Climate Change, Contaminants and Health

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Climate Change is the Issue of our Time

2014 was the warmest of the past 135 years

Mean surface temperature anomaly 2014 relative to 1951-1980 climatology

Source: Hansen et al., 2015 Earth Institute, Columbia

Snowmageddon in Boston
What does climate change mean for me?

FIRE IN THE WESTERN US

Percent increase in wildfire smoke PM$_{2.5}$ by midcentury relative to 2000s, by county.

- Some large cities affected by fires

EXTREME WEATHER

SEA-LEVEL RISE

Liu et al., in prep.
Courtesy of Michelle Bell (Yale) & Loretta Mickley (Harvard)
Should we be thinking about climate change or global change?

Human activities underlie many different types of ecological changes

One in six children suffers from a neurodevelopmental abnormality, mostly of unknown causes.

10 million U.S. children below age 17 have been diagnosed with asthma (14% population) and 12% suffer from skin allergies.

Dr. Philippe Grandjean: see: http://braindrain.dk/
Understanding effects of climate and industry on environmental contaminants

Global 3-D Models for the Atmosphere & Ocean

Satellite Data

Human Exposures & Health Outcomes

Biogeochemistry of Global Contaminants
Harvard School of Engineering and Applied Sciences
Modeled effects of temperature change on mercury bioaccumulation in the Gulf of Maine

Atlantic Cod (*Gadus morhua*)

![Graph showing modeled effects of temperature change on mercury bioaccumulation in Atlantic Cod. The graph illustrates the increase in tissue methylmercury levels with a 1°C temperature increase compared to the baseline (year 2000).]

- **Y-axis**: Tissue Methylmercury (ng/g)
- **X-axis**: Wet weight (kg)
- **Legend**:
  - Baseline (year 2000)
  - 1°C temperature increase

Qureshi et al., 2013

**Legend Image**: Atlantic Cod (left) and Gulf of Maine (right)
High concentrations of bioaccumulative contaminants pose risks for marine fisheries

Contributions of global rivers to seawater mercury concentrations

Source: Zhang et al., 2015
Effects of climate change are most severe in polar regions.

- Warming 2 x Global Average
- Melting Permafrost
- Loss of Sea Ice
- Increasing Freshwater Discharges to the Oceans

Vulnerable Human Populations
“The Island and the Whales”

KICKSTARTER
Hydroelectric Development throughout the Canadian North

Flooding causes a pulse in methylmercury, methane and carbon.
What can you do?

(1) Be conscious of your food choices

(2) We need new ideas about materials design and use of chemicals that are released into the environment. New Course Fall 2015 with Sadasivan Shankar (Intel): “Mitigating toxicity through materials design”

(3) Watch James Hansen’s TED talk

(4) Feel empowered to catalyze change