Infectious Disease Research Linked to Climate Change at CU

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Climate and Health Workshop

May 9, 2017

Waterborne diseases: Infectious diseases transmitted through direct contact with water (e.g. cholera, schistosomiasis).

Water washed diseases: Disease whose transmission is facilitated by a lack of water (e.g. trachoma, ascariasis)

Food-borne diseases: Diseases resulting from consumption of pathogens in food (e.g. listeriosis).

Vector-borne diseases: diseases transmitted by mosquitoes, biting flies, ticks and fleas (e.g. Lyme disease, dengue, malaria)

Sexually transmitted disease: diseases transmitted through sexual contact (e.g. HIV)

Zoonotic diseases (zoonoses): Diseases that can be passed from animals to humans, directly or indirectly (e.g. rabies, Lyme disease).

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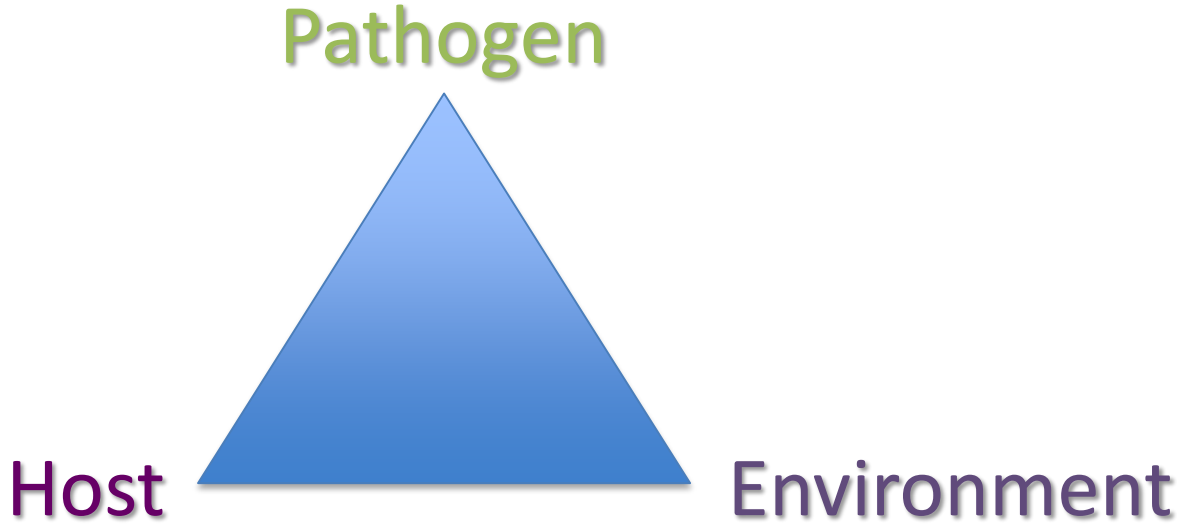
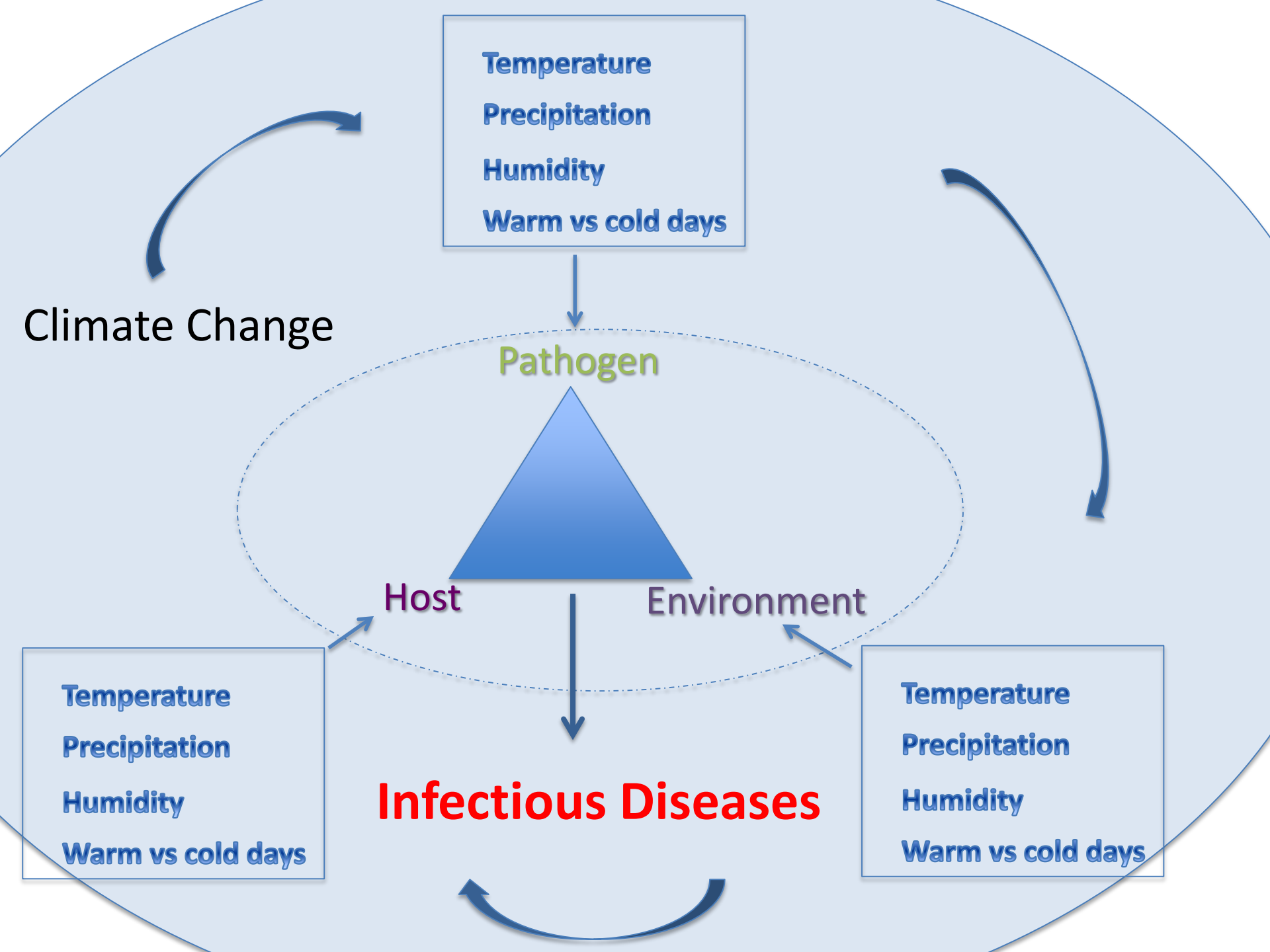
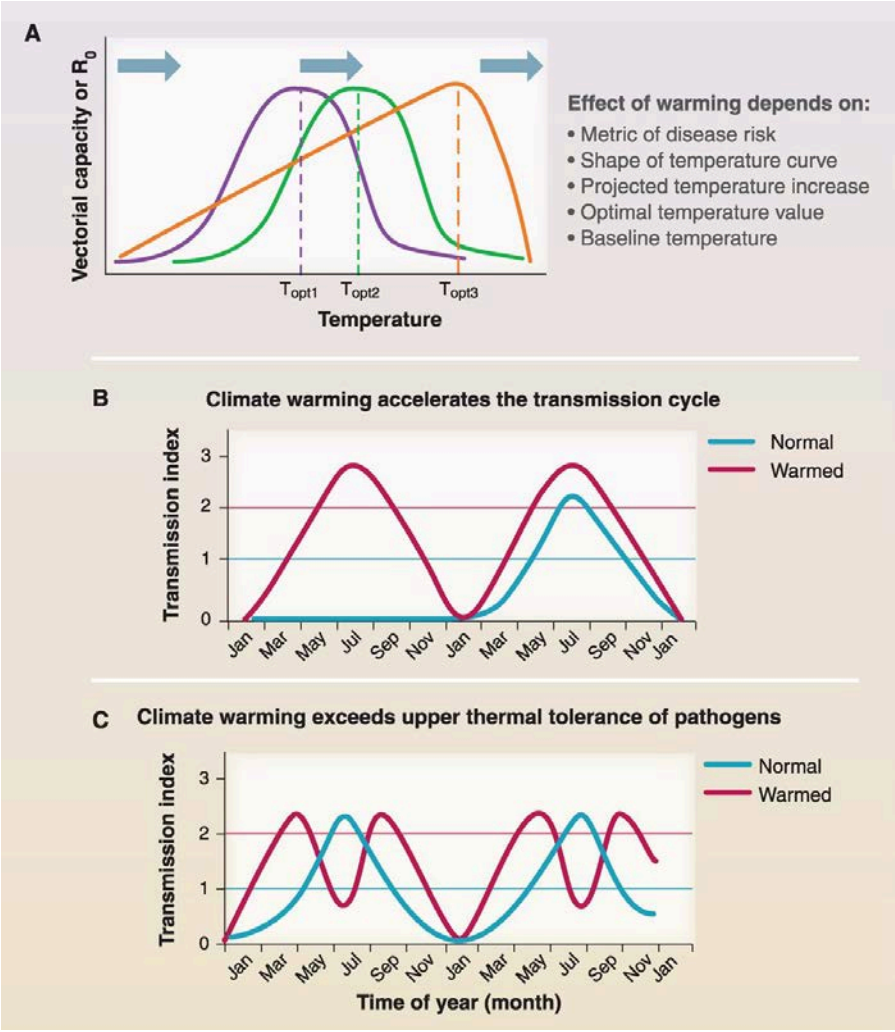
Epidemiologic Triad of Disease



- Recognizing components of triad is critical to control of infectious disease
- Recognizing components of triad is also critical to model infectious disease risk

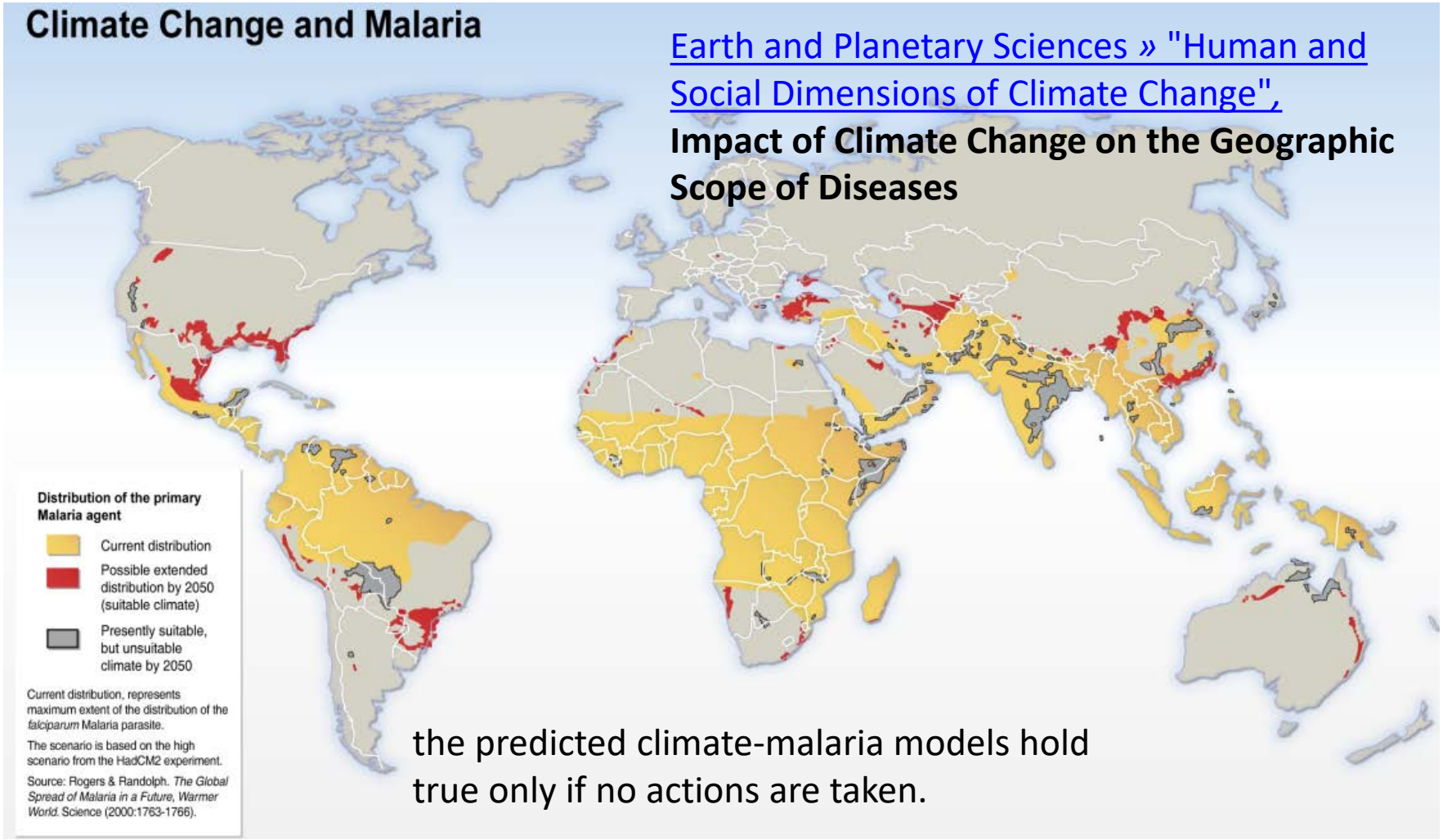

Temperature
Precipitation
Humidity
Warm vs cold days
Climate Change
Pathogen
Host
Environment
Temperature
Precipitation
Humidity
Warm vs cold days
Temperature
Precipitation
Humidity
Warm vs cold days
Infectious Diseases

Theoretical underpinnings and categorization of disease responses to climate change.



Sonia Altizer et al. Science 2013;341:514-519

How does climate affect malaria prevalence and distribution?



the predicted climate-malaria models hold true only if no actions are taken.

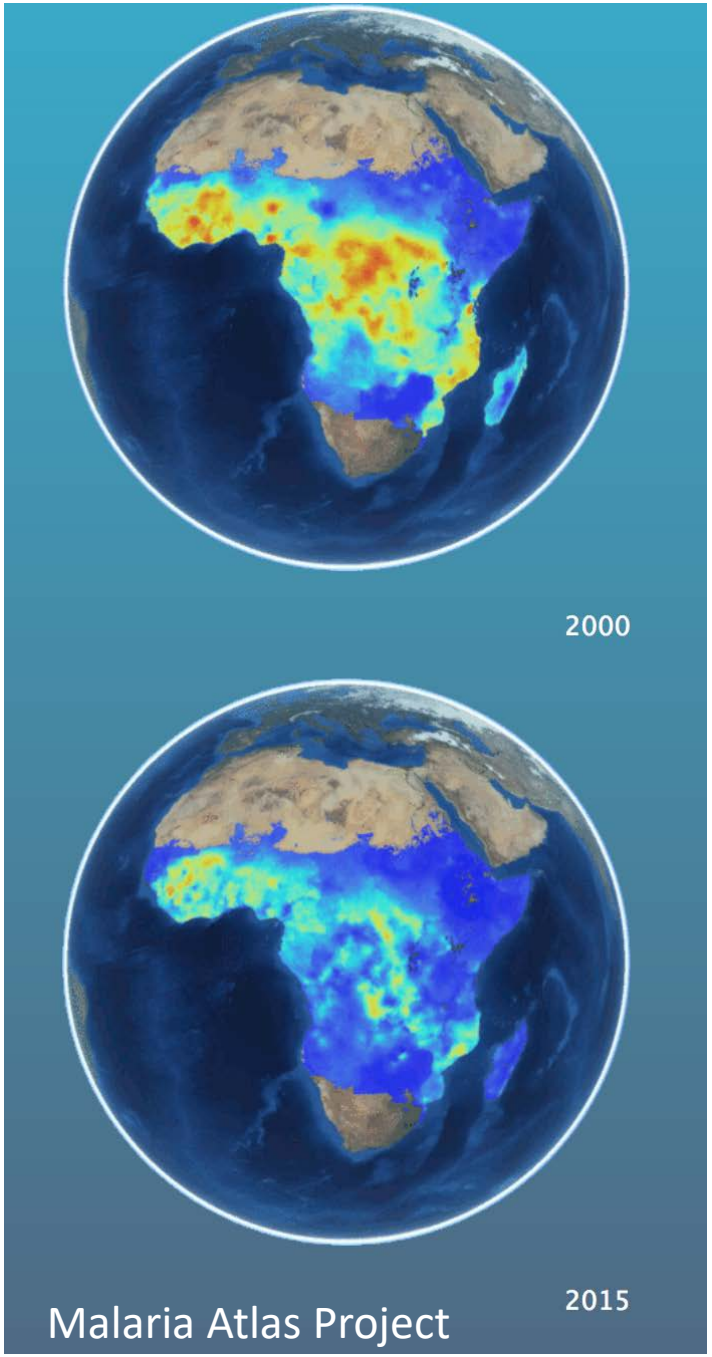
Malaria interventions have reduced parasite prevalence in last decade

Insecticide treated bed nets

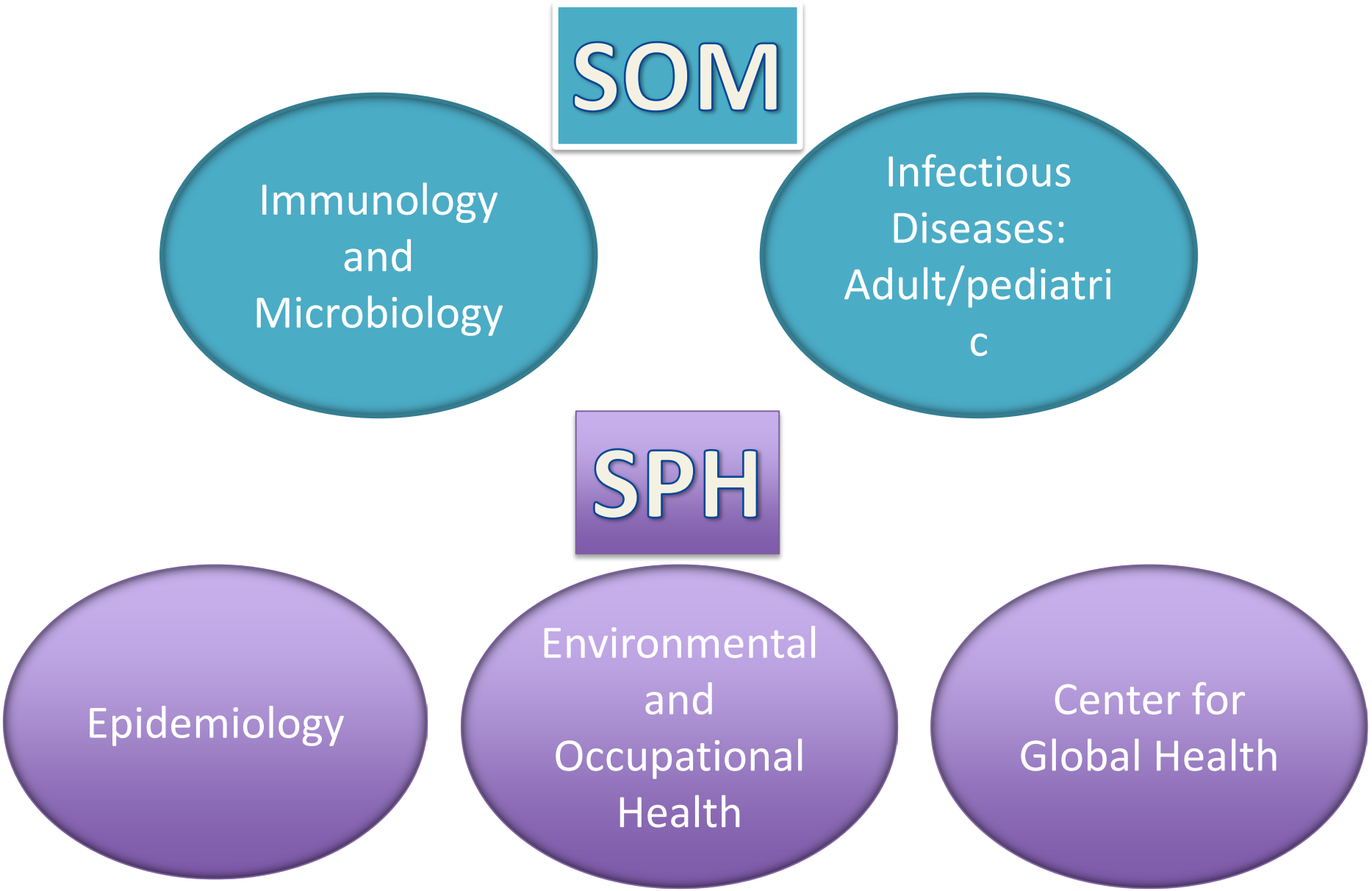
Indoor residual spraying

New anti-malaria drugs

How to model what can occur due to climate change when there are ongoing interventions?



CU Anschutz


SOM
Immunology and Microbiology
Infectious Diseases: Adult/pediatric
SPH
Epidemiology
Environmental and Occupational Health
Center for Global Health

The People

Immunology and Microbiology

Infectious Diseases

Rosemary Rochford: Malaria

Tem Morrison: Chikungunya, Zika

Andres Vasquez Torres: Salmonella

Stefan Pukatzki: Cholera

David Beckham: West Nile virus

The People

Epidemiology

Molly Lamb:
Dengue surveillance

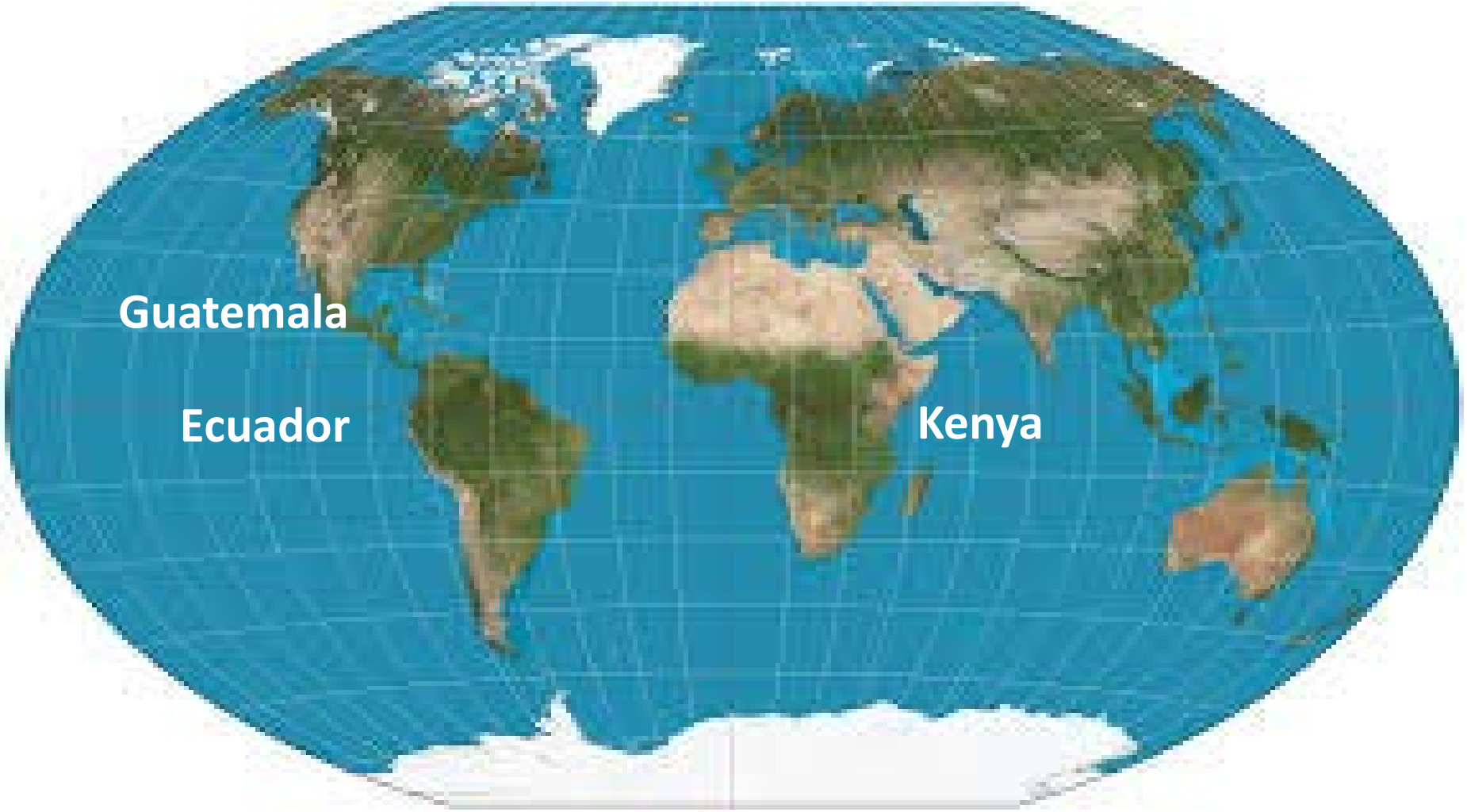
Environmental and Occupational Health

Beth Carlton:
Water-borne disease
Sara Paul:
Vector-borne disease
Katie Dickinson:
Environmental economist

Center for Global Health

Edwin Asturias:
Pediatric ID

The Places



An existing cross-disciplinary collaboration

Beth Carlton, Debashis Ghosh, Andy Monaghan

How will climate change impact water-borne diseases?

Climatic exposures X Vulnerability = Public health impacts

Does your household water source impact your vulnerability to climate change?

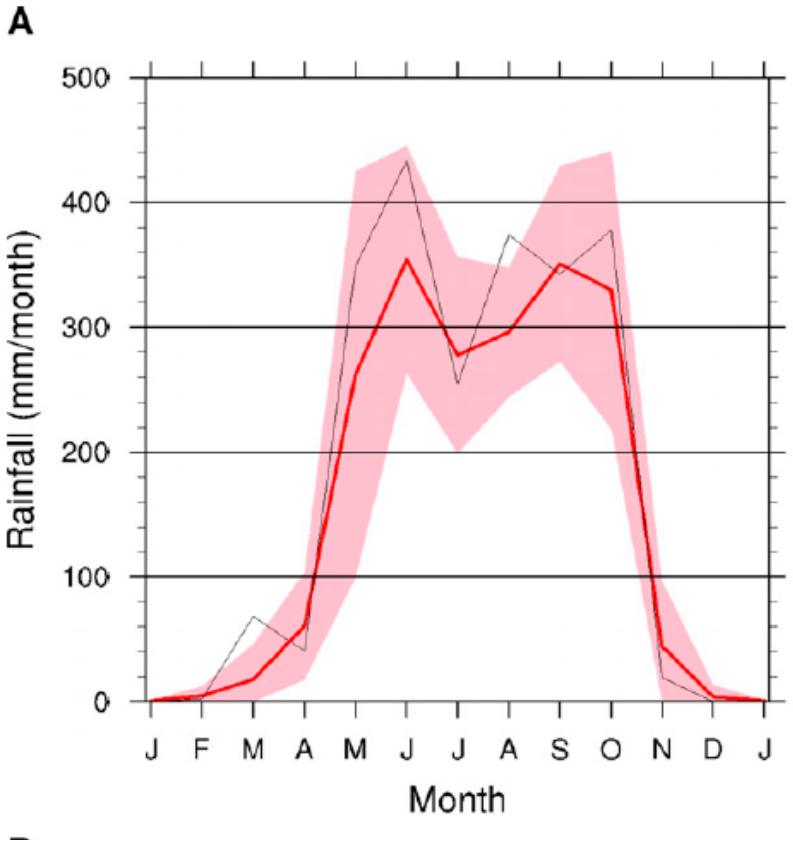
Am. J. Trop. Med. Hyg., 94(6), 2016, pp. 1403–1406
doi:10.4269/ajtmh.15-0600

Estimating the Risk of Domestic Water Source Contamination following Precipitation Events

Ian F. Eisenhauer, Christopher M. Hoover, Justin V. Remais, Andrew Monaghan, Marco Celada, and Elizabeth J. Carlton*

School of Medicine, University of Colorado, Anschutz Medical Campus, Aurora, Colorado; Environmental Health Sciences, School of Public Health, University of California, Berkeley, California; National Center for Atmospheric Research, Boulder, Colorado; Centro de Desarrollo Humano, Trifinio, Guatemala; Center for Global Health, Colorado School of Public Health, University of Colorado, Anschutz Medical Campus, Aurora, Colorado; Department of Environmental and Occupational Health, Colorado School of Public Health, University of Colorado, Anschutz Medical Campus, Aurora, Colorado

- Surveyed 59 shallow household wells during the wet season
- Found rainfall in the 24 hours before sampling was associated with higher *E. coli* concentrations
- This relationship was strongest at wells
  - Lower in the watershed
  - With pigs nearby at the time of sampling



Potential partners at CU Boulder?

Sara Sawyer: Disease emergence, zoonosis

Pieter Johnson: Disease emergence and species invasion

Valerie McKenzie: Anthropogenic disturbances affect on parasites

The challenges

- Integrating theoretical, observation and experimental approaches to better predict the direction and magnitude of changes in disease risk
- Identifying the contribution of environmental variables such as precipitation, humidity, and climate variability to disease risk
- Merging scale between ID and Climatology