Global Warming

- Should not be a liberal versus conservative issue
- CNA Military Advisory Board
- Retired Generals and Admirals
- Not-for-profit research and analysis organization dedicated to developing actionable solutions to complex problems of national importance
- Reports funded by U.S. Army, Navy...
  - “Climate change can act as a threat multiplier for instability in some of the most volatile regions of the world, and it presents significant national security challenges for the United States.”
- 2014: National Security & the Accelerating Risks of Climate Change
  - “a bipartisan call to action. It makes a compelling case that climate change is no longer a future threat—it is taking place now.”
- 2017 Report: The Role of Water Stress in Instability & Conflict
  - Examines the role of climate change/water stress “across a spectrum from civil unrest and localized violence to terrorism, insurgencies, and civil wars to state-on-state conflict.”

Additional Global Warming Effects

- Africa: ↑ 5-8% arid & semi-arid land
- Asia: ↑ flooding from sea level ↑
- Australia/New Zealand: Water shortages
- Southern Europe: Drought
- Latin America: ↓ soil water, food
- North America: ↑ winter floods & heat waves
- Coastal cities:
  - Flooding, inundation, storm surge erosion.

Global Warming

- The 16 of 17 warmest years on record (1880-2017):
  - Last 16 (exception: 1998)
  - 2016: Each month was the warmest on record
  - Global Temperature Change: 1850-2017
- 2014 Eastern Mediterranean drought
  - Worst in past 900 years (NASA)
- General expected effects (already occurring):
  - Increases in extreme weather events
    - heat waves, heavy precipitation, tropical cyclones, drought, floods
  - Sea level rise.
Global Warming

- Projections for change by 2100
  
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<th>Scenario</th>
<th>Temp °C/F</th>
<th>meters/feet</th>
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<tr>
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<td>1.8/3.24</td>
<td>.28m/.92ft</td>
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<td>4.0/7.2</td>
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<td>5.9/10.62</td>
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<td>2019 fairly likely</td>
<td>5.0/9.0</td>
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Sea Level Rise

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Additional Key Climate Change Points

- The speed of climate change is most damaging
- Almost half of 2014’s extreme weather events linked to human-caused climate change
- Rain + storm surge + sea level = flooding
- Warming trends will continue beyond 2100
- Compromised water, food, & other resources.

Bill Nye: Climate Change Deniers
**Situational Science**

**Direct Path: Heat Effect**
- Shakespeare, *Romeo & Juliet*

**3 Rapid Global Warming Paths to Violence**

- **Rapid Global Warming**
- **Increased Heat, Drought, Extreme weather, Sea level rise, Flooding ...**
- **#1. Direct heat effects (e.g., irritability)**
- **Indirect effects:** Failed crops, Natural disasters, Economic instability, Poverty, Eco-migration
- **#2. Violence prone adults:** Pre & post-natal developmental problems
- **#3. Intergroup conflict:** Civil/political unrest, Refugees & Internally Displaced Persons, Resource competition

**Heat Effect**
- Earliest reference: “The minds of men do in the weather share, Dark or serene as the day’s foul or fair.” Cicero (106-43 BC)
- Earliest data: From the late 1800s—Summer Effect
  - Leffingwell (1892), England and Wales in 1878-1887
  - Guerry in France (late 1800s?)
  - Lombroso in Italy, Spain (and elsewhere) (1899/1911),
  - Dexter (1899) in the U.S.
  - Aschaffenburg (1903/1913) in Germany and France.
  - Chang (1972) Korea
  - Rotton & Frey (1985) U.S.
  - Anderson (1987) U.S.
Heat Effect on Perception: Experimental Studies

• Hot people perceive more aggression than comfortable people


Heat Effect on Behavior: Experimental Studies

• Hot people retaliate more strongly than comfortable people in a laboratory task


Heat Effect on Police: Experimental Studies

• Hot police officers, in action-based training scenarios, are:
  • more likely to perceive a suspect as dangerous
  • more likely to draw their weapons
  • more likely to shoot the suspect.

Heat Effect: Geographic Region Studies

• Are hotter regions more violent than cooler regions?
• Old studies (1700s – 1800s): Suggestive evidence
  • France
  • Germany
  • Italy
  • Great Britain
• Modern studies, with socioeconomic controls
  • Hotter U.S. cities have higher violent crime rates than cooler cities (14 control variables)
  • No climate effect on nonviolent crime rates.

Heat Effect: Geographic Region Studies

- Hotter U.S. cities have higher violence rates.

Heat Effect-Days: Time Period Studies

- Hotter days yield more violence than cooler days
  - Houston
  - Dallas/Fort Worth
  - Chicago
  - Minneapolis

- Types of violence
  - Murder
  - Assault
  - Rape

- Hotter days, baseball, & hit batsmen
  - Even after controlling for pitcher’s control.

Heat Effect- Seasons: Time Period Studies

- Hotter seasons yield more violence, 1892-1987

Heat Effect- Years: Violent Crime in U.S.

- Heat hypothesis predicts higher violent crime rate in hotter years
- Data: U.S., 1950-2008
  - Violent crime: Assault + homicide
  - Average annual temperature of 50 major cities across U.S.
  - % population in high crime age range (15-29)
  - Prison incarceration rate
  - Poverty rate
  - GINI: index of income distribution inequality
  - % population who moved residence in last year

- Analysis strategy: Ordinary least squares & Time series
  - OLS of Temp on DV, then test for auto-correlation violations
  - Add auto-regressive parameters until no further evidence of violations
  - Add control variables.
Annual Temperature Effect: Violent Crime Results

- Base rate: 239 incidents per 100,000 population per year
- Simple correlations
  - VC positively correlated with year, temperature, incarceration, GINI
  - VC negatively correlated with poverty, % moved
- Auto-regression analyses
  - After AR controls, only year, prison rate, and temperature remained significant
  - VC ↑ 4.90 incidents per year
  - VC ↑ 4.20 incidents per 100 inmate increased prison rate
  - VC ↑ 7.54 incidents per 1°C increase in temperature (or 4.19 incidents per 1°F)
- No effect of temperature on nonviolent crime (details).

Heat Effect: Summer Surplus in Violent Crime

(Detailed version)

- Heat hypothesis predicts:
  - summer surplus of violent crimes in the summer
  - summer surplus larger in hotter summers
- Data: U.S., 1950-2004
- Average summer excess VC: 2.57%, \( t(54) = 18.86, p < .001 \)
- A 10% increase in # hot days yields an increased summer effect of almost 3%.

Heat Effect (Path #1): Summary

- Experimental studies
  - Uncomfortable heat increases aggressive perceptions & behavior
- Geographic region studies
  - Hotter regions, cities have more violent crime
  - Even controlling for socio-economic & demographic variables
  - Nonviolent crime is relatively unaffected
- Time period studies
  - Hotter time periods have more violent crime
    - 3-hour time blocks
    - Days
    - Seasons
    - Years
  - Nonviolent crime is relatively unaffected.
Indirect Path A (Path #2): Creating Violent Adults

- Global warming increases risk factors known to create violence-prone individuals
  - Poverty
  - Famine, disease
  - Neighborhood disorganization
  - Academic failure
  - Broken home
  - Separation from parents.

Indirect Path A: Individual Level Examples

- Malnutrition at age 3 increases:
  - aggression & hyperactivity at age 8
  - aggression and externalizing behavior at age 11
  - hyperactivity and conduct disorder at age 17
- Maternal nutritional deficiency 1st and 2nd trimester:
  - increases antisocial personality disorder by 250%
- Childhood maltreatment + MAOA genotype:
  - increases violent crime convictions by 360%
- Poverty increases cortisol in children:
  - mediated by heightened threat perception bias
  - mediated by chaos in daily family life.

Yet More Denial
Indirect Path B (Path #3): Intergroup Conflict

- Resource competition
  - Poverty
  - Food
  - Water
  - Land
- Eco-migration (across or within borders)
  - Racial, ethnic, cultural clashes
  - War, political instability, civil war, genocide
  - More likely in subsistence economies
- Can result from any rapid climatic change
  - Rapid warming or cooling both influence resources and migration
- 2017 study: # refugees by 2100: 2 billion.

Indirect Path B: Refugees & Internally Displaced

- 2016: > 31 Million NEW “Internally Displaced Persons”
- Violence/conflict: about 7 million new IDPs
  - Democratic Republic of Congo: 922,000
  - Syria: 824,000
  - Iraq: 695,000
  - Total IDPs: > 40 million
- “Natural Disasters”: 24.2 million new IDPs
  - China: 7.4 million
  - Philippines: 5.9 million
  - India: 2.4 million
- 2017 Refugee Estimate by 2100
  - 2 Billion (2,000,000,000).

Indirect Path B: Future U.S. Internally Displaced

- Assuming “only” a 6 ft rise in sea-level by 2100
  - 13 million U.S. residents will become IDPs
  - Worst hit:
    - Florida & East coast (including Miami, Boston, New York, D.C.)
    - West coast (including S.F. Bay area, Orange Country, Seattle)
    - Gulf coast (including New Orleans, Houston)
- More recent data suggest at least 8-10 ft. rise
  - Mostly under water U.S. cities
    - Boston
    - Miami
    - New York
    - Seattle
    - New Orleans.
**Indirect Path B—Recent Examples**

- 1930s U.S. “dust bowl” in Oklahoma…
  - Clashes over jobs, resources, way of life
  - Beatings, shack burnings
  - L.A. police sent to keep migrants out
- Since 1950s, Bangladesh to India
  - Thousands killed in riots, Army attacks, rebellion
- Hurricane Katrina, U.S., 2005
  - Border blockages in L.A., & Gretna, Louisiana
  - 150,000 to Houston: 28% - 70% homicide rate↑
- Syrian drought, civil war, ISIS…

**Indirect Path B—Past Examples**

- Rapid climate change (cooling) and war in eastern China in the last millennium
  - Peaks in warfare & in dynastic change coincided with (followed slightly) cooling changes
  - Warfare lagged 10-30 years behind start of a cooling period.

**Indirect Path B—More Past Examples**

- Pacific Basin, 700-1800
  - Medieval warm period: 700-1250
  - A.D. 1300 Event: rapid cooling, ↓ sea level
  - Little ice age: 1350-1800
    - Radical transformation of lifestyles
    - Increased conflicts, use of fortifications, cannibalism
    - Decreased trade
  - Fiji; Kaua‘i, Hawaiian islands; Easter Island; New Zealand; Southern Queensland, Australia.

**Indirect Path B—Empirical Example**

- Recent and current wars and genocide in Africa?
  - 1°C increase (1981-2002):
    - 54% increase in civil wars.
    - Projection: additional 393,000 battle deaths by 2030.

References:
Recent Examples in Africa

- **Sudan**
  - An estimated 2,000 armed herdsmen from drought-hit parts of southern Sudan have moved into northeastern Uganda in search of pasture and water. According to Lillian Nsubuga, spokeswoman for the Uganda Wildlife Authority, "Their weapons are superior and modern compared to those of our game wardens in the park. We are greatly concerned about the park. They were looking for water for their animals due to a long dry spell across the border."

- **Uganda**
  - Uganda is in the warning category by FEWS NET. Drought had already affected 29 districts, including the chief cattle-producing districts, where animals are dying. Water levels in Lake Victoria have dropped and food crops been affected. The current drought in particular in Karamoja (in the north east) is complicating the food security situation facing over 1.4 mil internally displaced people (IDP) and is set to continue until mid-March 06.
  - People in the Uganda districts of Gulu, Kitgum and Pader continued to be terrorized by the rebel Lord's Resistance Army. They were victims of brutal attacks and kidnappings by the rebel group. The main victims of the LRA have been the Acholi people of northern Uganda. More than a mil Acholi have moved to protected camps. As a result, they have not been able to plant their crops and hunger is widespread.

What Can We Do—About Climate Change?

- Treat the need for a clean energy revolution not as a threat, but as an opportunity
- Dramatically cut greenhouse gas production
  - Change to clean, renewable energy (wind, solar…)
  - Capture & sequester CO² & methane (trees, farms, factories)
- Cut use of fossil fuels
- Cut the demand for energy
  - Increase energy efficiency (cars, lights…)
  - Use more efficient substitutes (tap water, local foods…)
  - Turn off unnecessary stuff (lights, chargers…)
- Reduce population growth
- Communicate with policy makers, general public, politicians
- Vote appropriately.

What Can We Do—About the Human Crisis?

- Treat immigration, refugees, IDPs… not as a liability, but as an asset
- Prepare action plans and materials for
  - humanitarian aid on a huge scale
  - moving large populations
- Revamp immigration policies to welcome newcomers and to help them relocate and succeed
- Communicate with policy makers, general public, politicians
- Vote appropriately.

Summary

- Current global climate change will increase violence in 3 different ways
  - Direct effect on human aggression through increased heat-induced irritability
  - Indirect effect through creation of social conditions conducive to development of individuals predisposed to violence
  - Indirect effect through creation of resource problems for existing populations
- We must take action now
  - Short-term and long-term reduction in greenhouse gases
  - Prepare for eco-migration, humanitarian needs.
Tom & Doug Handle Global Warming

Siouxie & the Banshees, 92°

Global Wobble

Republican EPA Administrators
**Annual Temperature Effect: Nonviolent Crime Results**

- **Base rate:** 1311 incidents per 100,000 population per year
- **Simple correlations**
  - NVC positively correlated with year, age
  - NVC negatively correlated with poverty, % moved
  - No effect of temperature on nonviolent crime
- **Auto-regression analyses**
  - After AR controls, only age and year remained significant
  - NVC increased 112 incidents per 100,000 population per 1% increase in high crime age range
  - NVC increased 18 incidents per 100,000 population per year
  - No effect of temperature on nonviolent crime.

**Summer Effect in U.S.**

- **Heat hypothesis predicts higher violent crime rate in the summer**
- **Data:** U.S., 1950-2004
  - Violent crime: % summer excess Homicide and Assault
  - Nonviolent crime: % summer excess Burglary + Motor vehicle thefts
  - Average # Hot Days (90°F, 32°C) per year in 50 major cities
  - % population in high crime age range (15-29)
  - Prison incarceration rate
  - Poverty rate
  - GINI: index of income distribution inequality
  - % population who moved residence in last year
- **Analysis strategy**
  - Time series analyses to account for serial dependencies in the DVs
  - OLS of Temp on DV, then test for auto-correlation violations
  - Add auto-regressive parameters until no further evidence of violations
  - Add control variables.
Summer Effect: Violent Crime Results

- Average summer excess: 2.57%, t(54) = 18.86, p < .001
- Simple correlations
  - VC positively correlated with temperature
- Auto-regression analyses
  - AR controls not needed
  - A 10% increase in # hot days yields a summer excess of almost 3%.

Summer Effect: Nonviolent Crime Results

- Average summer excess: 0.88%, t(54) = 4.35, p < .05
- Simple correlations
  - NVC positively correlated with: % incarcerated, GINI, age, and year
  - NVC negatively correlated with: poverty, % moved
  - No effect of temperature
- Auto-regression analyses
  - # hot days unrelated to NVC summer effect
  - Summer effect has gotten bigger over time
  - Summer effect positively related to % in high crime age range.

Some Predicted Global Warming Effects

- Consider sea level rise of 1 to 2 meters
  - 13% world population lives in low-lying coastal areas
  - Dhaka, Bangladesh: 13 mil, 8 meters above sea level
  - Jakarta, Indonesia: 8.5 mil, 1-3 meters and sinking
  - Mumbai, India: 19 mil, 14 meters
  - Shanghai, China: 20 mil, 4 meters
  - Tokyo, Japan: 35 mil, 5 meters
  - New York, U.S.: 8.3 mil, 10 meters
  - Miami, U.S.: 5.4 mil, 2 meters
  - Cartagena, Colombia: 1.2 mil, 1 meter
- Consider New York City, “100 year storms”
  - 1 meter sea level rise—once every 3 years
  - 2 meter sea level rise—several times/year??
**Sea Level Rise**

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**Recent U.S. Temperature Averages (50 Cities)**

1950-2008, ave. temperature in 50 major U.S. cities increased.

**POGO**

- Deadly heat/humidity is point at which people start dying
- Currently, 30% humans: exposed to deadly heat/humidity 20+ days/year
- Even with drastic cuts in GW-gases, will increase to 48%
- Business as usual: 74%
Increased Deadly Heat Frequency by 2100, #2

Grey areas indicate high uncertainty.

Monthly Changes in Temperature, 1881-2016

How have seasonal temperatures changed since the 19th Century?

Monthly Changes in Temperature, 1850-2017

Global Temperature and CO²

http://www.climate-lab-book.ac.uk/spirals/
Three Routes of Global Warming Effects on Violence

1. Direct route: Heat effect
   - Uncomfortably warm temperatures increase irritability and aggressive behavior
     - Mostly field studies: Region, Time period
     - Exp. studies: Social perception, aggressive behavior

2. Indirect route A: Individual level
   - Risk factors for violence-proneness

3. Indirect route B: Group level
   - Resource competition & Eco-migration
   - War, genocide.