate change in the ecology and transmission of infectious diseases and the emergence of new pathogens. The course format will be a combination of lectures and classroom discussions guided by a series of questions. Many specific waterborne, vector-borne, and zoonotic infections will be used throughout the lectures and discussions to illustrate general principles of environmental transmission as well as hallmark aspects of climate change.
EVALUATION

There will be two class exercises (team work) and one homework assignments (individual work). The first class exercise is diagramming disease transmission cycles and ecological variables affecting transmission rates and virulence; the second exercise is a field and laboratory exercise on measuring microbiological water quality; the third exercise is researching, preparing and possibly presenting a short PowerPoint assignment. The homework assignment is a case study on a specific disease that has an environmental transmission component. These studies include selected readings and questions provided by the instructors. The class exercises and homework provide practice in critical literature review and synthesis skills necessary for the final assignment.

Final assignment: Each student will be required to give a final oral presentation on a selected topic and submit a final paper (10-12 pages) on the same topic. The presentation/paper should provide background material on a specific infectious agent, how the agent is transmitted, the role of specific environmental factors in disease transmission, the ways in which the agent’s range and/or virulence is expected to be affected by climate change, and an assessment of available control measures or specific interventions. Students will be evaluated on their understanding of the principles of environment transmission of infectious diseases and their ability to critically review and synthesize information from studies of their topic that are described in the literature.

COURSE GRADE: Three class exercises: 35%
Class 1 - Mapping transmission cycles (0%)  
Class 5 - Monitoring urban water quality (20%) Final report due Nov 20, 2007  
Class 7 - Water and sanitation in megacities (15%) Due Oct 23, 2007  

One homework assignment: Pfiesteria (15%) Due Sept 25, 2007  
Oral Presentation: 25% - Due December 11, 2007  
Final Paper: 25% - Due December 14, 2007

ACADEMIC HONOR CODE
The RSPH requires that all material submitted by a student in fulfilling his or her academic course of study must be the original work of the student.
LEARNING OBJECTIVES OR COMPETENCIES OF THE COURSE

The goal of the course is to provide the student with a clear understanding of the relationship between infectious agents, their hosts, and the environmental conditions that affect their interactions, to consider how climate change will affect these dynamics, and to discuss how this information can be used to design effective control measures. Topics include: basic principles of infectious disease transmission, the influence of climate variation and change on infectious diseases, the impact of deforestation, urbanization and other environmental changes on emergence or re-emergence of pathogens, the epidemiology and science of modeling and tracking climate-health relationships, and infectious disease outbreaks associated with natural disasters.

LEARNING OBJECTIVES OR COMPETENCIES FOR THE DEPARTMENT OR PROGRAM TO WHICH THE COURSE CONTRIBUTES

Learning Objectives for GH MPH students in the Infectious Disease Concentration

- Explain basic microbiology and ecology of groups of pathogenic organisms – including structure, replication strategy, survival in the host and survival in the environment.
- Review general aspects of climate change including projected ecological changes globally and by region, with consideration to effects on both endemic disease and emerging infections.
- Describe major transmission routes of infectious agents (including vector-borne pathogens) and the implications of these various routes for exposure and virulence.
- Explain basic principles of infectious disease epidemiology – including reservoirs, incubation period, transmission, infectivity, the distinction between infection and disease, etc.
- Explain the environmental, behavioral, ecological, and evolutionary factors that contribute to the emergence and re-emergence of infectious diseases.
- Consider how best to study the effect of climate change on the epidemiology of infectious disease, including time-series methodology, modeling, inter-disciplinary approaches, and vulnerability mapping.
- Describe and apply appropriate strategies to prevent and control infectious disease - including vaccines, antimicrobial therapy, behavior changes, environmental interventions and vector control.
- Evaluate effectiveness of interventions to control, prevent, eliminate or eradicate infectious disease.
“Environment, Climate and Infectious Disease” Lecture and Reading Schedule:
Tuesdays, 10 – 11:50 am; Location: GCR 103

NOTE: All readings will be posted on Blackboard as pdf files unless noted otherwise.

### Class One – September 4, 2007

**Introduction to infectious disease ecology and to climate change**

**Class Exercise I: Mapping Transmission Cycles**

<table>
<thead>
<tr>
<th>Readings</th>
<th>Authors</th>
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### Class Two – September 11, 2007

**Introduction to weather, seasonality and climate change modeling and prediction.**

<table>
<thead>
<tr>
<th>Readings</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dowell, SF. Seasonal variation in host susceptibility and cycles of certain infectious diseases. Emerg Inf Dis 7(3):369-374</td>
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<thead>
<tr>
<th>OPTIONAL CLASS – TBN</th>
<th>Christine L. Moe</th>
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<tr>
<td>“An Inconvenient Truth”</td>
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<td><strong>Summary:</strong></td>
<td>Documentary by former vice president Al Gore warns about the potential impacts of global warming within the next 10 years, including: could bring extreme weather, floods, droughts, epidemics and severe heat waves. Movie is 1 hour and 40 minutes, followed by discussion.</td>
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<tr>
<th>Class Three – September 18, 2007</th>
<th>Christine L. Moe</th>
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<tr>
<td><strong>The link between seasonality, climate change and emerging and re-emerging pathogens: Cholera and Assessing Water Quality</strong></td>
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| **Class Four – September 25, 2007** |
| **Modeling climate - Can we predict the impact of climate change?** |
| Peter Webster School of Civil and Environmental Engineering, GA Tech |

| **Readings:** |
| Using Climate to Predict Infectious Disease Outbreaks: A Review. WHO 2004 |
| Haines A and JA Patz. Health effects of climate change. JAMA 2004 291(1):99-103. [(REPEAT from Class 1)](REPEAT from Class 1) |
HOMEWORK ASSIGNMENT 1: PFIESTERIA CASE STUDY – Due September 25, 2007. Please leave your homework assignment in Dr. Moe’s mailbox.

<table>
<thead>
<tr>
<th>Class Five – October 2, 2007</th>
<th>Monitoring urban water quality – Class Exercise II</th>
<th>Christine L. Moe</th>
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<tr>
<td>Students will be asked to select urban streams on campus or in their neighborhoods and collect a water sample to be analyzed in the laboratory.</td>
<td>Readings: A handout will be provided that explains the field assignment (how to collect water samples) and the laboratory exercise (how to analyze water samples for fecal coliform bacteria by membrane filtration). This exercise will continue through mid-November 2007. Class groups will be assigned specific water bodies to monitor to observe the effects of combined sewer overflows and heavy precipitation events on water quality or urban streams. We will also explore gathering historical precipitation data and weather data, etc. and then synthesizing all this information in class to see if there are any trends. Final group reports due November 20, 2007. Standard Methods for the Examination of Water and Wastewater. 20th Edition. Sections 9010 – 9060, 9222, 9223 (Will make book available for scanning or copying)</td>
<td></td>
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</tbody>
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** There is no class on October 9, 2007 due to Fall Break at RSPH, Emory University. **

<table>
<thead>
<tr>
<th>Class Six – October 16, 2007</th>
<th>Modeling the interaction between the environment and infectious diseases</th>
<th>Lance Waller</th>
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</table>

**Class Exercise III:** Research and prepare megacity Powerpoint slides (student teams) for possible class presentations on October 23rd, 2007. All teams will turn in their
Powerpoint slides to Dr. Moe and Dr. Hess for evaluation. Teams will be chosen at random to present during class.

### Class Seven – October 23, 2007

**Megacity PowerPoint Presentations**  
Discussion of Pfiesteria homework assignment

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### Class Eight – October 30, 2007

**Understanding the relationship between the urbanization of populations and infectious disease: West Nile**

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### Class Nine – November 6, 2007

**Location and climate: Hantavirus**

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### Class Ten – November 13, 2007

| Schistosomiasis and the Environment | Evan Secor  
Division of Parasitic Diseases  
CDC |
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<tbody>
<tr>
<td><strong>Readings:</strong></td>
<td></td>
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</tbody>
</table>
| Sturrock, RF, Diaw OT, Talla I, Niang M, Piau JP, Capron A.  
Seasonality in the transmission of schistosomiasis and in populations of its snail intermediate hosts in and around a sugar irrigation scheme at Richard Toll, Senegal.  
Spatial patterns of human water contact and *Schistosoma mansoni* transmission and infection in four rural areas in Machakos District, Kenya.  
| Karanja, DMS, AW Hightower, DG Colley, PNM Mwinzi, K Galil, J Andove and WE Secor.  
Resistance to reinfection with *Schistosoma mansoni* in occupationally exposed adults and effect of HIV-1 co-infection on susceptibility to schistosomiasis: a longitudinal study.  
| N'Goran EK, Diabate S, Utzinger J, Sellin B. Changes in human schistosomiasis levels after the construction of two large hydroelectric dams in central Cote d'Ivoire.  
Available from [http://www.cdc.gov/EID/content/13/7/973.htm](http://www.cdc.gov/EID/content/13/7/973.htm) - will post pdf

### Class Eleven – November 20, 2007

**Malaria, Dengue and climate change**  
**Jeremy Hess**

**Readings:**

This reading is free online at the following URL: [http://www.cdc.gov/ncidod/eid/vol6no1/pdf/reiter.pdf](http://www.cdc.gov/ncidod/eid/vol6no1/pdf/reiter.pdf) (will post pdf)


Tanser FC, Sharp B, LeSueur D.  Potential effect of climate change on malaria transmission in Africa.  

Reiter P.  Climate Change and Mosquito Borne Disease.  

Reiter, P. Climate Change and Highland Malaria in the Tropics.  

Rua, G. et al.  Laboratory estimation of the effects of increasing temperatures on the duration of gonotropic cycle of Anopheles albimanus.  
*Mem Inst Oswaldo Cruz.* 2005 100(5): 515-520.

### Class Eleven – November 27th, 2007

**Onchocerciasis: Environmental controls vs. mass treatment**  
**Frank Richards, The Carter Center**

**Video:** Rx for Survival segment on River Blindness

**Readings:**


### Class Twelve – December 4, 2007

**The health effects of extreme weather**  
**Jeremy Hess**
**Readings:**


*Available at:*

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**Classes Fourteen – December 11, 2007**

**Student Presentations**

Group A Presentations: 

Group B Presentations:

All members of the group are required to attend both of their group sessions.

**Final papers are due December 14, 2007 by 5 p.m. You must provide a hard copy of your paper in Dr. Moe’s mailbox (7th floor of the Grace Crum Rollins building) before the deadline.**